Cube Light Yields Along Fibres

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Outline & Assumptions

- We expect a spread in cube light yield values along each fibre
- Average light yields should differ along $x$ and $y$
- Correcting for charge attenuation should narrow distributions and match $x$ and $y$ values
- Saba looked into LY distributions previously but did not correct for attenuation
Saba’s Plots

- Not sure which data run was used (possible 1September_20)
- Was definitely muon data
- Assuming only type 1 mppcs, not clear though
- An average LY was found for well-populated cubes
- Values from fibres along x are lower, as expected
My Results

- Used muon data from 1September_20
- Used cuts to isolate straight tracks and remove crosstalk
- Only type 1 mpcps
- Kept cubes with >500 hits only
- Values along x fibres smaller than y, same as Saba’s results
- My average values and distribution widths are larger though...

![Uncorrected Cube Light Yields along X](image1)

![Uncorrected Cube Light Yields along Y](image2)
My Results

Saba's

Uncorrected Cube Light Yields along X

Mine

Uncorrected Cube Light Yields along Y

Entries  2463
Mean     55.06
Std Dev  7.048
χ² / ndf 93.23 / 50
Constant 145.1 ± 3.9
Mean     55.08 ± 0.14
Sigma    6.517 ± 0.114

Entries  1273
Mean     59.32
Std Dev  8.694
χ² / ndf 97.78 / 53
Constant 63.72 ± 2.59
Mean     58.68 ± 0.23
Sigma    7.372 ± 0.211
Attenuation Correction

\[ LY_0 = \frac{LY_{\text{meas}}}{\left( \alpha e^{-\frac{(d+\beta)}{L_s}} + (1-\alpha)e^{-\frac{(d+\beta)}{L_l}} \right)} \]

- \( L_s = 8.54 \text{ cm} \)
- \( L_l = 431 \text{ cm} \)
- \( \alpha = 0.1716 \)
- \( \beta = 2 \text{ cm} \)
- \( d = 4 \text{ cm for y fibres} \)
- \( d = 12 \text{ cm for x fibres} \)

Saba’s plots made sense as applying the attenuation length Cesar measured gives 60 pe for the average x and y values.
My Attenuated Results

- My values for x and y also match after attenuation corrections (average of 65 pe)
- Seems the average light yield was higher for my data run…
- Also, the spread of charges increase after corrections, which is unexpected
My Attenuated Results

Corrected Cube Light Yields along X

Entries: 2463
Mean: 65.89
Std Dev: 8.398
$\chi^2$/ndf: 97.27 / 57
Constant: 121.5 ± 3.3
Mean: 65.84 ± 0.16
Sigma: 7.772 ± 0.142

Corrected Cube Light Yields along Y

Entries: 1273
Mean: 65.68
Std Dev: 9.574
$\chi^2$/ndf: 92.09 / 66
Constant: 56.51 ± 2.22
Mean: 64.98 ± 0.26
Sigma: 8.287 ± 0.219

Uncorrected Cube Light Yields along X

Entries: 2463
Mean: 55.06
Std Dev: 7.048
$\chi^2$/ndf: 93.23 / 50
Constant: 145.1 ± 3.9
Mean: 55.08 ± 0.14
Sigma: 6.517 ± 0.114

Uncorrected Cube Light Yields along Y

Entries: 1273
Mean: 59.32
Std Dev: 8.694
$\chi^2$/ndf: 97.78 / 56
Constant: 63.72 ± 2.59
Mean: 58.68 ± 0.23
Sigma: 7.372 ± 0.211
Summary

• Up-to-date cube LY plots produced

• Plots don’t match Saba’s averages, maybe difference in data set

• Cubes along x and y have same average LY after attenuation corrections

• Larger spread of LY after corrections, maybe hit position not main cause of LY fluctuations?
Backups