

# Physics Review of the Merging Beamlet Experiment

## Components, Experimental Plan, and Project Status

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# Outline

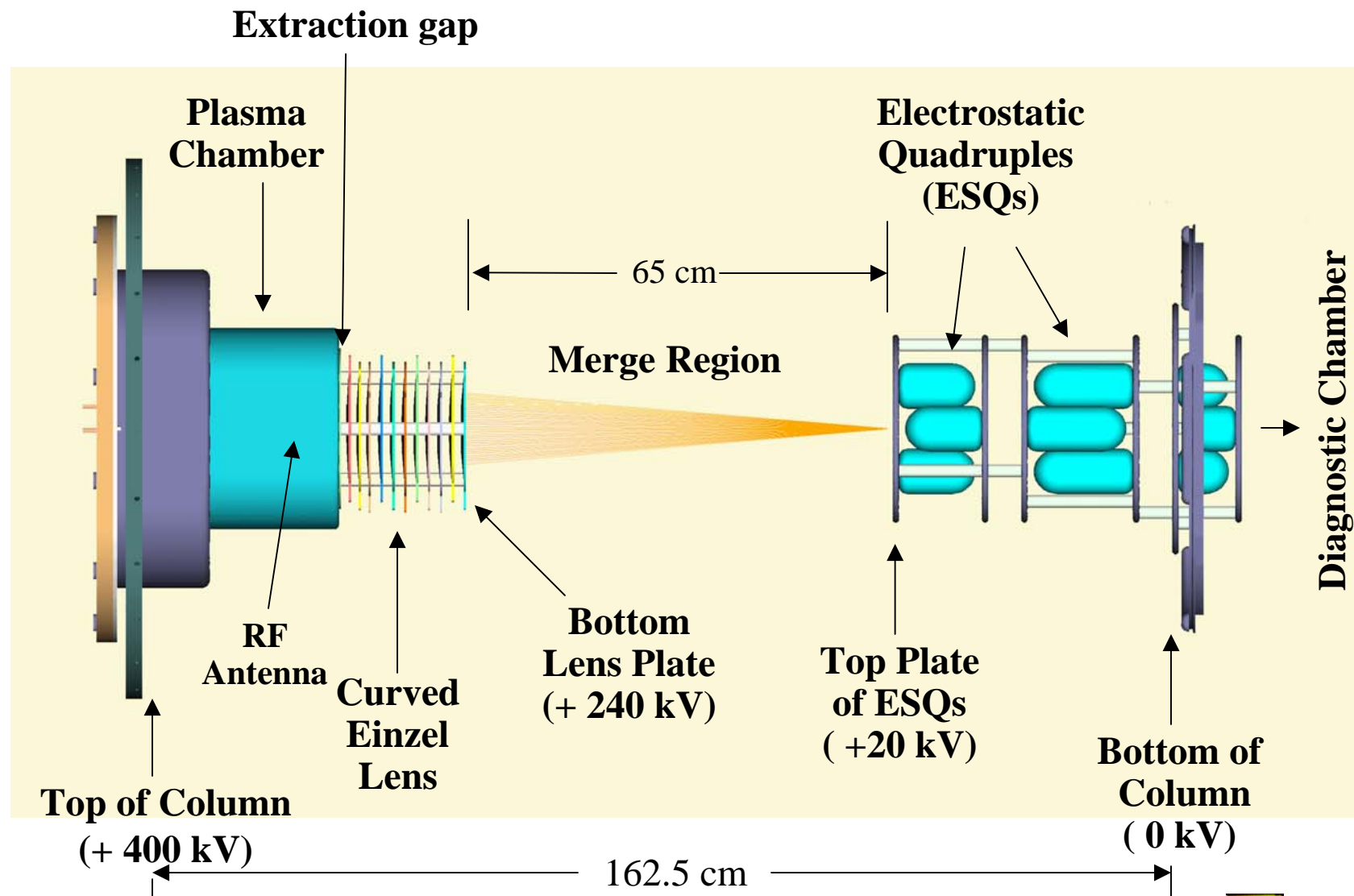
## 1. Hardware preparation

a. components

b. schedule and cost

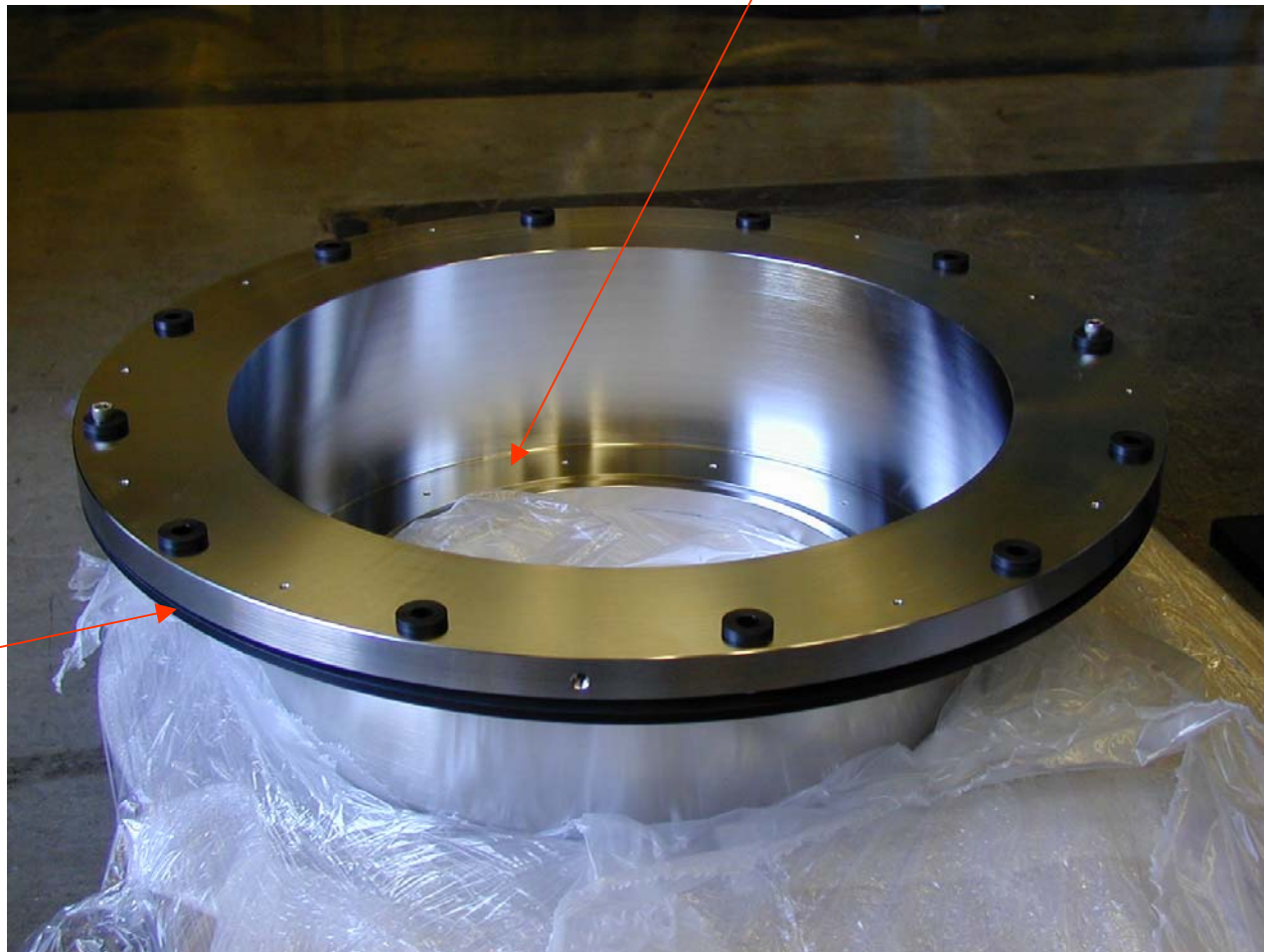
## 2. Experimental approach

# Elements of the Merging Experiment



# Top plate

Captures existing plasma can

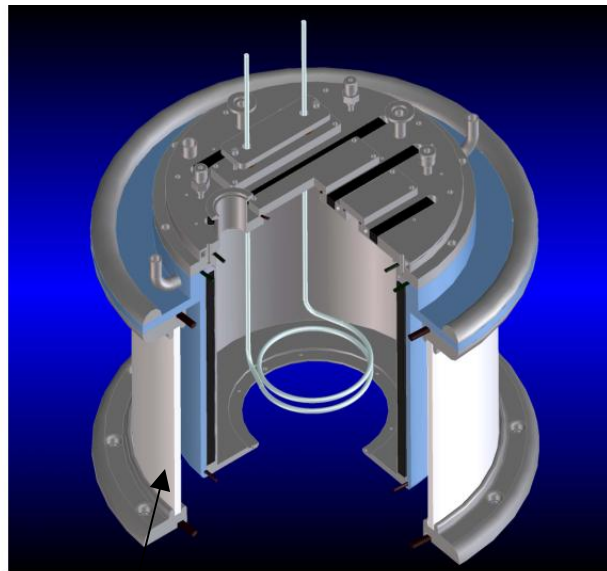


**Insulator**  
(will be able to  
measure current  
into the source)

Prepared for the full-gradient experiment

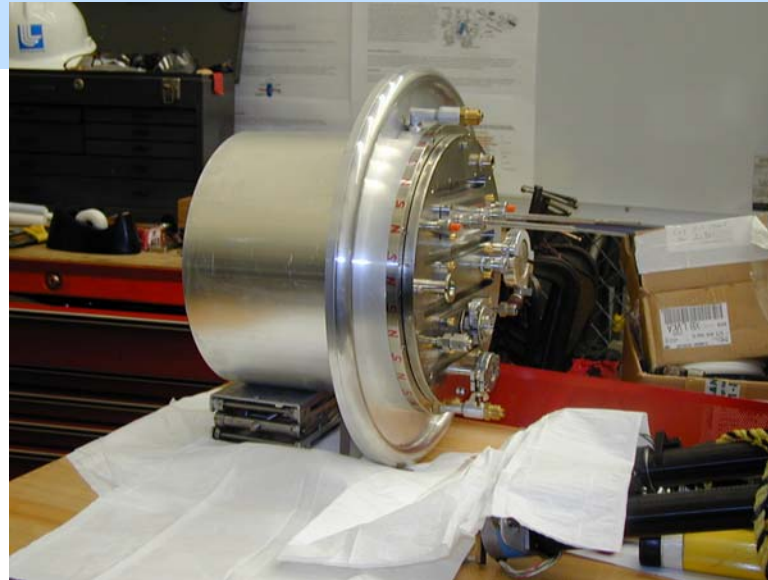
# Plasma chamber

STS-100 experiments

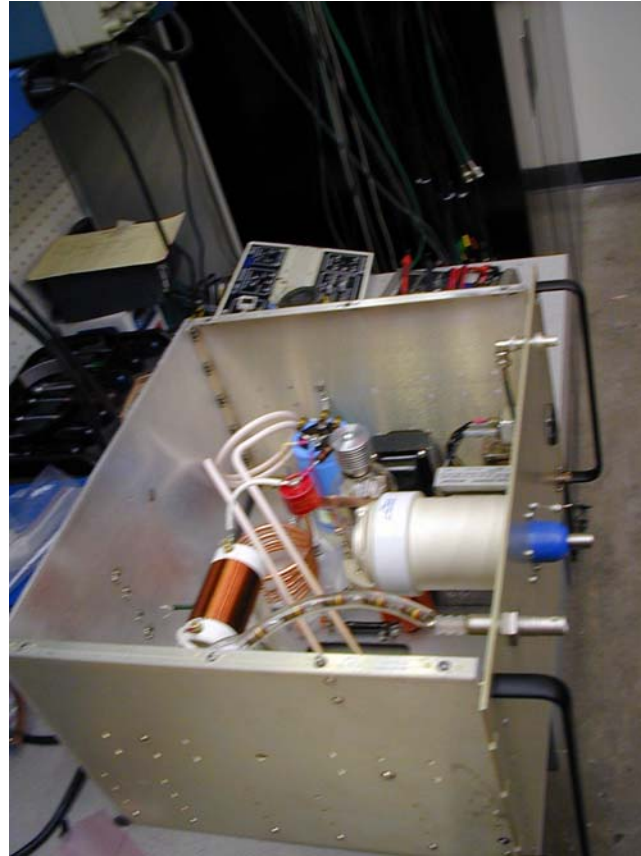


14 cm

Will not use the insulator shown in drawing

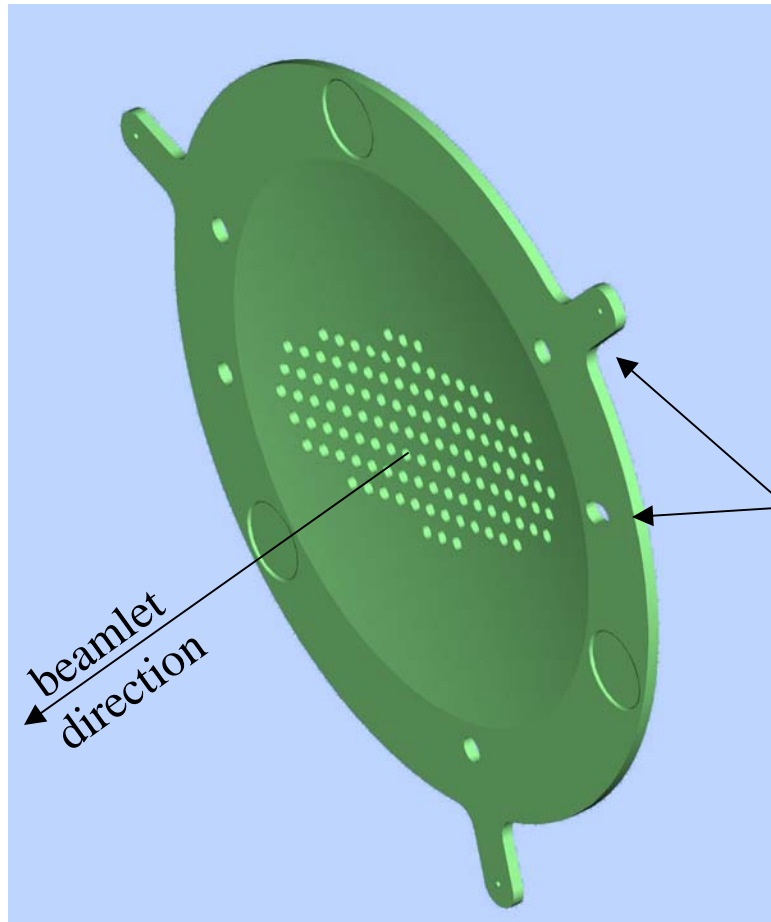


# RF Power source (11 MHz)



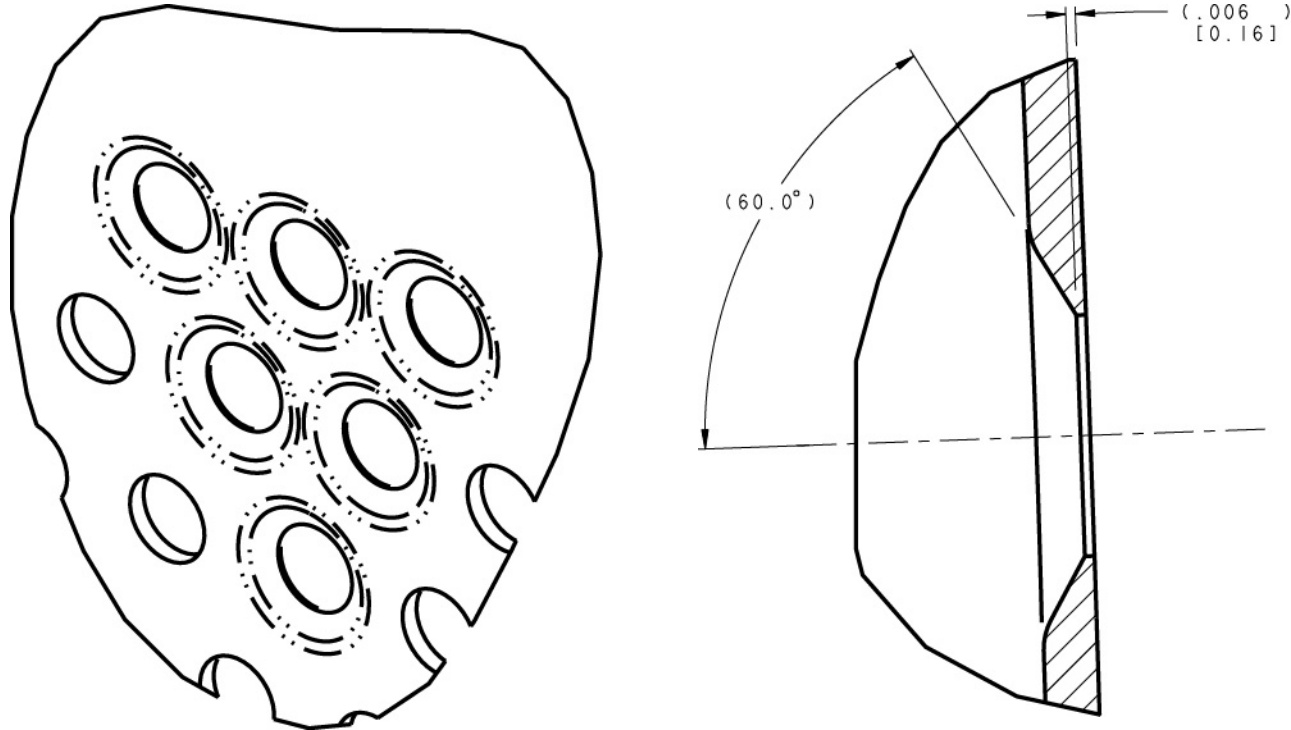
Prepared for the full-gradient experiment

## Example of a plate in the Einzel Lens Assembly



- 8 inch OD
- 1/8 inch thick
- SS material
- ~70 cm curvature
- 119 beamlets
- Alignment holes
- Rotated tabs (used to make electrical connection)

# Extraction plate with Pierce Cone



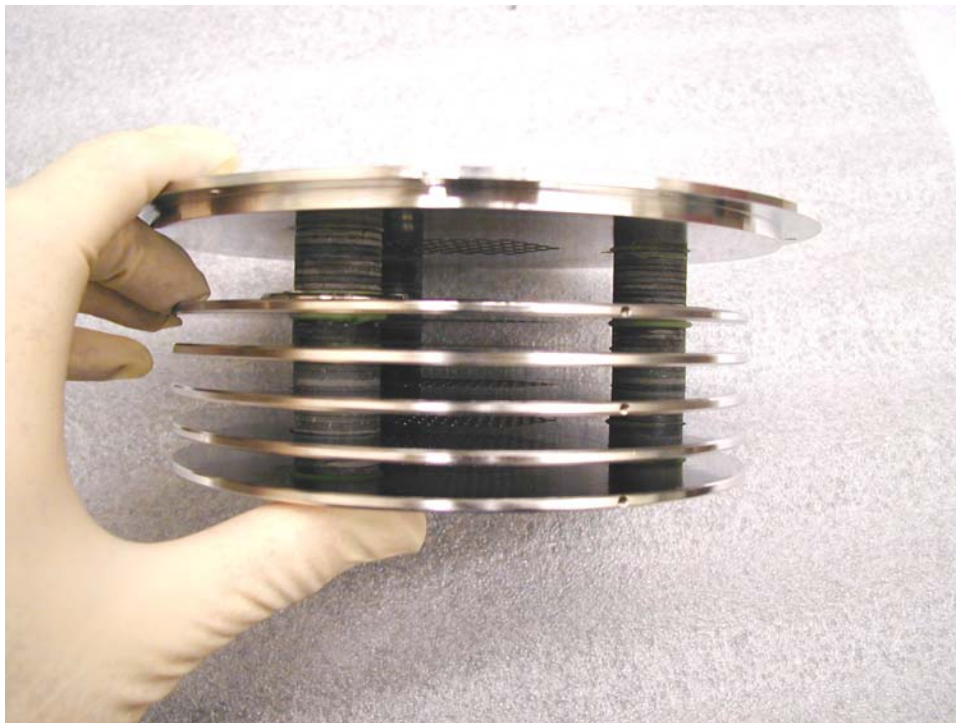


# Plate parameters

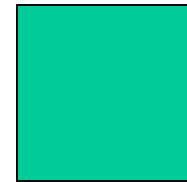
#	Voltage (kV)	Location (cm)	Ins	Gap Gradient (kV/cm)	Curvature (cm)
Extraction	400	0	S	18	66.13
1	384	1.25	S	36	64.89
2	352	2.45	S	-18	63.69
3	368	3.65	L	27	62.49
4	336	5.15	L	27	60.99
5	304	6.65	L	-27	59.49
6	336	8.15	L	27	57.99
7	304	9.65	L	27	56.49
8	272	11.15	L	-27	54.99
9	304	12.65	L	27	53.49
10	272	14.15	L	27	51.99
11	240	15.65	L	-	50.49

Plate thickness 0.32 cm

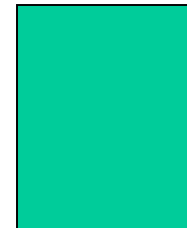
# High-gradient insulators



**9 units**  
**2 cm OD**  
**1.17 cm tall**

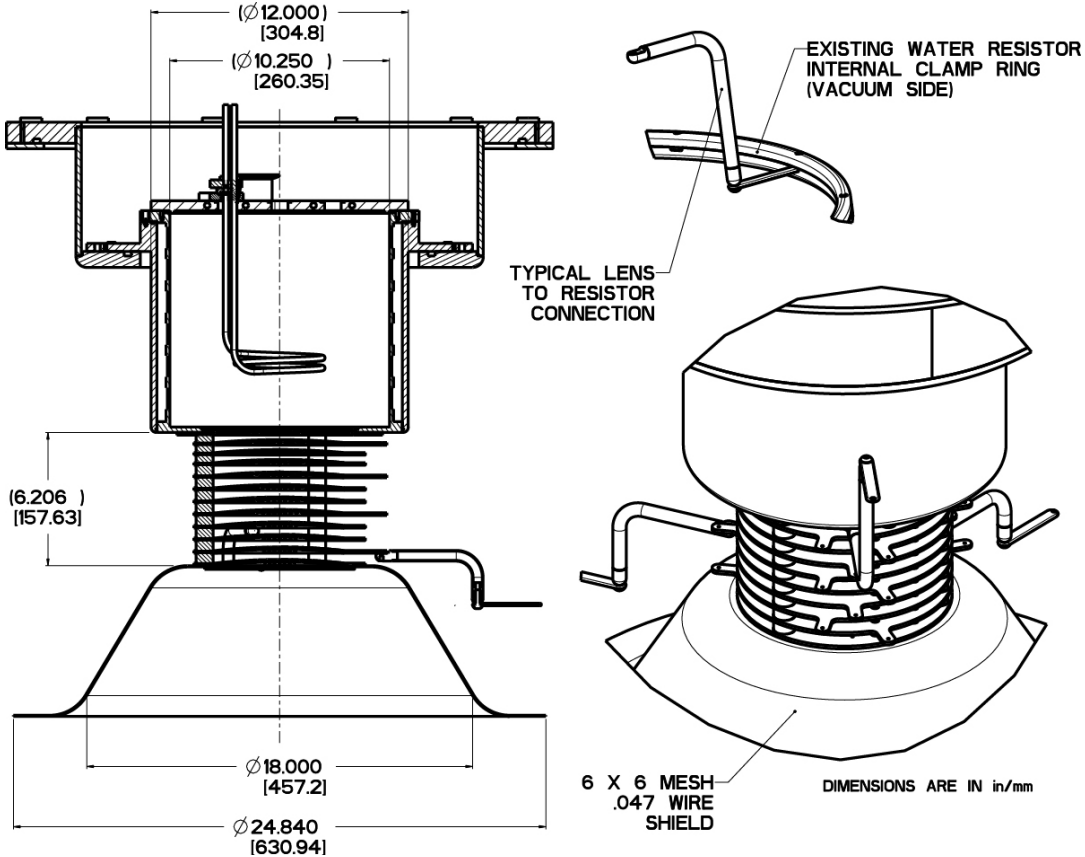


**27 units**  
**2 cm OD**  
**1.31 cm tall**

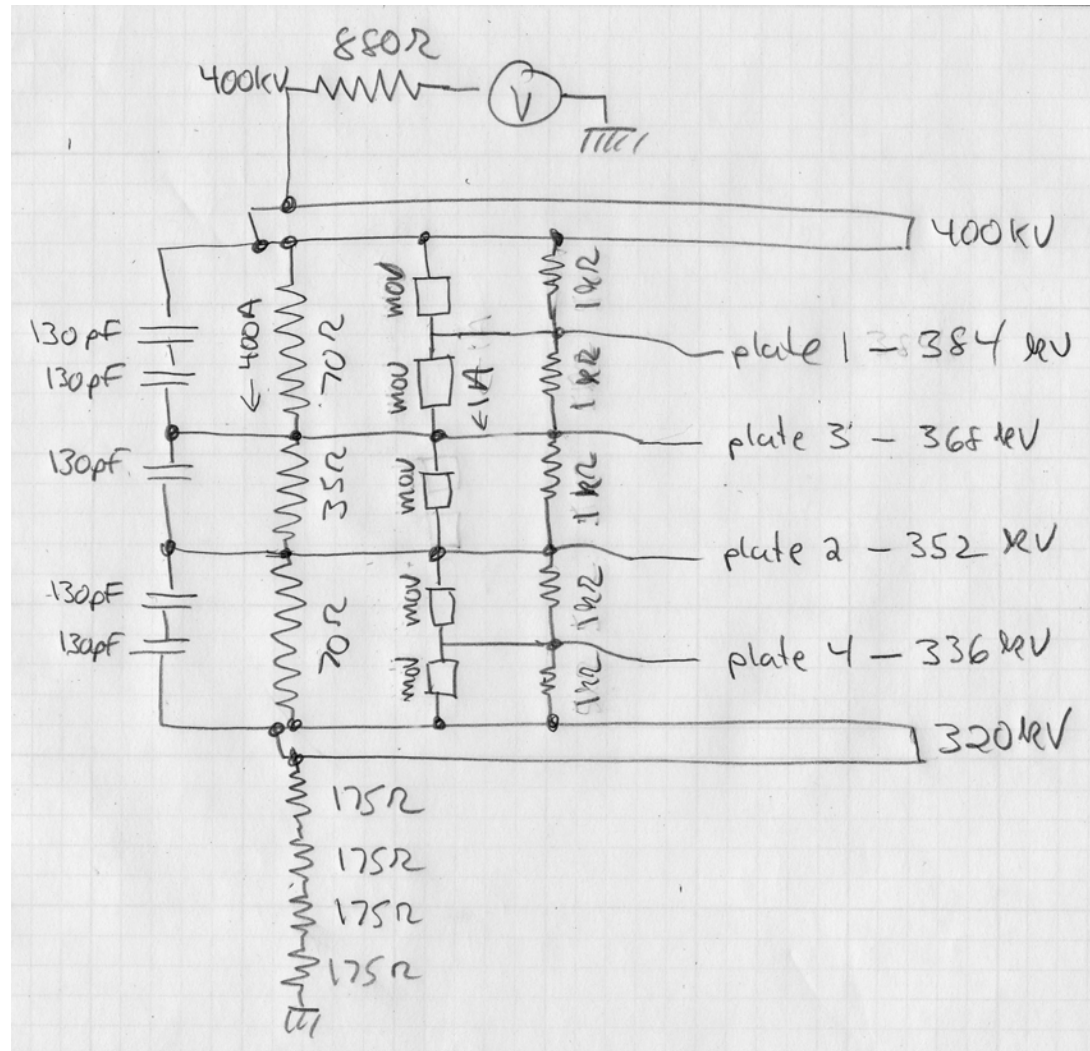


**HGIs used in STS100**  
**Lens assembly**

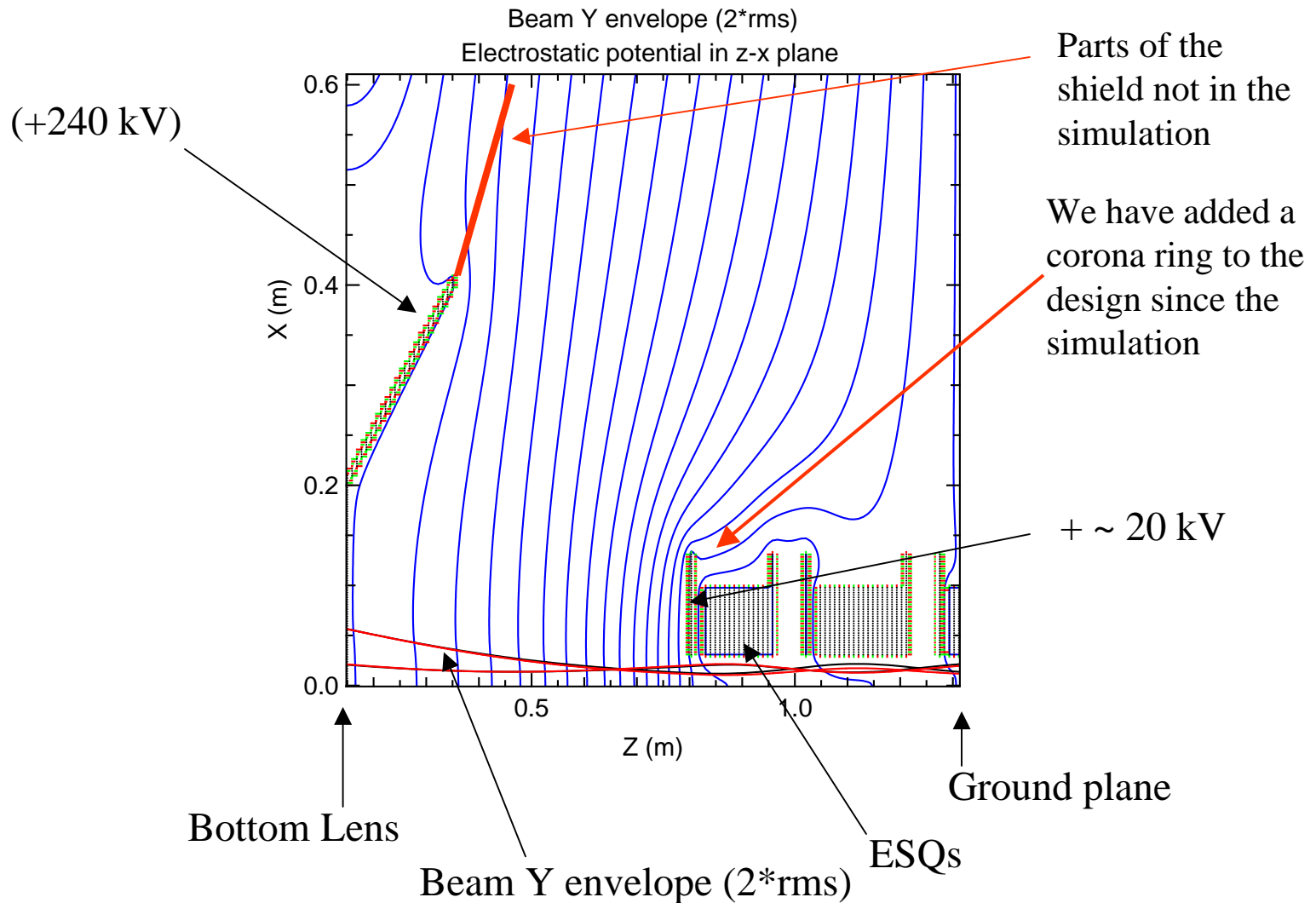
# Connectors (between plates and column)



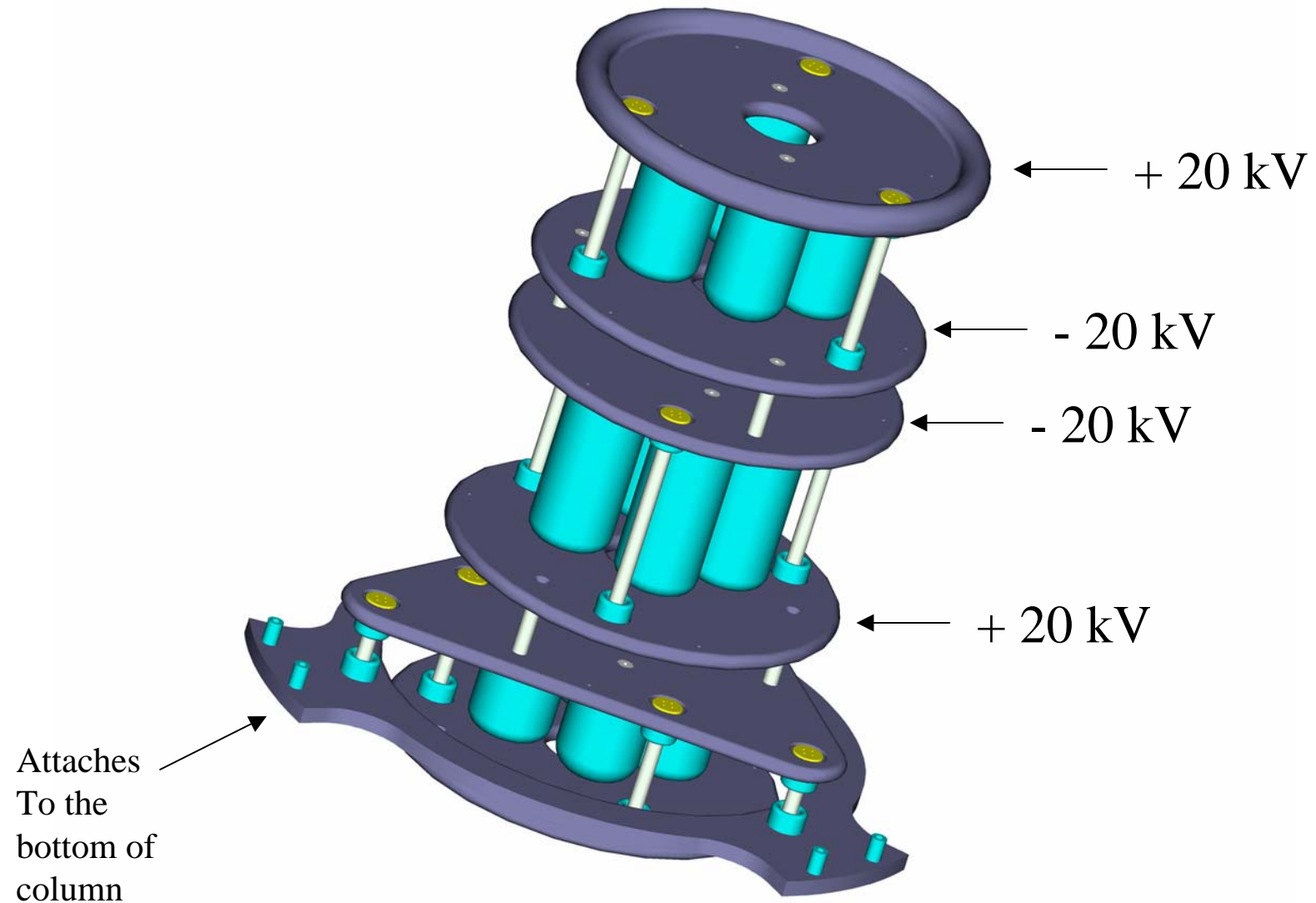
# Connection to the top spool



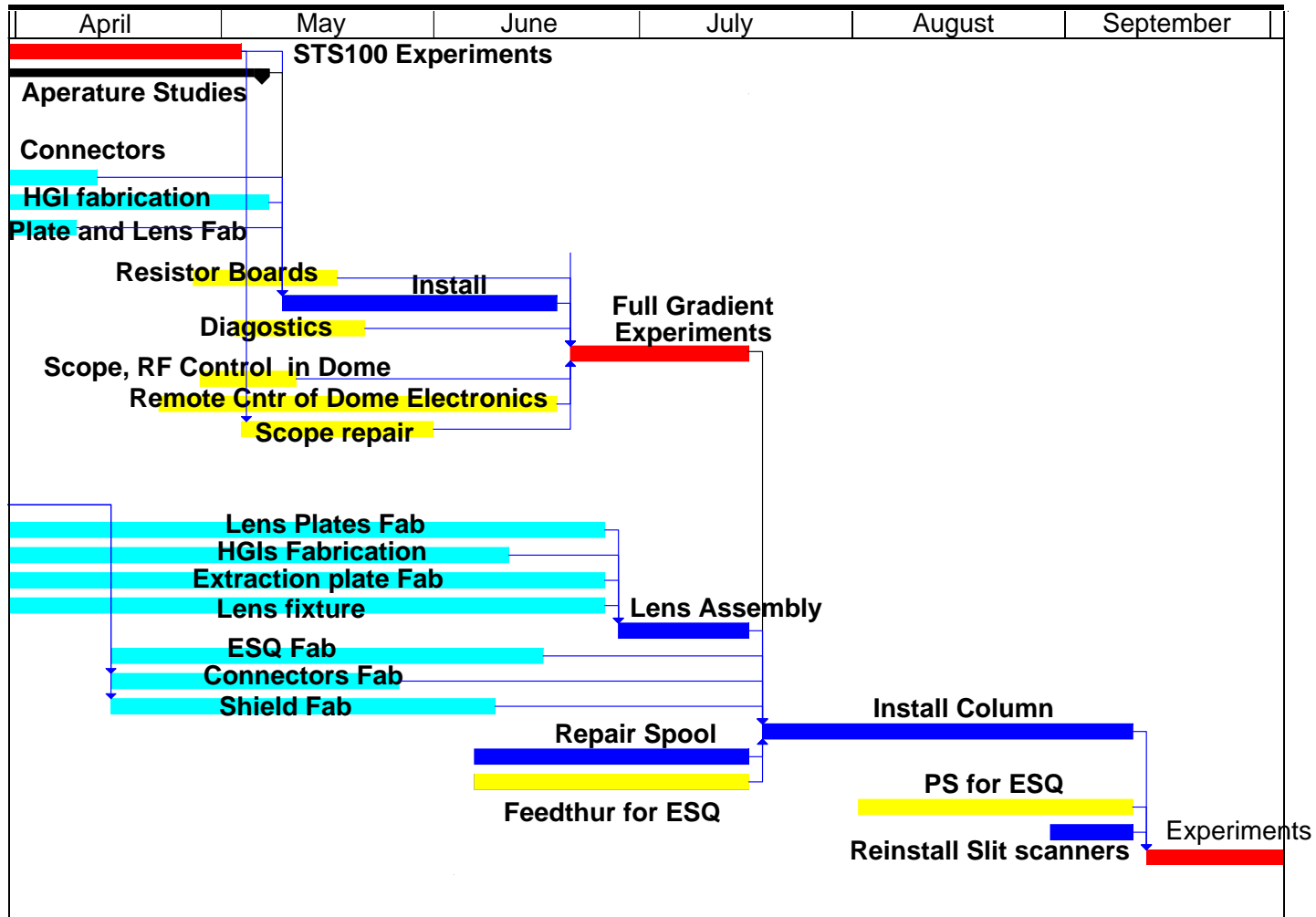
# Electric fields in merge region



# Electrostatic Quadrupoles



# Fabrication schedule



# Hardware cost

**Plates** \$ 36 K

**ESQ** \$ 15 K

**Feedthurs (ESQ power)** \$ 5 K

**Moveable Optical Diag.** \$ 8 K

**Misc (scope repair, shield, diagnostics)** \$ 8 K

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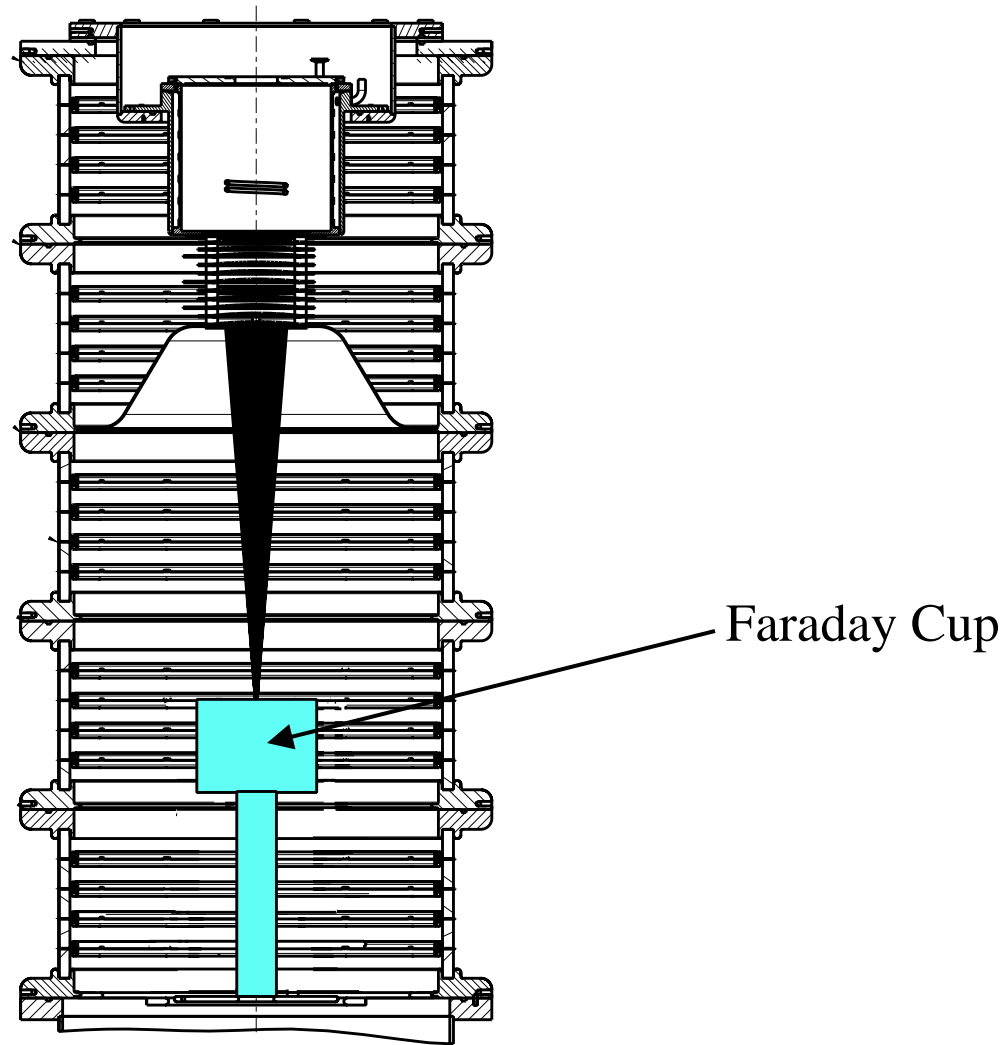
**Total \$ 72K**

(assuming we can get two +20kV PS from LBNL for ESQs)

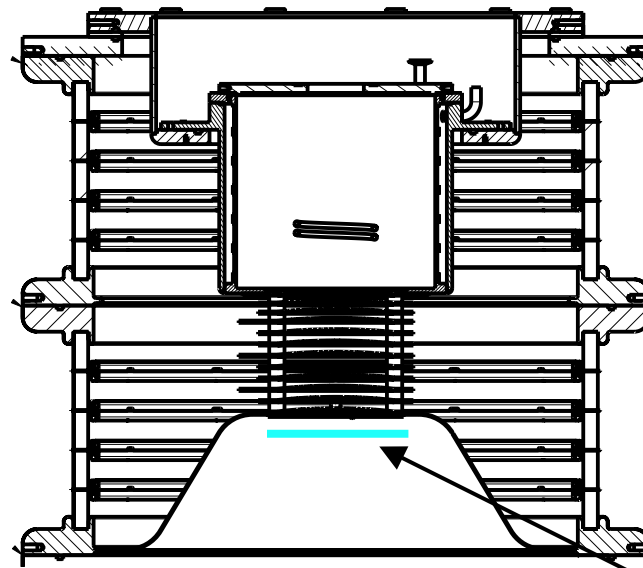


# Experimental approach

# First stage: Measure current at the merge point with a F. Cup

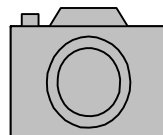
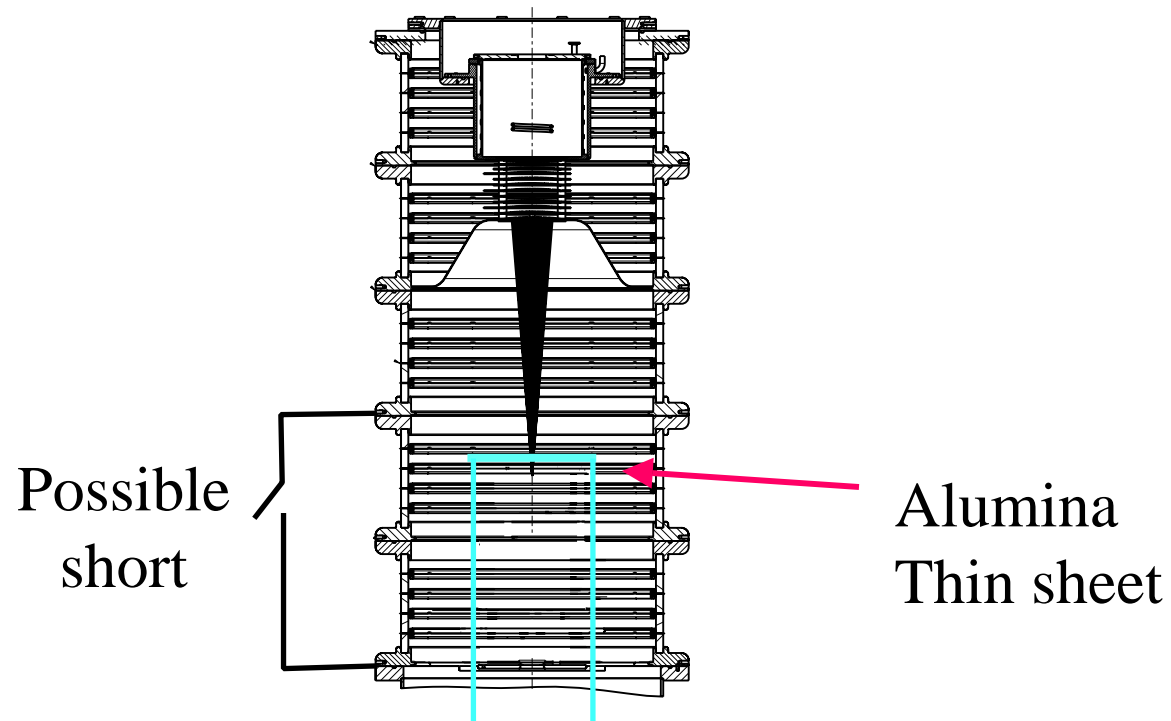


## Second stage: Capture image on a Kapton sheet



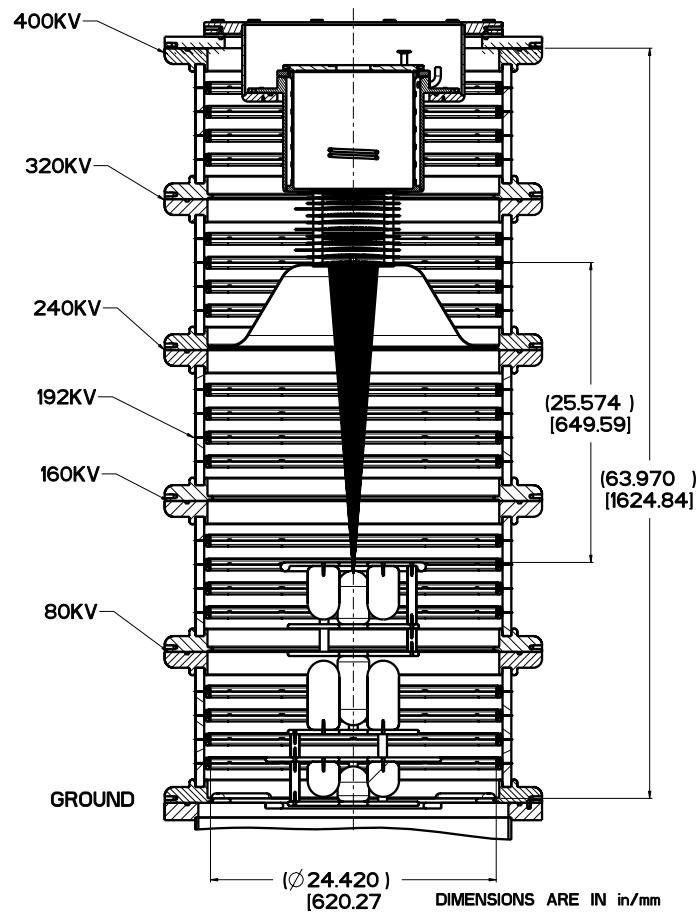
Kapton  
Sheet

## Third stage : Image beamlets

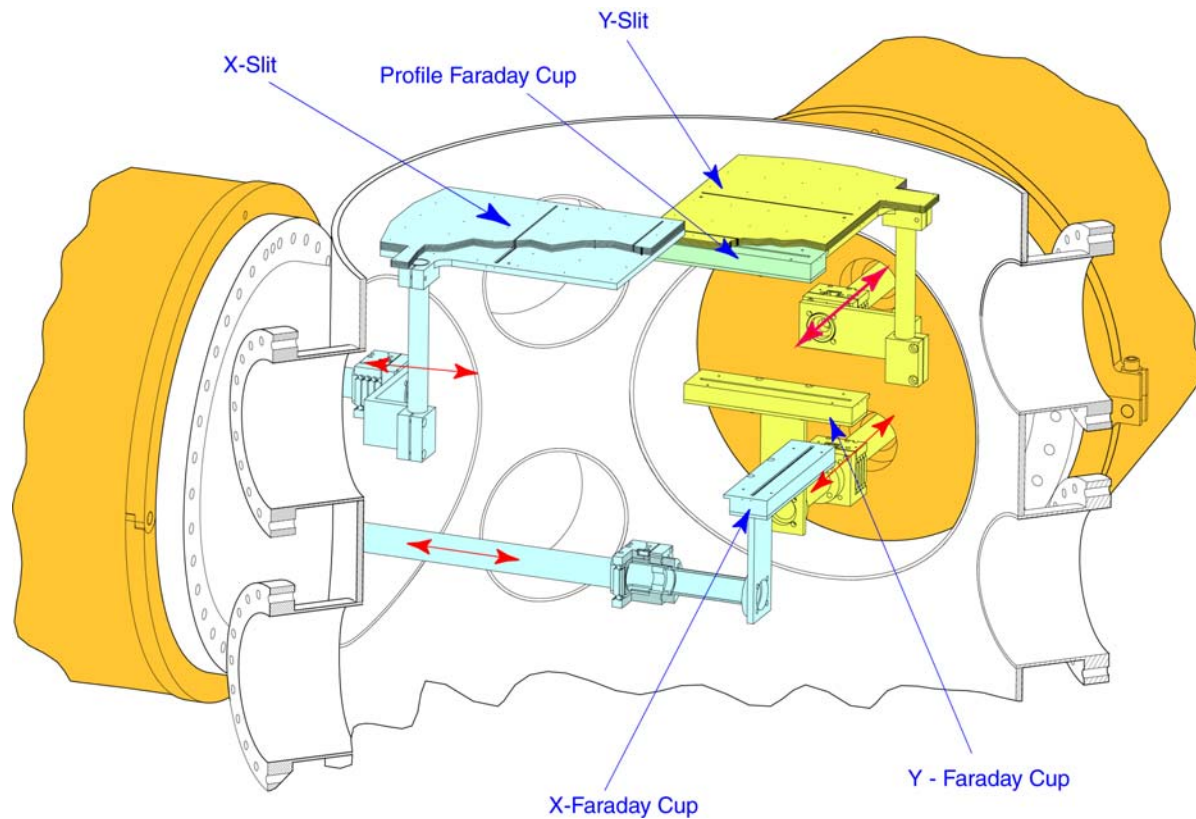


Gated Camera

# Four Stage: Install ESQs

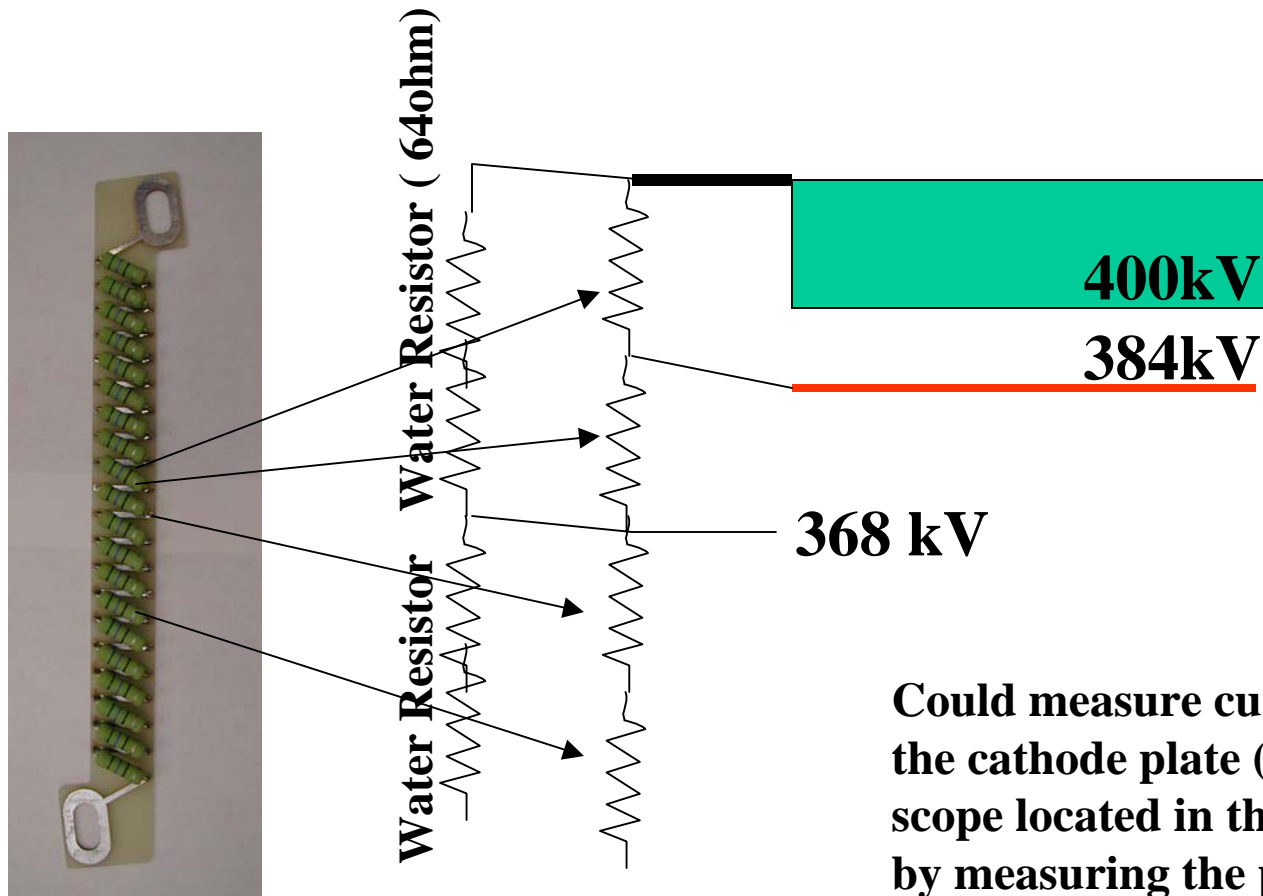


# Fifth stage: Measure phase space after ESQs



**After we have characterized the beam in the standard configuration we will alter the hardware to study effect on the beam. Several examples follow:**

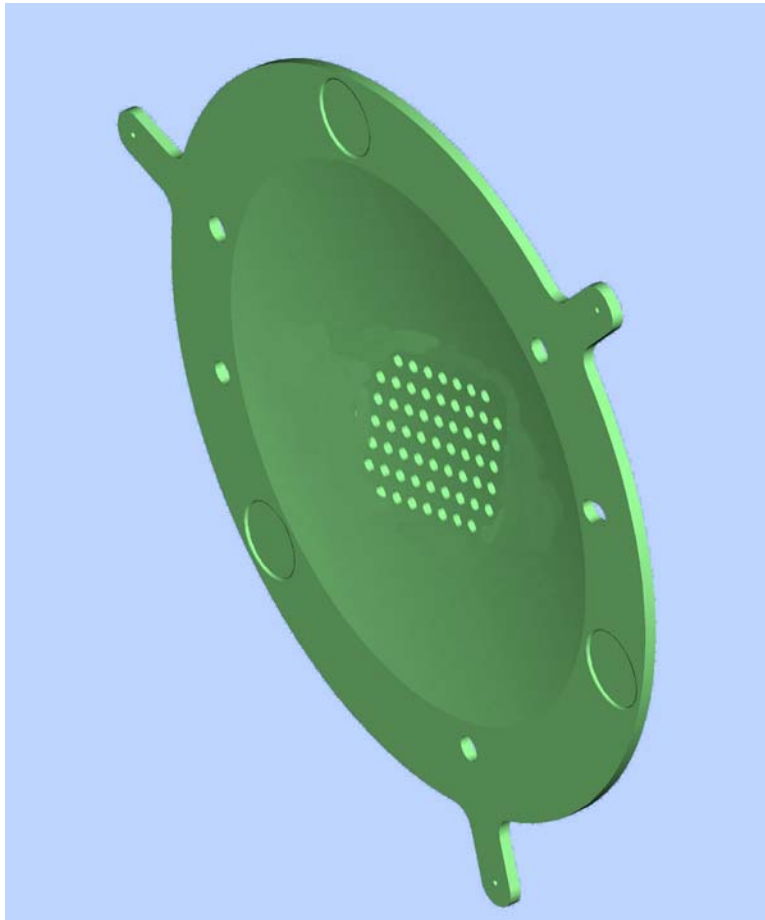
# Change AK voltage by swapping resistor straps



Could measure current into the cathode plate (using the scope located in the dome) by measuring the plate voltage (16 kV difference)



# Block beamlets



**Block holes at the  
extraction plate  
to study the effect on  
beam quality**

# Energy spectrometer

**Could measure energy spread**

**At a reduced voltage we could use the Energy Spectrometer from STS-100**