Test Beam 2024
Electron beam analysis

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Keeping up with Giacomo's proposal of using the (TS11-TS15)/(TS11+TS15) "asymmetry" variable to try correcting for response dishomogeneity of DRAGO towers.

For both S and C channels, fit a 5 degree polynomial to this new variable distribution. The obtained function can now be used to correct for this geometrical effect by exploiting calorimeter information.

Some other studies were done using the partial barycenter information
BarY = (T00 - 28.3*TS11 + 28.3*TS15)/(T00 + 28.3*T11 + 28.3*T15)

With the fS fitted function, the corrected S(C) energy is given by
E_S = S / fS

S Energy profile over Asymmetry 40GeV
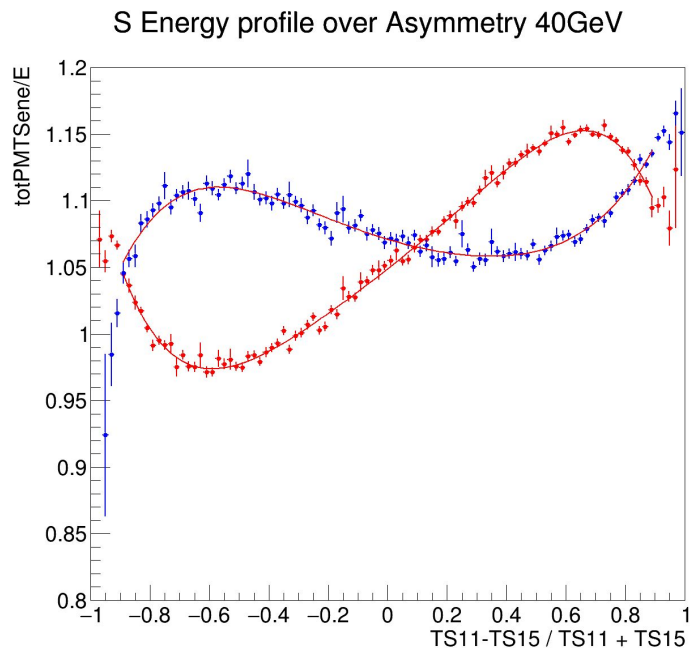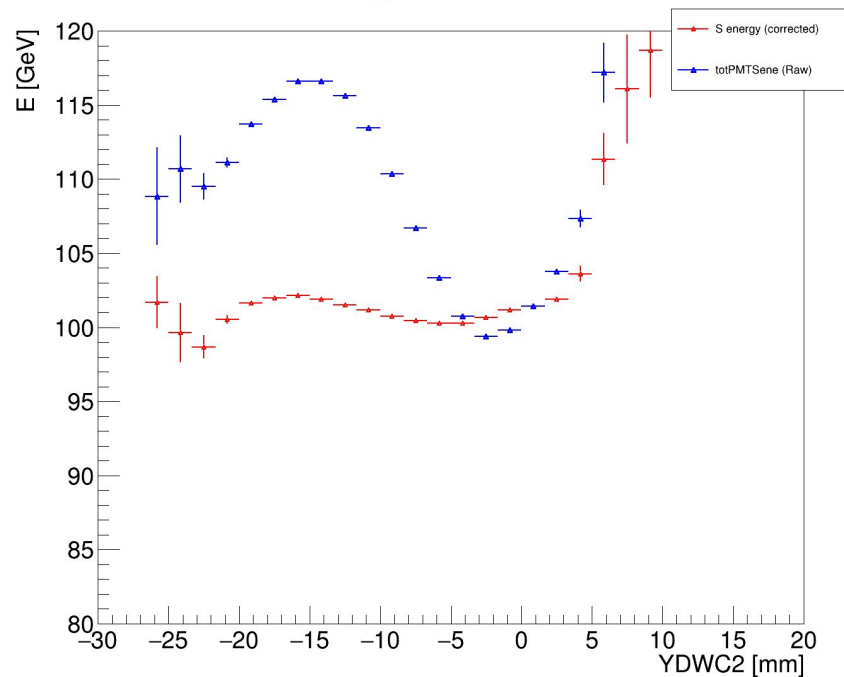
Comparing total PMT energy in S channel with the corrected one. Slightly better behaviour at higher energy but still an improvement
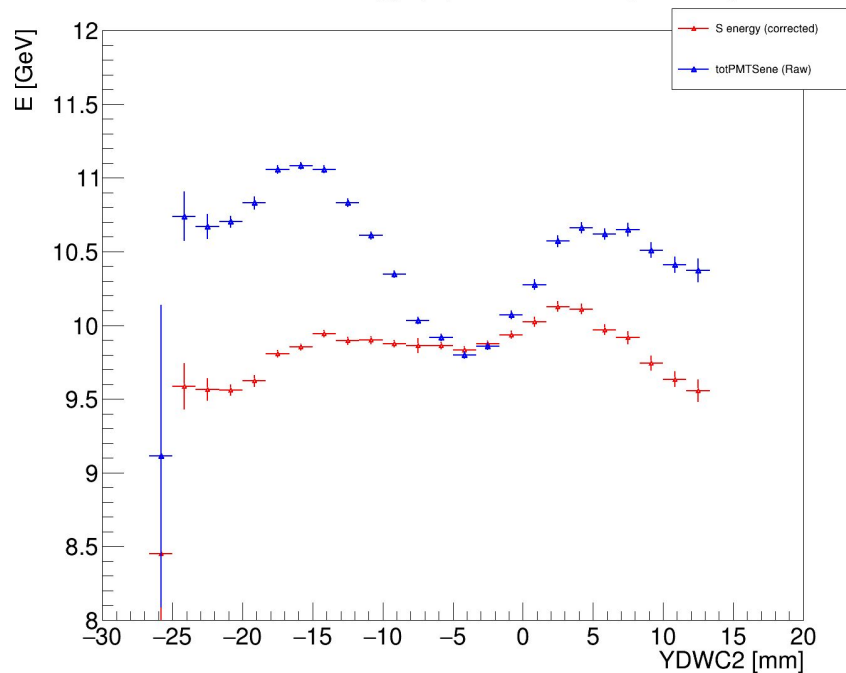
Same plot, but C channel

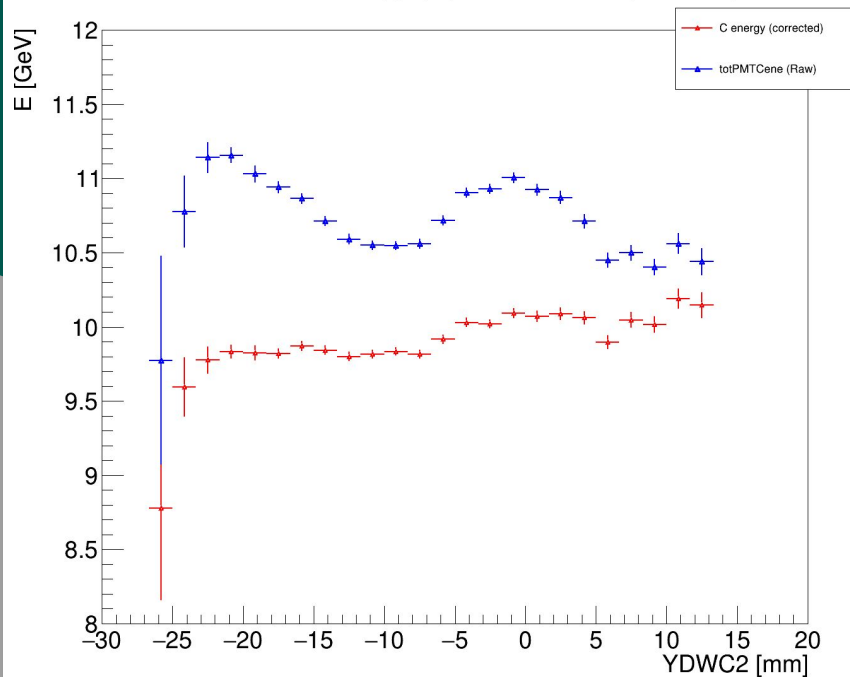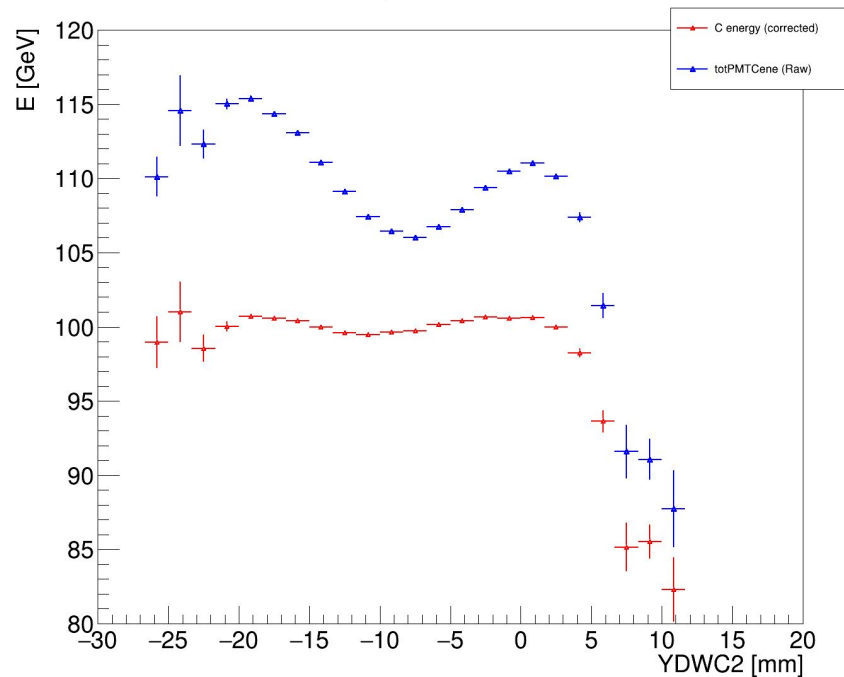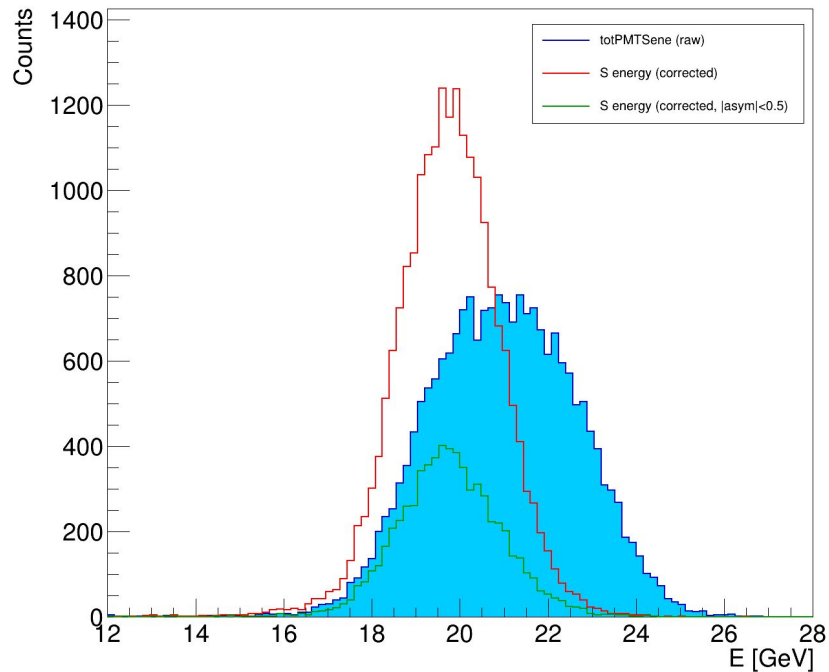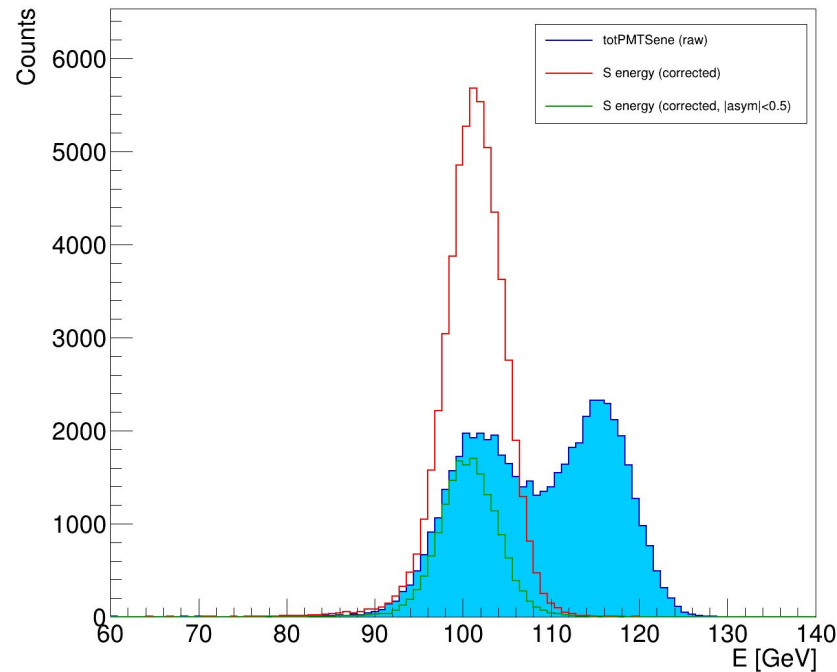Comparing energy distribution before correction (full light blue), after correction (red line), and after imposing a further cut on the asym variable (green line) abs(asym) < 0.5, meaning particles hitting mostly T00 tower
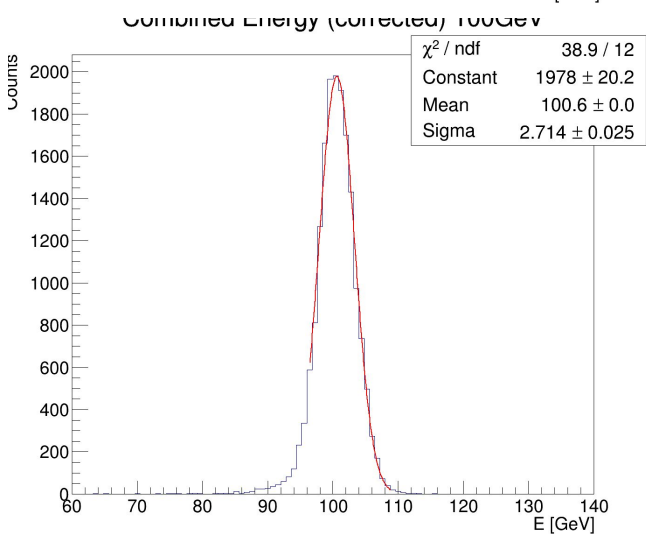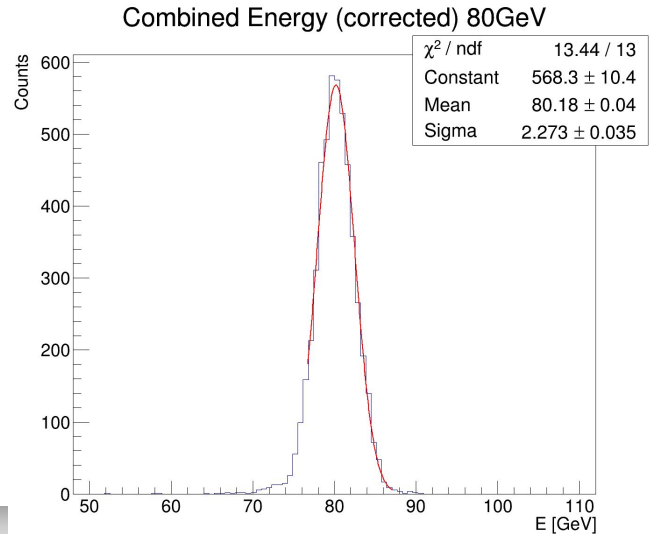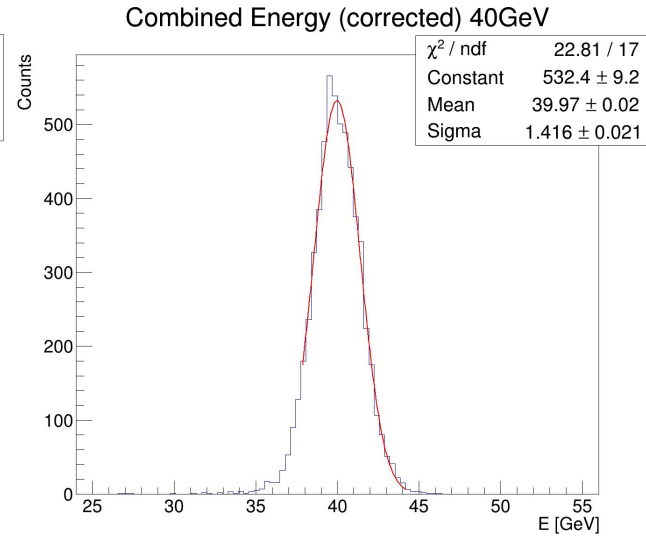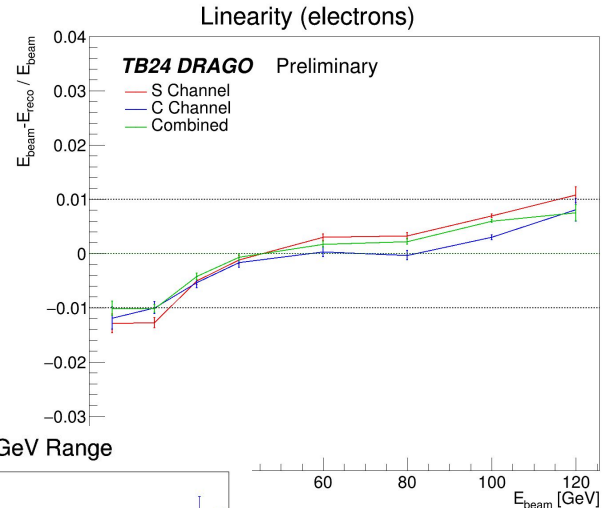
To get resolution, fit a first gaussian on the energy histogram, and then a second gaussian between (-1.5*σ, +3*σ) for cleaning low energy tail

Tried to get parametrisation at several energy point to check differences in the result

40 GeV:

Linearity (electrons)

Electron Resolution in [10, 120] GeV Range

S Channel: $\dfrac{\sigma(E)}{E} = \dfrac{20.92\%}{\sqrt{E}} + 1.03\%$

C Channel: $\dfrac{\sigma(E)}{E} = \dfrac{23.56\%}{\sqrt{E}} + 1.65\%$

Combined: $\dfrac{\sigma(E)}{E} = \dfrac{15.71\%}{\sqrt{E}} + 1.12\%$

Electron QuadResolution in [10, 120] GeV Range

S Channel: $\dfrac{\sigma(E)}{E} = \dfrac{23.83\%}{\sqrt{E}} \oplus 2.05\%$

C Channel: $\dfrac{\sigma(E)}{E} = \dfrac{28.12\%}{\sqrt{E}} \oplus 2.9\%$

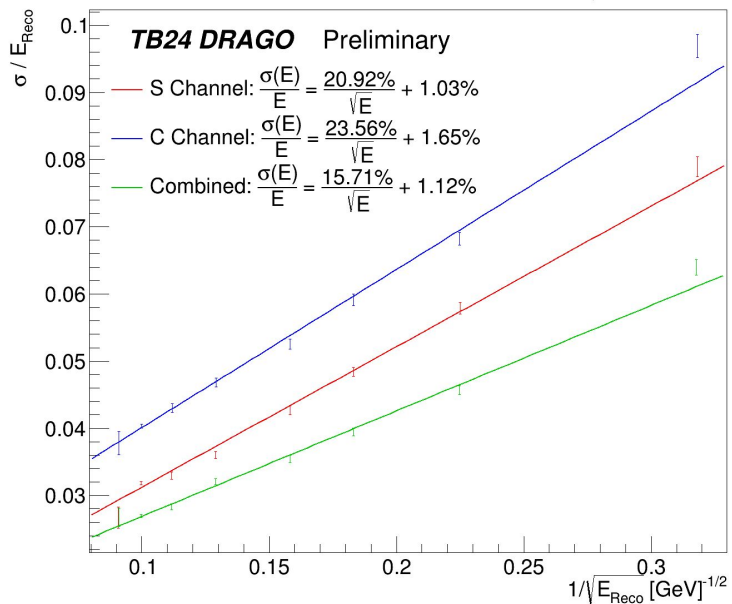Combined: $\dfrac{\sigma(E)}{E} = \dfrac{18.77\%}{\sqrt{E}} \oplus 1.95\%$

Linearity (electrons)

Tried to get parametrisation at several energy point to check differences in the result

20 GeV:

Electron Resolution in [10, 120] GeV Range

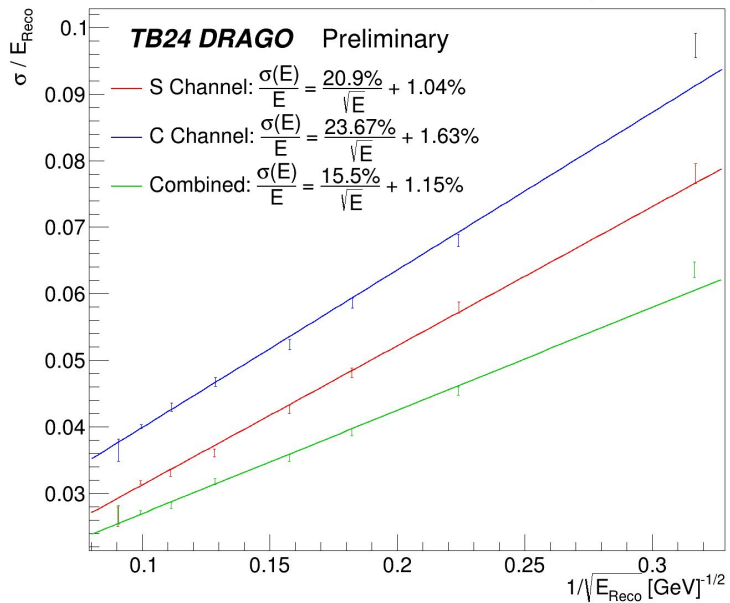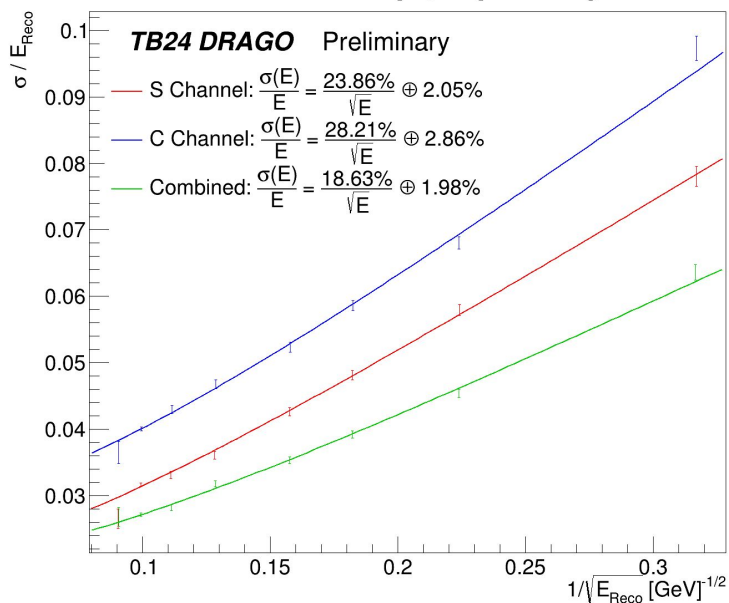**TB24 DRAGO** Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{20.9\%}{\sqrt{E}} + 1.04\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{23.67\%}{\sqrt{E}} + 1.63\%$

Combined: $\frac{\sigma(E)}{E} = \frac{15.5\%}{\sqrt{E}} + 1.15\%$

Electron QuadResolution in [10, 120] GeV Range

TB24 DRAGO Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{23.86\%}{\sqrt{E}} \oplus 2.05\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{28.21\%}{\sqrt{E}} \oplus 2.86\%$

Combined: $\frac{\sigma(E)}{E} = \frac{18.63\%}{\sqrt{E}} \oplus 1.98\%$

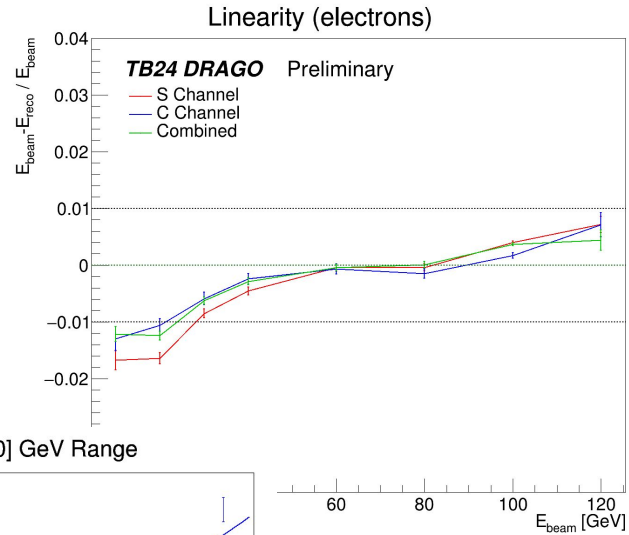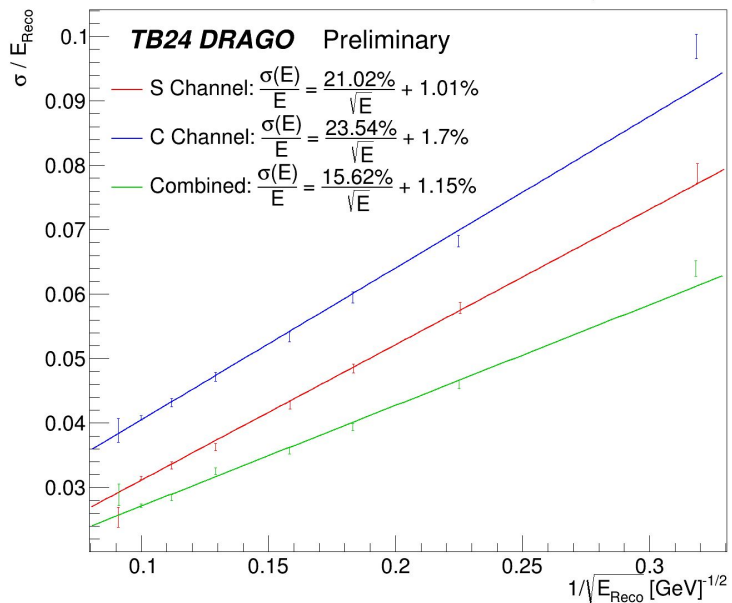Tried to get parametrisation at several energy point to check differences in the result

80 GeV:

Linearity (electrons)

Electron Resolution in [10, 120] GeV Range

TB24 DRAGO Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{21.02\%}{\sqrt{E}} + 1.01\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{23.54\%}{\sqrt{E}} + 1.7\%$

Combined: $\frac{\sigma(E)}{E} = \frac{15.62\%}{\sqrt{E}} + 1.15\%$

Electron QuadResolution in [10, 120] GeV Range

TB24 DRAGO Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{23.91\%}{\sqrt{E}} \oplus 2.02\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{28.22\%}{\sqrt{E}} \oplus 2.95\%$

Combined: $\frac{\sigma(E)}{E} = \frac{18.76\%}{\sqrt{E}} \oplus 1.99\%$

Tried to get parametrisation at several energy point to check differences in the result

100 GeV:

Linearity (electrons)
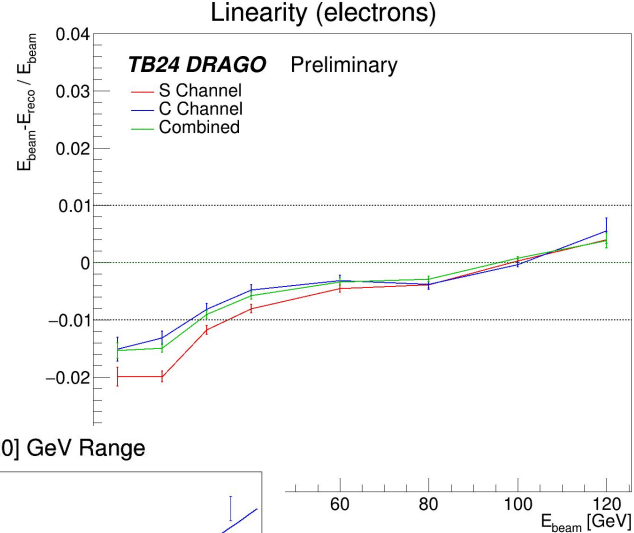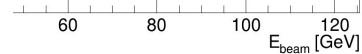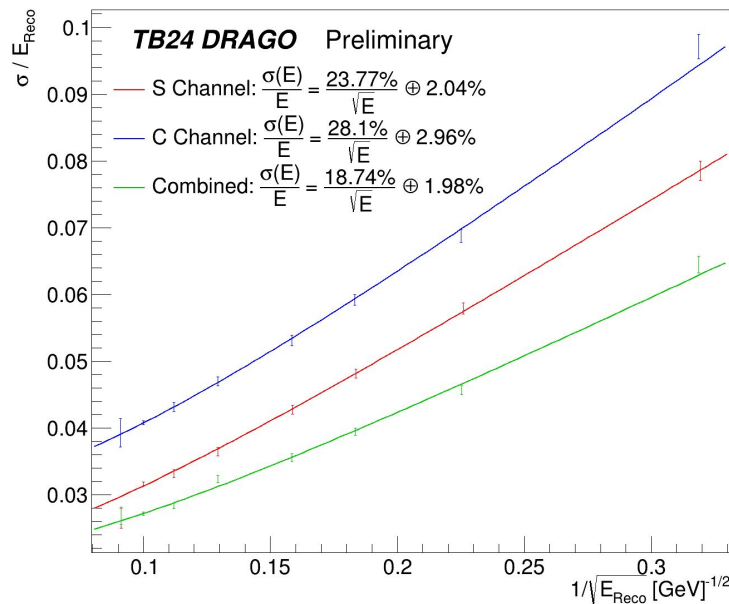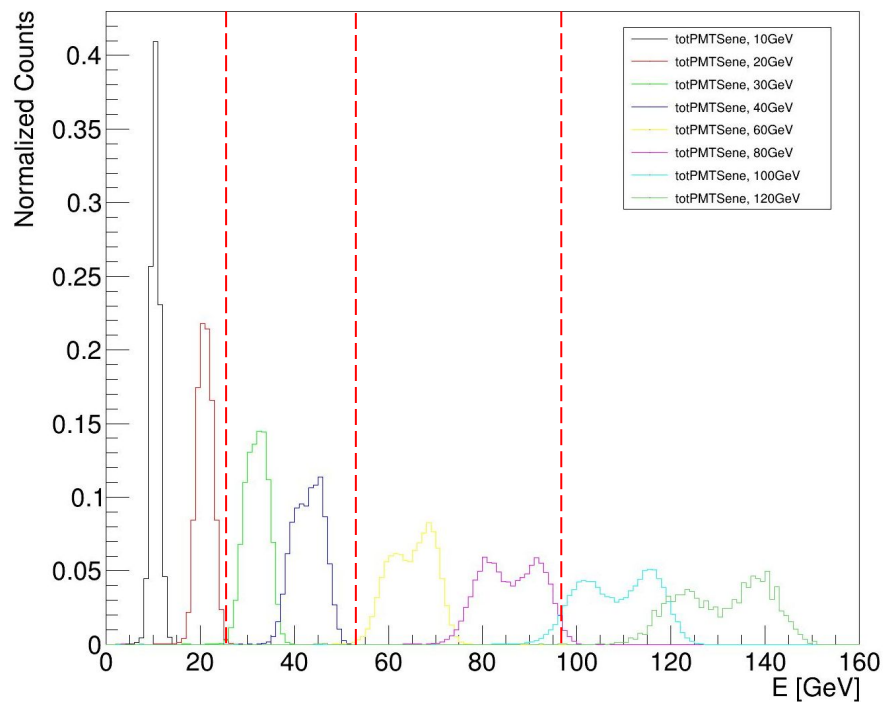

Electron Resolution in [10, 120] GeV Range
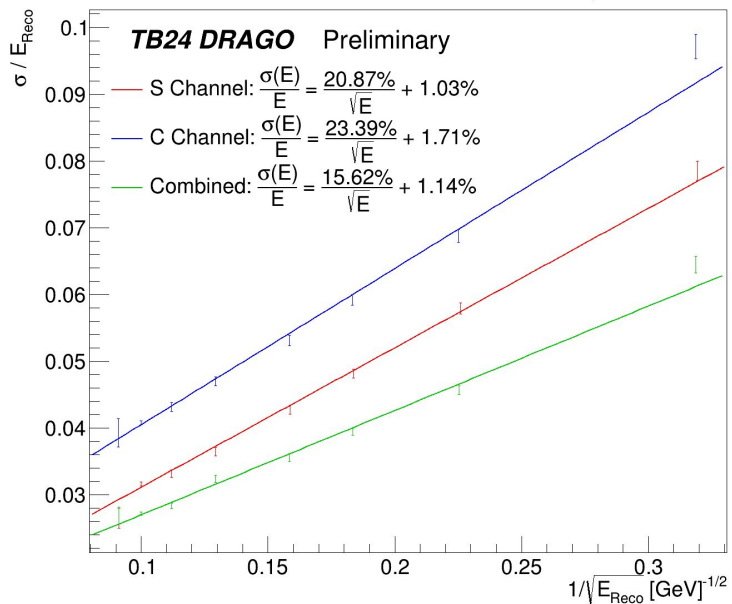
Electron QuadResolution in [10, 120] GeV Range

Also tried binning on pmt energy to choose which parametrisation to use
e.g. if totPMTSene < 25 GeV, choose fS extracted at 20 GeV and so on
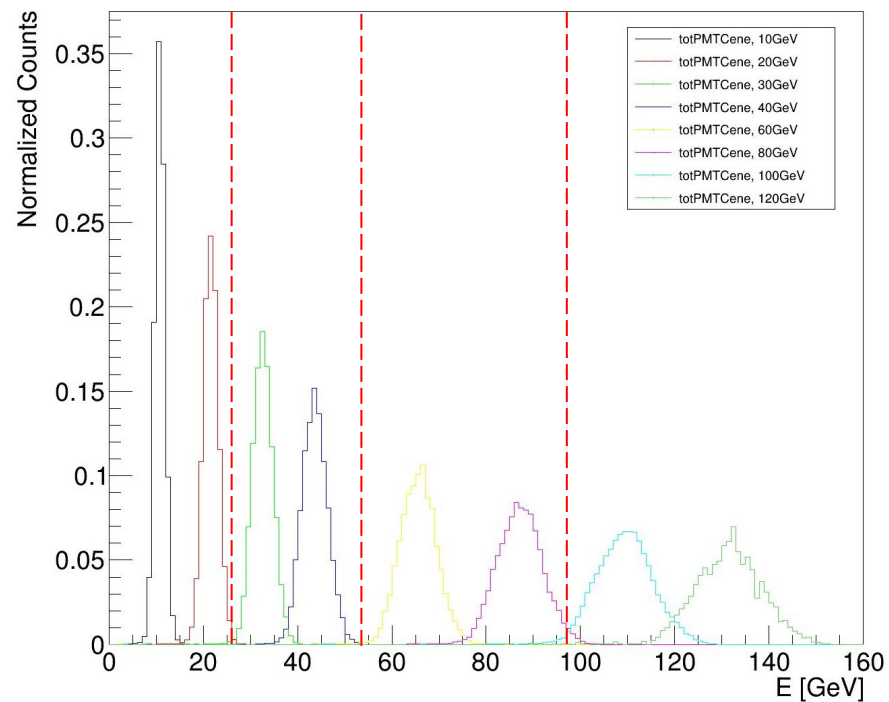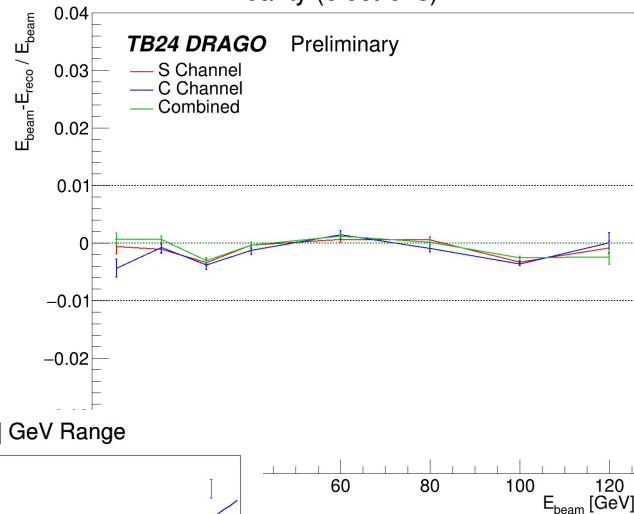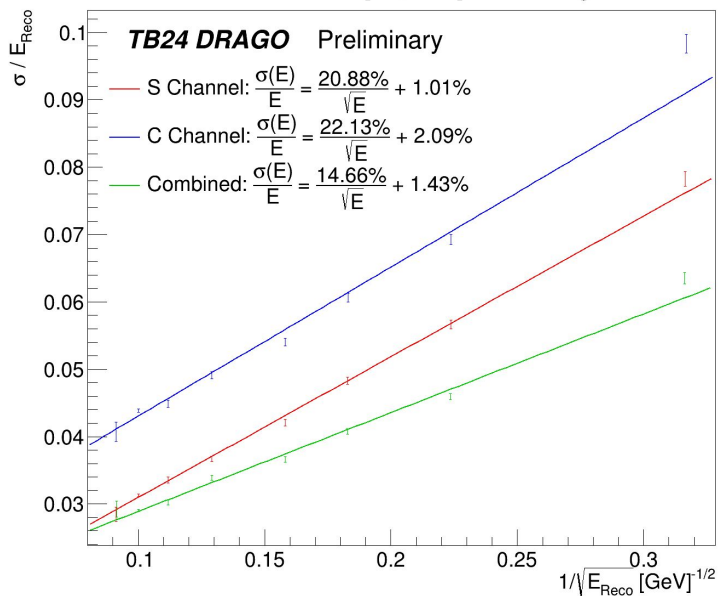
Also tried binning on pmt energy to choose which parametrisation to use
e.g. if totPMTSene < 25 GeV, choose fS extracted at 20 GeV and so on

-> No sensitive improvement in resolution by using multiple parametrisations
Note that Giacomo obtains slightly better results, I still have to subtract
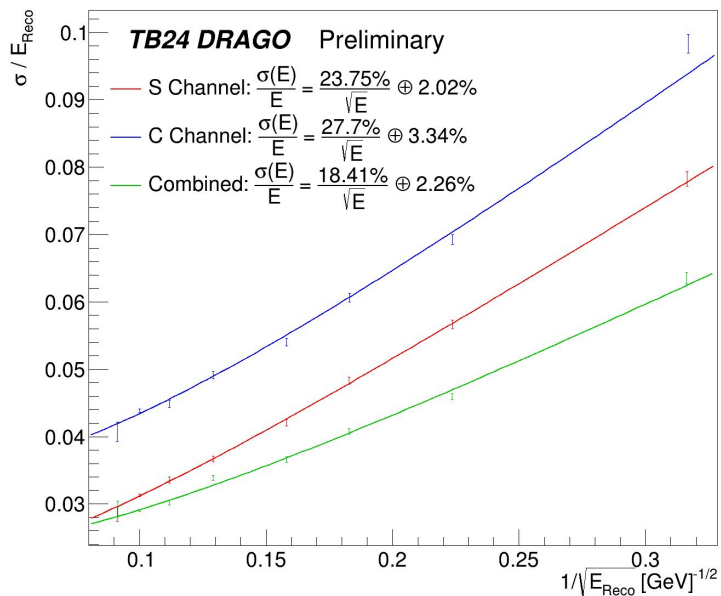PMT noise contribution, hopefully reducing a bit the stochastic component

Linearity (electrons)
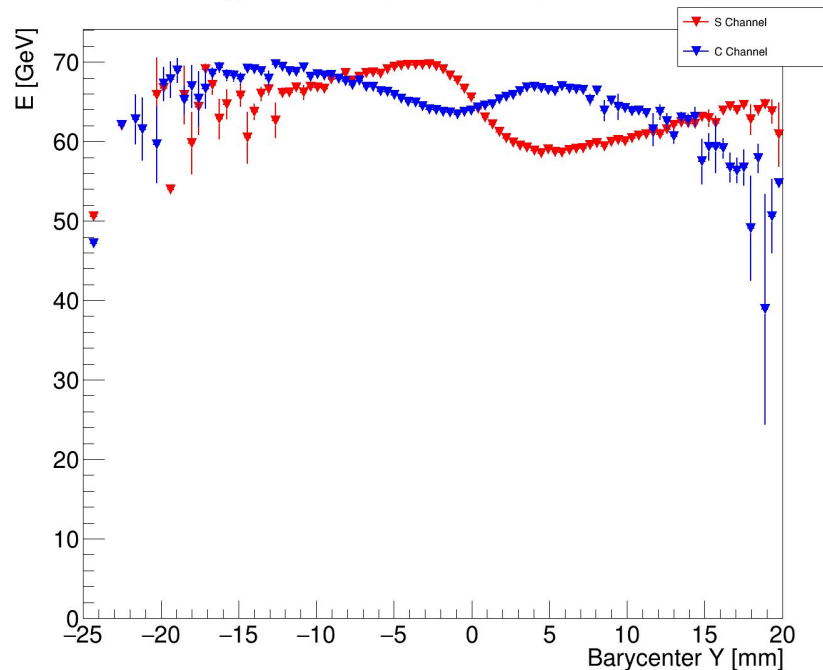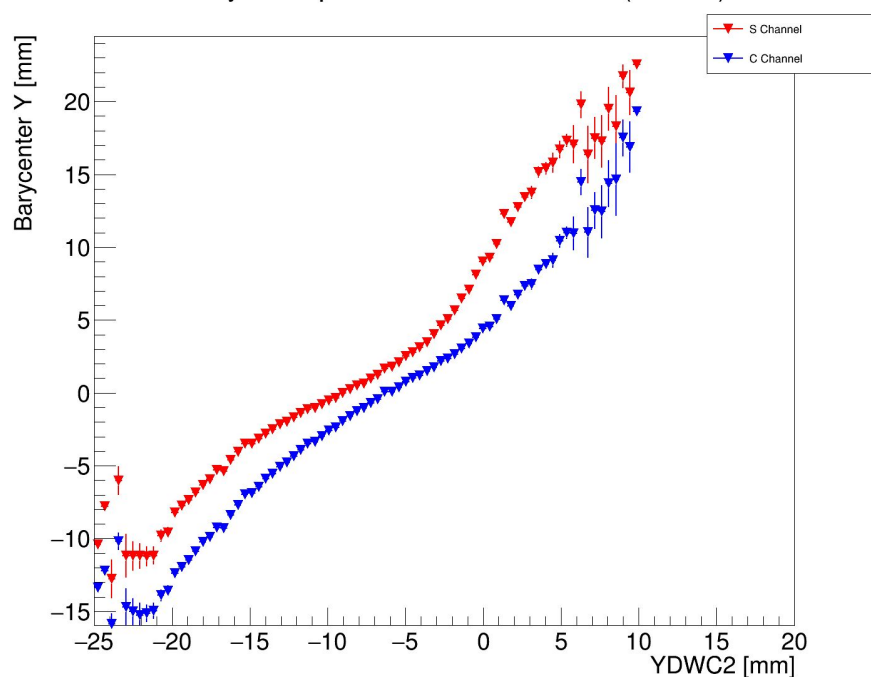

Electron Resolution in [10, 120] GeV Range

TB24 DRAGO Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{20.88\%}{\sqrt{E}} + 1.01\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{22.13\%}{\sqrt{E}} + 2.09\%$

Combined: $\frac{\sigma(E)}{E} = \frac{14.66\%}{\sqrt{E}} + 1.43\%$

Electron QuadResolution in [10, 120] GeV Range

TB24 DRAGO Preliminary

S Channel: $\frac{\sigma(E)}{E} = \frac{23.75\%}{\sqrt{E}} \oplus 2.02\%$

C Channel: $\frac{\sigma(E)}{E} = \frac{27.7\%}{\sqrt{E}} \oplus 3.34\%$

Combined: $\frac{\sigma(E)}{E} = \frac{18.41\%}{\sqrt{E}} \oplus 2.26\%$

Barycenter plots

Strange behaviour of total energy wrt the barycenter

Y barycenter well correlated with YDWC2, but some structure is present

Barycenter plots