Muon energy estimator

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Muon energy loss

$$-\frac{dE}{dx} = a + b(E)E$$

ionisation

Bremsstrahlung

Contributions to light yield

1. Random background
2. Cherenkov light from muon
3. Cherenkov light from ionisation¶
4. Cherenkov light from Bremsstrahlung

¶ Not considered here.

PDF

$$\mu(R,\theta,\phi) \equiv \int_{T_{min}}^{T_{max}} dt \, \frac{\partial P(R,\theta,\phi,t)}{\partial t}$$

number of photo-electrons

same as JGandalf

Light sources

$$\mu = \mu_0 + \mu_1 + \mu_b E$$

random background

Cherenkov light from muon

Bremsstrahlung

Fit¶

$$\chi^2 \equiv \sum_i -\log(P_i)$$

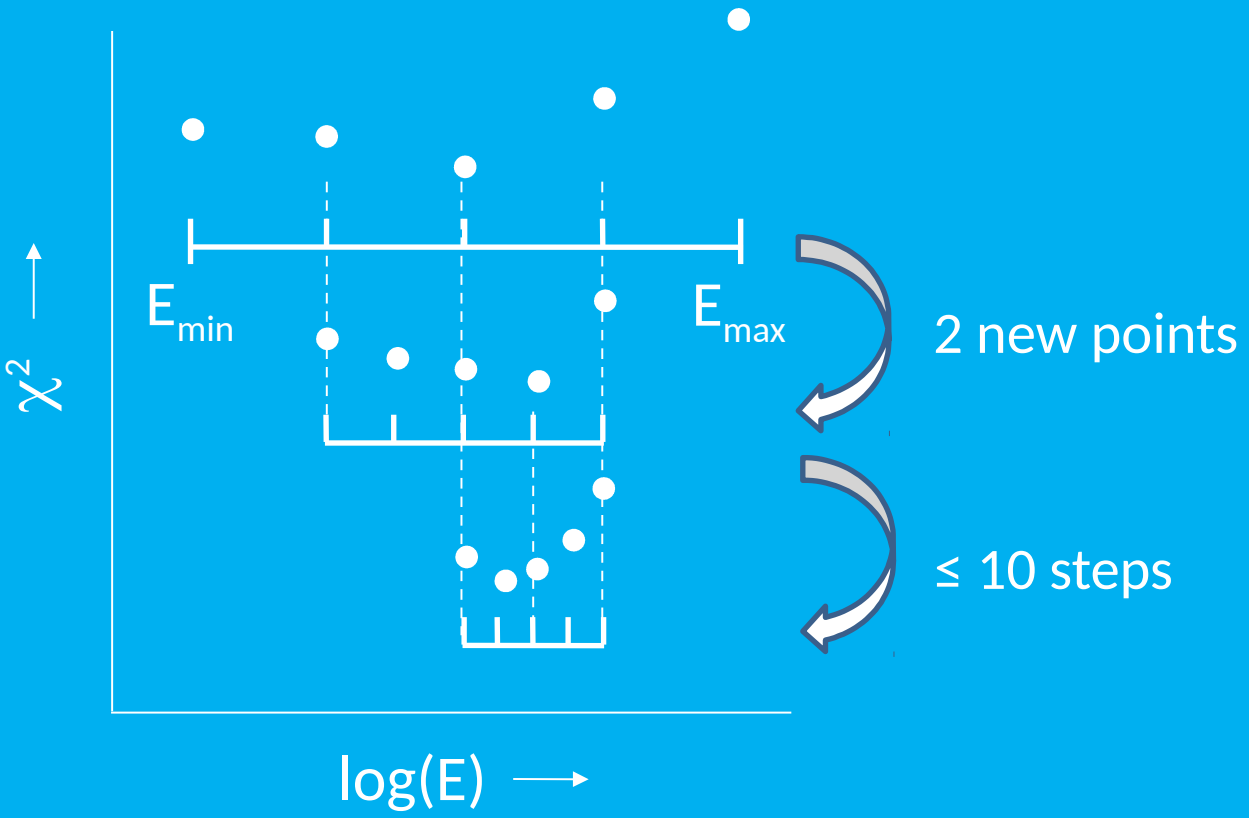
¶ An M-estimator of χ^2 is used.

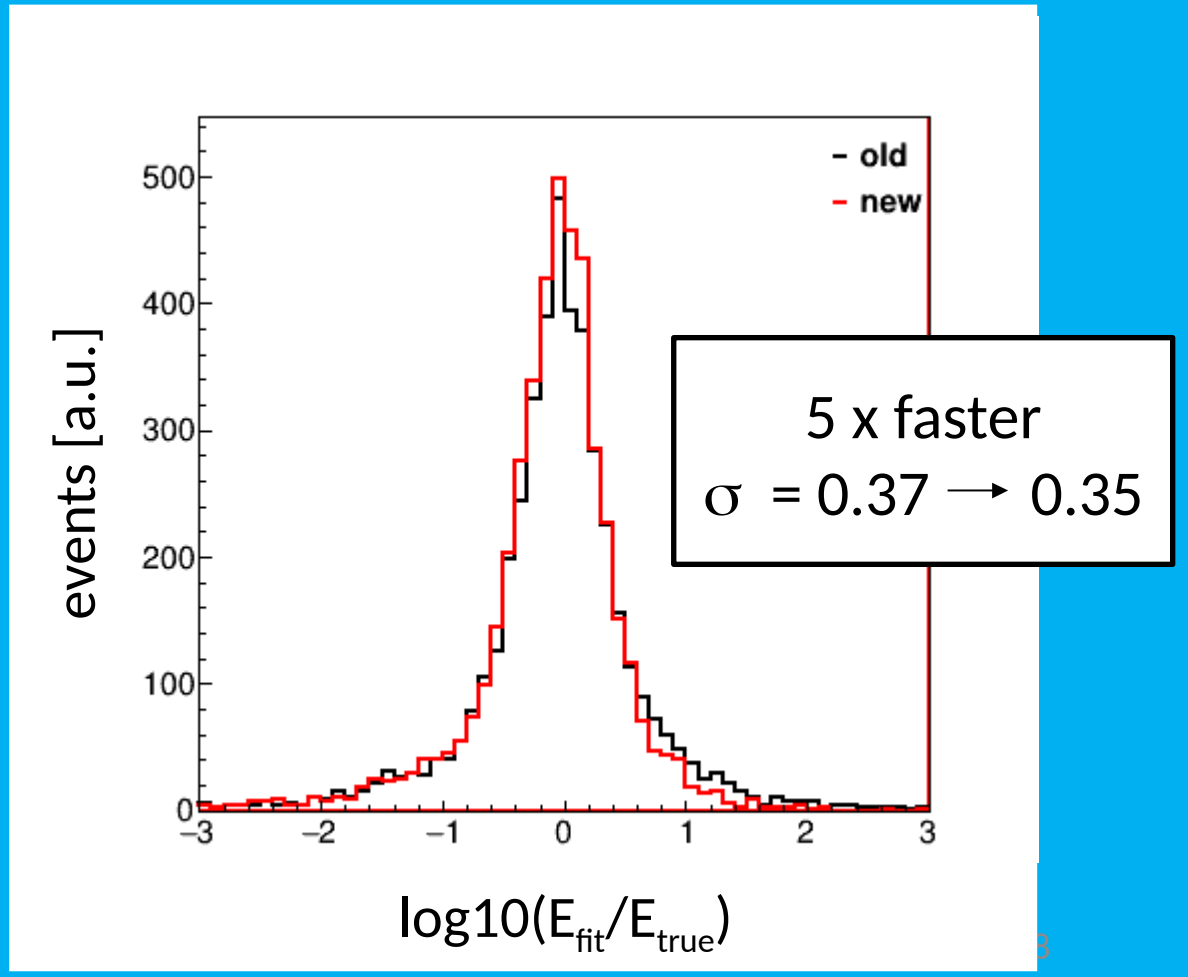
Probability

PMT w/o hit	PMT with hit
$P \equiv P(0)$	$P \equiv 1 - P(0)$

$$P(0) = e^{-\mu}$$

5-point search method

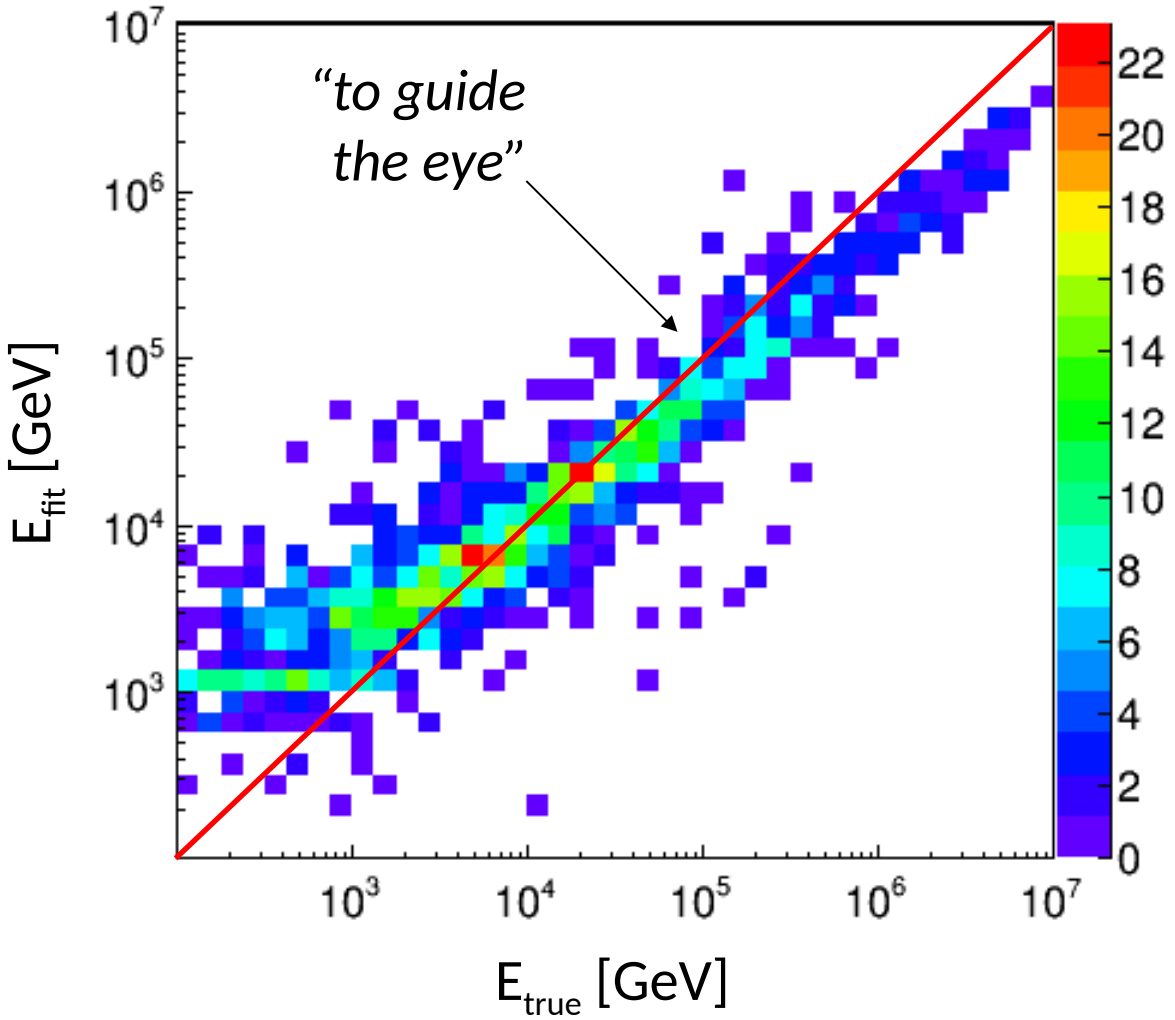




Search range

- option -x "E_{min} E_{max}"
  - units ^{10}log(GeV)

Energy estimate



Energy correction

- option -E <fcn>
  - where <fcn> can be either:
    - TFormula compatible expression
    - ROOT file
      - containing TFormula object with name "*energy_correction*"
    - ASCII file
      - containing TFormula compatible expression
- uncorrected energy is available in user vector
  - position JFIT::JENERGY_ENERGY

Summary & outlook

- It is possible to estimate muon energy from PDFs
  - no Monte Carlo information, no training, etc.
  - provides also for a test of Monte Carlo simulation
- Source code available in GIT
  - <Jpp>/software/JFit/JEnergy.cc
- Incorporate stochastic nature of energy loss
  - neutrino interaction vertex!