

Cherenkov detector for Sane

Z.-E. Meziani

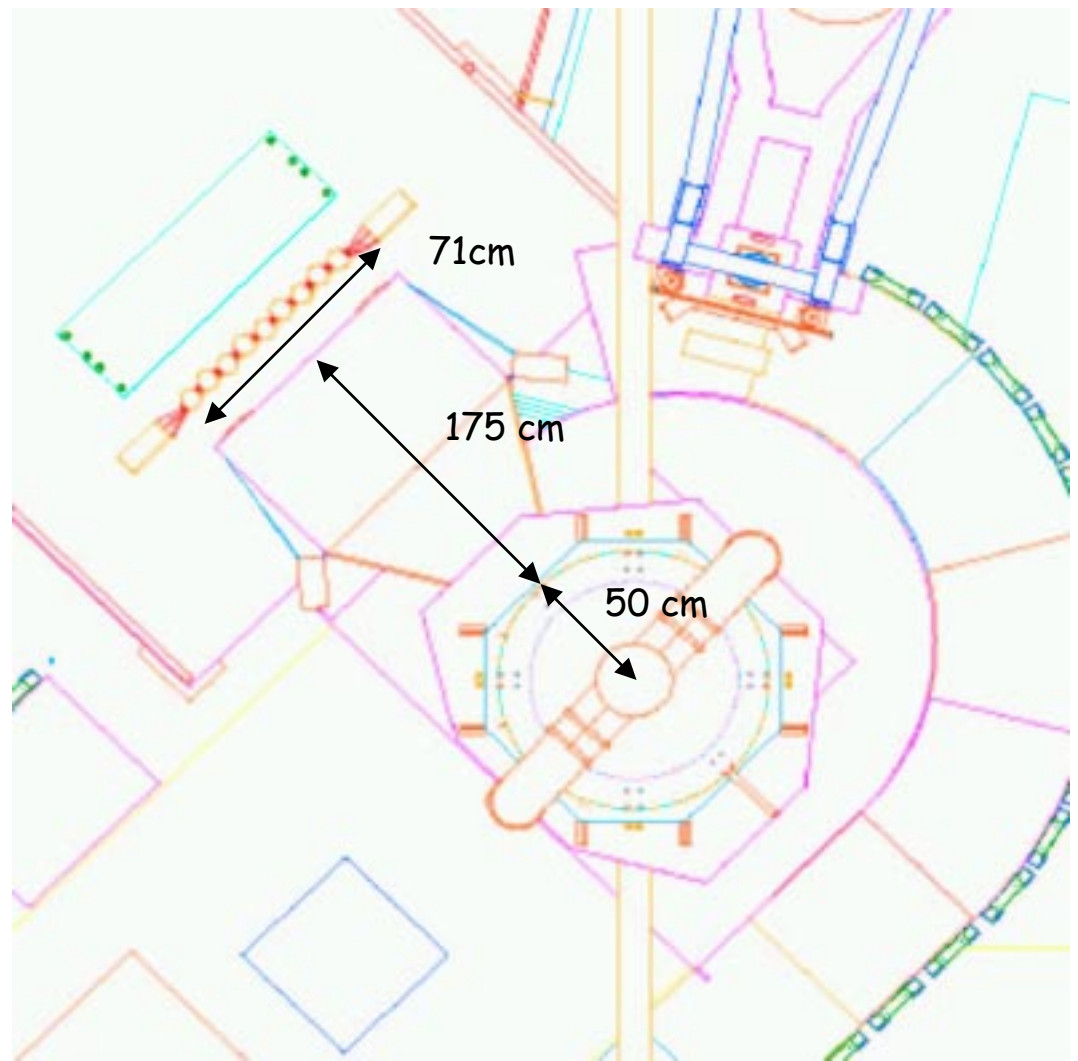
- **Goal:**
 - High electron detection efficiency
 - Pion rejection of at least 1000:1
- **Reference design presented in the proposal**
 - Operation at about atmospheric pressure (over pressure 1cm for water equivalent)
 - Radiator: dry nitrogen at 20°C, $n=1.000279$
 - Pion momentum threshold: 5.9 GeV.
 - Electron momentum threshold: 21.6 MeV

- Windows:
 - **tedlar** for light seal
 - polymer window for gas-tight seal
- Mirrors cover an area 71 cm (H)x 150cm (V) (8 mirrors)
- Point-to-Point focusing of the mirrors for electrons > 0.7 GeV from target cell to phototube

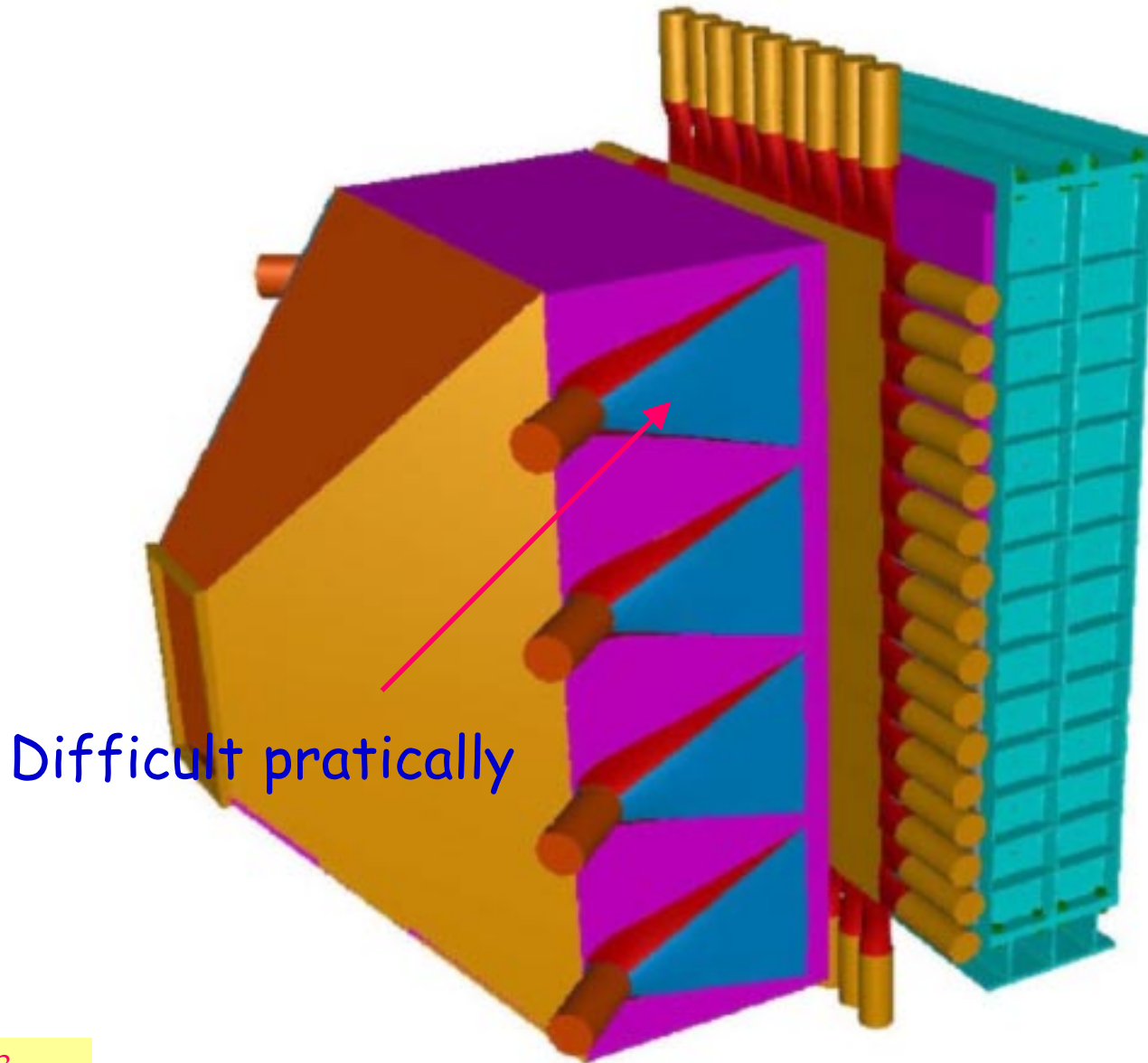
- Detailed ray trace simulation to be done

Some Dimensions

- Distance of front window to the target: 50 cm
- Length of box: 175 cm
- Horizontal/vertical aspect ratio 2:1
- 71 cm (H)x 150cm (V) back window area.

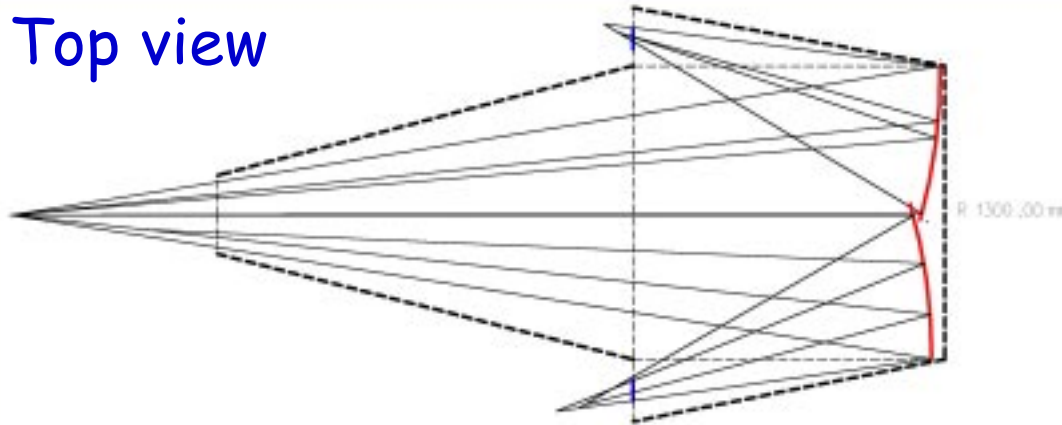


Beta detector with its Gas Cherenkov



New configuration for the Box

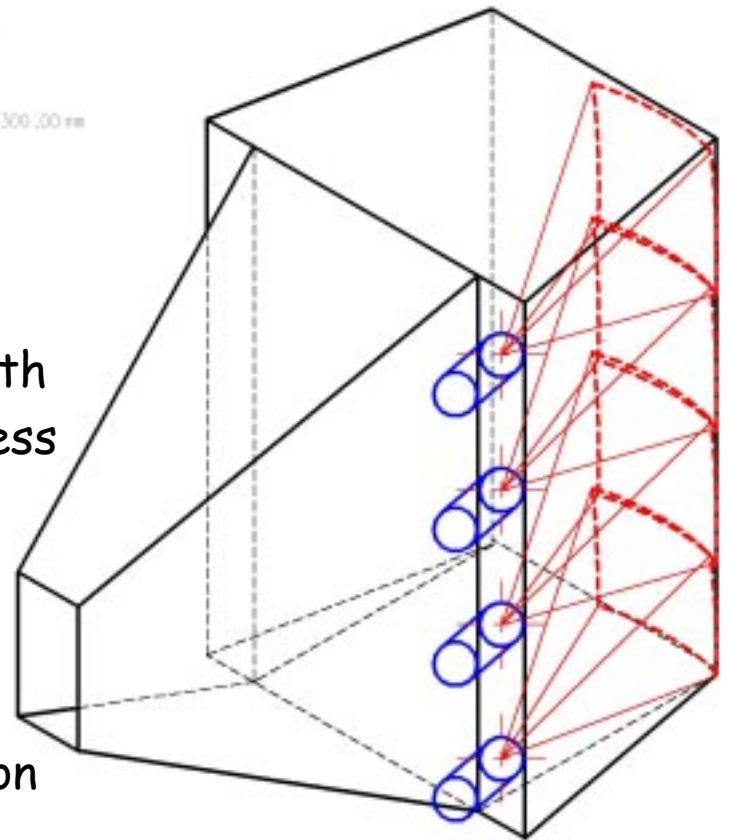
Top view



- Box made out of flat sheets of aluminum with frame reinforcement or non magnetic stainless steel.

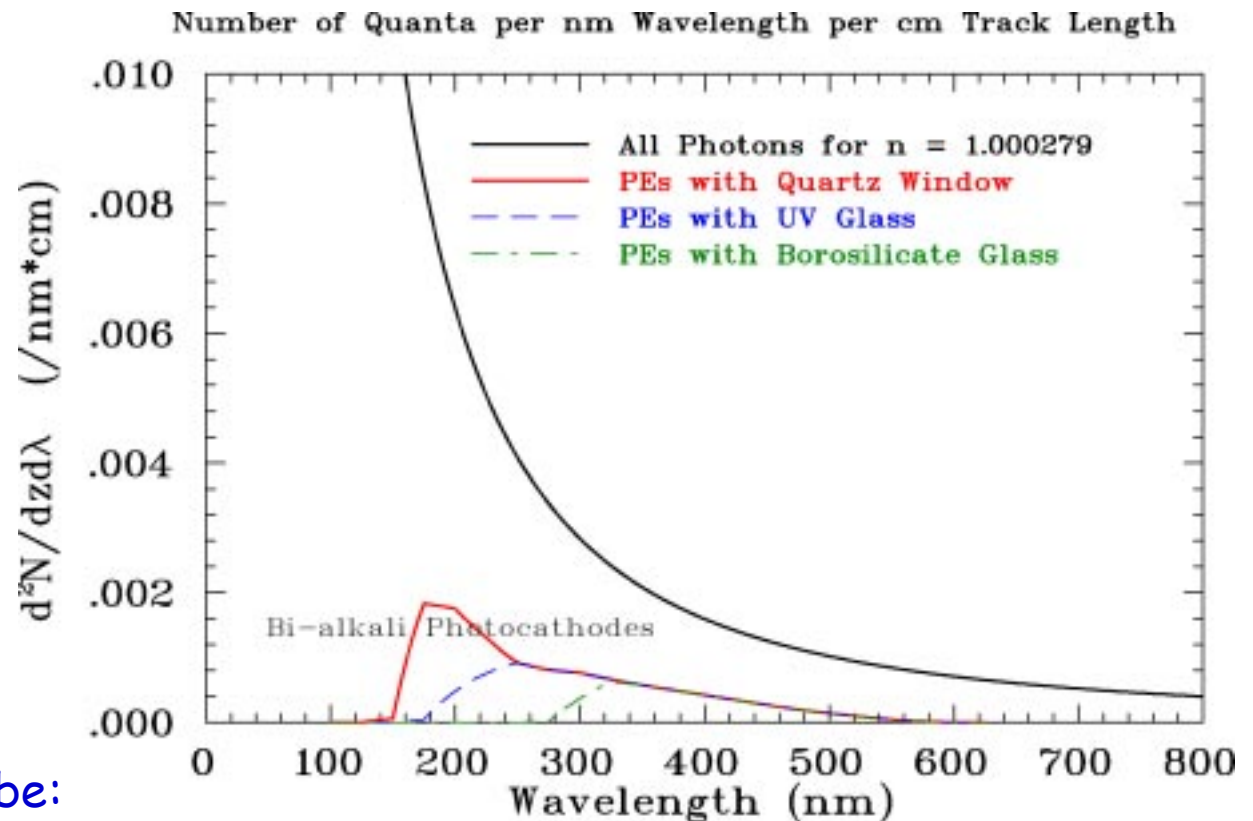
- Mirrors with $R \sim 1.3\text{m}$ and less likely to be at 45° . Flanges for mounting phototubes easy to setup with the proposed configuration

- Need to start design with a full simulation.



Electron detection efficiency and pion rejection

- Radiator Nitrogen
- Radiator length 125 cm



- Quartz window phototube:

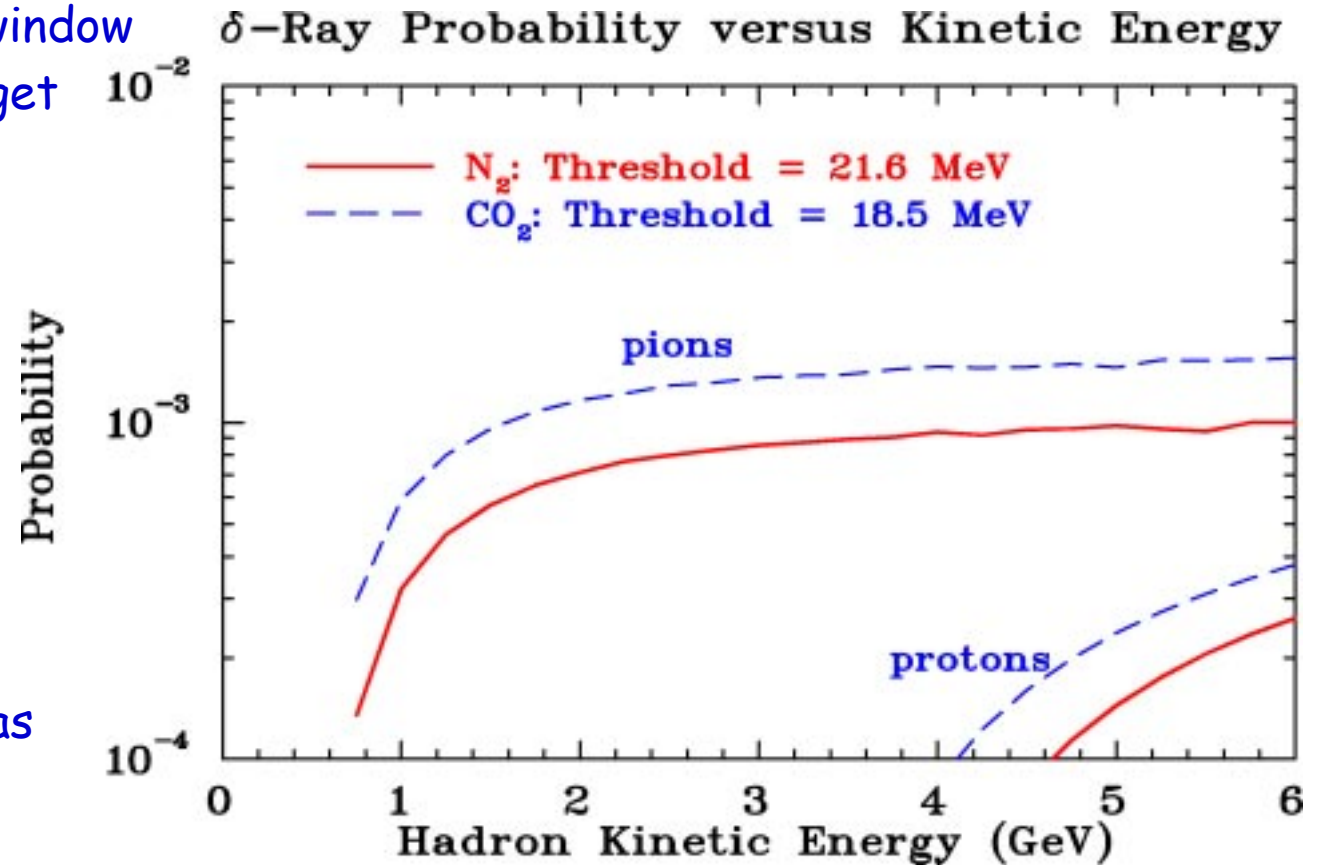
~20 pe including gas transparency, mirror reflectivity (90%), Fresnel reflection at the phototube window

Pion and proton of electron knock-on probabilities

16 mil aluminum exit window
of the vacuum target
chamber

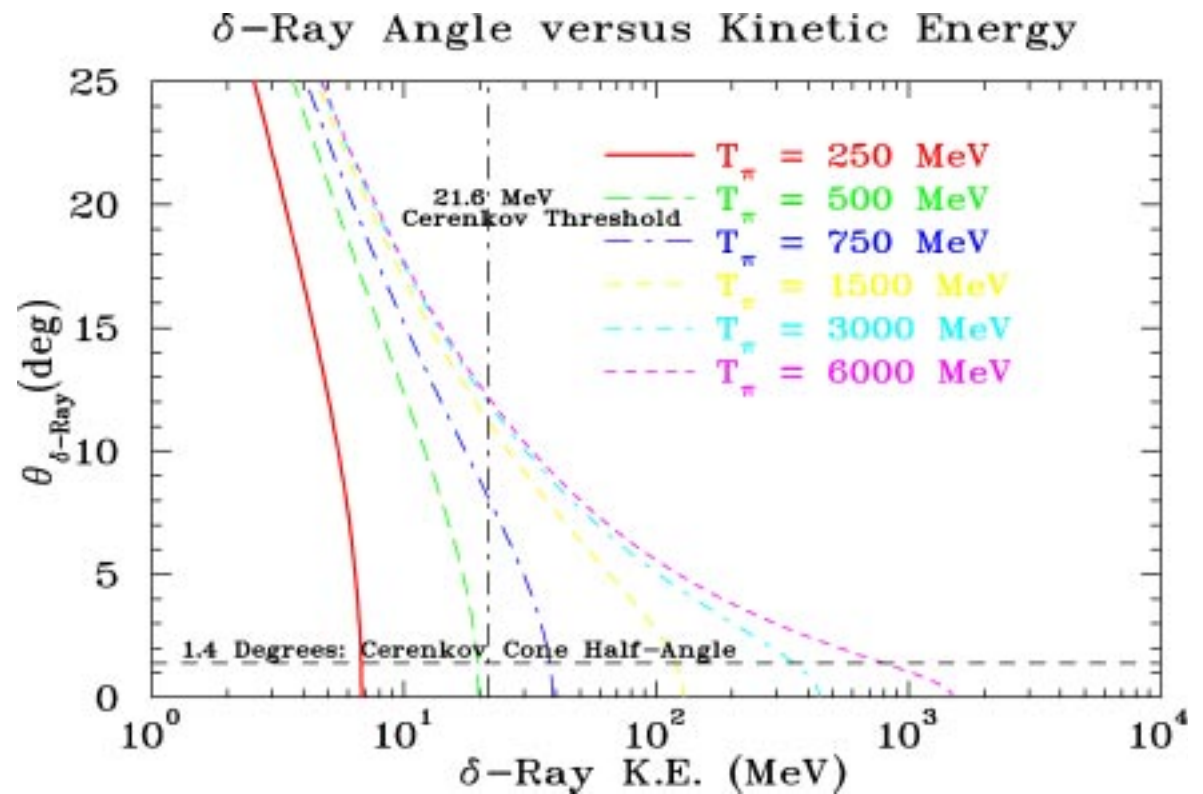
5 mil window of the
GC entrance window

125 cm of radiator gas



Delta ray angle vs Kinetic Energy

- Take advantage of the delta rays energy-angle distribution to minimize background



Plans

- Detailed ray trace simulation
- Mirrors radius of curvature and final dimensions to be defined
- Detailed box design
- Building of prototype with one mirror, one photomultiplier, same length of radiator
- Test of prototype at UVA and in Hall C for designing a good magnetic shield for the tubes.
- Plan to write an instrumentation proposal to DOE or NSF