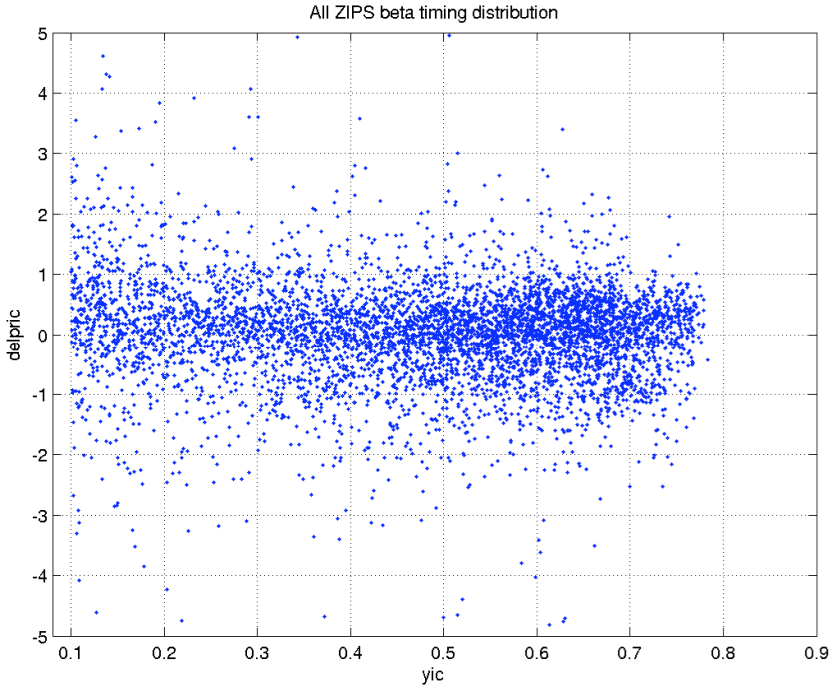
Timing cut approach: beta definition



In R118, we defined betas as events in the Ba data set in the 2 sigma NR band.
Beta timing distributions do not seem to be strongly dependent on y, and having a wider beta distributio gives us better statistics.
The beta definition used in this analysis is a Combination of a cut below the 5 sigma gamma band and a flat yic cut.

detector	betas in 2 sigma NR	~fivesigmagamma & flat yic cut	ratio 2sigma/wide
T1Z1	278	453	1.629496403
T1Z2	32	333	10.40625
T1Z3	60	575	9.583333333
T1Z5	56	641	11.44642857
T2Z3	82	733	8.93902439
T2Z5	44	394	8.954545455

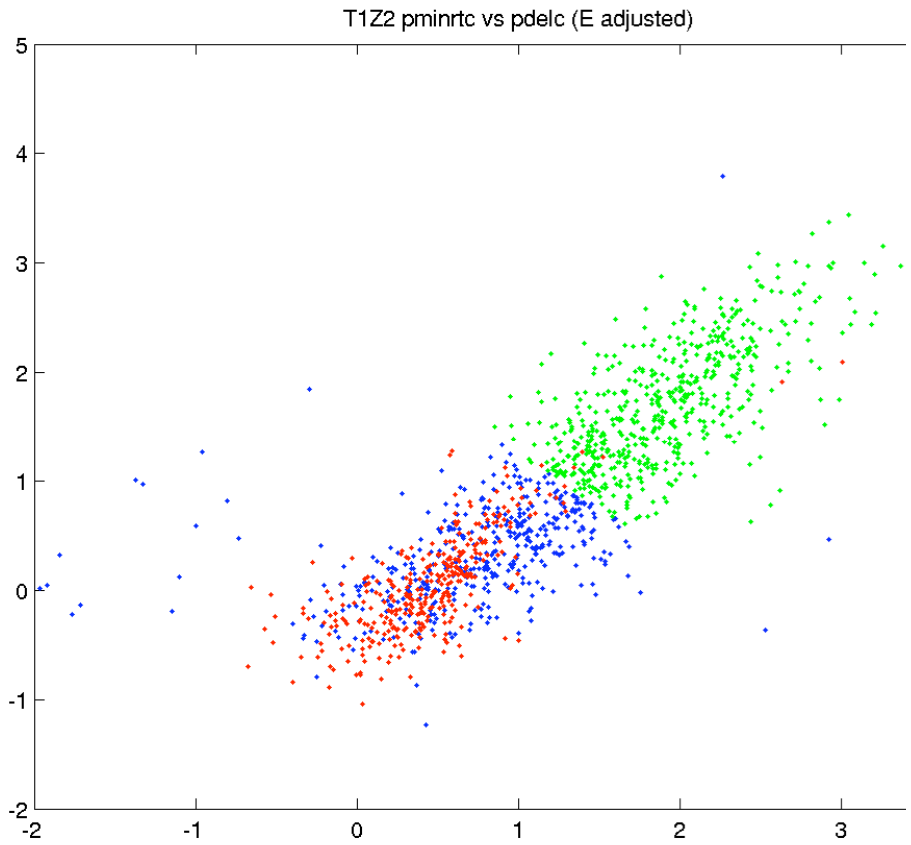
Defining a 2D cut in pminrtc and pdelc

Define new parameters delpric and rtpric, which are pdelc and pminrtc corrected for energy dependence

For events between 10 and 100keV in pric, plot pdelc and pminrtc neutrons and betas.

Fit delpric-rtpric distributions for neutrons with gaussian, exclude all events (betas) outside 4 sigma of this distribution.

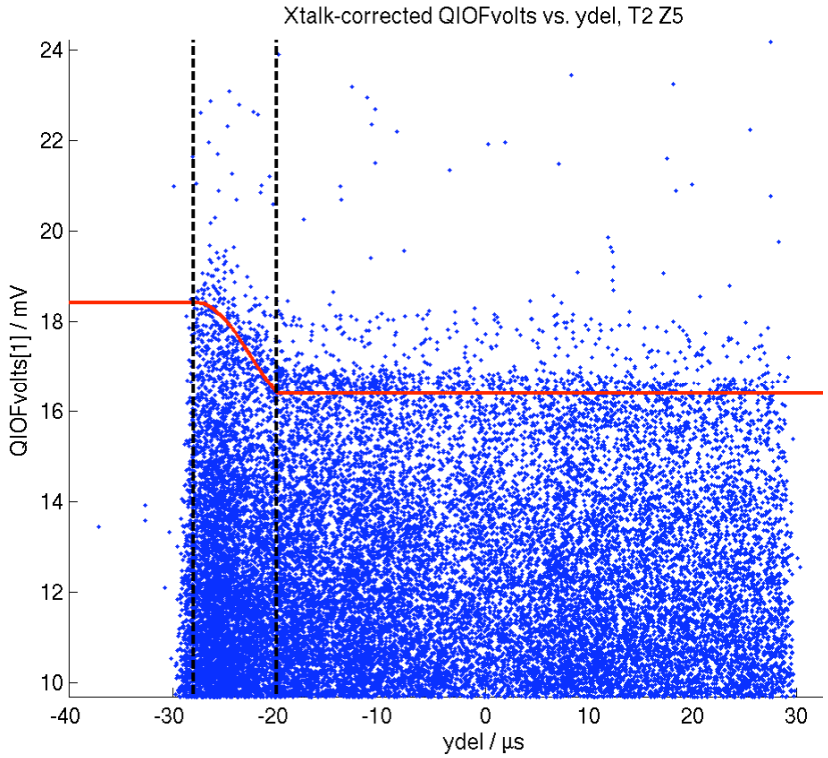
Define a cut in delpric+rtpric that allows desired beta leakage (set on the sixth event in each detecto for this analysis.



Some issues associated with timing cuts

- T2Z5 charge collection:

Walter did a study of the timing outliers in T2Z5, which are all clustered at the bottom of the delay plot. He defined several cuts to exclude the affected region. In this analysis, the cut used is a simple ydel>-20 cut.



- T1Z1has low efficiency for known reasons.

Results from 2D timing cut

Allowed 5 events of leakage in each detector for an exected leakage of 6 events/detector*6Ge detectors =36 betas.

In the WIMP search data, the leakage from these cuts is expected to be on the order of a fraction of an event overall.

Neutron efficiencies for these cuts are around 75% in the higher energy bins and worse at low energies.

Neutron Efficiencies	10-20keV	20-40keV	40-60 keV	60-100 keV
T1Z1	9.3	30.4	60	51.43
T1Z2	45.86	64.73	96.36	70.27
T1Z3	48.77	59.38	65.96	77.27
T1Z5	56.42	72.27	75	83.33
T2Z3	51.61	65.64	73.08	74.07
T2Z5	52.56	66.27	83.72	76.19

Leakage by E bin

det	5-10keV	10-20keV	20-40keV	40-60keV	60-100keV
T1Z1	0	0	2	2	0
T1Z2	0	0	3	0	2
T1Z3	0	0	0	2	3
T1Z5	4	0	1	1	3
T2Z3	1	1	2	1	1
T2Z5	0	0	0	2	2

Low energies and timing

- Below 7keV, Long has found that we start making mistakes in charge energy measurement, causing leakage from ER band to NR band.

- Below 15keV, we start making mistakes in Qist that affect pdelc. This does not affect the timing cut in most cases, though.

- Below 10keV, we start to have trouble defining a beta population for leakage estimates without gamma leakage.

- Below 20keV, the 2D timing cut efficiency is low, around 20% in most detectors.

Further work is needed to determine where to set our analysis threshold. Probably it should be above 7keV.