



Managed by Fermi Research Alliance, LLC for the U.S. Department of Energy Office of Science

Fermilab PIP Booster Accelerator RF Cavity Refurbishment

Matt Slabaugh

ARW 2015

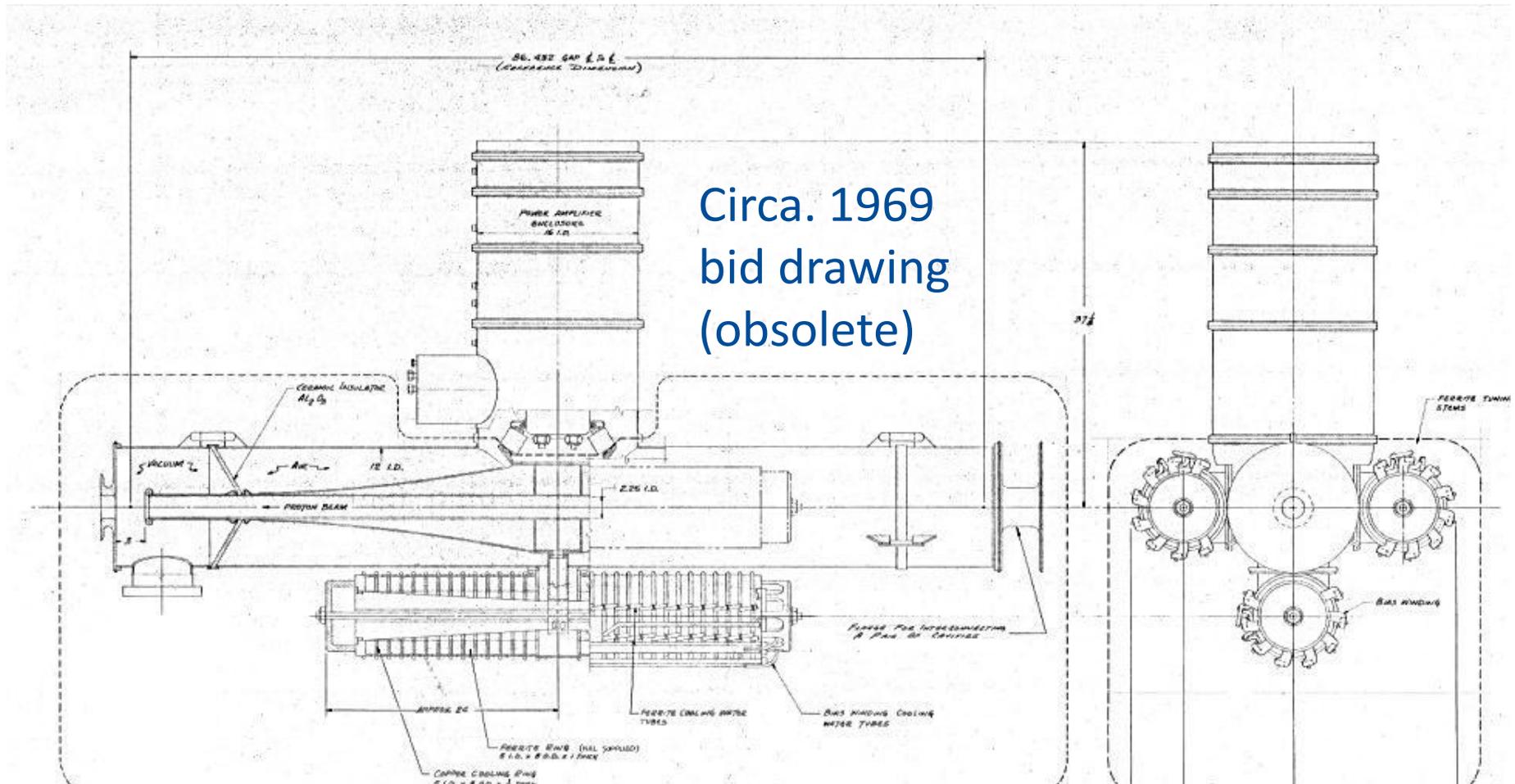
27 April 2015

Topics

- Proton Improvement Plan (PIP)
- Booster Radio Frequency (RF) Cavities
- Cavity Refurbishment
- Tuner Refurbishment
- Planning for failure
- Testing and Summary



Booster RF Cavity



Critical advantage: Access to retired personnel with development knowledge

Cavity Refurbishment- Scope

Cavities are radioactive and fragile!



Vacuum



Misc.

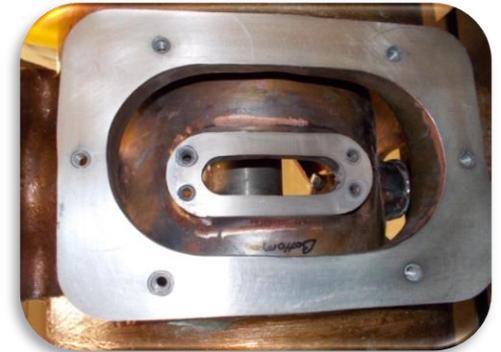


RF Contact

Cavity Refurbishment- RF Contact



Milling improved quality,
reduced time and distance
(dose). ~ 7 days → 2 days



Insufficient
contact
= heat and
RF leakage



Cavity Refurbishment- Vacuum Repair and Upgrade



Leaking “pie-tin” quick disconnect flange

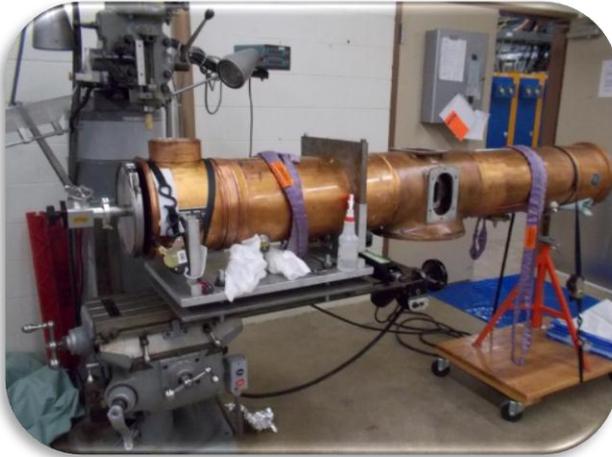
Removal with Wach’s tool



Replace with solid flange



Cavity Refurbishment



Improved repair tooling



Alignment fiducials installed



Water cooling repair/upgrade

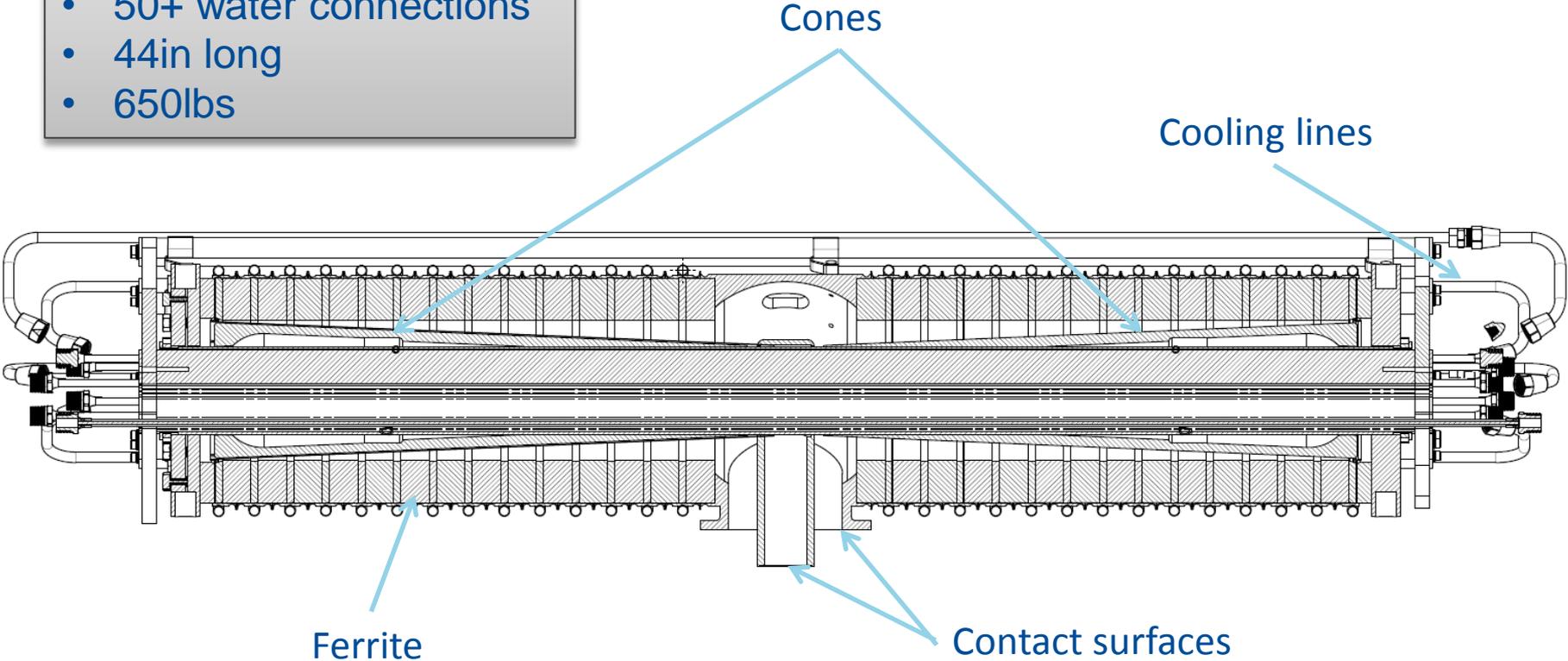


Internal sparking and damage

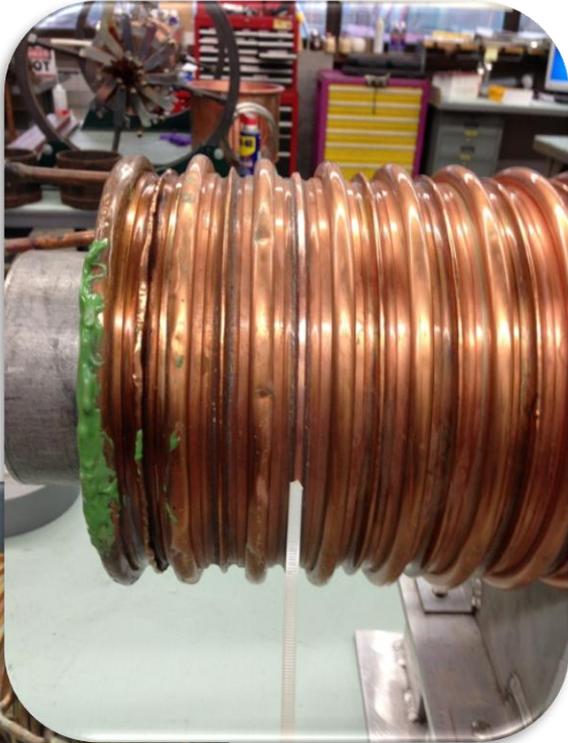
Tuner Refurbishment

Each tuner:

- 500+ pieces
- 150ft+ tubing
- 50+ water connections
- 44in long
- 650lbs



Tuner Refurbishment- Risk



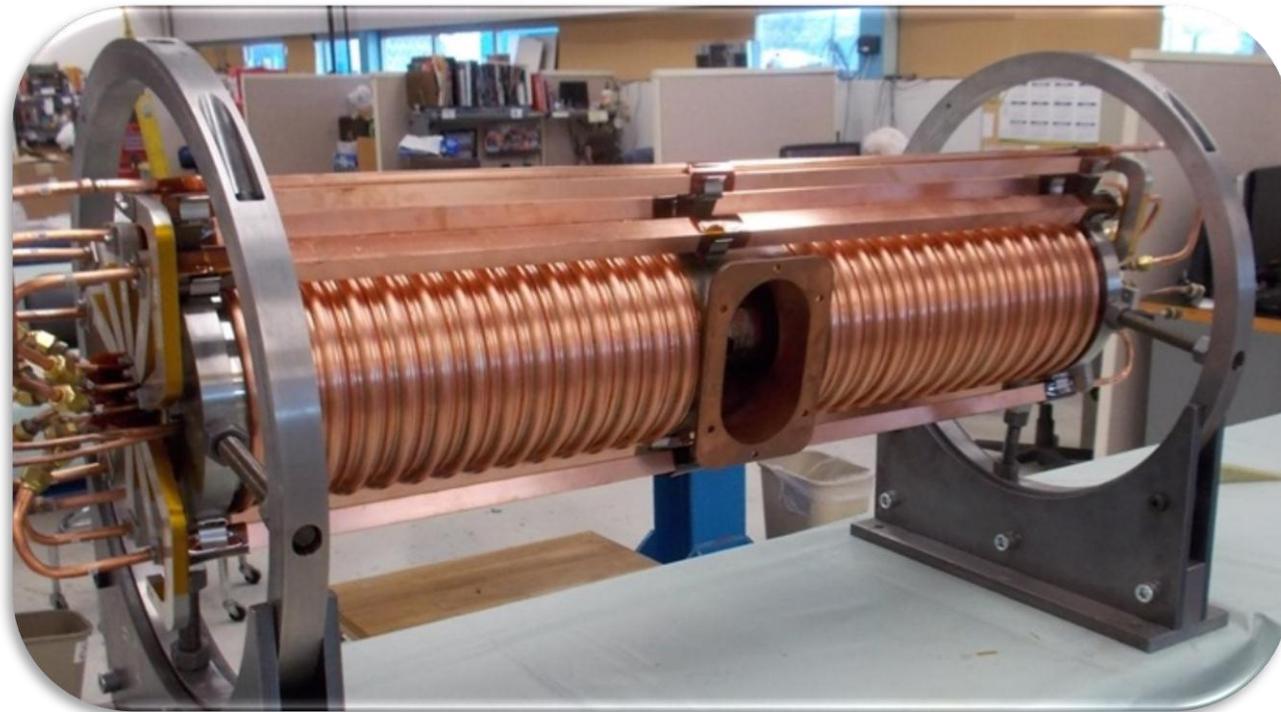
Tuner Refurbishment- Procurement and challenges

- Difficult procurement
 - Stock items not stock (tube sizes)
 - Common processes no longer common
 - Unusual materials
- Original drawings not updated
 - Undocumented revisions
 - All hand drawings, no CAD
- Little data available for optimizing design changes or benchmarking



Tuner Refurbishment- Planning for failure

- Have begun building new tuner assemblies
- Potentially replace all refurbished tuners with new



Cavity Testing and Summary

- Each assembly tested for two weeks prior to install
- Thermal sensors near critical surfaces for real time data
- Beginning production of two spare cavities

- 17 of 20 cavities installed
- 50 tuners refurbished
- 3 tuners built new

