Threshold Gas Cherenkov

Whitney Armstrong October 26, 2007

Temple University



Front view of the Gas Cherenkov

Status

- Tank Gas System
- Mirrors
- Simulations



Tank Gas System

Leak rate < 1scfh

- This is equal to about 12.5 days per bottle of compressed nitrogen
- Gang 6 bottles together to ensure a solid 2 month c more of continuous operation
- To be measured:
 - Leak rate vs Pressure Differential (in case of storms)
 - Filling time and gas volume needed per opening

Tank Gas System

Controller

- RS232 interface
- Manual switchs
- Transducer
 - Absolute pressure measurement
 - Can control to 0.1 torr



Mirrors (stored in nitrogen)

5 Toroidal

- One with shipping damage
- 5 Spherical
- Each to be attached to mounting clamp for
 easy mounting and
 storage

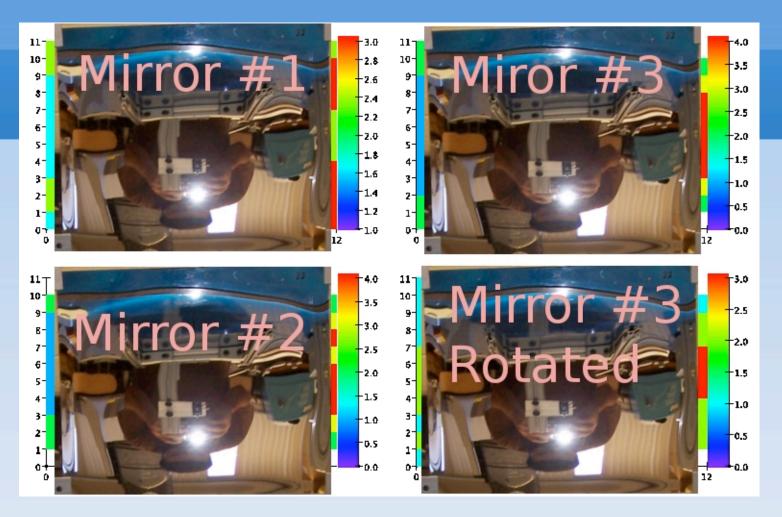


Focusing tests

With a laser+goniometer at the source, a grid, concentric 1, 2 and 3 inch circles for a target, one can map the surface quantifying by the largest circle. The results are easily shown in a 2D histogram.

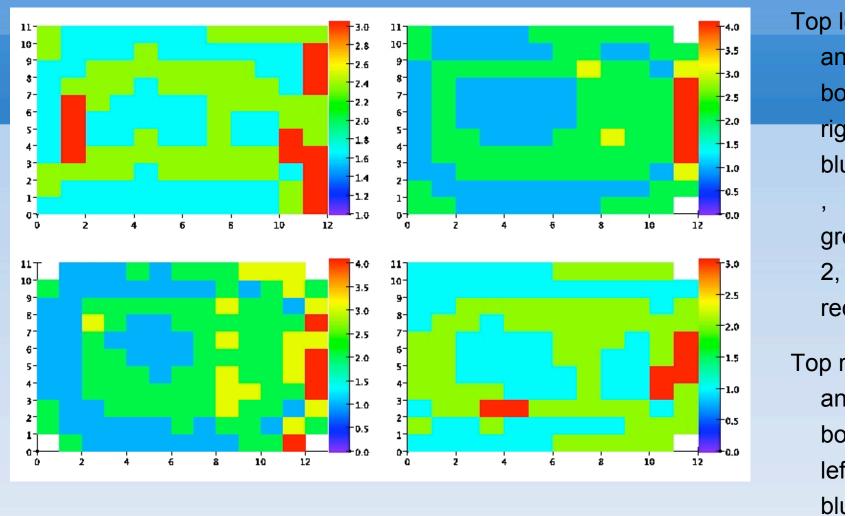






Results of a few toroidal mirrors.

Mirrors



Toroidal mirrors (counter clockwise from top left) #1,#2,#3 and #3-rotated

,

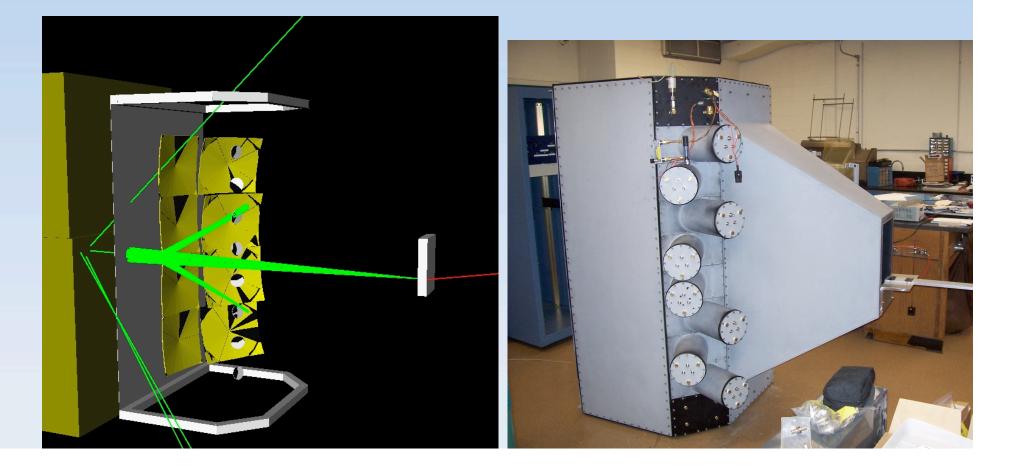
gr

2,

 $\cdot \cdot \cap$

Geant4 simulations:

- Mirror efficiency vs Electron momentum
- Effects on optimal mirror/pmt alignment



1GeV Electrons – No Field 🦉 1GeV. - <u>-</u> 🍊 Applications Places System 🎚 🚍 File ... 🦹 🖾 whit.. 滾 beta -Plotter 븮 Plotter PMT 3 photon locations PMT 5 photon locations PMT 7 photon locations PMT 1 photon locations (view behind t... cos theta Entries : 6046 Entries : 6103 Entries : 5911 Entries : 5284 1,800 т 4 4. Mean: 0.22169 XMean : -0.17548 XMean: -0.088263 0.41239 R. XRms : 1.0498 XRms : 0.89943 XRms : .901 91 XRms : 1.0216 B 1,600-: YMean: 0.15708 0.28453 Mean : 0.66359 3 3 -YMean : * 3 -YMean : - 0.93598 ſ TRms : XRms : 1.1281 1.214 Y.Rms : 1.1129 YRnas : 1.0894 1,400-0..... 000-000----2 2 2 1,200-1 1 1 1.000-0 0 0 0. 800--1 -1 -1 -1 600 -21 -2 -2 : -2 -400 -3 -3 -3 -31 200-Ω -4 -4 -4 0.б 0 -4 0 _4 -2 Ω 0 -4 _4 PMT 2 photon locations PMT 4 photon locations PMT 6 photon locations PMT 8 photon locations Front Tracker Loc Entries : 7294 Entries : 7881 Entries : 7951 Entries : 6504 Ent 40 4 4. Mean: 0.010266 XMean:-0.22496 -0.097611 XM. XMean: -0.57738 XMean X II ms 1.0842 XRms : 1.0180 XRms : 1.1769 XRms : 1.0870 XRI YMean : 01 7350 3. YMean : 0.61934 3 YMean: 0.30724 3-3+ YMean : -0.55783 30-YΜ YRms: 0.97438 1.3222 Reaso 1.3335 YRms : 1.0380 YR 2 2 2 2 20-1 1 1 10 0 0 0 0 0. -1 -10 -1 -1 -1 -21 -2 -2 -2 -20 -3 -3 -3 -30--31 .4 -40

-4

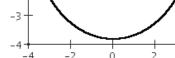
-4

-2

-4

-20

1GeV Electrons – With Field = 🙆 🔄 📰 🚯 Applications Places System 📱 🔲 whit@whit-lapt... 🕱 [beta - file:///h... Plotter Jould 1 8 °F 🖑 Plotter PMT 1 photon locations (view behind t... PMT 3 photon locations PMT 5 photon locations PMT 7 photon locations cos theta Entries : 2996 Entries : 3396 Entries : 3695 Entries : 5509 1,400 -E 4 4 4ean : -0.59498 Seen:-0.66628 Man: -0.23659 Gelpan: 0.75159 8 1,300 XRms : 0.90401 0.76141 N Russ 0.88801 1.0471 B id ms YMean : 2.6493 3 Wean : 2.6416 3. s Mean : 7393 3 -.7677 .0 Medaty 1,200 **YRms:** 0.74759 田識ms: 0.39475 YRms : 0.79481 0077 1,100 2 2 2 · 1,000 <u>,</u> 900 1 1 1 800 0 0. 700 600 -1 -1 -1: 500 400 -2 --2 -2 300 200 -3 -3 -3. 100 0 -4 -4 -4 0.б 0 -2 -4 -2 0 -2 -4 -4 -4 0 PMT 2 photon locations PMT 4 photon locations PMT 6 photon locations PMT 8 photon locations Front Tracker Loc Entries: 2626 Entries : 4165 Entries : 5074 Entries: 6278 Er 40-4 4. an:-1.6618 Mean : -1.0534 X!an:0.28206 an:1.4762 XRms 0.80609 Line 0.95599 10,0000 1.0903 1.1235 XI YMean : 2,2478 3 ¥Mean : 2.6054 3 -TME 2.6834 3 -.8139 30-Y! YRms: 0.92360 Res 0.74915 ¥9666 TRms: 0.61457 312 ΥL 2 2 2 20-1000 1 1 10 1 0 0. 0. -1 -1 -10 -1 -2 -2 -2. -20 -3



4

-4

-2

3 -

2

1

0

-1

-2 -

-31

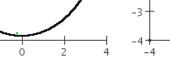
3.

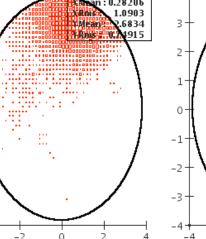
2.

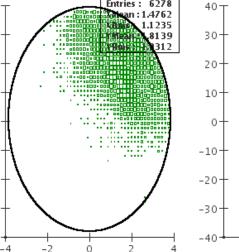
0

-1.

-2.



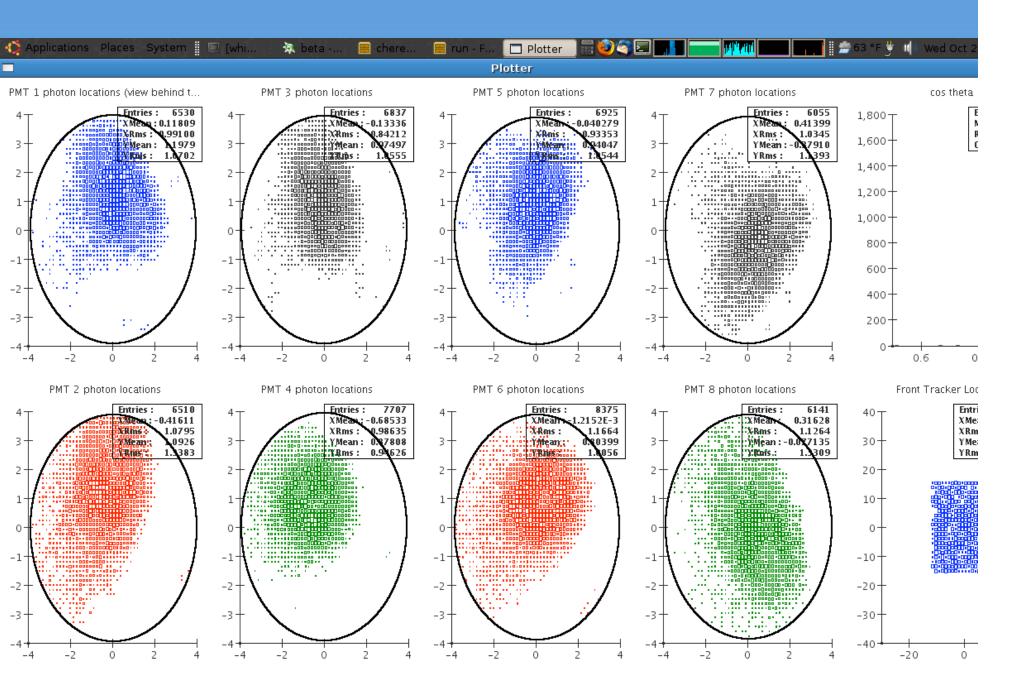




-20

0

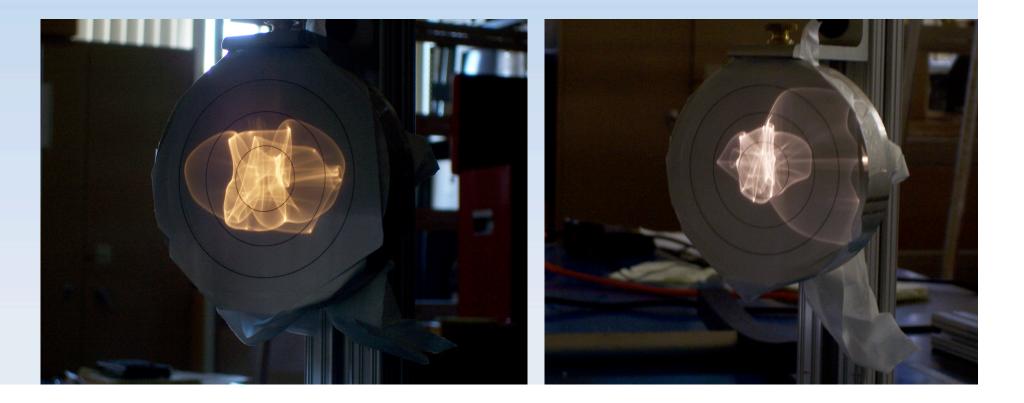
5GeV Electrons – With Field



- Mirror/PMT efficiency = (# of photons hitting the mirror)/(# reaching face of pmt)
 - With NO FIELD and 1GeV electrons, the efficieny is ~ 98%
 - With Field and 500MeV electrons, the efficiency is ~ 2%
- Can we improve the lower momentum efficiency?

Moving the PMT's 1cm vertically increases the lower momentu efficiency with minimal loss of 5 GeV

If we place the pmt target 1cm higher we can increase the acceptance at lower momentum without sacrificing higher momenta.



- Clearly improving the acceptance of lower momentum electrons (<1GeV), decreases the higher momentum.
- More simulations will help with selecting the alignment that optimizes the acceptance.