High Energy Analysis at KamLAND and Application to Dark Matter Search

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Overview

Track Reconstruction and Particle ID

Hellgartner's algorithm

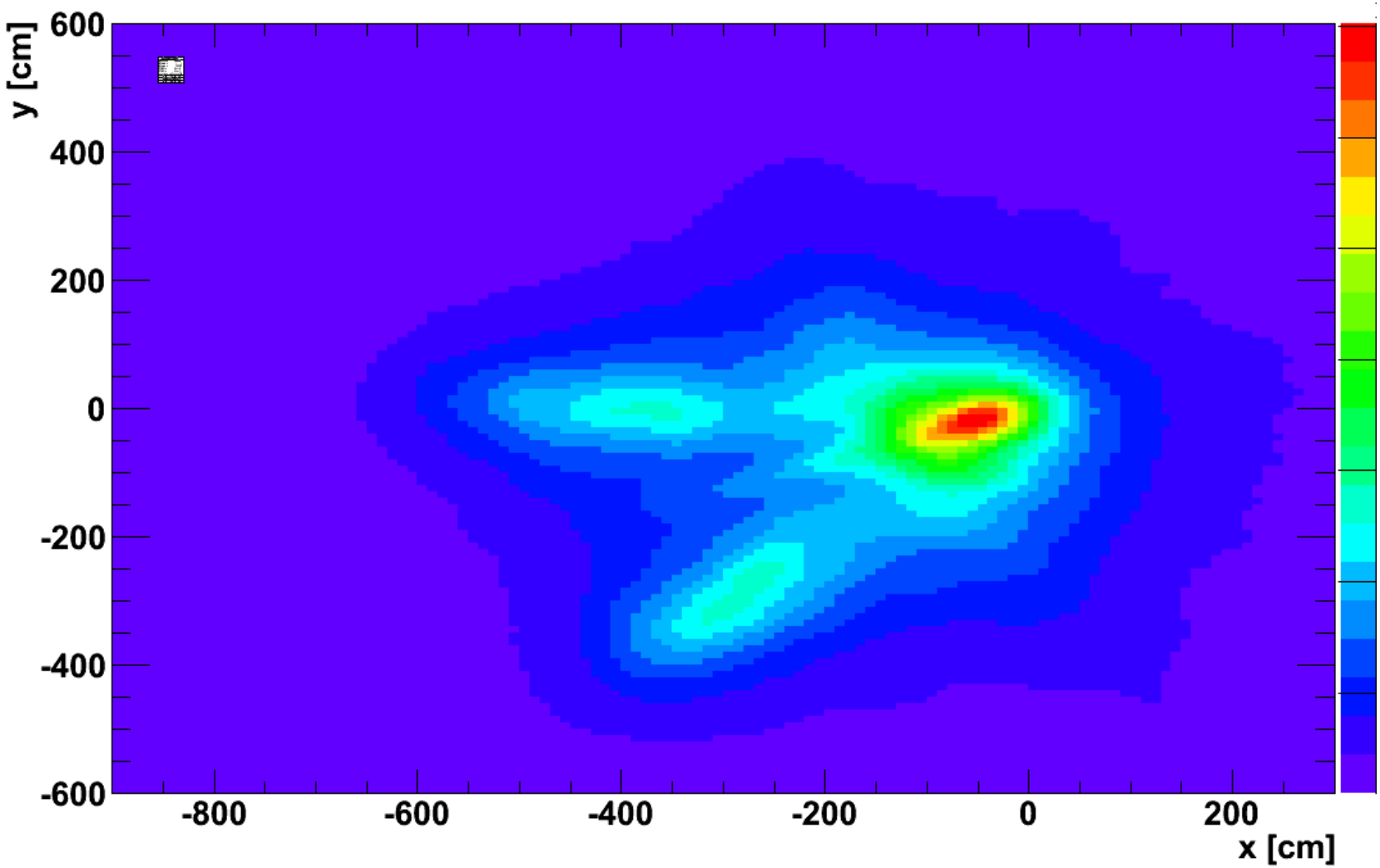
$$h(\vec{x},t) = \sum_{i=1}^{N_{\mathrm{PMT}}} \Theta(q_i - q_{\mathrm{threshold}}) \sum_{j=1}^{N_\gamma} f(t_{ij} - t_i^{\mathrm{TOF}}, t)$$

where N_{PMT}: number of PMTs
N_γ: number of photon hits to count per PMT
q_i: charge on i-th PMT, $q_{\mathrm{threshold}}$: minimum charge for analysis
t_{ij}: j-th hit time on i-th PMT
t_i^{TOF}: expected time-of-flight between i-th PMT and $\vec{x}$

$$f(\Delta t, t) \propto (t - \Delta t) \exp\left[- \frac{(\Delta t - t)^2}{2\sigma_{\mathrm{tts}}} \right]$$

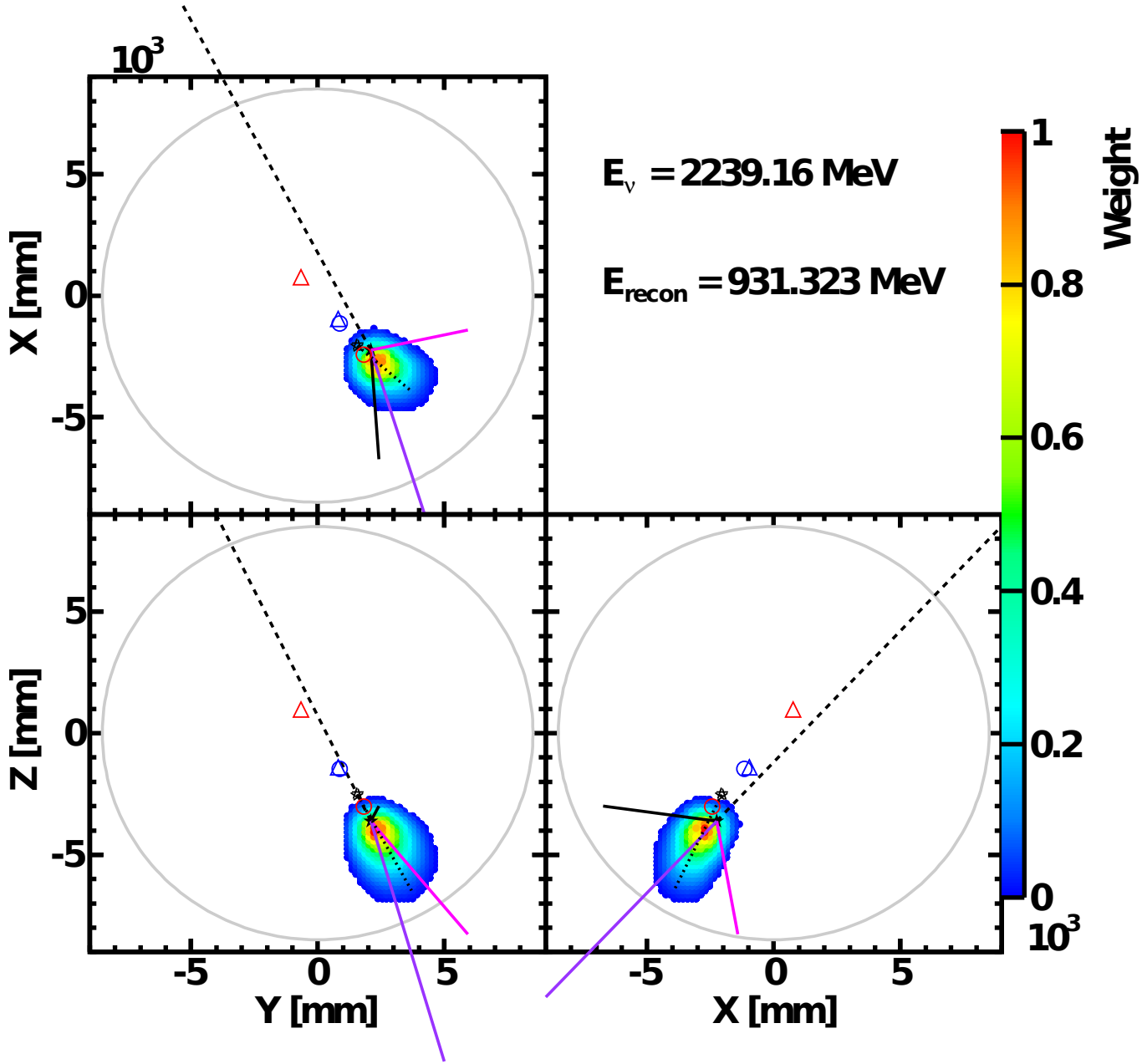
Figure of merit for each test point in space $= \int_{-\infty}^{\infty} |h(\vec{x},t)|^2 \, \mathrm{d}t$

Test Hellgartner on double 1 GeV muons (MC)

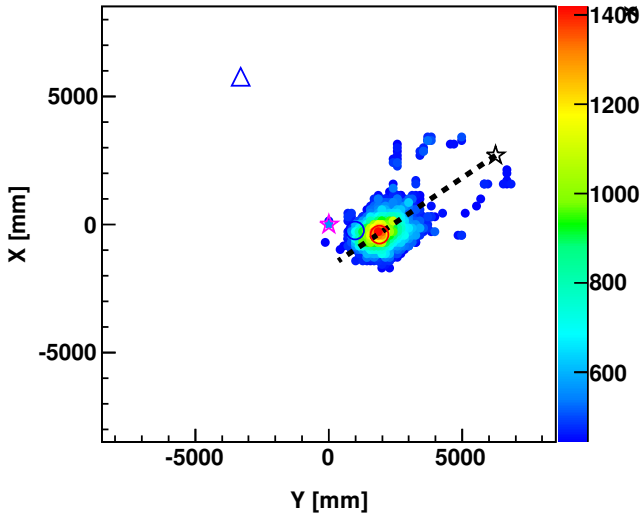


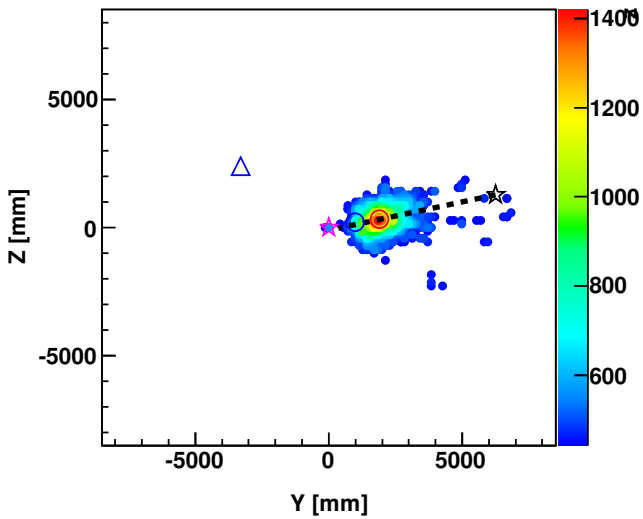
Dominikus Hellgartner

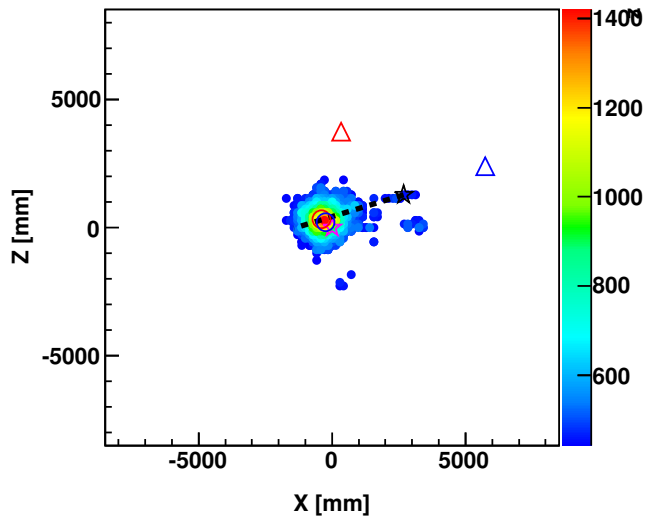
Test Hellgartner on 2 GeV ν_e (MC)



Test Hellgartner on T2K events (Data)







Lepton flavor discrimination