

Short Report on Bernese R&D



THOMAS STRAUSS

FOR AEC, LHEP BERN

WORK DONE BY I. KRESLO AND M. SCHENK

What you already know

2

LARASIC for ARGONTUBE

Timeline

- Following discussion with Veljko Radeka and Chen Hucheng
 - On February 21st we received 10 new LARASIC4 (IC127) including documentation.
- Visit of Dean Shooltz (Michigan State University) on March 18th.
 - Besides a lot of useful information, we got 2 host PCBs from BNL.
- Help was provided by Chen and Gianluigi to set up the BNL board and test it.
- LHEP, May 2013
 - A LARASIC controller is designed, produced and tested.
 - An ARGONTUBE frontend PCB is designed, produced and tested.

LARASIC for ARGONTUBE

Controller NIM Module and Frontend Board

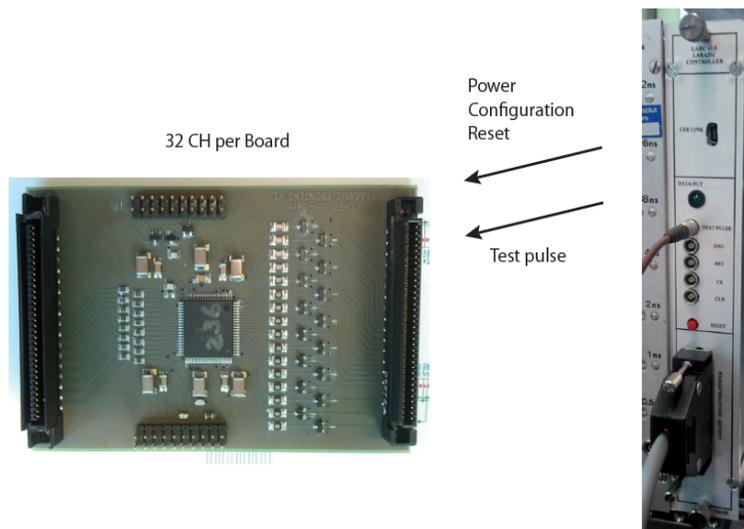


Figure 11: Controller NIM module and frontend board.

LARASIC for ARGONTUBE

Cold Tests in LAr

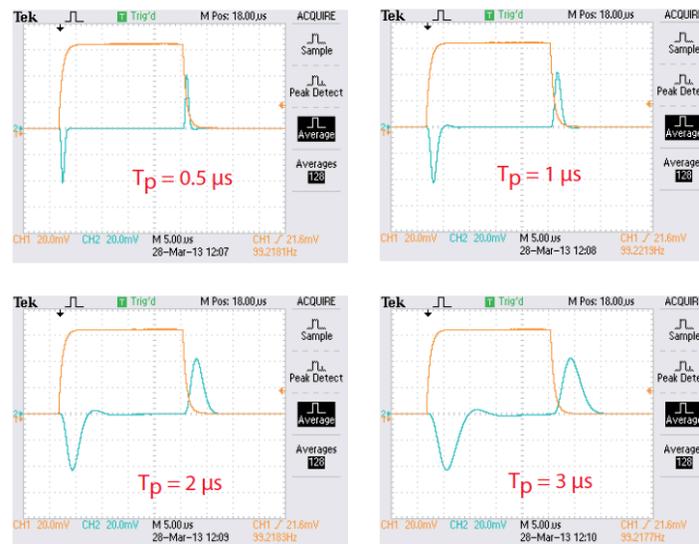


Figure 12: Response signals for different test pulses while chip is immersed in LAr.

LARASIC for ARGONTUBE

Cold Tests in LAr – Summary

- Charge gain $G = 25 \pm 1 \text{ mV/fC}$
- Transimpedance @ $T_p = 1 \mu\text{s}$: $Z = 39 \pm 3 \text{ mV/nA}$
- Droop (important for long tracks): $2\%/\text{ms}$
- Noise with $C_{\text{det}} \approx 1 \text{ pF}$
 - @ $T_p = 0.5 \mu\text{s}$ RMS = 194 e
 - @ $T_p = 3 \mu\text{s}$ RMS = 375 e

⇒ Perfect match to specs.

LARASIC for ARGONTUBE

Summary of the Preparation for the ARGONTUBE Test

- Digital controller for LARASIC is ready and tested.
- New frontend PCBs with 32 CH/board (2 ASIC) are ready and tested.
- Parameters are in full agreement with specs.
- Perfect match for ARGONTUBE with shaping time of $3 \mu\text{s}$.
- (Correction for droop $\approx 2\%/\text{ms}$ is necessary.)
- **Plan:** Test the full setup in ARGONTUBE during the upcoming run (June 2013).

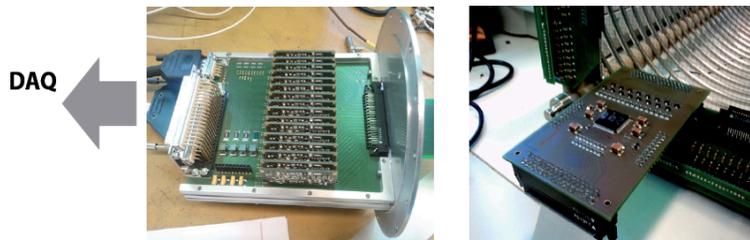
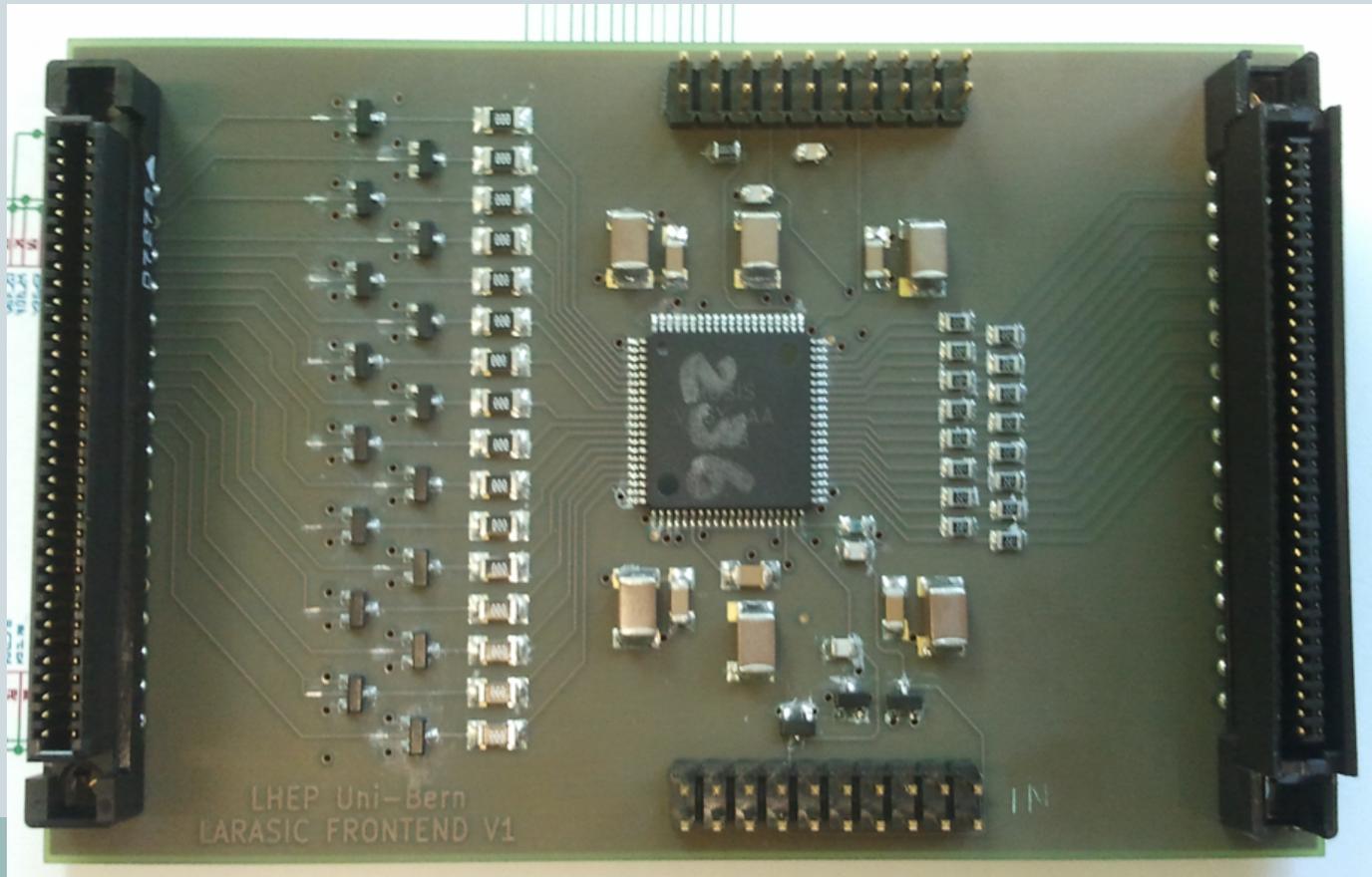


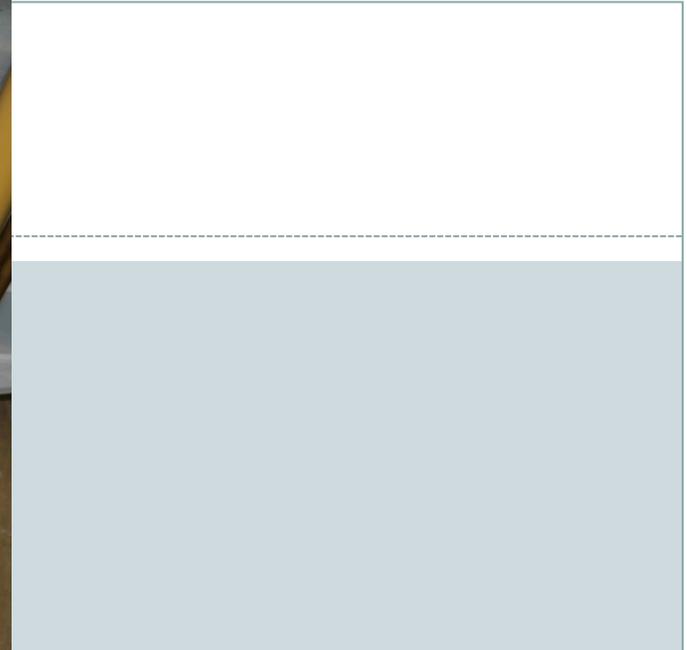
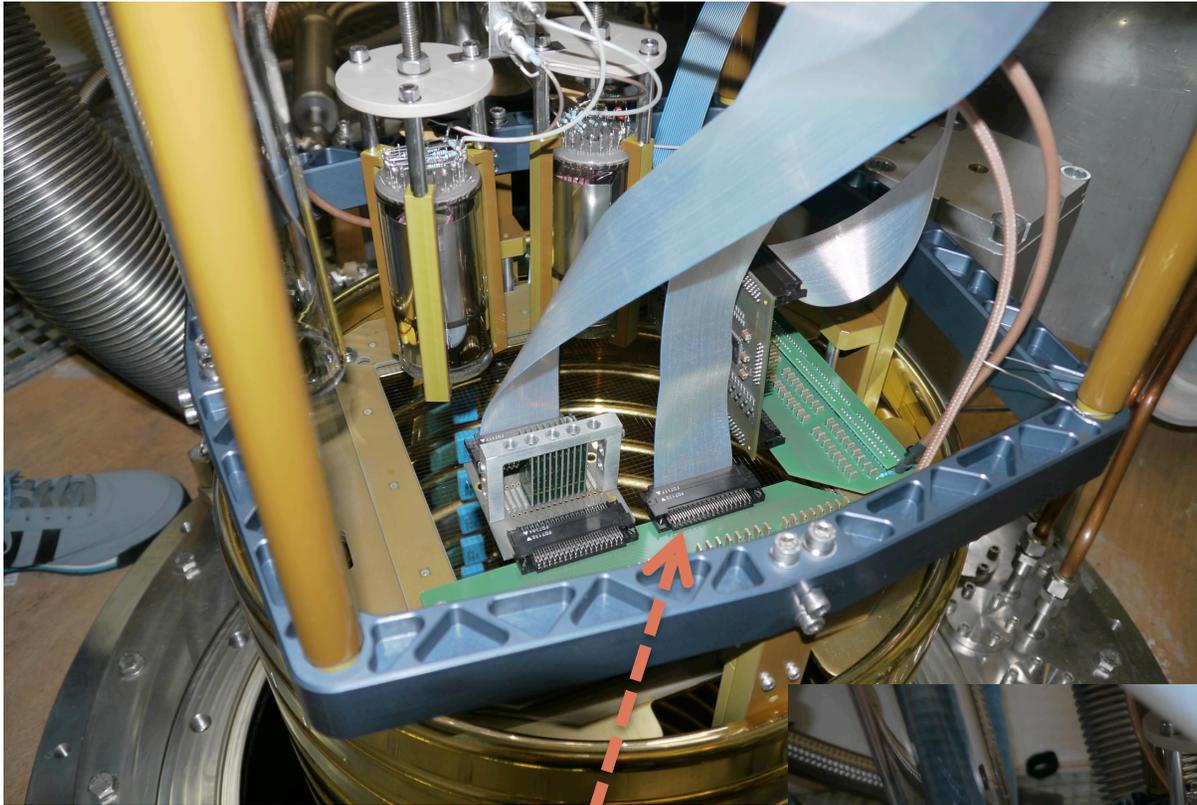
Figure 13: Left: 64 CH buffer amplifier with $G = 1$. Right: Frontend mounted on TPC.

What you do not know

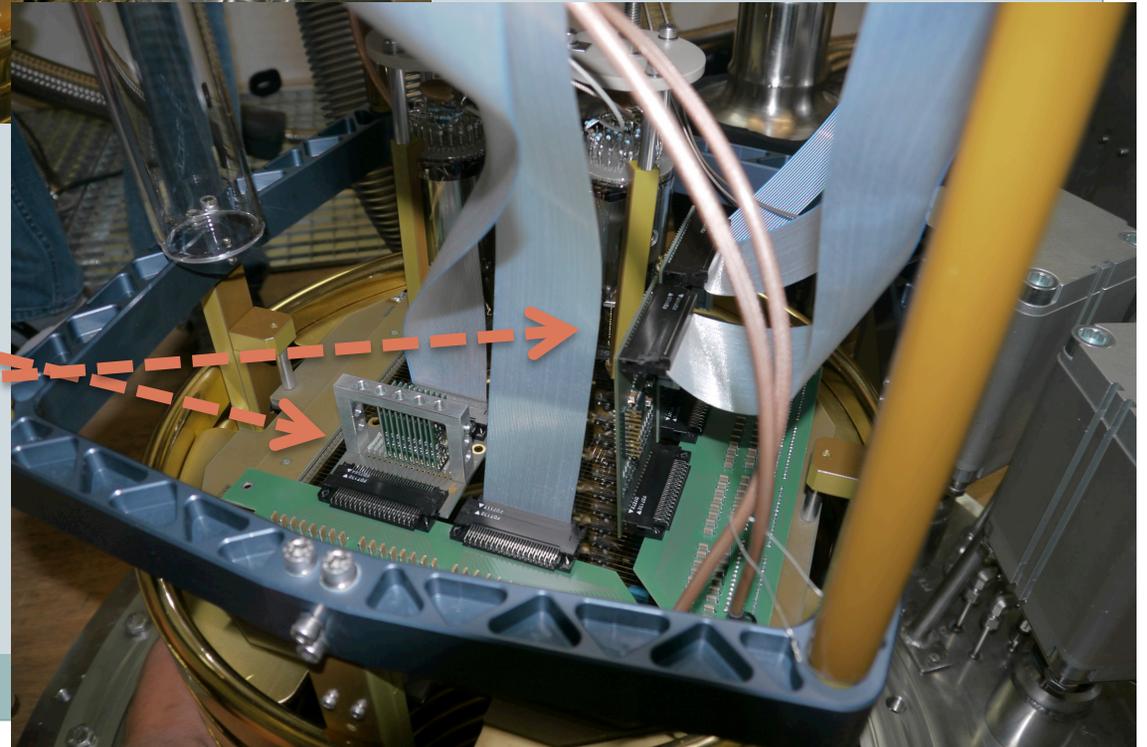
4

- We installed the AISIC board in the Argontube detector



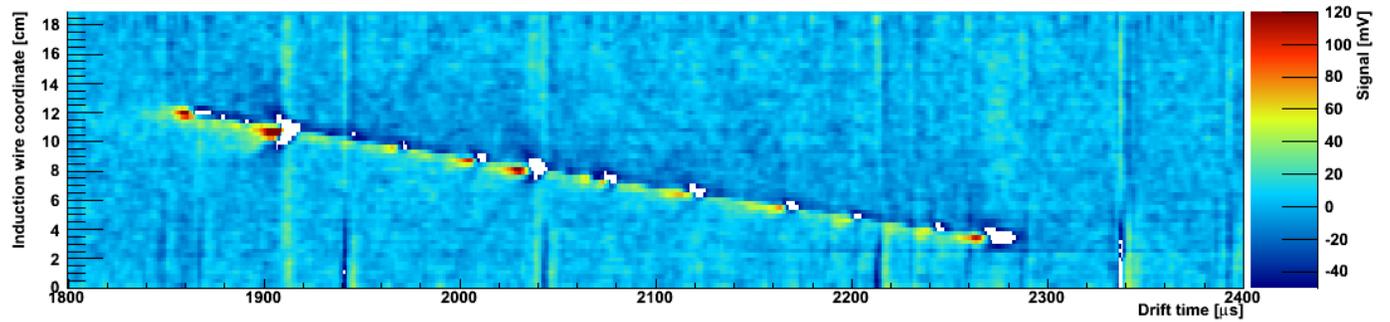
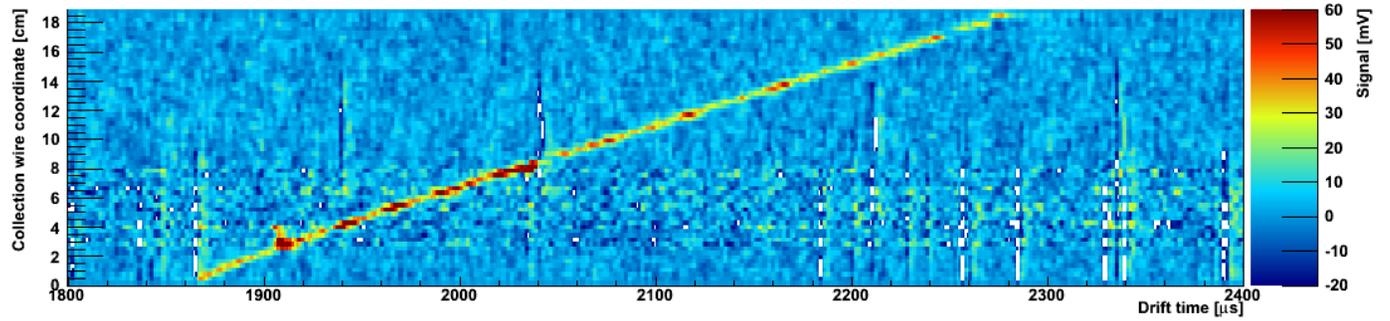
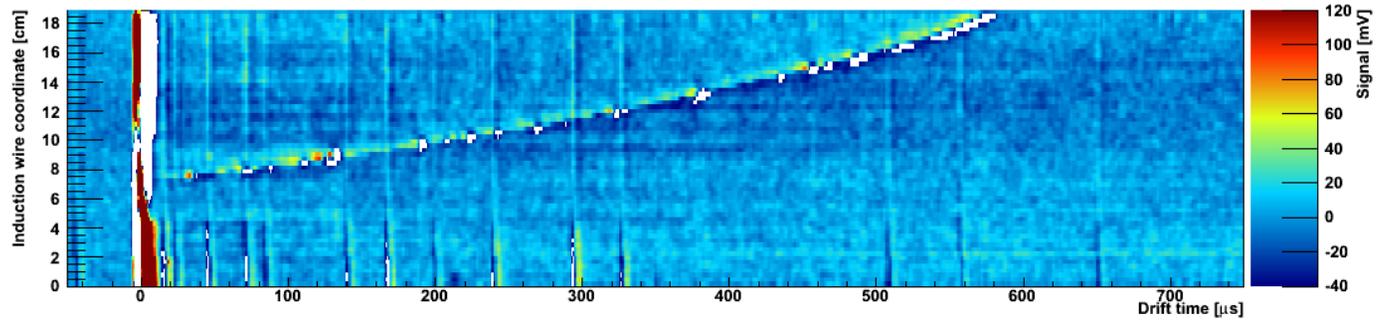
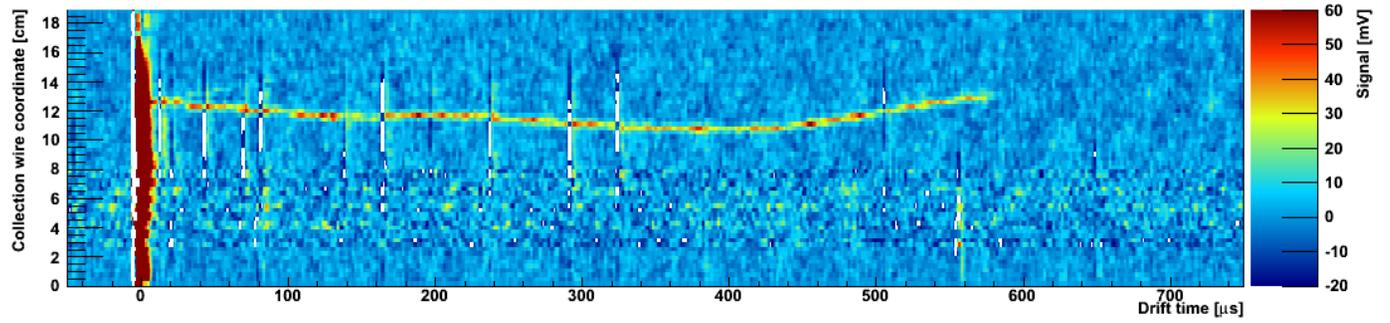


- Old wire readout
- Cold Bernese pre-amps
- MicroBooNE pre-amps



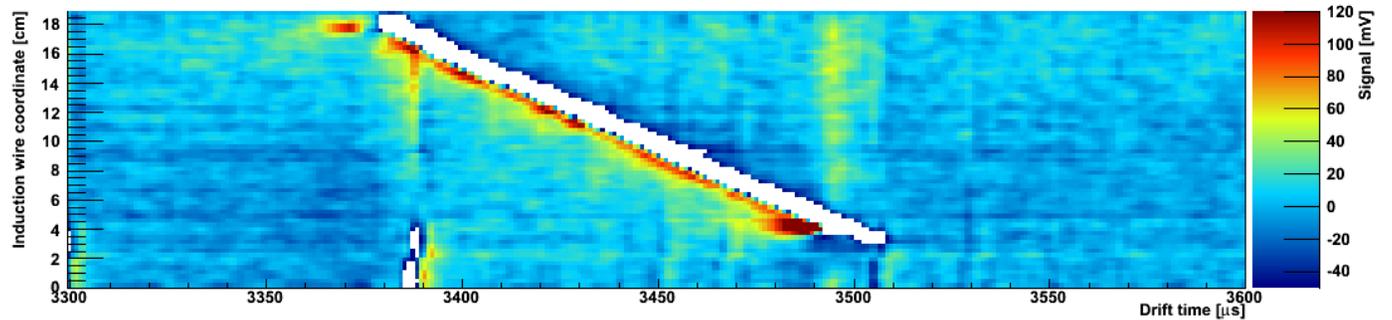
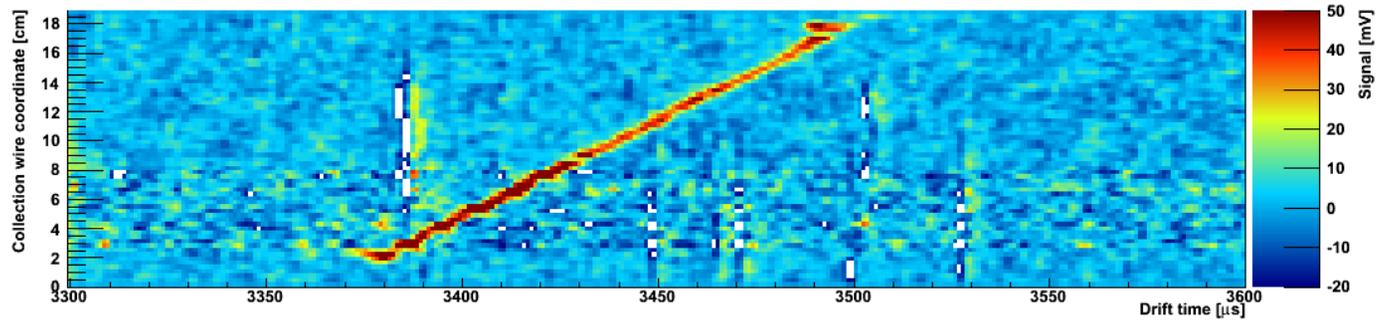
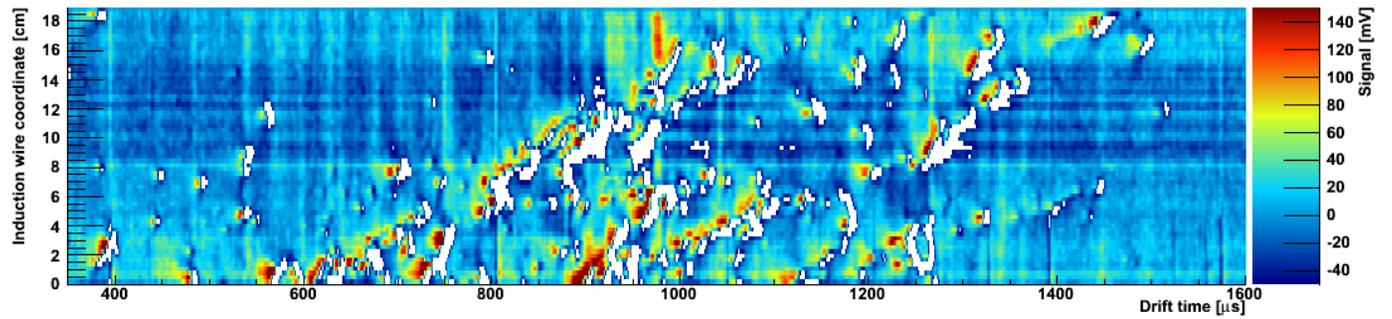
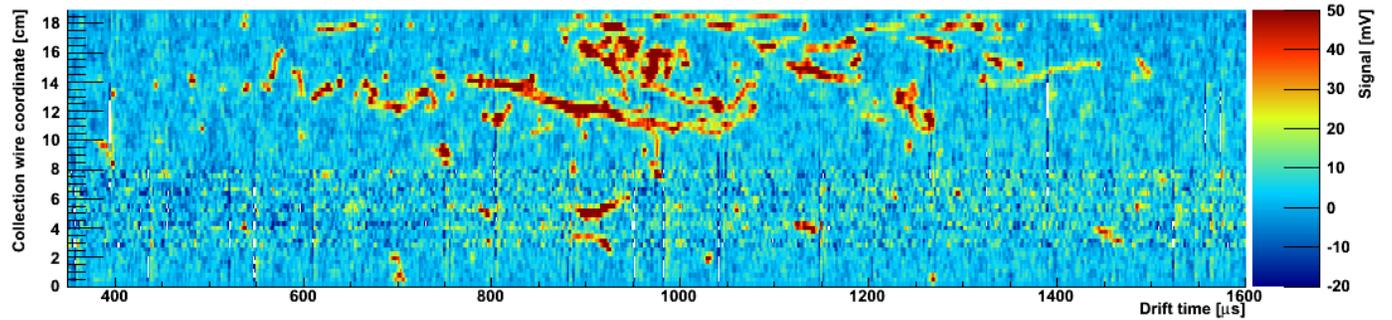
Induction Mode

Collection runs with old warm and new Bernese cold pre-amps

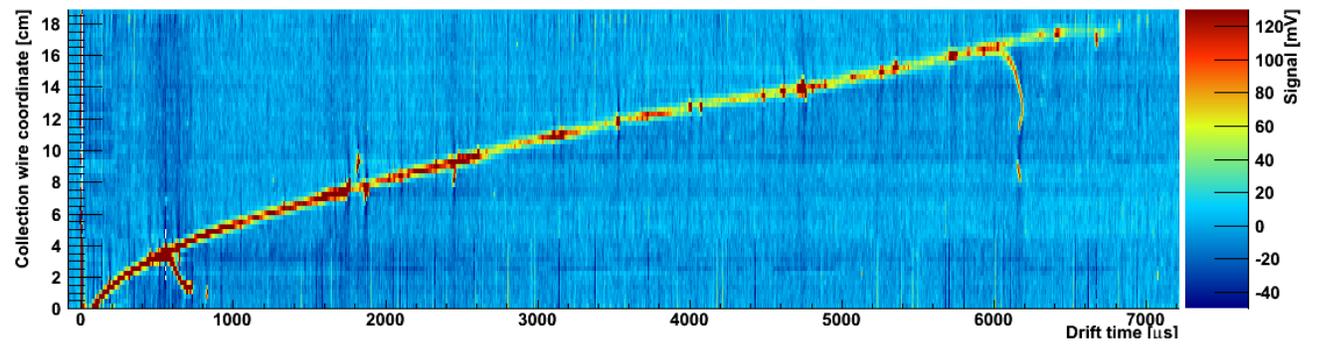
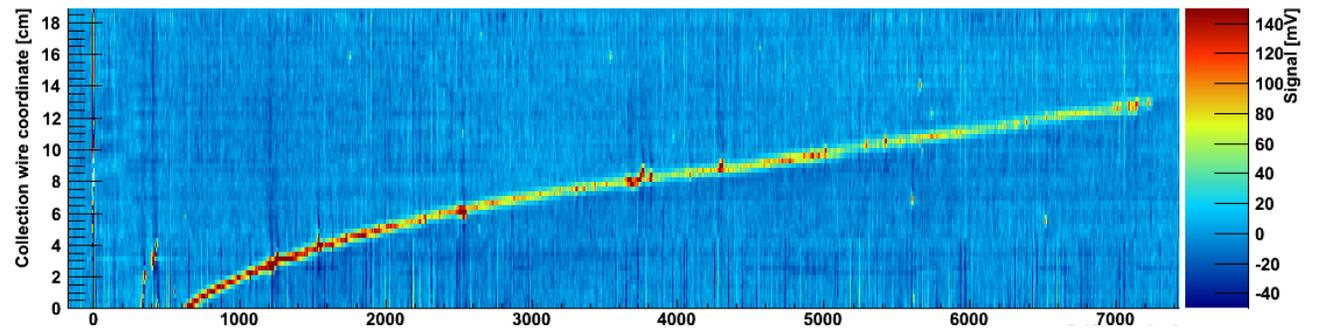
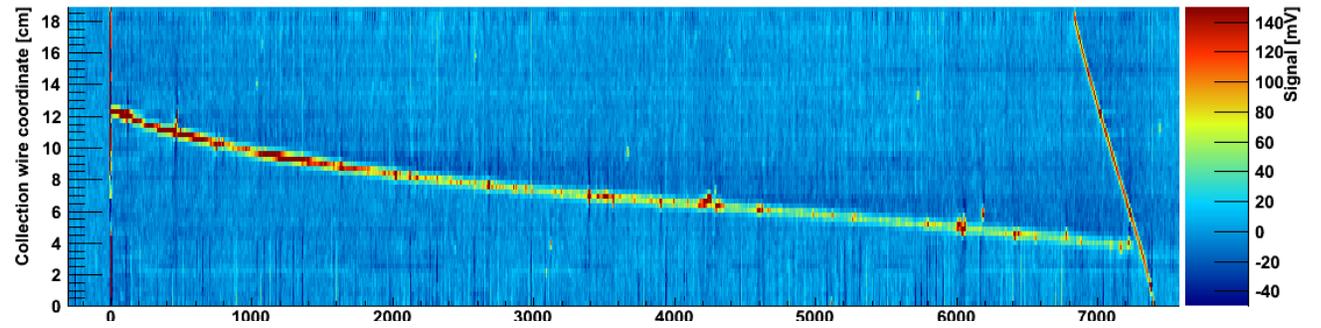
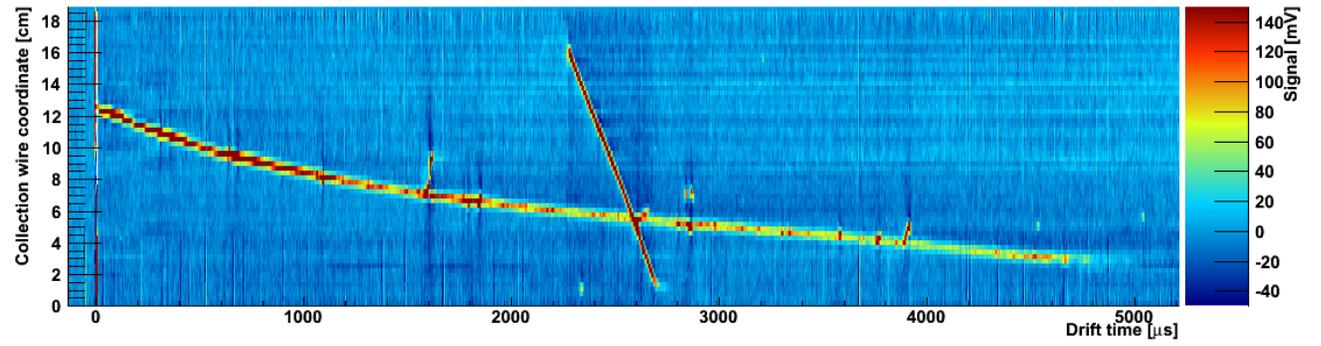


Induction Mode

Collection runs with old warm and new Bernese cold pre-amps

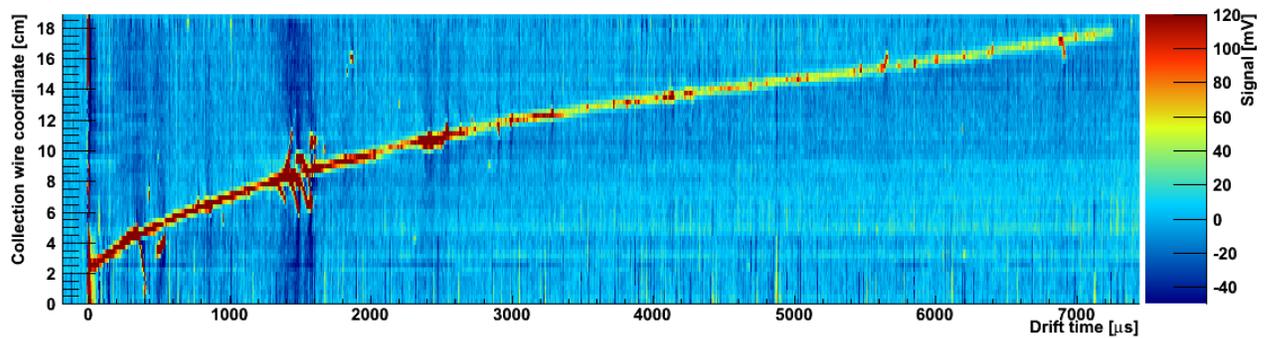
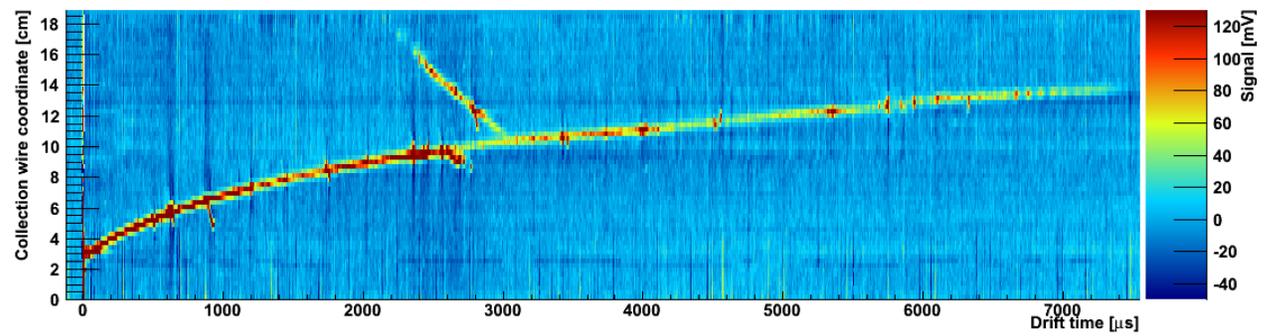
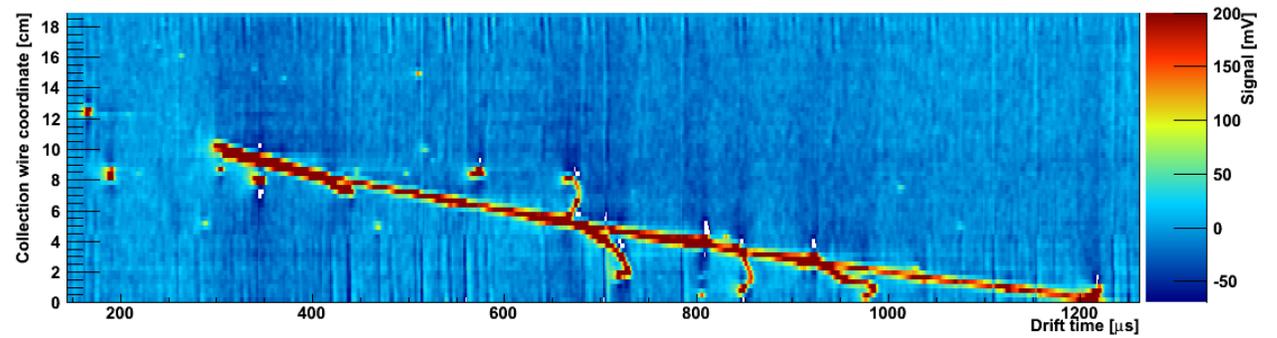
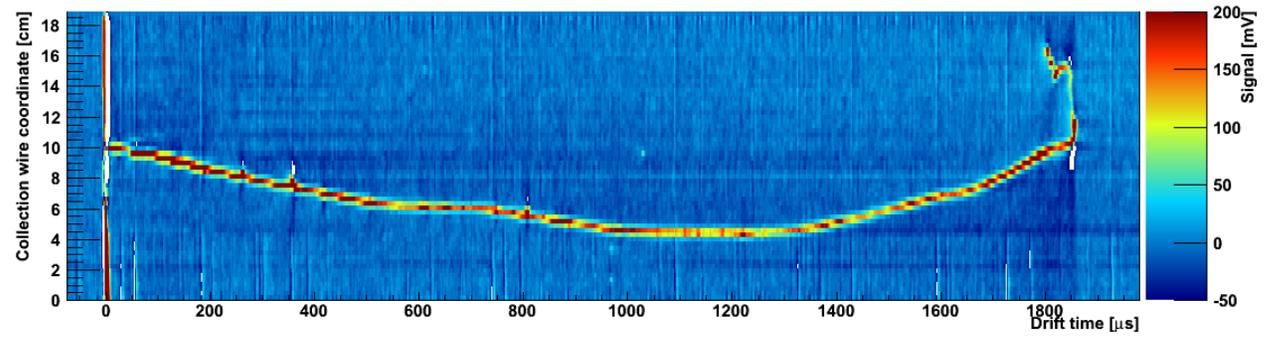


Collection Mode

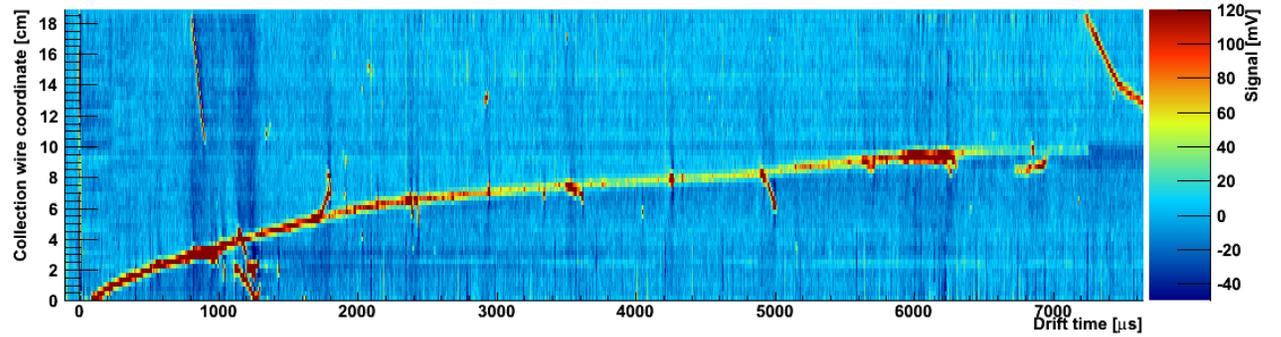
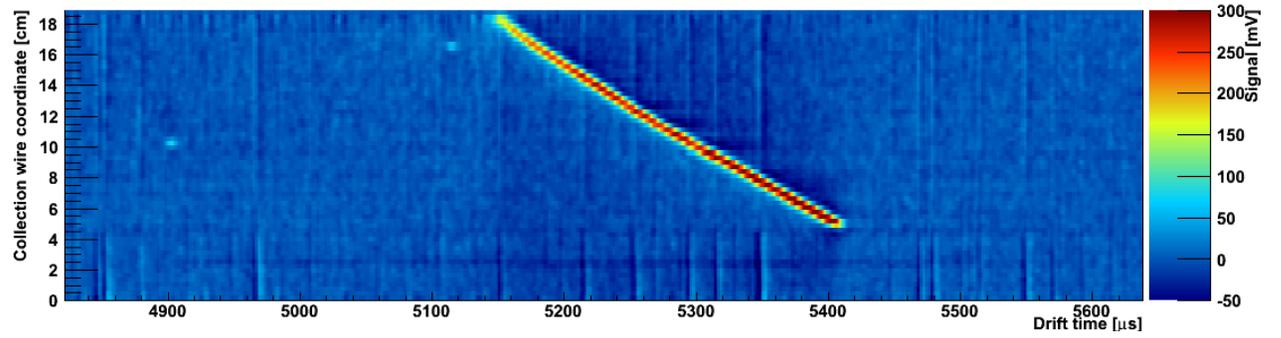
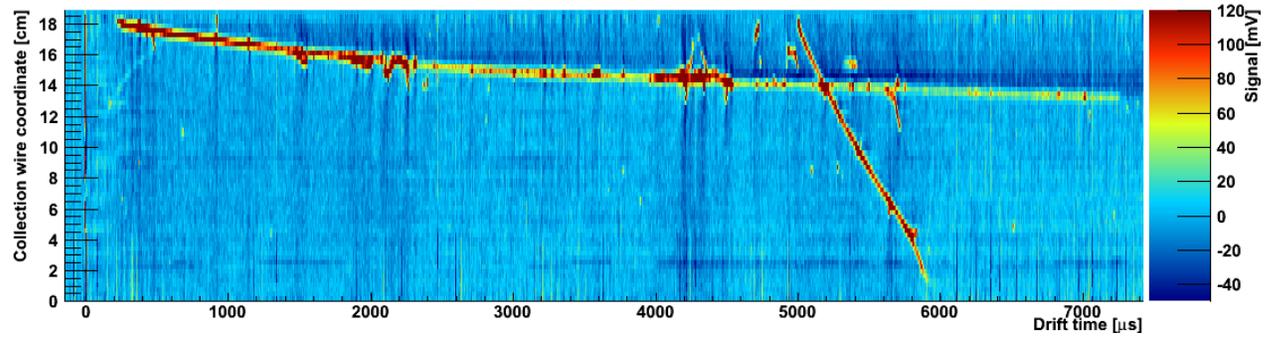
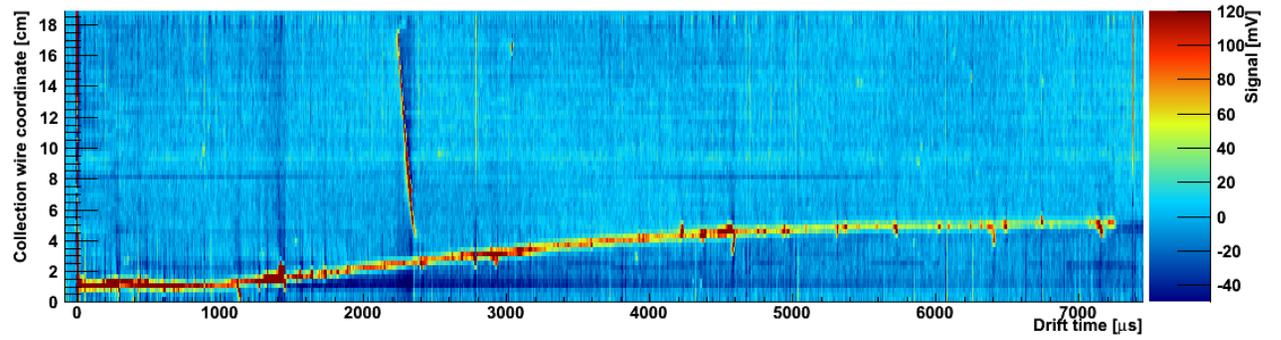


μ - decay

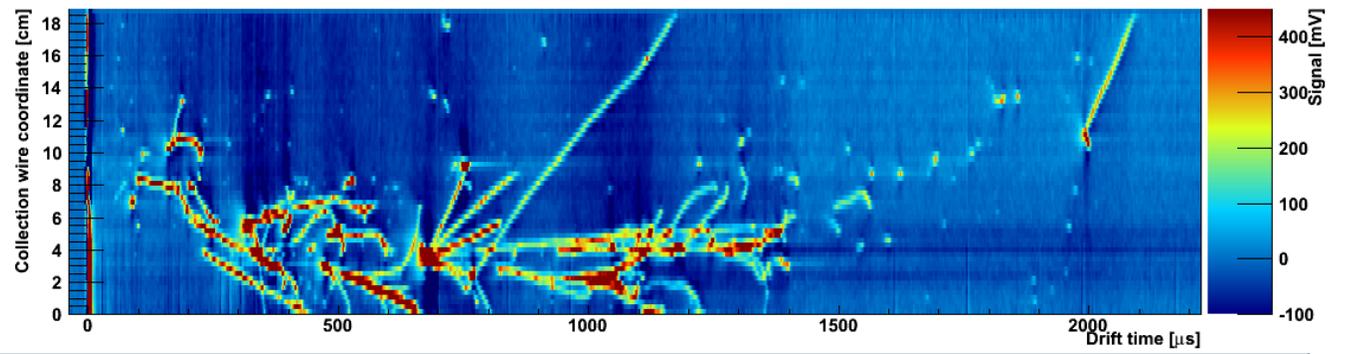
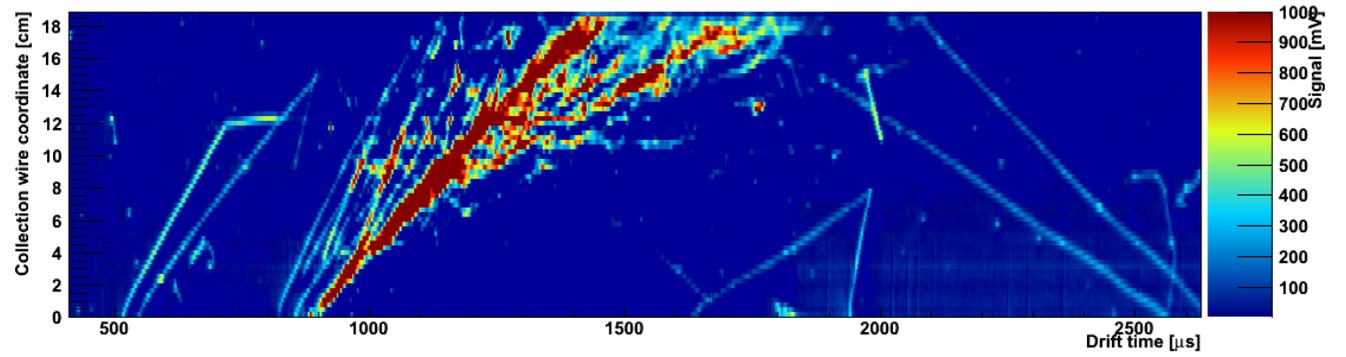
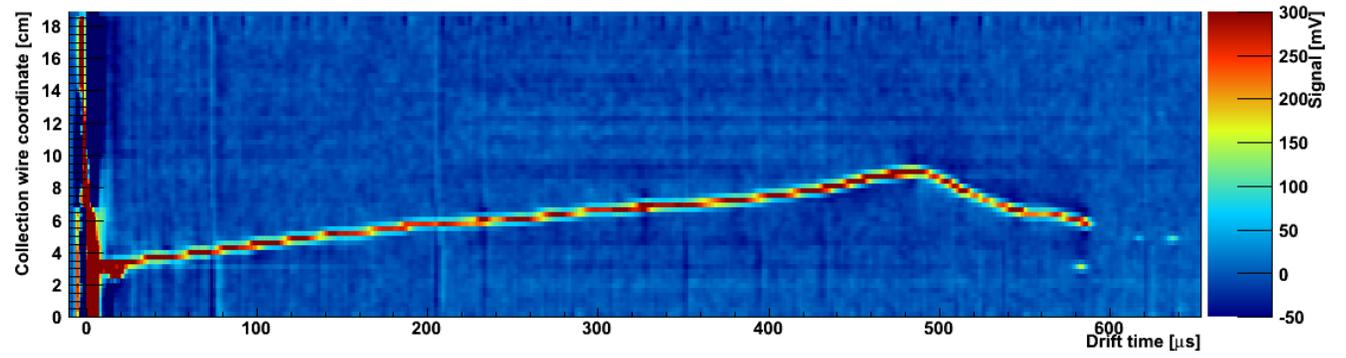
Collection Mode



Collection Mode



Collection Mode



Result

12

- Test of MicroBooNE AISIC in a real TPC
- Lifetime $O(2-3\text{ms})$
- Noise level 5-6mV
- Very good signal/noise ratio of 10 or better