



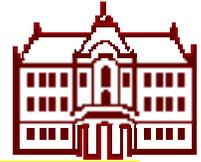
# PID performance of a dual radiator ARICH using a 2D likelihood function on simulated data - update with higher statistics

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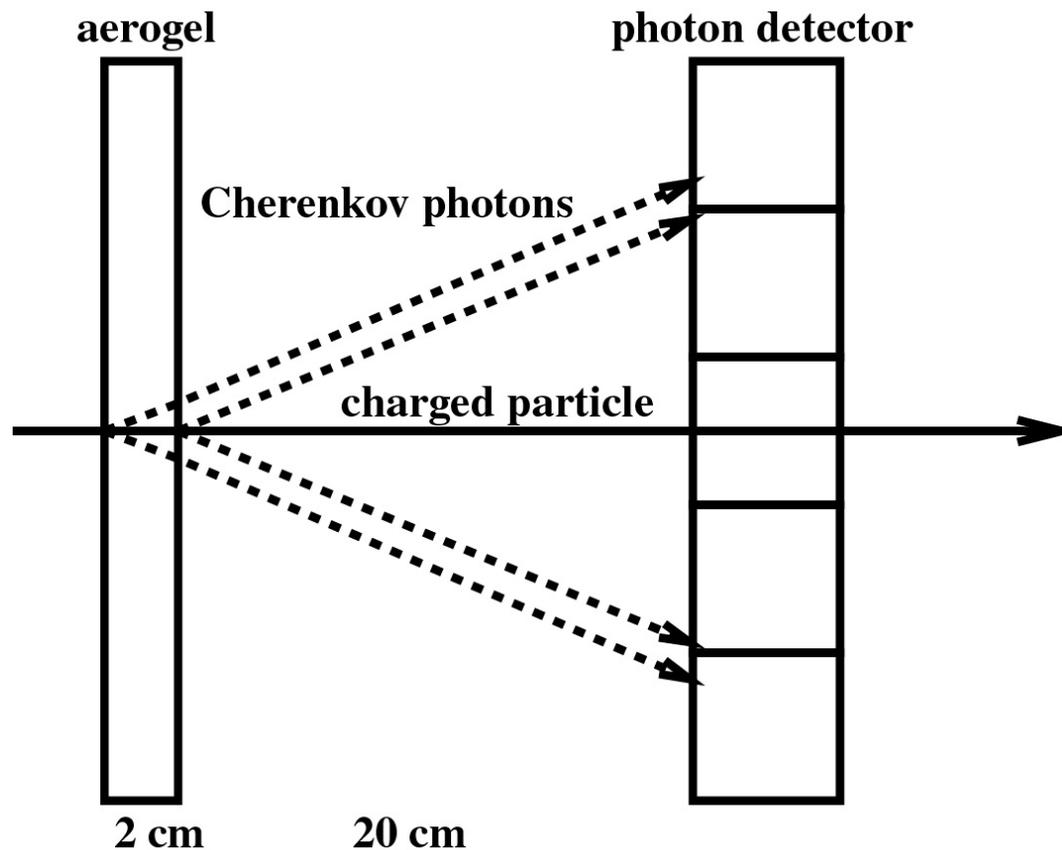
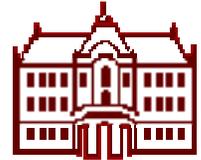
# Contents



Results: performace vs configuration,  
refractive index choice, angle, background  
level

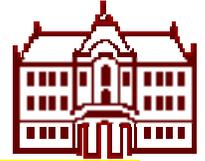
Plans

# Set-up 1



Fix total length, i.e. the distance between the entry point into the first (upstream radiator) and the photon detector surface, to 20cm.

## Set-up 2

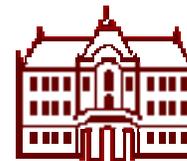


Vary:

- Configuration (focusing, defocusing)
- Background level
- Angle
- Exact refractive index choice

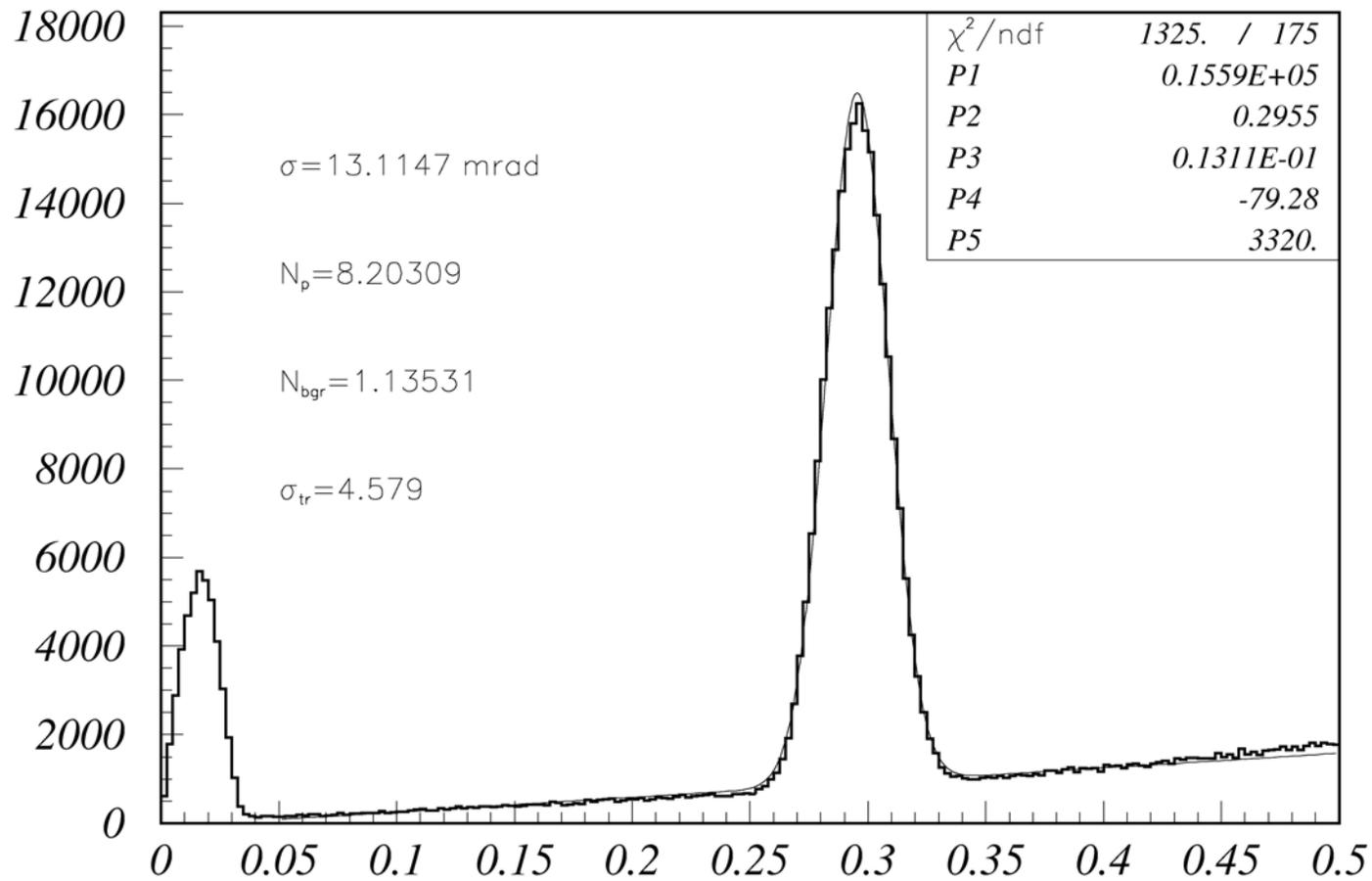
Up to now only two radiators – to avoid too many varied parameters...

# Simulation



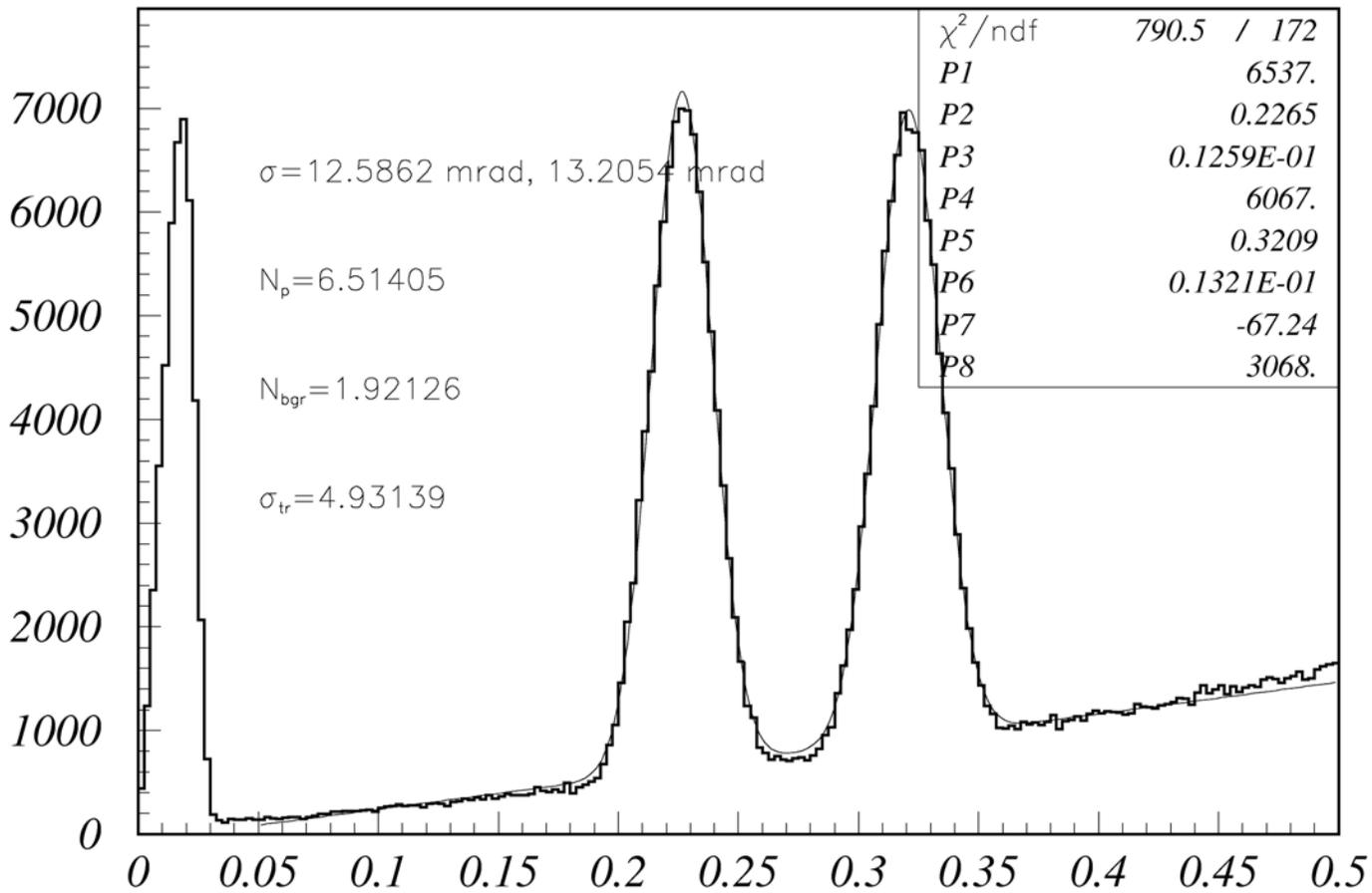
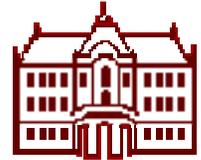
- Use the same code in Geant4 Rok has prepared for the Super-Belle MC.
- Background: generated uniformly over the photon detector.
- New: statistics increased to 500k single track events per set-up, half of it pions, half kaons, uniformly distributed up to 5GeV/c.

# Cherenkov angle distribution, focusing configuration



*hyp:2 a:0 thc*

# Cherenkov angle distribution, defocusing configuration



*hyp:2 a:0 thc*

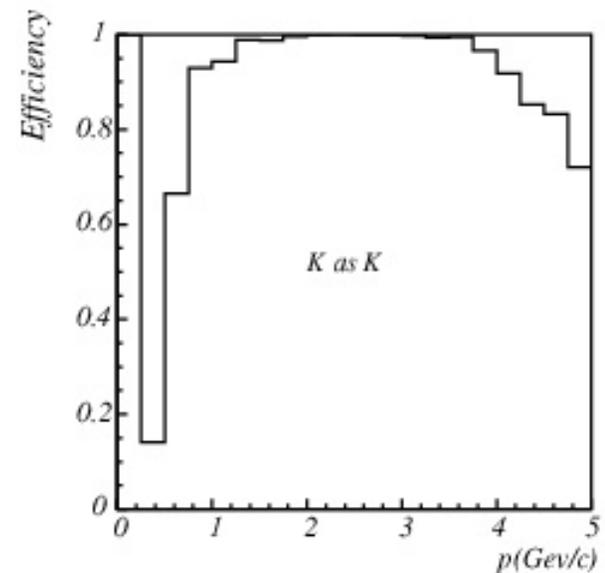
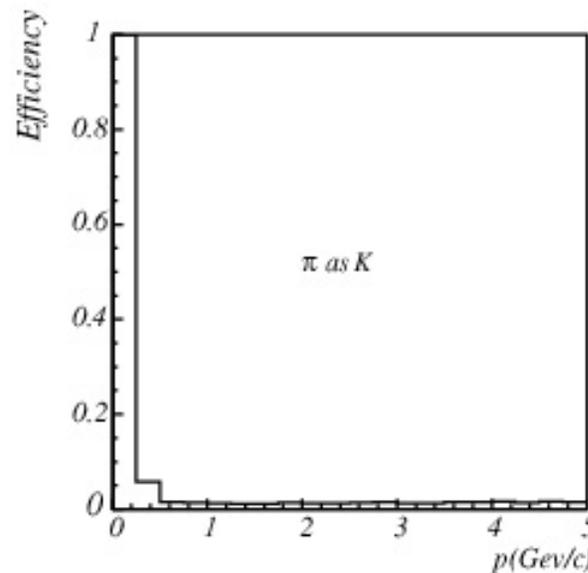
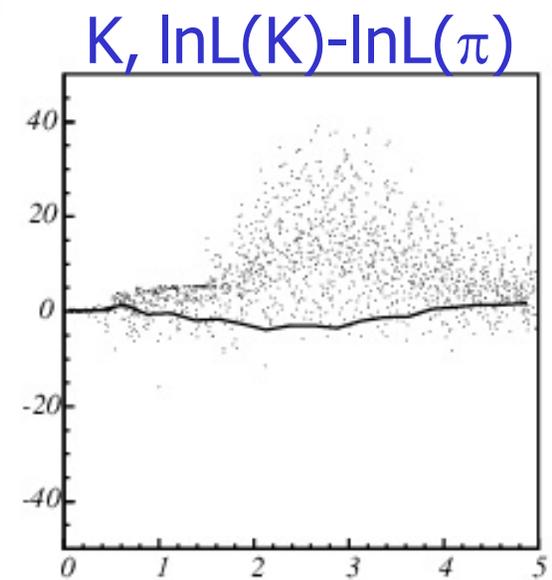
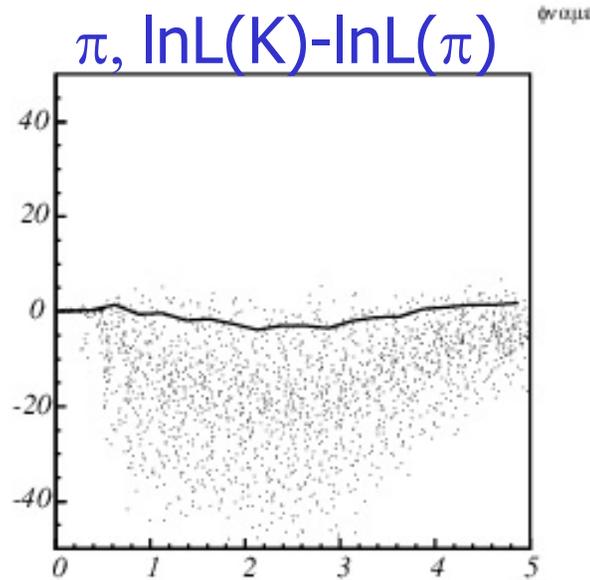


# Likelihoods – typical example

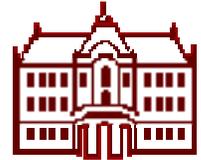


Focusing  
configuration  
15mm  $n=1.043$ ,  
15mm  $n=1.05$

Kaon efficiency at  
1% pion fake  
probability



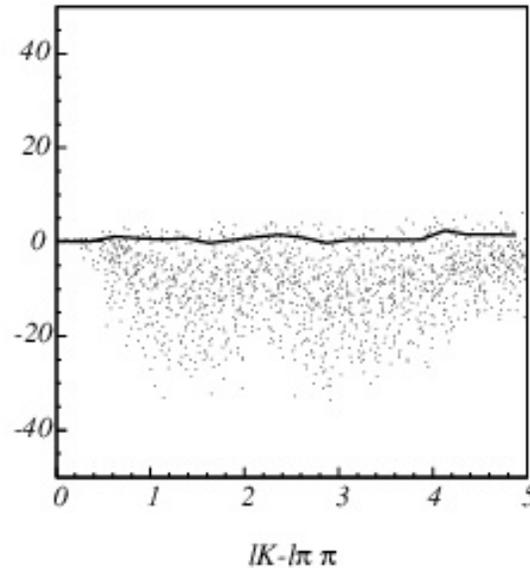
# Likelihoods – typical example



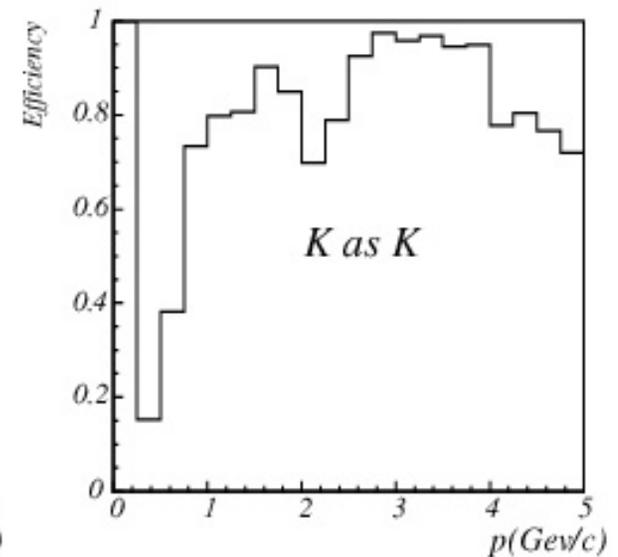
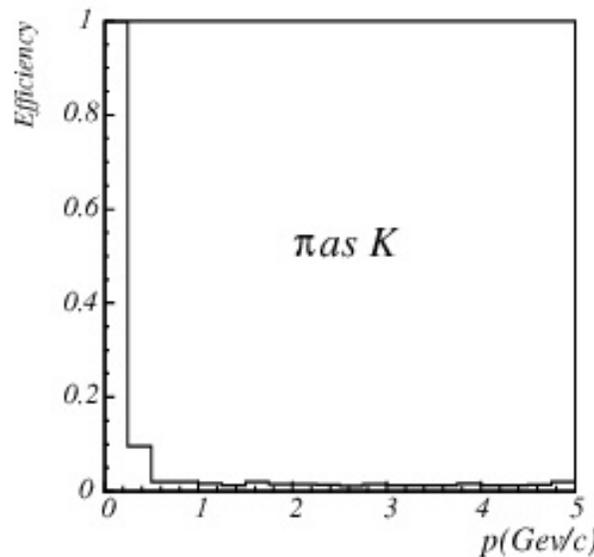
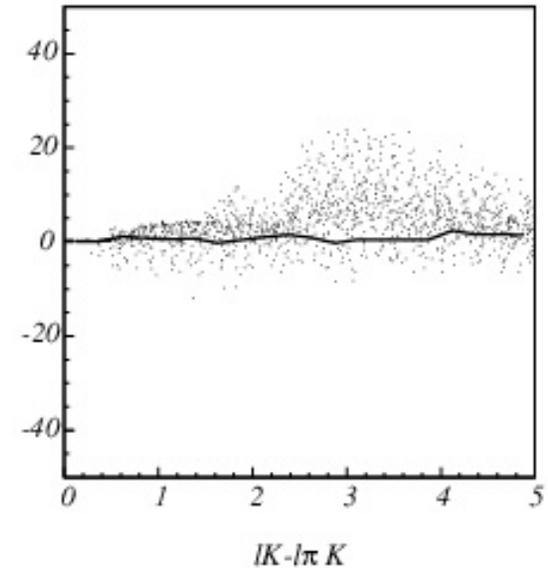
Defocusing  
configuration  
15mm  $n=1.050$ ,  
15mm  $n=1.030$

Kaon efficiency at  
1% pion fake  
probability

$\pi, \ln L(K) - \ln L(\pi)$



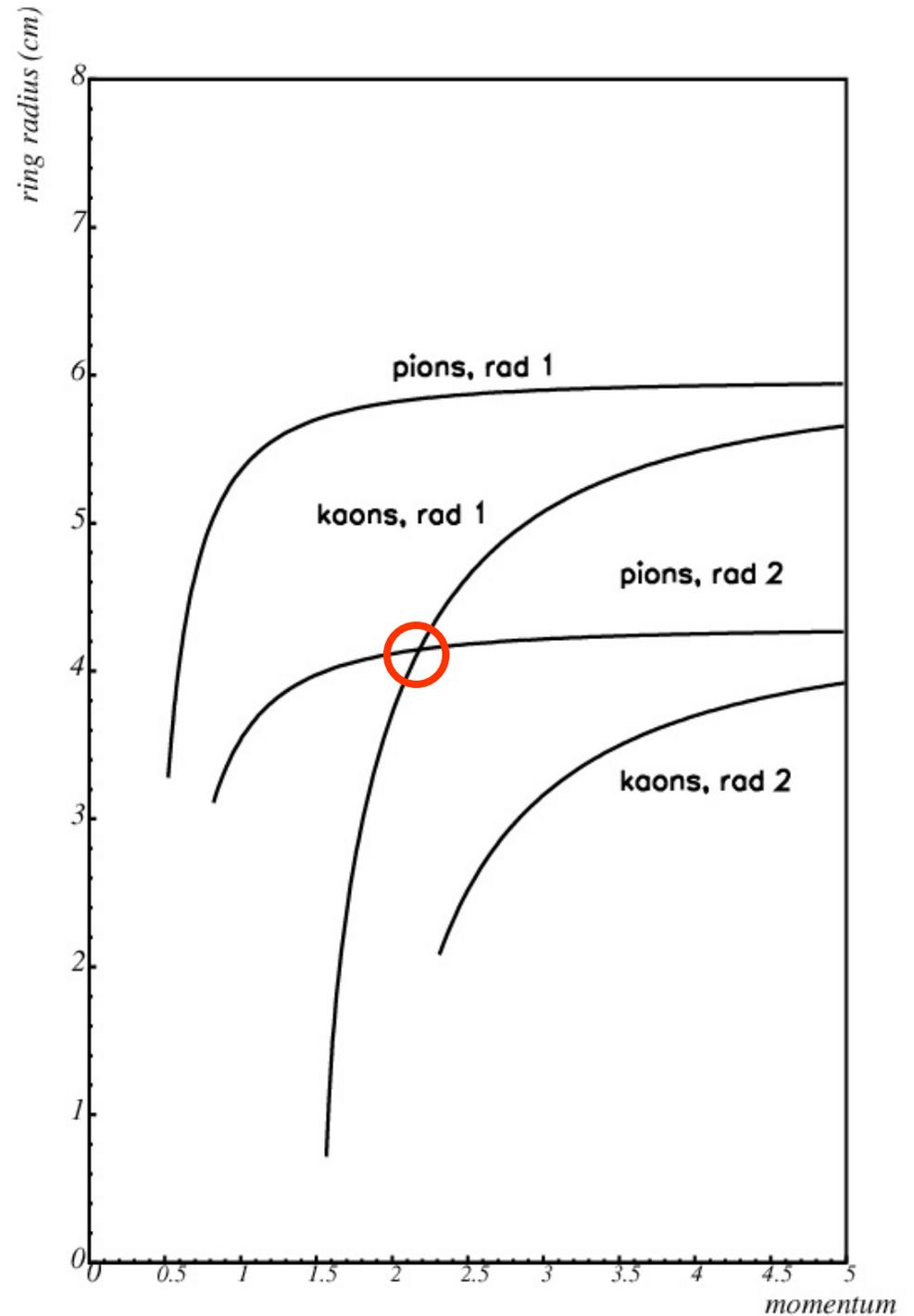
$K, \ln L(K) - \ln L(\pi)$



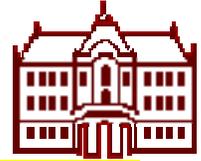
## Dip at 2 GeV/c in the defocusing case

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Related to the overlap of the kaon ring from radiator 1 with the pion ring from radiator 2.

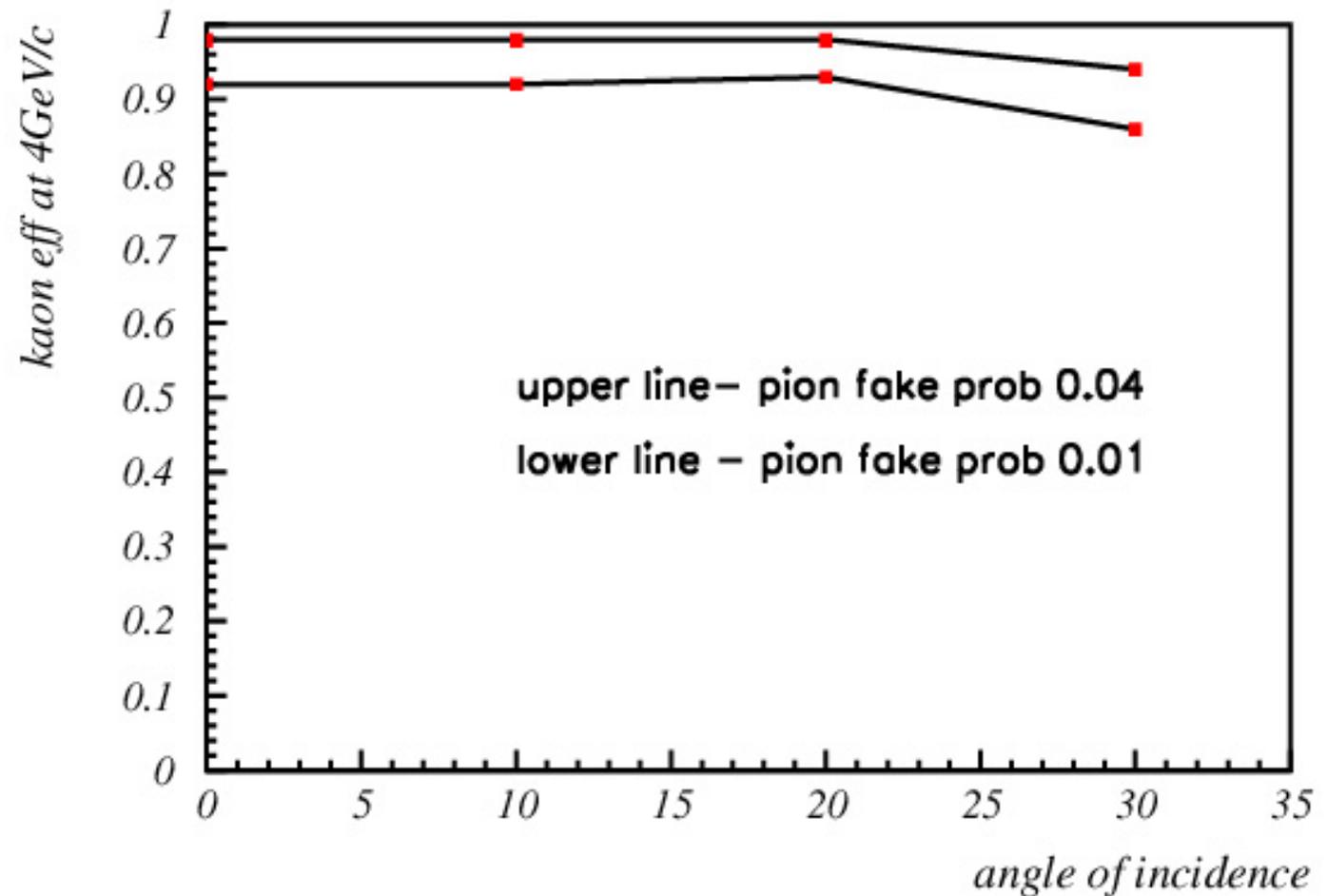


# Variation vs angle of incidence



Kaon efficiency at 4GeV/c, with 1% and 4% pion fake probability

Focusing conf.  
15mm  $n=1.043$ ,  
15mm  $n=1.05$



# Variation vs background level



Background: generated uniformly over the photon detector.

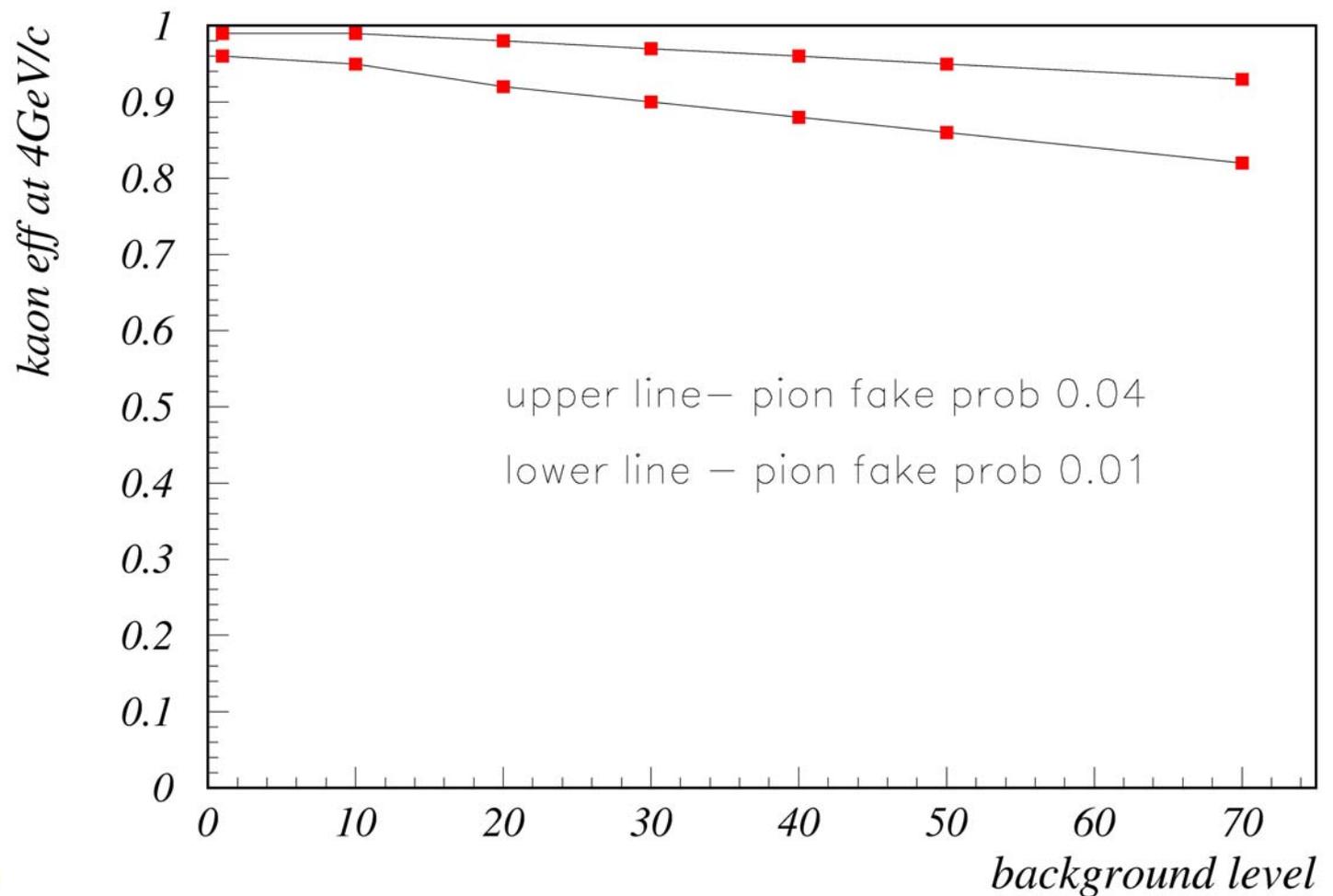
Normalization: background level of 20 corresponds to the beam test data.

Vary the background level from 0-70 , check efficiency at 4 GeV/c, just above threshold, at the cross-over for defoc.

## Variation vs background level

Kaon efficiency at 4GeV/c, with 1% and 4% pion fake prob.

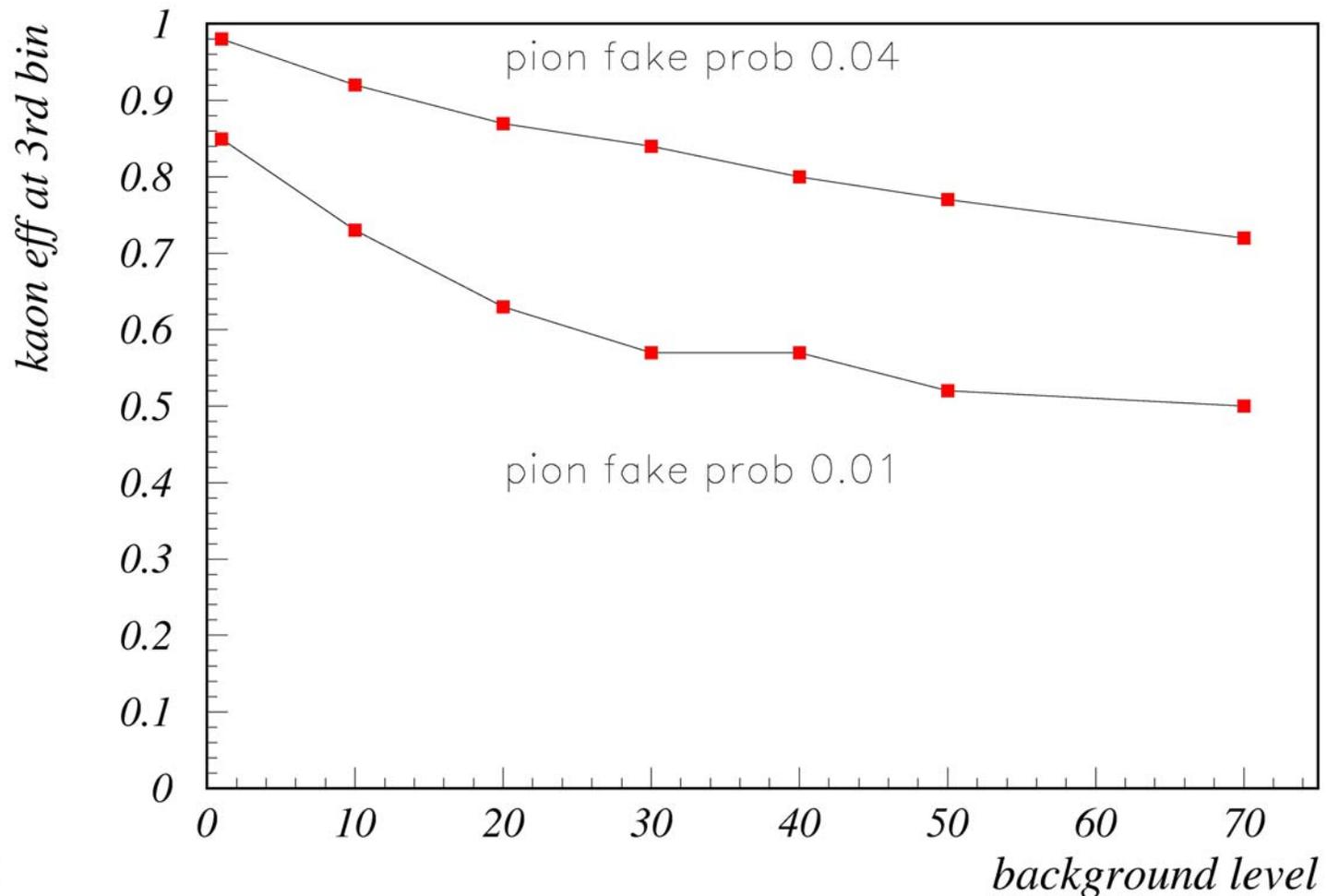
Focusing configuration, 15mm  $n=1.043$ , 15mm  $n=1.05$

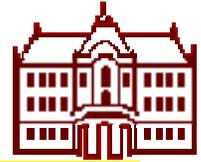


## Variation vs background level

Kaon efficiency just above threshold, with 1% and 4% pion fake prob.

Focusing configuration, 15mm  $n=1.043$ , 15mm  $n=1.05$

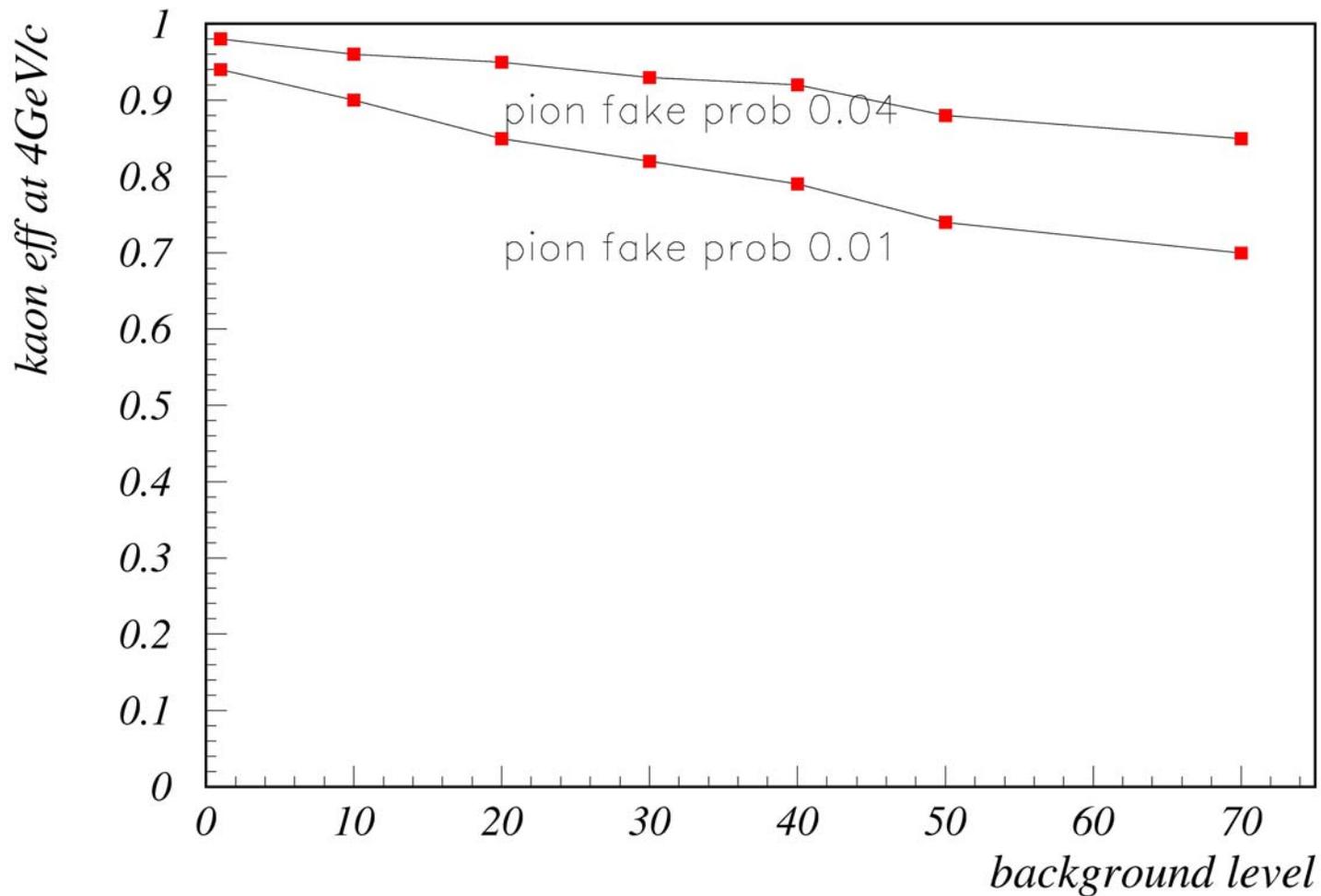




## Variation vs background level

Kaon efficiency at 4GeV/c, with 1% and 4% pion fake prob.

Defocusing configuration, 15mm  $n=1.050$ , 15mm  $n=1.030$

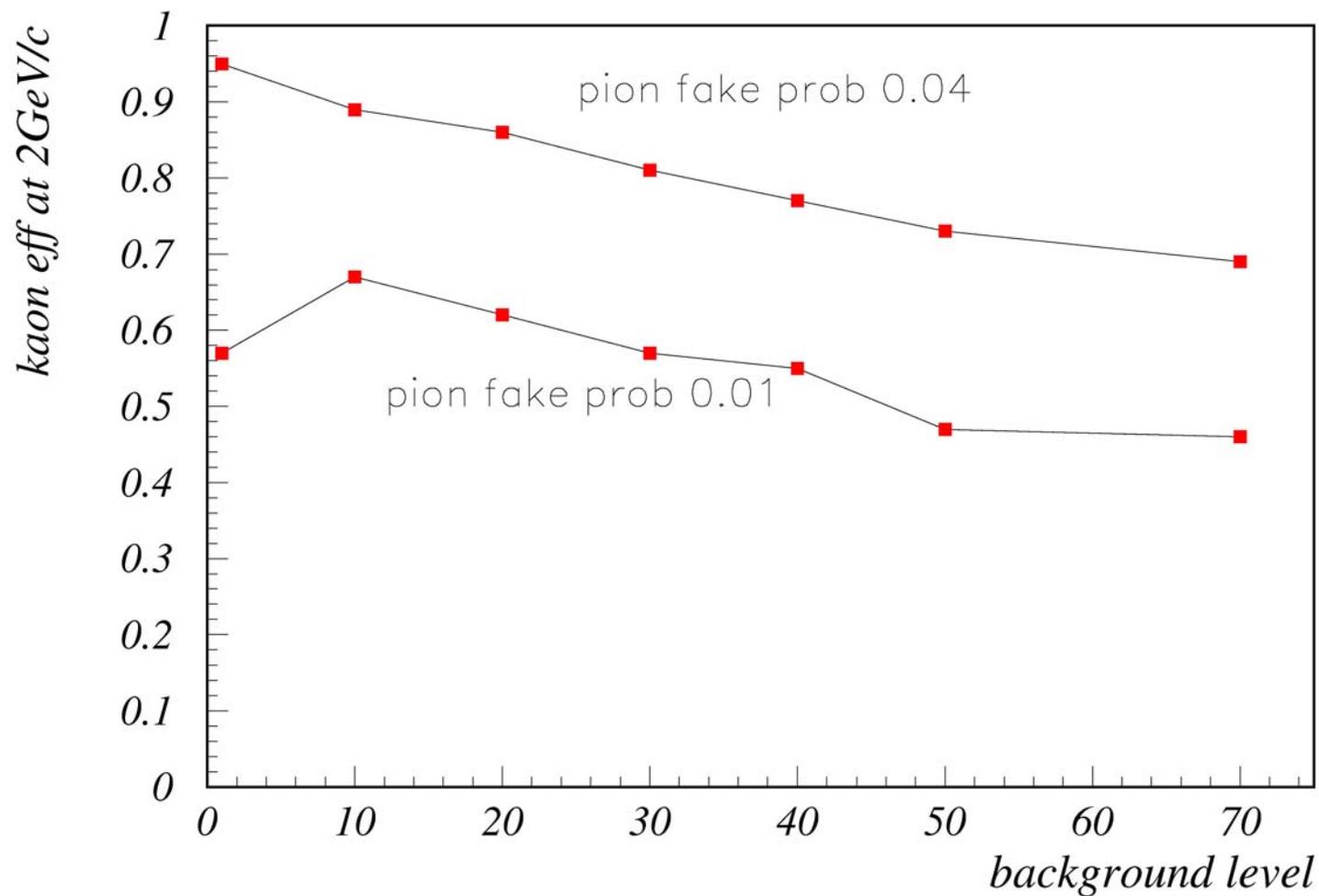




## Variation vs background level

Kaon efficiency at 2GeV/c, with 1% and 4% pion fake prob.

Defocusing configuration, 15mm  $n=1.050$ , 15mm  $n=1.030$

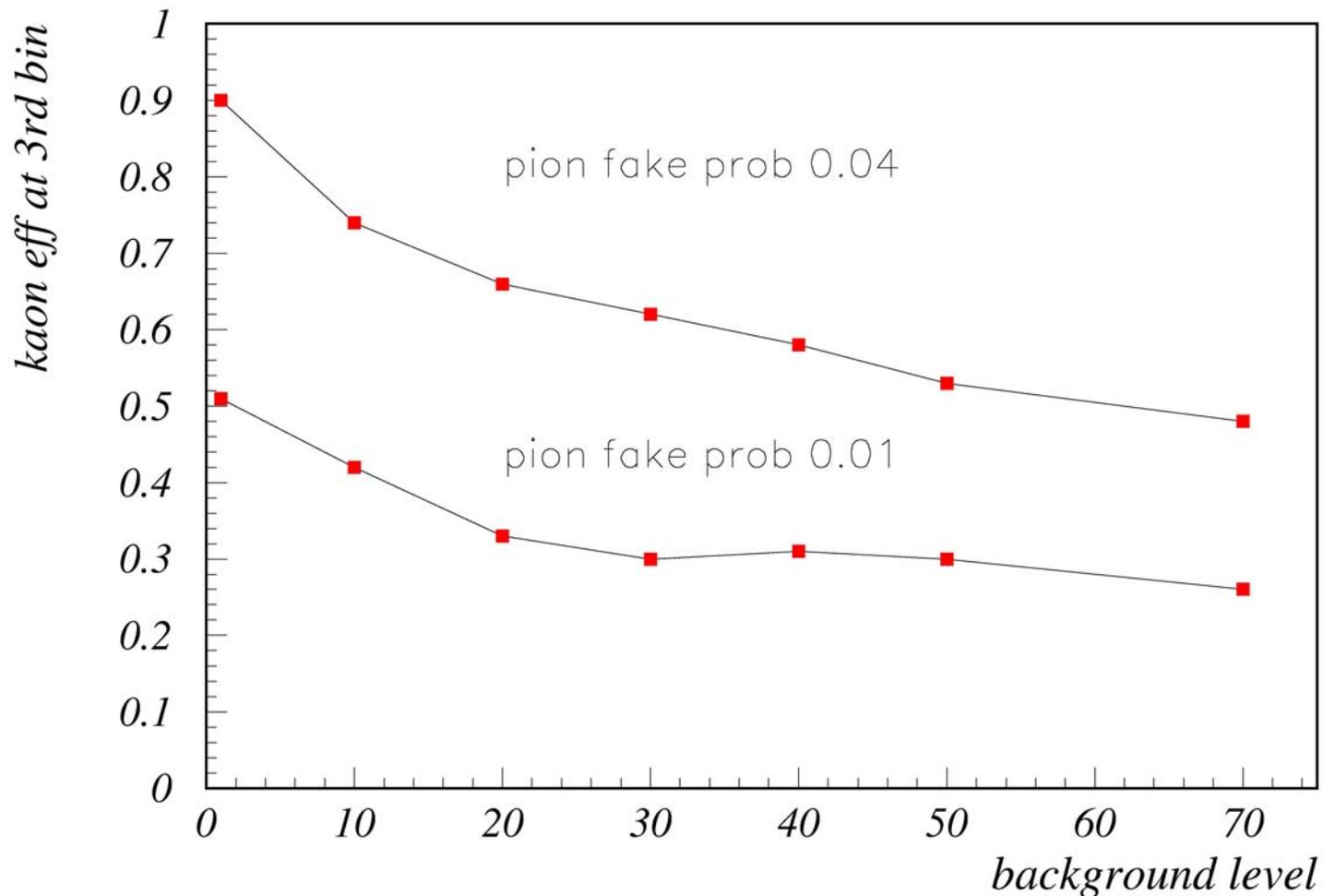




## Variation vs background level

Kaon efficiency just above threshold, with 1% and 4% pion fake prob.

Defocusing configuration, 15mm  $n=1.050$ , 15mm  $n=1.030$



# Variation vs refractive index



Idea: fix one of the refractive indices – say upstream to 1.050.

Vary the downstream index, check efficiency at 4 GeV/c etc.

Radiator thickness: both 15mm

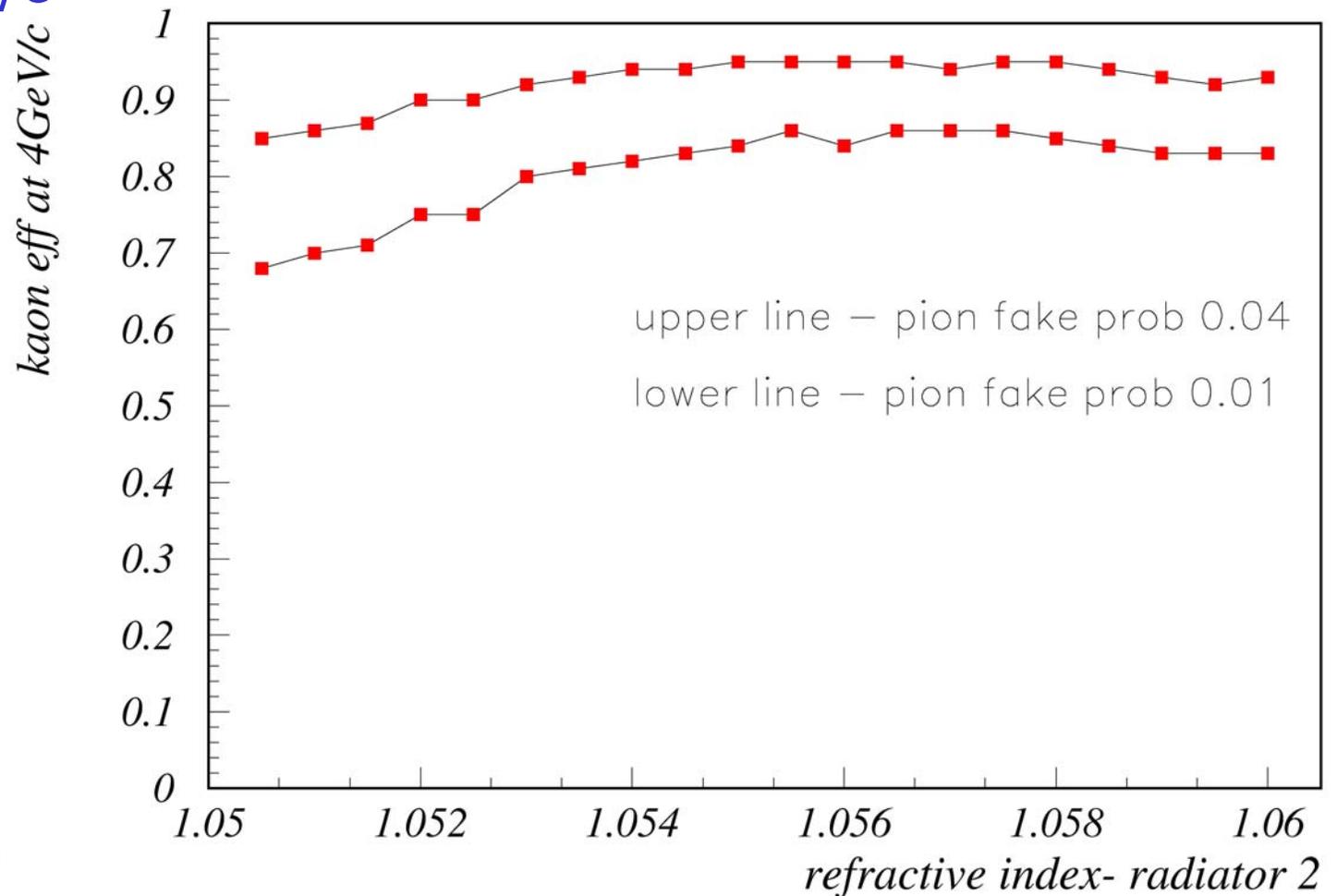
Check the sensitivity to exact index value.

## Variation vs refractive index

Upstream:  $n=1.050$ . Radiator thickness: both 15mm.

Downstream:  $n>1.050$  (focusing). Background level 60.

Eff. at 4 GeV/c



# Summary, plan



Varied with increased statistics :

- Configuration (focusing, defocusing)
- Background level
- Angle

New:

- Exact refractive index choice

Next vary:

- Exact refractive index choice - continued
- Multiple radiator combinations