Proposal for a New Electropolishing System in the Joint ANL/FNAL Processing Facility

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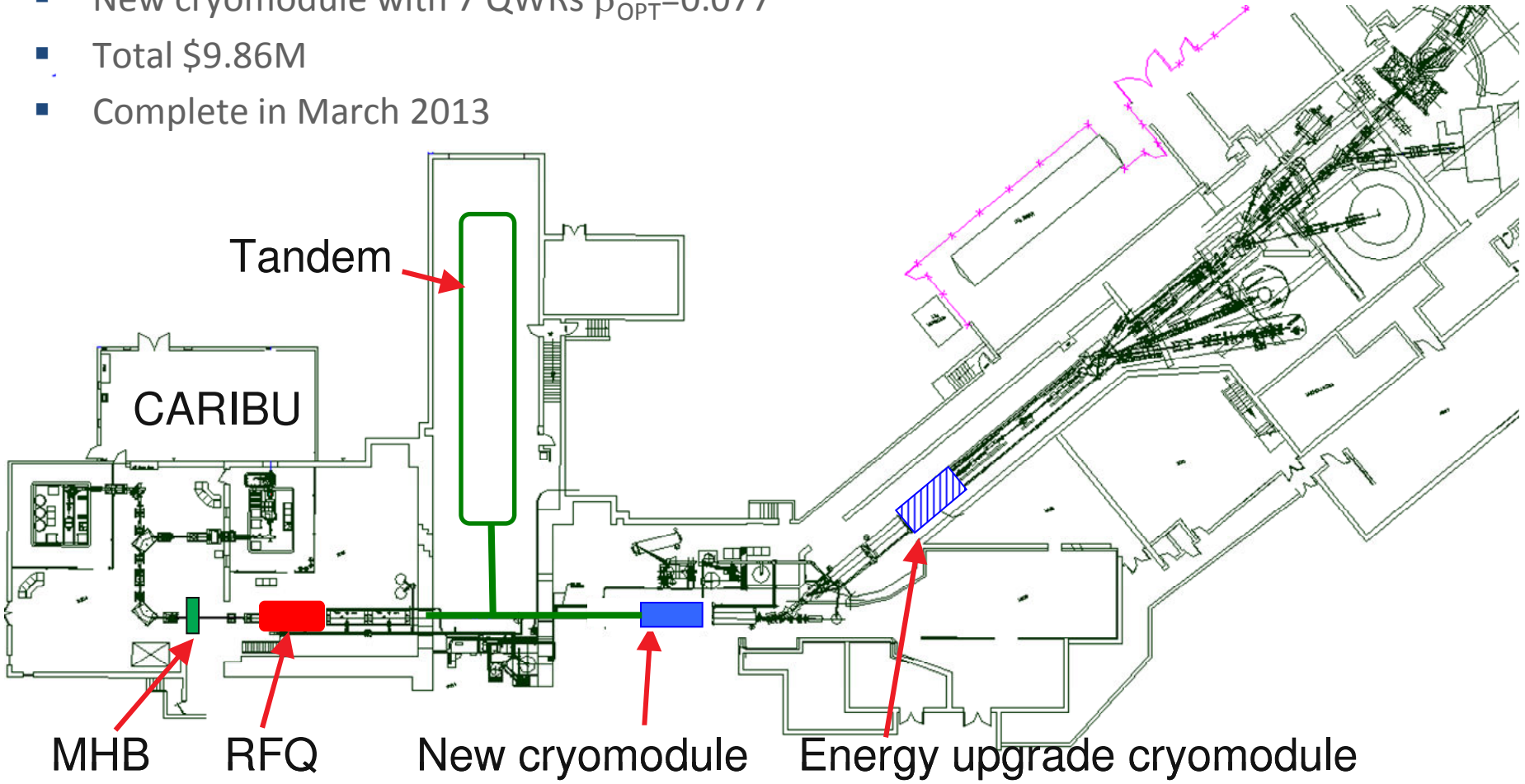
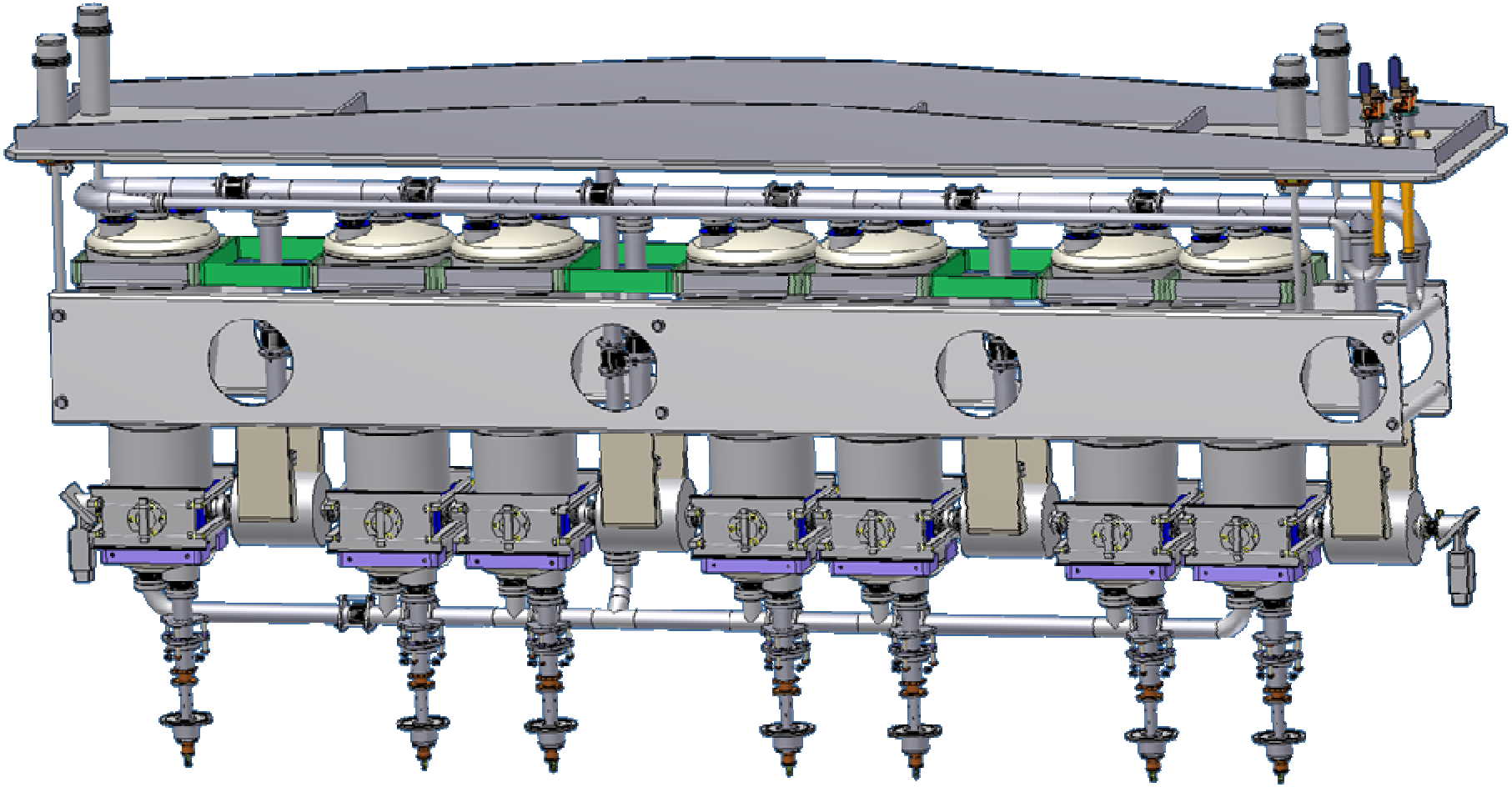
ATLAS Energy and Intensity Upgrade: Phase I Commissioned June 2009

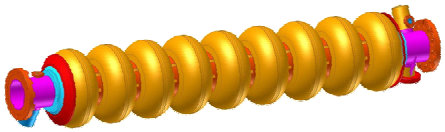
ATLAS Efficiency and Intensity Upgrade
ARRA projects: RFQ and new cryomodule

- New 60.625 MHz CW RFQ
- New cryomodule with 7 QWRs β_{OPT}=0.077
- Total $9.86M
- Complete in March 2013



ATLAS Energy and Intensity Upgrade: Phase II Commissioning in July 2012

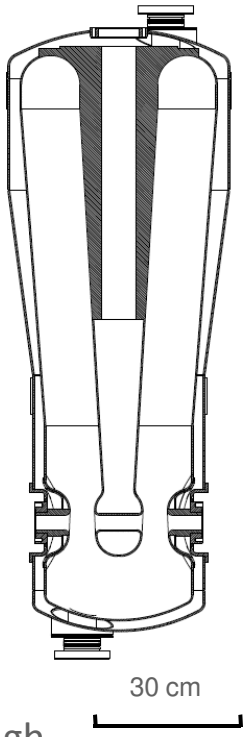




(for scale)

Pushing performance for low-beta SRF cavities

β=0.077
f=72.5 MHz
B_p/E_{acc}= 4.8 mT/MV/m
E_p/E_{acc}=3.25

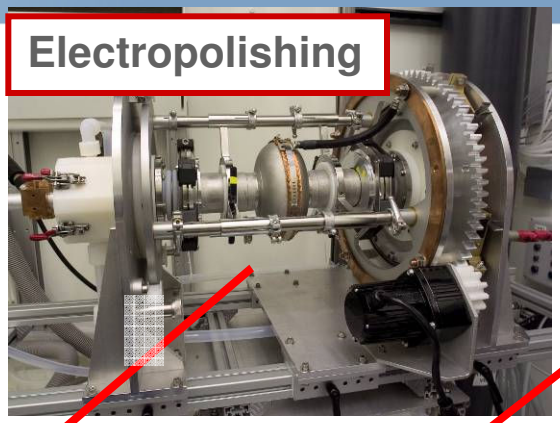


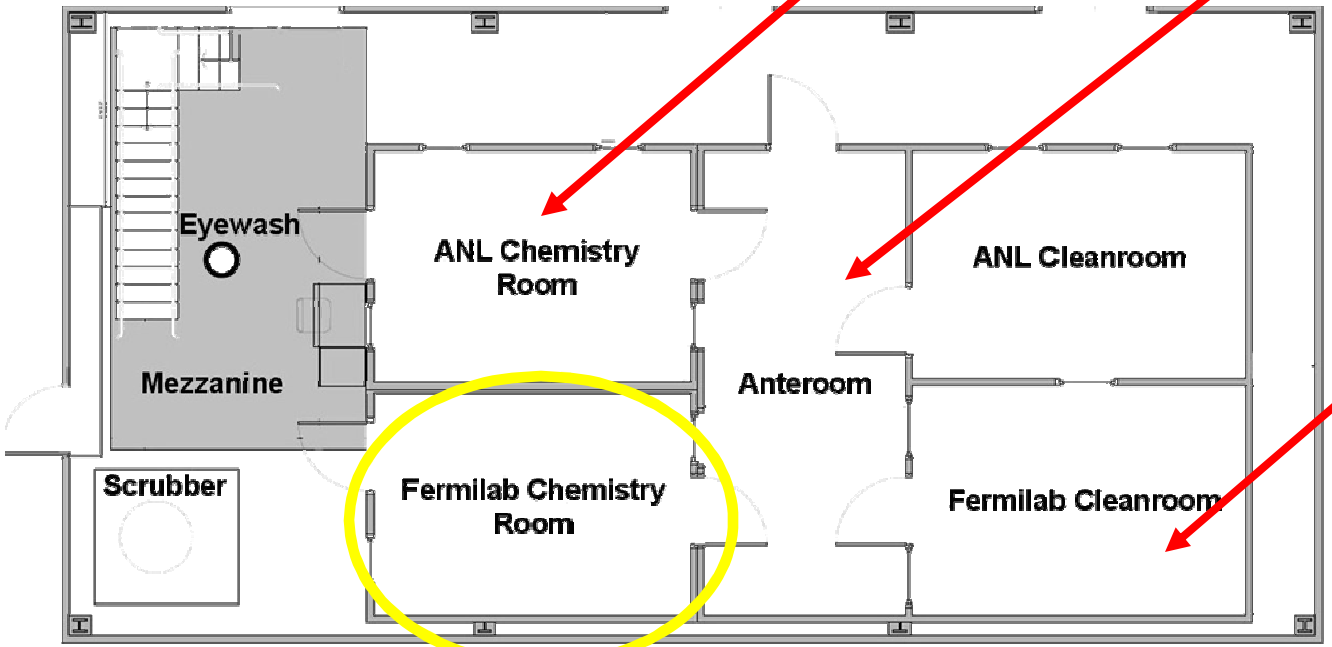
- Obvious benefits for ATLAS
  - Replace aging split-ring cryomodules
  - Higher energies (30-40% beam energy increase with Phase I)
  - Higher intensities
- Real possibilities for high-gradient low-beta for applications
  - National security (non-destructive interrogation methods)
  - Nuclear medicine (accelerators as solution to Mo99 crisis)

- To push for better performance in next upgrade…
  1. Presently our VCX fast tuner limits new cavity performance to ~8 MV/m (though average quench limit ~12 MV/m); replace with a piezoelectric transducer + 4 kW coupler
  2. Better performance through the use of techniques learned in FNAL collaboration; particularly *horizontal electropolishing on completed jacketed niobium cavity*

ILC: Cavity processing at Argonne

- Joint facility built by ANL/FNAL collaboration
- 2000 ft^2 facility @ ANL complete Mar 2009
- Commissioning, excellent single cell results, recent good 9-cell results
- EP tool, acid handling, cooling system works very well
  - Improvements still to be had in operating parameters
  - Work on personnel training, ANL support services (waste disposal), LabView data log

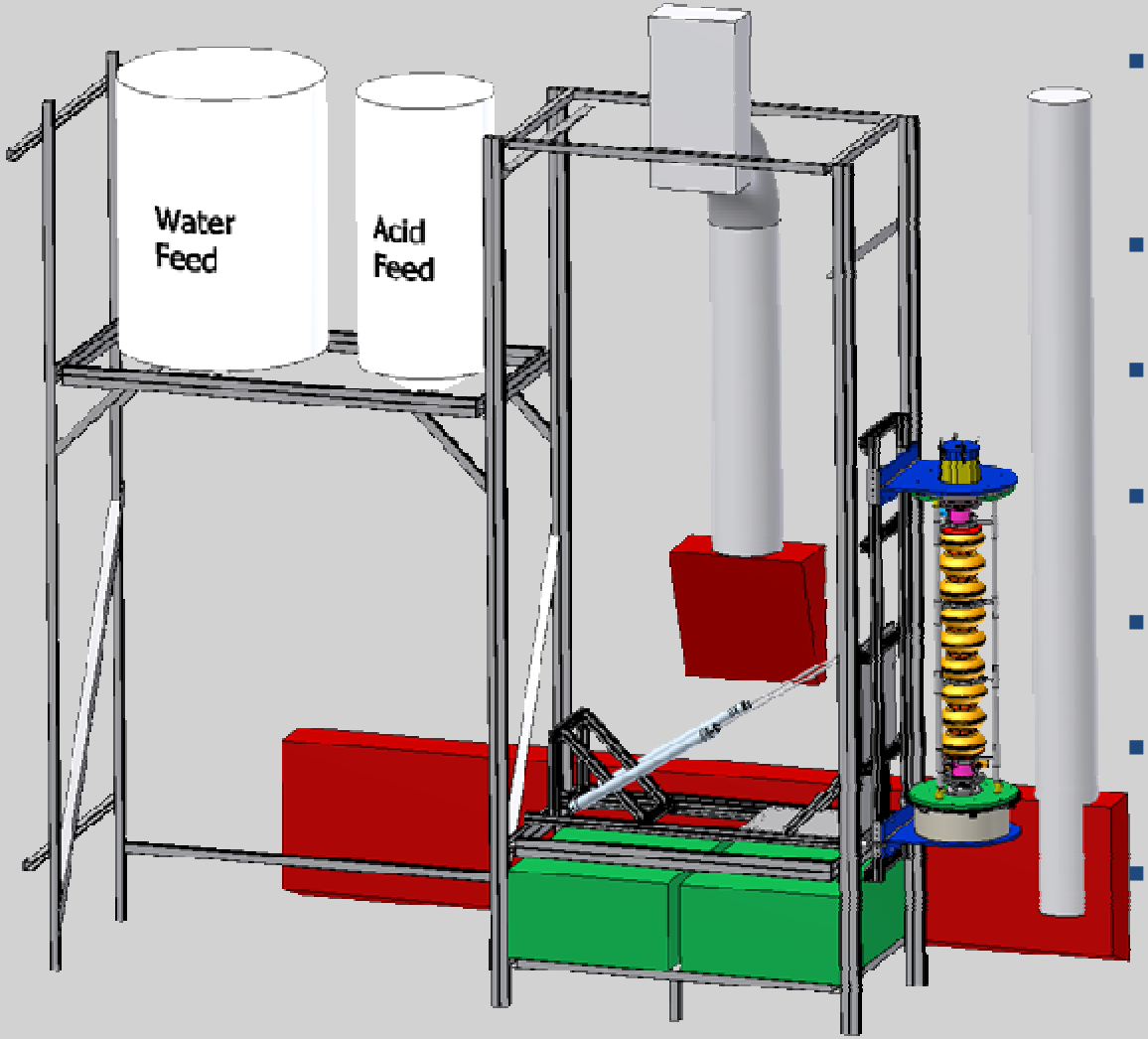




Present Status of FNAL Chemistry Room

- Chemistry room contains mostly functional 1.3 GHz BCP hardware (left)
- Control console outside room with PLC interface to pneumatic valves (right)
- No safety review performed at ANL since installation
- Little demand for 9-cell BCP in the mean time
- *ANL proposal: reuse pumps, valves, tanks, stand, console/PLC for EP*

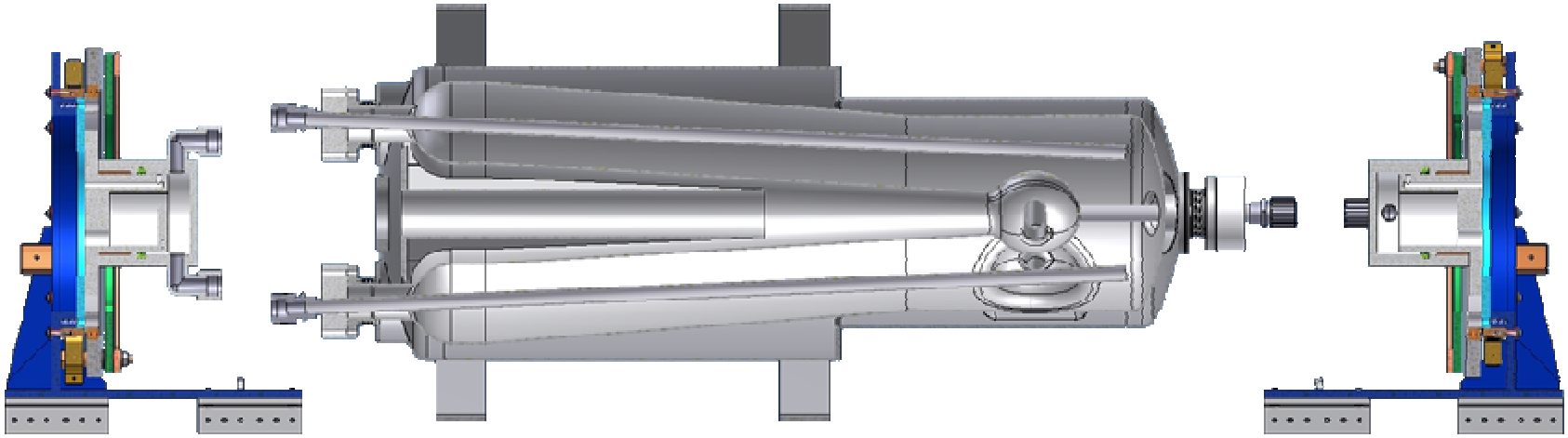
BCP for 1.3 GHz in existing EP Chemistry Room



- "Flash" BCP can be performed with cavity in vertical orientation as shown
- All hardware shown exists and operates in the room now
- Materials are all compatible (remove Al heat exchanger)
- Flow through scheme or recirculation possible
- Resources: a couple man-months and <$10 K
- ~1-2 days to switch between EP/BCP
- Allan Rowe (lead) w/ new ANL scientific assistants T. Reid and R. Murphy

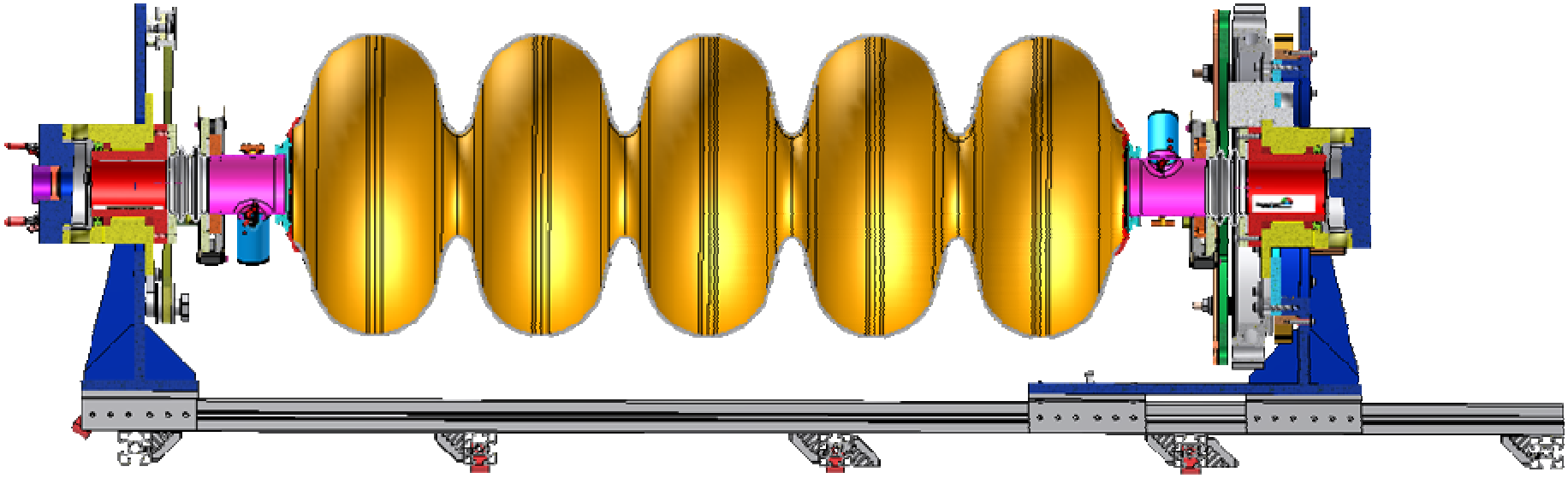
Electropolishing system for QWR cavities

- Final chemistry on finished cavities instead of components
  - All surfaces receive full bulk EP
  - No BCP
  - Major reduction in overall EP effort/number of procedures
  - Large fraction of components common to e-cell polishing

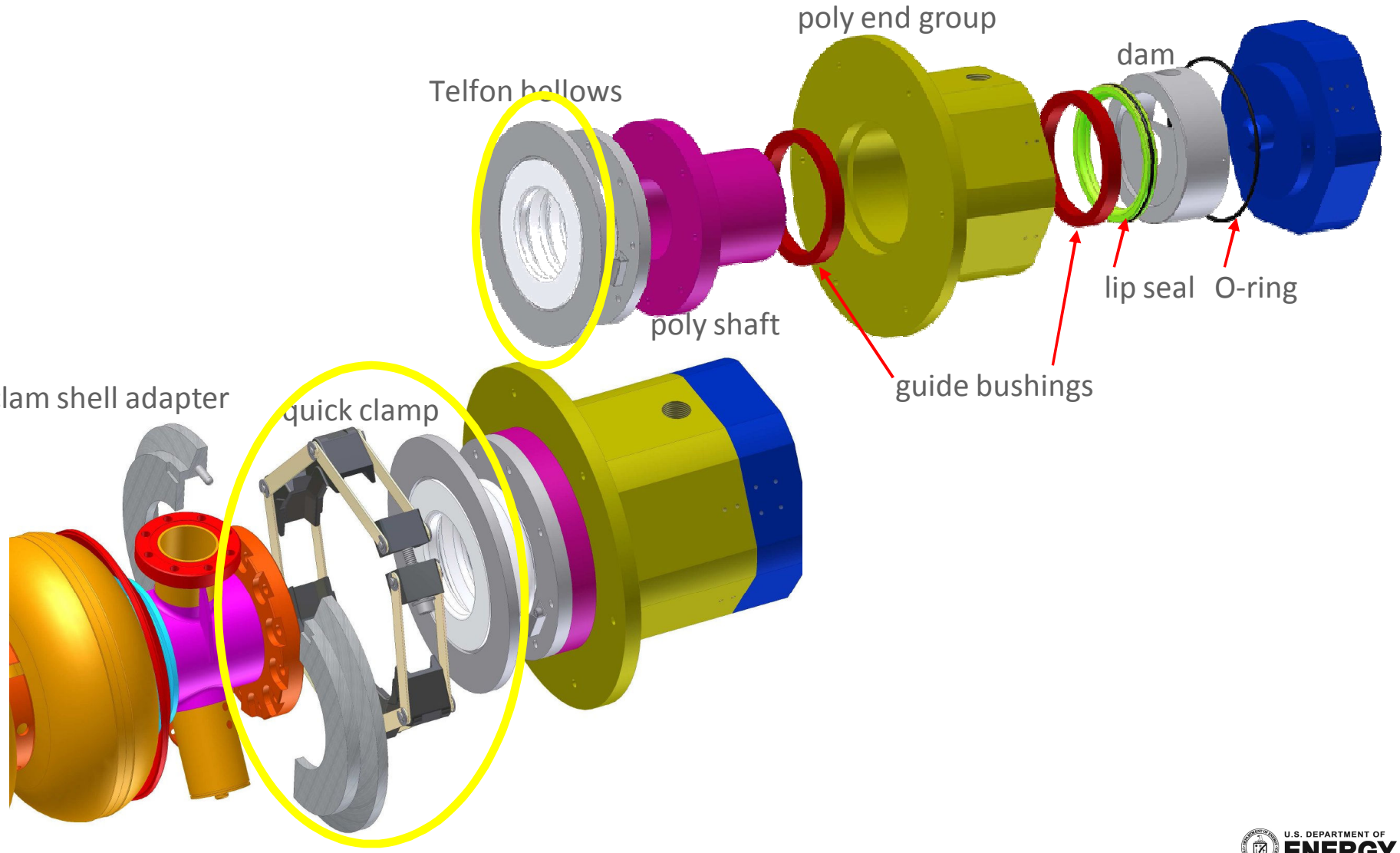


Electropolishing for 650 MHz 5-cell cavity

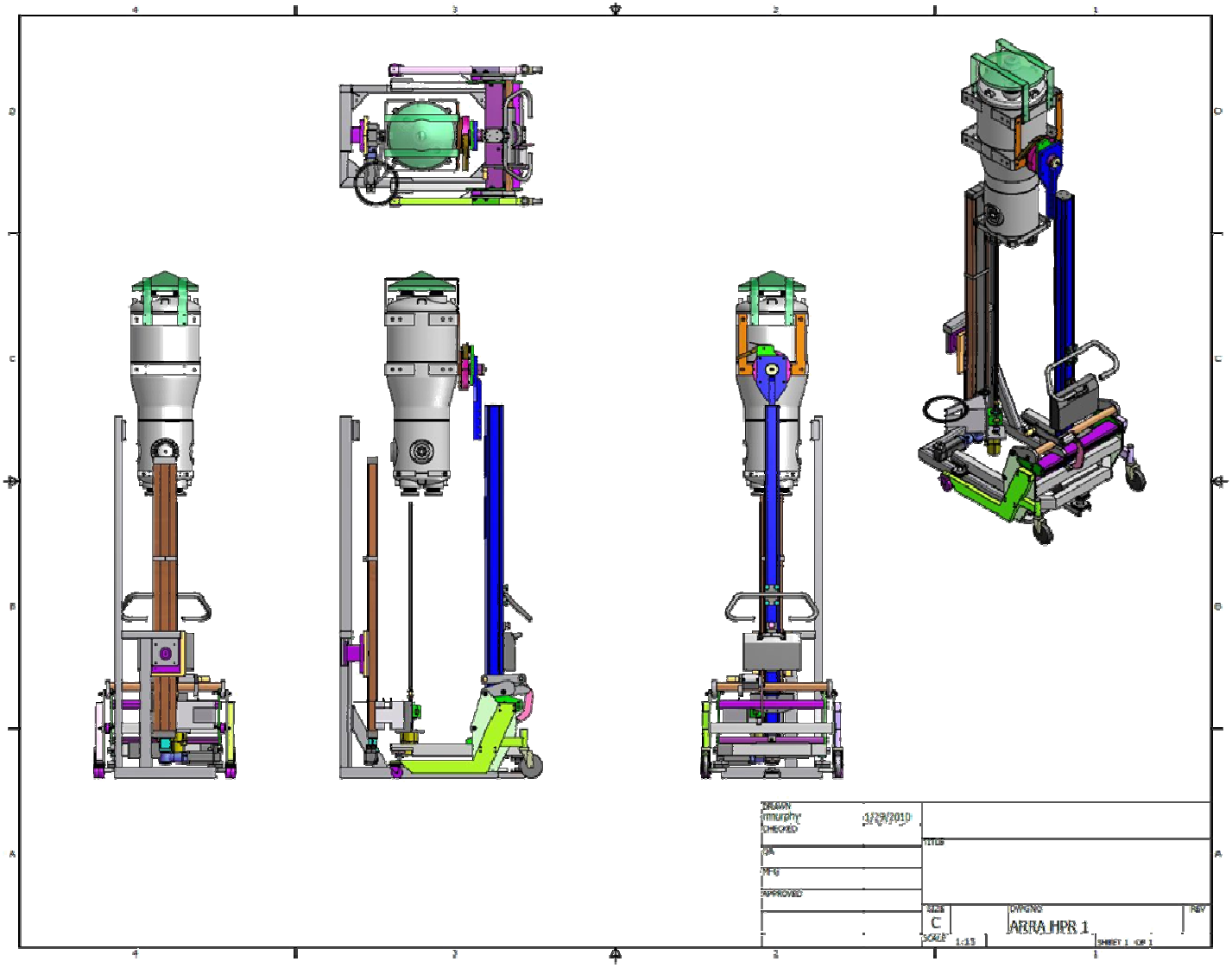
- Scaled cavity geometry shown with the existing EP hardware
  - Cavity with twice radial dimension of the 1.3 GHz 9-cell fits into the existing system with modest modification (no cavity frame shown, may need to shim under blue stands)
  - 55 gallon acid handling limit OK
  - 2 ½ times surface area, EP supply OK, 50% larger chiller
  - Cavity handling similar to 9-cell (crane in hi-bay, hoist in chemistry room)
  - *No major difficulties in adapting EP to this geometry*



e.g. Modular system requires straightforward modifications for new e-cell cavity sizes



HPR in ANL clean room



Summary

- Modifications for BCP in existing EP chemistry room
  - Technical lead A. Rowe w/ T. Reid, R. Murphy
  - Operations by ANL staff
  - Work can begin anytime
  - M&S < $10 K
- Re-tool FNAL 'BCP' room as a general use EP facility
  - Required for 1 prototype QWR EP by Oct. 2010
  - 6 QWR Production cavities late 2011
  - Total of 4 months for all QWR EP work
  - Otherwise available for single cells right away
  - Provision made now for straightforward mods for 650 MHz 5-cell EP
  - Technical lead S. Gerbick; funding from ATLAS upgrade; $40 K M&S + manpower
- HPR in ANL clean room by Nov. 2010
  - Can lay out 650 MHz cavity in HPR system (R. Murphy)