

Straw chamber TB report

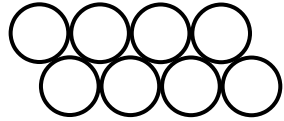
V.Bautin for the Straw TB team

11th May 22

Development of the testbeam setup, ongoing measurements and further plans

Available equipment:

- **DUT** : a straw chamber ($\sim 20 \times 20$ cm²) read out with a mu2e **VMM3**-based board



$D_{\text{straw}} = 6$ mm, $D_{\text{wire}} = 30$ μm , gas Ar(70%)+CO₂(30%), 2 layers of 32 straws

time-at-threshold mode

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- **Timing**: 3 scintillators ($\sim 10 \times 15$ cm²) + SiPM, read-out with the mu2e
- **Tracking**: a lab tracker telescope of 3 MM ($\sim 15 \times 15$ cm²) with an APV-based read out, triggered with the scintillator coincidence

Bottleneck: read out synchronization pf two independent DAQ systems

Solution: - offline synchronization

The TB program has been divided in several stages, from a minimalistic datataking (straws + scintillator) toward the complete read out with offline synchronization

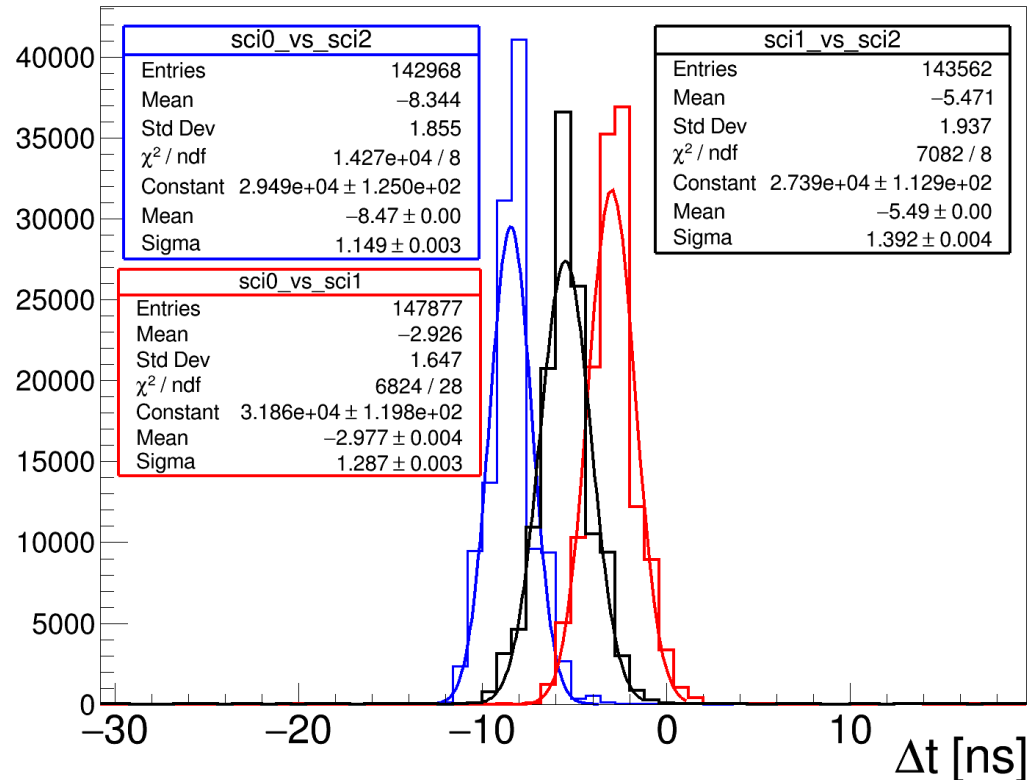
Stage 0: Straws + scintillators, common mu2e read out (time@threshold mode)

- **Goal:**
 - Read-out validation, including VMM3 operation in t@t
 - Choice of optimal straw/VMM3 operation parameters
 - Straw HV (scan) - done
 - Gain and thresholds of the VMM3 - done
 - Scintillator timing validation - done
 - Validation of the reconstruction procedure - done

Stage 0 preliminary results :

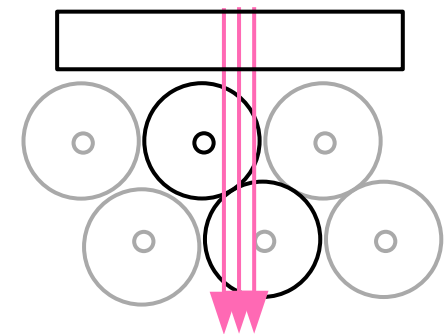
reconstruction validation, event synchronization and the scintillator time resolution

run_0146: 08.05.22, 1mV/fC, thr = 205

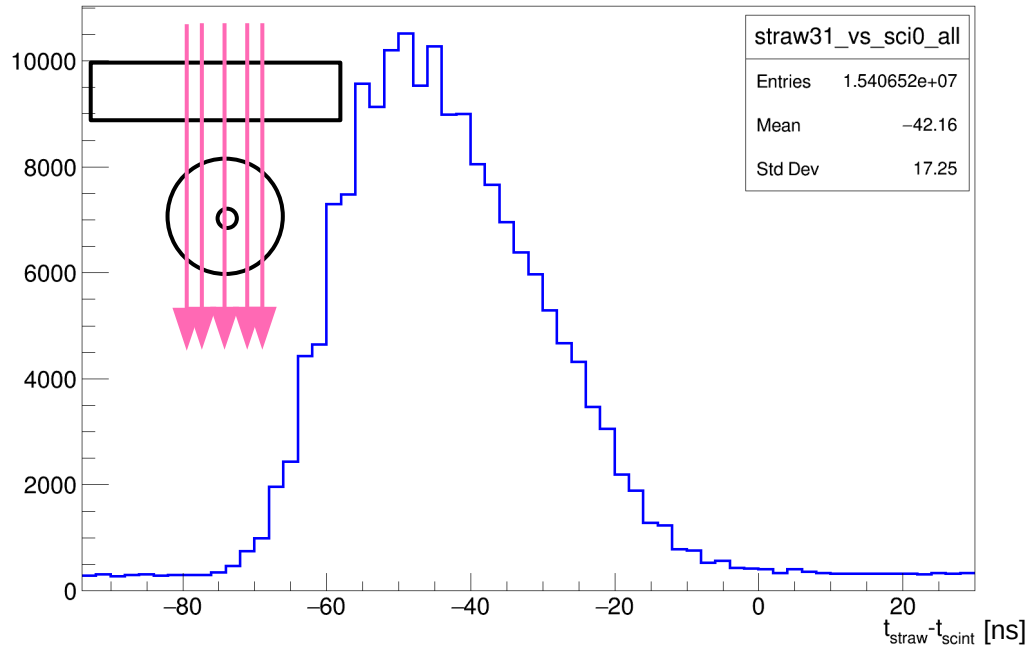


Stage 0 preliminary results :

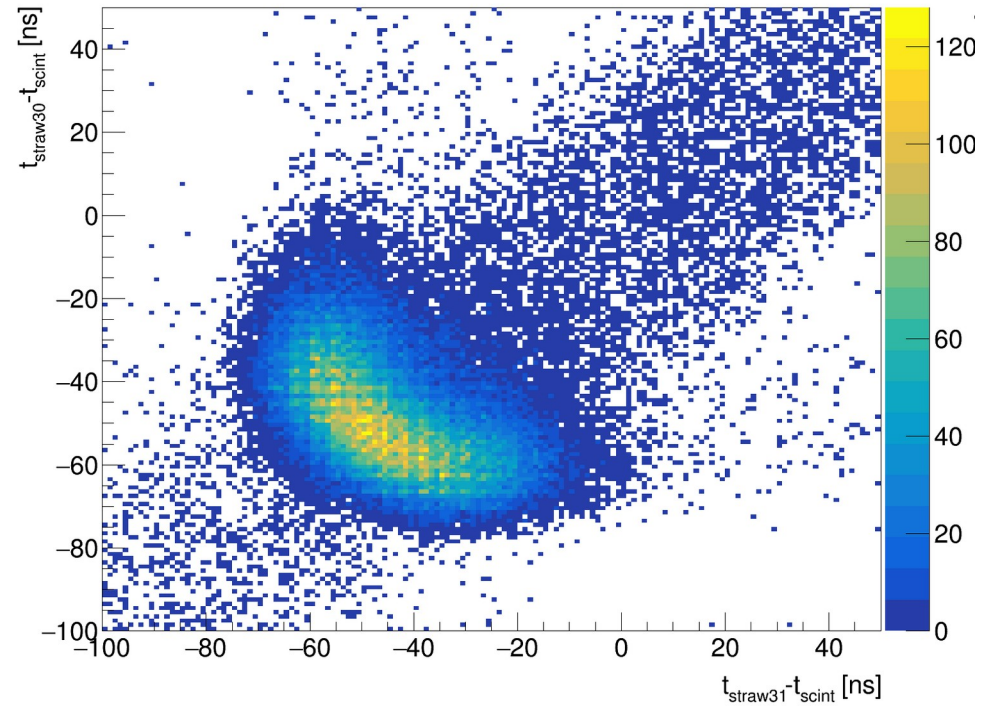
reconstruction validation, event synchronization, straw-scintillator and straw-straw time correlations



run_0146: 08.05.22, HV=1650 V, 1mV/fC, thr=205: straw31_vs_sci0_all

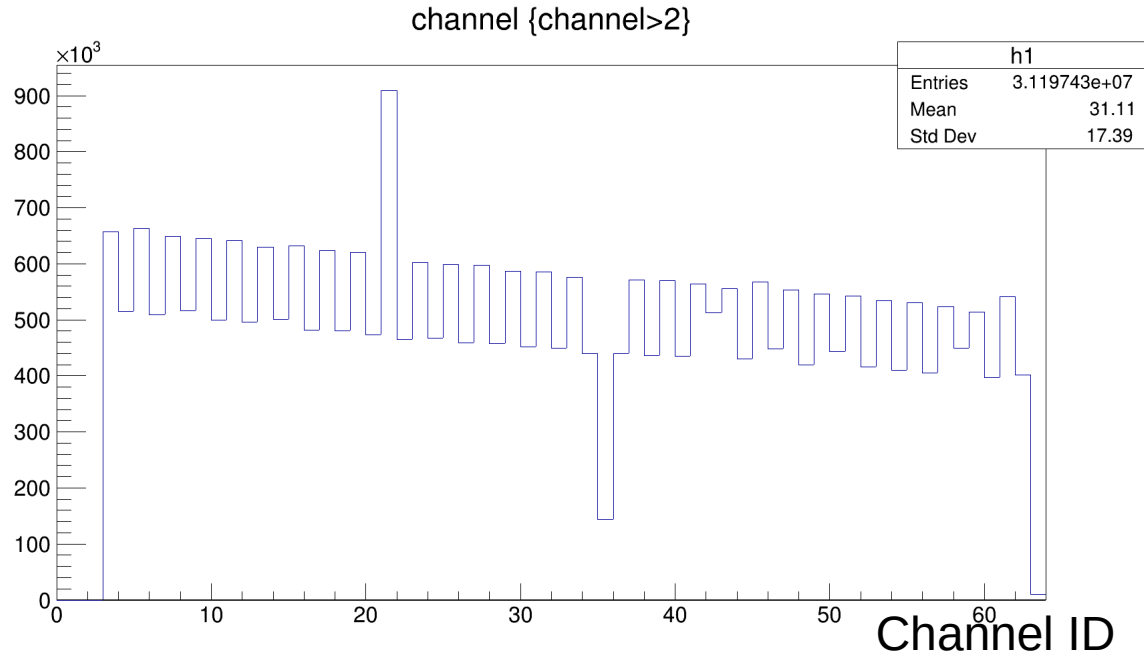
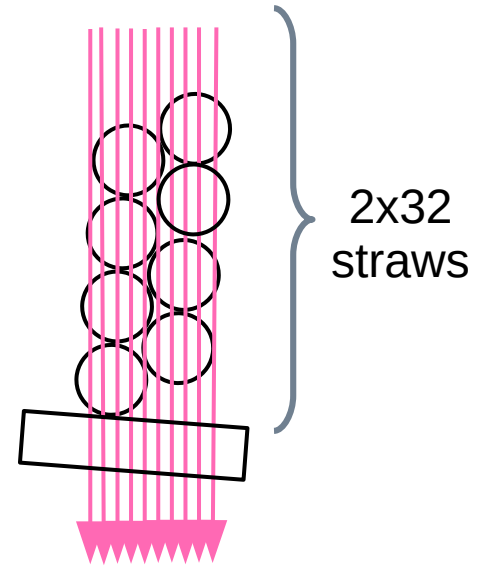


run_0146: straw31_vs_straw30_banana_ch0



Stage 1: Straws + scintillators, common mu2e read out at t@t with the ROTATED SETUP

- **Goal:**
 - Minimalistic (self)tracking with 32 straws – possibility go get rough(?) coordinate information from straws themselves
 - Possibility to get rough R-T dependence



Very rough estimate: $O(100k)$ tracks for every HV and gain settings

Data treatment requires a quite sophisticated analysis

Stage 2 (**WE ARE HERE**):

6 straws + 2 scint + 50 MM1 strips with VMM3 read out

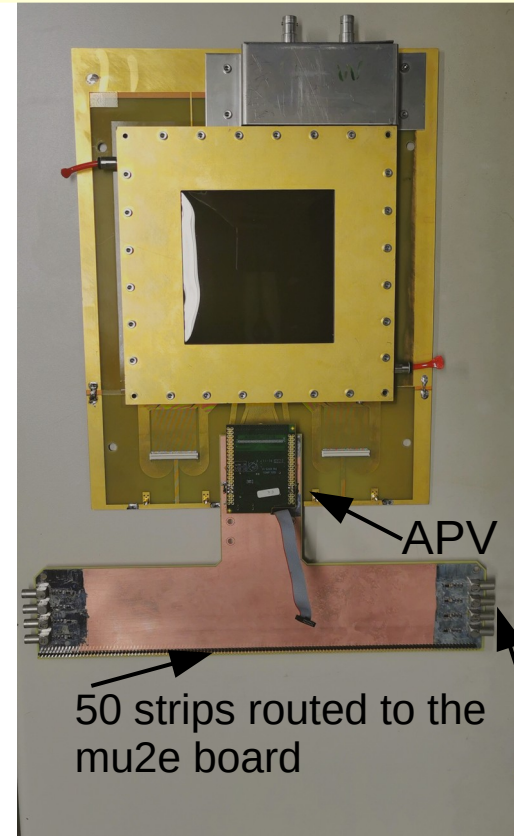
And (MM1), MM2, MM3 with APV read out

- **Goal:**

- To get hits from 50 MM1 strips synchronized with hits from 6 straws and two scintillators via the VMM3 read out
- The same 50 MM1 strips to be read-out via APV within the standard MM1+MM2+MM3 DAQ chain (optional)
- **Offline analysis:** merging two events from different DAQs according to
 - hit positions in the “double readout” MM1 area
 - mapping the MM1 hits in mu2e with MM2+MM3 APV DAQ (minimalistic option)

- **Expected result:** a high precision R-T curve

The cross-board with the double readout option has been produced!



50 strips routed to the mu2e board

4+4 LEMO inputs for straw and scintillator readout

First tests those days!

SUMMARY

- Despite of the very tough situation with tracking and DAQ availability, first data are obtained
 - Stable operation of VMM3 in time-at-threshold mode
 - Reasonable results (detailed analysis and simulation studies are ongoing)
- R-T dependence
 - Data with the rotated setup – collected
 - MM-based tracking + offline synchronization
 - Required MM read-out commissioning from scratch - done
 - Required development and production of a cross-board - done
 - First tests with cross-board and double readout to be done next days

MM tracker read-out – work in progress

