Two photon reconstruction with ECAL and low mass background

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Input

$2*10^4$ central UrQMD events AuAu@25AGeV (Local analysis)

Full ECAL reconstruction (version of February 2009) with

CBM root January 2009 version

(version with new geometry)

Cuts:

Minimal energy deposited in ECAL 500 MeV.

$\chi 2$ (of photon reconstruction) < 3.

Minimal distance between cluster (DBC) > 20 cm.

Particles from target = V_z < 1cm (conventional)

WA 98 experiment

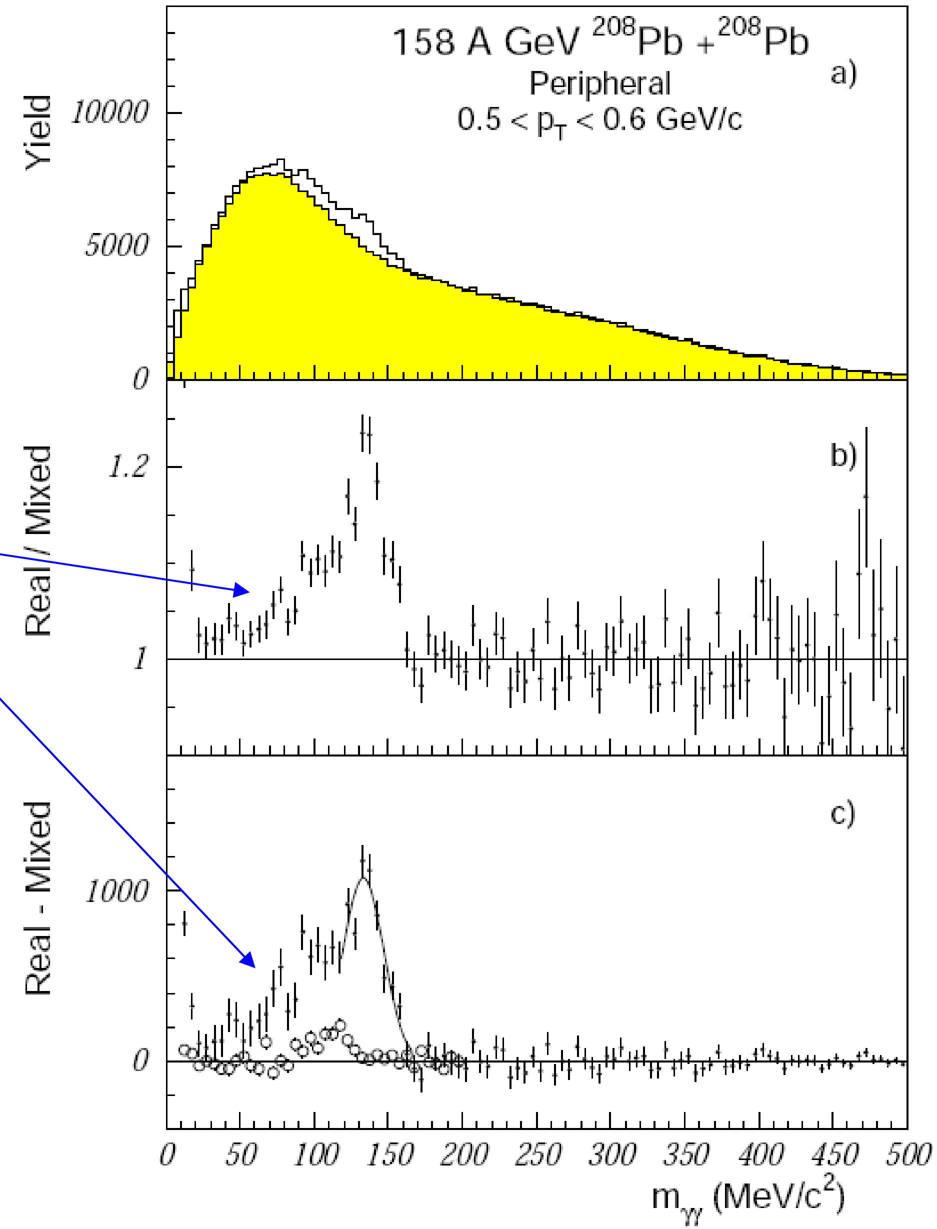
[arXiv:nucl-ex/0006007]

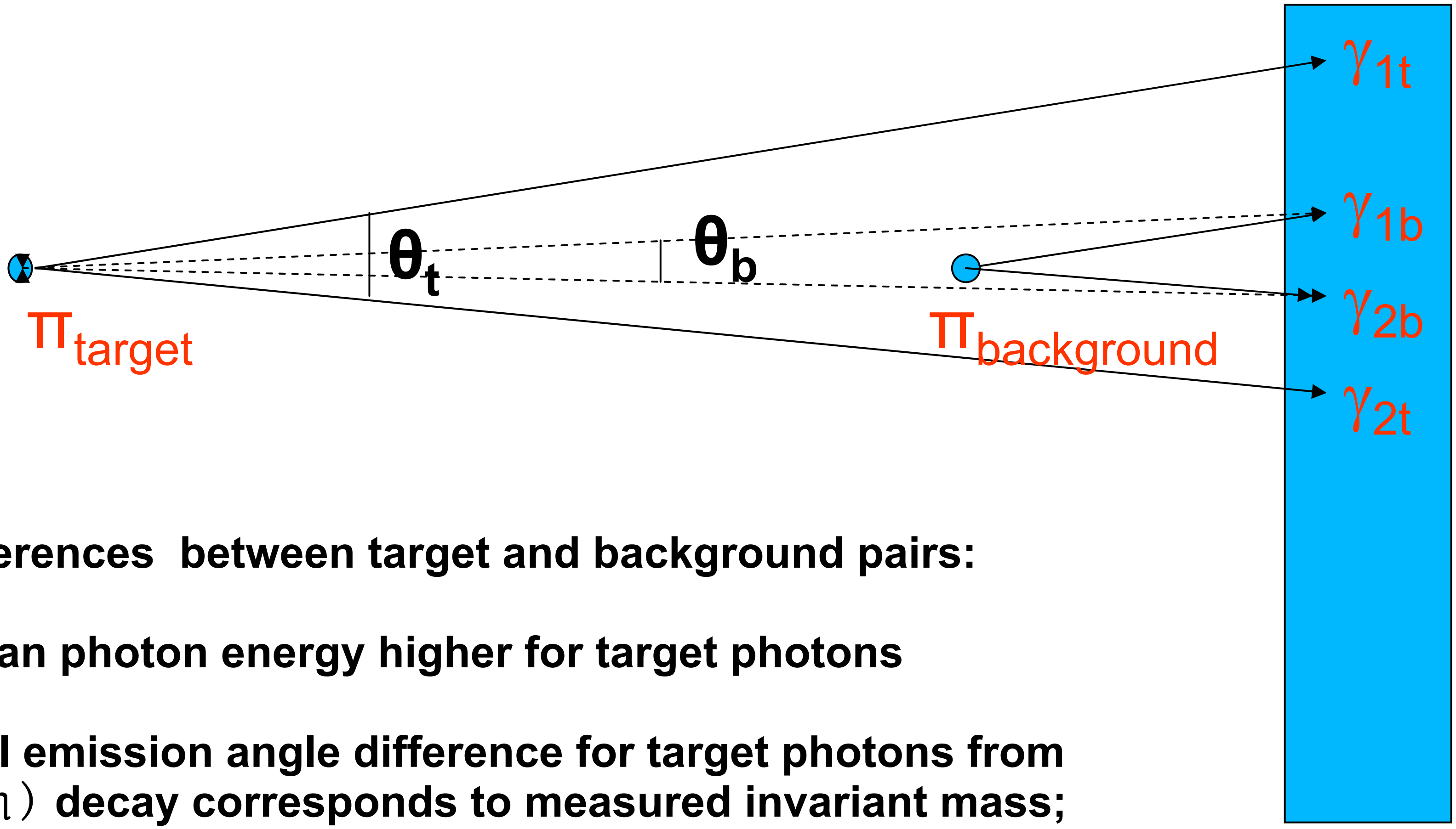
A low mass tail on the π^0 was observed.

The tail can result from π^0 produced downstream from target:

- from decays (K^0_s, ...)
- from background interaction on downstream materials

(the normalized target out background contribution is shown by the open circles In part c))





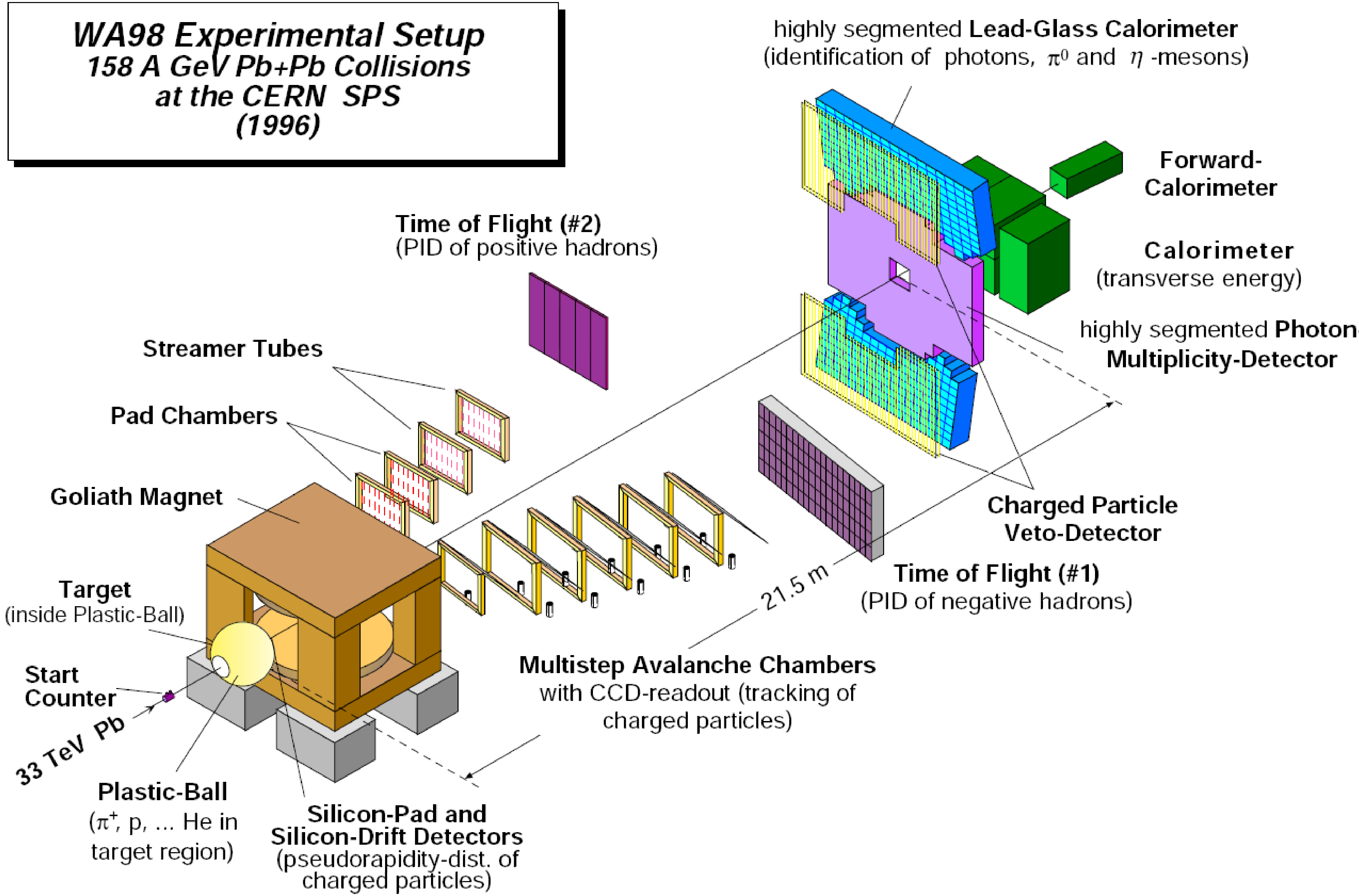
Differences between target and background pairs:

***mean photon energy higher for target photons**

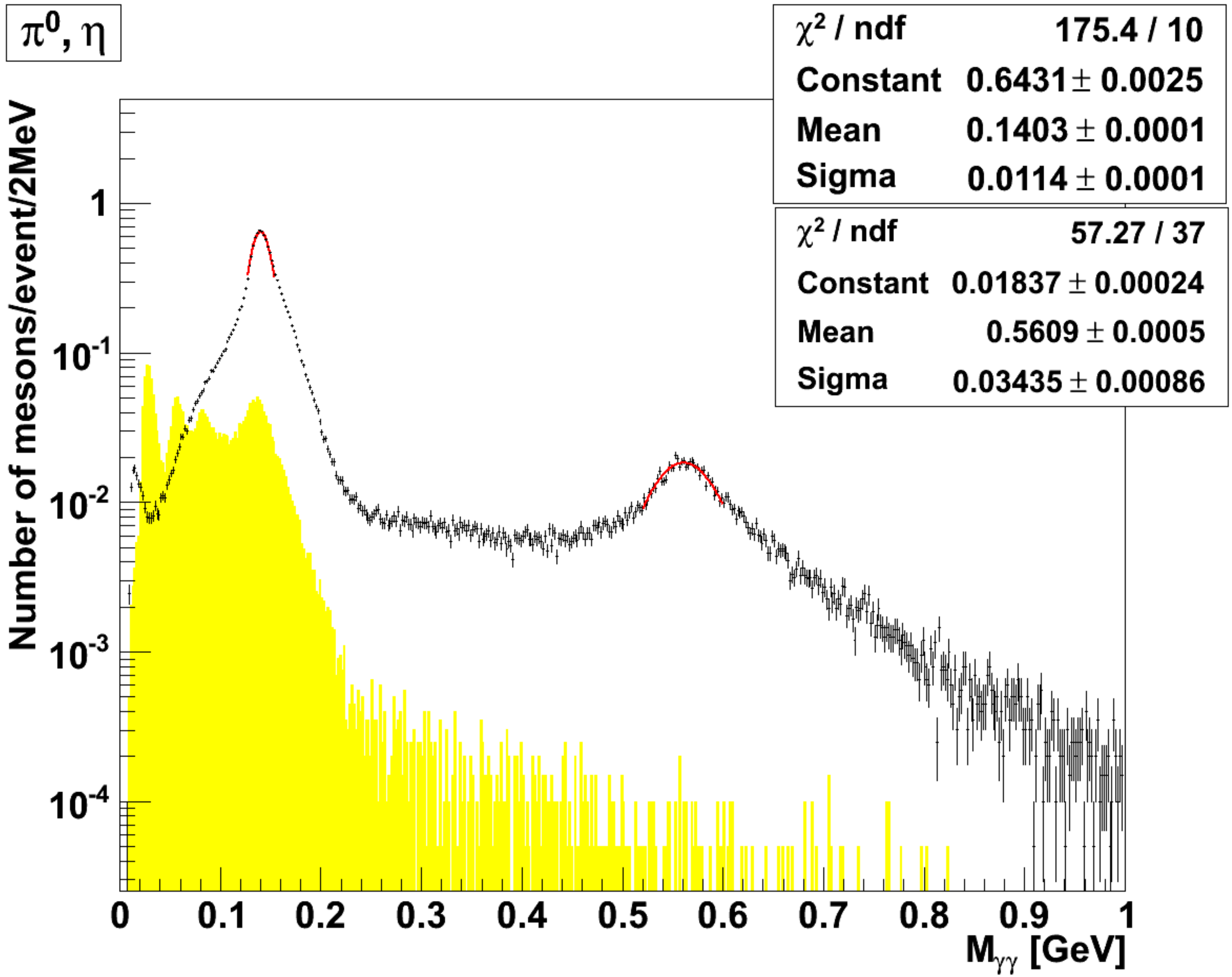
***real emission angle difference for target photons from π(η) decay corresponds to measured invariant mass; this is not the case for background pairs**

***vertex position is fixed for target pairs; for background pairs vertex position distribution corresponds to detectors (support) position**

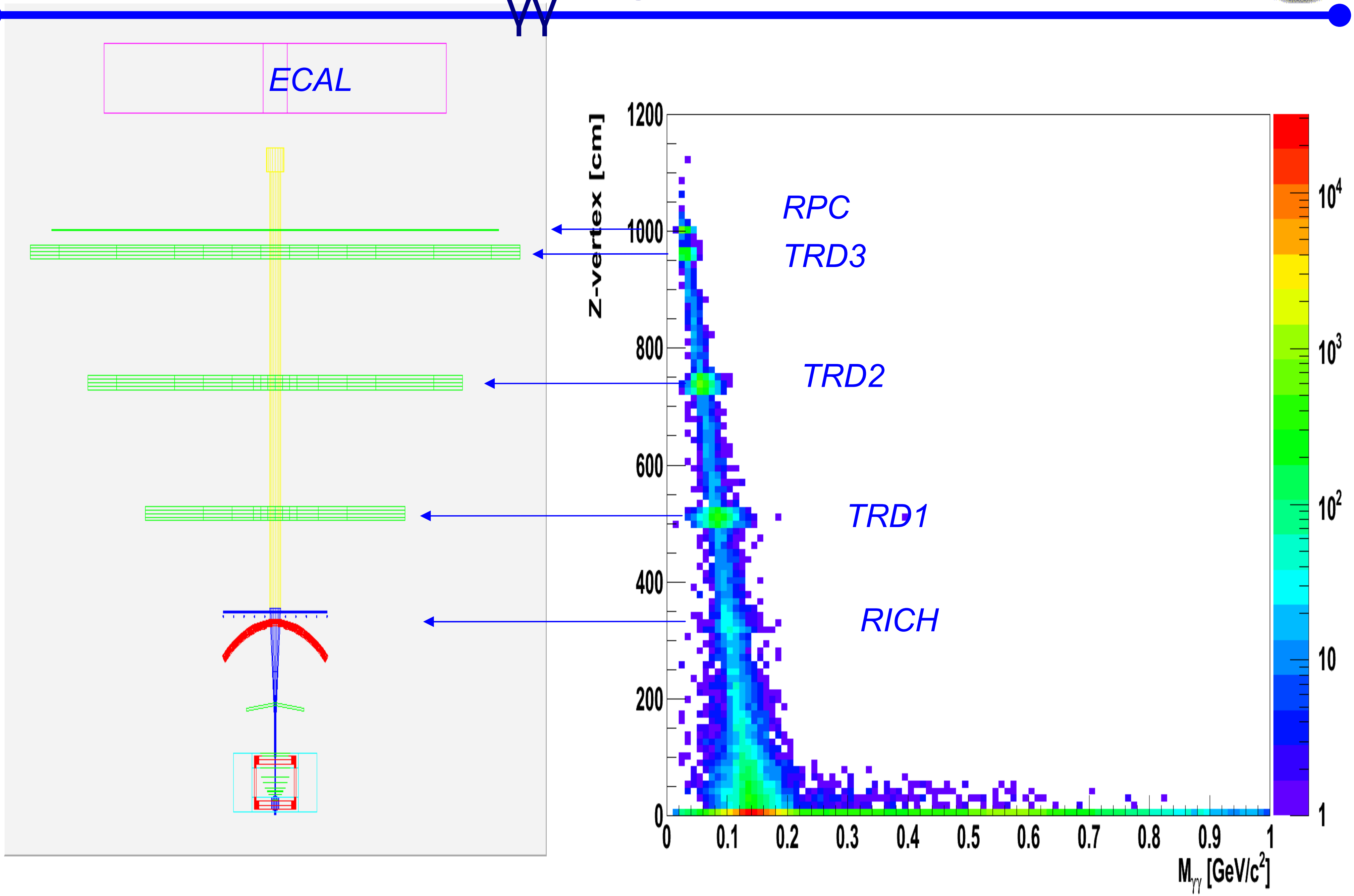
WA98 Experimental Setup
158 A GeV Pb+Pb Collisions at the CERN SPS (1996)



$M_{\gamma\gamma}$ same mother



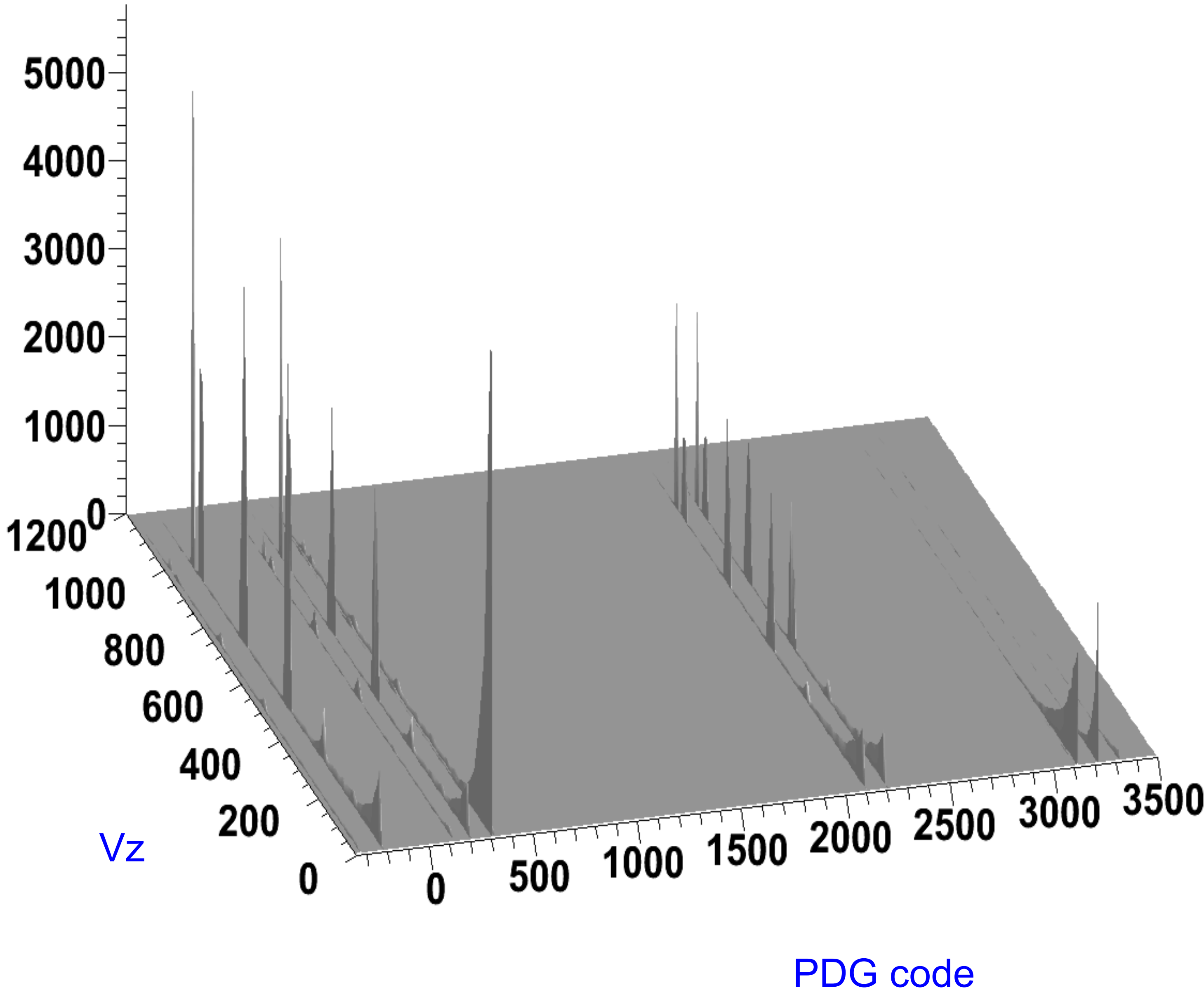
$M_{\gamma\gamma}$ vs Vz π^0



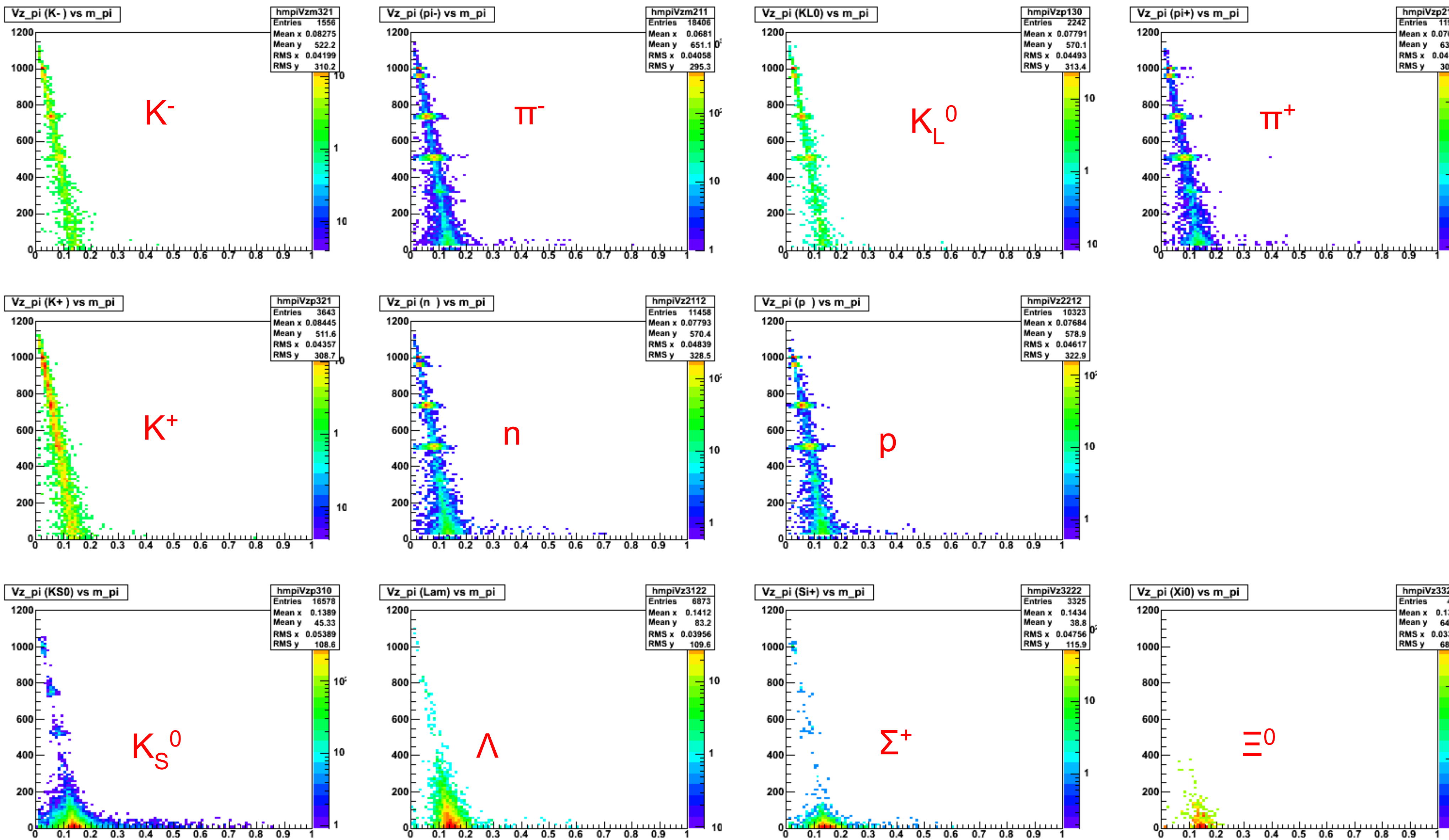
π[0] mothers vs Vz

For 0 with Vz>1. mothers:

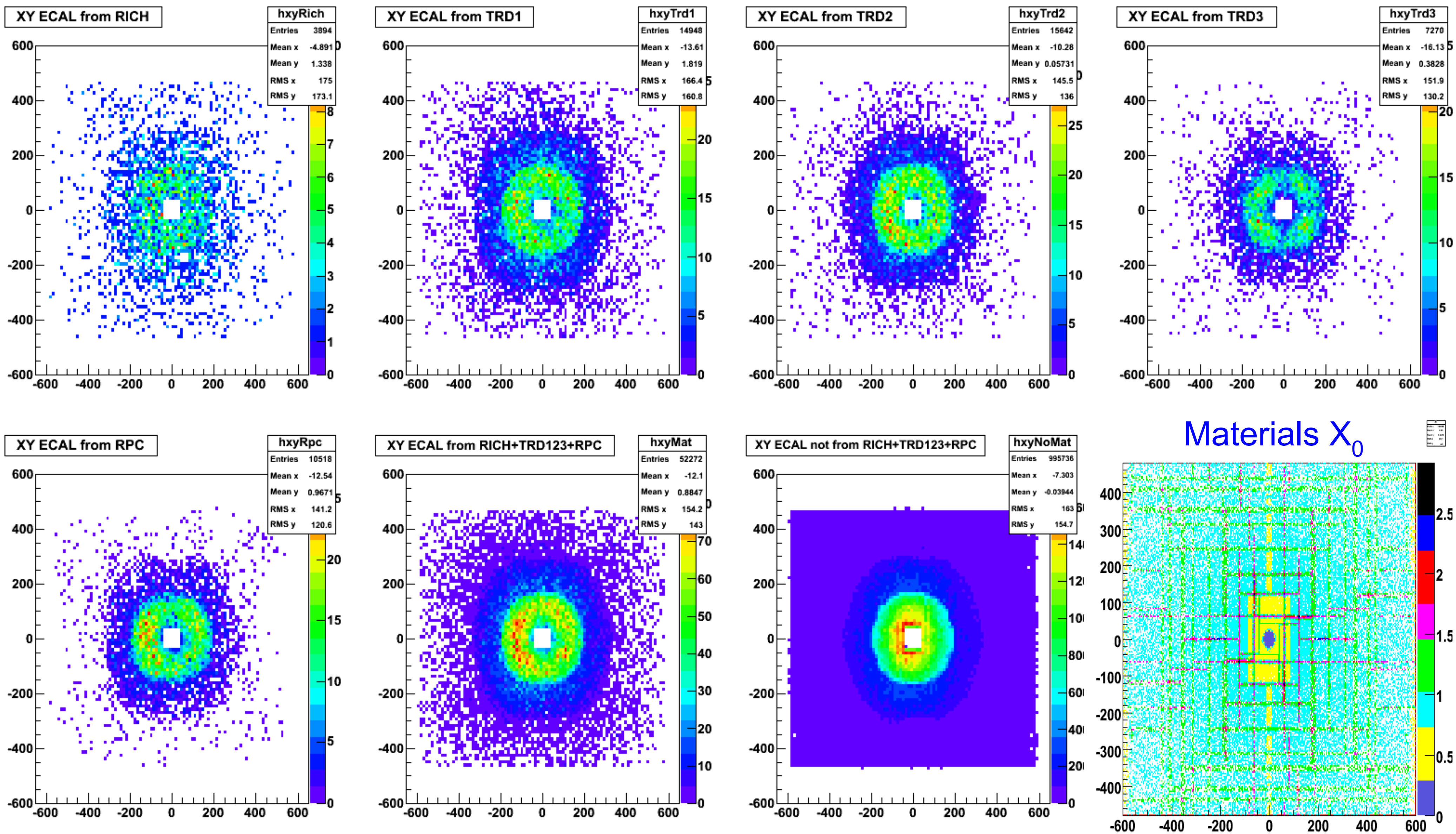
code	%	production
-321	1.9%	K- ->pi-pi0 cτ=3.7m
-211	22.1%	pi-
130	2.2%	K_L^0 ->pipipi0 cτ=15.34m
211	14.5%	pi+
310	22.2%	K_s^0 ->pi0pi0 cτ=2.7m
321	4.5%	K+ ->pi+pi0 cτ=3.7m
2112	11.9%	n
2212	10.9%	p
3122	5.6%	Lambda->npi0 cτ=7.8cm
3222	3.6%	Sigma+ ->ppi0 cτ=2.4cm
3322	0.4%	Xi0->Lambdapi0 cτ=8.7cm



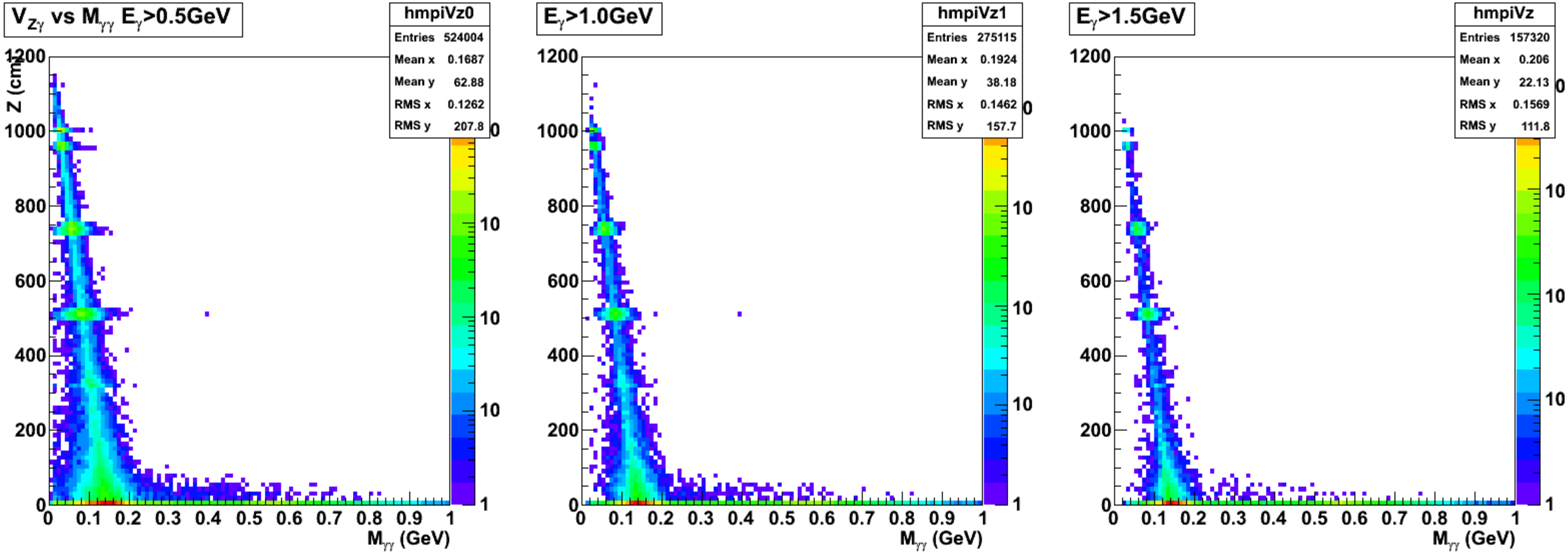
Pi0 mothers vs Vz



XY_{ECAL} for different V_Z

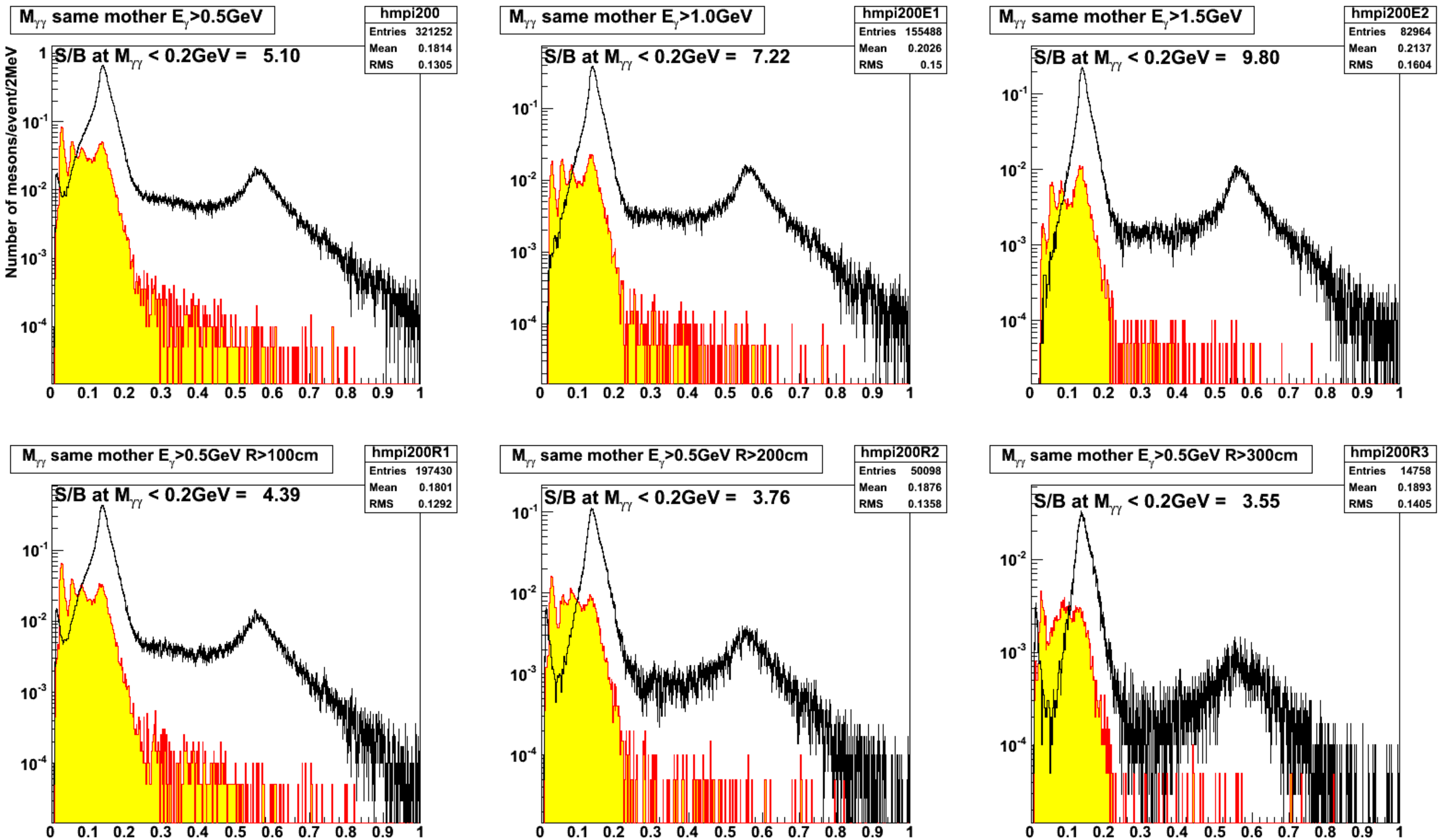


Ecut: π^0 Z-vertex vs Mγγ



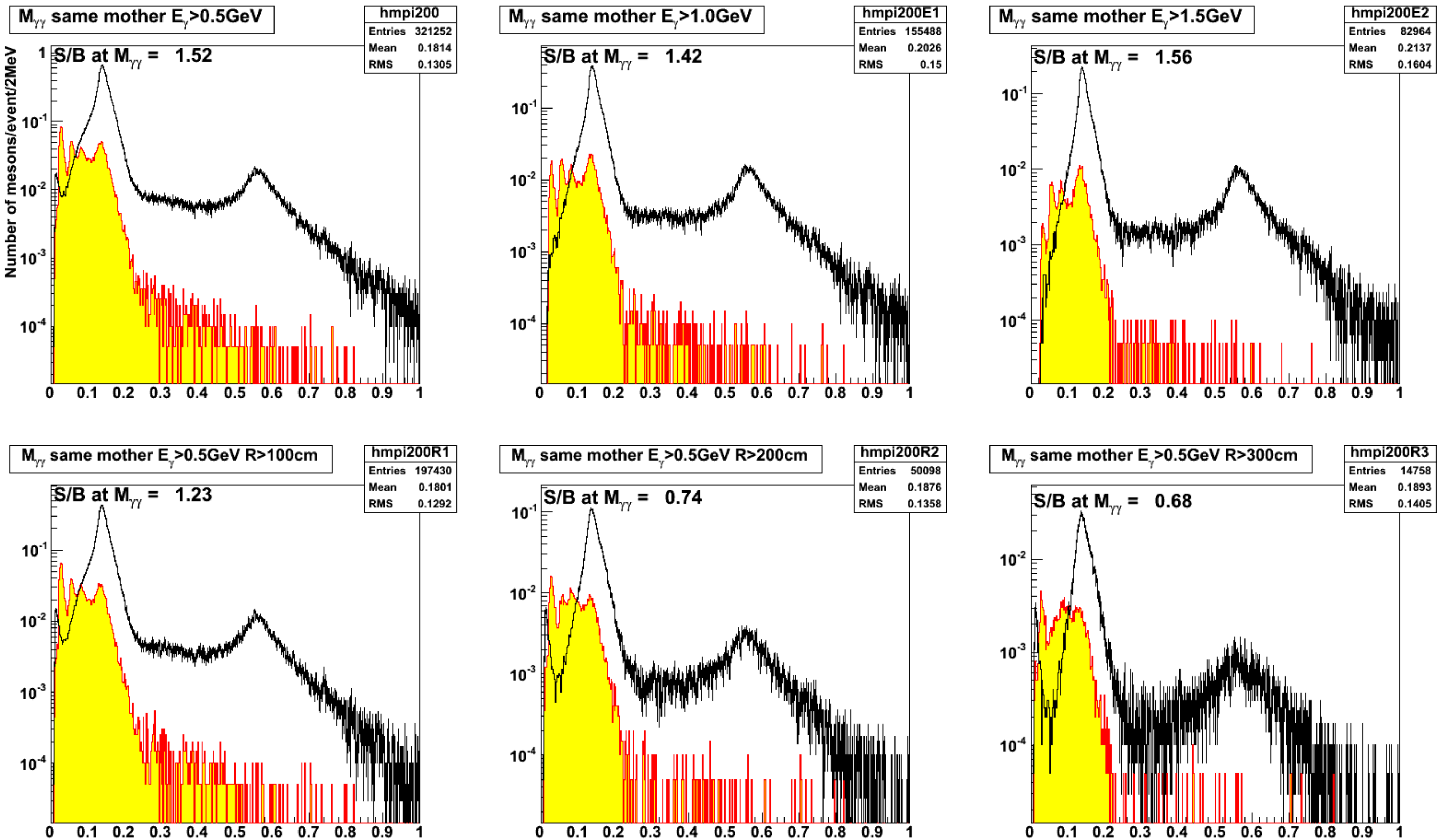
Ecut Rcut: Mγγ,same mother

S/B for 0<Mγγ<200MeV

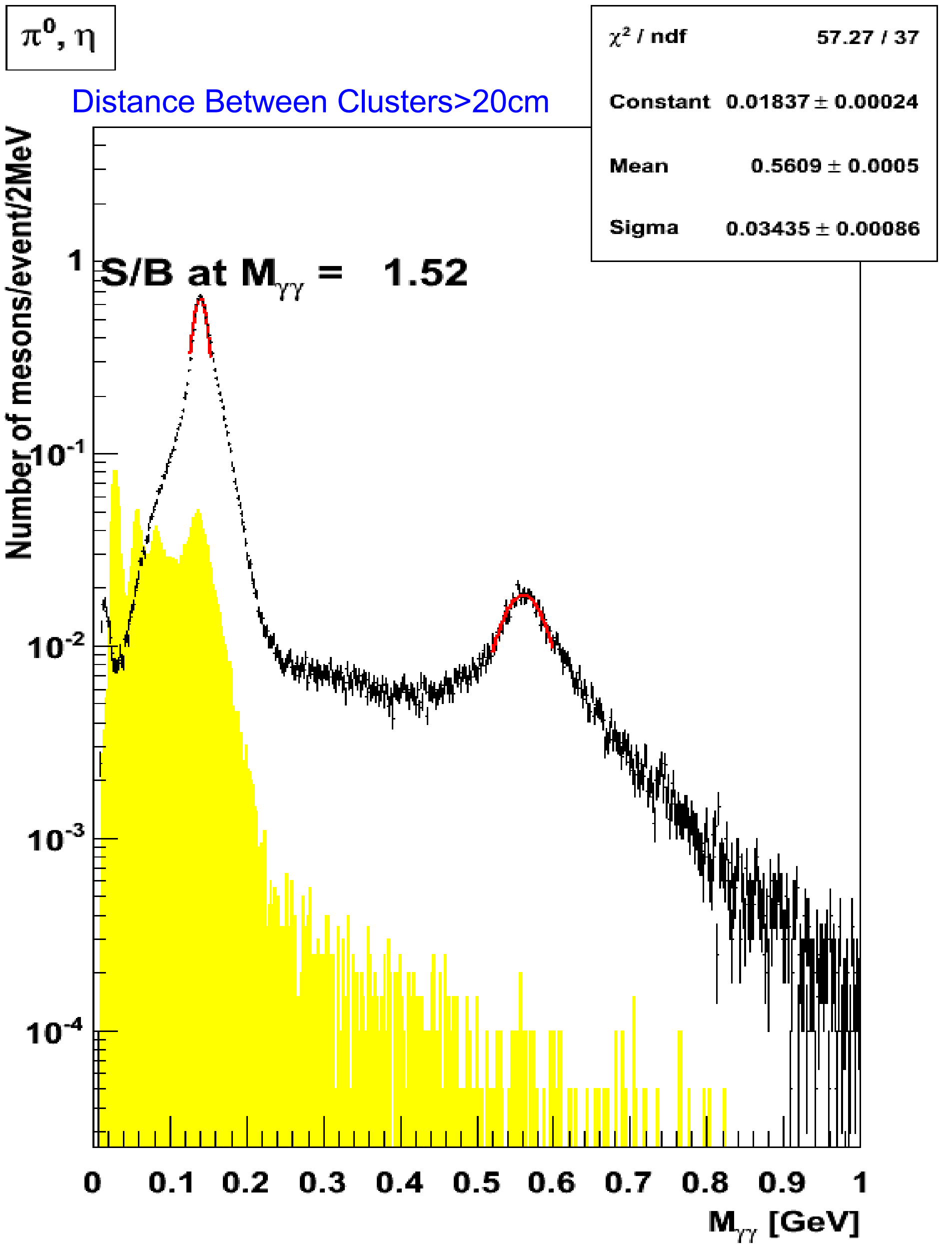


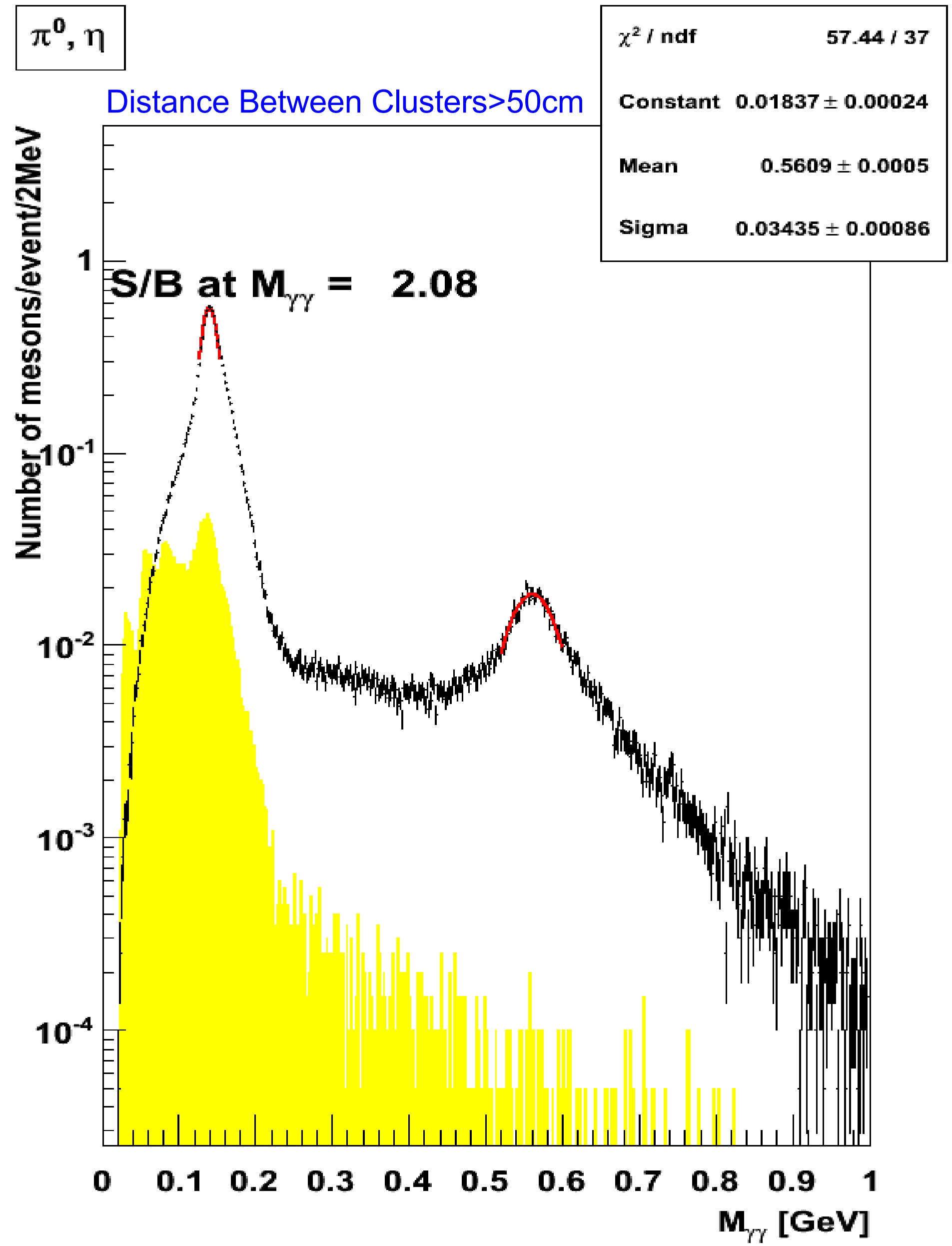
Ecut Rcut: Mγγ,same mother

S/B for 0<Mγγ<120MeV



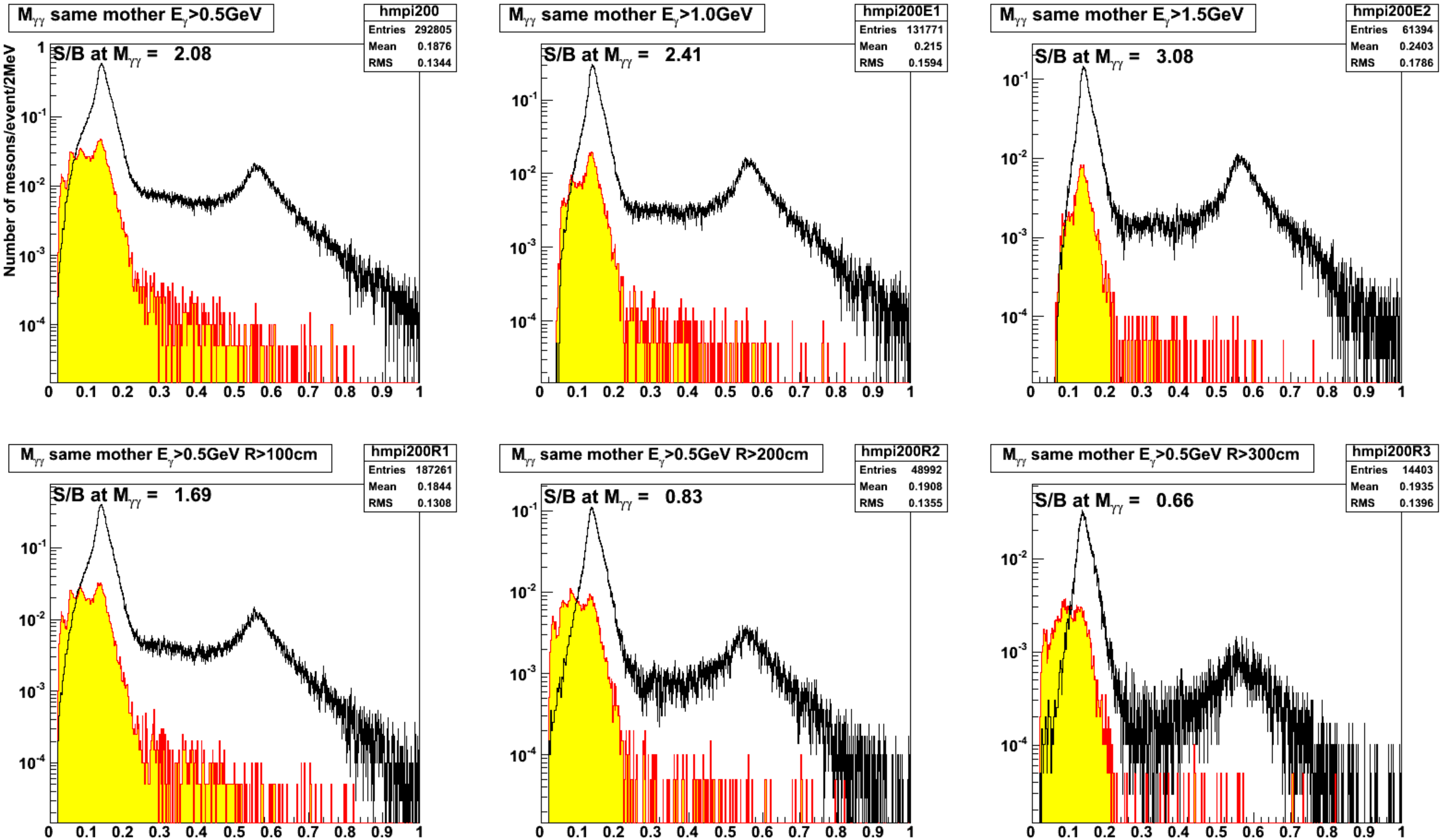
DBC cut: Mγγ,same mother



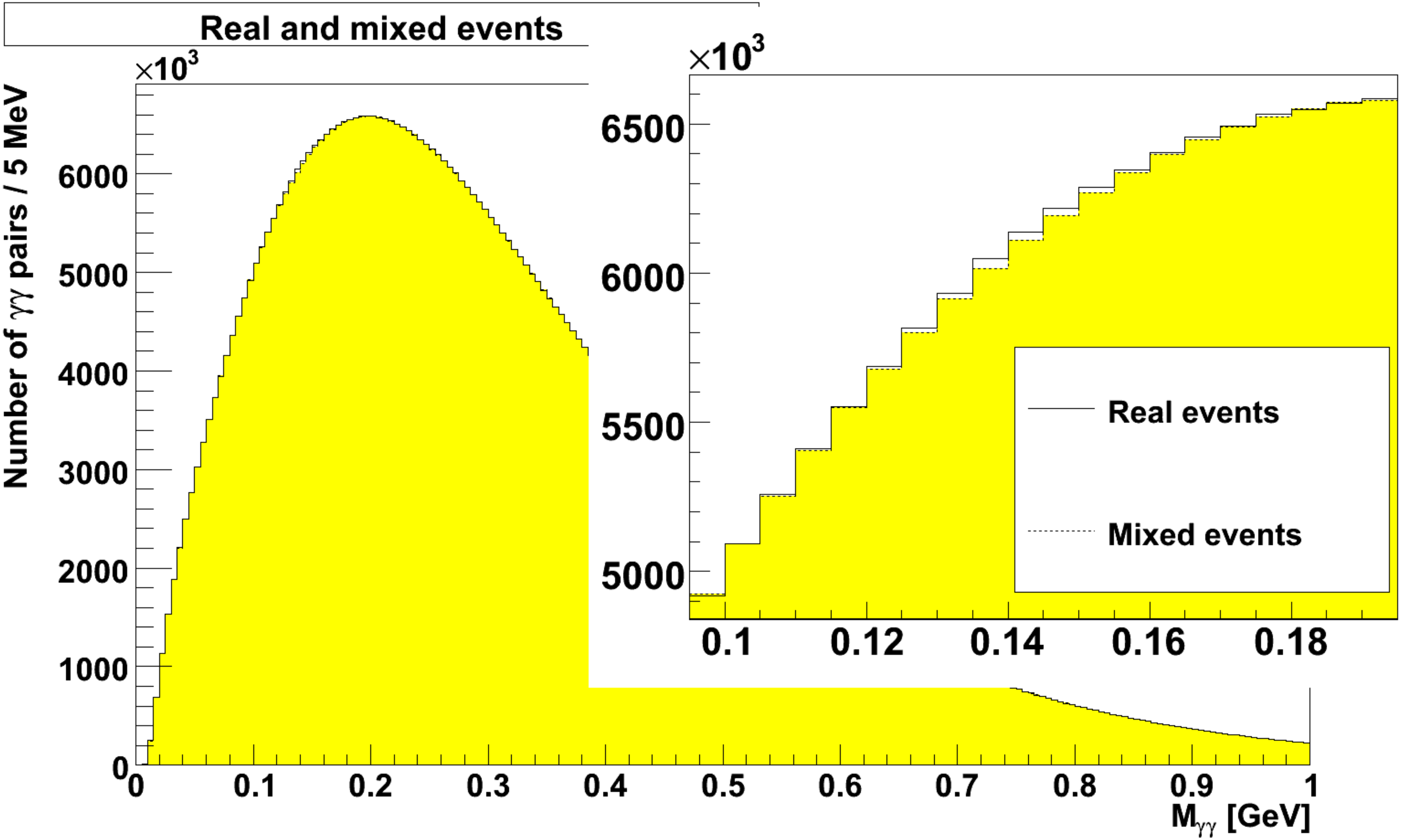


DBC > 50 cm, Ecut Rcut

S/B for 0<Mγγ<120MeV

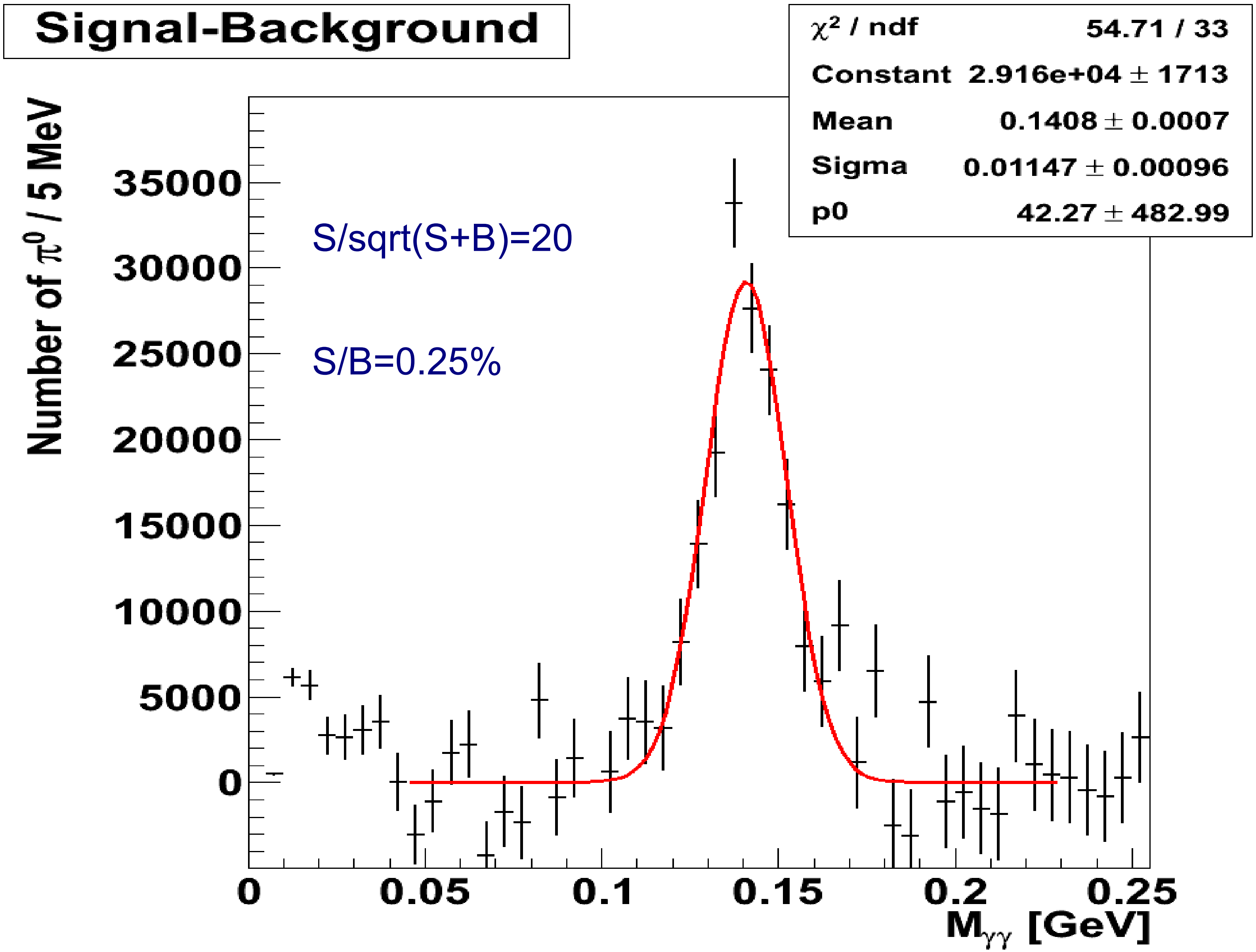


Signal and Background

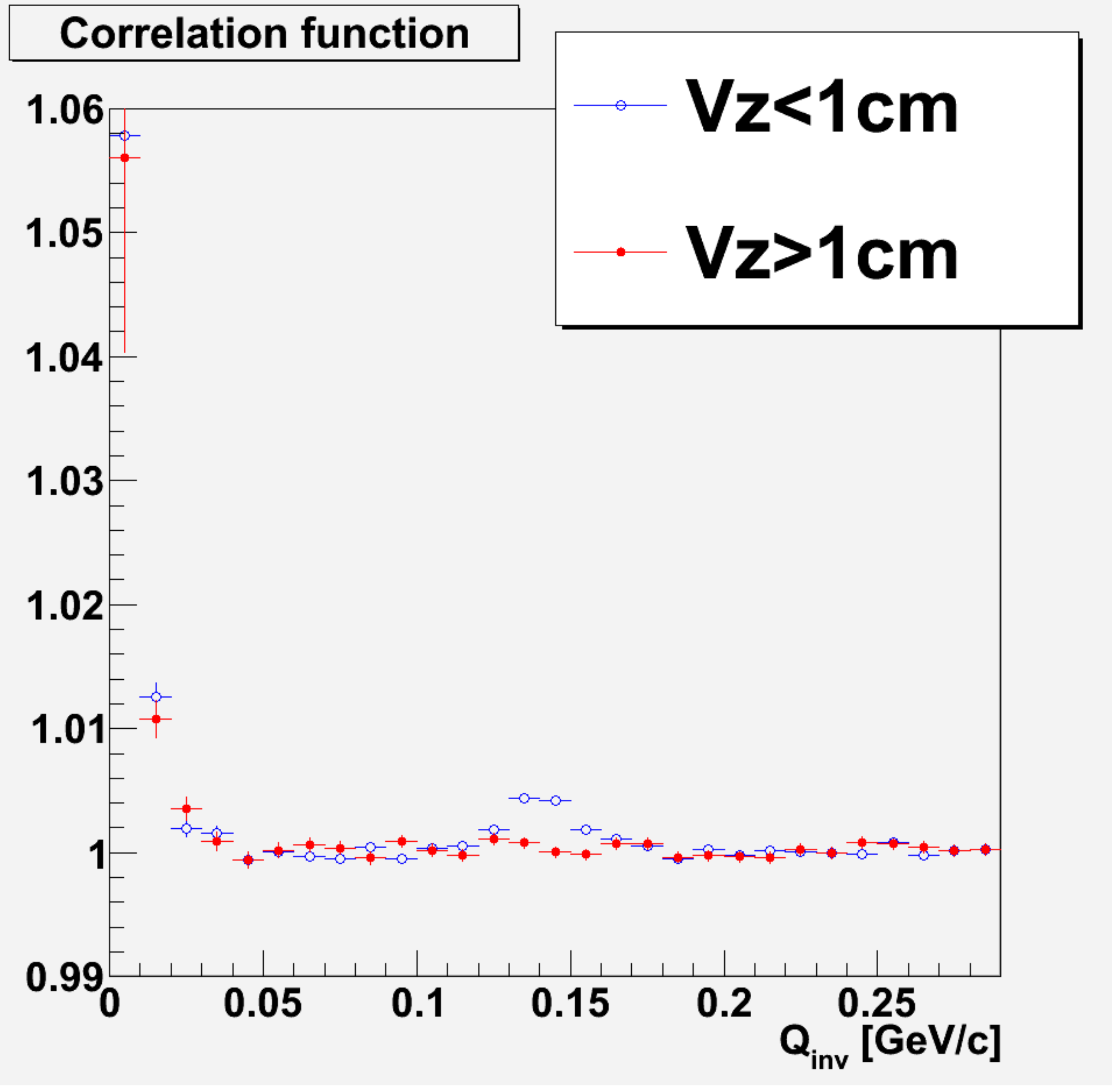


Signal-Background

$V_Z<1cm$

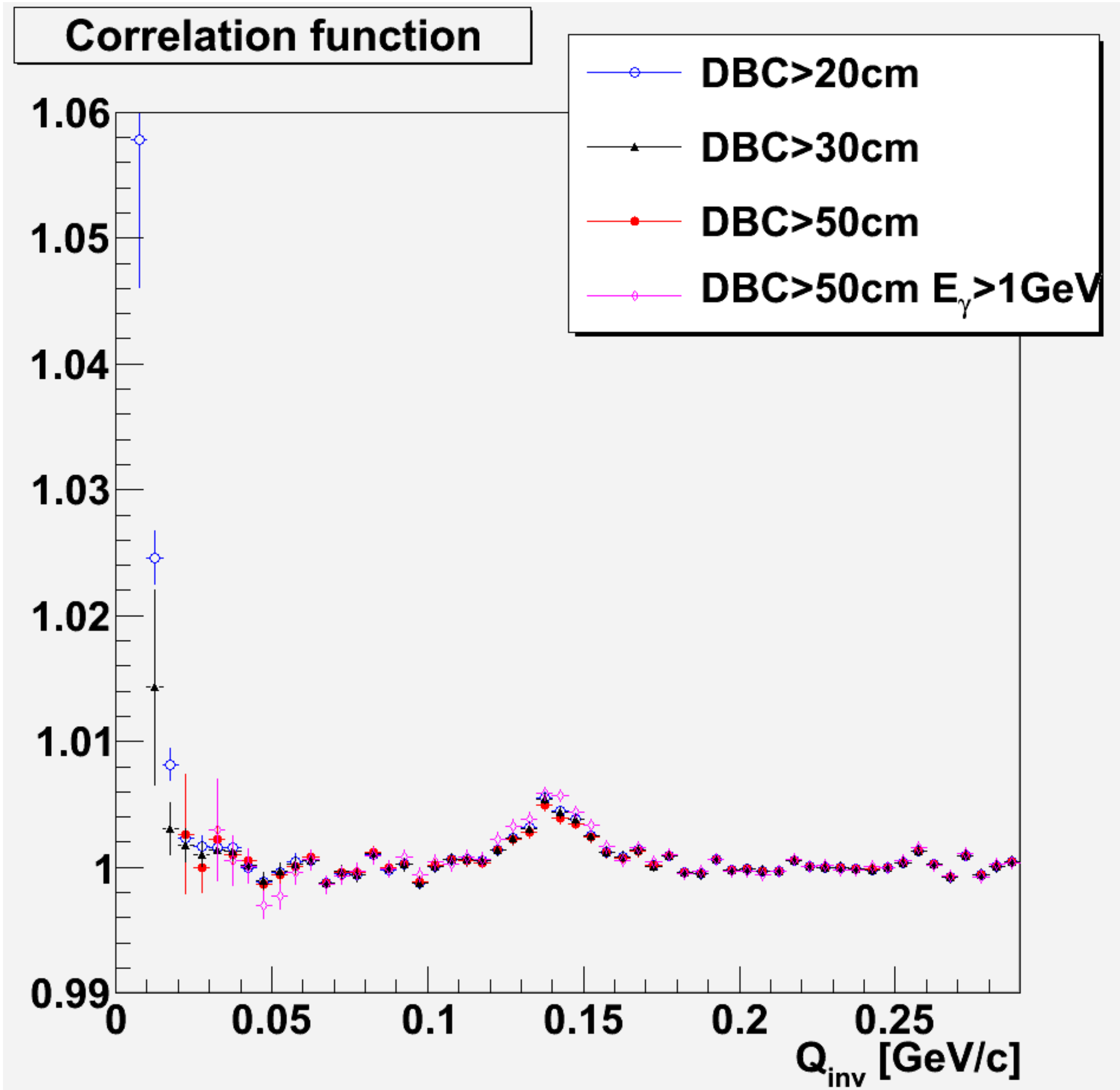


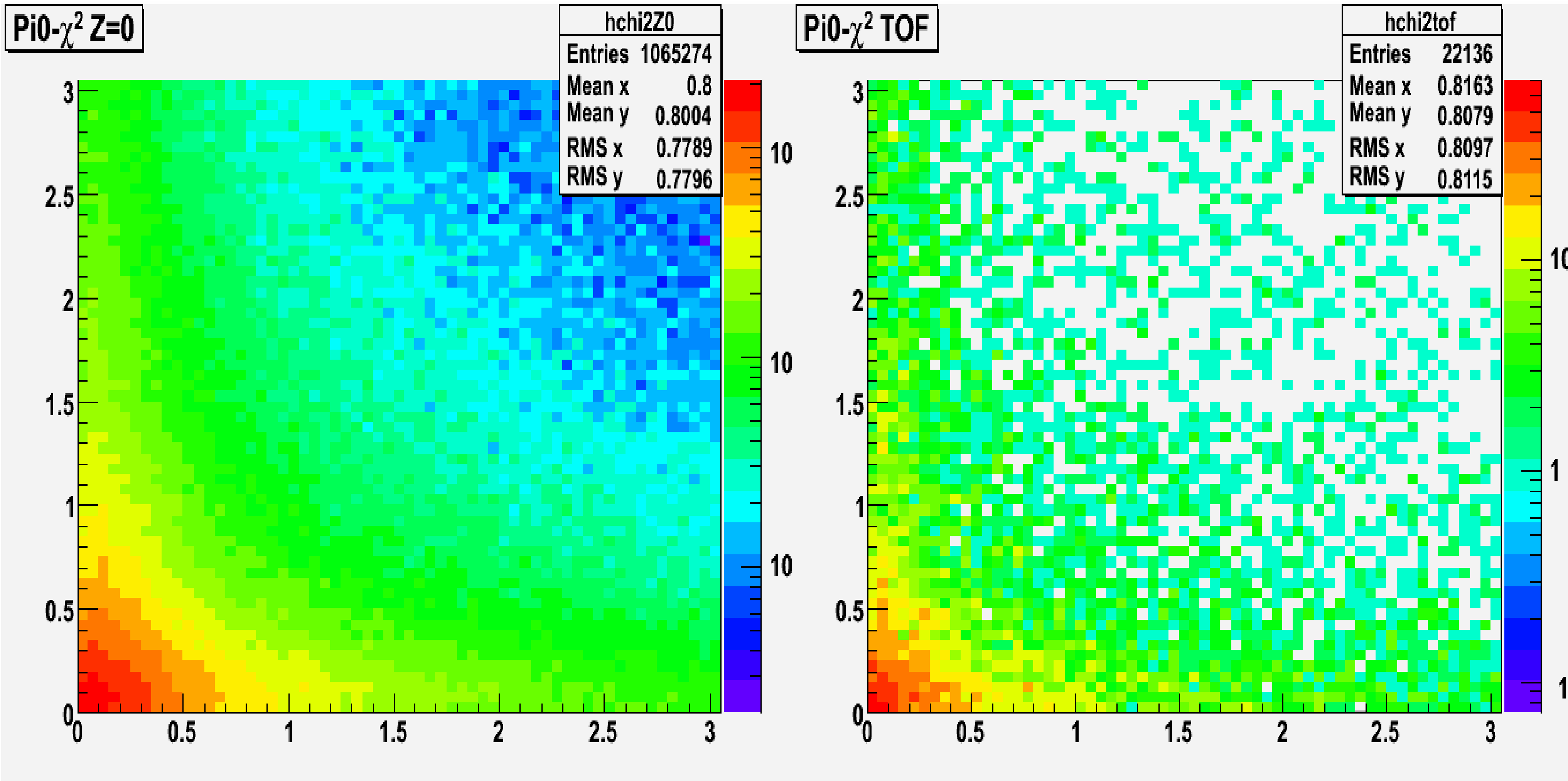
Correlation function (S/B)



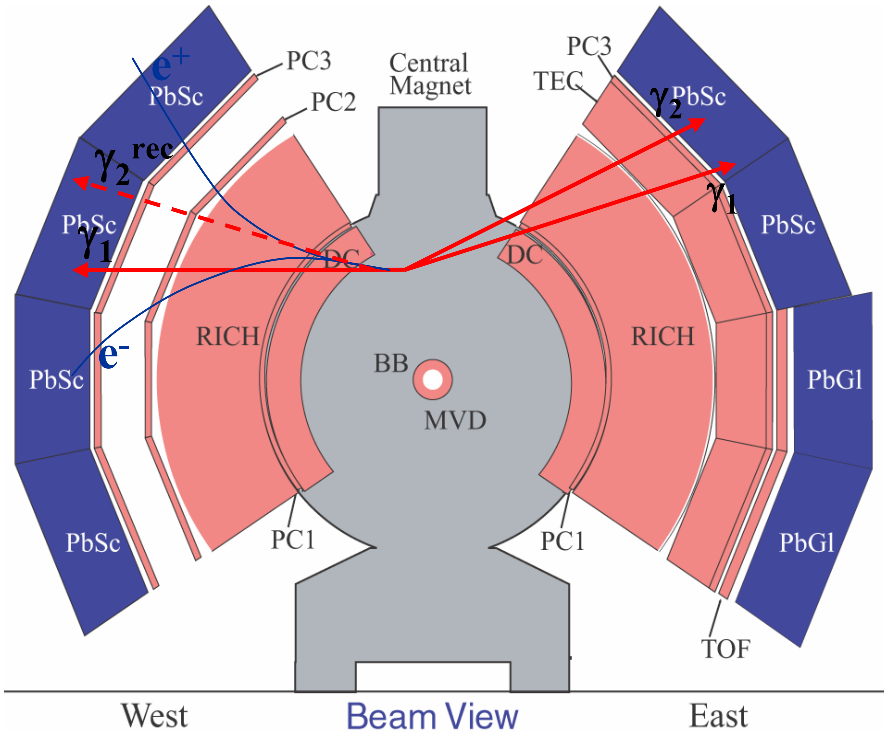
Correlation function (S/B)

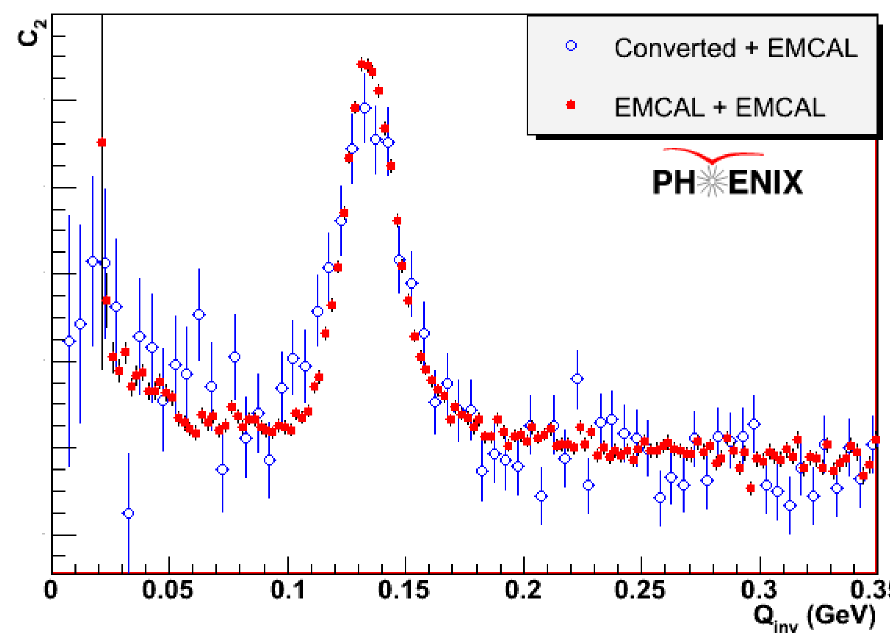
$V_Z<1cm$




Pi0-χ^2 Z=0
hchi2Z0
Entries 1065274
Mean x 0.8
Mean y 0.8004
RMS x 0.7789
RMS y 0.7796
Pi0-χ^2 TOF
hchi2tof
Entries 22136
Mean x 0.8163
Mean y 0.8079
RMS x 0.8097
RMS y 0.8115

Two-photon correlations





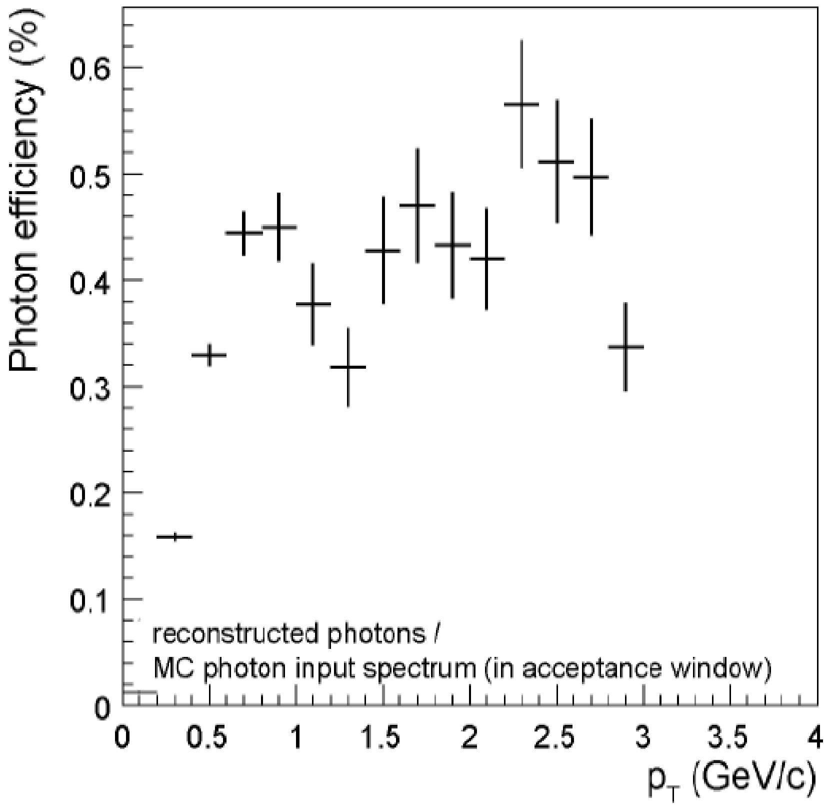
External conversion:

- No close cluster interference
- No hadron contamination

C_2 calculated in EMCAL and converted+EMCAL agree => both effects are under control

Measurement of Direct Photons
via Conversion in CBM
Melanie Klein-Bosing
WWU Munster,Germany
CBM Collaboration Meeting,
Dubna 2008, October

Real electron PID



With cut on θ and m_{inv}:

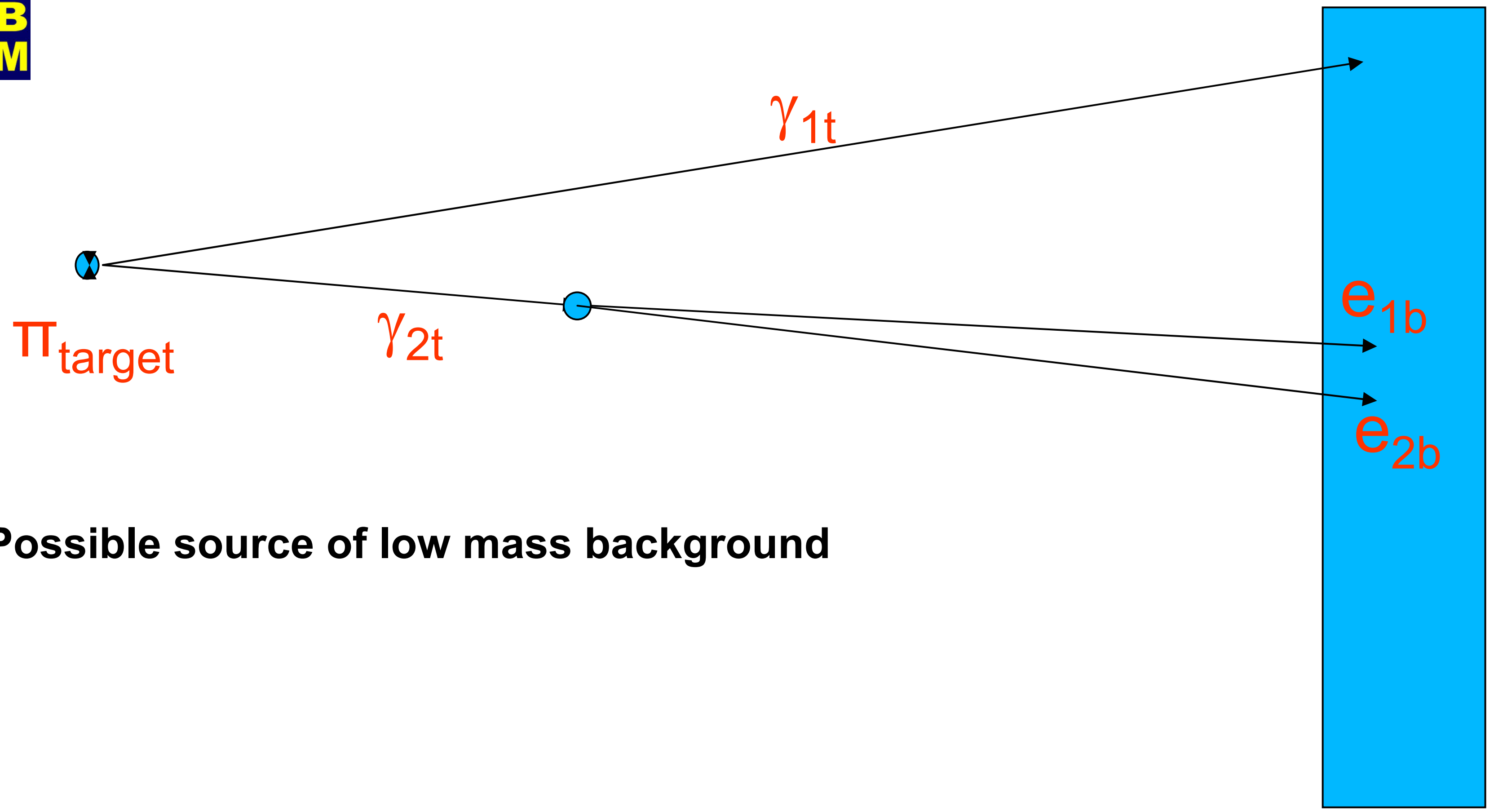
conversions/π^0 Dalitz: 9.1

conversions/all e^+e^-: 84.9%

Conclusions

- The feasibility of π and η meson identification with ECAL was shown
- The low mass background in two photon invariant mass was studied
- Two main contribution to the low mass background are:
  - Interaction with downstream detector construction
  - Decay of long lived particles
- Possible cuts to reduce (slightly) low mass background:
  - Cut on gamma energy
  - Cut on distance between center of clusters
- Other possible ways:
  - Background simulations
  - Combined photon pair identification with different detectors

Extra slides



Possible source of low mass background

R-dependence