very preliminary!

LHCb *week* *CALO software meeting*
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Sergey Barsuk
CERN/ITEP, Moscow

γ/π^0 SEPARATION AT HIGH E_T

- Motivation
- Method description and results
- Application to $B \to V\gamma$
- Summary

very preliminary !

Motivation

- ✓ π^0s dominate the remaining background in $B \to V\gamma$ analyses
- ✓ => Make use of shower shape difference

Energies treated

$E > 9$ GeV ; $E_T > 2$ GeV

Software used

- ✓ Vanya v*
- ✓ CaloEx v5r0
- ✓ Brunel v17r1
- ✓ Raw data, database v253r0
- ✓ Selection of merged π^0 by Vanya

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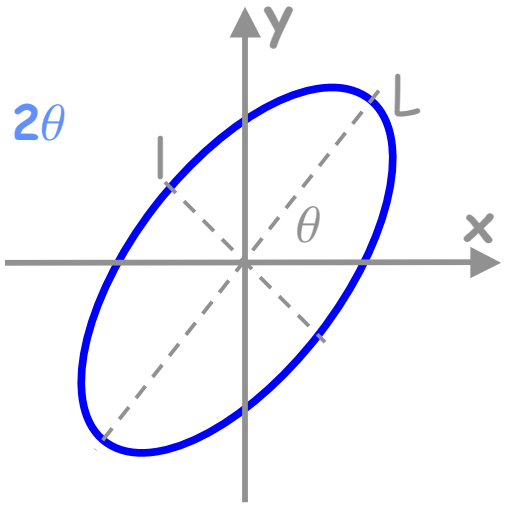
Variables used (calculated for each cluster)

- ✓ $f_{r2}(\langle r^2\rangle)$, $\langle r^2\rangle = s_{xx}+s_{yy} = \dfrac{\sum_i \epsilon_i \cdot ((x_i-x_c)^2+(y_i-y_c)^2)}{\sum_i \epsilon_i}$
- ✓ $f_{r2r4}\left(\dfrac{\langle r^4\rangle-\langle r^2\rangle^2}{\langle r^4\rangle}\right)$, $\langle r^4\rangle = \dfrac{\sum_i \epsilon_i \cdot ((x_i-x_c)^2+(y_i-y_c)^2)^2}{\sum_i \epsilon_i}$ ~ tails/core
- ✓ $f_{asym}(asym)$, $asym = s_{xy}/(s_{xx}\cdot s_{yy})^{1/2}$ ~ sin 2θ
- ✓ $f_{\kappa}(\kappa)$, $\kappa = \sqrt{1-4\cdot\dfrac{s_{xx}\cdot s_{yy}-s_{xy}^2}{(s_{xx}+s_{yy})^2}}$ ~ l/L



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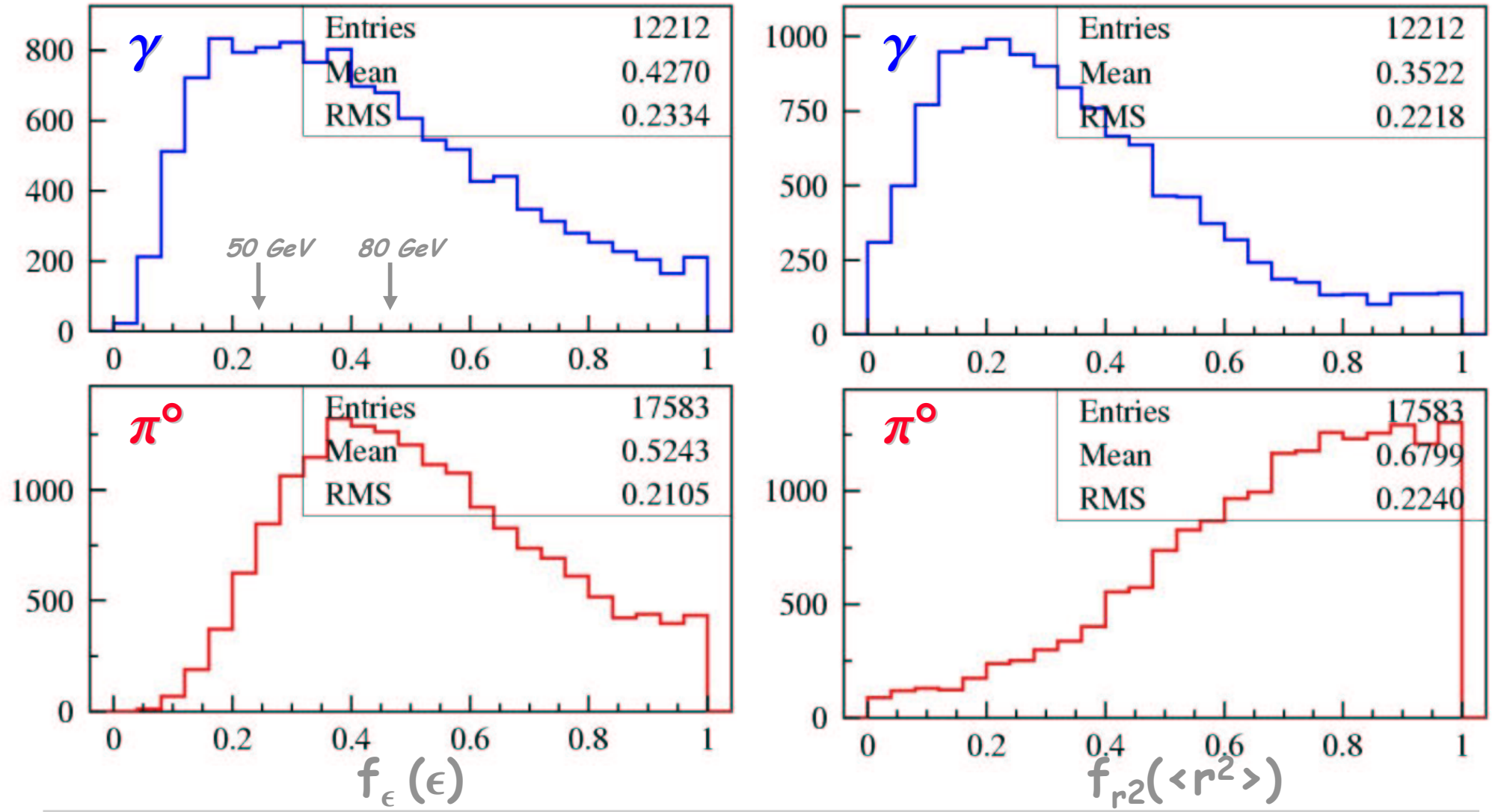
(<r²>, ϵ) – plane, inner section



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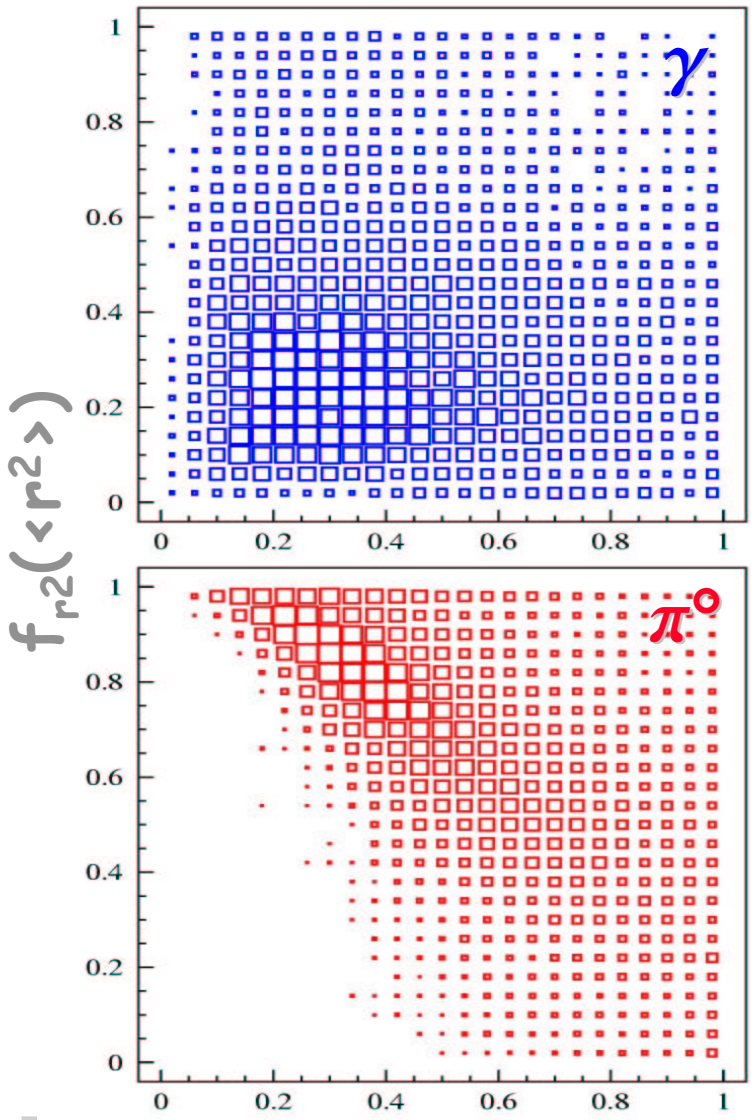
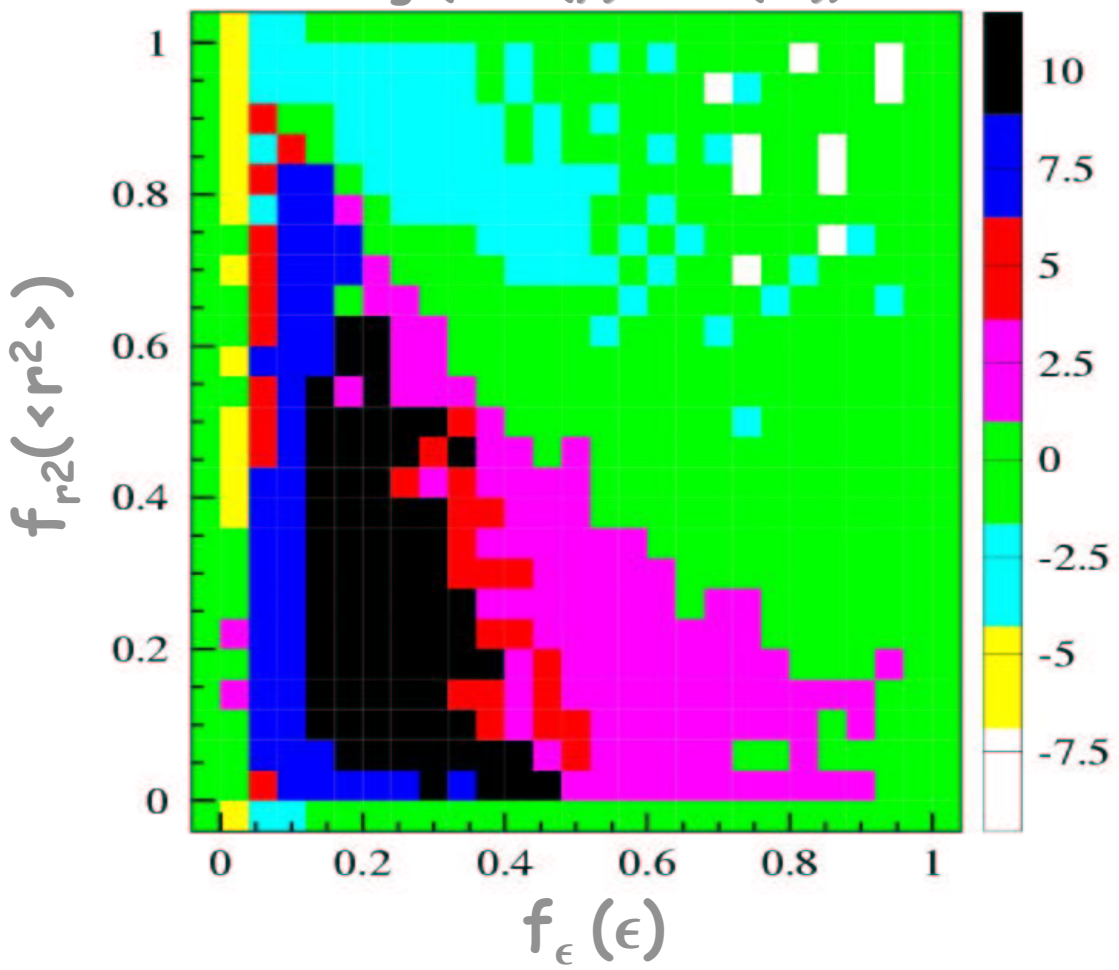
$f_\epsilon(\epsilon)$ $(\langle r^2 \rangle, \epsilon)$ – plane, inner section



γ/π° separation

log (Prob(γ)/Prob(π°))



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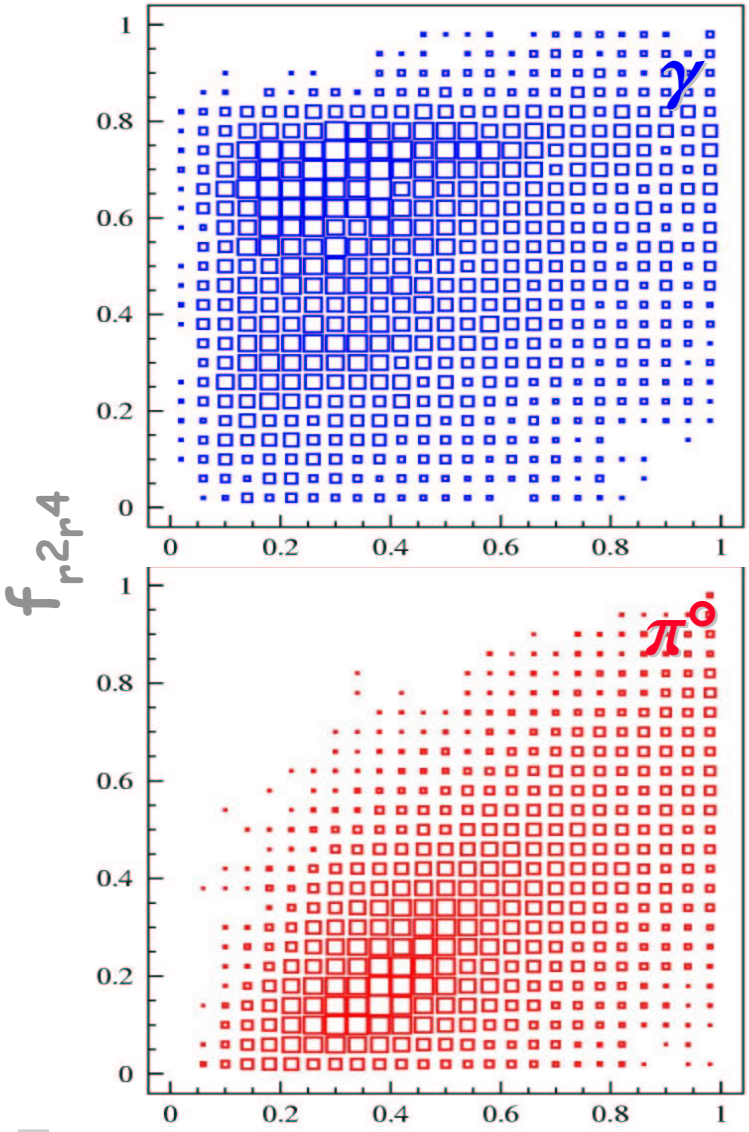
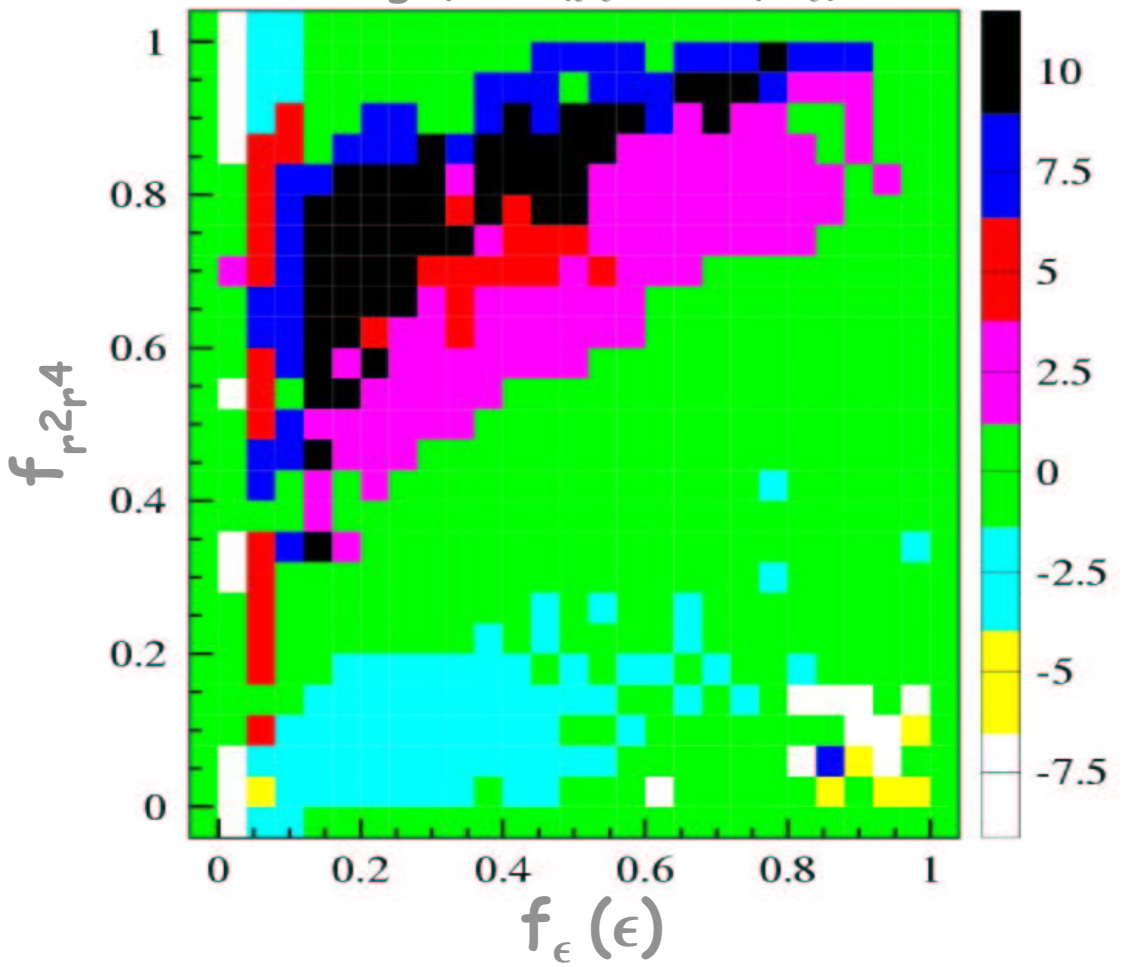
$f_\epsilon(\epsilon)$ $\left(\frac{\langle r^4\rangle - \langle r^2\rangle^2}{\langle r^4\rangle}, \epsilon\right)$ - plane

γ/π^0 separation

log (Prob(γ)/Prob(π^0))





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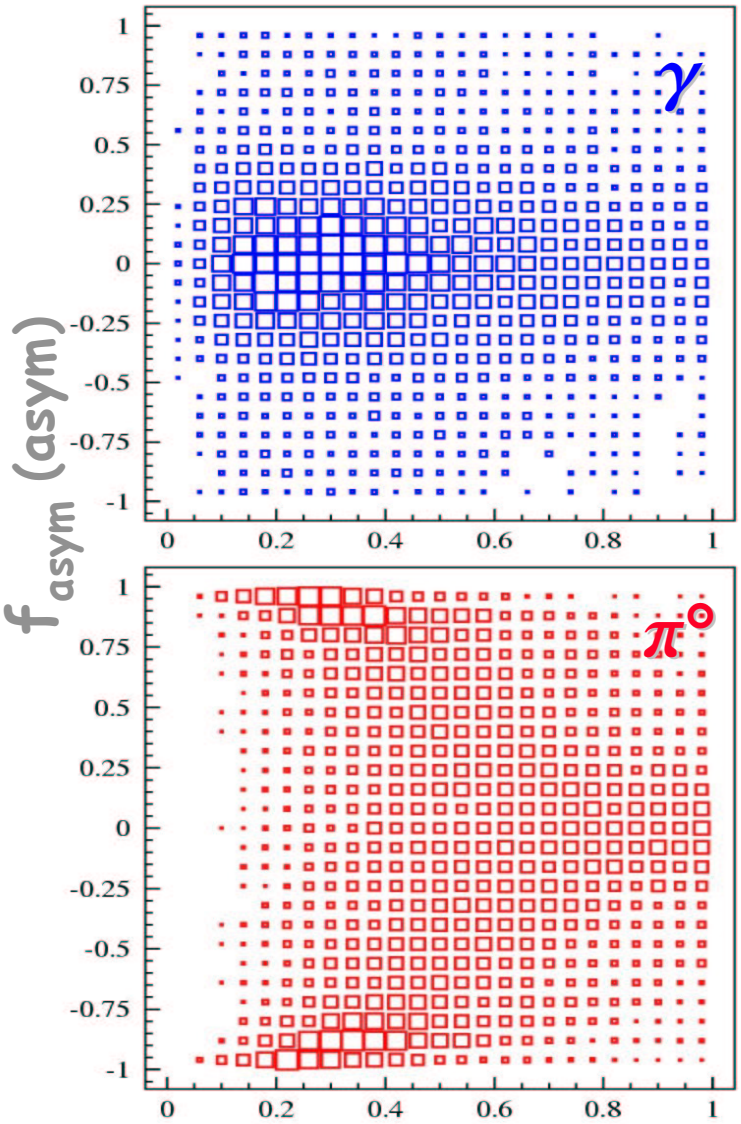
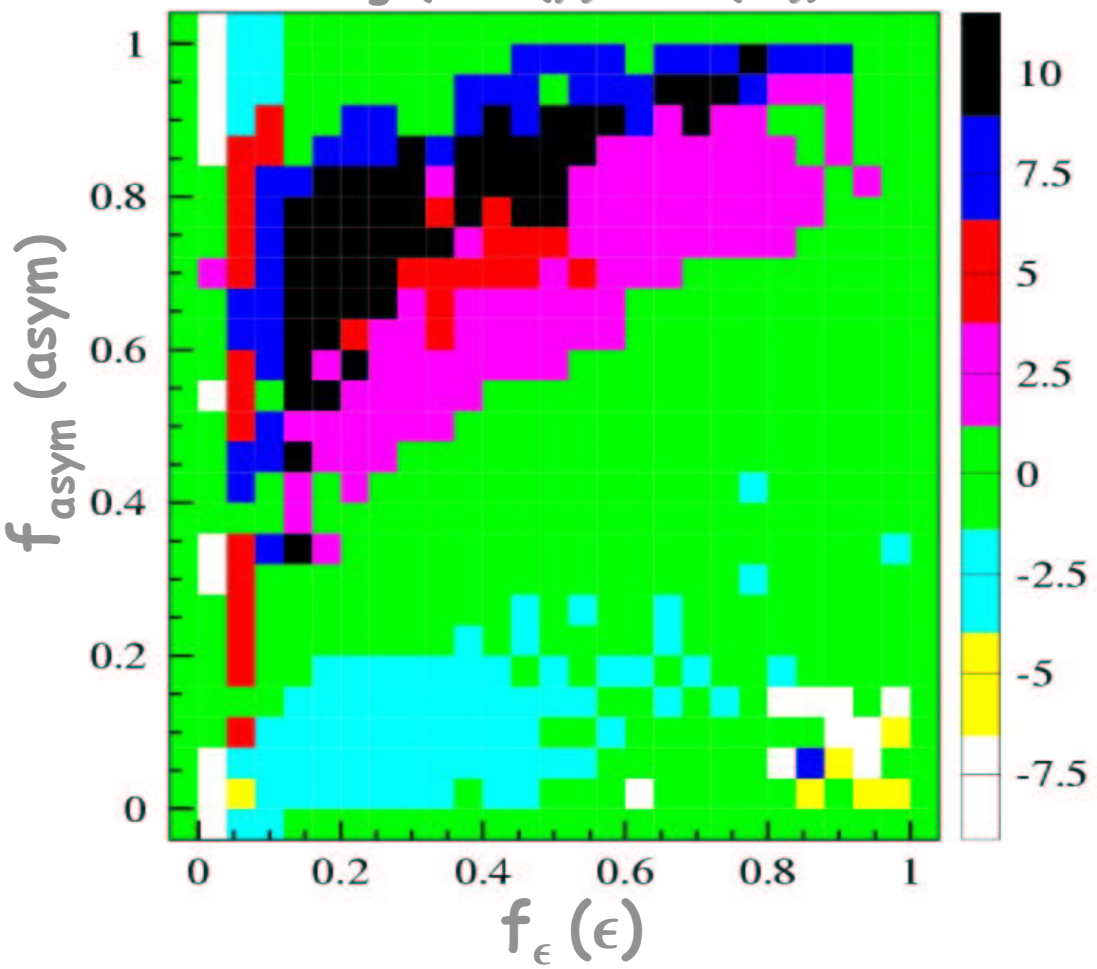
$f_\epsilon(\epsilon)$ (asym, ϵ) – plane, inner section



γ/π° separation

log (Prob(γ)/Prob(π°))



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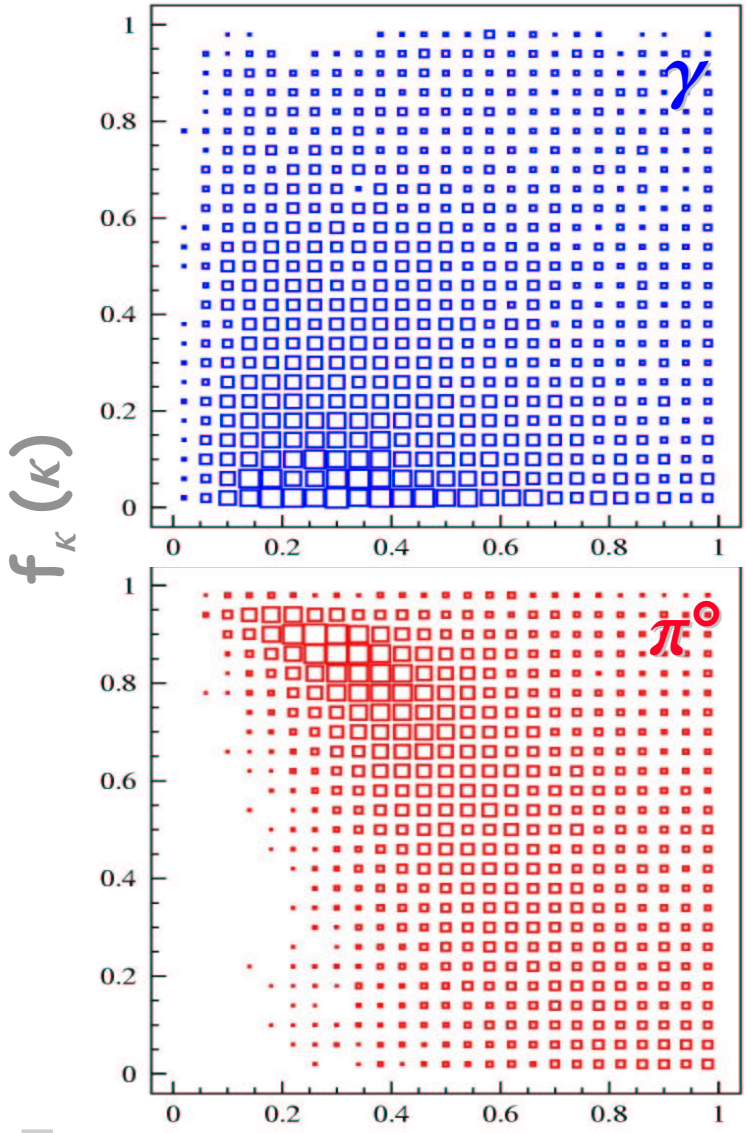
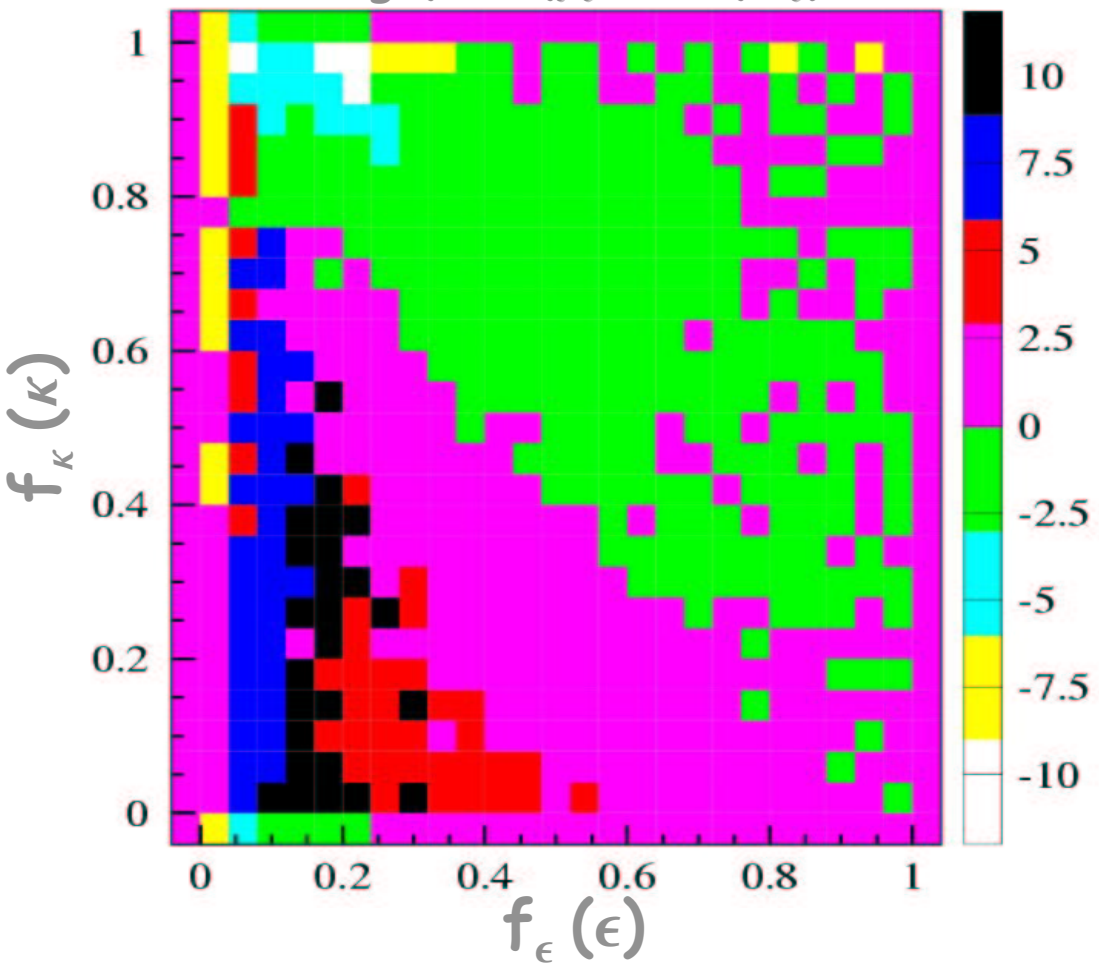
$f_\epsilon(\epsilon)(\kappa, \epsilon)$ – plane, inner section



γ/π° separation

log (Prob(γ)/Prob(π°))



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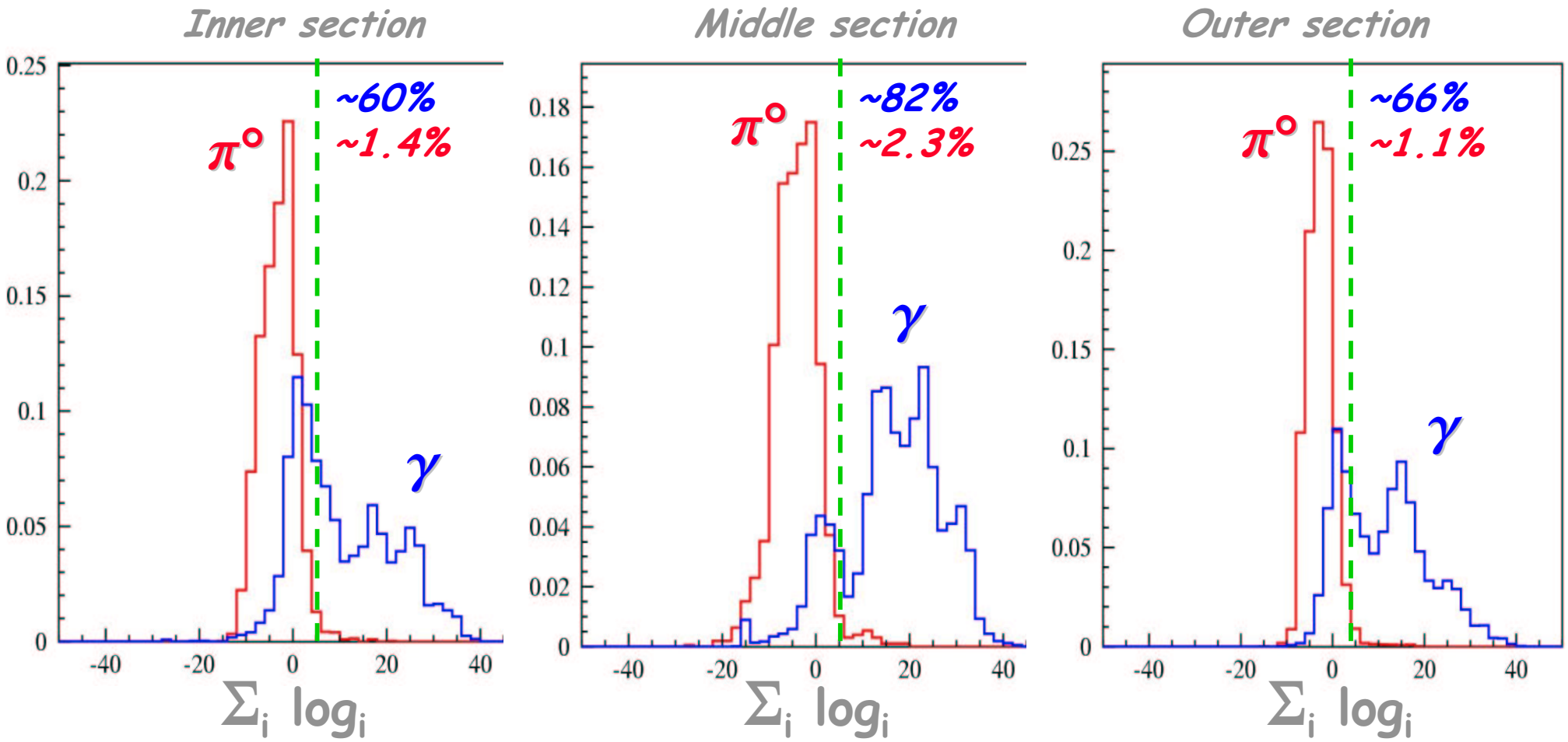
Combined γ/π^0 separation, as applied to γ's from B->K*γ, and π^0's from B->K*π^0



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SUMMARY

- The γ/π^0 separation for high ET clusters could be very helpful
- The γ/π^0 separation by analyzing cluster shape looks promising
- Δ_{LL} variable was constructed and applied to B->Vγ
- All the shapes will perhaps improve by using the new software, the results could be affected significantly