Tuning of trigger simulation parameters

(Bossi, Moulson, Palutan, Sciascia)

- Calorimeter trigger thresholds calibration using prompt photons from $K_S \to \pi^0\pi^0$ events (2001 and 2002 data).

- Drift chamber trigger threshold calibration using $K_S \to \pi^+\pi^-$ and K^+K^- events (2001 and 2002 data).

Calorimeter trigger

- An effective threshold is evaluated comparing the energy of a photon cluster (from $K_S \rightarrow \pi^0\pi^0$ events) with the trigger sector response. An unbiasing condition is imposed to the remaining clusters of the event (two sectors fired).

- During 2001 and 2002 data taking periods, a dishmap with unbalanced endcap thresholds has been used. A single step has been applied to the hardware thresholds of some endcap sectors at the beginning of 2002 data taking, to recover 2001 running condition.

- Data samples used for calibration (neutral kaons DST's):

2001 run 20800-21800 = 37 pb-1

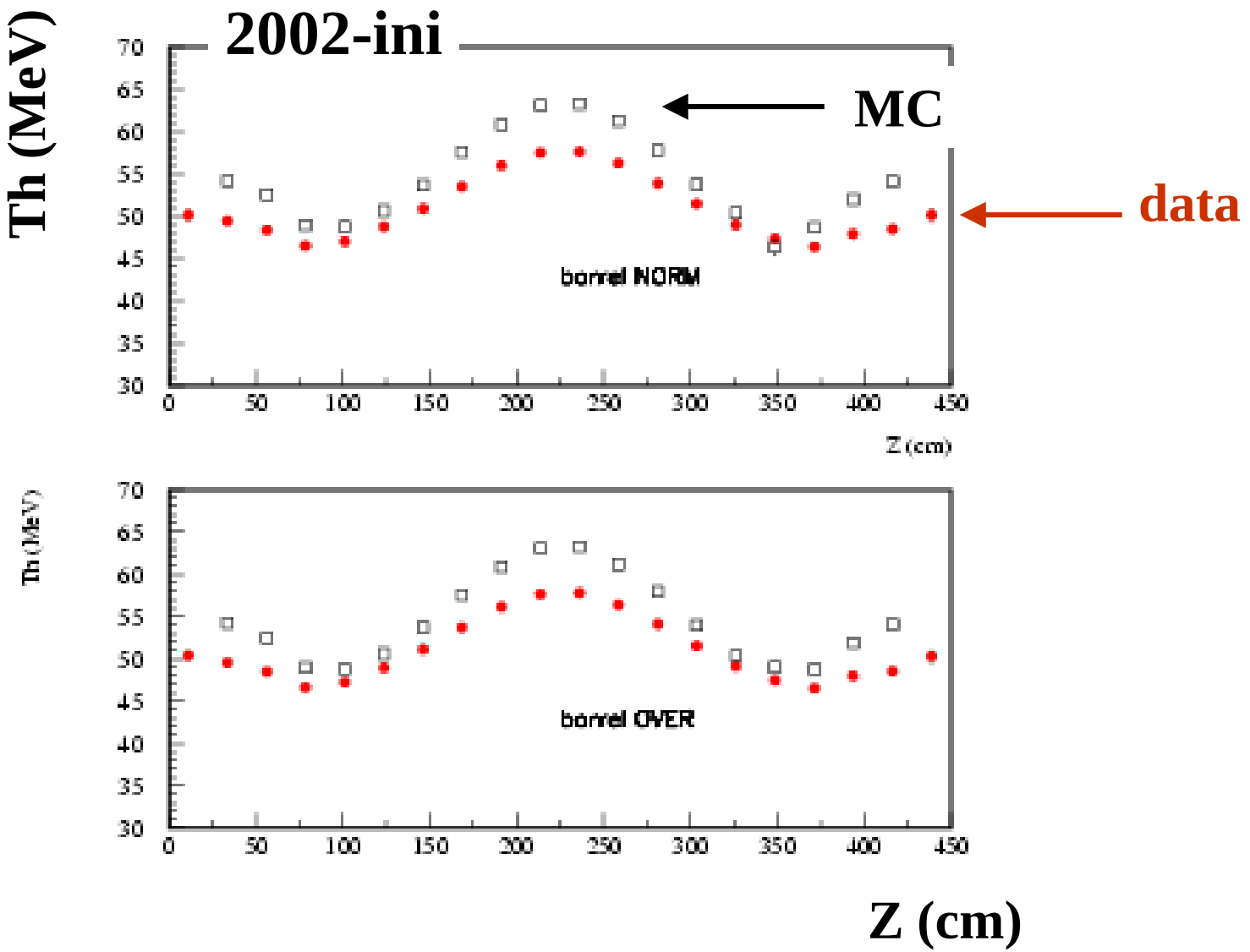
2002-ini run 23600-23980 = 26 pb-1

new hardware map starting from run 24036

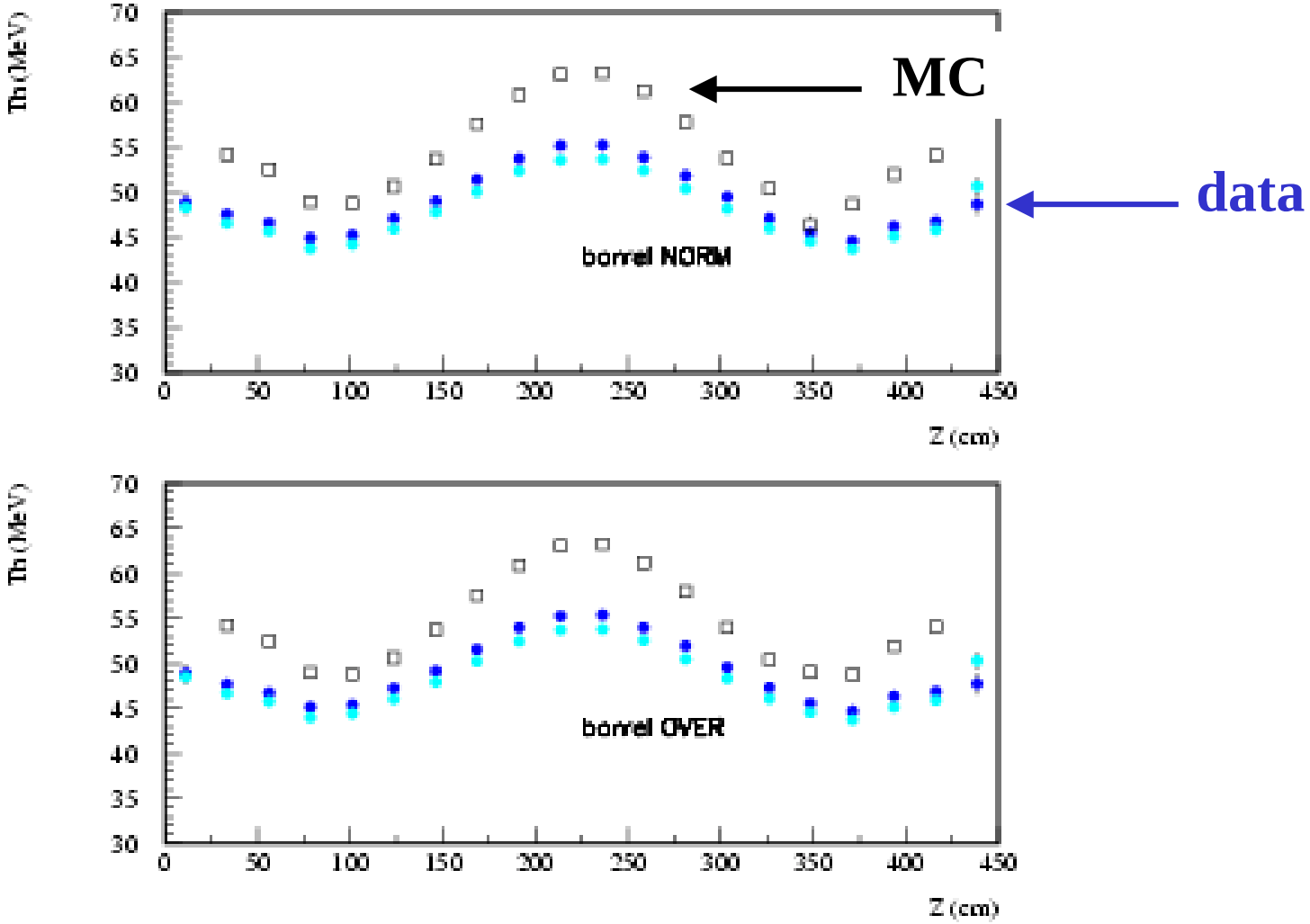
2002-mid run 24700-25000 = 17 pb-1

2002-end run 26090-26500 = 45 pb-1

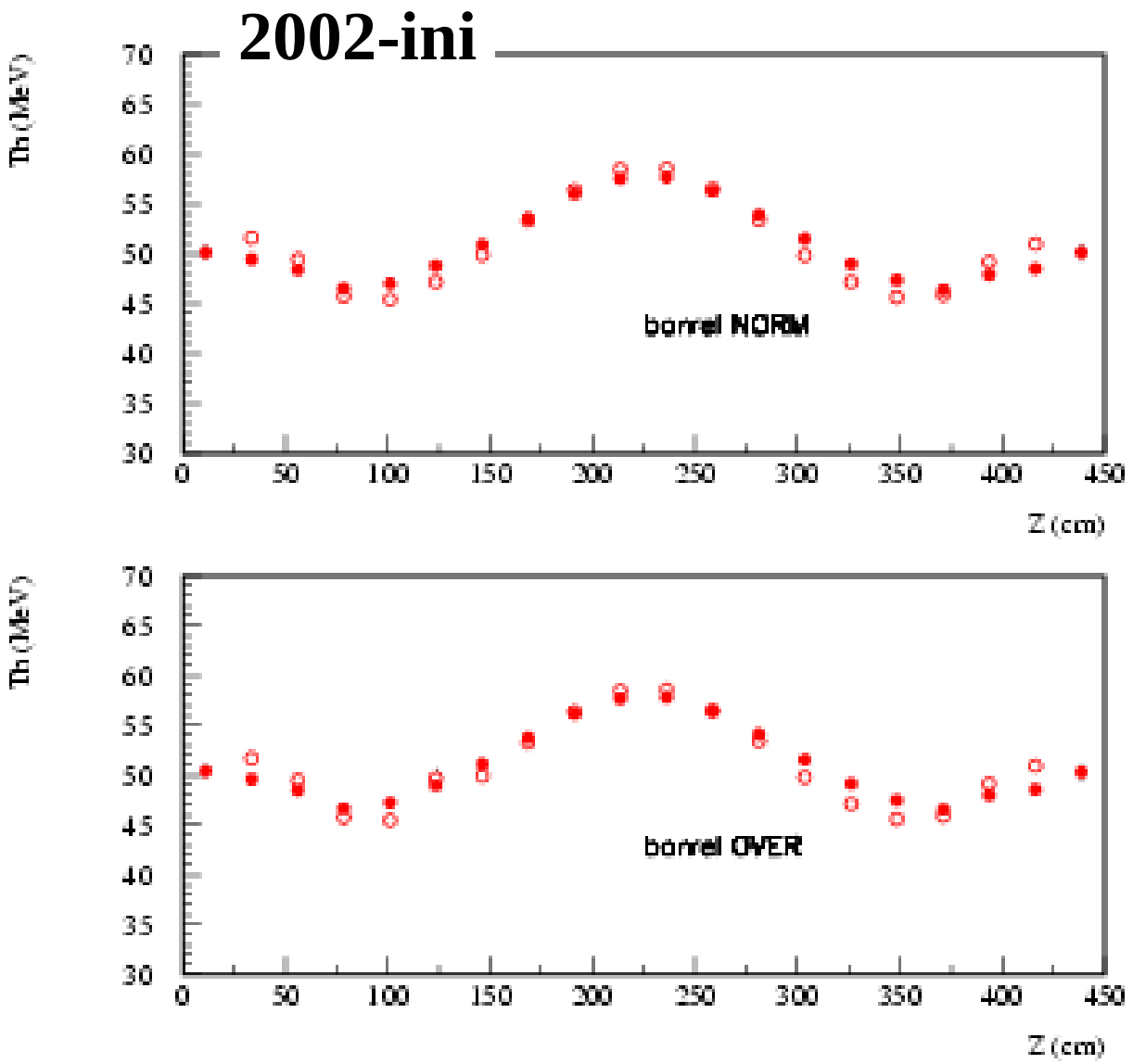
Barrel thresholds in the standard trigger simulation



2002-mid + 2002-end



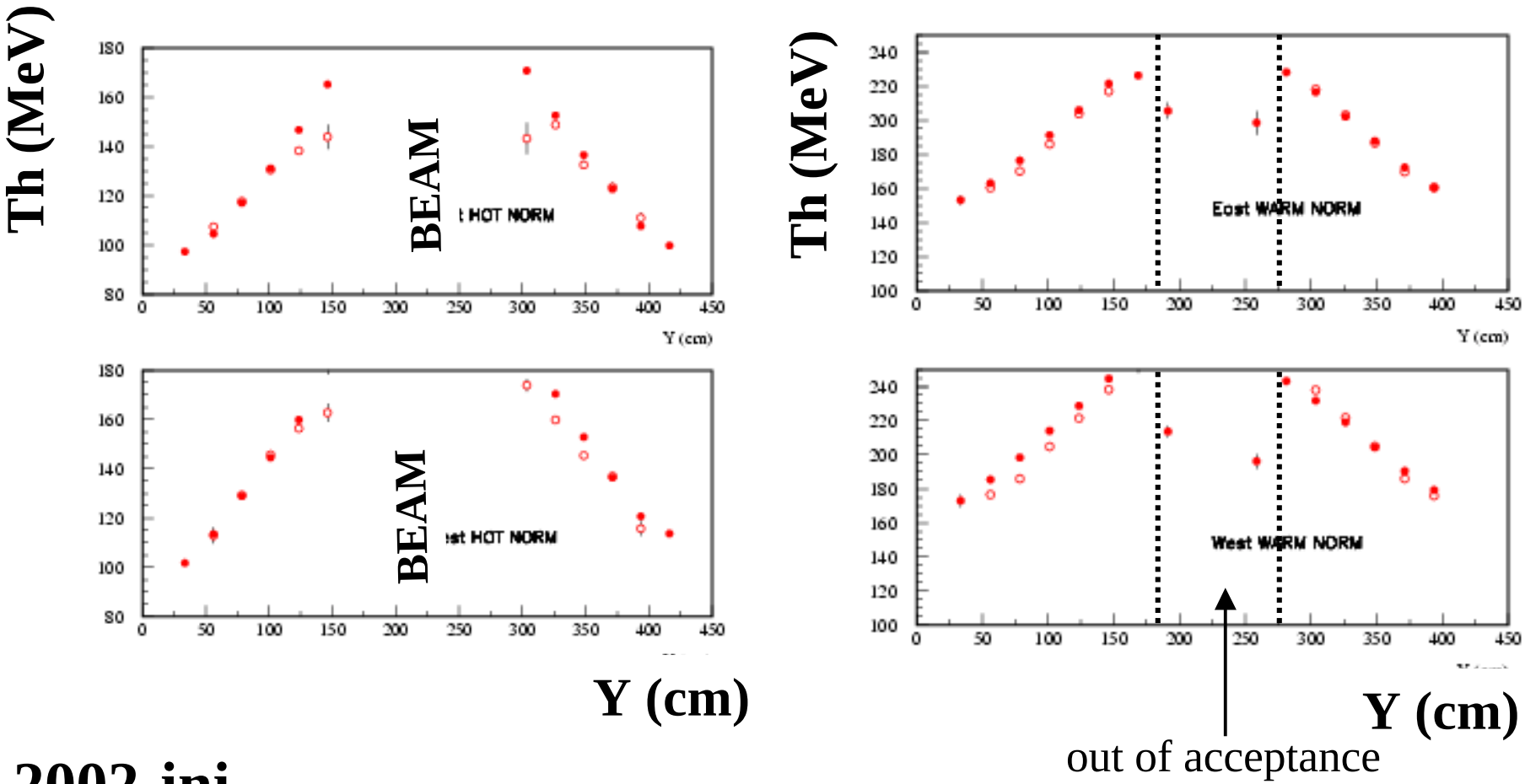
Data/MC comparison after calibration: Barrel



Data/MC comparison : Endcap unbalanced

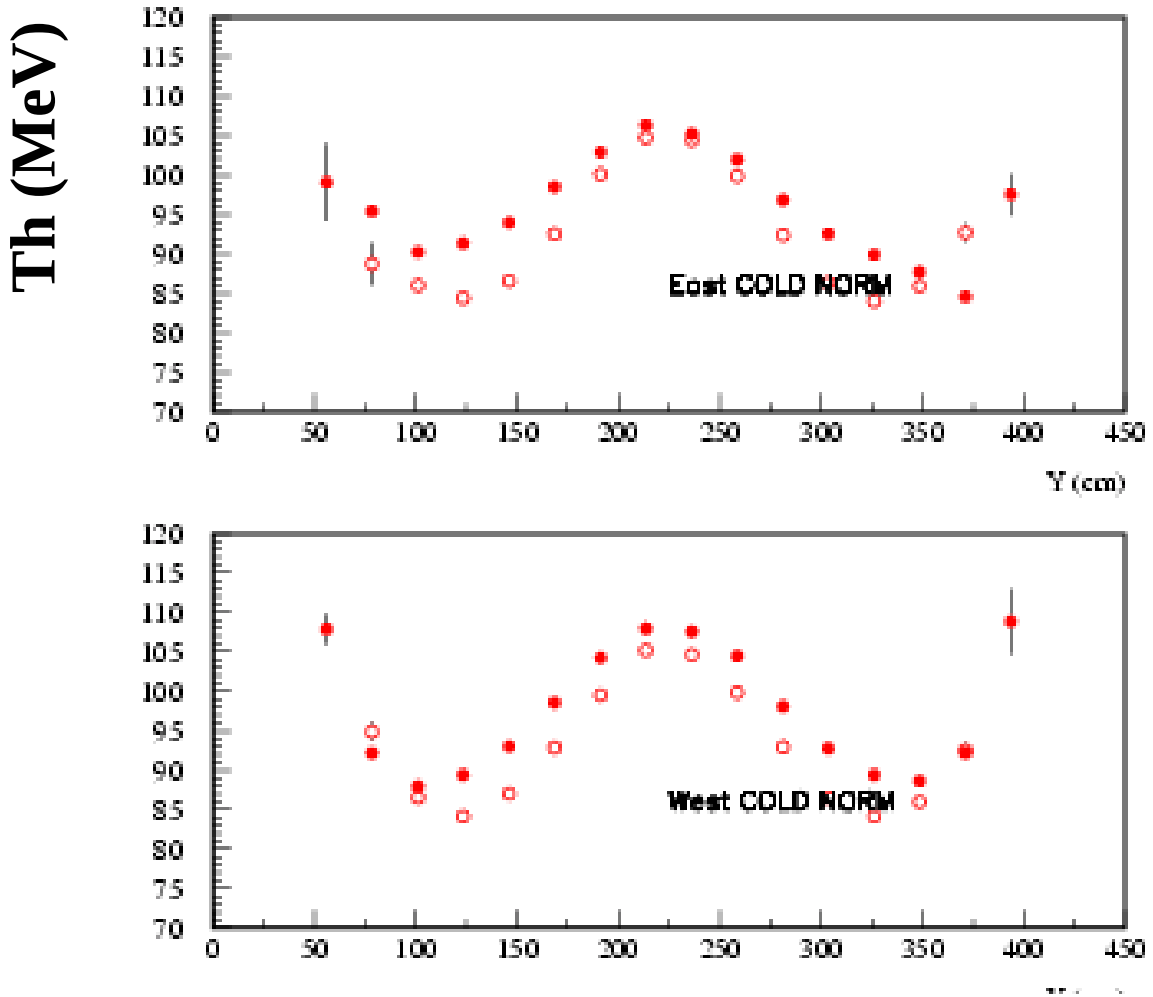
Short modules (HOT)

Beside the Beam pipe (WARM)



2002-ini

Data/MC comparison : Endcap COLD

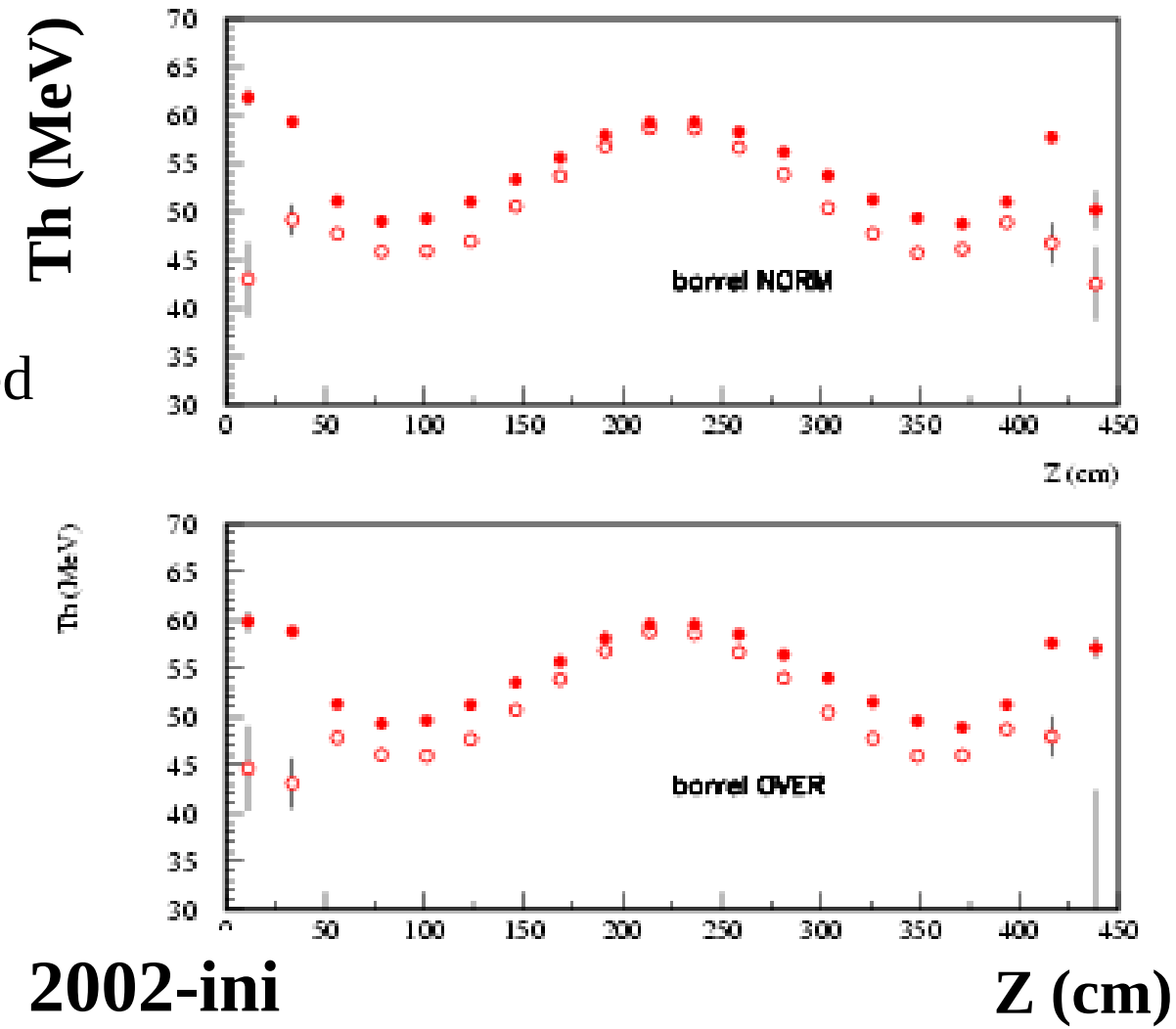


2002-ini

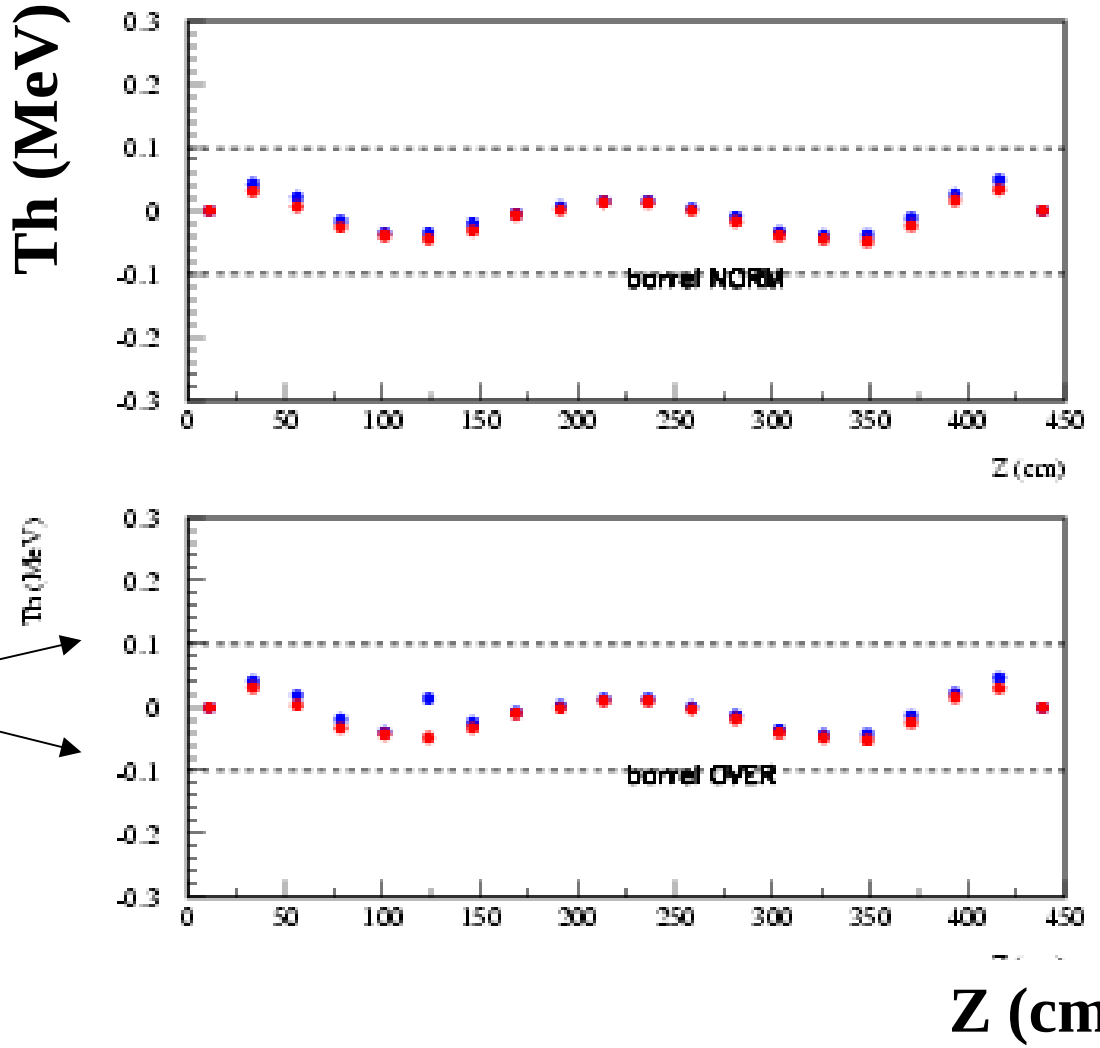
Data/MC comparison for charged pions ($K_S \rightarrow \pi^+\pi^-$)

The effective threshold is computed on clusters associated to charged pion tracks (well separated pion clusters + unbiasing procedure)

NB: the threshold have been calibrated on photons



Data/MC relative spread: photons on barrel



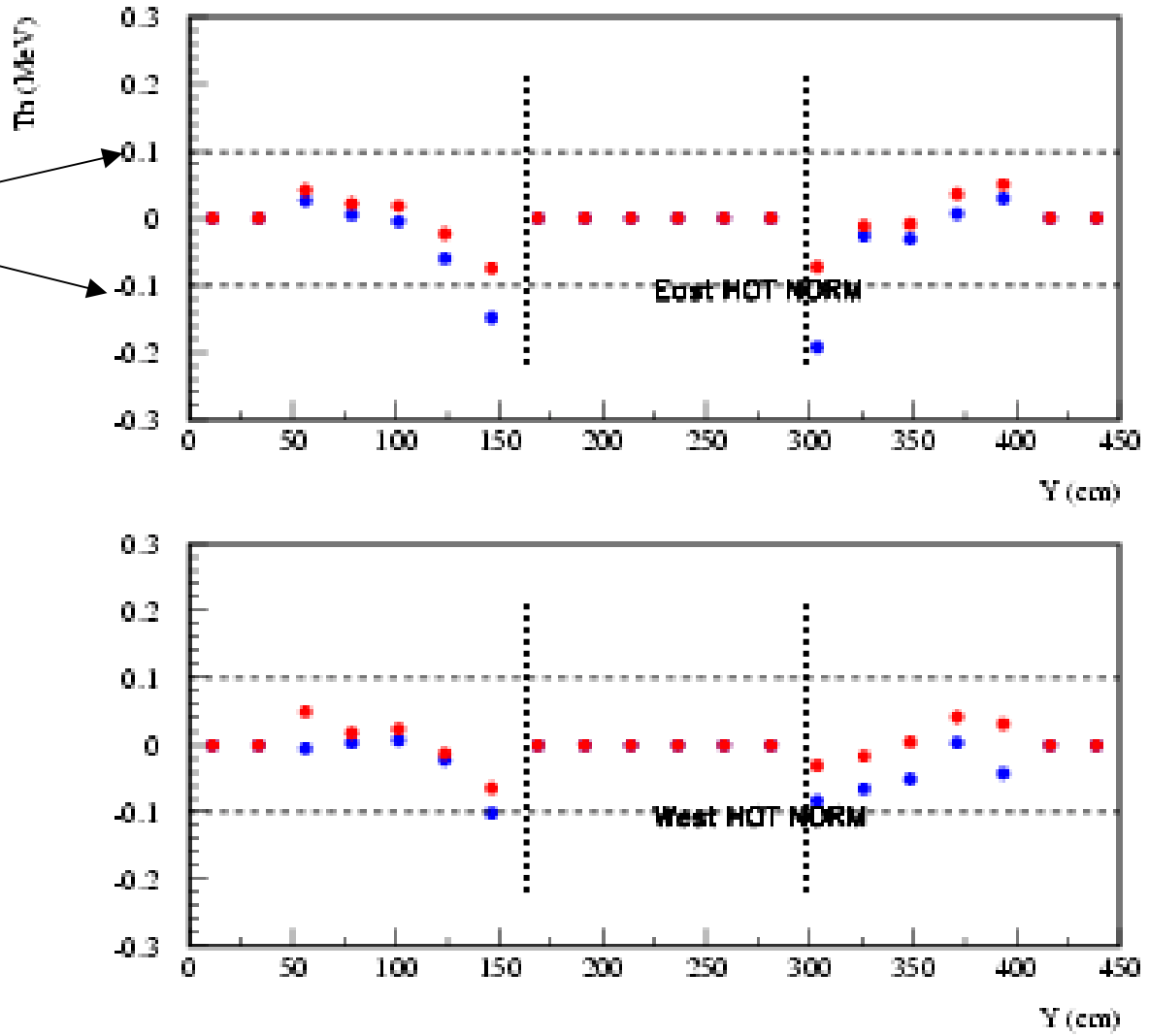
2002-end

2002-ini

10% band

Data/MC relative spread: photons on HOT sectors

10% band

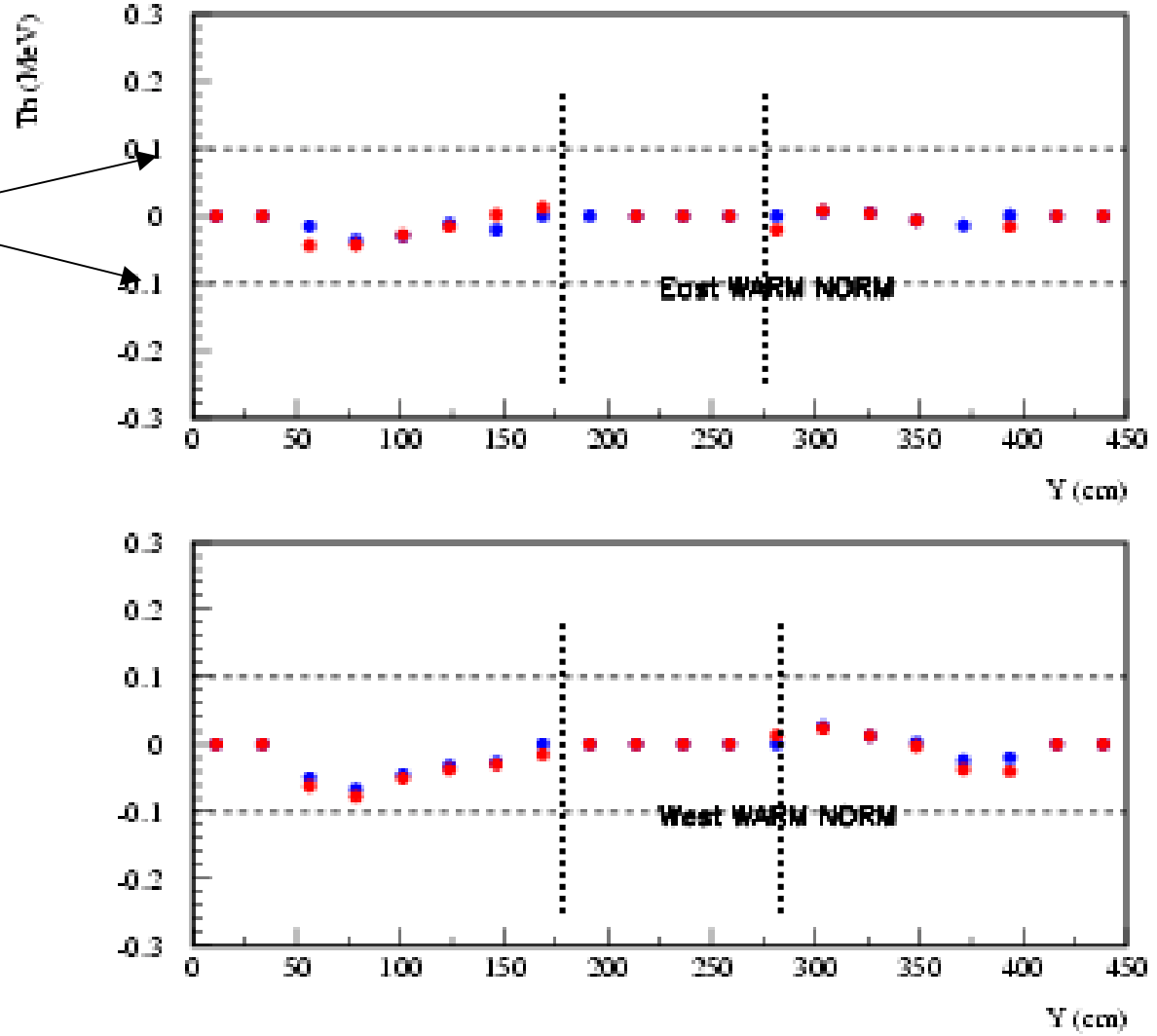


2002-end

2002-ini

Data/MC relative spread: photons on WARM sectors

10% band

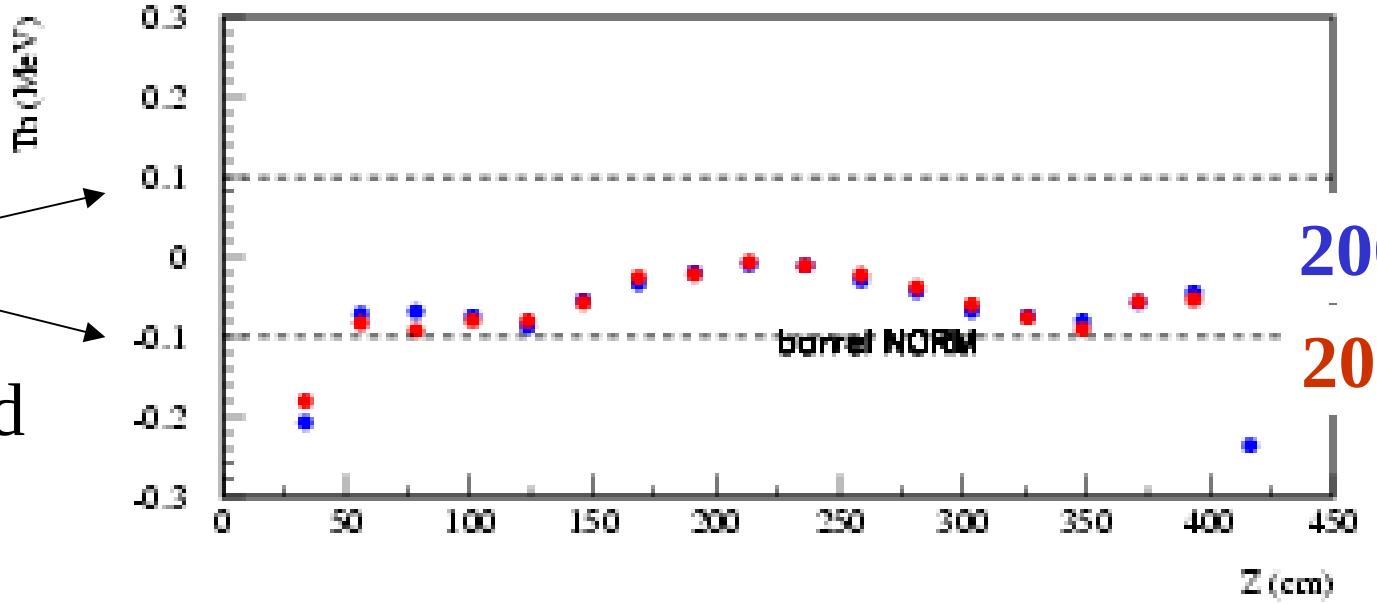


2002-end

2002-ini

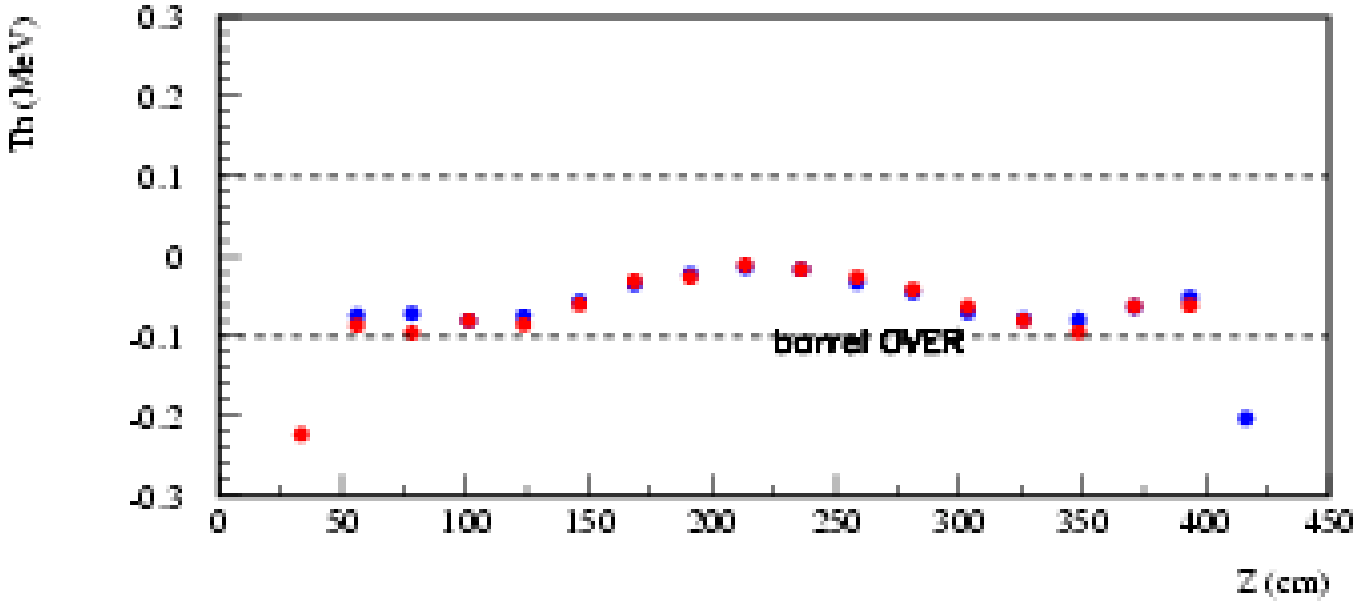
Data/MC relative spread: pions on barrel

10% band



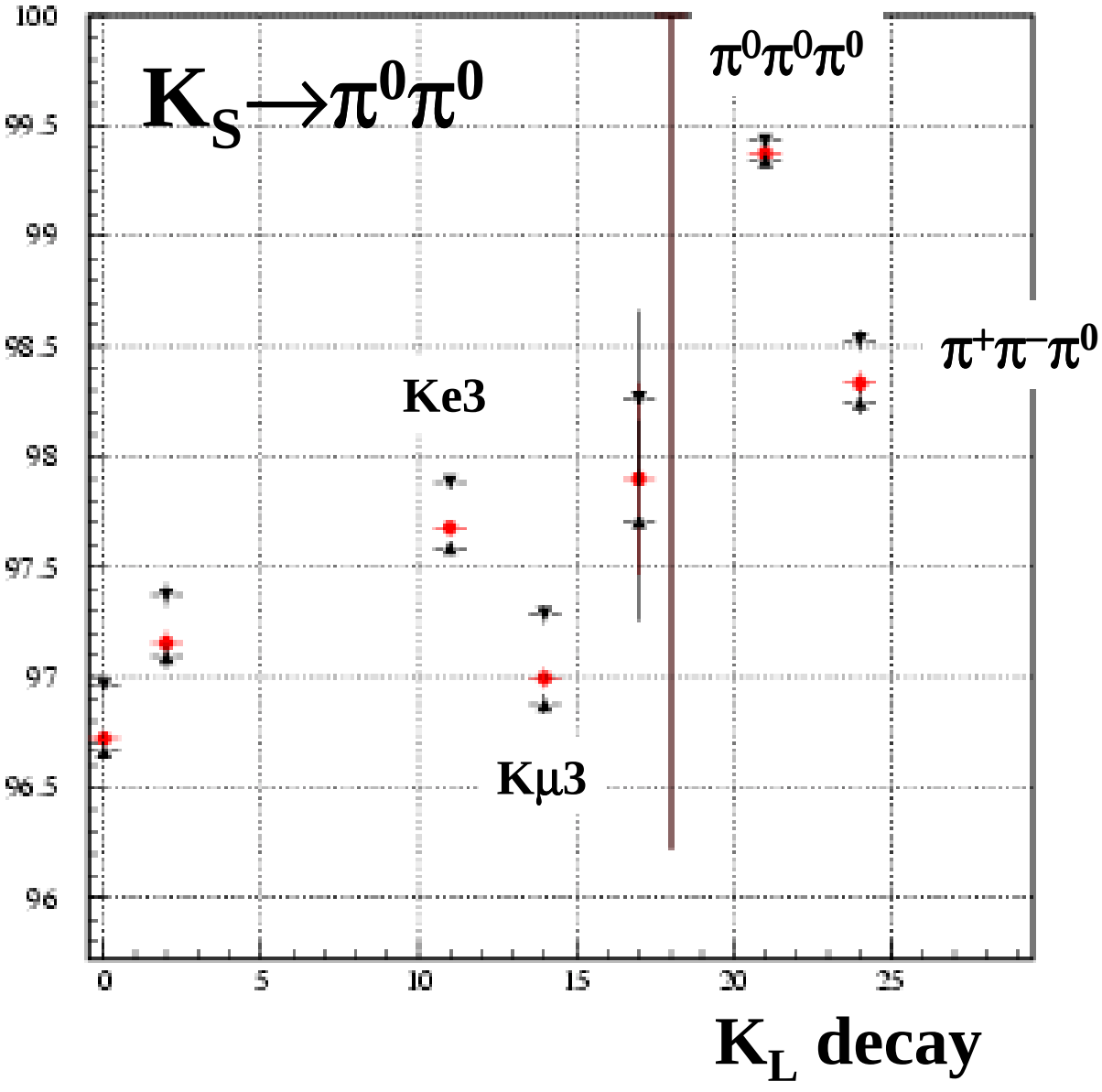
2002-end

2002-ini



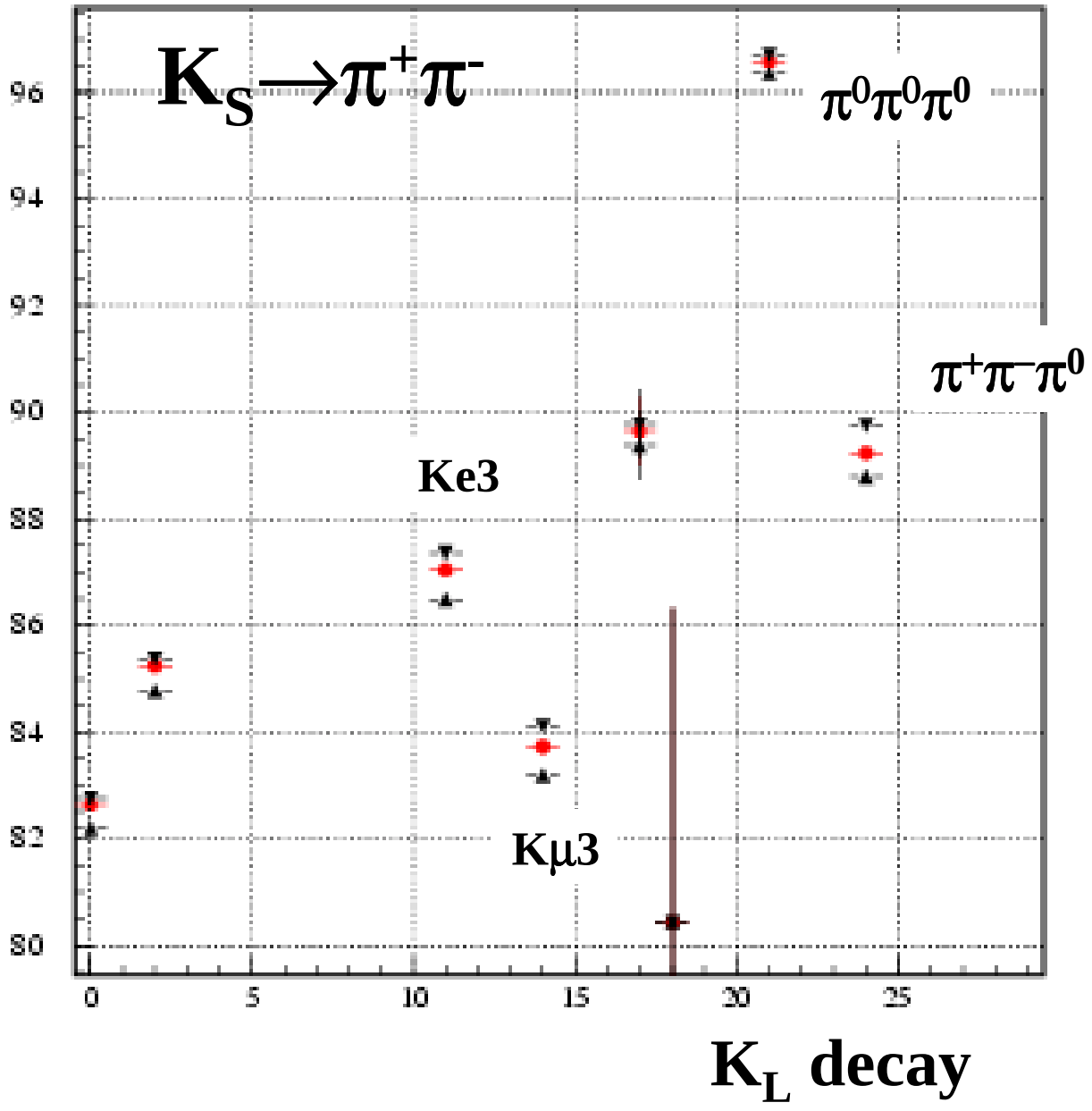
MC efficiency spread for a +/- 5% overall threshold drift

$\delta \approx 0.5\%$



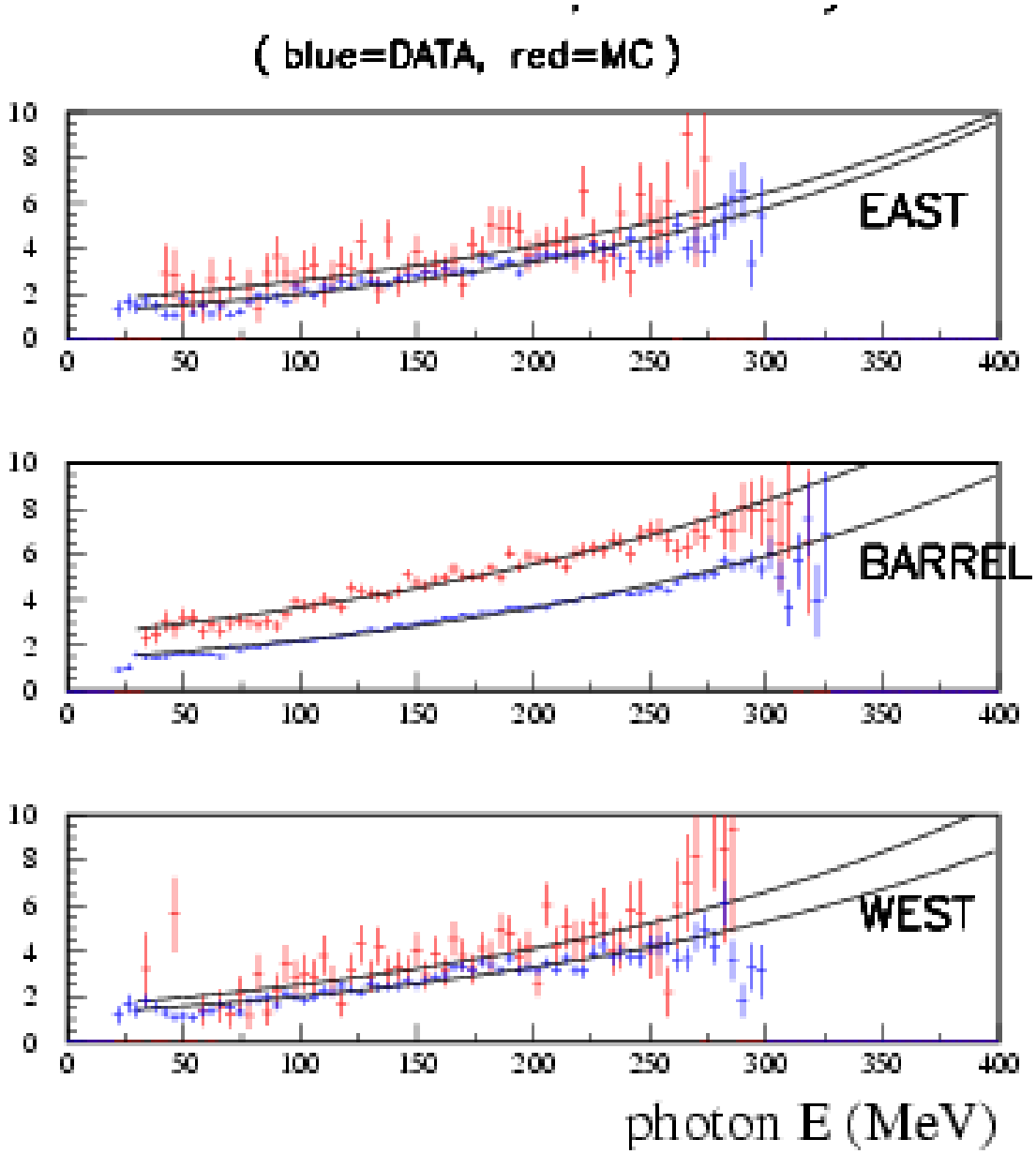
MC efficiency spread for a +/- 5% overall threshold drift

$\delta \approx 1\%$



Photon probability to fire the fifth plane

A better tuning is needed if the T3 filter has to be simulated...



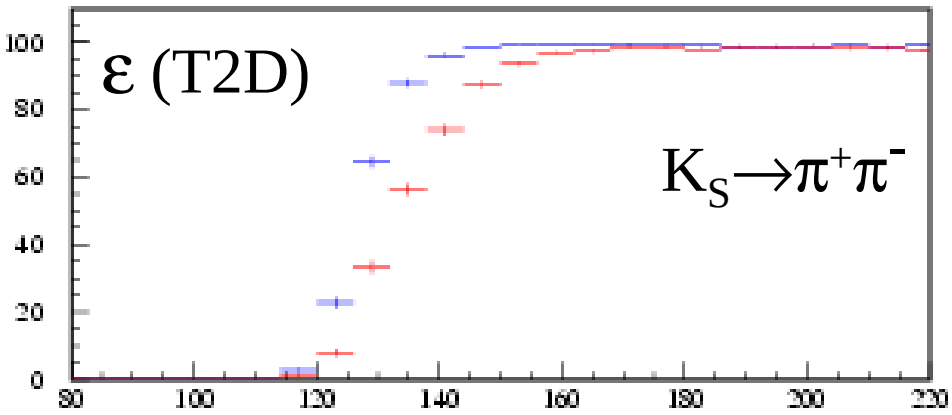
DC trigger: T2D effective threshold

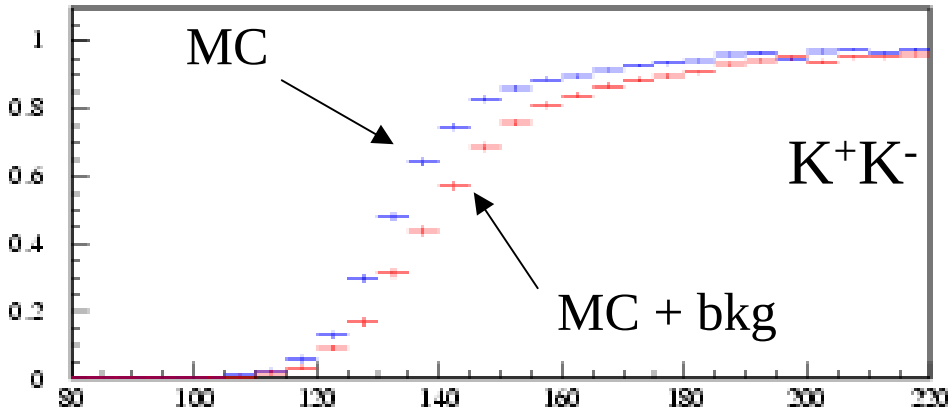
- No hardware monitor on the superlayer response (MC tuning can be performed only on the global trigger decision)
- T2D decision is processed after 1.3μs of integration (**also in the simulation**)
- The ADC counts from the hardware monitor of the CAFFE board are not easily translated into a number of hits

→ the T2D response is correlated with the total number of reconstructed hits

→ it is important to take into account the charged BKG

($\gamma\gamma$ events + insert module)

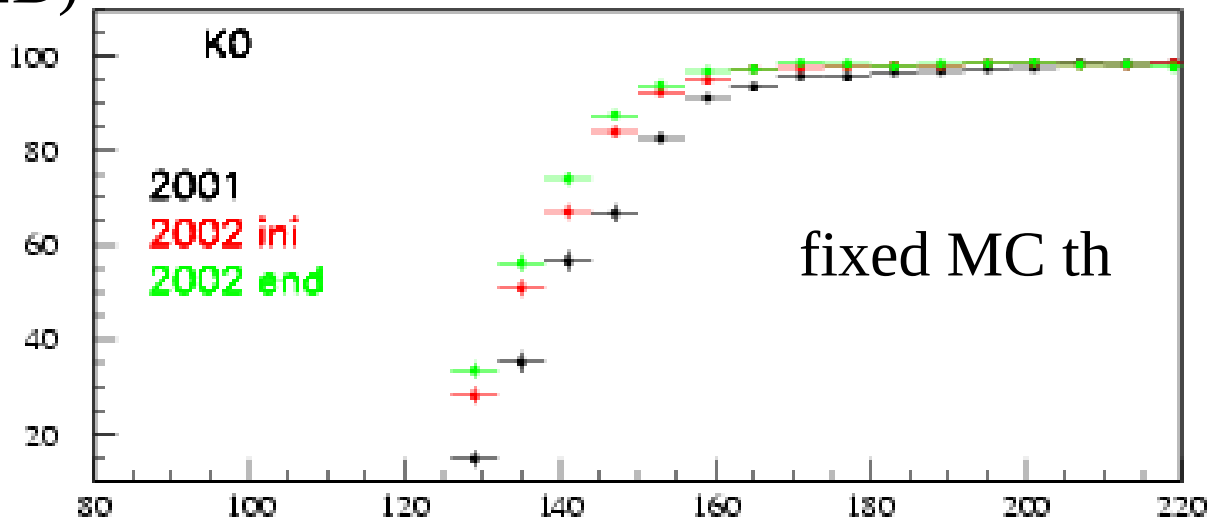




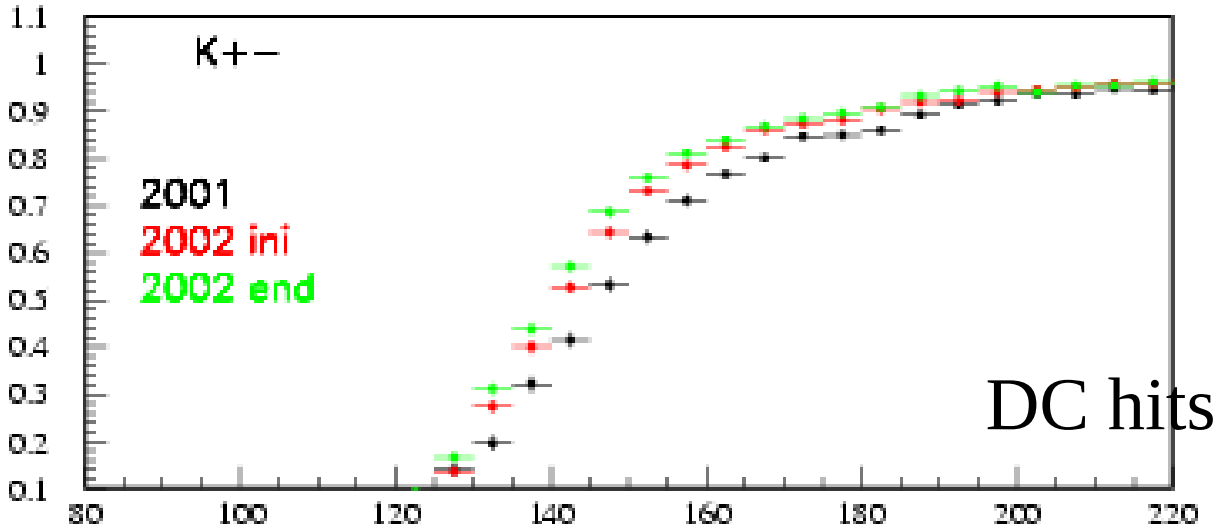
DC hits

MC + different bkg samples

ε (T2D)



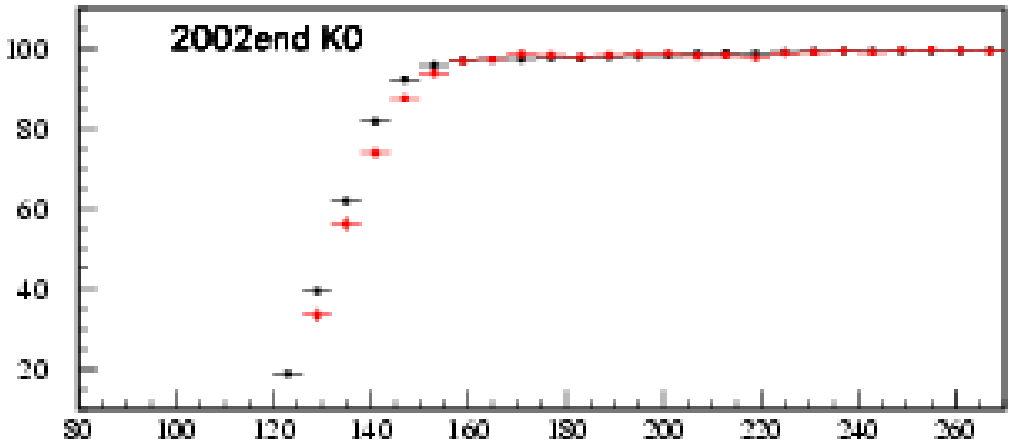
For each period ~1 pb-1 of γγ events has been filtered to get the charged BKG sample.

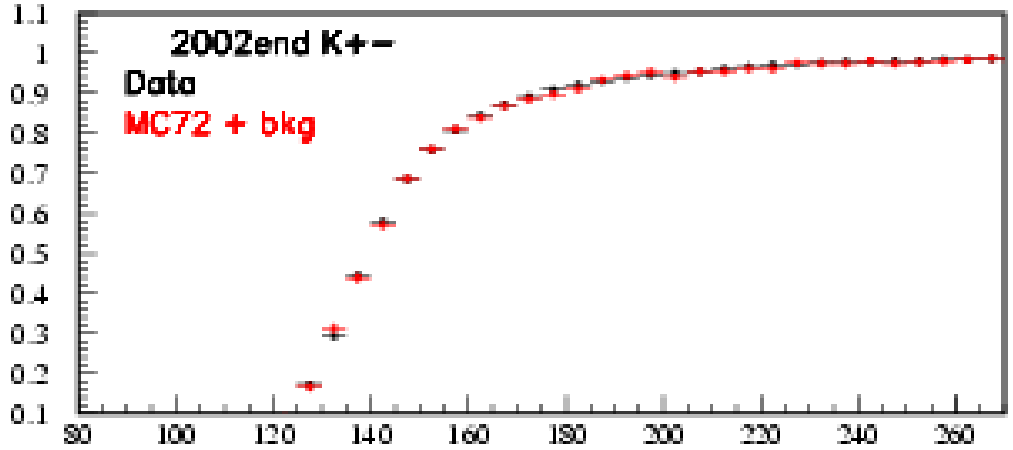


data/MC comparison: 2002-end sample

A single T2D threshold value (72 hits within 1.3 μs) fits approximately both the neutral and charged kaon efficiency profiles

ε (T2D)



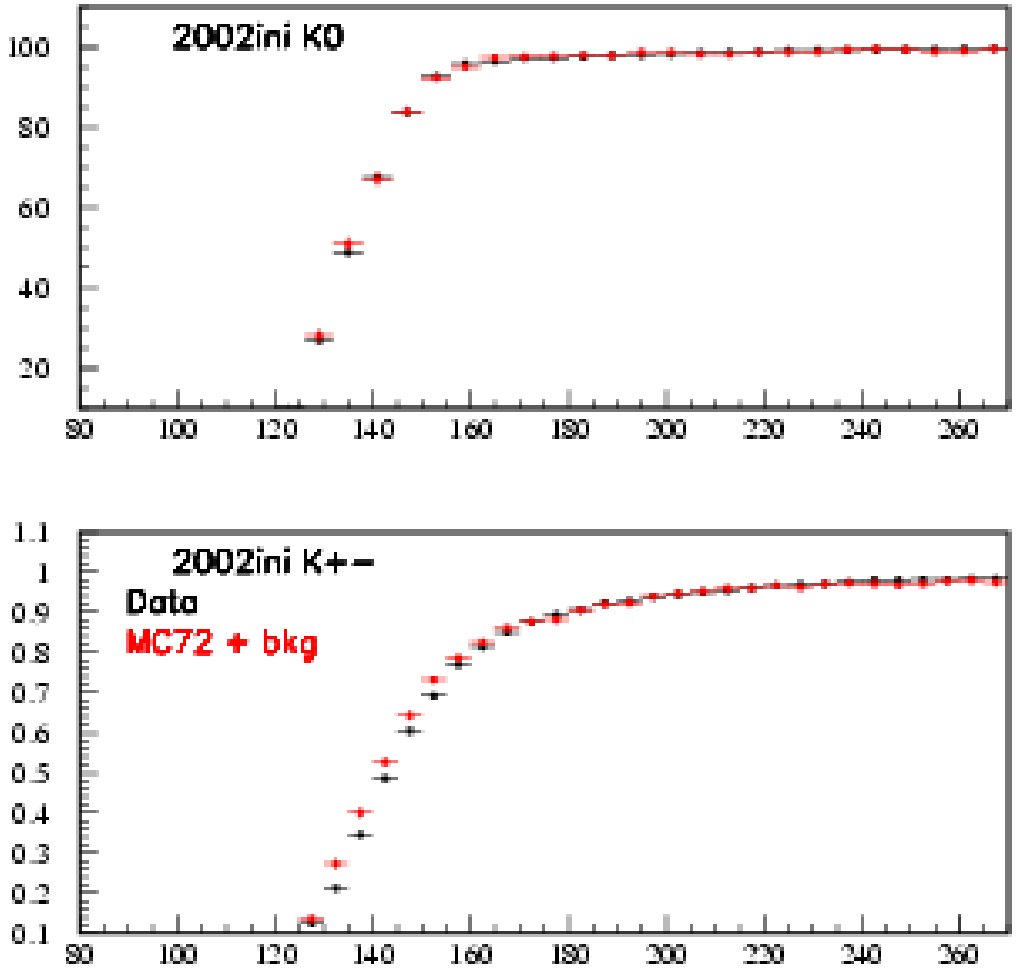


DC hits

data/MC comparison: 2002-ini sample

ε (T2D)

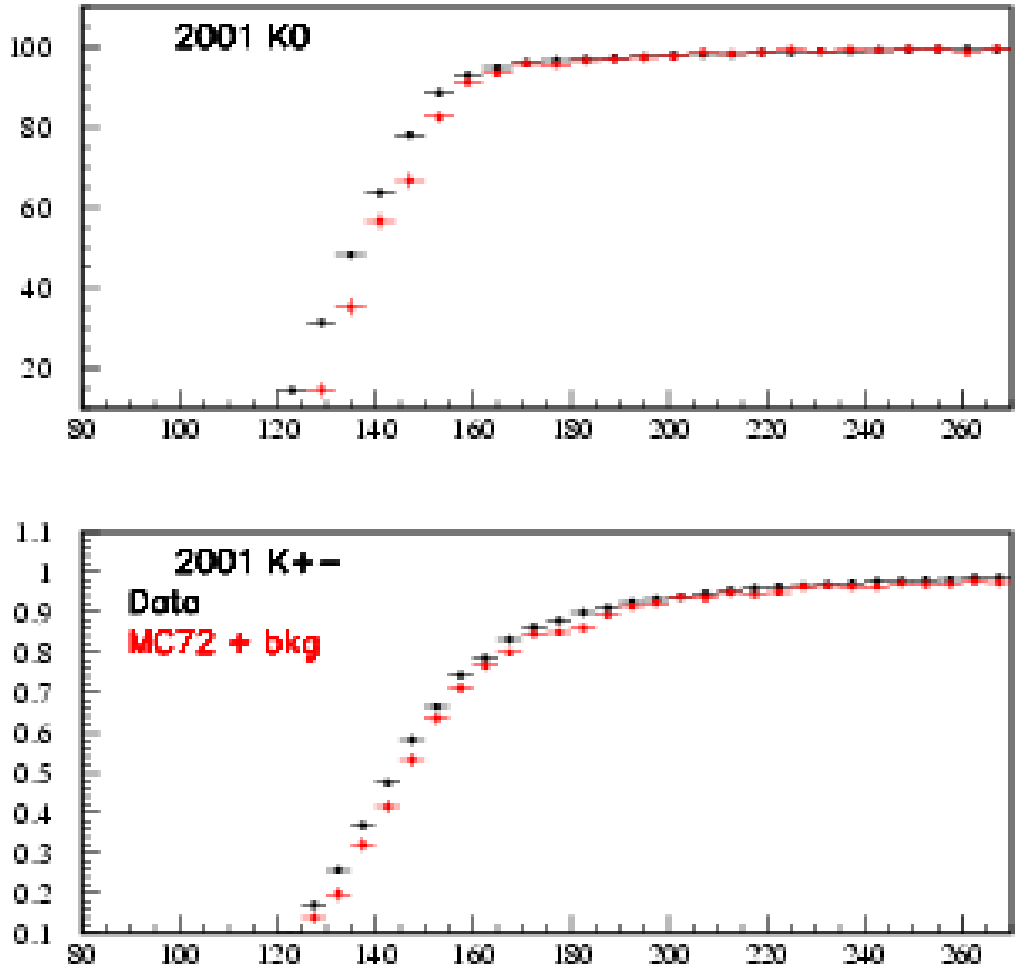
The same T2D threshold is applied to the different samples (as in the real hardware maps)



DC hits

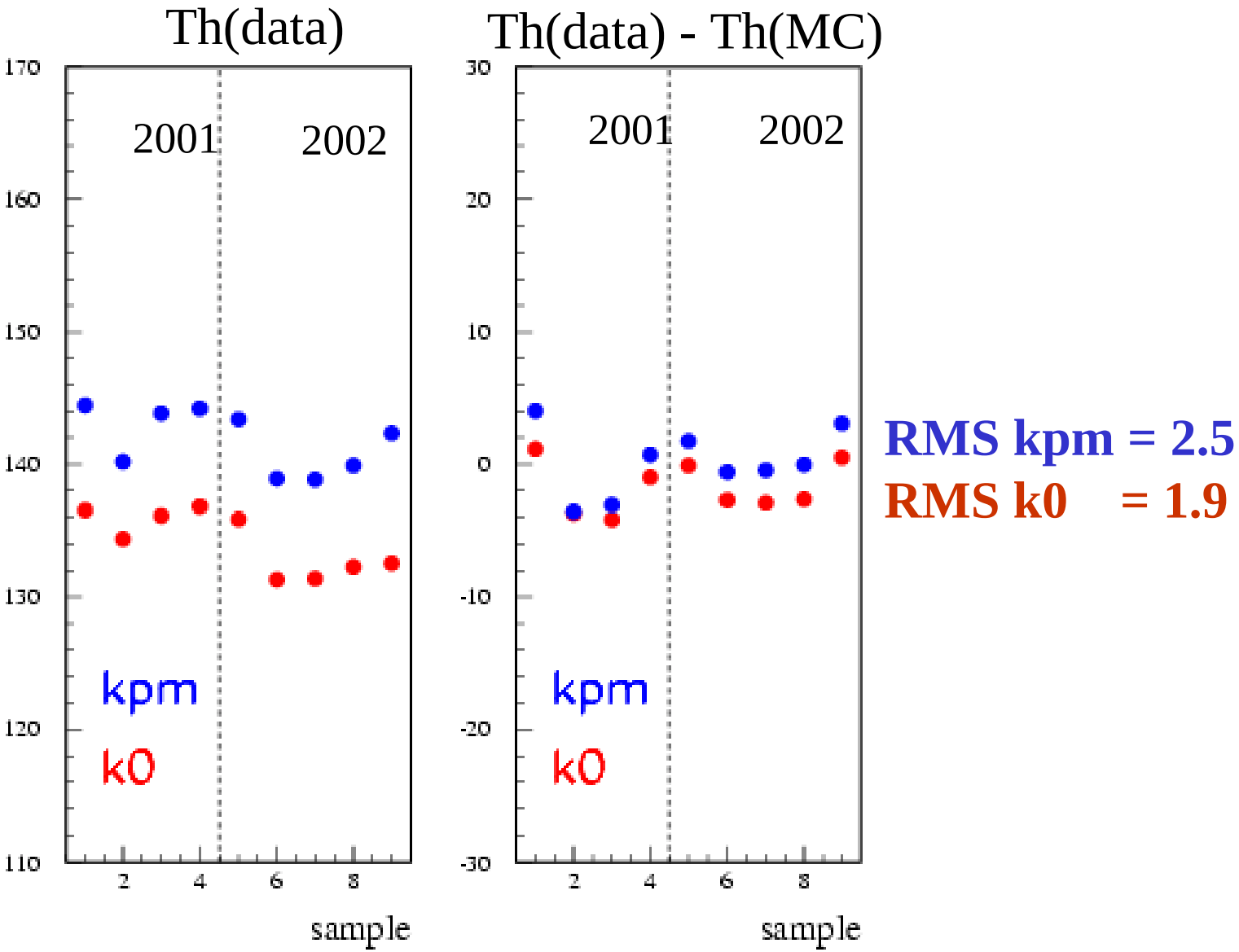
data/MC comparison: 2001 sample

ε (T2D)

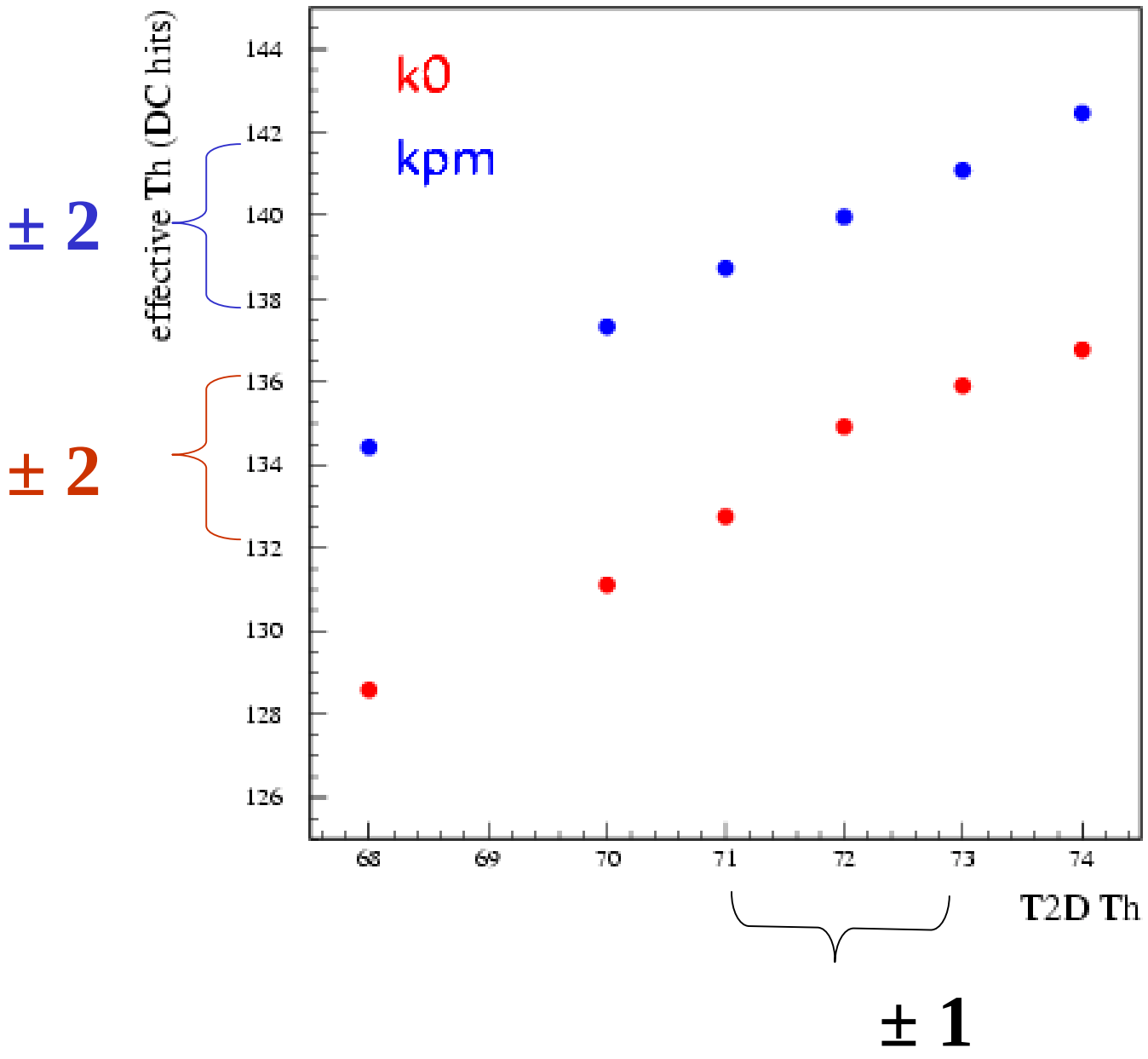


DC hits

hardware/bkg/calibration stability



Effective Threshold *vs* T2D Threshold (MC)



MC efficiency spread for ± 1 hit threshold shift

	Th	Δ
K^+K^-	75.0%	2.4%
K_SK_L	60.6%	1.3%
$K_S \to \pi^+\pi^-$ $K_L \to \pi e \nu$	87.9%	0.7%
$K_L \to \pi \mu \nu$	87.7%	0.7%
$K_L \to \pi^+ \pi^- \pi^0$	87.0%	0.7%
$\pi^-\pi^+\pi^0$	62.5%	3.2%