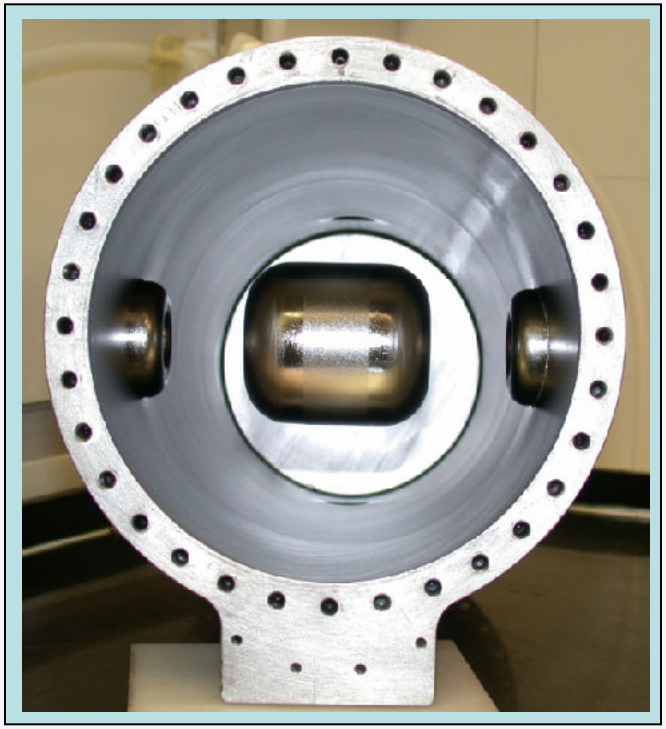
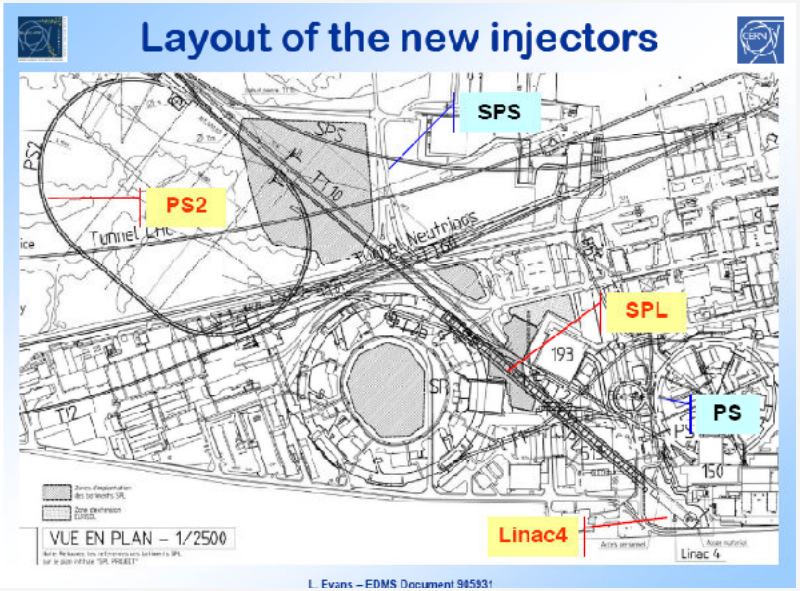


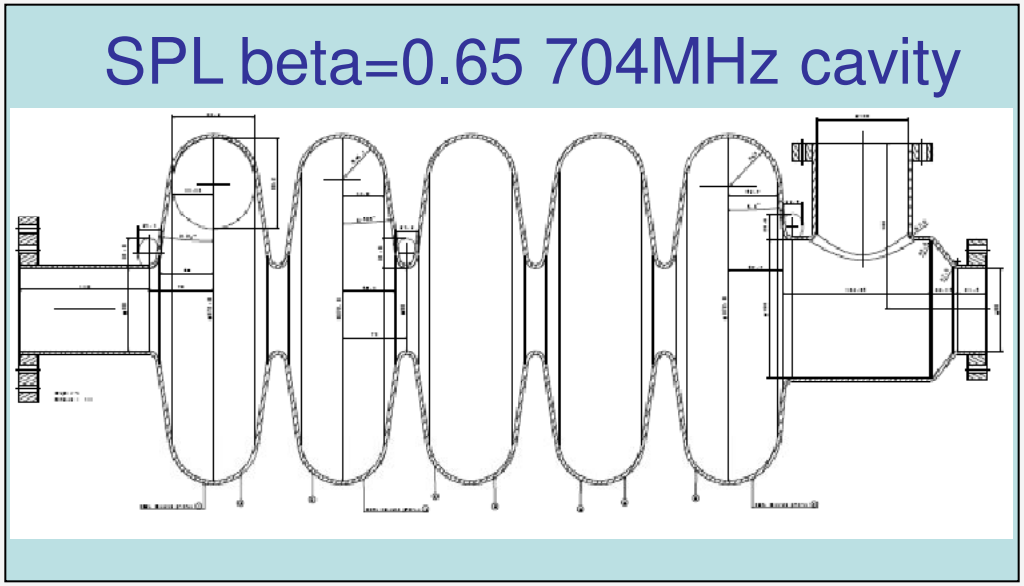
TRIUMF Involvement in the SPL

Bob Laxdal, TRIUMF

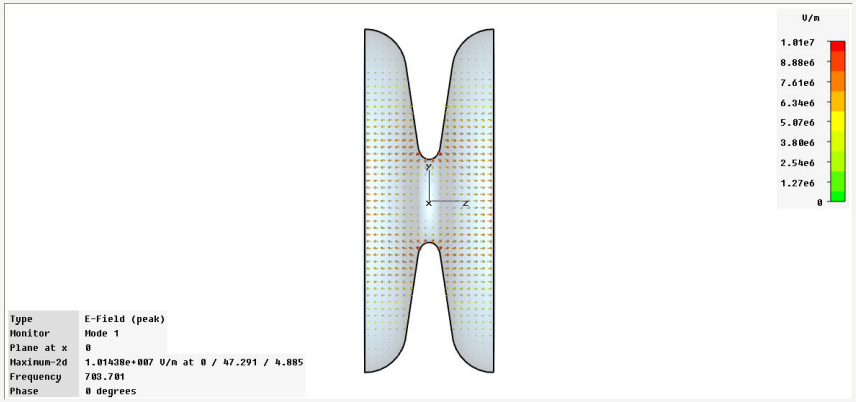
TRIUMF/CERN Collaborations

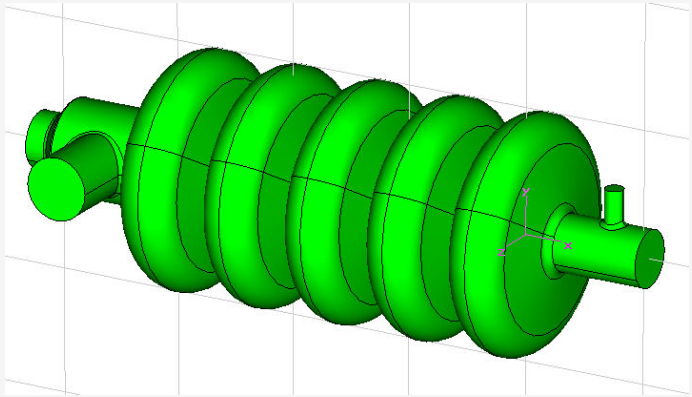
- TRIUMF has a long history of collaborations with CERN both on LHC and ISOLDE
  - Canadian contribution to LHC organized through TRIUMF
- TRIUMF – Five year plan proposal includes funds to support Canadian contribution to International Accelerator Projects at ~4M$, 4FTE's – announcement Feb. 2010
  - Prototype one SPL 704MHz (beta=0.65) cavity with PAVAC
  - Contribute to SPL building phase as allowed by funding
  - Contributing to HOM analysis with Beam Physics group



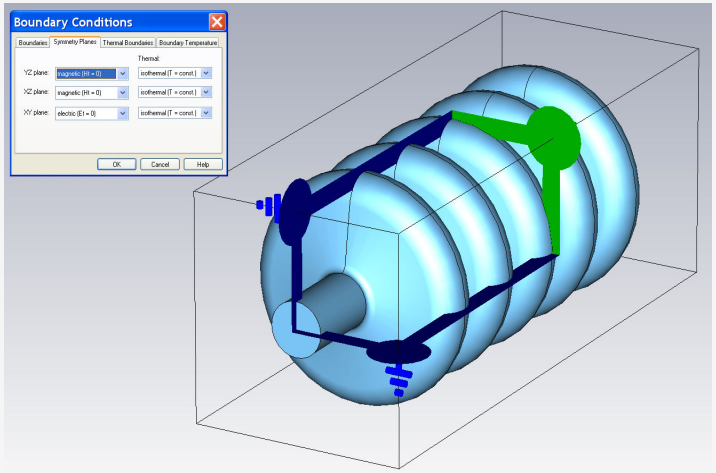


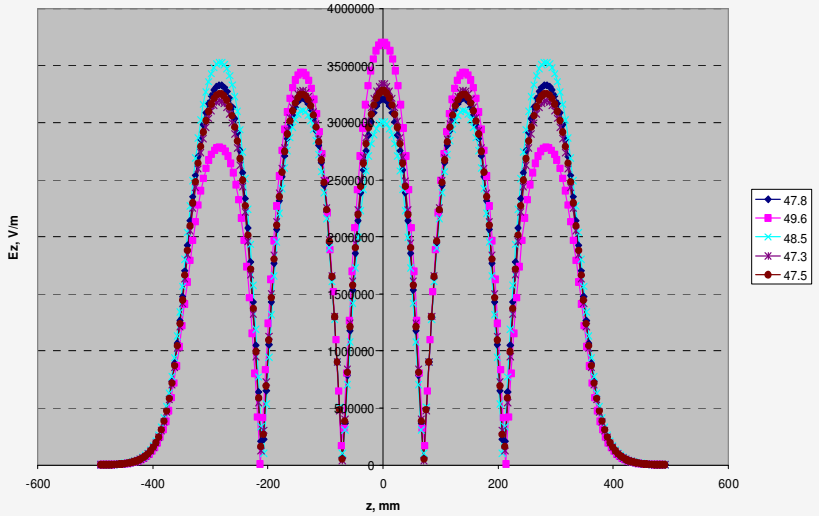
SPL 5 cell 704 MHz Cavity Optimization. EM Design





1) Tuning of inner and outer cells for operational frequency

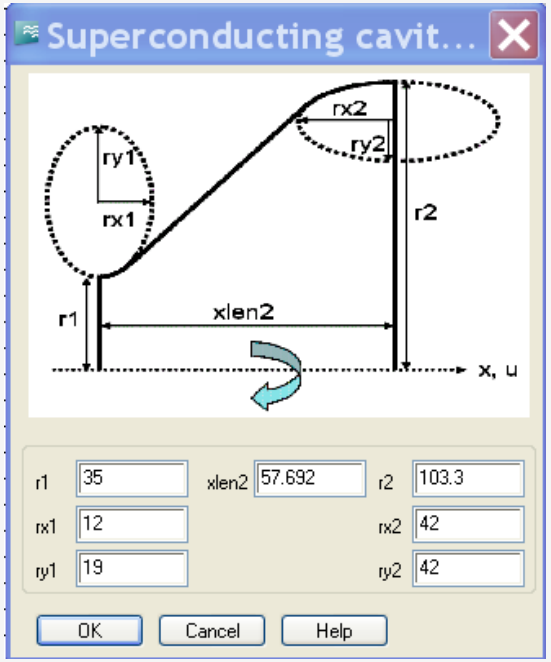




2) Symmetrical cavity modeling and tuning of flatness for pi-mode

SPL 5 cell 704 MHz Cavity Optimization

- Iris diameter varied to look at dependence of cavity performance parameters
- Impact on shunt impedance, Epeak, Bpeak and cell to cell coupling
- Suggestion from Sang-Ho choose R_{iris}-> k=1.5%

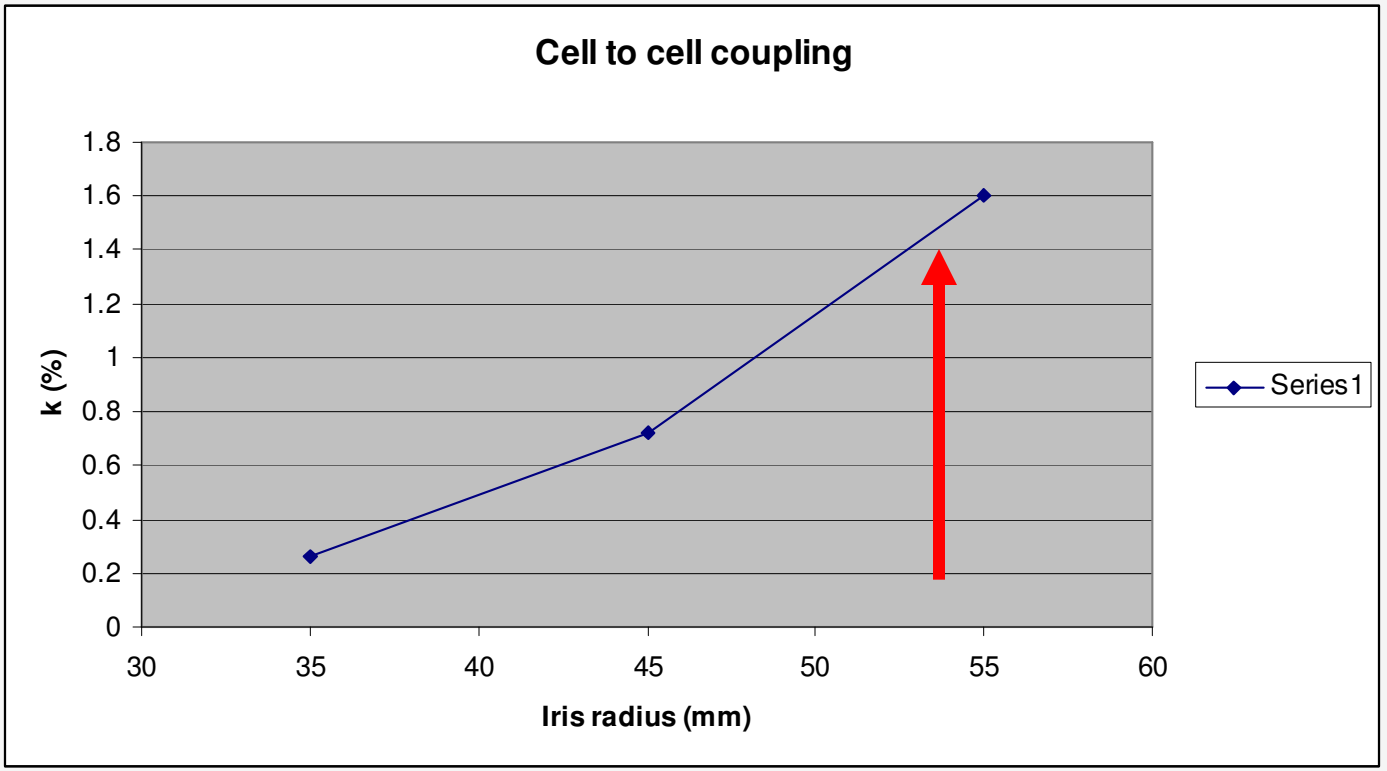


Variable | **RF Parameters**

Riris mm	bo	TTFo	U/Ea^2 J/(MV/m)^2	Rsh/Qo Ohm	RsQo Ohm	Ep/Ea	Bp/Ea mT/(MV/m)	k
35	0.69	0.74239	0.266698	415.3876	197.6048	2.091534	4.518078	0.002613
45	0.7	0.73722	0.313307	353.5884	202.3743	2.597187	4.868853	0.007197
55	0.71	0.72395	0.377958	293.1205	211.5948	3.037027	5.098117	0.015754

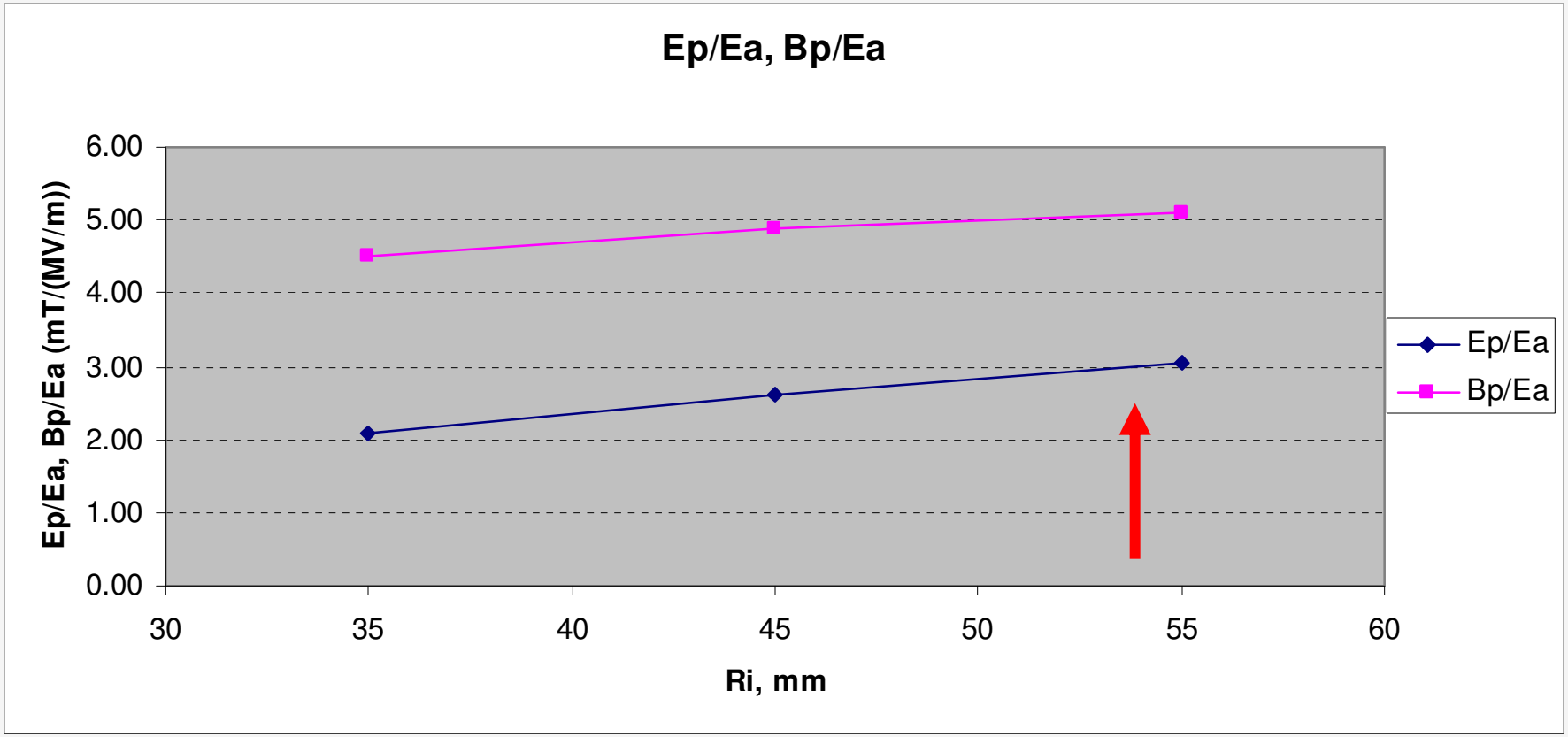
SPL 5 cell 704 MHz Cavity Optimization

- Field parameters as a function of iris diameter



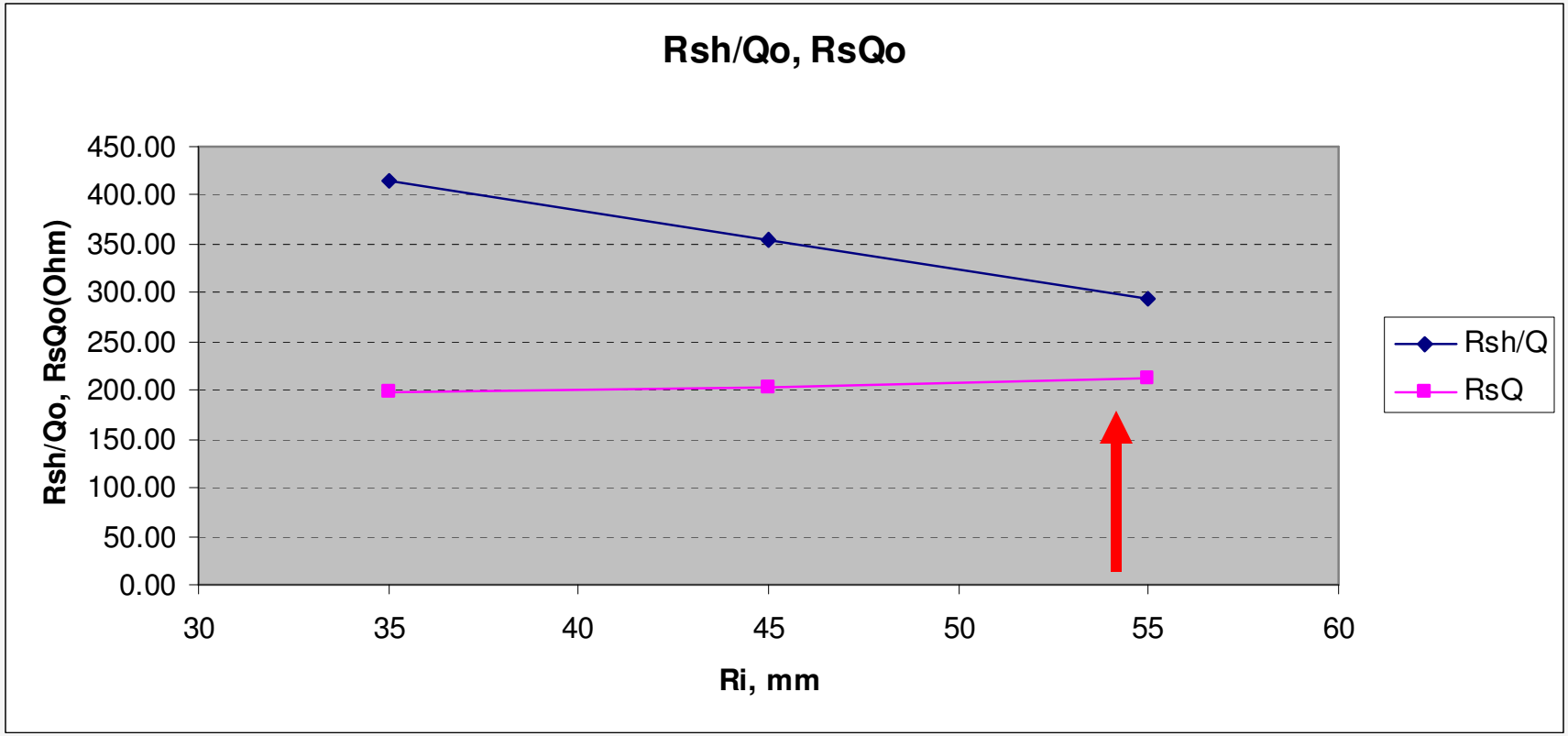
SPL 5 cell 704 MHz Cavity Optimization

- Field parameters as a function of iris diameter
- *For Ea=15MV/m: Ep=45MV/m and Bp=77mT*



SPL 5 cell 704 MHz Cavity Optimization

- Field parameters as a function of iris diameter



TRIUMF

Some numbers

Ea (MV/m)	15
Veff (MV)	10.5
R/Q (ohms)	300
Rs (nohms)	20
G (ohms)	210
Qo	1.10E+10
Pcav cw (W)	33.41
Bp (mT)	77
Ep (MV/m)	45

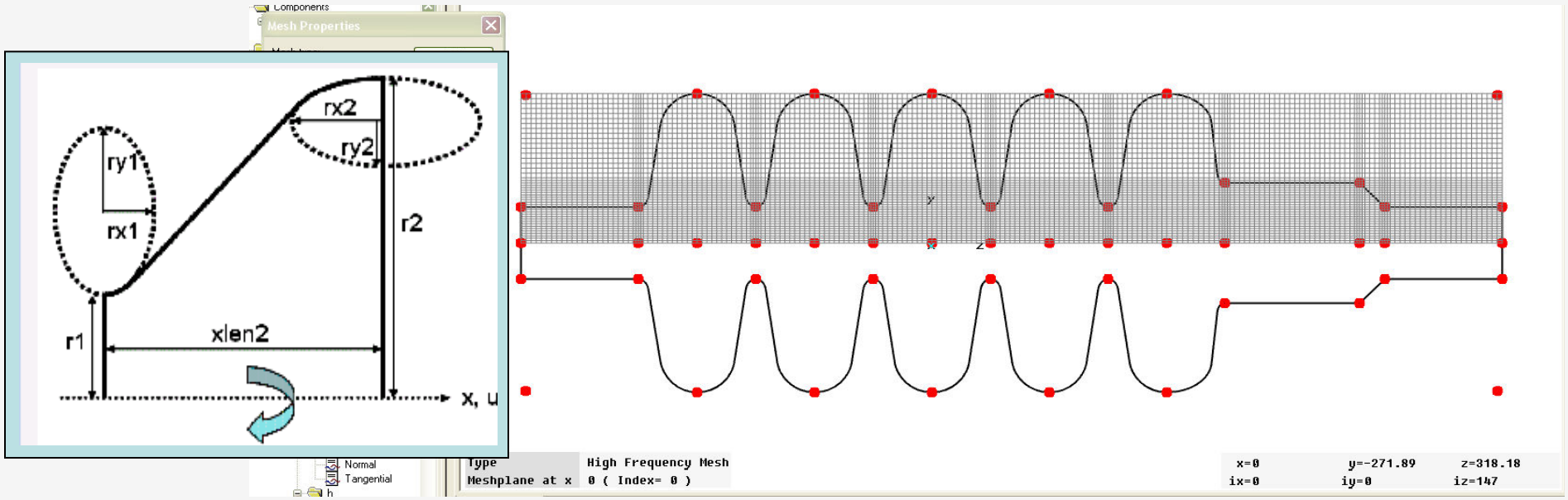
Beta=0.65 asymmetric modeling

TRIUMF

cell	inner	end	coupler enc
sr1	45	45	75
srx1	12.1	12.2	9
sry1	15.8	15.9	12.8
sr2	186.4	186.4	186.4
srx2	45.1	44.46	53.45
sry2	45.1	47.5	39
sxlen2	70	70	69.1

Orsay

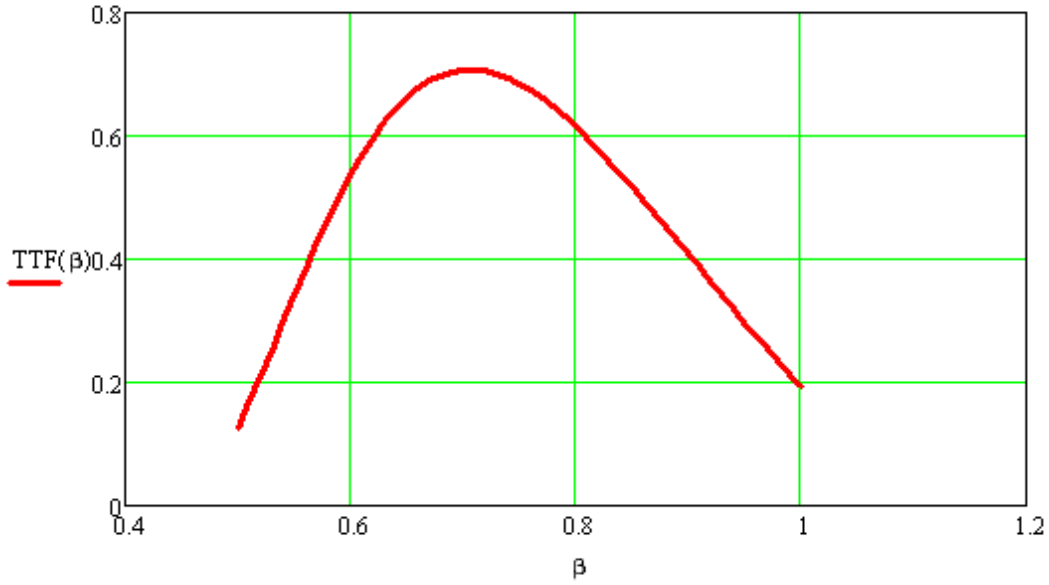
cell	inner	end	coupler enc
sr1	39	40	60
srx1	12.3	12.3	12.3
sry1	14.8	14.8	14.8
sr2	181.8	181.8	181.8
srx2	45.5	44.85	53.08
sry2	45.5	45.5	53
sxlen2	65.2	65.2	65.2



Transit Time Factor

- Definition of beta_0 based on cell length or optimized TTF?
- $\beta\lambda/2$=13.8mm for 704MHz and β_g=0.65 but gives β_{0TTF}=0.71

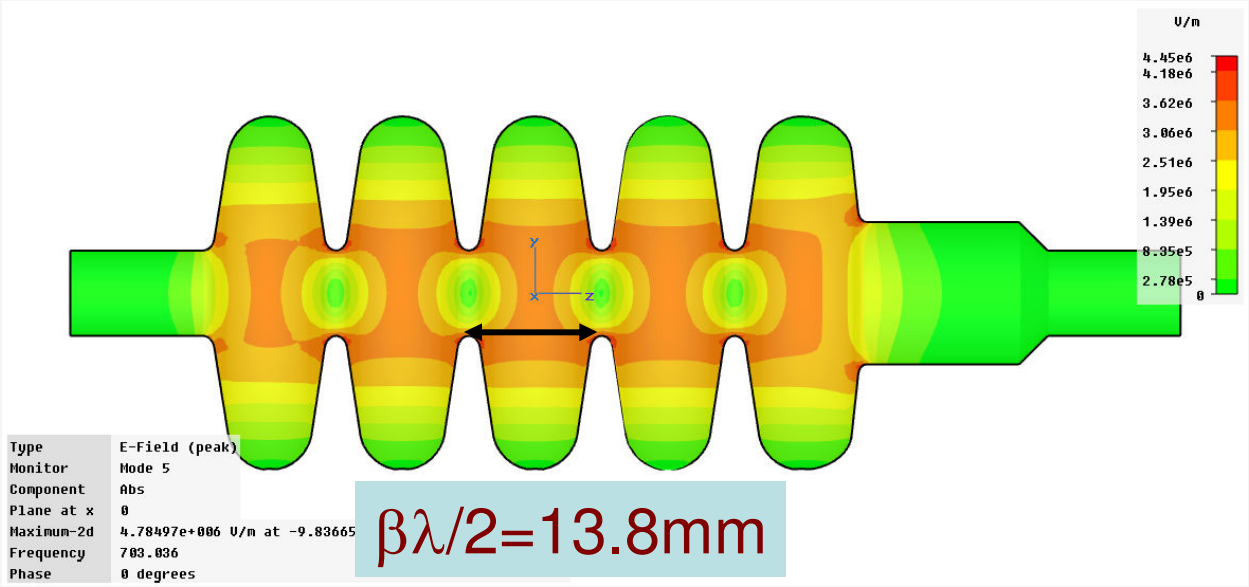
$$TTF(\beta) := \frac{\left| \sum_{n=0}^{N} \left[Ez_n \cdot e^{j \cdot \frac{2 \cdot \pi \cdot f \cdot (z_n)}{\beta \cdot c \cdot 1000}} \right] \right|}{\sum_{n=0}^{N} |Ez_n|}$$



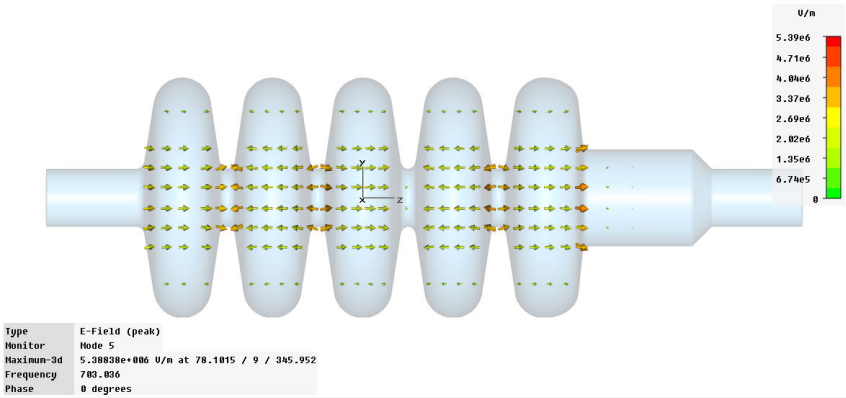
Some parameters (R_{iris}=45mm)

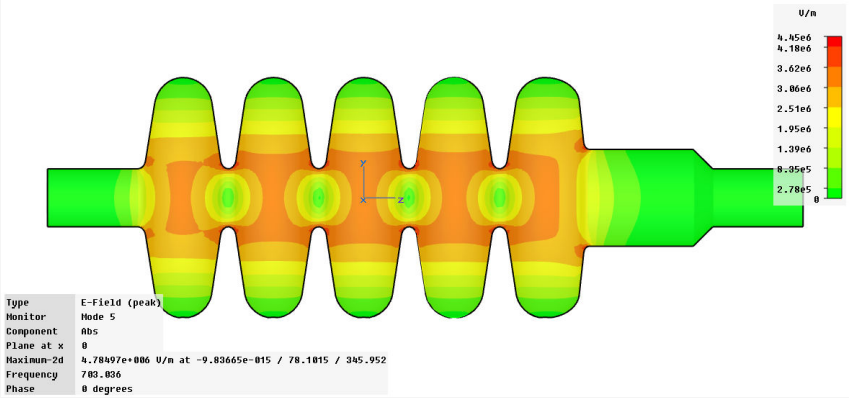
Riris	f1	f2	f3	f4	f5
mm	MHz	MHz	MHz	MHz	MHz
45	695.95	697.95	700.35	702.29	703.04

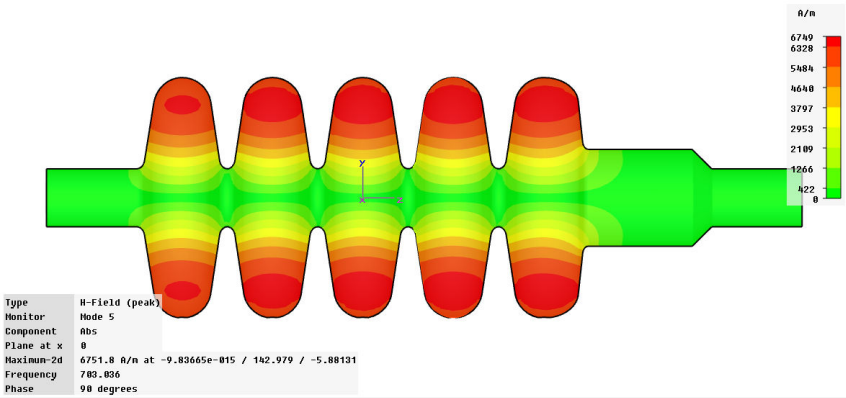
bo	TTFo	Rsh/Qo	RsQo	Ep/Ea	Bp/Ea	k
		Ohm	Ohm		mT/(MV/m)	
0.71	0.70724	338.14	207.50	2.52	4.82	0.007248

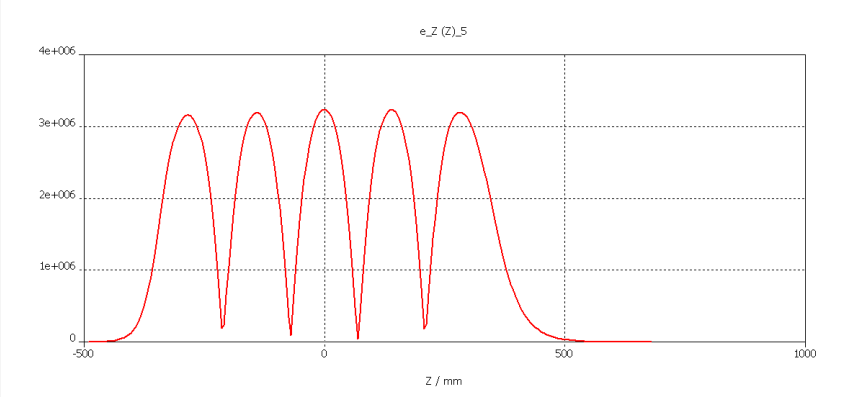


Cavity Fields



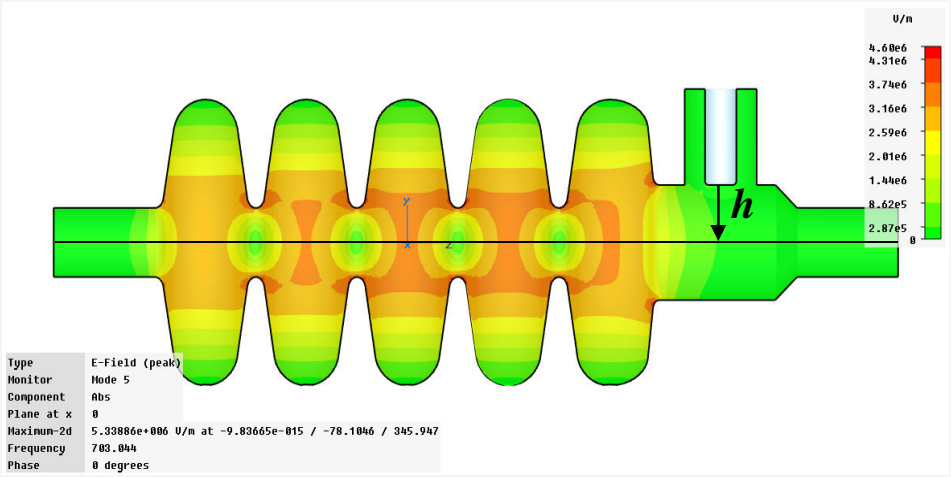


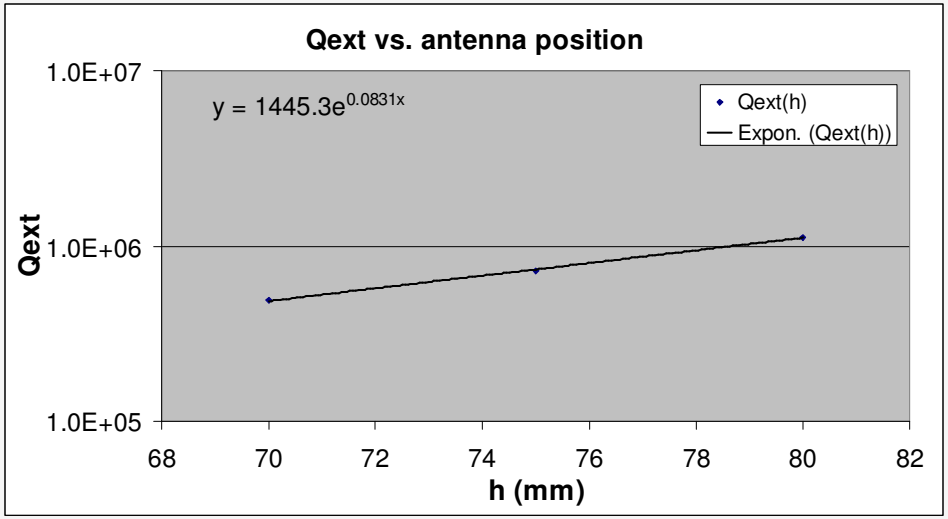




Coupling

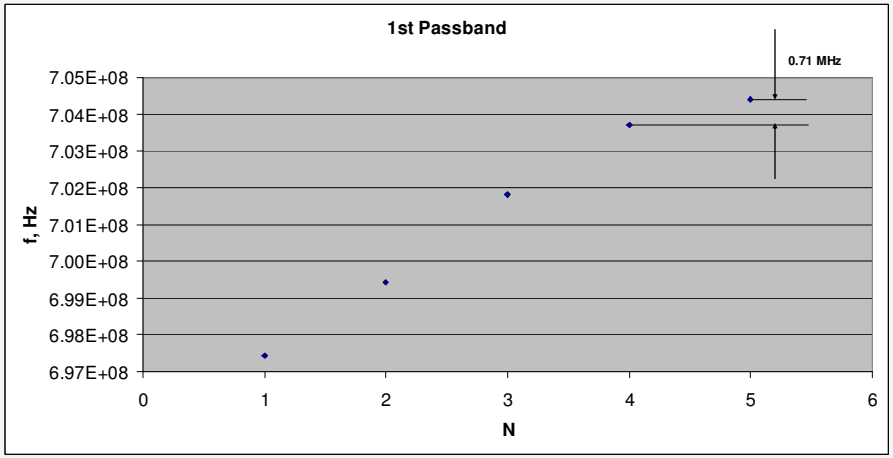
- Sensitivity of coupling to position of antenna

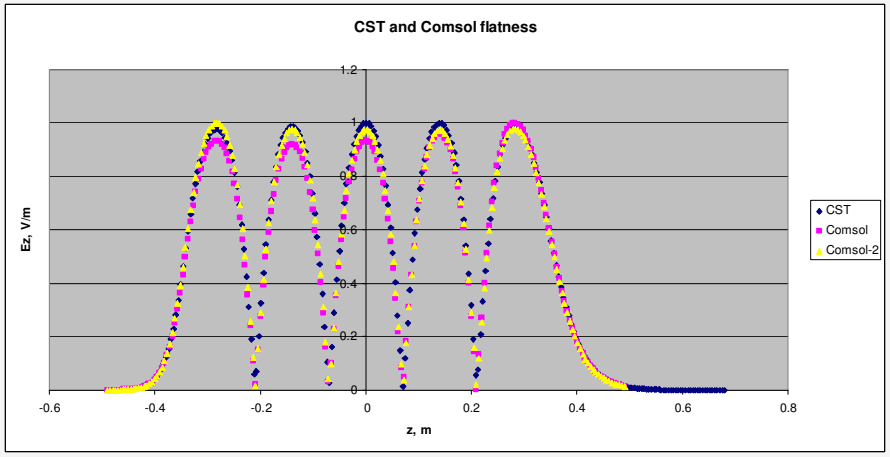


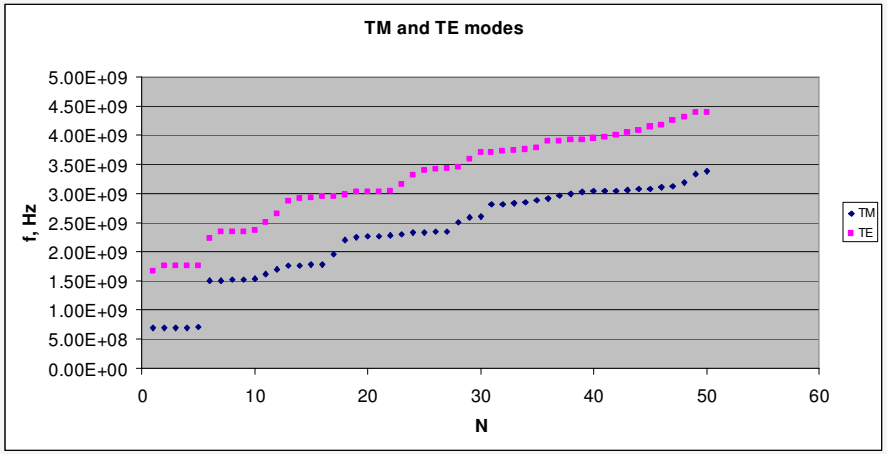


Mode Analysis

- The same geometry was modeled in COMSOL-2D
- Provides initial study of cavity modes

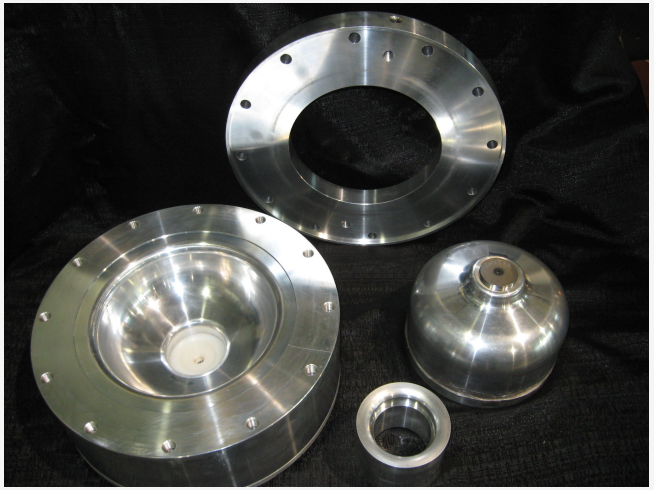






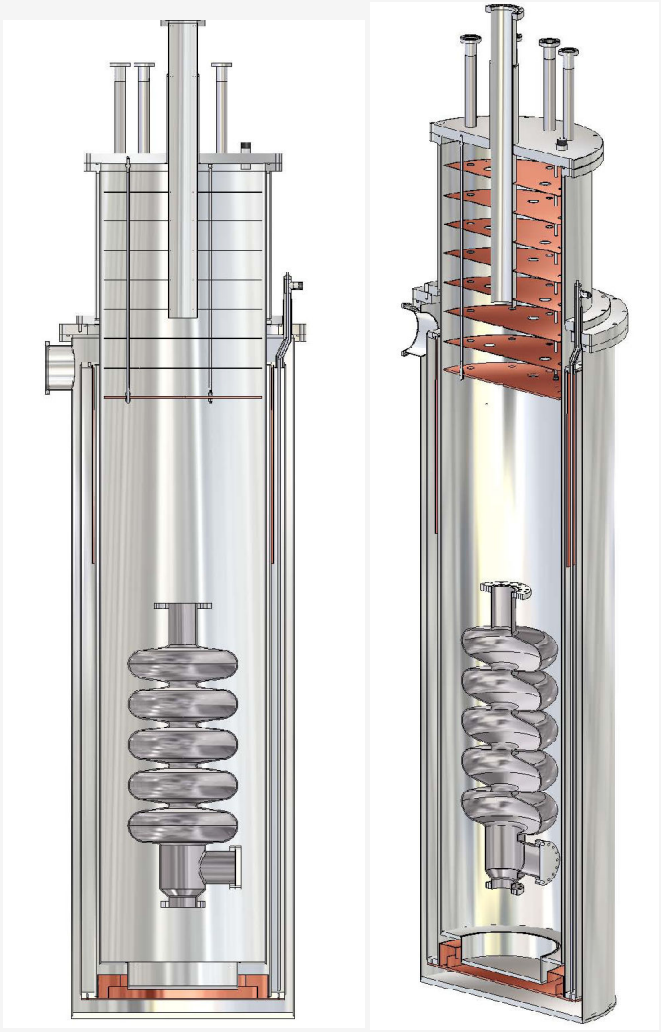
Cavity Dev't with PAVAC

- PAVAC now producing a number of single cell cavities at 1.3GHz
  - Produce and test fixtures, FNAL/RRCAT dies and Nb
  - Forming/welding tests
  - Cavity production and testing
- Initial discussions on forming and welding fixtures for 704MHz cavity



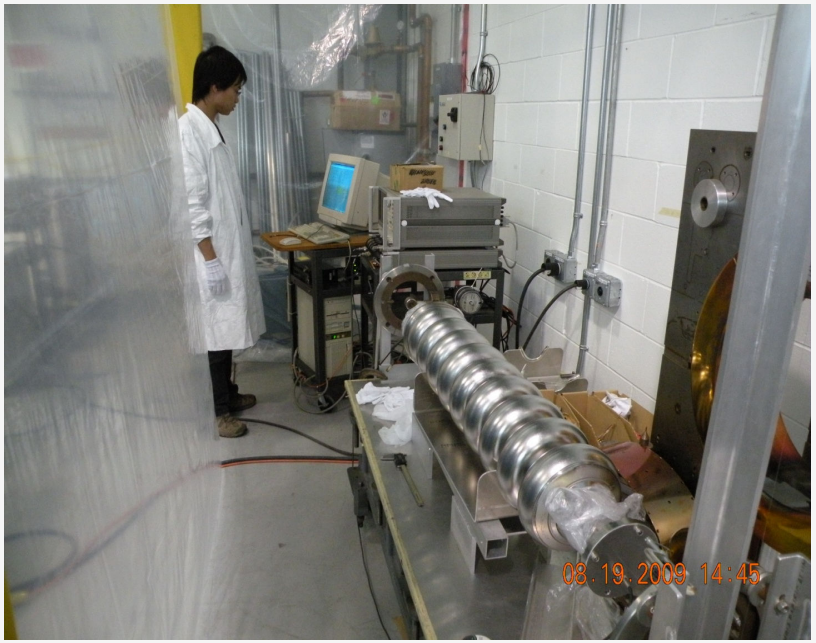
TRIUMF Infrastructure

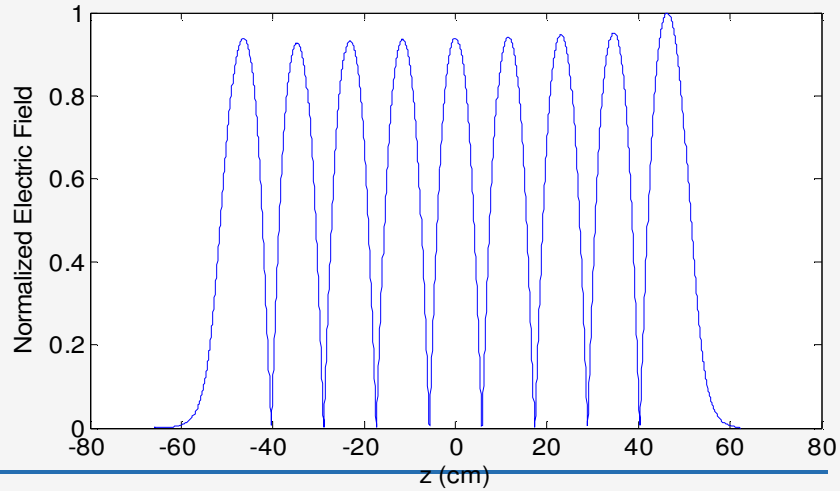
- TRIUMF quarter wave cryostat can be outfitted as a bath cryostat for 5 cell 704MHz testing
- Need to design the top assembly
- HPWR and BCP exist at TRIUMF



Bead Pull Measurement Setup

- Bead pull apparatus set-up
- Warm tuner being designed in collaboration with U of T
- Other ancillaries in design
  - Vertical high pressure water rinse
  - String assembly frame





Where are we

- SPL progress slow due to ISAC-II Phase II demands (ends Spring 2010) and e-Linac dev't (ongoing)
  - Two new positions opened in SRF group to be filled in Jan. 2010
- Rf modeling on-going at TRIUMF and Orsay – discussing collaboration meetings
  - Beam tube diameters, Rf fields, external coupling, Mode analysis
- Setting up a FEA mechanical model
  - To determine the size of the sheet and the location of the stiffening rings
- Quotes received for niobium – 4.2mm sheet
  - Estimate 510x510mm sheets required for half cells
- E-Linac funding announcement July 2009
  - Now securing building funds and preparing detailed budget
- TRIUMF five year plan announcement expected in Feb. 2010