Thoughts on transverse energy profile for e/m showers

David Ward

- We have work from G.Mavromanolakis on this topic.
- Hope to publish along with Valeria's longitudinal shower shape study.
- But George's work doesn't include any comparisons with MC. Try to address this.
- Has thrown up some issues, on which feedback would be appreciated.

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Hit energies data c.f. MC.

E Ecal hits /mips



E Ecal hits /mips



E Ecal hits /mips



•Standard e⁻ data and MC samples @ four energies.

•Reasonable, but not perfect agreement.

•Follow George's method, and separate hits into four ranges:

- •Ehit<2MIP
- 2<Ehit<10MIP
- •10<Ehit<50MIP</pre>
- •Ehit>50MIP

•Select events in same central region of calorimeter @ all energies:

- $|\langle x \rangle| < 15 \text{ mm}$
- |⟨y⟩| < 10 mm

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Shower profile in x : 30GeV



Symmetric

Narrower as we increase hit energy, of course.

Small shift in highest energy hits could reflect beam tilt in data

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Shower profile in y : 30GeV

-20

-10

-5

0

-15

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Slight aymmetry Attributable to interwafer gap.





Radial shower profile : 30 GeV



The same on log scale : 30 GeV

107

E vs r_{hit} : 2<Ehit<10 MIP



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une 3 ntries 2,734937e+0 21.79 10⁶ 14.44 10⁵ 104 90 100 r_{hit} /mm 0 10 20 30 40 50 60 70 80 E vs r_{hit} : Ehit>50 MIP noprod_test_30GeV Entries 2762685 107 Mean 3.63 RMS 1.942 uns 🔅 3364168 Intries 10⁶ 3.684 Mean RMS 1.982 10⁵ ??? But is it important? 10⁴ 10³ 10 C 5 15 20 25 r_{hit} /mm UNIVERSITY OF David Ward CAMBRIDGE

moored test 30GeV

intries 2.200762e+0

21.84

14.66

Radial shower profile : 10 GeV

1000

800

600

400

200

0

900

800F

700F

600È

500È

400E

300 F

200

100

0<mark>-</mark>

×тυ

10

E vs r_{hit} : Ehit>50 MIP

20

5

×10

E vs r_{hit} : 2<Ehit<10 MIP

30

40

50

60

70

80

Entries

Mean

RMS

Runs 1

Entries

Mean

RMS

20

90

cprod test 10Ge\

r_{hit} /mm

228112

SeV v0406

205567

3.028

1.639

2.956

1.52

100



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15

10



25 r_{hit} /mm

ncorod test 10GeV

Runs_10GeV_v0406

Entries 3270218

Entries

Mean

RMS

Mean

RMS

348057

17.6

13.67

17.88

13.91

Radial shower profile : 20 GeV



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2000

1000

0<mark>ò</mark>



10

15

20

5

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25

r_{hit} /mm

Radial shower profile : 45 GeV



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E vs r_{hit} : 2<Ehit<10 MIP moprod test 45GeV old Entries 1.832597e+07 14 Mear 23.63 RMS 14,99 Runs 45GeV v0406 12 Entries 6.450342e+03 Mean 23.53 10 RMS 14 72 8 6 4 00 40 50 60 70 80 90 100 10 20 30 r_{hit} /mm



Radial profile vs depth : 30 GeV



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E vs r bit Stack 2 : Ehit<2 MIP

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Radial profile vs depth (contd.) : 30 GeV



"Effective Molière radius"



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Effective Molière radius vs e- energy

Effective Molière radius



Pretty good agreement, to ~2%, except at 10 GeV.

But MC is systematically lower.

Likely to be linked with cut used for removal of double showers (upstream showering).

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max is parameter used to remove double showers

Threshold for 2 clusters







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Threshold for 2 clusters





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Effective Molière radius vs T_{max}



Largely confirms that data/MC discrepancy is associated with residual double showers present in data.

Should we cut lower? But then biasing the result (though not much, if we believe MC).

However....

- ✤ So far so good.
- All this was based on the same data and MC samples as used for Cristina's paper.
- But, since Mokka 06-07 we have a revised G10 density for the ECAL.
- This has a significant impact on the shower width, and reduces both r₉₀ and r₉₅ by ~1mm at all energies.
- ✤ This destroys the agreement between data and MC ⊗
- (But I believe it improves Valeria's longitudinal analysis).
- Not sure what to do about this.



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