

360kV Power Supply Enclosure

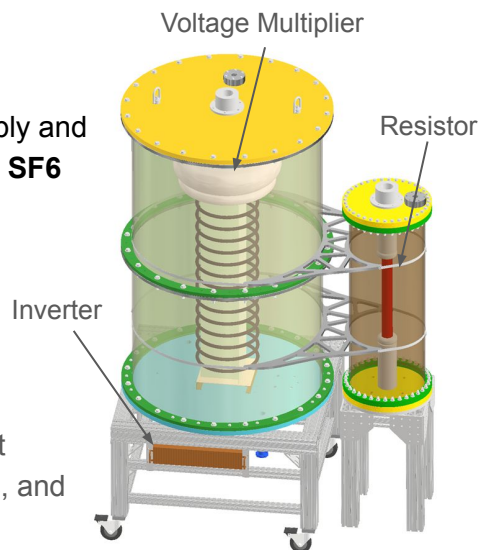
Xelera Research, Internship

Purpose: Design High voltage enclosure for **360 kV, 2 kW** power supply and a **50 MΩ** current-limiting resistor that can be **evacuated** and filled with **SF6 gas at 10 psig** to prevent electrical arcing

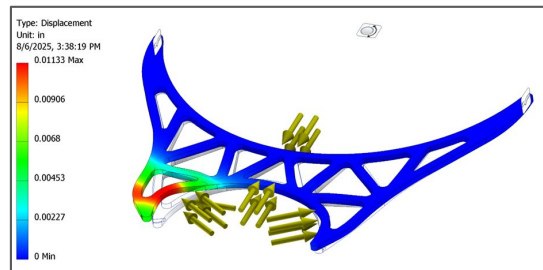
Contributions: Structural design, electrical integration, manufacturing

Technical details:

- ❖ 7.25" gap from charged surfaces derived from Paschen curve and validated with **Poisson Superfish FEA**
- ❖ Used **hand calculations** and **Inventor FEA** to design structure that maintains large safety factors against flange deflection, hoop stress, and vacuum buckling
 - Vacuum-rated burst disk prevents overpressurization
- ❖ Serviceable design separates power supply and resistor, supported on an 80/20 frame with standardized KF40 vacuum and electrical interfaces
- ❖ **Custom HV connections** between components and HV feedthroughs that prevents field concentration
- ❖ **Set up 3 axis CAM** to machine wheel mounts, resistor tank mount, and burst disk flanges with **Haas CNC**
- ❖ Created **engineering drawings** for custom flanges and tubes



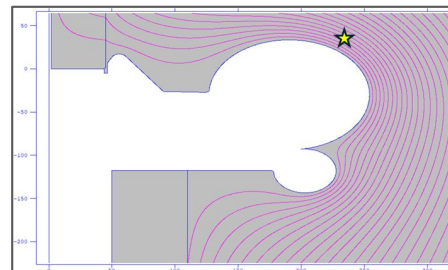
Full CAD model



Mount deformation for 1200 lbs laterally



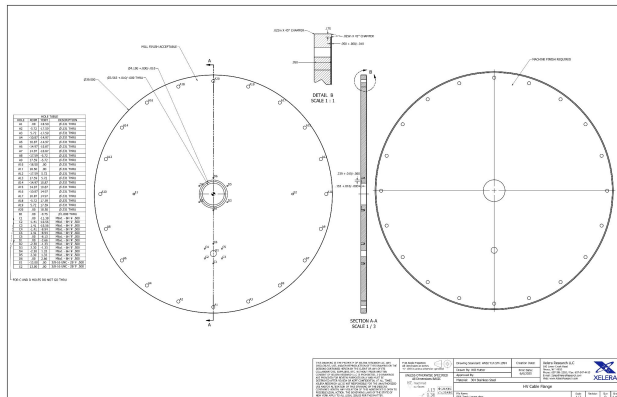
Assembled power supply system



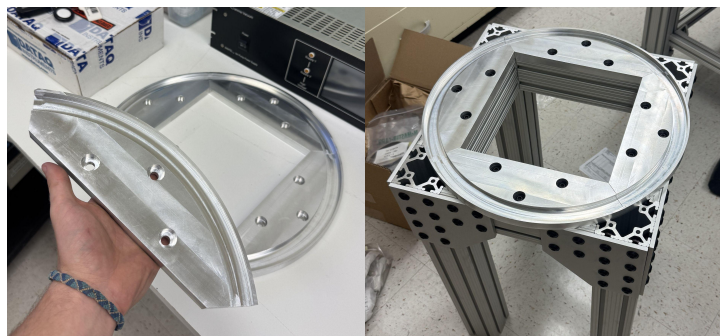
Poisson Electric Field Model

360kV Power Supply Enclosure (Cont.)

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HV Cable Flange Drawing



Personally machined custom mounts for resistor tank



Tank components

Flange Deflection: $y_{max} = k_1 \frac{wR^4}{Et^3}$

For $t = 1\text{in}$, $w = 20\text{psi}$, $R = 17.5\text{in} \rightarrow$

$y_{max} = 0.01265\text{in}$

Stress on flanges: $S_{max} = k \frac{wR^2}{t^2}$

For $t = 1\text{in}$, $w = 20\text{psi}$, $R = 17.5\text{in} \rightarrow$

$S_{max} = 4117\text{psi}$

Vacuum buckling: $P_{cr} = KE \left(\frac{t}{D} \right)^3$

For $t = 0.25\text{in}$, $D = 35\text{in} \rightarrow$

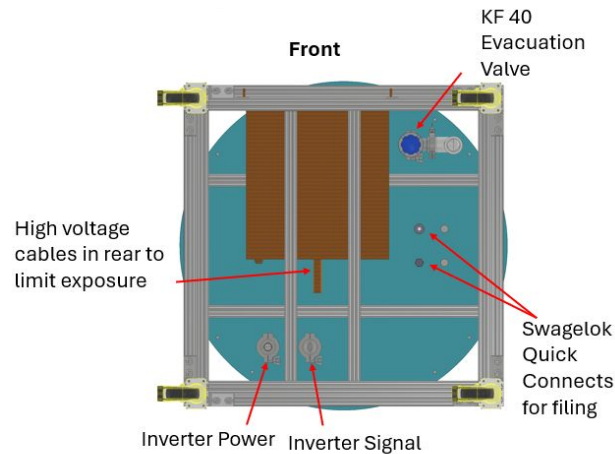
$P_{cr} = 272\text{psi}$, Safety Factor = 13.6

Hoop stress: $S = \frac{pr}{t}$

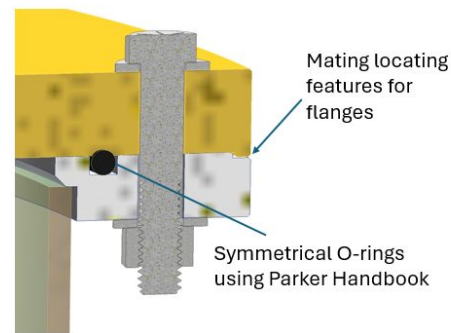
For $t = 0.25\text{in}$, $r = 17.43\text{in}$, $p = 20\text{psi} \rightarrow$

$S = 1394\text{psi}$, Safety Factor = 32.25

Project II



Selected and integrated feedthroughs



Custom 38" Flanges welded to rolled tubes