Cold L-Band Cavity BPM Status

– updated version 8/10/2007 –

BPM Team:

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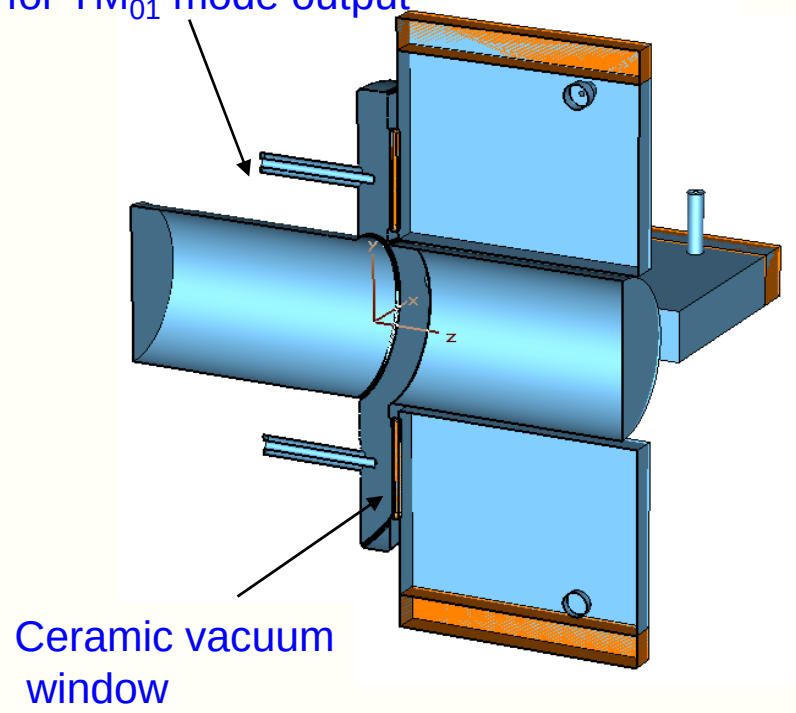
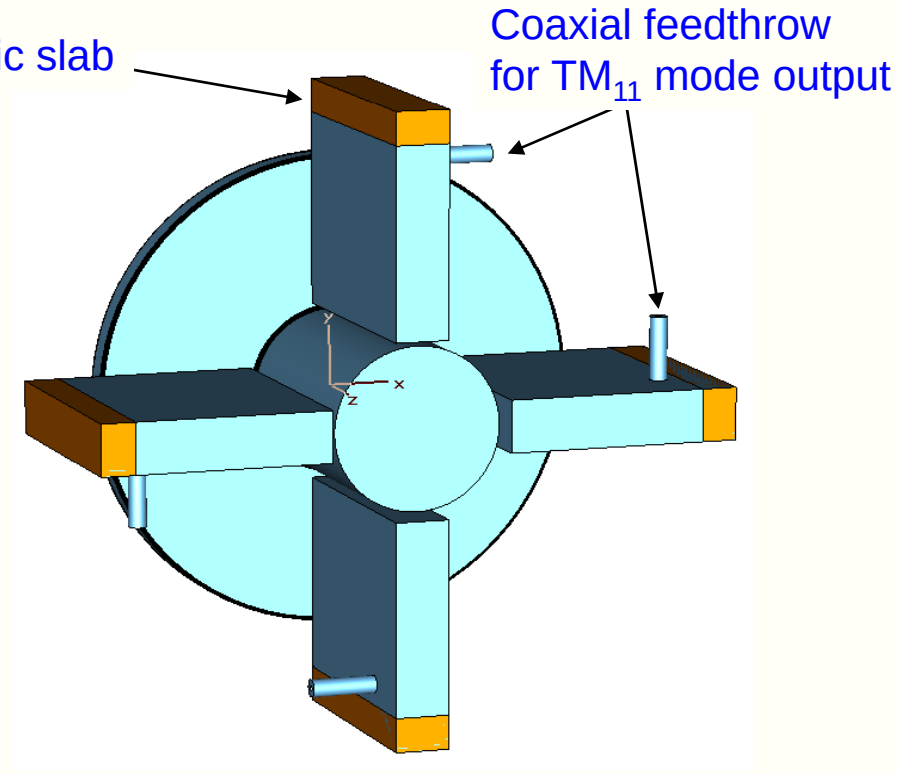
Development Goals

- Cold L-Band cavity BPM for an CM with < 1 μm resolution.
- Waveguide-loaded pillbox with slot coupling.
- Dimensioning for f_{010} and f_{110} symmetric to f_{RF}, f_{RF} = 1.3 GHz, f_{010} ≈ 1.1 GHz, f_{110} ≈ 1.5 GHz.
- Dipole- and monopole ports, no reference cavity for intensity signal normalization and signal phase (sign).
- Q_{load} ≈ 600 (~10 % cross-talk @300 ns bunch-to-bunch spacing).
- Minimization of the X-Y cross-talk (dimple tuning).
- Simple (cleanable) mechanics.
- EM-simulations for optimizing all dimensions/tolerances.
- Prototype testing / risk analysis to be ready for CM installation.

EM Modeling



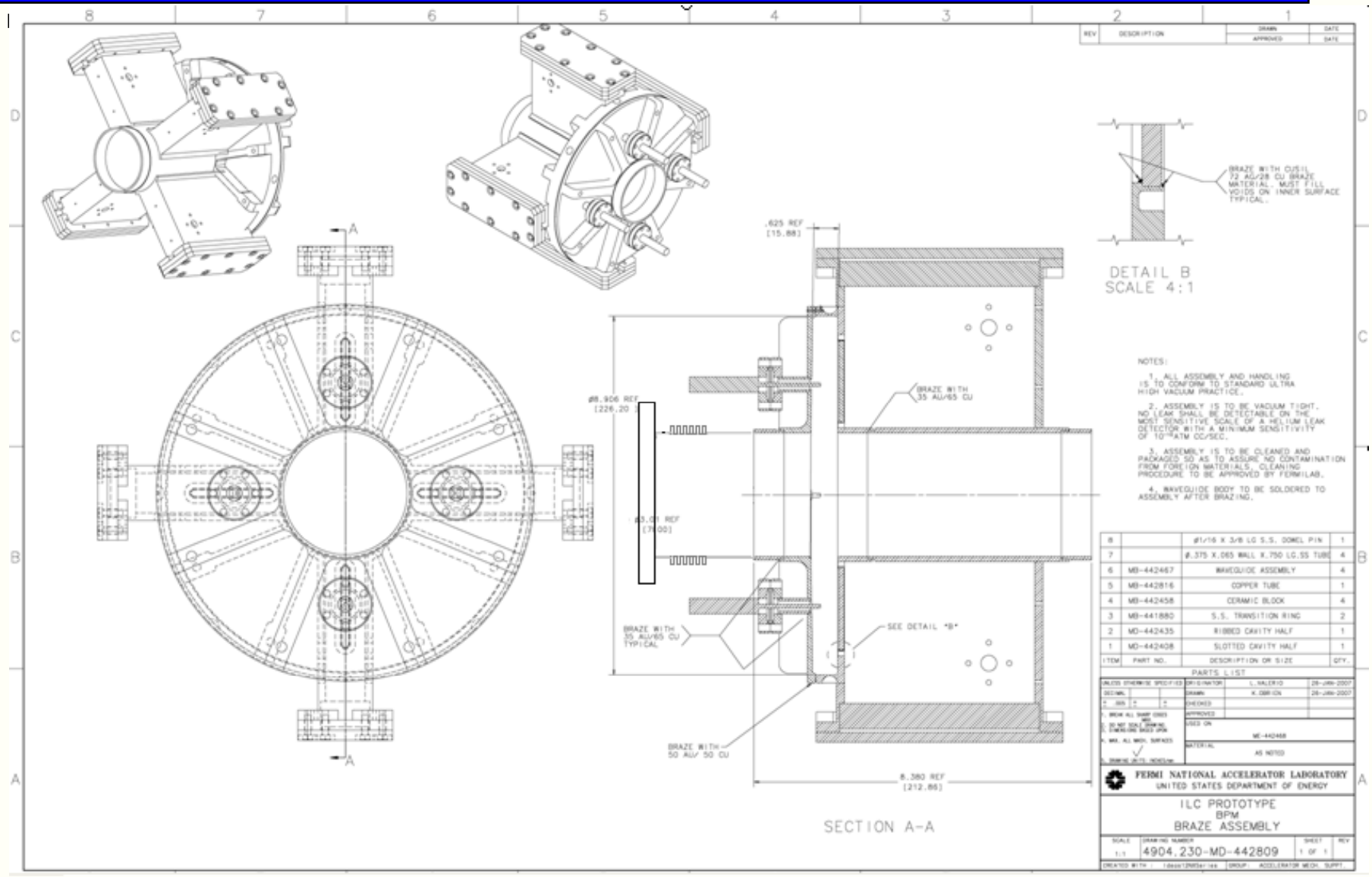


Cavity diameter: 113 mm
Gap length: 15 mm
Pipe diameter: 78 mm
Waveguide: 120 x 25 mm

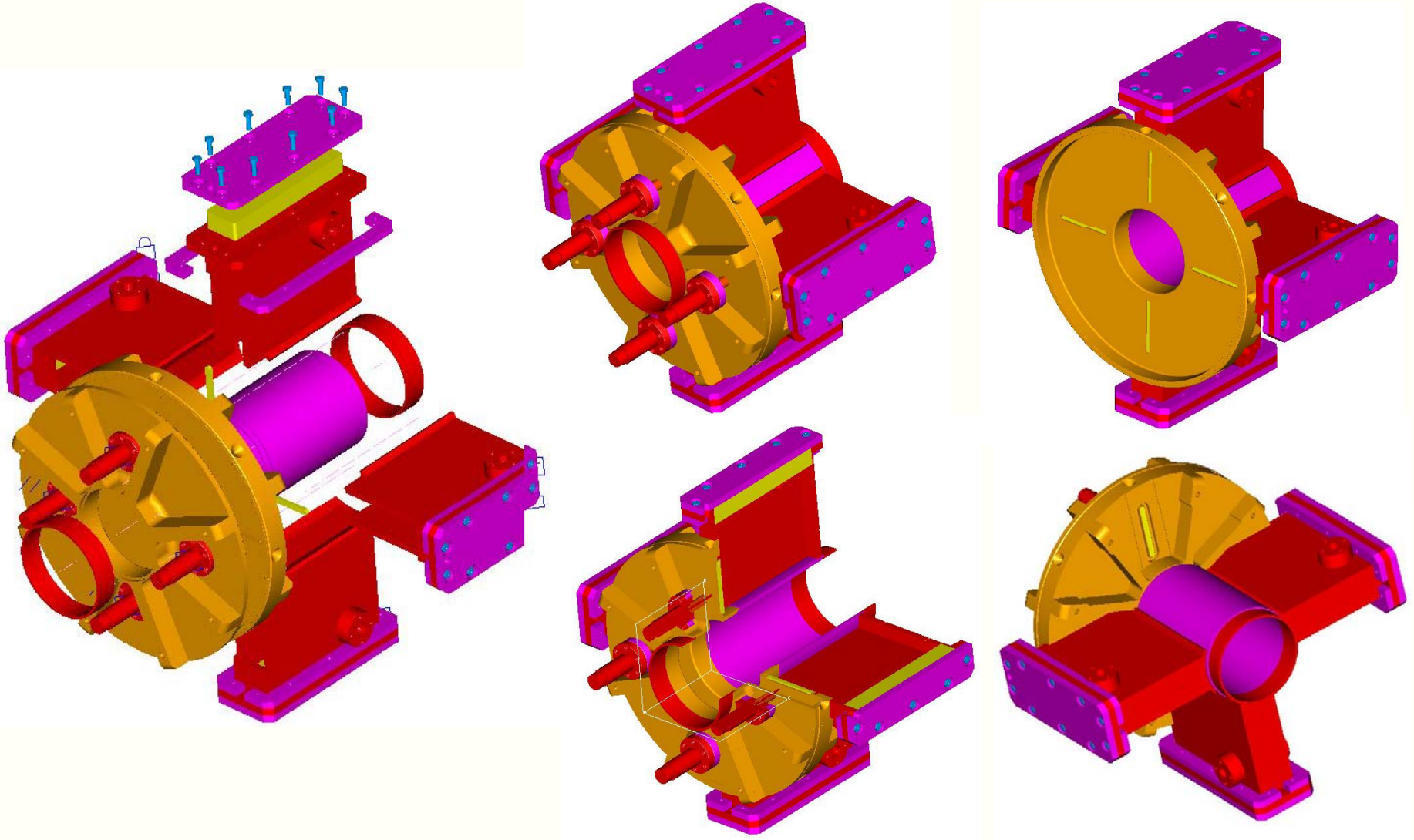
Features:

1. Ceramic (Al_2O_3) brazed vacuum windows
2. Common TM_{11} and TM_{01} cavity
3. Symmetrical signal processing
4. Time resolution: 0.3 μs (bunch by buch)
5 . Position resolution: < 1 μm (± 1 mm)

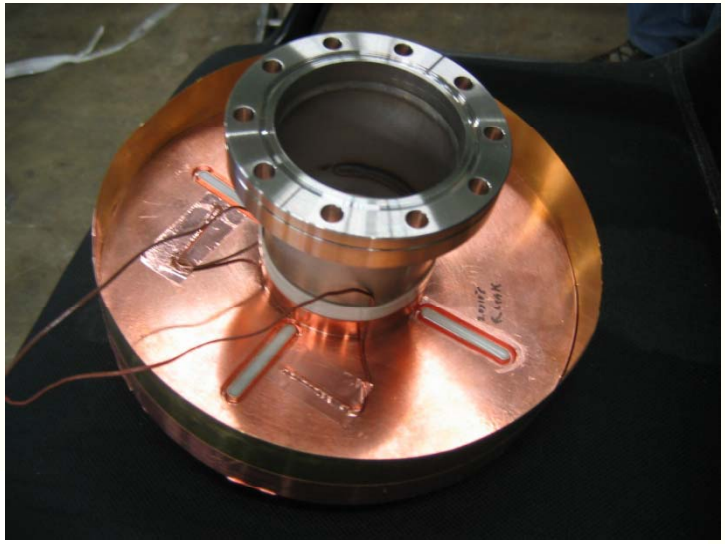
Construction Status 7/26/07

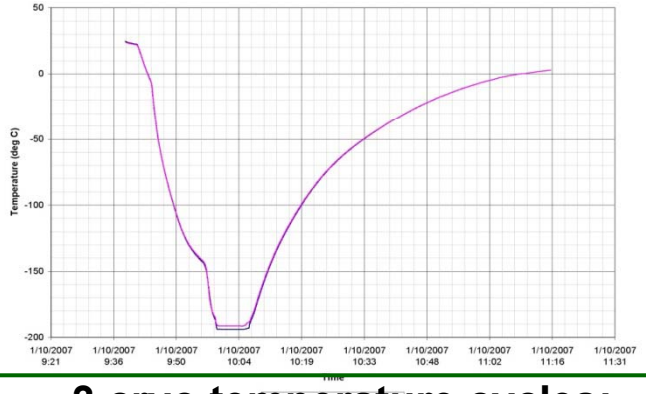


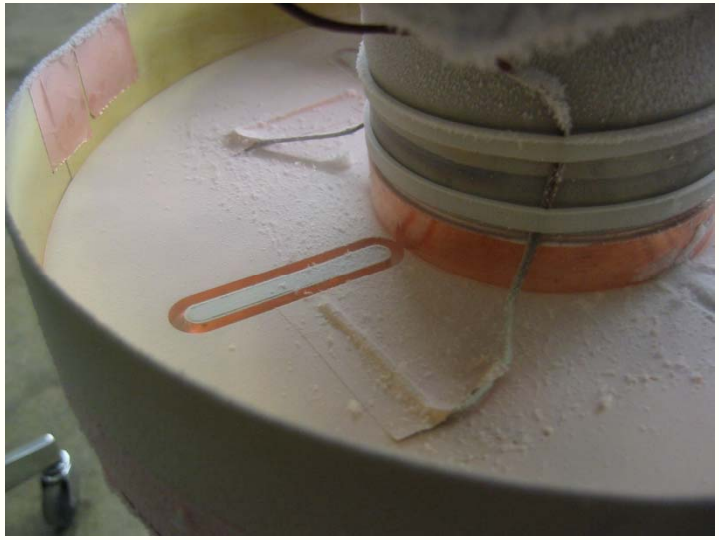
Construction Details 8/8/07



Cryogenic Tests

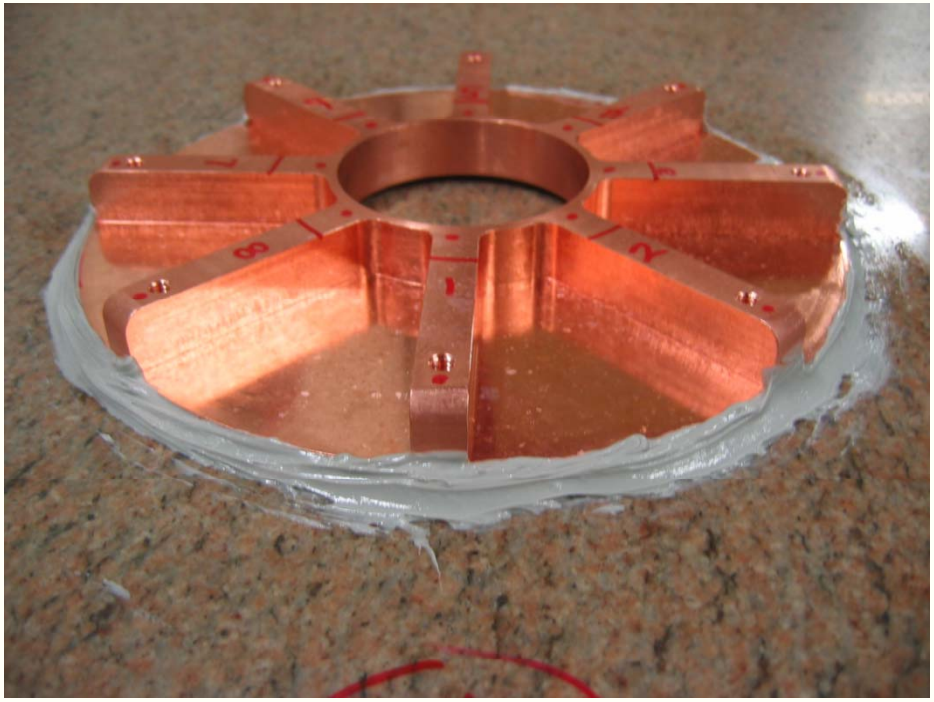




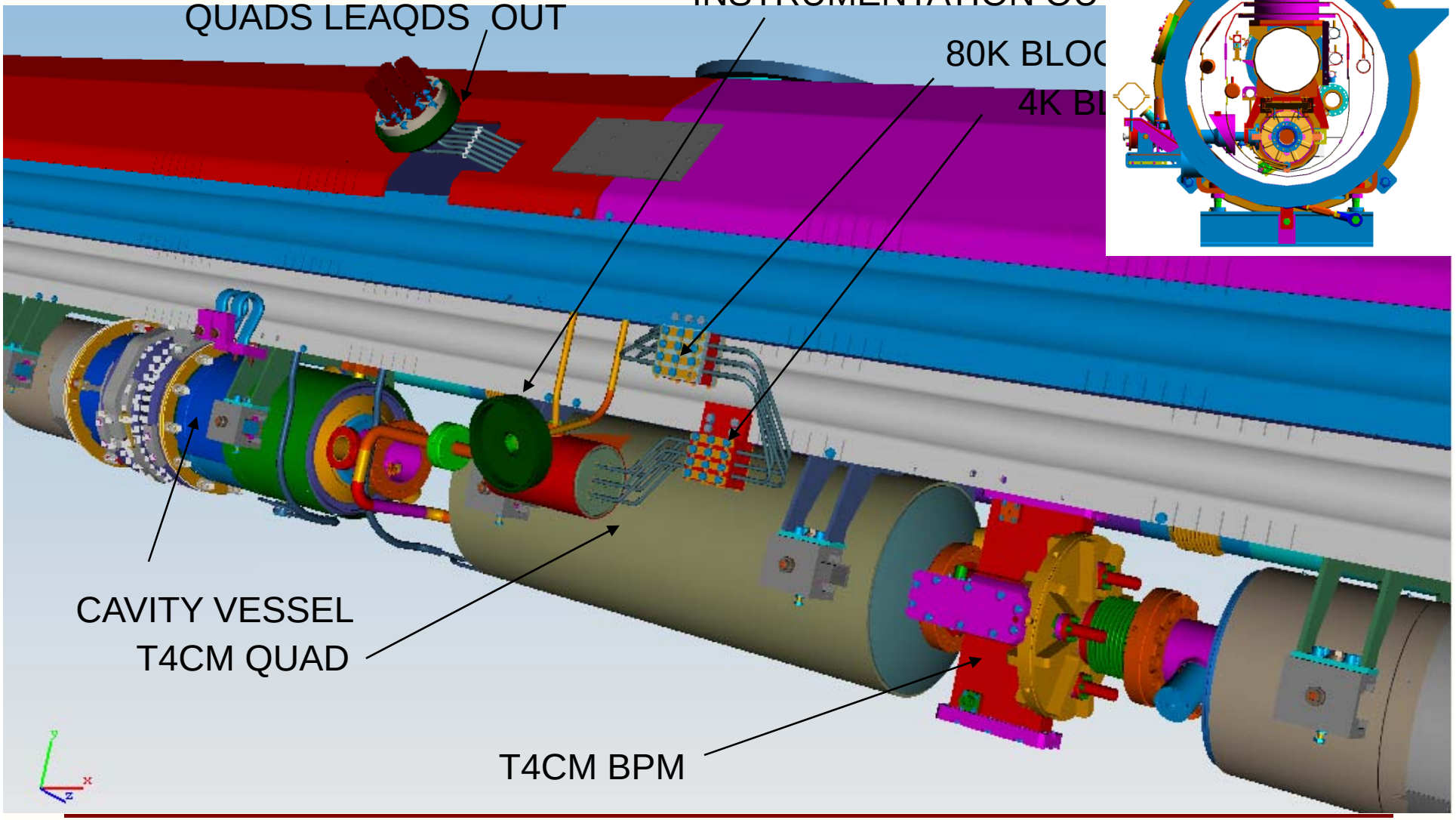


3 cryo temperature cycles:
~30-45 min. cool-down from RT to ~80 K
~ 60 min. warm-up form 80 K to RT
How many cycles do we need?!

Deflection Tests (cont.)



T4CM QUAD AND BPM



Risk Assessment

- **New, unproven component requires:**
  - Clean-room procedures
  - Assembly, mounting and alignment procedures
  - Integration to quad package and cryomodule
  - Cabling (RF-cables, temperature sensors & cables)
- **Risk levels:**
  - FATAL: Slot window or UHV feedthrough failure damages one or more cavities. Cryomodule becomes unusable!
    - Brazing procedures, temperature cycles, leakage tests
    - Cleaning
  - Malfunction: Vacuum and cleanliness O.K. Issues with tolerances, tuning, cabling, etc. makes the BPM in parts or totally not functioning.
    - Manufacturing, tolerances
    - Shrinking, tuning

Schedule, Status 8/8/07

8/7/07	Feedback from brazing company received. Fabrication process defined.
8/17/07	Begin fabrication of waveguide solder pieces.
8/20/07	Final waveguide specs provided to MSD. Place order for additional ceramics.
9/5/07	Final drawing for approval.
9/12/07	All drawings complete, approved and send to machine shop for fabrication.
9/13/07	Order ceramics, missing purchase parts. Address test fixture needs and tuning requirements.
10/19/07	All parts for 1st BPM assembly machined and sent out for brazing.
11/7/07	1st partially brazed BPM assembly delivered to lab.
11/14/07	Tests completed and send back for final brazing. Parts for two more assy's machined and send for brazing. Parts for 4th assy ready for TD (not brazed).
10/30/07	One final, two partial BPM assemblies delivered to lab.
12/14/07	Tests on partial BPM assemblies completed, sent to final brazing.
1/5/08	2nd and 3rd final brazed BPM assemblies delivered to lab.
1/31/08	Three tested cavity BPM assemblies available.

Discussion

- Installation in a “warm” environment for beam tests:
  - SLAC ESA
  - KEK ATF II
- “Cold” installation into the 2nd NML type 3+ cryomodule
- Scaling the design for smaller apertures?!