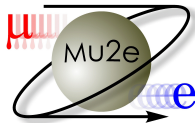# In situ monitoring of the stopped muon flux at Mu2e

Bastiano Vitali

Prof. Simone Donati (INFN, UniPi)
Dr. Pavel Murat (FNAL)

Mu2e experiment

- After ν oscillations[1], is Charged Lepton Flavour Violation possible?
- Mu2e looks for $\mu \to e$ conversion (near Al^{27} nucleus)
  - SINDRUM II set the limit at 7×10^{-13} and Mu2e aims at $\mathcal{O}(10^{-17})$
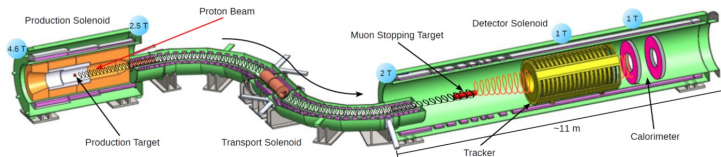 - The signal is a monoenergetic electron of ≈ 104.97 MeV

Figure: Mu2e apparatus: μ stopped in Al target; straw–tube tracker in yellow

---

[1]Calibbi and Signorelli, "Charged Lepton Flavour Violation: An Experimental and Theoretical Introduction".

Stopped muon flux monitor

- Resonant extraction: beam intensity variations on a 1 ms scale
- Physical processes
  - Deexcitation of muonic atoms $\rightarrow$ HPGe and LaBr$_3$ [Too low rate]
  - Nuclear muon capture $\rightarrow$ ejected proton counting   [2k/1.7 μs]
    - high energy deposition in the tracker ($\sim 1/\beta^2$)
    - higher multiple scattering ($\sim 1/\beta p$)
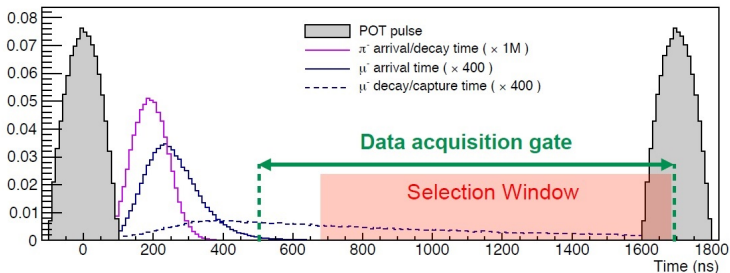   - absorbers $\rightarrow$ higher momenta than electrons

Figure: Mu2e *event*: everything between two proton pulses

Some key features

- Most of the work done was code related and 'less then engaging'...
- The the most intriguing studies
  - Possible cuts on the deposited charge in the straws
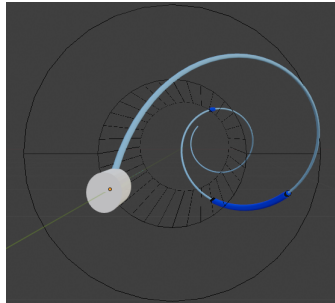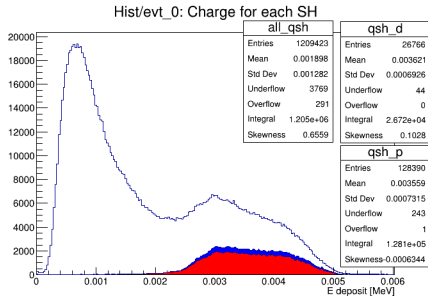 - Topology of the tracks

Figure: Energy deposit in the straws and tricky topology
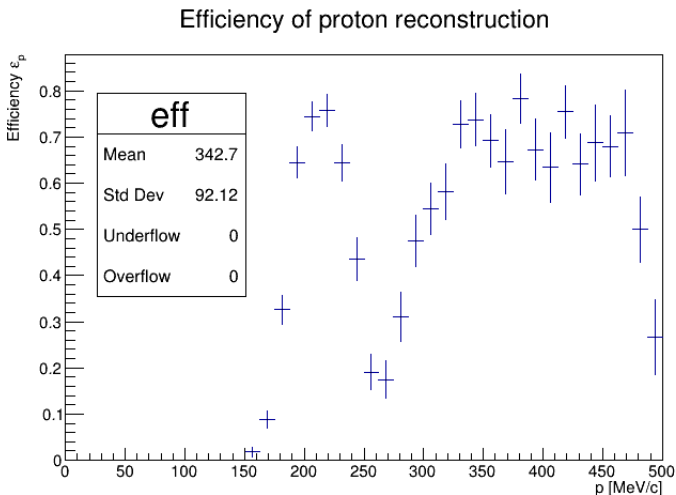
Single particle efficiency

Figure: Reconstructed/particles with at least 1 hit in the tracker

Conclusions

Number of tracks ≈ 4.5/1.7 μs
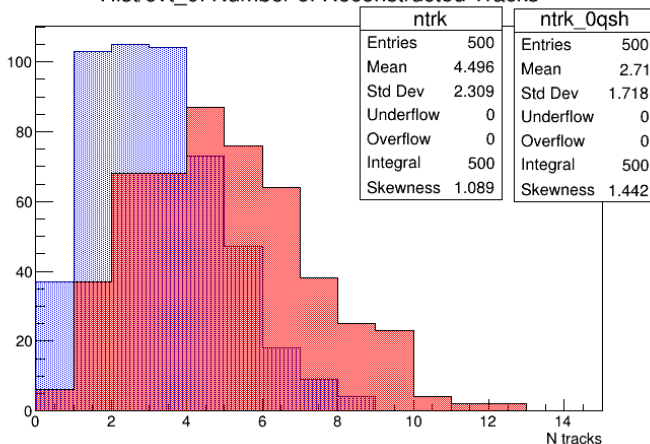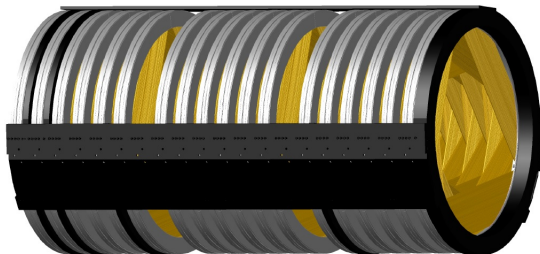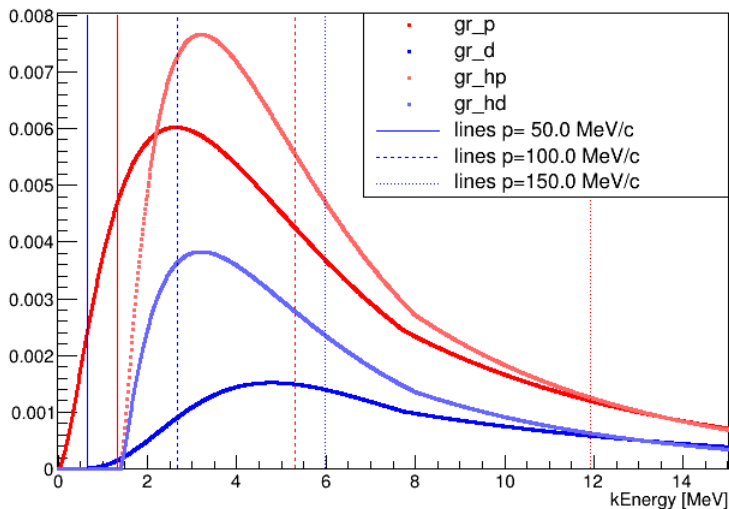**Adequate for monitoring fluctuations on ms**

Figure: The number of reconstructed tracks per event (red: cut on SH energy)
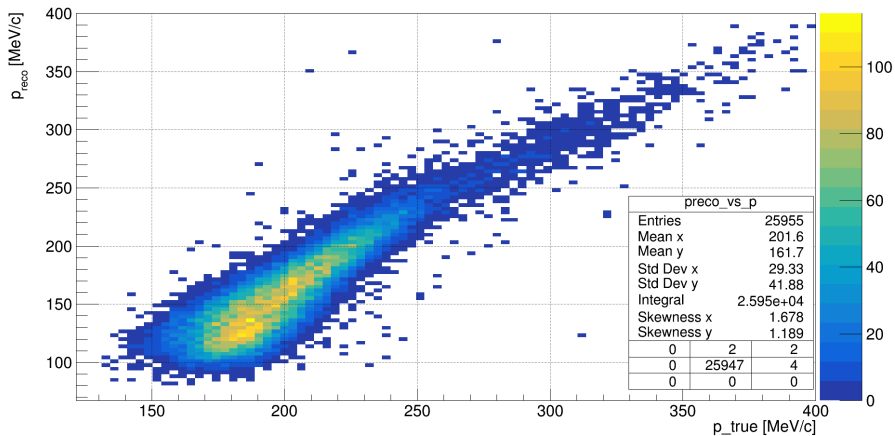
Backup: Tracker

Backup: Spectra parameterizations
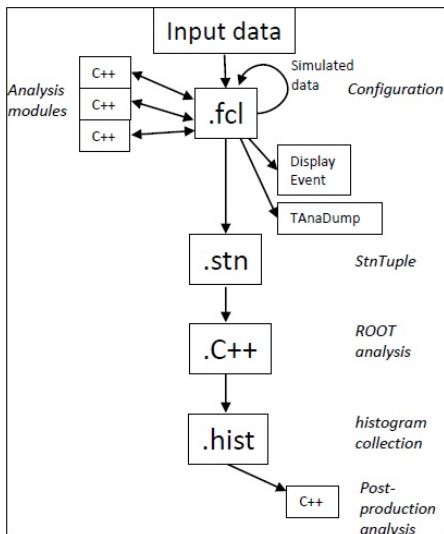

Comparison with Hungerford spectra

Backup: Reconstructed momentum

Hist/trk_0:Reco_mom vs true

Backup: Software structure

Calibbi, Lorenzo and Giovanni Signorelli. "Charged Lepton Flavour Violation: An Experimental and Theoretical Introduction". In: *Riv. Nuovo Cim.* 41.2 (2018), pp. 71–174. arXiv: 1709.00294 [hep-ph].