

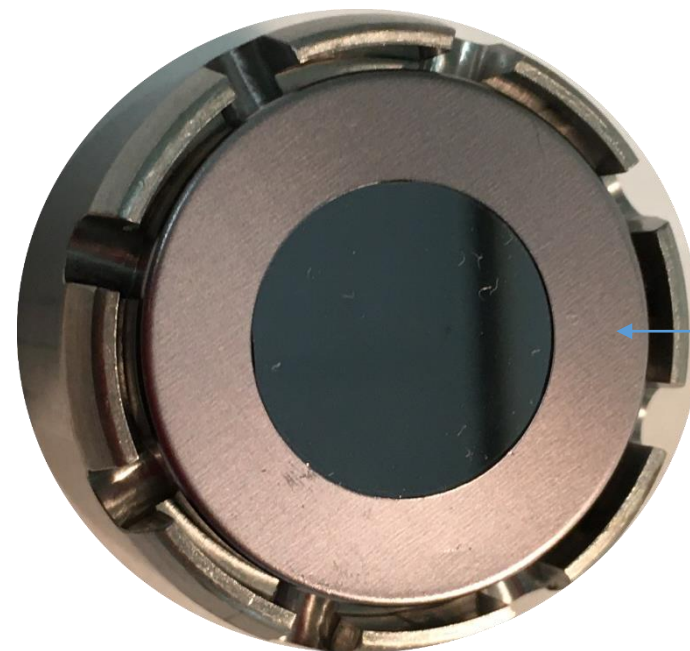
Findings about the photocathode position inside the cathode electrode

Sajini Wijethunga

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Puck



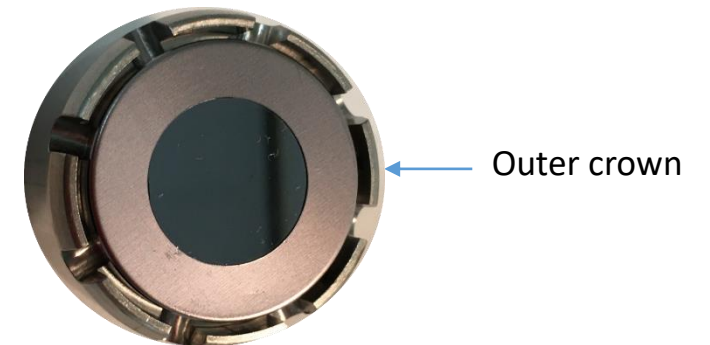
Ta cup

GaAs + Ta cup

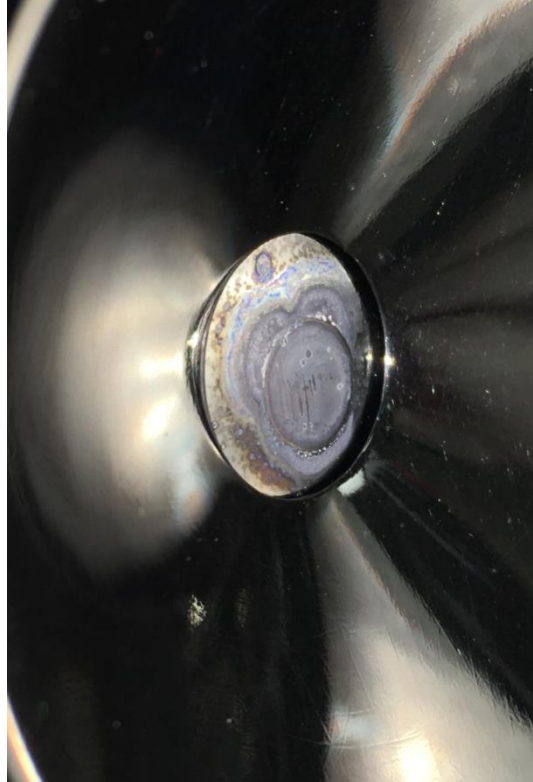
- We inserted each photocathode into the cathode electrode and measured the recessed length.
- Then took out the puck and measured the distance from Ta cup to the outer crown of the puck.
- Then took out the GaAs wafer and measured the thickness.

Photocathode type	Distance from GaAs surface to front of the cathode surface (full recessed length) [mm]	Distance from Ta cup to the outer crown of the puck [mm]	Substrate thickness [mm]
60 min	0.9525	0.3175	0.457
90 min	0.8255	0.5334	0.330
30 min	0.6985	0.5715	0.356
Moly	Didn't measure. It has a small curvature that comes out of the surface due to the polishing.	0.0000	0.889

- Due to the Pierce geometry, it is hard to measure the recessed length.
- Also, the activated area could be a bit expanded due to the oxidization (~0.01 mm).
- The photocathode we used for the beam size and rotation angle measurements is a full activated one which we don't have anymore.



GaAs 90 min

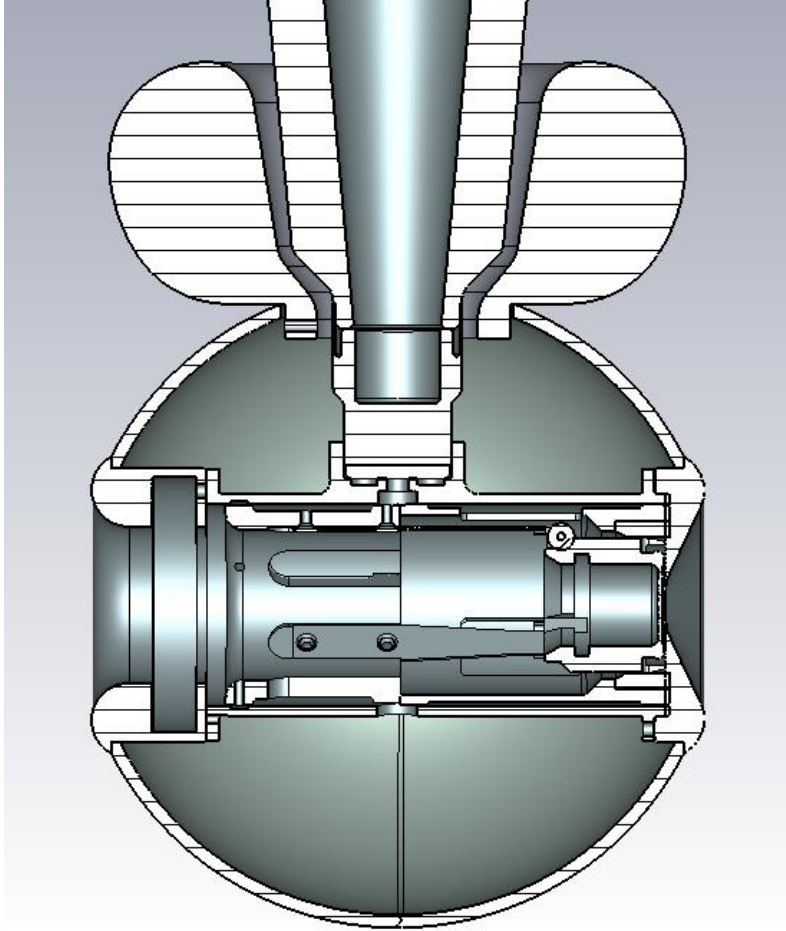


There is a visible space in
between photocathode and
cathode front

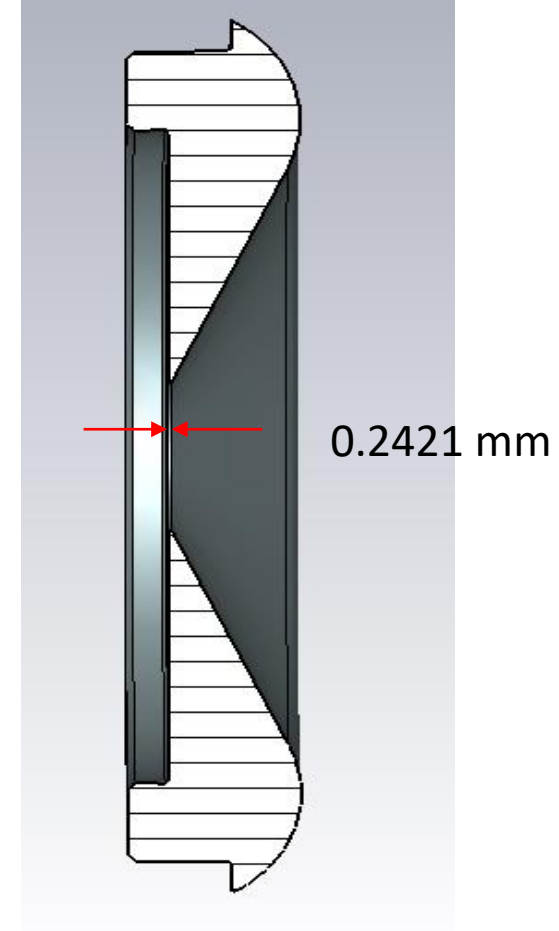
Moly



Original CST model of the GTS gun

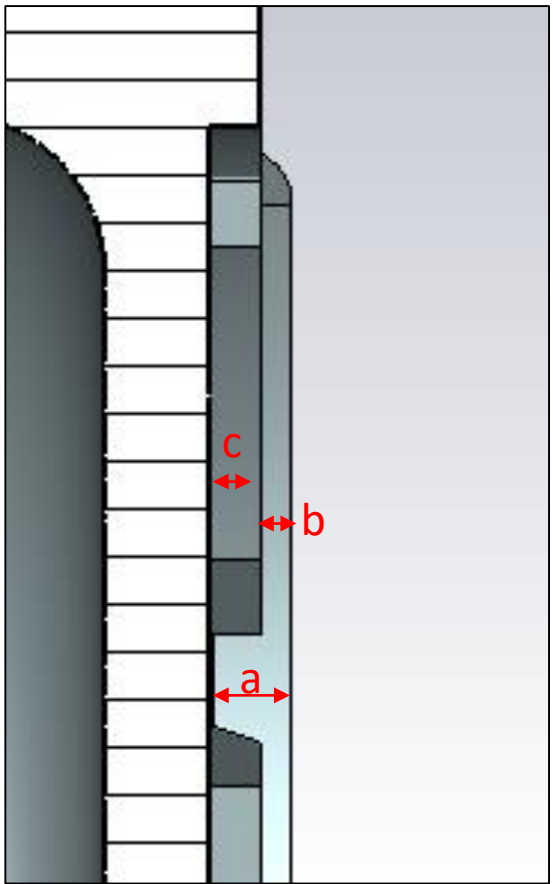
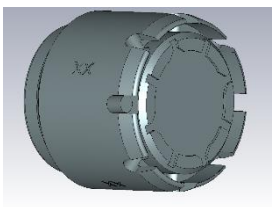
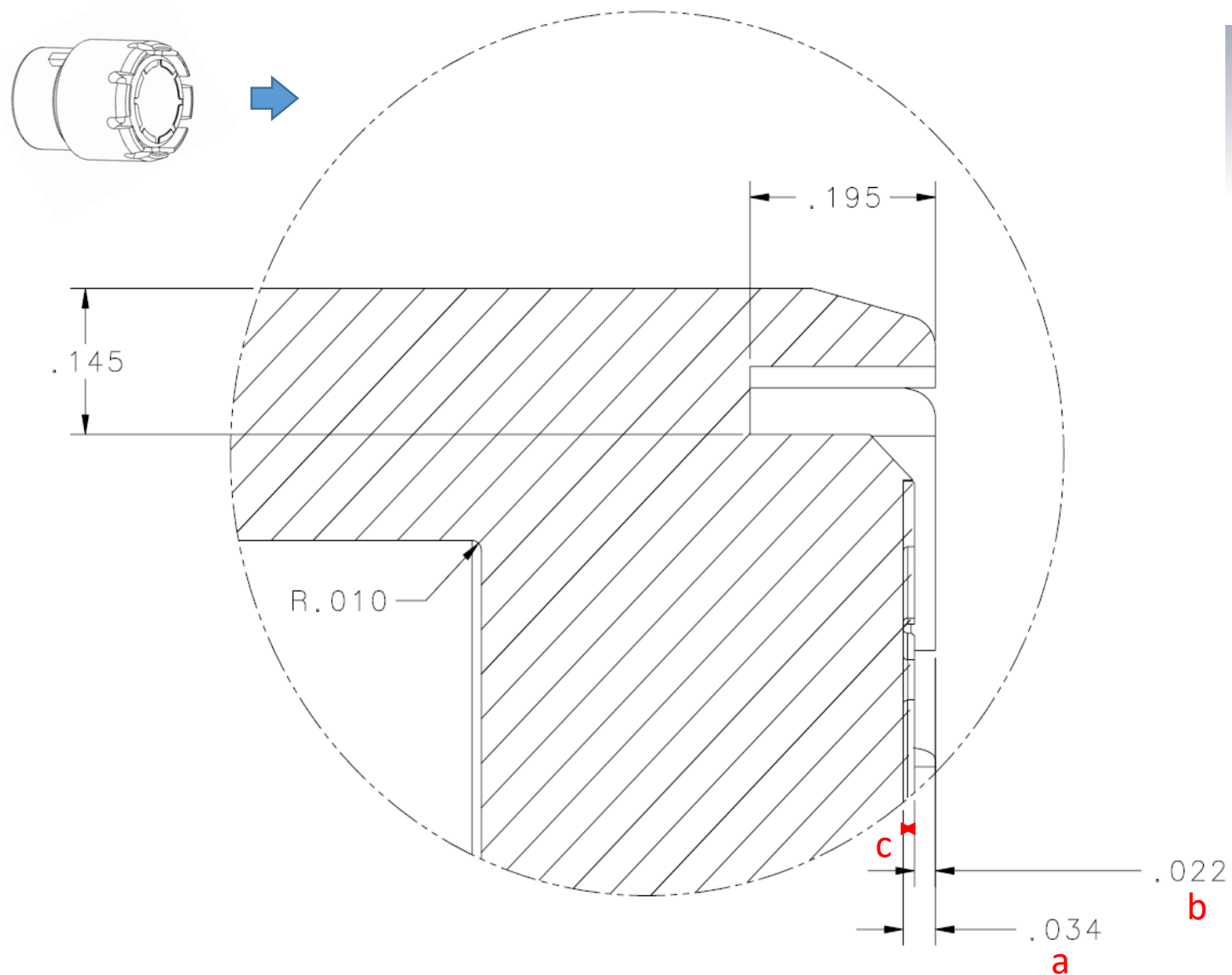


Thickness of the Pierce geometry front



- Thickness of the Ta cup = 0.3505 mm
- Ta cup + Pierce geometry front thickness = 0.5926 mm
- When a photocathode perfectly fits with the cathode electrode without any space in between, the photocathode is 0.5926 mm recessed from the cathode surface which we have to modify in our CST model.

Dimensions of the puck - drawing and CST comparison

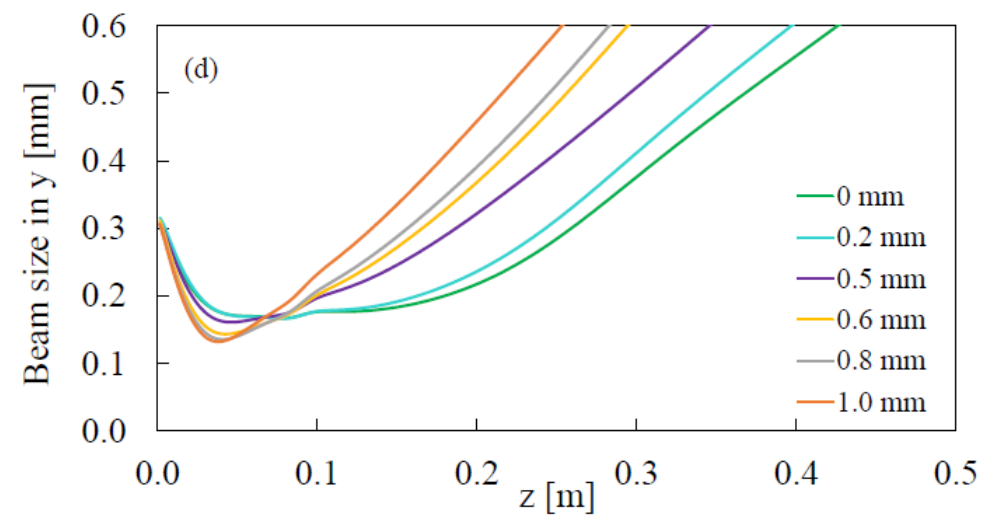
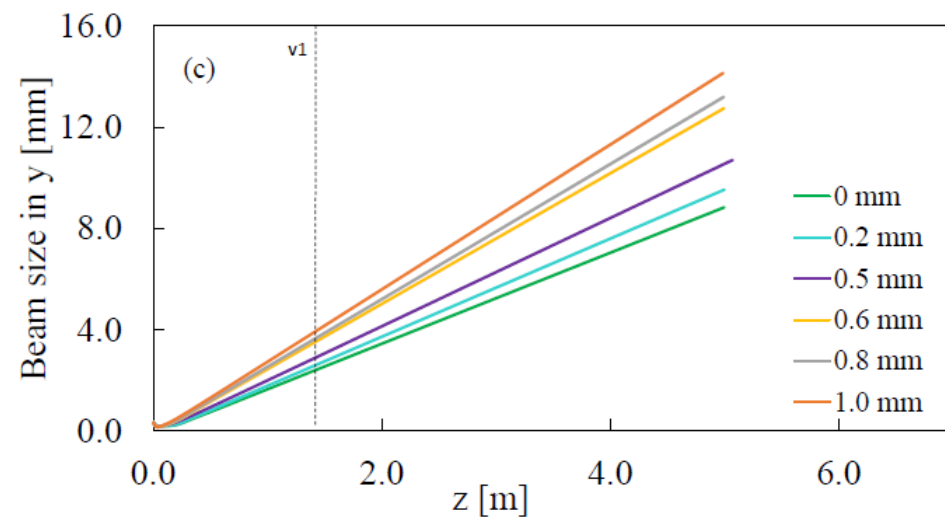
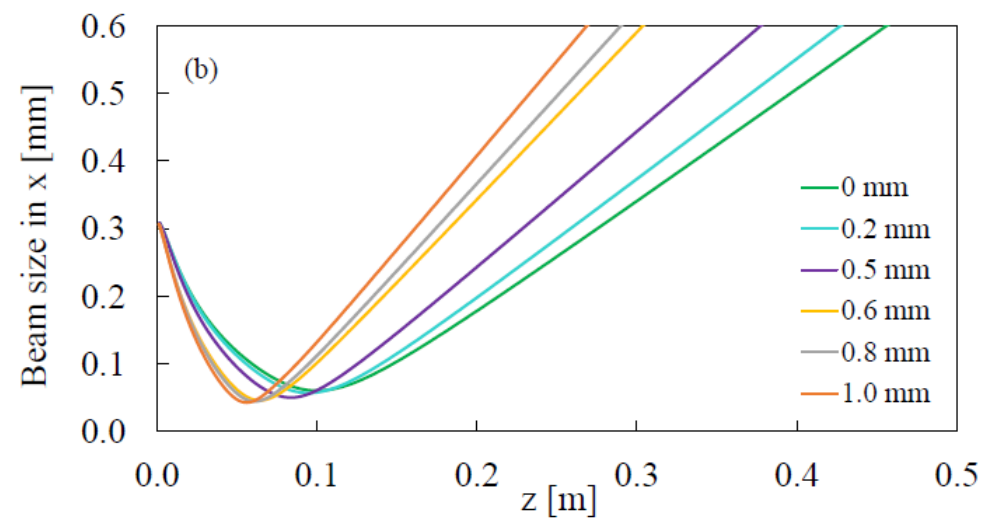
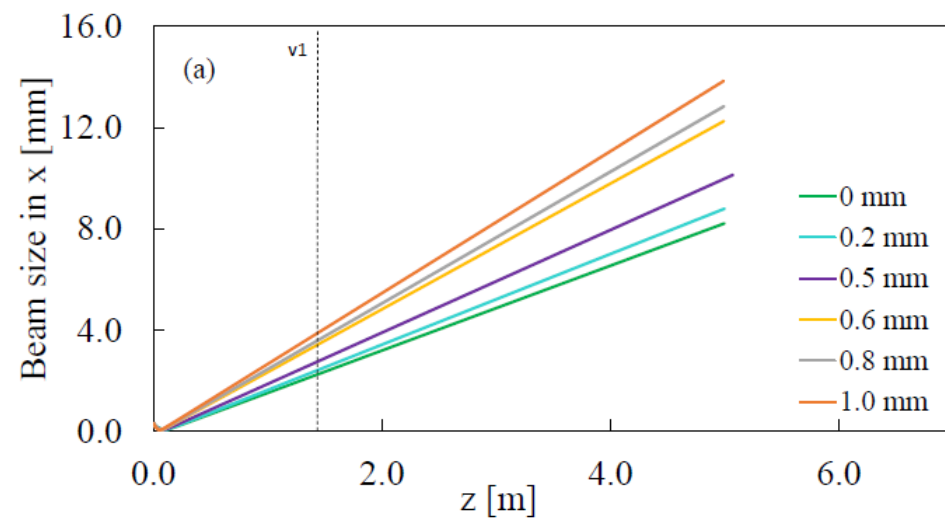


Part	Thickness	
	From the drawing mm	CST model mm
a	0.8636	0.8128
b	0.5588	0.3048
c	0.3048	0.508

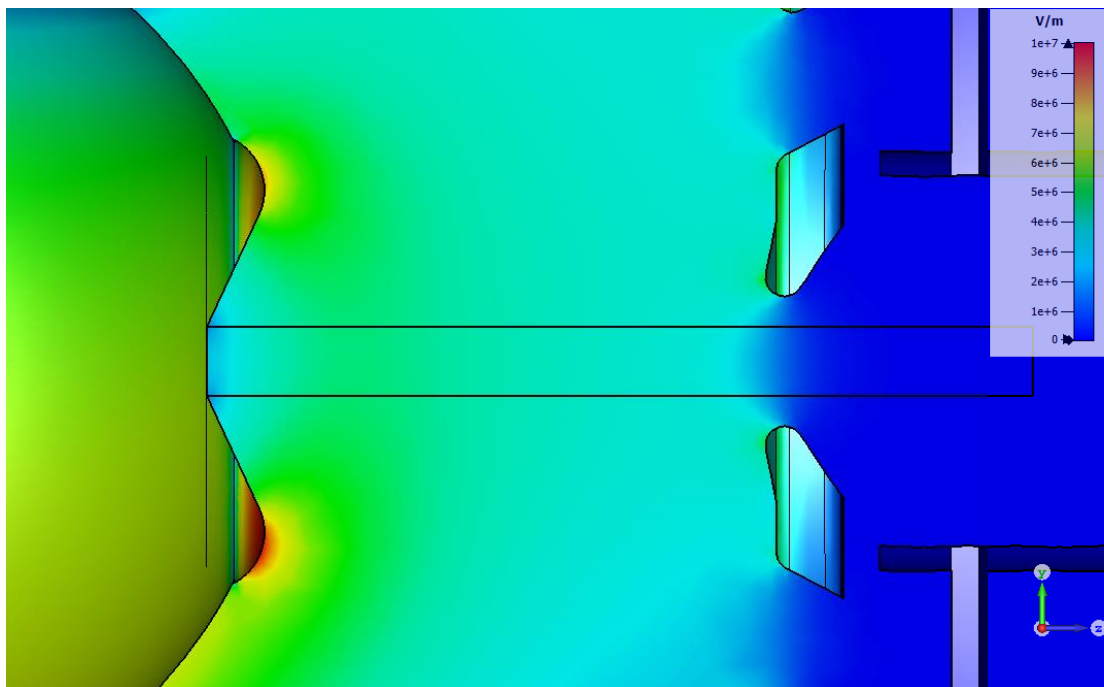
This discrepancy is not a problem for the simulations as long as we know the recessed length.

How beam size varies with the recessed length

From 0 - 0.5 m

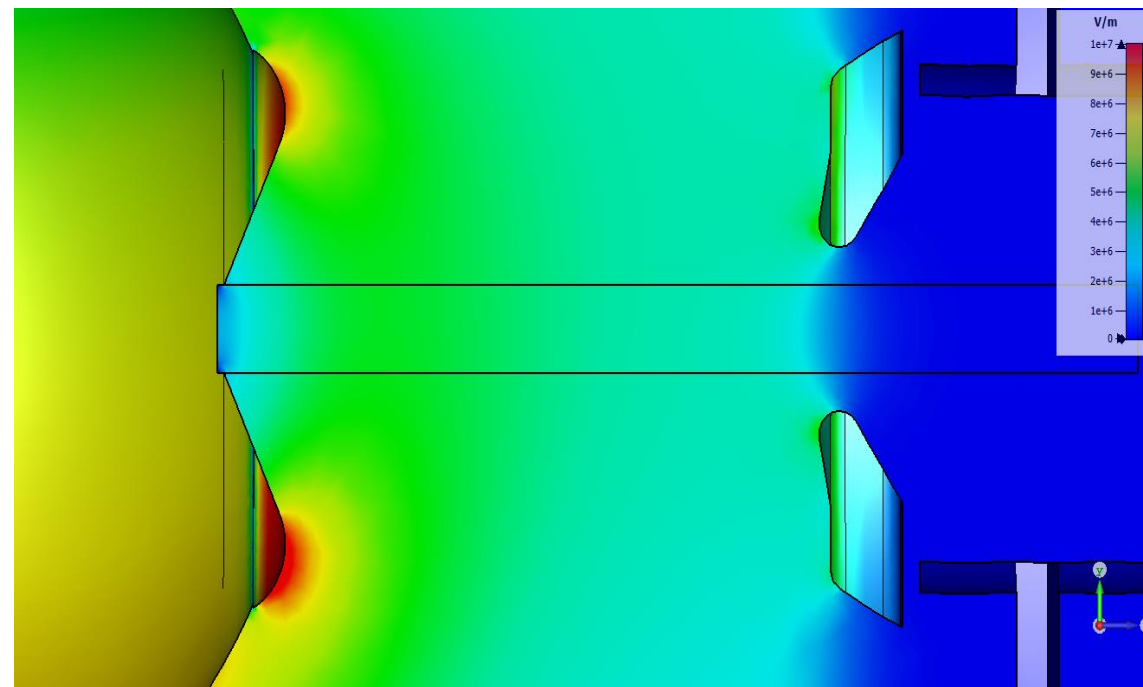


original



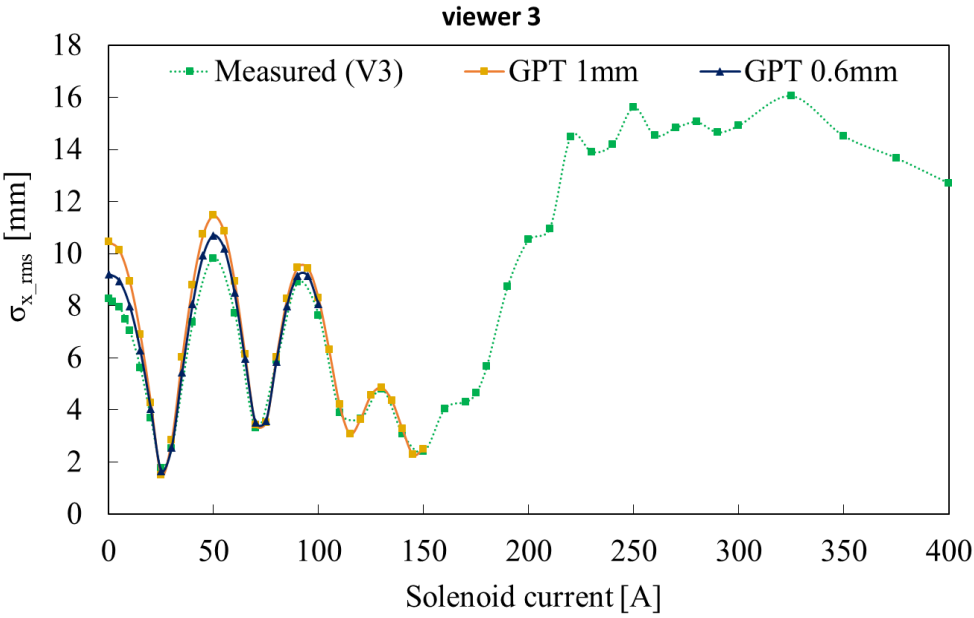
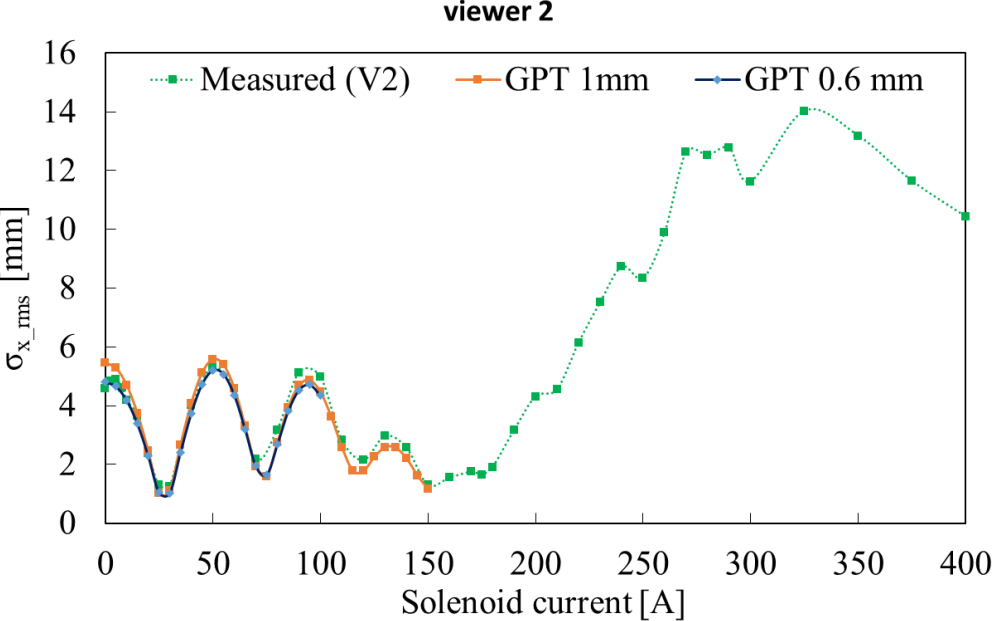
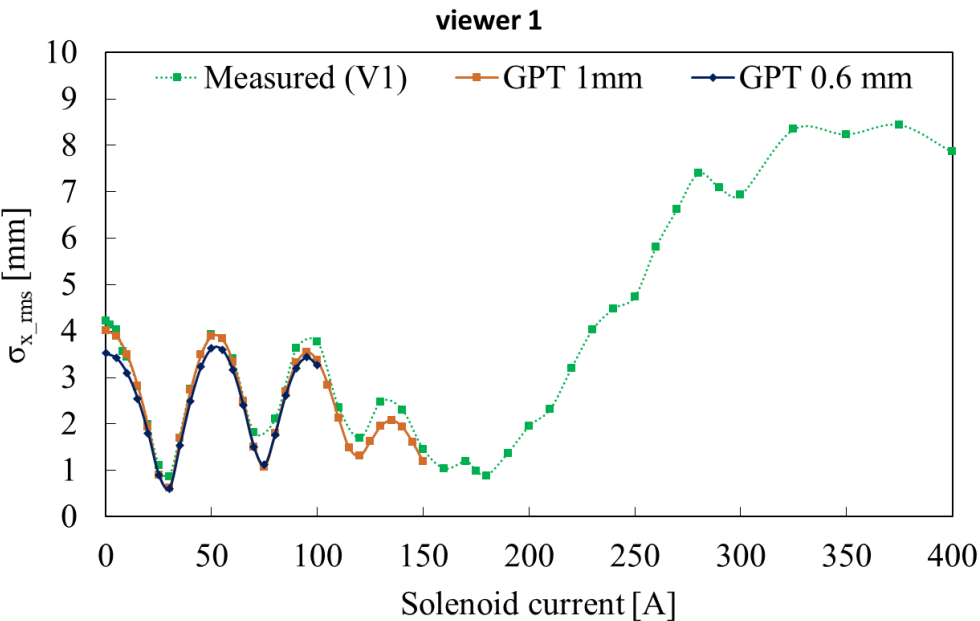
E_z at the cathode - 2.19 MV/m for -300 kV

1 mm recessed



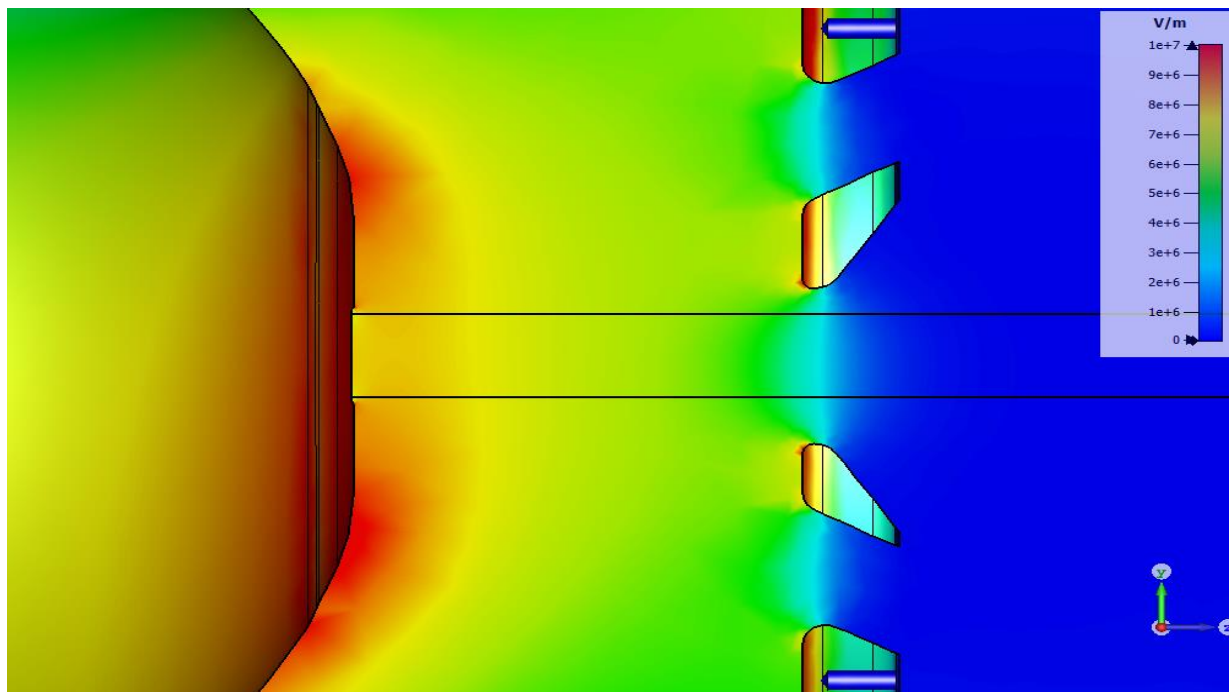
E_z at the cathode - 1.67 MV/m for -300 kV

Beam size variations with the solenoid current (Measured value on the three viewers , 1 mm recessed and 0.6 mm recessed)



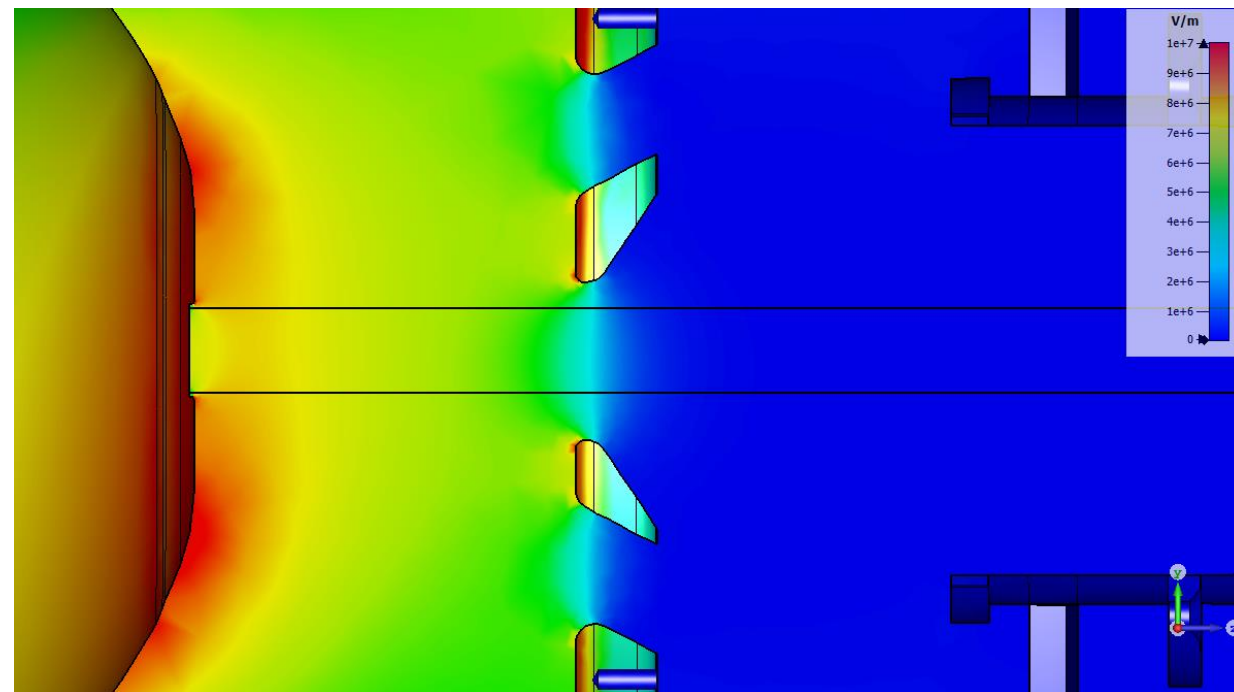
For the flat cathode front

Original (which is already 0.4 recessed from the design)



E_z at the cathode – 6.70 MV/m for -300 kV

0.6 mm recessed



E_z at the cathode – 6.21 MV/m for -300 kV

How beam size varies with the recessed length for flat cathode front

From 0 - 0.5 m

