

# ELECTROPOLISHING & HPR PLAN FOR THE PROJECT X 162.5 MHz HWR

Speaker: Scott M. Gerbick

Physics Division, Argonne National Laboratory

Status and Production Readiness of the 162.5 MHz HWR  
Cryomodule for Project X

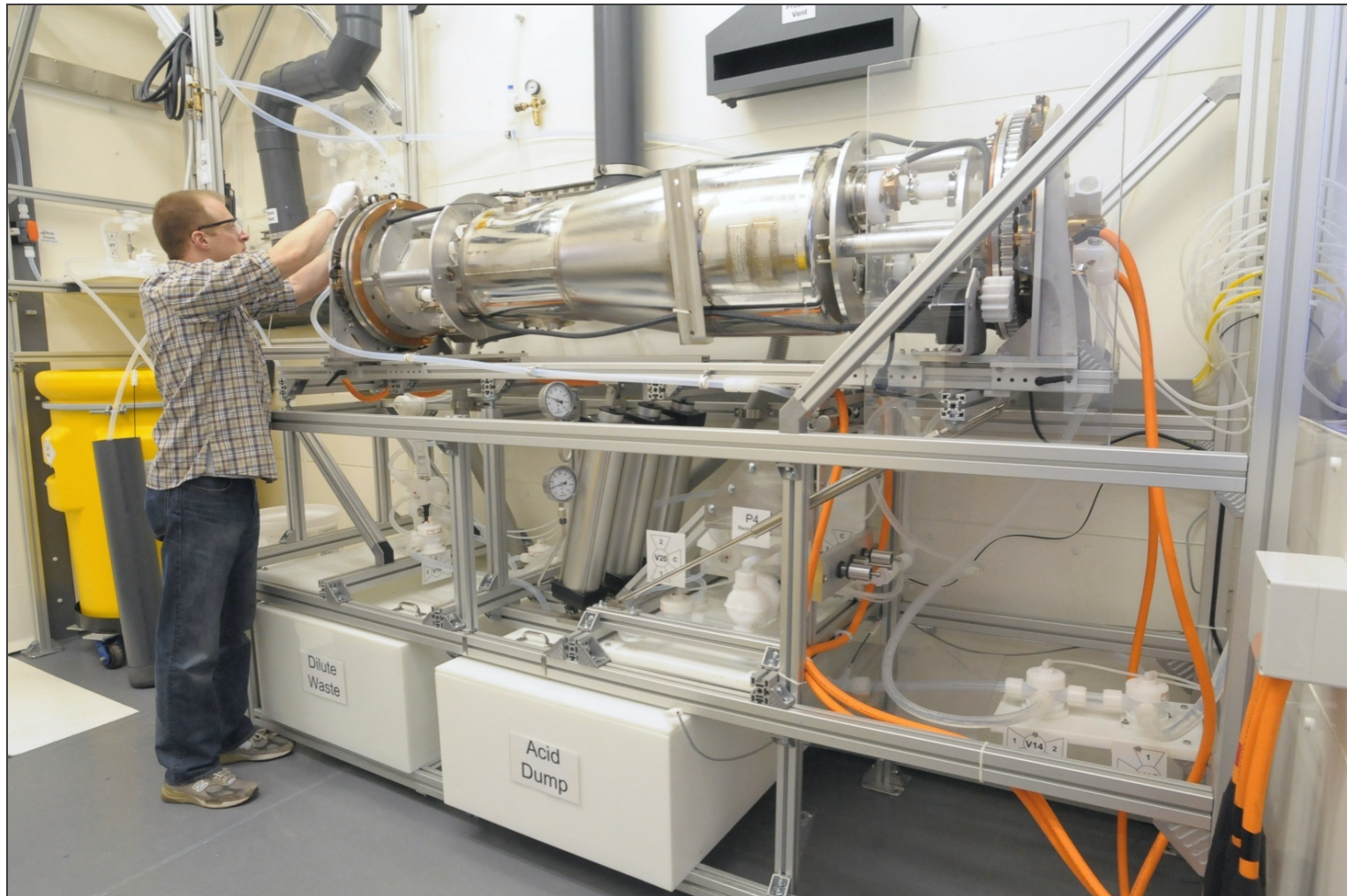
October 15, 2013

# Outline

1. Proposed EP and HPR Procedures
2. EP/HPR Fixturing Design and Fabrication Status
3. Cavity Handling Procedures
4. Summary



# Low- $\beta$ SC Cavity EP Tool

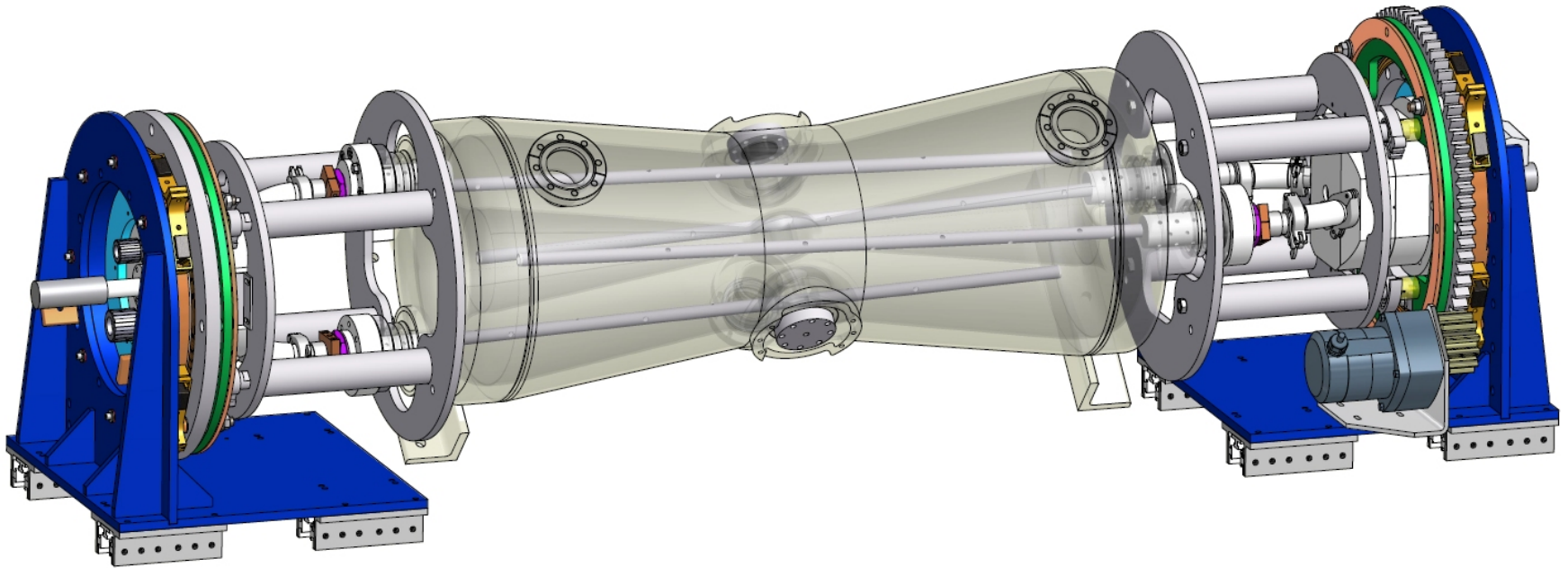


# Design Specifications

- Ability to EP a complete, fully jacketed cavity
- Direct water cooling through cavity LHe jacket during EP
- Two electrical slip ring assemblies to allow rotation of both anode and cathodes during EP
- Integrated cathode loading/alignment system for quick cathode insertion/extraction
- Ability to continuously circulate acid during EP
- Nitrogen purge to evacuate hydrogen
- Quick load/unload time at ~1 hour

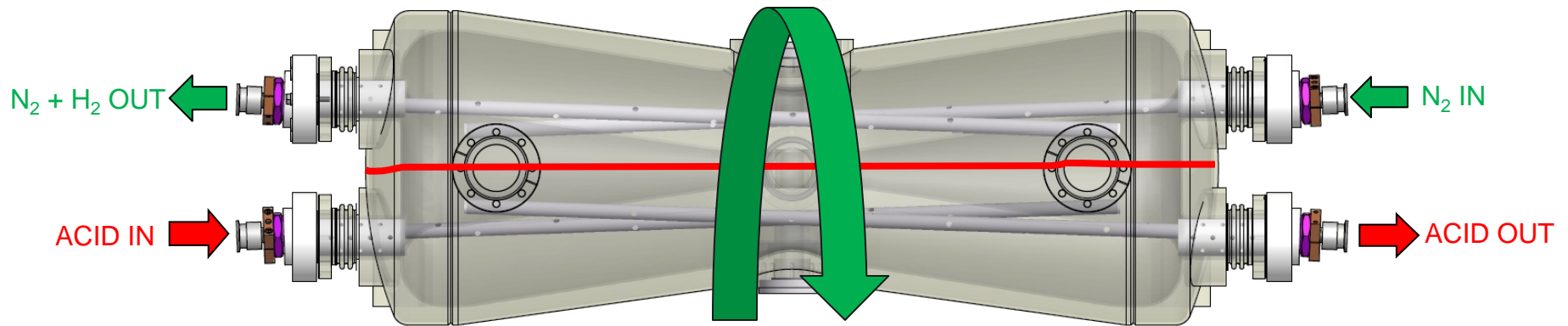


# Low- $\beta$ SC Cavity EP Tool



- Four cathodes which are used to flow both acid and N<sub>2</sub> to evacuate H<sub>2</sub>
- Cathode loading done via plastic port flanges
- Nearly identical to the ANL 72 MHz QWR EP setup

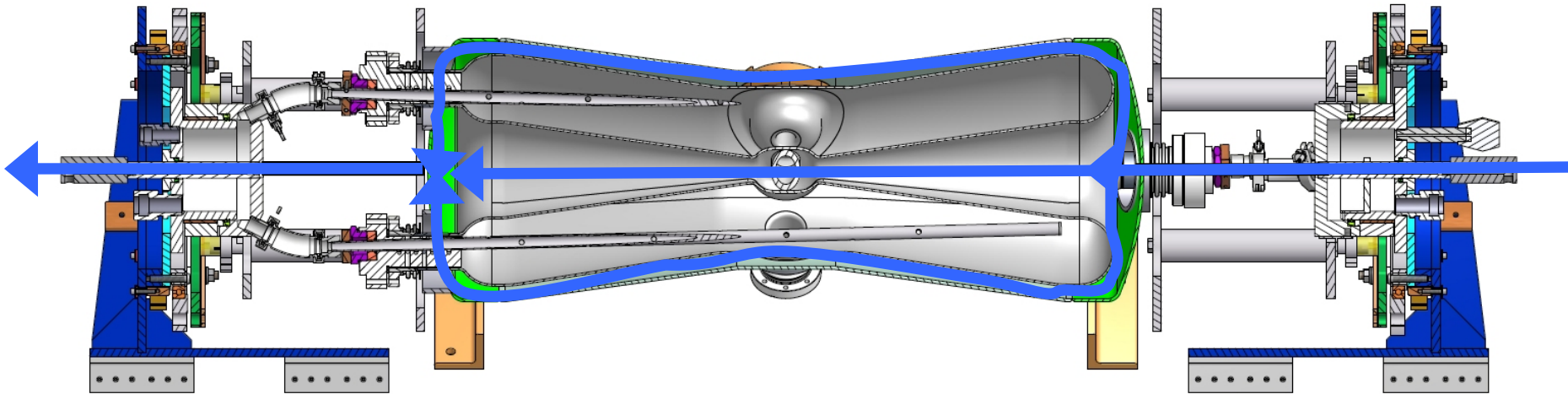
# Acid/N<sub>2</sub> Flow



- Low acid flow rate (~1 LPM)
- Acid flow only needed to refresh acid, not to maintain temperature
- Rotates at ~0.5 RPM

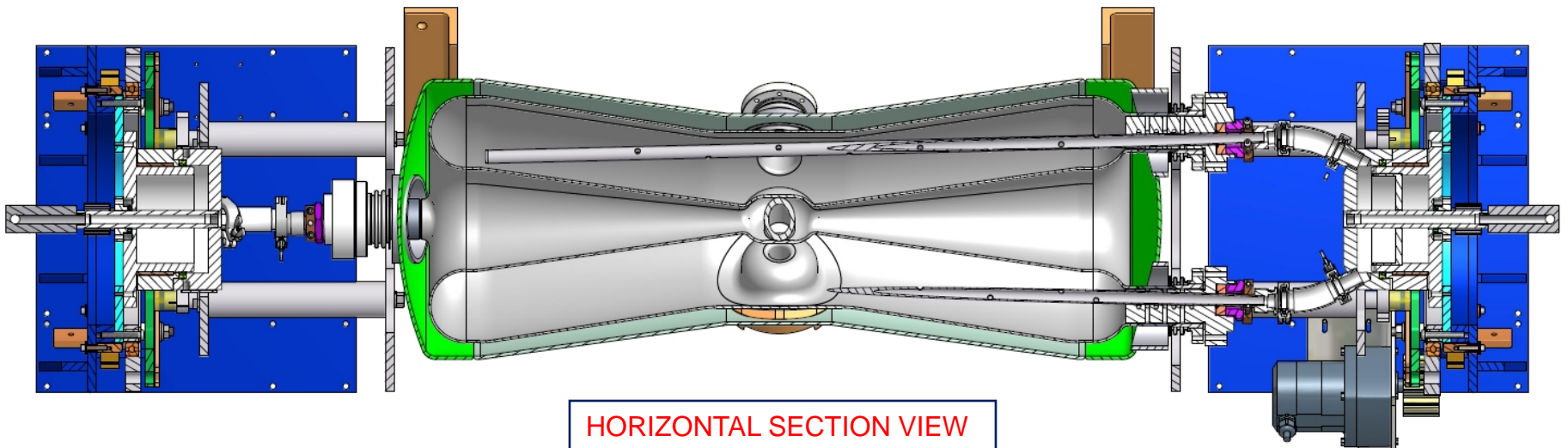
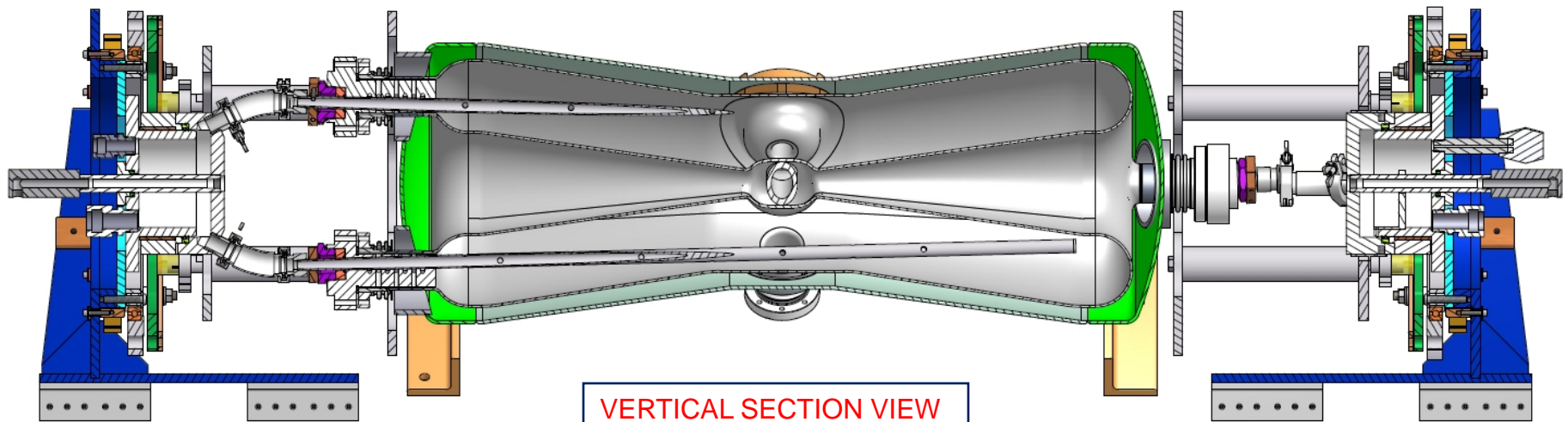


# H<sub>2</sub>O Flow



- Chilled water is circulated through the LHe space to control cavity temperature
- Offers an improvement over our ILC elliptical cell EP setup which chills the acid in order to control temperature

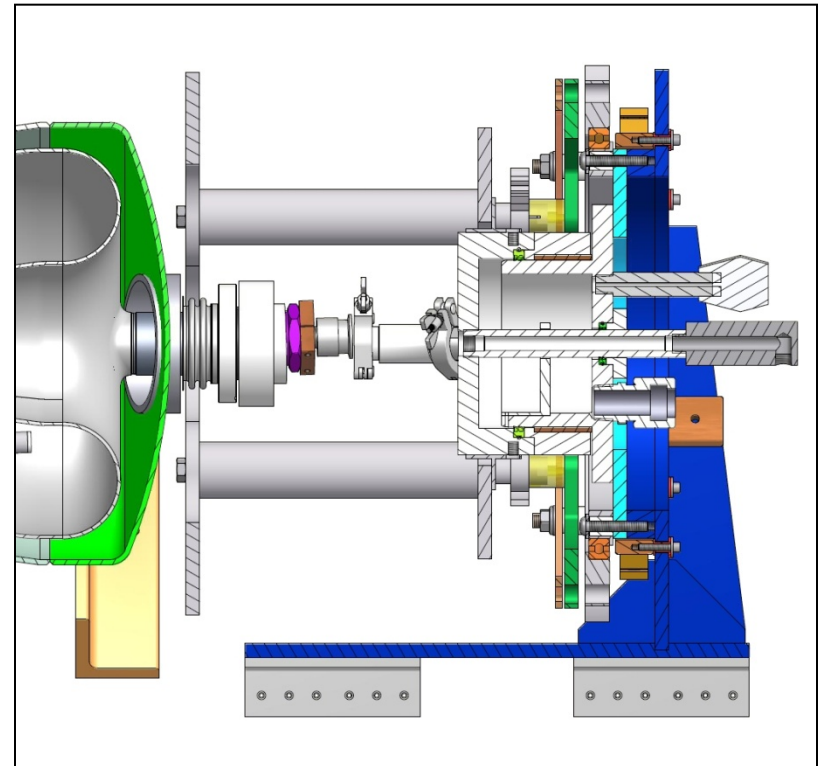
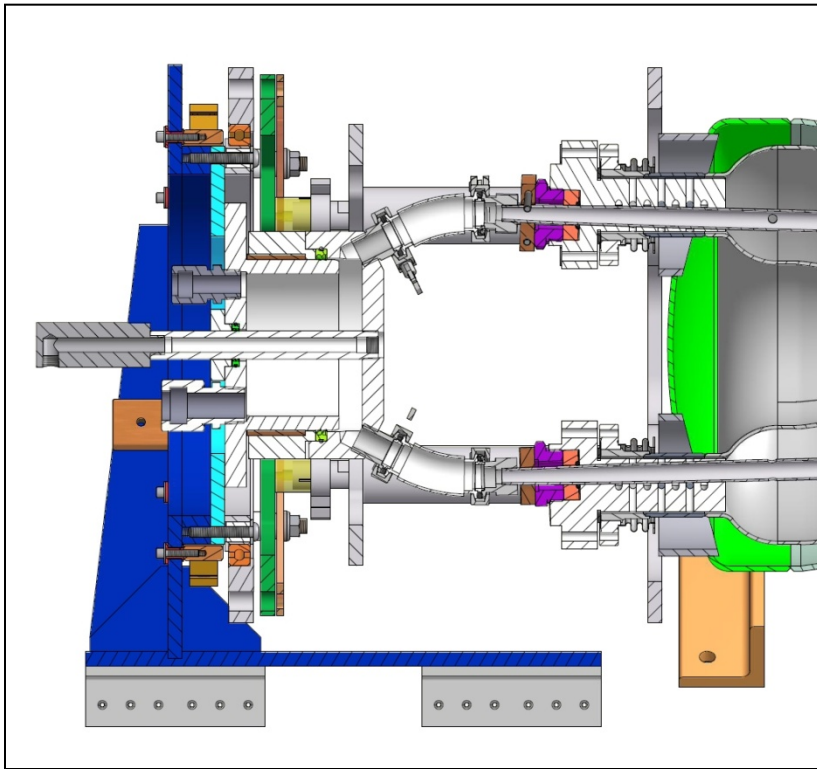
# PXIE 162.5 MHz HWR EP





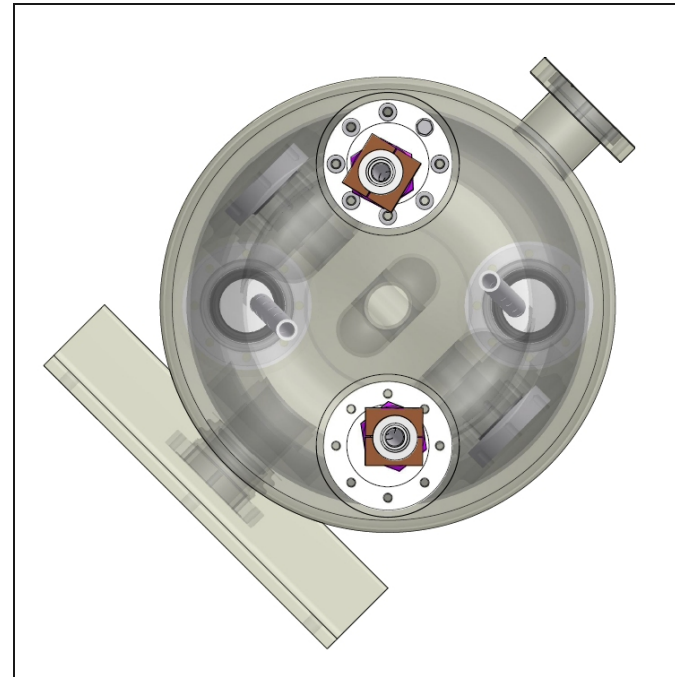
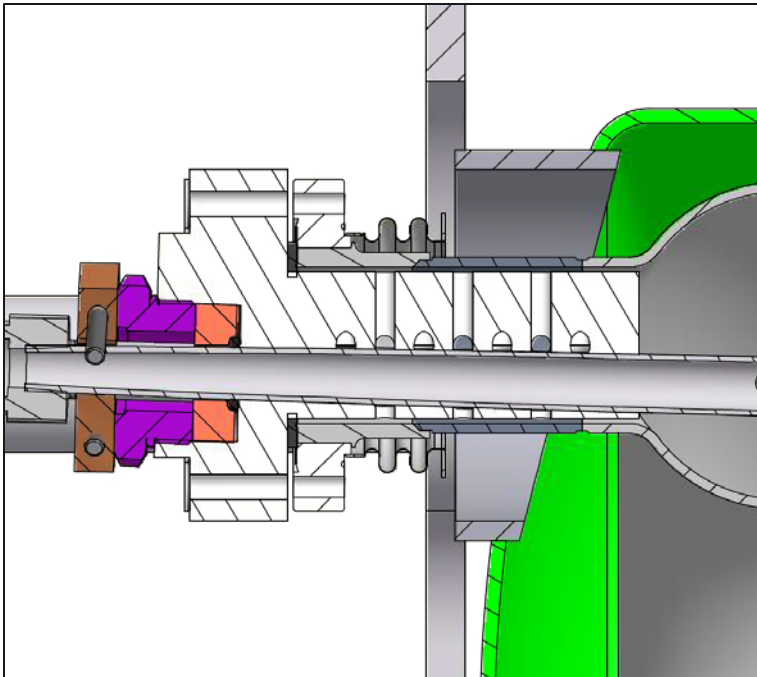
# PXIE 162.5 MHz HWR EP

- All acid wetted parts are made from HDPE, UHMWPE, Teflon, Viton, and 3003 series aluminum
- Minimal new hardware required to adapt to existing setup

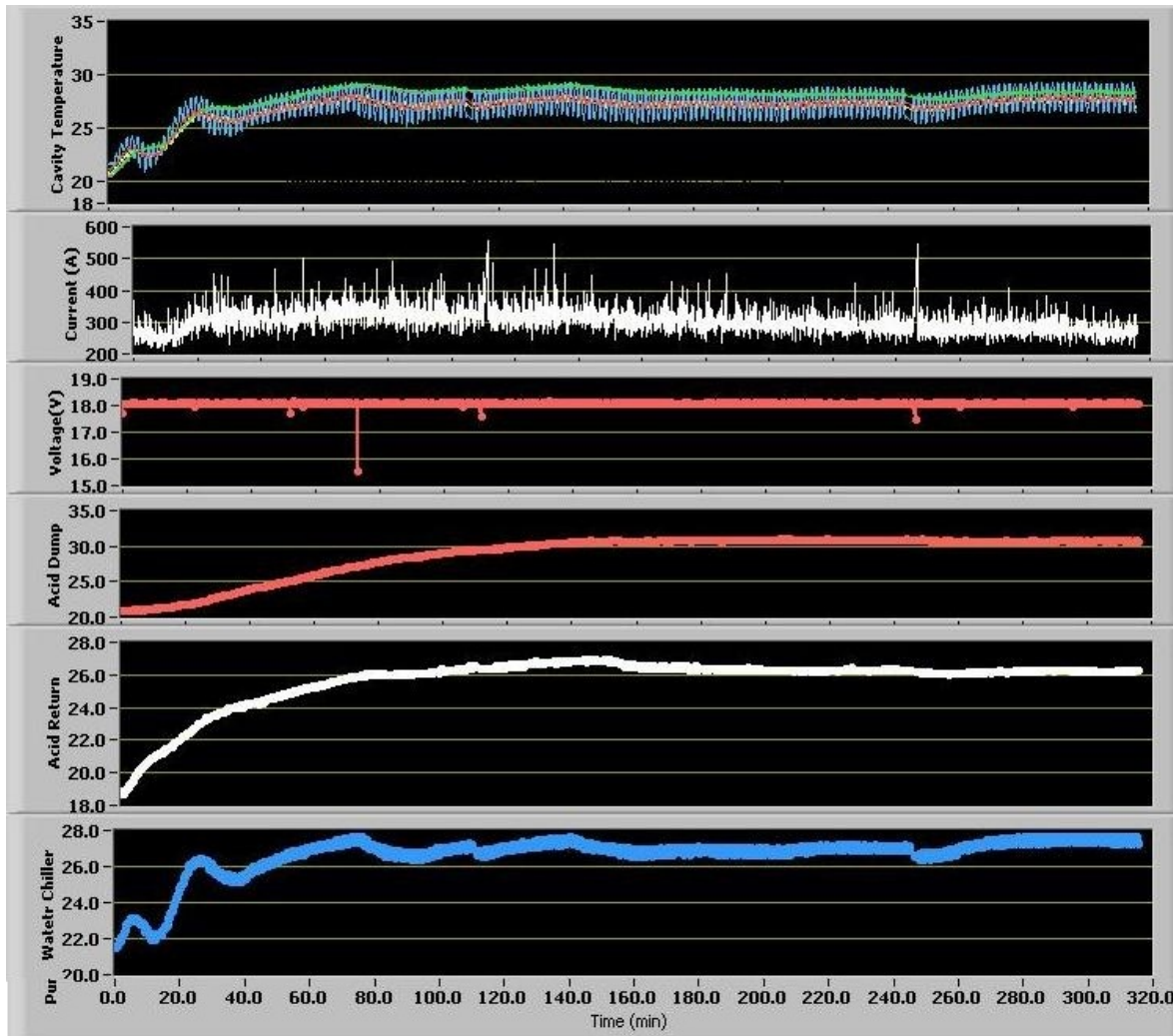


# Cathodes/Cathode Loading

- Precision HDPE port flanges allow cathode loading and set cathode location inside cavity during EP
- 4 cathodes made from 3003 series aluminum tubing
- Surface area ratio of Anode:Cathode is  $\sim 6.5:1$



# Operation Data for 72 MHz QWR EP



CAVITY TEMPS (C)

CURRENT (A)

OPERATING VOLTAGE (V)

ACID DUMP TANK TEMP (C)

ACID RETURN LINE TEMP (C)

WATER RETURN TEMP (C)

# Operating Parameters for 72 MHz QWR EP

Parameter	Unit	Value
Voltage	V	18
Current density	mA/cm <sup>2</sup>	30
Average temps.	C	27
Average temps. stability	C	+/- 1
Amplitude of temps. oscillations (due to cavity rotation)	C	3
Acid flow	l/min	1
Cavity rotation	rpm	0.5
Nitrogen flow	scfm	1.5

# ANL 72 MHz QWR

## Before and After EP



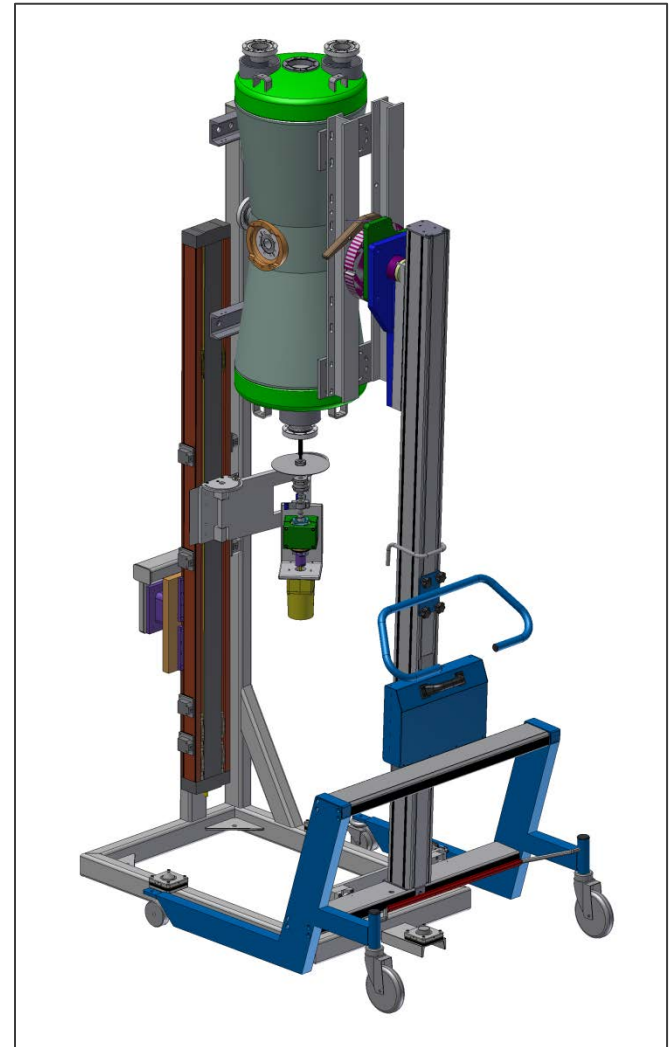
BEFORE EP



AFTER 12HRS OF EP  
150 $\mu$ m Nb REMOVED



# HPR



# HPR

- Cavity and all required components and hardware will be ultrasonic cleaned prior to HPR
- Couplers, pickups, hardware, etc, will be HPR'd with handheld tool
- Cavity will be HPR'd using ANL cavity HPR tool
- Multiple passes per port are performed during cavity HPR



# Fixturing/Fabrication Status

## EP:

- Modeling is complete
- PO is being processed for machining of required new parts
- Plan to have parts in-hand by late November

## HPR:

- Modeling is complete
- Modify existing 72 MHz QWR fixturing (drill some holes) for use with PXIE HWR
- HPR wand to get PFA coated
- PLC control in the works



# Cavity Handling Procedures

## EP:

- A checklist for the entire process
- Practically identical to that of the ANL 72 MHz QWR using proven tooling

## Ultrasonic Cleaning:

- More checklists...
- Same recipe/procedure developed for the ILC and used on recent ANL cavities

## HPR:

- Even more checklists...
- Follow the same techniques successfully used on cavities processed by ANL using the ANL HPR tool

## Clean Assembly:

- Yes, more checklists
- Clean assembly will follow all procedures developed for the ANL 72 MHz QWR



# Summary

- EP and HPR of FNAL 162.5 MHz HWR will be nearly identical to the ANL 72 MHz QWR in layout, operating parameters, and procedures
- Minimal new hardware required in order to EP HWR's in the ANL EP tool
- HPR of HWR's will use existing ANL tool, requiring only modification of existing mounting fixture
- All cavity handling procedures, from pre-EP to post-clean assembly will be nearly identical to those developed by ANL for the ILC cavity and ANL 72 MHz QWR cavity processing

