Update of L3 electron tool: study of shower shape cuts

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Status of L3E electron selection

- Current cuts on calorimeter-E_T, corresponding to L1, and on EM fraction (> 0.9) reduce background by factor 5
- Additional cuts needed to obtain factor 10 (L1: 100Hz $\rightarrow$ L3: 10Hz)
- No tracking information yet $\rightarrow$ only calorimeter information
  Most promising discriminant is transversal shower shape.

Samples

MC Electron Sample:

- ◇ 9282 single e,
- ◇ produced with p09
- ◇ D0TrigSim: p10.11.00
- ◇ flat in $p_T (p_T < 50\,\mathrm{GeV})$
- ◇ flat in η ($|\eta| < 3.5$) and ϕ
- ◇ min.bias: 0.5
- ◇ D0TrigSim L3E variables

Precuts: Fiducial Sample: particles in non fiducial detector regions skipped (intercryostate region, calorimeter ϕ-cracks . . .)

MC QCD Sample:

- ◇ 17500 Events,
- ◇ produced with p09
- ◇ D0TrigSim: p10.11.00
- ◇ $\mathrm{P_T} > 10\,\mathrm{GeV}$
- ◇ min.bias: 0.5
- ◇ D0TrigSim L3E variables

Precuts for the following plots:

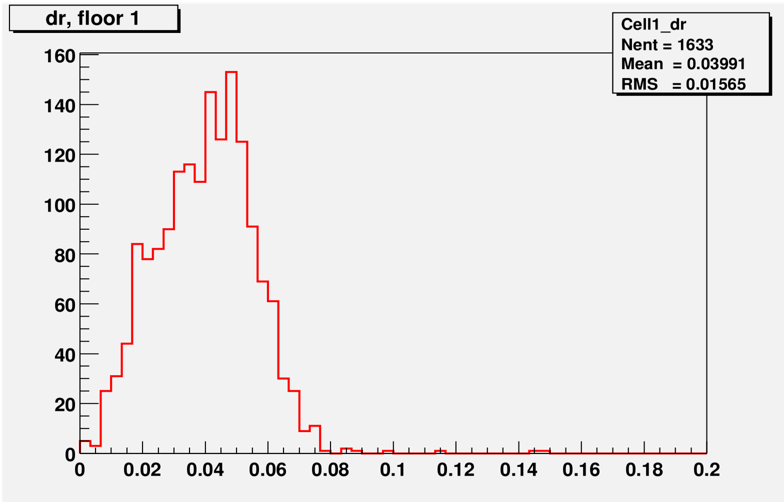
- ◇ EM fraction > 0.9
- ◇ Cluster $\mathrm{P_T} > 8.0\,\mathrm{GeV}$
- ◇ $|\eta| < 0.8$

Δr in Floor 1

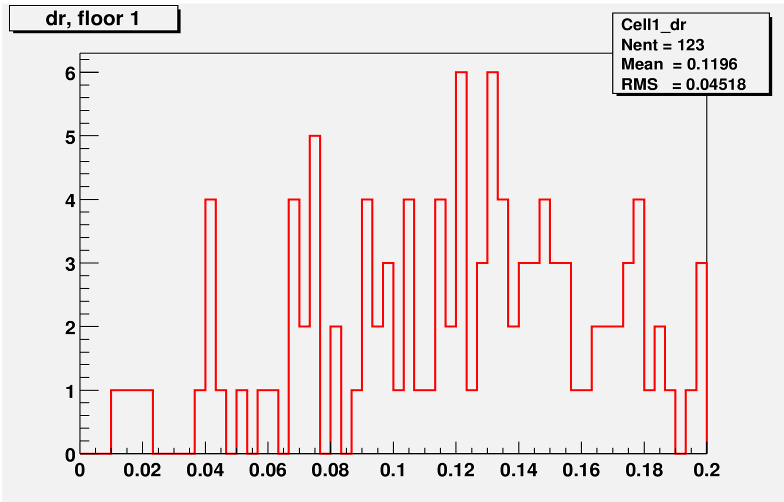
$$\Delta r = \frac{\sum \mathrm{E_i} \sqrt{(\phi_\mathrm{i} - \phi)^2 + (\eta_\mathrm{i} - \eta)^2}}{\sum \mathrm{E_i}} \tag{1}$$

ϕ, η : energy weighted cluster position in floor 3

Electron Sample:

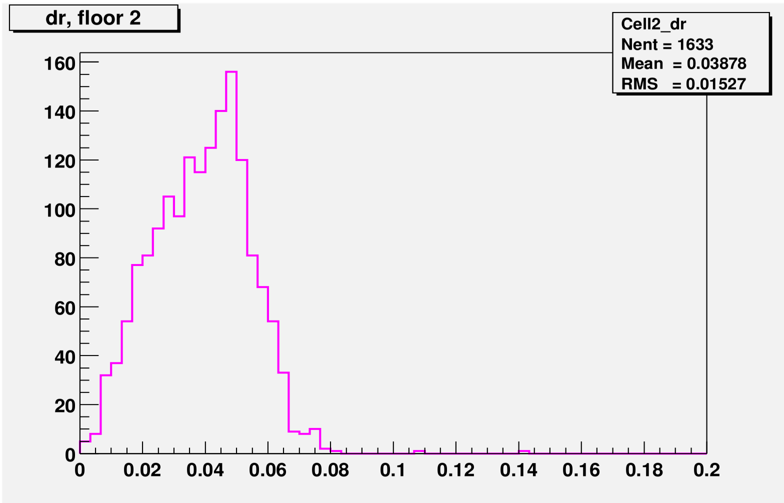


QCD Sample:

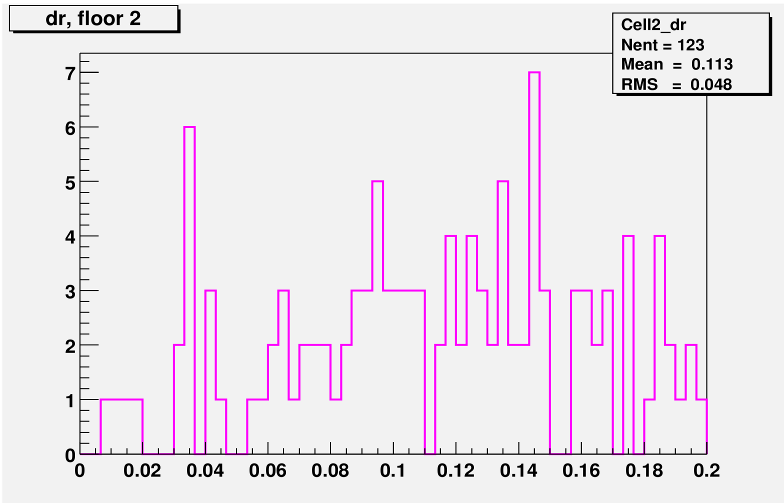


Δr in Floor 2

Electron Sample:

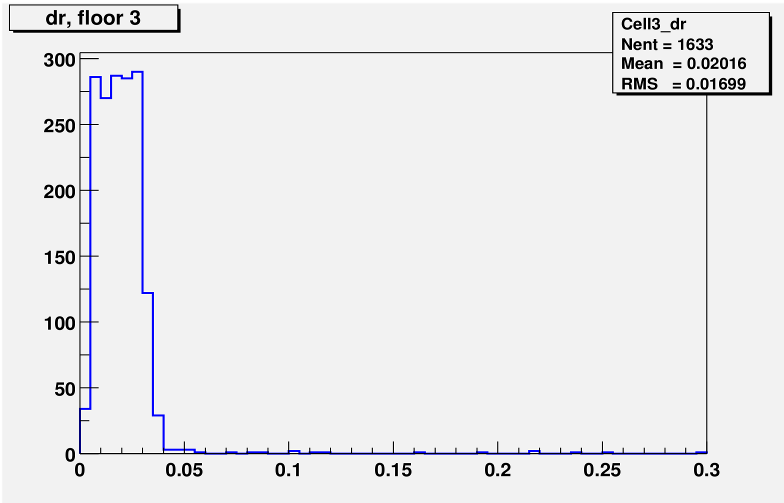


QCD Sample:

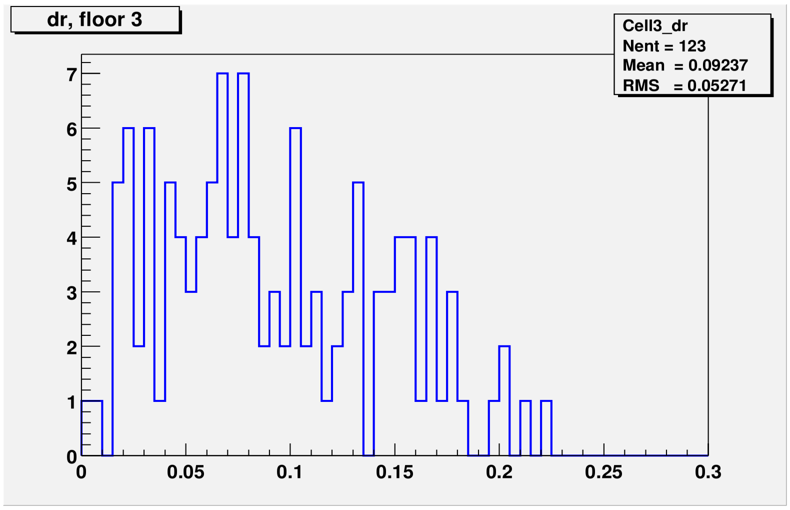


Δr in Floor 3

Electron Sample:

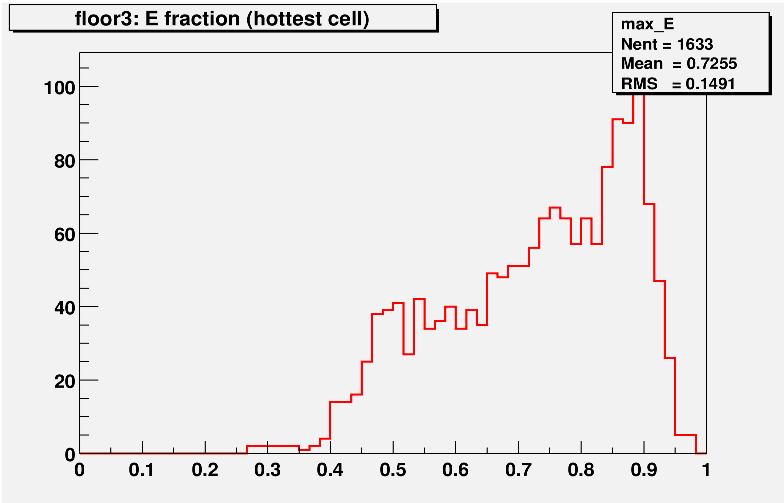


QCD Sample:

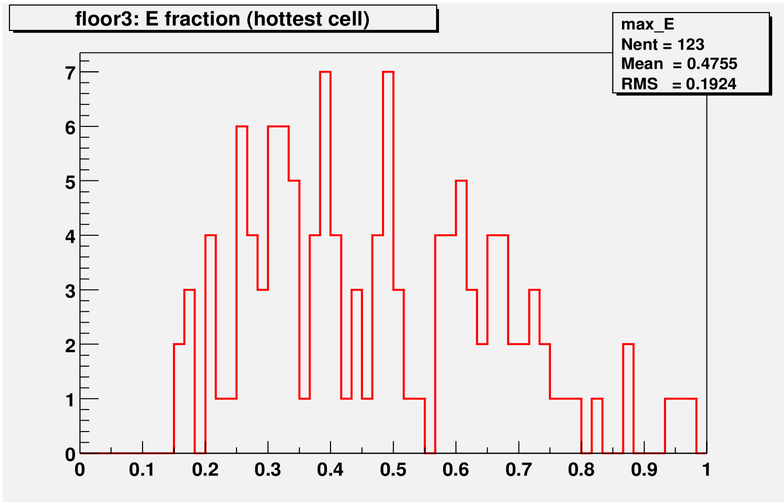


Floor3: Energy fraction of maximum energy cell

Electron Sample:



QCD Sample:

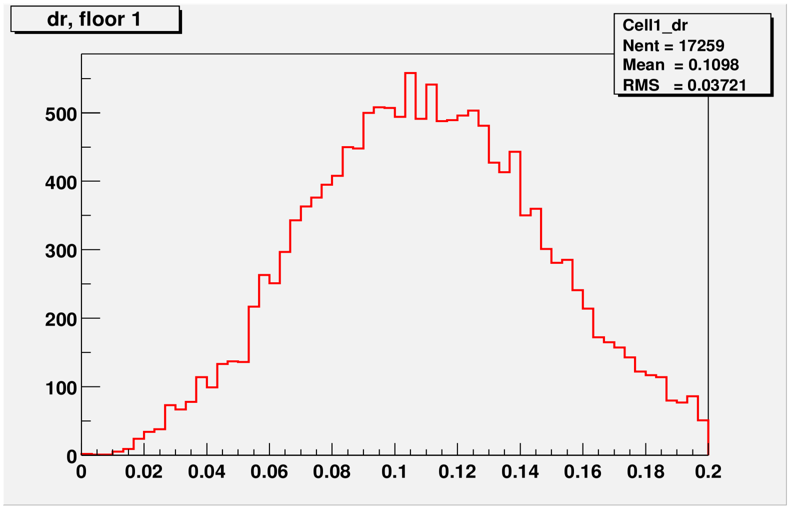


Data Sample

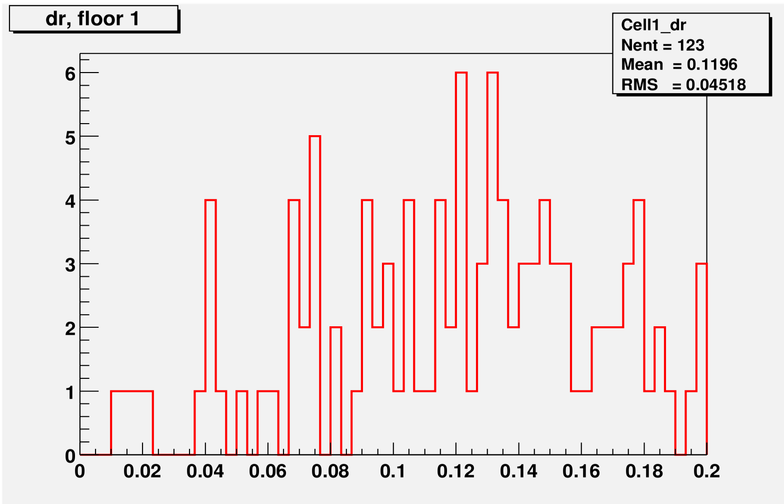
- ◇ 134284 Events
- ◇ run 142871–142874
- ◇ recoA: p10.11.00
- ◇ no trigger selection (yet)
- ◇ variables: JCCB, CAL

Comparison MC - Data : Floor1 Δr

Data Sample:

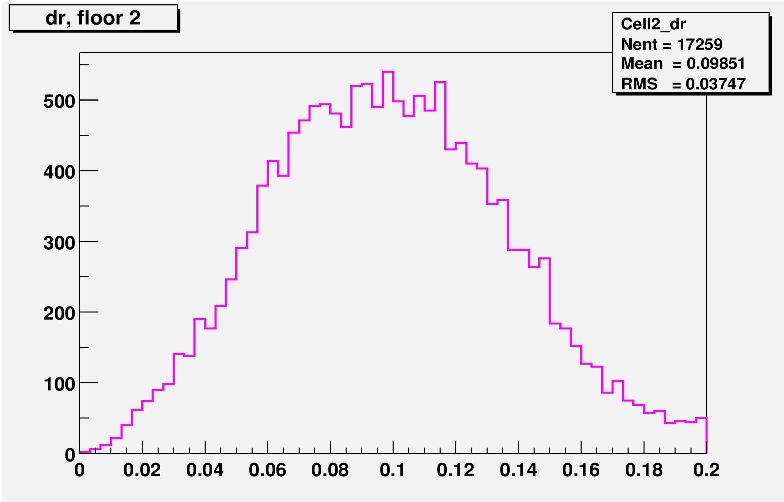


QCD Sample:

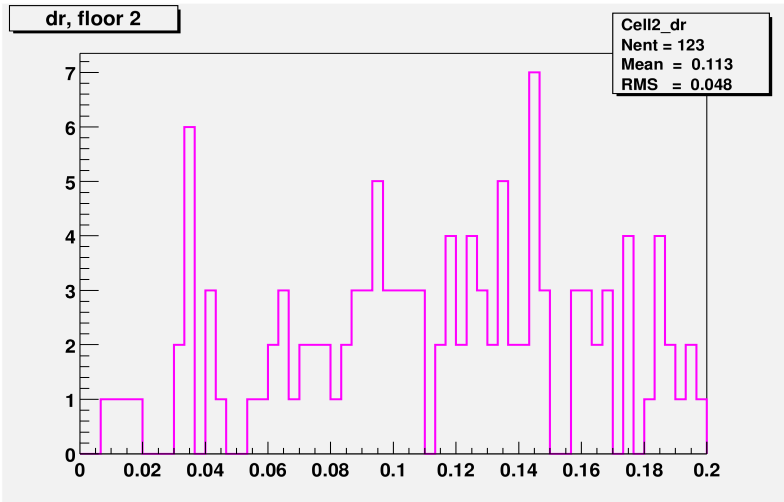


Comparison MC - Data : Floor2 Δr

Data Sample:

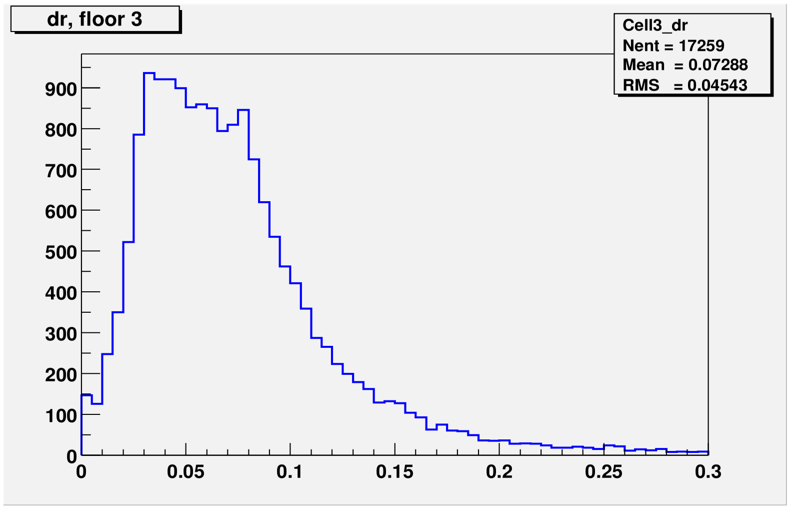


QCD Sample:

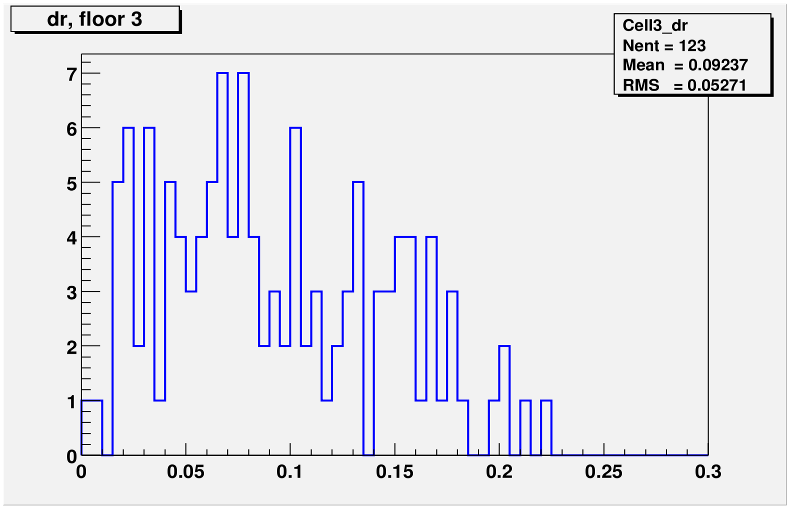


Comparison MC - Data : Floor3 Δr

Data Sample:

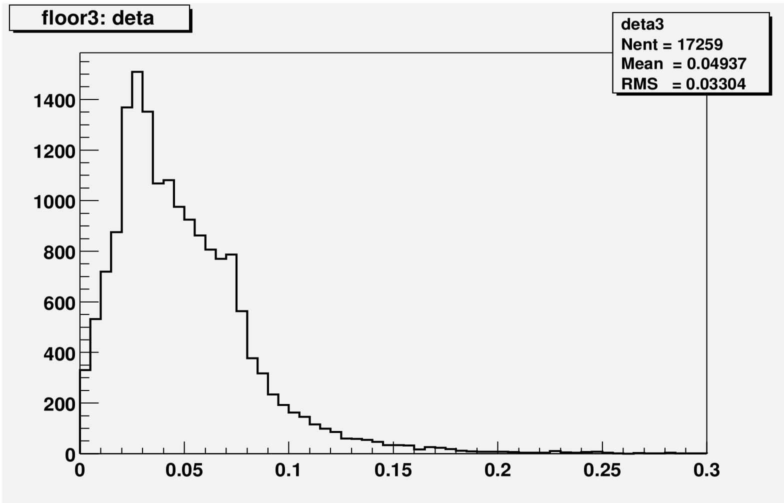


QCD Sample:

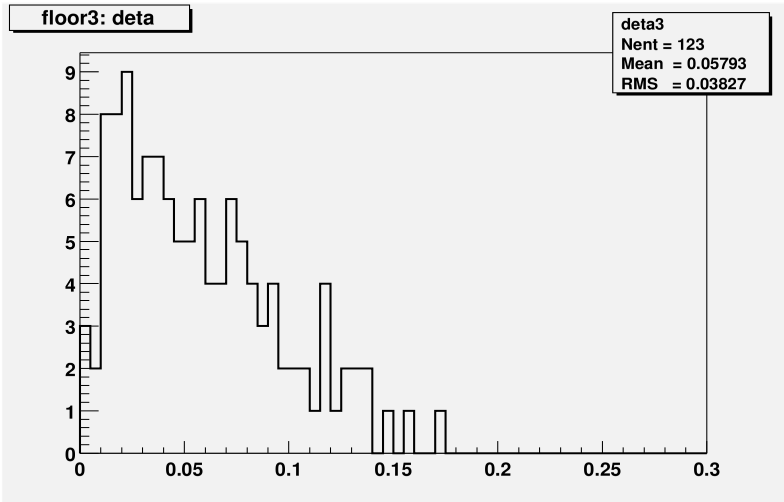


Comparison MC - Data : Floor3 $\Delta\eta$

Data Sample:

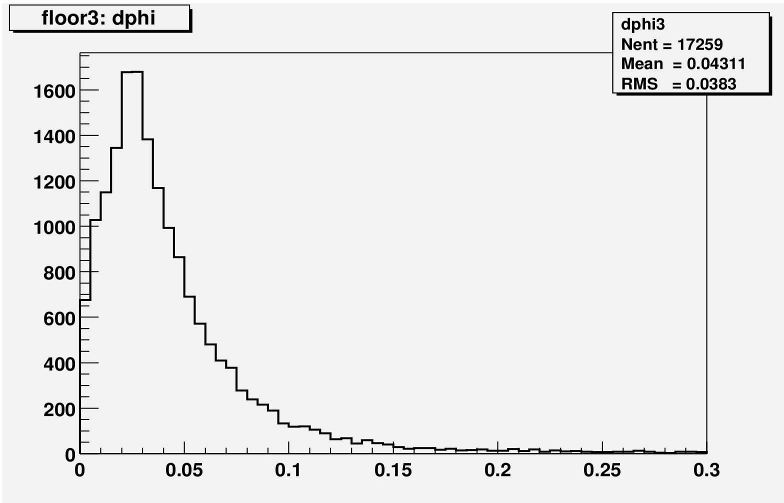


QCD Sample:

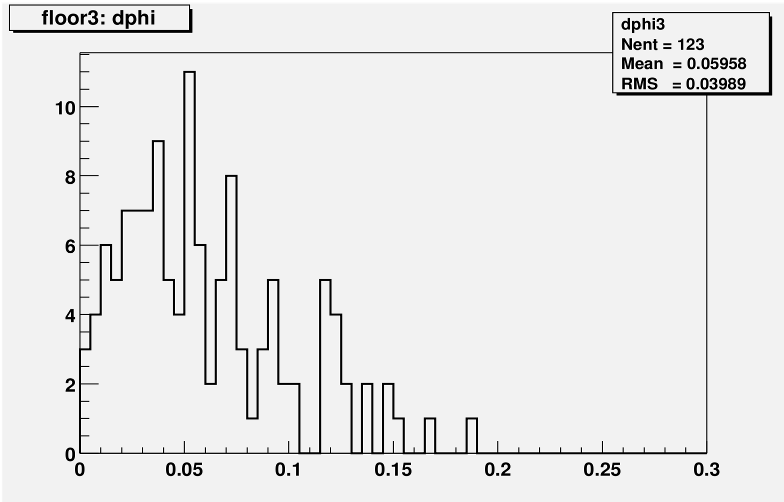


Comparison MC - Data : Floor3 $\Delta\phi$

Data Sample:



QCD Sample:



Impact of different cuts

Results for Cell variables with cone 0.4 and cone 0.2

Cut	Acceptance MC: electrons		Rejection MC: QCD		Rejection Data	
Precut	EM Cluster, $\eta < 0.8$		EM Cluster, $\eta < 0.8$ L1: CEM(1,5)		Jet, $\eta < 0.8$ P_T jet $> 8.0\,\mathrm{GeV}$	
Cluster PT $> 8.0\,\mathrm{GeV}$			1.9			
EM fraction $>$ 0.9	0.998		5.7		4.35	
a) + Isolation < 0.2	0.998		8.3		—-	
b) + floor3: $\Delta r < 0.05$	0.984	0.985	13.9	9.8	12.6	9.6
c) + fl1,fl2:$\Delta r < 0.08$	0.996	0.990	19.5	11.8	22.2	13.1
d) + b + c	0.977	0.983	24.4	15.0	35.3	21.4
e) + fl3: $\mathrm{E}_{\mathrm{max}} > 0.4\,\mathrm{E}$	0.987	0.982	8.5	7.6	7.4	6.6

Plans for the near future

◇ Acceptance studies:

- non isolated electron MC (W-Higgs MC)
- electron data samples (Zee events)

◇ QCD: Improved data and MC comparison:

- Data with selected triggers
- New TrigSim data sample
- more MC · · ·

Summary

- Set of transversal shower shape cuts tested in MC studies
- Cuts on E weighted average Δr (cone 0.4) proved to be most efficient
- Satisfying rejection as well in cone 0.2
- Difference in distribution of showershape variables in MC and data observed