

# Trigger Study

*Ideas for optimization of LArIAT Beamline Trigger system*

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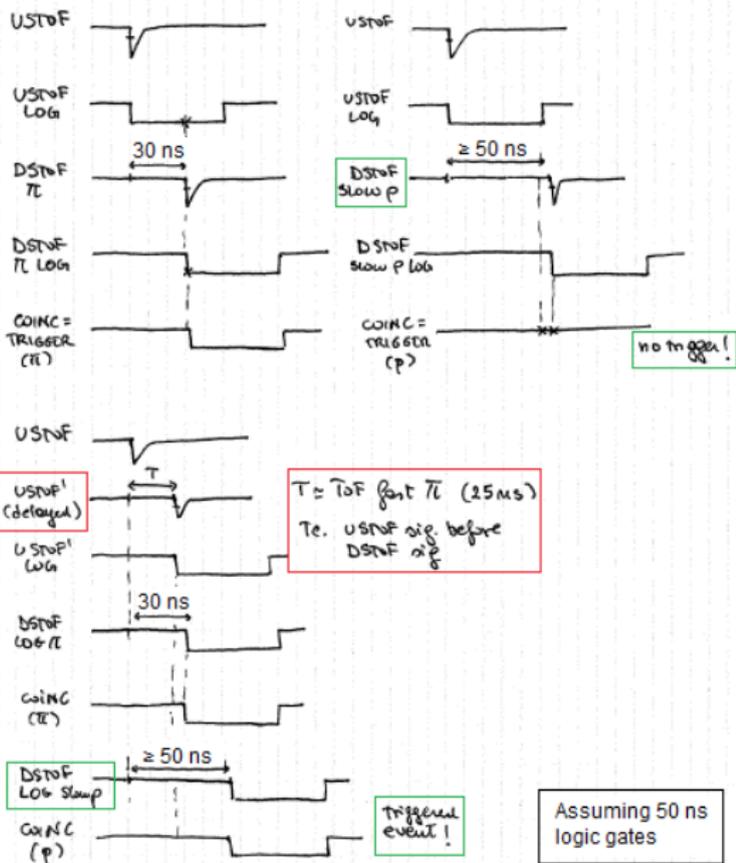
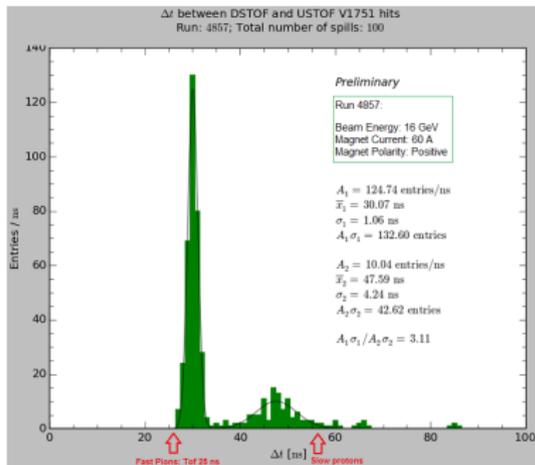
## Improvements on Trigger System

Actually, Trigger is made by coincidence of (USTOF1 & USTOF2 & USTOF3 & USTOF4) logic signal and (DSTOF1 & DSTOF2) logic signal & WCCOINC.

Improve Trigger Efficiency acting on ToFs:

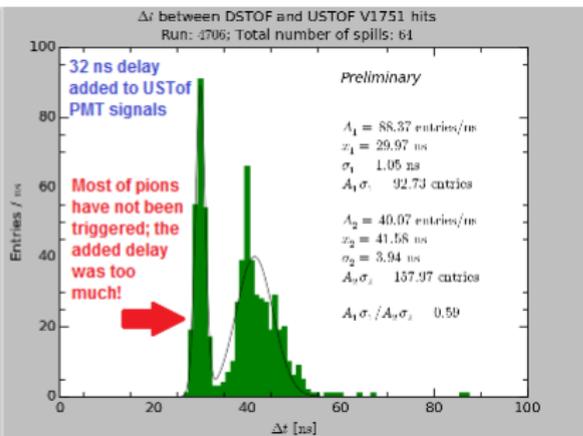
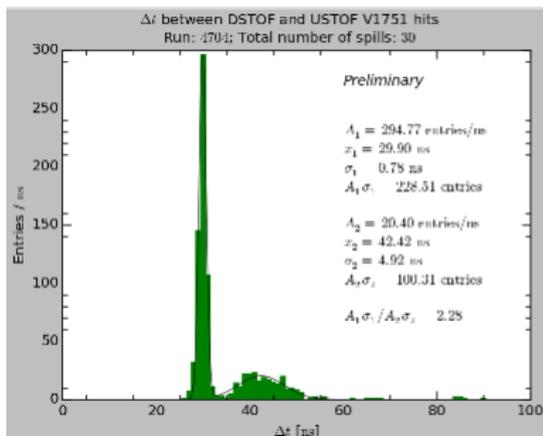
- ▶ Synchronize USToFs logic signals with DSToFs logic signals: not to lose slow pions ( $\text{ToF} \geq 50 \text{ ns}$ ), try to delay USToFs signals of an amount  $\simeq \text{ToF}$  pions
- ▶ Use CFDs (Constant Fraction Discriminators) instead of Threshold Discriminators, on PMT ToF signals; to reduce walk and to have better time resolution on trigger signals ( $\sigma_t \simeq 300\text{-}500 \text{ ps}$ )

# Synchronize USToFs with DSToFs

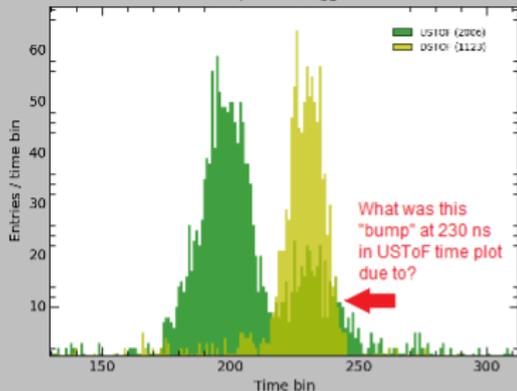


# Synchronize USToFs with DSToFs with 32 ns delay

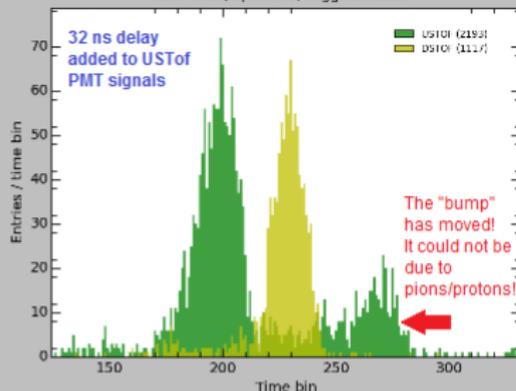
- ▶ On April 16th: USToF PMT signals delayed with 32 ns cable:  
(Run 4704, 4705, 4706)
  - Too much delay added, lose pions  $\rightarrow$  32 ns delay cables removed
  - See that USToF PMT signals were saturated - they were  $\approx 400V$  above their recommended voltage (Read values in ACNET were not real values on COW)



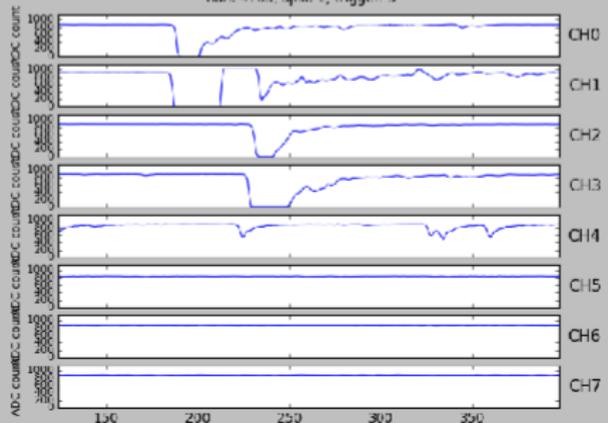
V1751 TOF hits  
Run: 4704; spills: 30; triggers: 1618



V1751 TOF hits  
Run: 4705; spills: 26; triggers: 1519



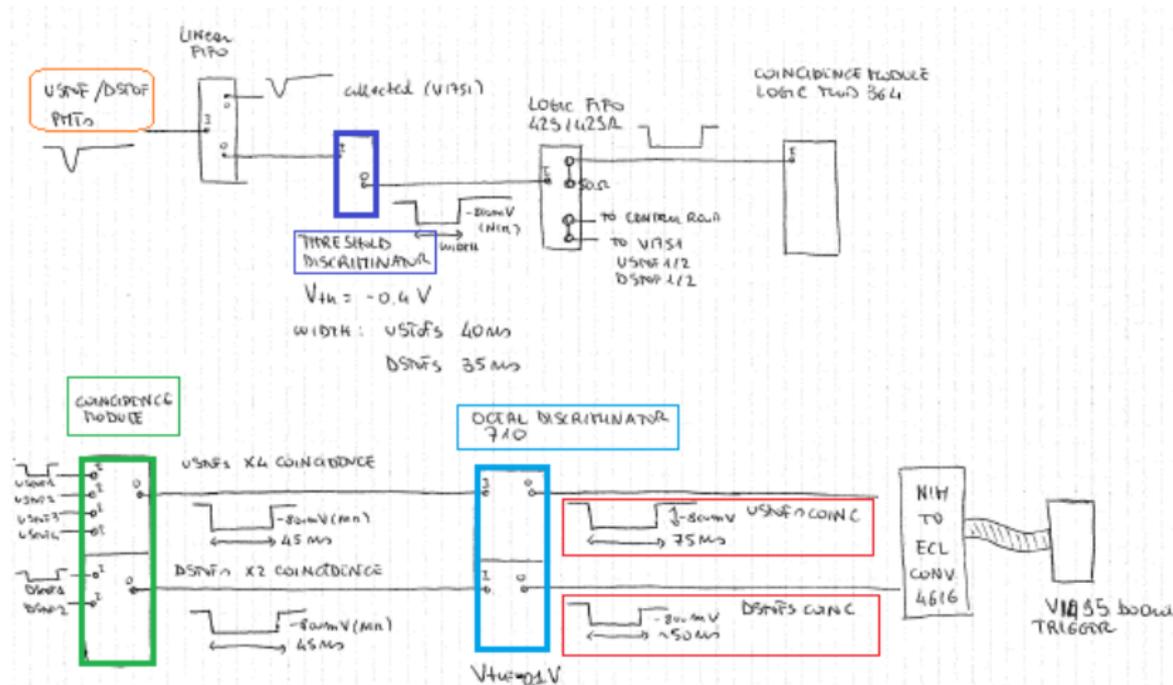
V1751 board 1 waveforms  
Run: 4705; spill: 1; trigger: 9



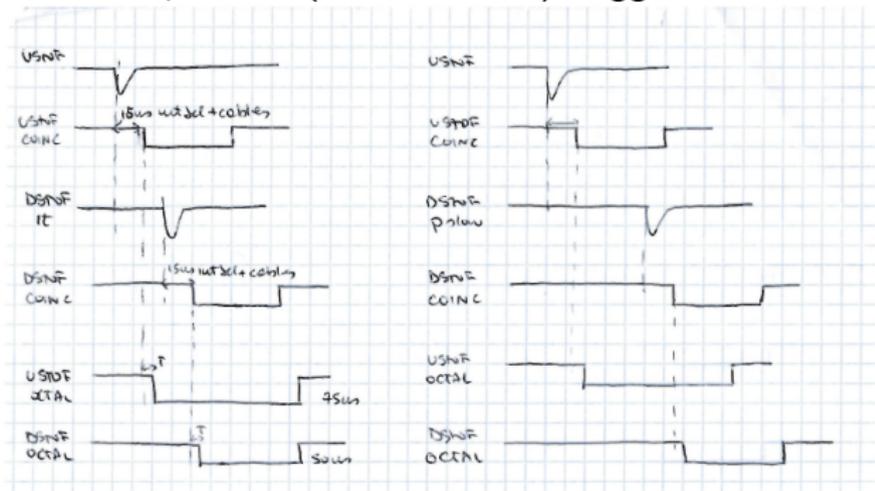
USToF PMT signals were saturated  
(PMT 400 V overpowered!)

# ToFs Setup

- On April 20th: Check ToFs setup: modules used, thresholds and logic signals width



- ▶ Different time width for DSToF and USToF coincidence signals coming out from Octal Discriminator ( 75 ns USToF coinc gate, 50 ns DSToF coinc gate) may make possible to have slow protons (ToF  $\geq 50$  ns) triggered too.



- ▶ Or try different delay cables on USToF PMT signals: 18ns, 24 ns (less than average ToF for pions)  $\rightarrow$  synchronize USToFs and DSToFs, no need for Octal Discriminator!
- ▶ Try CFDs instead of Threshold Discriminators, on PMT ToF signals.