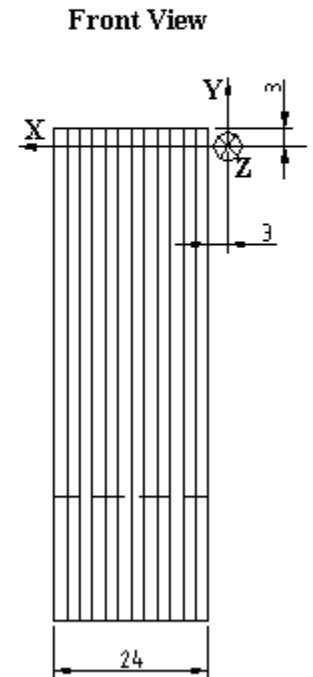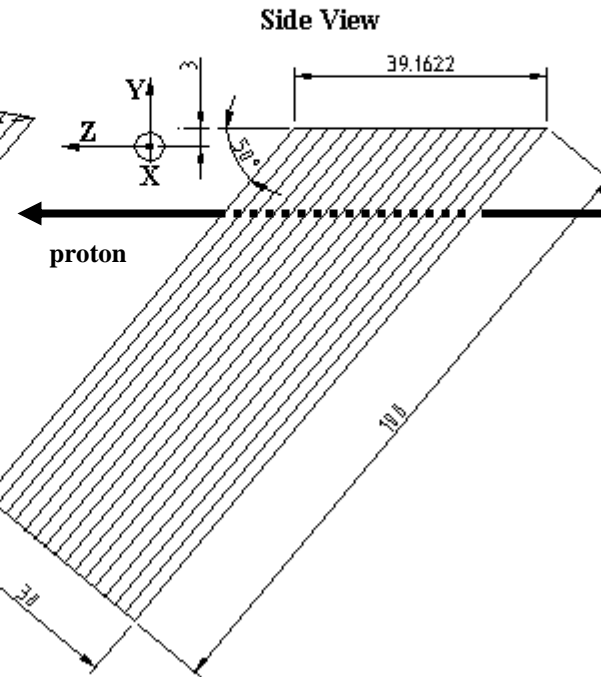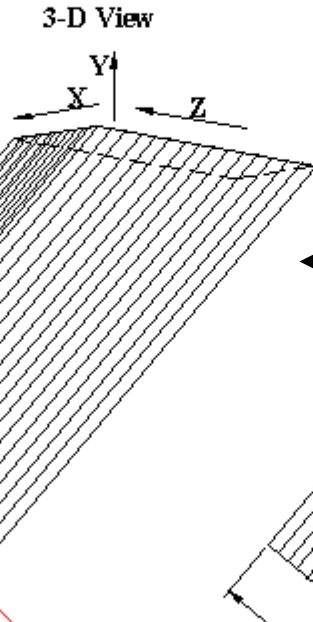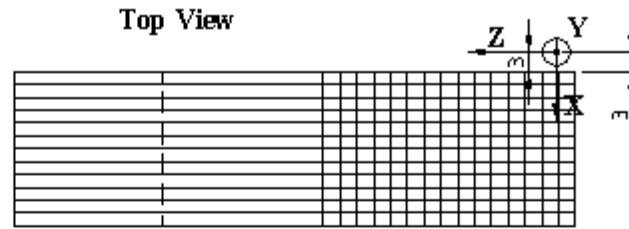# QUARTIC

Preliminary UTA drawing of Mike's concept for a fast time resolution Cerenkov counter:

Initial design uses 2 mm^2 rods, gives x segmentation: could help with multiple proton events (enough light?)

Microchannel plate PMT

Top View

3-D View

Side View

39.1622

proton

Front View

24
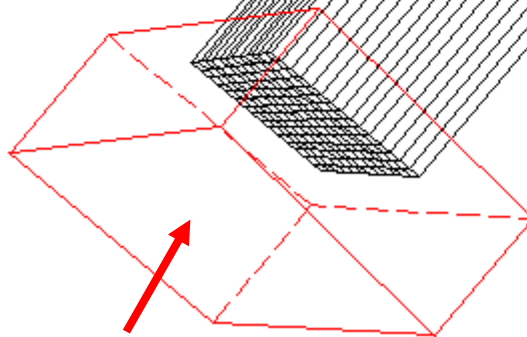
Cerenkov light in quartz:

$$\cos \theta_{ch} = \frac{1}{\beta n} \; ; \; \text{we have } \beta = 1 \;\Rightarrow\; \cos \theta_{ch} = \frac{1}{n}$$

$n(\lambda) = 1.54$ for quartz ... for sim. use $n(\lambda)$

$\theta_{ch} = 49.5^{\circ}$...put bars at this angle or optimum(λ)

$$\text{PDG}: N_{pe} = L \frac{\alpha^2 Z^2}{r_e m_e c^2} \int \varepsilon_{coll}(E) \varepsilon_{det}(E) \sin^2 \theta_{ch}(E) dE$$

$$\Rightarrow N_{pe} \approx 90 \text{ cm}^{-1} L \left\langle \sin^2 \theta_{ch} \right\rangle = 52 \text{ cm}^{-1} L$$

Photon energy

Proposed design L ~ 4 cm so ~ 200 pe
but each 2x2 mm bar effectively 2.6 mm $\rightarrow$ ~ 13 pe
(but this assumes 27% QE and whole cone of light!)
What happens if go to 4x4 (6x6) mm bars?
Note: 6x6 is standard pixel on Burle 85011 MCP

Simulation in progress at UTA, Alberta: Light at photocathode fn(time), with folded Cerenkov light, transmission, quantum efficiency all fn (wavelength).   Getting vendor quotes: $3-4k for fused silica; $4.3K for Burle MCP

2

Jobs and choices:

1. **Design**

   Concept: **bars**, plates, block, fibers, other? (**GASTOF Louvain**)
   Simulations: full Geant (Yushu Yao, Alberta), ray tracing (Noyola, Harenza UTA)
   Optimization

2. **Radiator**

   Fused silica, quartz other?
   Surface treatment: **aluminization** (**can be done at Fermi, but not polishing**)

3. **Photodetector**

   Microchannel plate (MCP): Hamamatsu, **Burle**, other?
   Avalanche photodiode (APD) ? other ? contacted Swain

4. **Assembly and mounting (Alberta+20% UTA?)**

   Engineering and manufacture (including motion control)

5. **Electronics (Alberta?)**

   Front end
   Read-out   } Needs investigation
   HV and slow controls

Jobs and choices (continued):

6. ## Software

   Controls (?)
   Readout (Alberta)
   Data analysis (UTA+Alberta)

7. ## Test Beam

   Integration with BTeV/CMS test setup
   Effort
   MOU

GOAL: test > = two identical counters in Fermilab test beam in June 2006.

Funding: some available from Alberta, UTA+FNAL requests in progress