Development of High-Power Microwave Vacuum Electronics at KIT

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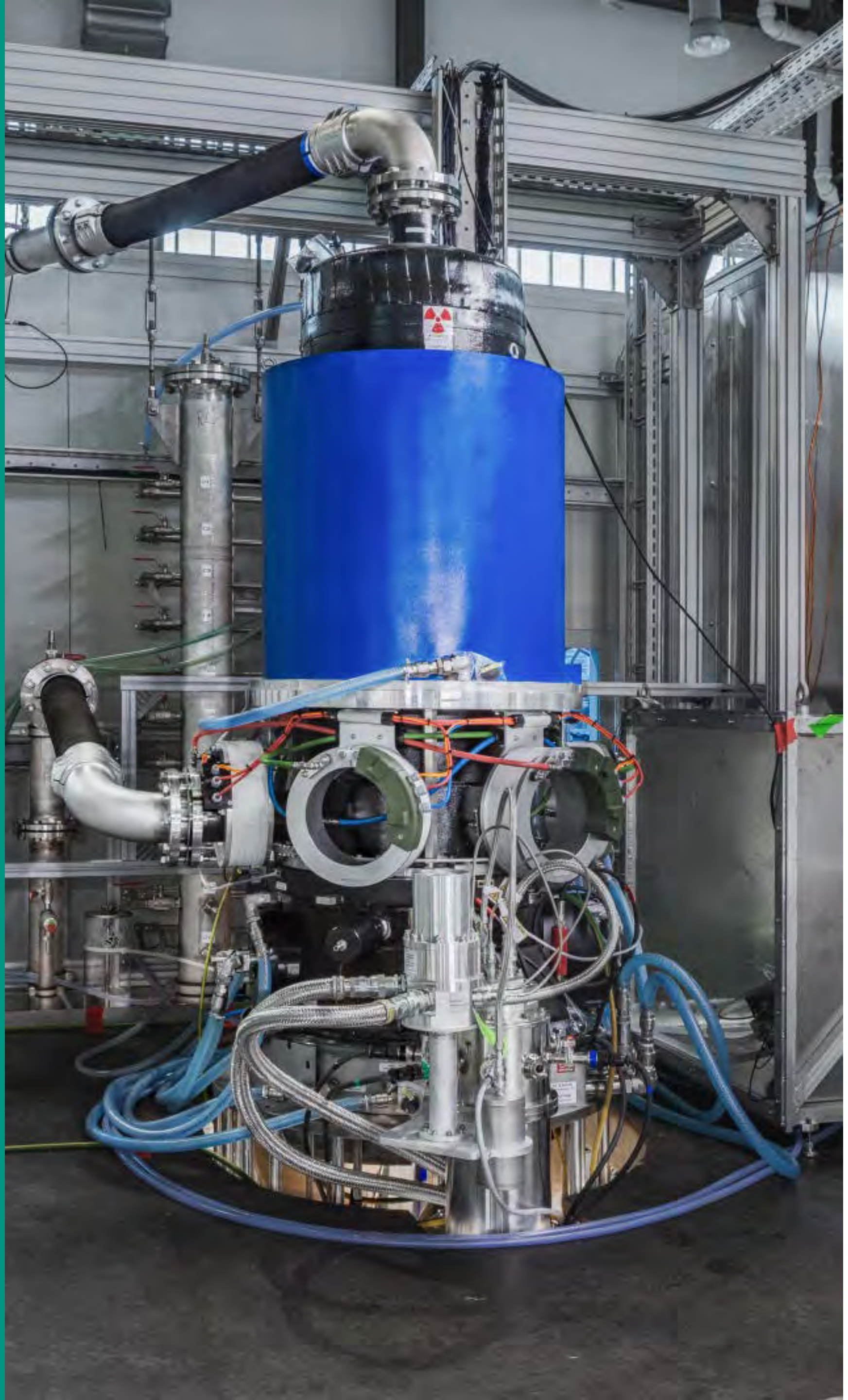
VDE ITG IVEW 2026, Bad Honnef, August 27th, 2026



KIT

10th VDE ITG International Vacuum Electronics Workshop
IVEW 2026
and
16th International Vacuum Electron Source Conference
IVeSC 2026
August 26 – 29, 2026,
Physikzentrum Bad Honnef
Germany

Part of this work has been carried out within the framework of the **EUROfusion Consortium**, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

EUROfusion

Part of presented results have been obtained within the frame of the **HeatQIS** and **HiPMiB** projects supported by the German Federal Ministry of Research, Technology and Space (**BMFTR**)

With funding from the:

Federal Ministry of Research, Technology and Space

IHM

Institute for Pulsed Power and Microwave Technology (IHM)

KIT Development Paths

Accelerators for Medicine and Materials Processing

- IBPT/IHM joint abstract to IPAC 2026
  Conceptual Design of a 0.2 MW Pulsed 140 GHz Gyroklystron Amplifier for Accelerator Applications, A. Malygin, J. Jelonnek, S. Illy, L. Feuerstein, M. Fuchs, M. Thumm

Gyro-Klystron

Gyrotron Oscillators for Nuclear Fusion

Gyro-TWT

Radar for Detection of Space Debris

mmW Spectroscopy

- **SFB Hyperion:** Broadband sub-THz high-power amplifier system for high-field pulsed DNP

KIT Development Paths

Gyrotron Oscillators for Nuclear Fusion

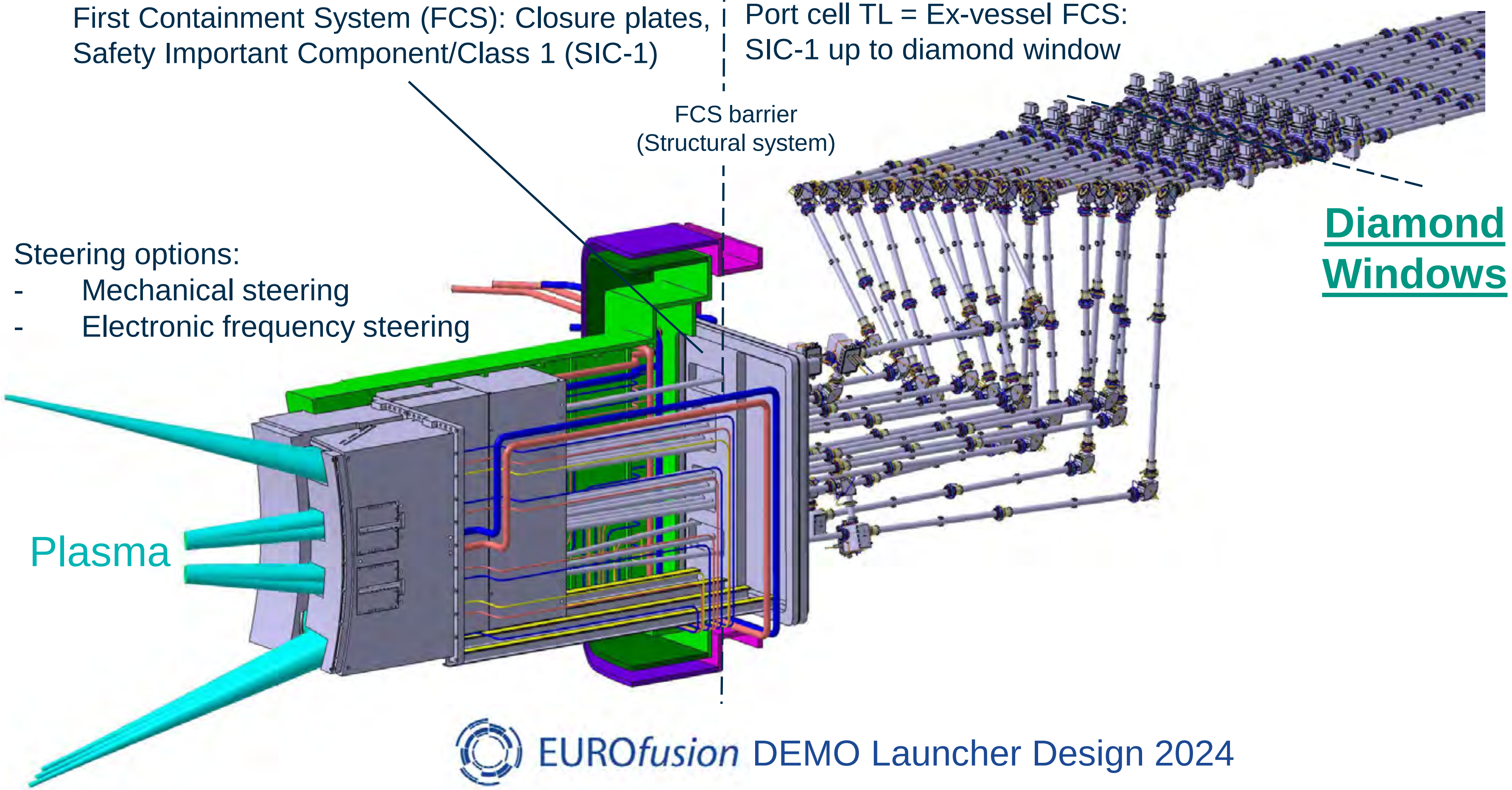
KIT Developments for EC Plasma Heating Systems

EC Launcher (In-vessel)

First Containment System (FCS): Closure plates, Safety Important Component/Class 1 (SIC-1)

Port Cell Transmission Line (TL) (Ex-vessel)

Port cell TL = Ex-vessel FCS: SIC-1 up to diamond window

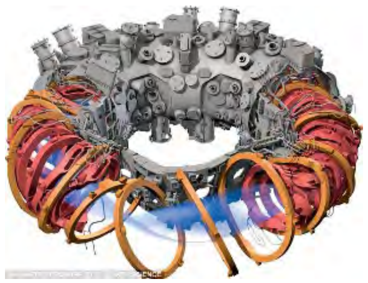


EUROfusion DEMO Launcher Design 2024

Gyrotron

Considered Advances in EC Plasma Heating (< 2024)

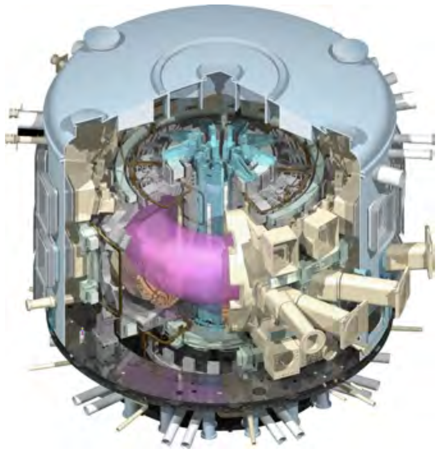
W7-X



f_{EC} = 140 GHz

$P_{EC\ Sources}$ = 10 MW

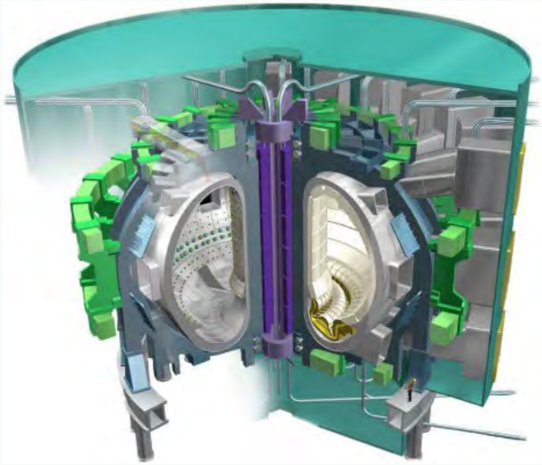
ITER/DTT



170 GHz

24 MW

EU DEMO



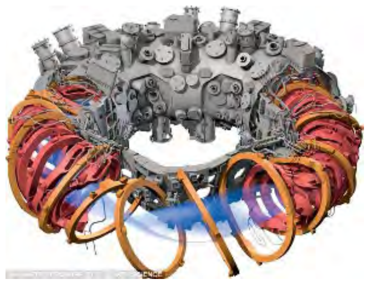
136 / **170** / **204** / 240 GHz

> 70 MW

+ multi-purpose operation
+ frequency steering into the plasma
+ operation at long pulses
+ sufficiently high plug-in efficiency

Split of Technology and Exciting Opportunities (>2024)

W7-X



f_{EC} = 140 GHz

$P_{EC\ Sources}$ = 10 MW

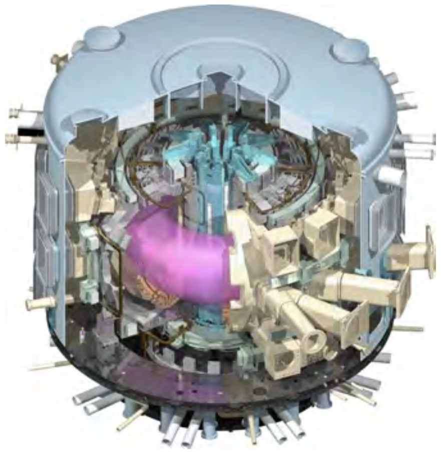
Before 2030

15-18 MW

≥1.5 MW power per gyrotron

(up to 2 MW per unit)

ITER/DTT



170 GHz

24 MW

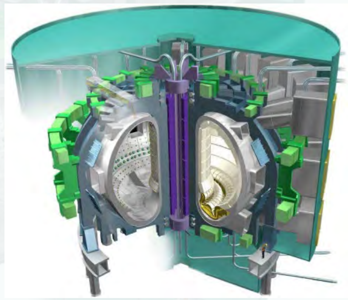
80 MW

Large gyrotron arrays

EU

Low-Field Devices with large footprint

≤ 200 GHz



136 / 170 / 204 GHz

> 70 MW

UKAEA STEP

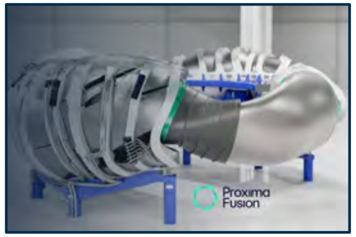
≥ 240 GHz, ≥ 1 MW

High-Field Compact Devices

J. Jelonnek et al., Development of High-Power Microwave Vacuum Electronics at KIT, VDE ITG IVEW 2026, Bad Honnef, August 27th, 2026

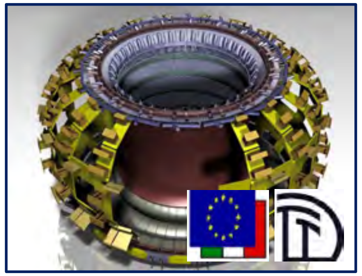
Institute for Pulsed Power and Microwave Technology (IHM)

Gyrotron Research and Development at KIT

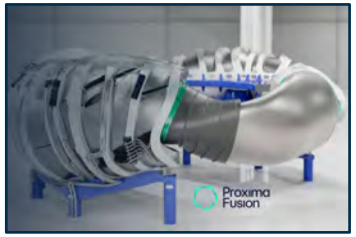


- **Member of European Gyrotron Consortium (EGYC)** for **ITER**
- Partner of IPP for 1 MW and **1.5 MW** / **2 MW developments** for **W7-X (BMFTR HiPMiB)**
- **EUROfusion tasks leader for gyrotron R&D**, leading the 2 MW coaxial-cavity gyrotron technology, Multistage Depressed Collector (MDC), operation at 2nd harmonics, electronic stability and frequency control
- Lead in test and validation of megawatt-class gyrotrons **(FULGOR)**
- Partner in gyrotron developments for European and worldwide nuclear fusion experiments such as **TCV, CEA/WEST, DTT** and **GA/DIII-D**
- **Project coordinator for BMFTR project HeatQIS** together with **PROXIMA Fusion**, **Diamond Materials** and **THALES** towards 238 GHz gyrotrons, EC launchers and windows

THALES



Gyrotron Research and Development at KIT



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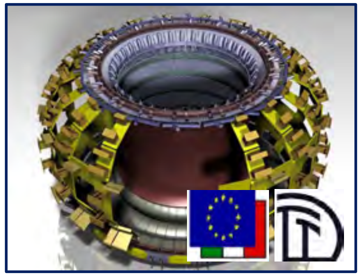


1 MW 170 GHz Gyrotron for ITER and Divertor Tokamak Test Facility (DTT)

KIT 1 MW Short-Pulse Pre-Prototype

Pre-prototype validation at KIT

- Up to 1.6 MW at short pulses (ms) demonstrated
- Efficiency ~50 % achieved (with singlestage depressed collector and novel potential elevation structure)

Industrial prototype TH1509U

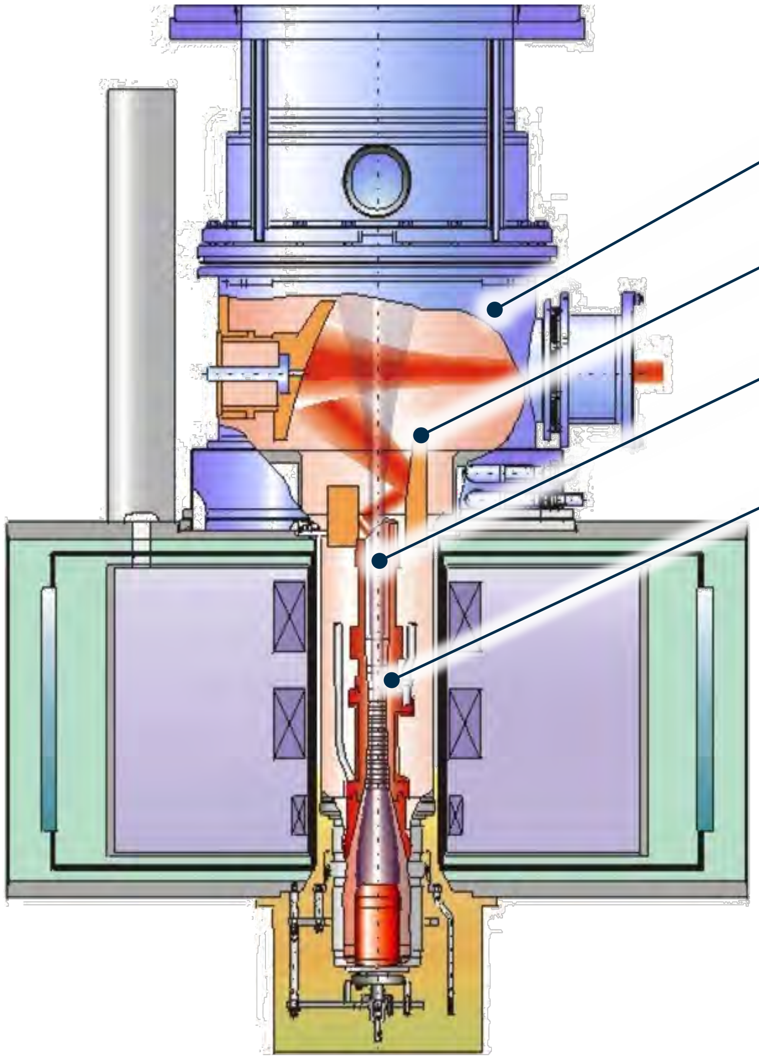
- 1.03/0.96 MW at 300/1000 s and 45/38 % (measured at F4E teststand, Lausanne)

→ Support of ITER in the final optimization, validation and installation

- **Final Design Review for DTT passed in 2024**
- **Final Design Review for ITER in May 2025**

THALES TH1509 Industrial Gyrotron

EU Gyrotron Upgrade for ITER (ITER upgrade / ITER néo)



New voltage concept

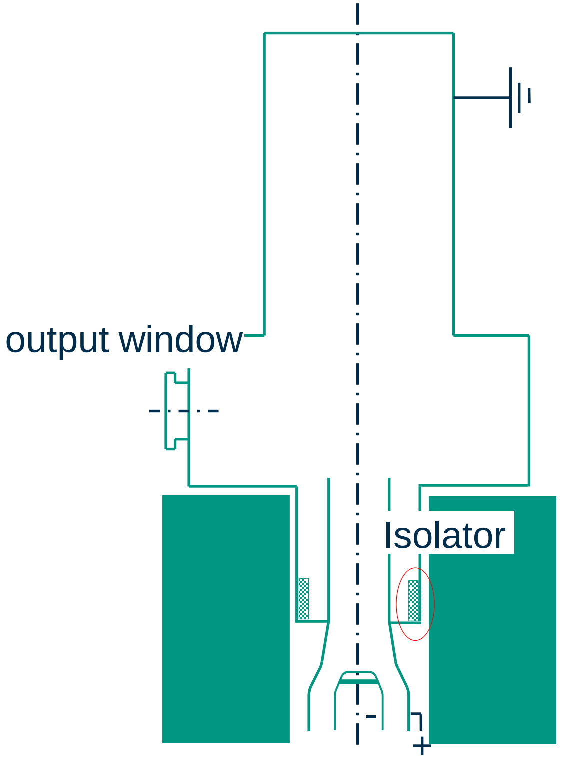
New 4-mirror system

New launcher antenna (mode-converter)

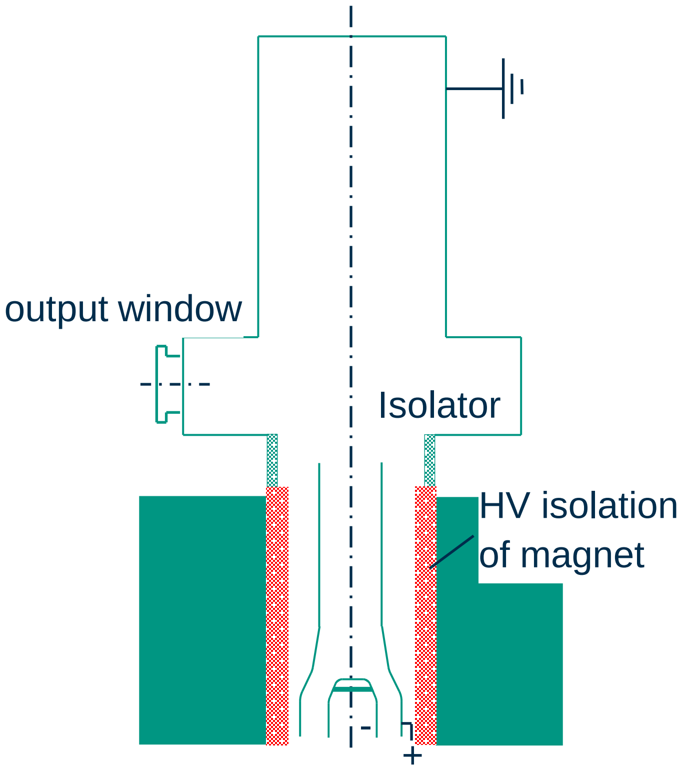
New cavity mode $TE_{32,11}$-mode
+ improved cooling capabilities

New Potential/Voltage Concept – Overview

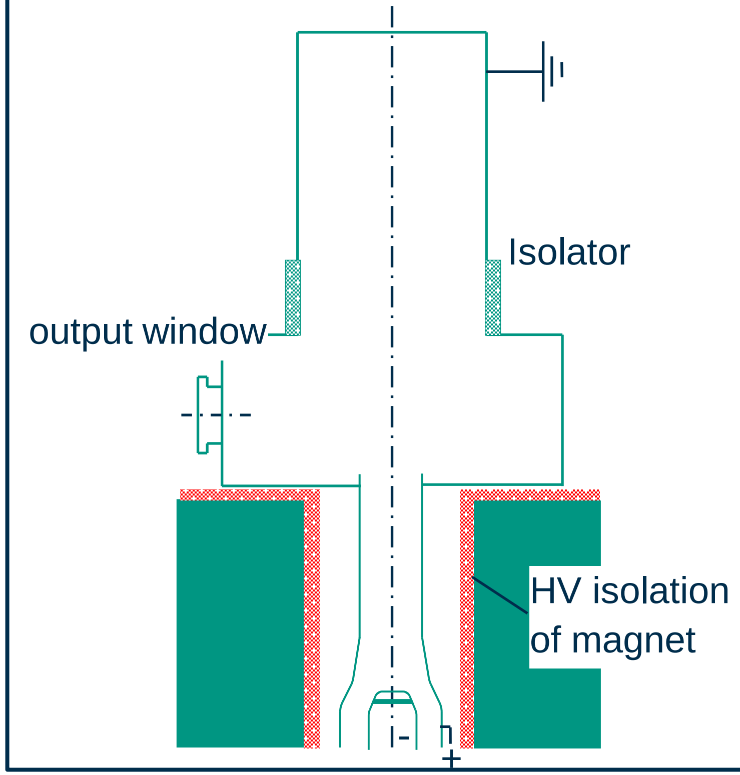
TH1507
- EU (Thales) State-of-the-Art
- Very compact design 👍
- Poor efficiency 👎



Intermediate
- Competitor State-of-the-Art
- Window grounded 👍
- Increased efficiency 👍



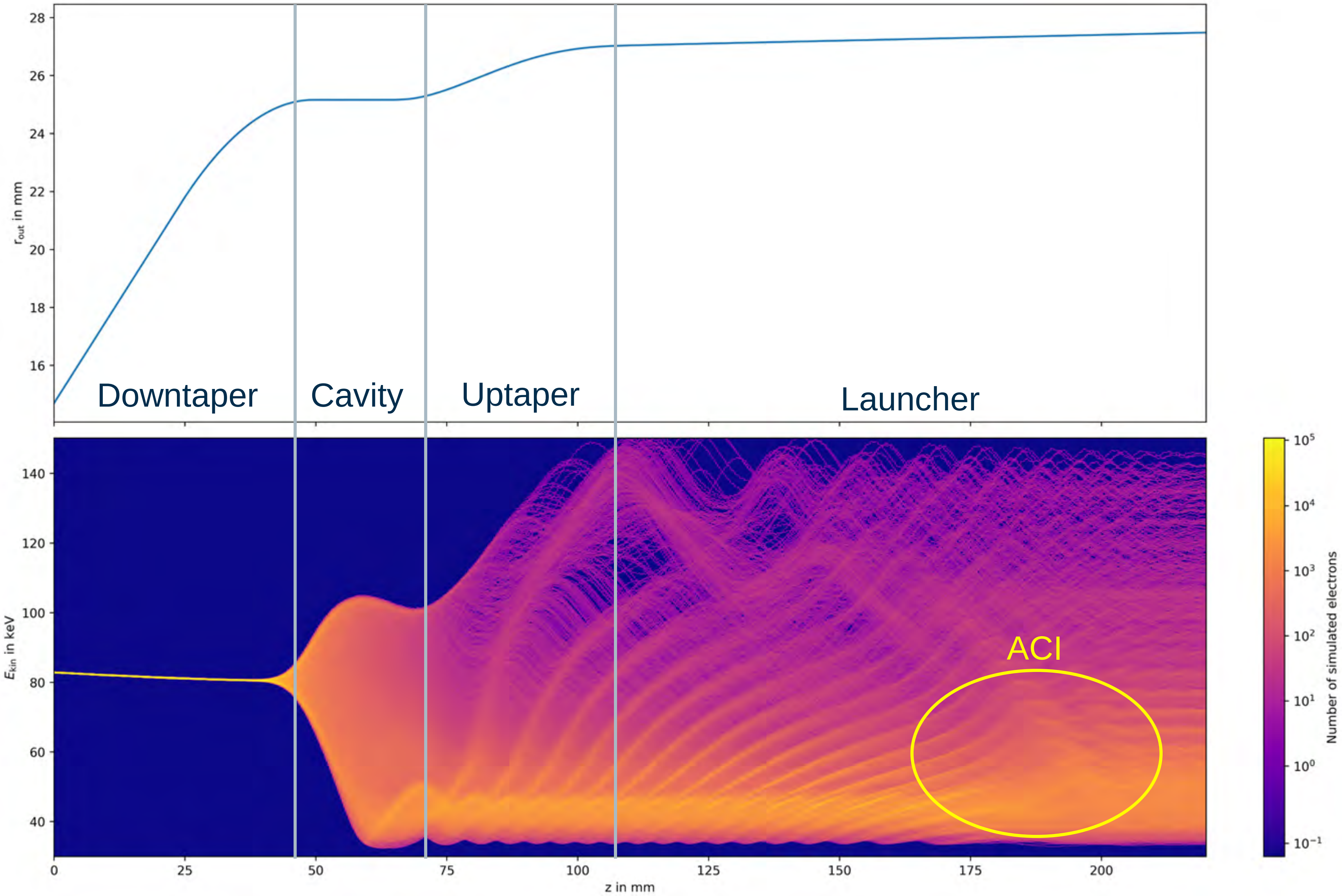
TH1508
- Coaxial tube
- Best concept in terms of efficiency 👍
- Big technological challenges 👎



Ref.: Moritz Misko et al.

Launcher Design to Mitigate After Cavity Interaction (ACI)

- Undesired interaction between microwave field and electron beam behind the interaction region
- Microwave power partially transferred back to the electron beam resulting in a reduction from 2.4 MW to 2.2 MW
- Investigation of possible measures to mitigate this interaction



A. Schmidt et al., Design and Operational Strategies for Mitigating Static After Cavity Interaction Based on the European ITER Gyrotron. J Infrared Milli Terahz Waves 47, 35 (2026). https://doi.org/10.1007/s10762-026-01141-4

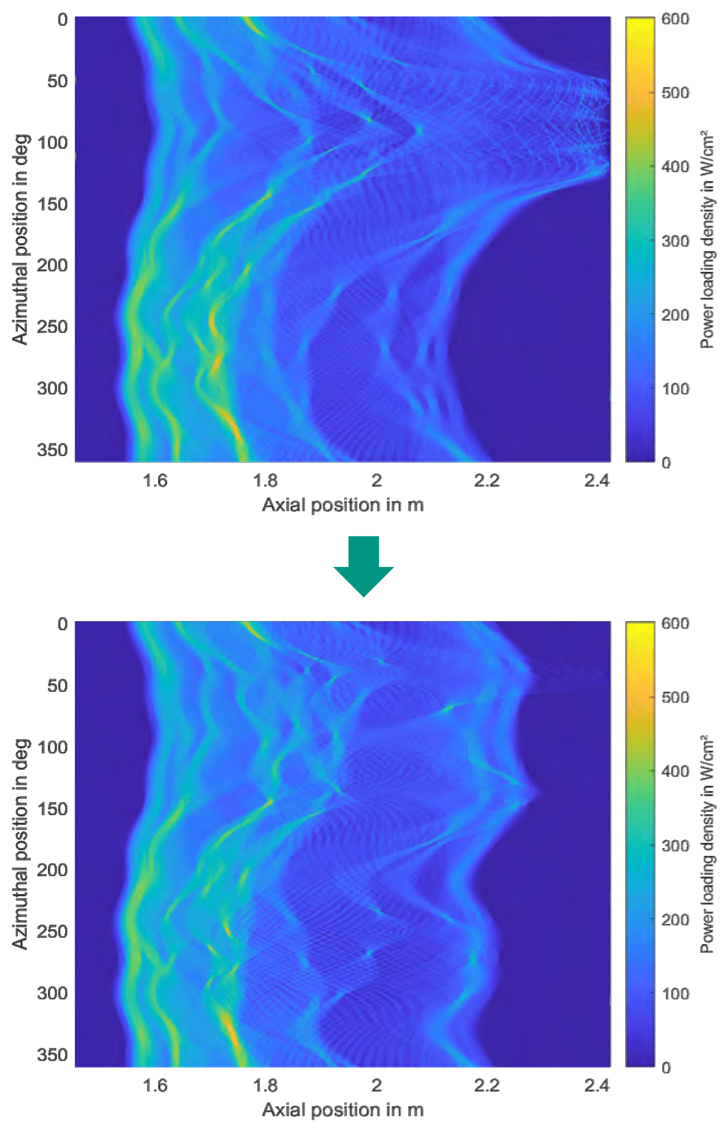
ITER Stray Magnetic Field (SMF)

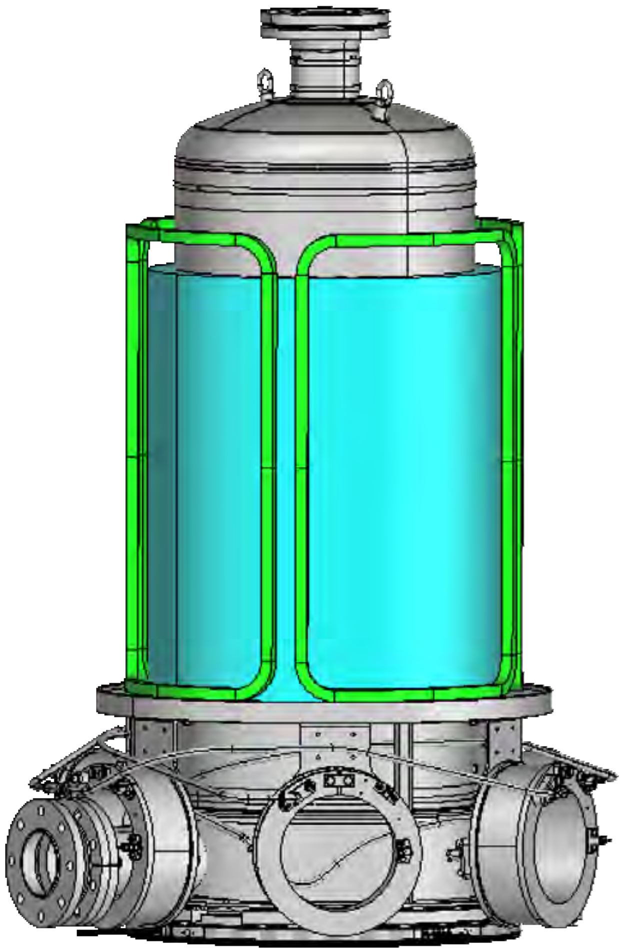
Benjamin Ell

Route de Vinon-sur-Verdon - CS 90 046 - 13067 St Paul Lez Durance Cedex - France

Service Contract with ITER on SMF IO/25/CT/4300003267

- ECRH upgrade -> more gyrotrons
- Influence of SMF on operation is studied
- Design of SMF compensation coils
- Operation in harsh environment





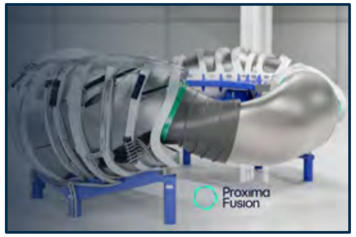
First concept for coils is presented

- Simple construction of winding body
- Fast production of first prototype

Outlook for experimental validation

- Verification of coils at CEA
- Gyrotron setup is ready

Gyrotron Research and Development at KIT



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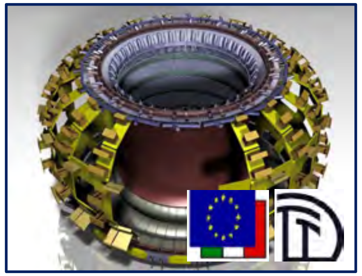


1.5 MW 140 GHz Gyrotron for Wendelstein 7-X

KIT 1.5 MW SP Pre-Prototype

Builds on IPP/KIT Helmholtz Innovation Pool project **"W7-X HiPower"**

Pre-prototype validation at KIT

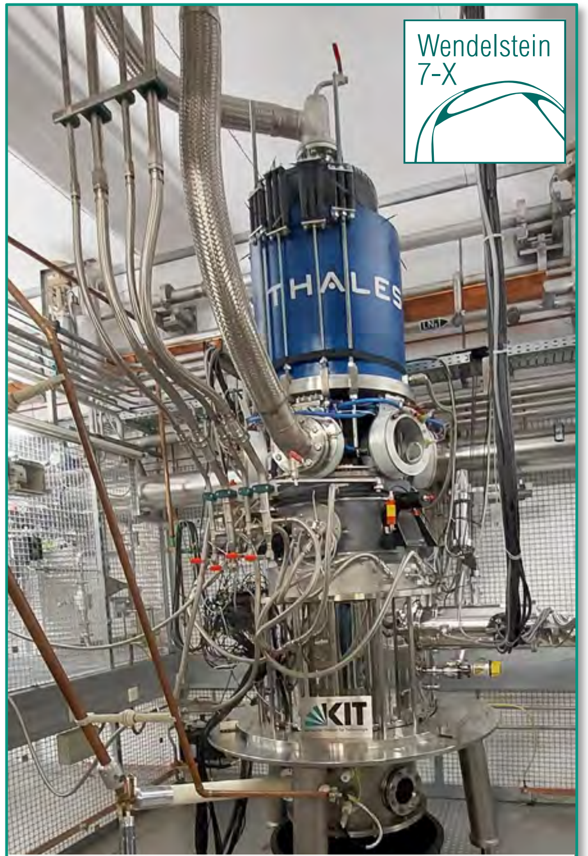
- ≥ 1.5 MW at short pulses (ms) demonstrated

Industrial prototype TH1507U

- Manufacturing of the industrial gyrotron by the industrial partner Thales, France (right)

→ World record of 1.3 MW / 46 % at 6 min. verified and tube in operation at W7-X

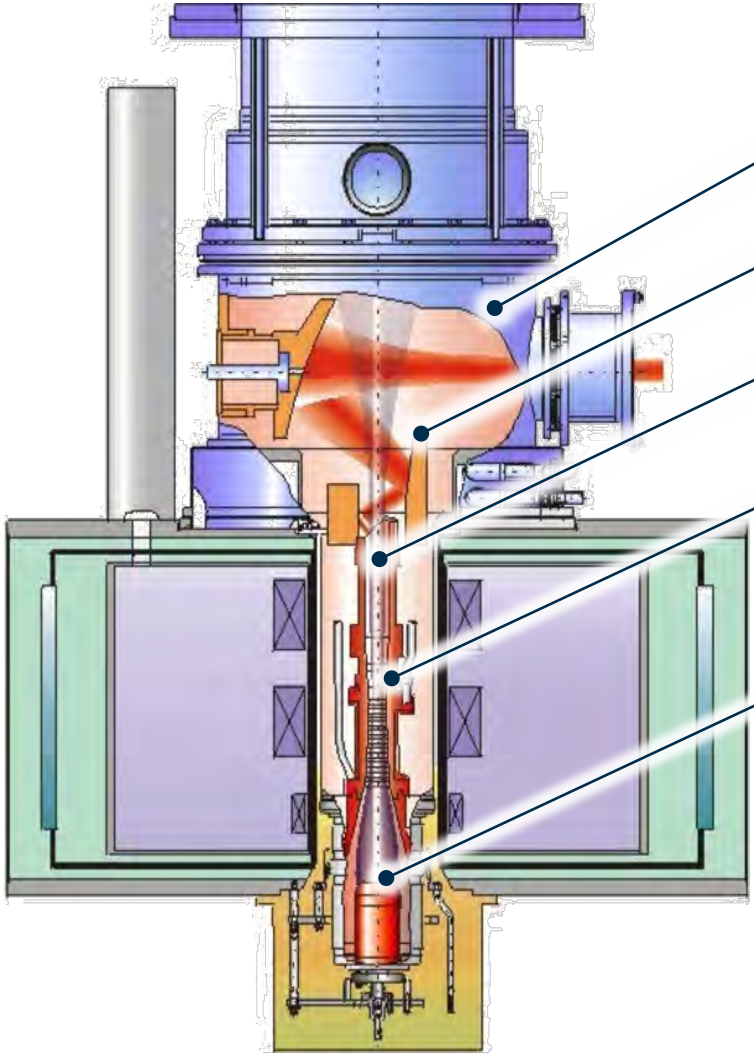
- **≥ 1.5 MW with improved industrial tube #2 expected**
- **→ first step towards 2 MW by moving to $TE_{28,12}$ mode**



Industrial Gyrotron TH1507U at W7-X

W7-X Gyrotron Upgrade for 2 MW Operation (BMFTR Project HiPMiB)

With funding from the:
Federal Ministry of Research, Technology and Space



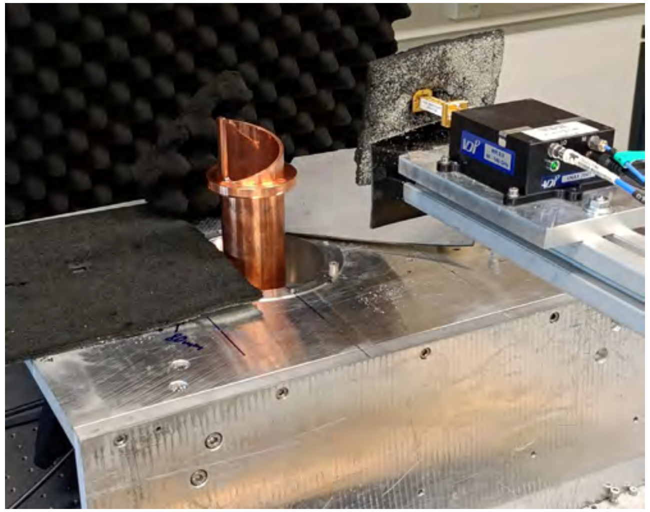
New voltage concept

New 4-mirror system

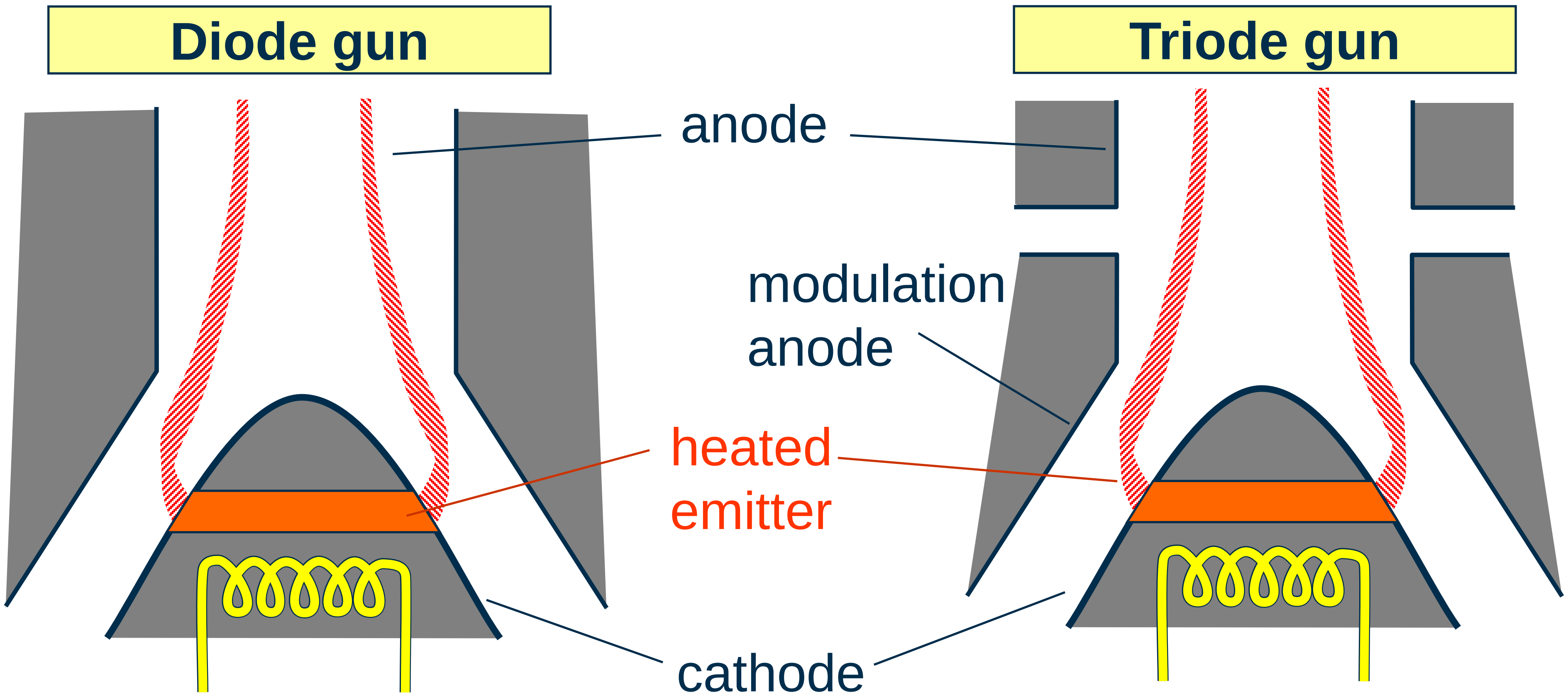
New launcher antenna (mode-converter)

New cavity mode $TE_{28,12}$-mode

Updated MIG



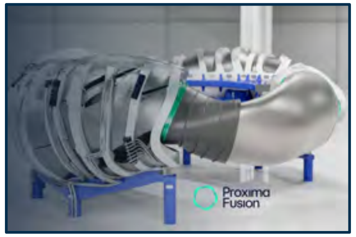
The Most Secure Option for 2 MW Operation: Triode MIG



α **is a function of the acceleration voltage** U_{acc}

more complicated, but independend control over α

Gyrotron Research and Development at KIT



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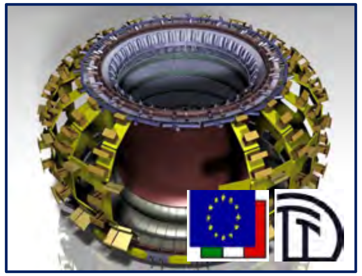
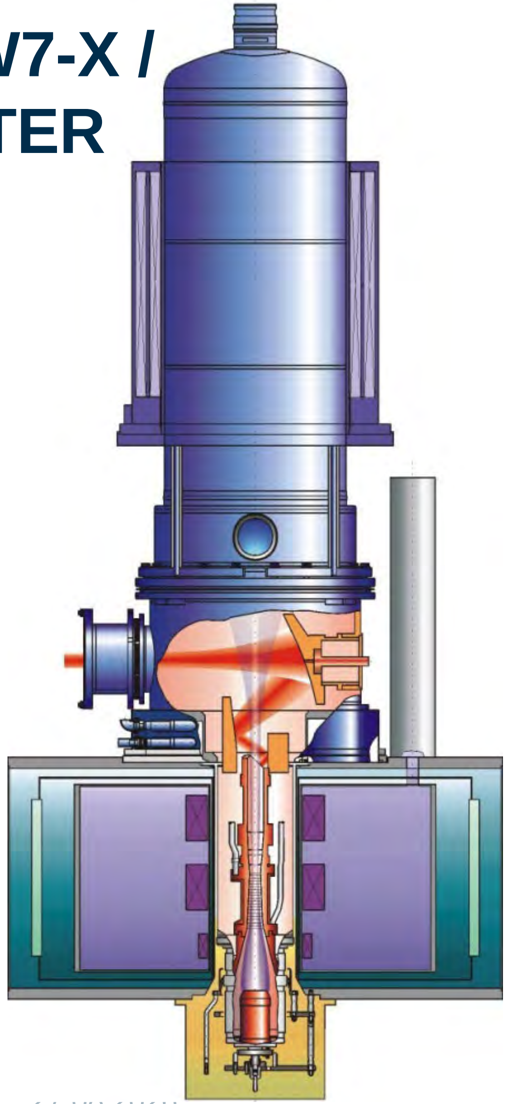
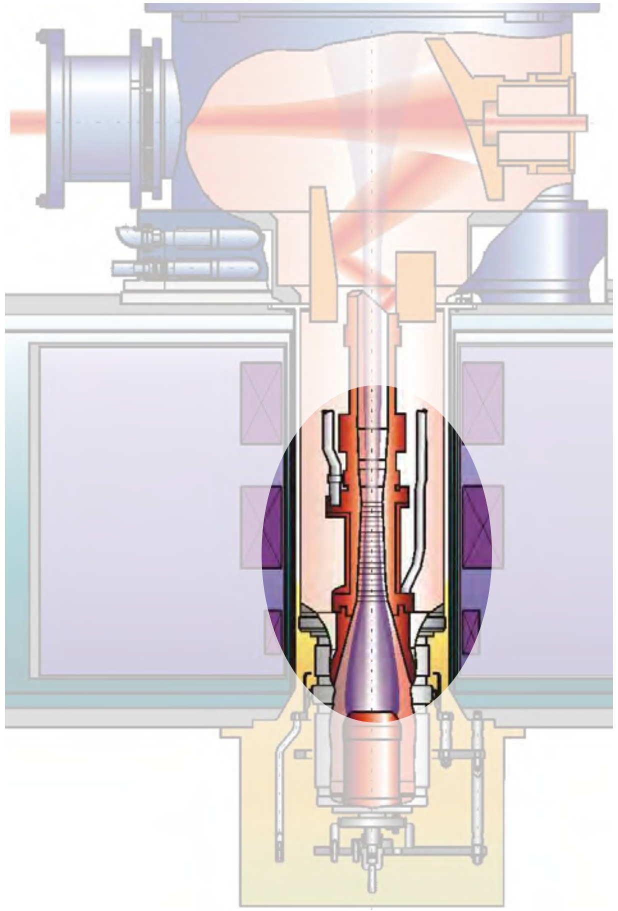


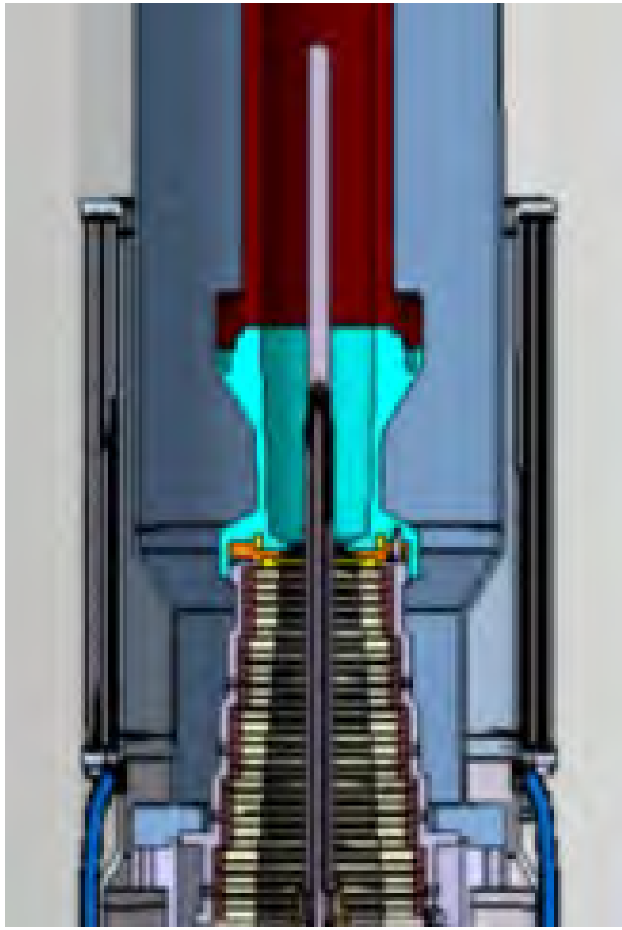
Towards ≥ 170 GHz and ≥ 1.3 MW Output Power → Coaxial-Cavity Gyrotron Technology

W7-X / ITER



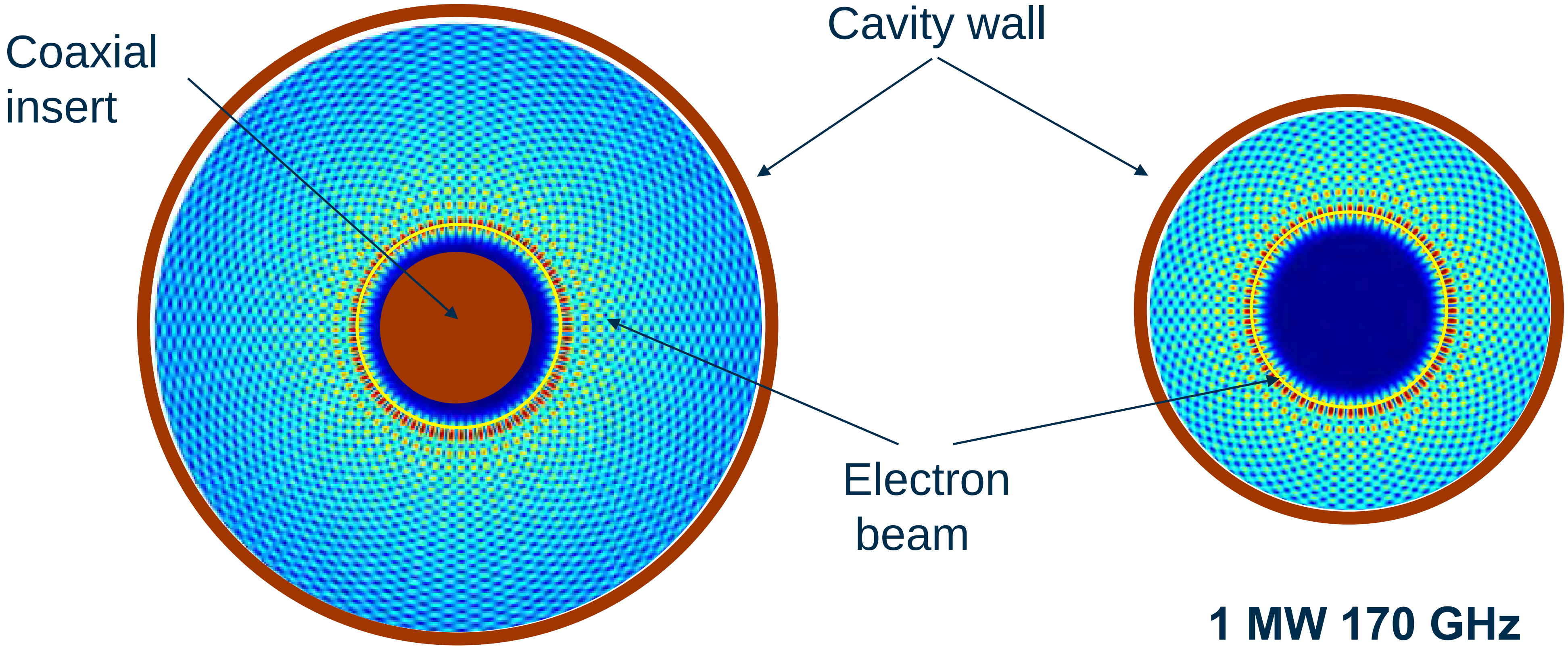


Hollow cavity



Coaxial cavity

$TE_{34,19}$–Mode ⇆ $TE_{32,09}$–Mode



2 MW 170 GHz

$TE_{34,19}$-mode coaxial cavity

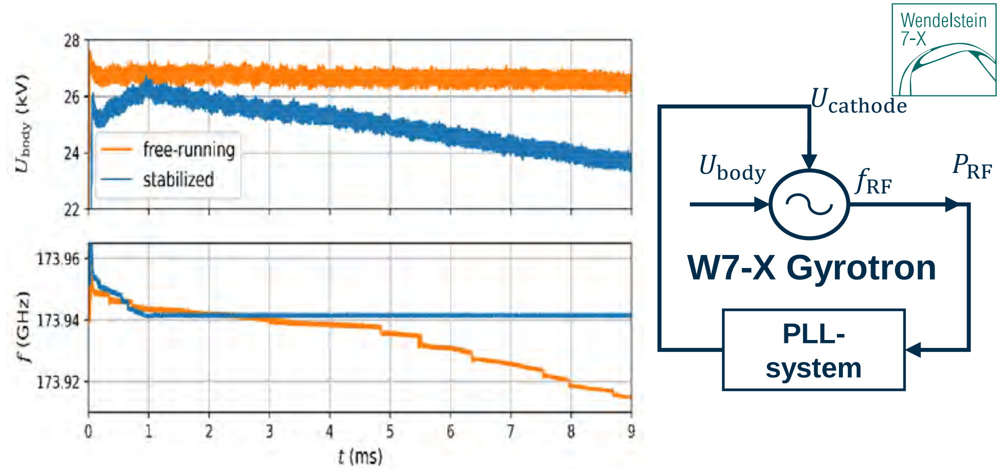
R_{cav} = 29.55 mm; R_b = 10.0 mm; R_{ins} = 7.86 mm

1 MW 170 GHz

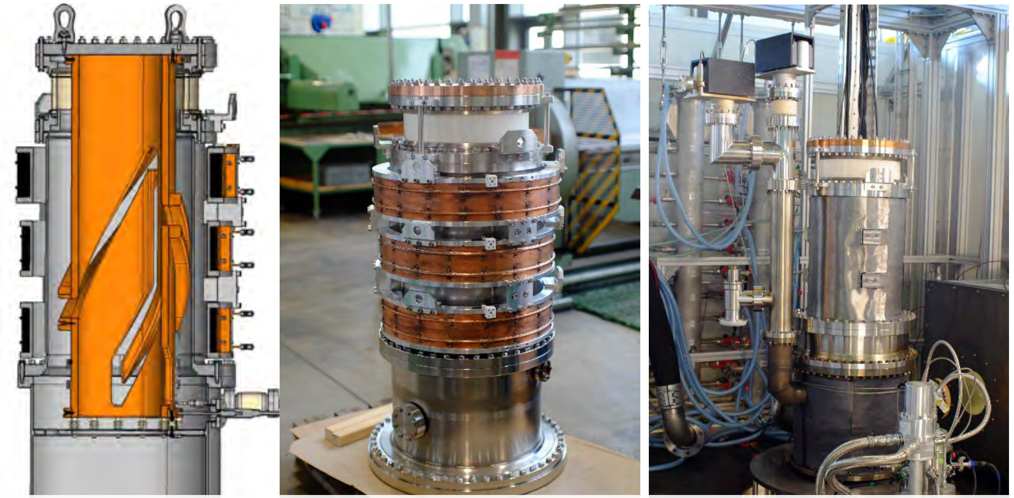
$TE_{32,9}$-mode hollow cavity

R_{cav} = 19.22 mm; R_b = 9.44 mm

EUROfusion Developments towards DEMO



W7-X gyrotron freq.-stabilized at 174 GHz for CTS



MDC mounted on W7-X pre-prototype in FULGOR

- 2 MW (< 1 s) modular coaxial pre-prototype prepared for test at longer pulses ≥ 50 ms
- FULGOR prepared, 10.5 T gyrotron magnet arrived and SAT approved
- First Multistage Depressed Collector (MDC) mounted onto W7-X SP pre-prototype and installed into CEA magnet for test in FULGOR (bottom)
- Collaboration with IPP on Engineering Grant on PLL-controlled gyrotrons led to world-first 174 GHz diagnostics tool for W7-X (top)
- Together with NKUA two enabling research project (ENR) on gyrotrons operating at 2^{nd} harmonic of electron cyclotron frequency
- FULGOR gyrotron test stand in full operation

Multi-Stage Depressed Collectors (MDCs) – Mandatory to Increase the Total Gyrotron Efficiency η_{total}

$$\eta_{total} = \frac{\eta_{int} \cdot \eta_{RF}}{1 - (1 - \eta_{int}) \cdot \eta_{col}}$$

Interaction efficiency: $\eta_{int} \approx 35\ \%$

- Limited by pitch factor
- Optimization limited

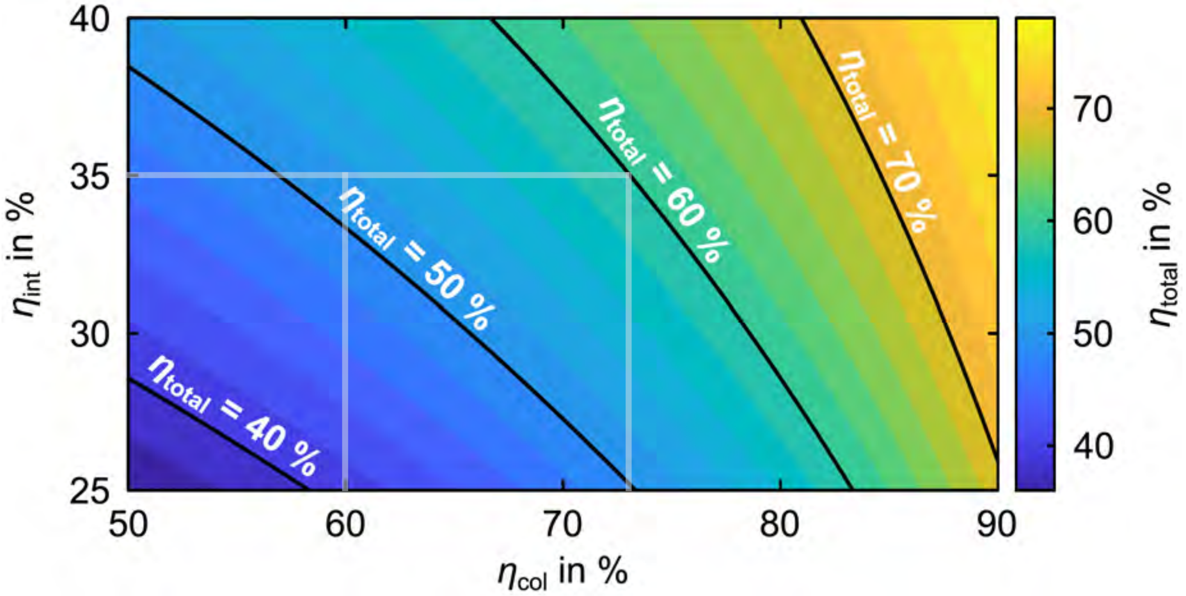
Transmission efficiency: $\eta_{RF} \approx 90\ \%$ (estimated)

- After cavity interaction
- Ohmic losses
- Stray radiation

Collector efficiency: $\eta_{col} \approx 60\ \%$

- State-of-the-Art SDC
- Recovered power / spent beam power

➡ Multistage Depressed Collector (MDC)



Multistage Depressed Collector (MDC) in Gyrotron

Challenges for gyrotron MDC

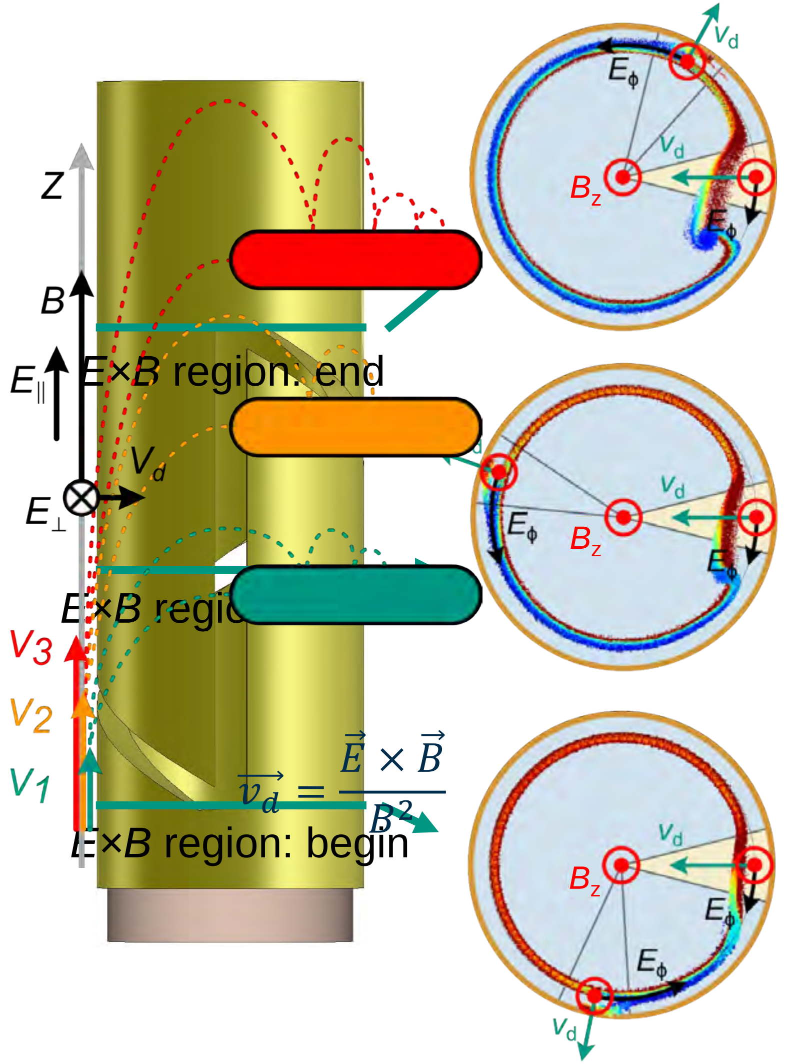
- Electrons are confined by magnetic field
- Axis-symmetric MDCs used in TWTs and klystrons are not reasonable

Solution for MDC in gyrotron

- Sorting electrons with *E*×*B* drift
- Spacial separation by kinetic energy

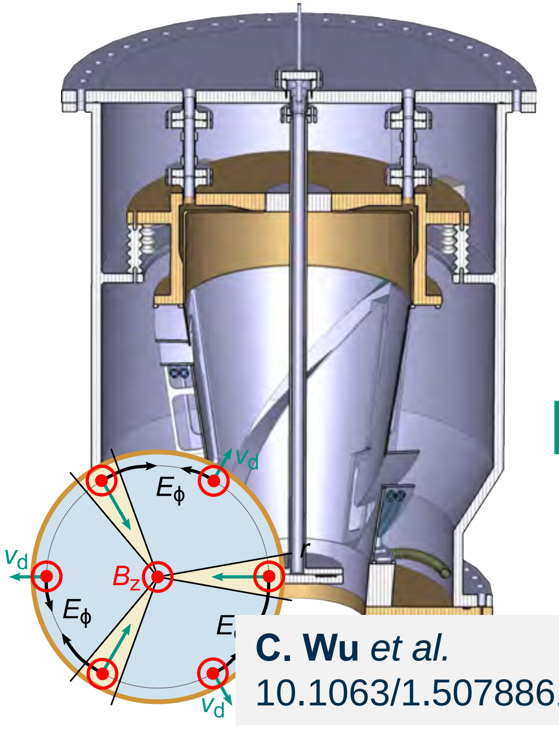
Basic design

- Non-axisymmetric *E*-field
- Most electrons drift radially outwards
- 1st electrode at bottom for slow electrons
- 2nd electrode at top for fast electrons

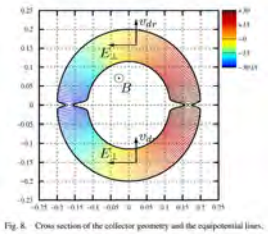


From Short-Pulse MDC to a CW Compatible Design

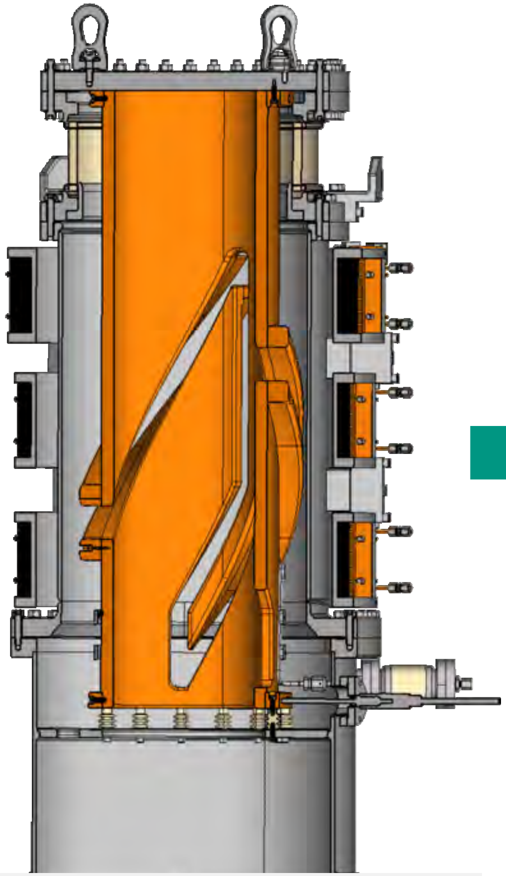
- Triple helix for reduced length
- Helical extensions for reduced reflected current



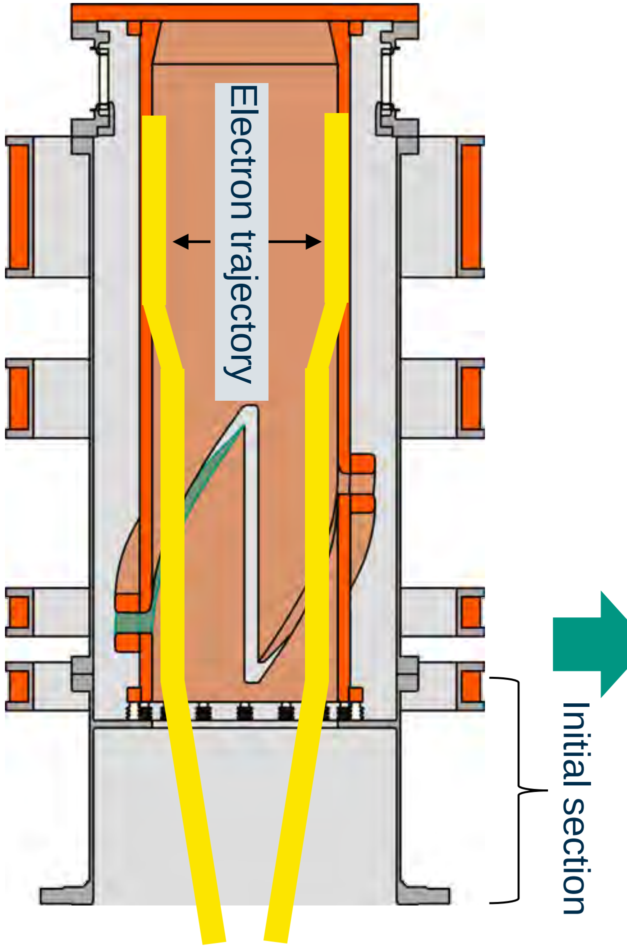
C. Wu *et al.*
10.1063/1.5078861



Pagonakis et al.
10.1109/TPS.2008.917943



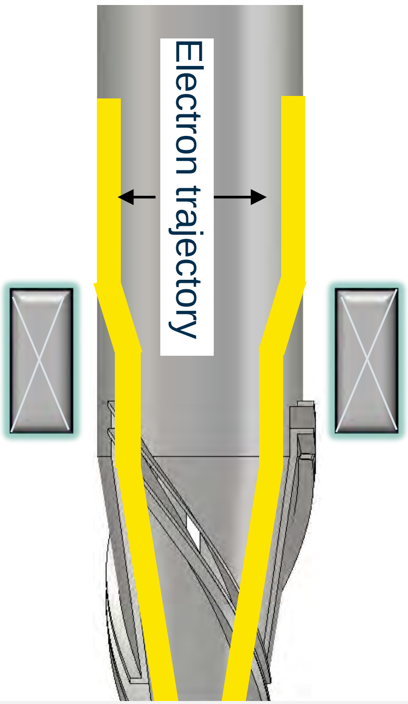
B. Ell *et al.*
10.1051/epjconf/202431304006



Upscaled CW MDC

B. Ell *et al.*
10.1109/TED.2023.3234885

Optimized CW MDC

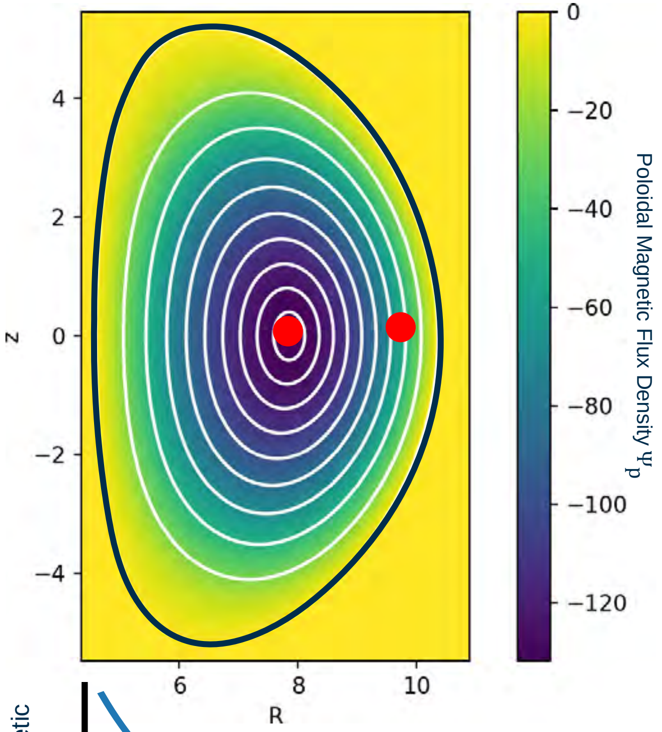


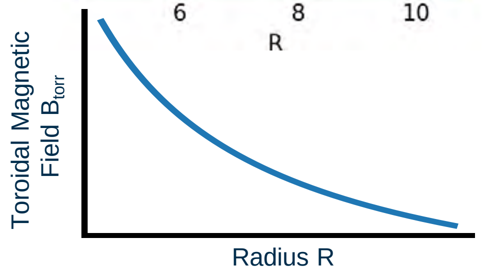
B. Ell *et al.*: Design Improvements of the Continuous Wave Gyrotron Multistage Depressed Collector at KIT, EC 23, Barcelona, 2026

EUROfusion Enabling Research Towards a New Generation of 2nd Harmonic Gyrotrons

- **AWP-21 (2021-2024):** New generation of megawatt-class fusion gyrotron systems based on highly efficient operation at the second harmonic of the cyclotron frequency
- **AWP-24 (2024-2026)**: Novel dual-harmonic gyrotrons for DEMO featuring fast switching between distant frequencies: concept elaboration and experimental demonstration of key elements

Target: Plasma center heating and mitigation of radiative instabilities with the **same gyrotron, transmission line and launcher**





Technologies Considered within EUROfusion AWP-24

***AWP-24 (2024-2026)**: Novel dual-harmonic gyrotrons for DEMO featuring fast switching between distant frequencies: concept elaboration and experimental demonstration of key elements*

Target: A MW class gyrotron operating at 1st harmonic (s = 1) and at 2nd harmonic (s = 2) of the electron cyclotron frequency → **Fast (sub-second) switching between distant frequencies**

Following two enabling technologies are included:

1. The **coaxial-type cavity technology** that is specifically adapted to the operation at 2nd harmonics in combination with advanced inner and outer corrugations
2. The **Multistage Depressed Collector (MDC) technology** based on $E \times B$ drift concept

Novel Concepts for Advanced Fast Switching Between Harmonics

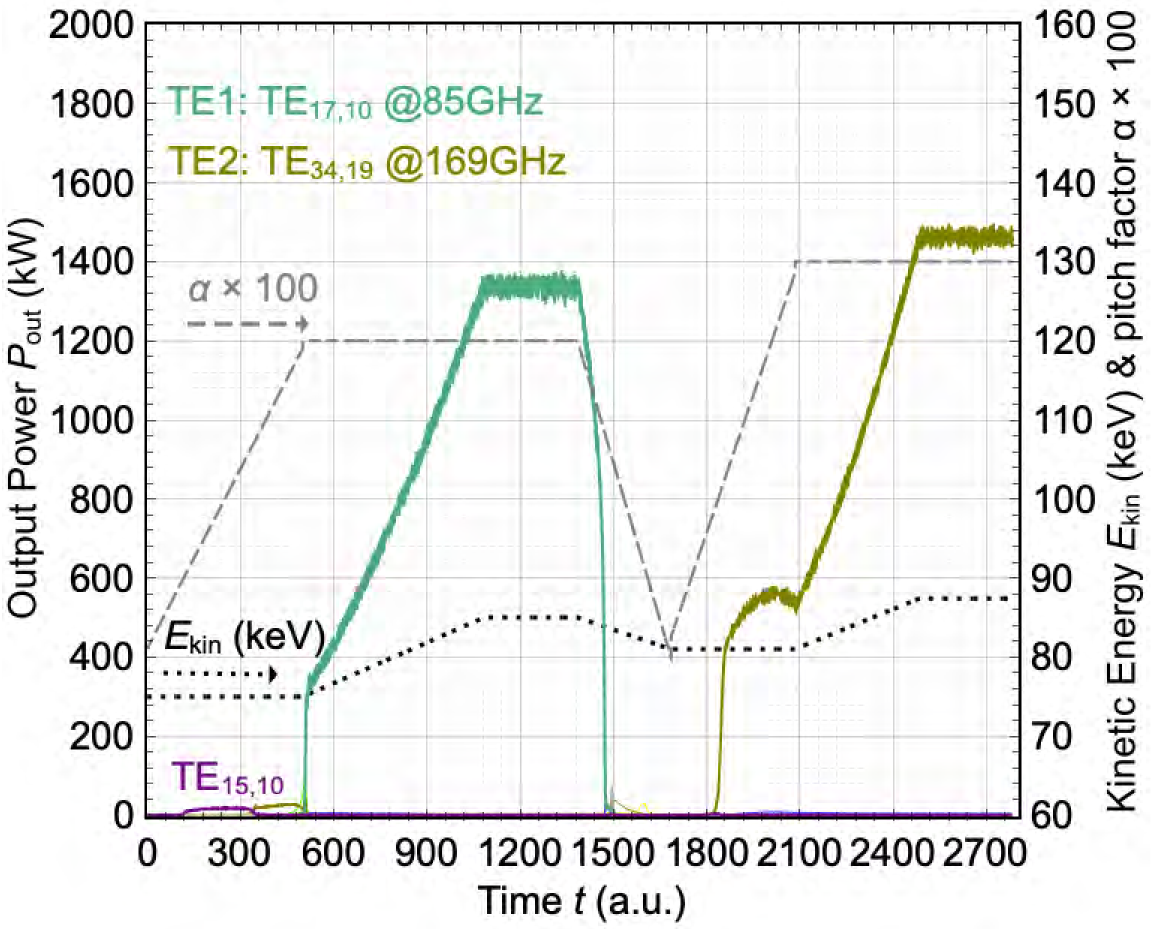
- Cavity (2^{nd} harmonic TE2, 1.55 MW @ 170 GHz) tested for:
  - also 1^{st} harmonic TE1 operation
  - the design of a fast-switching scenario
- Table I: Operating Points

	E_{kin} (keV)	I_b (A)	B_{max} (T)	Pitch factor α	*Eigenvalue*
$TE_{17,10}$	85	95	3.475	1.2	53.00
$TE_{34,19}$	87	95	3.475	1.3	105.19

- Table II: Performance

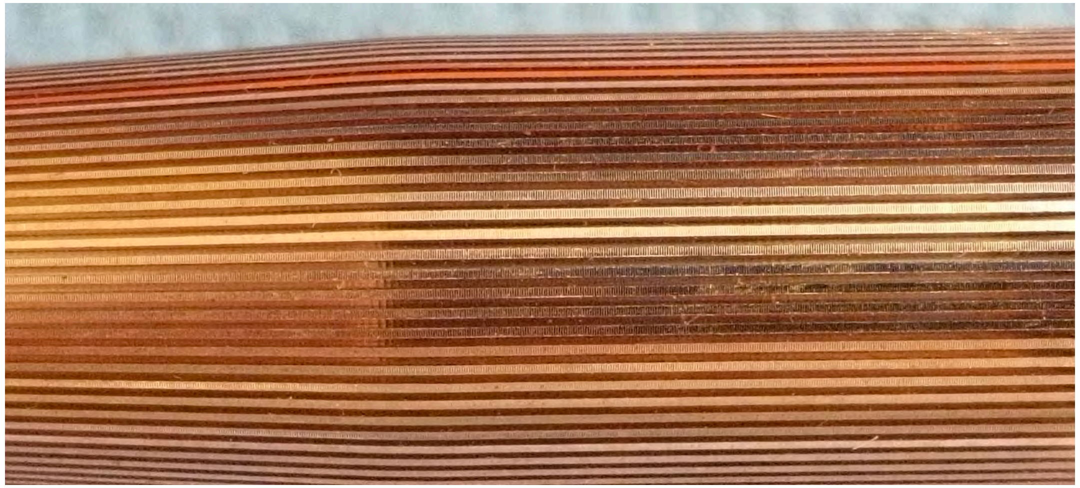
	P_{out} (MW)	efficiency	ρ_{out} (kW/cm^2)	ρ_{in} (kW/cm^2)
$TE_{17,10}$	1.35	18%	0.5	**1.35**
$TE_{34,19}$	1.45	19%	2.1	0.39

Multimode simulations demonstrate the fast-switching scenario between the TE1 and the TE2 mode by varying the electron-beam parameters (E_{kin}, α)



Design and Manufacturing of a Complex Shaped Insert

- Manufacturing of a short pulse cavity
- Novel mechanical design and manufacturing of a modular insert



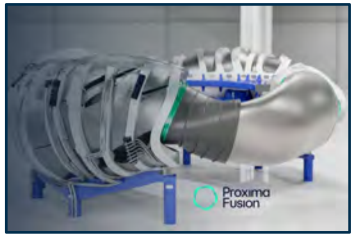
L. Feuerstein et al., Enhanced Suppression of First Harmonic Competing Modes in Harmonic Coaxial Gyrotron Cavities with Tapered Corrugation Depth. J Infrared Milli Terahz Waves 47, 21 (2026). https://doi.org/10.1007/s10762-026-01128-1

Status on the Experiment

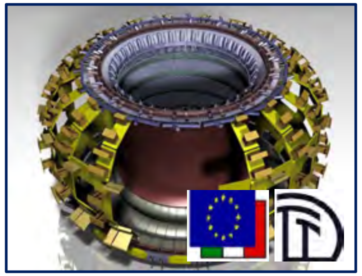
- Installation of the manufactured parts in the KIT short pulse coaxial prototype finished
- Superconducting magnet cooled down
- Conditioning phase has started

- **Status: First measurements campaign done**

Gyrotron Research and Development at KIT

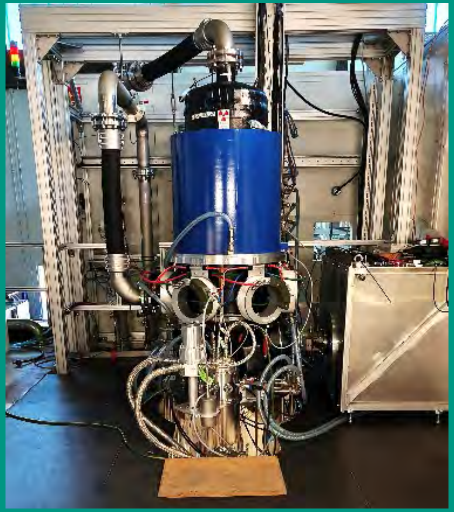


- Member of European Gyrotron Consortium (EGYC) for ITER
- Partner of IPP for 1 MW and 1.5 MW / 2 MW developments for W7-X (BMFTR HiPMiB)
- EUROfusion tasks leader for gyrotron R&D, leading the 2 MW coaxial-cavity gyrotron technology, Multistage Depressed Collector (MDC), operation at 2nd harmonics, electronic stability and frequency control
- **Lead in test and validation of megawatt-class gyrotrons (FULGOR)**
- Partner in gyrotron developments for European and worldwide nuclear fusion experiments such as TCV, CEA/WEST, DTT and GA/DIII-D
- Project coordinator for BMFTR project HeatQIS together with PROXIMA Fusion, Diamond Materials and THALES towards 238 GHz gyrotrons, EC launchers and windows



Gyrotron Test Stand(s) at IHM

FULGOR



CRYOGENIC
10.5 Tesla
gyrotron
magnet

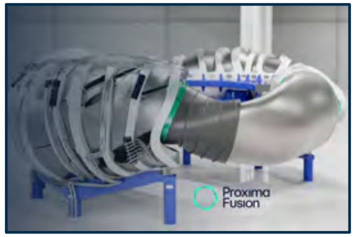
Simultaneous operation

WEST

EAST

- **B. Baumann et al,** "VECTOR BASED MAGNETIC AXIS DETERMINATION OF SOLENOIDS FOR GYRO-DEVICES" **(W22T)**

Gyrotron Research and Development at KIT



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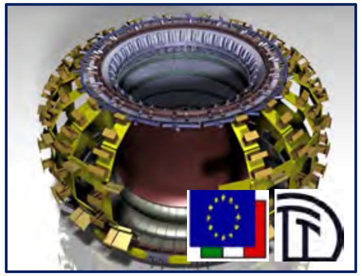
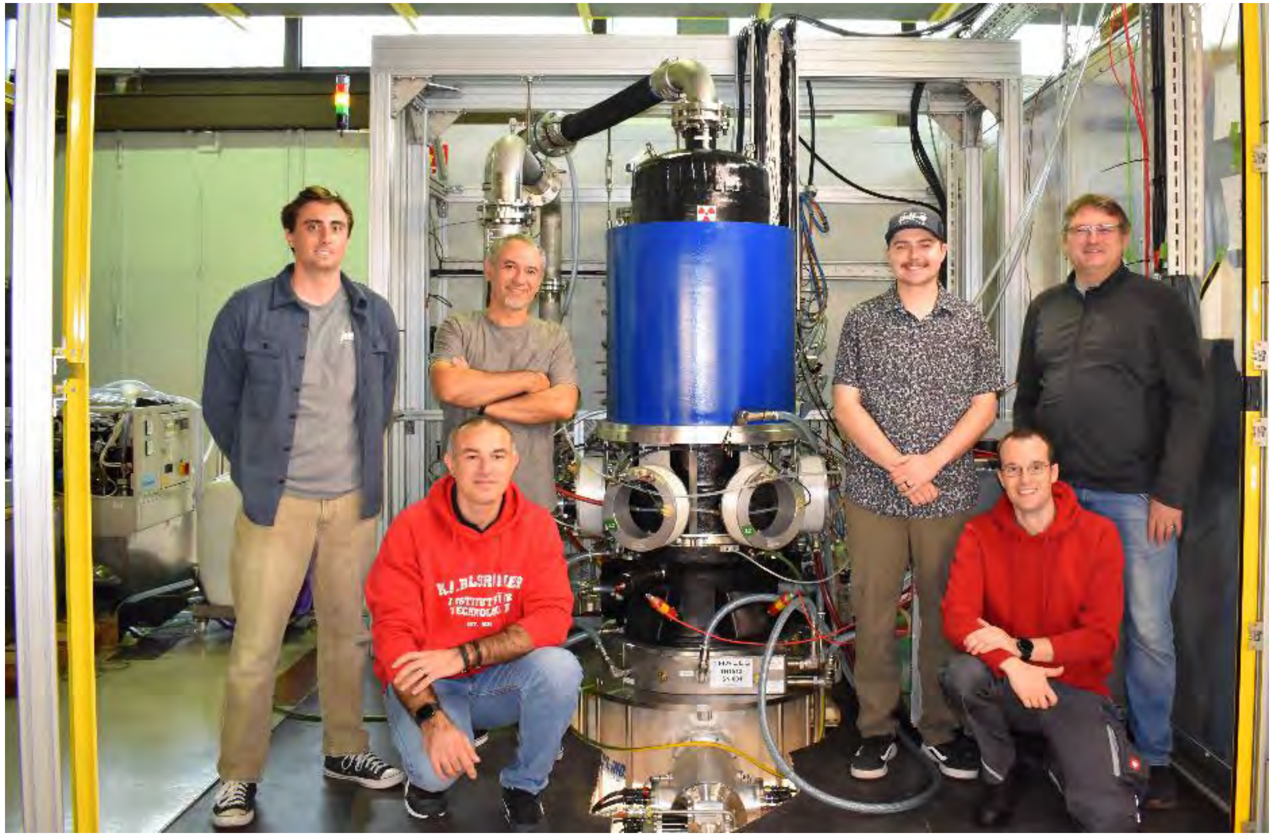


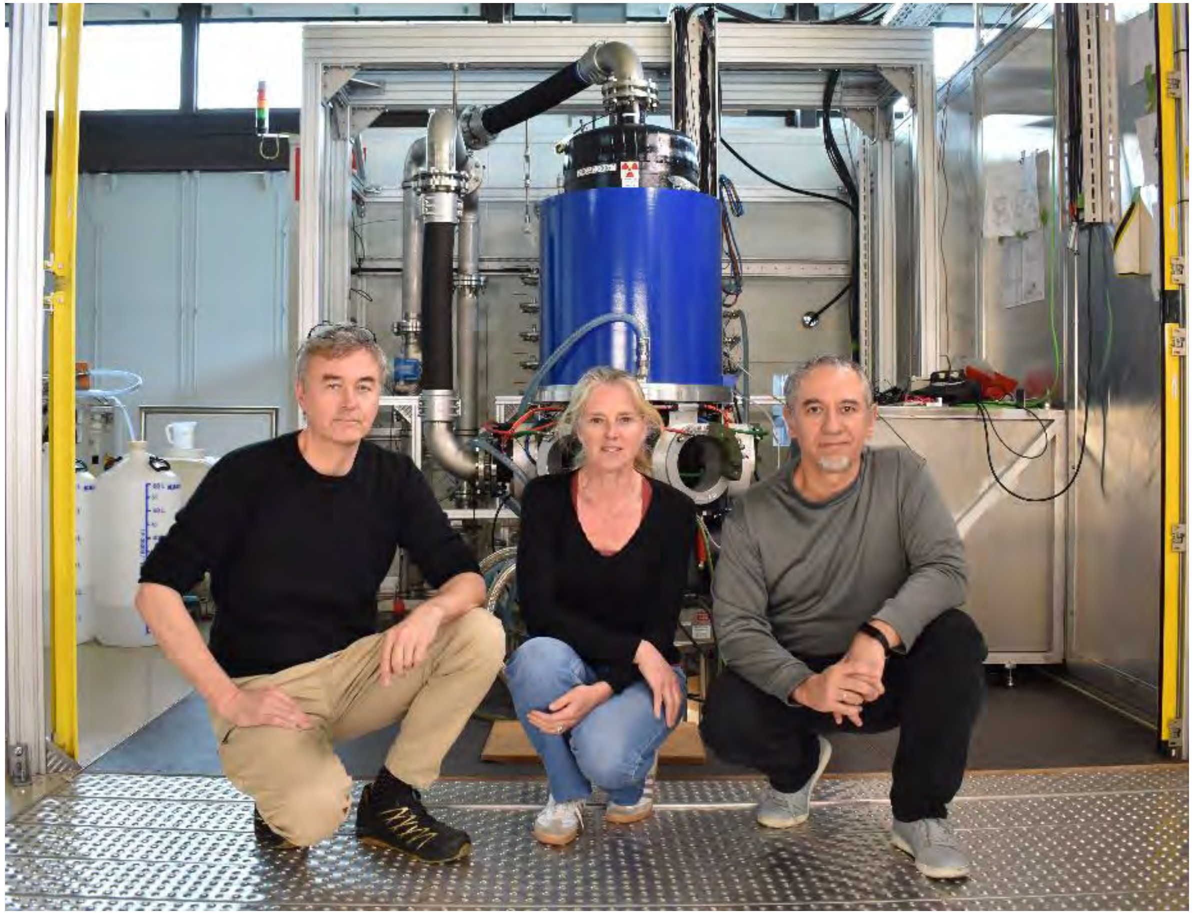
GA DIII-D Gyrotron (SN 01) – 117.5 GHz, 1 MW (10 s)



GA DIII-D 117.5 GHz, 1 MW CW	
f	117.5 GHz
B_c	4.7 T
P_{rf}	1 MW
Mode	$TE_{24,8}$
efficiency	42%
Pulse length	10 s
Magnets	Cryo free SCM - Cryomagnetics
Goal	FAT

- **A. Leggieri et al., "PROGRESS IN EUROPEAN COLLABORATIVE GYROTRON DEVELOPMENTS FOR CEA AND GENERAL ATOMICS" (W3I, Invited)**

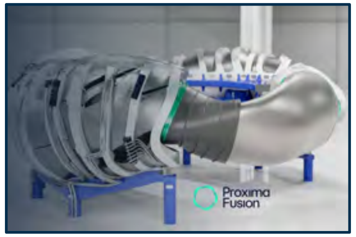
CEA WEST Gyrotron (SN 03) – 105 GHz, 1 MW (60 s)



CEA WEST 105 GHz, 1MW CW	
f	105 GHz
B_c	4.13 T
P_{rf}	1 MW
Mode	$TE_{20,8}$
Efficiency	40%
Pulse length	60 s
Magnets	Cryogen free SCM - Cryomagnetics
Goal	FAT

- **A. Leggieri et al., "PROGRESS IN EUROPEAN COLLABORATIVE GYROTRON DEVELOPMENTS FOR CEA AND GENERAL ATOMICS" (W3I, Invited)**

Gyrotron Research and Development at KIT



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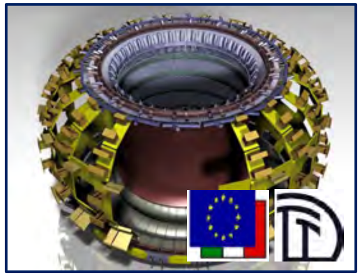


Key Components of EC Plasma Heating Systems

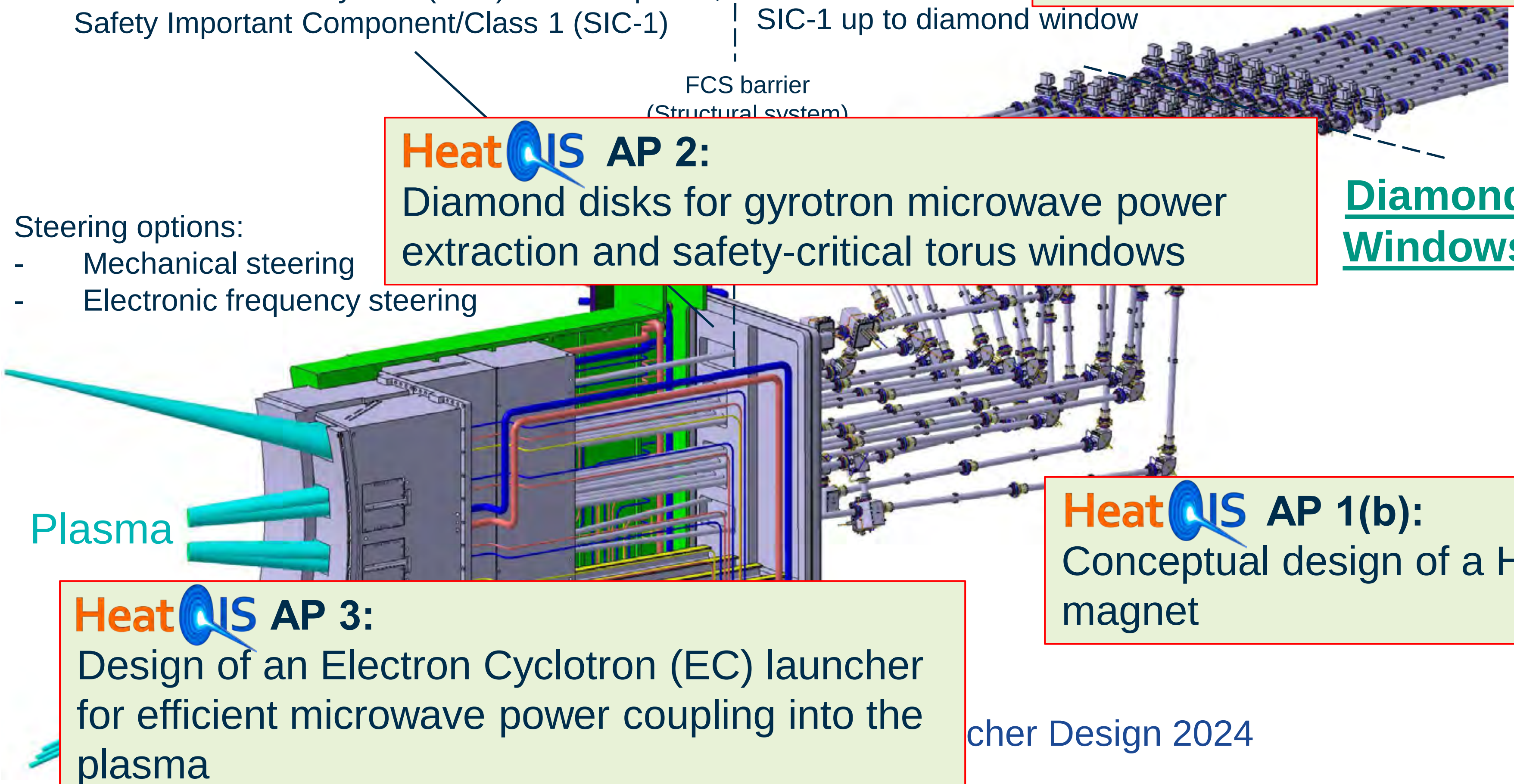
Heat IS AP 1(a):
238 GHz / 1,7 MW (100 s) gyrotron demonstrator

EC Launcher (In-vessel)

First Containment System (FCS): Closure plates, Safety Important Component/Class 1 (SIC-1)

Port Cell Trans

Port cell TL = Ex-ves
SIC-1 up to diamond window



Heat IS AP 2:
Diamond disks for gyrotron microwave power extraction and safety-critical torus windows

Diamond Windows

Steering options:
- Mechanical steering
- Electronic frequency steering

Heat IS AP 1(b):
Conceptual design of a HTS gyrotron magnet

Heat IS AP 3:
Design of an Electron Cyclotron (EC) launcher for efficient microwave power coupling into the plasma

Gyrotron

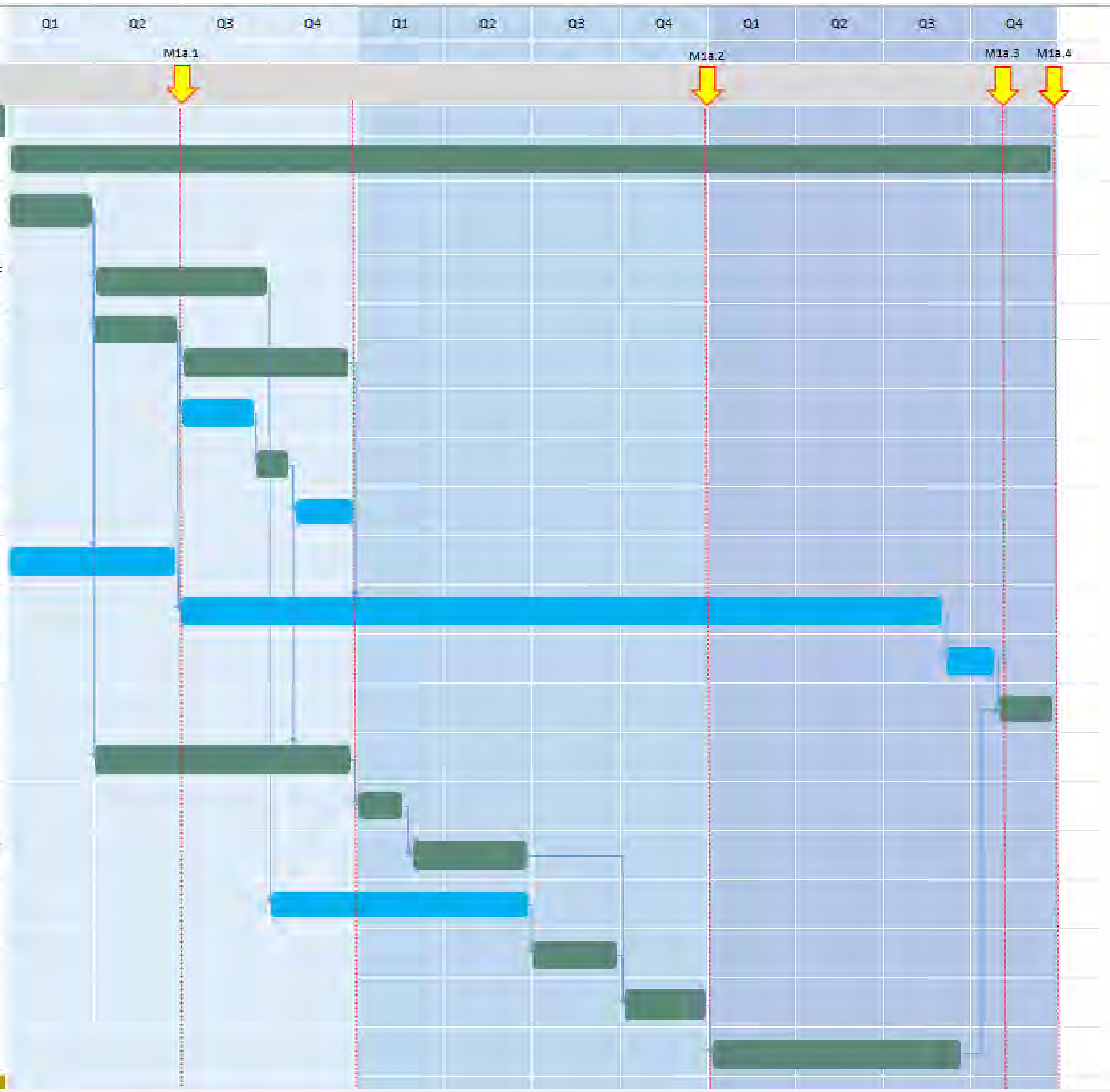
Sub Projects (Teilvorhaben)

Responsible
Contributor

	Teilvorhaben 1 KIT (GFA) John Jelonnek Dirk Strauss	Teilvorhaben 3 KIT (UA) Jens Gibmeier	Teilvorhaben 2 Proxima Fusion Lucio Milanese	Teilvorhaben 4 Diamond Materials Eckhard Wörner
Task 1a: „Gyrotron“	*KIT IHM* Physical design of a 240 GHz, 1.7 MW gyrotron Manufacturing a SP demonstr. Test and verification at KIT		Subcontract of the industrial demonstrator Support in design and test	
Task 1b: „Magnet“	*KIT IHM* Magnet profile definition		Major design	
Task 2: „Diamant“	*KIT IAM-AWP/MMI* Diamond disk characterization	KIT IAM-WK XRD analysis		Manufacturing process optimization Manufacturing of diamond disks
Task 3: „Launcher“	*KIT IAM-AWP* Launcher structural design		Major design	

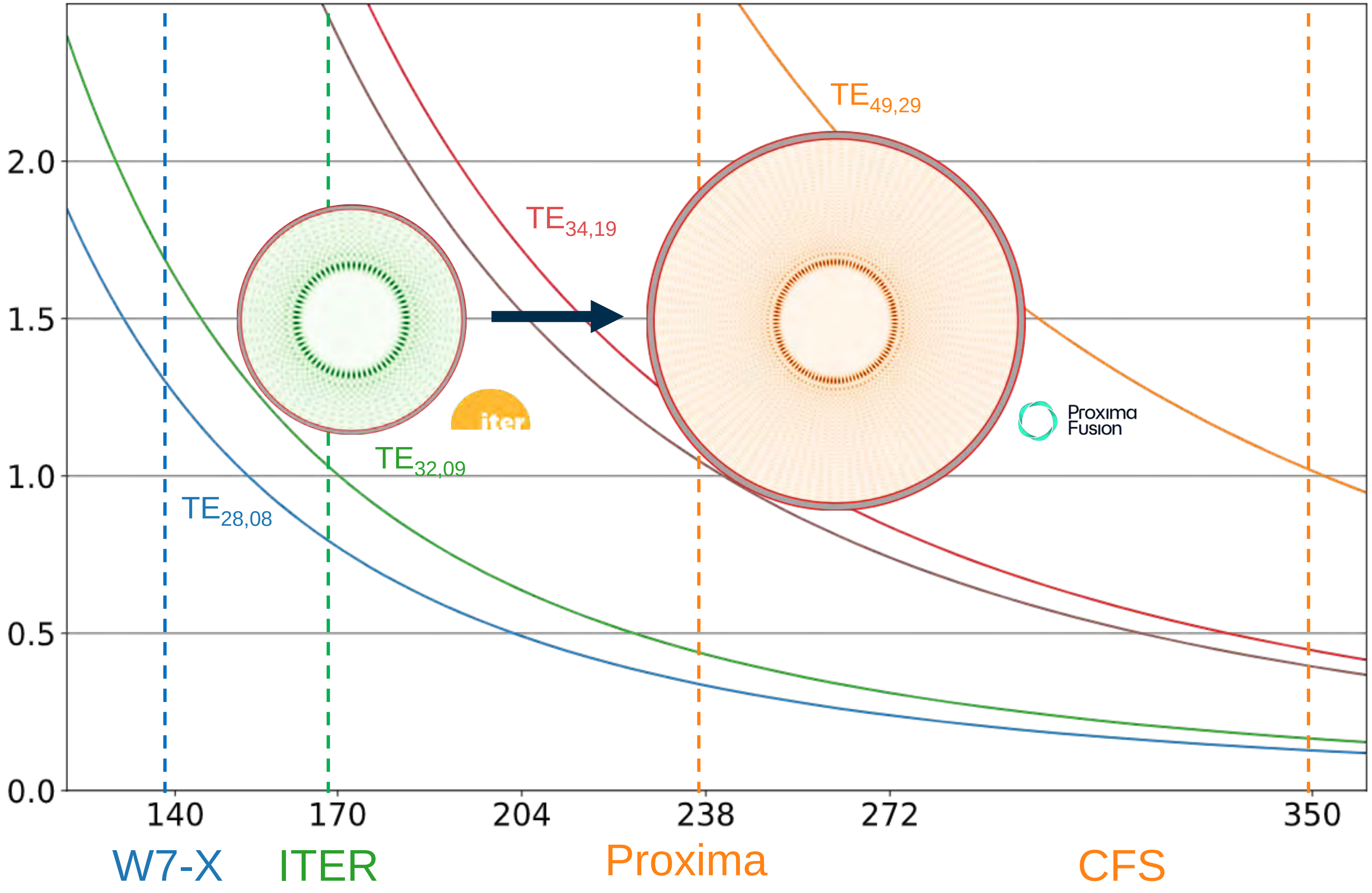
WP #1a „Gyrotron“

		AP 1a: Gyrotron
		AP 1a: KIT-IHM
AP1a.1	KIT-IHM	Coordination of Work package AP1a
AP1a.2	KIT-IHM	Fundamental selection of basic gyrotron parameters (operating mode, basic cavity design, fundamental MIG parameters, insert, potential voltage concept) and development of basic strategy of adaption of physical design of TH1508 tube
AP1a.3	KIT-IHM	Manufacturing of mode generator (to perform "cold" measurements of critical quasi-optical components)
AP1a.4	KIT-IHM	Major design of key components (MIG, Beam tunnel, Q. O. System, Collector) as input for start of manufacturing of gyrotron
AP1a.5	KIT-IHM	Fine tuning (final design) of key components (development contract with NKUA)
AP1a.6	KIT-IHM	Industrial sub-contract: Manufacturing of test launcher and first launcher for short-pulse pre-prototype at **company Reinhold Mühleisen**
AP1a.7	KIT-IHM	Verification of launcher performance (performing cold tests)
AP1a.8	KIT-IHM	Industrial sub-contract: Manufacturing of launcher for industrial prototype at company Reinhold Mühleisen
AP1a.9	Proxima/KIT-IHI	Industrial sub-contract: Principal design architecture based on TH1508 at Thales
AP1a.10	Proxima/KIT-IHI	Manufacturing of industrial prototype at Thales
AP1a.11	Proxima/KIT-IHI	Final Acceptance Test (FAT) at Thales factory and delivery to KIT
AP1a.12	Proxima/KIT-IHI	Site Acceptance Test (SAT) at KIT FULGOR teststand
AP1a.13	Proxima/KIT-IHI	Manufacturing of frame, components and integration of short-pulse pre-prototype for test at KIT
AP1a.14	KIT-IHM	Short-pulse-pre-prototype: installation and conditioning
AP1a.15	KIT-IHM	Short-pulse pre-prototype: Test of basic functionality with target of osciallation at 240 GHz using existing MIG
AP1a.16	KIT-IHM/Thales	Industrial sub-contract to manufacture MIG for short-pulse pre-prototype at Thales
AP1a.17	KIT-IHM	Short-pulse pre-prototype: adaption of pre-prototype to new MIG, installation and conditioning
AP1a.18	KIT-IHM	Short-pulse pre-prototype: initial experiments with target of operation at 240 GHz
AP1a.19	KIT-IHM	Parameter optimization and design optimization



- **A. Schmidt et al.**, "EVALUATION OF A LOW VOLTAGE HIGH CURRENT OPERATION POINT FOR A HIGH-FREQUENCY AND VERY-HIGH ORDER MODE GYROTRON" **(W16T)**
- **M. Misko et al.**, "QUASI-OPTICAL MODE GENERATOR FOR THE VERIFICATION OF A 238 GHz TE49,29 -MODE GYROTRON LAUNCHER ANTENNA" **(W18T)**

From „170 GHz“ to „238 GHz“ and from „1 MW“ to „2 MW“

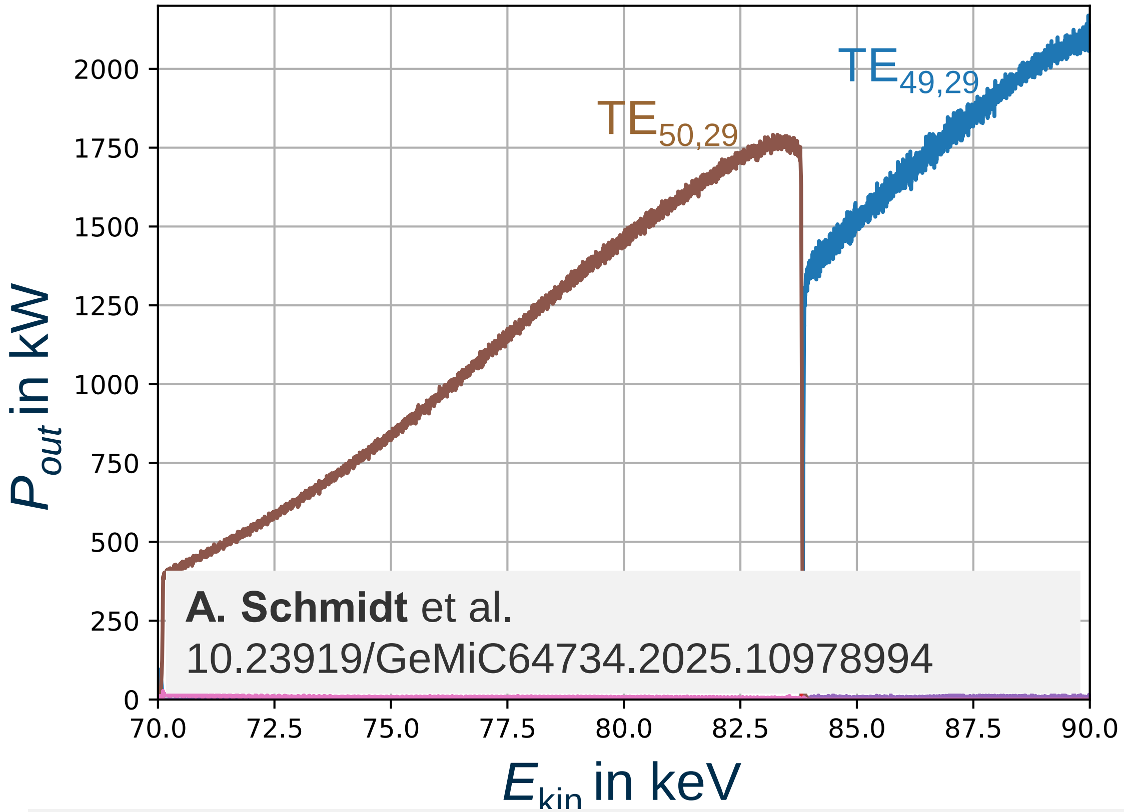


$$\rho \sim f^{\frac{5}{2}} \cdot \left[\chi_{m,p}^2 \cdot \left(1 - \frac{R_{\text{caustic}}}{R_{\text{cavity}}}\right)^2\right]^{-1}$$

Q	1400
L/λ	9
ρ	$2\,\frac{kW}{cm^2}$
σ	$1.73 \cdot 10^7\,\frac{\text{S}}{\text{m}}$

Interaction Simulation of a $TE_{49,29}$ –Mode Cavity at 238 GHz

- Self consistent time-dependent multi-mode simulation: ROCK[1]
- Using electron beam parameters from ESRAY[2]
- Considering over 40 competing modes



A. Schmidt et al.
10.23919/GeMiC64734.2025.10978994

Parameter	Value
B	9.62 T
U	90 kV
I	63 A
α	1.3
P	2.1 MW
$\eta_{\mathrm{interaction}}$	37 %
ρ	$2.1\ \mathrm{kW/cm^2}$

C. Wu et al., ROCK: a flexible gyrotron cavity simulation toolkit using an accuracy-improved time-dependent self-consistent multimode interaction model, *Journal of Infrared, Millimeter, and Terahertz Waves*

S. Illy et al., Gyrotron electron gun and collector simulation with the ESRAY beam optics code. 1-2. 10.1109/IVEC.2015.7223779

C. Wu et al.: Design Concepts and Highlight Features of the New KIT Gyrotron Interaction Code ROCK (EC-23)

KIT Development Paths

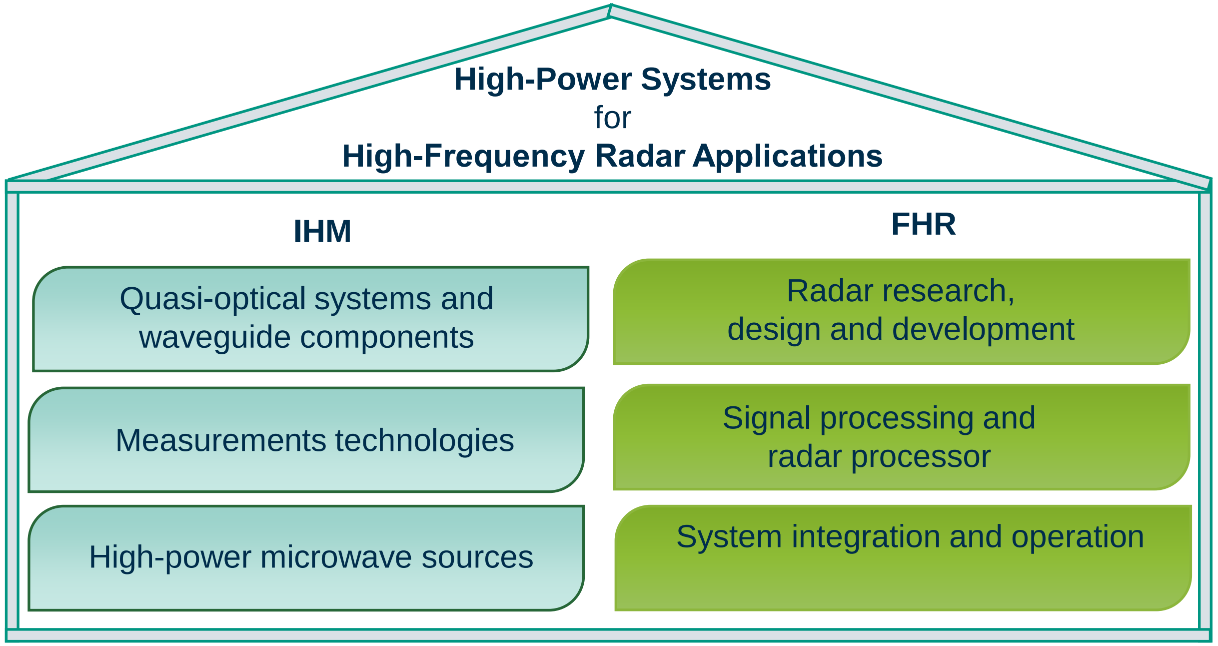
Gyro-TWT

Radar for Detection of Space Debris

mmW Spectroscopy

- **SFB Hyperion:** Broadband sub-THz high-power amplifier system for high-field pulsed DNP

Fraunhofer FHR Research Group at KIT



https://youtu.be/M-tLJWzzrZU

Kooperation IHM und FHR
(Fraunhofer-Institut für Hochfrequenzphysik und Radartechnik)

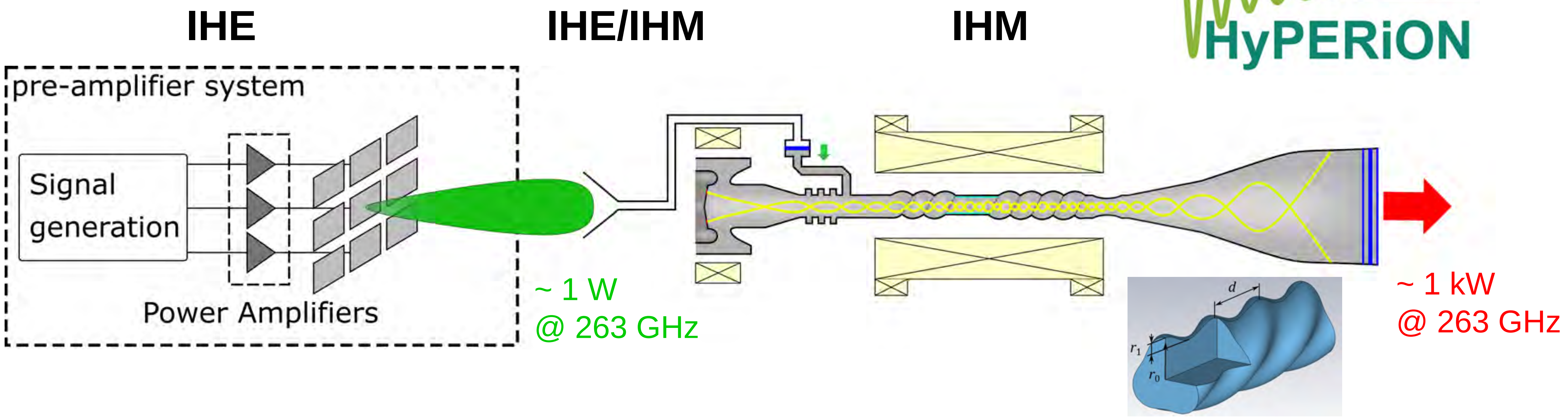
High-Power Systems for
High-Frequency Radar Applications

Future radar methods and technologies for space observation

- **A. Marek**, “Ka-BAND UPGRADE OF TIRA: THE FUTURE OF RADAR SPACE OBSERVATION IN EUROPA” **(W23T)**

Hybrid Broadband Sub-THz High-Power Amplifier System for High-field Pulsed DNP

SFB 1527 HyPERiON



- **M. Vöhringer et al.**, “ONGOING DEVELOPMENT OF A GYRO-TWT TEST STAND UP TO 263 GHz AT IHM” **(W20T)**
- **B. Bischofberger et al.**, “NOVEL BROADBAND FREQUENCY AND AMPLITUDE MEASUREMENT SYSTEM FOR 263 GHz GYRO-TWT AMPLIFIERS” **(W19T)**

Presentations Related to R&D at KIT

- **A. Leggieri et al.,** “PROGRESS IN EUROPEAN COLLABORATIVE GYROTRON DEVELOPMENTS FOR CEA AND GENERAL ATOMICS” **(W3I, Invited)**

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