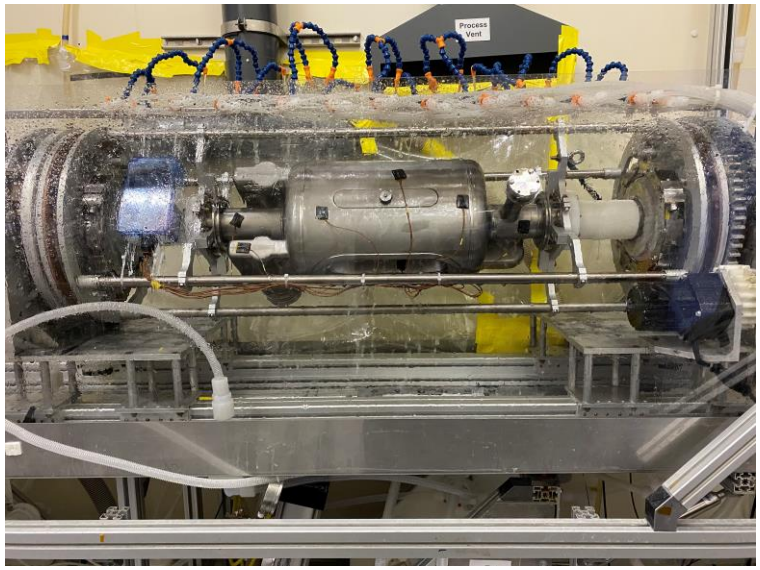
Processing and testing of AUP prototype #1 NRFDP001

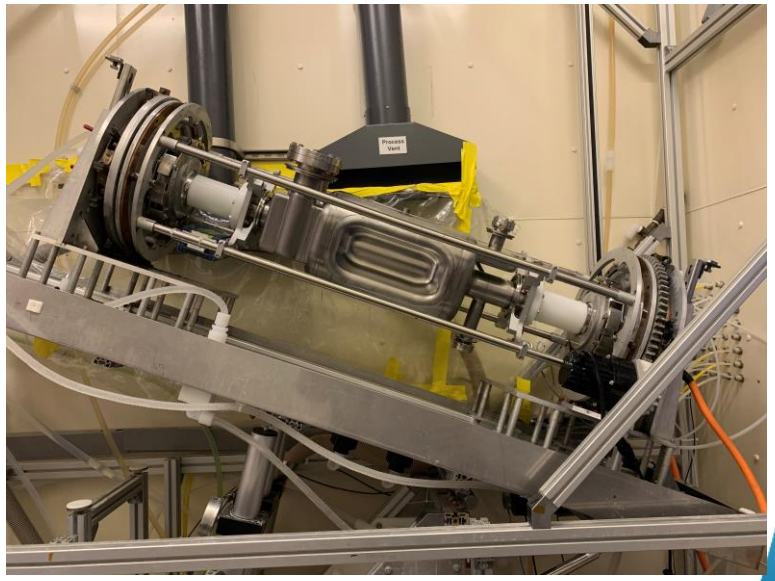
Paolo Berrutti– Fermilab

WP4 collaboration meeting: AUP-Canada-CERN-UK

Processing I: BULK/Light rotational BCP

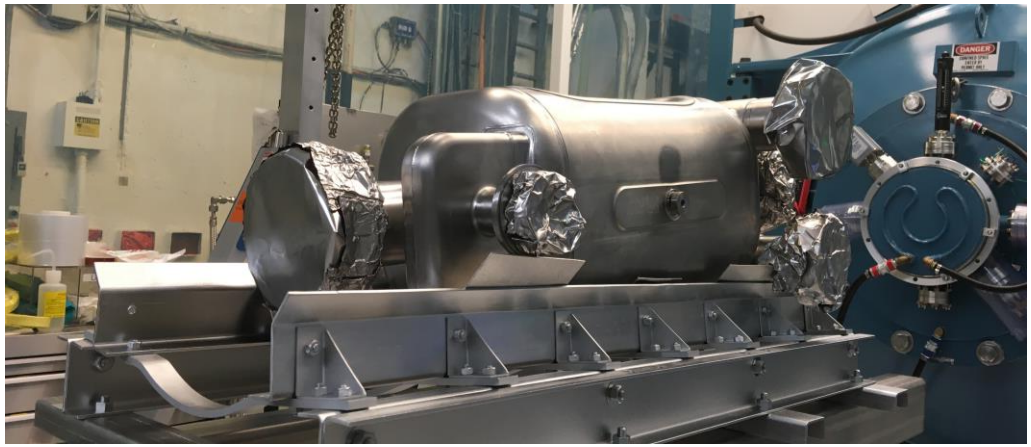
- Both bulk and light BCP were carried out at the ANL/FNAL facility: Acid and Nb temperatures are controlled well with sensors on the cavity surface and cooling water sprayed on the exterior Nb surface
- BULK removal: average 130 microns
- Light removal: average 40 microns
- All US thickness locations match locations used by CERN





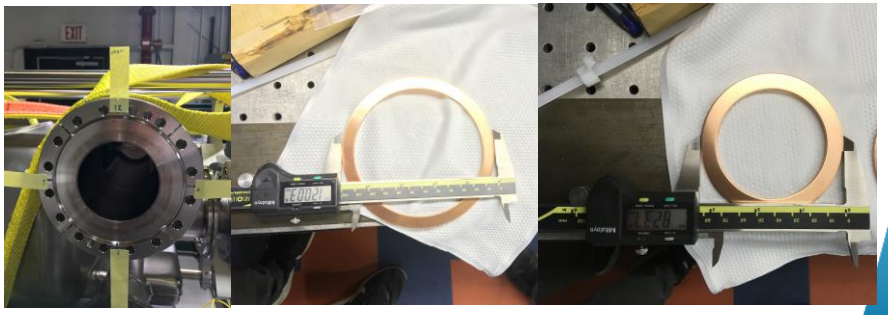
Processing II: Heat treatment 600C/120C bake

- 600 C for 10 hours H degassing completed at FNAL: Nb foil to cap flange to avoid contamination
- 48 hours 120 C bake to get rid of residual H_20 and minimize MP processing time carried out at FNAL



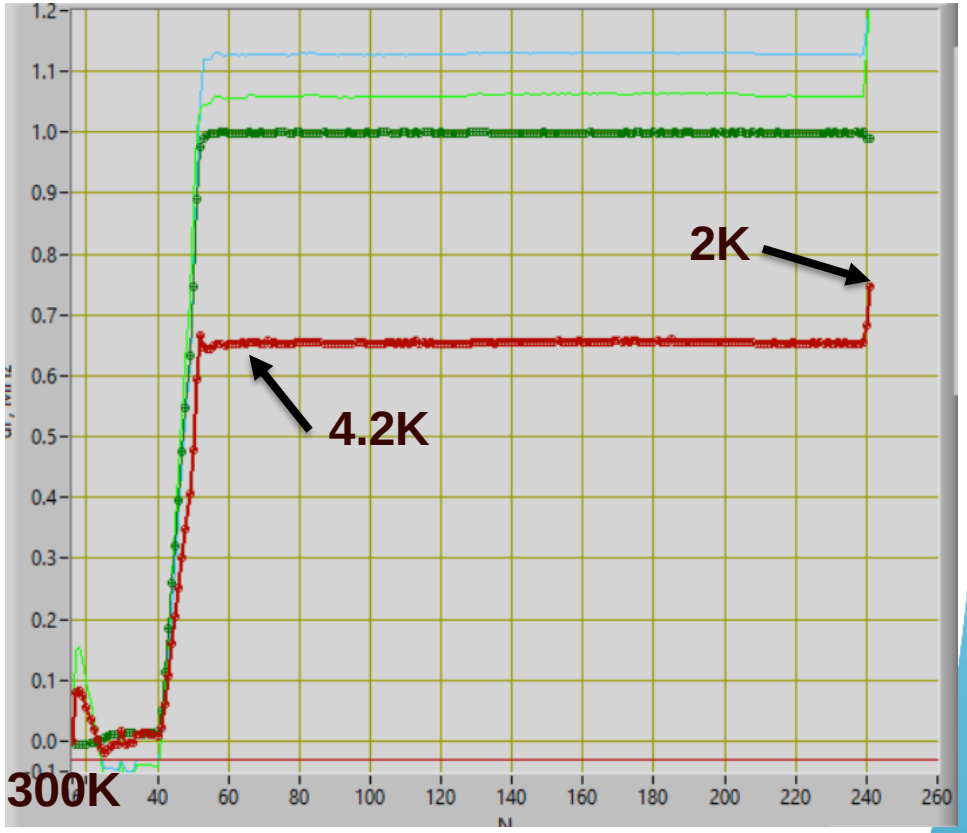
Processing III: Problems with CF flanges assembly

- Multiple times fully assembled bare cavity has been leaking due to a combination of:
  - Knife edge defects
  - Differences in the gasket sizes and tolerances between CERN and US standards
- Problems seemed to be resolved with:
  - Thorough flange inspections followed by knife edge polishing (if needed)
  - Custom gasket machining
- No leaks for prototype #1 at 2K
- Prototype #2 leak test went well: no leaks @ RT

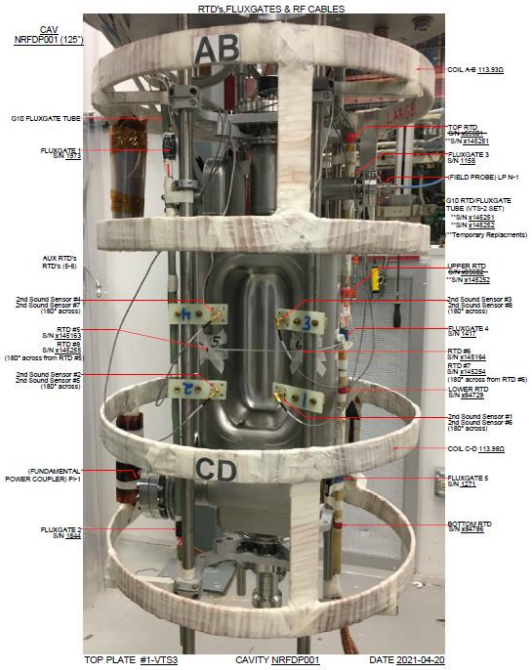


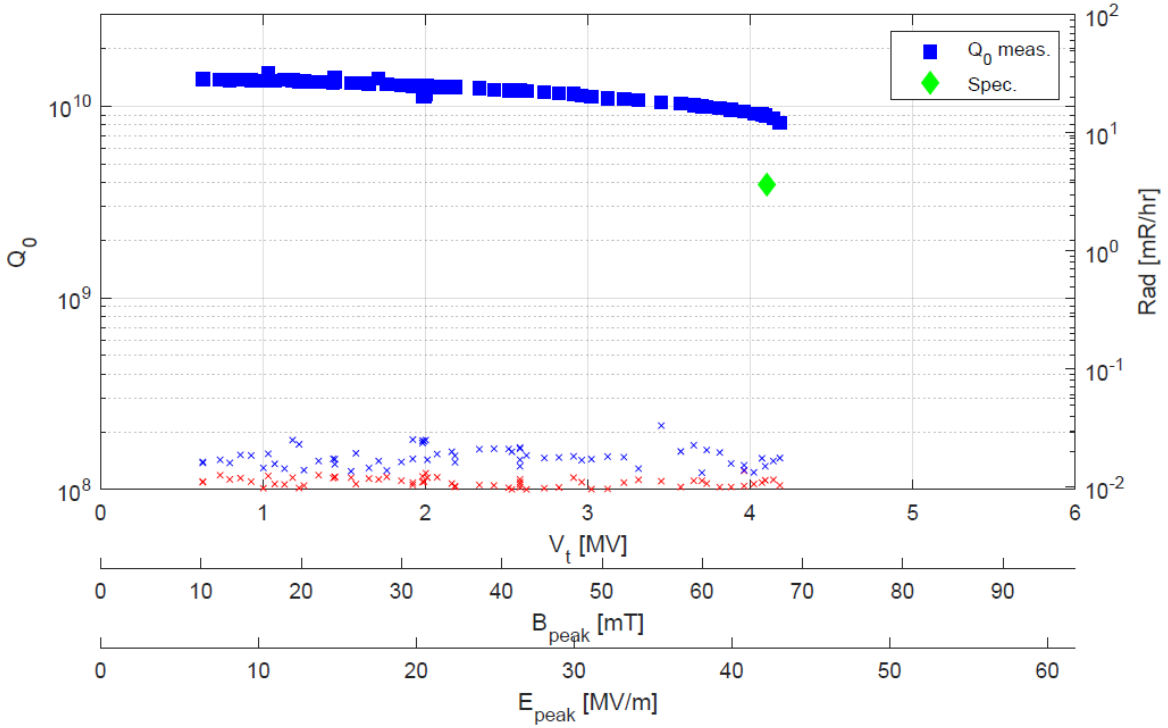
Frequency tracking: during VTS cooldown

- Four modes have been tracked during cooldown up to first dangerous HOM around 748 MHz
- 300 K → 2K shifts:
  - fundamental mode: Δf= 746 kHz, 2k frequency 400.449 MHz.
  - 748 MHz HOMS: Δf= 1.23 MHz, 2k frequency 749.316 MHz.
- 300K → 4.2 K in 3.5 hours



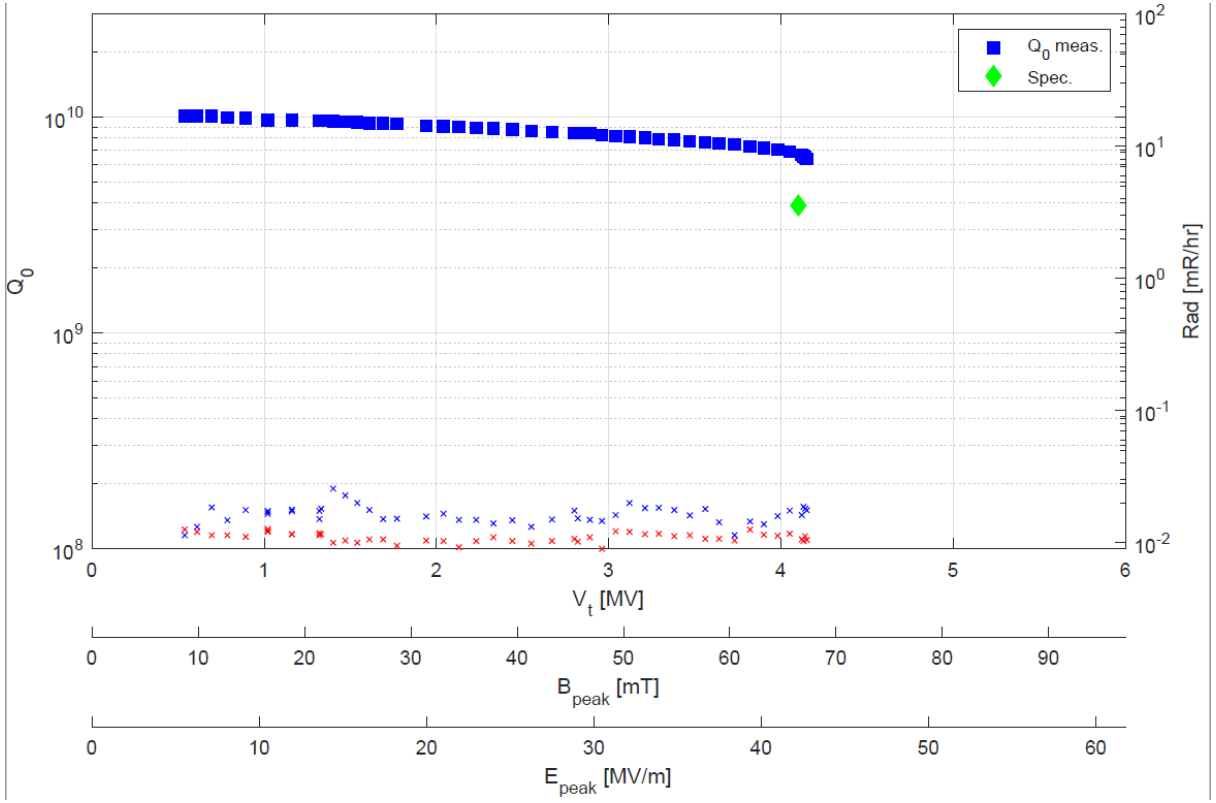
Test I: fast cooldown in compensated field





- Q_0= 8.2E9 V_t=4.18 MV at quench, Low field Q_0= 1.5E10.
- B_{ext}= 0.6 mGauss.
- No FE detected: effective HPR and clean assembly
- OST indicates quench spot on top of sensor 3, between corner and end-cap weld (preliminary result)
- Optical inspection showed defect in the probable quench area

Test II: fast cooldown in 100 mG field



- Q_0= 6.4E9 V_t=4.15 MV at quench, Low field Q_0= 1E10.
- B_{ext}= 100 mGauss.
- No FE detected: effective HPR and clean assembly
- OST indicates quench spot on top of sensor 3, location unchanged
- To maximize trapped B slow cool down with B field applied next time

Next steps

- NRFDP001:
  - Complete investigation of quench location and possible mitigation plan
  - Potentially test with HOMs damper from JLAB (later this summer)
  - Cavity jacketing…
- NRFDP002:
  - Bulk BCP
  - 600 C heat treatment
  - Light BCP
  - HPR and assembly
  - VTS (bare cavity)
  - …