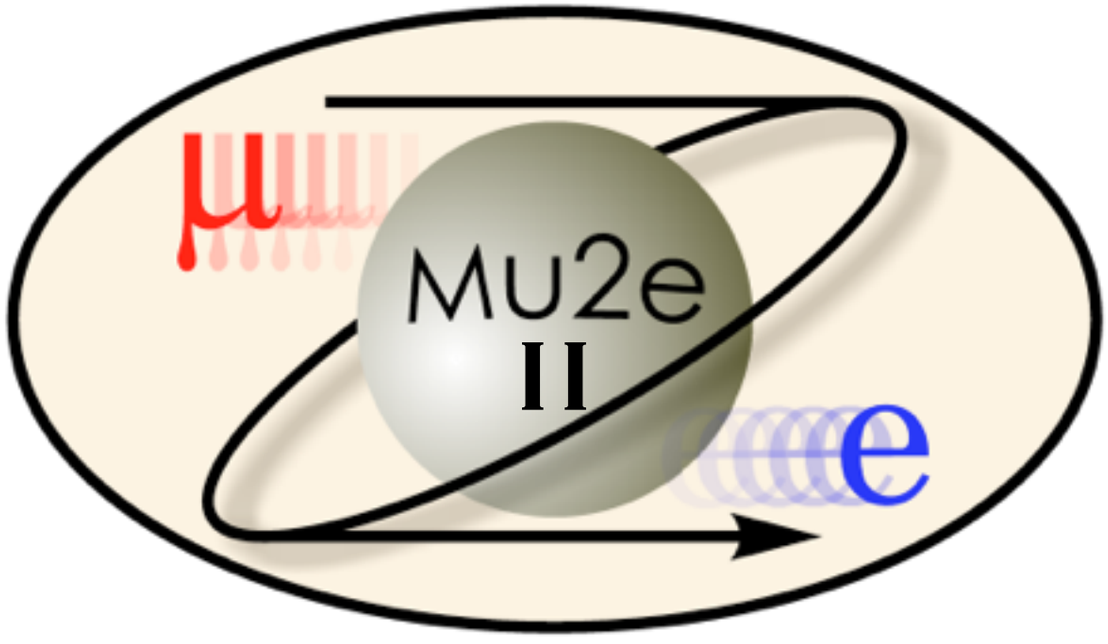
Mu2e-II Tracker with Molybdenum Sense Wires



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Key Properties

	Tungsten	Molybdenum
Density (g/cm^3)	19.17	10.14
Radiation Length (g/cm^2)	6.76	9.80
Resistivity (Ohm mm^2/m)	0.055	0.052
Tensile Strength@25um (N/mm^2)	2600	2200
Thermal Expansion Coefficient ($10^6/C$)	4.0	5.4
Magnetic Susceptibility (10^6 cm^3/mol)	59.0	89.0

Benefits

- Wires account for 11.4% of the total radiation length of the tracker active volume.
- Moving to molybdenum wires would reduce the total radiation length by ~3.5% (more if other components are also reduced).
- The lower density also means less force on the panel/ endplates & makes up for lower strength.
- Other properties are nearly the same or more compatible (e.g. thermal expansion closer to aluminum)
- Prices are the same.

Drawbacks

- Little history with these wires in ionization detectors.
  - SuperB was going to try to use them. Prototype drift chamber had them, never analyzed.
  - TOPAZ at TRISTAN used Mo for field wires. Not sure why.
- Long-term creep studies should be done.
- Solderability should be studied.

- 51% more magnetic than tungsten.

Other Differences

- "Molybdenum" is more difficult to pronounce.
- Possible advantage in an isolationist future:
  - Tungsten is primarily produced in China, Russia, Canada, Bolivia, Vietnam.
  - Molybdenum is primarily produced in China, USA, Chile, Peru, Mexico.

References

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- A. Imanishi, et. al., The TOPAZ inner drift chamber, NIM: A, Vol 269, Issue 3, 1988, Pages 513-521, ISSN 0168-9002, https://doi.org/10.1016/0168-9002(88)90127-1.
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