Calculations for a combined PID and tracking detector based on C6F14, CsI and GEMs (Proposal: Lars Schmitt)

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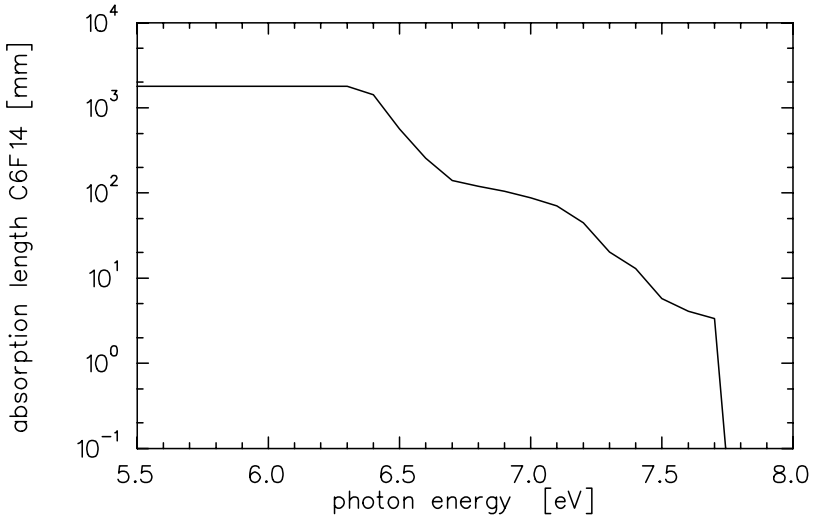
PID-TAG 1/3/2007 presentation

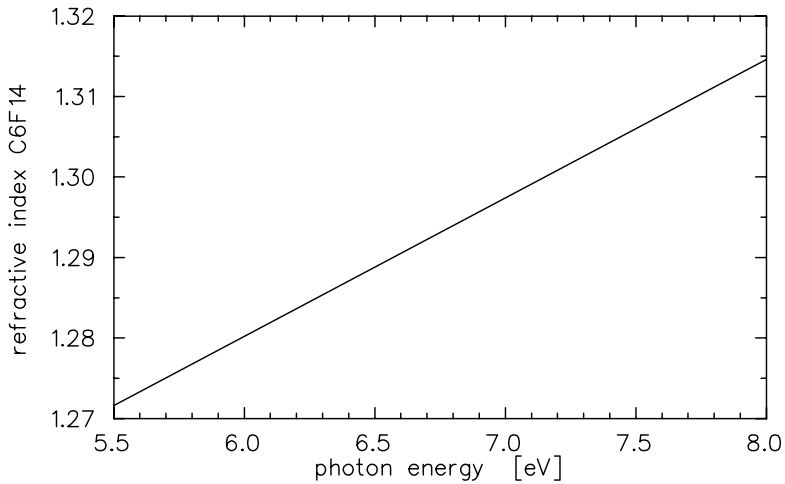
expanded write-up 2/3/2007

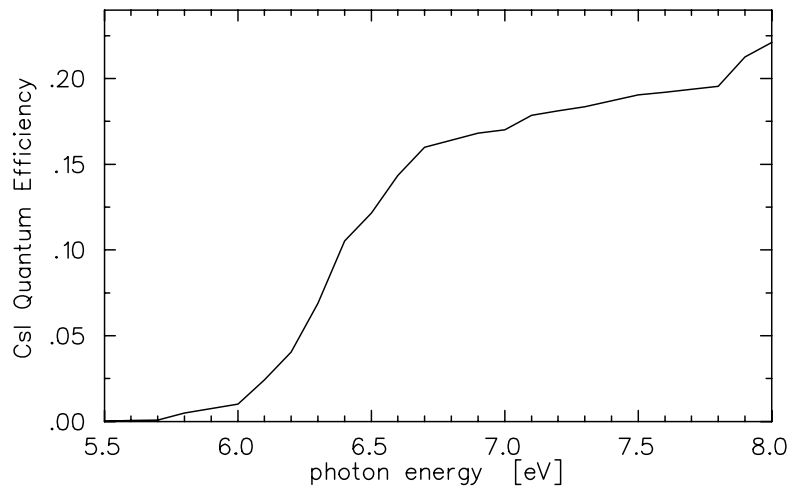
source of material properties



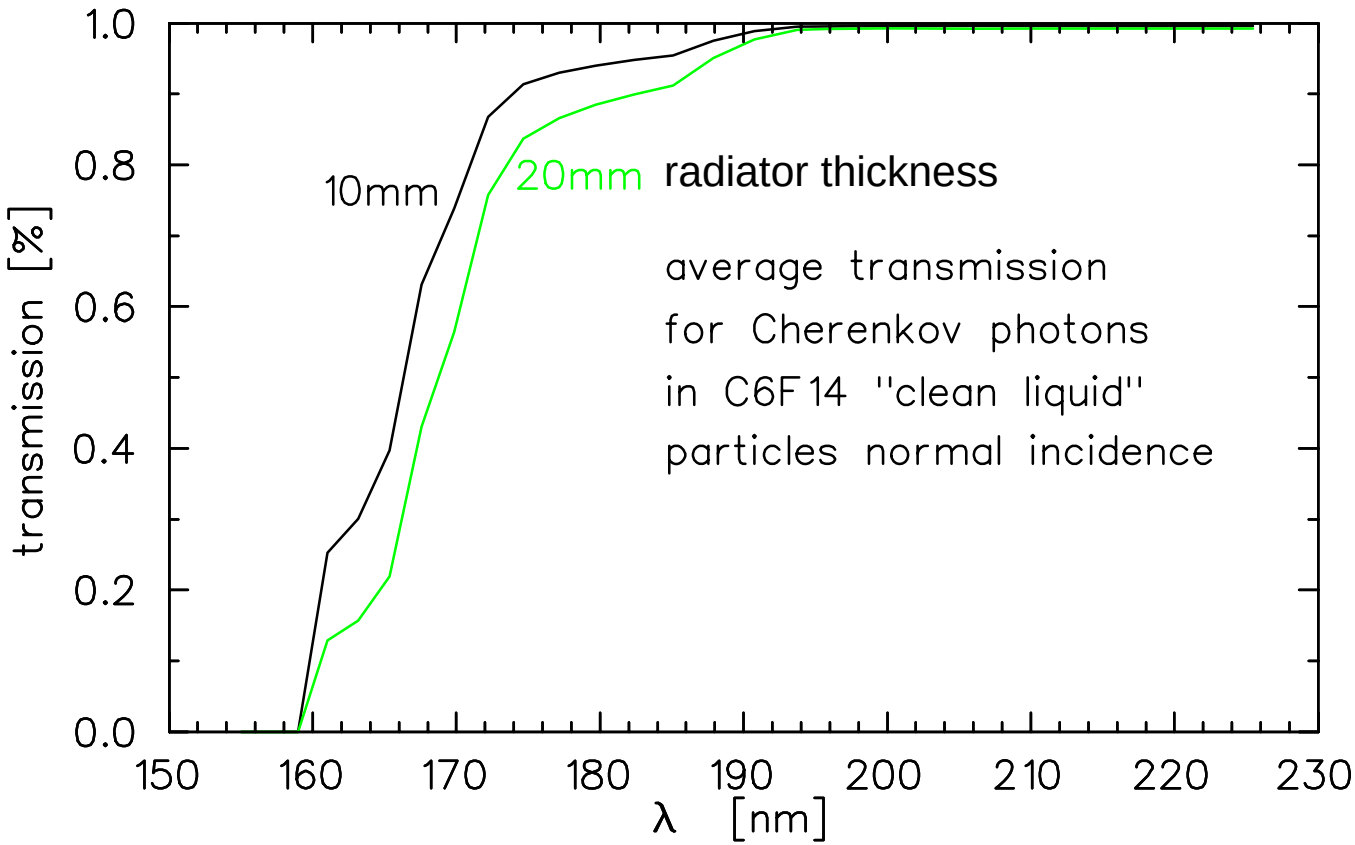
- material data used is shown left and below
- from a RICHSIM web page at CERN

r.home.cern.ch/r/richrd26/www/hmpid/richsim.html

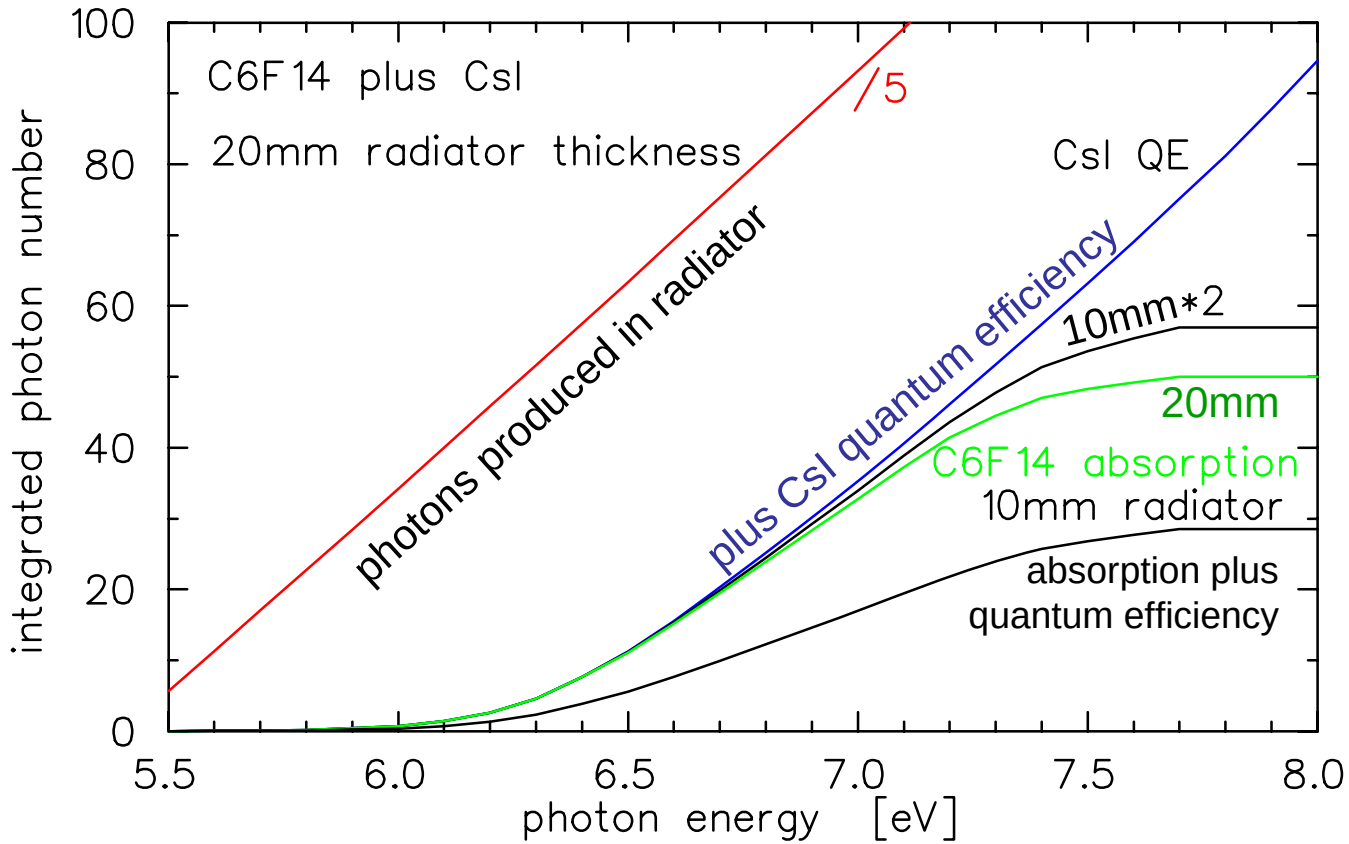




material transmission

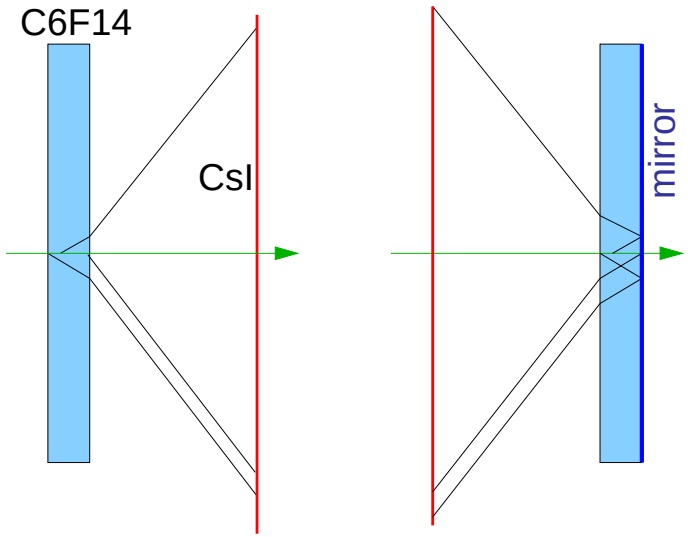


photon yield – visible photons



curves show photon yield for an energy interval
starting at E_photon=5.4eV

simulation ingredients

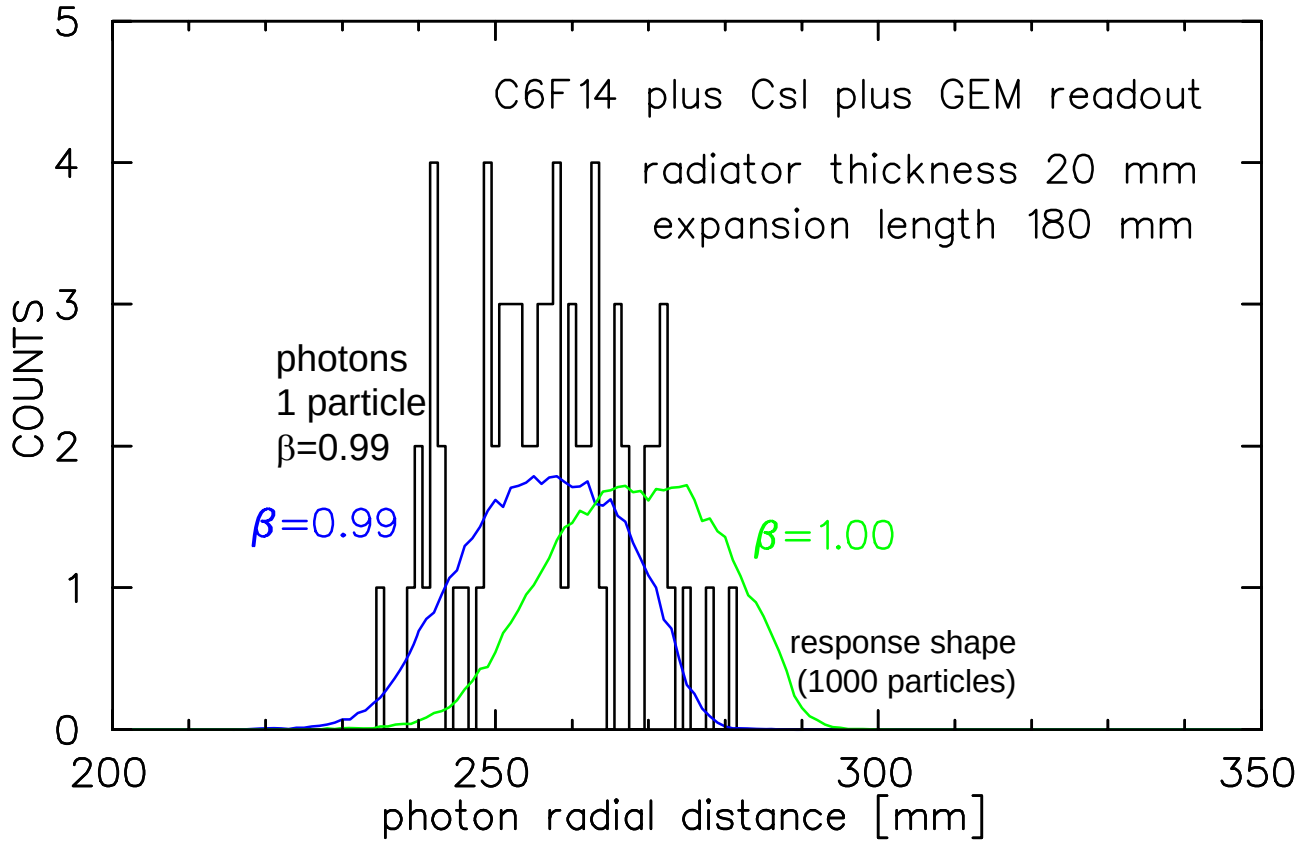


- proper Cherenkov photons number and colour
- refractive index dispersion
  - Cherenkov angles
  - Snell's law
- absorption length
- quantum efficiency
- statistical analysis

Simplifications & Approximations

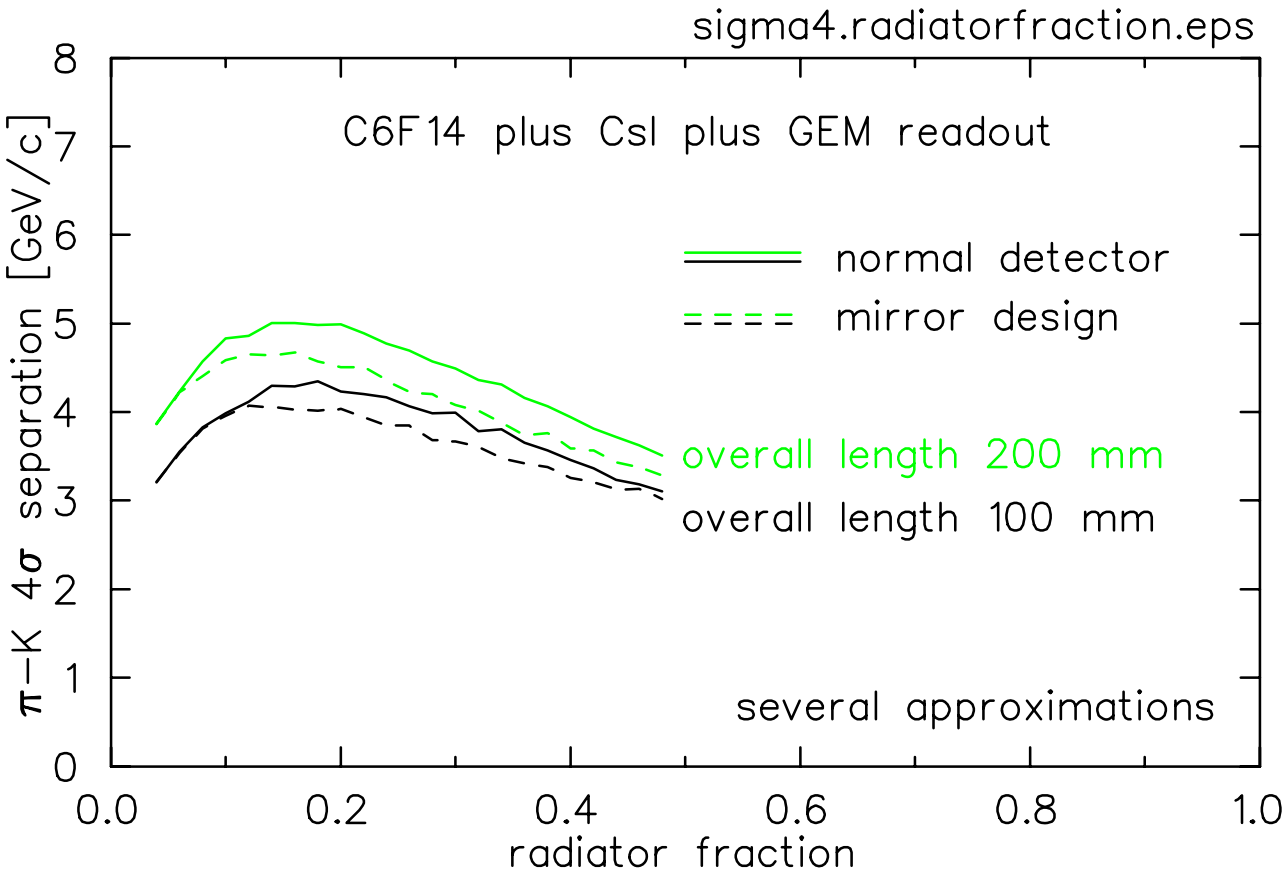
- normal incidence particles only
  → maths simplification
- no angular straggling
- liquid without vessel
- no detector pixels
  (assumed to be small)
- Fresnel formula simplified
  (Brewster angle being close)
- perfect mirror

hit pattern

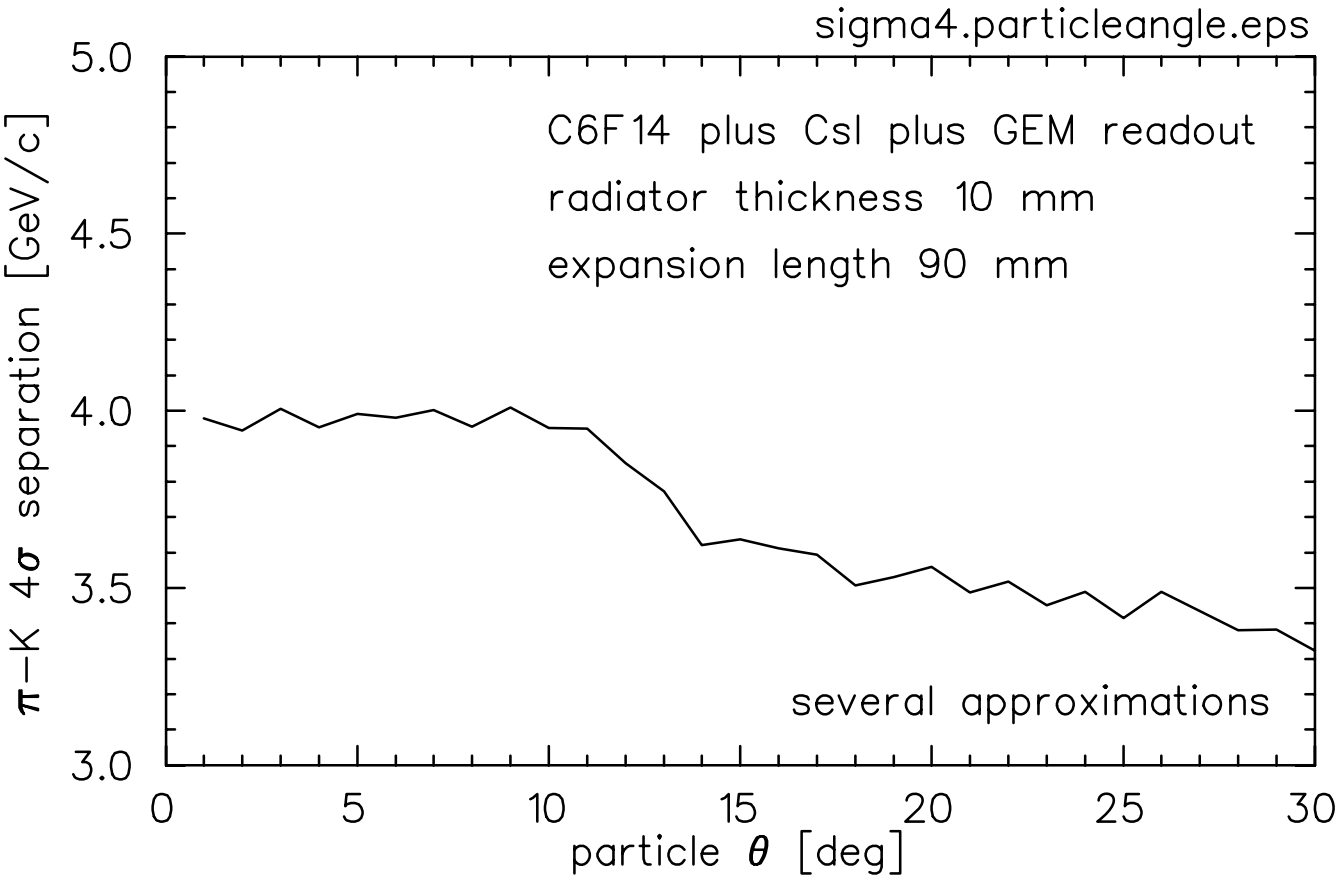


The particle distance is the average of the photon radial distances resulting from one charged particle. Particle distance mean and sigma are computed for samples of 1000 events β=1 and 1000 events β=0.99 and sigma separation & 4σ-limit derived.

performance – radiator width

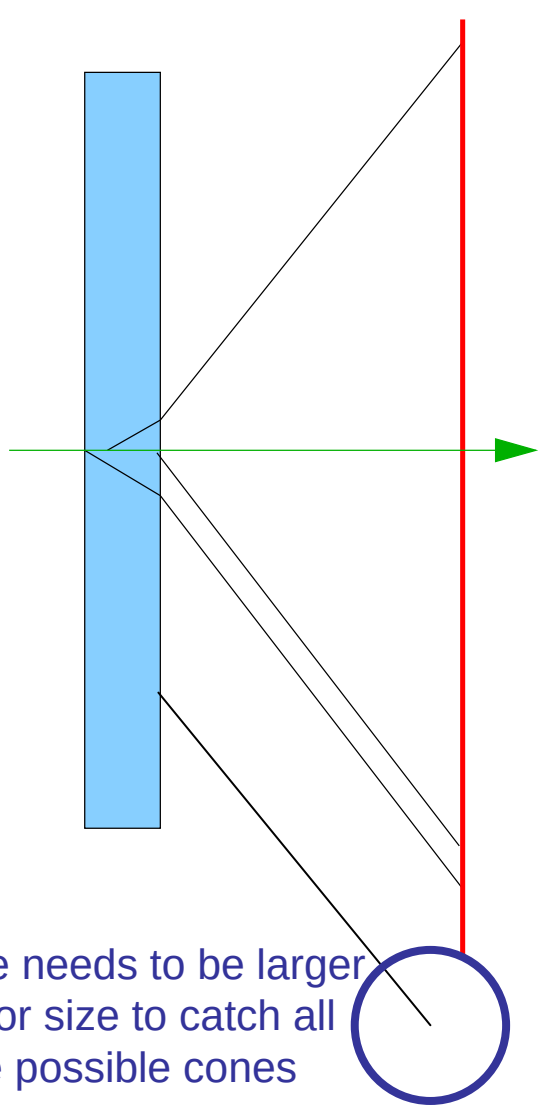


angle dependence



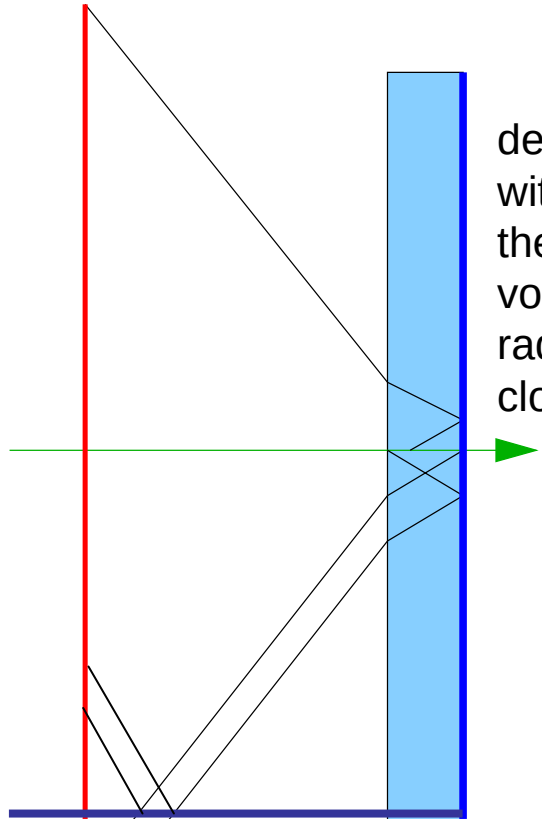
preliminary and approximate calculation

potential edge effects



detection plane needs to be larger than the radiator size to catch all photons on the possible cones

or



design variation with mirror and the expansion volume upstream radiator placed closer to EMC

mirrors at the fringes to fold Cherenkov cone back onto the active area