

	I = -60 A	I = -100 A
G4Pions	70.0 $\pm$ 3.0 %	81.9 $\pm$ 2.1 %
G4Muons	15.1 $\pm$ 1.0 %	13.4 $\pm$ 0.6 %
G4Electrons	14.9 $\pm$ 1.0 %	4.7 $\pm$ 0.3 %

Table 1: Simulated beamline composition per magnet settings

$$E_{\text{Front Face}}^{\text{kin}} = \sqrt{p_{\text{Beam}}^2 + m_{\text{Beam}}^2} - m_{\text{Beam}} - E_{\text{Loss}} \quad (1)$$

$$E_j^{\text{kin}} = E_{\text{Front Face}}^{\text{kin}} - \sum_{j < i} E_{\text{dep } i} \quad (2)$$

$$E_i = \sqrt{p_{\text{Beam}}^2 + m_{\text{Beam}}^2} - m_{\text{Beam}} - E_{\text{Loss}} - E_{\text{dep FF-i}} \quad (3)$$

$$\delta E_i = \sqrt{\delta p_{\text{Beam}}^2 + \delta E_{\text{Loss}}^2 + \delta E_{\text{dep FF-i}}^2} \quad (4)$$

$$E_{\text{dep FF-i}} = \sum_{j < i} E_{\text{dep } i} \Rightarrow \delta E_{\text{dep FF-i}} = (i - 1) \delta E_{\text{dep } i} \quad (5)$$

$$\sigma_{TOT}^{\pi^-}(E_i) = \frac{1}{n} \frac{\epsilon^{\text{Inc}}(E_i)}{\delta X} \frac{C_{\text{Int}}^{\pi MC}(E_i)}{\epsilon^{\text{Int}}(E_i)} \frac{N_{\text{Int}}^{\text{TOT}}(E_i)}{C_{\text{Inc}}^{\pi MC}(E_i) N_{\text{Inc}}^{\text{TOT}}(E_i)}. \quad (6)$$

$$\sigma_{TOT}^{K^+}(E_i) = \frac{1}{n} \frac{\epsilon^{\text{Inc}}(E_i)}{\delta X} \frac{C_{\text{Int}}^{K MC}(E_i)}{\epsilon^{\text{Int}}(E_i)} \frac{N_{\text{Int}}^{\text{TOT}}(E_i)}{C_{\text{Inc}}^{K MC}(E_i) N_{\text{Inc}}^{\text{TOT}}(E_i)}. \quad (7)$$

$$\mathcal{L}(\mu_0; \sigma_0^2; \Delta\theta_0, \Delta\theta_1) = \prod_{i=0}^1 f_X(\Delta\theta_i, \mu_0, \sigma_0^2) \Rightarrow \quad (8)$$

$$\log \mathcal{L} = -\frac{1}{2} \log(2\pi) - \log \sigma_0 - \frac{1}{2} \frac{(\Delta\theta_0 - \mu_0)^2}{\sigma_0^2} + \text{same for } \Delta\theta_1 \quad (9)$$

	Run-II Neg Pol
1. Events Reconstructed in Beamline	158396
2. Events with Plausible Trajectory	147468
3. Beamline $\pi^-/\mu^-/e^-$ Candidate	138481
4. Events Surviving Pile Up Filter	108929
5. Events with WC2TPC Match	41757
6. Events Surviving Shower Filter	40841
7. Available Events For Cross Section	40841

Table 2: Number of data events for Run-II Negative and Positive polarity