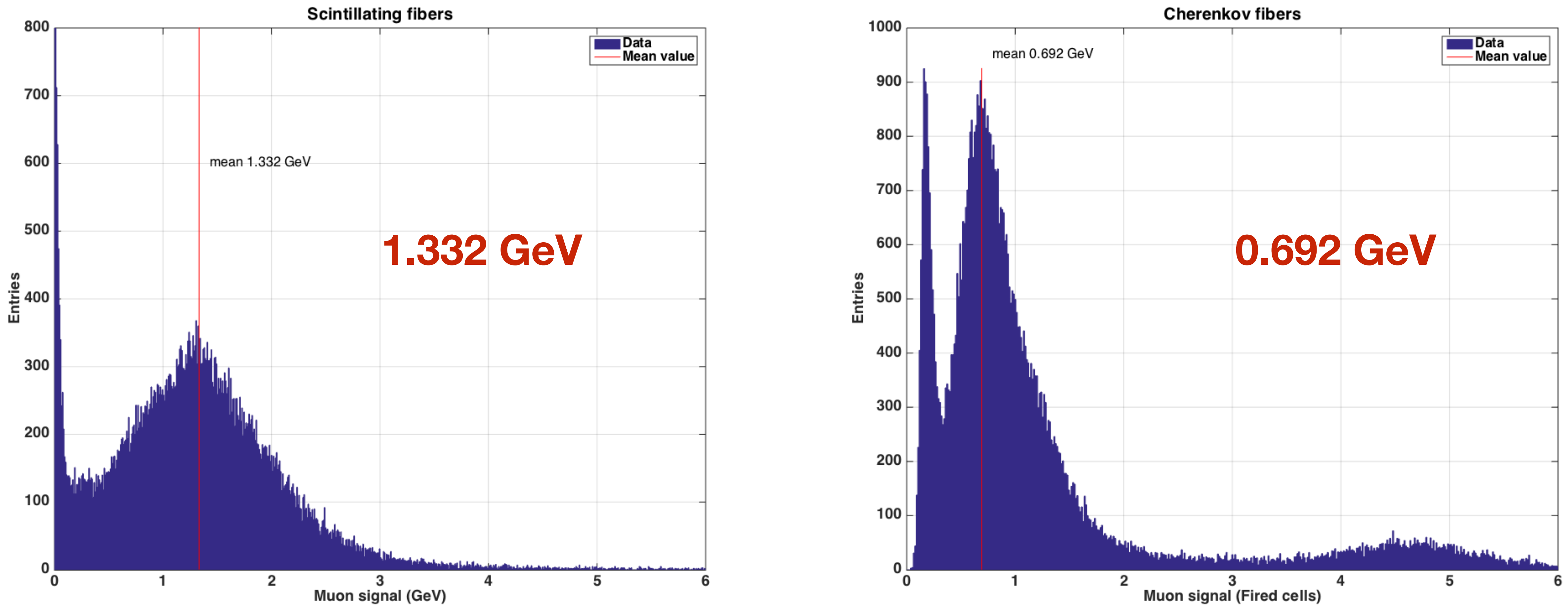
TEST BEAM 2017 FINAL PLOTS

COMO - 17/11/2017

INSUBRIA TEAM

Fig. 9

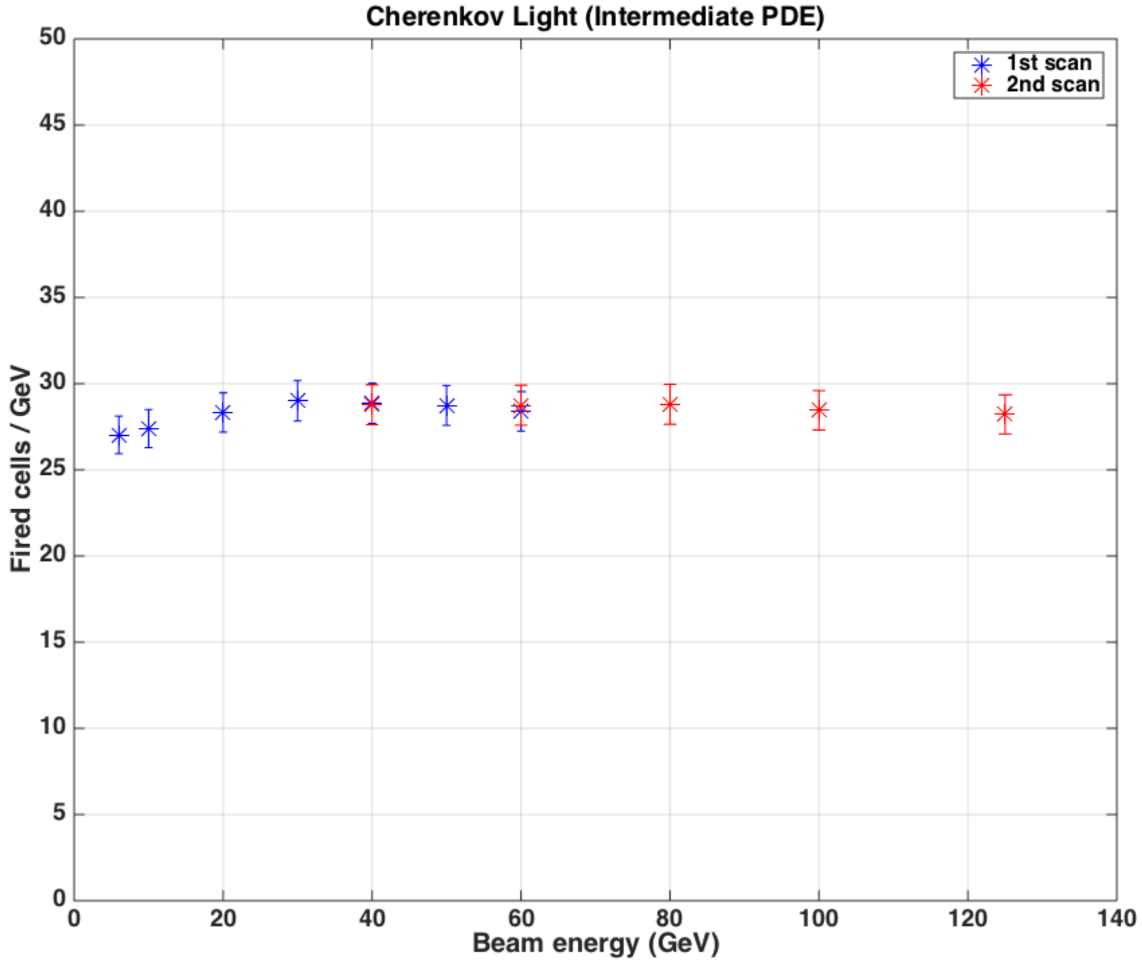
- Fig.9.Scintillation(a) and Cherenkov(b) signal distributions for 125 GeV μ^+ measured in the copper based dual-fiber calorimeter with SiPM readout.



- For Cherenkov energy conversion we used 75 fired cells/GeV
- For Scintillating energy conversion we used 166 fired cells/GeV
- Both histograms are in a txt file

Fig. 10

- Fig.10.The average number of Cherenkov photoelectrons measured in the SiPMs divided by the electron beam energy, as a function of the electron energy. These results were obtained with a bias voltage 1.5 V below the nominal value.



- 1st scan:
  - X=[6 10 20 30 40 50 60]
  - Y=[27.0250 27.3940 28.3270 29.0040 28.8605 28.7354 28.3912]
  - Err=[1.0893 1.1042 1.1418 1.1691 1.1633 1.1583 1.1444]
- 2st scan:
  - X=[40 60 80 100 125]
  - Y=[28.7750 28.7487 28.8022 28.4556 28.2139]
  - Err=[1.1599 1.1588 1.1610 1.1470 1.1373]

Fig. 12a

- Fig. 12. Number of photoelectrons divided by the electron beam energy, as a function of energy, for the signals from the scintillating fibers. The quantum efficiency was deliberately set very low for these measurements (nominal bias voltage minus 5 V). Results are shown separately for the hottest fiber and for the sum of the signals measured by the other 31 scintillating fibers (a). The ratio of these two signals, as a function of the electron beam energy (b).
- hottest:
  - X=[10 20 30 40 50]
  - Y=[37.4880 31.4230 26.9590 23.4240 20.4290]
  - Err=[1.2666 1.0617 0.9109 0.7914 0.6902]
- rest:
  - X=[10 20 30 40 50]
  - Y=[128.9200 123.4470 116.3033 108.9705 99.9214]
  - Err=[4.3654 4.1716 3.9298 3.6829 3.3821]

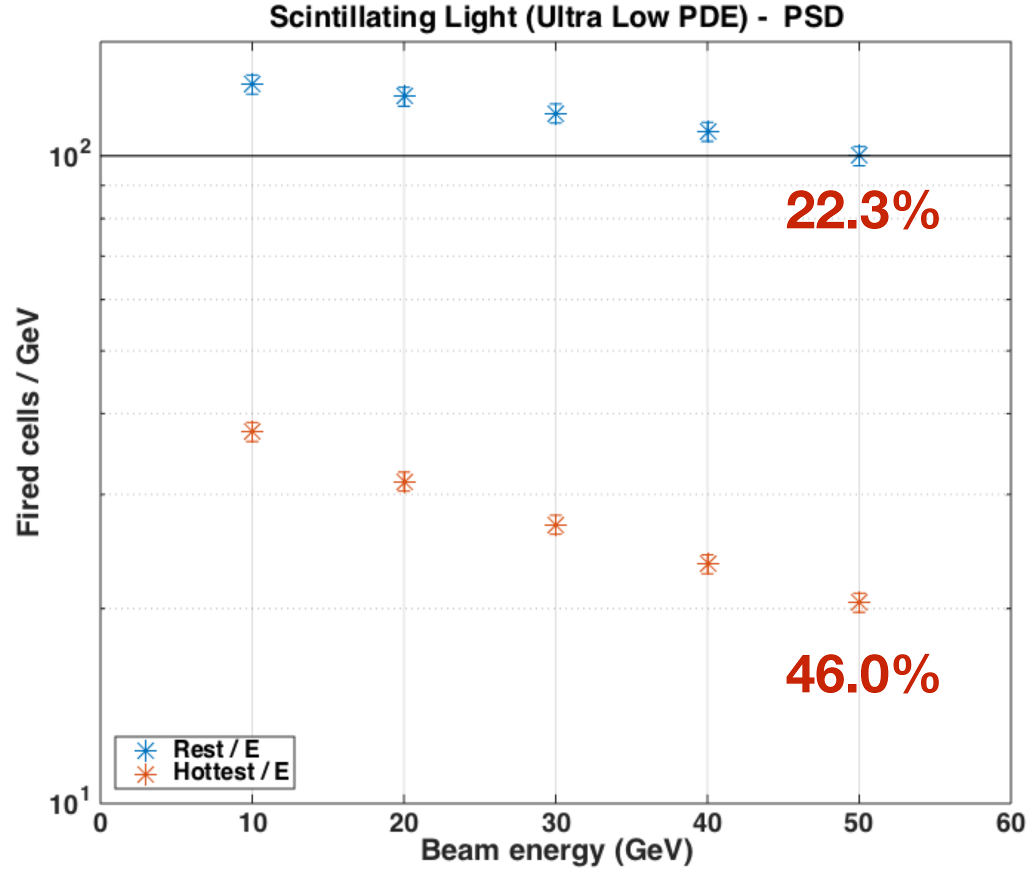
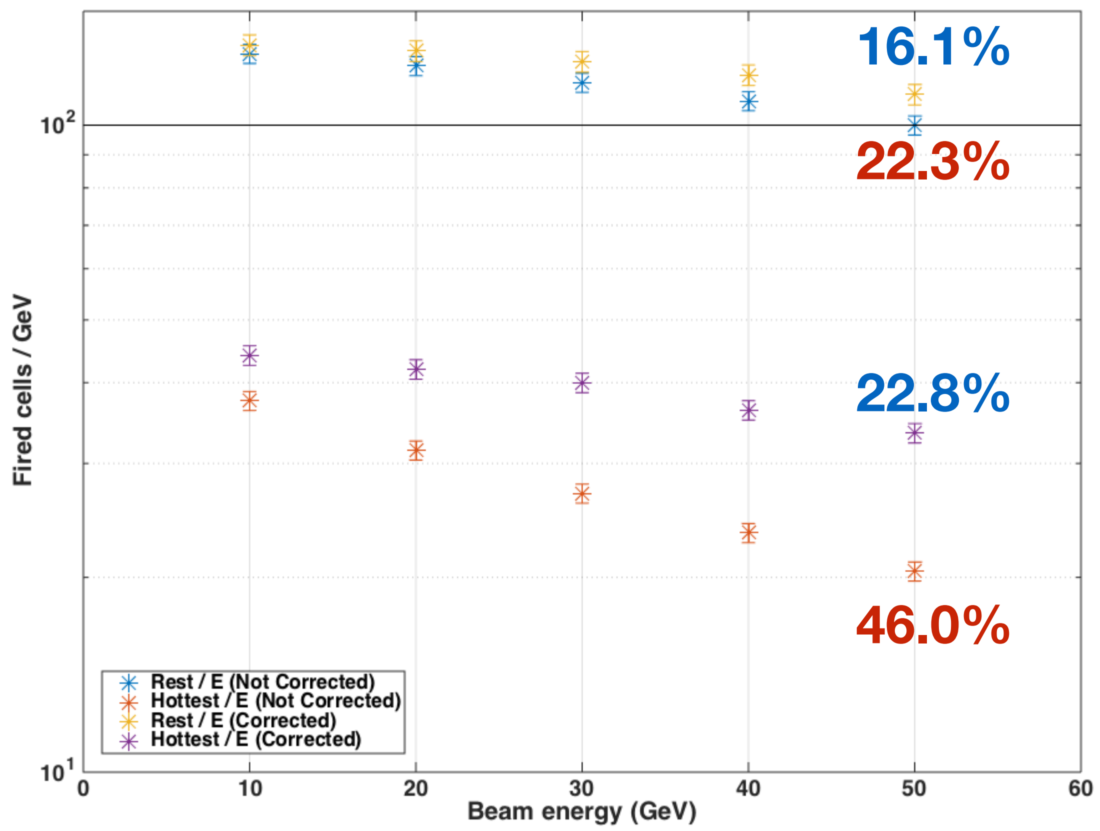


Fig. 12a corrected

- Fig. 12. Number of photoelectrons divided by the electron beam energy, as a function of energy, for the signals from the scintillating fibers. The quantum efficiency was deliberately set very low for these measurements (nominal bias voltage minus 5 V). Results are shown separately for the hottest fiber and for the sum of the signals measured by the other 31 scintillating fibers (a). The ratio of these two signals, as a function of the electron beam energy (b).
- hottest:
  - X=[10 20 30 40 50]
  - Y=[44.0680 41.9465 39.9737 36.2620 33.4184]
  - Err=[1.5315 1.4558 1.3855 1.2539 1.1534]
- rest:
  - X=[10 20 30 40 50]
  - Y=[132.9310 130.1950 125.3560 119.5505 111.5132]
  - Err=[4.9181 4.7941 4.6001 4.3719 4.0602]



- Fig 12b:
  - X=[10 20 30 40 50]
  - Y=[0.2908 0.2545 0.2318 0.2150 0.2045]
  - Err=[0.0139 0.0122 0.0111 0.0103 0.0098]

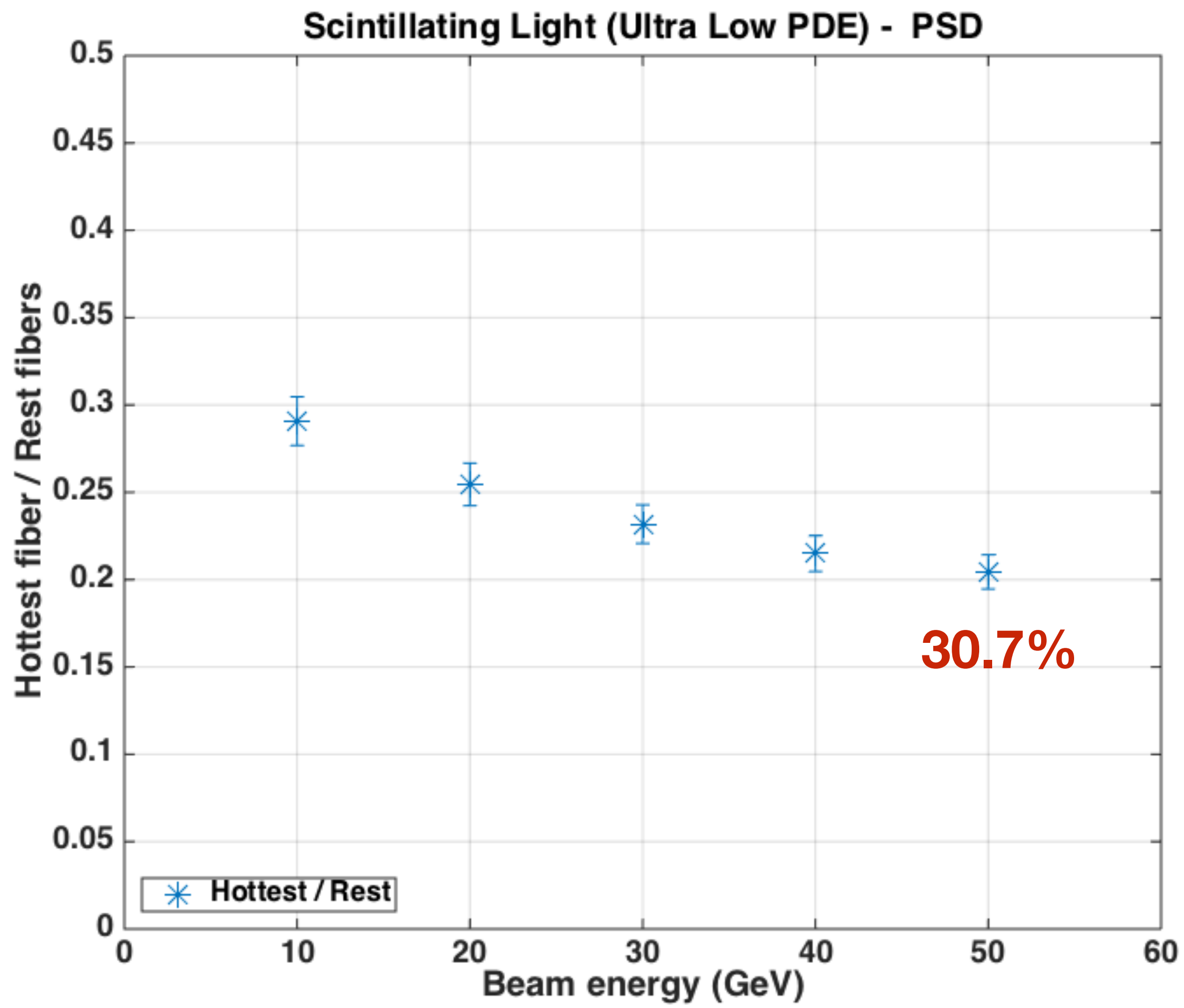


Fig. 12b corrected

- Fig 12b:
  - X=[10 20 30 40 50]
  - Y=[0.3315 0.3222 0.3189 0.3033 0.2997]
  - Err=[0.0168 0.0163 0.0161 0.0153 0.0150]

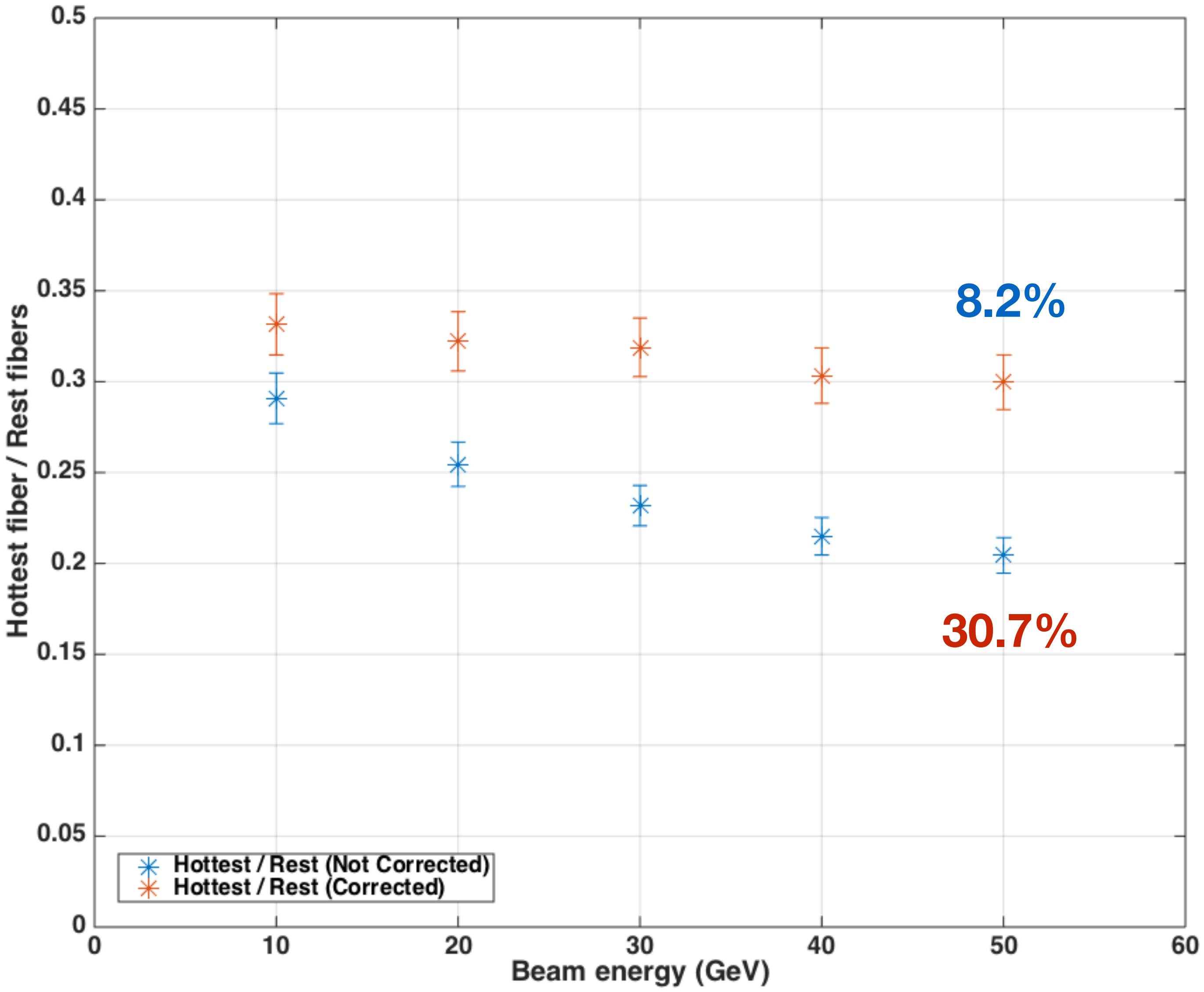
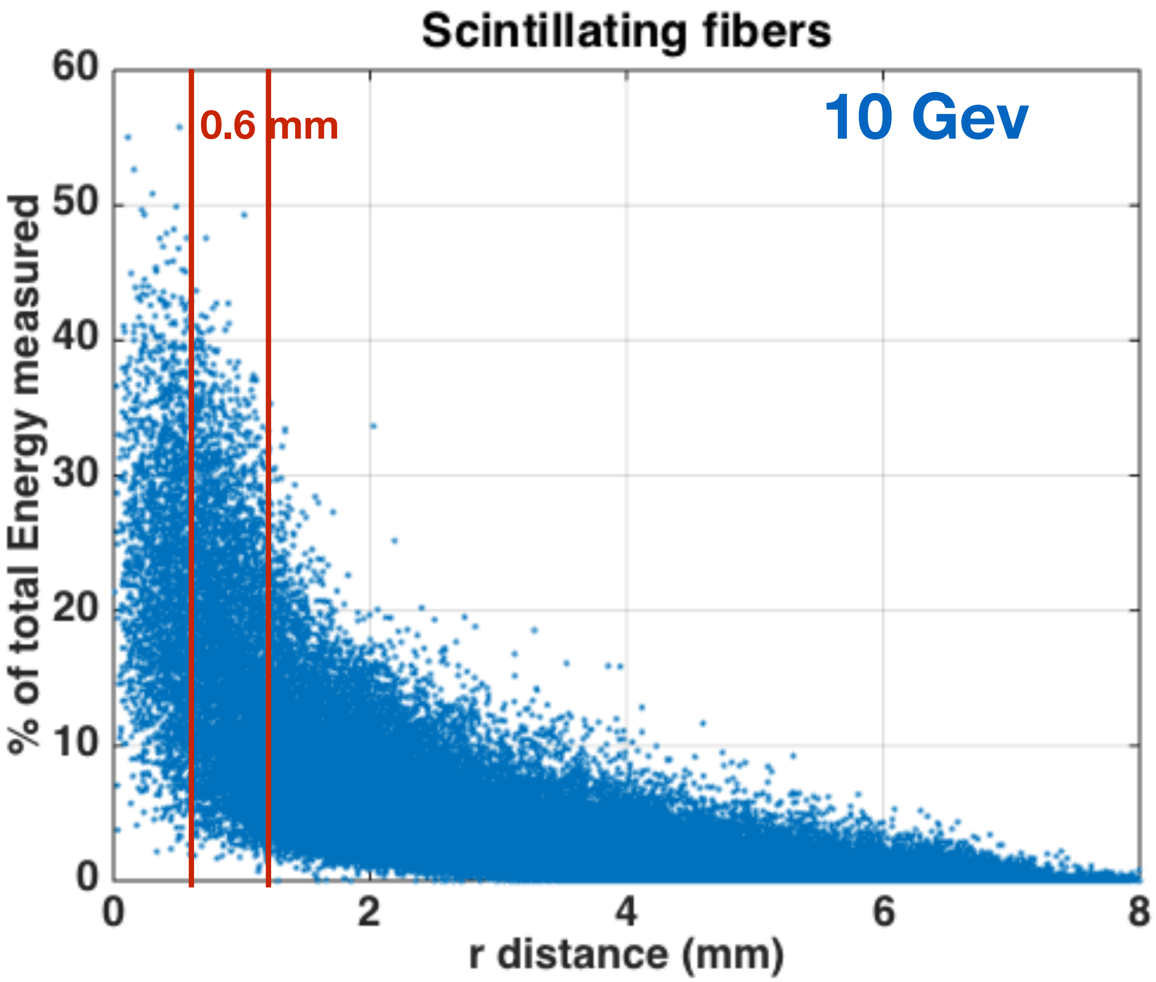


Fig. 13

- 1) **LATERAL profile:** for each event, the signal in a given fiber is plotted as a function of the distance of that fiber to the shower axis (r). All the data are than binned and averaged for each bin (0.6 mm pitch).
- 2) **RADIAL profile:** for each event, the signal in a given fiber is plotted as a function of the distance of that fiber to the shower axis (r). Different radius are defined (0.6; 1.2; 1.8 mm etc from the shower axis). Than the signals from all fibers that have their centers located between 2 different radius are summed. All the sums are averaged.



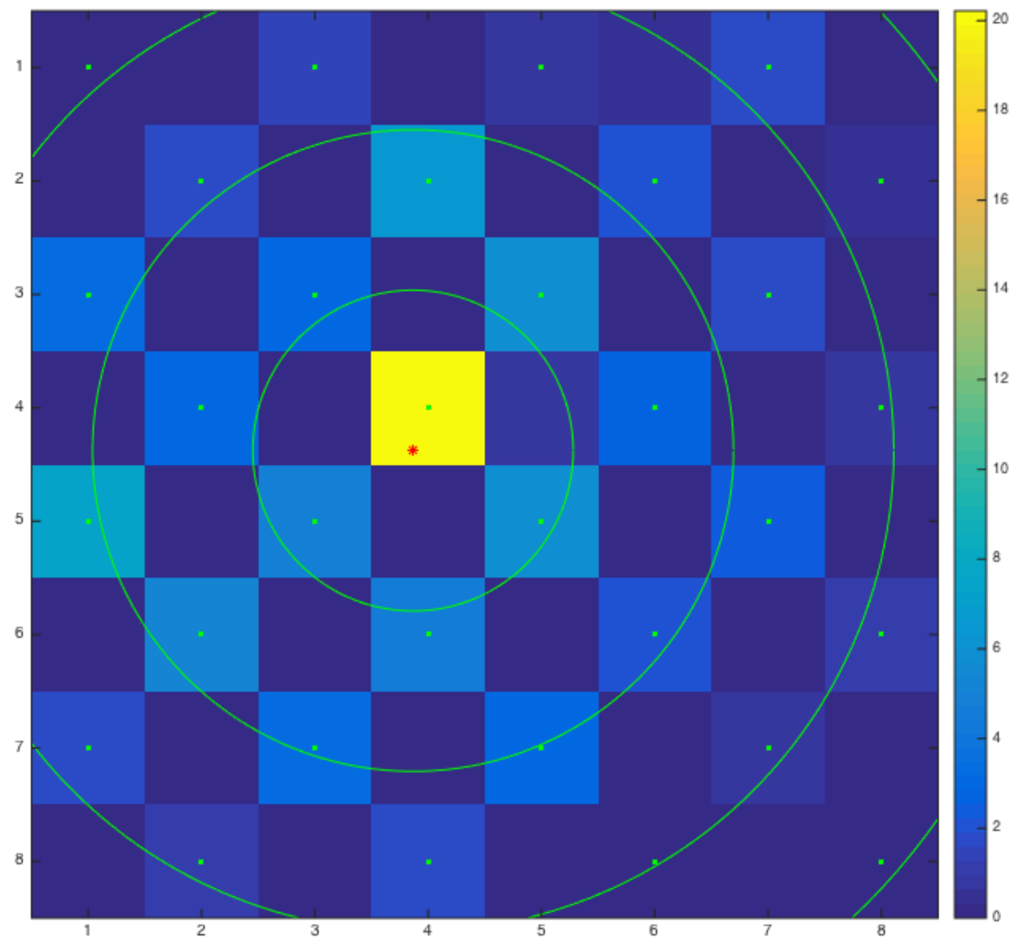


Fig. 13

- Fig. 13. LATERAL profiles of electromagnetic showers in the copper-fiber dual-readout calorimeter, measured separately with the Cherenkov and the scintillation signals (a). The same radial profiles simulated with GEANT4 (b).

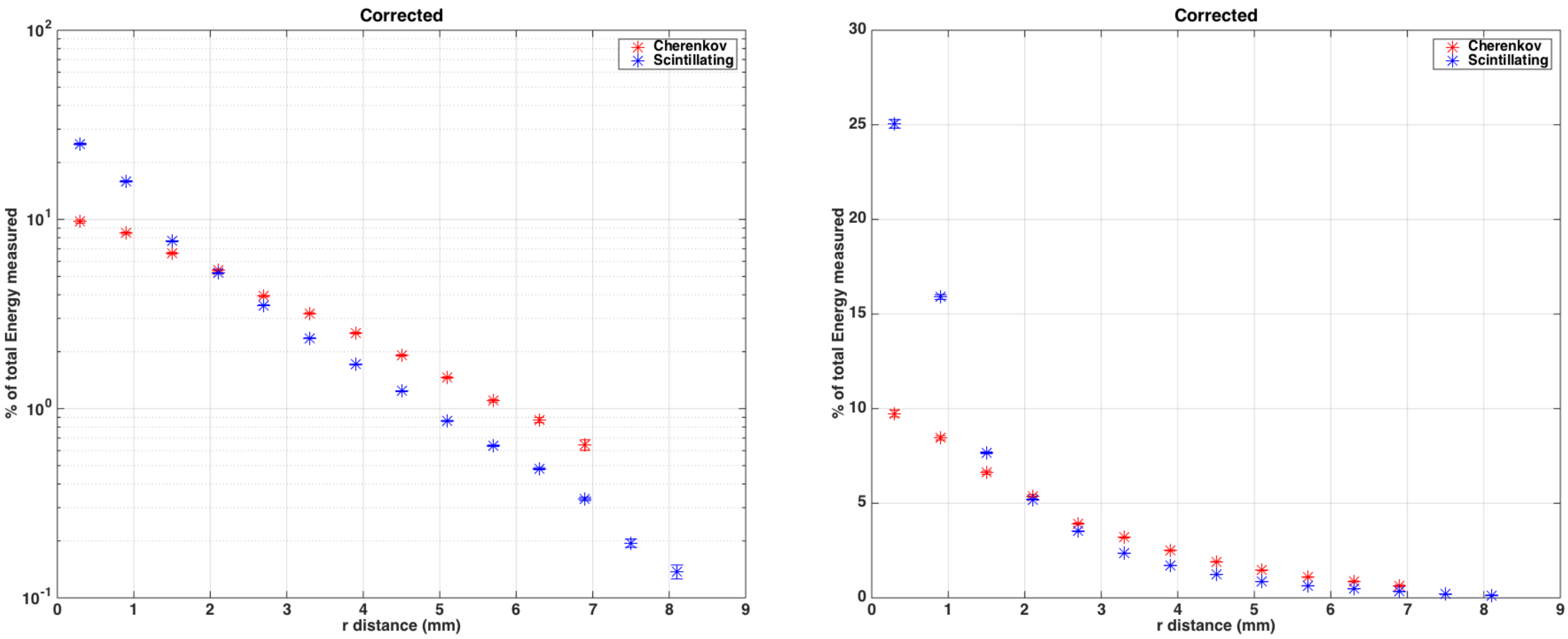


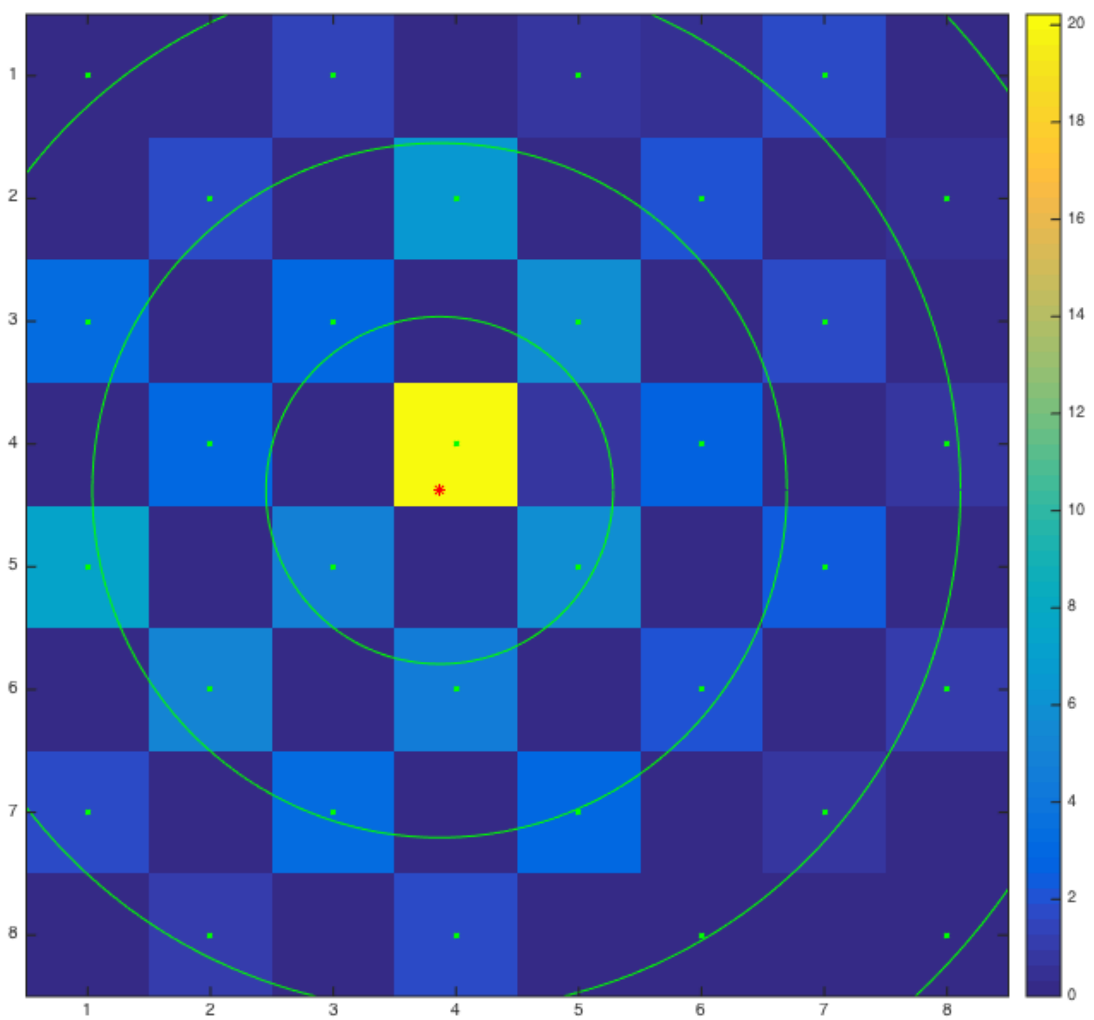
Fig. 13

- Fig. 13. Radial profiles of electromagnetic showers in the copper-fiber dual-readout calorimeter, measured separately with the Cherenkov and the scintillation signals(a). The same radial profiles simulated with GEANT4 (b).

- Cherenkov:
  - X=[0.3 0.9 1.5 2.1 2.7 3.3 3.9 4.5 5.1 5.7 6.3 6.9]
  - Y=[9.7459 8.4564 6.6192 5.3863 3.9270 3.1927 2.5087 1.9110 1.4589 1.1005 0.8706 0.6435]
  - Err=[0.2262 0.1235 0.04426 0.07455 0.0366 0.02846 0.02145 0.01745 0.01505 0.01745 0.02715 0.04148]
- Scintillating:
  - X=[0.3 0.9 1.5 2.1 2.7 3.3 3.9 4.5 5.1 5.7 6.3 6.9 7.5 8.1]
  - Y=[25.0484 15.8978 7.6702 5.2014 3.5196 2.3583 1.7130 1.2369 0.8607 0.6375 0.4821 0.3334 0.1949 0.1376]
  - Err=[0.1834 0.1105 0.08246 0.02362 0.01576 0.00986 0.007463 0.006297 0.005143 0.00542 0.00605 0.006738 0.009727 0.01165]

Fig: 13 - RADIAL Profile

- We sum the contribution of all SiPMs that have the center sitting inside each circumference
- The energy measured in the first circumference is less than in the second one since the chess board structure



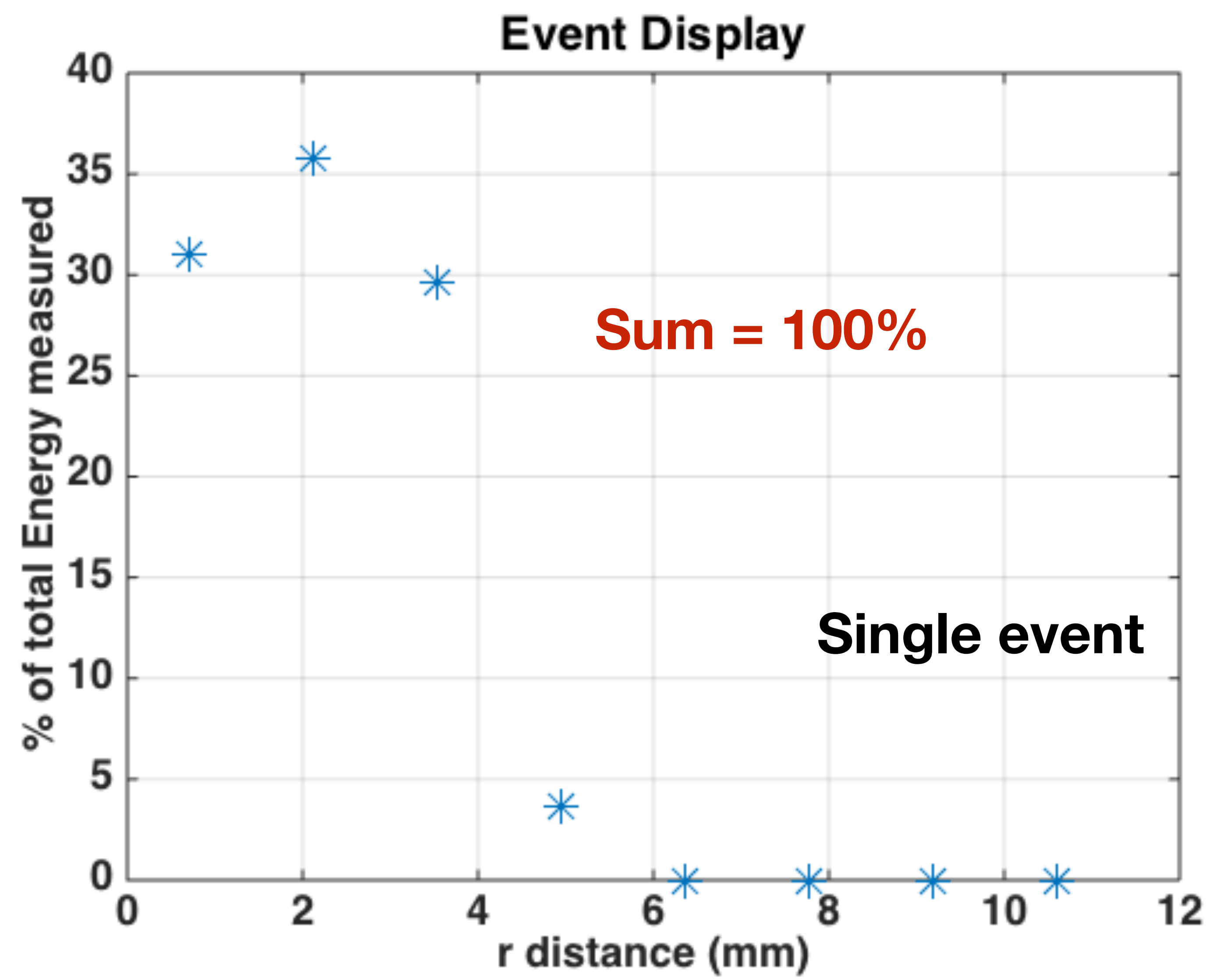
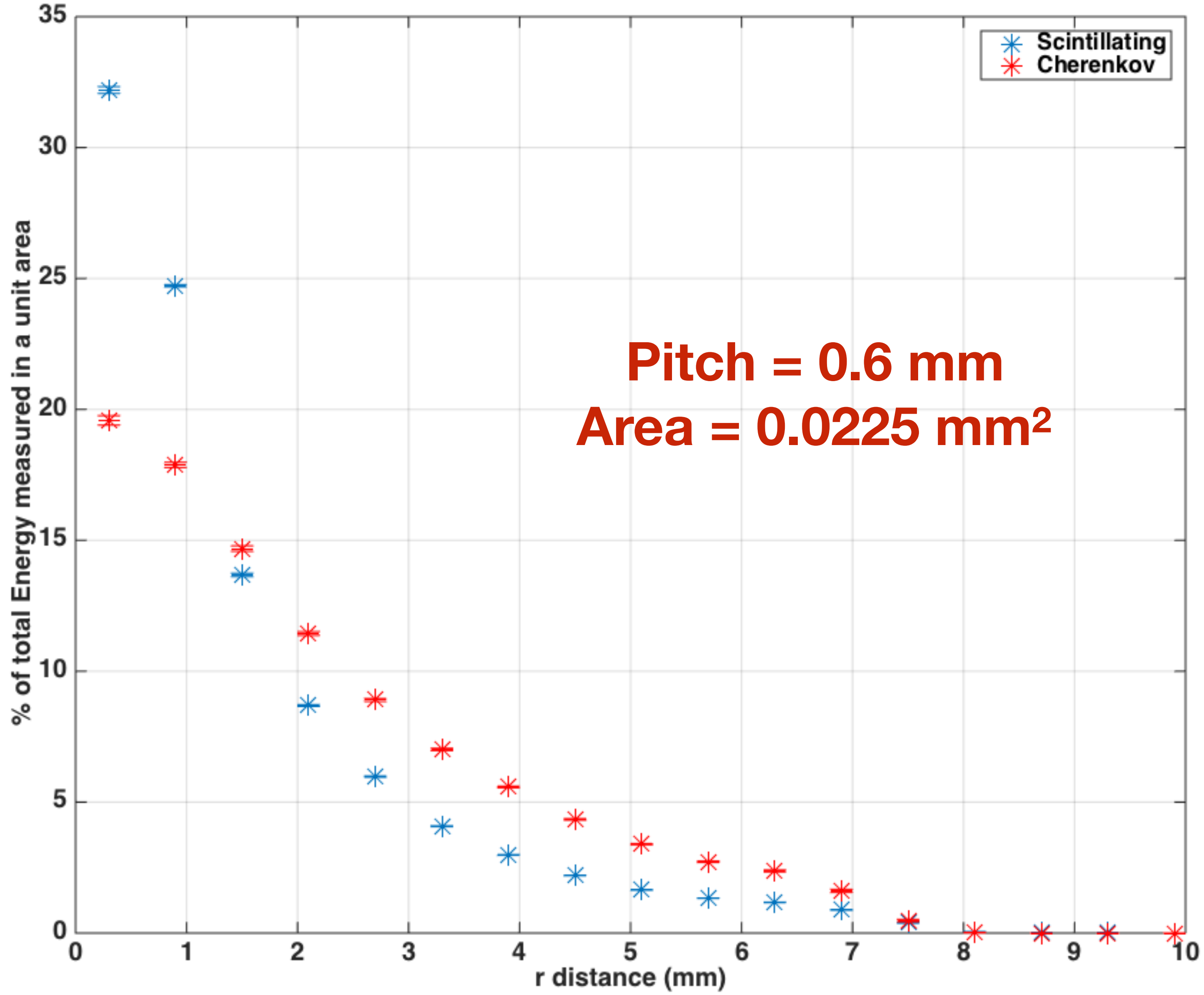


Fig: 13 - RADIAL Profile

- To avoid this problem each SiPM is divided in 64 sub-pixel, each with 1/64 of initial SiPM's value
- We sum all the scintillating sub-pixel that have the center sitting inside each circumference and we divide this value by the number of sub-pixel summed
- This gives the Energy fraction / Area



BACKUP

X-Talk - Scintillating fibers

Extrapolate Energy Values:

- Considering the number of fired cells/GeV ~**166 fired cells** (number taken from the **10 GeV e- with Ultra Low PDE)**
- Extrapolating at **Intermediate PDE** (considering the different PDE):

166*0.2218/0.01733 = **2129.5 fired cells/GeV**

- We get that the released energy is 2823.6/2129.5 = **1.3 GeV**