

# Trigger Reconstruction

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MIPP Collaboration Meeting  
October 1, 2004  
FNAL

# Goals

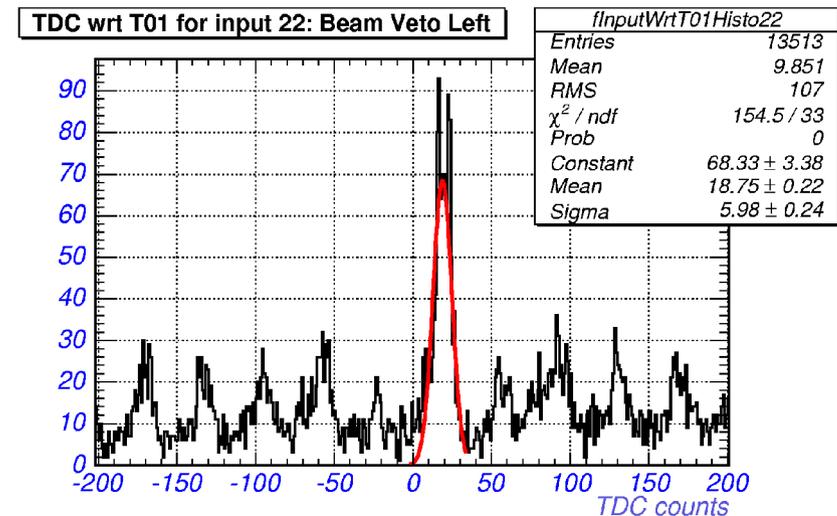
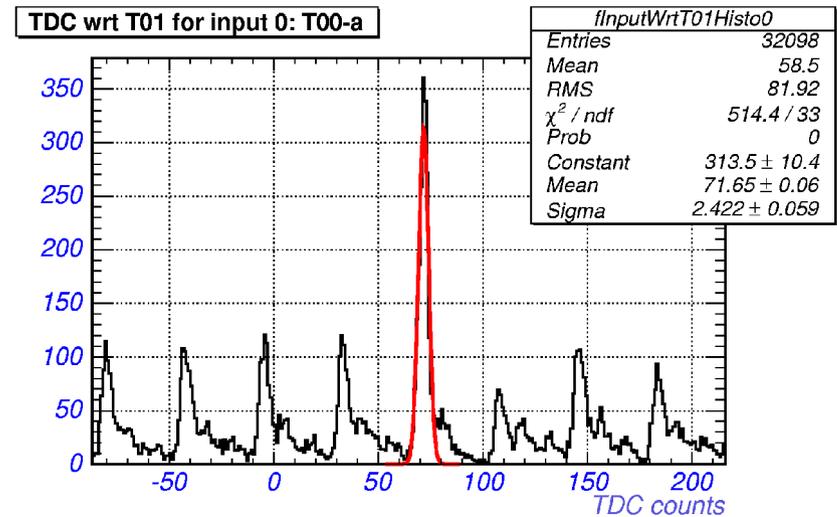
- Provide a standard way to reconstruct trigger information
- Provide a standard way to select events based on trigger information
- Calculate time reference for each event
  - Triggers may not be timed in perfectly

# Outline

- Calibrate all channels w.r.t. T01  $\frac{3}{4}$  coincidence (separate job)
  - Calculate offsets and width for each channel
  - Determine what to call  $t_0$
- Store calibration data to DB
- Reconstruct TDC information into TrigWord's
- Make cuts based on TrigWord's
- All presented results were done on run 9304 (beam trigger, 40 GeV beam)

# Calibration Algorithm

- Create histograms of all signals w.r.t. ANY T01  $\frac{3}{4}$  signal
- Find the most populated peak
- Fit a Gaussian if the peak has enough statistics. Otherwise, calculate mean and RMS



# Definitions

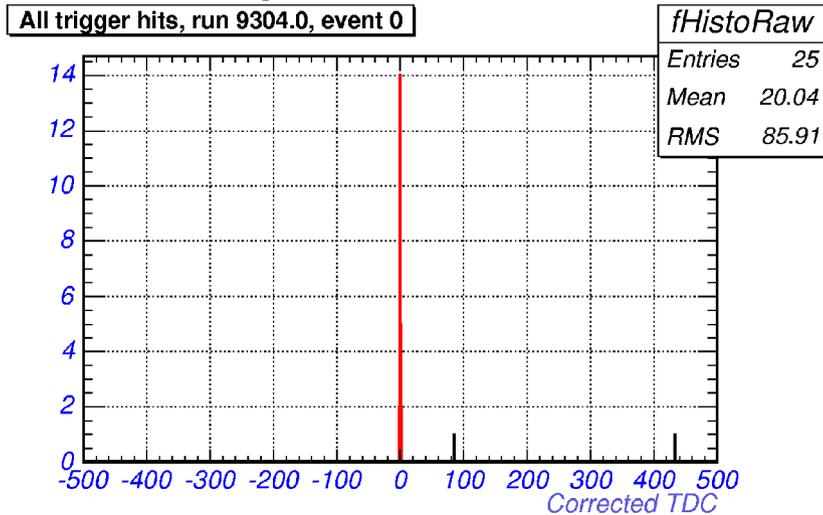
- Trigger bit: any of the 20 signals that is capable of triggering an event
- Trigger input: any signal that is recorded into trigger block (T00, T01, TBD, Bckov's, veto, etc)
- Trigger word: a temporally coincident combination of trigger bits and inputs
- Beam word: a trigger word containing T01 or Beam coincidence in trigger bit or input

# Reconstruction Algorithm

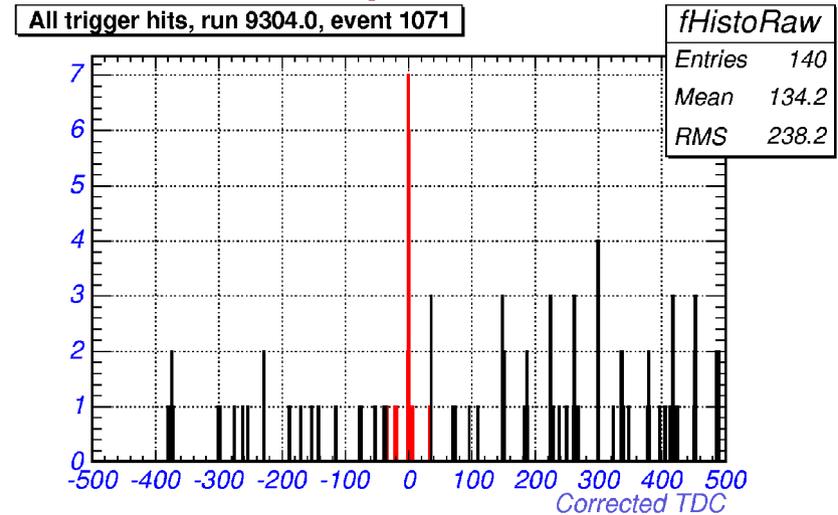
- For every beam signal, add all in-time bits and inputs to form a trigger word
  - In-time are within  $x \cdot \sigma$  of the calibration gaussian width;  $x$  is user-defined
- Collect nearby out-of-time hits
  - Time window is user-defined
- Label other groups as miscellaneous words
  - User-defined width of the word
- Store remaining single hits

# Results

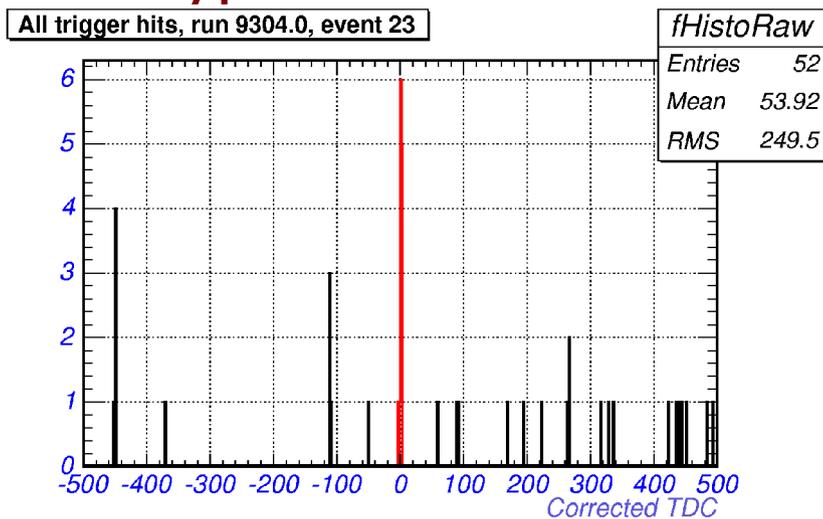
## Very clean event



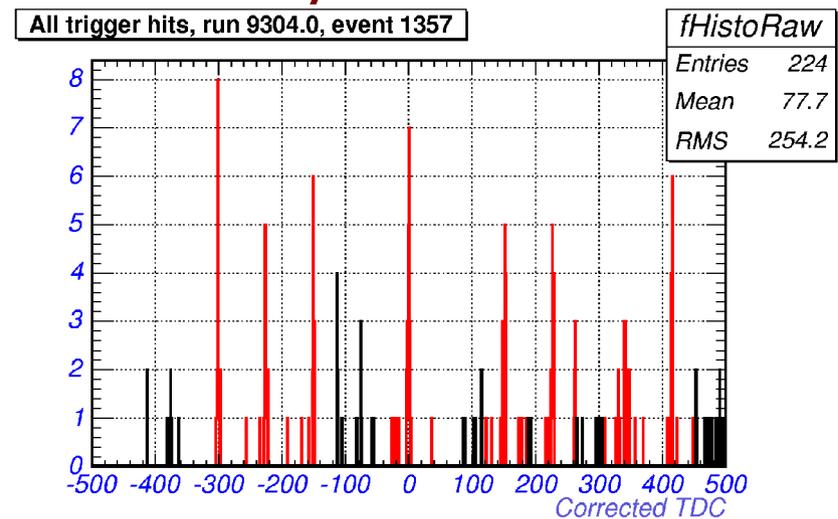
## Noisy event



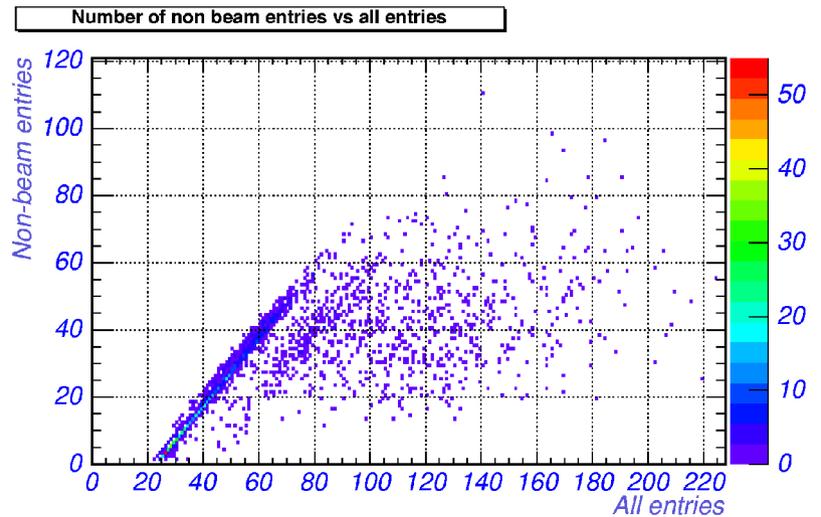
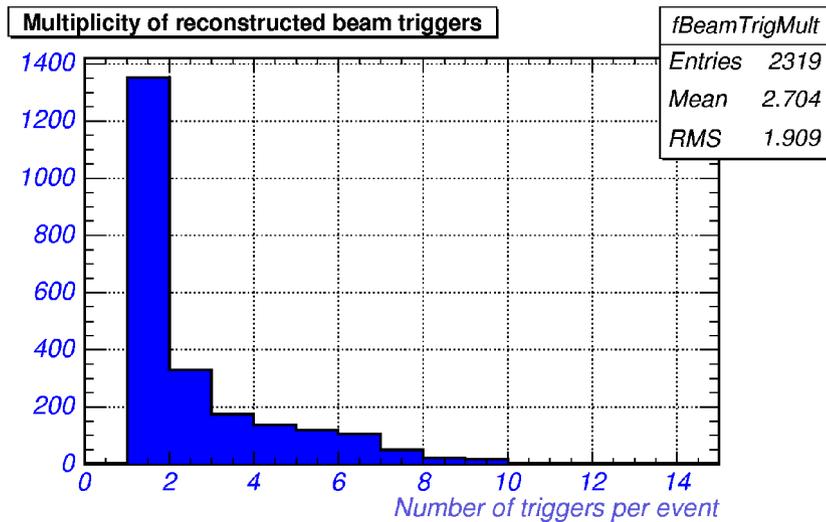
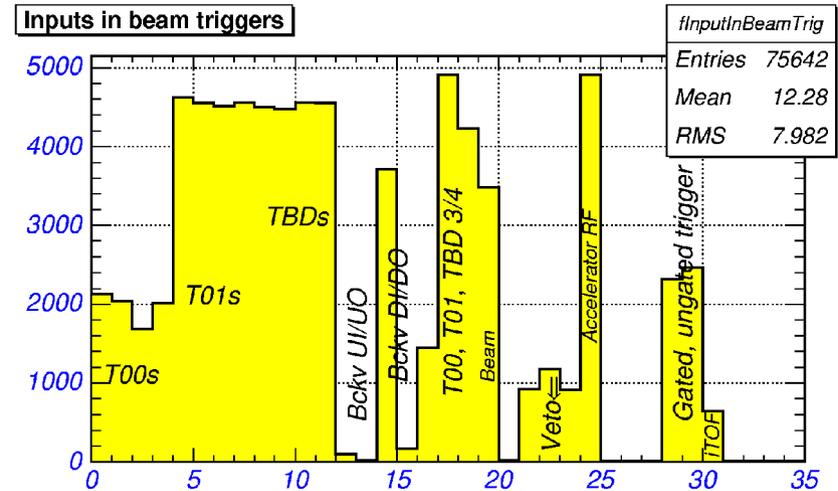
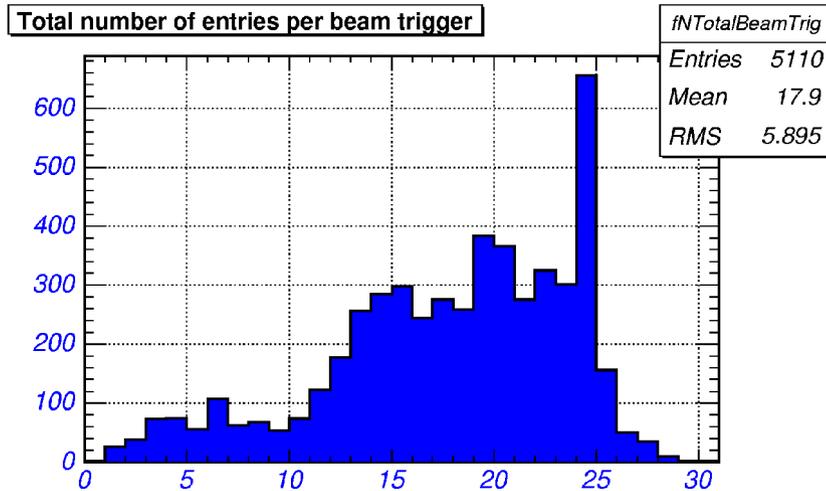
## Typical event



## Very "full" event



# Results (cont.)



# Completed and Remaining Tasks

- Connection map is working
  - Need to go through log book and populate tables
- Trigger calibration is working
  - Could use improvement in searching and fitting algorithm
- Reconstruction is working to 0<sup>th</sup> order
  - Need to create “miscellaneous” words
- Simple filtering exists
  - Need input from users about improvements and specific needs

# Where Should This Be Headed?

- Tune the algorithm and associated constants
- More reconstruction
  - Fold this information together with beam chambers to calculate likelihood for PID of incident particle
- Trigger studies
  - Allows to perform more detailed studies of trigger efficiency, problems
  - Geared to be invaluable tool to trigger group