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ALBERT EINSTEIN CENTER
FOR FUNDAMENTAL PHYSICS

PMT Noise Test in LAr at Bern

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The Test Setup

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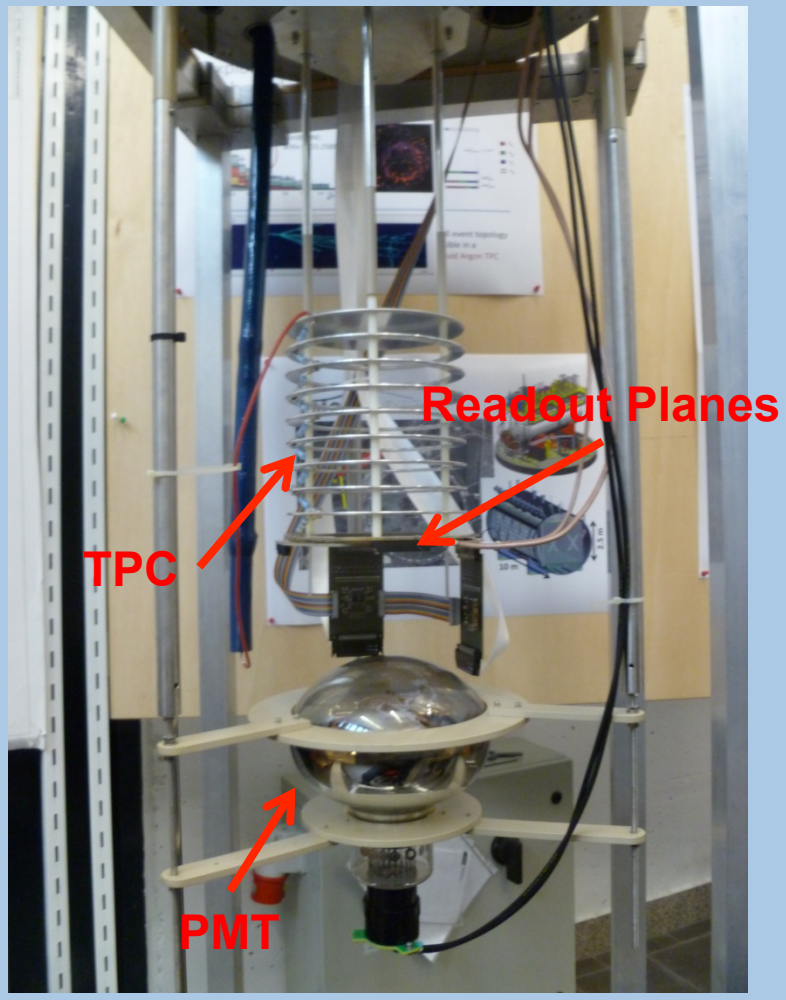
- Hamamatsu 5912-02 TPB coated
- Small EXO TPC with 2 x 32 readout wires
- Medium Argontube Cryostat
- MicroBooNE cold pre-amps (gain 25 mV/fC, rise time 3 µs)
- CAEN V1724 ADC boards



Tests performed

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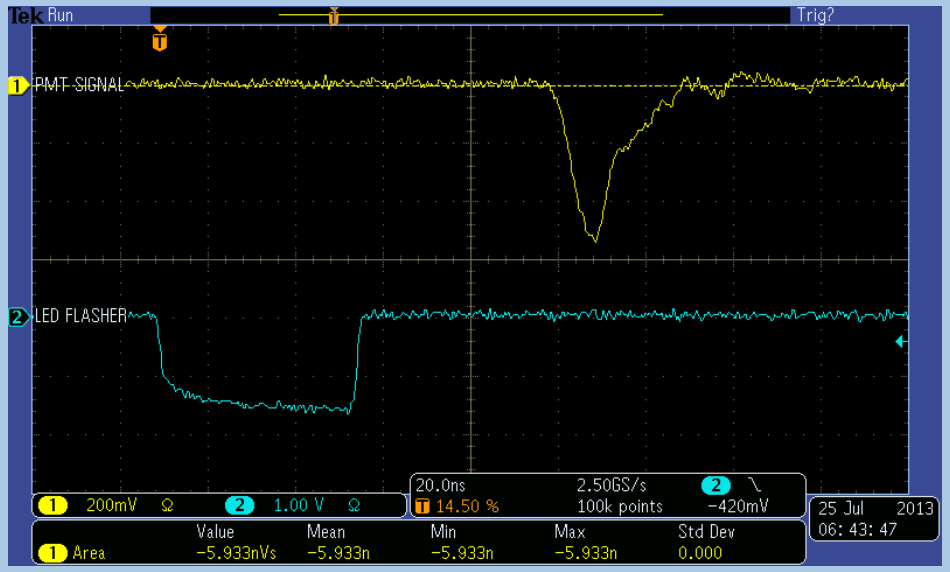
- LED flasher delivering ~750PE (Not stable at 400PE)
- Trigger on LED flasher monitor output
- ADC settings: 2k Samples of 30ns



- 1. PMT in air at room temp.
- 2. PMT in LAr
- 3. PMT in SF_6 and air at room temp.

1. Warm test in Air

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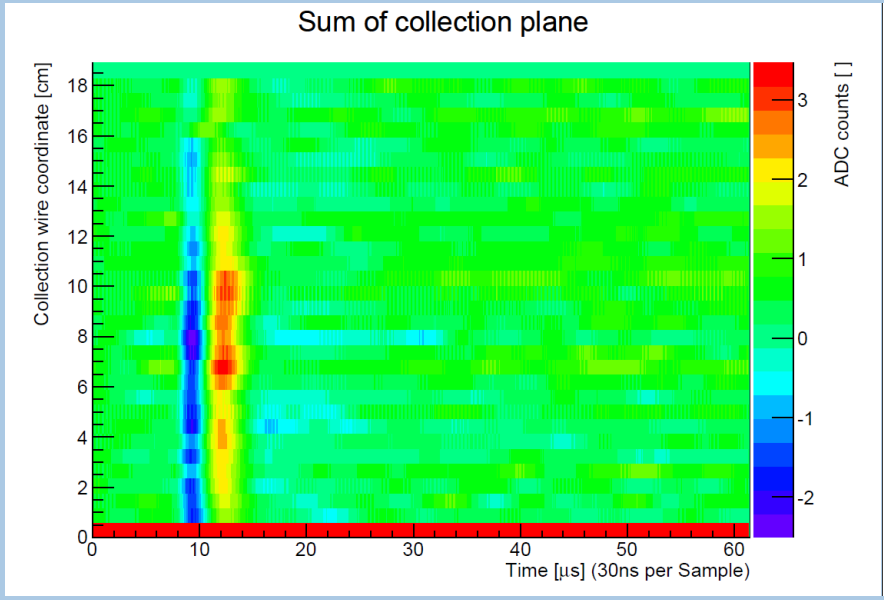

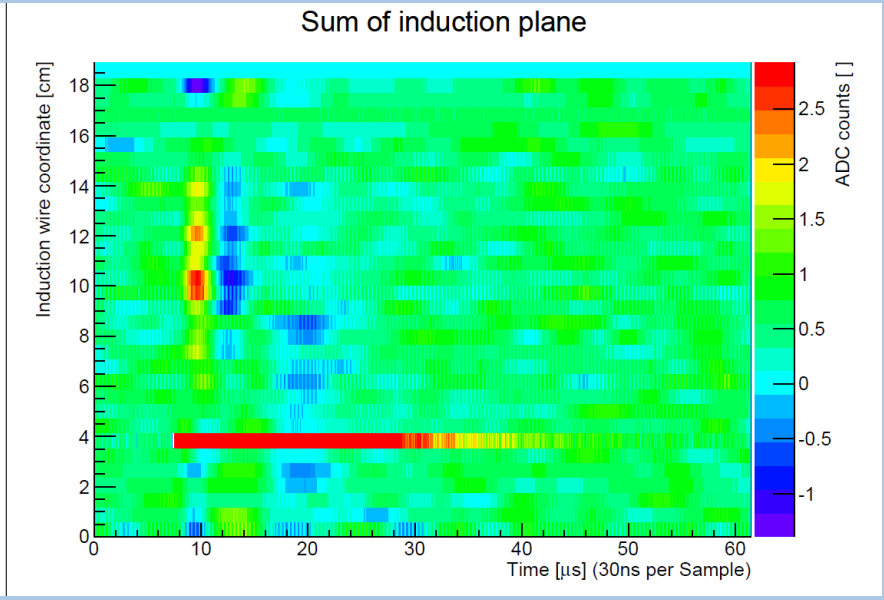

- Average of 10000 events
- Signal not visible in single events!

- PMT signal fed in channel 7 of the induction plane

1. Test in air with 300V bias on collection

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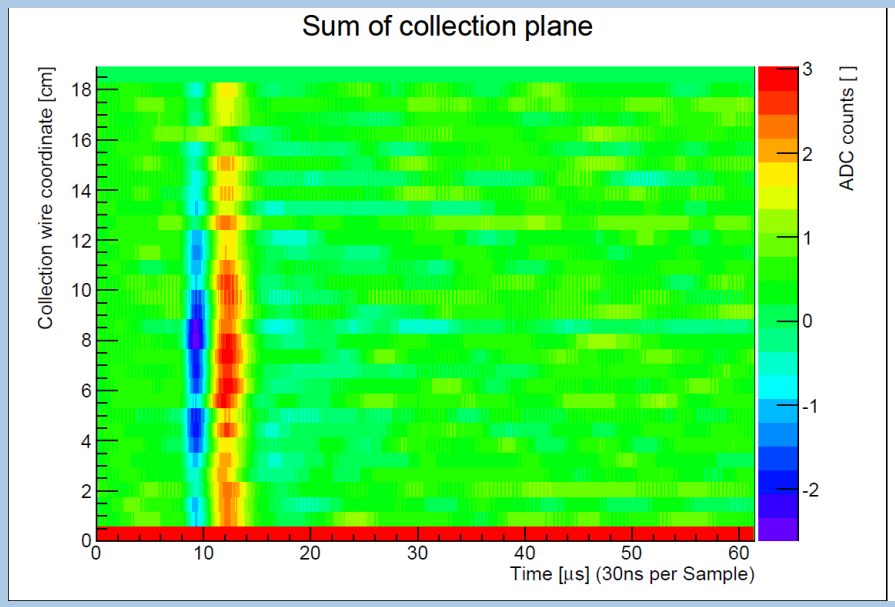

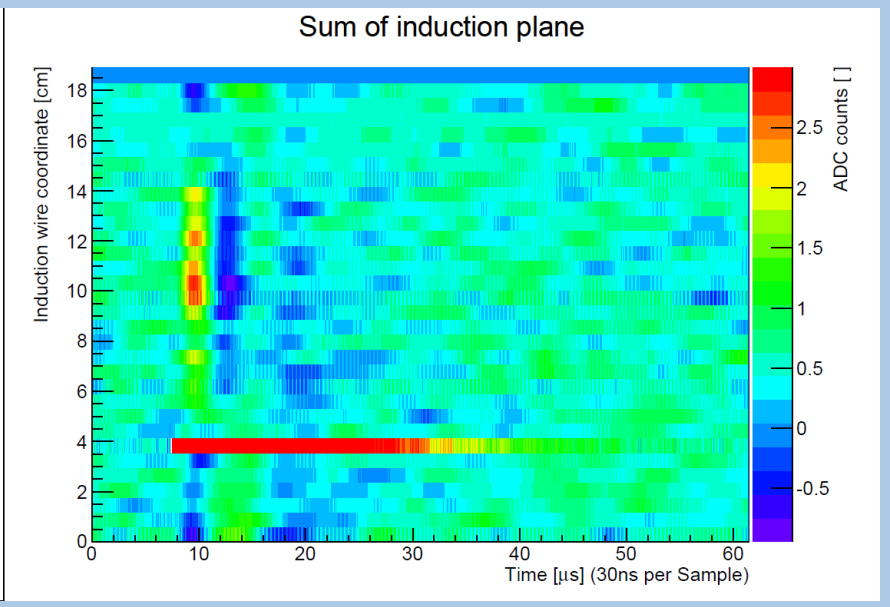

- Same procedure as before
- 300 V bias on collection wires

2. Cold test in LAr

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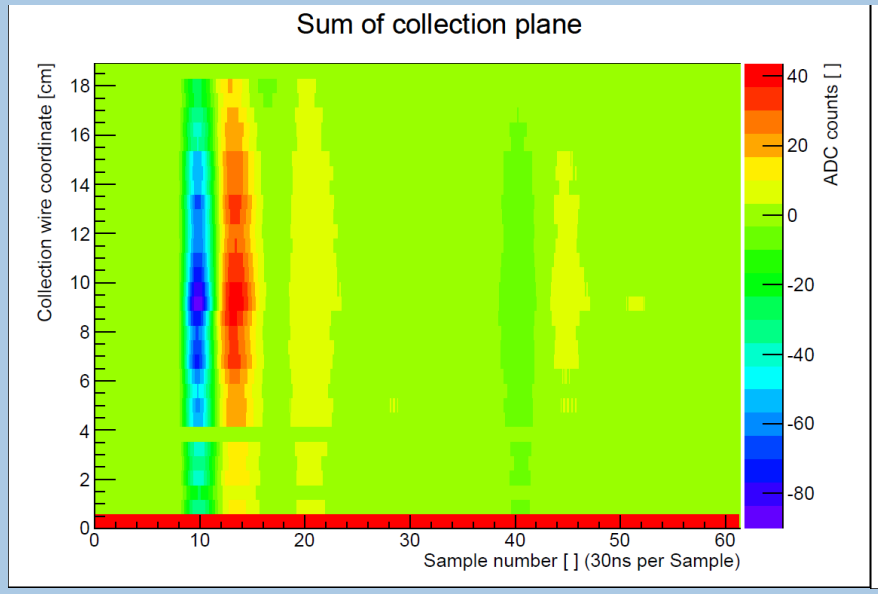

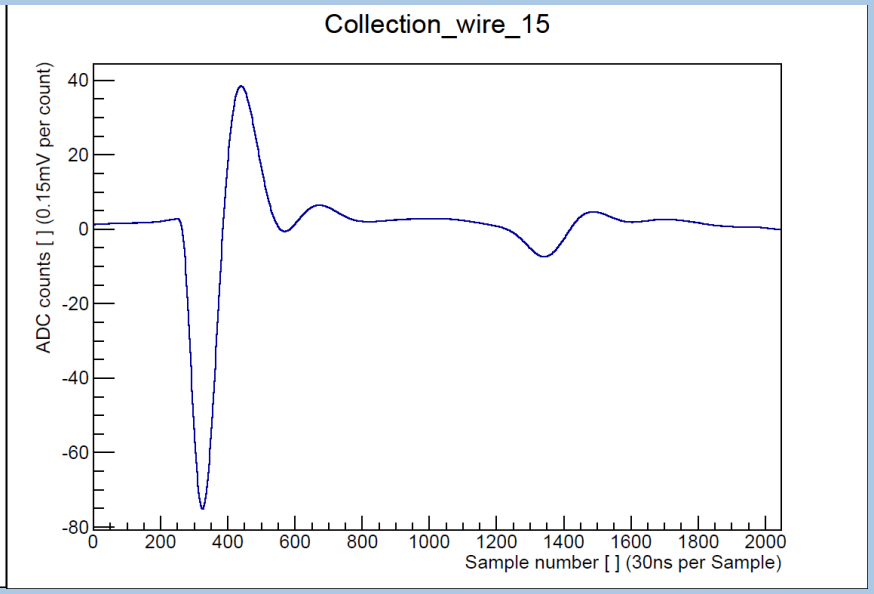

- Induction pre-amps broken after 23kV discharge
- Average of 10000 events
- No bias on wires

- Negative peaks 40 times higher than in warm air
- Positive peaks 15 times higher
- Pulses are clearly visible in single events

2. Cold test in LAr, Muon run

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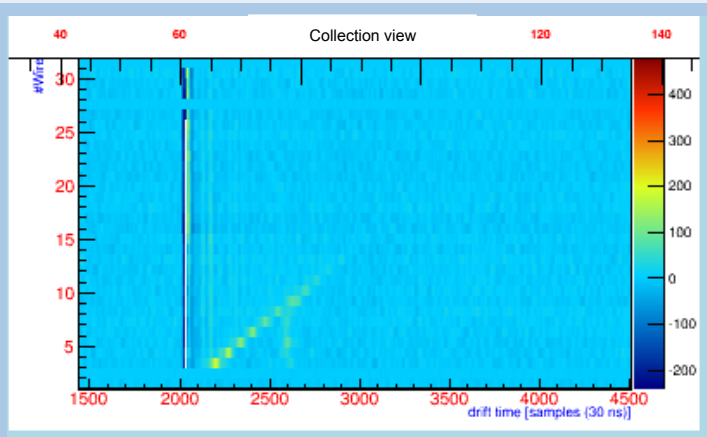

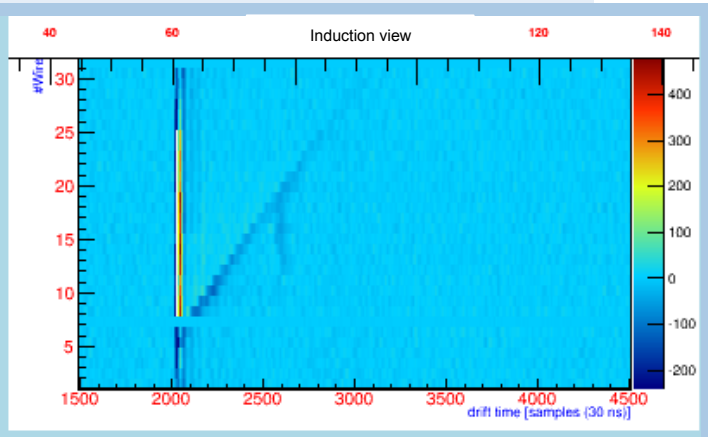

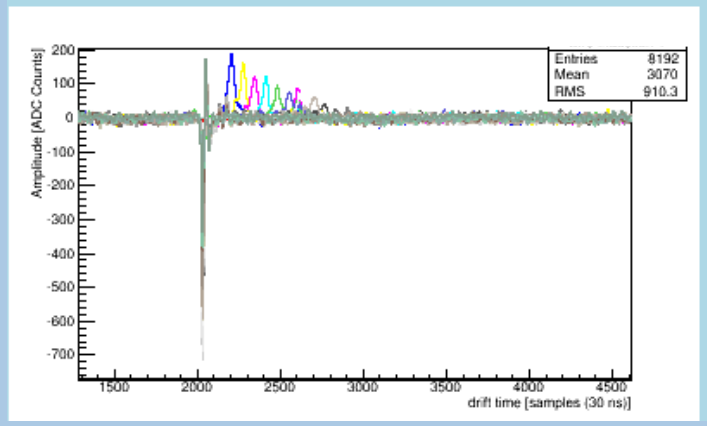

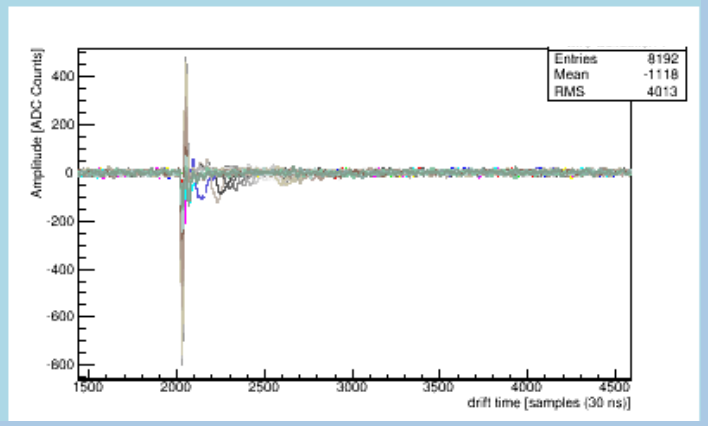

- Cosmic muons were measured
- The PMT noise is visible on all wires

3. Test in warm again, SF_6 and air

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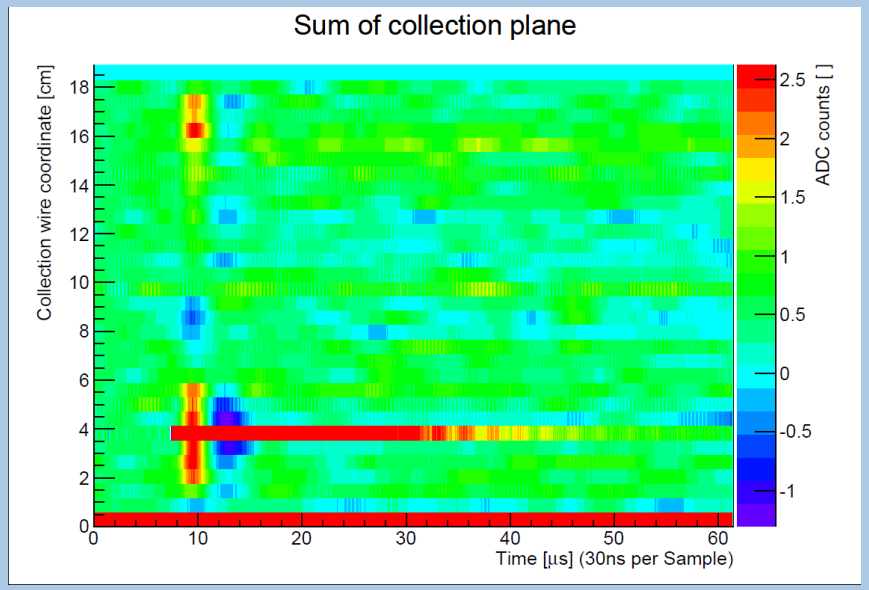

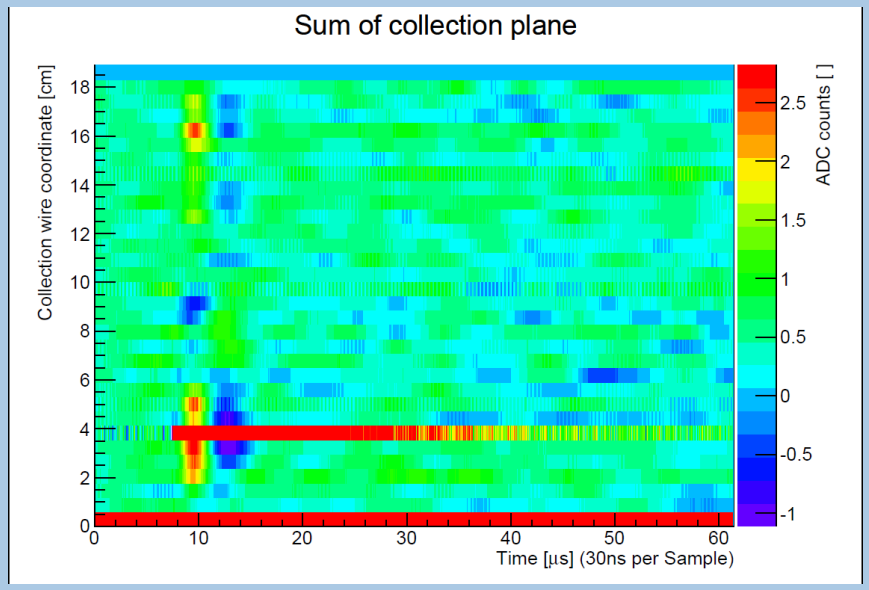

- Collection signal in SF_6
- Average of 10000 events
- No bias on wires
- PMT signal on channel 7

- Same in air
- The signal looks induction like which is not understood so far

Conclusion

- The PMT performed well in cold and in warm environment (signal rate and shape were as expected)
- The PMT noise was not visible on single events in Air
- The bias voltage of 300V has only a minor effect on the recorded noise
- In LAr environment the noise is 15 to 40 times higher than in warm air. (The reason for that is not yet understood!)
- The high noise was also seen in muon runs

- We will check the voltage divider components and cable properties in cold and warm to make sure if it is a general problem or just our components.