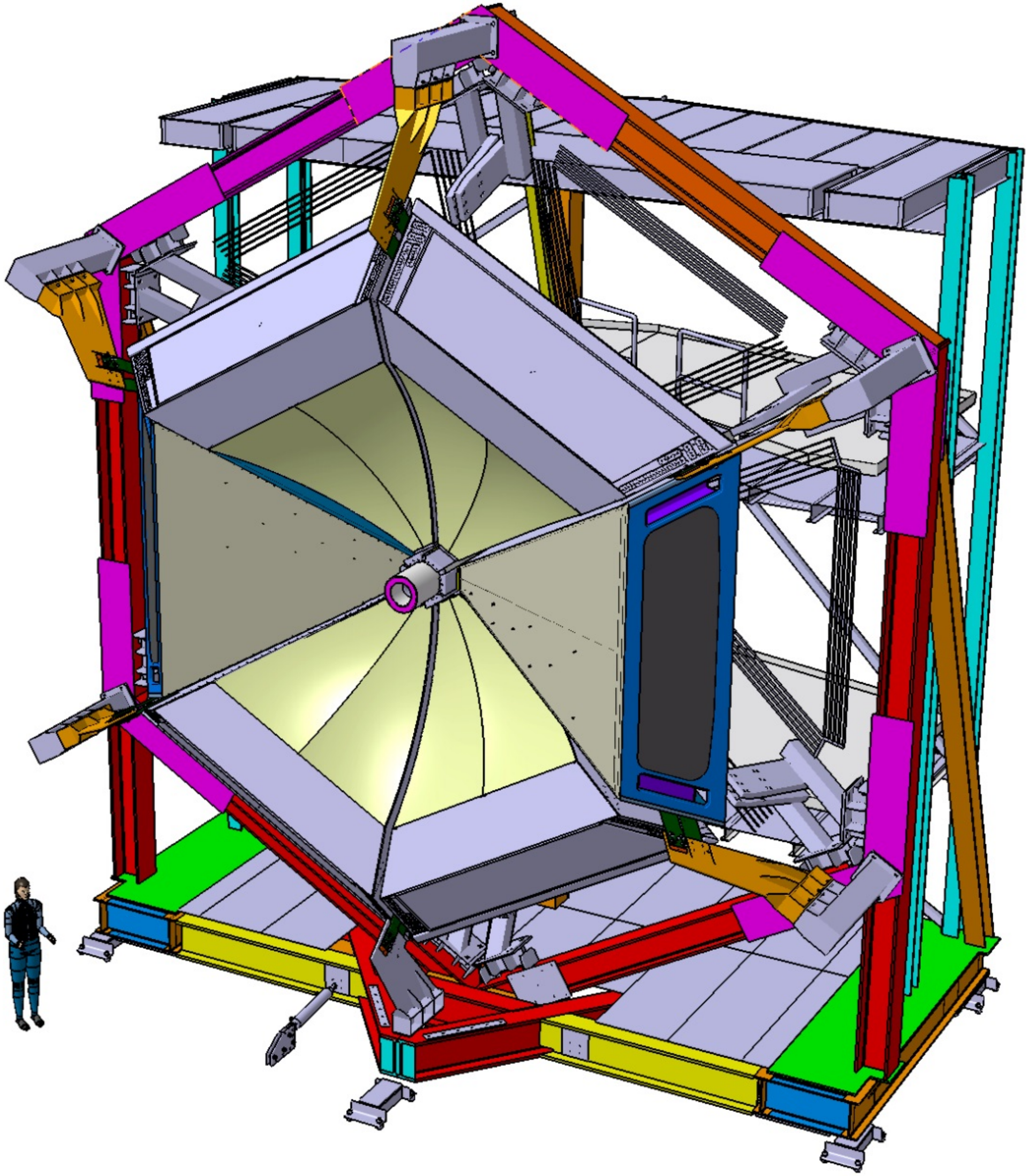
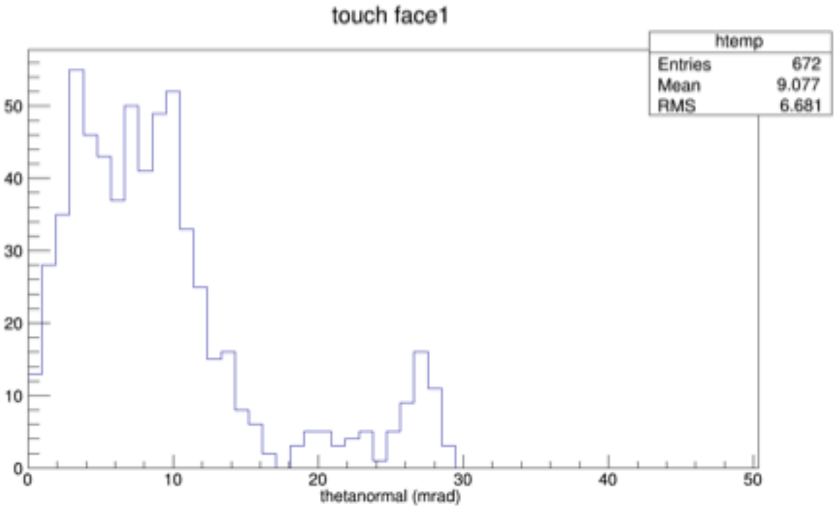


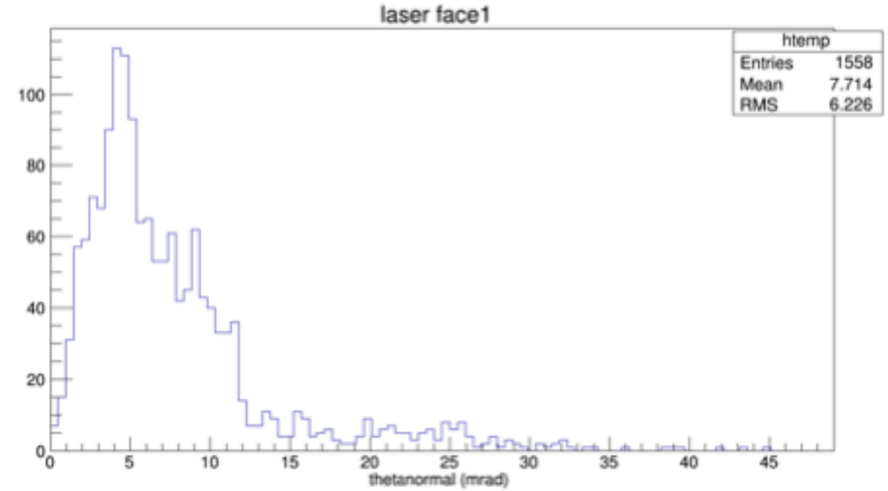
CLAS12-RICH Status-Report

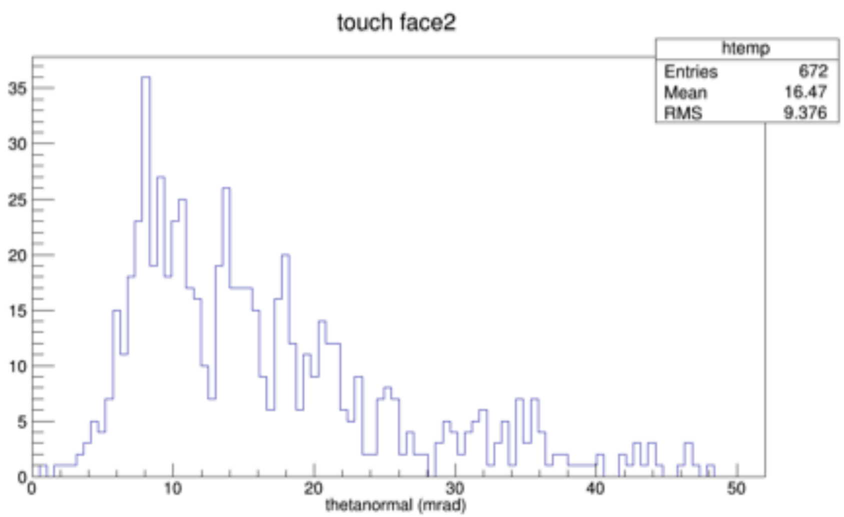
March 6th 2015

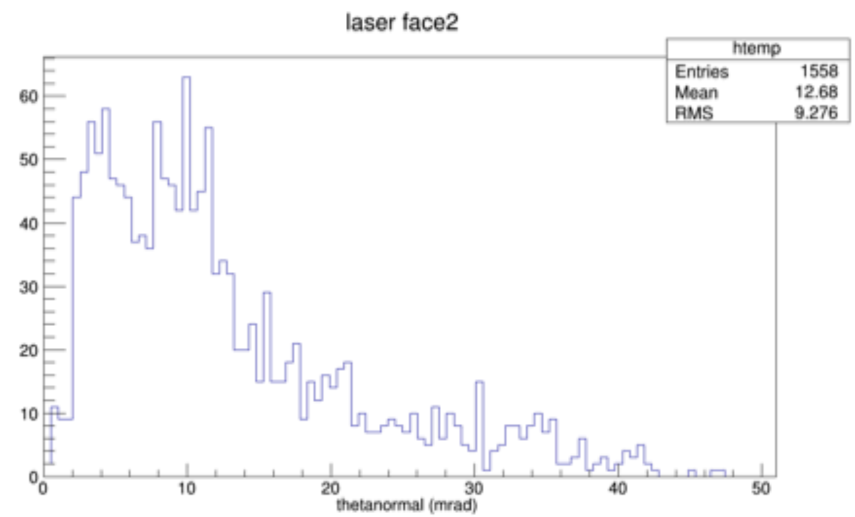
Aerogel Surface Quality

Normal angle distribution



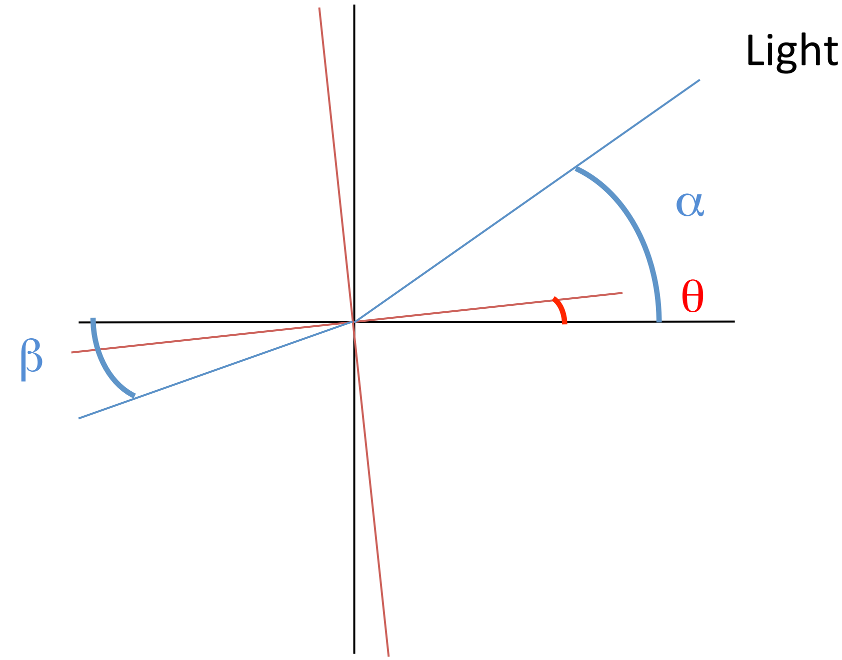






Light Transmittance

Perfect aerogel surface ($n = n_{Aero}/n_{Air} \sim 1.05$)
$\beta = \text{asin}(1/n \sin \alpha)$



Aerogel surface with normal error θ
$\beta = \theta + \text{asin}(1/n \sin(\alpha - \theta))$

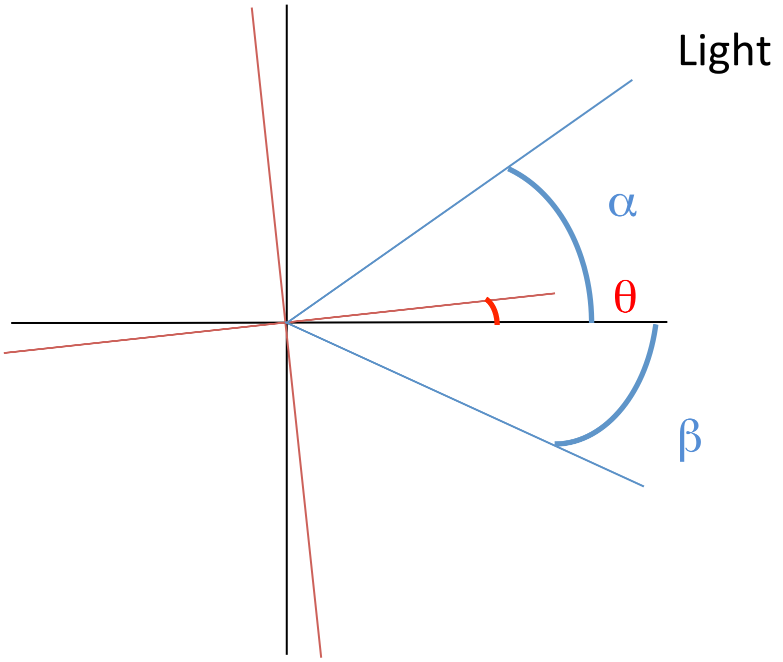
Surface transmittance angular spread
$\sigma \sim (1 - 1/n)\ \sigma_\theta \sim 0.05\ \sigma_\theta$

Aerogel transmittance angular error ($\alpha_e = \alpha_i$ if $\theta_e = \theta_i$)
$\alpha_e = \theta_e + \text{asin}(n \sin(\beta - \theta_e)) =$
$= \theta_e + \text{asin}(n \sin(\theta_i - \theta_e + \text{asin}(1/n \sin(\alpha_i - \theta_i)))) \sim \alpha_i + 0.05\,(\theta_i - \theta_e)$

Aerogel transmittance angular spread for independent surface errors
$\sigma = (n - 1)\ \sqrt{2}\ \sigma_\theta \sim 0.05\ \sqrt{2}\ \sigma_\theta$

Angular spread due to aerogel surface (double pass)
$\sigma \sim 0.1\ \sigma_\theta$

Light Reflection



Perfect mirror surface
$\beta = \alpha$

Mirror surface with normal error θ
$\beta = \alpha - 2\,\theta$

Surface reflection angular spread
$\sigma \sim 2\,\sigma_\theta$

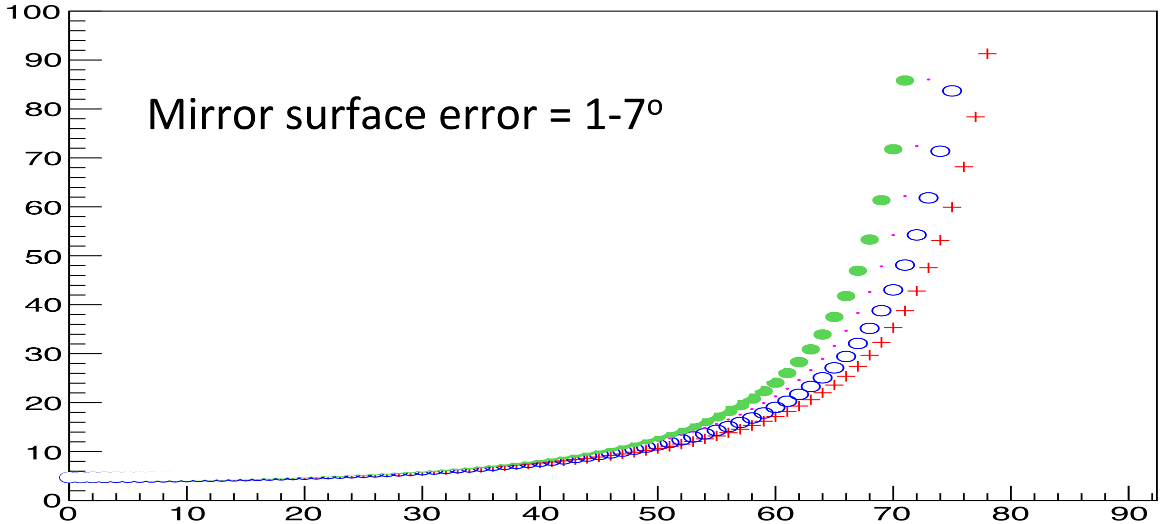
Photon detector 2D resolution
$\sigma_x \sim \sqrt{2} / \sqrt{12} \times 6$ mm ~ 2.45 mm

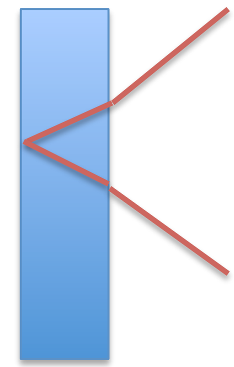
Acceptable surface error spread at distance L = 1000 mm

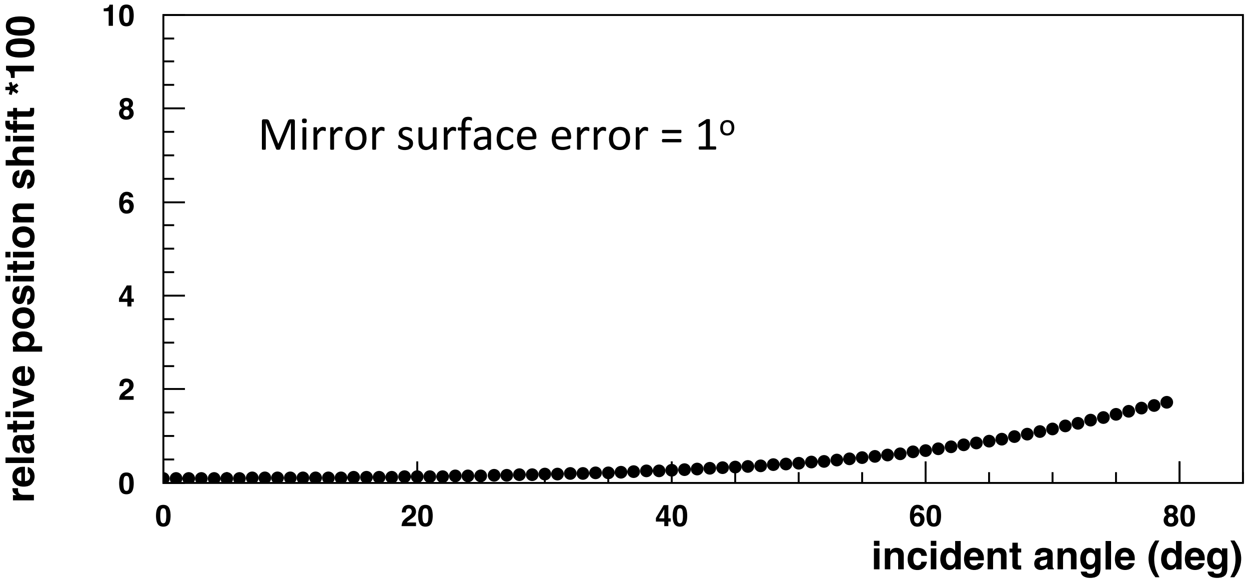
Planar mirror: $\sigma = \sigma_x / 2\,L = 1.2$ mrad

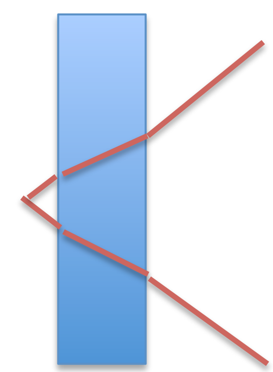
Aerogel: $\sigma = \sigma_x / 0.05\,L = 49$ mrad

Planar Mirror Surface Quality

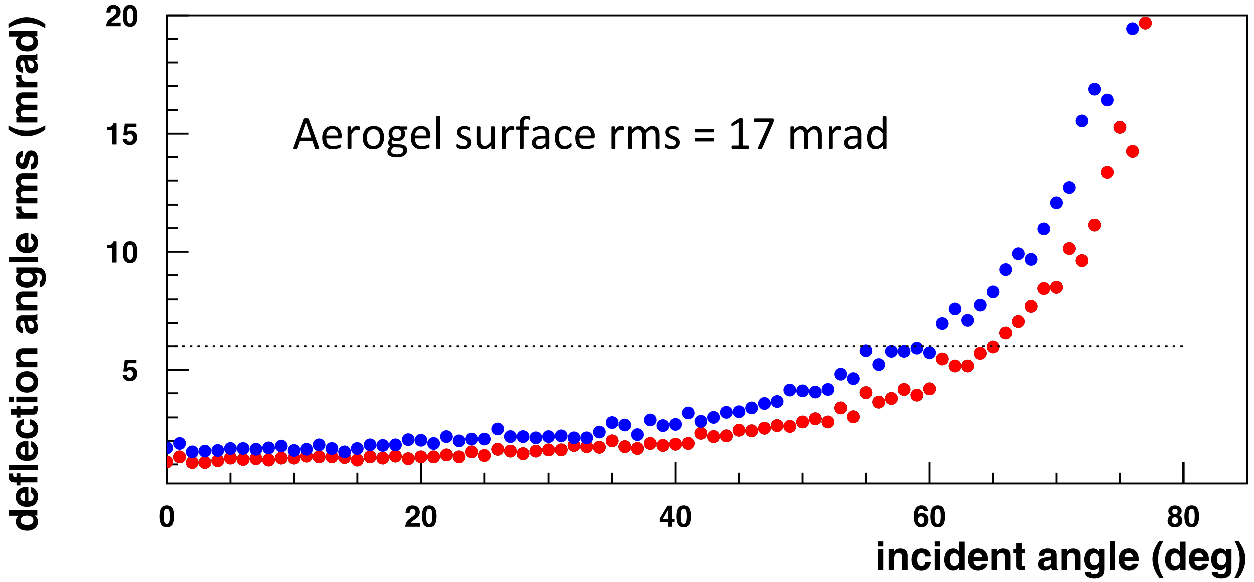


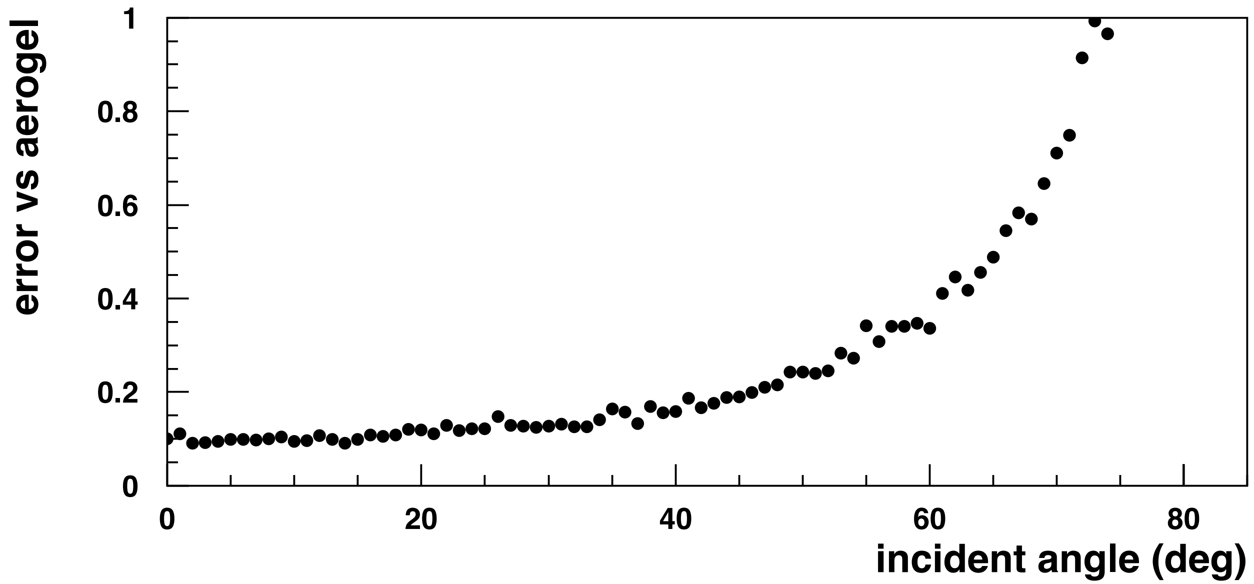






Aerogel Surface Quality



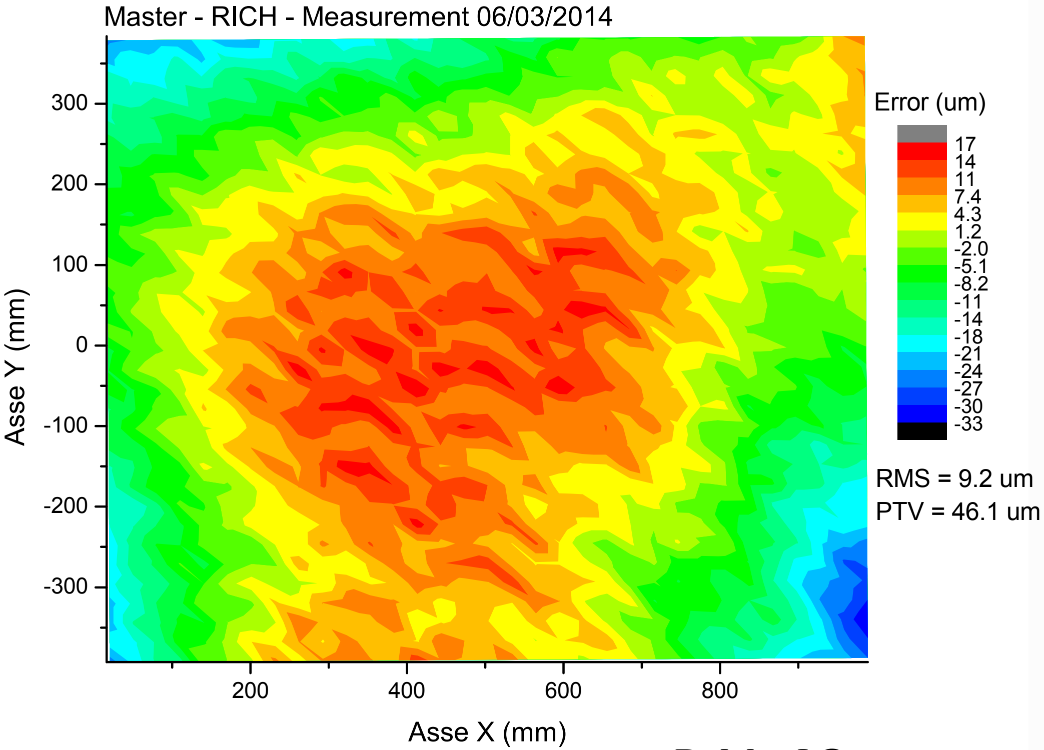


Media-Lario Mirror

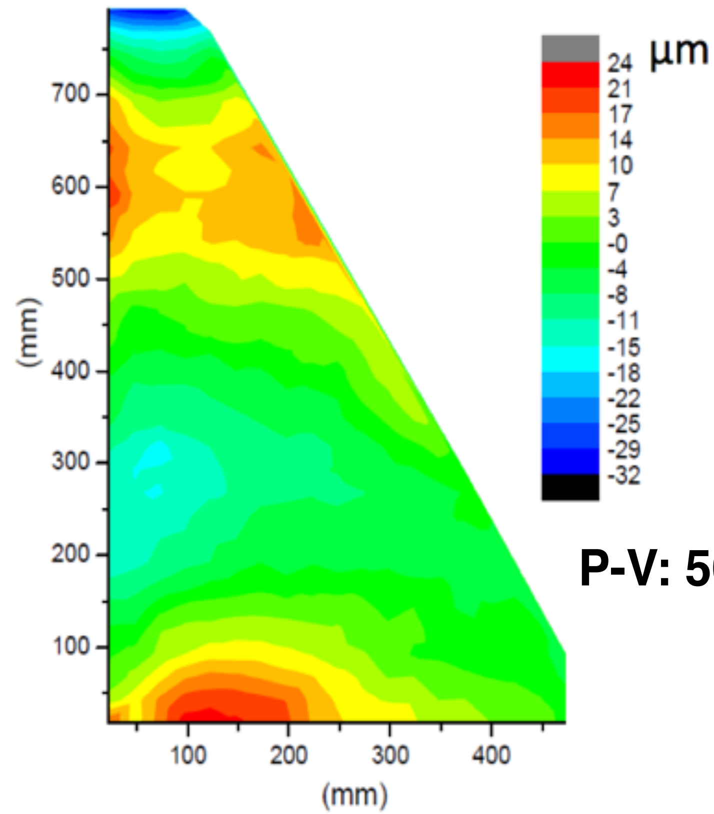
Peak-to-valley similar to the mandrel
but σ_θ is acceptable:

do we need to improve the mandrel ?

σ_θ = 0.1 mrad



P-V: 46 μm



P-V: 50 μm

Glass Mirror Optimization

For the future production four type of optimizations are foreseen:

1. Reduction of the glass thickness from 1.6 mm to 0.7 mm per each skin and density (2200 instead of 2500 kg/m^3)

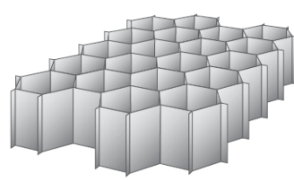
2. Usage of a lighter honeycomb aluminum core (49,65 kg/m^3 instead 83,3 kg/m^3) with a smaller cell (1/8” instead of 1/4”). The new weight is 1.7 kg instead 2.8 kg.

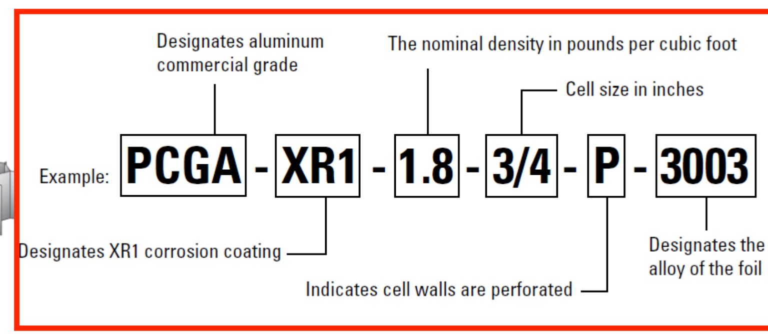
3. Relocation of the foot positions

The weight gain (due to #1 and #2) is 1.1 kg (1.7 kg instead 2.8 kg)

The suggested honeycomb aluminum core is:

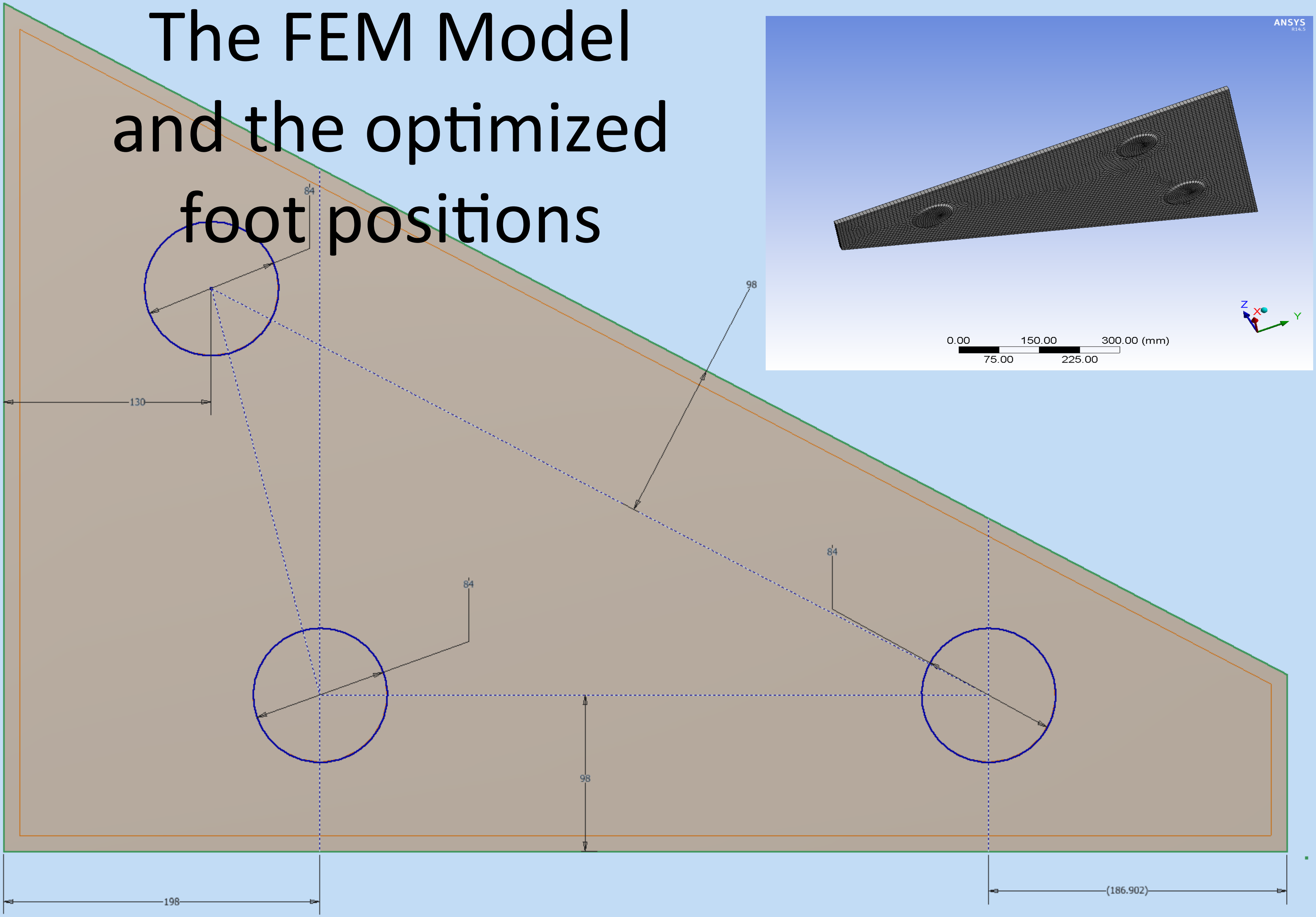
Plascore PCGA-XR1 – 3.1 – 1/8 - .0007 - P - 5052





4. Polishing of mandrel surface ?

The FEM Model and the optimized foot positions



Aerogel Holding Frame

For the future production the following changes are foreseen:

1. Slightly change of the mirror dimensions

2. Do not insert an Al frame inside the mirror core

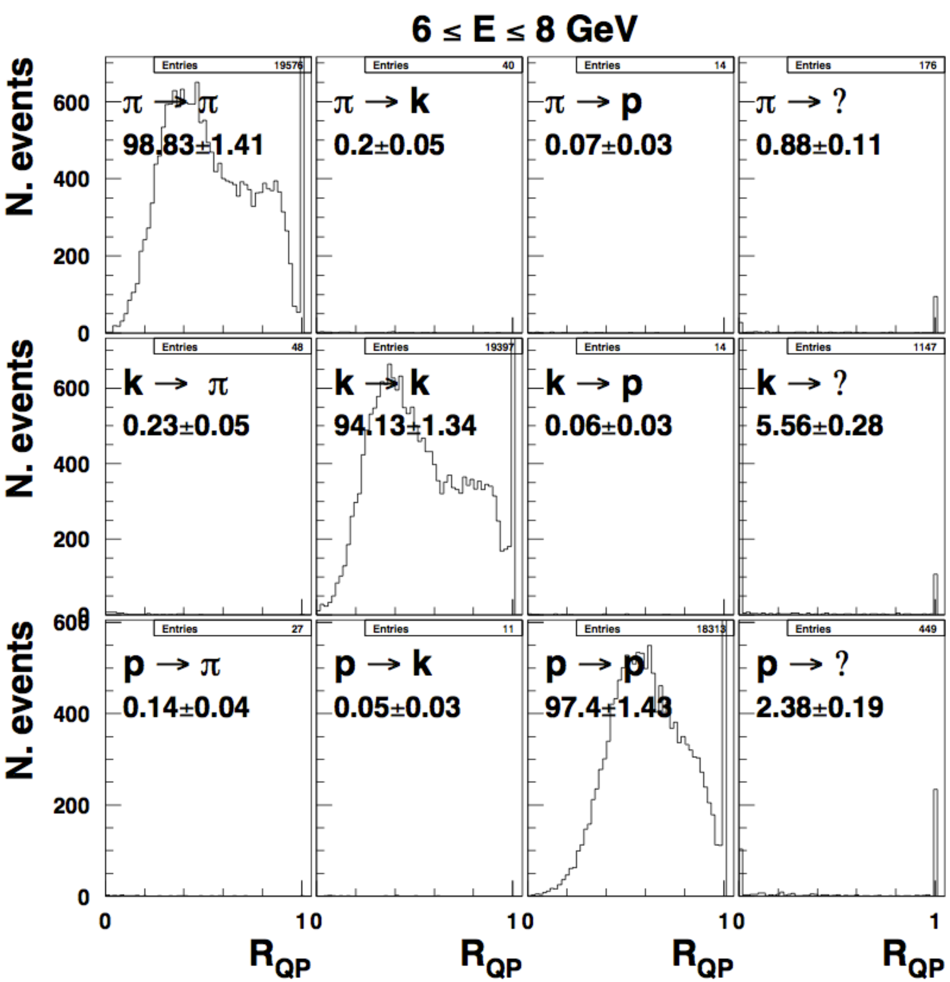
3. Glue a 25x35 mm L section bar of 2-3 mm thickness around the mirror perimeter

   - short side on the mirror back
   - long side with machined holes
   - material can be Al or plastic (delrin, MMA, plexiglass, polietilene)

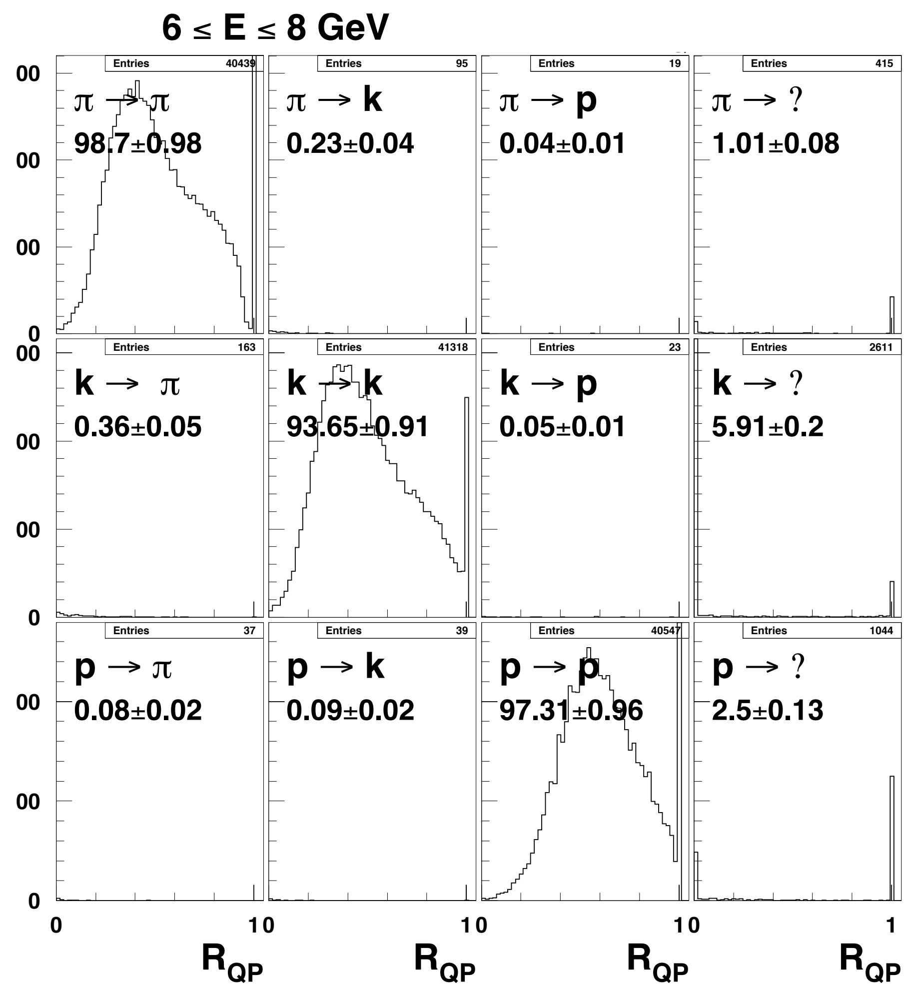
3. Prepare small samples for radiation damage tests

RICH Likelihood

4 m radius mirrror

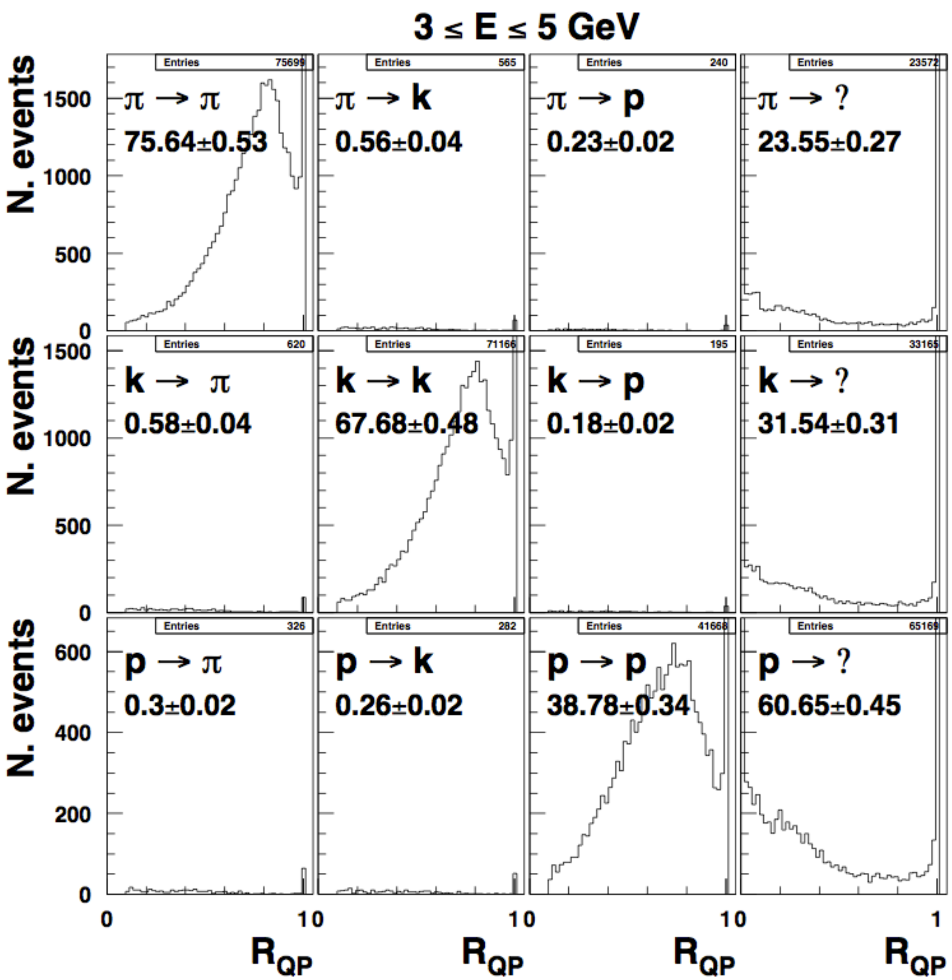


2.7 m radius mirror



RICH Likelihood

4 m radius mirror



2.7 m radius mirror