Normal Conducting RF

R&D Program

RF R&D Outline

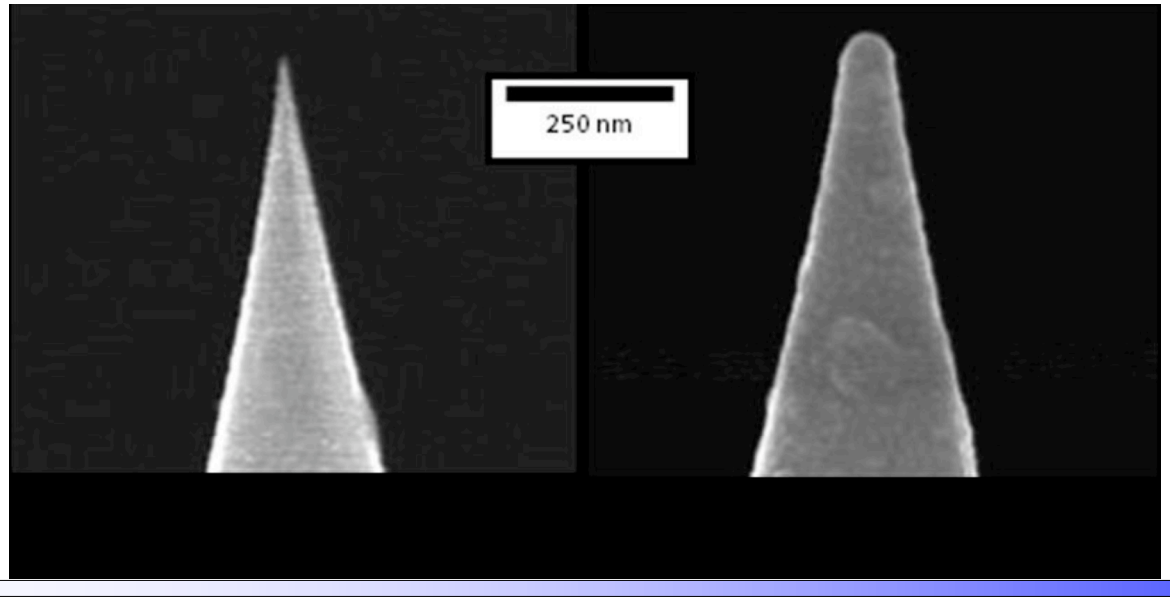
- 4 areas of research
  - Cavity processing using SRF techniques
  - Atomic Layer Deposition ALD
  - Magnetic Insulation of Cavities
  - High Pressure RF Cavities
- R&D Plans
- Cost Breakdown
- Time Line

Cavity Processing with SRF Techniques

- 201 MHz Cavity Fabrication
  - Made from spun copper
  - Electro polished
  - High power rinsing
  - Required minimal processing to achieve gradient

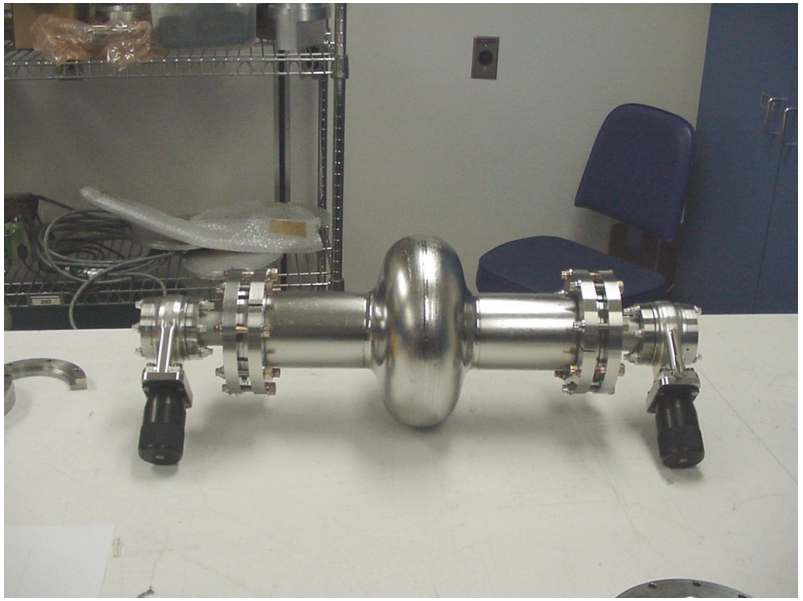
Cavity Processing with ALD

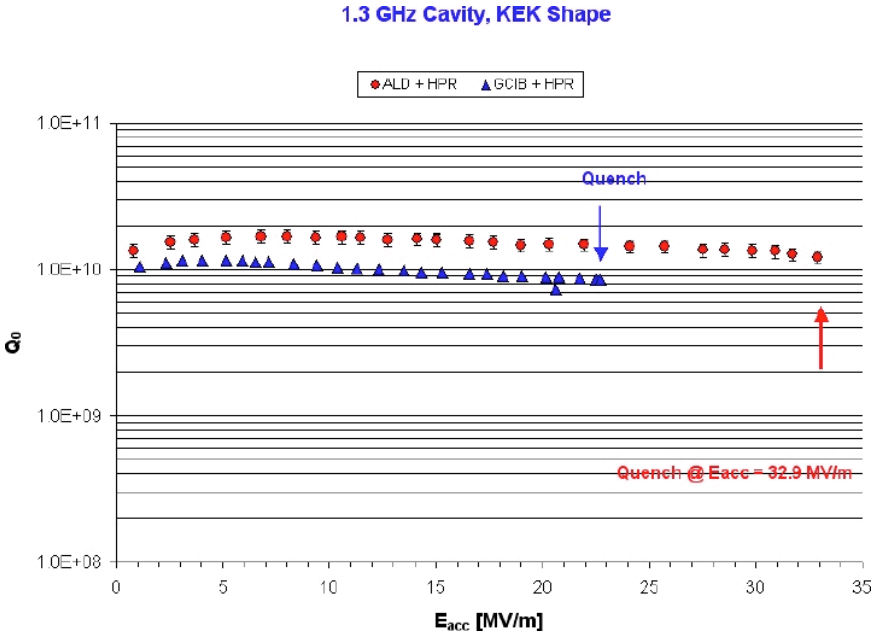
- Atomic Layer Deposition (ALD)
  - Chemical process
  - Nanometer films of Nb, AL_2O_3, MgB_2,TiN, NbN…
  - Rounds features of asperities reduces arcing
  - Change in work function reduces arcing



Cavity Processing with ALD

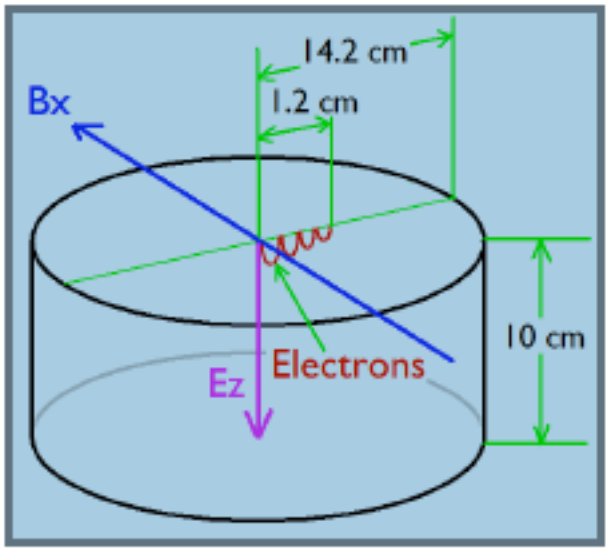
- Single-cell cavity ALD coated by Jerry Moore, Jim Norem, Mike Pellin, Jeffrey Elam at Argonne
  - Alumina barrier layer plus niobium oxide coating
- Cavity prepared and tested at JLab by Peter Kneisel
  - Result equaled best previous performance with no FE

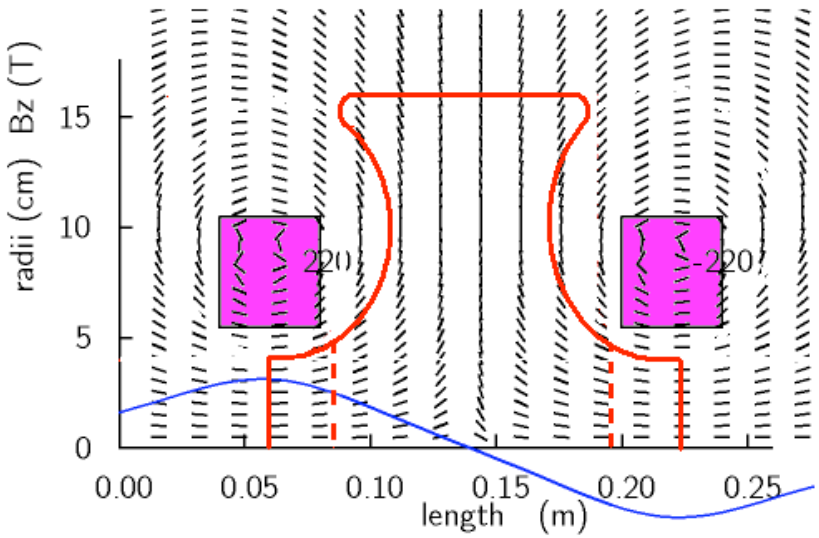




Magnetic Insulation

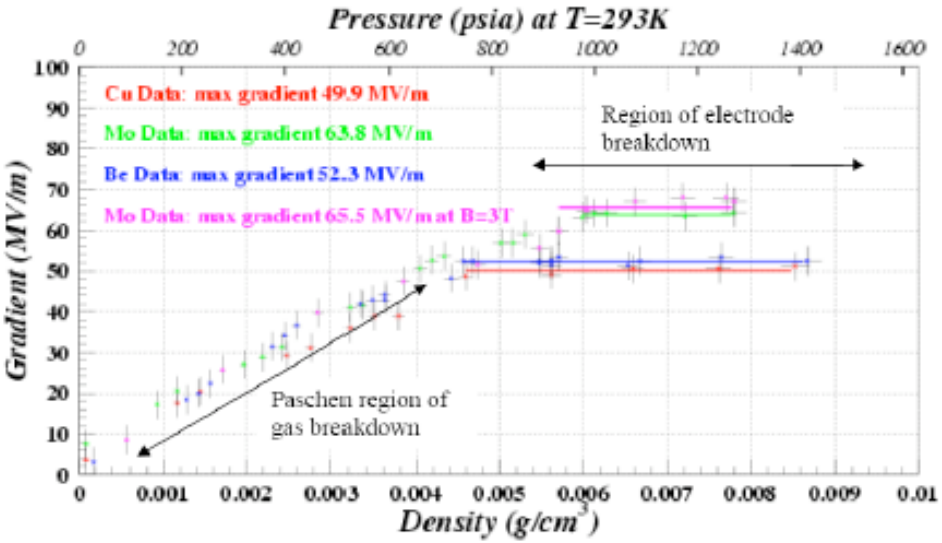
- By orienting the cavity to have high gradient surfaces parallel to the magnetic field, emitted electrons are guided to low gradient surfaces, reducing arcing

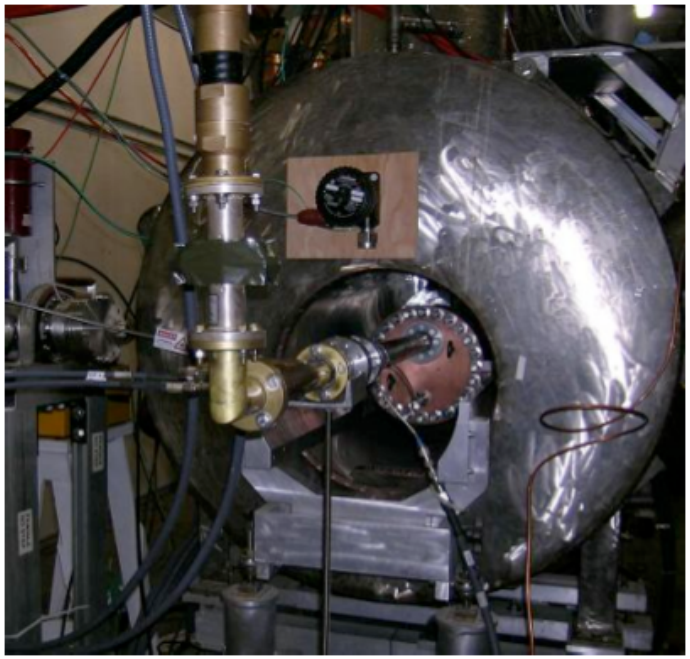




High Pressure RF Cavities HPRF

- Cavities pressurized to 100 bar with H_2 reduces arcing
- H_2 acts as absorber in cooling channel





R&D plans

- Cavity processing
  - Test 201 MHz cavity adjacent to multi Tesla magnetic field
  - Build a 805 MHz cavity modeled after the 201 MHz cavity and test immersed in magnetic field
  - Continue button testing of various cavity materials
- ALD
  - Test ALD cavity in a magnetic field
  - Test durability of ALD films
  - Build an ALD processed 805 MHz accelerating cavity
- Magnetic Insulation
  - Study performance of 805 MHz cavity in two orthogonal magnetic field alignments. Requires a cavity that can be rotated inside the magnet.
- HPRF
  - A beam test of a HPRF cavity in MTA.
  - If beam test successful, build a accelerator cavity

Cost Breakdown

2.2 COMPONENTS & TESTS: Cooling Channel RF

	FY08	FY09	FY10	FY11	FY12	NOTES
2.2.0 Travel&Workshop						**Bross**
M&S (K$)	0	0	0	0	0	
Engineers	0	0	0	0	0	
Techs (FT	0	0	0	0	0	
Post Docs	0	0	0	0	0	
Scientists	0	0	0	0	0	
2.2.1 MTA RF Operations						**Bross**
M&S (K$)	90	110	110	110	110	
Engineers	1	0.25	0.25	0.25	0.25	
Techs (FT	1	1	1	1	1	
Post Docs	0	0	0	0	0	
Scientists	0	0.25	0.25	0.25	0.25	
2.2.2 Vacuum RF						**Bross/Moretti**
M&S (K$)	90	150	150	75	75	
Engineers	0	1.5	1.5	0.75	0.75	
Techs (FT	0	1.5	1.5	0.25	0.25	
Post Docs	0	0	0	0	0	
Scientists	1.162	0.5	0.5	0.5	0.5	
2.2.3 High Pressure RF						**Yonehara**
M&S (K$)	200	20	150	0	0	
Engineers	2	0	1	0	0	
Techs (FT	3.5	0	0.5	0.5	0	
Post Docs	0	0.5	1	0.5	0	
Scientists	1	0.5	1	0.5	0	
2.2.4 Atomic Layer Deposition RF						**Norem**
M&S (K$)	0	300	100	100	100	
Engineers	0	1	0	0	0	
Techs (FT	0	0.5	0.5	0	0	
Post Docs	0	1	1	0	0	
Scientists	0	1	1	1	1	
M&S	**380**	**580**	**510**	**285**	**285**	
FTE	9.662	9.5	11	5.5	4	
SWF	**1530.5**	**1507.5**	**1732.5**	**967.5**	**742.5**	
TOTAL	**1910.5**	**2087.5**	**2242.5**	**1252.5**	**1027.5**	

Time Line

- Cavity processing
  - 2009 cavity fabrication
  - 2010 cavity testing
- ALD
  - 2009 cavity fabrication
  - 2010 cavity testing
- Magnetic Insulation
  - 2009 test setup preparation
  - 2010 cavity testing
- HPRF
  - 2009 cavity testing
  - 2010 cavity modifications