Systematic uncertainties

- Normalization with spectrometer A

For a single measurement (run) we can say, that σ for this measurement is:

(495 MeV): $\sigma_i = \frac{0.00053}{0.1015} = 0.522\%$

I have 10 runs. How much does this affect the average: $\bar{\sigma} = \frac{\sqrt{\sum_i \sigma_i^2}}{N} = \frac{\sqrt{N\sigma_i^2}}{N} = \frac{\sigma_i}{\sqrt{N}} = 0.165\%$

(330 MeV): $\sigma_i = \frac{0.00089}{0.32069} = 0.2775\%$ | $\bar{\sigma} = 0.09\%$

- Cerenkov and Scintillation detectors:

Cerenkov: $\varepsilon_{eff} = 99.7388 \pm 0.02127\%$?

Taf: $\delta_{Eff} \leq 0.2\%$

Vdd: $\delta_{Eff} \leq 0.02\%$

$\delta_{TOT} = 0.2\%$

This error changes the amplitude, normalization, but does not change the slope, ie, position!

MAID :

Near threshold the MAID has accuracy of approx ~ 5–10%. Having approx. 10% events in the lowest bins, the uncertainty is ~ 0.5 – 1%

Background Simulation: check this!

We know the simulation to ≤ 5%. (Probably ≤ 2%.)
The largest contribution to data at lowest energy:

495 MeV: $\delta = \frac{470 \text{ evts}}{\sim 10000 \text{ evts}} \cdot 5\% = 0.24\%$ 10k / 470

330 MeV: 330_02: $\delta = \frac{400 \text{ evts}}{14400 \text{ evts}} \cdot 5\% = 0.14\%$

Contribution of the μ-diagrams:

$$\delta = 3 \cdot 10^{-4} = 0.03\%$$

Higher order corrections: (dominated by the lepton side)
The largest correction in the last order is 2γ emission (50%). In the third order

$$\delta_{3rd} = \frac{50\%}{137} = 0.36\%$$

(0.21)