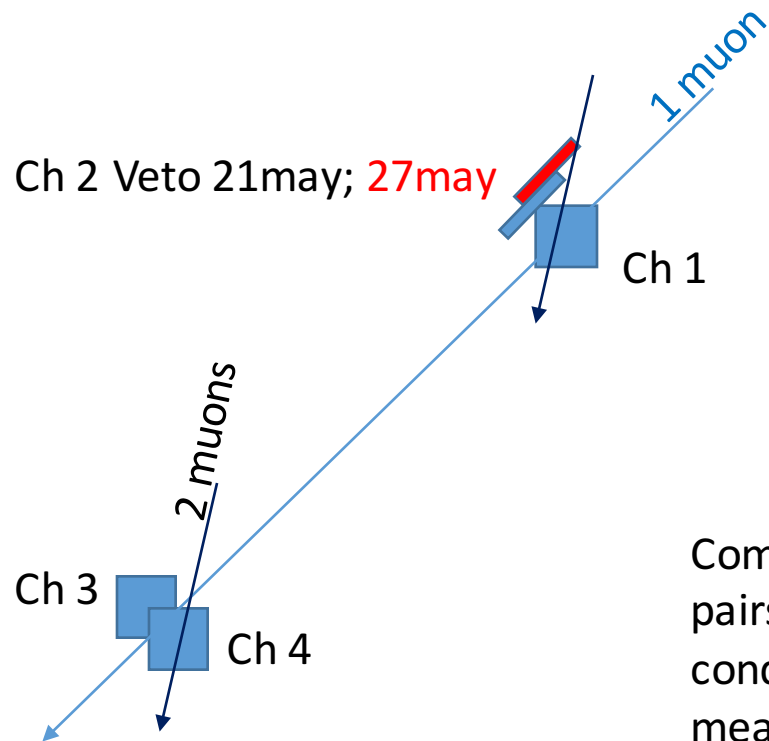# Eclipse 2-muon background estimate using TOF
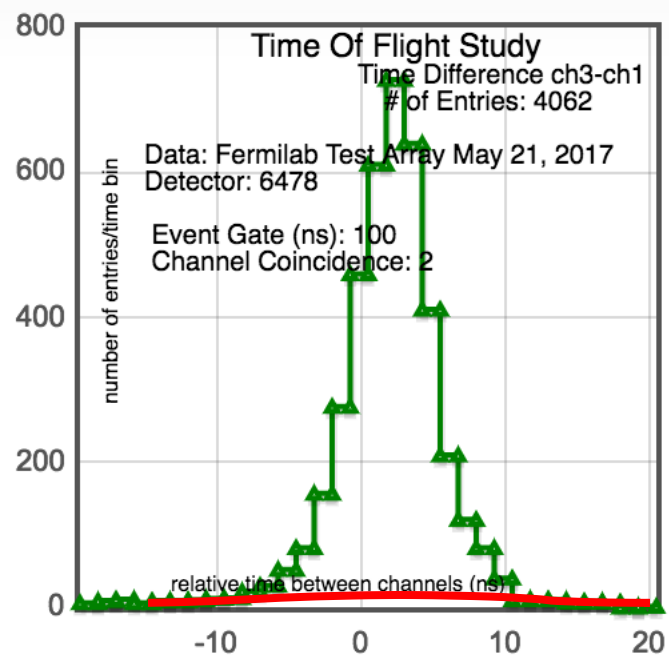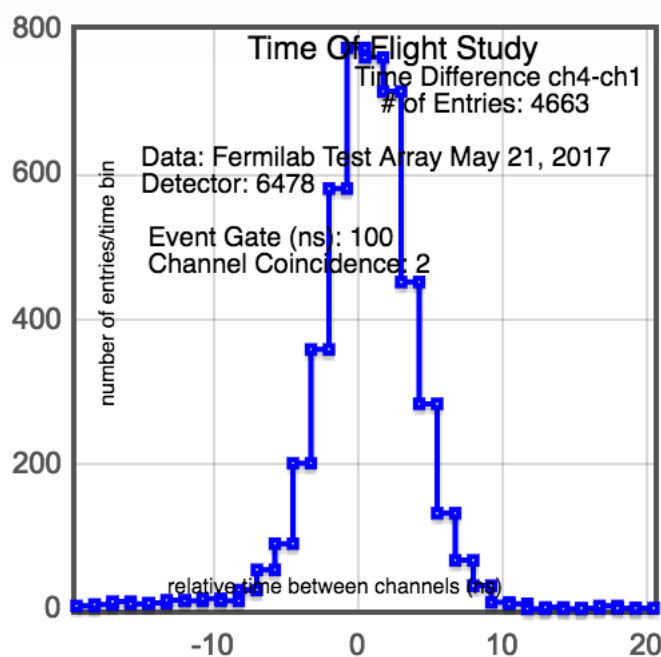
Muon telescope:

Pairs of QN counters separated by 10 ft;
Geneva, IL;
50 degrees above the horizon;
Pointing 5 degrees E of N;
DAQ 6478

Compare timing distributions between counter pairs 3-1 and 4-1 under various software trigger conditions, e.g. 1.2.3 or 1.2bar.3, where 2bar means vetoing the event if counter 2 is present

1 muon

Ch 2 Veto 21may; 27may

Ch 1

2 muons

Ch 3

Ch 4

Timing distributions between counters on the top and bottom of the telescope.

Top Row requires ch2 NOT to be present, indicating a single muon travelling though the telescope
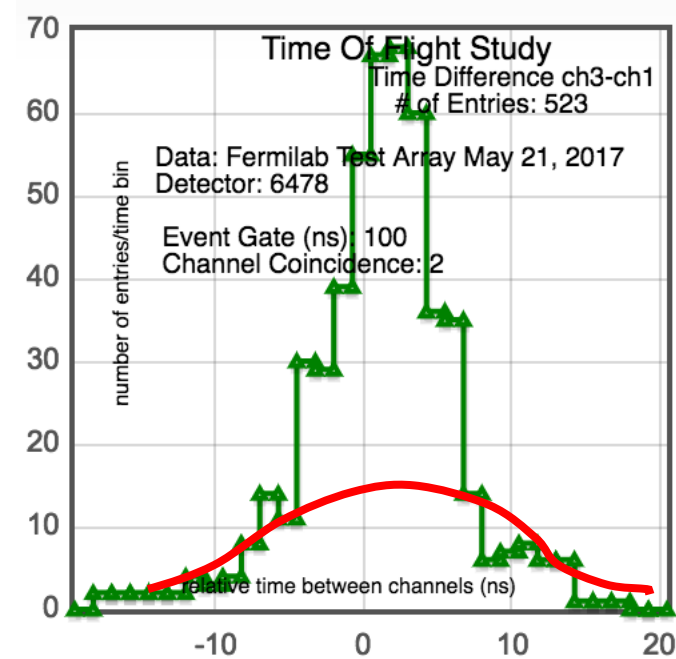
Shape of 2-muon background from lower sample applied to top single muon sample to estimate background

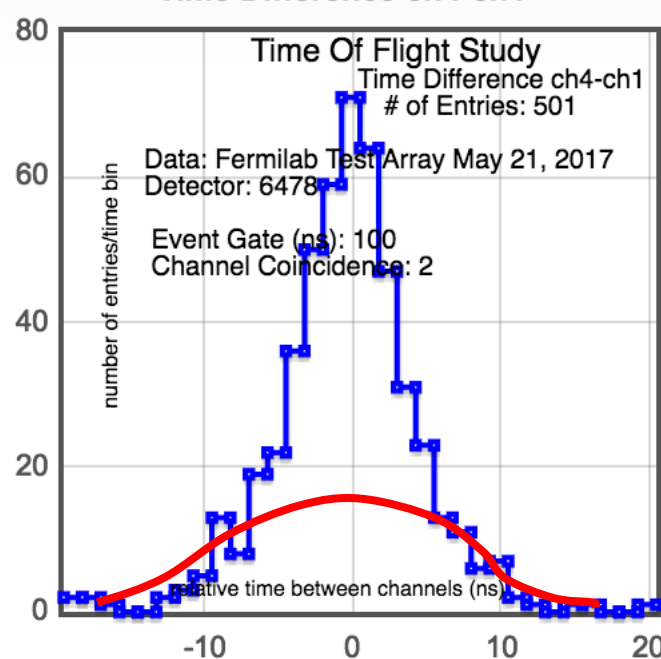Bottom Row requires ch2 to be present, indicating two muons not in the telescope direction.
Ch2 coverage of ch1 is not perfect so both the signal (1 muon) and the background (2-muons) are present in both samples.
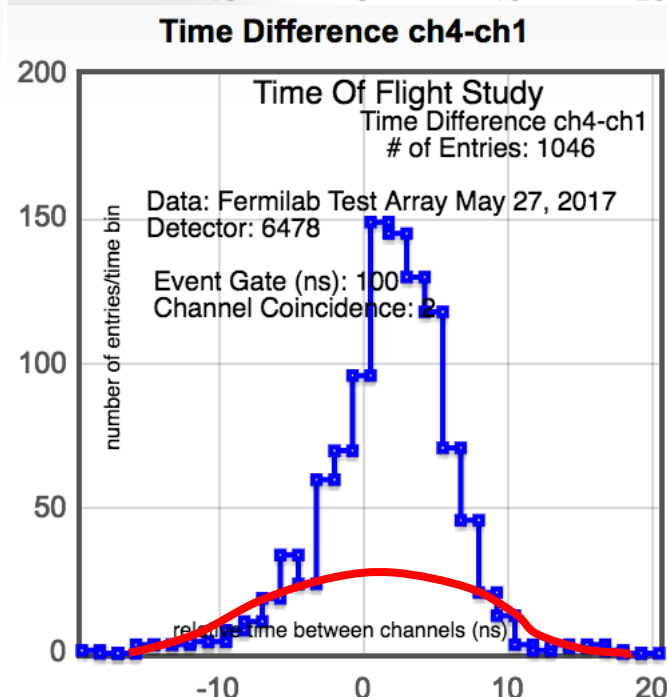
On 21May, coverage of ch2 over ch1 was poor. Bottom row is small fraction of top row and wide (2-muon) sample has few events

Timing distributions between counters on the top and bottom of the telescope.

Top Row requires ch2 NOT to be present, indicating a single muon travelling though the telescope

Shape of 2-muon background from lower sample applied to top single muon sample to estimate background

Bottom Row requires ch2 to be present, indicating two muons not in the telescope direction.
Ch2 coverage of ch1 is not perfect so both the signal (1 muon) and the background (2-muons) are present in both samples.
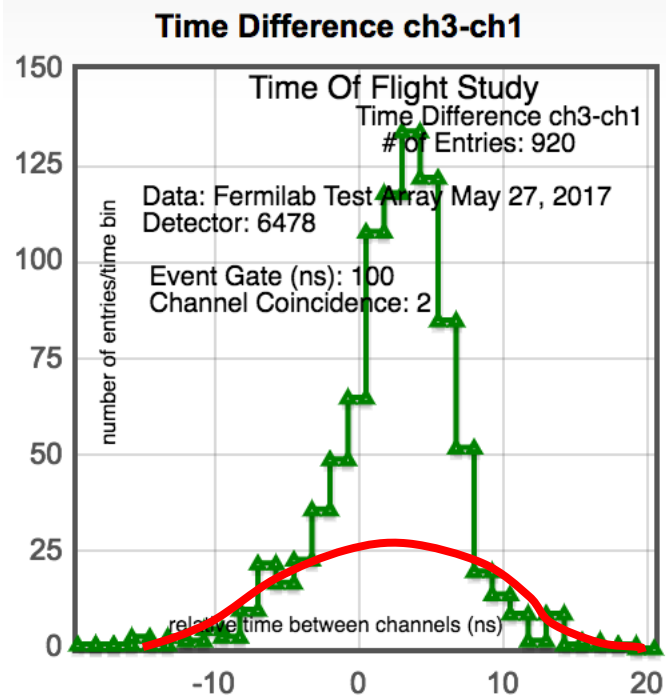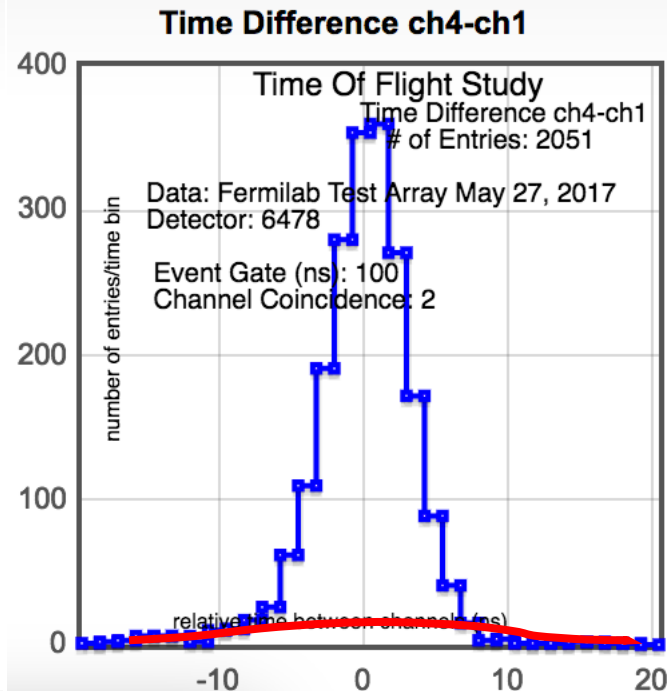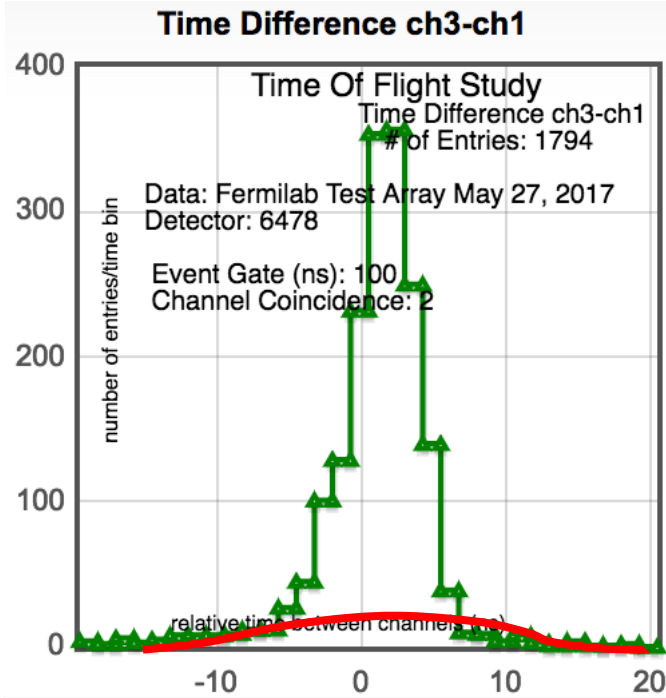
On 27May, coverage of ch2 over ch1 improved. Bottom row is larger fraction of top row and wide (2-muon) sample has more events

Results and Conclusions:

- 2-muon background is a small contamination (<3% by eye estimate) compared to the number of single muons coming from the direction along the muon telescope (based on histograms)

- Contamination should be even less at the larger angles (~60 degrees) expected during the eclipse.

- Timing resolution of 3.8ns for top-bottom telescope counter pairs