Proceedings

Fourth Webinar

Expert Talk

New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

Dedicated to the memory of VED Researcher

Jeevan M

9 January 2021, Saturday

Editors:

Vishal Kesari

B N Basu

Thinkers in Vacuum Electron Devices Group

India

From Editorial Desk

We, on 9th January in 2021 in Weniar#4, presented, on the platform of our group, a lecture by Professor Claudio Paoloni, Cockcroft Chair Professor and Head of the Engineering Department, Lancaster University, U.K. The topic of his lecture was “New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes.” Professor Paoloni dedicated his presentation to the memory of Late Jeevan M Rao.

Professor Claudio Paoloni is well known to vacuum electronic device (VED) community for his outstanding contribution to the area of VEDs. We have included his resume in brief in Proceedings. His earlier work in the analysis of helical slow-wave structures was referred to by many researchers in India. Similarly, he was aware of the Indian contributions to this area. We express our gratitude to him for acceding to our request to present his lecture.

Mr. Raj Singh convened the programme. We sincerely thank Ms. Nalini Pareek for hosting the programme. Our thanks are due to Ms Rupa Basu who was the Coordinator of the programme. Dr. Vishant Gahlaut and Dr. Uttam Goswami and their team took the responsibility for the web management; we thank them very much.

Professor PK Jain chaired the lecture session. Professor Sheel Aditya took the responsibility of proposing the vote of thanks for the entire group. We very sincerely express our gratitude to both of them.

Vishal Kesari
On behalf of the Editorial Board

Some Messages

Professor Sheel Aditya

Professor
School of Electrical and Electronic Engineering
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Nanyang Technological University, Singapore

Former Lecturer to Professor
Department of Electrical Engineering
Indian Institute of Technology, Delhi, India

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Message

These webinars provide a unique opportunity to the members of this group of scientists and researchers in the field of vacuum electron devices (VEDs). The group cuts across different geographies, organizations, experience as well as age profile. This simultaneously allows the mature group members to share their wisdom, international experts to provide a glimpse of their cutting-edge research, and the young members to present their research & development work and receive advice from the rest of the group. In a manner of speaking, the members of this group need not feel that they are working in 'vacuum'! On the contrary, they can feel a part of an active community. This is extremely beneficial, particularly in times of a pandemic like COVID-19, when such webinars very well fill the need for interaction with peers. It is heartening indeed that the members of this group, eminently guided by Professor BN Basu, are participating in these webinars enthusiastically. I am sure they find the time spent in this activity very rewarding.

Raj Singh

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Message

Electronic Communication has become a very important or one should say the most important field in today's era of human life. It looks as if a person can live for a day or two without food but cannot for an hour or so without mainly his mobile or otherwise TV or laptop. If you see all around you, you will find that EVERYONE is bouncing upon his or her mobile. You will hardly find any person who is idle and is not engaged with his or her mobile or TV or laptop. Yesterday, I was listening to a discussion from the Principal of the school of my child and he, on a lighter tone, told that when he had asked a student how much marks he or she would award to the online and offline classes, the student replied that he or she would give 110 and 100 marks out of 100 to online and offline classes, respectively. This incidence gives a clear indication that electronics communication is going to jump in leaps and bounce bounds, and this, in turn, is going to arouse the one most important demand and that is the demand of ever-expanding bandwidth.

Our 4th webinar was very much around this emerging field of bandwidth requirement. As more and more work is going to be done now online, the demand for bandwidth is going to increase in many folds. The increasing demand of bandwidth encouraged the researchers to look for high bandwidth fields like sub-THz and so. The enlightening talk by Prof. Cladio Paoloni titled "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling Wave Tubes" was very much addressing the concern of bandwidth and its realisation. As told by Prof. Paoloni, the data requirement by

5G communication will be around 135 EB (ExaByte – billion billion byte) per month, which forces the researchers to look for very high bandwidth areas. Sub-THz field supported by TWTs is one of the lucrative options for high bandwidth requirements. As discussed by Prof. Paoloni, the future requirements of 6G communication and its huge bandwidth will further stretch the need for sub-THz communications enabled by TWTs. The young researchers need to stress on this area to meet the human demand well in time.

We are thankful to Professor Paoloni for delivering such an enlightening and scientifically enriched talk on a topic of the need of the hour.

Dr. Pankaj Kumar Dalela

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Message

This webinar lecture on New Frontiers of Sub-THz Wireless Communications Enabled by Travelling Wave Tubes provides us a great insight towards utilization of vacuum tubes as high power, stable broadband transmitter which can have distinct advantage in 5G cellular communication and satellite communication to fill digital divide in India. I have been invited by Professor BN Basu, my fatherly figure, stating that this will help me to learn new development in wireless communication. The comparison shown in the lecture for different use cases was very informative from industrial development point of view especially 5G and 6G communication systems. After attending this webinar I am feeling that there is convergence of vacuum tubes as high frequency, high power, and broadband transmitter in cellular communication for masses especially in disaster situation. Eventually I express my special thanks and appreciation to all involved in the organization of this webinar of topical interest.

Programme of the Webinar

Dedicated to the memory of VED Researcher Jeevan M

Date: 9 January 2021, Saturday

Time: 03:00 – 04:30 pm

Convener: Mr. Raj Singh

03:00 - 03:05 pm Tribute to VED Researcher Jeevan M

Expert Talk

Chair: Professor Pradip Kumar Jain

Duration	Topic of deliberation	Speaker
03:05 - 04:20 pm	New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes	Professor Claudio Paoloni
04:15 - 04:20 pm	Concluding Remarks	Professor Pradip Kumar Jain
04:20 - 04:25 pm	Questions and Comments	Audience
04:25 - 04:30 pm	Vote of thanks	Professor Sheel Aditya

Organizing Committee

Name	Designation	Affiliation	Role
Professor Pradeep Kumar Jain	Director	National Institute of Technology, Patna	Chair
Raj Singh	Scientistific Officer H	Institute of Plasma Research, Gandhinagar	Convener
Prof. B N Basu	Adjunct Professor	Supreme Knowledge Foundation Group of Institutions	Advisor
Professor Sheel Aditya	Professor	Nanyang Technological University, Singapore	Vote of Thanks
Dr. Vishal Kesari	Scientist E	Microwave Tube Research and Development Centre, Bangalore	Editor of Proceedings
Dr. Vishant Gahlaut	Assistant Professor	Banasthali Vidyapith, Banasthali	Webinar Coordinator
Ms. Rupa Basu	Research Scholar	Lancaster University, Lancaster, UK	Coordinating Link
Ms. Nalini Pareek	Scientist	Central Electronics Engineering Research Institute, Pilani	Host

Tribute to VED Researcher

Jeevan Mahadev Rao, Research Scholar, Lancaster University

We inform you with immense sadness and grief that we have lost a valuable member of our community. Mr. Jeevan Mahadev Rao (04/06/1988 – 25/12/2020), a very promising Engineer and Researcher, succumbed to a health complication and passed away at a very early age of 32 years. We would like to pay tribute to him, by dedicating this webinar in his memory.

Jeevan was born in Bangalore, India and spent his formative years there. He was a meritorious student and received a scholarship to pursue a Bachelor of Engineering (B.E). He was awarded the BE degree in Electronics and Communication Engineering from B.M.S College of Engineering, Bangalore, India in 2010. He then went for higher studies and received his M.Tech degree in Microwave & TV Engineering from the College of Engineering, Trivandrum in 2012.

He worked for a short period as a Senior Research Fellow, at DRDO-Microwave Tubes Research and Development Centre, Bangalore where his work was mainly focused on design of millimeter wave Gyrotrons. In 2014, he joined Bharat Electronics Ltd, Bangalore as a Deputy Engineer in the D&E Department of Microwave Tubes Division. He worked in BEL for 4 years, contributing to the development, testing and indigenisation of travelling wave tubes (TWTs) and Microwave

Power Modules. He was instrumental in the finalization of Electronic Power Condition for C-X-Ku Band amplifier.

Mr. S Senthil Kumar, (Sr-DGM, MWT Division, BEL) his supervisor during the 4 years, has shared his grief in the following words:

“Jeevan who was with us for a short period of time for nearly 4 years has left an indelible mark in the minds of Microwave Tubes Fraternity in BEL. He was very attentive, keen observer, quick learner and above all hard working young guy.

It is unbelievable that he is no more with us. Microwave Tubes Community missed a bright contributing engineer and we all pray almighty for his Soul to Rest in peace and to give strength and courage to his family members for the loss.”

Jeevan joined Prof. Claudio Paoloni’s research group at Engineering Department, Lancaster University in November 2018. He worked towards the development of sub-THz traveling wave tubes for high data rate networks and setting up facilities for the TWT lab. His expertise in high voltage power supplies for TWTs, contributed some of the facilities that now permit us to state that Engineering at Lancaster is one of the few academic laboratories worldwide equipped to build state of the art sub-THz tubes.

Jeevan’s interest included reading and hiking. He used to read a lot on diverse topics of interest from science to philosophy. He was very passionate about electronics and would always keep experimenting. Jeevan also devoted his weekend volunteering for the Oxfam Charity at Lancaster. He was a wonderful person, calm, kind and generous. He never denied his help and support to anyone.

Prof. Claudio Paoloni, who is the Head of Engineering & also Jeevan’s Supervisor stated:

“During these two years at Lancaster, Jeevan was a privilege to work with. I really enjoyed discussing with ideas, plans, challenges and solutions with Jeevan and was impressed by his considerate and highly professional approach to challenges and novelties.

He was a very talented part time PhD student and produced very high-quality research. Jeevan has been great value for Engineering and my research group, we sincerely miss him. His memory will continue to be alive by the research achievements seeded by his excellent work and contribution".

Jeevan is remembered as an attentive, keen observer, quick learner and above all a hard working person.

Publications:

1. Rupa Basu, Jeevan M. Rao, Rosa Letizia, Qiang Ni, Edward Wasige, Abdullah Al-Khalidi, Jue Wang, Claudio Paoloni, "Front end for D-band high data rate point to point links," 45th Int. Conf. Infrared, Millimeter and Terahertz Waves (IRMMW-THz), NY USA, Nov 8-13, 2020.

2. Claudio Paoloni, Rupa Basu, Jeevan Rao, Rosa Letizia, "Sub-THz traveling wave tubes for novel wireless high capacity networks," IEEE Int. Conf. on Plasma Sciences (ICOPS2020), virtual, Dec 6-10, 2020.

3. Claudio Paoloni, Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Rosa Letizia, Qiang Ni, Edward Wasige, Abdullah Al-Khalidi, Jue Wang, and Razvan Morariu, "Long range millimeter wave wireless links enabled by traveling wave tubes and resonant tunnelling diodes," IET MAP 2020.

4. Claudio Paoloni, Viktor Krozer, François Magne Trung Le, Maruf Hossain, Rupa Basu, Jeevan M Rao, Rosa Letizia, Ernesto Limiti, Marc Marilier, Giacomo Ulisse, Antonio Ramirez, Borja Vidal, Hadi Yacob, "Advancement in high capacity wireless distribution above 140 GHz," 13th UK-Europe-China Workshop on Millimetre-Waves and Terahertz Technologies (UCMMT2020), virtual, Aug 29 – Sep 1 2020.

5. Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Rosa Letizia, Claudio Paoloni, "TWTs for point to point D-band wireless links," IEEE International Vacuum Electronics Conference (IVEC), California, USA, Oct 26-29, 2020.

6. Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Nicholas Rennison, Benjamin Rodgers, Quang Trung Le, Rosa Letizia, Claudio Paoloni, “On a D-band traveling wave tube for wireless links,” IEEE International Vacuum Electronics Conference (IVEC), California, USA, Oct 26-29, 2020.

7. Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Logan Himes, Yuan Zheng, Nicholas Rennison, Benjamin Rodgers, Rosa Letizia, Diana Gamzina, Neville C. Luhmann, Jr, Claudio Paoloni, “Design and microfabrication of a double corrugated waveguide for G-band TWTs,” IEEE International Vacuum Electronics Conference (IVEC), California, USA, Oct 26-29, 2020.

8. Claudio Paoloni, Viktor Krozer, Francis Magne, Quang Trung Le, Rupa Basu, Jeevan Rao, Rosa Letizia, Ernesto Limiti, Marc Marilier, Giacomo Ulisse, Antonio Ramirez, Borja Vidal and Hadi Yacob, “D-band point to multi-point deployment with G-band transport,” European Conference on Networks and Communications (EuCNC 2020): Operational & Experimental Insights (OPE); Dubrovnik, Croatia, 15-18 June 2020.

9. Laxma Billa, Claudio Paoloni, Rosa Letizia, Rupa Basu, Jeevan M. Rao, Qiang Ni, Edward Wasige, Abdullah Al-Khalidi, Jue Wang, “Long range millimeter wave wireless links enabled by traveling wave tubes and resonant tunnelling diodes,” 12th UK/Europe-China Workshop on Millimetre-Waves and Terahertz Technologies (UCMMT-2019), IEEE, 2019.

10. Rupa Basu, Laxma Billa, Jeevan M. Rao, Rosa Letizia, Claudio Paoloni, “Design and fabrication of a D-band traveling wave tube for millimeter wave communications,” 44th Int. Conf. Infrared Millimeter and Terahertz Waves, 2019.

11. Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Rosa Letizia, Claudio Paoloni, “Design of slow wave structure for G-band TWT for high data rate links,” IEEE Int. Vacuum Electronics Conf. (IVEC-2019), Busan, S. Korea, 2019.

12. Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Rosa Letizia, Claudio Paoloni, “Design of D-band double corrugated waveguide TWT for wireless communications,” IEEE Int. Vacuum Electronics Conf. (IVEC-2019), Busan, S. Korea, 2019.

13. Jeevan M., Vishal Kesari, S. Kamath, “Beam present simulation of $TE_{10,4}$ mode gyrotron cavity’, National Conf. Emerging Trends in Vacuum Electronic Devices and Applications, 3-5 Dec. 2015.

14. Jeevan M., Vishal Kesari, S. Karmakar, S. Kamath, and M. V. Kartikeyan, “Simulation of higher order modes in a tapered circular cavity for a millimeter-wave gyrotron,” 9th Int. Conf. Microwaves, Antenna, Propagation and Remote Sensing (ICMARS-2013), International Centre for Radio Science, Jodhpur, India, 11-14 Dec. 2013.

It is note worthy that for his very first publication [14] in conference proceedings he could win **best paper award**.

Expert Talk

Topic of Deliberation

New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

Speaker

Professor Claudio Paoloni

Professor Pradeep Kumar Jain

Director
National Institute of Technology, Patna

Professor
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Chairman's Desk

I thank the organizers of VED Thinkers Group to give me an opportunity to chair the webinar lecture session in which Professor Claudio Paoloni delivered his discourse on "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes."

Professor Paoloni began his talk by apprising us of the opportunity of exploring the sub-THz spectrum (W, D, and G bands) in wireless communication in the perspective of cost, technology and feasibility. He also explained his role of executing projects at Lancaster University on the development of travelling-wave tube based W-band wireless networks with high data rate distribution, spectrum and energy efficiency, in tandem with various companies such as Thales and universities such as Goethe University aiming at achieving 100Gbps/km^2 wireless communication.

In particular, Professor Paoloni mentioned about his effort to develop TWTs at D (141-149GHz) and G (275–305GHz) bands with a view to bringing Europe at the state-of-the-art in wireless high capacity networks by providing an ultra-capacity layer with the combination of D-band point-to-multipoint and G-band point-to-point links. He discussed how he and his team addressed the challenges at Lancaster University aiming at

developing TWTs in 'DLINK' technology: (i) D-band TWT with frequency 151-161.5GHz, output power 10W, gain 35-40dB and bandwidth 10GHz and (ii) G-band TWT with frequency 161.5–174.5GHz GHz, output power 10W, gain 35-40dB and bandwidth 13GHz. Lancaster University has one of the select laboratories worldwide which has developed several facilities, namely, (i) microfabrication technology such as CNC milling, CNC Lathe, and LIGA (lithography, electroplating, and moulding) for the fabrication of slow-wave structure such as folded-waveguide; (ii) tube-part assembly such as diffusion bonding, laser welding, brazing, and TIG Welding; (iii) tube processing and conditioning such as **v**acuum pumping, baking, and cathode conditioning; and (v) tube testing such as vacuum leakage test, magnetic field measurements, magnetizer, high voltage test, beam transmission test, vector network analyzer up to 220 GHz.

Professor Paoloni thus through his presentation has narrated his effort in developing millimetre-wave and sub-THz TWTs that has huge impact on the creation of new high capacity wireless communication networks. His lecture has evoked a lot of interest among the participants. I am happy to note that Professor Paoloni enjoyed responding to the questions and comments from them. Hats off to Professor Paoloni for presenting such an illuminating lecture to the VED Thinkers Group!

Professor Claudio Paoloni

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New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

(In memoriam of Jeevan M. Rao)

Claudio Paoloni, Rupa Basu, Jeevan M. Rao and Rosa Letizia

The huge increase of wireless internet traffic cannot be anymore supported by the actual networks. 5G relies on high density deployment of small cells with radius below 100 m. Wireless backhaul is considered an affordable and attractive solution in alternative to fiber. The needed Gigabit per second data rate can be only supported by the wide frequency bands available above 100 GHz. The W-band (92 -95 GHz) and D-band (141 – 174.5 GHz) have relatively low attenuation and wide bands available for data transmission, making them attractive for point to multipoint backhaul.

However, solid state power amplifiers at this frequency have no sufficient power to assure hundreds of meter propagation range in rain condition.

The talk describes our pioneering vision to create novel wireless network with high capacity enabled by new generation traveling wave tubes.

Two large projects funded by European Commission Horizon 2020, Claudio Paoloni coordinates, are exploring the design and fabrication of

multigigabit per second wireless networks. The two projects include international partners covering the full expertise for building front end from C band at modem level up to W-band, D-band and G-band.

The first one is EU H2020 TWEETHER Traveling wave tube based W-band wireless networks with high data rate distribution, spectrum & energy efficiency, that has for the first time demonstrated a Point to point wireless system at W-band (92 -95 GHz). The TWT was designed and fabricated based on folded waveguide.

The second still in progress is EU H2020 ULTRAWAVE "Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes". A transmission hub and terminals at D-band are in advanced fabrication stage and the D-band point to point system will be tested at Universitat Politechnica de Valencia (Spain). The G-band transmitter is in fabrication. One TWT at D-band and one TWT at G-band are in fabrication phase.

The double corrugated waveguide, due to its easy fabrication is used for the D-band and Gband TWT. The D-band TWT is designed to provide 10 W and 35 - 40 dB gain.

Expert Biography

Claudio Paoloni received the degree cum laude in Electronic Engineering from the University of Rome “Sapienza”, Italy. He was assistant professor at the University of Rome, Tor Vergata, Italy, Since 2012, he has been Cockcroft Chair with the Engineering Department, Lancaster University, U.K. Since 2015, he has been the Head of Engineering Department.

He is member at large of the Board of Governors of IEEE Electron Devices Society. He is IEEE Senior member and Senior Fellow of the Higher Education Academy. He was Chair of the IEEE Electron Devices Society Vacuum Electronics Technical Committee (2017 – 2020). He was Guest Editor for the Special Issue of Transaction on Electron Devices on Vacuum Electronics (June 2014).

He is member of the editorial board of Journal of Infrared and millimetre waves. He organised numerous international conferences and workshops, on vacuum electronics, millimetre wave and terahertz communications and technology. He is regular member of TPC of major conferences.

He is coordinator of two European Commission Horizon 2020 projects, TWEETHER and ULTRAWAVE and Principal Investigator in a number of EPSRC research grant.

He is author of more than 240 articles in international journals and conferences in the field of high frequency electronics, millimetre waves and THz vacuum electronics devices, microfabrication, wireless communications.

Relevant Publications

C. Paoloni, R. Basu, L. Billa, J. Mahadev Rao, R. Letizia, Q. Ni, E. Wasige, A. Al-Khalidi, J. Wang, and R. Morariu, “Long-range millimetre wave wireless links enabled by travelling wave tubes and resonant tunnelling diodes,” IET Microwaves, Antennas and Propagation, vol. 14, no. 15, pp. 2110 – 2114, 2020 (Invited). https://doi.org/10.1049/iet-map.2020.0084

C. Paoloni, D. Gamzina, R. Letizia, Y. Zheng and N. C. Luhmann Jr., “Milimeter Wave Traveling Wave Tubes for the 21st Century”, J. Electromagn. Wav. Appl., Dec. 2020. (Invited) https://doi.org/10.1080/09205071.2020.1848643

F. André, et al., "Technology, assembly, and test of a W-Band traveling wave tube for new 5G high-capacity networks," IEEE Transactions on Electron Devices, vol. 67, no. 7, pp. 2919-2924, July 2020, doi: 10.1109/TED.2020.2993243.

Some Questions and Comments

Question/Comment from Professor B. N. Basu

1. Prior to the implementation of vacuum microelectronics such as EDM, DRIE and LIGA, attempts were made in developing mm-wave TWTs using highly thermally-conducting II-A diamond helix support rods or by plasma-spraying BeO over the outer surface of the helix over the length of the helix. Perhaps Hughes Company developed mm-wave TWTs without going for vacuum microelectronic techniques, to the best of my knowledge.
2. There was some study made on the enhancement of the transverse dimensions of a folded waveguide by metamaterial assistance for its potential applications in the high-frequency regime. What do you think is the prospect of such study in the practical development of folded waveguide TWTs?

Question/Comment from Dr. Pankaj Dalela

3. In Indian scenario natural disasters are very prominent, which cause telecommunication backhaul fiber cut and hence isolate disaster prone area from the rest of the world. In this context,

   (a) Can we create sub THz-TWT based secured point-to-point long-distance backhaul link?

   (b) Can we carry such system in a mobile van with a portable power generator?

   (c) Can this system support application of power amplifier in fragmented bandwidth?

Question/Comment from Dr. A. Bandyopadhyay

4. Could you comment on the possibility of relevant systems in V band?
5. What should be the power level at ~60 GHz?
6. Should the thermal effects be considered in antennas with radiated power in watts at mm wave with MIMO type?

Question/Comment from Dr. Richards Joe Stanislaus

7. What is the maximum beam current density that has been achieved in the D band/G band TWTAs?
8. Were the periodic cusp magnets used in D band/G band TWTAs, or did they have PPM? What were the magnetic field values used in the respective TWTAs?

Question/Comment from Mumtaz Ansari

9. What are the slow-wave structures other than the folded waveguide, and what are the VEDs other than the TWT used in the sub-THz band?

Topic of Deliberation

Vote of Thanks

Proposed by

Professor Sheel Aditya

Professor Sheel Aditya

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It is my easy and pleasant duty to propose a vote of thanks for this program. First of all I thank the speaker Professor Claudio Paoloni from Lancaster University, UK for an extremely informative and state-of-the-art presentation on "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes". The speaker, a renowned expert in this area of research, included highly informative charts that showed the current status of wireless communication and went on to propose application of millimetre-wave TWTs in wireless communication networks. He listed various projects in this area which are running in different parts of the world and described the projects running at Lancaster University. He described the system architecture for futuristic wireless communication networks, showed the fabricated components of TWTs at millimetre-wave bands, and mentioned the challenges in realizing TWTs at such high frequencies. The audience participation clearly demonstrated their appreciation for the advanced and thorough presentation.

Thanks are due to the Chair of the webinar, Professor Pradeep Kumar Jain, Director National Institute of Technology, Patna and Professor Indian Institute of Technology, Banaras Hindu University, India, for expertly conducting the session. He introduced the speaker and summarized the key takeaways after the presentation.

The host of the webinar, Ms. Nalini Pareek, CSIR-CEERI, India, efficiently managed the entire proceedings. The coordinator, Ms. Rupa Basu, Lancaster University, UK, liaised with the speaker to fix up a mutually convenient date and time for the webinar. The convenor, Mr. Raj Singh diligently put together the program for the webinar and kept the Thinkers in VED community informed. Very effective IT management was performed by Dr. Vishant Gahlaut and Dr. Uttam Goswami. Sincere thanks are due to all these scientists.

Last but not the least, very grateful thanks are due to Professor B. N. Basu, who is the guiding and motivating spirit behind the Thinkers in VED community and who has tirelessly worked to establish this unique series of webinars.

Annexure I:
Expert Talk Slides

Lancaster University

In memoriam of Jeevan M Rao

Thinkers in VED' Group

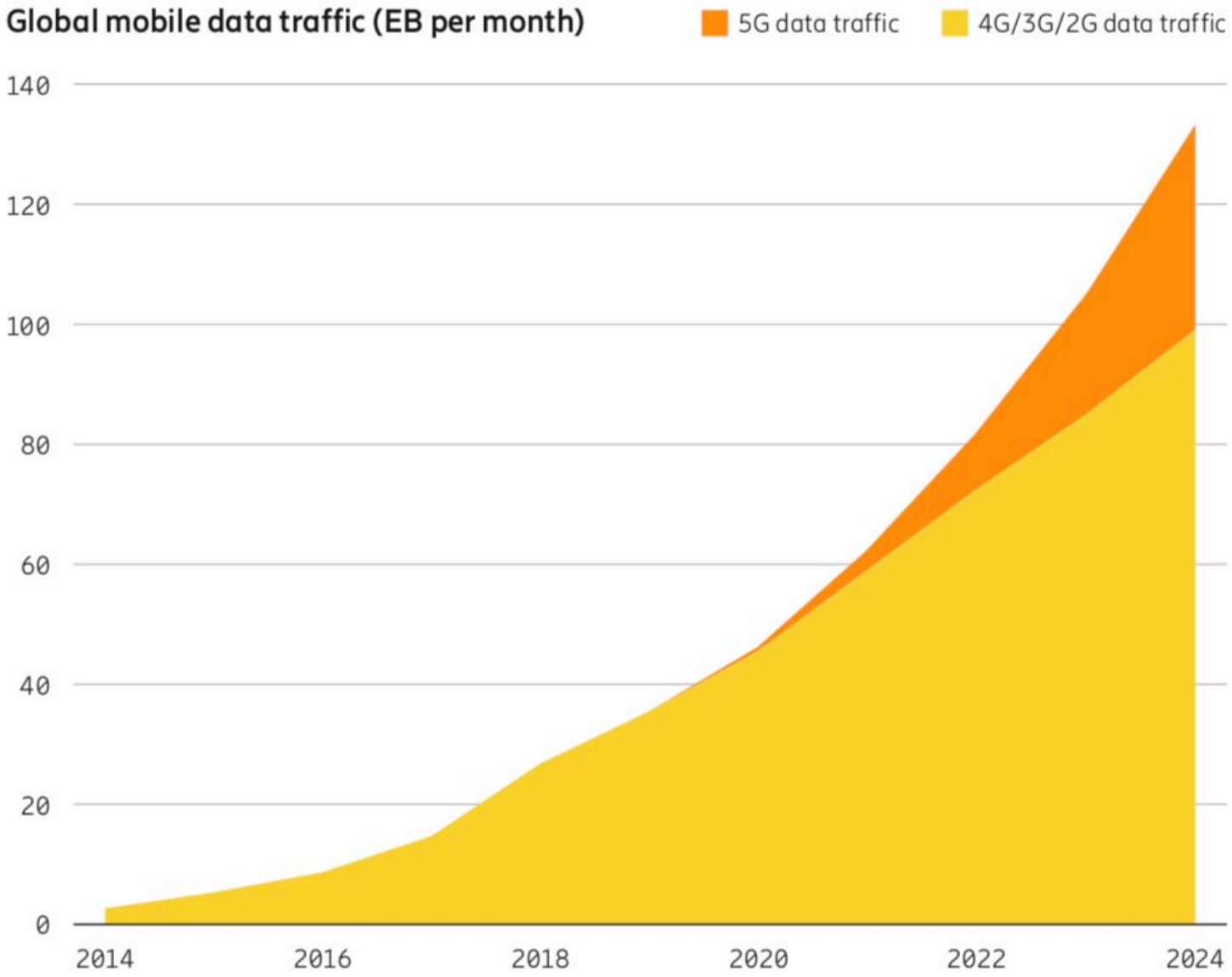
New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

Claudio Paoloni
Rupa Basu, Jeevan M Rao, Rosa Letizia
Engineering Department
Lancaster University

Thinkers In VED 9th January 2021

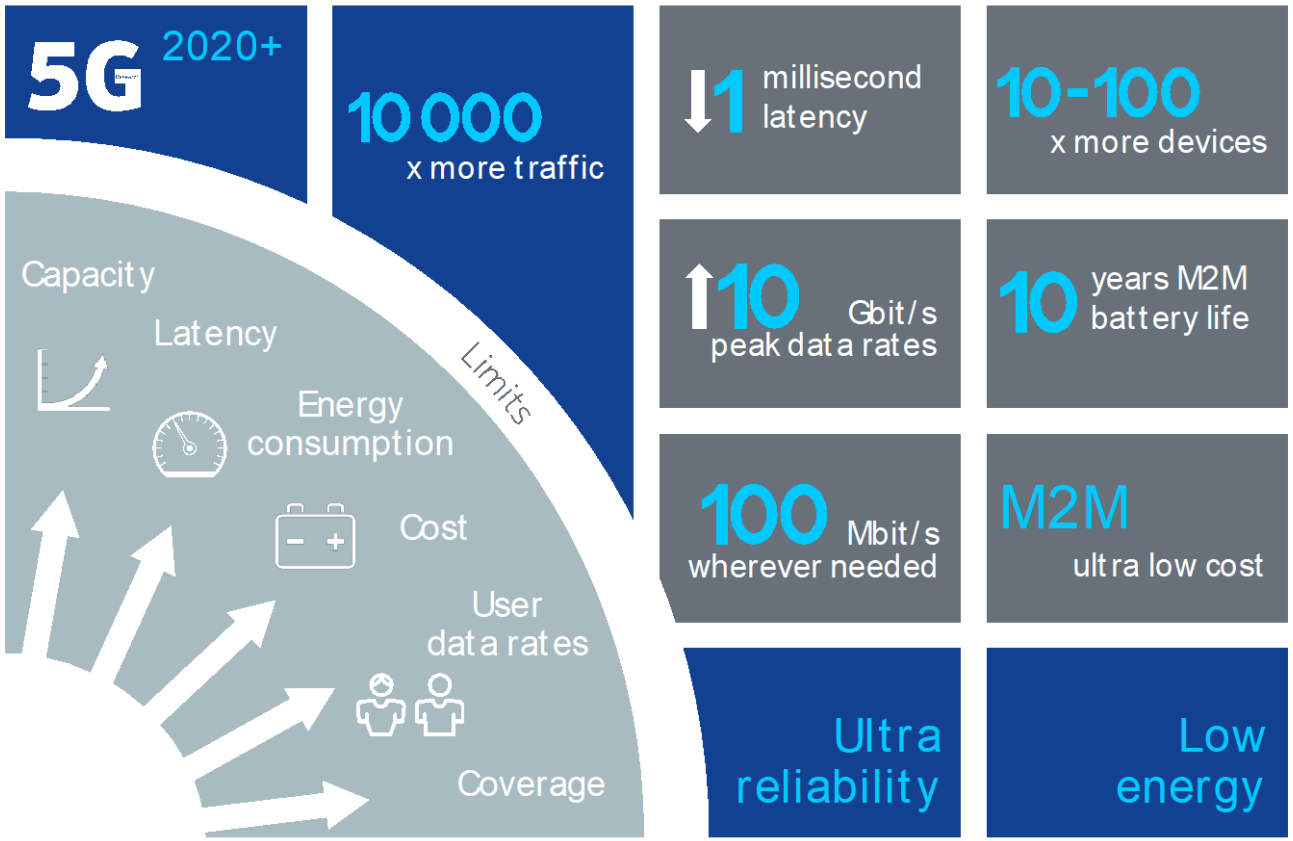
More data for mobile traffic and internet

Lancaster University



Courtesy Ericsonn

Stretching performance targets for 5G

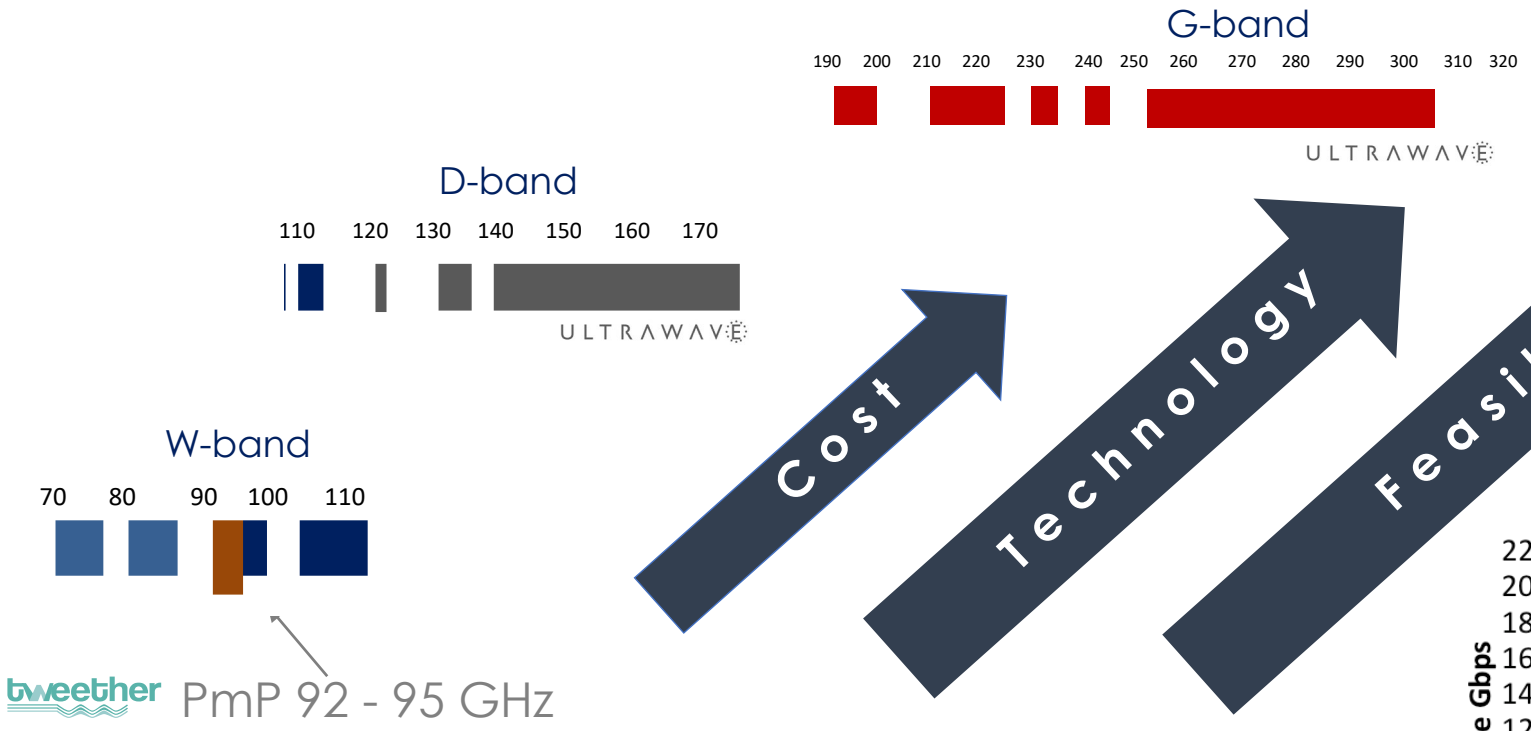


6G Requirements *(versus 5G)*

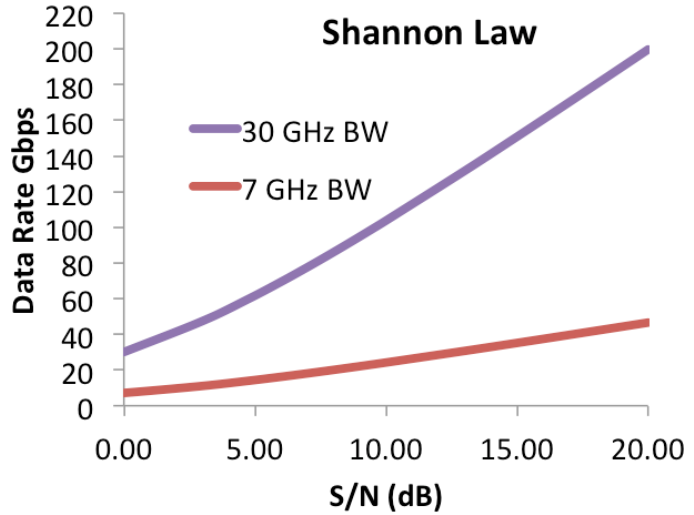
KPI	5G		6G	
Peak data rate	20 Gb/s	10x	1 Tb/s	both indoor and outdoor
Experienced data rate	0.1 Gb/s	10x	1 Gb/s	@ 95% of UE locations
Peak spectral efficiency	30 b/s/Hz		60 b/s/Hz	with MIMO technology and modulations
Experienced spectral efficiency	0.3 b/s/Hz	10x	3 b/s/Hz	
Maximum bandwidth	1 GHz	100x	100 GHz	THz, optical bands
Area traffic capacity	10 Mb/s/m^2		1 Gb/s/m^2	
Connection density	10^6 devices/km^2	10x	10^7 devices/km^2	5x10^{11} connected devices by 2030
Energy efficiency	not specified		1 Tb/J	Energy efficiency is core of 6G
Latency	1 ms		100 µs	
Reliability	1-10^{-5}		1-10^{-9}	Mission and safety-critical applications
Jitter	not specified		1 µs	
Mobility	500 km/h		1000 km/h	

HUAWEI

Opportunity – sub-THz spectrum



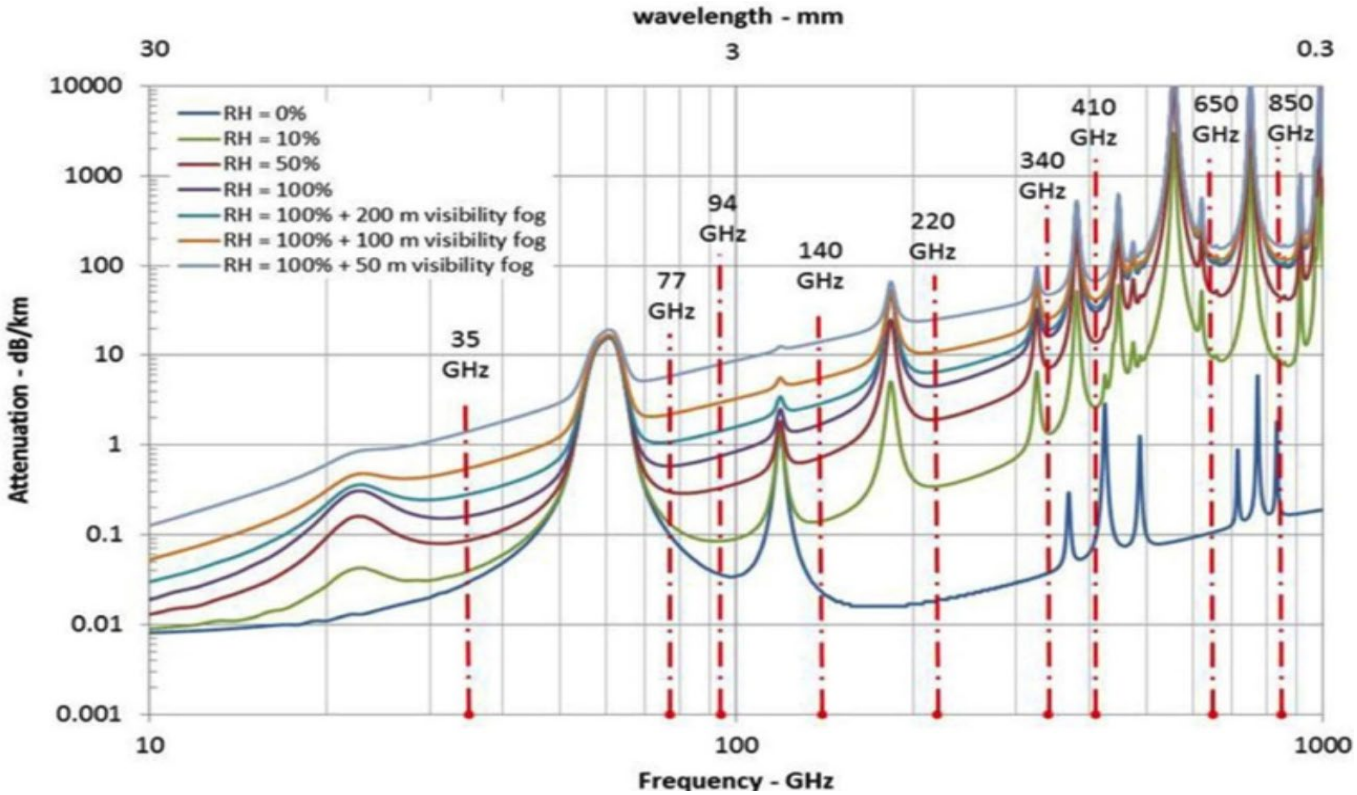
Challenges



The aggregation of the three bands could provide more than 100 Gbps/km^2

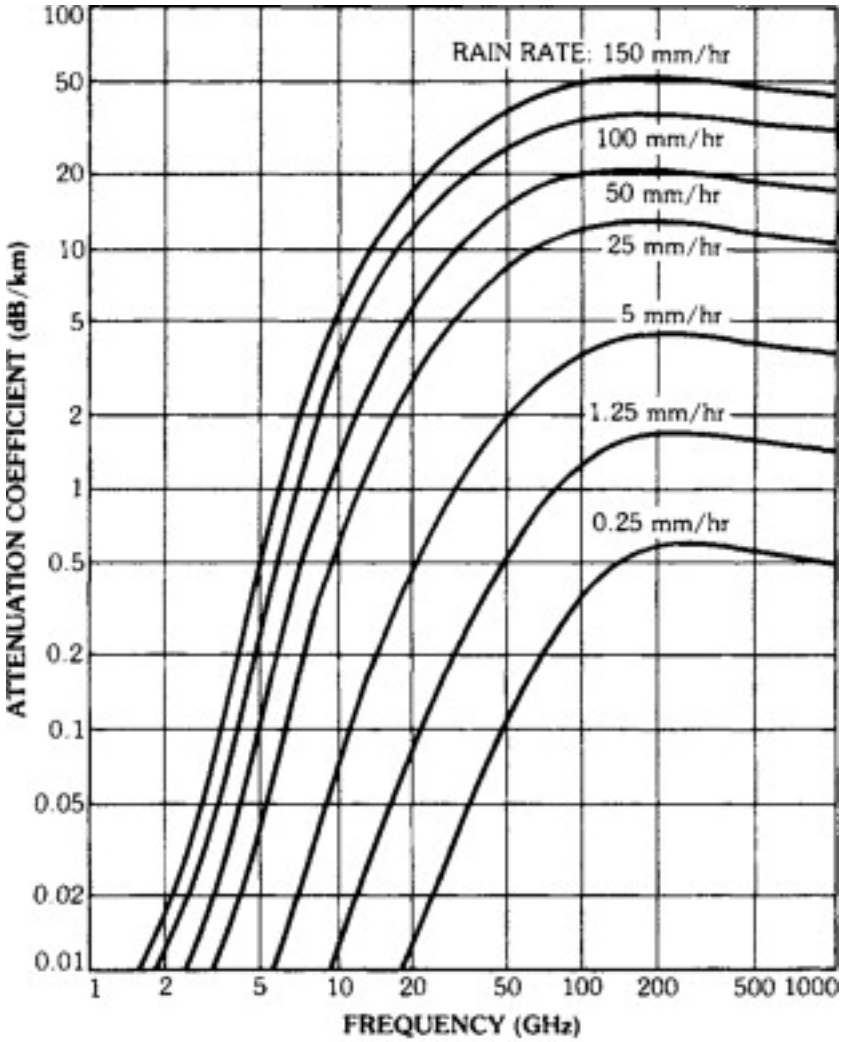
Challenge and opportunity: Atmosphere attenuation

Challenging for availability



Humidity

Rain

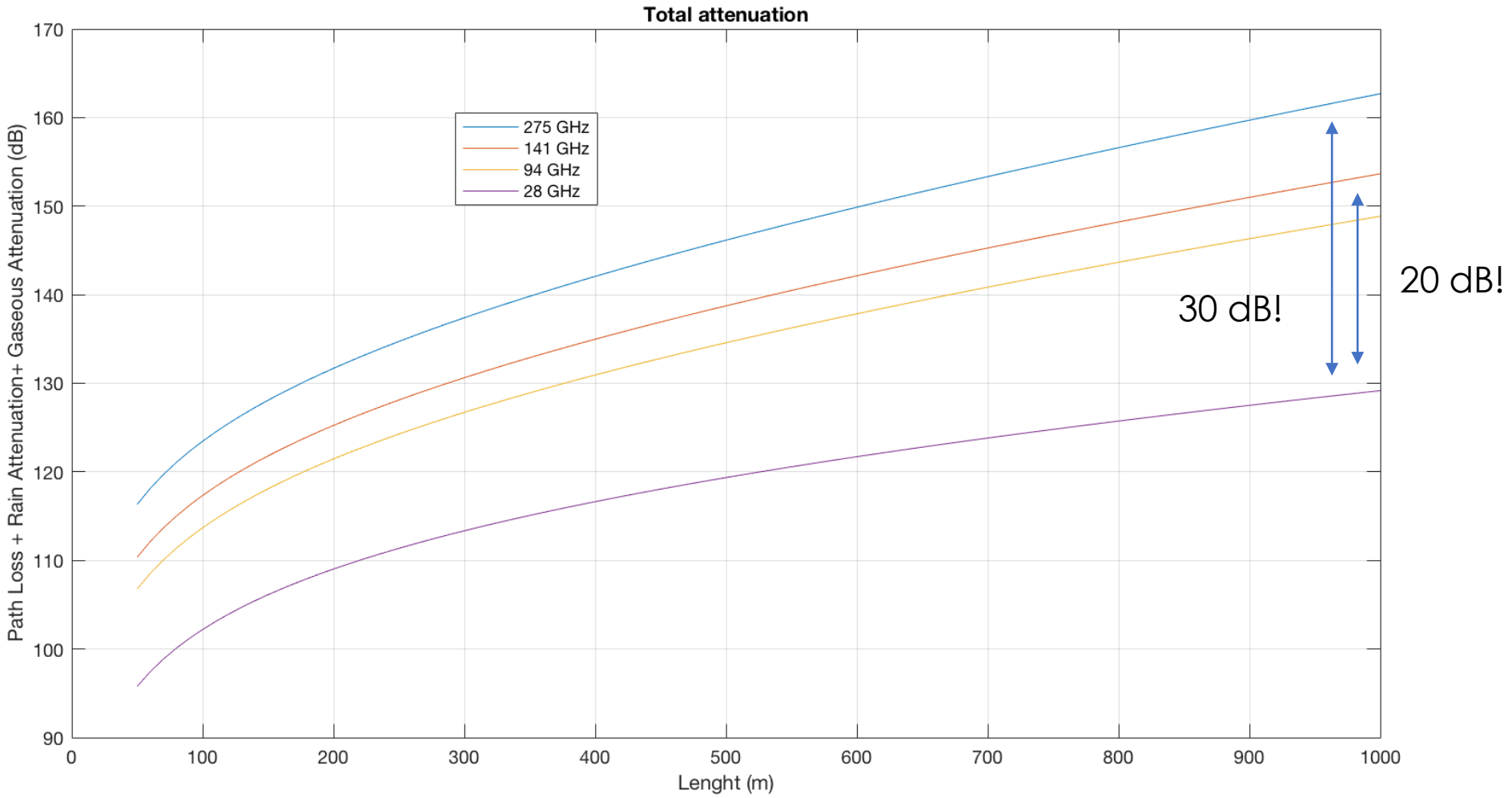


Raindrop size distribution: Laws and Parsons, 1943
Terminal velocity of raindrops: Gunn and Kinzer, 1949
Dielectric constant of water at 20°C: Ray, 1972

Challenge and opportunity: up to 30 dB needed

Lancaster University

Thinkers In VED 9th January 2021



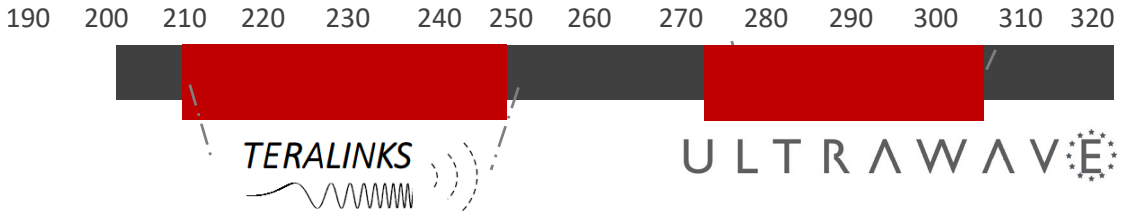
Projects on sub-THz wireless systems at Lancaster

Lancaster University

Thinkers In VED 9th January 2021

← Microwaves

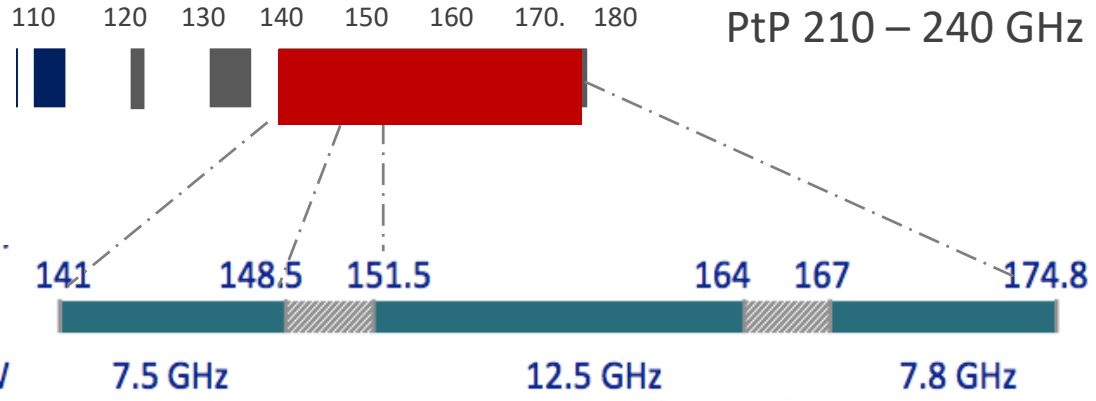
G-band → THz



PtP 210 – 240 GHz

PtP 275 – 305 GHz

D-band



ULTRAWAVE

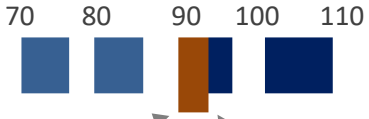
PmP 141 – 148.5 GHz

DLINK

PtP 151.5 – 161.5 GHz

PtP 161.5 – 174.8 GHz

W-band



tweether

PmP 92 - 95 GHz

About €7M

tweether

Traveling wave tube based W-band wireless networks with high data rate distribution, spectrum and energy efficiency

Thinkers In VED 9th January 2021

THALES

Company Leader in TWTs

Lancaster University

Project Coordinator
TWT technology

BOWEN

Innovative RF technologies

OMMIC
Innovating with III-V's

Supplier of MMIC up to 300 GHz

- Start date 1st January 2015
- End Date 30st September 2018
- Funding €3.33M

fibernova

Photonics devices and subsystems

HÜBNER
HF Systems Engineering

Millimeter wave
and THz technologies

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Network architecture

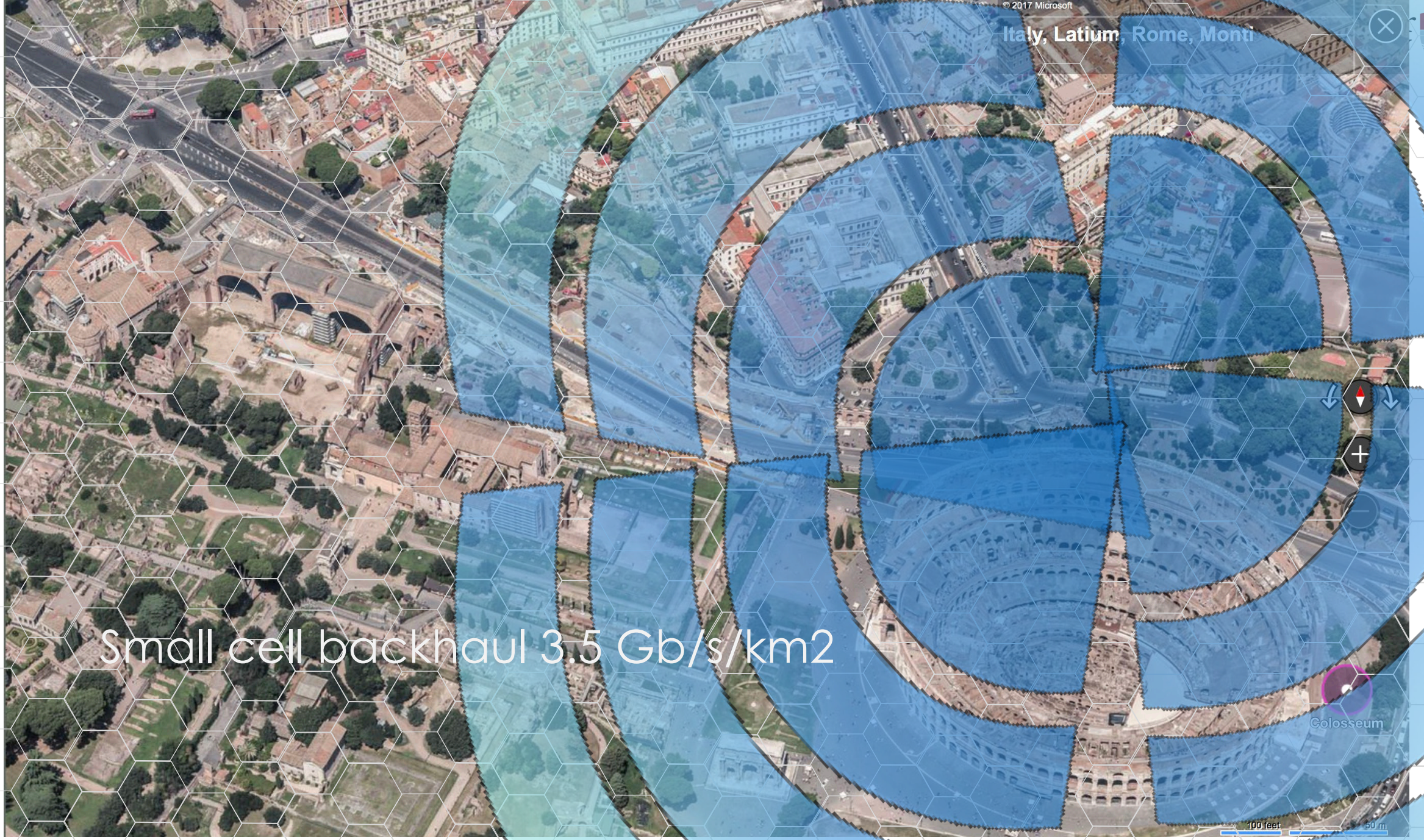
GOETHE UNIVERSITÄT FRANKFURT AM MAIN

THz technologies

TELECOM ParisTech

Millimeter wave Antennas and components

Thinkers In VED 9th January 2021




Fixed wireless access
Morecambe
Heysham
Lancaster
Royal Lancaster Infirmary
Heaton
Aldcliffe
Middleton
Stodday
Halton
Marine Rd E
Marine Rd W
Balmoral Rd
Oxcliffe Rd
Westgate
Bare Ln
A589
B5274
B5273
B5321
A6
A683
M6
Halton Rd
River Lune
Lancaster Rd
Heysham Rd
Middleton Rd
Ashton Rd
Google

Performance and specifications

Lancaster University

Thinkers In VED 9th January 2021

Scenario:
1 GHz per operator
Each sector 500 MHz for frequency reuse
10 channels 40 MHz, 10 MHz guard
Modulation order max **64QAM3/4**
Availability: **99.99%**
Range more than **1 km**
Frequency **92 -95 GHz**

Capacity per sector 1.35 Gbps

Total capacity

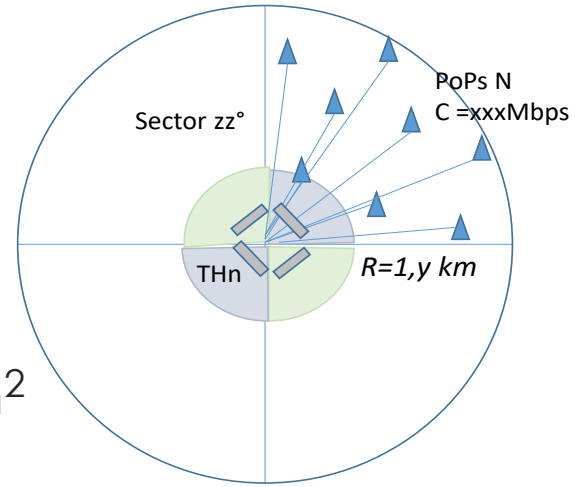
S (number of sectors) *1.35 Gbps

S = 4 C = 5.3 Gbps

S = 6 C = 8.1 Gbps

S = 8 C = 10.6 Gbps

Area capacity 3.5 Gbps/km^2



The output power specifications :

Transmission Hub: 10 W linear, 6dB backoff, **40W** saturated.

No solid-state PA are available to provide this power

Terminals: 23 dBm (saturated)

PmP Competitive Footprint and TCO

Lancaster University

Backhaul of 10 small cells 20% Footprint TCO 30% lower

ULTRAWAVE

Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes

Thinkers In VED 9th January 2021

Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes

- Toward 100 Gbps/km^2
- To provide an ultracapacity layer by combination of D-band Point to multipoint and G-band Point to Point links
- To build the enabling technology for millimeter waves up to 300 GHz
- To build two novel TWT at D band (141 -149 GHz) and G-band (275 – 305 GHz)
- To bring Europe at the state of the art in wireless high capacity networks

Lancaster University

Lancaster University

Leibniz Ferdinand Braun Institut

OMMIC Innovating with III-V's

GOETHE UNIVERSITÄT FRANKFURT AM MAIN

HÜBNER HF Systems Engineering

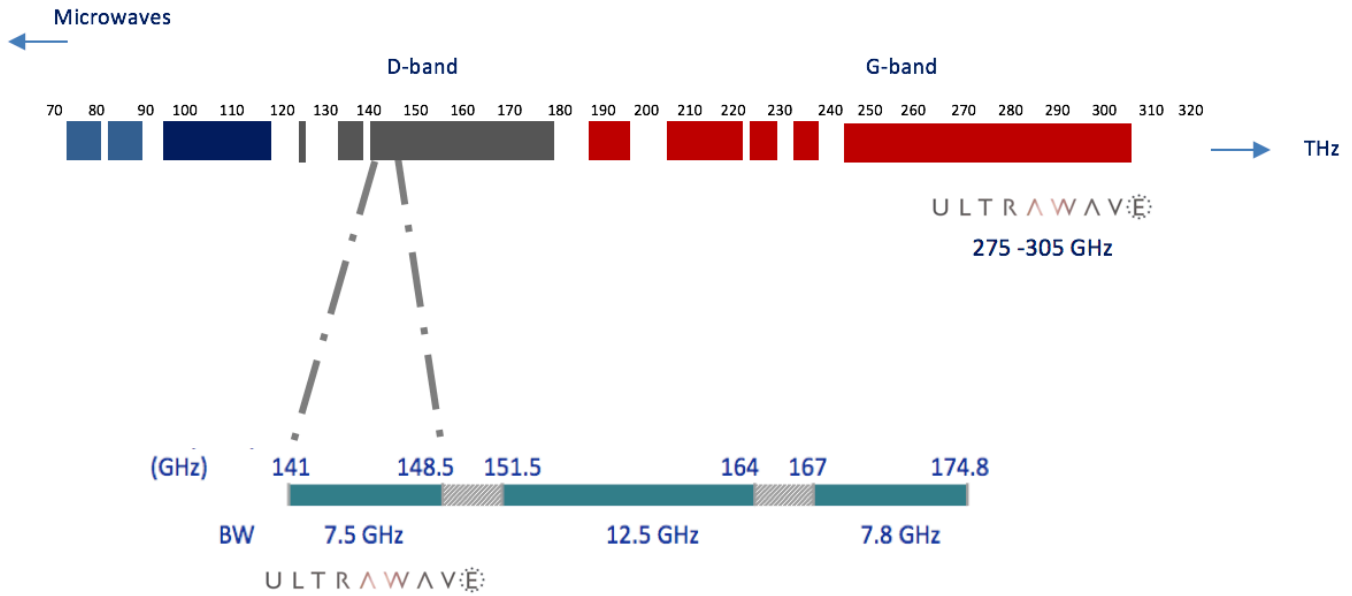
fibernova

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Università di Roma Tor Vergata

The concept: ULTRAWAVE

Lancaster University



Challenges and breakthrough above 140 GHz

Lancaster University

- Novel European MMIC chipset at D-band and G-band
  - Design and testing
  - Low noise at G-band
- Novel millimeter waves Traveling Wave Tubes
    - Formidable micromechanic task
    - Developing affordable fabrication processes
    - Low cost
    - Suitable for large scale production
- Novel D-band Sub Assembly
    - Transitions, packaging and integration
- Photonics transmitter

Millimeter wave TWT
Only a few laboratory worldwide.
One in Lancaster University

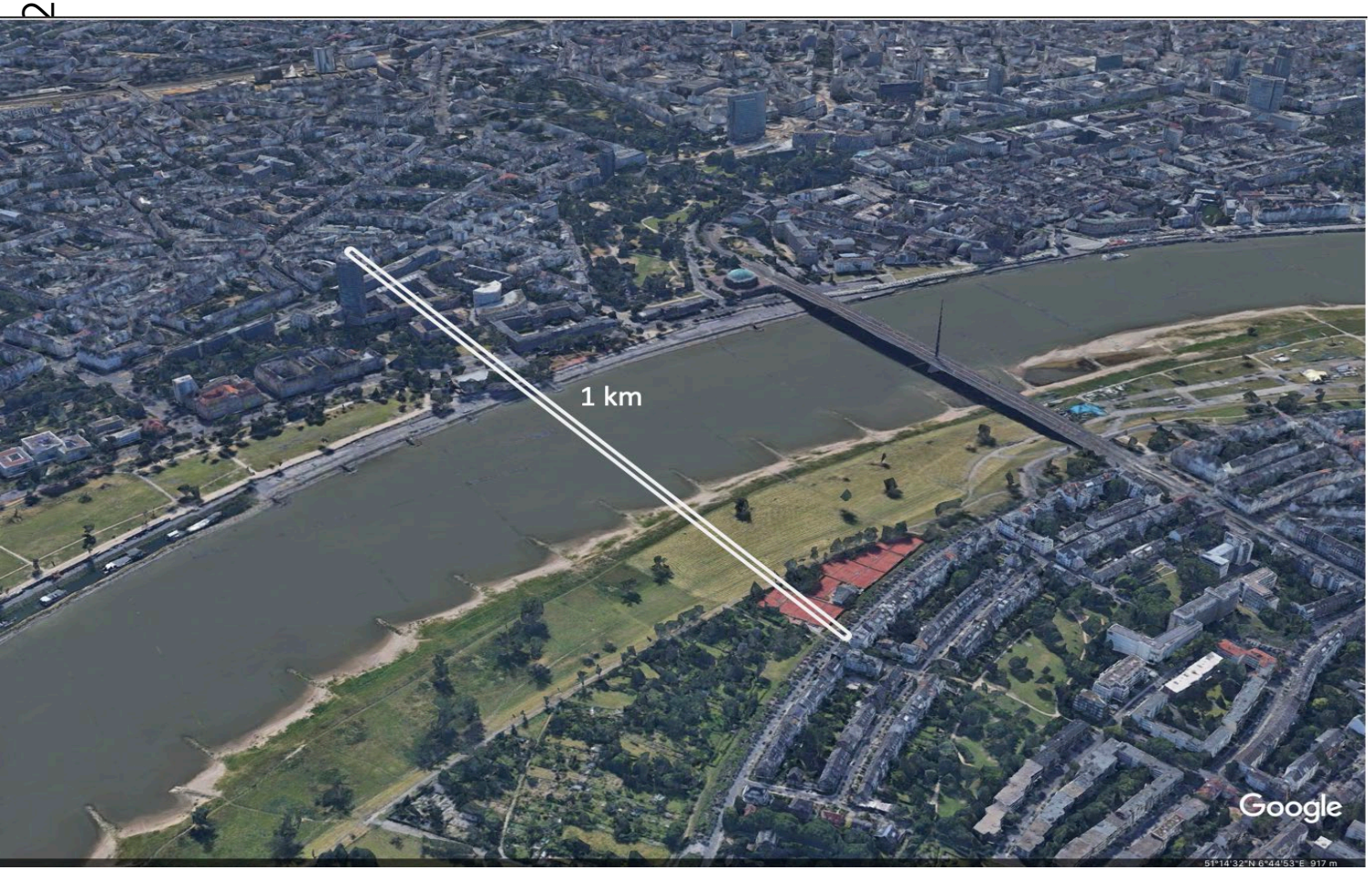
DLINK D-band Wireless Link with Fibre Data Rate

Lancaster University

1. Demonstrate the first long distance, D-band Point to Point link with unprecedented 45 Gb/s over 1 km distance with 99.99% availability in ITU zone K

DLINK

DLINK D-band Wireless Link with Fibre Data Rate

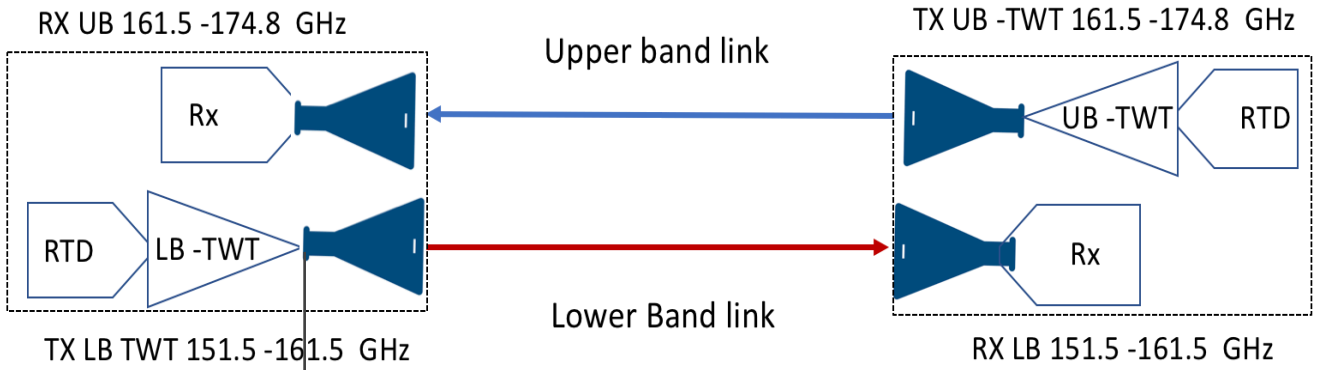


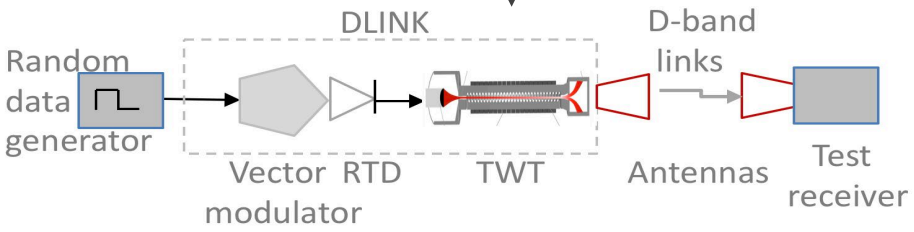
2. Design and build novel D-band Traveling Wave Tubes (TWTs) with state of the art performance, up to 10% bandwidth, 10W (40dBm) saturated power and 40dB gain for large volume fabrication.

3. Design and build the first transmitter based on a Resonant Tunnelling Diode (RTD) oscillator integrated with a vector modulator using PIN diodes on the same substrate for high data rate at D-band.

EPSRC
Engineering and Physical Sciences Research Council

DLINK Technology





Each front end includes one vector modulator, one RTD, one TWT, and one receiver.

DLINK full system consists of two front ends:

- one for transmission in the Upper Band with receiver in Lower Band,
- the second, for transmission in Lower Band with receiver in Upper Band.
- FDD

DLINK performance

Lancaster University

DLINK D-band Wireless Link with Fibre Data Rate

	D-band TWT	G-band TWT
Frequency	151 – 161.5 GHz	161.5 – 174.5GHz
Bandwidth	10 GHz	13 GHz
Gain	35 - 40 dB	35 - 40 dB
Output power, P_{sat}	10 W	10 W

Millimeter wave vacuum electron devices: very difficult to build

VEDs are three-dimensional metal structures with high precision alignment

- Fabrication
  - Reliable manufacturing of miniature electromagnetic structures
  - High quality surfaces and compatible with hard vacuum, high temperature thermal processing during manufacture,
  - Highly precise alignment accuracy (micron-level or < 0.1 degree) between components (cathode, beam optics, electromagnetic circuit, and beam collector)

- High quality cathodes
  - New cathodes that enable high current density, small cross-section electron beams with long lifetimes and lower cathode temperatures

- Interaction structures
  - Novel circuit designs having strong beam-wave interaction at THz frequencies with low voltage electron beams

Millimetre wave Traveling Wave Tubes: challenges

Lancaster University

- High vacuum level 10^{-7} - 10^{-8} Torr
  - Material vacuum compatible
  - High vacuum sealing

- Low cost
  - Low voltage for low power supply cost
  - Low cost cathode and gun subassembly

- Simulations
  - 3D particle in cell simulators, million of cells, million of particles to model the beam
    - Conventional PC: days or weeks
    - GPU: one or more days.
    - No tuning, accuracy depends on the mesh density.

Traveling Wave Tube Fab Lancaster

Lancaster University

Thinkers In VED 9th January 2021

Fabrication
- CNC milling
- CNC Lathe
- Electroforming
- LIGA

Assembly
- Diffusion bonding
- Laser welding
- Brazing
- TIG Welding

TWT conditioning
- Vacuum pumping
- Baking
- Cathode conditioning

Test
- Vacuum leakage
- Magnetic field measurements
- Magnetizer
- High voltage test
- Beam transmission test
- Vector Network analyzer up to 220 GHz

Microfabrication technologies for THz

Lancaster University

CNC milling

CNC Computer Numerical Control
- High speed for one piece
- High precision
- Low cost

Lithography

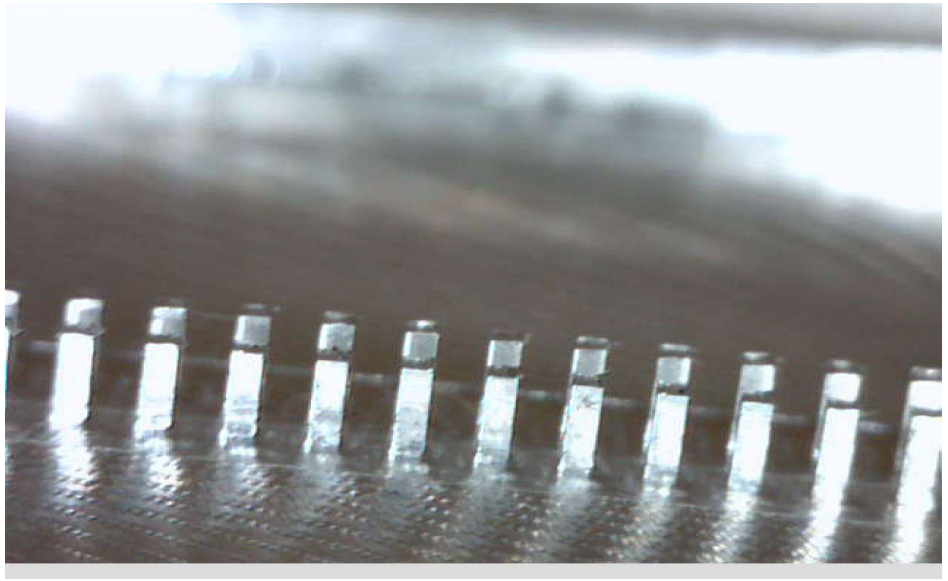
LIGA Lithography, Electroplating, and Molding
- UV LIGA
- Deep X-ray LIGA
- Multiple SWSs at the same time.
- Electroforming slow (weeks)

?

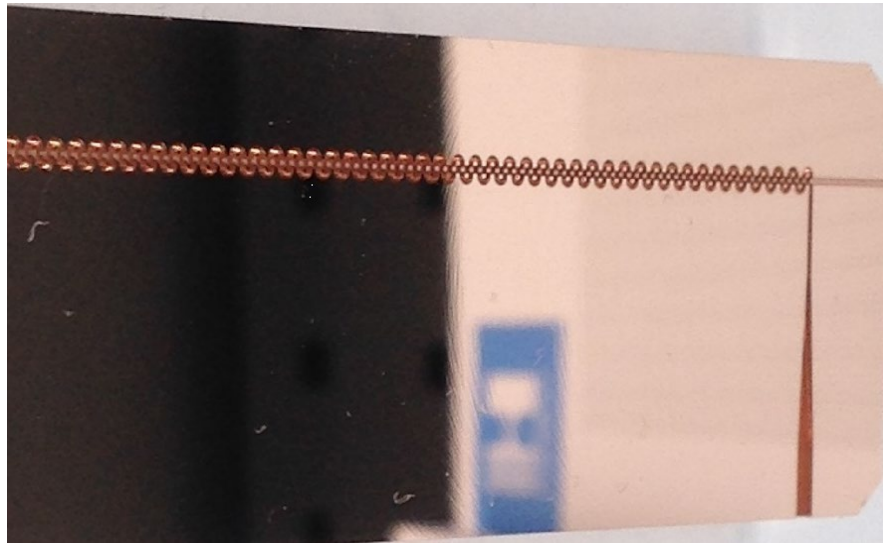
Additive manufacturing

Low-cost CNC milling of sub-THz structure

Lancaster University



E-band 71 – 76 GHz



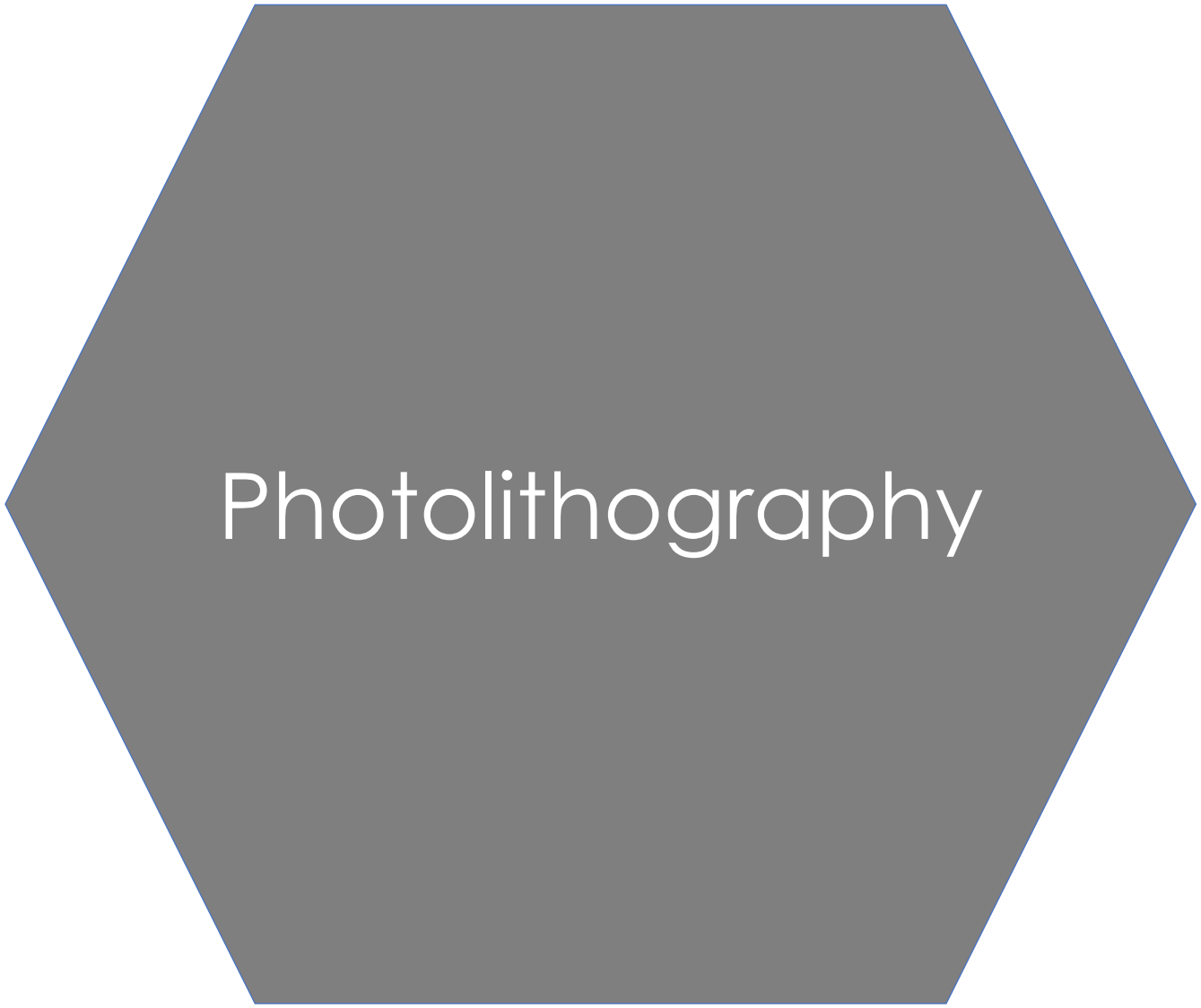
Folded waveguide 92 -95 GHz

tweether

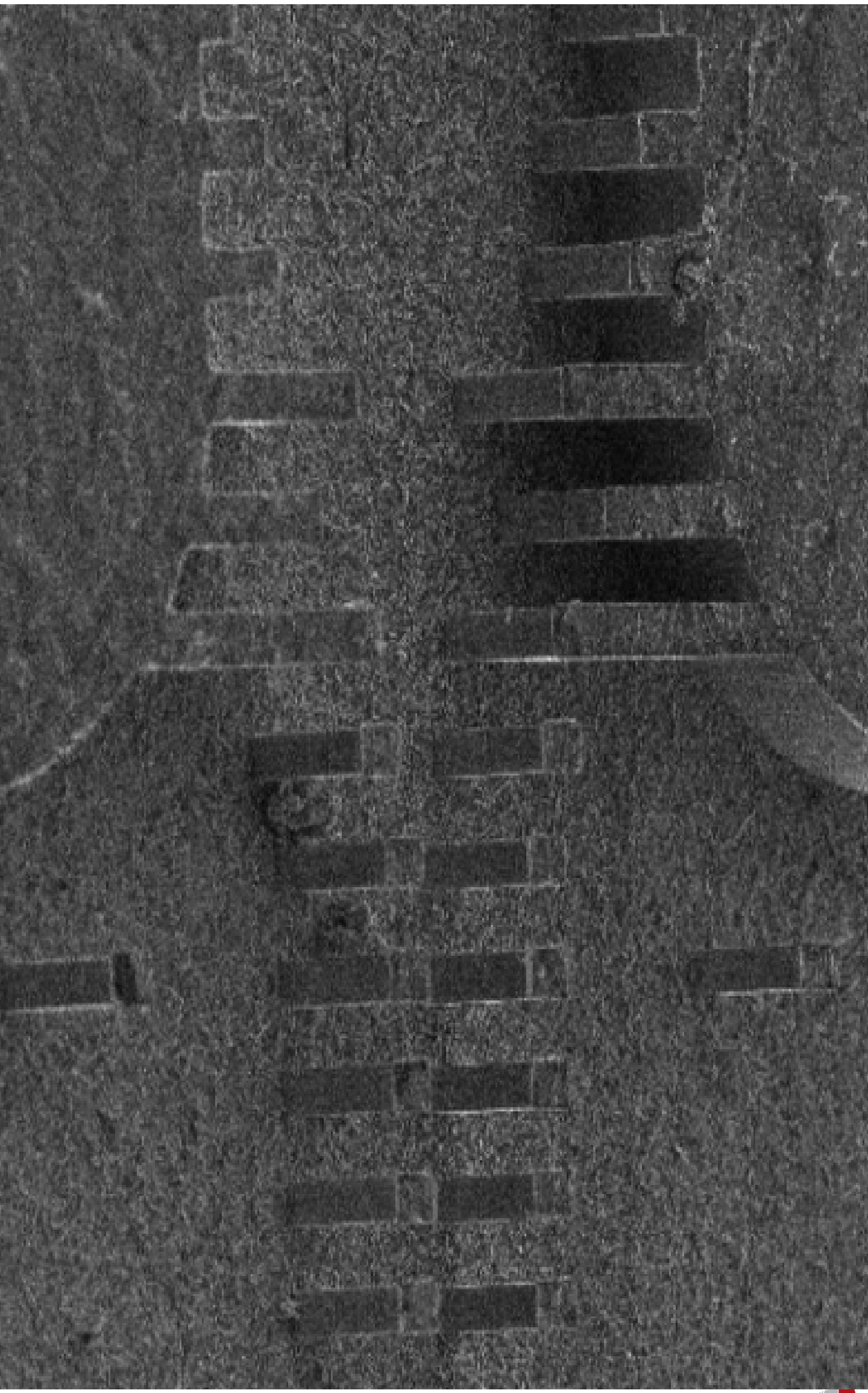
Microfabrication technologies for sub-THz

Lancaster University

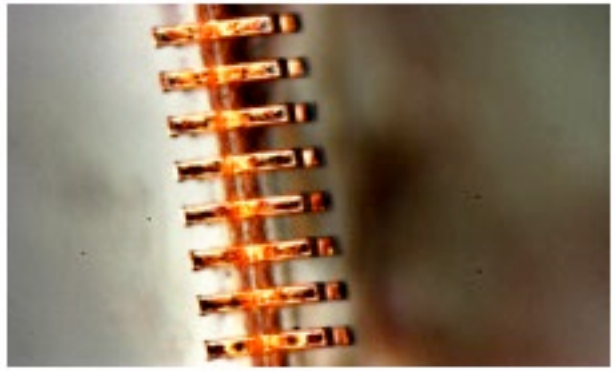
Thinkers In VED 9th January 2021

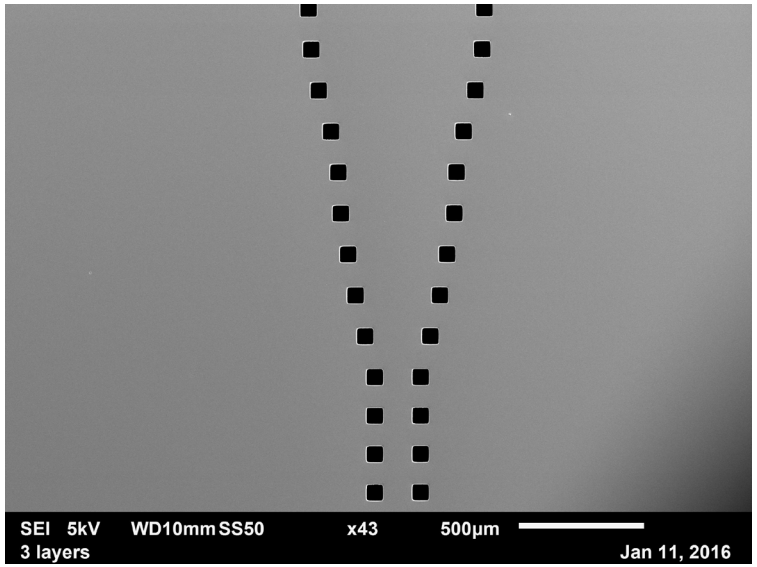


Thinkers In VED 9th January 2021



Ultraviolet LIGA (UV-LIGA)





Pillar dimensions
70 x70 x 150 microns

Copper DCW

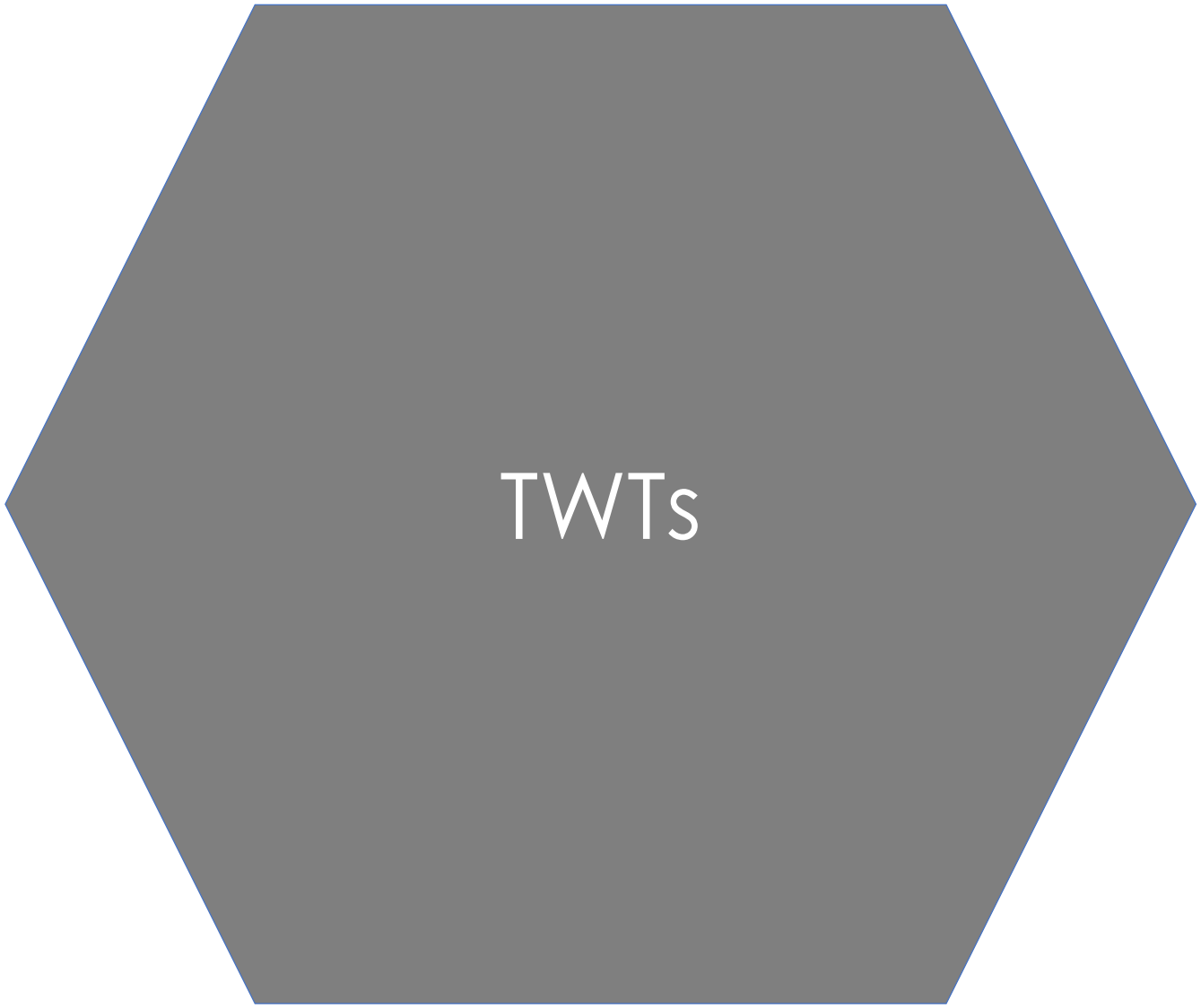
SU-8 Mold 300 GHz BWO

EPSRC
Engineering and Physical Sciences Research Council

J. Micromech. Microeng. **20** (2010) 125016

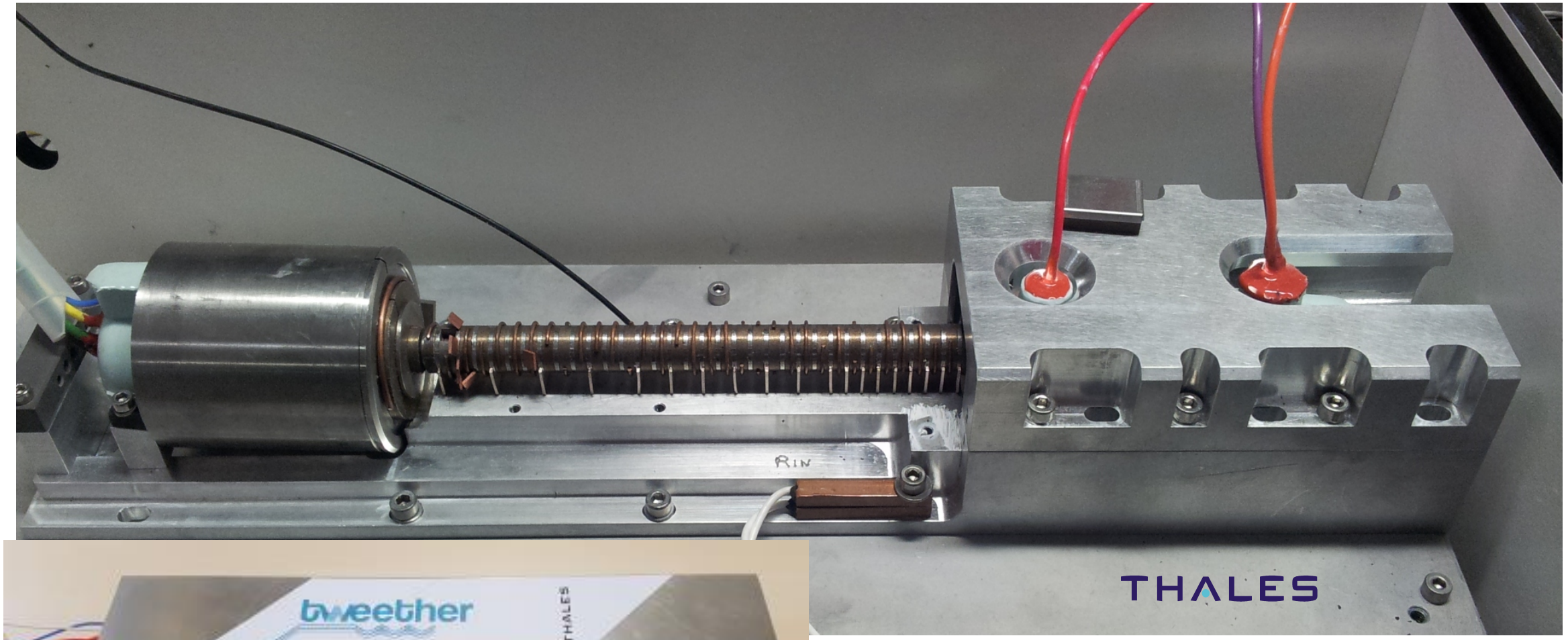
Design and fabrication

Lancaster University

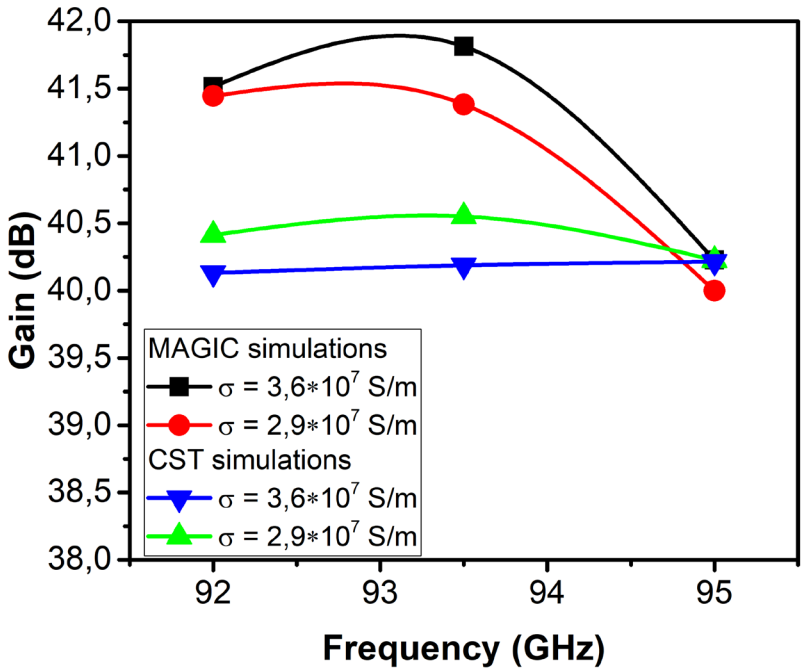


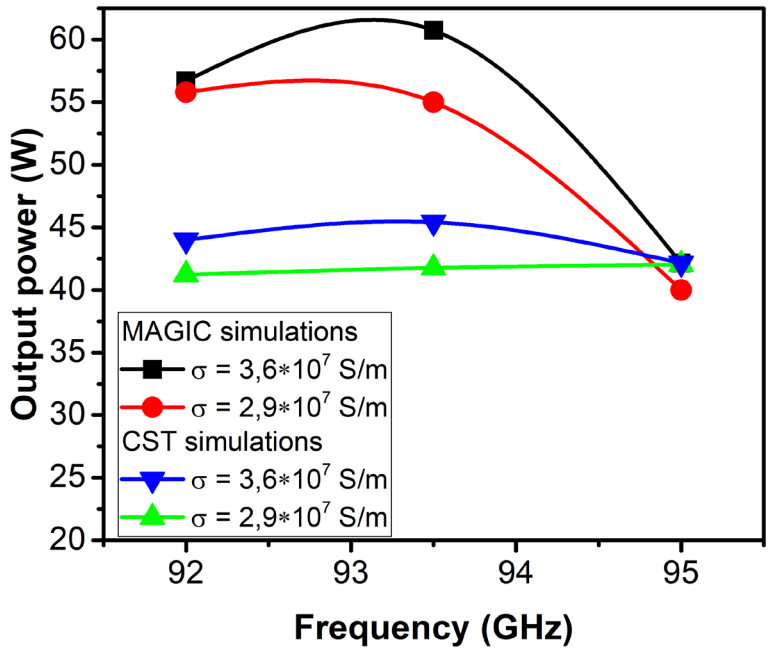
The W-band TWT

Lancaster University



W-band TWT performance





Specifications of the ULTRAWAVE D-Band TWT

Lancaster University

Frequency	**141-148.5 GHz, D-Band**
Power	**About 12W**
Gain	**About 40dB**
Beam Parameters	12.0 - 12.7 kV beam voltage
Beam Parameters	50 – 60 mA beam current
Axial Magnetic Field	Max 0.4T using Samarium Cobalt magnets
Interaction Structure	Double Corrugated Waveguide with bent couplers
Focusing Electrode	Isolated, 25V Floating on Cathode
Collector	Single Stage Depressed, 5kV floating on Cathode
Input / Output Port	Waveguide WR05, Pillbox window with Alumina disc

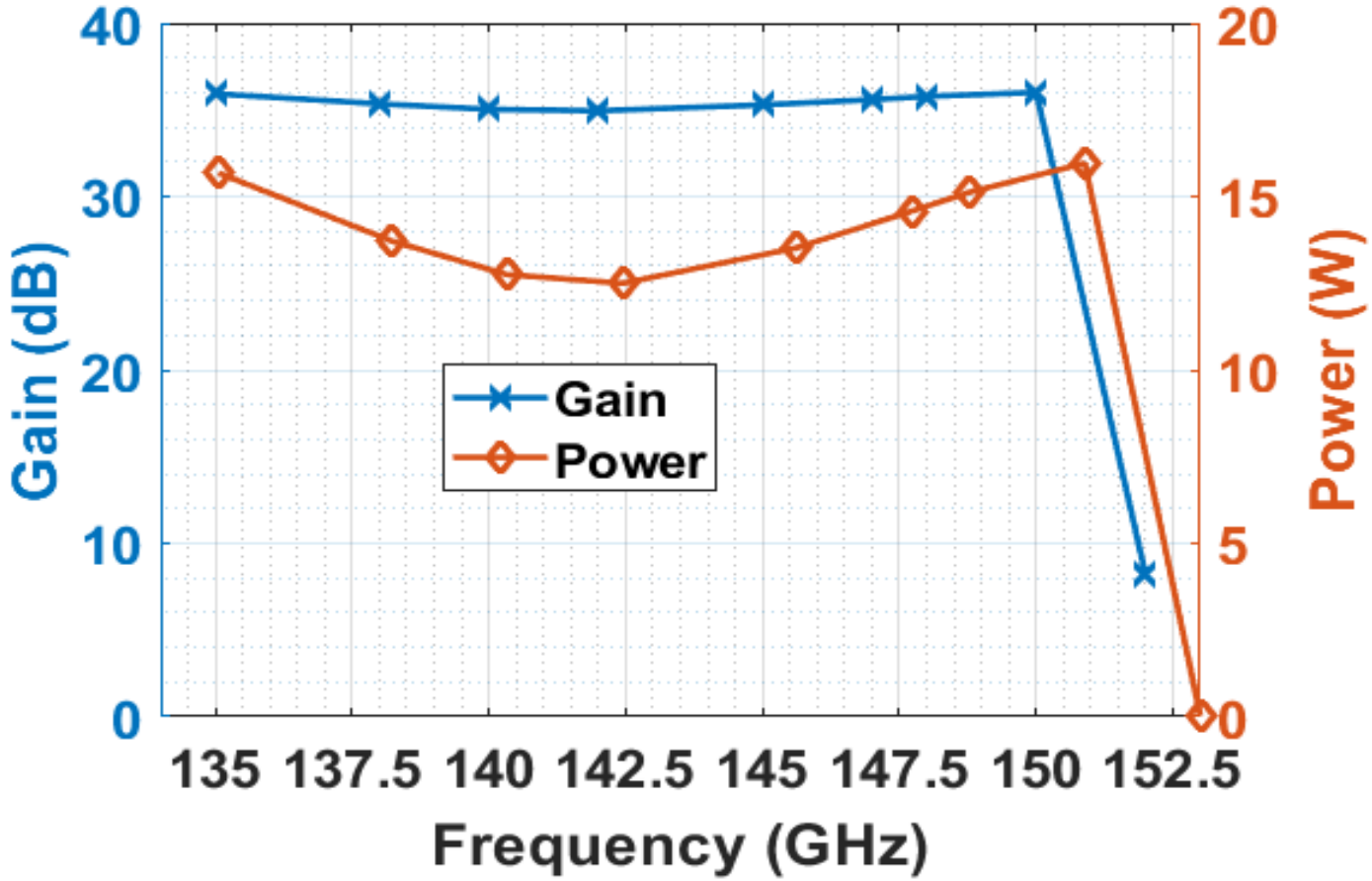
ULTRAWAVE

Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes

TWT Performance

Lancaster University

Thinkers In VED 9th January 2021



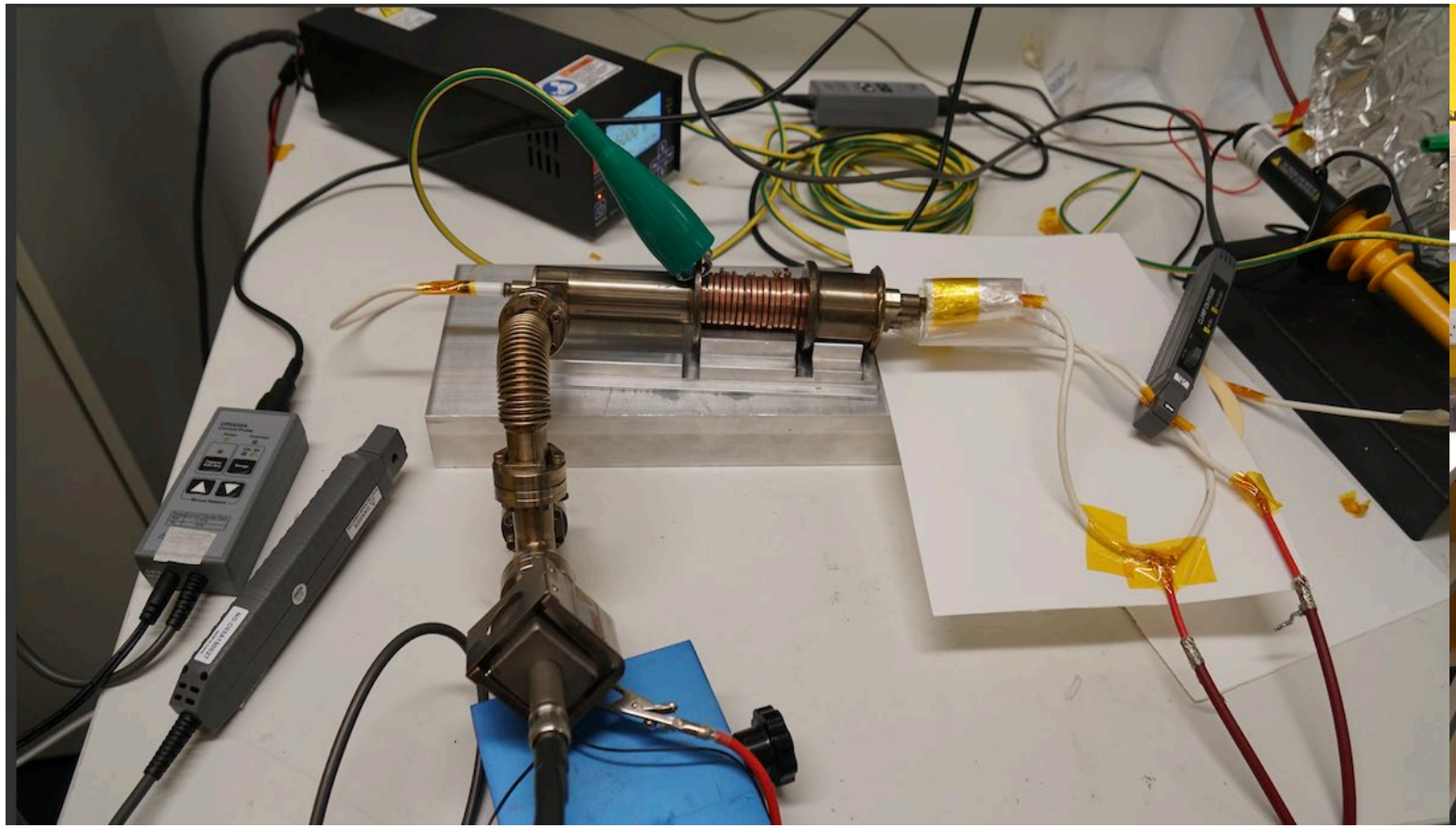
ULTRAWAVE

Ultra capacity wireless layer beyond 100 GHz based on millimeter wave Traveling Wave Tubes

Beam Emission & Transmission test

Lancaster University

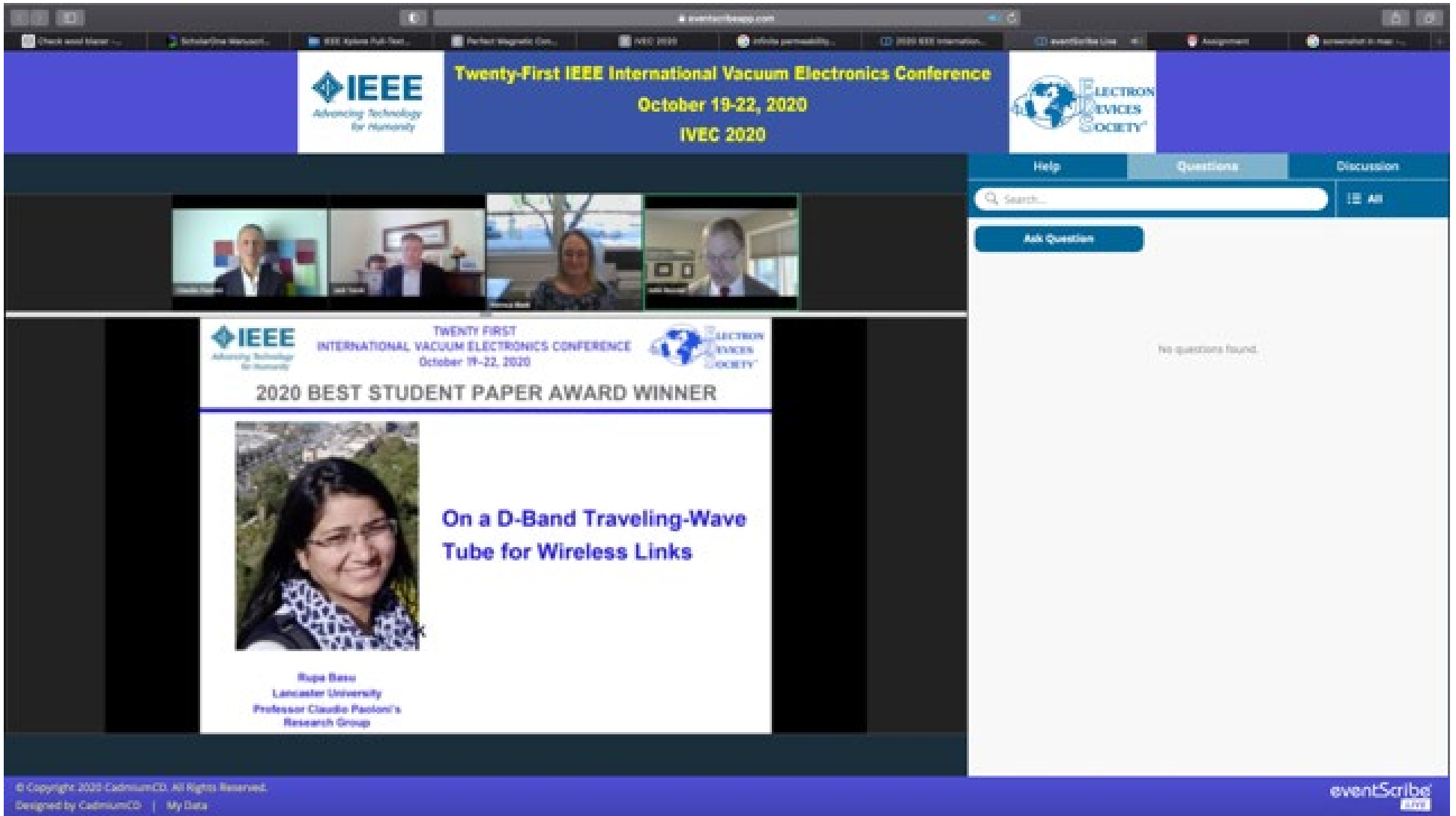
Thinkers In VED 9th January 2021



• Conclusions

- Millimeter wave and sub-THz TWTs are a reality
- Their impact as enabling device for new high capacity wireless networks is huge
- More work is needed to make them affordable and repeatable, but the road is clear.

IVEC 2020 Best Student Paper Award
Rupa Basu



Thank you!

EPSRC
Engineering and Physical Sciences Research Council

The DLINK- D-band Wireless Link with Fibre Data Rate project is funded by EPSRC grants EP/S009620/1

The ULTRAWAVE project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement no 762119.

Annexure II:

Typical WhatsApp Chats with Thinkers in VED

07/11/2020, 21:43 - Dr. Vishal Kesari: Dear Dr. Richards Joe Stanislaus and Dr. S. Yuvaraj,

Please share your slides of today's talk to be included in the proceedings of webinar#3.

Thanks

Vishal Kesari

08/11/2020, 08:37 - Sheel Aditya Prof: It was a pleasure to hear the stalwarts, young researchers, as well as the expert comments. Congratulations to the organizers. Special thanks to Professor Basu for motivating and bringing the VED community together.

08/11/2020, 08:47 - KSBhat MTRDC: It was a great opportunity to hear Dr SSS Agarwala on his journey in vacuum tubes arena. Equally motivating was the talk by Dr SN Joshi on the very first tube designed and developed in the country. Presentations by the young researchers were are also impressive. Thanks to Prof Basu for creating the platform.🙏🙏

08/11/2020, 10:42 - SSS Agarwala Ex-CEERI: It was a great experience for me to participate in the Webinar yesterday evening. I warmly thank all who organised it, and Prof BN Basu, in particular, for getting me included in this group. My greetings and best wishes to all - SSSA

08/11/2020, 11:35 - BNBasu Prof: We all seek your blessings. I thank Dr. Lalit to give me the courage to request you to give a lecture. Subsequently, Professor SN Joshi and Dr. Vishant Gahlaut helped us to make it happen.

08/11/2020, 12:30 - SNJoshi CEERI: It was a very well organized Webinar under the domain of "Thinkers in VED". I very much appreciate the efforts of the organisers under the umbrella of Prof. BN Basu.

It was a great opportunity for all of us to hear the experiences of my mentor Dr SSS Agarwala, with whom I had a priviledge to remain associated in CSIR- CEERI for about 24 years. He enriched the knowledge of all of us particularly those of our younger generations working in this critical area having vital significance.

This platform also provided an opportunity to me to share about the first TWT designed and developed by CEERI under the steward leadership of Dr. SSS Agarwala.

It was also nice to hear our two young and dynamic researchers working in this area. I express my best wishes to them in their endeavors.

With best wishes and greetings,

SN Joshi

08/11/2020, 14:42 - Chandra Shekhar CEERI: A forum that cross-links all the researchers in VED area across institutional boundaries for mutual strengthening and leveraging to meet vital national challenges is a great service to the discipline of VED.

I congratulate Dr. Basu and others involved in conceptualising and implementing this initiative.

Best wishes!

08/11/2020, 14:47 - Chandra Shekhar CEERI: It was also a great idea to bring the generations of researchers together to share the perspectives and evolving context.

08/11/2020, 23:04 - BNBasu Prof: Webinar#3 on 7th November 2020:

I thank the Convener Raj Singh for organizing the webinar with support to him from Dr. Uttam Goswami, Dr. Vishant Gahlaut, and others. I thank Professor LM Joshi for proposing vote of thanks on our behalf. It was so nice of Dr. S Yuvraj and Dr. JS Richards for making their excellent presentations in the scond session of the webinar hosted by Dr. Vishant Dwivedi. We learned a lot from their presentations.

We have no words to express our gratitude to Dr. SSS Agarwala to shower his blessings on our Group. I thank Professor Lalit Kumar to encourage me to invite Dr. Agarwala to present a glimpse of his experience in the area of VEDs. I also thank Professor Lalit Kumar for kindly introducing Dr. Agarwala to young members of the group. Professor Lalit Kumar was present in the programme despite his engagements in teaching and research besides his engagements as the Editor of IEEE Transactions on Electron Devices. It was so nice of Professor Chandra Shekhar for kindly chairing the first session of the webinar in which Professor SN Joshi presented his talk on the first ever travelling-wave tube (TWT) in India. We are fortunate that the erstwhile Director of CEERI Professor Chandra Shekhar could spare his time to be present in our programme despite his engagements as the Chancellor of Academy of Scientific and Innovative Research of CSIR and his other engagements including teaching students and carrying out research. The talk of Professor SN Joshi on the development of the first ever TWT in India was very exciting. It was a helix-TWT comprising a helix closely fitting in a glass tube with contra-wound helical couplers and with contra-wound helical attenuator in a resistive medium, both the couplers and attenuator being arranged external to the tube. In connection with this glass tube, Dr. Agarwala in passing mentioned the work of the legendary Dr. DT Swift-Hook. I remember Dr. Swift-Hook felicitated me in a programme in London for citing his paper maximum number of times in published journal papers. I am thankful to Dr. Agarwala for sharing me with the said paper: D.T. Swift-Hook, “Dispersion curves for a helix in a glass tube”, Proc. IEE 105b (1958) 747-755 for me and Dr. AK Sinha to learn from.

In passing it was mentioned perhaps by Professor SN Joshi that Rudolf Kompfner invented the TWT. In fact, at one point of time, the TWT used to be known as the Kompfner tube. I draw the attention of the group to Figure 10.1 on page 271 of the book: A.S. Gilmour, Jr., Microwave Tubes (Artech House, Washington, 1986). There we get that on 12th November 1942

Kompfner sketched how an 'untuned' amplifier could be conceived in a device to be later known as the TWT. Apparently, Kompfner was unaware of the US Patent 2,300,052, filed much earlier on May 4, 1940 by N. E. Lindenblad on 'TWT amplification at 390 MHz over a 30 MHz band'. However, the patent Andrei Haeff filed as early as in 1933 for a primitive type of TWT has been largely ignored. I thank Professor Chandra Shekhar for mentioning Haeff in one of his remarks.

I am grateful to our group for giving me the opportunity to attend Webinar#3 on 7th November 2020.

09/11/2020, 20:11 - BNBasu Prof: I hope the problem of inadvertent posting on the Group will be taken care of by our web team.

However, I take this opportunity to inform our Group that Dr. Niraj Kumar is already in touch with Professor KP Maheshwari in arranging his lecture in the series of "First Ever VED Developed in India." Professor SN Joshi joined this series in the third webinar of our Group by delivering his scintillating lecture on the first ever travelling-wave tube developed in India.

The credit of developing the first ever relativistic backward-wave oscillator goes to Professor Maheshwari and his team. We are all eagerly waiting to learn from the scholarly presentation of Professor Maheshwari. The younger researchers of our Group will be greatly inspired by the lecture of Professor Maheshwari.

I would like to inform our Group that Vacuum Electron Devices and Applications (VEDA) Society, India was honoured in 2012 by conferring on Professor Maheshwari 'Lifetime Achievement Award' for his immense contributions to the area of VEDs.

Our Group is honoured to have Professor Maheshwari in our midst.

10/11/2020, 13:35 - Ansari BHU:
https://www.rfcafe.com/references/Electricity-Basic-Navy-Training-Courses/electricity-basic-navy-training-courses-chapter-19.htm

10/11/2020, 18:31 - KSBhat MTRDC: https://sciencex.com/news/2020-11-traceable-microwave-unprecedented-sensitivities.html

11/11/2020, 12:04 - BNBasu Prof: ELLIPTICAL CAVITY COUPLERS FOR A HELIX-TWT:

Recently, through his talk, Professor SN Joshi informed us how his team had used contra-wound helical couplers for a helix-TWT glass tube in late 1970's. That was indeed very interesting.

Long ago, I heard about another type of couplers, namely, 'elliptical cavity couplers' for a helix-TWT (wideband, low-loss couples). Could anyone throw light upon this type of couplers? What is the status of the development and use of this type of couplers?

I am eagerly looking forward to the response from our group members, and, in particular, from younger researchers of our Group who are relatively more conversant with the latest developments in our area.

Could the practical development of this type of couplers be taken up in a postgraduate programme?

11/11/2020, 23:55 - BNBasu Prof: I am awaiting the response to my inquisitiveness for elliptical cavity couplers for a helix-TWT.

14/11/2020, 12:38 - BNBasu Prof: (1) Webinar#4 of our Group:

I am happy to inform all that

Professor Claudio Paoloni, Head of Engineering Department and Cockcroft Chair, Lancaster University, UK will deliver a talk on the topic:

“New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes”

on 9th January 2021 tentatively at 3-30 pm Indian time (IST) (Duration: one hour and a half including question-answer session).

Mr Raj Singh, the convener of the webinar, is coordinating with Ms Rupa Basu (Shaw) of Lancaster University to work out the other details. There will be a single lecture on that day of the session. Professor PK Jain, who will chair the session, will let us know the other requirements, if any.

(2) Webinar#5 of our Group:

I am happy to inform all that Professor RS Raju will deliver a talk on

“The First Ever Dispeser Cathode Developed in India” (including historical timeline and the activities at CEERI encompassing the various areas of cathode development). There will be a single lecture on that day of the session. Mr Raj Singh, the convener of the webinar, will be in touch with Professor Raju to decide the date and time of the programme. Dr. Ranjan Barik will host the programme. Dr. KS Bhat, who will chair the session, will let us know the other requirements, if any.

THANK YOU.

16/11/2020, 10:06 - BNBasu Prof: ELLIPTICAL CAVITY COUPLERS FOR A HELIX-TWT:

Recently, through his talk, Professor SN Joshi informed us how his team had used contra-wound helical couplers for a helix-TWT glass tube in late 1970’s. That was indeed very interesting.

Long ago, I heard about another type of couplers, namely, ‘elliptical cavity couplers’ for a helix-TWT (wideband, low-loss couples). Could anyone throw light upon this type of couplers? What is the status of the development and use of this type of couplers?

I am eagerly looking forward to the response from our group members, and, in particular, from younger researchers of our Group who are relatively more conversant with the latest developments in our area.

Could the practical development of this type of couplers be taken up in a postgraduate programme?

17/11/2020, 12:25 - BNBasu Prof: In connection with my question, Vishal (Dr Kesari) provided references for elliptical cavity couplers useful for “accelerators”. About the elliptical cavity coupler for a “helix-TWT”, I came

across the following text from a book authored by one of the members of our Group:

“There is yet another type of broadband coupler in which an innovative concept of elliptical cavity coupling is utilised [45]. At one of the focii of a right-elliptic cylindrical cavity is positioned a conical antenna with its base fixed on one of the flat walls of the cavity of elliptical cross section. The tip of the cone is connected to the central conductor of the input/output coaxial connector through the remaining flat wall. At the other focus is connected a wire antenna which is connected to the helix at one end and is terminated in a quarter-wave cylinder at the other. Coupling of power takes place as a result of transfer of power between the wire and the conical antenna via reflection from the curved side wall of the elliptical cavity. The transition from the coaxial line to the cone is designed for best matching; the cone angle determines the radiation resistance. In order to keep the side wall area low and hence reduce losses the eccentricity of the ellipse has to be of a low value. However, it should not be so low that there is no space left for the placement of the conical antenna and the helix [45].”

The said reference [45] in the above text is: G. T. Konrad and S. K Cho, “Elliptical-cavity coupler for travelling-wave tubes,” IEEE Trans Electron Dev. 10 (1963) 85-88.

18/11/2020, 20:26 - Subhradeep Chakraborty: 2nd Doctoral Scholars' Colloquium (2020) - call for abstract submission from registered PhD scholars across the nation within scope of the MTT Society, IEEE

IEEE MTT-S SBC, Jadavpur University is pleased to announce its "2nd Doctoral Scholars' Colloquium (2020)" - which calls for registered PhD Scholars from institutes across the nation to submit and present their research ideas in front of the Chapter and a panel of experts, which enables the researchers to showcase their novelties and seek the comments from the learned peers in their respective domains. Top candidates will be chosen as per the decision of the Expert Panel, during the presentations for special mention amongst the others and each will be rewarded with Certificates of Merit for the same. Certificates of Participation will be available for all the short listed candidates who will present their works.

Interested scholars are requested to submit an abstract of their proposed research ideas in not more than 400 words to this mail address (jumtts.sbc2019@gmail.com) with subject line "Abstract submission for 2nd Doctoral Scholars' Colloquium by [Name of Candidate]", on or before 20th Nov, 2020. All submissions should be accompanied by a valid proof of PhD registration/ proof of PhD enrollment/ endorsement by PhD Supervisor(s)/ institutional ID card. The name of the shortlisted candidates will be announced on or before 22nd Nov, 2020 and they will be invited for virtual presentations before the experts on 28th Nov, 2020.

The broad scope for the research topics includes everything under the scope of the MTT Society, IEEE and can be extended to the further associated research areas. We look forward to novel research ideas, brilliant topics and excellent project proposals for this meet. Submit your works now for a greater experience that awaits you!

Please forward this mail to your researcher colleagues.

Best wishes,

IEEE MTT-S SBC Jadavpur University, Kolkata, India

18/11/2020, 21:18 - Shyam BhU: https://youtu.be/gvtEX9dW-9s

Shyam BhU: https://youtu.be/gvtEX9dW-9s

Impact of microwave on national security

20/11/2020, 16:33 - BNBasu Prof: Elements of Proceedings of Webinar#3 held on 7th November 2020:

Kindly send your contribution in the formats of word, ppt or pdf to Dr Vishal Kesari <vishalkesari@gmail.com> through email with copies to <raj@ipr.res.in> and bnbasu.india@gmail.com.

(1) Professor Lalit Kumar: Kindly provide us with a write-up introducing Dr. SSS Agarwala.

(2) Dr. SSS Agarwala: Kindly provide us with the abstract of your talk.

(3) Professor Chandra Shekhar: Kindly provide us with a write-up as the Chairman of the first session of the webinar in which Professor SN Joshi delivered his talk on 'First Ever TWT Built in India'.

(4) Professor SN Joshi: Kindly provide us with (i) abstract and (ii) ppt of your talk on 'First Ever TWT Built in India'.

(5) Dr. Vishant Dwivedi: Kindly provide us with a write-up as the Host of the second session of the webinar in which (i) Dr. Richards Joe Stanislaus delivered his talk on 'Large-Signal Analysis of Helix-TWT' and (ii) Dr. S. Yuvaraj delivered his talk on 'Recent Trends in Millimeter/THz Wave Vacuum Electron Beam Devices'.

(6) Dr. Richards Joe Stanislaus: Kindly provide us with (i) abstract and (ii) ppt of your talk on 'Large-Signal Analysis of Helix-TWT'.

(7) Dr. S. Yuvaraj: Kindly provide us with (i) abstract and (ii) ppt of your talk on 'Recent Trends in Millimeter/THz Wave Vacuum Electron Beam Devices'.

(8) Professor LM Joshi: Kindly provide us with a write-up on 'Vote of Thanks'.

(9) Mr Raj Singh: Kindly provide us with a write-up as the Convener of the webinar.

(8) Dr Vishal Kesari: Kindly provide us with the Editorial of the Proceedings.

20/11/2020, 16:40 - BNBasu Prof: Dr. Yuvraj and Dr. Richards have submitted Abstracts and ppts. Professor SN Joshi has submitted the ppt. He has to submit Abstract. The others are requested to kindly submit the relevant write-ups to Dr. Vishal Kesari for their inclusion in Proceedings of the third webinar.

21/11/2020, 10:23 - Datta S K MTRDC: Astronautical Society of India (ASI) in it's continued endeavor to disseminate technical and ancient Indic

knowledge to the astronautics fraternity of the nation brings yet another unique webinar on 21 Nov 2020 at 04:30 PM onwards.

Title: Astronomy of Aryabhata

Session Overview:

Āryabhata (born, 476 CE) is perhaps the foremost among the Indian mathematician-astronomers. His work Āryabhaṭīya composed at the age of 23, commences with this interesting invocation:

प्रणिपत्यैकमनेकं कं सत्यां देवतां परं ब्रह्म ।

आर्यभटस्त्रीणि गदति गणितं कालक्रियां गोलम् ।।

Here, besides conveying his reverences to the devata, Āryabhata also gives an outline of the text itself. Some of the main contributions of Āryabhata include providing a very good approximation to the value of pi, a harmonic equation in its finite difference form to determine first-order sine-differences, methods for resolving problems pertaining to mensuration, root extraction and so on. From the viewpoint of physics, his ideas on the nature and division of time, source of light on the moon, spinning of the Earth on its axis, are all quite intriguing and remarkable. The value of the sidereal year given by him was extremely accurate and so too the revolution periods of the various planets.

The book Āryabhatīya is divided into four parts. The first part, Gītikā, provides a variety of important astronomical parameters. The second part, Gaṇita, deals with mathematics. The third part, Kālakriyā, deals with the determination of the true position of the sun, the moon, and the planets by means of epicycles. The fourth part, Gola, deals with description of planetary motions on the celestial sphere, which includes a succinct description of the phenomenon of the eclipse as well. During the talk we will be highlighting some of these aspects.

Please register to join the talk by Prof. Ramasubramanian to further decode the amazing research “Astronomy of Aryabhata”

Guest Speaker: Prof. K. Ramasubramanian, IIT Bombay

Note: Please visit https://www.asindia.org for registration and meeting link

21/11/2020, 16:27 - BNBasu Prof: Kindly note the group contact of Professor Choyal. Dr. Niraj Kumar is going to organize a webinar on First Ever Relativistic BWO Developed in India in our group.

He is interacting with Professor Choyal in this context.

22/11/2020, 23:53 - BNBasu Prof:

Mechanical Design Study for Gyrotron E×B Drift Two-Stage Depressed Collector

Ell, Benjamin; Pagonakis, Ioannis Gr.; Wu, Chuanren; Albert, David; Gantenbein, Gerd; Illy, Stefan; Kobarg, Thorsten; Rzesnicki, Tomasz; Thumm, Manfred; Jelonnek, John

Abstract (english):

The key for a significant increase of the gyrotron efficiency is the development of an efficient multistage depressed collector (MDC) for the annular spent electron beam. During the past years, many different design approaches based on E×B drift concept have been theoretically investigated at KIT. The next step towards the experimental validation of such an MDC is the development of a prototype. The complexity of the mechanical design of the MDC is strongly dependent on the size of the electrodes, the manufacturing possibilities of individual parts, the electric field distribution, etc. Considering all those factors, an MDC system has been optimized in order to significantly reduce the manufacturing complexity of the prototype. As a result, a significant smaller and simpler conceptual design for the MDC system is presented.

23/11/2020, 00:05 - BNBasu Prof:

The progress in high frequency, high power gyrotron development in Russia

Mikhail Yu. Glyavin, Gregory G. Denisov

Proceedings Volume 11582, Fourth Int. Conf. on Terahertz and Microwave Radiation: Generation, Detection, and Applications; 1158213 (2020) https://doi.org/10.1117/12.2580566

Event: Fourth Int. Conf. on Terahertz and Microwave Radiation: Generation, Detection, and Applications, 2020, Tomsk, Russian Federation

Abstract

This report aims to bring together information about the most striking experimental results, new trends in gyrotron development, modern remarkable applications, new demands in parameter enhancement and future goals. The paper separated into two parts: first, related to progress in MW class gyrotron development for nuclear fusion and second, focused on the development of terahertz band gyrotrons. The data about pulsed and CW tubes, working in both specified frequencies ranges, are given. In particular, the series of 1MW/170 GHz/CW tubes with efficiency more than 50% has been developed successfully for ITER project. Same time, despite the requirement for strong magnetic fields, the problem of high ohmic losses and electron beam formation, the gyrotrons go through magic 1 THz mark with kW power level and demonstrate (in some specific combinations) operation at extremely low voltage and beam current, narrow frequency spectrum, wide frequency tuning. Novel schemes of high-frequency gyrotrons are analyzed. The novel quasioptical mode converters opened the possibility of phase-locking a number of tubes, which makes maximum power almost "unlimited"

23/11/2020, 11:44 - BNBasu Prof: Copyright 2018 Morgan & Claypool Publishers

Edl Schamiloglu wote in the Foreword of a book on microwave tubes (DOI 10.1088/978-1-6817-4561-9):

Vacuum electron devices (VEDs) have played a central role in electrical engineering almost since the birth of the profession near the end of the nineteenth century1. However, despite all the successes of VEDs, including the Voyager twin spacecraft, which are still chugging along, logging 35 000 miles an hour as they zoom farther and farther into the cosmos, forty years after their launch2, VEDs are still cast in a negative light. Recall Senator Lloyd Bentsen's comments on NBC's program Meet the Press during the 1988 United States Presidential Campaign as Michael Dukakis's candidate for Vice President3:

'You can't compete if you build vacuum tubes in a solid-state world.'

Of course, nothing can be further from the truth. Although solid-state microwave devices are making progress in achieving higher output power levels, they have important limitations (electrons transport in a solid-state medium in solid-state devices, whereas electrons are 'free' in vacuum in VEDs) that will prevent them from overtaking VEDs4. VEDs play essential roles in communications, manufacturing, healthcare, homeland security, defense, manufacturing, the food industry, and in many other areas.

This new book by Drs Kesari and Basu is targeted at students just entering the field. It is a welcome contribution since it provides a historical context to the pedagogical development of the subject. The material is accessible by undergraduates and easily grasped by graduate students. At a juncture where the practitioners in the field are aging, this book will help to bring a new generation of students into this vibrant area that promises to continue contributing to science and humanity.

Edl Schamiloglu

Distinguished Professor of Electrical and Computer Engineering

IEEE Fellow

Associate Dean for Research, School of Engineering

University of New Mexico

October 2017

1 IEEE Electron Devices Society, '50 Years of Electron Devices: The IEEE Electron Devices Society and Its Technologies 1952–2002' (IEEE, Piscataway, NJ, 2002), available at http://ethw.org/w/images/f/ff/

50_Years_of_Electron_Devices.pdf

2 'The Voyagers eventually will go quiet. The spacecrafts' electric power, supplied by radioisotope thermoelectric generators, weakens each day.' Dodd (Suzanne Dodd, the Voyager project manager at NASA's Jet Propulsion Laboratory) said that scientists and engineers will likely begin shutting off instruments in 2020, a debate that she says is already underway. 'These scientists have had their instruments on for 40 years,' she said.

'Nobody wants to be the first one turned off.' The spacecrafts' transmitters will be the last to go. They will die on their own, in the late 2020s or perhaps in the 2030s. 'One day we'll be looking for the signal and we won't hear it anymore,' Dodd said. From

https://www.theatlantic.com/science/archive/2017/09/voyager-interstellarspace/538881/

3 R S Symons 1998 Tubes: Still Vital after all these Years IEEE Spectrum p 52.

4 Refer to the article and accompanying text in: J H Booske 2008 Plasma physics and related challenges of millimeter-Wave-to-terahertz and high power microwave generation Phys. Plasmas 15 055502.

24/11/2020, 07:58 - Dr. Lalit Kumar:

https://ci4.googleusercontent.com/proxy/IAa85YJGvm2TtewOtDQtt-g0GKQAqTIZkW0OPiUbhzggyKlvVlLiaCXobpPuhmK9eCTvyhr7wAFwNknppoiVaj-HW3WHvba70NxkhUXIP5NN1jruiyK_LPJbSR7eXl7ODC6ffbMLUK8niWuYfEVxcGlbWLbkh8oeeG1OiO-q3x8DCCAluccX2cuXXjhywbtYxYjg7plcnIHuYUdUKlmDVmDhbgqXCL0ID6EsebeHoBFevOxFTd_Ab1UWmLRYOlAWrRokIDRScQX3ZzRY6kusHyRBwwKMyAP9nILFmdDRuF_hbZaKqZRj1V6O-ygVUVTd7PDqU6ekpZmo-Meu0TajAfGSw8qR6aqFswSJsjsUGENQFAYTMpSXaJEKvOGSXYe93C8S5hyo85Q-Jy86fkGVl5rtCzdO-mji140Bpz8_HNjkm_yER00kn4GrCgZHleZMELYC6cDJMte21UsQELp-oYFgzkyd3a7GwhzBBVMPoBM=s0-d-e1-ft#http://4sw2s.img.ag.d.sendibm3.com/im/2850084/e614869f73414631f18545419cbc3d33bab544b371ba3653cb5b3b64be406c6a.jpg?e=4QiHWRa3XrfLzQNcxa6clLy_ab1XU_PnEyh_bxKU5Tbn7WniFK-6ORNf3k9atEFO1phDEqEtnonYTfSM9HVP7P9AZhpjLMWIpEbXdIErDd7ktxfwm0svDP0GzVyRoMx2HfFB7XggoobTrWFhV7HnxHdID5bxi2RG6x4cJ_s0vgthf-58dsJJKmxcNxd-025t8W5hUxAsJ9QJ_nc07gUH6cY6RlBEBDkoaqJBcmw

24/11/2020, 07:59 - Dr. Lalit Kumar: Distinguished lecture on Philosophy of Ultimate Success in Scientific Ilife

26/11/2020, 08:34 - BNBasu Prof: I think Chalmers is one of the best institutes for Microwave Engineering. If any students are finishing PhD post doc please look into it

28/11/2020, 18:52 - BNBasu Prof: I am happy to inform our Group that Professor Sheel Aditya, who has a long research experience in the area of VEDs at Chalmers University of Technology, Sweden; Indian Institute of Science, Bangalore; Florida State University, USA; Indian Institute of Technology, Delhi; and Nanyang Technological University (NTU), Singapore has given his consent to deliver a lecture on the forum of VED Thinkers Group on the topic of “Microfabricated TWTs”. Professor Sheel Aditya is internationally acclaimed in VED community for his invention of planar helix with straight-edge connections (PH-SEC). I earnestly request Mr. Raj Singh (Scientist-H, IPR, Gandhinagar) to kindly convene a webinar of the group sometime in 2021 in this context.

29/11/2020, 00:11 - BNBasu Prof: Thoughts of the Day:

Vacuum is needed in a MWT to prevent the electrons emitted from the cathode (electron emitter) from colliding with the atoms thereby losing their energy before crossing or passing through the anode of the tube. Besides, the vacuum prevents ionization inside the tube caused by electrons colliding with atoms that produces positive ions, which can strike the cathode and damage it. A high order of vacuum prevents high power tubes from high voltage breakdown and arcing. The vacuum in MWTs is created in the range of high vacuum (10□−5–10□−7 Torr) to ultra high vacuum (<10□−7 Torr).

1 Torr = 1 mm Hg = 1.33□x10□2 Pascal =1.33 mbar

[1 bar = 10□5 Pascal]

29/11/2020, 08:47 - BNBasu Prof: Thoughts of the Day:

The successes of VEDs include “the Voyager twin spacecraft, which are still chugging along, logging 35 000 miles an hour as they zoom farther and farther into the cosmos, forty years after their launch.”

29/11/2020, 15:43 - BNBasu Prof added +91 6282 687 254

30/11/2020, 08:07 - BNBasu Prof: Thought of the Day:

Comparison between SSDs and VEDs

(a) Collisional heat produced by electron stream:

SSD: Throughout volume

VED: Only at the collector

(b) Operating temperature:

SSD: Lower temperature operation for a longer life (lower mobility—a greater drag or inertial forces due to collision); Degradation at a higher temperature due to dopant migrating excessively, lattice becoming imperfect, mobility becoming reduced impairing high frequency performance; Wide-band-gap semiconductors such as SiC and GaN to be used for high temperature operation

VED: Higher temperature operation

(c) Breakdown limit on maximum electric field inside the device:

SSD: Lower

VED: Higher

(d) Base plate size:

(Determined by cooling efficiency increasing with (i) the temperature difference between the hot surface and the cool environment and (ii) the surface area of the hot surface)

SSD: Larger

VED: Smaller (Higher collector temperature)

(e) Peak pulsed power:

SSD: Lower (calling for power combining by multiple transistors and proportionate increase in package size)

VED: Higher (in view of the potetial of beam being pulsed in the region separated from the interaction region

(f) Ultra-bandwidth performance (three-plus-octaves):

SSD: Possible below 1 GHz (corresponding to longer wavelengths ensuring negligible phase difference in the voltage between the emitter and base)

VED: Possible only by innovative structures with controlled dispersion

(g) Hardening against radiation and tolerance to temperature and mechanical extremes:

SSD: Not possible

VED: Can be hardened and is fairly resistant to temperature and mechanical extremes

(h) Direct cooling of heat zone:

SSD: Not possible

VED: Possible

(i) Enrgy recovery out of waste beam:

SSD: Not possible (No recovery out of waste beam)

VED: Possible (Significant recovery of spent beam energy)

(j) Ionization:

SSD: Ionization of lattice

VED: Ionization of residual gasses (though much less)

(k) Permissible operating temperature:

SSD: Lower (mobility of electrons is less at elevated temperature)

VED: Higher

(l) Handling power in interaction volume:

SSD: Less power in smaller interaction volume

VED: More power in smaller interaction volume

(m) Noise figure:

SSD: Lower

VED: Higher

(n) Efficiency:

SSD: Lesser

VED: Higher

(o) Linearity/nonlinearity performance:

SSD: Linear

VED: Nonlinear

(p) Warm-up delay:

SSD: Short

VED: Long

(q) Periodic maintenance:

SSD: Not required

VED: Required

(r) High voltage power supply requirement:

SSD: Not required

VED: Required

(s) Process cost:

SSD: Lesser

VED: Higher

30/11/2020, 08:18 - Shyam BhU: https://ieee-npss.org/conferences/

30/11/2020, 13:52 - BNBasu Prof: Yes. I will try. I will try to send the image from the book with Dr. Vishal Kesari. From my end I am trying.

01/12/2020, 11:57 - BNBasu Prof: Please forward it to whoever is interested.

From: Oleg Cojocari <oleg.cojocari@acst.de>

Date: 26 November 2020 at 11:54:17 GMT-8

To: info@acst.de

Subject: PhD position at ACST GmbH

Dear Colleagues,

I am pleasant to announce ACST advertisement for a PhD position in framework of an Innovative Training Network (Marie Skłodowska-Curie MSCA-ITN) in Terahertz Photonics (TERAOPTICS Project 956857). Please find corresponding advertisement on EURAXESS under https://euraxess.ec.europa.eu/jobs/568242

PDF-Version of the advertisement is attached to this e-mail. ACST expects applications before December 31st 2020.

Permanent employment after successful project completion is possible.

I would much appreciate if you could distribute this advertisement among potential candidates.

Please consider main eligibility criteria: the candidate should not have more than 4 years research activity from his university graduate, and he should not have more than 12 month lived in Germany last 3 years.

I apologize if some of you consider this e-mail as a spam. Just wish to activate many possible opportunities.

Greatly thankful in advance,

Oleg.

Dr.-Ing. Oleg Cojocari

CEO/Geschäftsführer

ACST GmbH | Josef-Bautz-Straße 15 | 63457 Hanau | Germany

Tel.:+49 6181 9669850 | Fax: +49 6181 96698-01

Email: oleg.cojocari@acst.de | www.acst.de

01/12/2020, 13:40 - BNBasu Prof: I am happy to inform you that Dr. MM Ajith Kumar, a PhD graduate of Nanyang Technological University, who received tutelage from Professor Sheel Aditya, will present in the forum of Young Researchers a talk on “Planar helix slow-wave structure for backward-wave oscillators” sometime in the year 2021.

01/12/2020, 17:52 - BNBasu Prof: Sergey S. Ponomarenko; Alexander A. Likhachev; Viktoriia V. Stoyanova; Yurii S. Kovshov; Sergey A. Vlasenko; Sergey A. Kishko; Eduard M. Khutoryan; Alexei N. Kuleshov, “Spectral Characteristics of THz CW Clinotrons,” IEEE Transactions on Electron Devices, Volume 67, pp 5766 – 5770 (2020)

Abstract:

The spectral properties of terahertz (THz) continuous-wave (CW) clinotrons have been studied both theoretically and experimentally. The resonant properties of clinotrons having strong influence on the spectral linewidth have been analyzed both for the frequencies below 150 GHz where resonances are determined by reflections of surface wave, and for THz tubes where resonances are caused mainly by the effect of mode transformations in oversized cavities. The influence of beam voltage ripples in THz clinotron on spectral line broadening has been studied and discussed. The clinotron spectral linewidth of 1.18 MHz has been demonstrated at 346.4 GHz with the output power of 100 mW when the output voltage stability of high-voltage power supply (HVPS) was 5 ppm.

01/12/2020, 22:05 - Vijaya Kumar M MTRDC:

https://www.powerelectronictips.com/iedm-good-bye-x-ray-tubes-hello-vacuum-transistors/

02/12/2020, 02:11 - BNBasu Prof: Thought of the Day:

If the length of the magnet is increased by a factor of ‘N’ to cover a larger interaction length, then one can realize the advantages of a PPM over its PM counterpart in terms of weight by a factor of

(a) N

(b) N raised to the index of power 2

(c) N raised to the index of power 3

(d) N raised to the index of power 4.

[PPM stands for periodic permanent magnet].

Answer: (b)

02/12/2020, 15:21 - BNBasu Prof: I am happy to inform you that Dr Vikram Kumar of NIT-Patna will deliver a talk on the platform of our group on “Sectoral Waveguide HPM Mode Converters” sometime in 2021.

02/12/2020, 18:20 - Panchariya PC CEERI: Curtain Raiser of Student Engineering Model Competition and Expo event of IISF - 2020, on 03, Dec. 2020 at 3:30 p.m. Please do join and grace the occasion. Thank you all, PC Panchariya

03/12/2020, 05:32 - Dr. Vishal Kesari: Registration is now open for COMSOL Day: Electromagnetics in Government R&D.

This free online event will be held on Wednesday, 20 January 2021.

Join us to stay up-to-date with multiphysics modeling, engage in product demonstrations, and listen to experts in the field of simulation.

Programme highlights include:

- COMSOL presentations

- Software demonstrations with Q&A

- Talks by invited speakers

- Interactive Tech Caf&#65533;©s

For more information and to register for COMSOL Day: Electromagnetics in

Government R&D, visit: http://comsol.co.in/c/b9pv

03/12/2020, 10:23 - BNBasu Prof: Vishal Kesari, Sudhakar R., R. Seshadri, “Thermal management of a quasi-optical mirror in a millimetre-wave gyrotron,” Fusion Engineering and Design (Dr. Kesari may porivide further details)

ABSTRACT

A quasi-optical mirror of a millimetre-wave gyrotron was thermally analysed considering three different surface heat loads on mirror surface. The heat load on reflecting surface of the mirror were considered: i) over the full reflecting surface, ii) over the circular cross section similar to that of RF beam, and iii) over the circular cross section in Gaussian distribution. Thermal images were captured under these three considerations. Values and locations of highest temperature attained on the mirror were observed. Maximum temperature reached in three considerations of heat load were 348.72, 330.53 and 391.64 ◦C, respectively. Further, three cooling channel routings: i) cooling cavity, ii) rectangular serpentine, and iii) circular serpentine were implemented behind the mirror. The rectangular serpentine cooling channel was the most effective for the considered millimetre-wave mirror. The maximum localised temperature reached under consideration of Gaussian heat load was below 400 ◦C (allowable maximum temperature). Therefore, the present cooling proposal would be suitable for the heat load of 5 kW on reflecting surface of the mirror.

03/12/2020, 12:01 - BNBasu Prof: Dear all,

Please showcase the abstracts of your research papers published or accepted for publication on the platform of our group. The papers must be

related to VEDs and their applications as well as their supporting systems and technologies, such as magnetic field, power supply/EPC, coupler, window, mode converter, thermal and structural management, fabrication/micro-fabrication, etc). If you have any difficulty in posting them, you may send the pdf versions of your papers/ abstracts of papers to my email address: <bnbasu.india@gmail.com>. In turn, I will try to post them from my end to the extent I can. Thank you. ---- BN Basu

03/12/2020, 18:33 - Dr. Vishal Kesari: Thanks Sir for posting this detail to the group. Elsevier has provided me 50 free download links. Interested people may write a mail to me at vishalkesari@gmail.com for getting free download link.

Regards.

03/12/2020, 23:44 - BNBasu Prof: Oleg I. Louksha, Pavel A. Trofimov, Vladimir N. Manuilov, and Mikhail Yu. Glyavin, “Multistage Depressed Collector with Azimuthal Magnetic Field for the DEMO Prototype Gyrotron,” International Youth Conference on Electronics, Telecommunications and Information Technologies, Proc. of the YETI 2020, St. Petersburg, Russia

Abstract:

In this paper, the numerical simulation of a multistage depressed collector system based on separation of electrons in the crossed axial electric and azimuthal magnetic fields for the DEMO prototype gyrotron is described. In the simulation, the idealized model with the azimuthal magnetic field created by an on-axis conductor was studied. The trajectory analysis was performed for the spent helical electron beam with electron energy distribution close to the distributions obtained experimentally in high-power gyrotrons. As a result of geometry and potential optimization of the collector sections, the total efficiency of more than 80% was achieved, which is close to the maximum value of the collector efficiency with ideal separation. The obtained results will be used at the next stage of the study, in which the azimuthal magnetic field will be created by a toroidal solenoid.

04/12/2020, 11:37 - BNBasu Prof:

https://www.cv.nrao.edu/~demerson/bose/bose.html

05/12/2020, 00:41 - BNBasu Prof: Theoretical investigation on possible operation of a 140 GHz 1 MW gyrotron at 175 GHz for CTS plasma diagnostics at W7-X

Physics of Plasmas 27, 113107 (2020); https://doi.org/10.1063/5.0022151

L. Krier, I. Gr. Pagonakis, K. A. Avramidis, G. Gantenbein, S. Illy, J. Jelonnek, J. Jin, H. P. Laqua, A. Marek, D. Moseev, M. Thumm, and W7-X Team

ABSTRACT

Collective Thomson scattering is a common diagnostic technique for ion temperature measurements in experimental fusion plasma reactors. Such a system was successfully installed and commissioned at the Wendelstein 7-X stellarator. For this purpose, a 140 GHz gyrotron of the Electron Cyclotron Resonance Heating system was used as a source of the required probing

millimeter (mm)-wave beam. However, accurate measurements in the plasma core were not possible at this heating frequency due to the absorption of the mm-waves and the high electron cyclotron emission background. To suppress these effects and to enhance the accuracy of the measurements, it is required to increase the frequency of the probing beam. In this work, the possibility to operate the same gyrotron, which has its nominal operation at 140 GHz, at a higher frequency is comprehensively investigated.

05/12/2020, 10:36 - Ansari BHU:

https://devicematerialscommunity.nature.com/amp/posts/52719-nanoscale-vacuum-channel-transistor

05/12/2020, 11:57 - Dr. Vishal Kesari: Congratulations to all the group members who are listed as Golden Reviewer 2020 in IEEE Electron Device Letters and IEEE Transactions on Electron Devices...

05/12/2020, 13:02 - BNBasu Prof: I am proud to see a good number of our group members have figured out in Golden Reviewers list of TED! Thank you, Vishal; and congratulations to you and others listed. One of our group members, Dr. Lalit Kumar, is TED Editor.

05/12/2020, 19:51 - Bansiwal MTRDC: Greetings to all the members..

I want to have glazing and metallisation on the bare gun ceramic. One can offer these two processes independently or both together but either of the process not to be performed below 1200oC. final assembly should withstand step brazings in H2 atmosphere.

I am looking for a vendor/institute/organization in India who can help.

Let me know if someone you know who can help in this regard.

Ping me separately, as I may not be able to provide complete details here in this forum.

Ashok

05/12/2020, 20:50 - Dr. Lalit Kumar: Dear Ashok

I would be glad to discuss about how to achieve your objective. You may message me your req.

05/12/2020, 20:54 - Dr. Lalit Kumar: Congratulations to all the IEEE golden reviewers.

I also express my thanks to all those who helped me in my editorial task by their timely critical reviews.

05/12/2020, 21:02 - Dr. Lalit Kumar: IEEE Int Conf on Plasma Science Singapore begins through web mode tomorrow (6-10 Dec). Please go through the schedule to identify useful papers related to your work.

Glad to share that I would be attending and Chairing the session on Non-Fusion Microwave Systems.

Prof Sheel Aditya would Chair the vacuum microelectronic devices session.

05/12/2020, 22:03 - Uttam Goswami CEERI: Sir, CEL Sahibabad lab has built bullet proof jackets for our Indian army using metallised ceramic and once I have seen that prototype in exhibition and LHCD lab of IPR is in need of that process facility up to more than 2000 C for their plasma discharge experiments and CEL experts at that time enhancing it but I am damn sure up to 1200 C they have. I will share you his contact details on Monday...

07/12/2020, 00:11 - BNBasu Prof: Development of a 1.5 MW, 140 GHz Continuous-Wave Gyrotron for the Upgraded ECRH System at W7-X

W7-X Team; Illy, Stefan; Avramidis, Konstantinos A.; Ioannidis, Zisis C.; Aiello, Gaetano; Bénin, Patrick; Chelis, Ioannis; Dinklage, Andreas; Gantenbein, Gerd; Jelonnek, John; Jin, Jianbo; Laqua, Heinrich P.; Leggieri, Alberto; Legrand, François; Marek, Alexander; Marsen, Stefan; Pagonakis, Ioannis Gr.; Ruess, Tobias; Rzesnicki, Tomasz; Scherer, Theo; Strauss, Dirk; ... mehr

45th Int. Conf. on Infrared, Millimeter and Terahertz Waves (IRMMW-THz 2020), online, 08.11.2020 – 13.11.2020

Abstract:

To increase the total injected Electron Cyclotron Resonance Heating (ECRH) power in the plasma of the nuclear fusion experiment Wendelstein 7-X (W7-X), an upgrade of the existing gyrotron installation is in progress. The existing ECRH system, currently equipped with ten 1 MW, 140 GHz continuous wave (CW) gyrotrons will be upgraded by enhanced 1.5 MW tubes, which are based on the successful existing design.

07/12/2020, 12:04 - Dr. Lalit Kumar: I have following suggestion

1. Glazed joints are glassy joints and would not sustain 1200 deg.C.temp.

2. High temp Mo Mn metallization definitely meets your req.

The solution to your req. could be:

1. Take an alumina ceramic disc with Pin holes and pre-metallized at the rim.

2. Braze it to a Monel collar

3. Make a glazed joint of Kovar pins in assembly made above.

Dr RS Raju is an expert of glazing process and can definitely help you.

4. Assemble the header with gun Electrodes by spot welding.

5. Braze this header to Gun seal by induction heating.

The above process is doable and was developed by us for 30 W S band TWT at CEERI.

The technology know how manuals were handed over to BEL and may be available in their archives.

Another alternative which you may be considering is to replace the glazed joint by metallized ceramic-metal joint.

09/12/2020, 20:24 - BNBasu Prof: (1) Webinar#4 of our Group:

I am happy to inform all that

Professor Claudio Paoloni, Head of Engineering Department and Cockcroft Chair, Lancaster University, UK will deliver a talk on the topic:

“New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes”

on 9th January 2021 tentatively at 3-30 pm Indian time (IST) (Duration: one hour and a half including question-answer session).

Mr Raj Singh, the convener of the webinar, is coordinating with Ms Rupa Basu (Shaw) of Lancaster University to work out the other details. There will be a single lecture on that day of the session. Professor PK Jain, who will chair the session, will let us know the other requirements, if any.

(2) Webinar#5 of our Group:

I am happy to inform all that Professor RS Raju will deliver a talk on

“The First Ever Dispeser Cathode Developed in India” (including historical timeline and the activities at CEERI encompassing the various areas of cathode development). There will be a single lecture on that day of the session. Mr Raj Singh, the convener of the webinar, will be in touch with Professor Raju to decide the date and time of the programme. Dr. Ranjan Barik will host the programme. Dr. KS Bhat, who will chair the session, will let us know the other requirements, if any.

THANK YOU.

09/12/2020, 23:48 - BNBasu Prof: Thoughts of the Day:

We can appreciate, with the help of the beam-wave coupled dispersion relation of a VED amplifier (such as TWT or gyro-TWT), that a real β corresponding to a complex ω and, at the same time, a real ω corresponding to a complex β, refers to the convective instability and amplification in the device. For this udersanding, you may refer to the Table [Source: AI Akhiyezer, IA Akhiyezer, RV Polovin, AC Sitenko, and KN Stepanov, “Collective oscillations in a plasma,” Int. Series of Monographs in Natural Philosophy, vol. 7 (Oxford: Pergamon Press, 1967)].

10/12/2020, 13:22 - Shyam BhU: What is the significance of the magnetron word in Magnetron injection gun (MIG)? As I think it consist inner cathode surrounded by anode, like in magnetron. Please anyone explain this in detail, why it's called magnetron injection gun?

10/12/2020, 13:58 - +91 70239 74424: Dear Sir,

The method of producing spiral electron beams is called the "magnetron injection" technique. It operates on the principle of crossed electric and magnetic fields such that the beam is generated initially with a transverse component. Thus, the electric field extends between the cathode and the anode, and also between the cathode and a control electrode, so that it includes both an axial component and a radial component. The magnetic field is an axial one, so that as soon as the electrons leave the cathode, they experience a crossed electric and magnetic field producing the spiral motion of the electron beam.

In other words, the term “magnetron injection gun” (or MIG) pertains to a class of electron guns in which thermionic emission arises from an axially symmetric cathode immersed in an axially symmetric magnetic field, arranged so that the axes of symmetry of the cathode and the field coincide.

10/12/2020, 14:33 - +91 70239 74424: Yes you are right;

The word “magnetron” came from the magnetron device. Because in MIG design, the principle of the cylindrical magnetron is used in which a rotating space-charge cloud is formed between a cylindrical cathode and coaxial anode immersed in an axisymmetric magnetic field.

Further, by modifying the form of the anode, it is possible to obtain a component of electric field in the axial direction; thus the rotating electrons were caused to move axially parallel to the cathode and out of the gun, to form a hollow electron beam.

10/12/2020, 15:51 - BNBasu Prof: Shyam, Alok has elaborately answered to your question on MIG. You can also interact with Dr. Udaybir Singh of CSIR-CSIO. If you have his email address, it is fine. I will share the email addresses of both Alok and Udaybir with you if you send me an email instruction.

10/12/2020, 16:01 - Shyam BhU: Sure sir, further any discussion with them, will definitely enhance my understanding.

10/12/2020, 16:09 - BNBasu Prof: The magnetron injection gun (MIG) is so named because of its cathode assembly resembling a magnetron. It is meant for fast-wave VEDs such as a small-orbit gyrotron. It forms a hollow annular beam of gyrating electrons comprised of helical beamlets of small orbital radii compared to the transverse dimensions of the interaction structure of the device. The convex (conical) thermionic dispenser cathode of an MIG is operated in the temperature-limited condition to minimize the velocity spread in the beam.

10/12/2020, 19:26 - BNBasu Prof: Ruess, Tobias; Avramidis, Konstantinos A.; Gantenbein, Gerd; Illy, Stefan; Rzesnicki, Tomasz; Thumm, Manfred; Jelonnek, John, “Theoretical Study on the Possibility for Stepwise Tuning of the Frequency of the KIT 2MW 170/204 GHz Coaxial-Cavity Gyrotron,” 45th Int. Conf. on Infrared, Millimeter and Terahertz Waves (IRMMW-THz 2020), online, 08.11.2020 – 13.11.2020.

Abstract:

A first theoretical study on the possibility for stepwise tuning of the frequency of the KIT 170/204 GHz TE34,19/TE40,23-mode pre-prototype has been done. A bandwidth of ± 10 GHz around both center frequencies is considered as tuning range. For each of the two bands in total 11 modes have been selected to cover the entire frequency range. The theoretical study has shown that just changing the azimuthal index of the mode series is insufficient because the insert loading constraint is not fulfilled. A new mode series has been found in which the TE42,22-mode is excited after the TE40,23-mode and reduces the insert loading to a maximum of 0.1 kW/cm2.

11/12/2020, 00:41 - BNBasu Prof: The lecture by Professor Claudio Paoloni is going to be convened by Mr. Raj Singh on our Group platform on 9th

January 2021. Some of the recent publications of Professor Paoloni are as follows.

1. Claudio Paoloni, Rupa Basu, Jeevan Rao, and Rosa Letizia, “Sub-THz travelling-wave tubes for novel wireless high capacity networks, Dec 6 – 10, 2020 IEEE Int. Conf. on Plasma Sciences (ICOPS2020).

2. Claudio Paoloni, Rupa Basu, Laxma R. Billa, Jeevan M. Rao, Rosa Letizia, Qiang Ni, Edward Wasige, Abdullah Al-Khalidi, Jue Wang, and Razvan Morariu, “Long range millimeter wave wireless links enabled by traveling-wave tubes and resonant tunnelling diodes,” IET MAP 2020.

3. Maruf Hossain, Viktor Krozer, Trung Le, Rupa Basu, Rosa Letizia, Ernesto Limiti, François Magne, Marc Marilier, Antonio Ramirez, Jeevan M Rao, Giacomo Ulisse, Borja Vidal, Hadi Yacob, and Claudio Paoloni, “Sub-THz wireless system with electronic and optoelectronic transmitters,” SPIE Photonics West Opto, Broadband Access Communication Technologies XV, Mar 6-9, 2021, San Francisco, USA.

4. C. Paoloni, V. Krozer, F. Magne, T. Le, M. Hossain, Rupa Basu, J. M Rao, R. Letizia, E. Limiti, M. Marilier, G. Ulisse, A. Ramirez, B. Vidal, and H. Yacob, “Advancement in high capacity wireless distribution above 140 GHz”, 2020 13th UK-Europe-China Workshop on Millimeter Waves and Terahertz Technologies (UCMMT).

5. M. Hossain, V. Krozer, T. Le, Rupa Basu, R. Letizia, E. Limiti, F. Magne, M. Marilier, A. Ramirez, J. M Rao, G. Ulisse, B. Vidal, H. Yacob, and C. Paoloni,“D-band transmission hub for point to multipoint wireless distribution,” European Microwave Week 2020.

6. Rupa Basu, L. R. Billa, J. M. Rao, N. Renninson, B. Rodgers, Q. T. Le, R. Letizia, and C. Paoloni,” On a D-band travelling-wave tube for wireless links,” 2020 International Vacuum Electronics Conference (IVEC), Monterey, California, USA, 2020 (Rupa Basu having been felicitated with Best Student Paper Award).

7. Rupa Basu, L. R. Billa, J. M. Rao, L. Himes, Y. Zheng, N. Renninson, B. Rodgers, R. Letizia, D. Gamzina, N. C. Luhmann, Jr., and C. Paoloni, “Design and Microfabrication of a Double Corrugated Waveguide for G-Band TWTs”, 2020 International Vacuum Electronics Conference (IVEC), Monterey, California, USA, 2020.

8. Rupa Basu, L. R. Billa, J. N. Rao, R. Letizia, and C. Paoloni, “TWTs for Point to Point D-band Wireless Links”, 2020 International Vacuum Electronics Conference (IVEC), Monterey, California, USA, 2020.

9. C. Paoloni, V. Krozer, F. Magne, Q. T. Le, Rupa Basu, J. Rao, R. Letizia, E. Limiti, M. Marilier, G. Ulisse, A. Ramirez, B. Vidal, H. Yacob. “D-band Point to Multi-Point Deployment with G-Band Transport,” European Conference on Networks and Communications 2020.

10. A Ramirez, V. Krozer, Q.T. Le, J. Rao, Rupa Basu, R. Letizia, E. Limiti, F. Magne, M. Marilier, G. Ulisse, H. Yacob, B. Vidal, R. Llorente, C. Paoloni, “D-band Point to MultiPoint Wireless Evaluation Platform in Real Environment”, European Conference on Networks and Communications 2020.

11/12/2020, 10:13 - BNBasu Prof: Thought of the Day:

The persons in the accompanying photo are Russell Varian and Siguard Varian.

12/12/2020, 09:58 - Anurag Misra Dr. VECC Kolkata joined using this group's invite link

12/12/2020, 14:46 - BNBasu Prof: Title: Design and Analysis of a Wideband Staggered Double-Vane Slow-Wave Structure for W-Band Amplifier

Published in: IEEE Transactions on Plasma Science (Early Access)

Date of Publication: 11 December 2020

Authors: Richards Joe Stanislaus, Anirban Bera, Rajendra Kumar Sharma

Keyword: Beam-wave interaction (BWI), Bragg reflector, dispersion analysis, slow-wave structure (SWS), staggered double vane (SDV).

Abstract: This article presents the design and analysis of a staggered double-vane (SDV) slow-wave structure (SWS) for W-band amplifier, with 20-dB gain and a very high bandwidth (~25%). The use of dual Bragg reflector at either end of the interaction structure increases the impedance matching and the radio frequency (RF) coupling efficiency at the input and output ports, thereby reducing the RF leakage at the electron gun and collector ends, from 15% to 25% to less than 0.6%. The attenuator section is simple to fabricate and optimally designed in order to provide an effective isolation (>20 dB) between the input RF signal in the input section and the RF signal reflected from the output section. The dispersion analysis, the transmission analysis of each section, and the beam-wave interactions were simulated using the Dassault system's computer simulation technology (CST) eigenmode solver, time-domain solver, and the particle-in-cell (PIC) solver, respectively. The proposed design of the SDV SWS conclusively provides an enormous bandwidth of ~25 GHz with 20-dB gain for W-band amplifier, when compared to its solid-state counterparts and earlier reported work as per the author's knowledge.

Doi: 10.1109/TPS.2020.3040223

Link: https://www.doi.org/10.1109/TPS.2020.3040223

12/12/2020, 23:37 - BNBasu Prof: Thought of the Day:

The inventor of TWT is

(a) R. Kompfner.

(b) Andrei Haeff.

(c) J. R. Pierce.

(d) N. E. Lindenblad.

Answer: (b)

13/12/2020, 10:22 - +91 70239 74424: China turns on nuclear-powered 'artificial sun' (Update) https://phys.org/news/2020-12-china-nuclear-powered-artificial-sun.html

13/12/2020, 16:33 - Ansari BHU: Design and Simulation of Dual-Band Nonuniform Relativistic Backward Wave Oscillator Using a Bragg Structure as Its RF Circuit and Reflector-Cum-Mode Converter

Authors

MA Ansari, M Thottappan

Publication date 2020/3/2 Journal IEEE Transactions on Electron Devices

Volume 67 Issue 4 Pages 1814-1818 Publisher IEEE

Description

A relativistic backward wave oscillator (RBWO) operating in dual (C and X) band is designed and studied using finite-difference time domain (FDTD) particle-in-cell (PIC) simulations implemented in MAGIC. It consists of a sinusoidally corrugated, moderately overmoded nonuniform slow wave structure (SWS) in the downstream section and a single fold two-way helically corrugated Bragg structure in the upstream section. A single intense relativistic electron beam (IREB) having ~5.1 kA of current is predicted for 600 kV of diode voltage. An RF output power ~720 MW in X -band and ~510 MW in C -band are predicted in TE_11 mode with a guiding magnetic field of ~2.5 T.

13/12/2020, 17:55 - BNBasu Prof: Mumtaz, the first author of the paper abstracted, delivered a talk on 5th September 2020 on this forum of Thinkers Group.

13/12/2020, 22:49 - BNBasu Prof: Thought of the Day:

Design & Development - NEW PARADIGM

- Integrated Design Environment (IDE)
- Concurrent Engineering- Sub Assy. Design
- Configuration Control

Optimization using Neural Network & GA

Establish Standard Design Rules

Smart Tubes –Iterative Learning Control

First Pass Design Success

Networking : CAD-CAM-Process control & Inventory

Collected from a lecture by Dr. Lalit Kumar

14/12/2020, 18:20 - Mahto NIT Patna: Manpuran Mahto and P. K. Jain, “Study of virtual cathodes formation during beam-wave interaction in the reltron oscillator,” Physics of Plasmas 24, 093107 (2017).

Abstract

In the present work, a high power microwave oscillator—reltron has been analyzed to investigate the virtual cathode formation mechanism during the beam-wave interaction. In reltron, a side coupled modulation cavity is used as its RF interaction structure containing three metal grids along the longitudinal direction. The space charge current responsible for the virtual

cathode and its steady state electric field distribution has been analyzed. Space charge and beam impedance conditions for efficient device operation have been demonstrated. It has been shown that during the beam-wave interaction in the device, first a virtual cathode forms in the post-acceleration gap, and then the second virtual cathode develops between the first and second grids of the modulation cavity. These two virtual cathodes co-exist and cause the formation of a third virtual cathode between the second and third grids. At this instant, only the third virtual cathode remains, and for sustained device oscillation, this process repeats periodically in the device. The present study would be useful in understanding the beam-wave interaction mechanism as well as the design and development of efficient reltron devices.

Published by AIP Publishing. [http://dx.doi.org/10.1063/1.4991793]

15/12/2020, 07:55 - +91 95289 12230: https://www.linkedin.com/posts/edl-schamiloglu-2433991b7_scientists-suggest-us-embassies-were-hit-activity-6742985586325364736-zpyM

15/12/2020, 09:33 - Subhradeep Chakraborty: Mauro Mineo and Claudio Paoloni, “Double-corrugated rectangular waveguide slow-wave structure for terahertz vacuum devices,” IEEE Trans Electron Devices, vol. 57, no. 11, pp. 3169-3175 (2010)

Abstract

A novel rectangular-corrugated waveguide is proposed for submillimeter and terahertz vacuum devices. Two parallel corrugations that are enclosed in a rectangular waveguide create a beam channel that supports an interaction with a cylindrical electron beam. A notable advantage of the double-corrugated rectangular waveguide slow-wave structure (SWS) is the extension of well-established cylindrical beam technology to corrugated waveguide SWSs. The structure is also fully realizable with the most recent microfabrication techniques and is easily assembled. A detailed study to describe the electromagnetic behavior of the presented SWS is performed by 3-D electromagnetic simulation. A 650-GHz backward-wave oscillator and a 227-GHz traveling-wave tube are designed and simulated, by 3-D particle-in-cell code, to highlight the great potential of the double-corrugated rectangular waveguide for submillimeter frequency vacuum devices.

15/12/2020, 10:03 - BNBasu Prof: https://ee.princeton.edu/news/super-surfaces-use-terahertz-waves-help-bounce-wireless-communication-next-generation

15/12/2020, 23:01 - BNBasu Prof: Group members:

With a view to knowing one another’s work let us list up to five most recent journal papers authored/co-authored by us. Charity begins at home as follows:

(1) Xin Wang, Shifeng Li, Xuanming Zhang, Shengkun Jiang, Zhanliang Wang, Huarong Gong, Yubin, Gong, B. N. Basu, and Zhaoyun Duan, “Novel S-band metamaterial extended interaction klystron,” IEEE Electron Device Letters, vol. 41, no. 10, October 2020, page form 1580-1583 (2020).

(2) Shifeng Li, Zhaoyun Duan, Hua Huang, B. N. Basu, Fei Wang, Zhenbang Liu, Hu He, Xin Wang, Zhanliang Wang, and Yubin Gong, “Input and output couplers for an oversized coaxial relativistic klystron amplifier at Ka band,” IEEE Trans. Electron Devices, vol. 66, (no. 6, June) pp. 2758-2763 (2019).

(3) Xin Wang, Z. Duan, Xirui Zhan, Fei Wang, Shifeng Li, Shengkun Jiang, Zhanliang Wang, Yubin Gong, and B. N. Basu, “Characterization of metamaterial slow-wave structure loaded with complementary electric split-ring resonators,” IEEE Trans. Microwave Theory and Technique, vol. 67, pp. 2238-2246 (2019).

(4) Z. Duan, M. A. Shapiro, EdI Schamiloglu, N. Behdad, Y. Gong, J. H. Booske, B. N. Basu, and R. J. Temkin, “Metamaterial-inspired vacuum electron devices and accelerators,” IEEE Trans. Electron Devices, vol. 66, pp. 207-218 (2019).

(5) Amit K. Varshneya, Raktim Guha, Sushanta Biswas, Partha Pratim Sarkar, Subrata K. Datta and B. N. Basu, “Tape-helix model of analysis for the dispersion and interaction impedance characteristics of a helix loaded with a double-negative metamaterial for potential application in vacuum electron devices, Journal of Electromagnetic Waves and Applications, vol. 33, pp. 138-150 (2019).

16/12/2020, 22:21 - Dr. Lalit Kumar: Very impressive! Your collaboration with China seems to be growing well.

16/12/2020, 23:04 - BNBasu Prof: Dr. Lalit Kumar, Thank you. I am co-authoring a book chapter for CRC Press with Duan of UESTC, Chengdu and Professor Shapiro of MIT. Raktim of CEERI is the first author. It's a review on metamaterial assisted vacuum electron devices.

17/12/2020, 05:00 - SNJoshi CEERI: Good morning Prof. Basu. I had just gone through your tribute to Dr SSS Agarwala. You have very meticulously (as always) written this article, which would be very beneficial to all those particularly youngsters working in this field. I congratulate you for bringing out this document.

Regards and best wishes for your future endeavors.

17/12/2020, 07:38 - BNBasu Prof: My presentation had been dedicated to Dr. GS Sidhu who founded a factory to manufacture electron tubes at Sangrur after leaving CEERI.

17/12/2020, 12:58 - Raj Singh IPR: Dear All, we are privileged to announce our forth webinar in the VED Thinkers group Webinar Series.

The forth webinar will be held on 9th January 2021.

First three webinars have been very useful for the audience and the delegates are very happy with the level of knowledge, disseminated in these webinars.

This forth seminar is very special in the sense that we are inviting International Personalities as the speakers in our webinars and trying to make our webinar series of global importance.

Proceedings Fourth Webinar

Expert Talk: New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

Prof. Claudio Paoloni, Head of Engineering Dept. & Cockcroft Chair, Lancaster University UK has agreed to deliver a talk in this webinar.

The title of the talk will be "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes".

The talk will be delivered from 3:00 PM - 4:30 PM including question-answer session.

You all are welcome to enjoy this one and half hour of Science deliberation.

The session will be chaired by Prof. P K Jain.

Ms. Rupa Basu from Lancaster University will be the coordinator.

Ms. Nalini Pareek from CEERI will host the event.

This is tentative information. Program Schedule will be uploaded on the group very soon.

17/12/2020, 13:01 - BNBasu Prof: I will be in touch with Professor Claudio Paolini.

17/12/2020, 22:41 - Dr. Lalit Kumar: People may be interested in Indian work on reflex klystron- not much known as it was done at NPL in initial dayshttps://www.tandfonline.com/doi/abs/10.1080/03772063.1963.11486475?needAccess=true&journalCode=tijr20

17/12/2020, 23:26 - BNBasu Prof: Thanks, Dr. Lalit Kumar. One of the authors, Professor NC Vaidya, shifted from NPL to CEERI. Subsequently, he joined IT-BHU. He established Centre of Research in Microwave Tubes. He is the inventor of synklystromotron lense. You may correct me.

18/12/2020, 00:21 - BNBasu Prof: Vishal and I dedicated our book on high power microwave tubes published by Morgan and Claypool to Dr. NC Vaidya.

18/12/2020, 07:07 - BNBasu Prof: Mr. R Patnaik may please correctly write the spelling of the election lense synklysmotron lense invented by Dr. NC Vaidya. He closely worked with him.

18/12/2020, 08:03 - Patnaik BEL BLR: Yes. The spelling is correct. Nice to remember the great soul by dedicating the book.

18/12/2020, 08:31 - BNBasu Prof: It's so nice of Raktim of CEERI to place the full paper of Professor NC Vaidya referred to by Dr. Lalit Kumar. Raktim works in the areas of TWTs and metamaterial assisted vacuum electron devices.

18/12/2020, 10:46 - BNBasu Prof: You were among those including Professor ML Sisodia with Professor Vaidya to establish the microwave tube Centre at Electronics Engineering Department of BHU. You also worked with him on klystrons before joining BEL. So, you can give more information. Professor Lalit Kumar can educate us more on the prospect of reflex klystron.

18/12/2020, 10:51 - Dr. Lalit Kumar: Incidentally Dr Kailash Chandra of NPL had long association with CEERI in subsequent years.He fast sone more papers too on klystron. Dr Joshi may have his contact or we ask Mr Subodh Johri

18/12/2020, 12:09 - BNBasu Prof: The book chapters are in the review process. Dr. Purushothaman of CEERI has already sent his consent to deliver a talk on the effect of metamaterial assistance on the performance improvement of VEDs. Dr. SK Datta of MTRDC has initiated the work in the area and presented his paper at IVEC that you had chaired in 2011 if I remember alright.

18/12/2020, 13:25 - BNBasu Prof: Dear All, we are privileged to announce our forth webinar in the VED Thinkers group Webinar Series.

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The session will be chaired by Prof. P K Jain.

Ms. Rupa Basu from Lancaster University will be the coordinator.

Ms. Nalini Pareek from CEERI will host the event.

This is tentative information. Program Schedule will be uploaded on the group very soon.

21/12/2020, 11:16 - BNBasu Prof: Terahertz vacuum electronic circuits fabricated by UV lithographic molding and deep reactive ion etching

Appl. Phys. Lett. 95, 181505 (2009); https://doi.org/10.1063/1.3259823

Young-Min Shin, Larry R. Barnett, Diana Gamzina, Neville C. Luhmann Jr., Mark Field, and Robert Borwick

ABSTRACT

The 0.22 THz vacuum electronic circuits fabricated by UV lithography molding and deep reactive ion etching processes are under investigation for submillimeter wave applications. Eigenmode transient simulations show that, accounting for realistic values of our currently achievable fabrication tolerances, the transmission, and dispersion properties of the operation modes of a TE-mode, staggered, double grating circuit are maintained within less than 1 dB and 2% deviation, respectively. Scanning electron microscopy and atomic force microscopy analyses of the fabricated circuit samples demonstrate that both of the microelectromechanical system

fabrication approaches produce circuits with ±3–5 μm±3–5 μm dimensional tolerance and ∼30 nm∼30 nm surface roughness.

This work was supported by the HiFIVE (High Frequency Integrated Vacuum Electronics) program of DARPA, Grant No. G8U543366.

21/12/2020, 14:12 - Dr. Lalit Kumar: I visited UC Davis in 2018. Prof Luhmann showed me hos lab and presented his recent work to me. Diana Gamzina is now at SLAC and was my visit coordinator to SLAC the same year.

21/12/2020, 15:19 - BNBasu Prof: What a great experience! We need to develop terahertz devices. I attended your lecture on vacuum microelectronic devices. It would be nice to see the pdf version of your lecture posted on this platform. I am wondering if Vishal (Dr Kesari) could locate it.

21/12/2020, 15:29 - BNBasu Prof: Claudio at Lancaster whom I had the Abstract through email wrote to me a while ago that he had seen the circuit at UC Davis.

22/12/2020, 00:11 - BNBasu Prof: Anisullah Baig;Diana Gamzina;Takuji Kimura;John Atkinson;Calvin Domier;Branko Popovic;Logan Himes;Robert Barchfeld;Mark Field;Neville C. Luhmann.

“Performance of a Nano-CNC Machined 220-GHz Traveling Wave Tube Amplifier,”

IEEE Transactions on Electron Devices 64 (5), 2390-2397 (2017).

Abstract:

We report on hot test measurements of a wide-bandwidth, 220-GHz sheet beam traveling wave tube amplifier developed under the Defense advanced research projects agency (DARPA) HiFIVE program. Nano-computer numerical control (CNC) milling techniques were employed for the precision fabrication of double vane, half-period staggered interaction structures achieving submicrometer tolerances and nanoscale surface roughness. A multilayer diffusion bonding technique was implemented to complete the structure demonstrating wide bandwidth (>50 GHz) with an insertion loss of about -5 dB achieved during transmission measurements of the circuit. The sheet beam electron gun utilized nanocomposite scandate tungsten cathodes that provided over 438-A/cm 2 current density in the 12.5:1 ratio sheet beam. An InP HBT-based monolithic microwave integrated circuit preamplifier was employed for TWT gain measurements in the stable amplifier operation region. In the wide-bandwidth operation mode (for gun voltage of 20.9 kV), a gain of over 24 dB was measured over the frequency range of 207-221 GHz. In the high-gain operation mode (for gun voltage of 21.8 kV), over 30 dB of gain was measured over the frequency range of 197-202 GHz. High-power tests were conducted employing an extended interaction klystron.

ISSN Information:

INSPEC Accession Number: 16823332

DOI: 10.1109/TED.2017.2682159

22/12/2020, 00:55 - Rupa BEL: https://youtu.be/SNJ9L1JkBEg

A very interesting public lecture by Diana Gamzina

22/12/2020, 12:33 - BNBasu Prof: No doubt very much interesting lecture, the question-answer session, in particular. So, let's develop strong 'copperotrons'.

22/12/2020, 15:47 - BNBasu Prof: Recently, I was discussing with Dr Richard Temkin (MIT) and Prof Edl Schamiloglu (Univ New Mexico) through emails regarding the areas in which we should focus on in the area of vacuum electron devices. Their responses are as follows.

Edl Schamilo: "I see a lot of interest these days in W and V band for space communications."

Richard Temkin: "I agree that solid state sources are making tremendous progress. That is a good thing. Vacuum electronics is still important for many applications. For peak power levels of several megawatts, vacuum electronics is dominant. Applications include accelerators at a wide range of frequencies, but particularly for medical accelerators. Vacuum electronics is dominant in plasma heating applications for fusion energy research. Vacuum electronics is important for power levels above 100 Watts at frequencies above 100 GHz. Solid state may eventually reach these frequencies but it may take a long time and require power combining. It may also be worthwhile to review papers at the IVEC conferences to see where research is heading."

23/12/2020, 00:26 - Subhradeep Chakraborty: You have been featured in this edition of the Newsletter.....It is really wonderful to see a researcher from India is contributing in TWT research having a relevance with 5G and beyond....

23/12/2020, 00:29 - Rupa Basu: Some of our other projects are: H2020 Tweether, EPSRC DLINK & Chistera Teralinks

All these projects are in high data rate wireless communication systems using TWTs

23/12/2020, 11:11 - BNBasu Prof: It would be nice if Rupa presents the details in a webinar on this platform. I believe the Convener has also noted this development.

23/12/2020, 11:11 - BNBasu Prof: Anisullah Baig;Diana Gamzina;Larry R. Barnett;Calvin Domier;Neville C. Luhmann, "233 GHz ultra-wide band TWTA: PPM Integrated sheet electron beam transport and PIC analysis,"

2013 38th Int. Conf. on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz)

Abstract:

We report on the design and development of a PPM integrated 233 GHz staggered vane sheet beam TWTA. The permanent magnetic (NdFeB) based focusing lens structure for the sheet electron beam transport has been designed for a gun operated at 19 kV. For a beam tunnel of 830 μm 160 μm, a transmitted current of ~ 200 mA is achieved for > 40 mm length

channel. For 19 kV operation, the TWTA circuit has been re-designed. The EM/PIC simulation analysis predicts ~ 40 GHz cold band width and ~ 20 GHz hot bandwidth for a power gain of > 25 dB. The PCM based transmission results, TWT circuit cold test, and the pulsed proof of concept hot test status will be presented in the conference.

Published in: 2013 38th Int. Conf. on Infrared, Millimeter, and Terahertz Waves (IRMMW-THz)

Date of Conference: 1-6 Sept. 2013 Date Added to IEEE Xplore: 21 November 2013

Electronic ISBN:978-1-4673-4717-4 INSPEC Accession Number: 13915990

DOI: 10.1109/IRMMW-THz.2013.6665485 Publisher: IEEE

Conference Location: Mainz, Germany

23/12/2020, 11:33 - BNBasu Prof: Anisullah Baig, Diana Gamzina, Robert Barchfeld, Calvin Domier, Larry R. Barnett and Neville C. Jr. Luhmann, “0.22 THz wideband sheet electron beam traveling wave tube amplifier: Cold test measurements and beam wave interaction analysis,” Physics of Plasmas 19(9) September 2012 DOI: 10.1063/1.4750048

Abstract

n this paper, we describe micro-fabrication, RF measurements, and particle-in-cell (PIC) simulation modeling analysis of the 0.22 THz double-vane half period staggered traveling wave tube amplifier (TWTA) circuit. The TWTA slow wave structure comprised of two sections separated by two sever ports loaded by loss material, with integrated broadband input/output couplers. The micro-metallic structures were fabricated using nano-CNC milling and diffusion bonded in a three layer process. The 3D optical microscopy and SEM analysis showed that the fabrication error was within 2-3 {mu}m and surface roughness was measured within 30-50 nm. The RF measurements were conducted with an Agilent PNA-X network analyzer employing WR5.1 T/R modules with a frequency range of 178-228 GHz. The in-band insertion loss (S{sub 21}) for both the short section and long section (separated by a sever) was measured as {approx}-5 dB while the return loss was generally around {approx}-15 dB or better. The measurements matched well with the S-matrix simulation analysis that predicted a 3 dB bandwidth of {approx}45 GHz with an operating frequency at 220 GHz. However, the measured S{sub 21} was ~3 dB less than the design values, and is attributed to surface roughness and alignment issues. The confirmation measurements were conducted over the full frequency band up to 270 GHz employing a backward wave oscillator (BWO) scalar network analyzer setup employing a BWO in the frequency range 190 GHz-270 GHz. PIC simulations were conducted for the realistic TWT output power performance analysis with incorporation of corner radius of 127 μm, which is inevitably induced by nano-machining. Furthermore, the S_{21} value in both sections of the TWT structure was reduced to correspond to the measurements by using a degraded conductivity of 10% International Annealed Copper Standard. At 220 GHz, for an elliptic sheet electron beam of 20 kV and 0.25 A, the average output power of the tube was predicted to be reduced from 90 W (for ideal conductivity/design S-parameters) to 70 W (for the measured S-

parameters/inferred conductivity) for an average input power of 50 mW. The gain of the tube remains reasonable: ~31.4 dB with an electronic efficiency of ~1.4%. The same analysis was also conducted for several frequencies between 190 GHz-260 GHz. This detailed realistic PIC analysis demonstrated that this nano-machined TWT circuit has slightly reduced S-parameters and output power from design, but within an acceptable range and still have promising output power, gain, and band width as required. Thus, we expect to meet the specifications of 1000 W-GHz for the DARPA program goals.

23/12/2020, 17:58 - Raj Singh IPR: Hello sir, we can chalk out the detail of 5th webinar to be held in the month of March 2020. One talk by Dr. R S Raju on "First Ever Cathode Development in the Country" is scheduled in 5th webinar. Another talk by Ms. Rupa can be comfortably included into the 5th webinar.

23/12/2020, 21:45 - BNBasu Prof: Interestingly, I was also thinking on the same line. Please check if we could include another talk.

24/12/2020, 13:18 - BNBasu Prof: Yanmei Wang, Changjiang Zhao, Li Qiu, Lei Zhang, and Xiaojin Kong, “Development of Ku band miniature TWT,” 2017 Eighteenth International Vacuum Electronics Conference (IVEC), 24-26 April 2017, London, UK

Abstract:

This paper describes the development of miniature Ku-band pulsed helix traveling wave tube (VE3306) within 2GHz bandwidth. The peak power reached more than 450W and overall efficiency was 42% with 30% pulsed duty cycle. The miniature TWT can be used as the transmitter of T/R module and booster of MPM (Microwave Power Module).

INSPEC Accession Number: 17578554

DOI: 10.1109/IVEC.2017.8289498

25/12/2020, 07:57 - BNBasu Prof: Sir, we had worked on 0.22THz twt's SWS simulation with 32GHz bandwidth (Post PIC simulations).

Though the cold bandwidth was over 40GHz.

This was using staggered double vane slow wave structure.

The above reports the work of Richards.

25/12/2020, 09:10 - +91 82697 04759: https://forms.gle/1ogRxg8vjWjyV1k67

28/12/2020, 12:46 - Ansari BHU: Sir, what is the difference between Pseudospark-sheet electron beam and sheet electron beam?

28/12/2020, 16:09 - +91 81074 33661: There are different ways of generating sheet electron beam. One method is pseudospark based emission.It consists of hollow cathode, anode and apertures on hollow cathode/anode are in sheet form. Beam generated from pseudospark discharge requires less or even zero magnetic field. Because it propagates in ion-focusing regime.

28/12/2020, 16:11 - Ansari BHU: Thank You! Is it interaction length dependent? I mean if the length of the device is more then whether it will be effective as you said it required less or zero magnetic field.

28/12/2020, 18:10 - Dr. Vishal Kesari: Please find the attached proceedings of webinar#3 held on 7 November 2020.👇

28/12/2020, 20:43 - BNBasu Prof: Vishal, Nice of you for your great effort put into its making. It enriches our group. Now, we are looking forward to the final announcement of the next webinar.

29/12/2020, 21:01 - BNBasu Prof: "South Korea's 'artificial sun' sets new world record, lights up at 100 million degrees for record 20 seconds - SCIENCE News" https://www.indiatoday.in/amp/science/story/south-korea-artificial-sun-sets-new-world-record-100-million-degrees-record-20-seconds-1754132-2020-12-29

31/12/2020, 09:01 - Raj Singh IPR: Webinar #4 Program

Date: 9th January 2021

Time: 3:00 to 4:30 PM

Expert Talk

Speaker: Prof. Claudio Paoloni,

Head, Engineering Dept. & Cockcroft Chair, Lancaster University, UK

Topic: "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes"

Chair: Prof. P K Jain

Co-ordinator: Ms. Rupa Basu, Lancaster University

Host: Ms. Nalini Pareek, CEERI

31/12/2020, 09:37 - BNBasu Prof: Mauro Mineo and Claudio Paoloni, “Double-corrugated rectangular waveguide slow-wave structure for terahertz vacuum devices,” IEEE Trans Electron Devices, vol. 57, no. 11, pp. 3169-3175 (2010)

Abstract

A novel rectangular-corrugated waveguide is proposed for submillimeter and terahertz vacuum devices. Two parallel corrugations that are enclosed in a rectangular waveguide create a beam channel that supports an interaction with a cylindrical electron beam. A notable advantage of the double-corrugated rectangular waveguide slow-wave structure (SWS) is the extension of well-established cylindrical beam technology to corrugated waveguide SWSs. The structure is also fully realizable with the most recent microfabrication techniques and is easily assembled. A detailed study to describe the electromagnetic behavior of the presented SWS is performed by 3-D electromagnetic simulation. A 650-GHz backward-wave oscillator and a 227-GHz traveling-wave tube are designed and simulated, by 3-D particle-in-cell code, to highlight the great potential of the double-corrugated rectangular waveguide for submillimeter frequency vacuum devices.

Proceedings Fourth Webinar

Expert Talk: New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

01/01/2021, 12:56 - BNBasu Prof: Webinar #4 Program

Date: 9th January 2021

Time: 3:00 to 4:30 PM

Expert Talk

Speaker: Prof. Claudio Paoloni,

Head, Engineering Dept. & Cockcroft Chair, Lancaster University, UK

Topic: "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes"

Chair: Prof. P K Jain

Co-ordinator: Ms. Rupa Basu, Lancaster University

Host: Ms. Nalini Pareek, CEERI

04/01/2021, 20:00 - Dr. Vishal Kesari: Join us for COMSOL Day: Electromagnetics in Government R&D on Wednesday, 20 January 2021, to see how experts are using simulation for their research in various areas of electromagnetics.

This live, interactive event will feature presentations from:

- Dr. Shriganesh S. Prabhu, an expert on terahertz spectroscopy and metamaterial modeling, currently an associate professor of physics at the Tata Institute of

Fundamental Research

- Dr. Balamati Choudhury, principal scientist at the Center of Electromagnetics, CSIR - National Aerospace Laboratory, with extensive experience in computational electromagnetics

- Dr. Rahul Shukla, scientific officer at the Indus Synchrotrons Utilization Division of Raja Ramanna Centre for Advanced Technology and assistant professor at Homi Bhabha National Institute

In addition, COMSOL Day: Electromagnetics in Government R&D will include interactive Tech Caf©s, live software demonstrations, and a number of COMSOL presentations. To register, please visit: http://comsol.co.in/c/b9pv

04/01/2021, 20:29 - BNBasu Prof: Must be of great relevance to our group since Electromagnetics is the backbone of vacuum electron devices.

05/01/2021, 13:53 - +91 93143 96993:

https://www.linkedin.com/events/europeanmicrowaveweek20206747115797757489152

06/01/2021, 09:21 - BNBasu Prof: Thought of the Day:

In a gyrotron interaction cavity, the wave group wave velocity is made close to zero to make

(i) energy velocity much slow to keep enough electromagnetic energy in the cavity to provide the field for beam-wave interaction;

(ii) phase propagation constant small thereby mitigating the effects of velocity spread in the electron beam on the inhomogeneous broadening of the cyclotron resonance band; and

(iii) even a small down-tapering of the waveguide radius on the cathode side of the cavity effective to make the cutoff frequency in this region larger than the operating frequency thereby preventing electromagnetic radiation from entering the cathode region.

07/01/2021, 07:26 - Raj Singh IPR: Dear All, please find final announcement of IVth Webinar to be held on 9th January Saturday. Web link will be shared soon.

07/01/2021, 07:26 - Raj Singh IPR: Webinar #4 VED Thinkers' Group

9th January 2021, Saturday, 1500 hrs IST

SCHEDULE

Introductory Remarks by Sri Raj Singh Ji, Convener

Welcome and Introduction of Guests

Remembering Sri Jeevan Rao

Session Commencement by Dr. P. K. Jain, Chairman

Invited Talk by Prof. Claudio Paoloni, Invited Speaker, Lancaster, UK

Vote of Thanks by Dr. Sheel Aditya, Area Expert

07/01/2021, 11:28 - Raj Singh IPR: Webinar #4

Dedicated to the memory of VED Researcher Jeevan M

Date: 9th January 2021

Time: 3:00 to 4:30 PM

Expert Talk:

Speaker: Professor Claudio Paoloni,

Head, Engineering Dept. & Cockcroft Chair, Lancaster University, UK

Topic: "New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes"

Chair: Professor Pradip K Jain

Host: Ms. Nalini Pareek, CEERI

Coordinator: Ms. Rupa Basu, Lancaster University

Convener: Mr. Raj Singh

Vote of Thanks: Professor Sheel Aditya

Link for the webinar: To be posted on the group forum by Dr. Vishant Gahlaut and Dr. Uttam K Goswami.

07/01/2021, 19:34 - Raj Singh IPR: Change is always resistive. This time we thought of changing the announcement pattern on the suggestion of our

team members and we made announcement in the changed pattern. But we got so many phone calls that people want the announcement in old pattern and we have to give up.

07/01/2021, 19:46 - Vishant Gahlaut Bansthali: Dear VED Thinkers,

I request all the eminent members of VED consortium to join the Google meet cloud well before 3 PM in order to commence the webinar at scheduled time.

I hope that we will keep the video mode off and mute audio to avoid the cross-link, while the speaker is delivering a talk, it will help us to conduct the session better.

The web link is as follows:

https://meet.google.com/yeq-bbmm-bab

On behalf of the convener Webinar#4

09/01/2021, 17:38 - Dr. Vishal Kesari: Pl. consider Jeevan's very first publication in conference proceedings:

Jeevan M., Vishal Kesari, S. Karmakar, S. Kamath, and M. V. Kartikeyan, "Simulation of higher order modes in a tapered circular cavity for a millimeter-wave gyrotron," 9th Int. Conf. on Microwaves, Antenna, Propagation and Remote Sensing (ICMARS-2013), International Centre for Radio Science, Jodhpur, India (Dec. 11-14, 2013) (Oral presentation).

for which he could win best paper award.

09/01/2021, 17:41 - Dr. Vishal Kesari: Thanks to all for active participation in Webinar#4.

Special thanks to the Speaker, Session Chair, Proposer Vote of Thanks, and the webinar coordinating team!

It was a wonderful academic event seeing TWT leading over solid-state devices.

We are in the process of developing the proceedings of Webinar#4.

I request Today's Session Chair Professor PK Jain and Proposer Vote of Thanks Professor Sheel Aditya to share a few lines to be included in proceedings to vishalkesari@gmail.com.

Regards

Vishal Kesari

09/01/2021, 22:37 - BNBasu Prof: From BN Basu to Professor Claudio Paoloni:

Dear Professor Paoloni,

I have no words for thanking you for your kind gesture of sparing your precious time and delivering such an illuminating talk!

With warm regards from me and VED Thinkers Group,

BN Basu

Reply:

Dear Professor Basu,

I am very grateful of this outstanding opportunity to contribute to the VED Thinkers group and I am very honoured of the interest of so many distinguished scientists in vacuum electronics.

Best wishes,

Claudio

09/01/2021, 23:02 - BNBasu Prof: I am already in touch with Dr. RS Raju for his talk on CATHODES in a session to be chaired by Dr. KS Bhat, coordinated by Dr. Ranjan Barik, and convened by Mr. Raj Singh.

10/01/2021, 06:20 - SNJoshi CEERI: Dear Prof. Basu, I am grateful to you and your entire team for arranging such an informative lecture by Prof. Paoloni. He informed a very positive future for these devices particularly in the communication area.

10/01/2021, 06:30 - BNBasu Prof: Right you are. I take this opportunity to profoundly congratulate Ms Rupa Basu, Ms Nalini Pareek, Dr Vishant Gahlaut and Dr. Uttam Goswami Goswami and their associates to help the group to make the programme successful.

I am grateful to Professor Sheel Aditya and Professor PK Jain for their direct contributions to the programme.

Motivated by Professor SN Joshi, as I am told by the webinar convener Mr Raj Singh, our group is having its next webinar on CATHODES in the month of March 2021 under the guidance of Dr. KS Bhat.

11/01/2021, 12:07 - BNBasu Prof: “Dear friends, Excellence in life can only be achieved by burning midnight oil. There is no shortcut to hard work in reaching the pinnacle either in personal life or professional career. And to take your organization to unassailable heights, it requires sustainable efforts from each member, unstinting support from the family members and clear cut vision and directions from the leaders in the organization. DRDO has abundance of all these in writing the saga of our achievements in golden letters for the past 60 years. Today, we stand tall with pride celebrating DRDO@60. The events planned for DRD0@60 have got overwhelming response. ‘Submarine Exhibition’ was inaugurated by Hon’ble Raksha Mantri, Smt Nirmala Sitharaman. The logo competition has received creative logo entries from many labs worth appreciating and having professional touch. The painting competition “DRDO in my Eyes” is also progressing well. I am happy to know that Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur has planted over 1000 tree saplings of more than eight varieties giving a green look to the campus. The young scientists have given invaluable input for DRDO@60 and have come forward voluntarily to conduct the events. This type of positive response from the team raises the threshold level of the team as well as boost up the confidence level of people heading such a dynamic team. My complements to one and all. Let the tempo remain. Let the fire in the belly to achieve the impossible burn more vigorously. Let our predecessors, who worked tirelessly to enhance the image of our esteemed organization, feel that their

contributions did not go waste and today the organization is in safe hands, who have the capability, willpower and confidence to contribute to nation building and New India - 2022. Let us aim for the New India where innovations in defence sector are synonym with DRDO. Together we can and we will show to the world that we are “Second to None”. Jai Hind.”

Dr S Christopher

11/01/2021, 13:29 - Raj Singh IPR: Dear All,

A popular talk on "Simulating Sun on Earth: The ITER Project" by Mr. Ujjawal Baruah, Project Director, ITER India has been organised today (11th January) at 6:00 PM.

Weblinks:

Zoom link: https://zoom.us/j/96620746979

YouTube Live at: https://youtu.be/p8PI375k9uo

Hosted & Moderated by

Dr. B. Satyanarayana

TIFR Mumbai

Organisers:

INO (India-based Neutrino Observatory)

TIFR, Mumbai

http://www.ino.tifr.res.in/ino/ols

online interactive lecture series for general audience

12/01/2021, 20:25 - Dr. Vishal Kesari: 'COMSOL Day: Electromagnetics in Government R&D'

Wednesday, 20th January 2021 between 9:30 am to 4:30 pm IST

For more details and to register for this event, please click on:

http://comsol.co.in/c/b9u1

13/01/2021, 12:35 - BNBasu Prof: Assistant Professor with tenure track in Microwave Engineering at Chalmers University of technology:

Please find announcement for assistant Professor with tenure track in Microwave/THz Engineering at Chalmers University of technology. We would appreciate if you can send this announcement to possible candidates. Many thanks.

To support the long-term competitiveness and development in microwave engineering, we are seeking excellent candidates for a tenure-track Assistant Professor position at the department of microtechnology and nanoscience, Chalmers, who will pursue a strong and internationally leading research programme related to microwave and/or terahertz technologies. We particularly welcome applications from junior researchers that will bring complementary expertise to our department.

Please find more information and instructions how to apply at:

http://www.chalmers.se/en/about-chalmers/Working-at-Chalmers/Vacancies/?rmpage=job&rmjob=8931

Application deadline: 31 January, 2021

13/01/2021, 21:15 - Subhradeep Chakraborty CEERI: @919956777372 I have shared the required qualifications for the post of Assistant Professor at Chalmers University. To the best of my knowledge PhD is mandatory for recruitment for the post of Assistant Professor from this year.

13/01/2021, 22:46 - BNBasu Prof: Professor Manfred Thumm, in reply to sending him Proceedings of Webinar#3 of our group, writes:

Dear Professor Basu,

Thank you very much for sending me these very valuable proceedings.

I follow with great interest and pleasure this webinar series.

Again, many congratulations, it's wonderful that you colleagues in India managed to organize these events!

Best wishes, yours

Manfred Thumm

13/01/2021, 23:39 - Raj Singh IPR: Good Evening Sir. It's is of great value to us. It's all because of your and group's other senior member's dedicated and untiring efforts and guidance. We wish to go on getting you people's guidance and blessing like that in future as well.

Thanks to Vishal also for his untiring efforts for producing the proceedings which is really a tough job. Hats off to him as well.

13/01/2021, 23:44 - BNBasu Prof: Hats off to Vishal!!!

14/01/2021, 12:08 - Dr. Lalit Kumar: Congratulations to Prof Kartikeyan on being awarded the Fellowship of INAE. His talk schedule is attached.Pl. join.

15/01/2021, 18:28 - Ansari BHU: Metamaterial-inspired vacuum electron devices and accelerators

Zhaoyun Duan, Michael A Shapiro, Edl Schamiloglu, Nader Behdad, Yubin Gong, John H Booske, BN Basu, Richard J Temkin

IEEE Transactions on Electron Devices 66 (1), 207-218, 2018

Metamaterials (MTMs) are structured materials with subwavelength features that can be engineered to have some unique properties not found in nature, such as negative refractive index, reversed Doppler effect, and reversed Cherenkov radiation. Based on these novel MTMs, several important research groups have made great attempts to develop novel MTM-inspired vacuum electron devices (VEDs) and accelerators. Just as solid-state power devices are innovated by incessant emerging of new semiconductor materials, VEDs can also be inspired by MTMs to have very remarkable advantages, such as smaller size, higher power, higher efficiency, and/or larger gain relative to conventional VEDs, such as traveling-wave tubes, backward-wave oscillators, and klystrons. Similarly, relative to conventional

accelerators, MTM-inspired accelerators have obvious advantages, such as smaller size and higher accelerating gradient. Furthermore, MTM-inspired devices have promising applications in areas such as radar, communication, electronic warfare, microwave heating, and imaging.

15/01/2021, 19:13 - BNBasu Prof: This paper is reference [93] of the paper titled “Progress in narrowband high-power microwave sources” published in Phys. Plasmas 27, 010501 (2020), the pdf of which was posted by Mumtaz a few days ago.

16/01/2021, 10:36 - BNBasu Prof: Jun Zhang, Dian Zhang,a) Yuwei Fan, Juntao He, Xingjun Ge, Xiaoping Zhang, Jinchuan Ju, and Tao Xun, “Progress in narrowband high-power microwave sources,” Phys. Plasmas 27, 010501 (2020); doi: 10.1063/1.5126271.

ABSTRACT

Even after 50 years of development, narrowband high-power microwave (HPM) source technologies remain the focus of much research due to intense interest in innovative applications of HPMs in fields such as directed energy, space propulsion, and high-power radar. A few decades ago, the main aim of investigations in this field was to enhance the output power of a single HPM source to tens or hundreds of gigawatts, but this goal has proven difficult due to physical limitations. Therefore, recent research into HPM sources has focused on five main targets: phase locking and power combination, high power efficiency, compact sources with a low or no external magnetic field, high pulse energy, and high-power millimeter-wave generation. Progress made in these aspects of narrowband HPM sources over the last decade is analyzed and summarized in this paper.

There is no single type of HPM source capable of excellent performance in all five aspects. Specifically, high pulse energy cannot be achieved together with high power efficiency. The physical difficulties of high power generation in the millimeter wave band are discussed. SemiconductorbasedHPM sources and metamaterial (MTM) vacuum electron devices (VEDs) are also commented on here. Semiconductor devices have the advantage of smart frequency agility, but they have low power density and high cost. MTM VEDs have the potential to be high power efficiency HPM sources in the low frequency band. Moreover, problems relating to narrowband HPM source lifetime and stability, which are the important determinants of the real-world applicability of these sources, are also discussed.

17/01/2021, 01:10 - BNBasu Prof: While Dr. Vishal Kesari is busy in making the Proceedings for Webinar#4, let us plan the Programme of Webinar#5 tentatively as follows:

WEBINAR#5

CONVENER: Mr. Raj Singh

HOST: Ms Nalini Pareek

WEB MANAGEMENT: Dr. Vishant Gahlaut, Dr. Uttam K Goswami and their team

13TH MARCH 2021 (tentative)

FROM 4.00 PM TO 6:00 PM (tentative)

SESSION 1: EXPERT TALK

DURATION OF SESSION 1: 50 minutes

CHAIR OF SESSION 1: Dr. KS Bhat

COORDINATOR OF SESSION 1: Dr. Ranjan Barik

SPEAKER: Dr. RS Raju

TOPIC: Some Aspects of the Development of Cathodes for Microwave Tubes

DURATION OF TALK: 50 minutes

SESSION 2: RESEARCH CONTRIBUTIONS OF YOUNGER RESEARCHERS IN VEDS

DURATION OF SESSION 2: 50 minutes

CHAIR OF SESSION 2: Dr. Hasina Khatun

SPEAKERS:

1. Dr. Vikram Kumar

Topic: Sectoral Waveguide HPM Mode Converters

Duration of talk: 20 minutes

2. Dr. Ajith Kumar MM

TOPIC: Application of Planar Helix Slow-Wave Structure in Backward-Wave Oscillators

DURATION OF TALK: 20 minutes

VOTE OF THANKS: Professor KP Ray

The final programme will be announced by the convener Mr. Raj Singh in the month of March 2021.

17/01/2021, 18:33 - BNBasu Prof: The following mail from the legendary Professor Manfred Thumm of KIT, Karlsruhe is very inspiring.

Dear Colleagues in India,

Hopefully you all and your families are fine in these strange and terrible times of Corona-Pandemic.

Again, I would like to send many congratulations to the VED Thinkers Group for establishing, organizing and conducting the very successful Webinar Series on VED in India.

Could you please inform me about the planned date of the next Webinar in April?

Best wishes, yours

Manfred Thumm

(I informed Professor Thumm that our next webinar is going to be held in the month of March 2021).

17/01/2021, 18:56 - Dr. Vishal Kesari: Following message is from Prof. Paoloni:

Dear Dr Kesari

I would be grateful if you could share the tribute to Jeevan with the link for the donation to support his mother.

https://www.crowdfunder.co.uk/in-memoriam-of-jeevan-m-rao

I think it could be of interest that the paper below is open access and can be download free of charge.

C. Paoloni, D. Gamzina, R. Letizia, Y. Zheng and N. C. Luhmann Jr., “Milimeter Wave Traveling Wave Tubes for the 21st Century”, J. Electromagn. Wav. Appl., Dec. 2020. https://doi.org/10.1080/09205071.2020.1848643

Thank you

Best wishes

Claudio

18/01/2021, 12:45 - BNBasu Prof: Alexander G. Litvak, Gregory G. Denisov, and Mikhail Y. Glyavin, “Russian Gyrotrons: Achievements and Trends, IEEE Joural of Microwaves,” IEEE Journal of Microwaves (Accepted invited paper)

Institute of Applied Physics RAS, Nizhny Novgorod 603950, Russia

Corresponding Author: Mikhail Y. Glyavin (e-mail: glyavin@appl.sci-nnov.ru).

ABSTRACT: The last decade has contributed to the rapid progress in the gyrotron development. Megawattclass, continuous wave gyrotrons are employed as high-power millimeter (mm)-wave sources for electron cyclotron heating (ECH) and current drive in the tokamaks and stellarators. The progress in gyrotron development pushes ECH from a minor to a major heating method. Also gyrotron based technological complexes successfully applied in electron cyclotron resonance ion sources, for microwave ceramic sintering and diamond disk production. The paper describes the main features of high frequency gyrotrons. Some data about pulsed and CW tubes, working in the terahertz frequency range, are given. These gyrotrons operate (in some specific combinations) at very low voltage and beam current, demonstrate an extremely narrow frequency spectrum or wide frequency tuning. Although in comparison with the classical microwave tubes the gyrotrons are characterized by greater volume and weight due to the presence of bulky parts (such as superconducting magnets and massive collectors where the energy of the spent electron beam is dissipated) they can easily be embedded in a sophisticated laboratory equipment (e.g., spectrometers, technological systems, etc.). All these advantageous features have opened the road to many novel and prospective applications of gyrotrons.

18/01/2021, 13:00 - Dr. Lalit Kumar: I appreciate the good initiative taken by Prof Paolini to collect fund to support his mother. I request all of us to generously support the cause. Towards that cause I have the following suggestion: Considering the fact that Jeevan's mother must be residing in India, it may be better if some funds are collected by VEDA Society or this VED Thinkers group and contribution received are donated to his mother in addition to what us being collected by Prof Paolini.

Request Prof Basu and President VEDA soc. to please consider.

18/01/2021, 20:31 - Dr. Vishal Kesari: 2 Webinars by ANSYS coming up next week

Model Bulk Phase Change Processes Using Ansys Fluent to be held on Jan 27,2021 from 11:30 AM(IST)

Registration Link: https://tinyurl.com/Phasechangemodellingwebinar

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Accelerating EMI/EMC Testing Using Simulation to be held on Jan.28,2021 from 11:30 AM(IST)

Registration Link : https://tinyurl.com/EMI-EMCtestingwebinar

19/01/2021, 22:31 - BNBasu Prof: Professor Subal Kar, the author of the book Microwave Engineering under the imprint of Universities Press is now a member of our group. He gave his consent to deliver a talk on metamaterial in a session followed by a talk by Dr. N Purushothaman on metamaterial assisted VEDs on the platform of our group.

20/01/2021, 12:55 - BNBasu Prof: Intiative from Dr. N Purushothaman:

Dear Prof. Subal Kar,

As you may be aware, the "Thinkers in VED" group has been organizing webinars on various topics in the field of Vacuum Electron Devices (VEDs). Having covered the conventional VEDs, we would like to steer the discussion into research on futuristic VEDs.

With the research on metamaterial-inspired VEDs gaining momentum globally, we realize that an introduction to metamaterials (MTMs) and their applications is essential to continue any fruitful discussions on MTM-inspired VEDs. In this regard, we believe that an expert lecture by you on the topic of metamaterials would be highly beneficial to the researchers of the VED community. It would certainly enrich our knowledge of the field of metamaterials and guide us in realizing the next-generation VEDs. Hence, we would like to invite you to deliver an expert lecture on metamaterials and applications.

The organizing committee has suggested 10-Apr-2021 or 17-Apr-2021 as tentative dates for your lecture. However, the final date and time of your lecture will be decided as per your convenience.

We hope you will accept our humble invitation to deliver your lecture. We would look forward to your response. …….

Regards,

Purushothaman Narasimhan,

Response from Profesor Subal Kar:

Dear Dr. Purushothaman N,

I would be glad to deliver such a lecture to the VED group. The title of the talk you have chosen is also very appropriate as far as my knowledge and expertise in this field is concerned.

Best wishes,

Subal Kar

Prof. Subal Kar, Fulbright Fellow

Ex. Head of the Department

Institute of Radio Physics & Electronics

University of Calcutta

92, A. P. C. Road,

Kolkata - 700009,

India

23/01/2021, 05:59 - BNBasu Prof: Dr. B. C Roy Engineering College (BCREC), Durgapur, West Bengal is going to organize a webinar talk by Dr. SN Joshi on the topic: “R&D Opportunities in the Country: a Case Study on Microwave Tubes” on 30th January 2021 at 3 pm. The Programme Coordinator from BCREC is Professor Sarit Pal (who is one of our group members). The announcement from Professor Pal will be brought to the notice of our group.

23/01/2021, 06:18 - Dr. Vishal Kesari: Sir, thanks for sharing the information on the talk by Dr. SNJoshi, who always motivates us. Many of us including me will be happy in attending the same. I request Prof. Sarit Pal to provide talk link at this plateform. He may take help of Dr. Vishant Gahlaut so that the members of our group will also be benefited.

23/01/2021, 14:19 - BNBasu Prof: WEBINAR#5

CONVENER: Mr. Raj Singh

HOST: Ms Nalini Pareek

WEB MANAGEMENT: Dr. Vishant Gahlaut, Dr. Uttam K Goswami and their team

13TH MARCH 2021 (tentative)

FROM 4.00 PM TO 6:00 PM (tentative)

SESSION 1: EXPERT TALK

DURATION OF SESSION 1: 50 minutes

CHAIR OF SESSION 1: Dr. KS Bhat

COORDINATOR OF SESSION 1: Dr. Ranjan Barik

SPEAKER: Dr. RS Raju

TOPIC: Some Aspects of the Development of Cathodes for Microwave Tubes

DURATION OF TALK: 50 minutes

SESSION 2: RESEARCH CONTRIBUTIONS OF YOUNGER RESEARCHERS IN VEDS

DURATION OF SESSION 2: 50 minutes

CHAIR OF SESSION 2: Dr. Hasina Khatun

SPEAKERS:

1. Dr. Vikram Kumar

Topic: Sectoral Waveguide HPM Mode Converters

Duration of talk: 20 minutes

2. Dr. Ajith Kumar MM

TOPIC: Application of Planar Helix Slow-Wave Structure in Backward-Wave Oscillators

DURATION OF TALK: 20 minutes

VOTE OF THANKS: Professor KP Ray

The final programme will be announced by the convener Mr. Raj Singh in the month of March 2021.

23/01/2021, 14:59 - BNBasu Prof: (i) Webinar#5 of VED Thinkers Group will be held on 13th March 2021 as already informed earlier.

(ii) Webinar#6 of VED Thinkers Group will be held on 10th April 2021 at 4 pm onward as follows:

a lecture by Professor Subal Kar (ex-Professor, Institute of Radiophysics and Electronics, Calcutta University) on “Metamaterials and Metasurfaces: An Emerging Field of Research in Microwaves and Photonics” (duration 1 hour), followed by another lecture by Dr. N. Purushothaman on “Metamaterial Inspired Vacuum Electron Devices” (duration 45 minutes). The programme will be coordinated by Dr. Somak Bhattacharyya of IIT-BHU.

Mr. Raj Singh informed me that, as the Convener of the programme, he would make the final announcements of both Webinar#5 and Webinar#6 in the month of March 2021.

24/01/2021, 20:52 - Dr. Sarit Pal: *Invitation Letter*

Dr. B. C. Roy Engineering College, Durgapur,

Cordially invites you to join One-day Webinar on "R&D Opportunities in the country - A case study of Microwave Tubes"

Dear All,

Proceedings Fourth Webinar

Expert Talk: New Frontiers of Sub-THz Wireless Communications Enabled by Travelling-Wave Tubes

Greetings from Dr. B. C. Roy Engineering College, Durgapur.

It gives us immense pleasure to announce that we are going to organize a National Webinar on “R&D Opportunities in the country - A case study of Microwave Tubes" on 30th January 2021 from 3 pm to 4 pm.

Please share it with the Faculty of your respective branch.

There is no registration fee for the Webinar.

The E-Certificate will be awarded to the participants who will attend and submit feedback of the webinar.

Kindly register at:

https://forms.gle/eEedMdx2r1UTVCz9A

Please follow this link to join our WhatsApp group:

https://chat.whatsapp.com/JoQZqcSawKM10KnXDSIXYj

For more information kindly contact:

Prof.(Dr.) SARIT PAL

Dr. B. C. Roy Engineering College, Durgapur

Contact: 9800765952

E-mail: pal.sarit@gmail.com

sarit.pal@bcrec.ac.in

Regards

Dr. Sarit Pal

Professor,

Department of ECE

Dr. B. C. Roy Engineering College, Durgapur 713206

26/01/2021, 13:54 - Dr. Sarit Pal: *Invitation Letter*

Dr. B. C. Roy Engineering College, Durgapur,

Cordially invites you to join One-day Webinar on

"R&D Opportunities in the country - A case study of Microwave Tubes"

Speaker: Dr. S. N. Joshi

Dear All,

Greetings from Dr. B. C. Roy Engineering College, Durgapur.

It gives us immense pleasure to announce that we are going to organize a one-day Webinar on “R&D Opportunities in the country - A case study of Microwave Tubes" (speaker: Dr. S. N. Joshi) on 30th January 2021 from 3 pm to 4 pm.

Please share it with the Faculty of your respective branch.

There is no registration fee for the Webinar.

The E-Certificate will be awarded to the participants who will attend and submit feedback of the webinar.

Kindly register at:

https://forms.gle/eEedMdx2r1UTVCz9A

Please follow this link to join our WhatsApp group:

https://chat.whatsapp.com/JoQZqcSawKM10KnXDSIXYj

For more information kindly contact:

Prof.(Dr.) SARIT PAL

Dr. B. C. Roy Engineering College, Durgapur

Contact: 9800765952

E-mail: pal.sarit@gmail.com

sarit.pal@bcrec.ac.in

Regards

Dr. Sarit Pal

Professor, Department of ECE

Dr. B. C. Roy Engineering College, Durgapur 713206

26/01/2021, 21:15 - Ajesh Palliwar: https://iterconnections.wordpress.com/2021/01/25/interim-mission-opportunities-at-the-iter-organization-3/

27/01/2021, 15:32 - Rupa BEL: https://hr-jobs.lancs.ac.uk/Vacancy.aspx?ref=A3276

Dear All,

Please find the link to the Job Opportunity at Lancaster University. Expertise in high voltage power supplies is highly desirable.

28/01/2021, 04:27 - Dr. Vishal Kesari: Science and Engineering Research Board DST, Government of India

Call for proposals under SERB-TETRA is now open. SERB-TETRA (Technology Translation Award) is a new scheme for catalyzing technology translation through core research programs of SERB.

Submissions under TETRA can be made by PIs of ongoing SERB research grants and all extramural grants completed in the last three years, where PI holds or has applied for a patent, with an acknowledgement to SERB support.

The eligibility, nature of support, selection & mode of application, instructions for online submission and documents required are available in the website: http://serbonline.in/SERB/Tetra

Eligible Researchers are encouraged to submit their proposals in the online portal (www.serbonline.in). Please note that the deadline for submission is 10 February 2021 (5:00 PM).

28/01/2021, 13:22 - BNBasu Prof: There was a request from some VED Thinkers Group members to reduce the gap between two consecutive webinars: Webinar#5 and Webinar#6 (both to be held yet). Accordingly, we have modified the date of Webinar#6 as 8th May 2021, while the date 13th March 2921 of Webinar#5 remains unchanged.

WEBINAR#5: 13th March 2021: From 4.00 pm to 6:00 pm

Session 1 of 60 minutes duration

Chair of session 1: Dr. KS Bhat

Coordinator of session 1: Dr. Ranjan Barik/Mr. Sushil Shukla

Speaker: Dr. RS Raju

Topic: Some Aspects of the Development of Cathodes for Microwave Tubes

Duration of talk and discussion: 60 minutes

Session 2 (Research contributions of younger researchers in VEDs) of 60 minutes duration

Chair of session 2: Dr. Hasina khatun

Speakers:

1. Dr. Vikram kumar

Topic: Sectoral waveguide HPM mode converters

Duration of talk and discussion: 30 minutes

2. Dr. Ajith Kumar MM

Topic: Application of planar helix slow-wave structure in backward-wave oscillators

Duration of talk and discussion: 30 minutes

Vote of thanks: Professor KP Ray

28/01/2021, 13:27 - BNBasu Prof: WEBINAR#6: 8th May 2021 (modified date): From 4.00 pm to 6:00 pm

A lecture by Professor Subal Kar (ex-Professor, Institute of Radiophysics and Electronics, Calcutta University) on “Metamaterials and Metasurfaces: An Emerging Field of Research in Microwaves and Photonics” (duration 1 hour), followed by another lecture by Dr. N. Purushothaman on “Metamaterial Inspired Vacuum Electron Devices” (duration 45 minutes).

28/01/2021, 18:35 - Dr. Vishal Kesari: Good evening to all,

VEDAS has already extended its arm to support Late Jeevan's mother.

There is another parallel channel is now open to help the family. In this the helping hands can immediately and directly reach to the family. The details may be found in attached Appeal for Support to Late Jeevan's Mother.

Regards,

Vishal Kesari

Appeal for Support to Jeevan's Mother

This appeal is made to generously support Jeevan's mother.

Jeevan M. Rao (4th June 1988 - 25th December 2020) was awarded the Bachelor of Engineering (B.E) in Electronics and Communication Engineering at B.M.S College of Engineering, Bangalore in 2010 and M. Tech. in Microwave Engineering at Kerala University, India in 2012.

He started his career in the field of vacuum electronic devices (VEDs) as Senior Research Fellow (2013) at Microwave Tubes Research and Development Centre, Bangalore, India, where he worked in the area of gyrotrons.

In 2014, he got the position of Product Development Engineer at Bharat Electronics Limited, Bangalore, India, where he successfully contributed to the development of the microwave power module in which VED, namely, TWT, is a key component along with solid state power amplifier and electronic power conditioner.

He joined Lancaster University, UK in November 2018 to work on the development of novel sub-THz TWTs, where he was contributing towards the development of TWTs for 5G wireless communication.

The loss of Jeevan has been devastating for his family and his mother; Jeevan was the lone financial support to them.

With due consideration to the above, the individuals of VED community may affectionately consider sending their generous financial support directly to Jeevan's mother at her bank account as follows:

Name:	SHAMANTHA BAI
Account No.:	0445117027259
Bank:	Canara Bank
IFSC:	CNRB0000445

The postal address of Jeevan's mother:

#162, Sri Annapurneshwari Nilaya
4th Cross, Subhashnagar
Nelamangala, Bengaluru – 562 123
Karnataka

29/01/2021, 18:09 - Dr. Sarit Pal: Dear all,

Thank you for registering for the event. Please find the link for joining the webinar from 3:00 PM onwards on 30.01.2021-

meet.google.com/ktw-dhzp-csu

As we all know the limit for joining through google meet is 100, you may find some problems in joining the event. You may watch it live on our youtube channel. The link is given below-

https://www.youtube.com/channel/UCRSD0M49CuYhqPVT0BvWXEw

Regards,

R&D Cell,

Dr. B. C. Roy Engineering College, Durgapur.

30/01/2021, 22:11 - Dr. Sarit Pal: Those who participated in the webinar on "R&D Opportunities in the Country - A Case Study on Microwave Tubes" by Dr. S N Joshi Sir, are requested to fill and send the feedback form to get certificate. Please submit your feedback as soon as possible.

31/01/2021, 19:58 - Prabhakar Tripathi:

https://recruitment.iiita.ac.in/faculty_recruitment/

31/01/2021, 23:50 - BNBasu Prof: I learned a lot from the following brilliant webinar lecture presentations on our group platform:

(1) Dr. Manpuran Mahato: Compact and Efficient High-Power Microwave Source: Reltron (Webinar#2)

(2) Mr. Mumtaz Ansari: RF Pulse Shortening Studies of High-Power Relativistic BWO Using MAGIC-PIC Simulation (Webinar#2)

(3) Dr. Richards Joe Stanislaus Topic: Large-Signal Analysis of Helix-TWT (Webinar#3)

(4) Dr. S. Yuvaraj Topic: Recent Trends in Millimeter/THz-Wave Vacuum Electron Beam Devices (Webinar#3)

I am now eagerly looking forward to the next presentations in series to take place on 13th March 2021 on our group forum:

(5) Dr. Vikram Kumar: Topic: Sectoral Waveguide HPM Mode Converters (Webinar#5)

(6) Dr. Ajith Kumar MM: Application of Planar Helix Slow-Wave Structure in Backward-Wave Oscillators (Webinar#5)

It would be so nice if similarly other young researchers come forward to propose their presentations and send the topics of their presentations to Mr. Raj Singh, the Convener of the webinar programmes.

04/02/2021, 10:36 - Barik CEERI: R. K. Barik, A. K. Singh, S. K. Shukla, T. P. Singh, R. S. Raju, and G.-S. Park, "Development of Nanoparticle-Based High Current Density Cathode for THz Devices Application," IEEE Transactions on Electron Devices, vol.63, no.4, pp. 1715 - 1721, April 2016.

DOI: 10.1109/TED.2016.2524539

ABSTRACT: Scandia (Sc2O3)-doped tungsten nanoparticle-based high current density cathode is developed for the application in terahertz (THz) devices. This paper involves synthesis of scandia doped tungsten nanoparticle powder using chemical technique, estimation of optimum porosity, and development of pellet with required porosity by optimizing process parameters. The cathode, made out of the above pellet, is tested in an analytical system containing Auger electron spectroscope and anode. The results show that the cathode can deliver more than 100 A/cm2 current density with stable emission—strongly recommending it as a candidate for the use in a THz device. Theoretical estimates show that the void porosity is to be kept at 21% for proper surface coverage to produce good emission with long life.

04/02/2021, 10:50 - BNBasu Prof: Was the work showcased carried out at CEERI or Seoul National University?

04/02/2021, 15:07 - BNBasu Prof: The article is certainly a good preamble before the expert webinar lecture on cathodes by Dr. RS Raju on 13th March 2021. I request Dr. Barik to apprise our group of more such work on cathodes from time to time.