

**Update on
Time Projection Chambers
for the Muon-Collider Cooling Experiment**

H. Guler, C. Lu, K.T. McDonald, E.J. Prebys and S.E. Vahsen

Princeton U.

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<http://puhep1.princeton.edu/mumu/tpctrans2.ps>

Goal: Measure the emittance of the muon beam to 3% accuracy before and after the muon cooling apparatus.

Overview

Measure muons individually, and form a virtual bunch in software:

⇒ Must know timing to ≈ 10 psec to select muons properly phased to the 800-MHz RF of the cooling apparatus.

⇒ Use RF accelerating cavity to correlate time with momentum.

⇒ Must measure momentum 4 times.

[⇒ Must also have coarse timing ($\lesssim 150$ psec) to remove phase ambiguity. See talk by S. Vahsen.]

Large transverse emittance, $\epsilon_{N,x} = 1500\pi$ mm-mrad:

⇒ Confine the muon beam in a 3-Tesla solenoid channel.

⇒ All muon detection in the 3-T field.

⇒ Use bent solenoids (toroidal sectors with guiding dipoles) for momentum dispersion.

Muon momentum = 165 MeV/c:

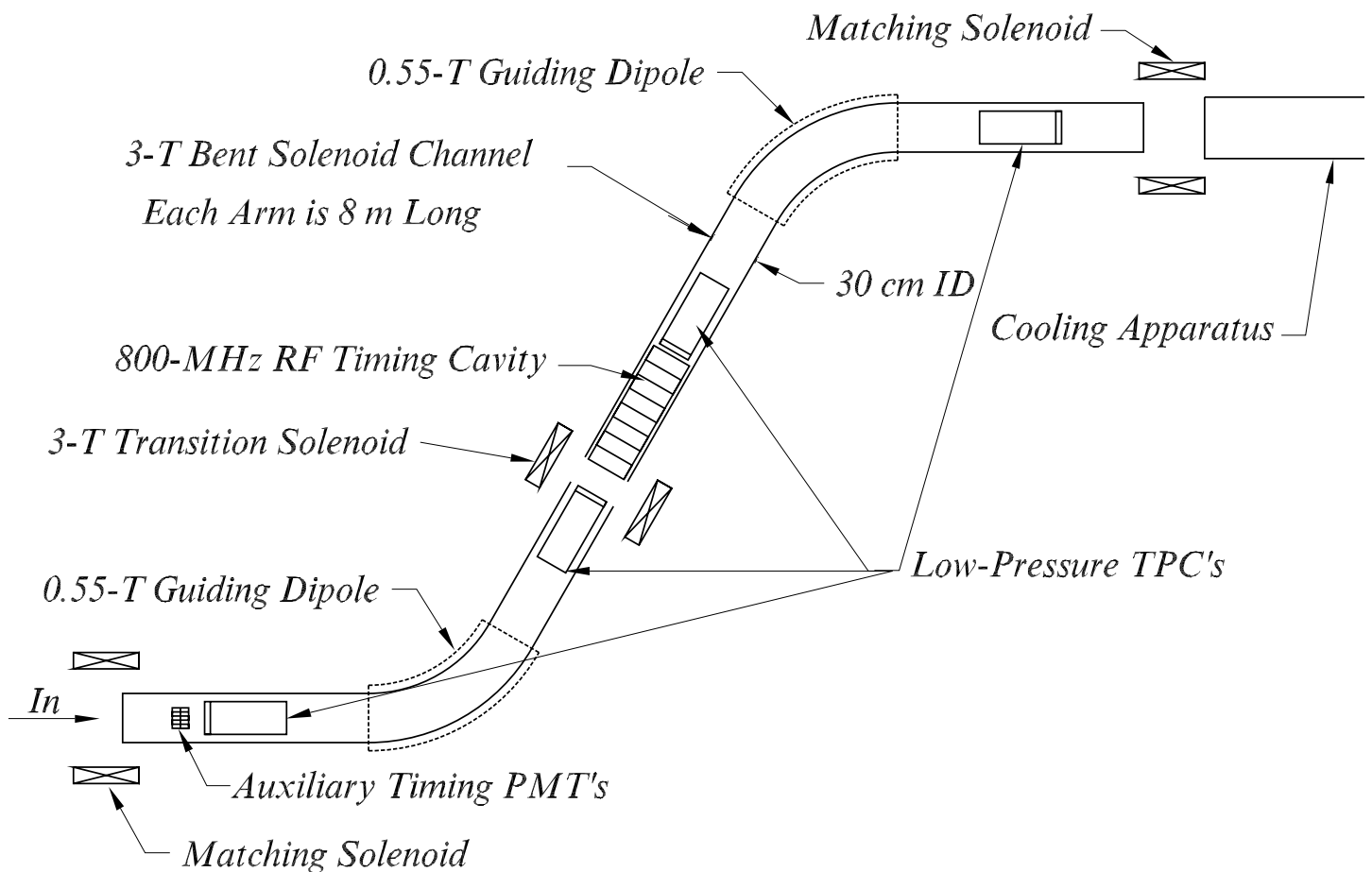
⇒ Larmor period of 1.15 m sets scale for detector arrangement.

⇒ Resolution limited by multiple scattering.

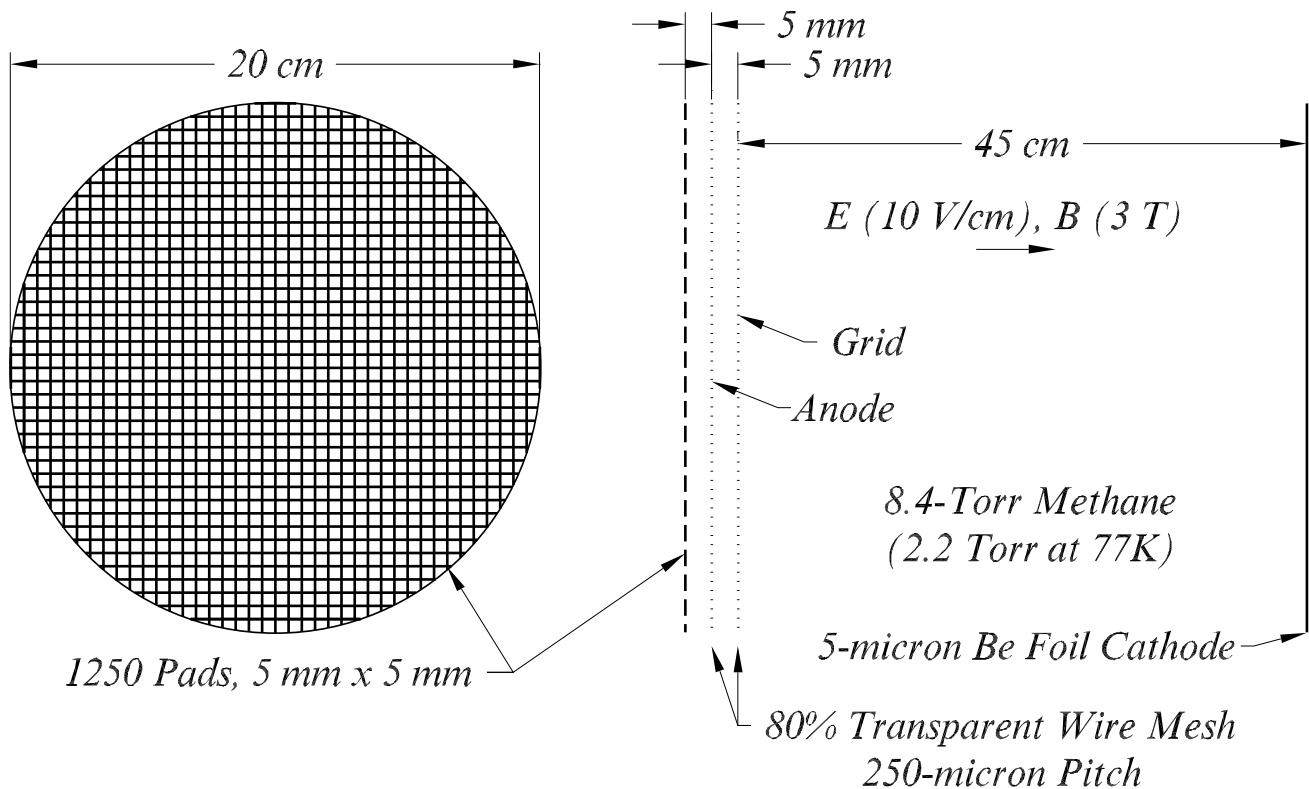
⇒ Perform tracking in a low-pressure gas.

Simplest detector configuration: **E** || **B**.

⇒ **Time Projection Chambers (TPC's)**

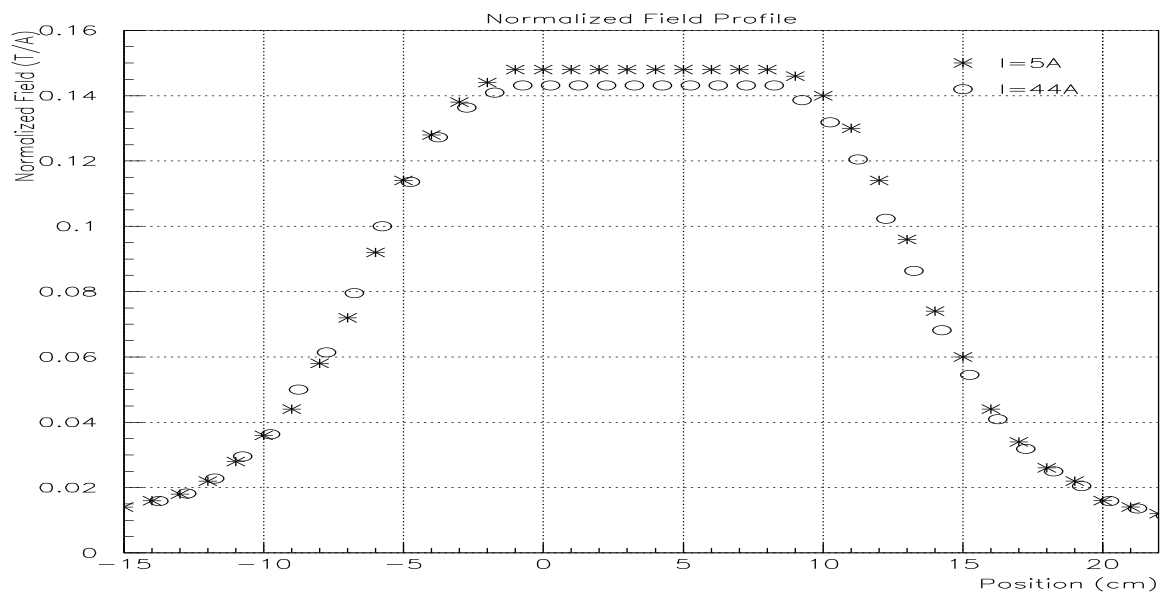


Time Projection Chamber

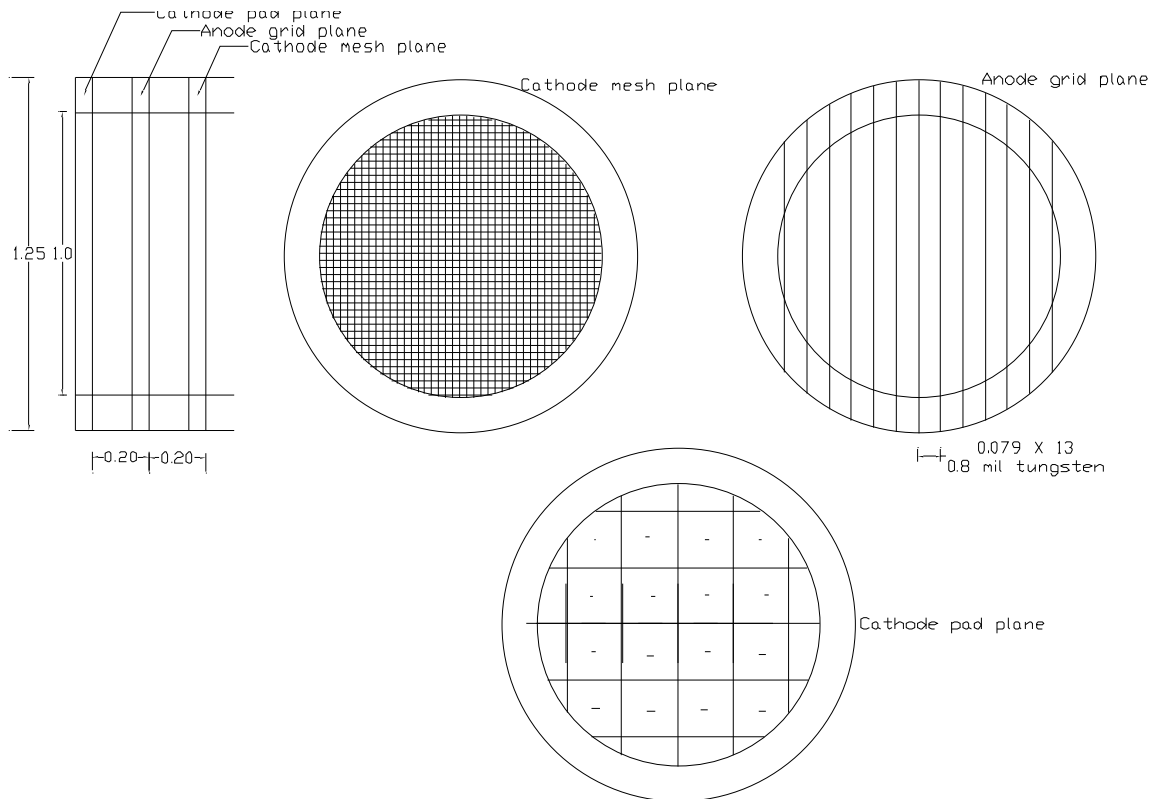
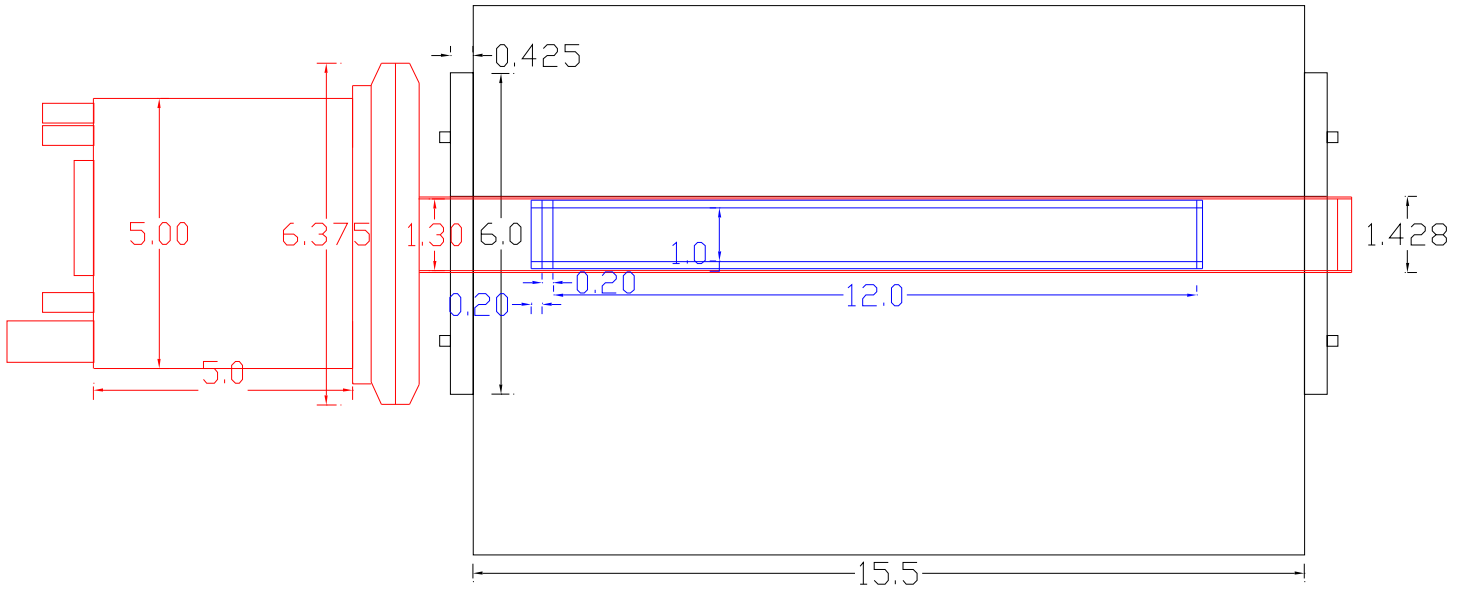


- Two TPC's in same pressure vessel for each of 4 momentum spectrometers.
- Low gas pressure \Rightarrow low operating voltage.
- 1250 cathode pads, 50-MHz timing sampling.
- Analog pipeline via 512-deep switched-capacitor arrays.
- No trigger: capture entire $10 \mu\text{sec}$ window.
- Could process ≈ 10 tracks $\Rightarrow \approx 1 \text{ MHz}$ rate capability.

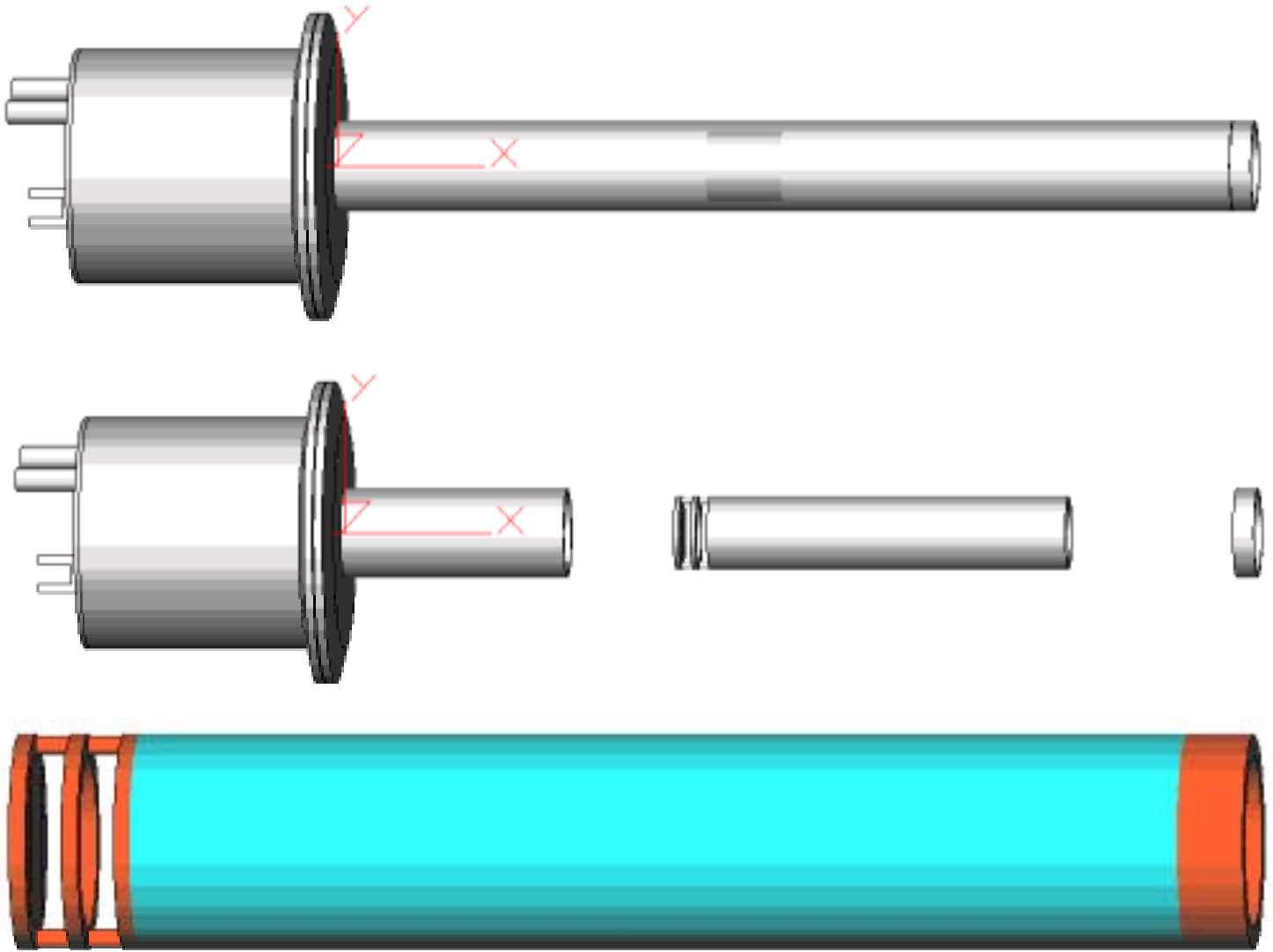
6-T, 3.5-cm-Diameter, Warm-Bore Magnet



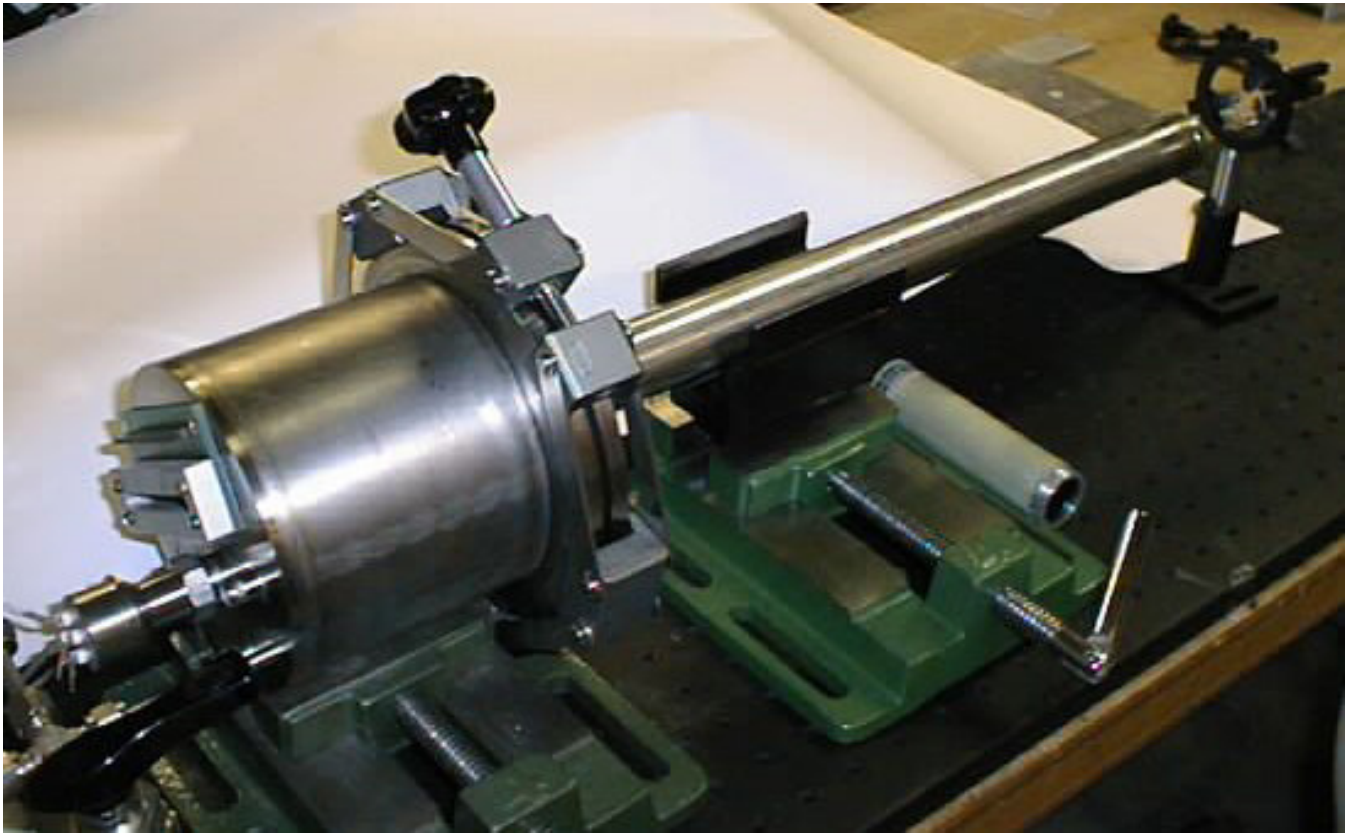
Prototype TPC



Prototype TPC



Prototype TPC Photos



TPC's in the Muon Collider Targetry Experiment

(Advertisement)

