CHERENKOV DETECTOR FOR SANE

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Overview of Talk

→ Comment on Backgrounds.

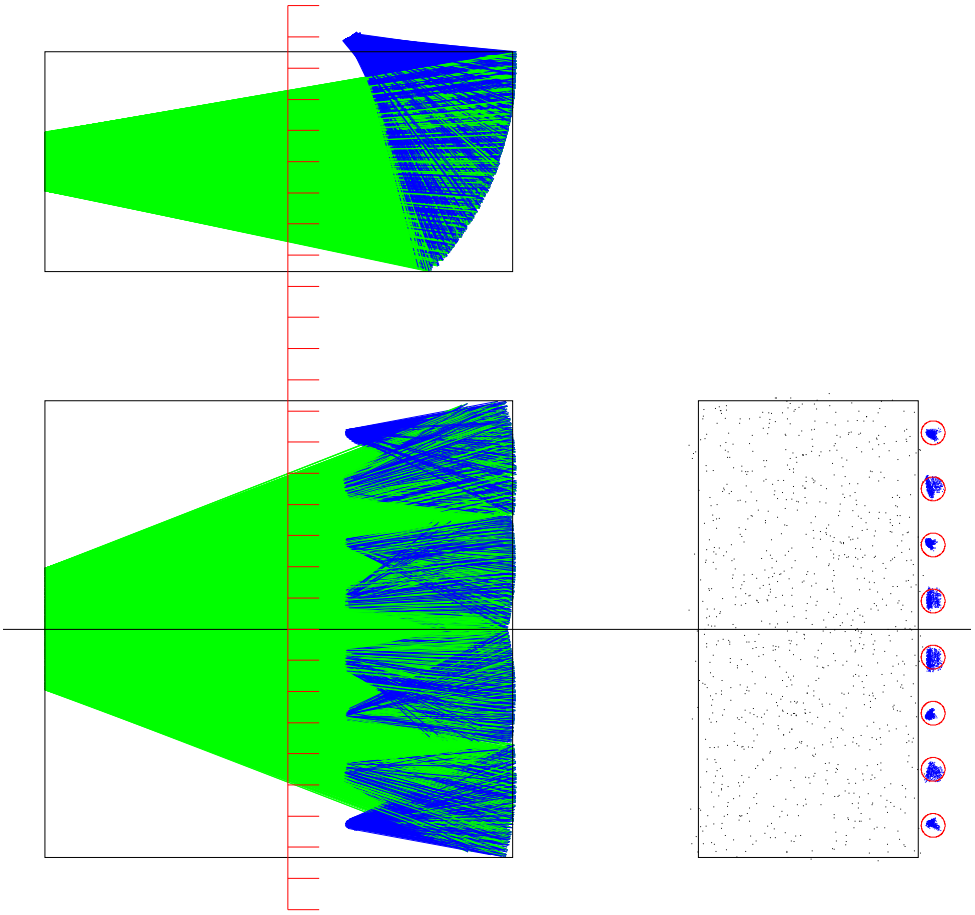
→ Overview of Draft Design.

→ Future Plans.

Reference Design

- Goals
  - High electron detection efficiency
  - Pion rejection factor of at least 1000:1
- Some details
  - Operation at roughly atmospheric pressure
  - Radiator: dry nitrogen at 20°C, n=1.000279
  - Pion momentum threshold: 5.9 GeV
  - Electron momentum threshold: 21.6 MeV

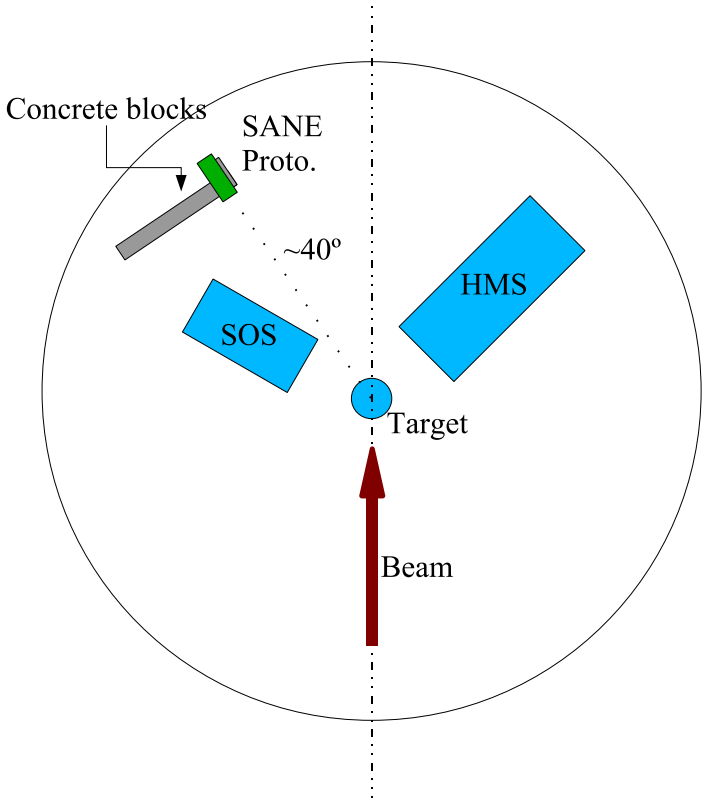
RAY TRACE SIMULATION



- 8 mirrors focused on 8 3” PMTs
  (focal lengths: 45 cm, 53 cm)
  - 96% collection efficiency in 3.0” ring (shown)
  - 93% collection efficiency in 2.5” ring
  - 85% collection efficiency in 2.0” ring

PROTOTYPE DETECTOR

PROTOTYPE BACK AT FORWARD ANGLE (40°)



- Added Pb shielding PMTs from target
  - 8” total in front of Cherenkov PMT
  - Paddle trigger still blown away by rate
  - Pb-glass replacement for PbW (needed elsewhere) was swamped — no help in trigger.

→ BG rate in Cherenkov PMT now reasonable...

Background Rates in 5" PMT

- Detector at 40° and $12\,\mathrm{m}$ from target
- $59\,\mu\mathrm{A}$ on $4\,\mathrm{cm}$ LD_2 target

Threshold	Rate
50 mV ($\approx$1 p.e. thr)	310 kHz
100 mV	154 kHz
150 mV	84 kHz

- (saw similar rates for $59\,\mu\mathrm{A}$ on 1% C target)
- Pb shielding in place:
  - $\rightarrow$ 2" Pb in cylinder around PMT
  - $\rightarrow$ 8" Pb (total) between target and PMT
- Worst case: BG $\propto r^2$
  - $\rightarrow$ $r \approx 1.2\,\mathrm{m} \Rightarrow$ solid angle $\uparrow 100\times$
  - $\rightarrow$ μA on pol. target $\downarrow 100\times$
  - $\rightarrow$ How does BG production off NH_3 compare to $4\,\mathrm{cm}$ LD_2 (?)

FUTURE WORK...

- In-Hall parasitic tests weren't satisfactory
  - → "best" result: 4–5 p.e.'s with CO_2 ($\Rightarrow \lambda_{\text{cutoff}} \approx 400\,\text{nm}...$)
  - → poor resolution of Hamamatsu PMT could also lead us to underestimate #p.e.'s using $N_{\text{pe}} = \left(\frac{\mu - \text{ped.}}{\sigma}\right)^2 ...$

→ Benchtop tests using ^{90}Sr β emitter with quartz radiator

- In this controlled environment we will study:
  - → better determination of actual # p.e.'s
  - → actual mirror reflectivity (incl. sample from Glass Mountain Optics)
  - → actual PMT performance

UPCOMING TIME-TABLE. . .

- Mirrors
  - → Vendor: Mountain Glass Optics
    (4–6 week delivery)
  - → Sample ordered for evaluation.
- PMTs
  - → Vendor: Photonis (XP4318/B)
    (4–6 week delivery)
  - → Have sample to test.
- Frame Design
  - → Essentially complete.
    (PMT mounts to be finalized.)
- Frame Construction
  - → Vendor: (already lined up)
    (8 weeks after final drawings delivered)

Bottom line: Expect to have all components in hand by late summer 2005.