Recent Measurements with the All-Season Cavity

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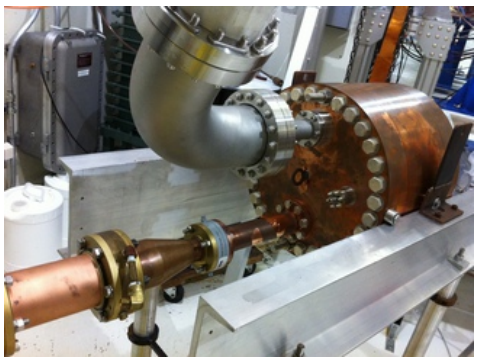
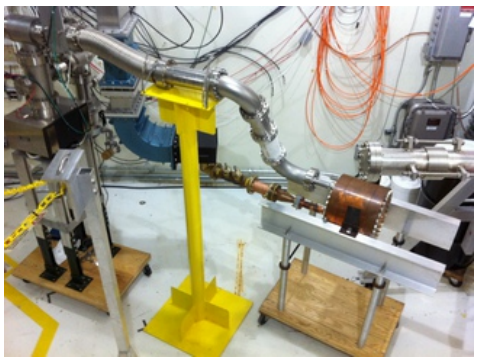
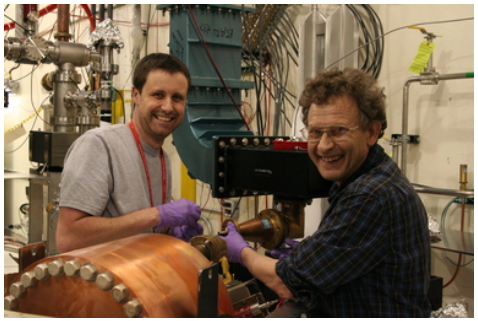
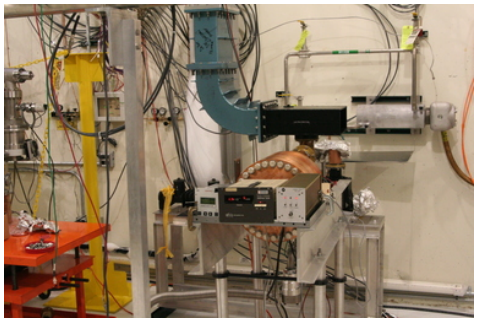
All-Season cavity (Muons Inc., LANL)

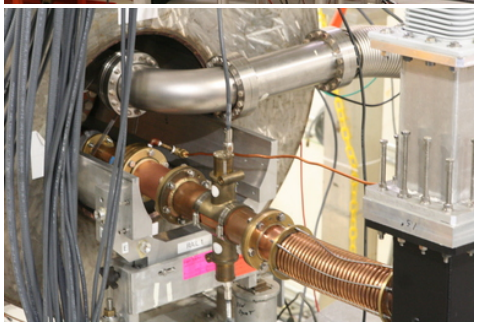
- modular pillbox with replaceable end walls
- designed for both vacuum and high-pressure
- made of 316 SS with 25μm Cu-plating
- 3.9cm-thick center ring, 6.6cm-thick outer end-plates; 2.7mm-thick inner plates
- RF volume ϕ 29.1cm x 12.9 cm L
- 1-5/8" Cu coax coupler
- f_0=810.375 MHz with vacuum (at upper edge of RF source power band); $Q_0 \simeq 2.8 \times 10^4$

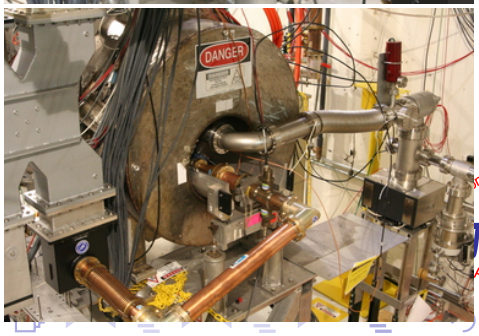






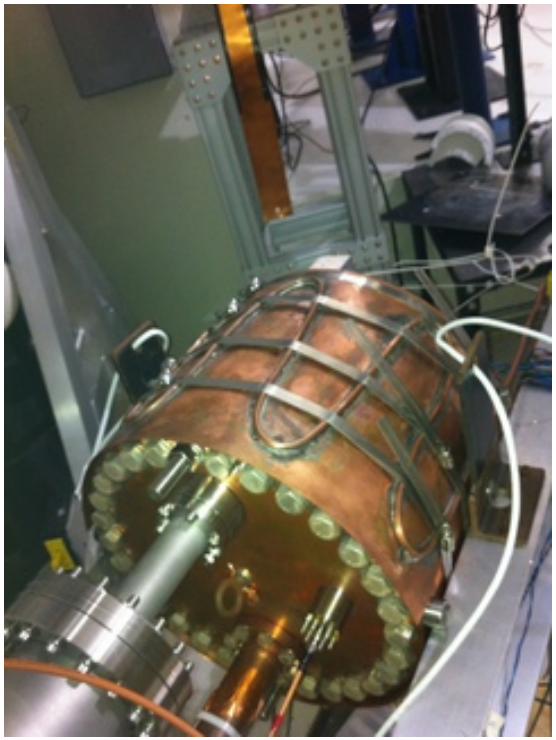




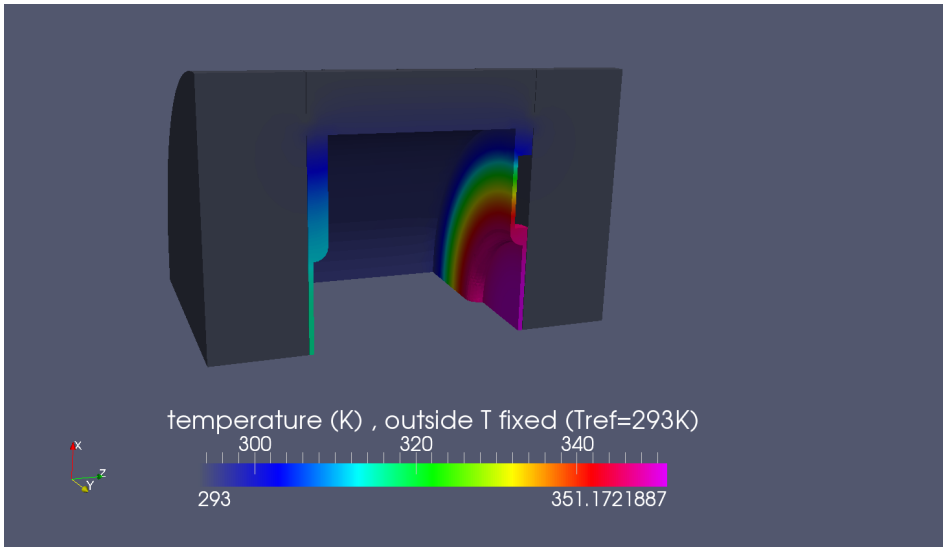


Power handling

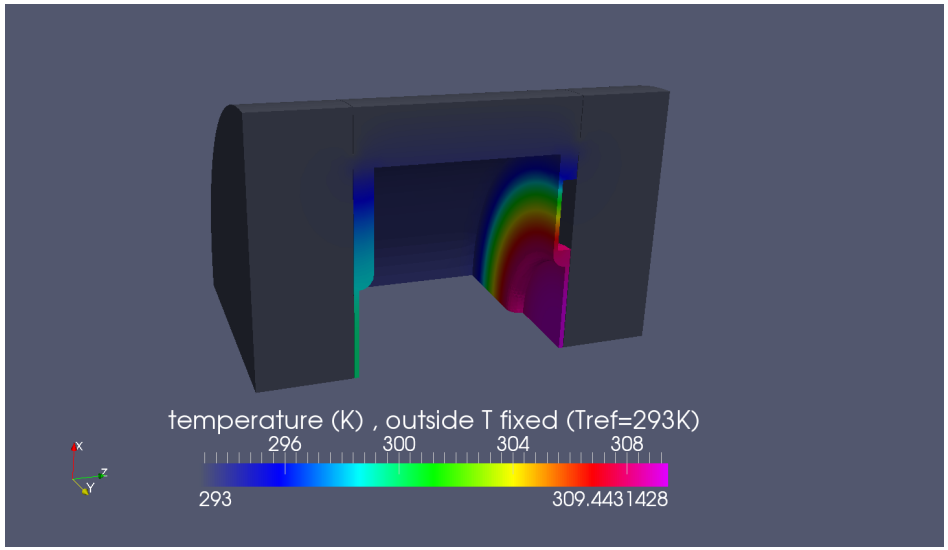
- $\sim$1.2 MW @ 25 MV/m
- 12 MW available at MTA
- No cooling included in cavity design
- Ran with no flattop (30μs)
- Estimated Δf 14kHz/^{o}C (F. Marhauser)
- Rep rate limited to keep temperature <25^{o}C on the outside
  - 5Hz @ 10 MV/m
  - 2Hz @ 15 MV/m
  - 1Hz @ 20 MV/m
  - 0.5 Hz @ 25 MV/m
- Tried external water cooling jacket
  - initial Δf>0 with cooling



Thermal analysis (F. Marhauser)



2MW
2×10^{-4} duty cycle



6×10^{-5} duty cycle
eg. 20μs @ 3Hz

Configuration history

- First run: poor external vacuum system, no RF pickup
- Connect to MTA vacuum cart
- Install RF pickup
- Install water cooling (removed later)
- Remove gas stop and SF6
- Install hybrid coupler
- Install high-power circulator, remove hybrid
- Add external diagnostics (radiation detectors)
- RF control system upgrade (D. Peterson), 24-hour operation since Mar 21, 2013

Recent running

- Started in B=3T Mar 2, 2013
  - >100k spark-free pulses each at 15 & 20 MV/m
  - 2 attempts to go higher, sparking at 21.5
  - back off, >100k spark-free pulses at 21 MV/m
  - try again, 60k pulses at 23 MV/m, sparking
  - back at 20 MV/m, sparking
  - B-field sweep at 19+ MV/m
    5k pulses at 2.5, 2, 1.5, 1, 0.5T (1 spark at 0.5T)
- Start conditioning at B=0T Mar 23, 2013
  - >100k pulses at 24+ MV/m after some conditioning
  - didnot hold at 25 MV/m for >50k pulses
- Back to B$\neq$0
  - >100k pulses at 19 MV/m
  - didnot hold at 20 MV/m for >50k pulses
- Stopped Apr 9, 2013
  - >3M pulses total
  - cavity removed from solenoid

Next steps

- Inspect interior
  - Clean room cleaning later today
- Install fiber for light detection?
- Reassemble
  - Seals on order
- Reinstall in solenoid
  - after quench training (to 5T)
- Data at >3T
- Analysis just starting
  - conditioning history
  - spark events
  - RF waveforms (pickup, forward, reflected)
  - radiation monitors (ionization chambers)
  - X-ray detector (NaI crystal + PMT)
  - vacuum pressure
  - cavity temperature (P. Hanlet)
  - acoustic sensors (P. Lane, P. Snopok)