HLT ECal alley – recent developments

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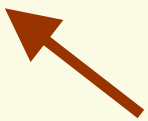
Introduction

- Two lines: e-line and γ-line. Focus on γ-line today.
  - $B_s \to \varphi\gamma$, $B \to K^*\gamma$ – offline selection by Lesya
  - Two ingredients of confirmation:
    - L0 photon
    - L0 hadron ($\varphi \to KK$, $K^* \to K\pi$)
- Old L1 ~ first implementation in HLT
  - photon E_T>2.95 GeV + track 0.15 mm < IP <3 mm & PT>1.2 GeV
- γ-line starts for L0Photon=1
  - Signal eff = 56% @ mbias rate = 8 kHz



Starting point for improvements

L0 photon – π^0 merged removal

- Check quality of L0 photon – remove π^0 to reduce mbias rate
  - Inpired by method by Sergey Barsuk – „γ/π^0 *separation at high* E_T"
    - http://indico.cern.ch/getFile.py/access?contribId=s1t10&resId=1&materialId=0&confId=a031013

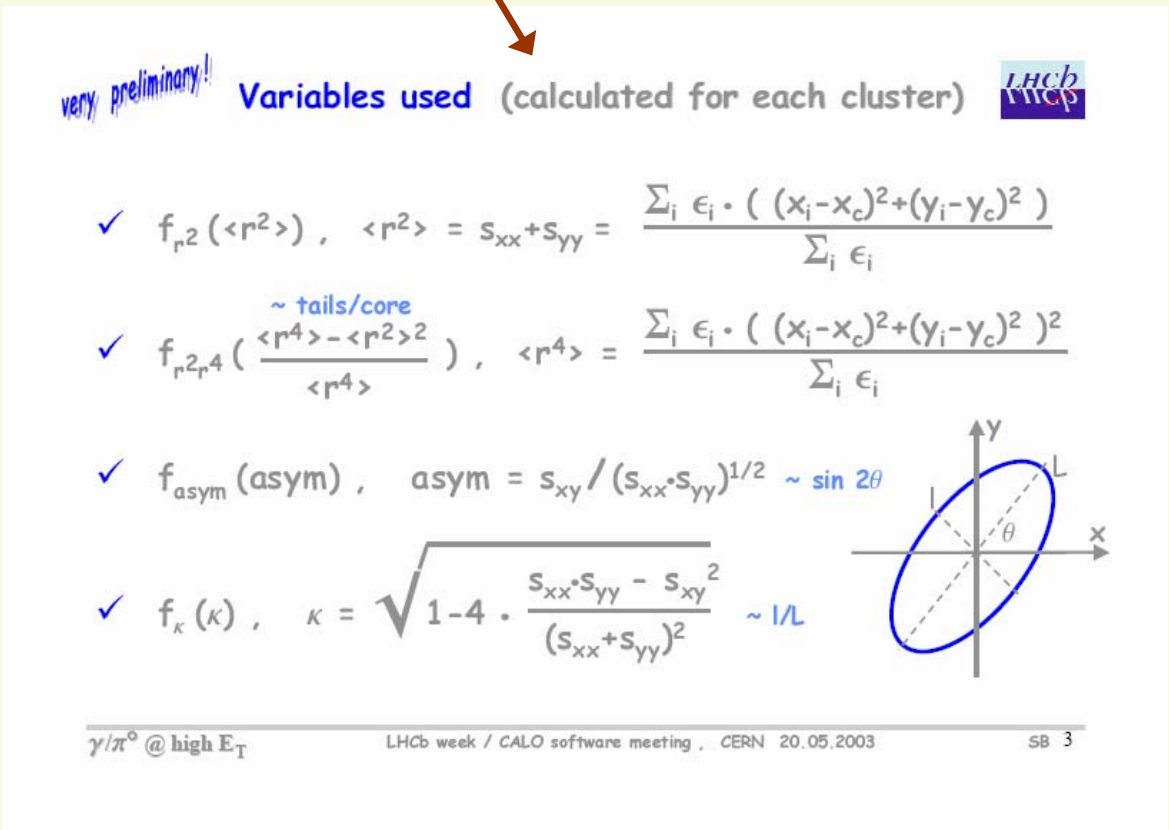
Variables for π^0/γ discrimination

Shower Shape

Tails/Core

Asymmetry

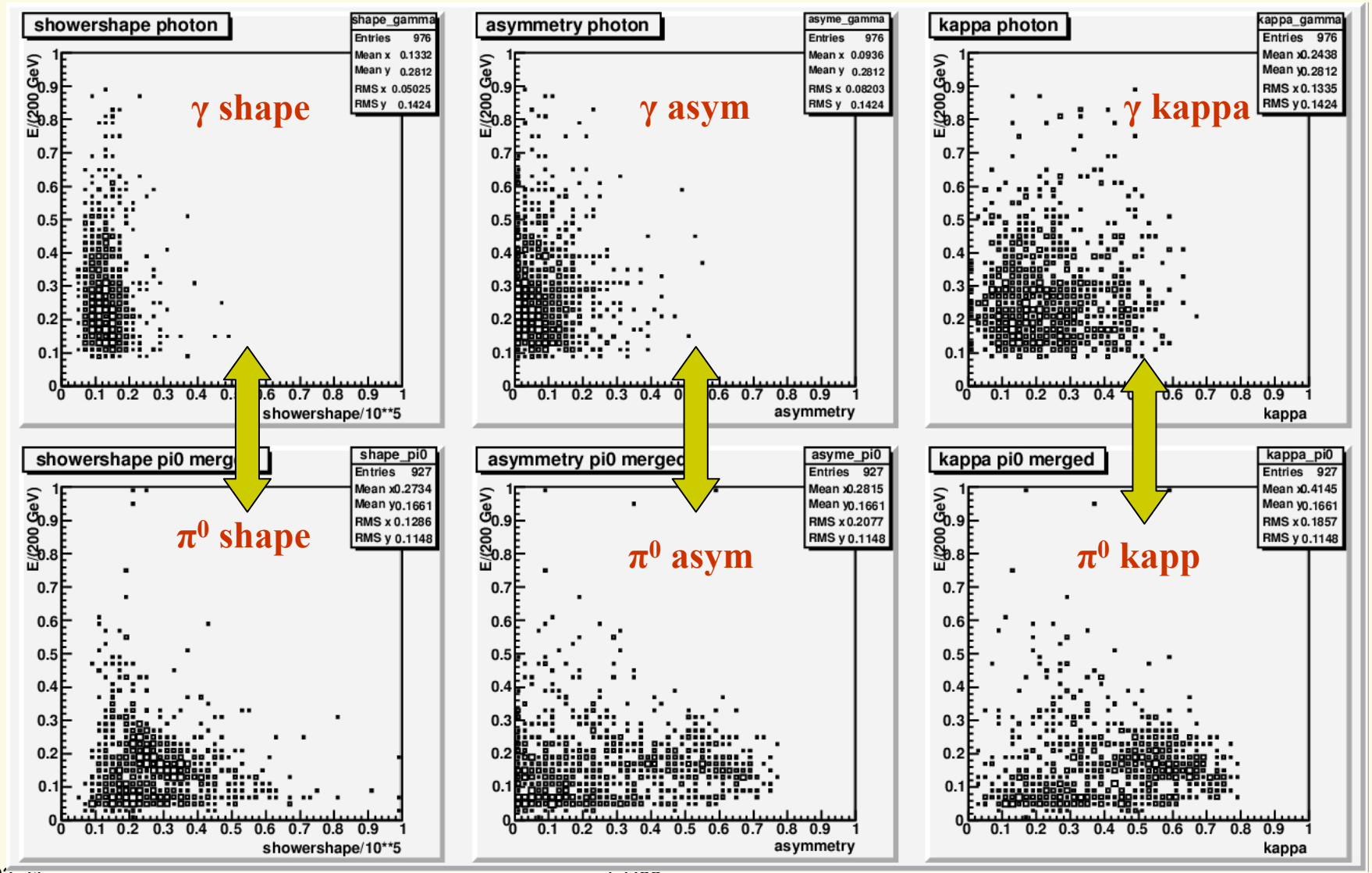
Kappa



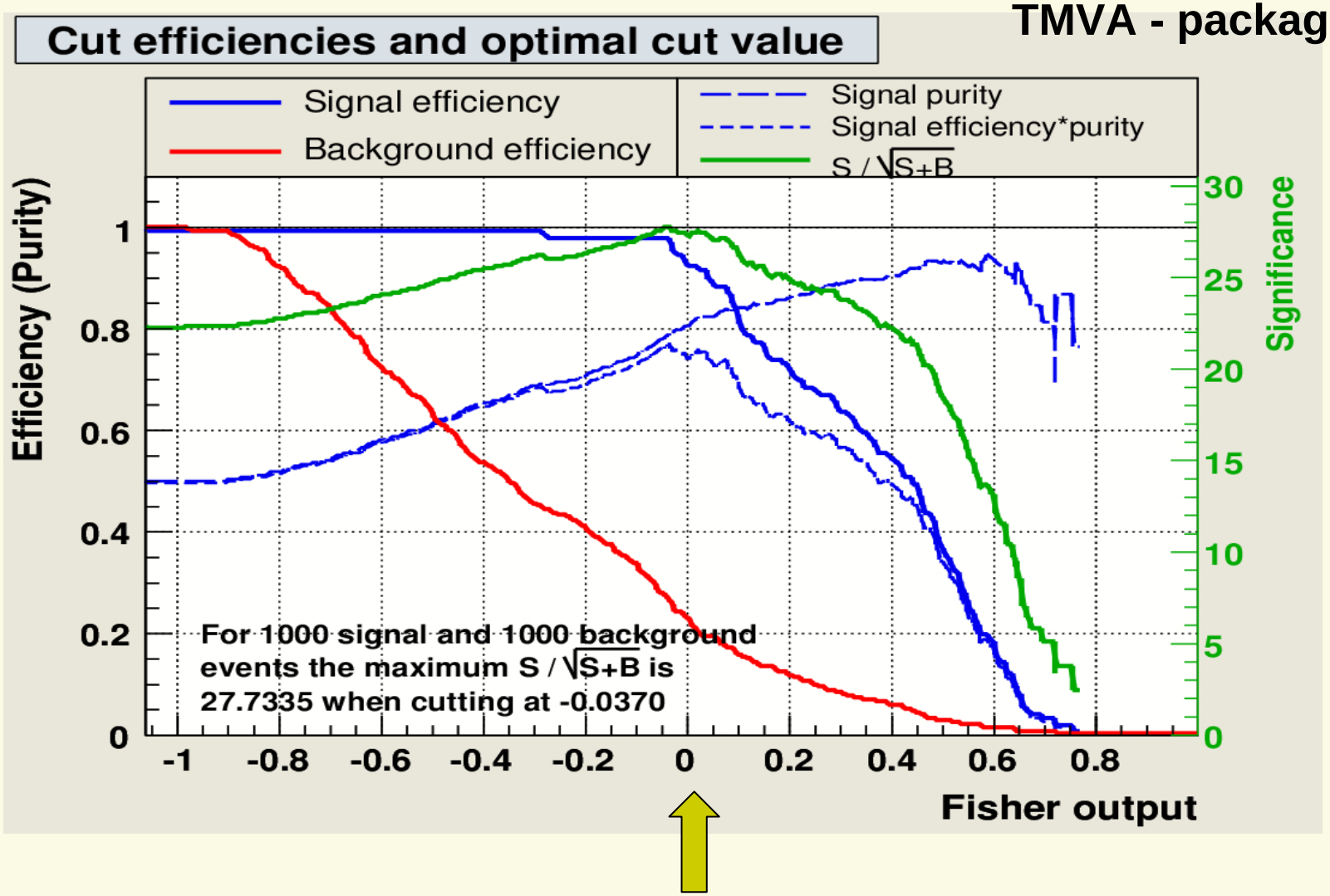
L0 photon – π^0 merged removal

- ECal reconstruction needed to calculate shower shape variables.
  - At this stage of HLT is has to be a fast version of full Calo reconstruction.
    - Cut on minimum E_T of Calo clusters
- Treat 3 ECal regions separately (different cell size)
  - γ from signal,
  - π^0 merged from mbias events (two photons form one cluster)

L0 photon – shower shape variables



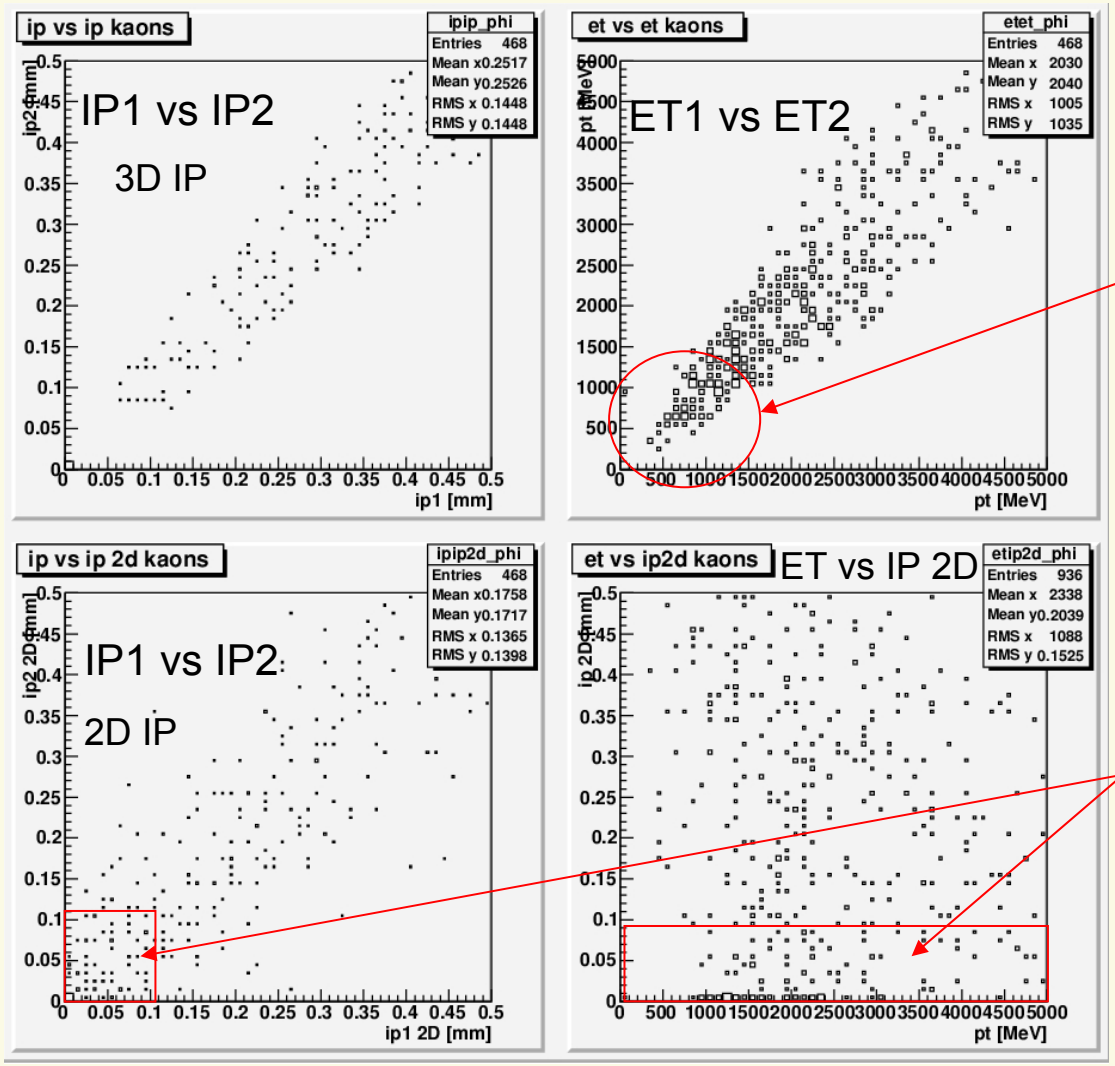
L0 photon – π^0/γ discrimination



L0 photon – π^0/γ discrimination

- π^0 merged removal
  - 90 % signal - 25% mbias efficiency at the cluster level.
- But only 85 % of L0 photons that trigger are due to π^0 in mbias and only 35% are π^0 merged.
- At the level of events it gives
  - Signal eff = 90 % and 50 % reduction of mbias

L0 hadron part - φ→KK

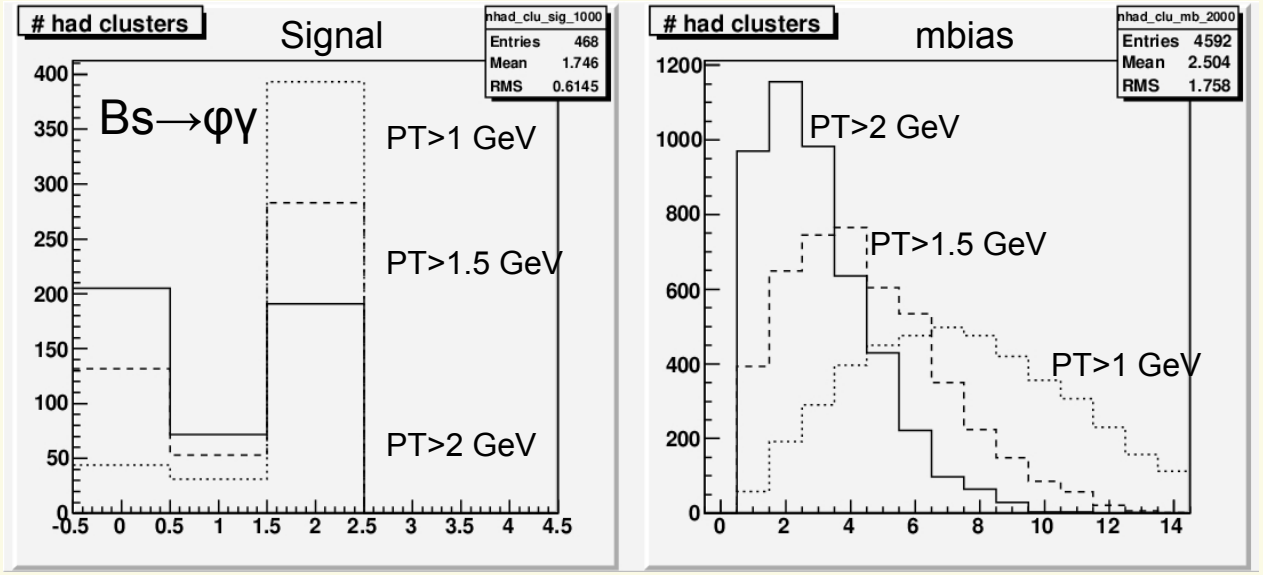


Correlation in PT distributions of kaons
Large fraction – both PT<1500 MeV

Loss in 2D => 3D HLT phase of VELO track reconstruction
Main cause of efficiency loss for L1 style (eff = 56 %)

Confirmation

- Problem with confirmation for $\varphi \rightarrow KK$ from $B_s \rightarrow \varphi\gamma$
  - Need to lower PT min of L0Hadron cluster to be confirmed in T.



For PT> 1 GeV number of L0 hadron clusters seems to be too large.
Alternative is to use modified version of L1 trigger.

- 2 tracks 0.15 mm < IP <3 mm & PT>0.6 GeV (using standard HLT VELO reconstruction – IP_{2D}>0.1 mm)
- photon ET>2.5 GeV + π^0/γ discrimination

=> Signal eff = 75 % at mbias rate ~ 8 kHz

Summary

- Useful discrimination of π^0/γ based on shower shape variables
  - Needs fast Calo reconstruction
- Confirmation of L0 hadron ($\varphi \rightarrow KK$ from $B_s \rightarrow \varphi\gamma$) results in low PT threshold (too many L0 hadron clusters to consider)
- Try different scenarios, check timing, choose optimal solution.