# RFQ Repair and Installation Plans

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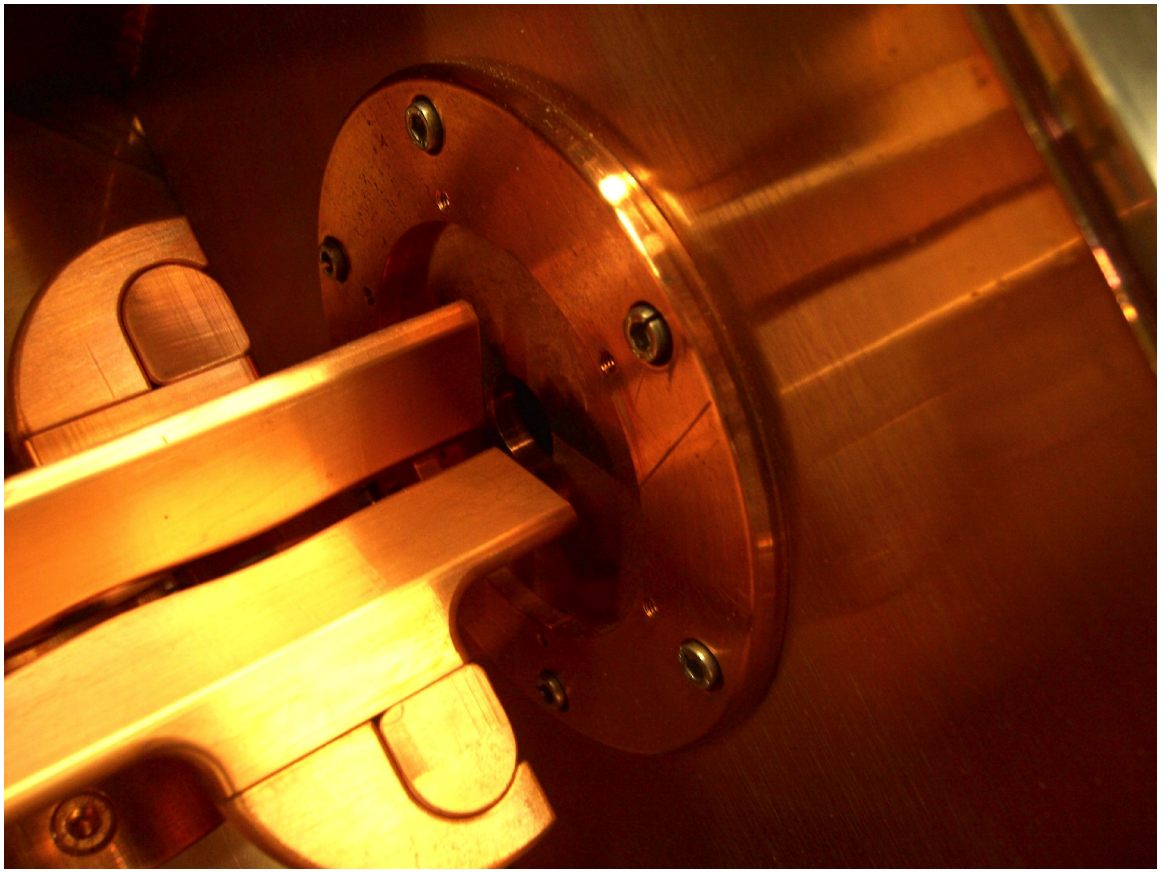
11 Jul 2012

# Simulations and Experiments

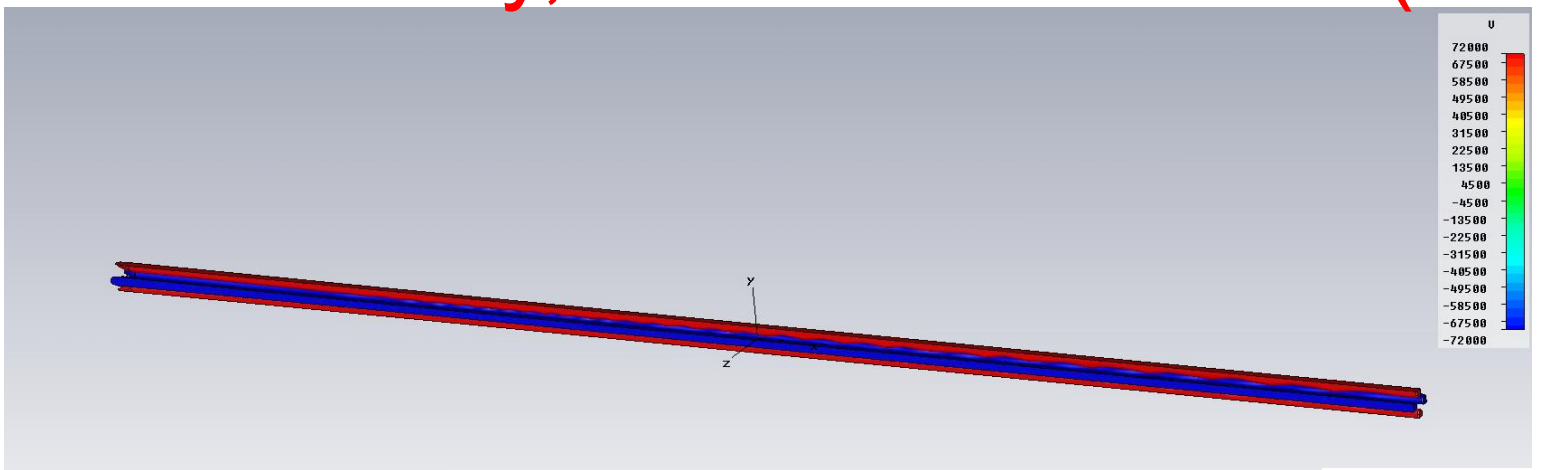
- CST Microwave studio and Particle in cell tracking
  - S. Kurennoy (LANL), G. Romanov (FNAL), J. Schmidt (U. Frankfurt)
- Simulations guided us to a fix for the energy.
- Thanks to the three groups who helped find the reason for the energy error

# Picture of end plate before removal



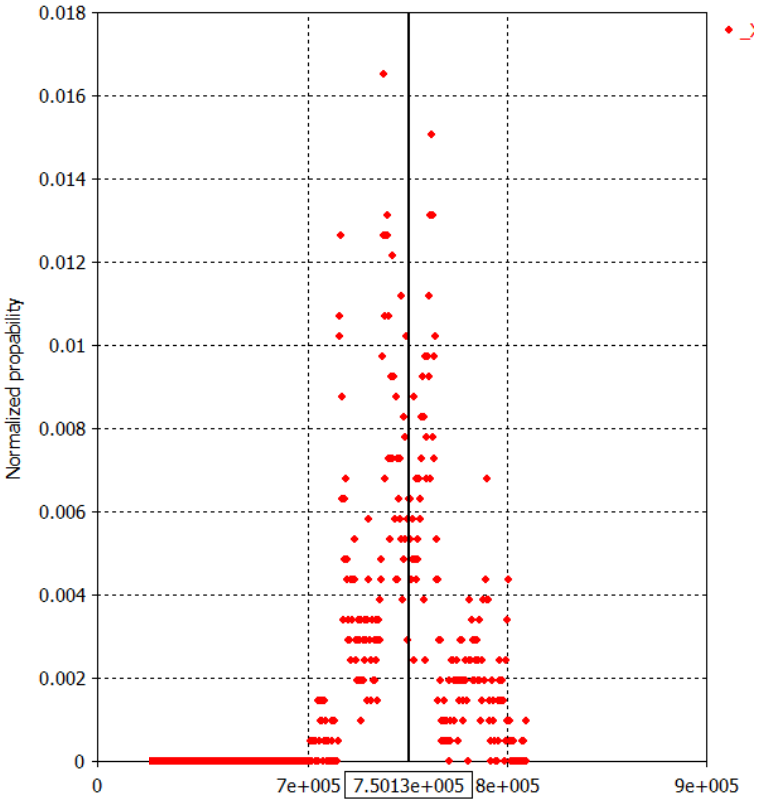
Increases hole size from 20 mm (diameter) to 100 mm (diameter)

# Rods only, beam accelerated (G. Romanov)

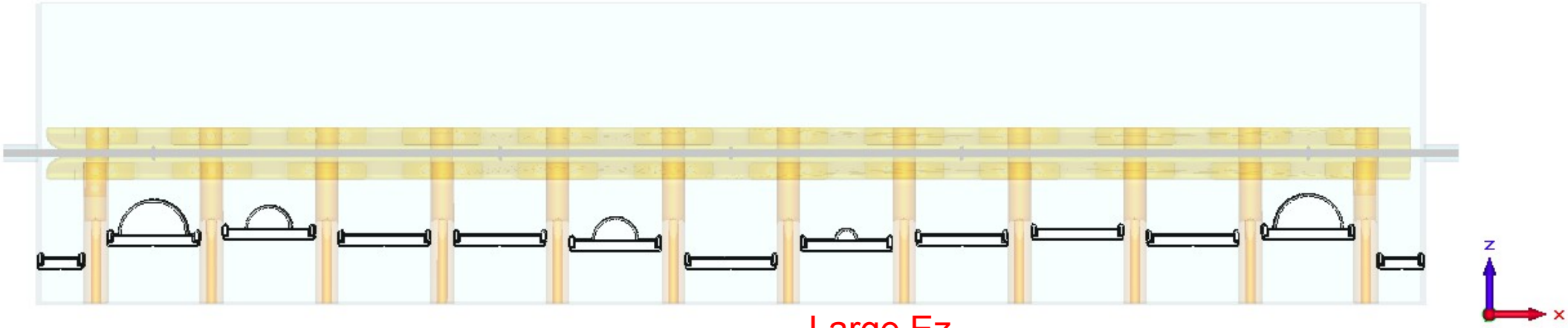



Energy of beam is 750 keV using engineering data for the vane modulations.

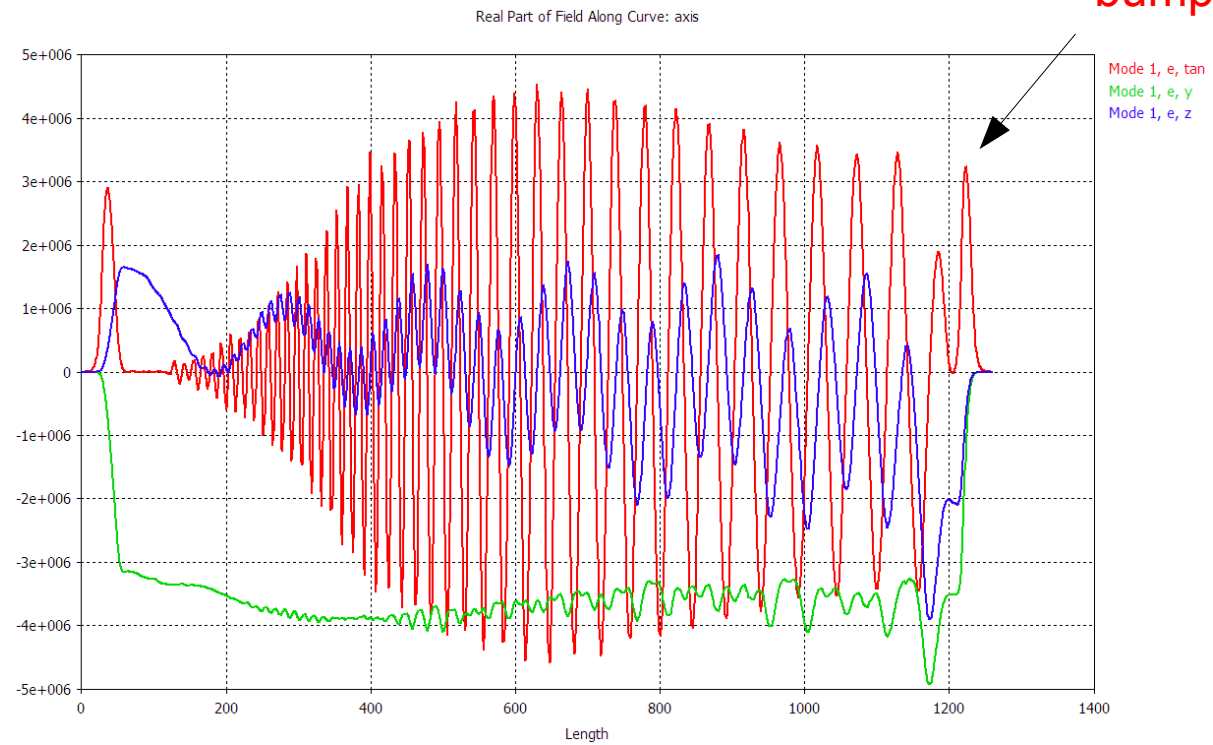
This simulation confirms that the PARMTEQM vane modulations are correct.



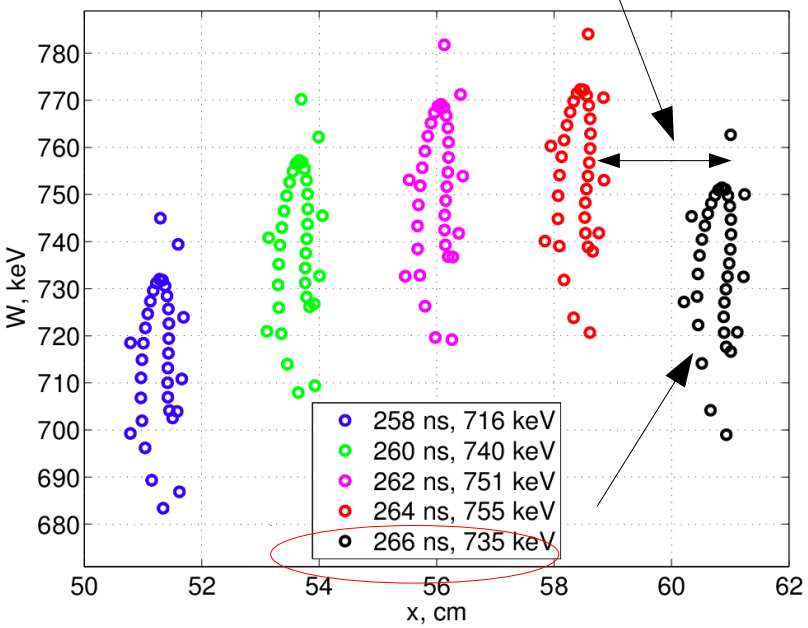
# 15 mm beampipe (S. Kurennoy)



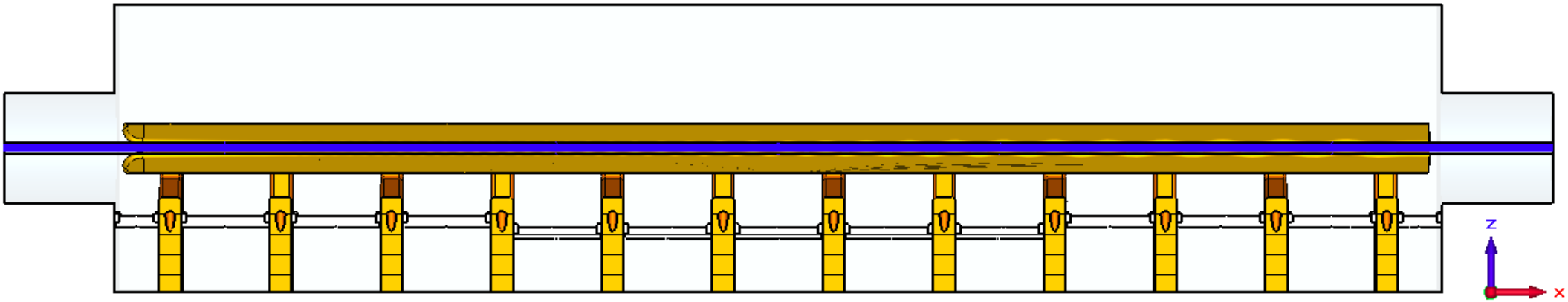

Large Ez
bump in gap



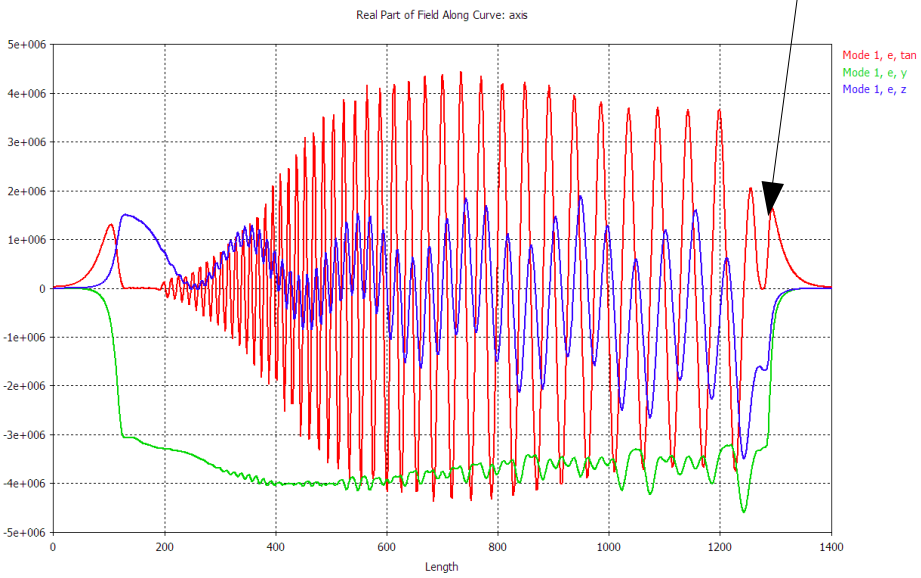

Energy
drop!



# 100 mm beampipe (S. Kurennoy)

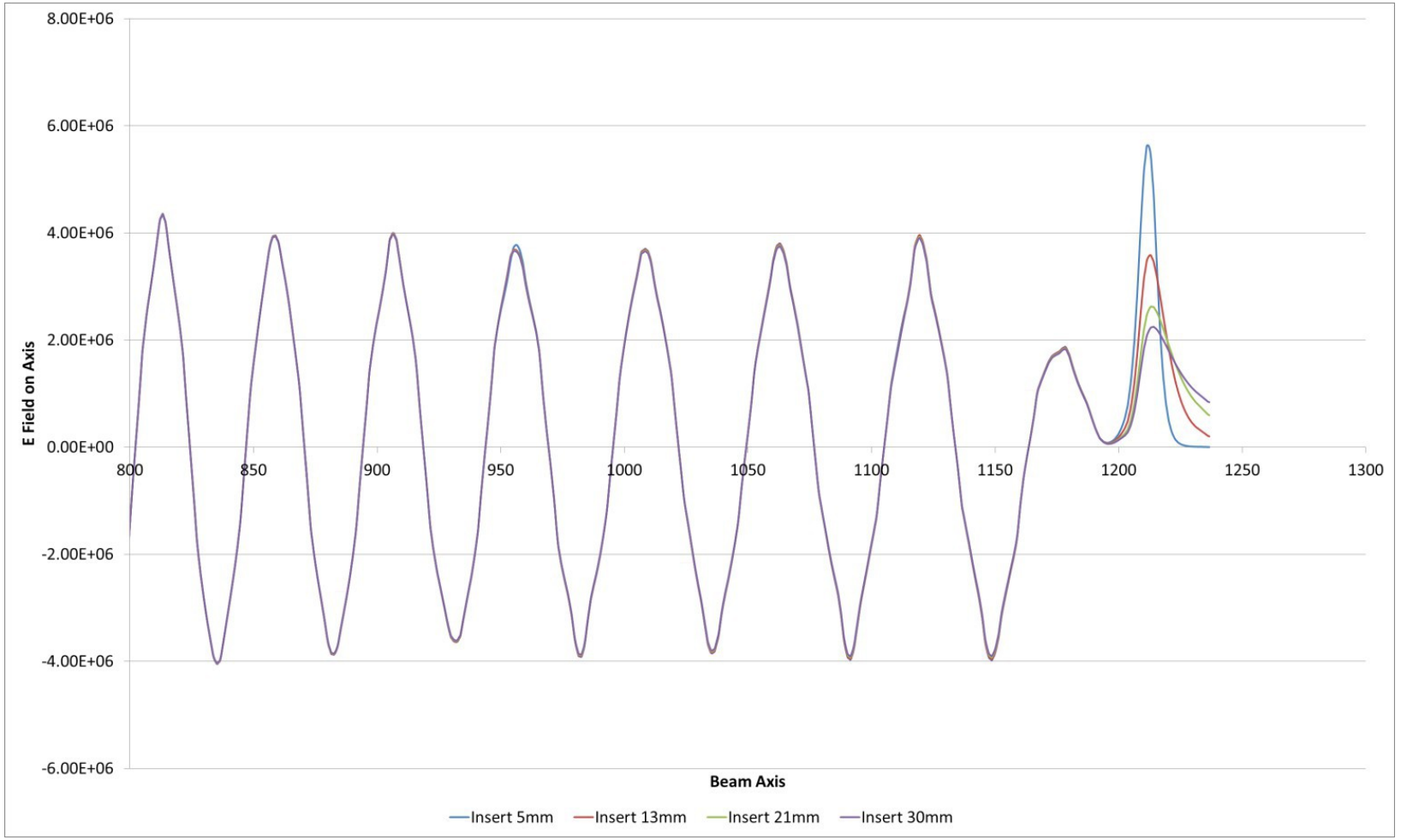



Smaller Ez bump



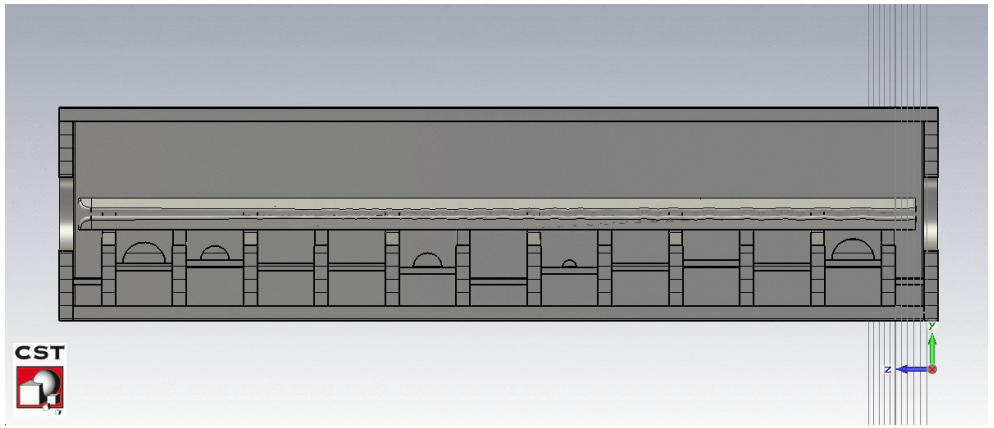

Energy is 753 keV.

# Gap Ez bump is reduced as the end plate aperture is increased (J. Schmidt)



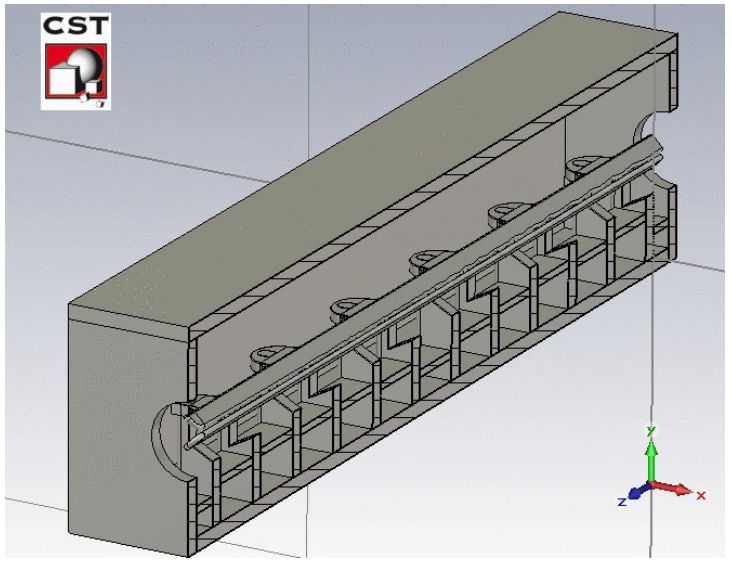

Resonant frequency increases from 200.39 MHz to 200.619 Mz from 5 mm radius to 30 mm radius hole.

# Resonant Frequency for different rod and half moon configs (J. Schmidt)

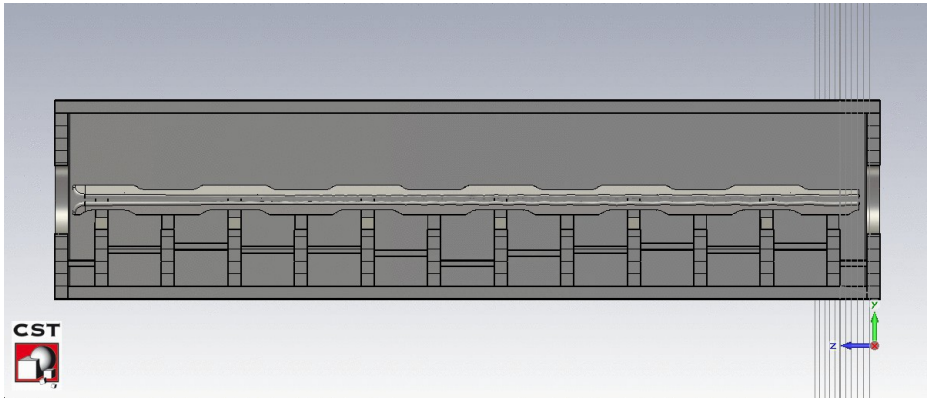



202.9 MHz with thick rods and half moons

Difference in frequency between the two means tuning plates are too close to the thin rods, i.e. inductance is too SMALL. Must move plates further away to increase inductance.

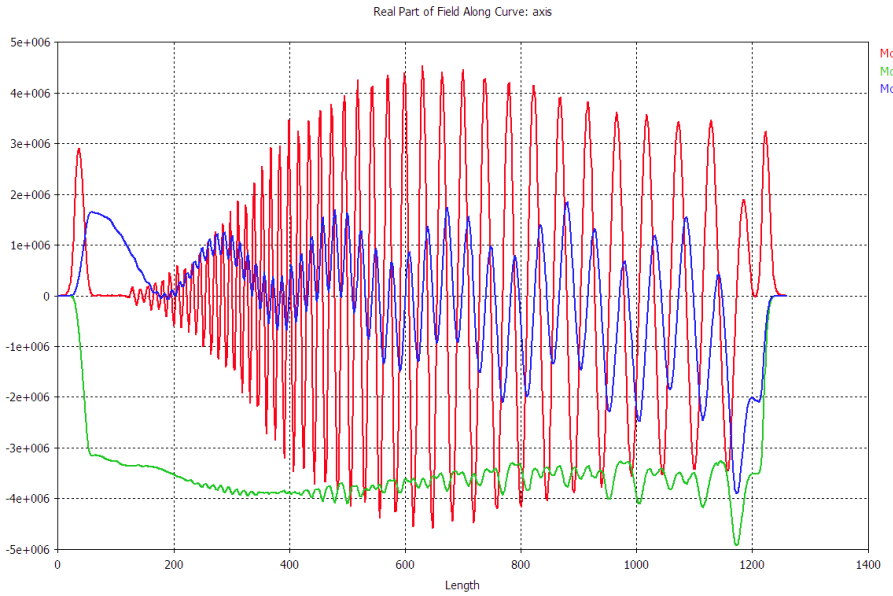



195.84 MHz with thick rods and no half moons

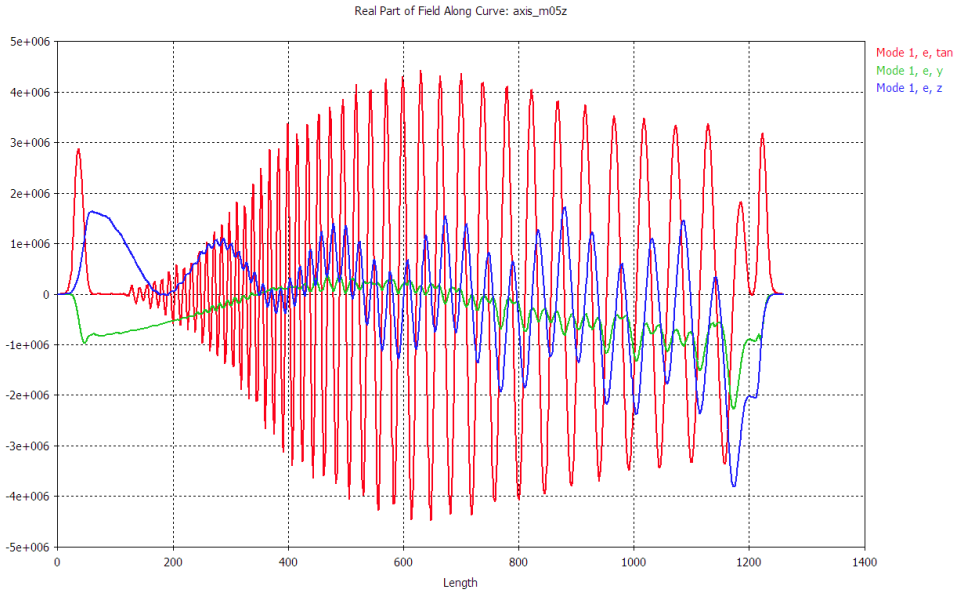



206 MHz, thin rods no half moons

# Fields are displaced vertically from half moons.




On geometric symmetry axis




-0.5 mm displacement vertically

Getting rid of half moon should fix this.

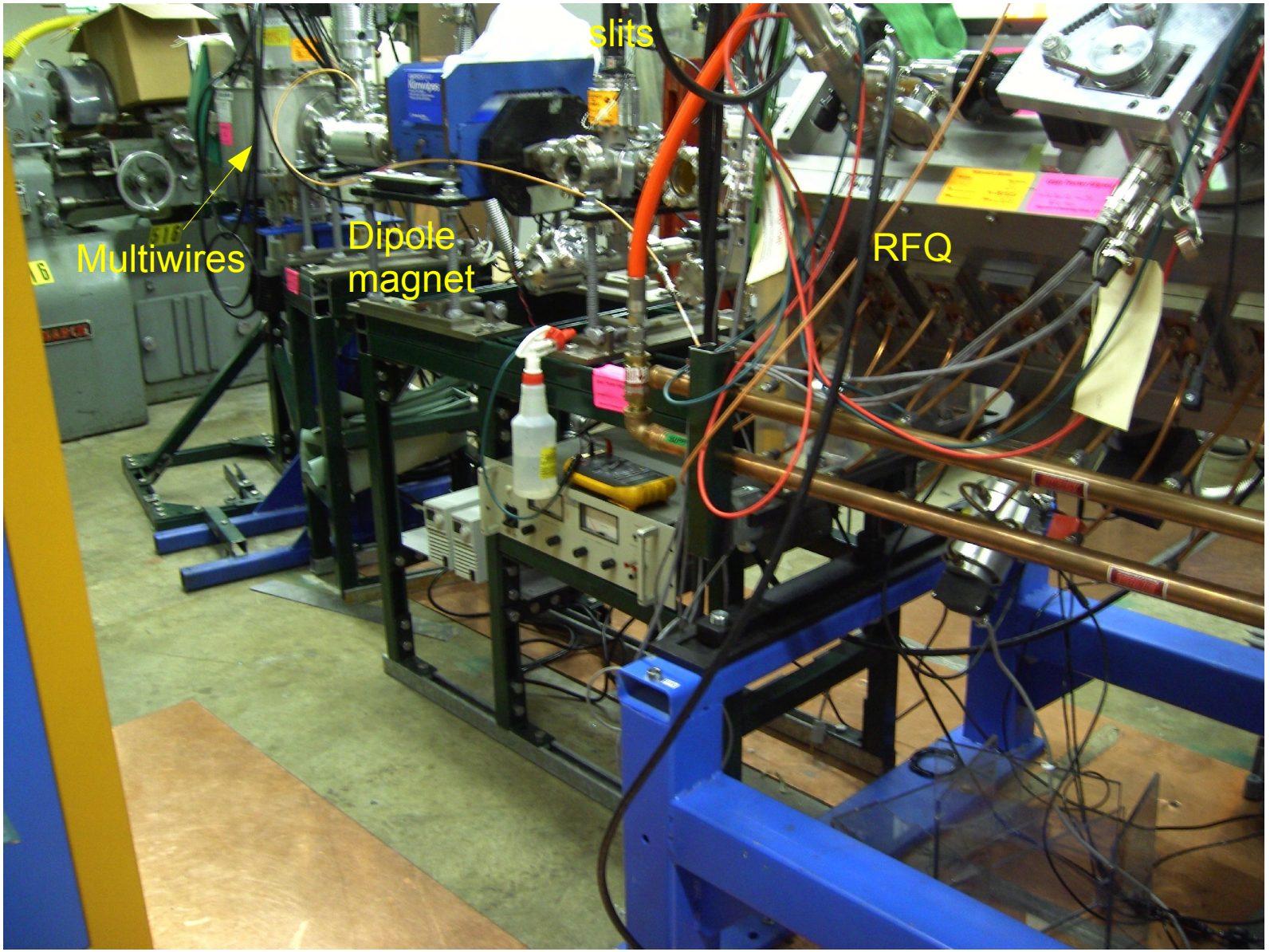
Better transmission efficiency?

# Experiment

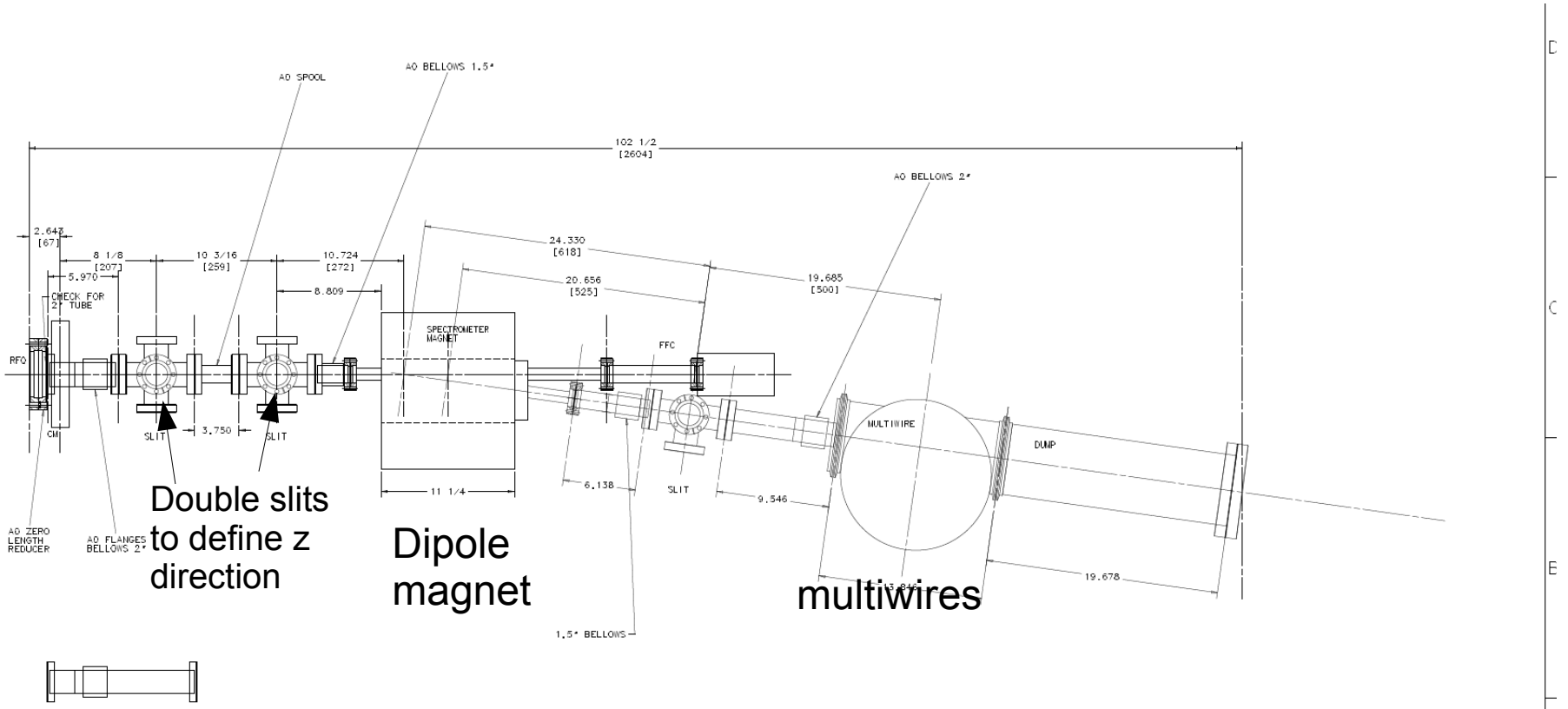
- From simulations done by S. Kurennoy (LANL), G. Romanov (FNAL) and J. Schmidt (U. Frankfurt) the Ez field between the rod and the end plate changes the energy of the beam.
- The goal is to measure the energy of the beam with the end plate removed.

# End Plate of RFQ removed

# Spectrometer



# Spectrometer layout

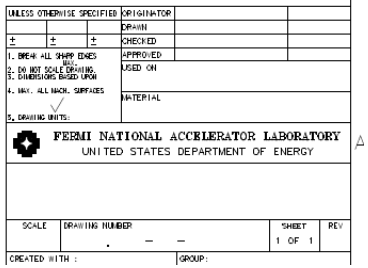



Double slits to define z direction

Dipole magnet

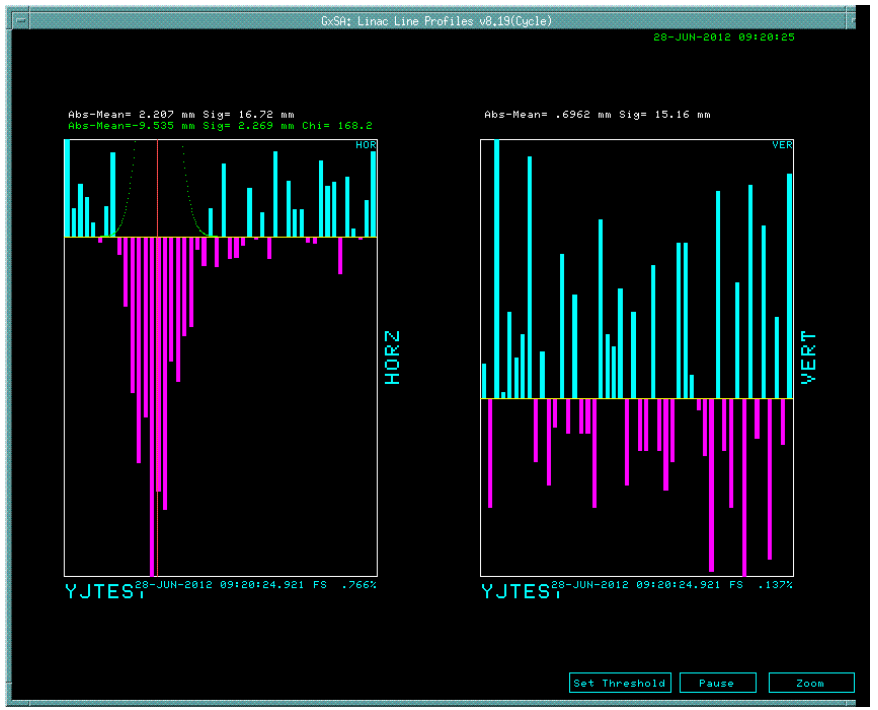
multiwires



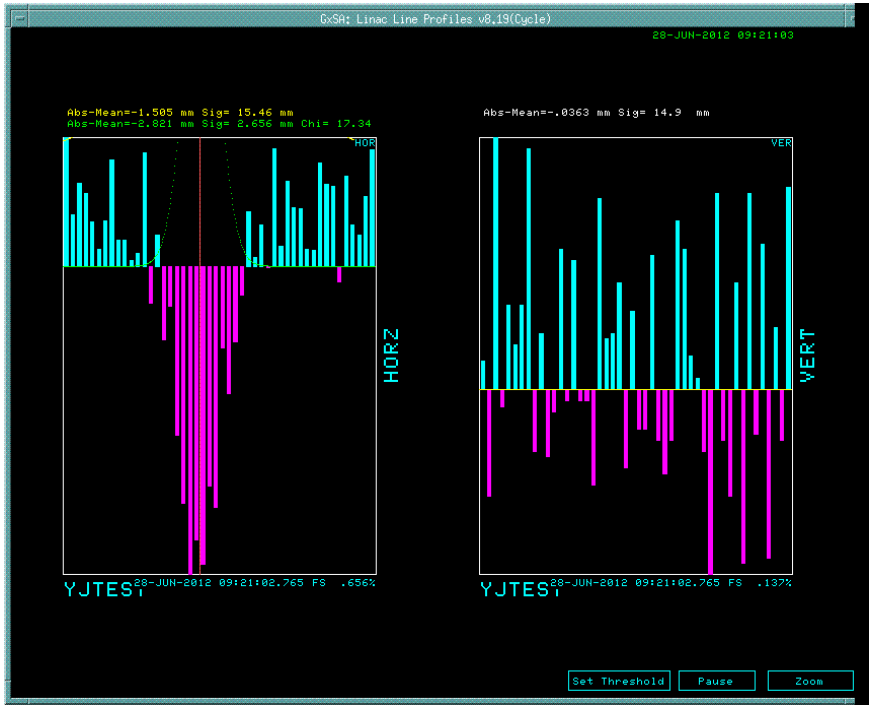



Dimensions and distances are approximate (things were moved).
Deflection angle required to get to centre of multiwires is 12 deg.

# Beam as seen on multiwires




Magnet at 7.2 A

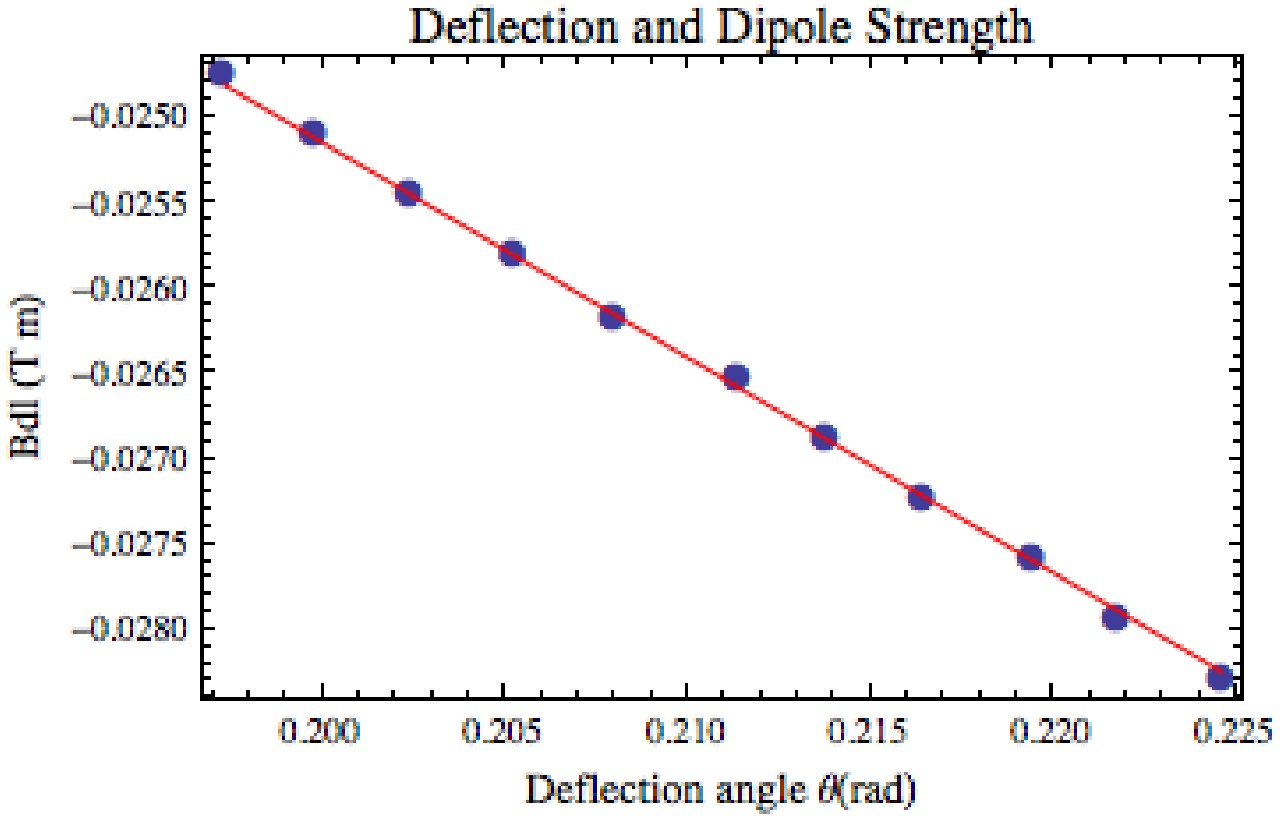



Magnet at 7.4 A

RFQ set to approx 170 kW of forward power, 3 kW reflected

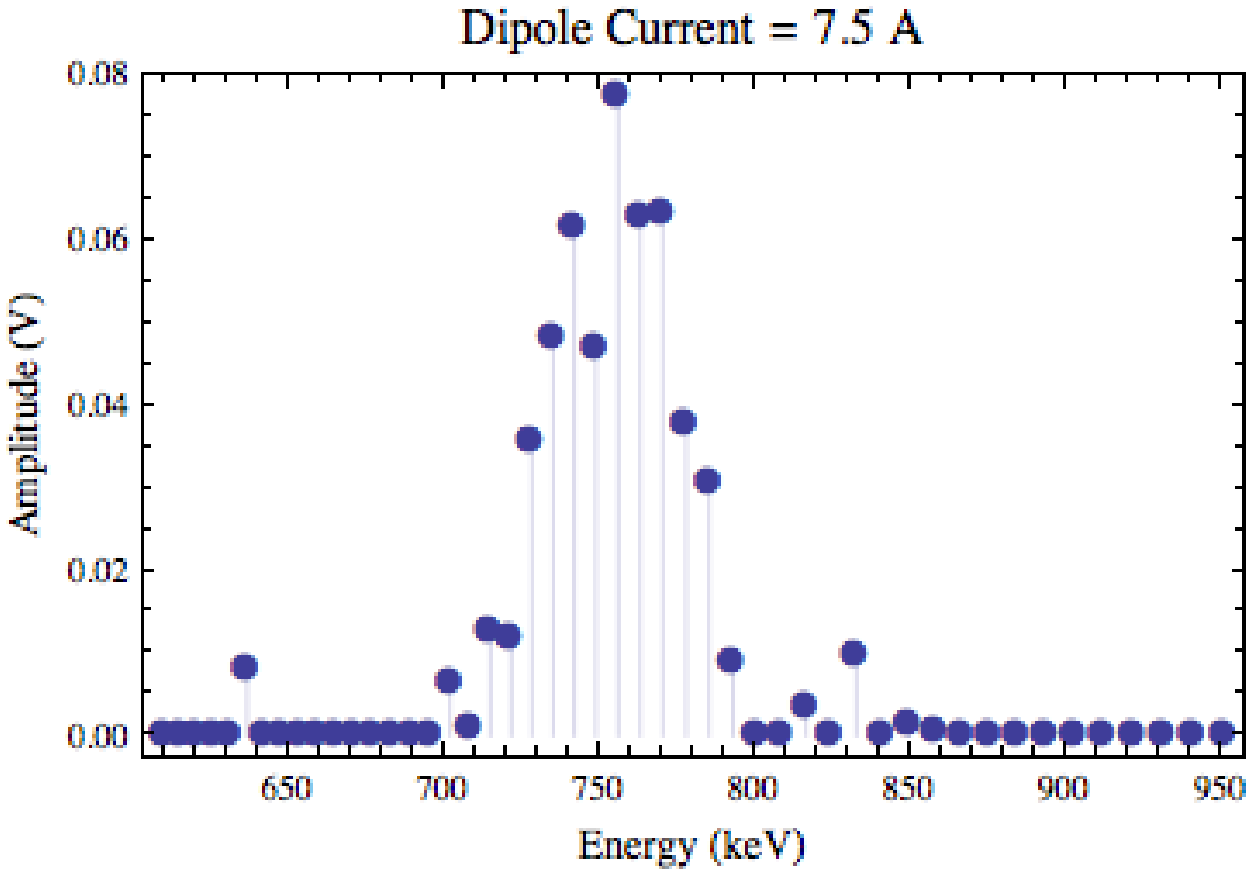
# Data Analysis

The position of the beam distribution is analyzed by tracking the average position as the dipole magnet strength is changed.



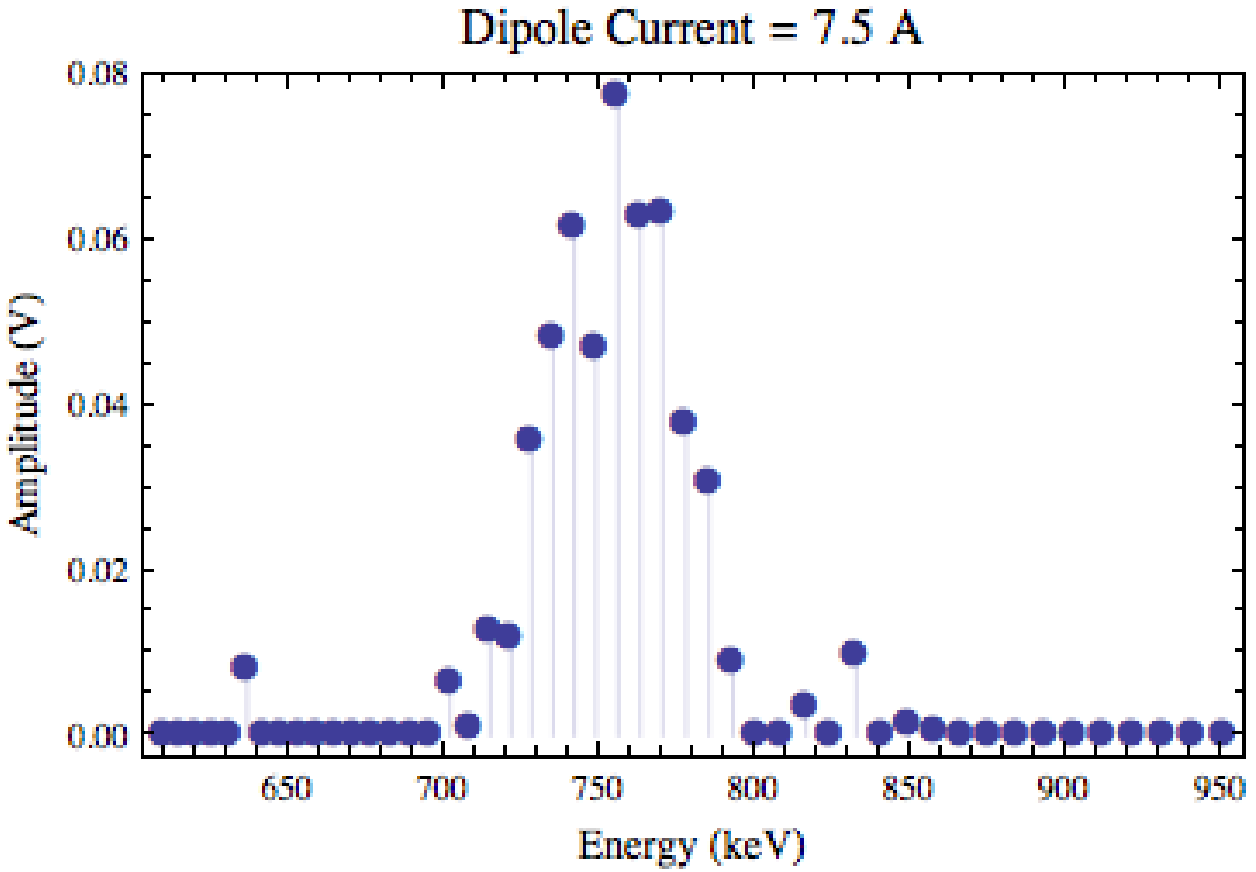

Energy is (756.5 ± 0.5) keV

# Energy Spectrum



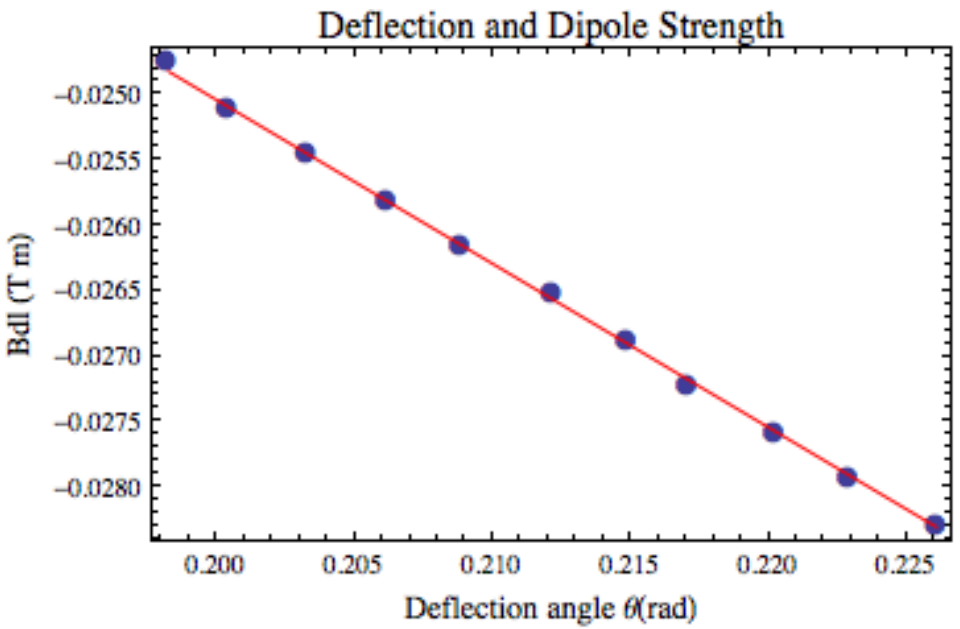

It is clear from the spectrum that the energy is around 750 keV!!!!

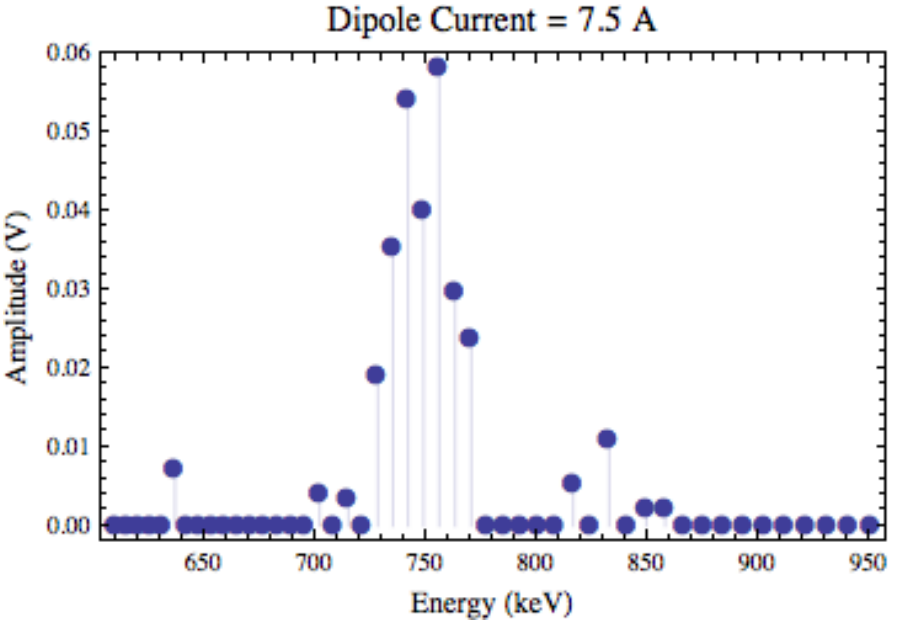
# Energy Spectrum




It is clear from the spectrum that the energy is around 750 keV!!!!

# RF power at 150 kW, 3 kW reversed




Energy=(750.0 +/- 0.5) keV

# Plans

- New rods are here
  - Thinner rods to lower capacitance
    - Move tuning plates further from the rods. Improves field quality.
    - Lowers power requirements. (Increases impedance)
  - Hopefully also increases transmission efficiency
  - Presently ~67% transmission efficiency.
- Janet will be coming next Tuesday 17 July
  - Field flattening and rod installation.
  - Energy measurement, transmission efficiency, and transverse emittance measurements qualification tests.