

CBO Systematic Study Status Report (addendum)

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E821

Basic physics equation describing the rate of detected positrons:

$$dN/dt = N_0 e^{-t/\gamma\tau_\mu} [1 + A \cos(\omega_a t + \varphi)]$$

$$N_0 \rightarrow N_0 [1 + A_N \exp(-t/\tau_{CBO}) \cos(\omega_{CBO} t + \varphi_N)]$$

$$A \rightarrow A [1 + A_A \exp(-t/\tau_{CBO}) \cos(\omega_{CBO} t + \varphi_A)]$$

$$\varphi \rightarrow \varphi + A_\varphi \exp(-t/\tau_{CBO}) \cos(\omega_{CBO} t + \varphi_\varphi)$$

Expanding the part in brackets inside the blue box gives us

$$A_N(t) = A_0 + A_1 \bar{x}_{CBO} + A_2 (\bar{x}_{CBO}^2 + 0.05 \sigma_{CBO}^2)$$

$$A_N(t) = A_0 + A_1 \bar{x}_{\text{CBO}} + A_2 (\bar{x}_{\text{CBO}}^2 + 0.05 \sigma_{\text{CBO}}^2)$$

Using the linear and quadratic fit constants in $A_N(t)$ and setting

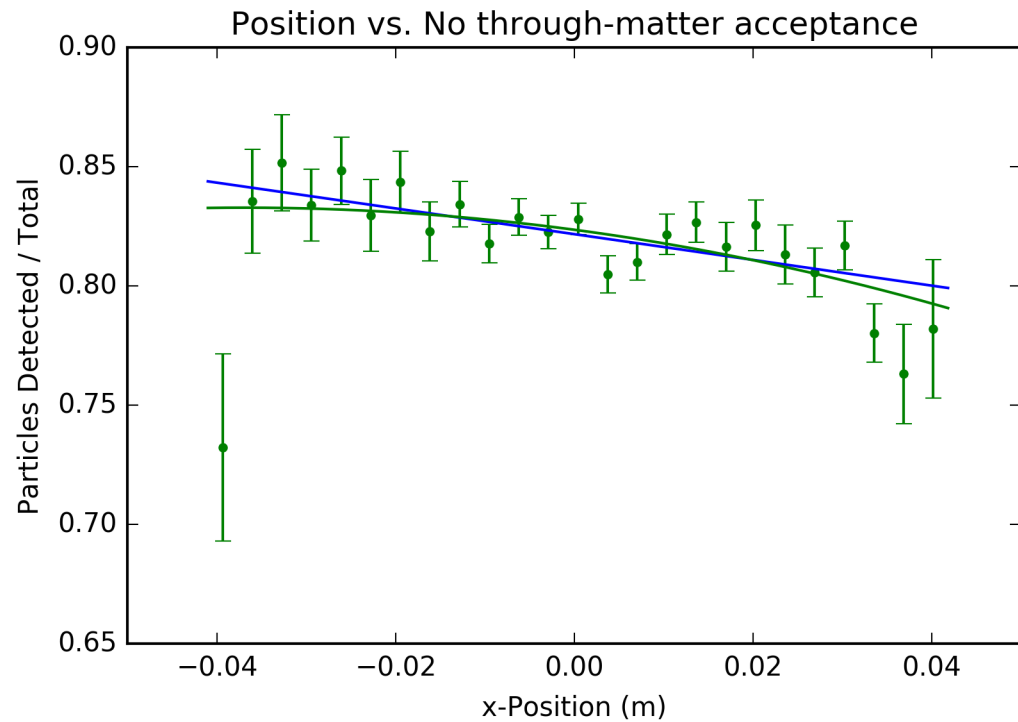
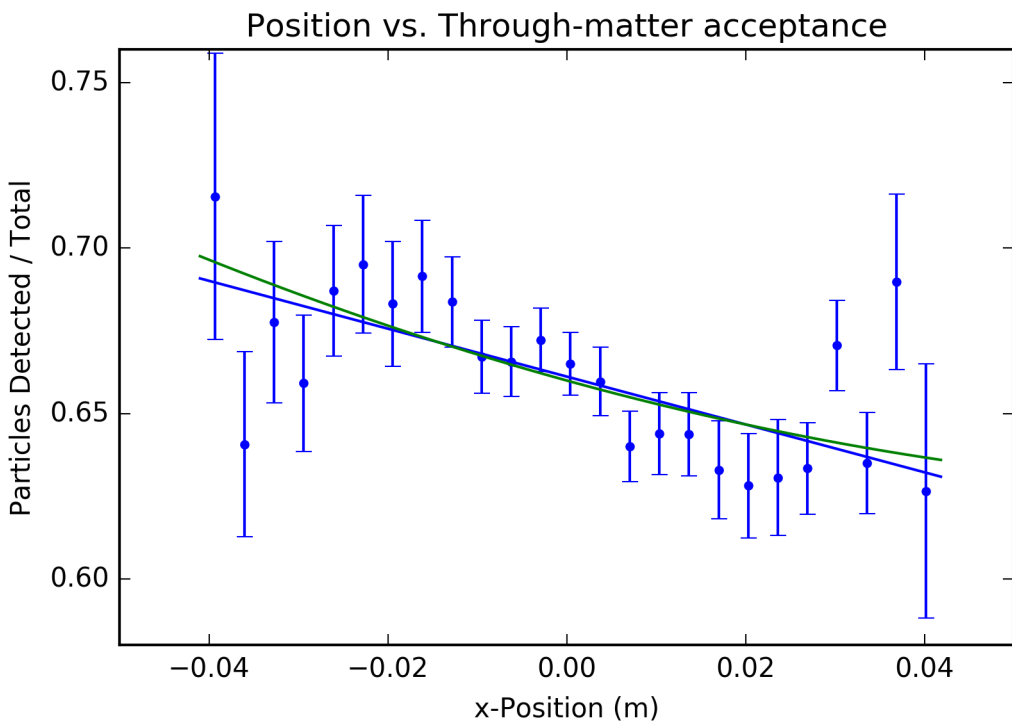
$$\sigma_{\text{CBO}} = 2.9\text{mm} \text{ and } \bar{x}_{\text{CBO}} = 0.45\text{mm} \text{ (doc-db 4363)}$$

we get the following quadratic influence:

Through Matter			Not Through Matter		
Linear Fit	Quadratic Fit	Quadratic Influence	Linear Fit	Quadratic Fit	Quadratic Influence
0.609	0.660	7.7%	0.822	0.823	0.22%

Take-away: For positrons that do not pass through any matter, the acceptance is linearly dependent on the muon x-position.

For positrons that do pass through matter, the acceptance has some non-negligible influence. ART-Geant is needed.



Future Work

$$N_0 \rightarrow N_0 [1 + A_N \exp(-t/\tau_{\text{CBO}}) \cos(\omega_{\text{CBO}} t + \varphi_N)]$$

$$A \rightarrow A [1 + A_A \exp(-t/\tau_{\text{CBO}}) \cos(\omega_{\text{CBO}} t + \varphi_A)]$$

$$\varphi \rightarrow \varphi + A_\varphi \exp(-t/\tau_{\text{CBO}}) \cos(\omega_{\text{CBO}} t + \varphi_\varphi)$$

Find the quadratic influence in the asymmetry and phase offset.