Grids for NEXT-100

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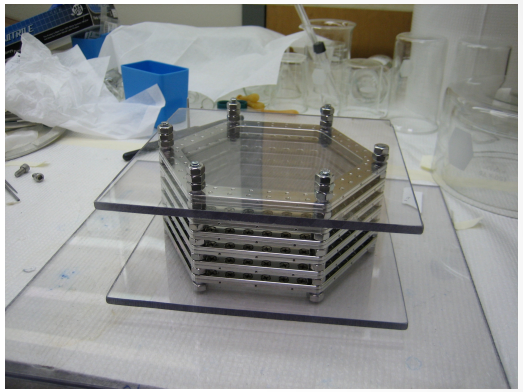
Outline

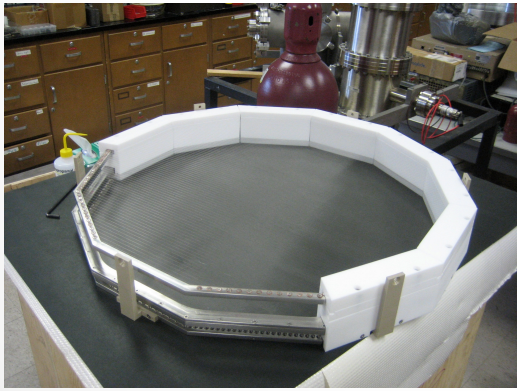
- Large scale grids
  - Wire mesh
  - Parallel wire
  - EL grid R & D
  - EL grid alternatives

Wire Mesh Grids

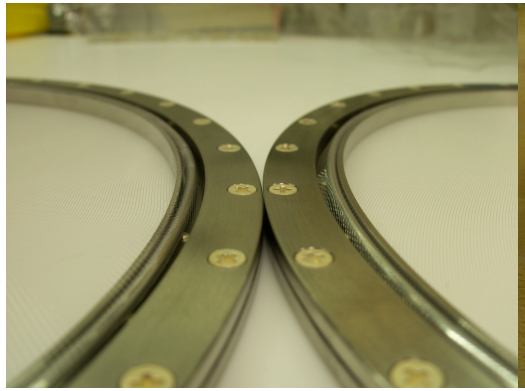
- What we have done (All 88% open)
  - NEXT-1 LBNL (18 cm, 6 sided)
  - NEXT-1 IFIC (26 cm, circular)
  - Zeplin II (37.5 cm, circular)
  - LUX (55 cm, 12 sided)
- What's the difference?
  - Size, shape, clamping, tensioning, surfaces



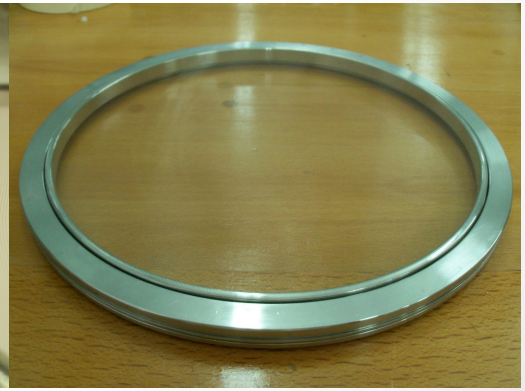
LBNL



LUX



First NEXT-1 IFIC

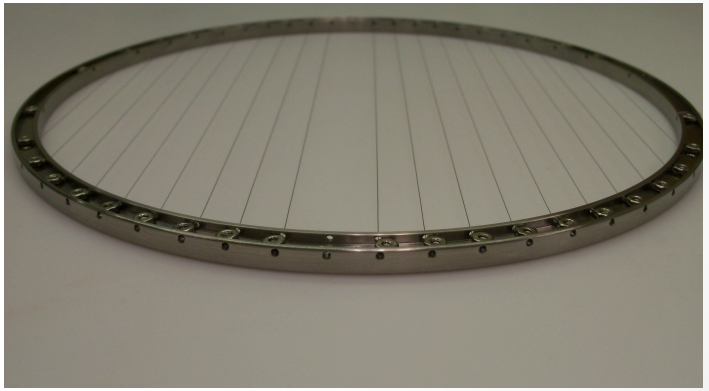


Latest NEXT-1 IFIC

Parallel Wire Grids

- Why parallel wire grids?
  - More open area (~97%) for non-EL grids (e.g. cathode, PMT shield)
- What we have done
  - NEXT-1 IFIC
  - LUX
- What's the difference?
  - Grid size/shape, wire diameter, pitch, clamping

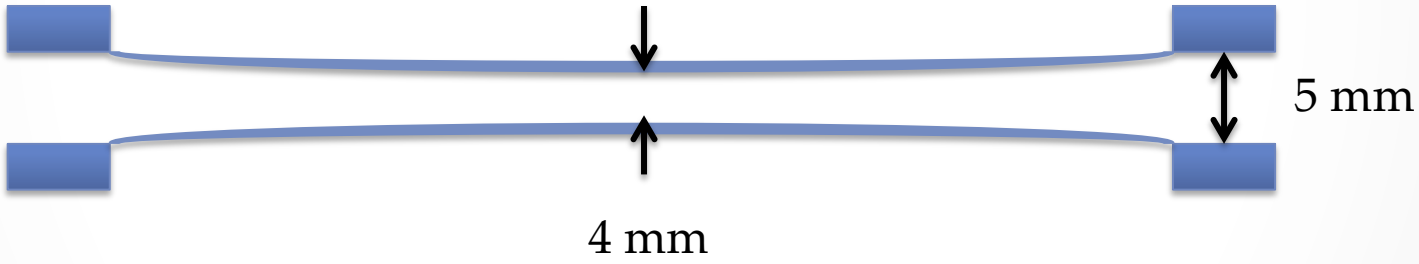
LUX



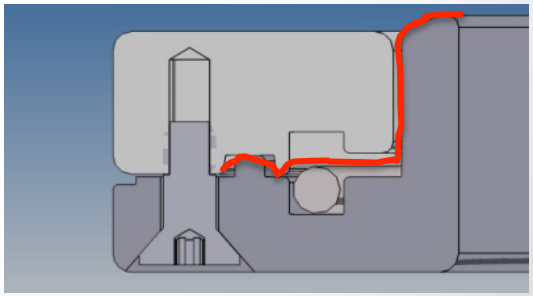
NEXT-1 IFIC

EL Grid R & D

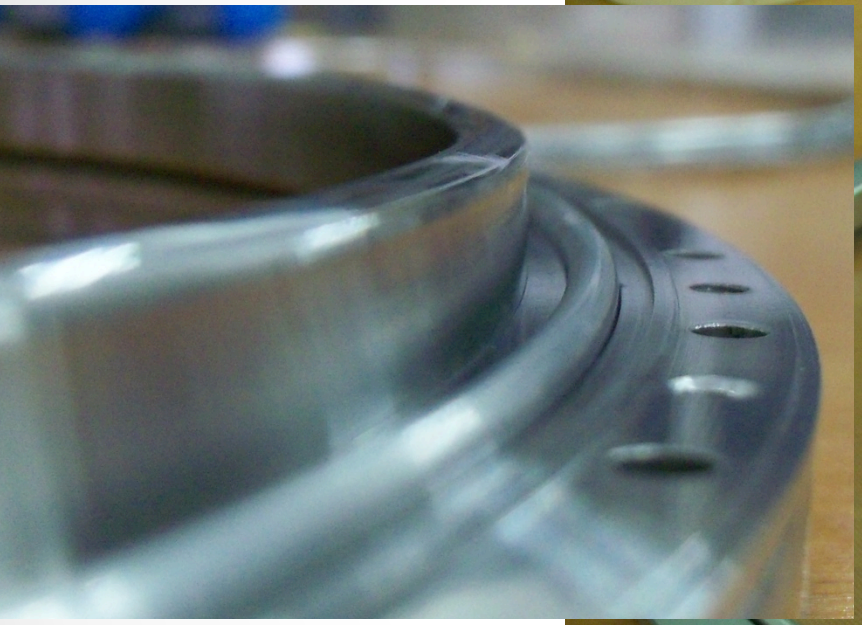
- Priority - Build 1 m scale mesh grid and measure deflection of wire mesh
  - Need ~26 kV across 5 mm gap in 15 bar Xe to achieve E/p=3.5 kV/cm/bar
  - Preliminary calculation shows deflection up to ~1 mm (20% of total gap)
  - LUX grid deflects ~100 μm with 10 kV/cm

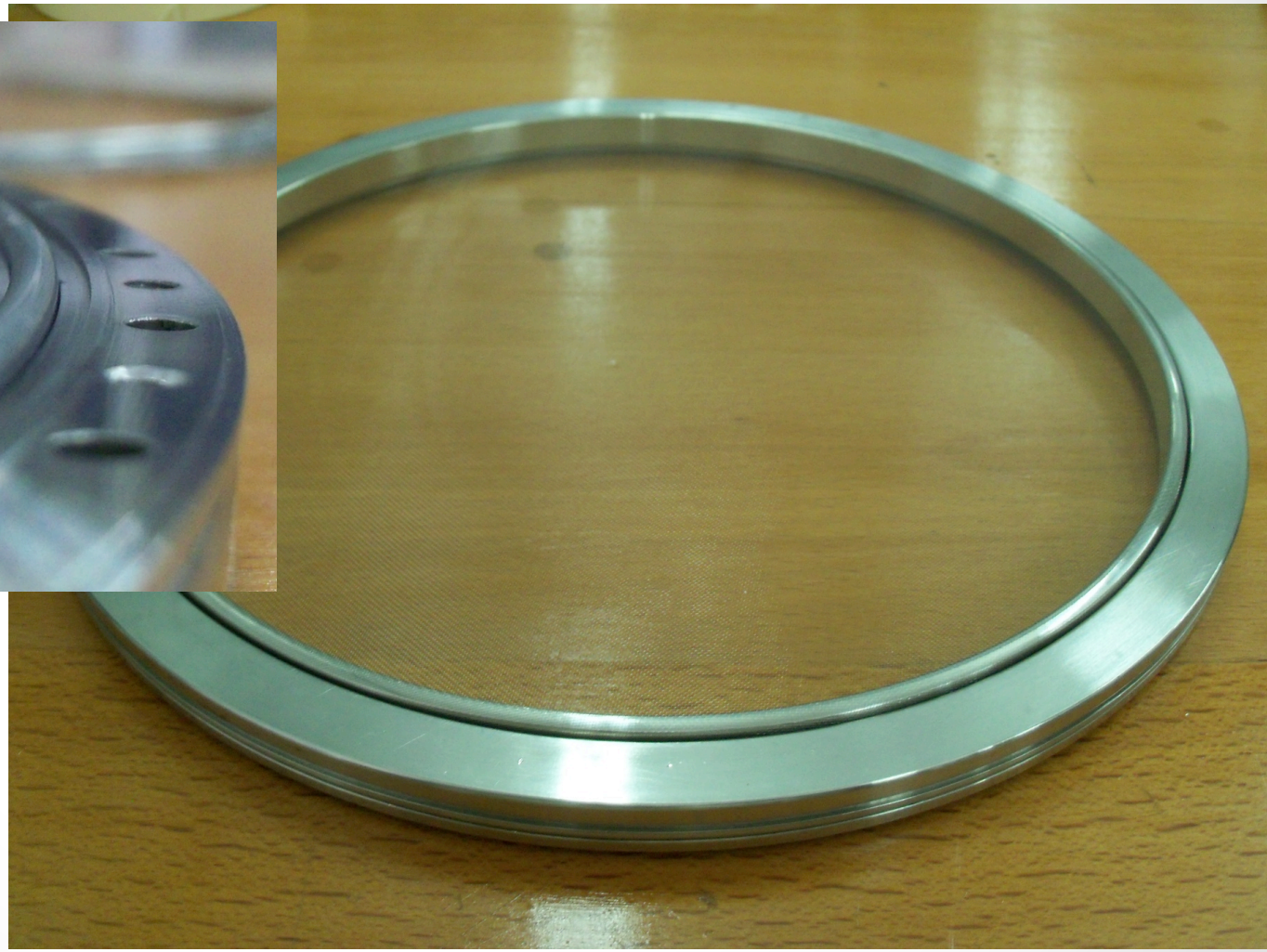


- Plan
  - Start with same basic design as latest NEXT-1 EL grids
  - Build ~1.1m ID grid with existing 1.2m wide mesh
  - Already part of DUSEL R&D



Current NEXT-1 IFIC EL Grids



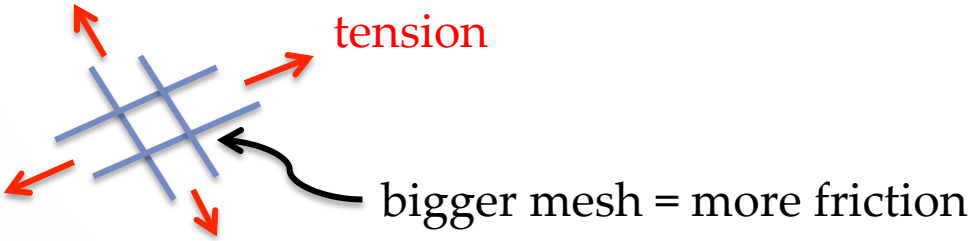


EL Grid R & D

- Other priorities
  - Grid flatness (before and after stringing)
    - Potato chipping more of an issue with parallel wire grids

potato chip

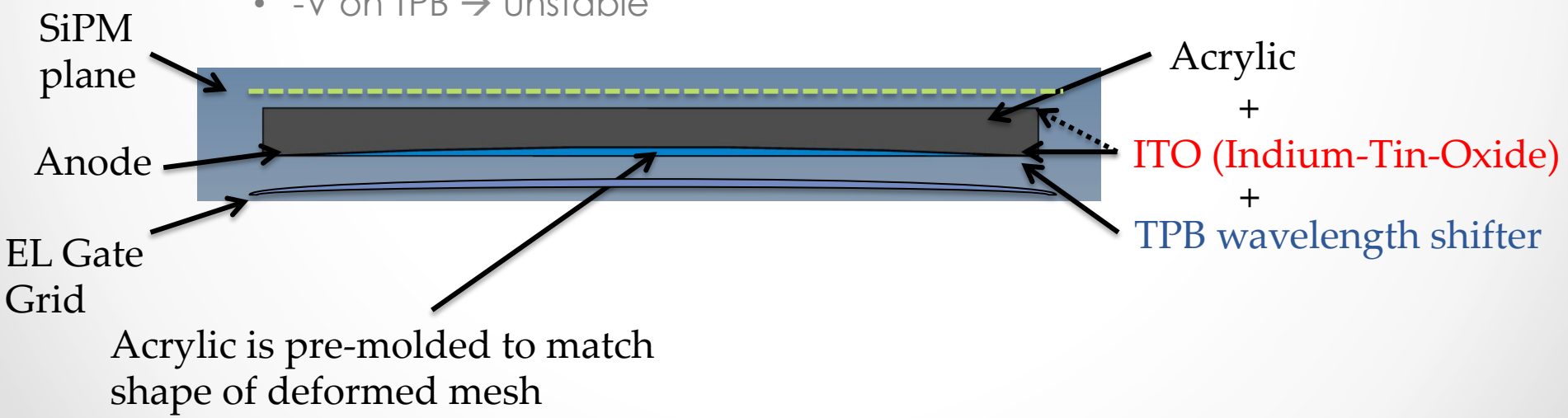
  - Can we achieve high enough tension without ripping the mesh?
    - Probably not an issue



  - How do we keep a large scale grid MASSLESS?!

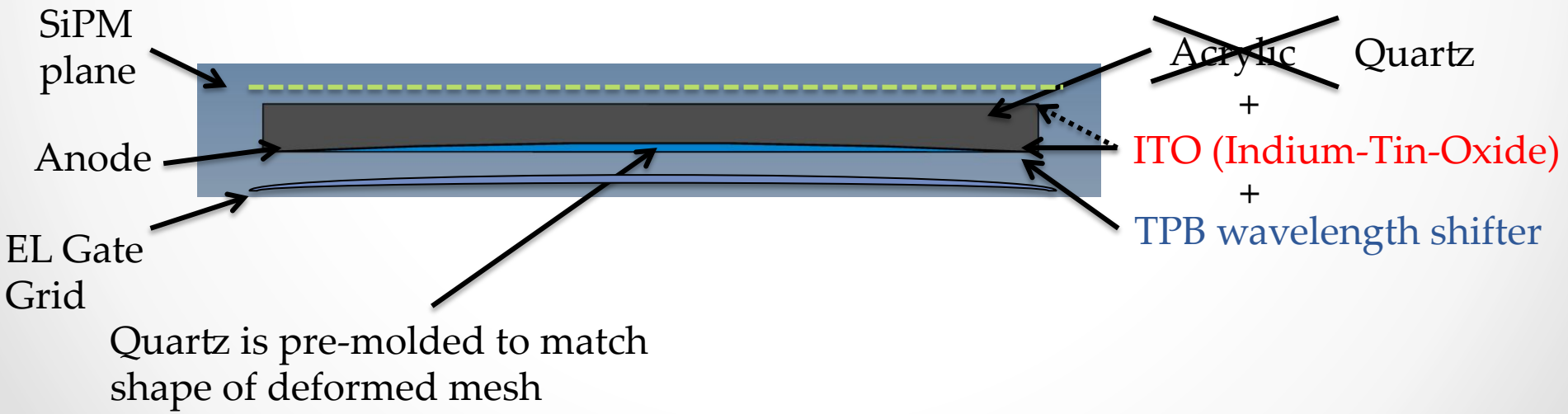
EL Grid Alternative 1

- ITO + TPB wls coated acrylic
  - Acrylic optical transmission >90%
  - ITO ~80-90% transmission of 420nm light
    - Coating both sides with ITO means we can put high voltage on it (not ground) → lower overall field cage voltages
  - Does the TPB charge up?
    - We coated Al-mylar with TPB → stable with +V on TPB side
    - -V on TPB → unstable



EL Grid Alternative 2

- ITO + TPB wls coated quartz
  - Quartz optical transmission >90%
  - ITO ~80-90% transmission of 420nm light
    - Coating both sides with ITO means we can put high voltage on it (not ground) → lower overall field cage voltages
  - Does the TPB charge up?
  - Quartz = ¡mucho dinero!



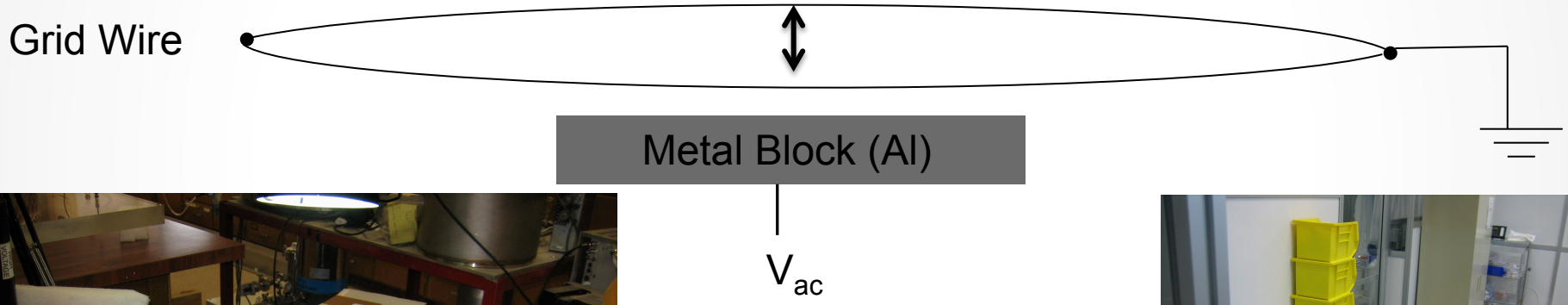
Conclusion

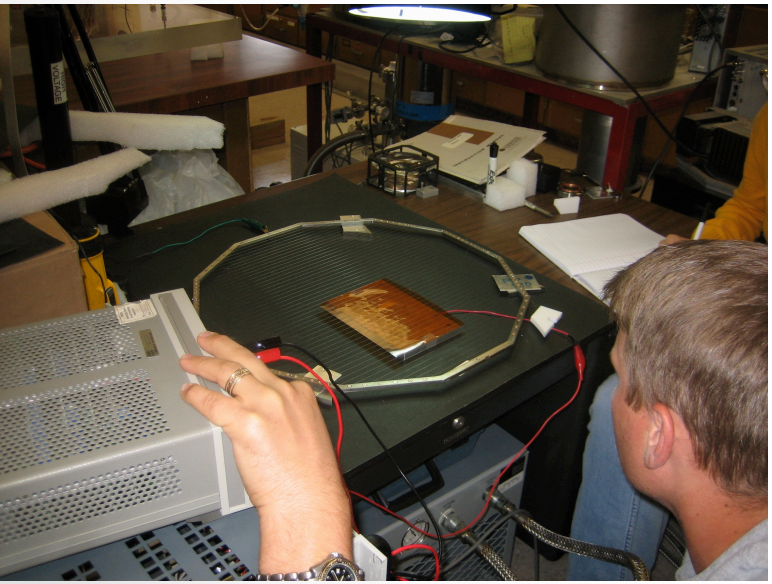
- Lots of R&D already done up to 0.5 m scale
- 1 m scale is within reach and we will test it soon
- Biggest problem = deflection of the mesh
- Design the can with the grid in mind
  - We don't want to be stuck with "massless" grids (e.g. Zeplin II had to design grid after the vessel → nearly disaster)
- Viable alternatives
  - More R&D needed

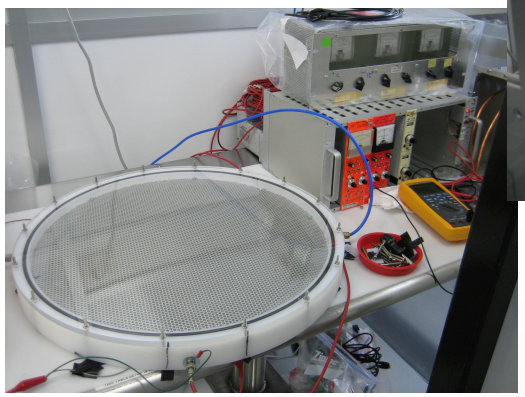
Back-up Slides

Wire Tension Measurement: Parallel Wire Design

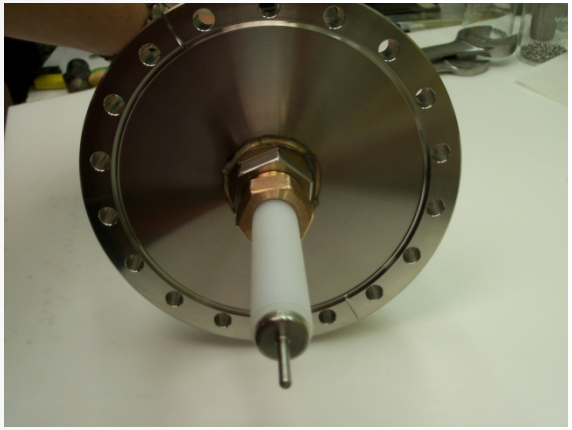
$$f = \frac{1}{2l}\sqrt{\frac{T}{\mu}}$$

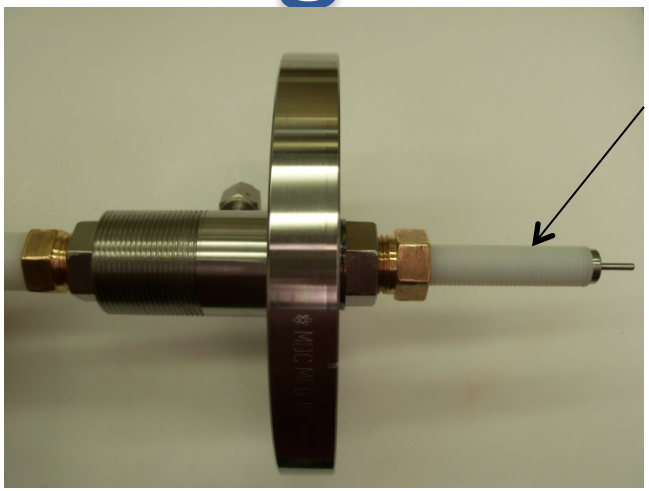


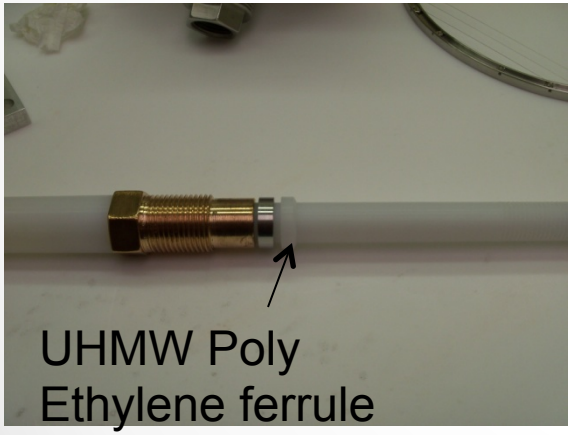


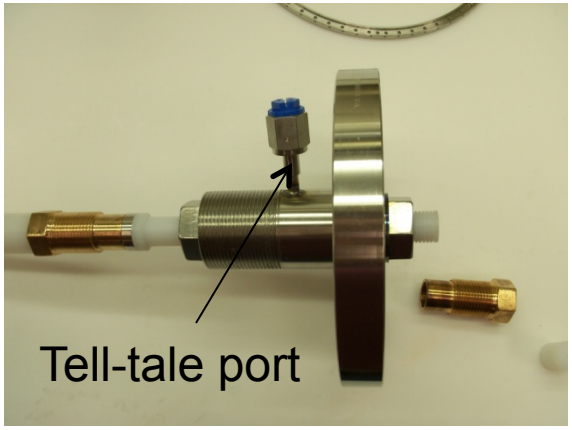


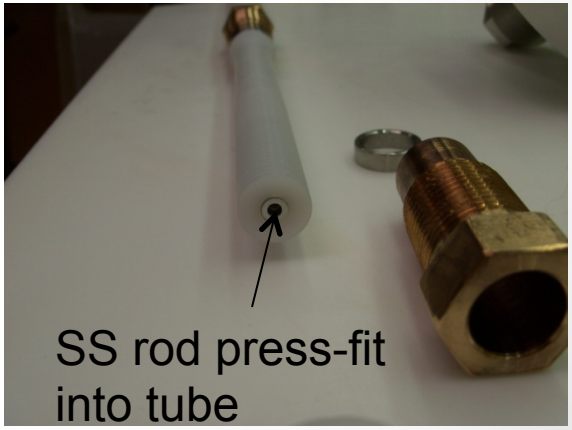
HVFT Design




Tefzel tube
(κ=1800 V/mil)


UHMW Poly
Ethylene ferrule


Tell-tale port


SS rod press-fit
into tube

HVFT Prototype Testing: Pressure and Electrical

Pressure:
- 8e-7 torr vacuum, but need proper He leak check

Electrical:
-Tested in vacuum to 100 kV

-Tested in 3 bar N2 to70 kV

-Removed temporary end connector and was stable at 68 kV in air