Karlsruhe Institute of Technology

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Progress in the Short-Pulse *E×B* Drift Two-Stage Depressed Collector Prototype for Gyrotrons

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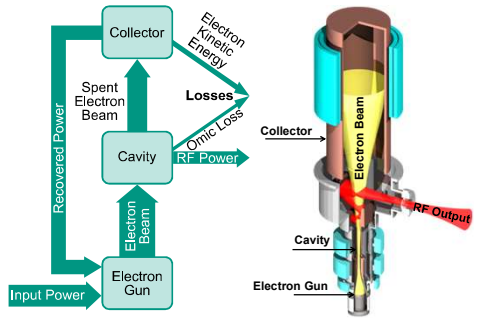
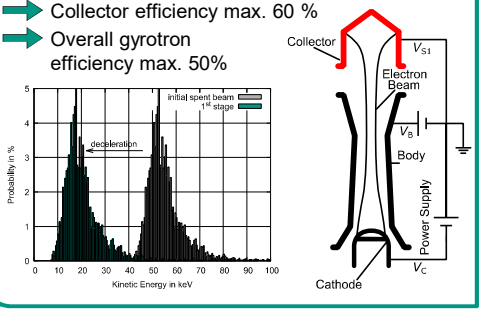
Energy Recuperation for Gyrotron



Today: Single-Stage Depressed Collector (SDC)

All electrons are decelerated equally by one potential

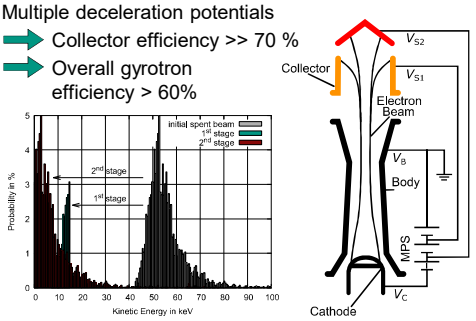
- Collector efficiency max. 60 %
- Overall gyrotron efficiency max. 50%



Future: Multi-Stage Depressed Collector (MDC)

Multiple deceleration potentials

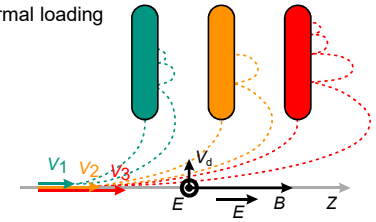
- Collector efficiency >> 70 %
- Overall gyrotron efficiency > 60%



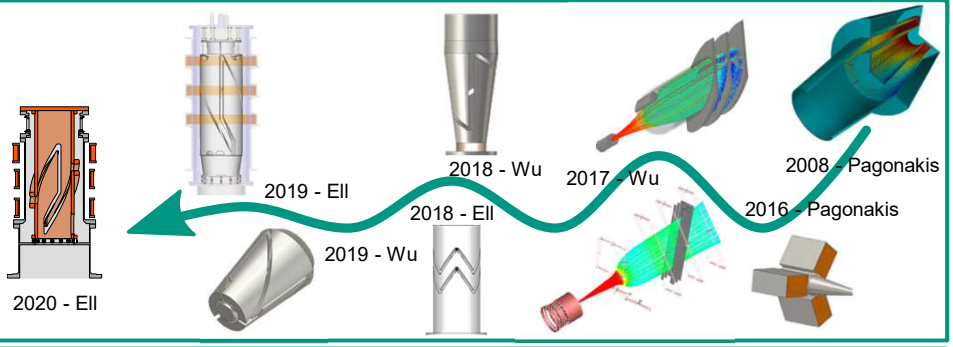
The Basic Concept of Electron Separation

Proposed principle

- Robust
- Compatible with high *B* (high frequency)
- High efficiency
- Low thermal loading



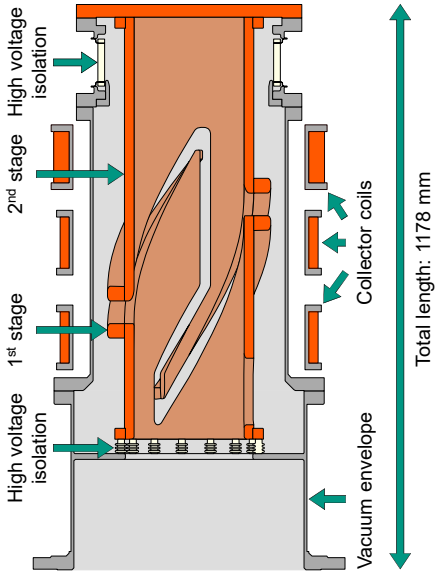
Design Studies at KIT: From concept to a realistic and simple design



The World's First Gyrotron MDC Design

Design optimized for the KIT 2 MW **170**/204 GHz short pulse coaxial cavity gyrotron

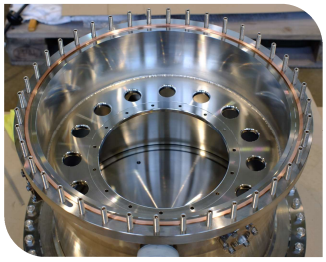
- Triple helix design for reduced length
- Helical extension for low reflected current (< 0.2%)
- Collector efficiency: 79.5 % (with SEE 76.1 %)
- First electrode @ - 11 kV
- Second electrode @ - 46 kV



Progress in Manufacturing

- The vacuum envelope and collector coils are mounted
  - All tolerances are as specified
  - No vacuum leaks were found at 1.1e-7 mbar
  - DC coil performance as expected with 1.6 Ω and 2·0.9 Ω
- Two electrodes
  - Pipe needs to be split in CNC machine
  - Helical ribs are ready
- Second version of the lower assembly is under construction
  - Optimized for the W7-X 1.5 MW 140 GHz upgrade gyrotron
  - Flexibility in experiments
  - Decreased in length by over 200 mm

Helical rib



Lower assembly

Conclusion

- The progress in the short-pulse *E×B* drift two-stage depressed collector prototype for the KIT 2 MW **170**/204 GHz gyrotron was presented
- The manufacturing at KIT is making great progress
- Only a few final steps to complete the collector
- The modularity of the design can be validated in future experiments either with the KIT 2 MW **170**/204 GHz or the W7-X 1.5 MW 140 GHz short pulse gyrotron

Acknowledgement

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