

Master Thesis on JUNO

Status Report 02

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Outline

Status Report 01

Recap

Other variables

Mean, Max and Standard deviation

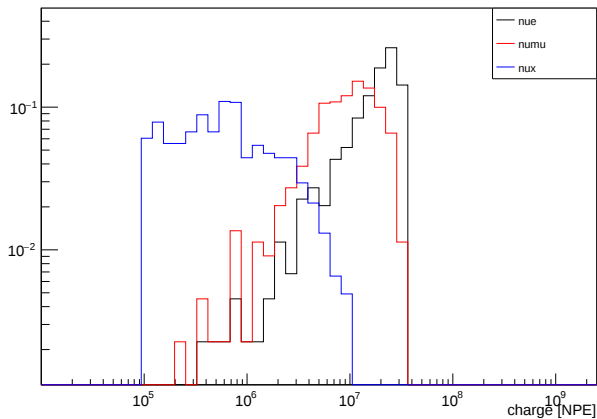
“Slope” in the FHT/Charge distribution

Next steps

Status Report 01 : Recap

Things I had to do :

- Charge spectrum with less bins

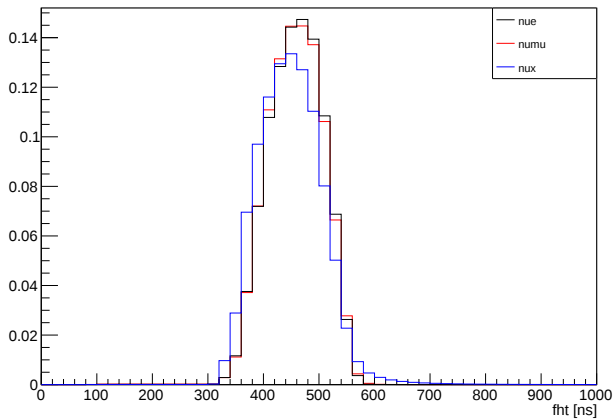


Status Report 01 : Recap

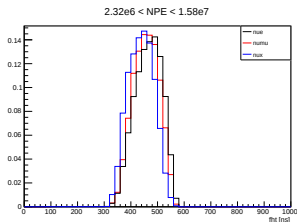
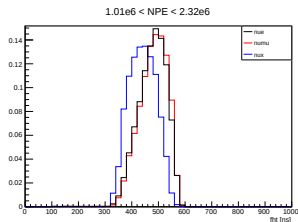
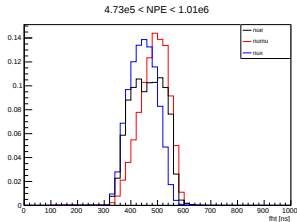
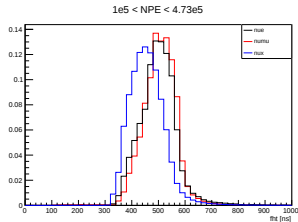
- ▶ **Physical interpretation** of the FHT :
 - ▶ First “hit”, **first photon** triggered by a PMT
 - ▶ Each lepton **ionises the medium** (LS) differently
 - ▶ ex: $\nu_e \rightarrow e^+ e^- \rightarrow$ EM-cascade
 - ▶ ex: $\nu_\mu \rightarrow \mu \rightarrow$ minimum-ionising particle
 - ▶ Different energy deposit (dE/dx)

Status Report 01 : Recap

► First Hit Time (personal results)



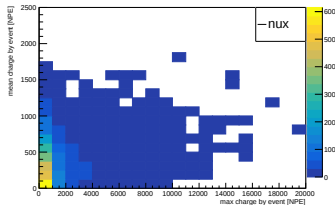
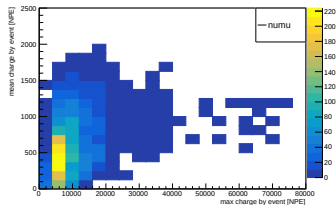
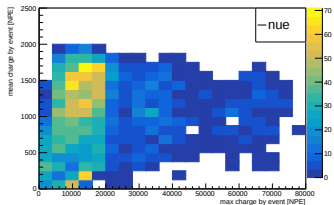
Status Report 01 : Recap



- ▶ Arbitrary separation by NPE... Maybe change it ?
- ▶ Different by interaction but **not enough**

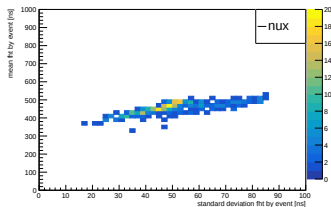
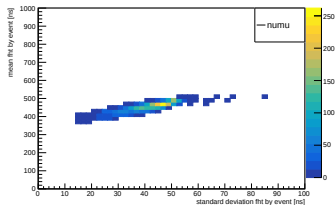
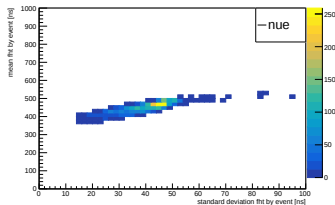
Other variables : Mean, Max and Standard deviation

► Charge per PMT : Max vs Mean



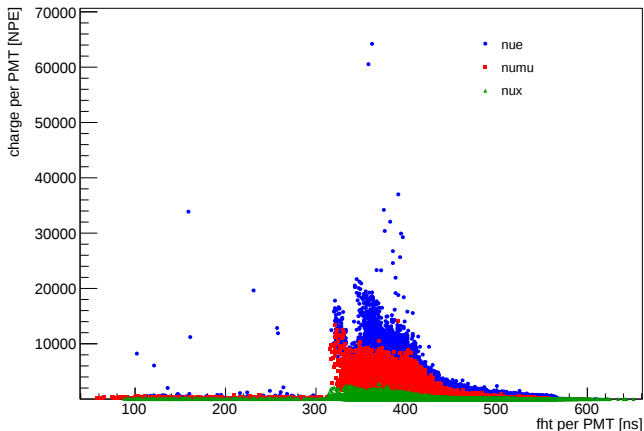
Other variables : Mean, Max and Standard deviation

► FHT per PMT : Standard deviation vs Mean



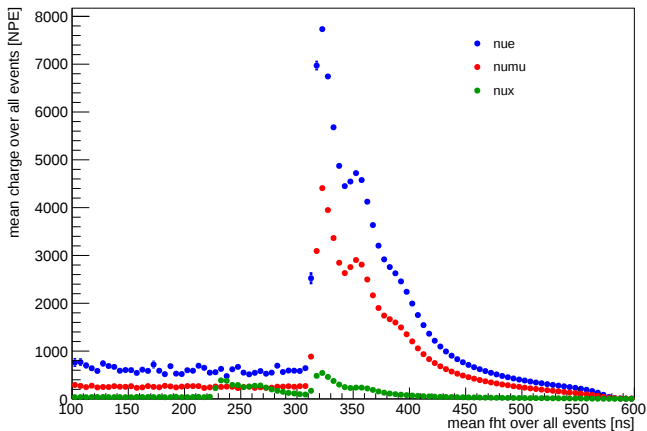
Other variables : “Slope” in the FHT/Charge distribution

► Distribution per PMT



Other variables : “Slope” in the FHT/Charge distribution

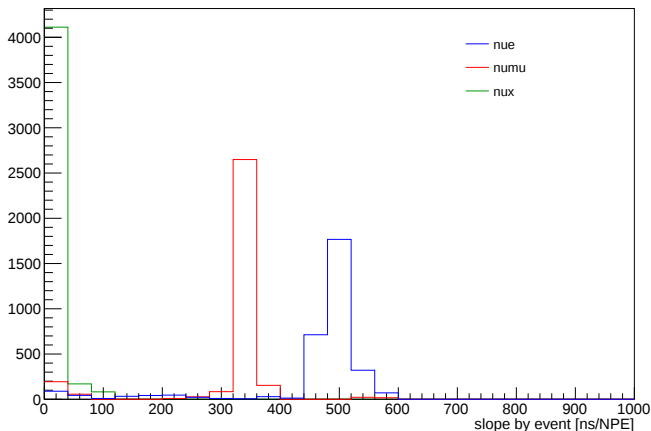
► Mean over all events



► First point above the mean background and the **maximum**

Other variables : “Slope” in the FHT/Charge distribution

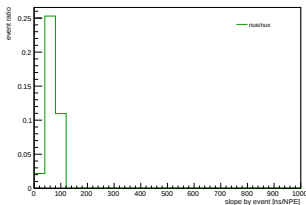
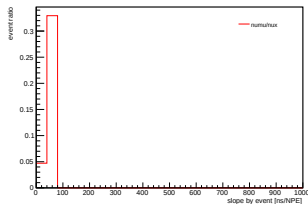
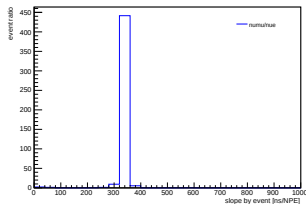
► Distribution of the slope



► Clear separation between the 3 types

Other variables : “Slope” in the FHT/Charge distribution

► Distribution of the slope (ratio representation)



Next steps

- ▶ Correction to the FHT (medium) : $t_{\text{res}}^i = t_{\text{hit}}^i - \left(\frac{n \cdot R^i}{c} \right)$
- ▶ **Discrimination parameters** : implementation in a “neural network” (Boost Decision Tree or RFC)
 - ▶ Setup labels for true events (ex: $\nu_e = 0$, $\nu_\mu = 1$, $\nu_x = 2$)
 - ▶ Train the network on known events (simulations)
 - ▶ Apply it to not-known ones (real data)
- ▶ State of the Art...