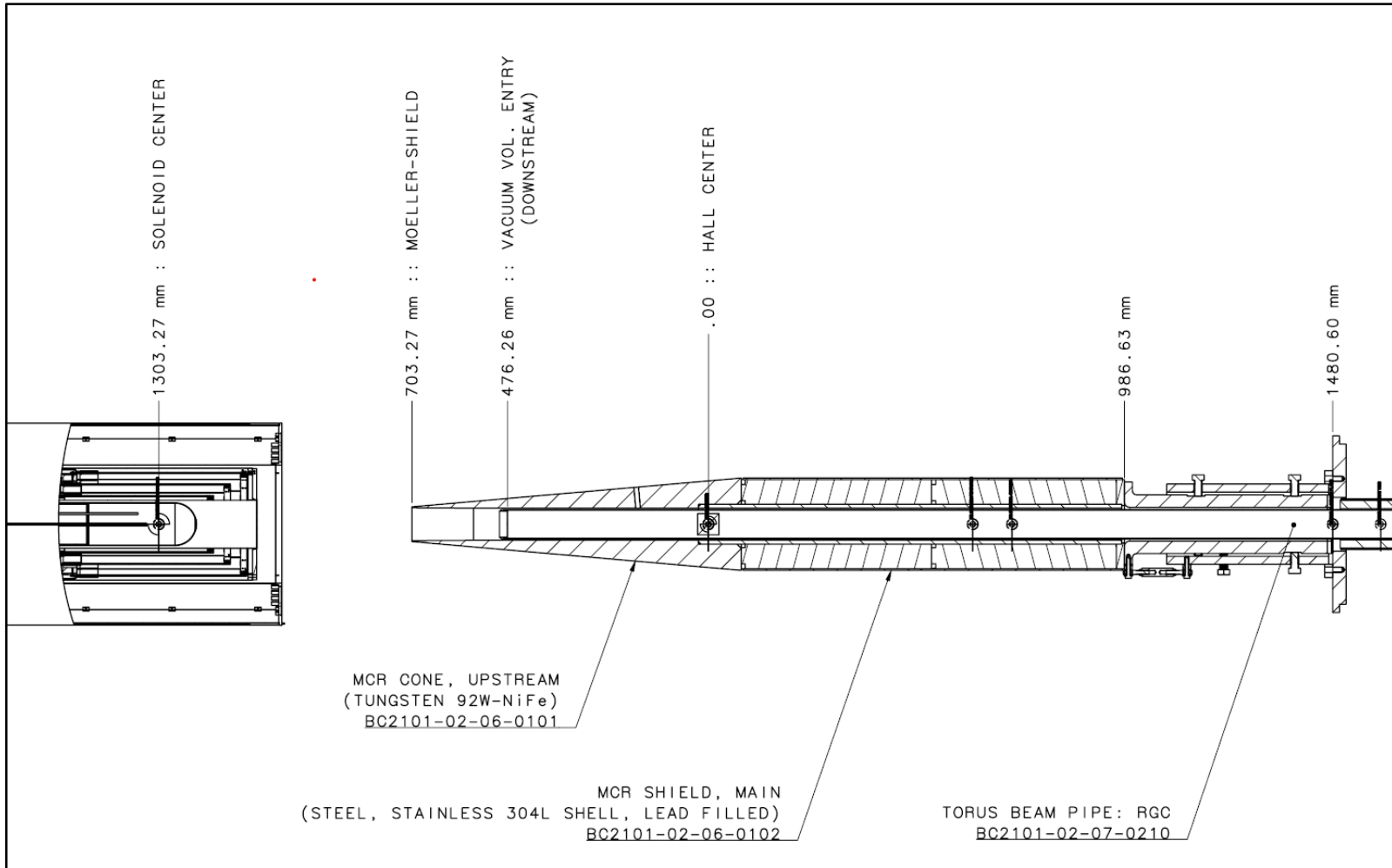

Experience with Particle Shielding in Hall B at JLab March 2024

Bob Miller
Lead Engineer
Jefferson Lab
Hall B

Outline

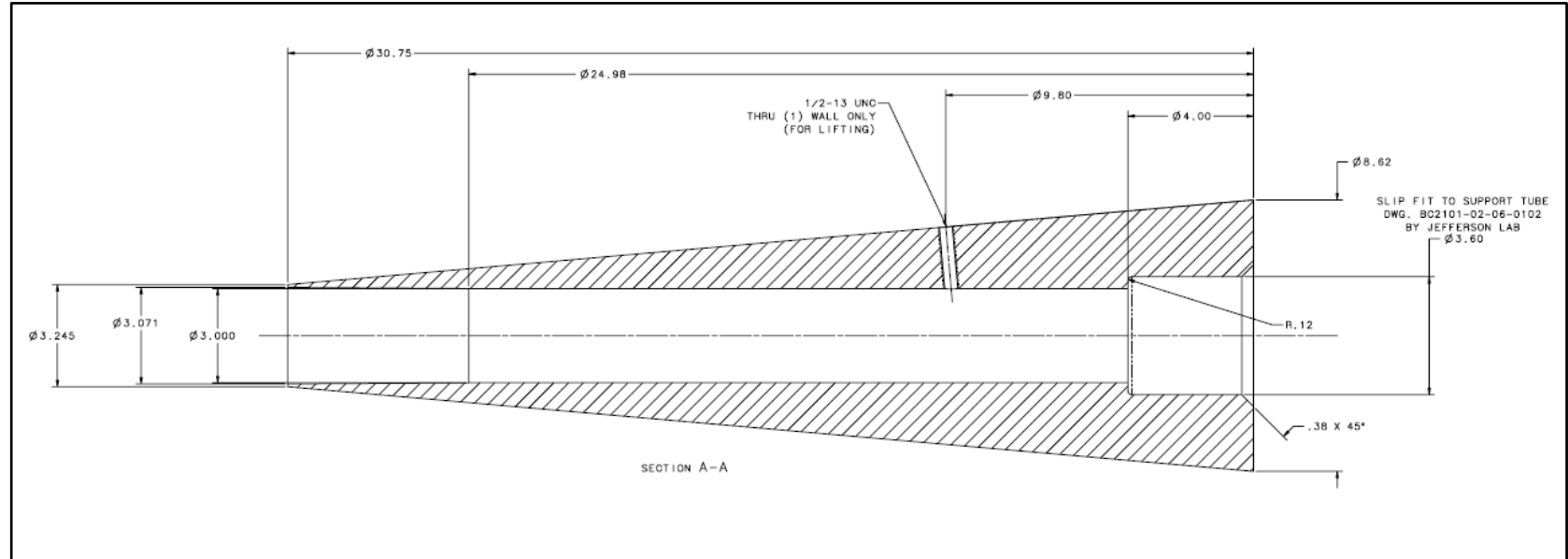
- Beam Line Shielding
 - Tungsten Shields
- Tungsten Fabrication
 - Lead Shields
 - Shield Supports
- Shielding Material

Beam Line Shielding



Beam Line Shielding for One Experiment

Tungsten Shields

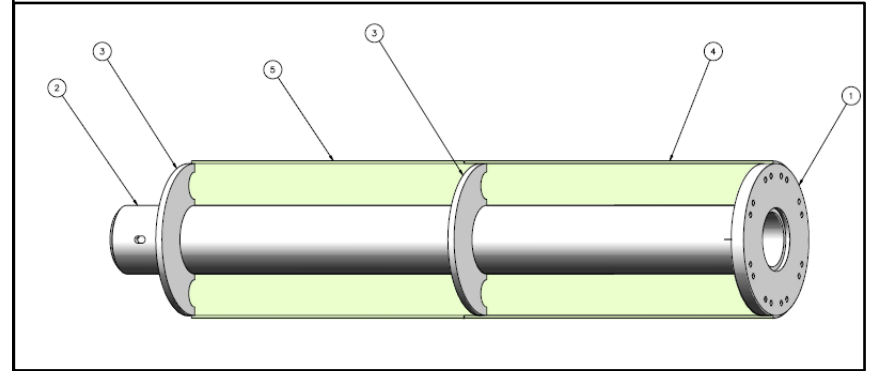
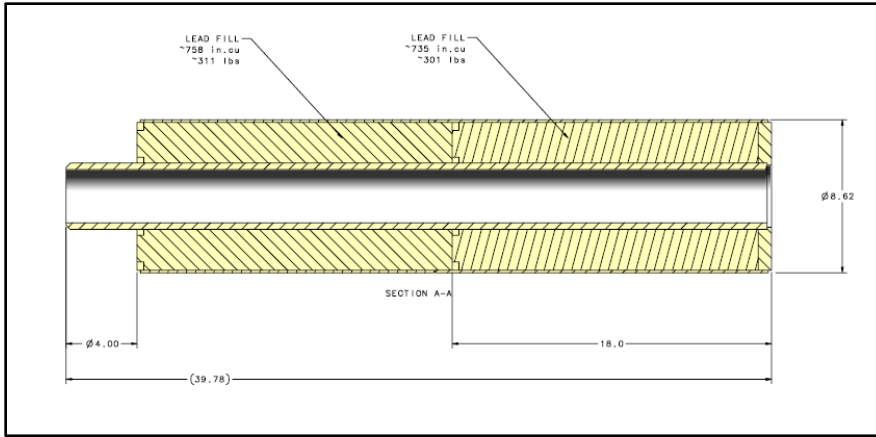


- Shield for Moller Electrons
- 470 pounds
- \$96K in 2021
- 92% W, 5.25% Ni, 2.25% Fe
- Density of 17.5 g/cc

Tungsten Fabrication

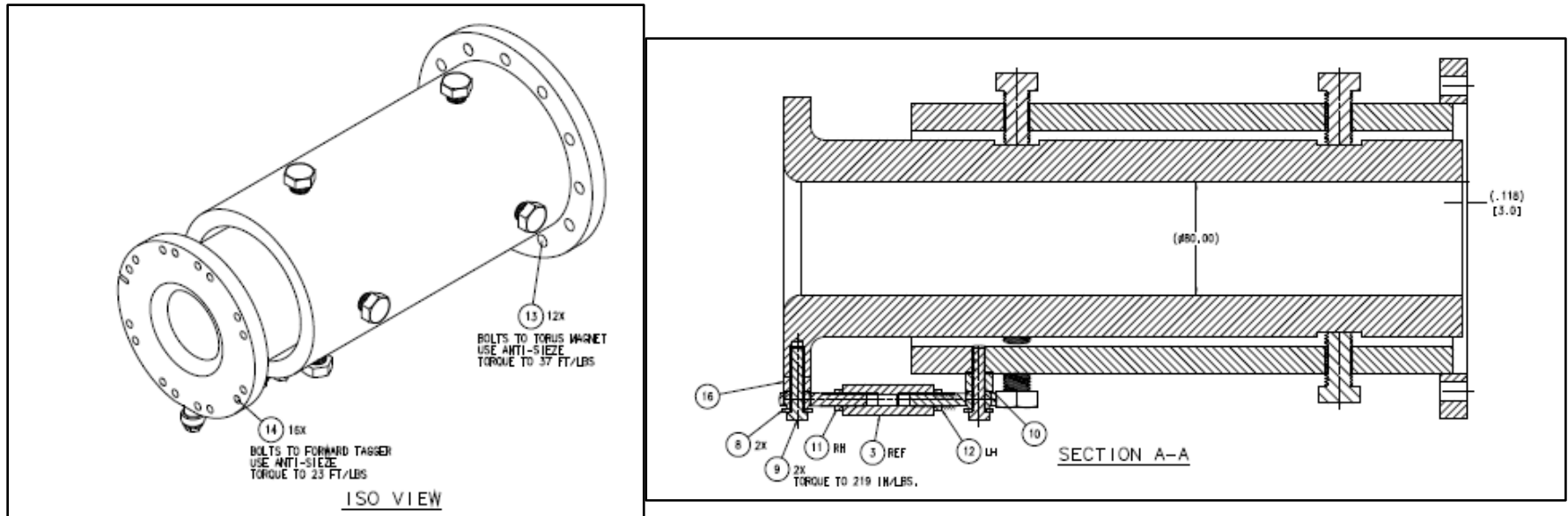
- **Eagle Alloys Corporation, Tennessee, USA**
- Eagle Alloys Corporation can supply High Density Machinable Tungsten Alloy custom finished parts from 0.002” Dia up to 20” Dia and square or rectangular custom finished parts from 0.002” Thk up to 8” Thk
- High Density Tungsten Alloys are made produced by a process called powdered metallurgy. This is a technique where tungsten powder is mixed with [nickel, iron](#) (magnetic) powder or copper (non-magnetic) or some other binder elements. It is then compacted, and liquid phase sintered.

Lead Shields



- Shield for Moller Electrons
- 715 pounds
- \$9K in 2021
- 304 Stainless Steel Structure, Lead Filled
- Density of 11 g/cc

Shield Supports



Mount to Support and Align Shielding

- Tungsten Inner Tube with Flange
- Stainless Steel Outer Tube with Welded Flange

Shielding Materials

Material	Density (g/cc)	Comments
Tungsten Alloy	17.5	Limited in size High cost
Tungsten Powder	10	Lower density due to the space between particles
Lead	11	Pour into an enclosure
Tungsten Powder / Lead	~14	May be possible to mix tungsten powder with lead powder, then melt the lead and pour it into an enclosure