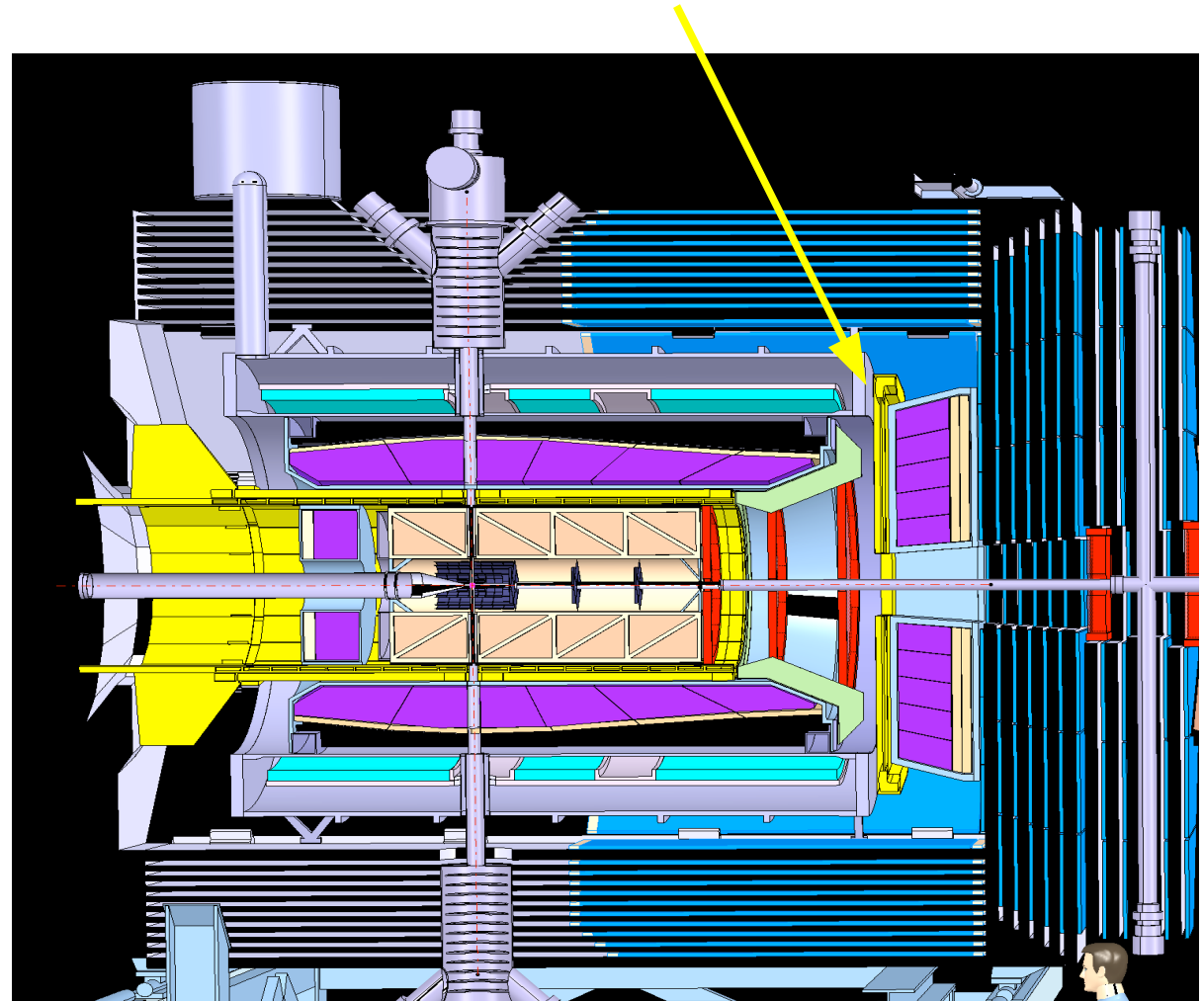


Lightguide

for the

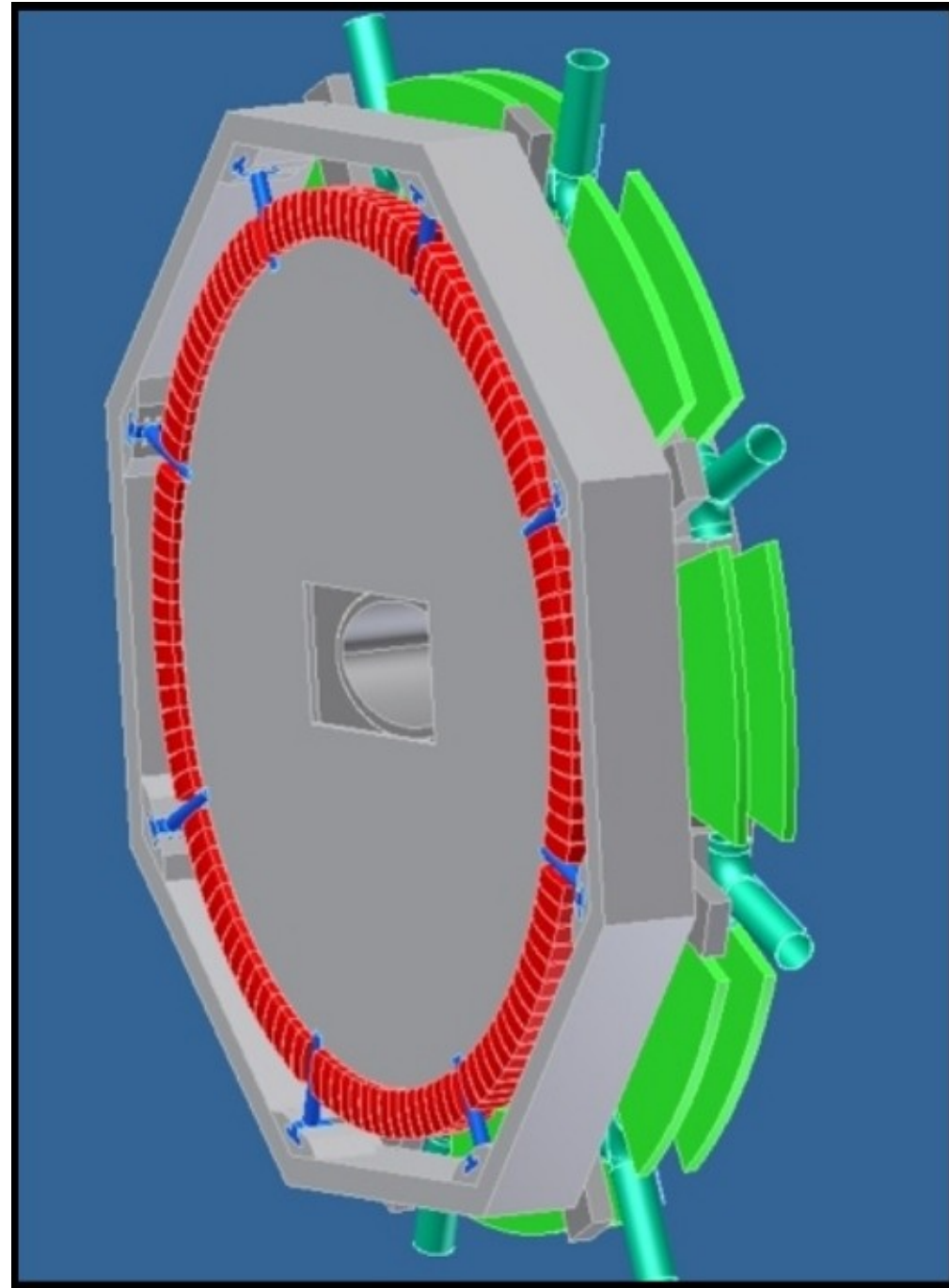
Focussing Disc DIRC

- Detector Setup
- Ray tracing
- Optimizations
- Results
- Outlook

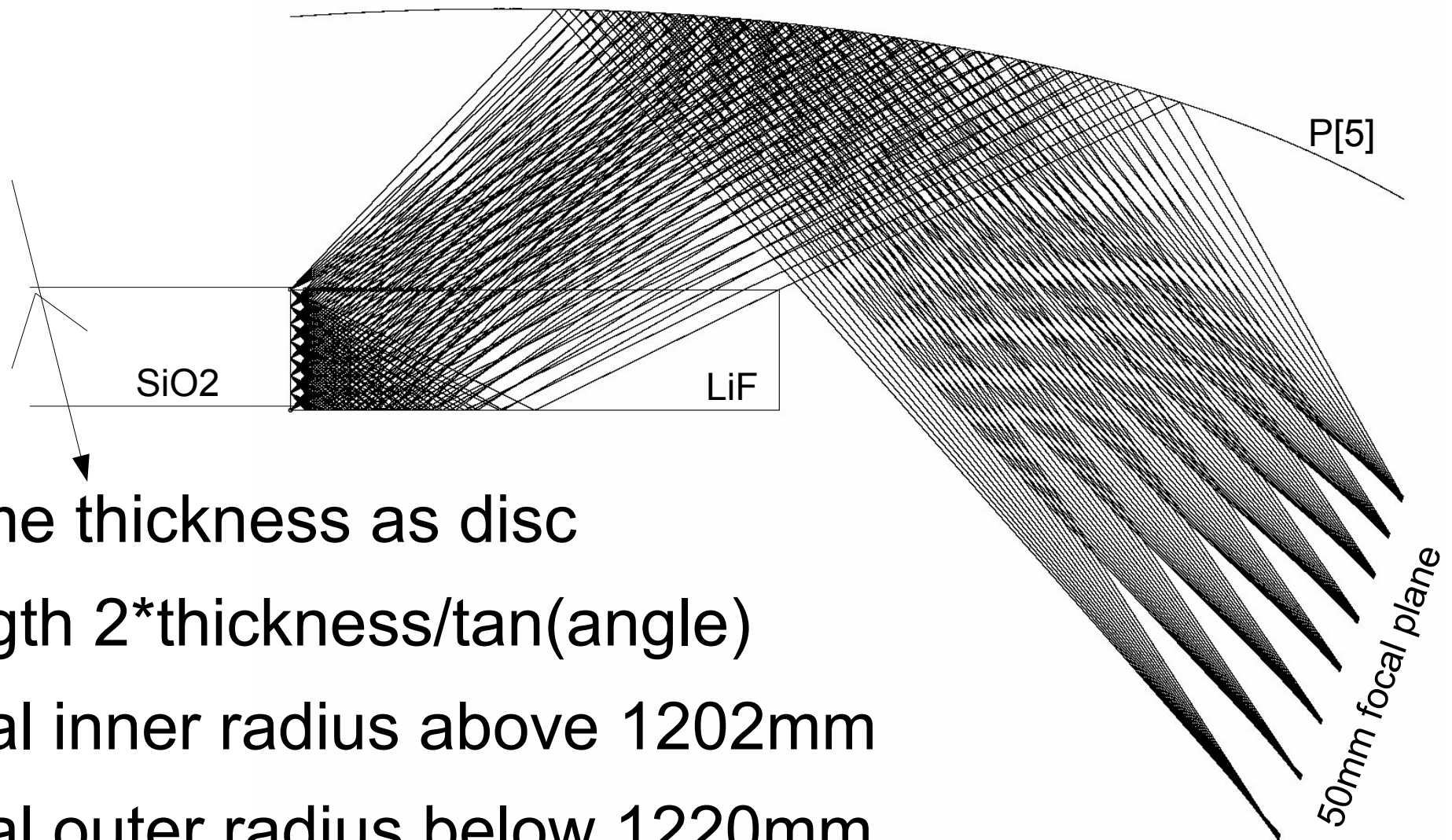


Detector Setup

- Disc
 - Fused Silica (SiO_2)
Suprasil 311
 - 4+2 pieces
 - Radius 1100mm
 - Thickness 20mm
- LiF-Crystal Block
 - Dispersion correction
 - $50 \times 50 \times 20 \text{mm}^3$
- Focussing Lightguide
 - Focussing Cherenkov angles to focal points
- Converter
 - 128 MCP-PMT
Burle 85011
 - $50 \times 50 \text{mm}^2$
 - 15mm Thickness
 - 1x32Channels
 - 4096 channels total



Ray tracing



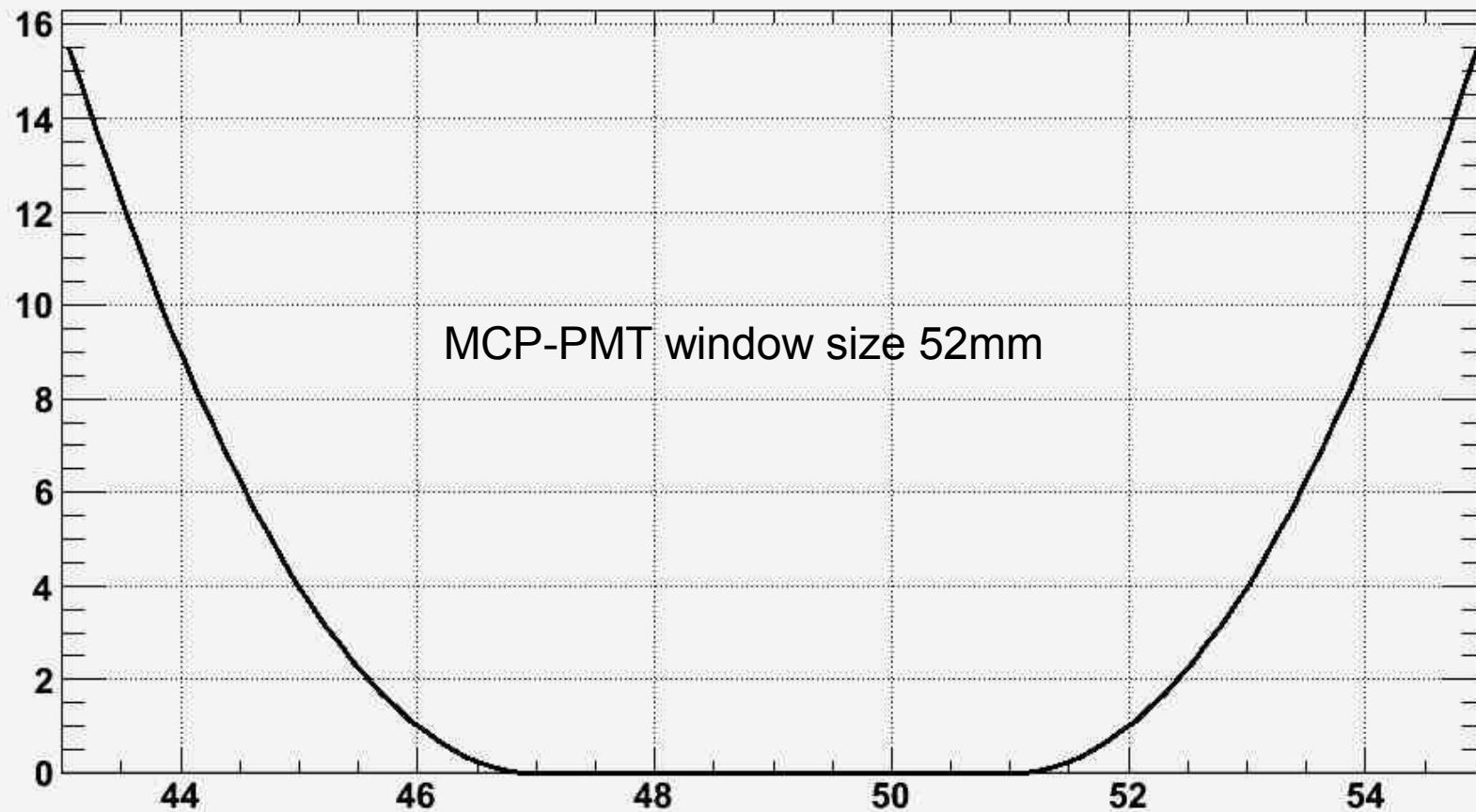
- same thickness as disc
- length $2 \cdot \text{thickness} / \tan(\text{angle})$
- focal inner radius above 1202mm
- focal outer radius below 1220mm
- focal plane with 70deg to fit magnet field shape

Optimizations

- Minimize the maximal focal distribution
 - barrier function optional switchable
- Framework for optimizations
 - TMinuit inside ROOT
 - Fumili, IMPR, MINIMIZE,...
 - GNU scientific Library or others
- Variable
 - Number/Range of Angles, Bundles
 - focal plane property
 - Refraction index for SiO₂/LiF
 - Quantumefficiency
 - Properties of Fitparameter
 - Scan for different Focal plane properties parameter space
 - Scan for different Parameter to test stability

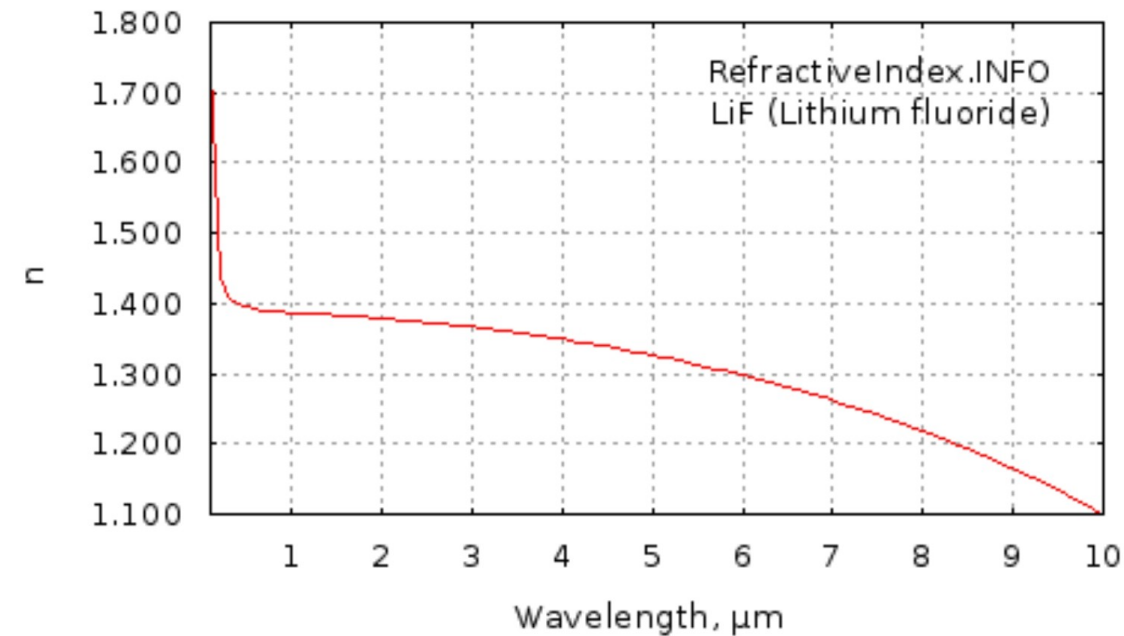
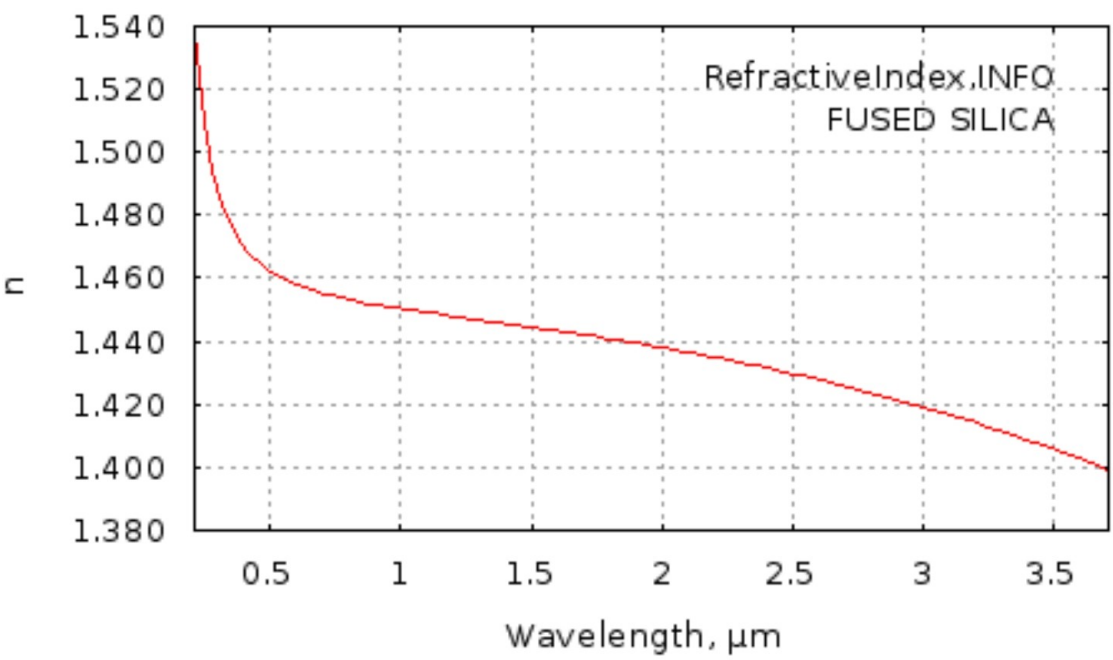
Sample barrier function

$$(x < 47) * (x - 47) * (x - 47) + (x - 51) * (x - 51) * (x > 51)$$

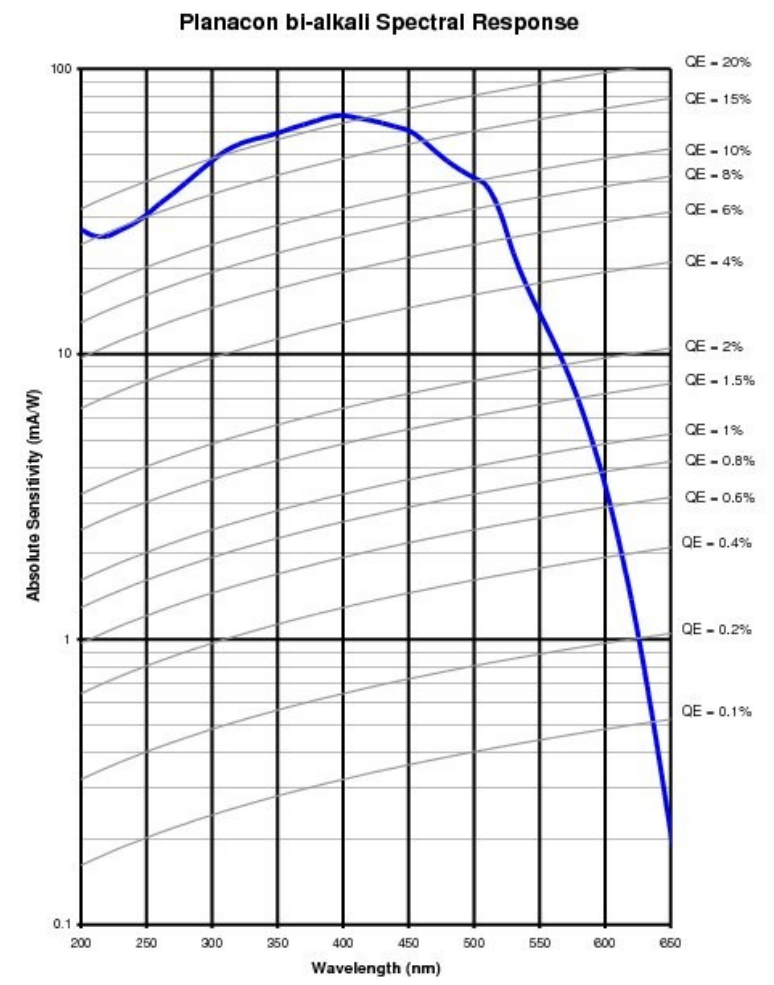


Refractions and Quantum efficiency

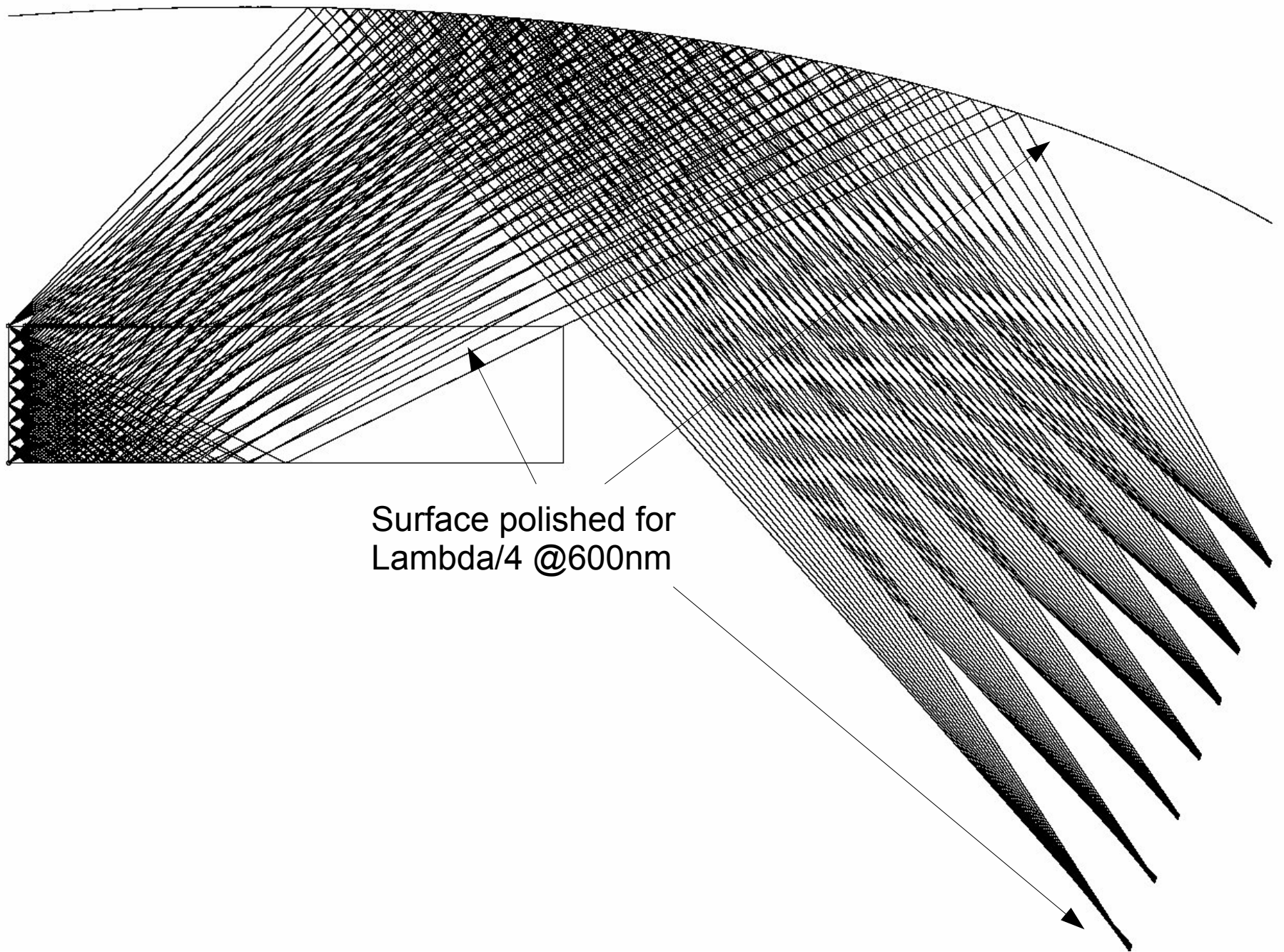
1.45804@600nm < n < 1.48779@300nm
 300nm glue cutoff
 ~43.3 > Angle to Normale/deg > ~42.2



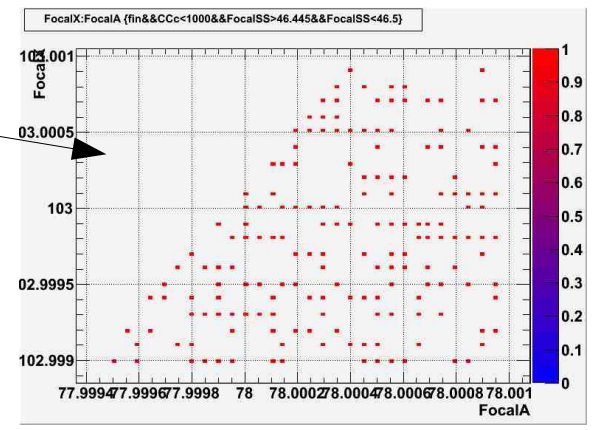
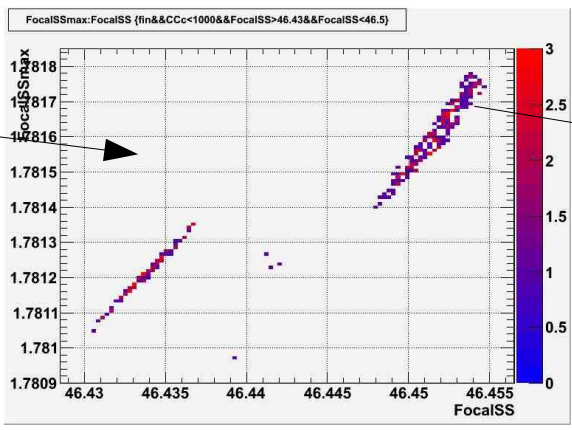
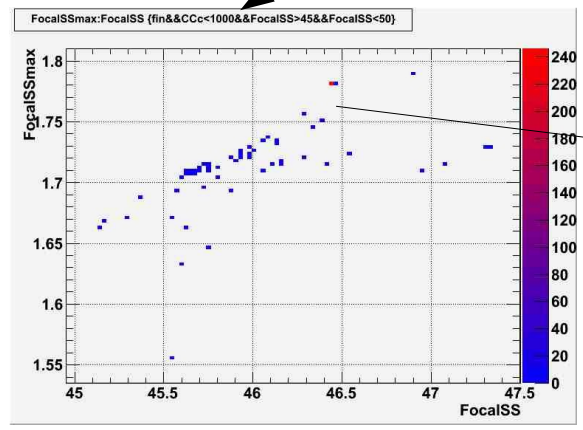
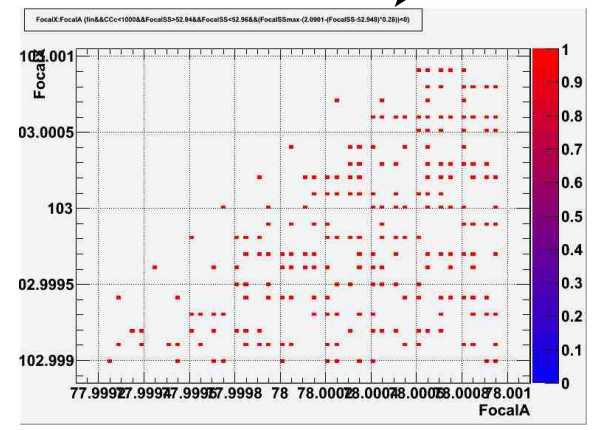
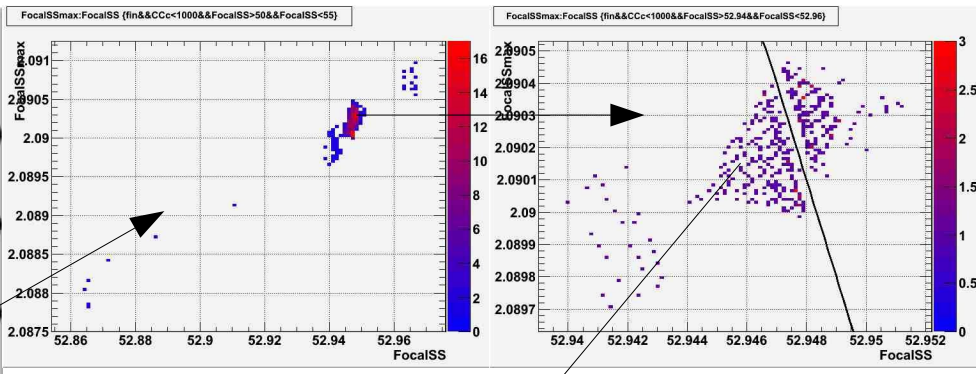
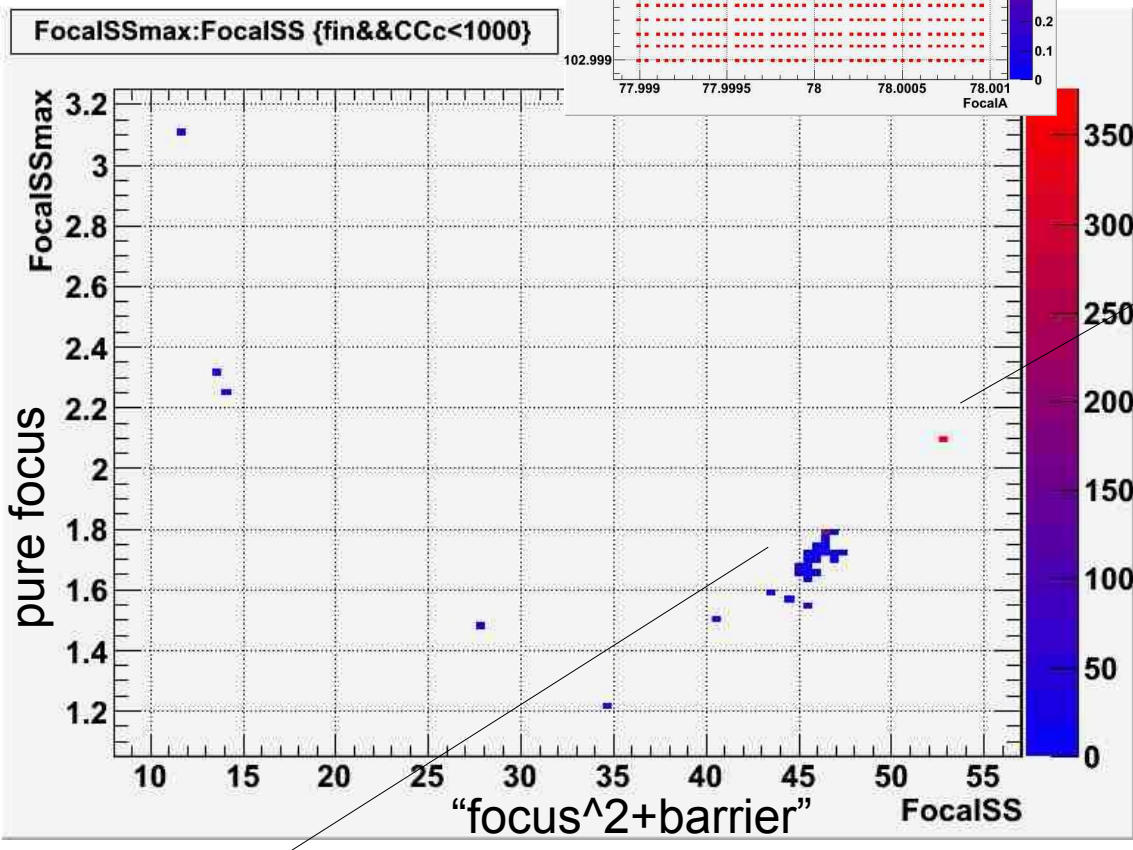
1.39189@600nm < n < 1.40971@300nm



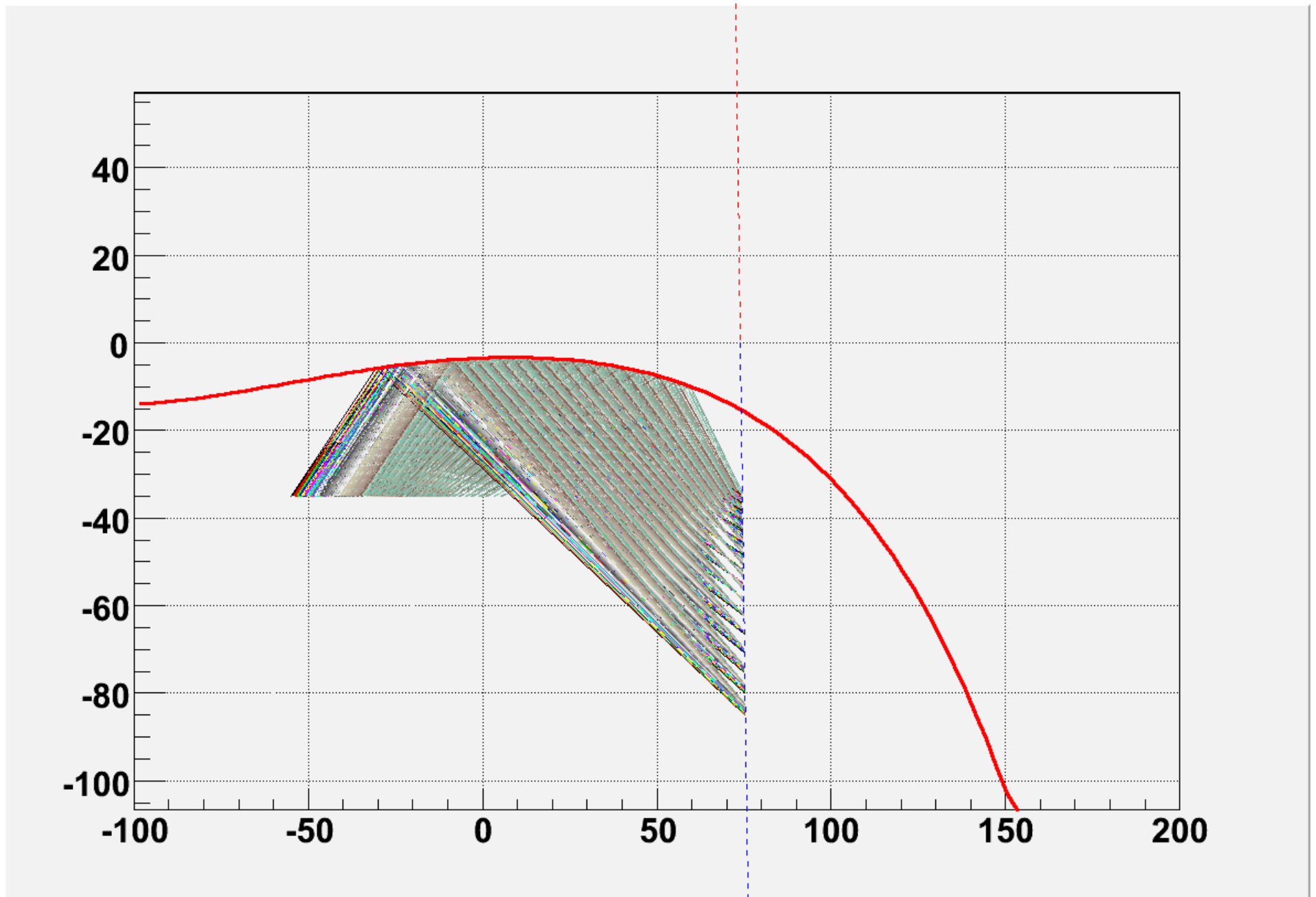
Results



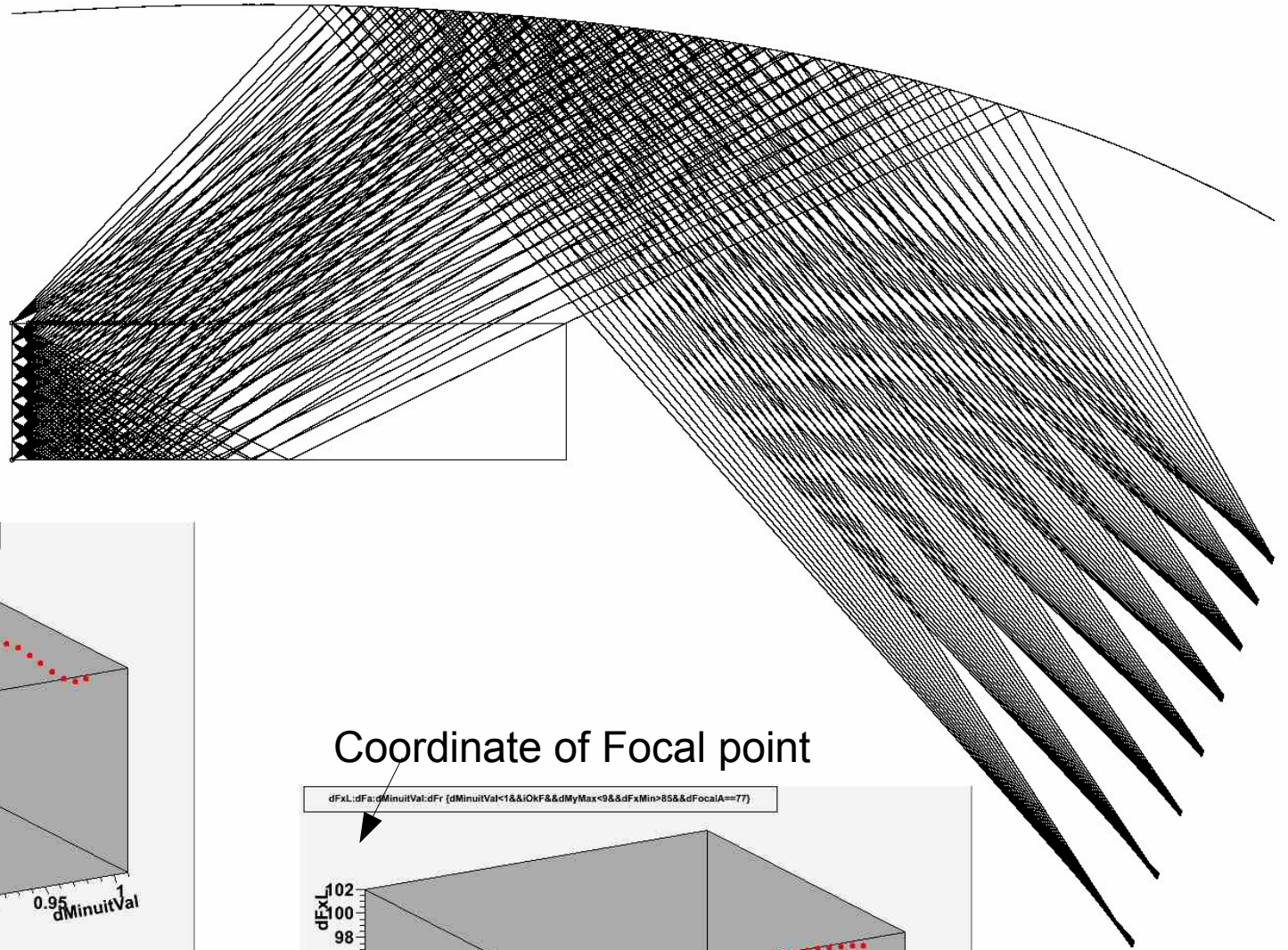
Stability



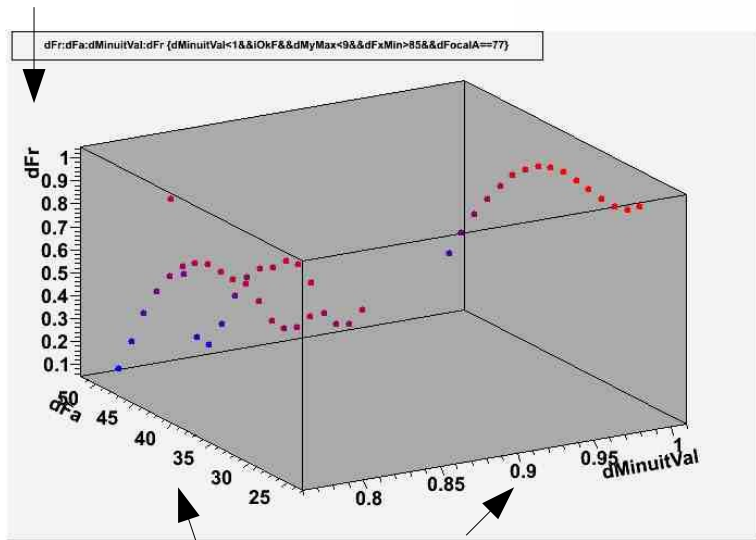
Focal point distribution (not fully optimized yet for impression)



Focal point distribution



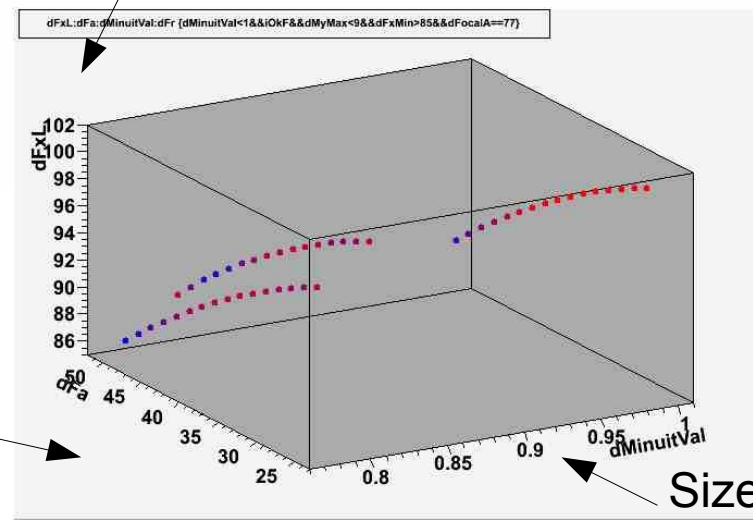
Size of focal point



Size of worst focal point

Cherenkov Angle

Coordinate of Focal point



Size of worst focal point

Outlook

- Curvature optimization
 - Other set of **more orthogonal** functions
 - **Other fitting routines / Metropolis-Hastings-MC**
 - Set of **barrier** function
- Multi step optimization **recipe**
 - Scan focal plane
 - Scan area around parameter space
 - Approximate mirroring plane for production
 - Polygon
 - Cylindrical
 - Fine tuning for stable solution
- **Interfacing** to pandaROOT/GEANT/Litrani/DXF.....