

Preliminary Study of ^{214}Bi Background in ^{100}Mo foils



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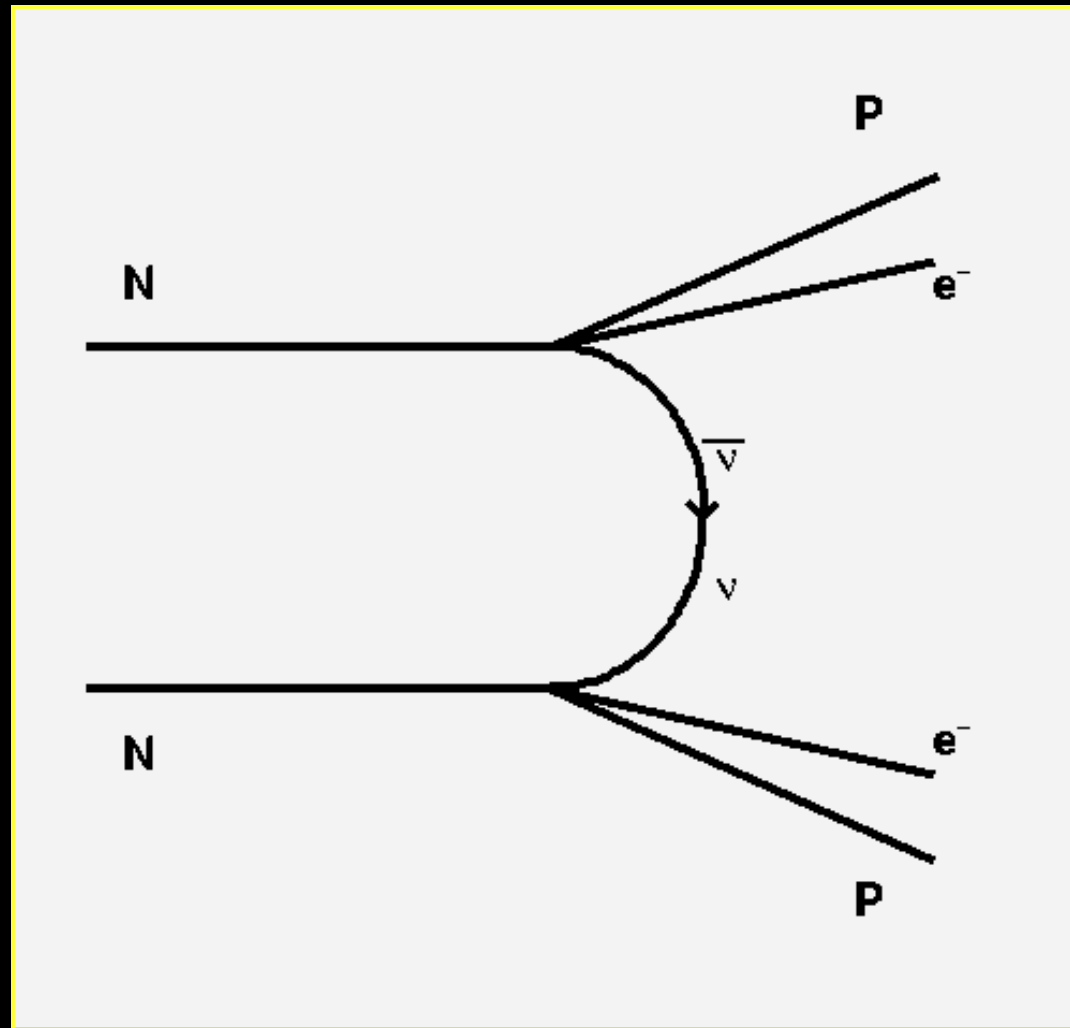


6th April 2004

IoP

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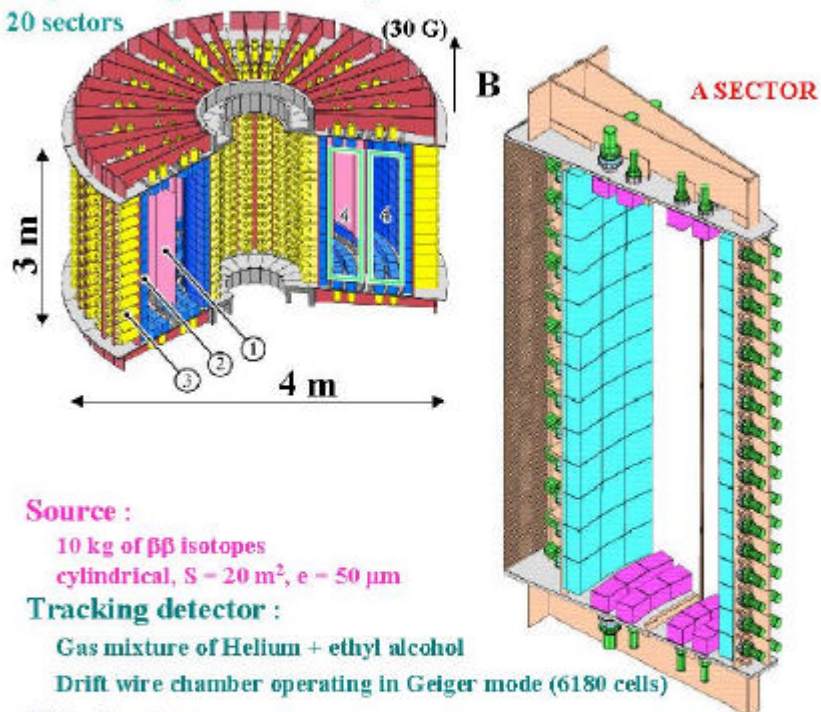
Neutrinoless Double Beta Decay



The NEMO3 detector

Fréjus Underground Laboratory : 4800 m.w.e.

20 sectors



Source :

10 kg of $\beta\beta$ isotopes
cylindrical, $S = 20 \text{ m}^2$, $e = 50 \mu\text{m}$

Tracking detector :

Gas mixture of Helium + ethyl alcohol
Drift wire chamber operating in Geiger mode (6180 cells)

Calorimeter :

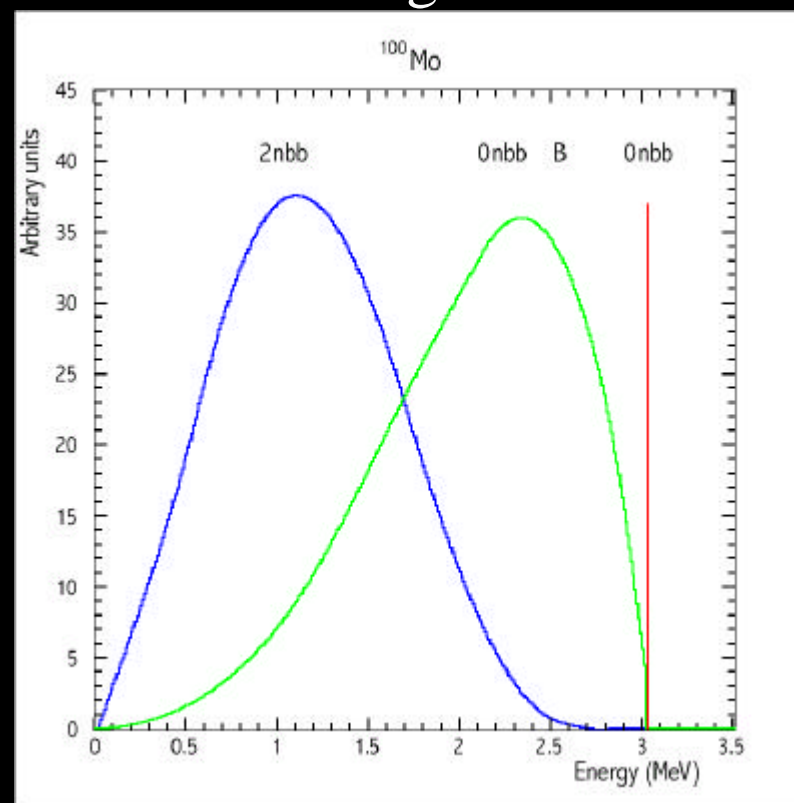
1940 plastic scintillators coupled to low radioactivity PMs ;
 $\sigma(E)/E$ at 3 MeV $\sim 3.5\%$

+ Magnetic field + Iron shielding + Neutron shielding

Identification : e^- , e^+ , γ , n and delayed- α

- $\beta\beta$ events detection
- Measurement of source radiopurity
- Background rejection

1. Source Foils
2. Scintillators
3. PMTs
4. Tracking Volume

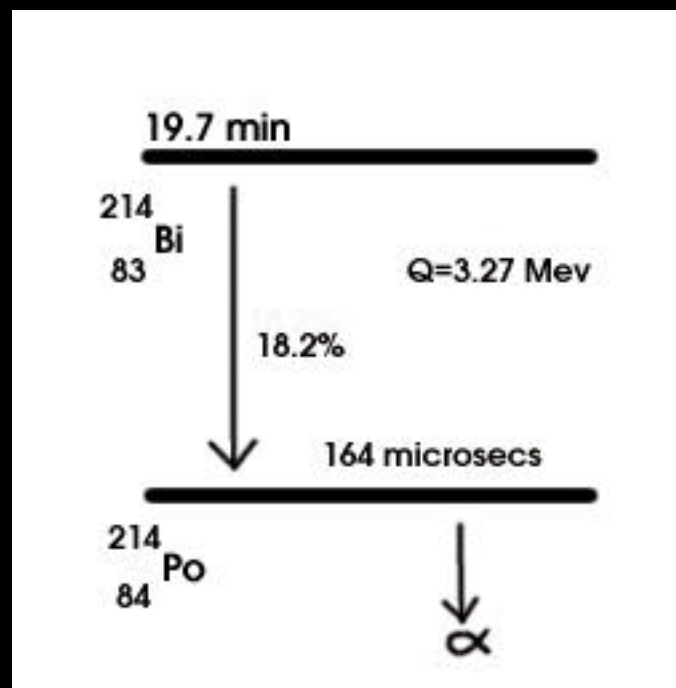


In Brief...

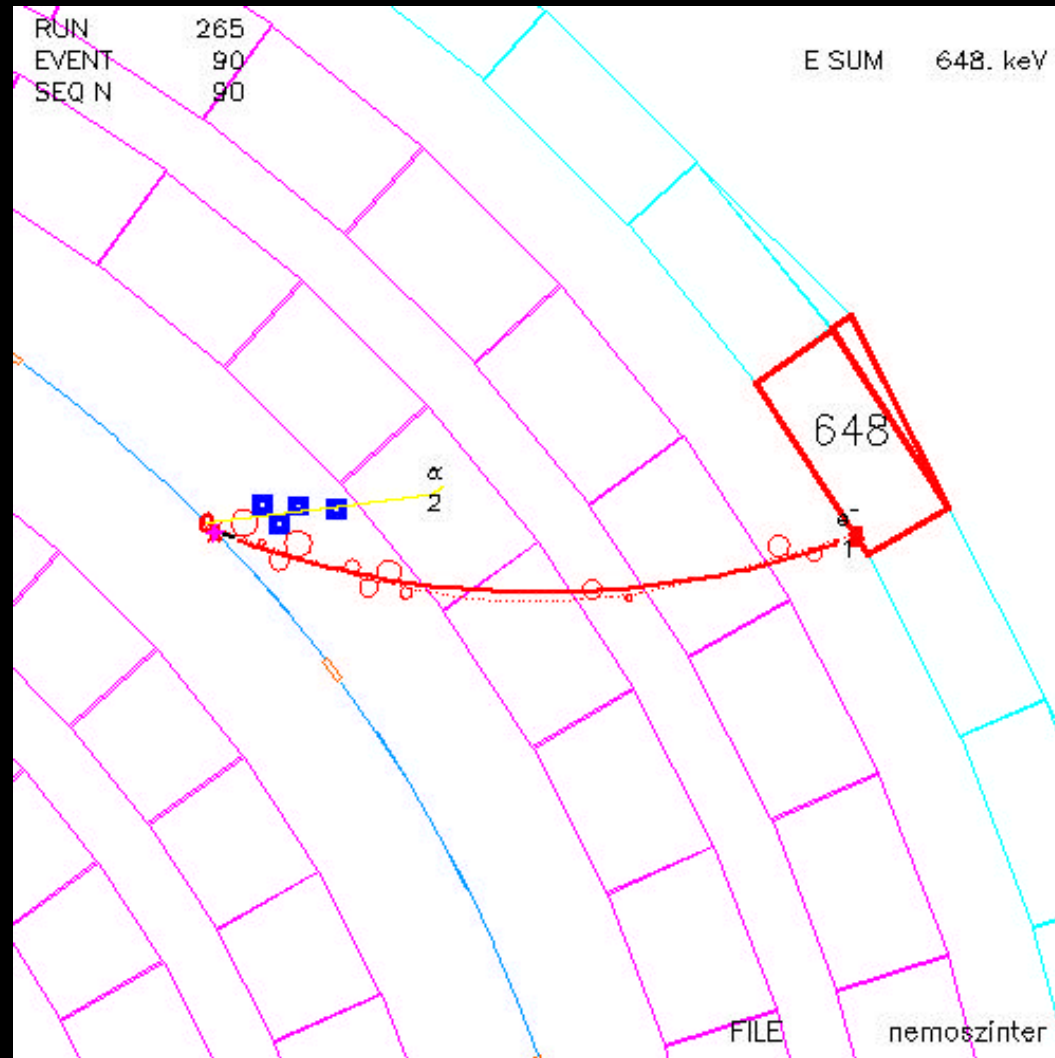
- Analysis developed to identify ^{214}Bi events from foils
- Apply to MC, extract efficiency, apply to data
- Look for ^{214}Po decay $T_{1/2}$ spectrum as cross-check

- Rather higher rate than expected...

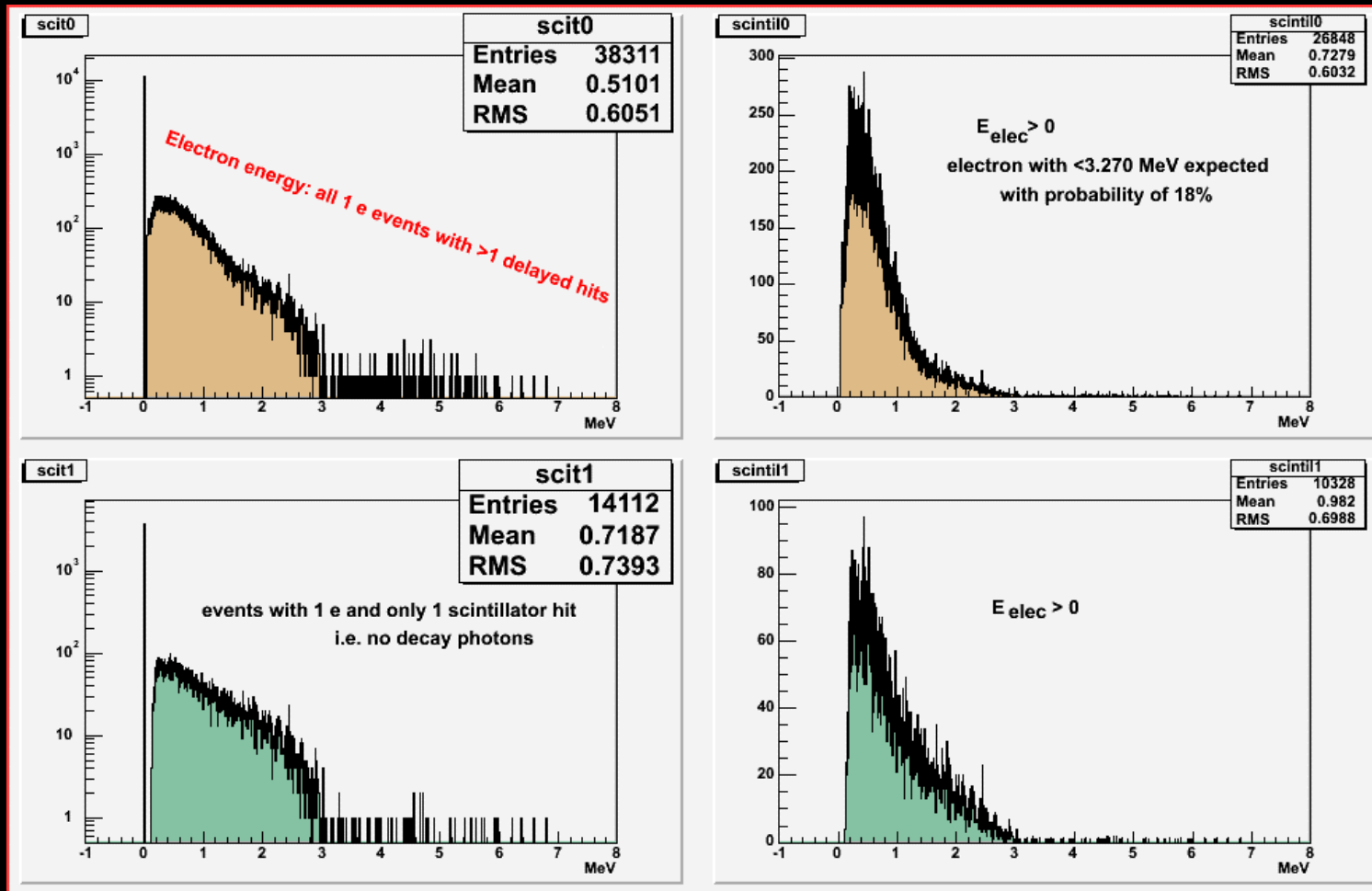
- Principle decay: e^- with delayed α
- Nemo simulation v5.5: 150,000 MC foil events generated
- Compare to 1,400,000 data events
(107 hours of data from Apr 2003)



A Bi event

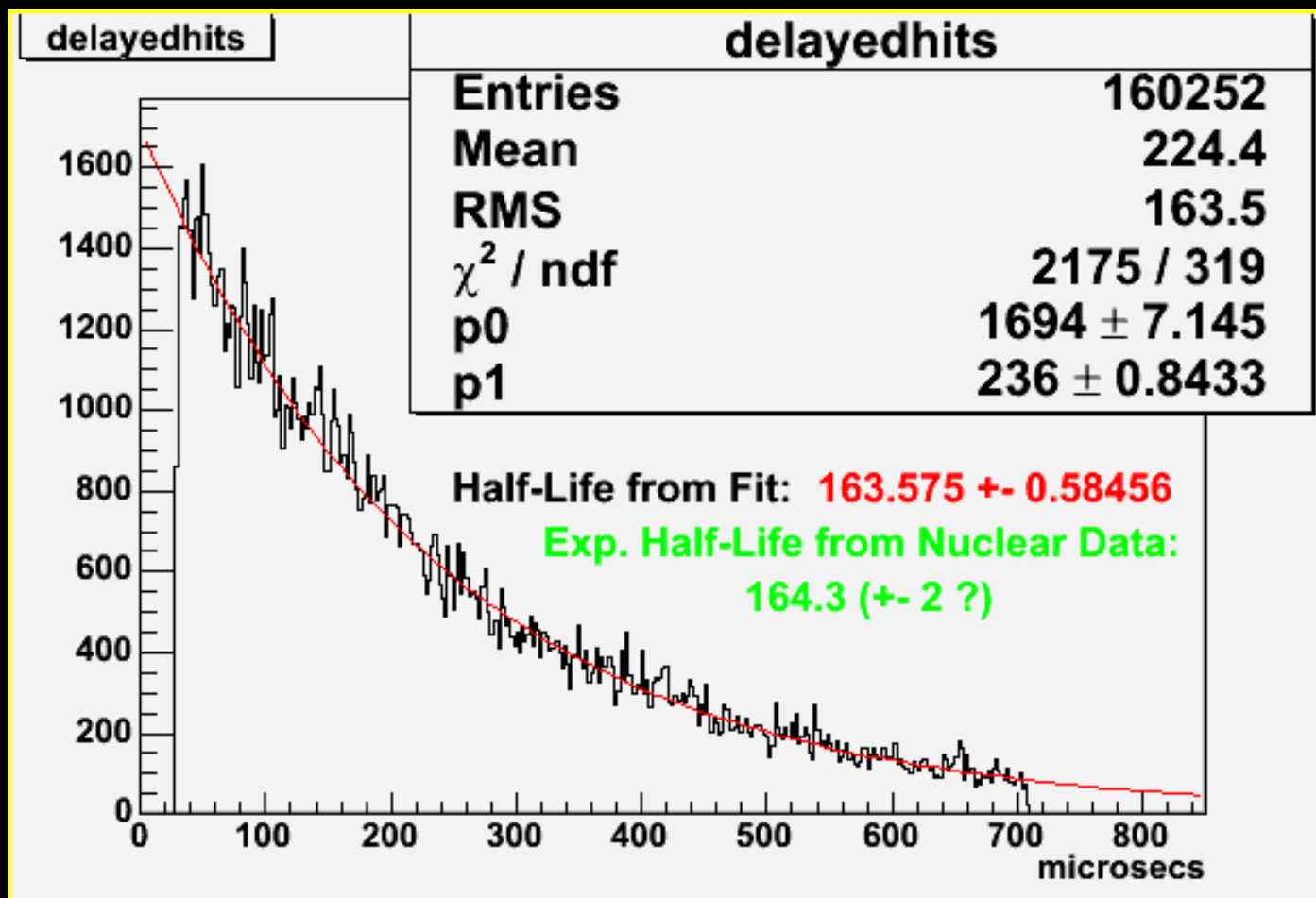


MC :1 track , >1 delayed hits



$\Delta Q=3.2$ MeV: High energy tail...(reconstruction?)

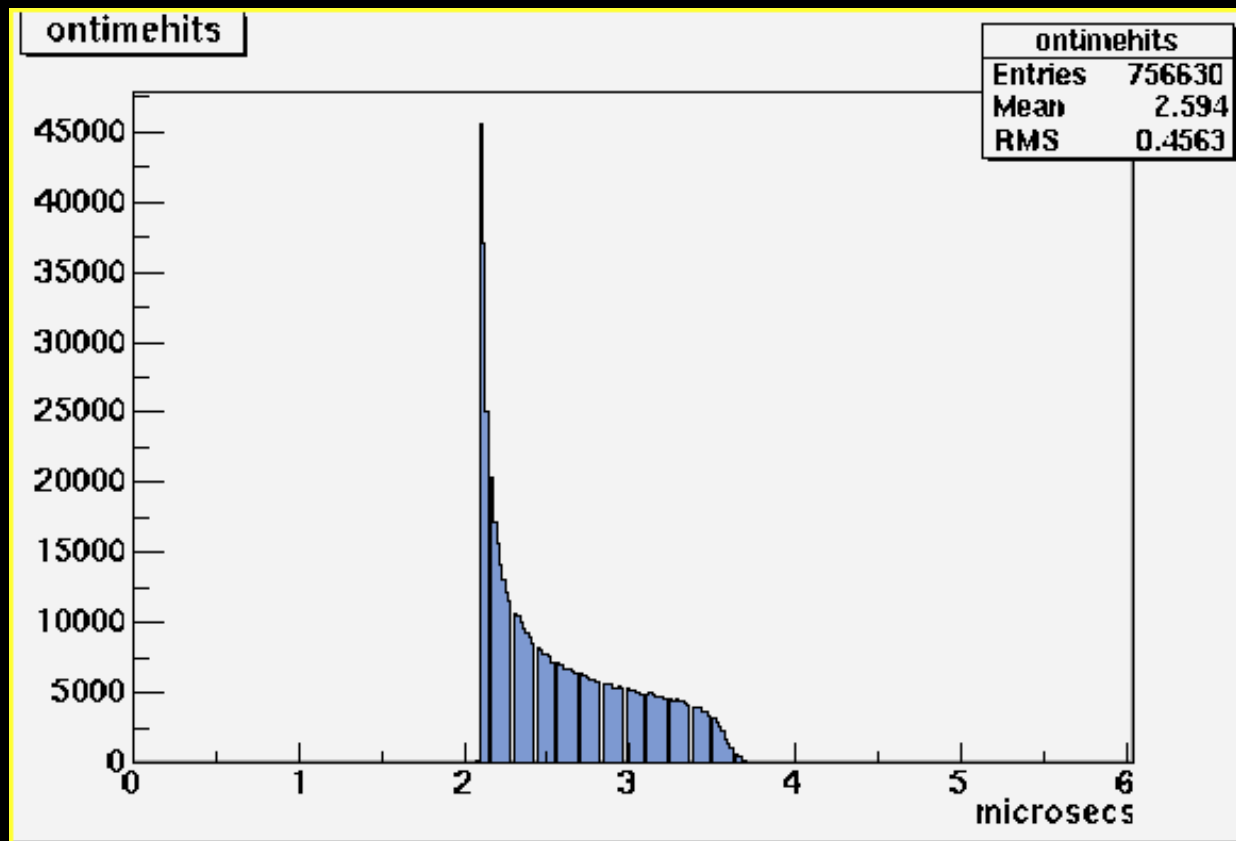
Monte Carlo



List of Cuts

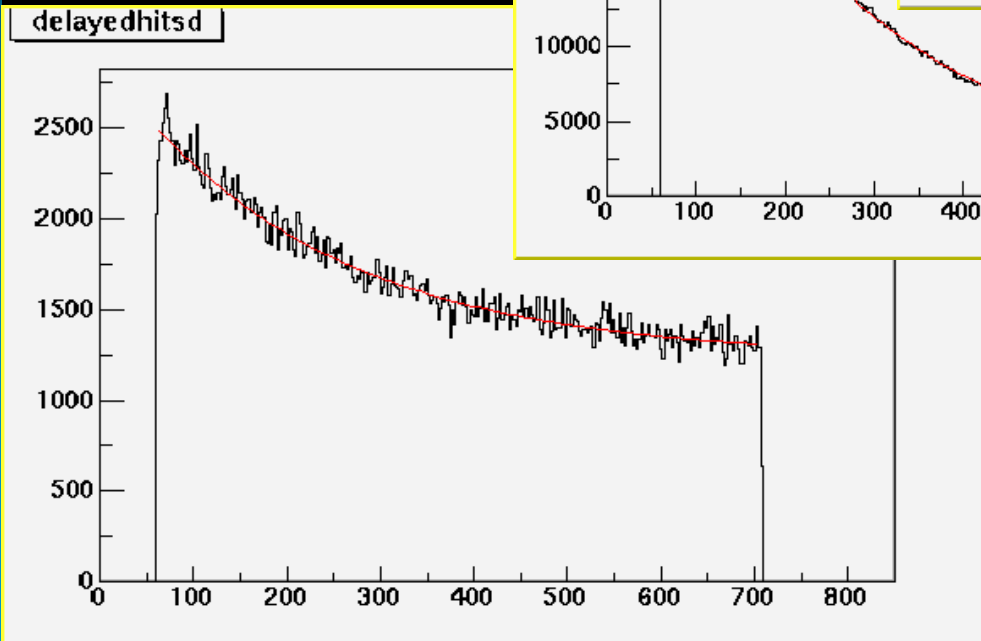
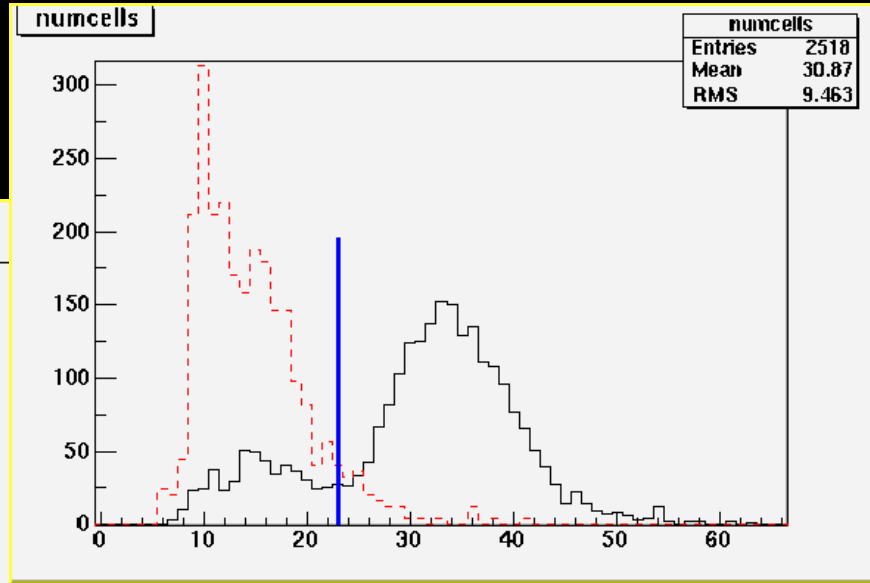
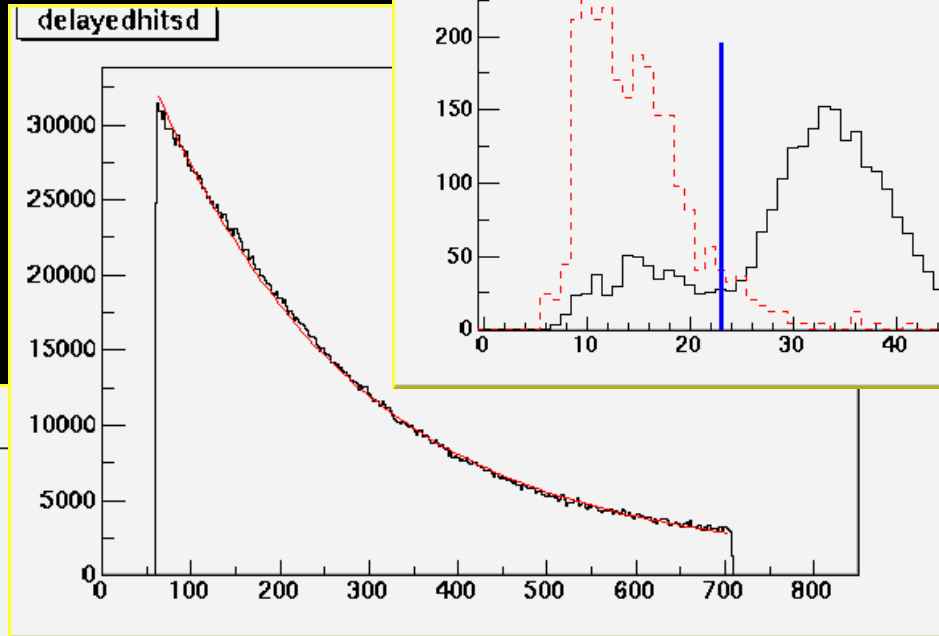
- 1 track only
- 1 scintillator hit only (associated to track)
- 1st layer of geigers hit (fast)
- 4+ delayed geiger hits, $>60 \mu\text{sec}$
- Mo foil sectors only
- Track and delayed geiger start in same sector
- $Q_{\text{track}} < 0$
- $2.08 \mu\text{sec} < \text{fast hits} < 3.9 \mu\text{sec}$

MC: Most fast hits appear in 2.08 – 3.9 μ sec window

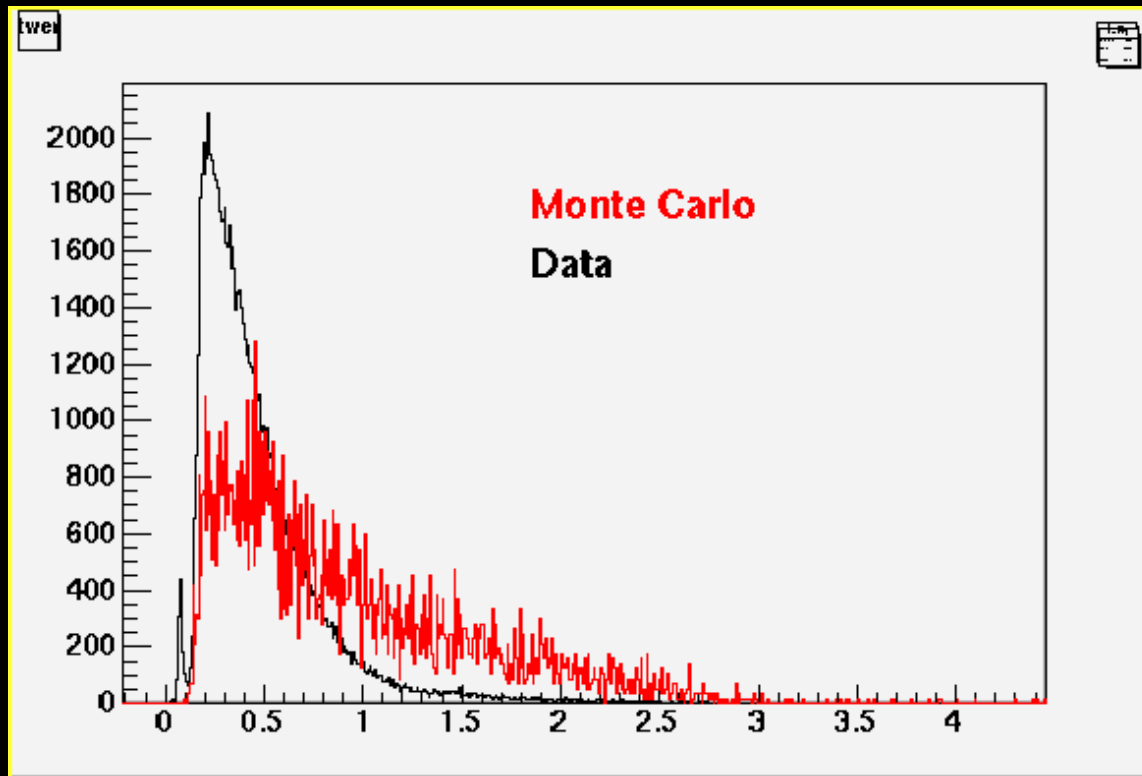


Data: humpy?

140
 μ secs



300 μ secs

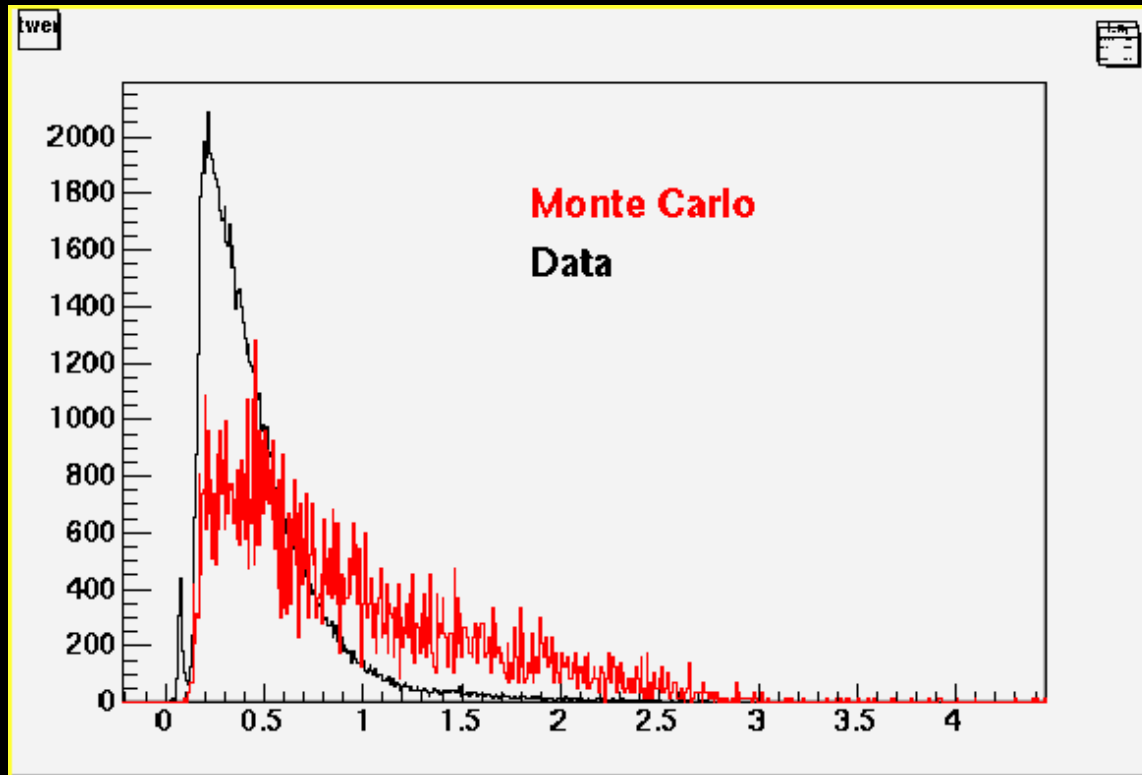


All cuts

MC: 498/150,000 remain

Efficiency : 0.332%

Data: 2106 events



All cuts

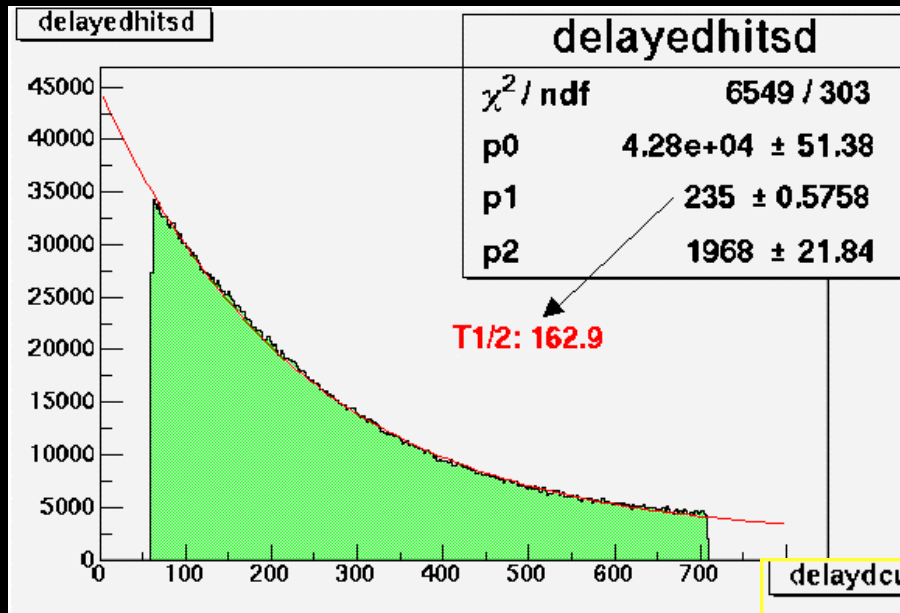
MC: 498/150,000 remain

Efficiency : 0.332%

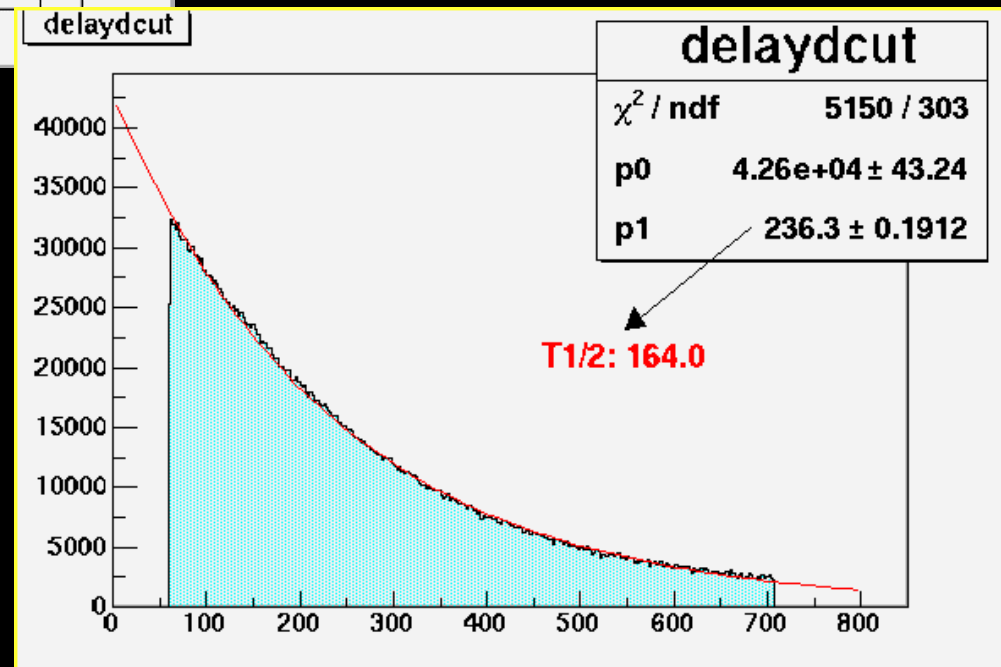
Data: 2106 events

34,364 $\mu\text{Bq/kg}$!!!

Exp: $\sim 300 \mu\text{Bq/kg}$



p2 offset in data
corresponds to constant
noise level? (20%)



After noise removal...

Summary...

- Far too many events remain after cuts...
- Noise (geigers?), α sources in detector?
- High Energy tail of MC distribution?

- Larger MC sample, gas, wires
- Nemo v6.0

Monte Carlo

