

VENUS Updates

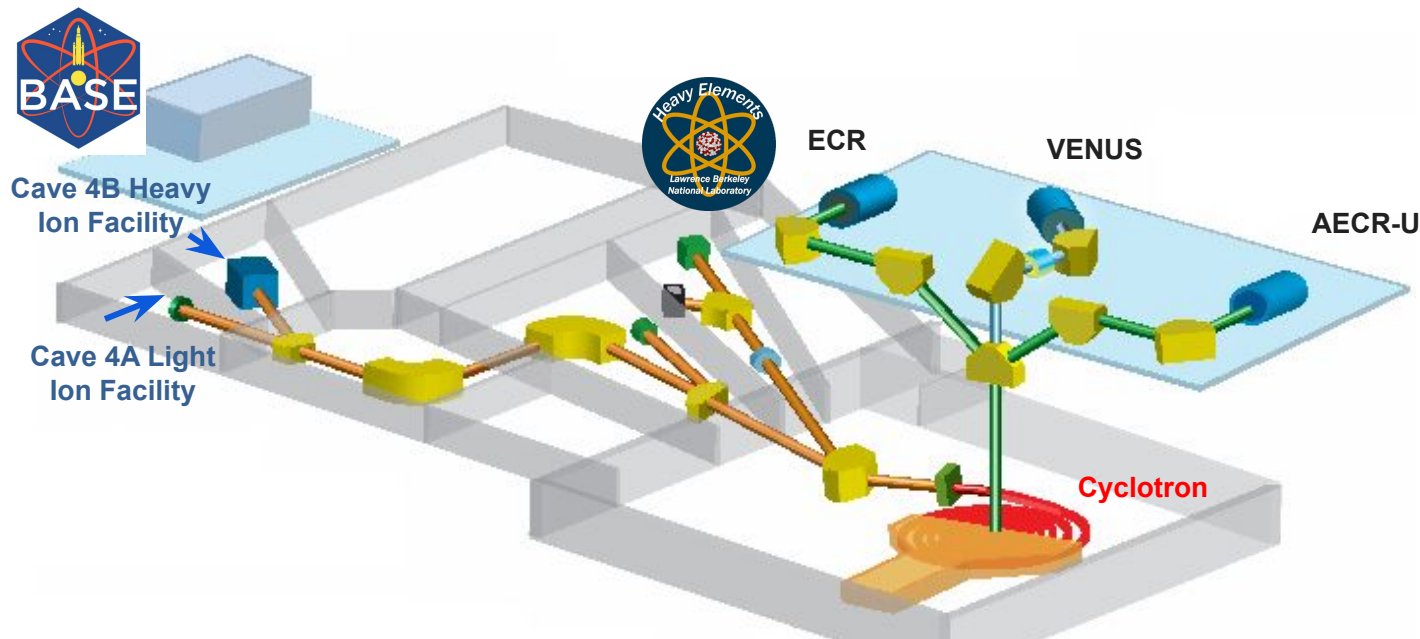
Janilee Benitez, Damon Todd

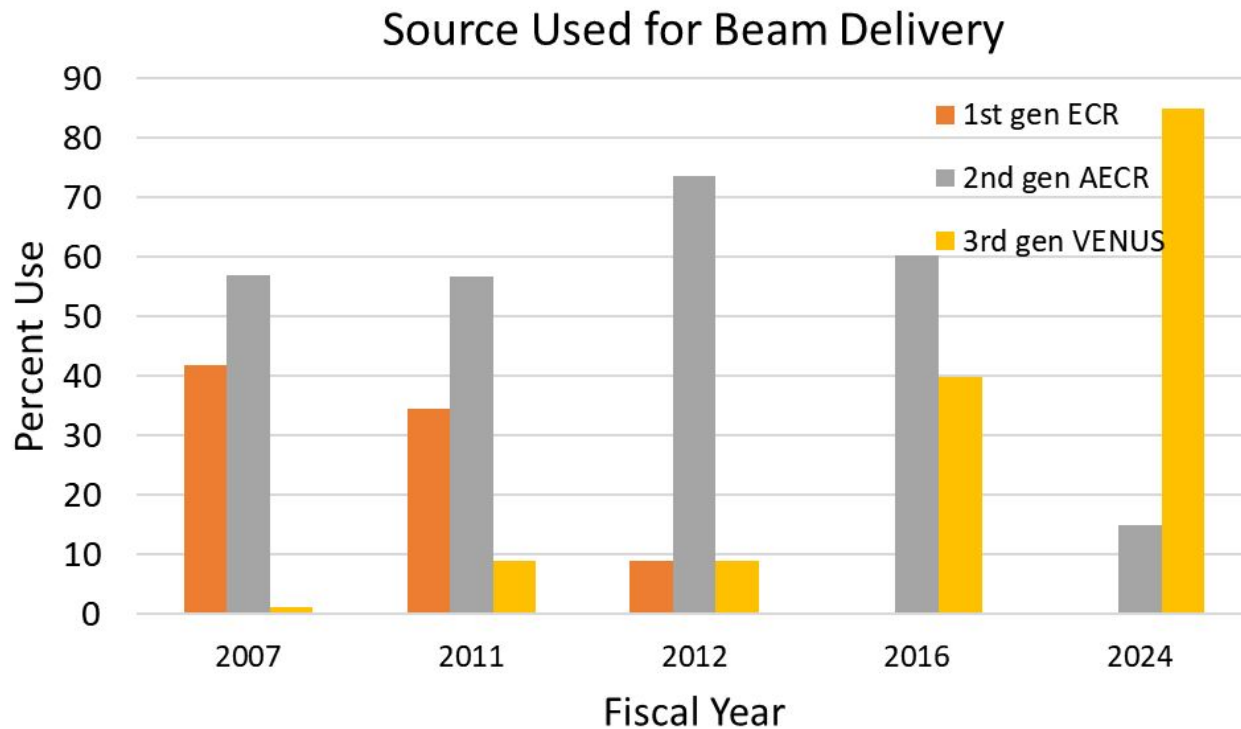
Production of Intense Beams and Highly Charged Ions
April 8, 2025

1. VENUS Use and Maintenance Updates
2. Primary ECR for Space Effects Testing
3. Primary ECR for Super Heavy Element Experiments (D. Todd, Wednesday)
4. Machine Learning Efforts
5. Plasma Chamber Issues
6. New additional 18 GHz klystron

LBNL 88-Inch Layout

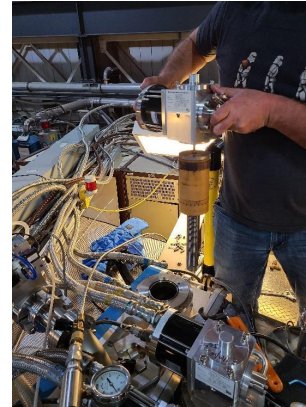
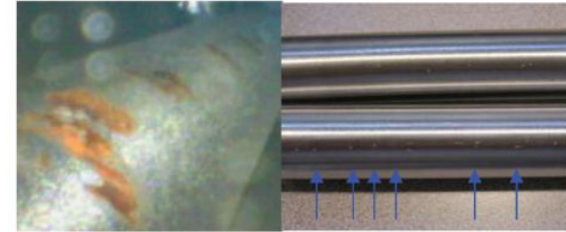
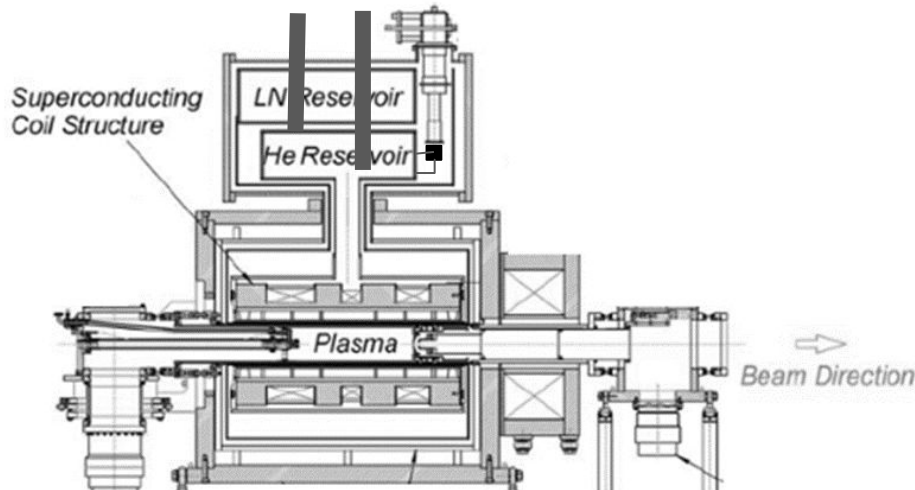
The 88-Inch Cyclotron is fed by three ECR ion sources:
ECR, AECR-U, and VENUS





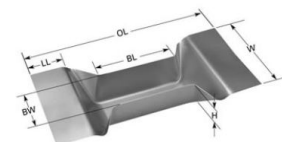
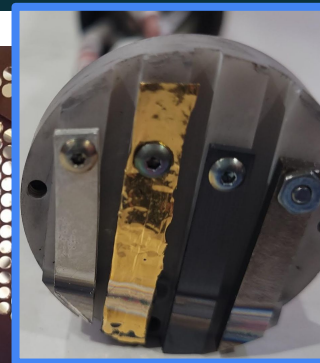
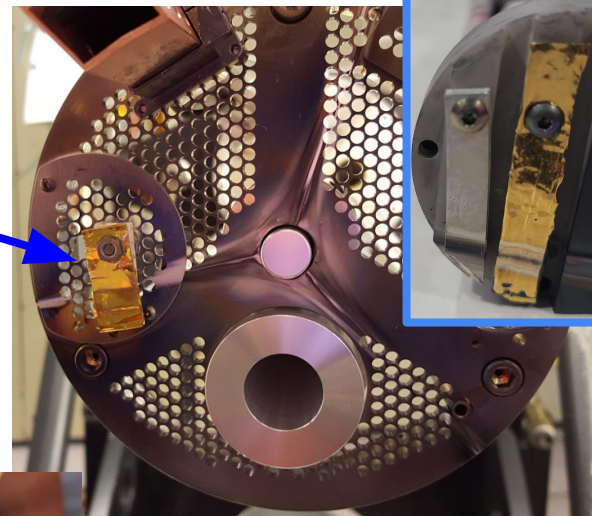
Modifications to VENUS Cryostat

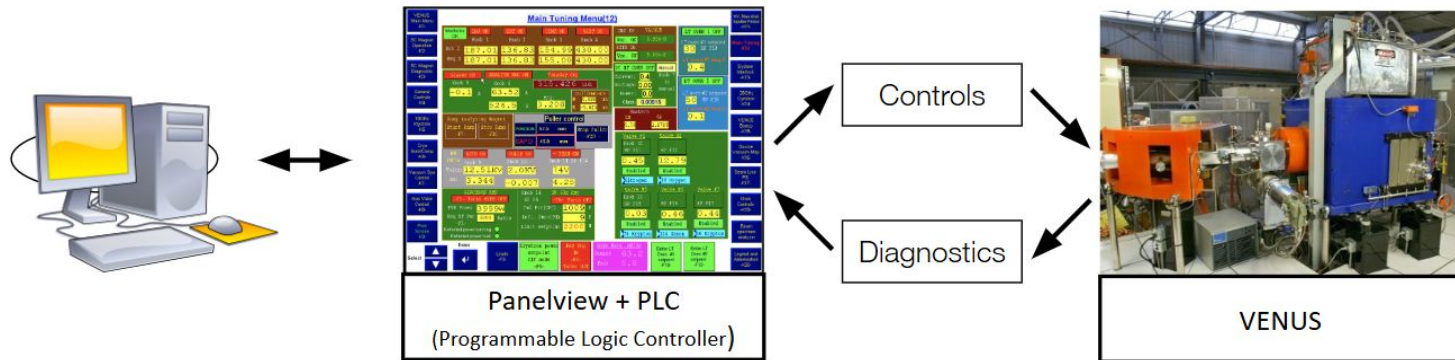
- Previously, coldhead maintenance was ~6 - 8 weeks every 1.5 years
- Fast warm-up caused corrosion/leak of LHe fill tubes in 2014, warm-up process was slowed down



New Additions:

1. $^{197}\text{Au}^{52+}$ for 10 MeV/u cocktail by sputter
2. Addition of $^{107}\text{Ag}^{38+}$ for 16 MeV/u cocktail by boat oven
3. New 20 MeV/u cocktail with $^{124}\text{Xe}^{46+}$





Possible Goals:

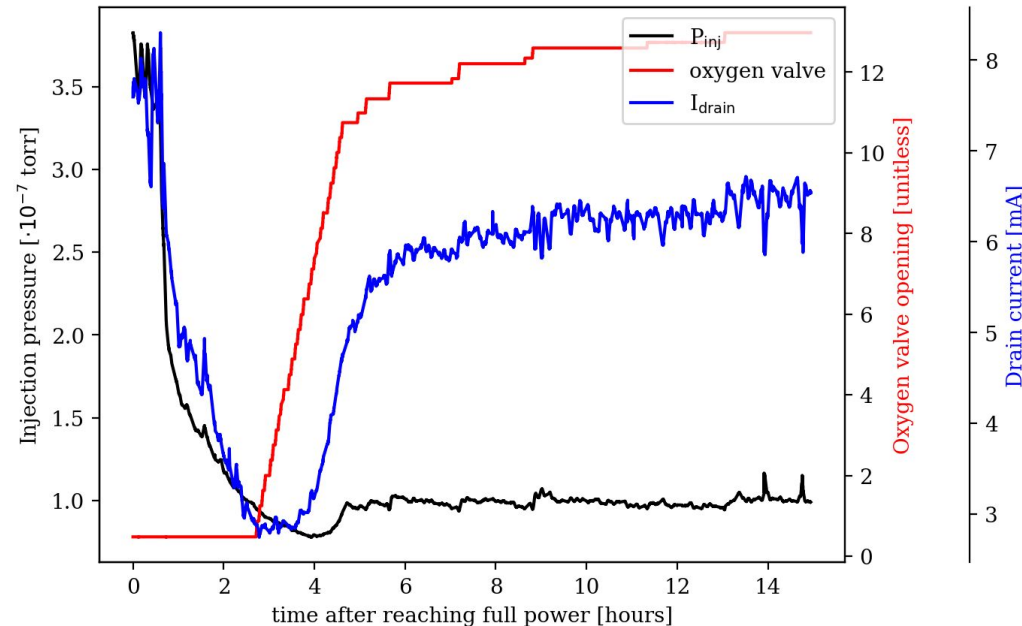
- Maximize beam current
- Minimize emittance
- Maintain stability
- Understand source physics!

Diagnostics:

- Faraday cup
- Emittance scanner
- Drain and bias currents
- Cryostat heat load
- Bremsstrahlung
- Microwave transmission

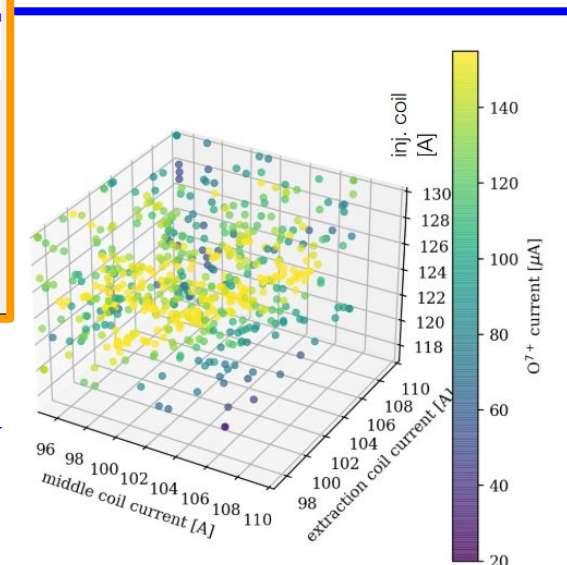
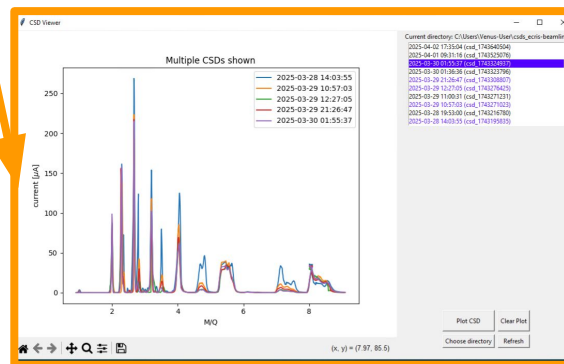
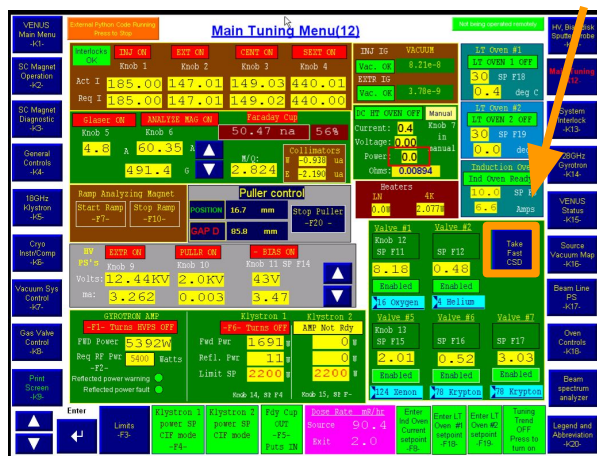
By D.S. Todd

Automated baking program will bake source over the weekend



By D.S. Todd

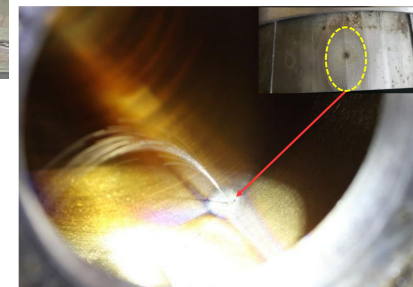
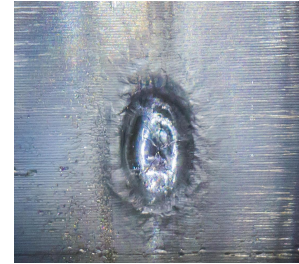
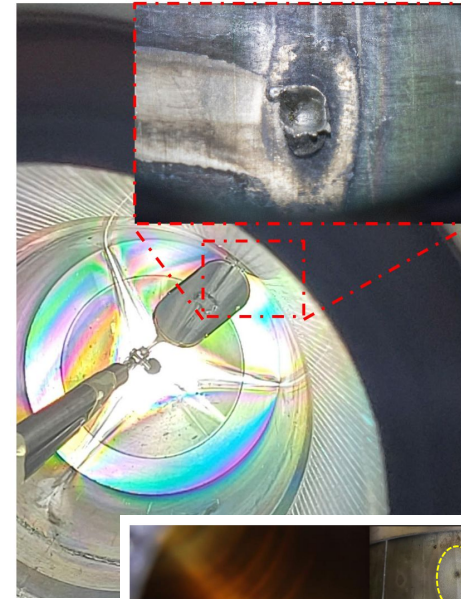
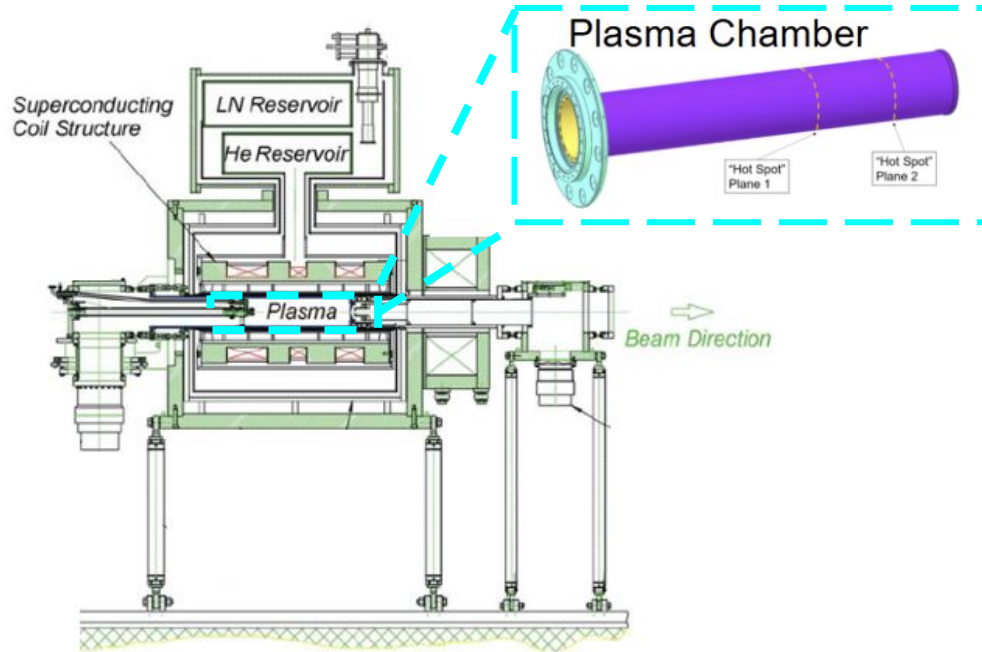
- Fast charge state distributions (6s)
 - Returns to original state (30s total)



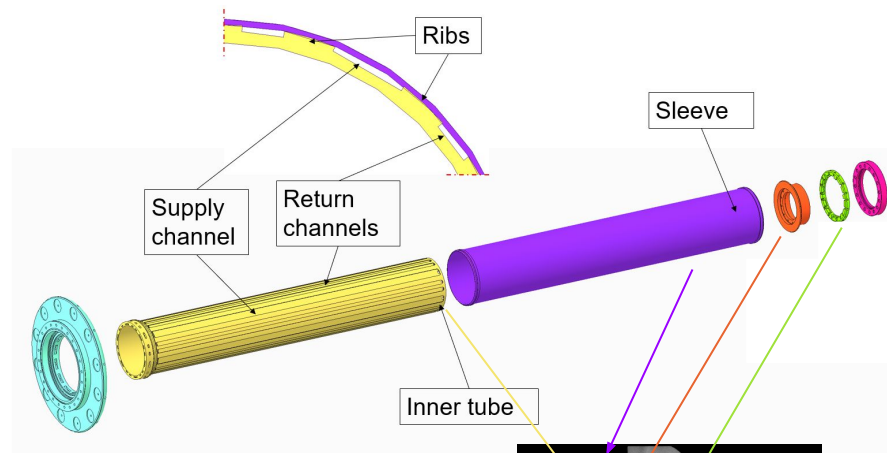
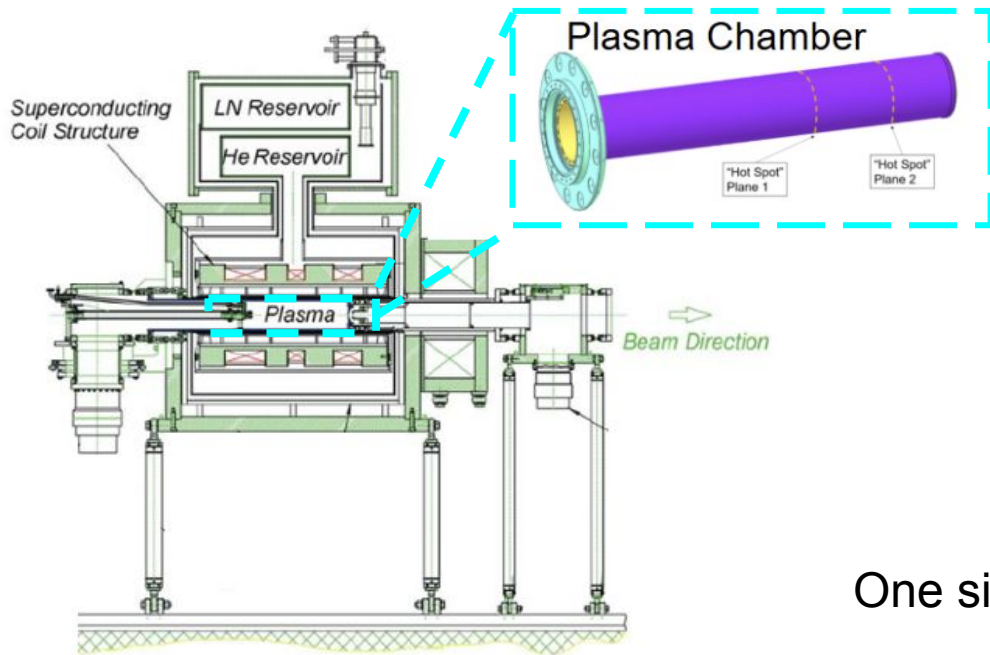
- Continue working on optimizing beams
 - Need to expand the boundary conditions

By D.S. Todd

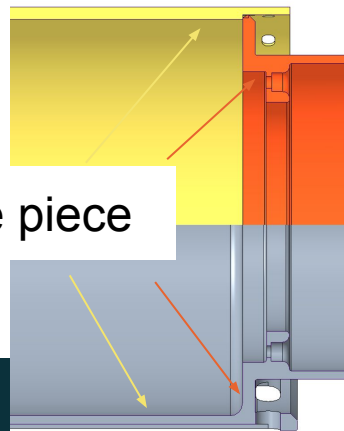
Plasma Chamber Fabrication Issues



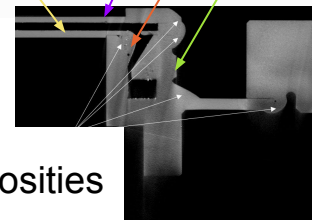
Plasma Chamber Fabrication Issues



One single piece



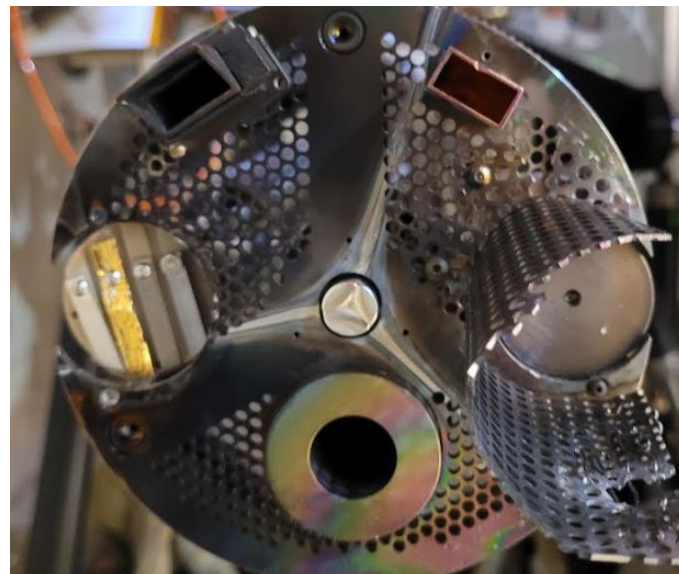
porosities



Second 18 GHz Klystron



Addition of 2nd 18 GHz
klystron



- Total 14kW (10 kW 28 GHz + 4 kW 18 GHz)
- Each own oscillator
- Preliminary test with same oscillator: best output at phase offset of 90° and 270°

Thank you!