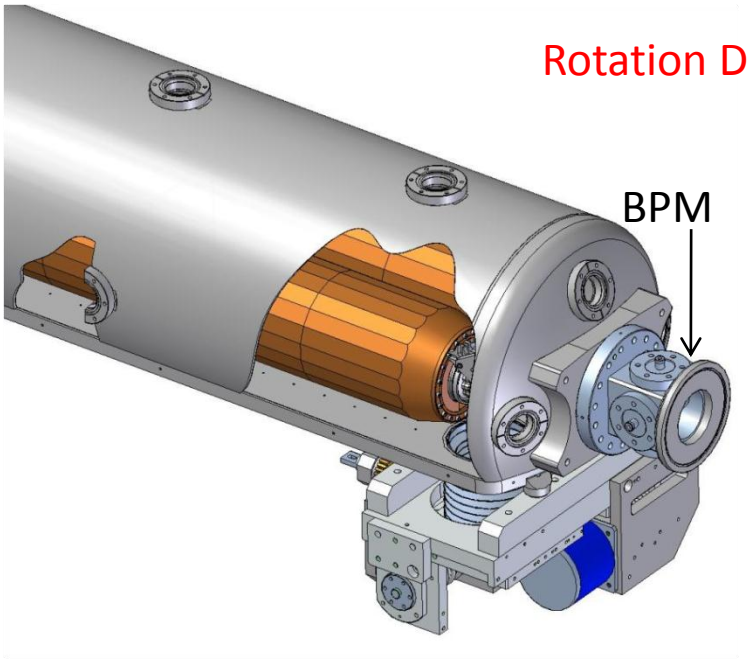
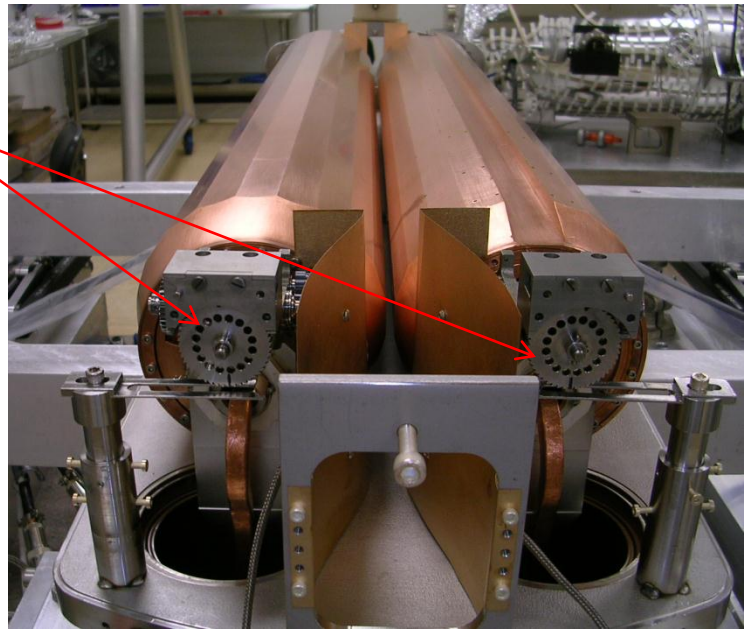
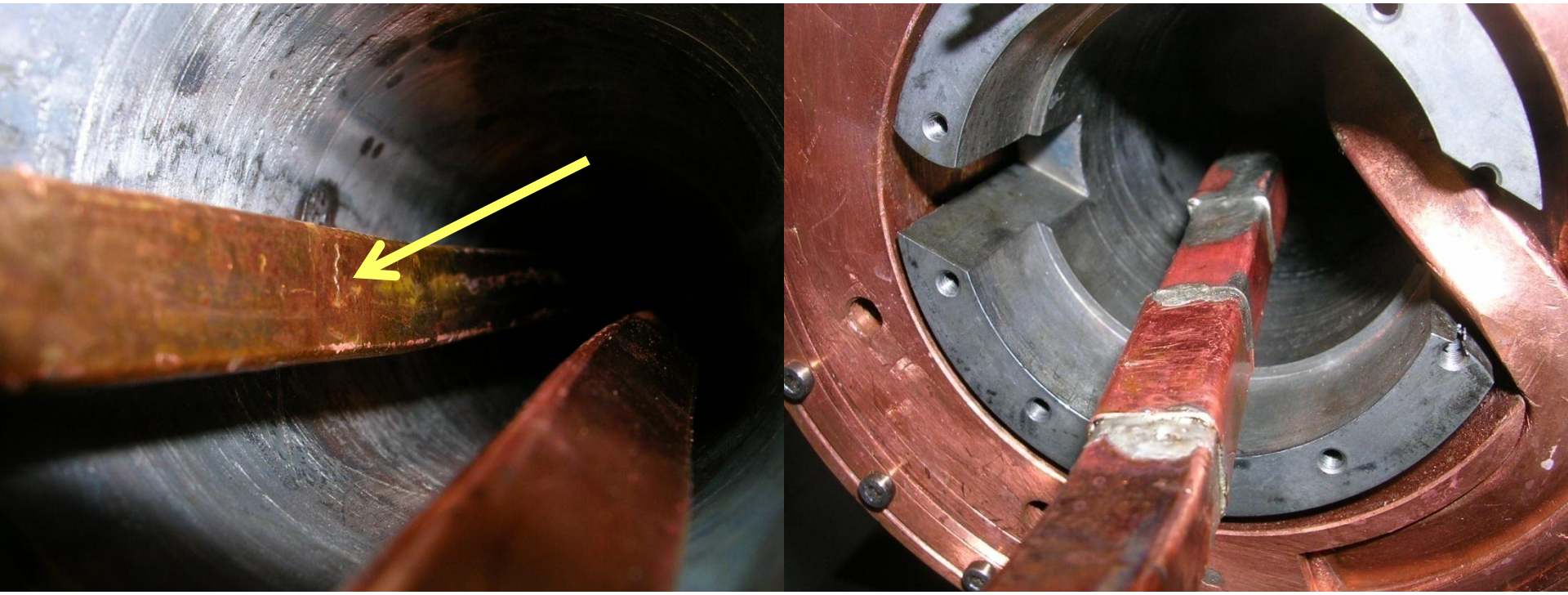
LARP Rotatable Collimator Prototype





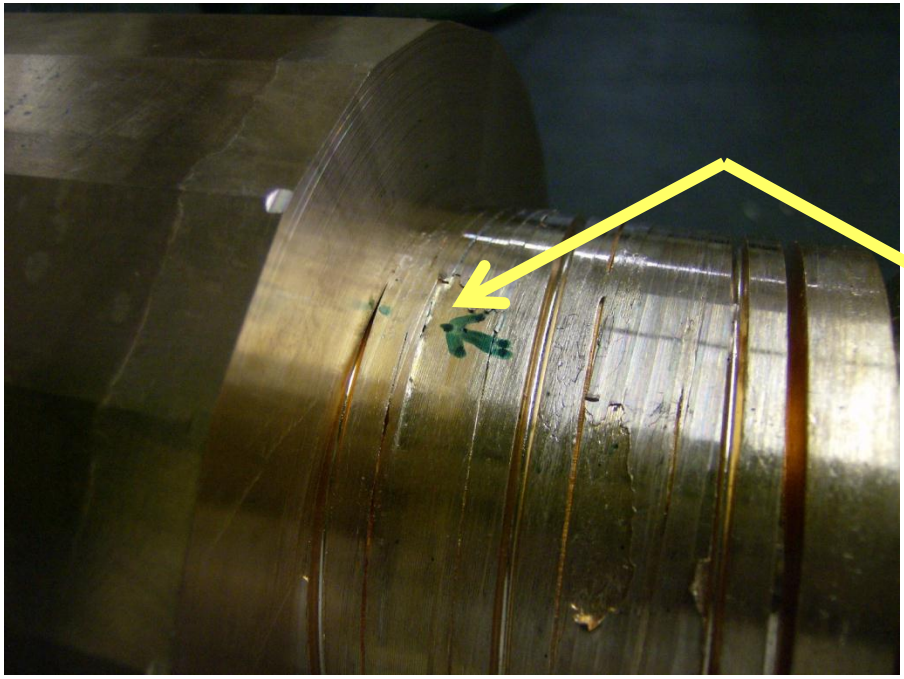
- Assembly completed and all mechanical tests successful:
  - Cooling tubes now twist, under vacuum, as jaws turn, with R~1 mΩ & align well
- Discovered after tank welded that the cooling tube of each of the two jaws had been damaged
- First jaw, the thermal performance prototype, was wound with non-OFE Cu magnet conductor, 3/8” square with ¼” round cooling channel
- Second jaw was wound with 10mm square, 1.5mm wall OFE Cu tubing

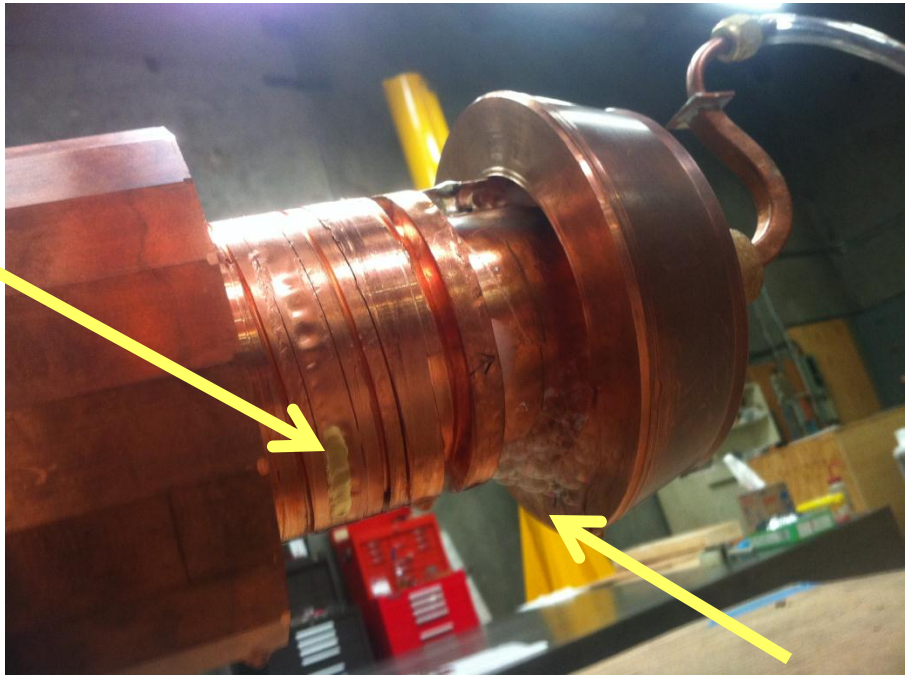
Crack in Copper Magnet Conductor Used for Winding First Prototype Jaw



Suspect weakening in non-OFE Cu tubing at crystal grain boundaries after last of many high temperature firings
Repaired with solder patch

Leaks at Tack Welds and Perhaps at Thinned Points in Thinner Walled Tubing Used for Winding 2nd Prototype Jaw





Tube walls thinned to 0.030” in places when mandrel prepped for jaw braze

Repaired with “CuSil”

“SNOOP” bubbles at tack welds used to secure tubing: 5 leak points

Neither of these procedures are fundamental; assembly process will avoid these two procedures

Other Lessons Learned During Prototype Testing and Next Steps

- After 5 weeks of bakeout tank & jaws (tubes sealed) reach P=4.4E-9 torr with clean RGA & rotation mechanism works after bakeout
- "Less important" mechanical issues that need attention
  - Replace problematic free floating RF bearings with race-constrained bearing
  - Capture main bearing so cannot slide off during bakeout
  - Replace W-S2 440 Stainless coated main bearing with ceramic bearing
    - 1 of 4 main bearings froze to race during bakeout (W-S2 316 SS bearings all fine)
  - Replace 1 of 2 molybdenum rotation drives that cracked when spot welded
- Non-fundamental issues that will not be changed
  - Impedance dominated by tank size & simplified RF transitions
  - Recent desire for BPMs that move with jaws will not be implemented

- **Plan is to replace both jaws & reinsert into existing base plate with existing vacuum bellows and motion system** for beam and then destructive testing in HiRadMat facility
- Modify assembly procedure to guarantee cooling tube integrity
- Delivery to CERN Summer 2012
- Activity supported by SLAC and carry-forward funds

Work in Progress

- New Procedure:
  - Wrap a 2mm thick OFE copper sheet around the mandrel with its wound cooling tube
    - Braze material between sheet and OD of mandrel
  - Braze in 316 SS Compression Fixture to lock down tubes without spot welds
  - Tubes not touched during machining to true OD for jaw braze
- Tests in progress
  - 20cm proof-of-principle (10.02.12)
  - Destructive hydraulic test of 1.5mm wall 10x10 tuning (17.02.12)
- Two new shafts were scheduled to be brazed 06.02.12
- Next steps
  - Full length compression fixture
  - Wind exitsing mandrels with existing tubing braze