

# Rock Background Measurement with the DRIFT-IID Detector at Boulby

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# Outline

The DRIFT-IID detector was left to run unshielded during 45.4 live-days.

14 nuclear recoil-like events were recorded during this time.

We used Geant4 to demonstrate that the observed nuclear recoil rate is consistent with the detection of fast neutrons from salt rock around the Boulby Lab.

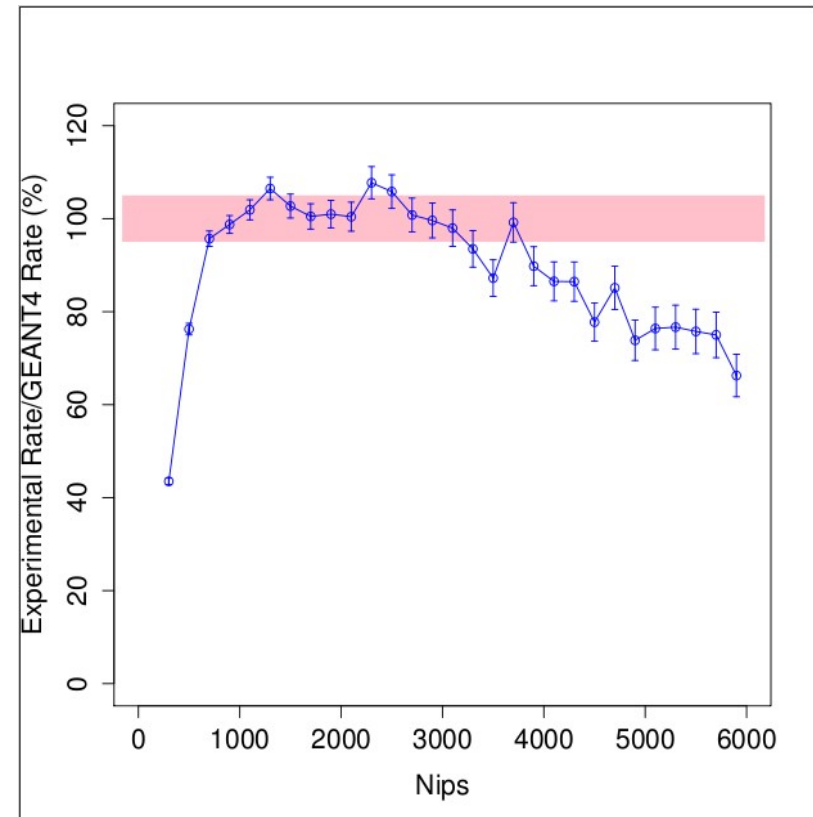
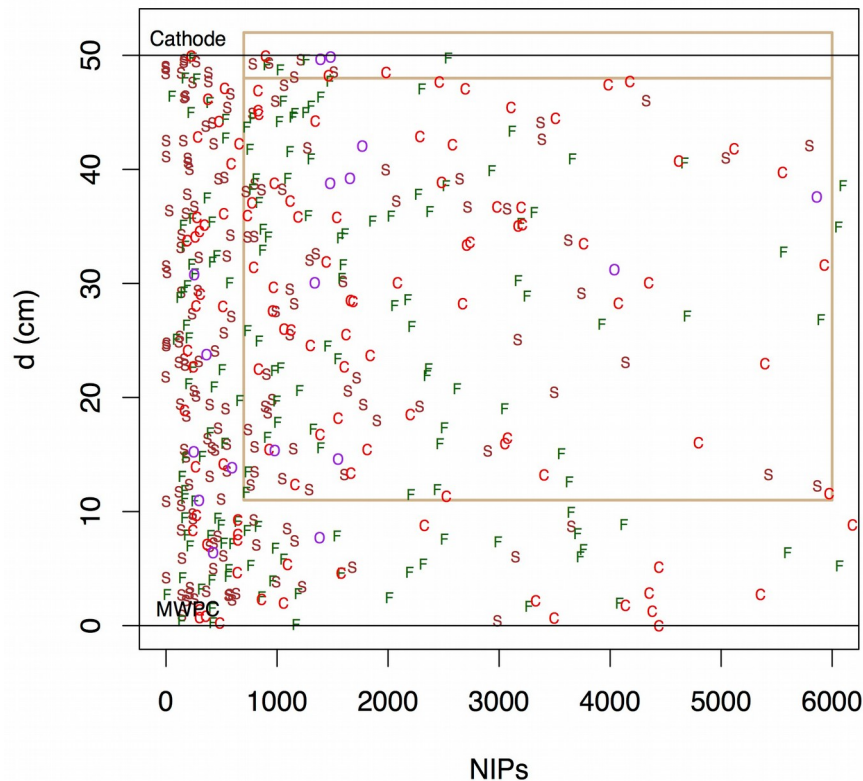
All results are preliminary.

# Neutron Detection Efficiency

The detector was exposed to a Cf-252 source.

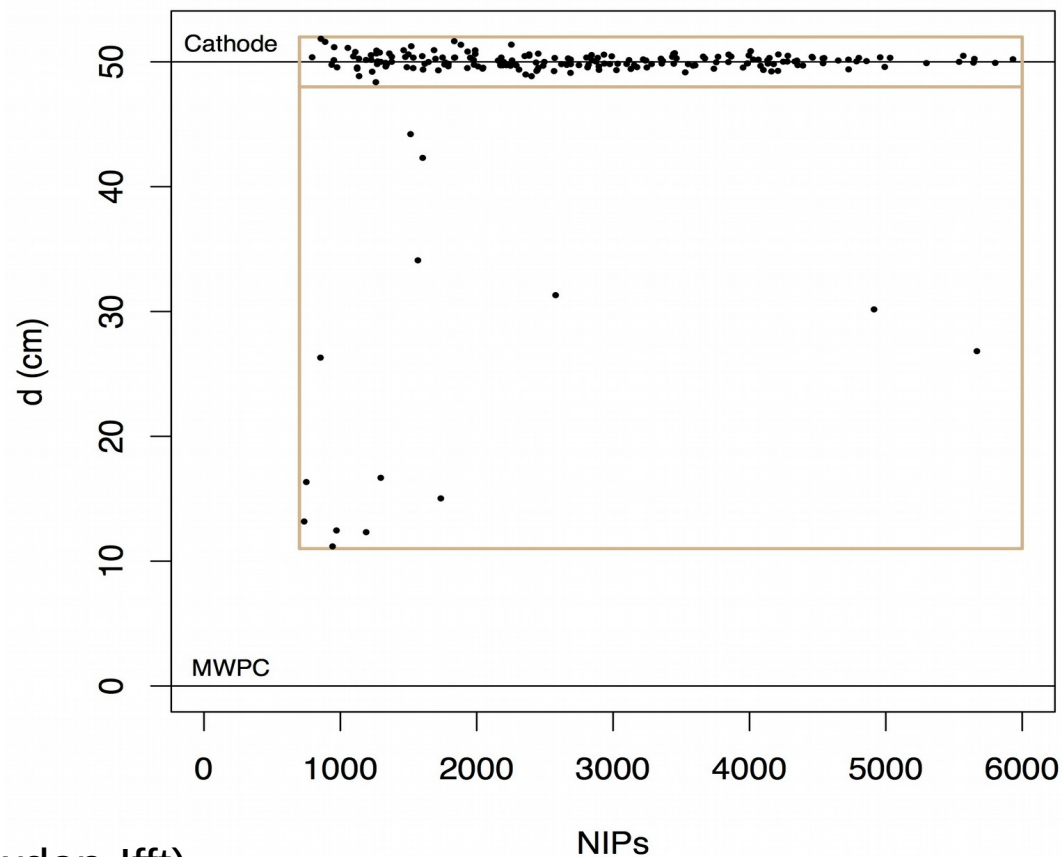
This set-up was reproduced with Geant4 in order to estimate neutron detection efficiency.

a)



# Nuclear recoils

The detector was left unshielded during 45.4 live-days. 14 nuclear recoils-like events were recorded.



(from Dan Snowden-Ifft)

# Co60 simulation

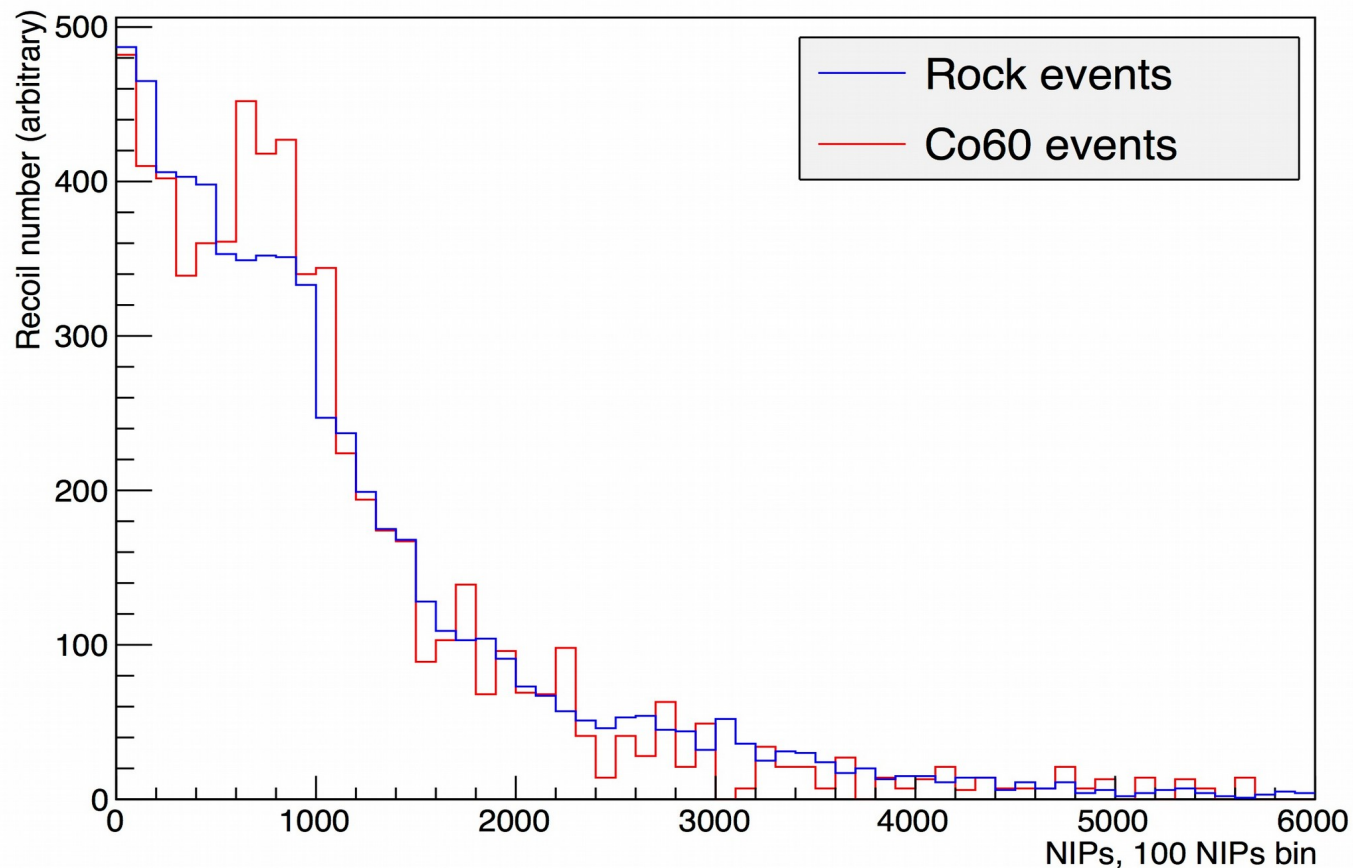
We tried to determine the fraction of events due to Compton scattering of gamma rays from the rock.

The detector was exposed to Co60 sources for which Geant4 predicted a rate of  $46.26 \pm 0.07$  Hz in the fiducial volume.

No events were observed, giving a rejection factor of  $1.98 \times 10^{-7}$  (90% C.L.).

# Rock gammas simulation

A Geant4 simulation of the gamma background from the rock predicted a rate of  $7.8 \pm 1.3 \text{ Hz}$ . After applying the gamma rejection factor this gives an upper-limit on the gamma contamination of 6 events (90% C.L.).



# Rock neutrons simulation

Using Sources-4C, we simulated the neutron spectrum from 10ppb of U238 and 10ppb Th232 in the salt rock at Boulby.

For each isotope, a Geant4 simulation tracked  $5.5 \times 10^8$  neutrons created within 3m of rock around the cavern.

The predicted detectable rate rates were  $(2.1 \pm 0.3) \times 10^{-3} \text{ day}^{-1}/\text{ppb U}$   
And  $(1.0 \pm 0.1) \times 10^{-3} \text{ day}^{-1}/\text{ppb Th}$ .

We assumed secular equilibrium and that Th232 is two times as abundant as U238 (from previous measurements).

# Results

Source	Method	U238 (ppb)	Th232 (ppb)
Smith	Ge gamma ray	$67 \pm 6$	$127 \pm 10$
Tziaferi	Gd scintillator	$95 \pm 34(\text{stat}) \pm 21(\text{sys})$	$190 \pm 69(\text{stat}) \pm 42(\text{sys})$
DRIFT	NITPC	$77 \pm 20(\text{stat}) \pm 7(\text{sys})$	$150 \pm 40(\text{stat}) \pm 10(\text{sys})$