

Apertures in the UMD 10 kV Electron Gun

D. Kehne

10/13/98

The following 6 apertures were agreed upon at the UMD Ring meeting of 10/1/98:

Apertures not easily changeable after activation

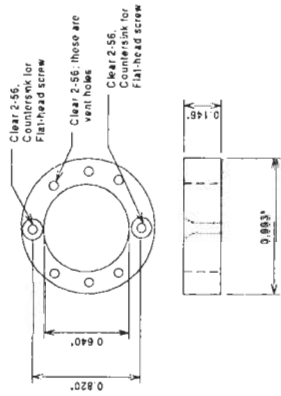
Note: Resolution of aperture placement is 0.1 mm +/- 0.03 mm

1. **Full open aperture:** no aperture; $I_{out} = I_{gun}$
Use: Allows full gun current to be measured
2. **Pepperpot** -- pattern of 0.2 mm diameter holes
Use: Measure gun emittance
3. **Pinhole** -- 0.5 mm diameter hole, located at center;
Use: Will double for quad centering and beam profile scanner
Transmitted current approximately 0.4% (0.4 mA)
4. **14% current aperture:** $I_{out} = 14$ mA
Use: Provides small beam over BPM threshold (10 mA)
 $R = (0.14)^{1/2} R_{beam} = 1.5$ mm
5. **56% current aperture:** $R = 2.85$ mm
Uses: Provides easy way to cut current in half without changing A/K gap
6. **Multiple beamlet aperture**
Uses: Provides detailed structure in x-y space to compare with simulation

10 kV Gun Apertures and Anode Grid Clamp

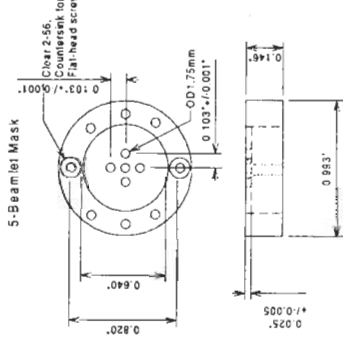
Anode Grid Clamp for the UMD Ring Gun
D. Kehne, 04/06/99

Material: 303 SS



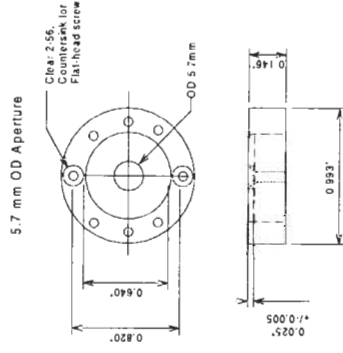
D. Kehne, 04/06/99

Material: 303 SS



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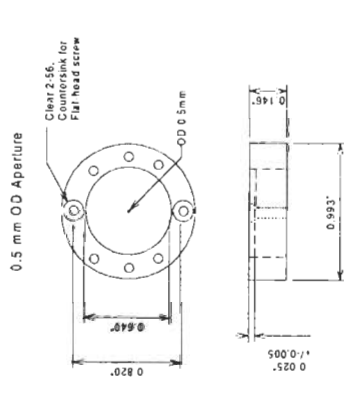
Material: 303 SS



Note: These disks will hold anode mesh and apertures in place

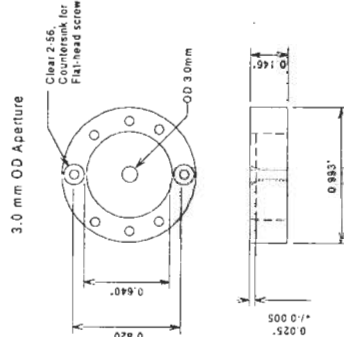
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5/4/00
filename: Apsfinal.skf

Calculation of Aperture Placement Accuracy

D. Kehne

9/15/99

Rotary vacuum feedthrough: Huntington VF-1160

Diameter of Small Gear(D_2): 0.72"

Diameter of Large Gear(Aperture Plate)(D_1): 3.58"

Radial position of Aperture center(R_{1a}): 1.1"

Angular Resolution of Rotary Feedthrough($\Delta\theta_2$): +/- 0.5 degree

Backlash: 0.1 degree

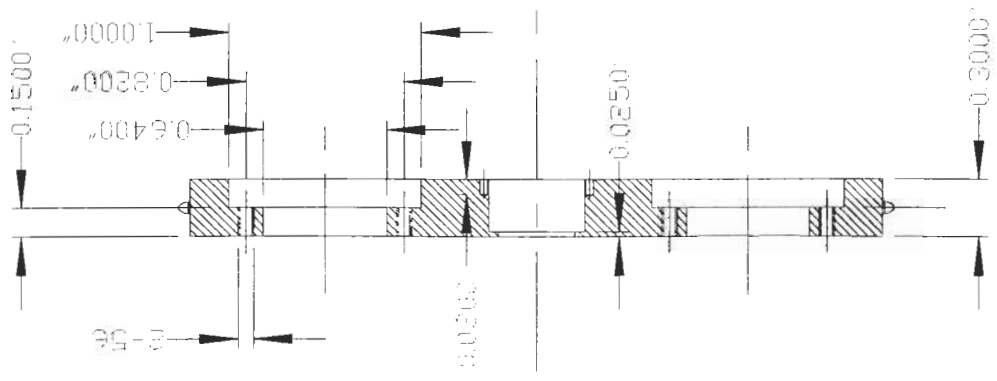
Repeatability of Rotary Feedthrough: +/- 0.5 degrees

Aperture Position Resolution ($\pm\Delta L$) = $\Delta\theta_2 * R_{1a} * (D_2/D_1)$

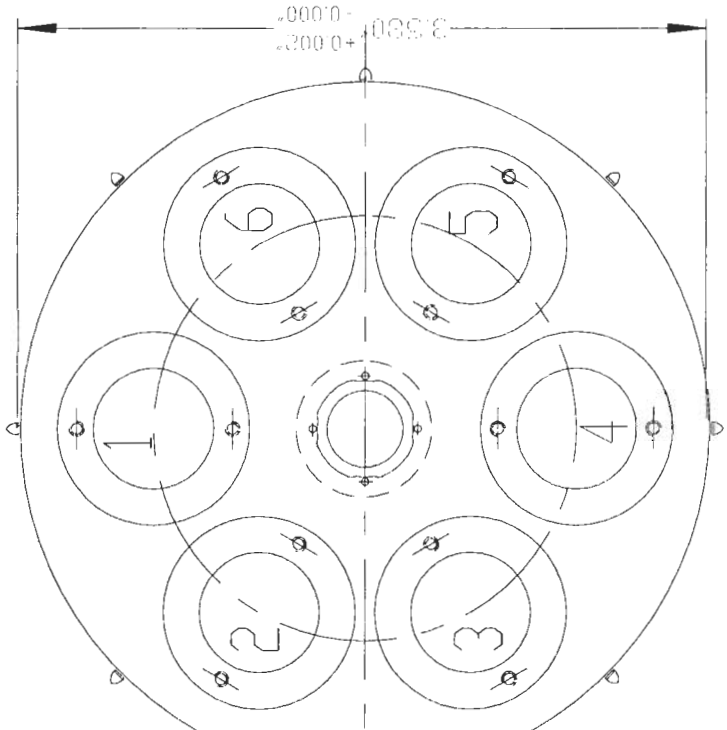
$\pm\Delta L = \pm(0.5 * \pi/180) * 1.1 * 25.4 * (0.72/3.58) = \pm 0.049$ mm

$\pm\Delta L = \pm 0.049$ mm

Calibration: 0.098 mm of translation at the center of each aperture per degree of rotation of the rotatable feedthrough



View: Looking toward cathode; cathode is behind plate



Note: Move Rotary feedthrough Clockwise +300 degrees to advance from Aperture 1 to Aperture 6, from Aperture 6 to Aperture 5, from Aperture 5 to Aperture 4, from Aperture 3 to Aperture 2, from Aperture 2 to Aperture 1.

Calibration: Center point of each aperture translates 0.098 mm per degree of rotation of the rotatable feedthrough

Aperture Placement :

- Aperture 1: Full size; i.e. no aperture: 19.5 degree
- Aperture 2: 5.7 mm OD : 79.5 degree
- Aperture 3: 3.0 mm OD : 139.5 degree

- Aperture 4: 0.5 mm OD : 199.5 degree
- Aperture 5: 5-beamlet : 259.5 degree
- Aperture 6: Peppercot : 319.5 degree