

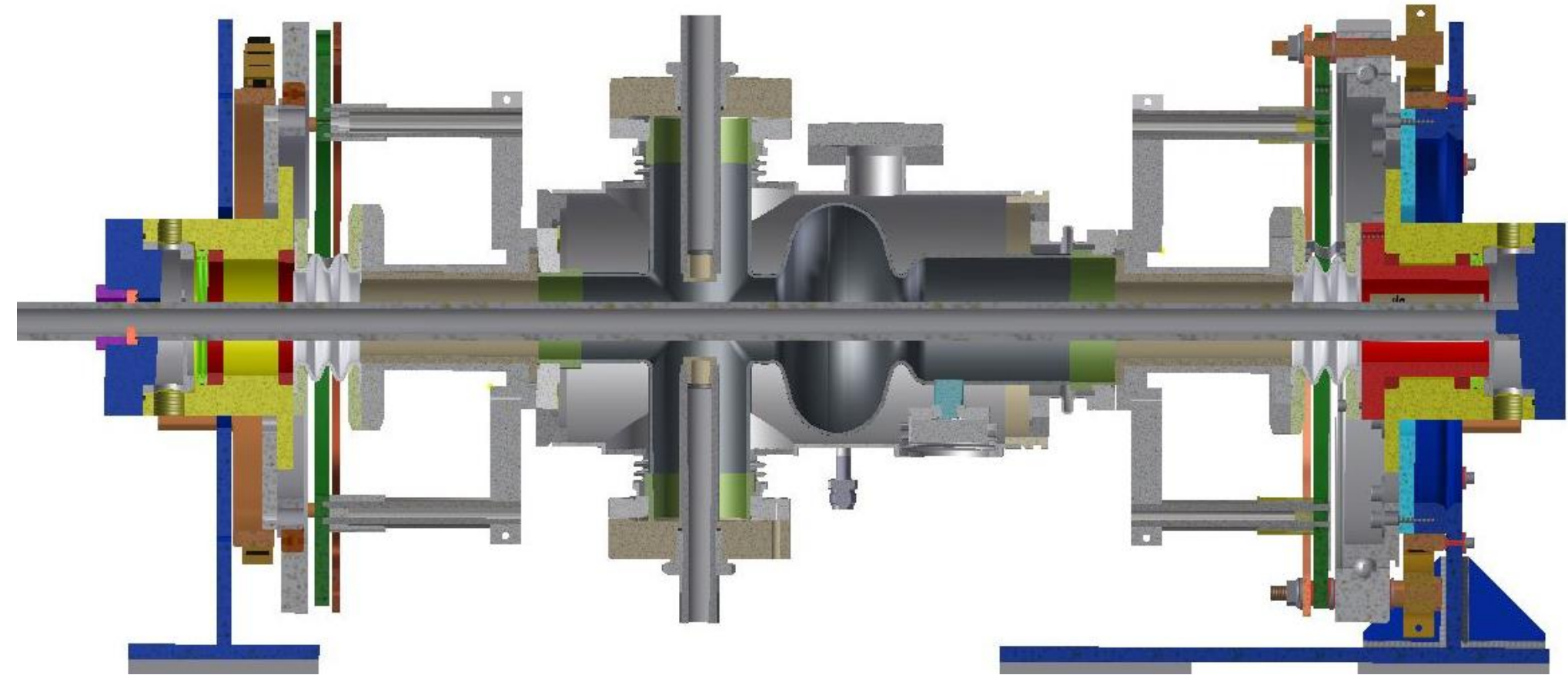
New SRF Structures Processed at Argonne National Laboratory

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Argonne National Laboratory (ANL) has extended high quality cavity processing techniques based on those developed for the International Linear Collider to several more complex superconducting RF cavities. Recently, these include a bunch lengthening harmonic cavity, a crabbing rf-dipole cavity, a compact half-wave cavity, and both medium and high frequency elliptical cavities. These systems are an improved version of the one originally developed for 1.3 GHz 9-cell cavities and include a second rotating electrical contact that can support multiple cathodes, necessary for optimum polishing in difficult cavity geometries. All include the possibility for external water cooling.

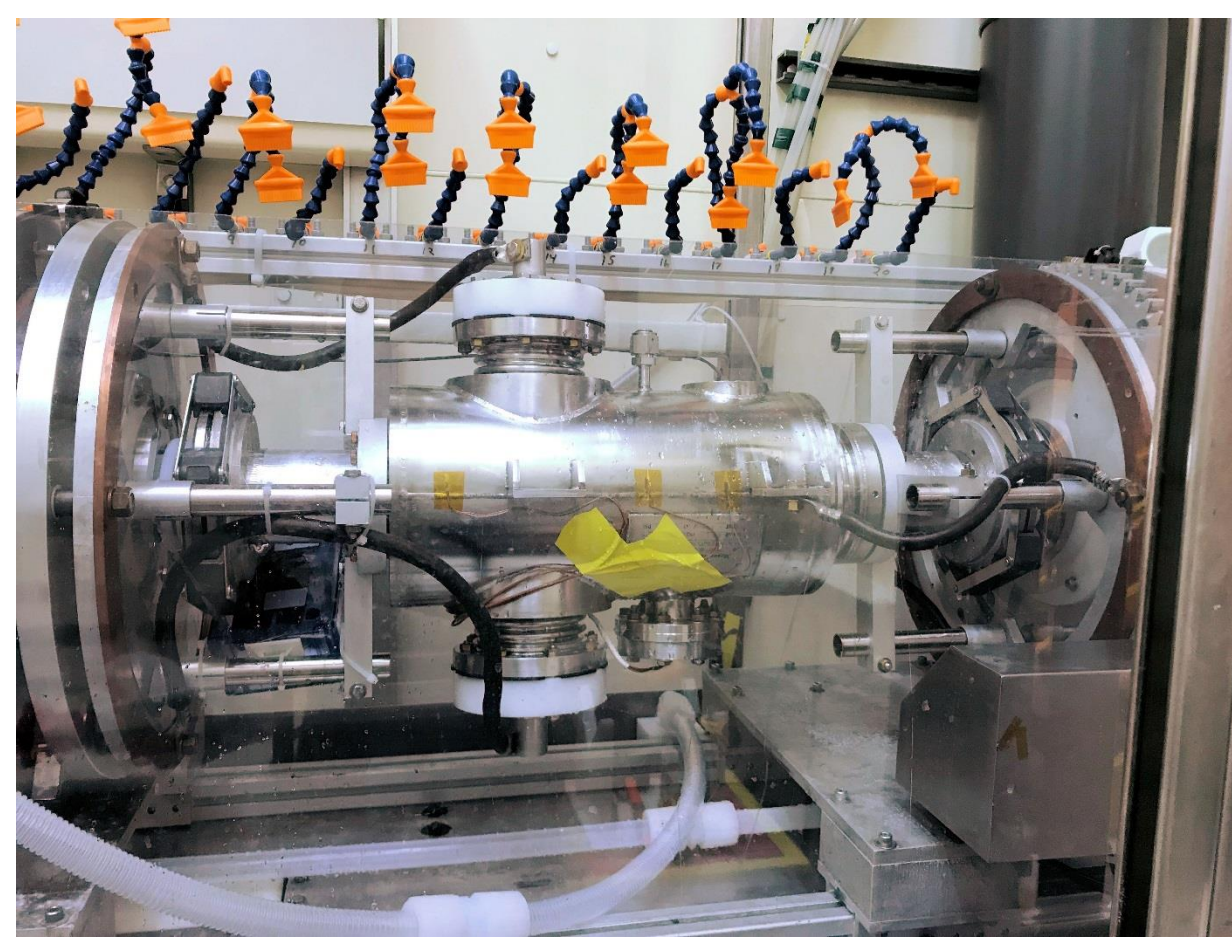
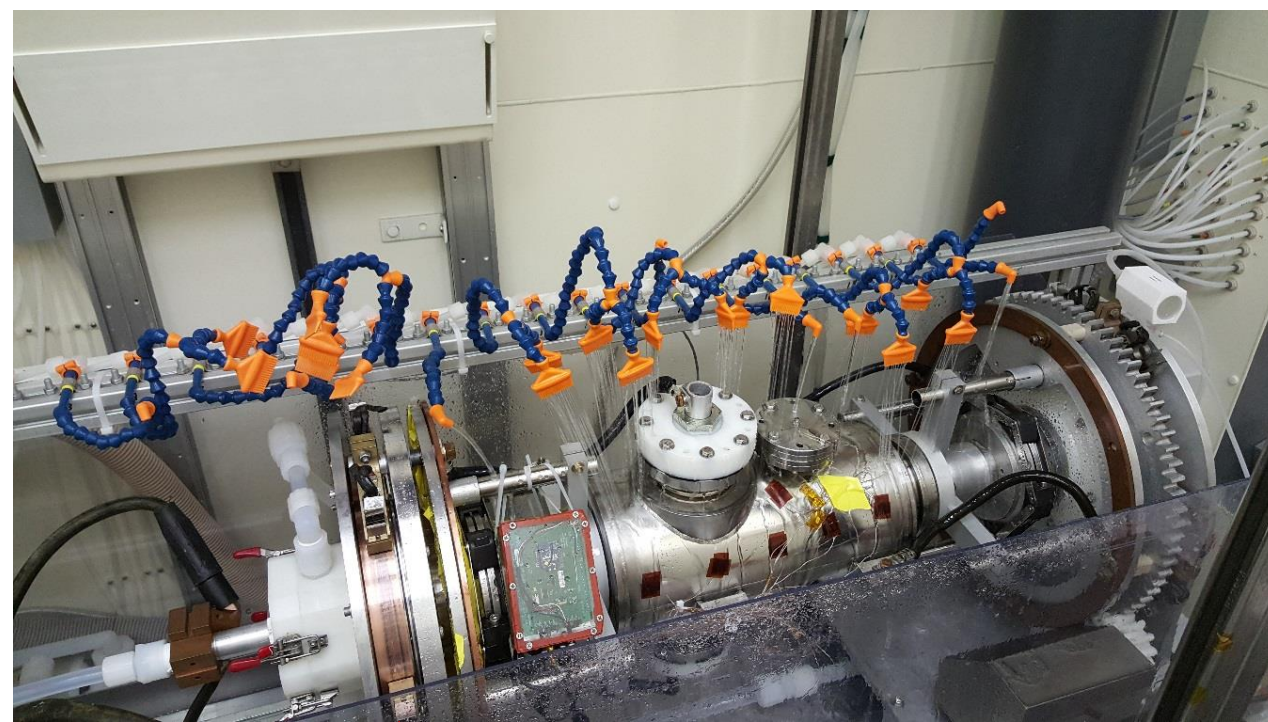
1.4 GHz 4th Harmonic Cavity

EP



Key component of a single cavity bunch lengthening cryomodule for the Advanced Photon Source Upgrade at ANL.

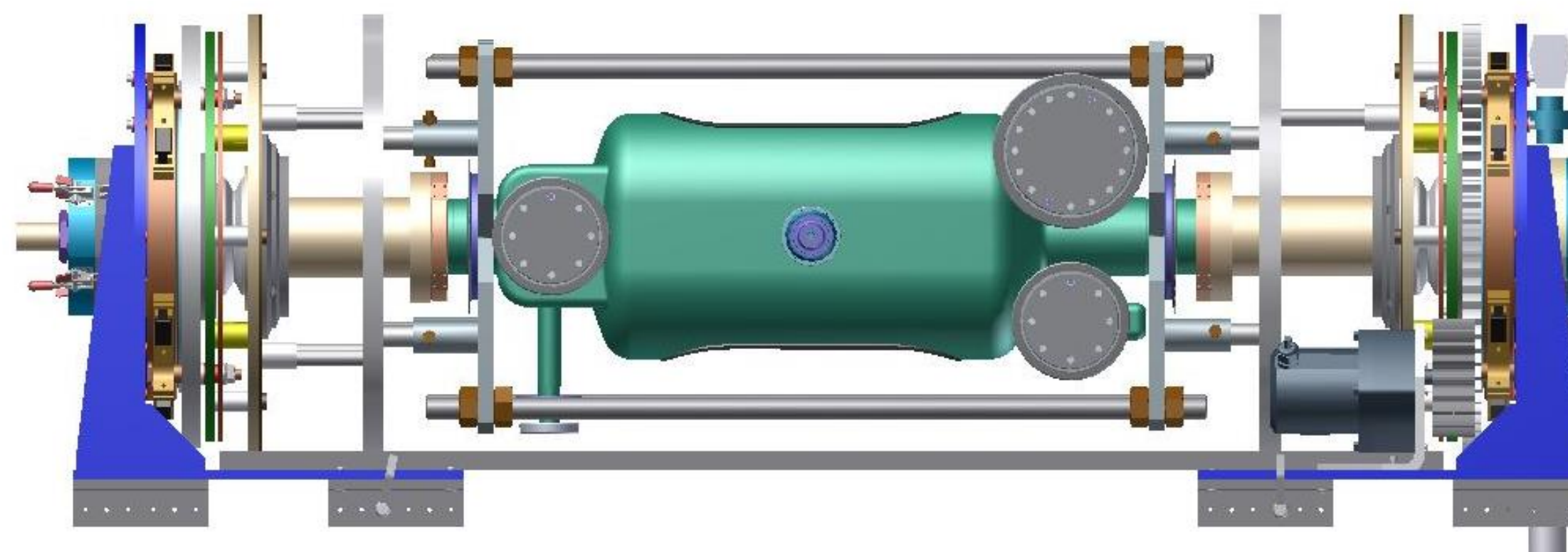
- Helium jacket is filled with DI water
- External cooling water flows over the helium jacket
- Cools the niobium cavity by conduction



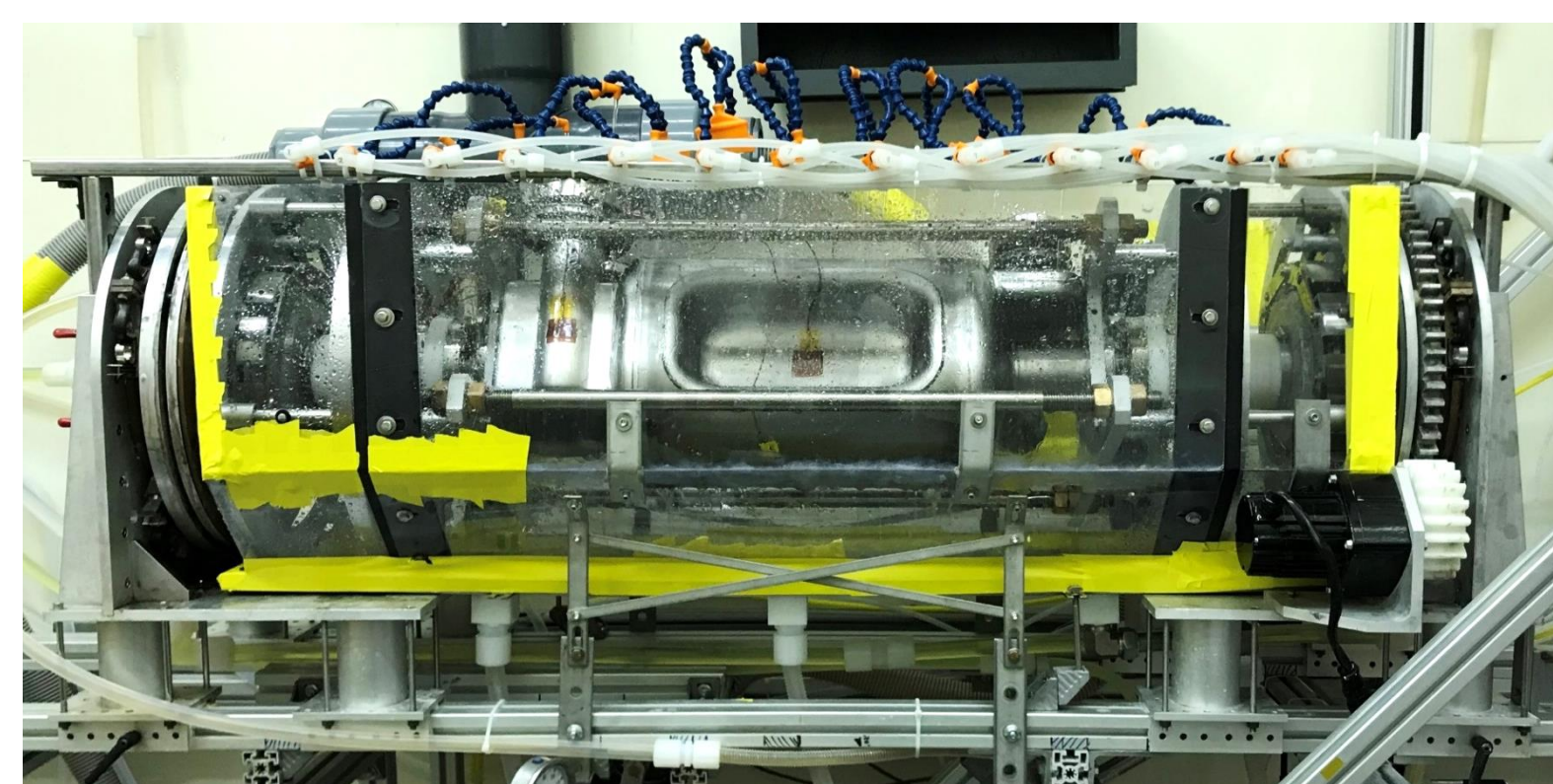
- Second rotating electrical contact
- Primary cathode travels length of the cavity
- Two additional cathodes in large power coupler ports

400 MHz RF-Dipole Cavity

BCP



Proof-of-principle crab cavity for the High Luminosity Upgrade of the LHC at CERN, processed in collaboration with Fermilab/ODU.



Light BCP



Left: Vertical HPR

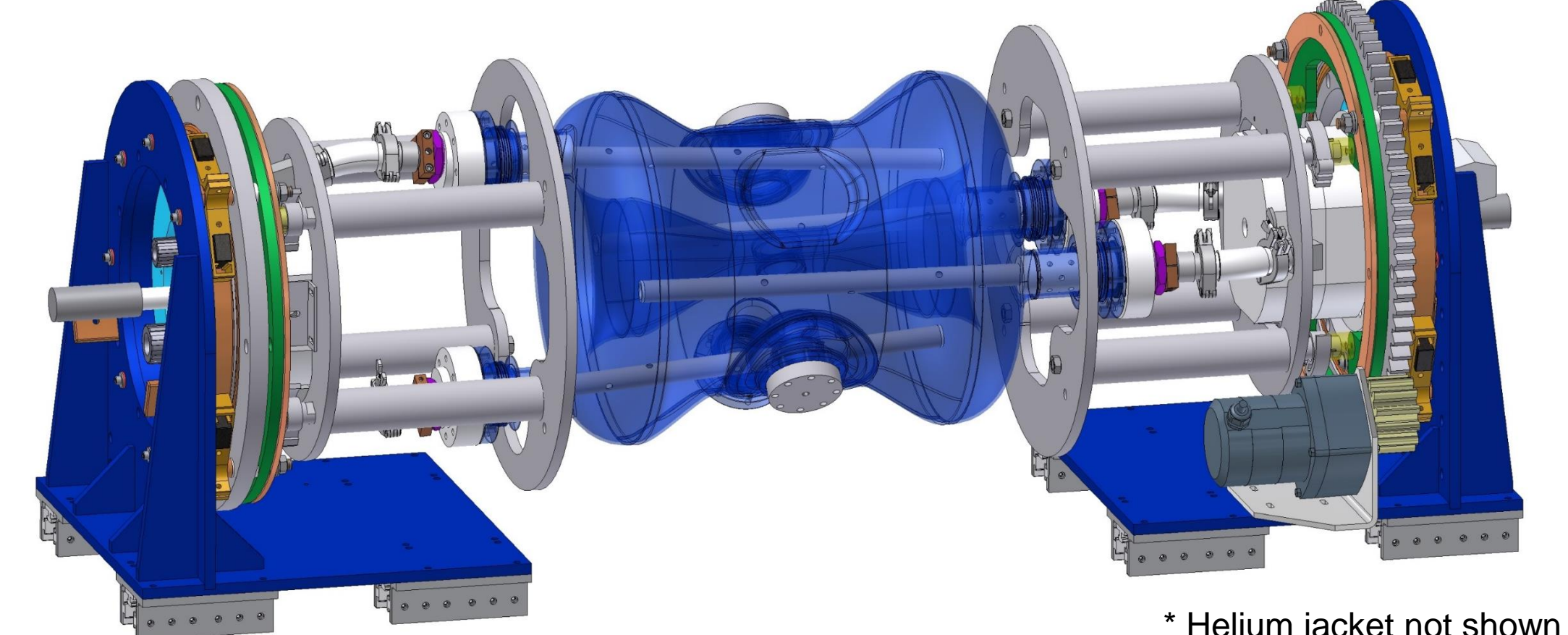
Center: Horizontal HPR



Right: Clean Assembly

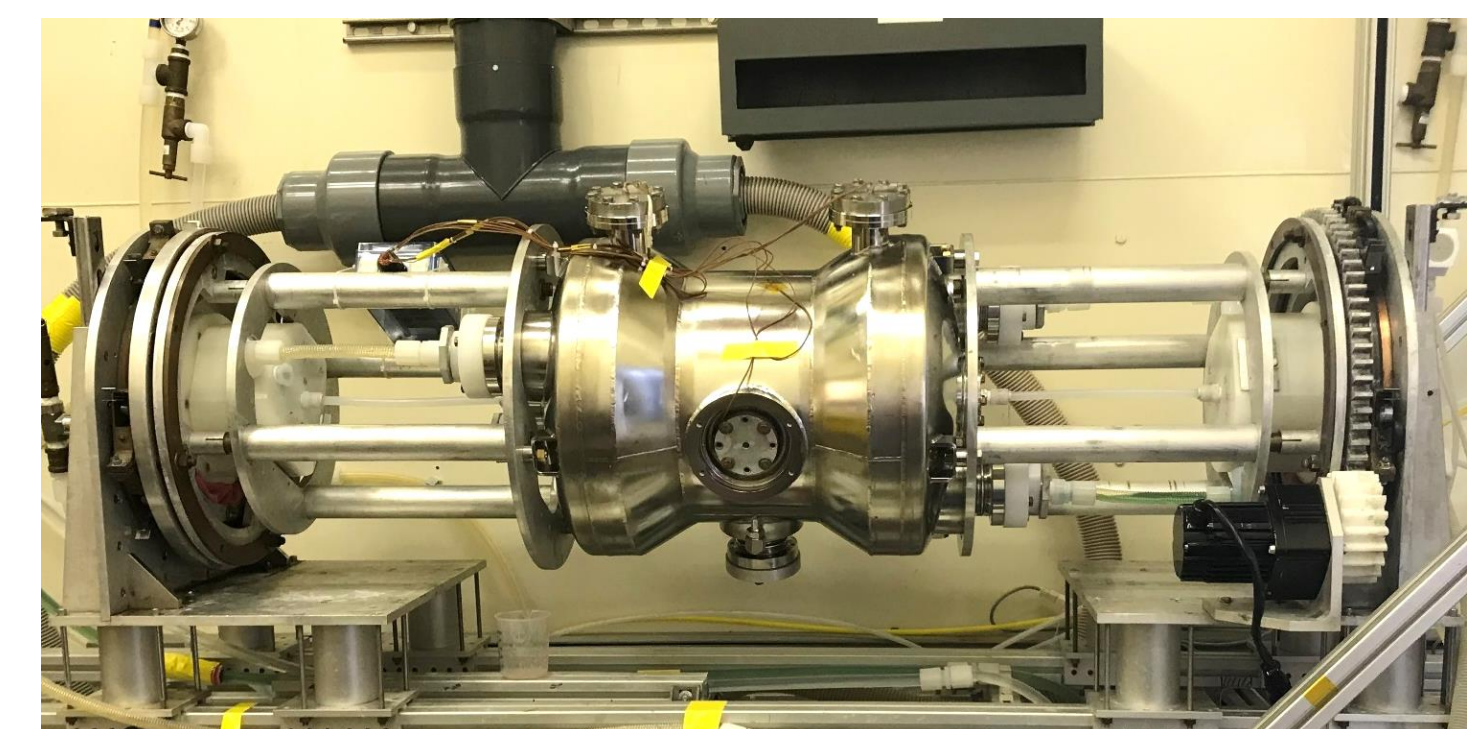
325 MHz Half-wave Cavity

BCP/EP



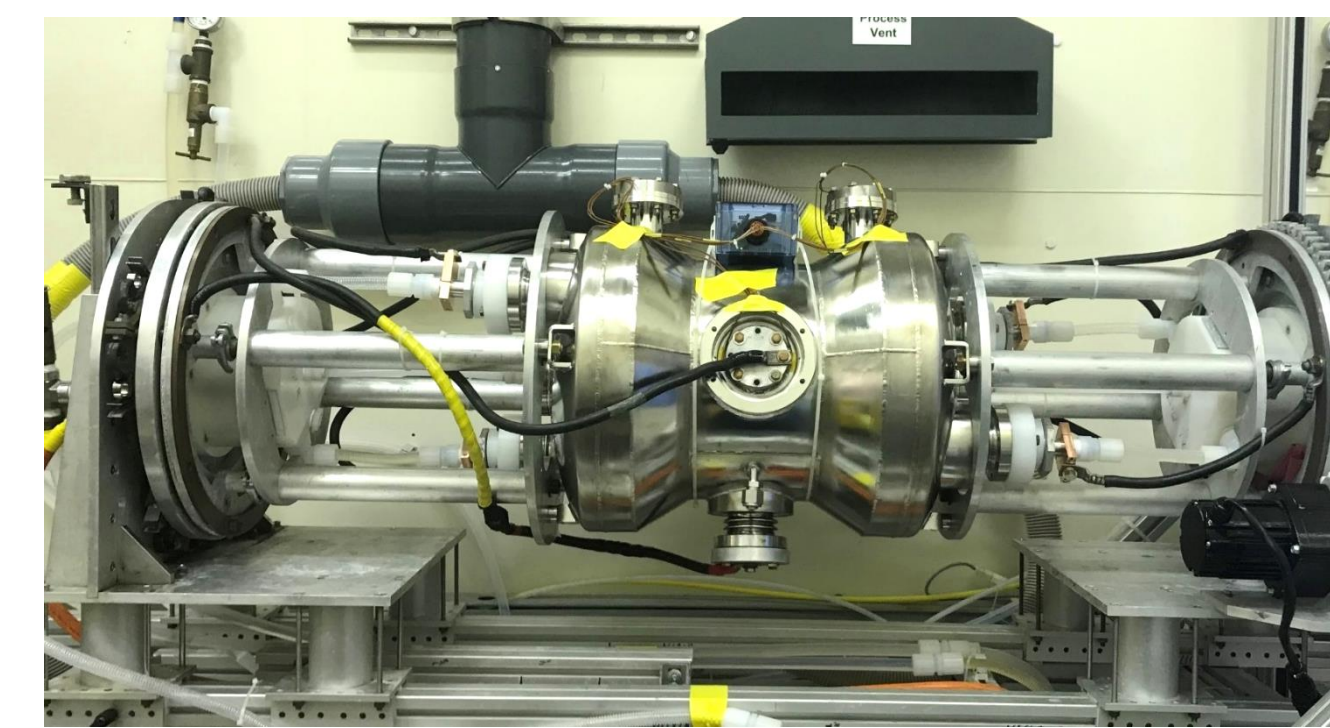
* Helium jacket not shown

Compact half-wave cavity with highly optimized geometry, currently used for flux trapping and expulsion studies at ANL.



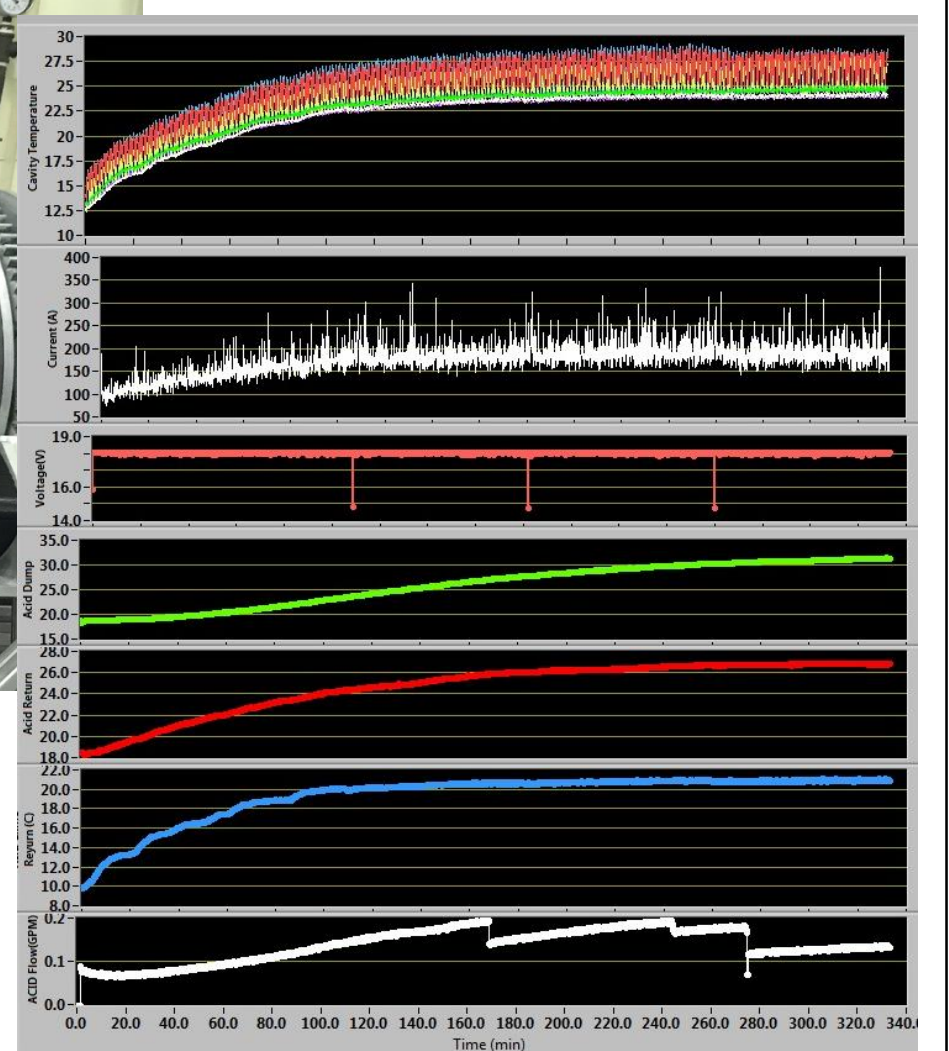
Light BCP

Helium jacket allows for direct-water cooling of the cavity during processing.



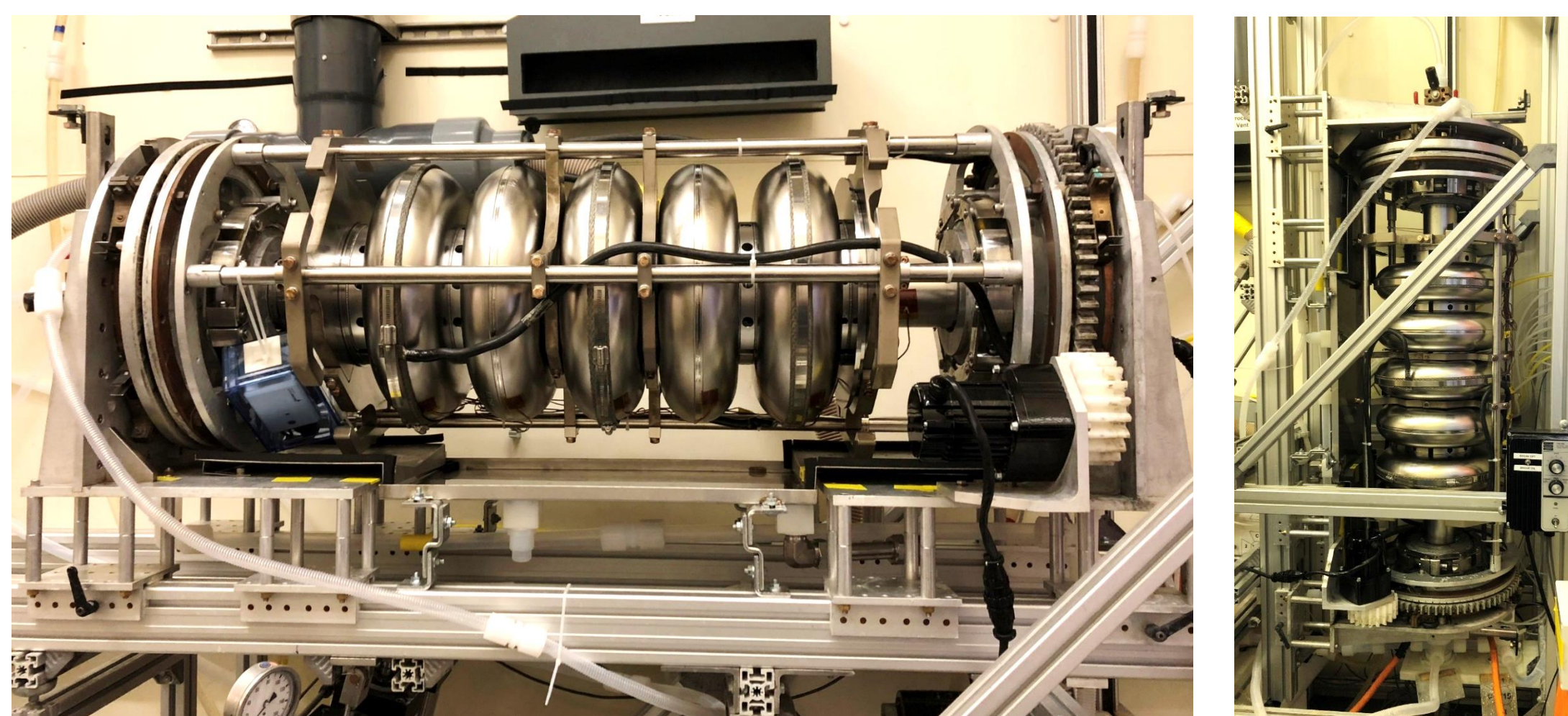
Bulk/Light EP

Use same tooling for BCP and EP



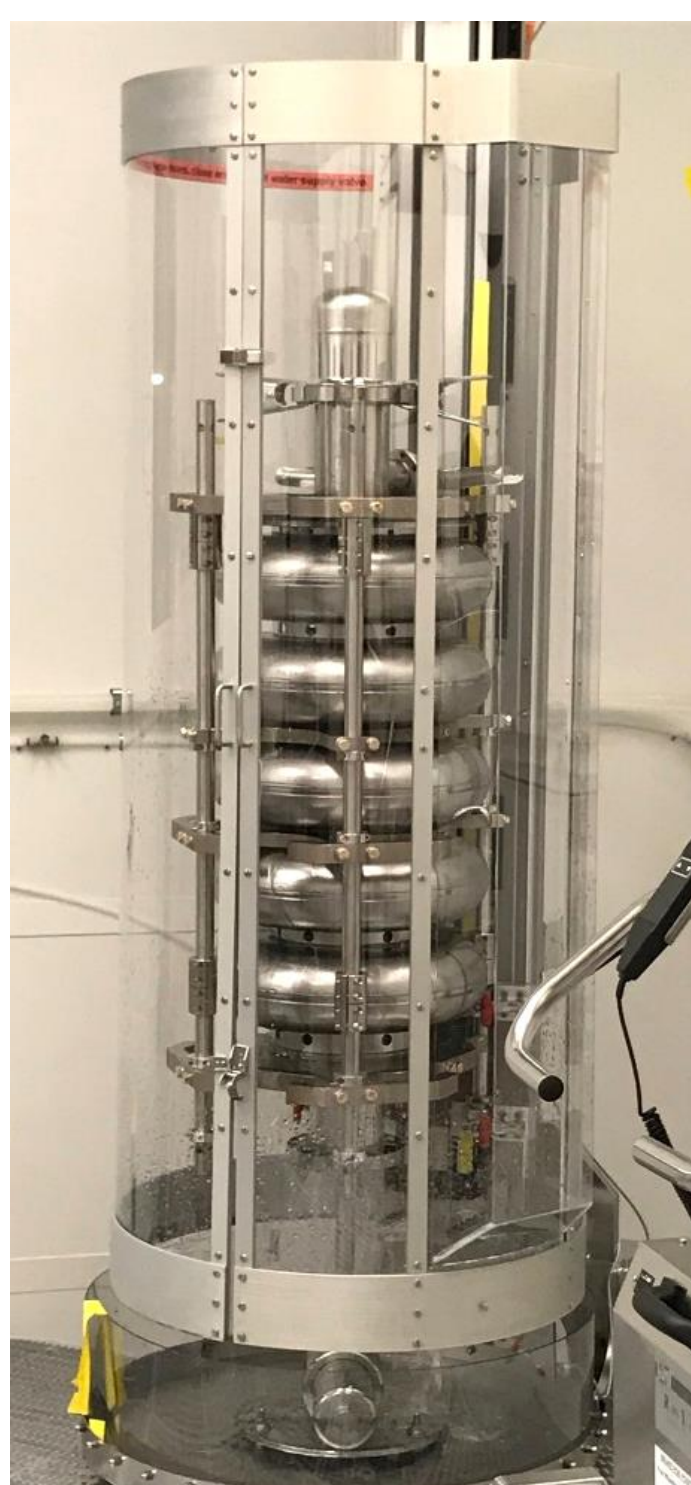
644 MHz 5-cell Cavity

EP



Horizontal EP and cavity rinsing

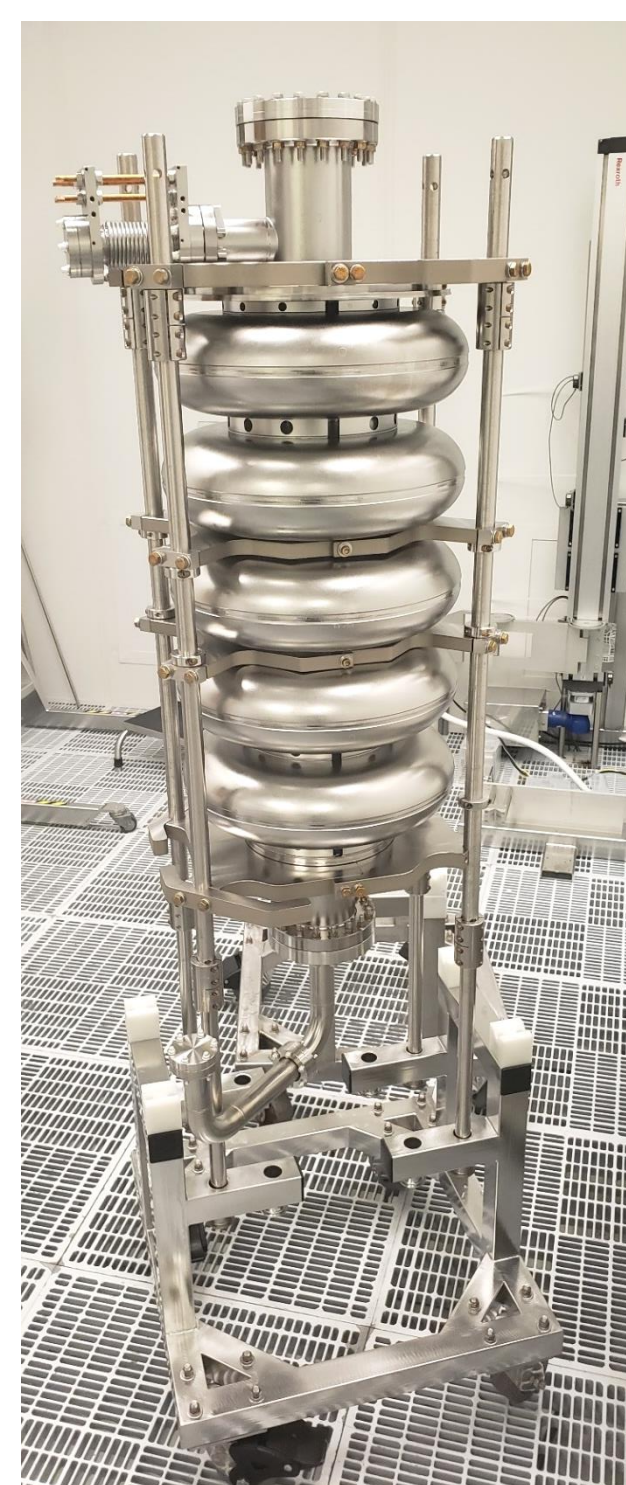
Developmental cavity for a future energy upgrade of FRIB, electropolished and high pressure rinsed at ANL.



HPR



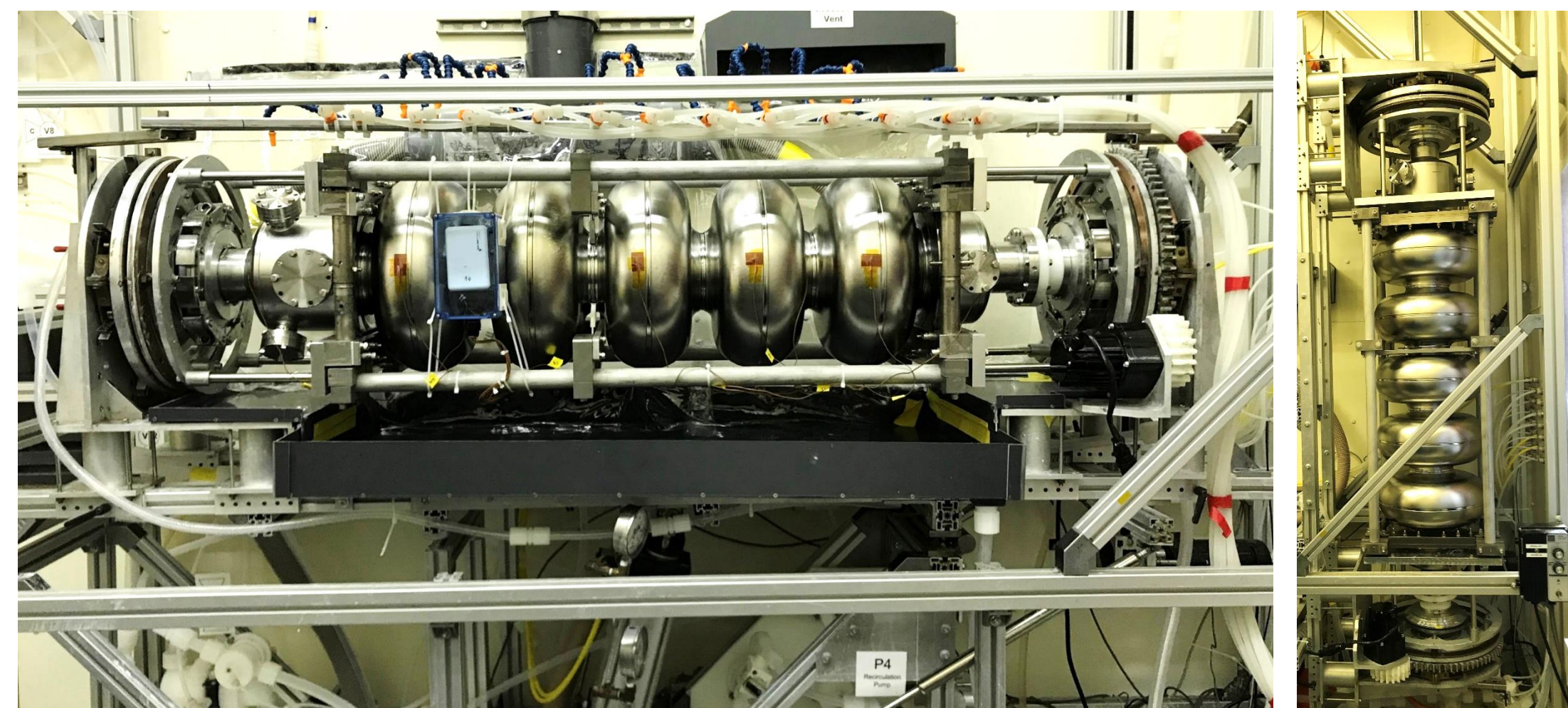
Clean assembly



Assembled cavity

647 MHz 5-cell Cavity

BCP



Horizontal BCP and cavity rinsing

Large research cavity for the proposed electron-ion collider (eRHIC), processed in conjunction with BNL.



Before bulk BCP



After bulk BCP



Internal ultrasonic cleaning

5 GHz 1-cell Cavity

BCP/EP



Vertical BCP



Vertical EP

Small research cavity used to explore SRF applications to quantum computing, processed in collaboration with Fermilab.



Left: Acid-resistant masking



Bottom Left: EP mock setup

Bottom Right: Bulk EP

