# EMCal Depth

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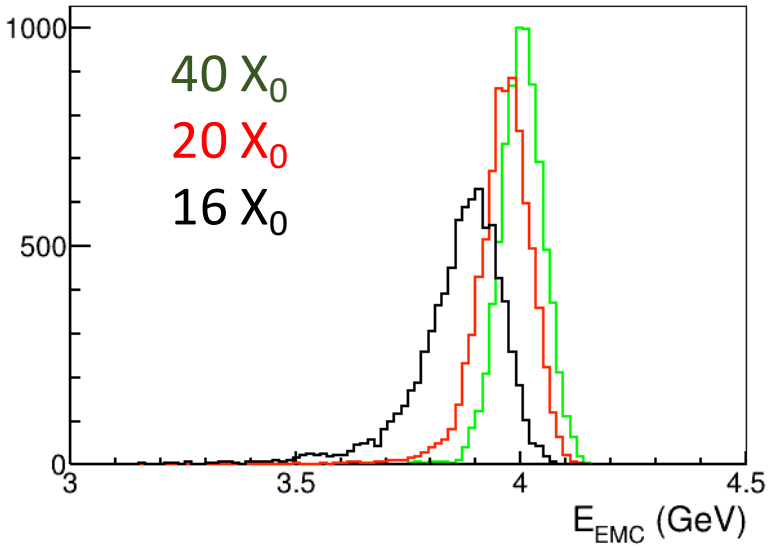
YR-Calorimetry TF Meeting

August 11, 2020

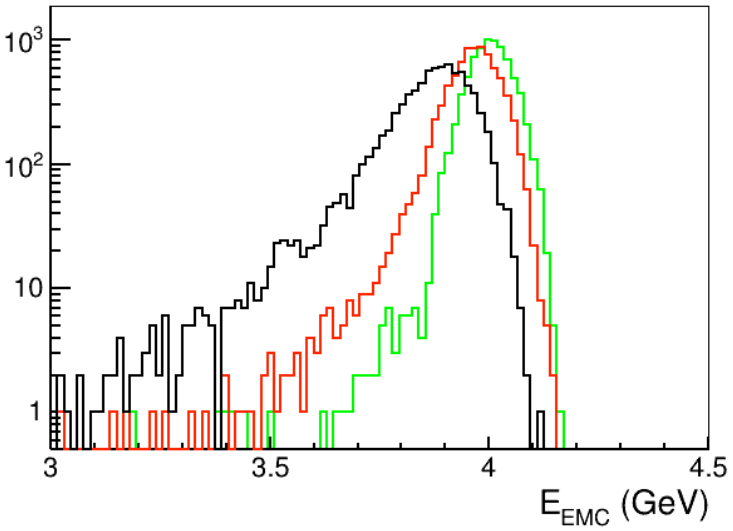
# EMCal response to e

4 GeV/c *e*

Lin.




Log




PWO EMCal:

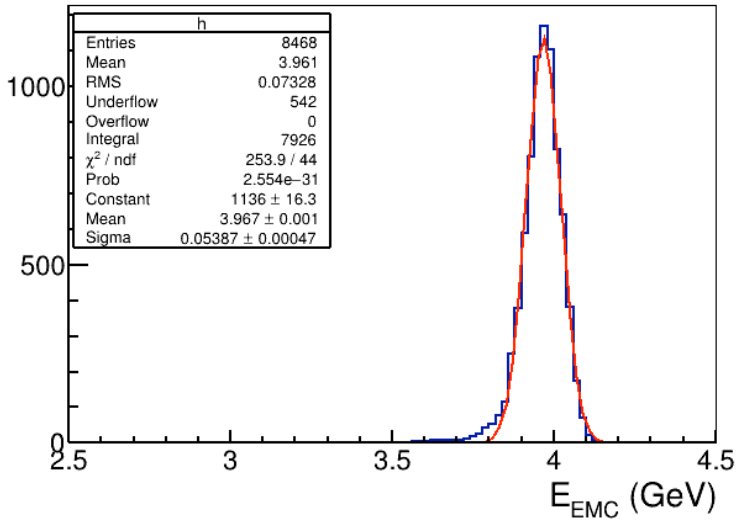
$$\frac{\sigma_E}{E} \sim \frac{2.5\%}{\sqrt{E(GeV)}}$$

# EMCal response: fit to Gaus

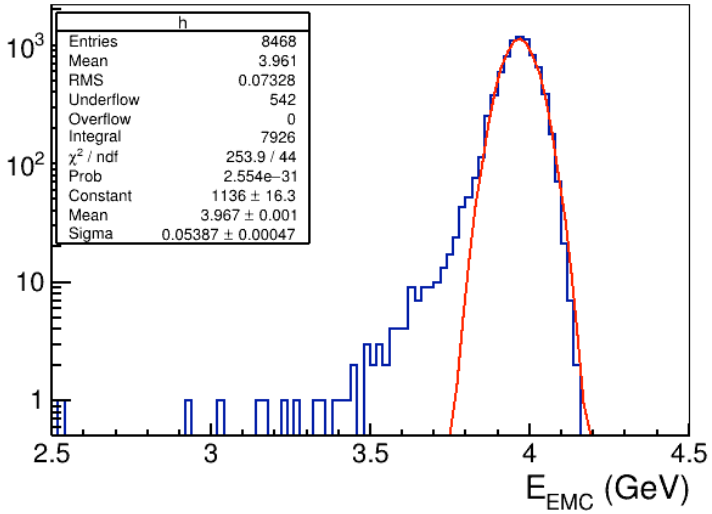
4 GeV/c *e*

20 $X_0$

Lin.



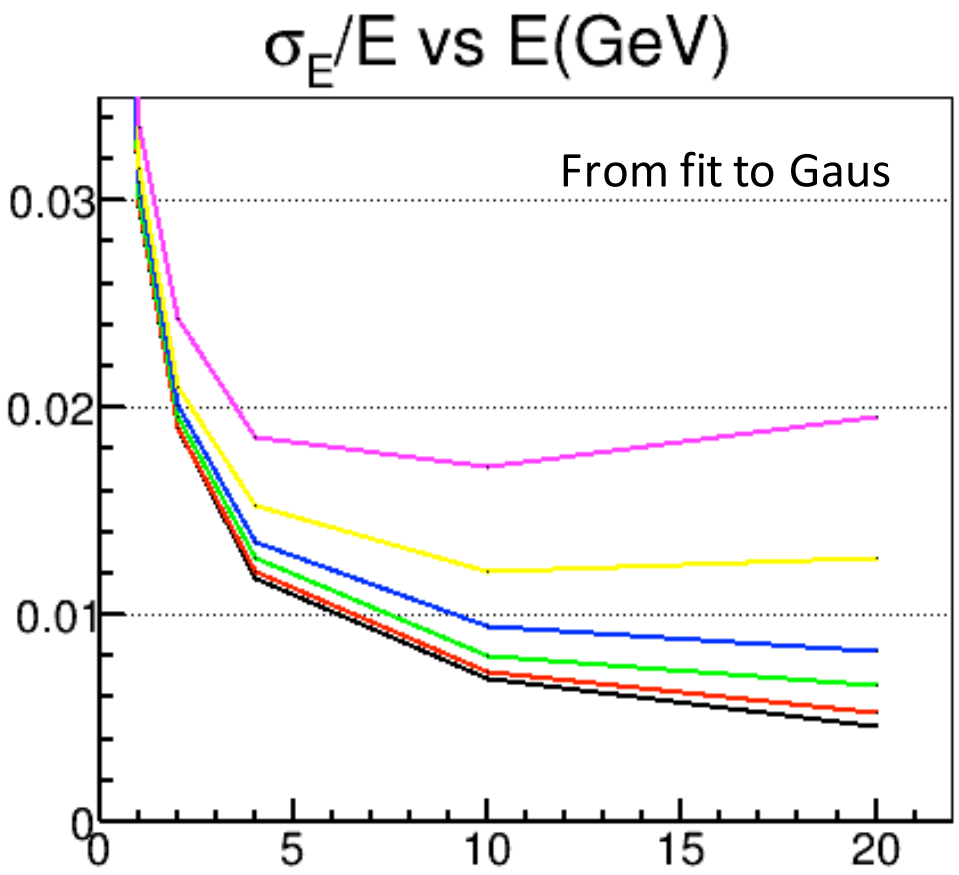

Log




Effect of tails may also be important!

# EMCal resolution vs depth

From Gaus fit




PWO EMCal:

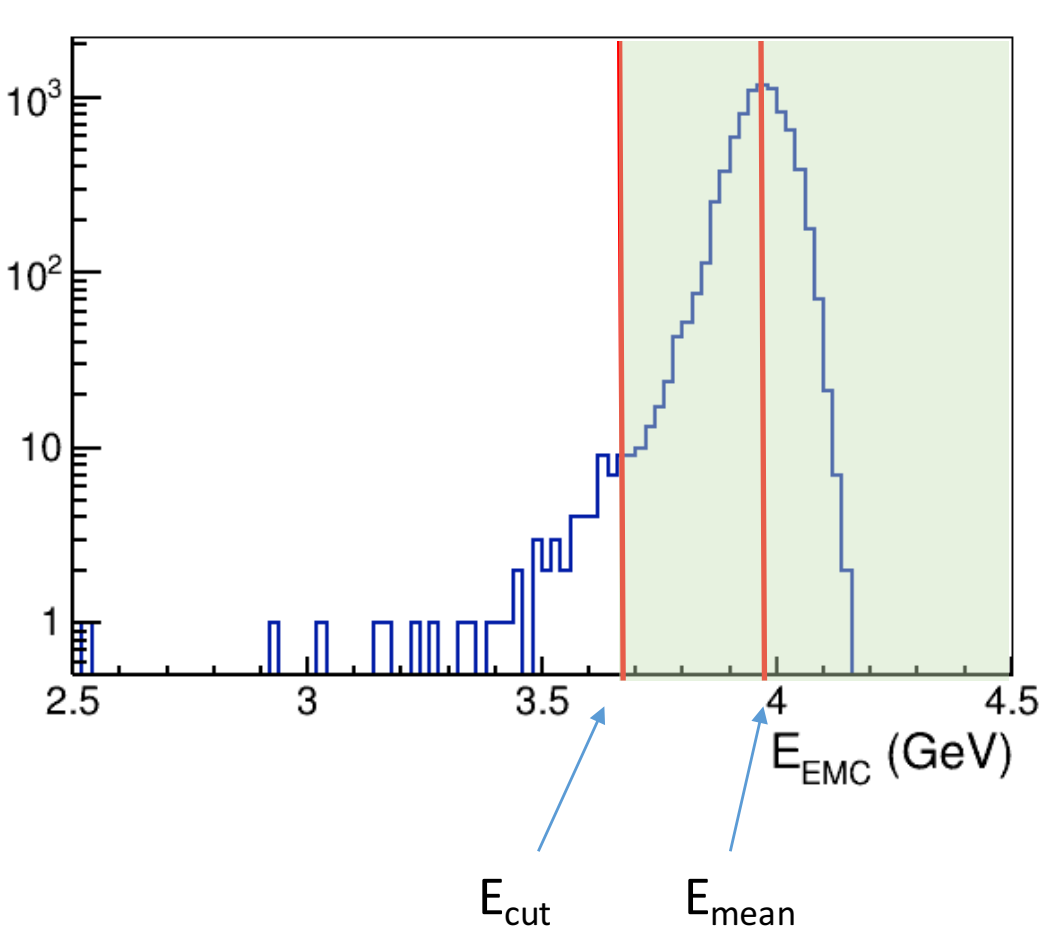
$$\frac{\sigma_E}{E} \sim \frac{2.5\%}{\sqrt{E(GeV)}} \oplus b$$

Depth: b

16 $X_0$
18 $X_0$ : 1.2%
20 $X_0$ : 0.6%
22 $X_0$ : 0.3%
25 $X_0$ : 0.2%
40 $X_0$ : 0.1%

>20 $X_0$ looks “ok”

# Effective Resolution




For a particular cut, e.g. $2\sigma$ cut ($\varepsilon_e \sim 98\%$):

Define $E_{cut}$ for which $N(E>E_{cut})=98\%$

$\sigma_{eff} = (E_{mean} - E_{cut})/2$

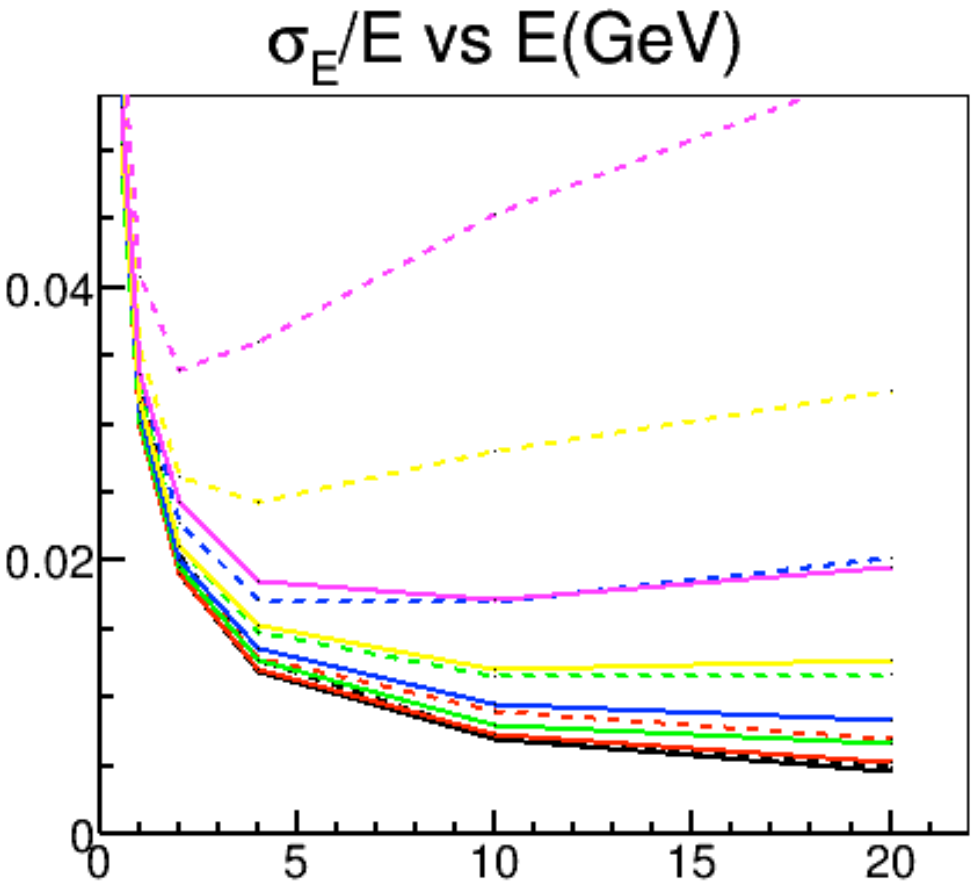
For Gaussian shape:

$\sigma_{eff} = \sigma_{Gaus\_fit}$

Tails lead to:

$\sigma_{eff} > \sigma_{Gaus\_fit}$

# Effective resolution vs depth




Solid: from fit to Gaus
Dashed: Effective (for $\varepsilon_e$=95%)

PWO EMCal:

$$\frac{\sigma_E}{E} \sim \frac{2.5\%}{\sqrt{E\,(GeV)}} \oplus b$$

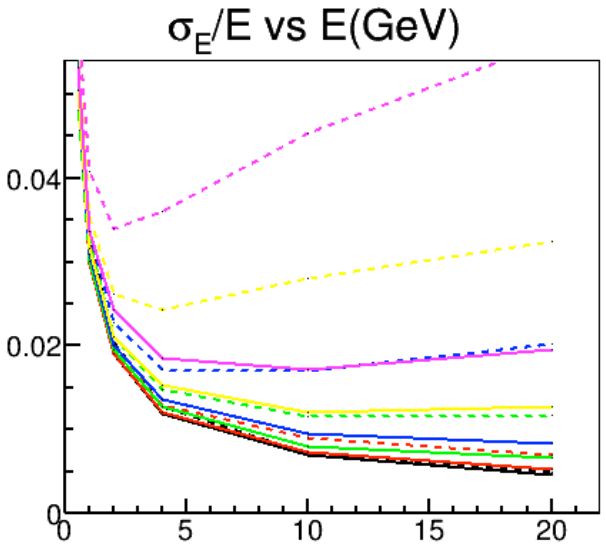
| Depth: | b | $b_{eff}$ |
|---|---|---|
| 16 $X_0$ | | |
| 18 $X_0$ : | 1.2% | |
| 20 $X_0$ : | 0.6% | |
| 22 $X_0$ : | 0.3% | 1.0% |
| 25 $X_0$ : | 0.2% | 0.4% |
| 40 $X_0$ : | 0.1% | 0.1% |

>22 $X_0$ looks “ok”

# Different EMCals

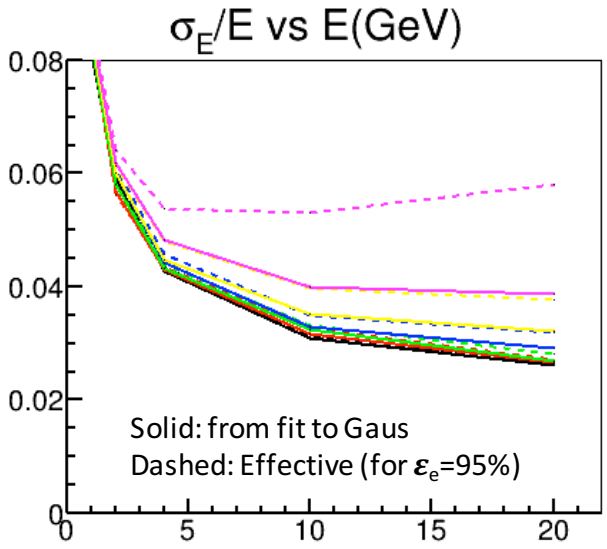
16 $X_0$
18 $X_0$
20 $X_0$
22 $X_0$
25 $X_0$
40 $X_0$

$$\frac{\sigma_E}{E} \sim \frac{2.5\%}{\sqrt{E(GeV)}} \oplus 1\%$$



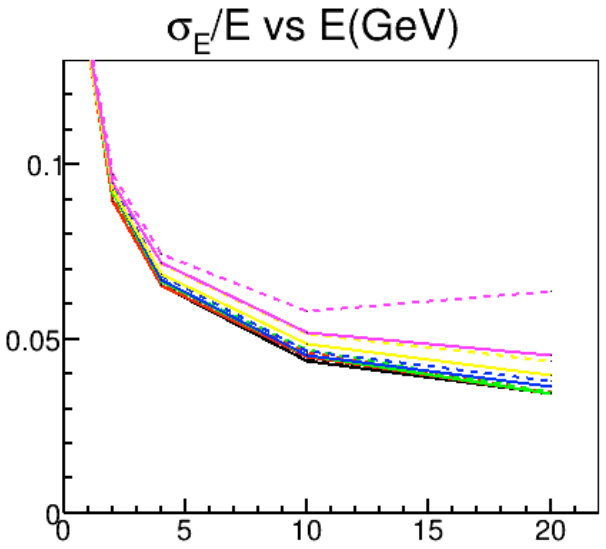

>22 $X_0$ looks “ok”

$$\frac{\sigma_E}{E} \sim \frac{7\%}{\sqrt{E(GeV)}} \oplus 2\%$$



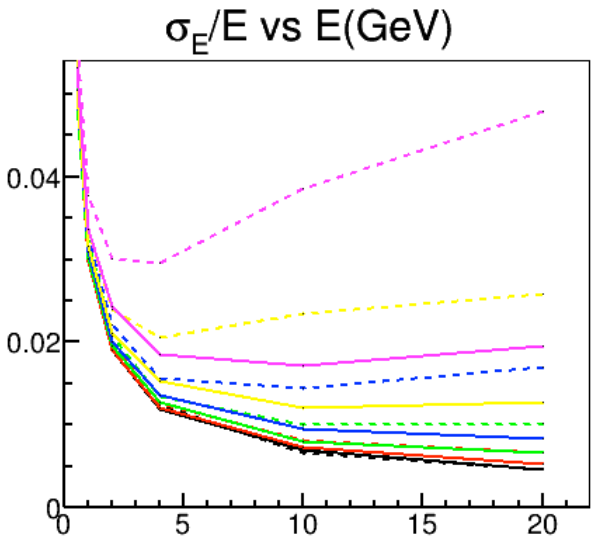

>20 $X_0$ looks “ok”

$$\frac{\sigma_E}{E} \sim \frac{12\%}{\sqrt{E(GeV)}} \oplus 2\%$$

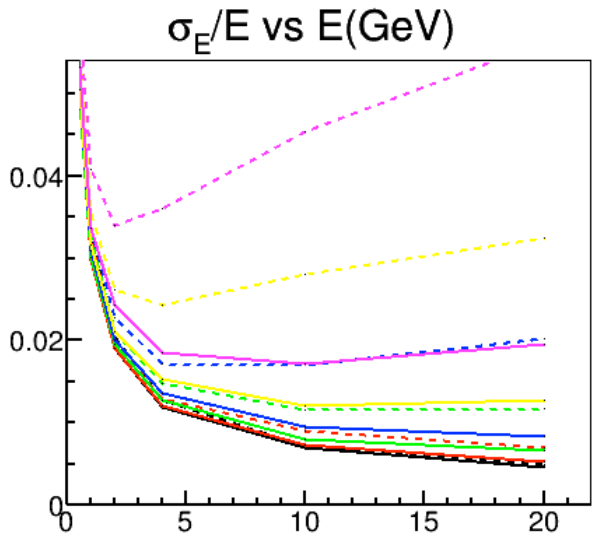



>18 $X_0$ looks “ok”

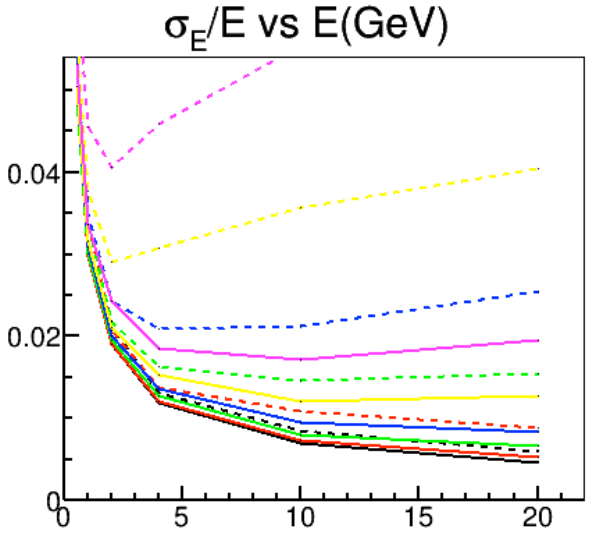
# Backup




Solid: from fit to Gaus
Dashed: Effective (for $\boldsymbol{\varepsilon_e}$**=90%)**

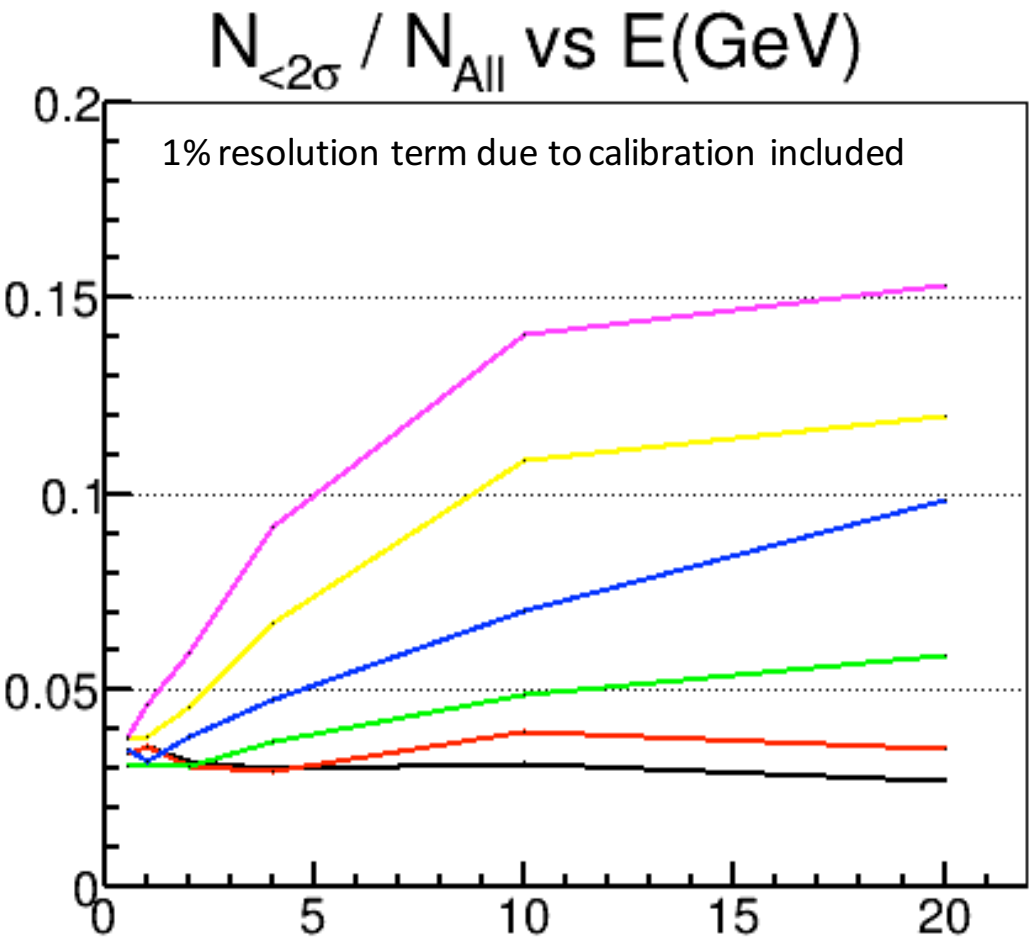



Solid: from fit to Gaus
Dashed: Effective (for $\boldsymbol{\varepsilon_e}$**=95%)**

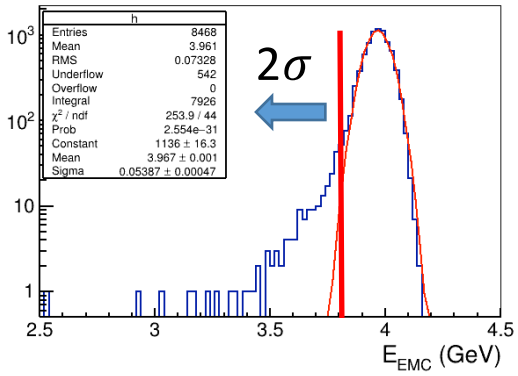



Solid: from fit to Gaus
Dashed: Effective (for $\boldsymbol{\varepsilon_e}$**=98%)**

# Quantifying the tail




N(<2$\sigma$)/N(ALL) = 0.023 for pure Gaussian shape




Depth: b

16 $X_0$
18 $X_0$ : 1.2%
20 $X_0$ : 0.6%
22 $X_0$ : 0.3%
25 $X_0$ : 0.2%
40 $X_0$ : 0.1%

At least 22 $X_0$ required