VMM tests at a GEM detector and the multiplexed Micromegas prototype for GBAR

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Main goal of test beam (VMM part)

Test VMM readout with SRS

Data losses in readout chain seen at neutron test beam at BNC (Wigner Institute Budapest) some weeks before

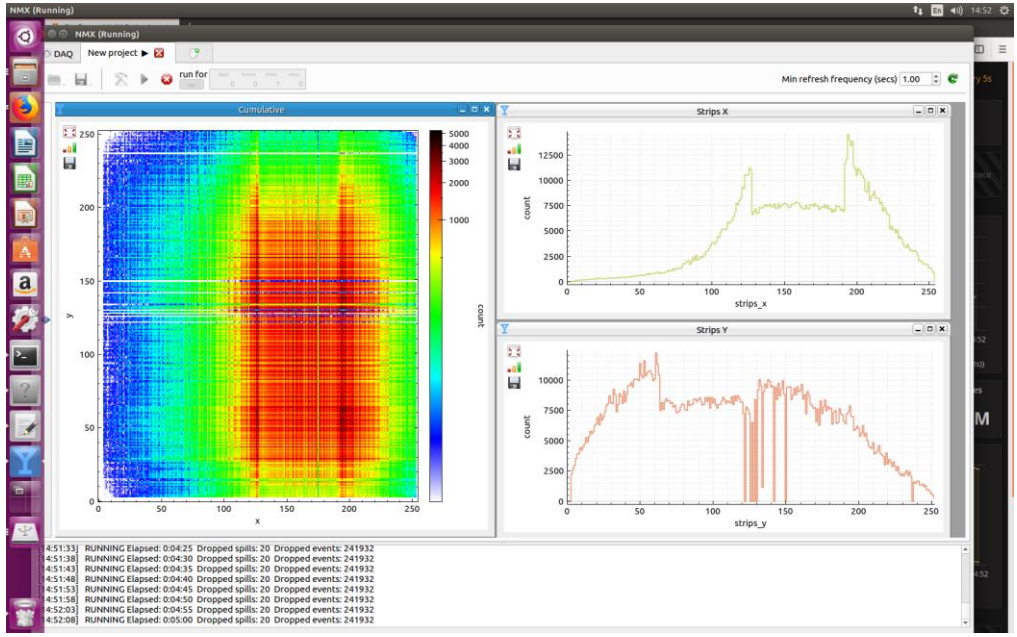
→ Reason: Data throughput from VMM to Spartan6 FPGA on hybrid (only 40 MHz SDR=40 Mb/s)

→ Freddy's firmware improvements not implement at that time (up to 320 Mb/s)

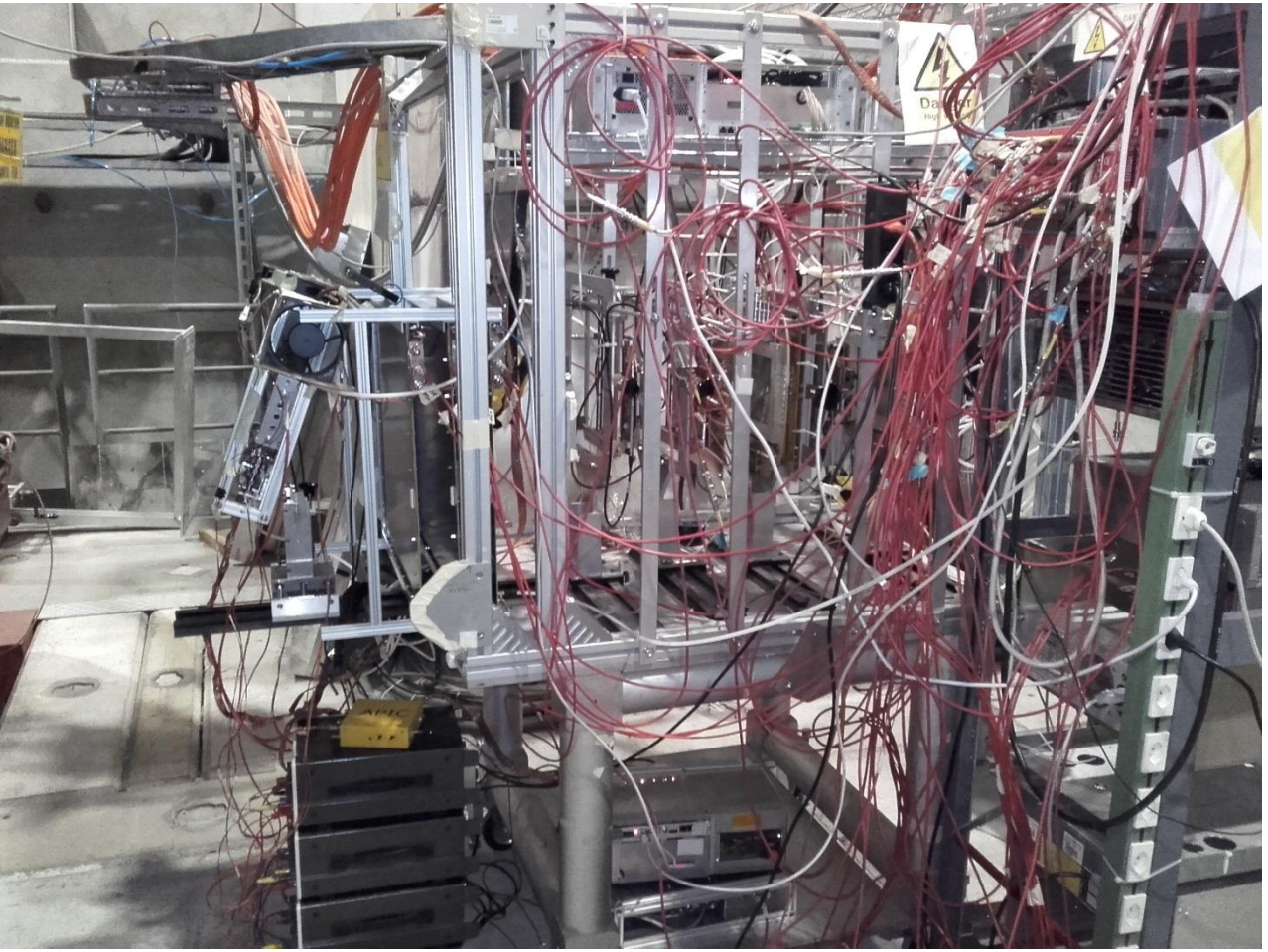
⇨ Use high intensity pion beam to reproduce effect

⇨ See if data loss disappear with Freddy's improvement

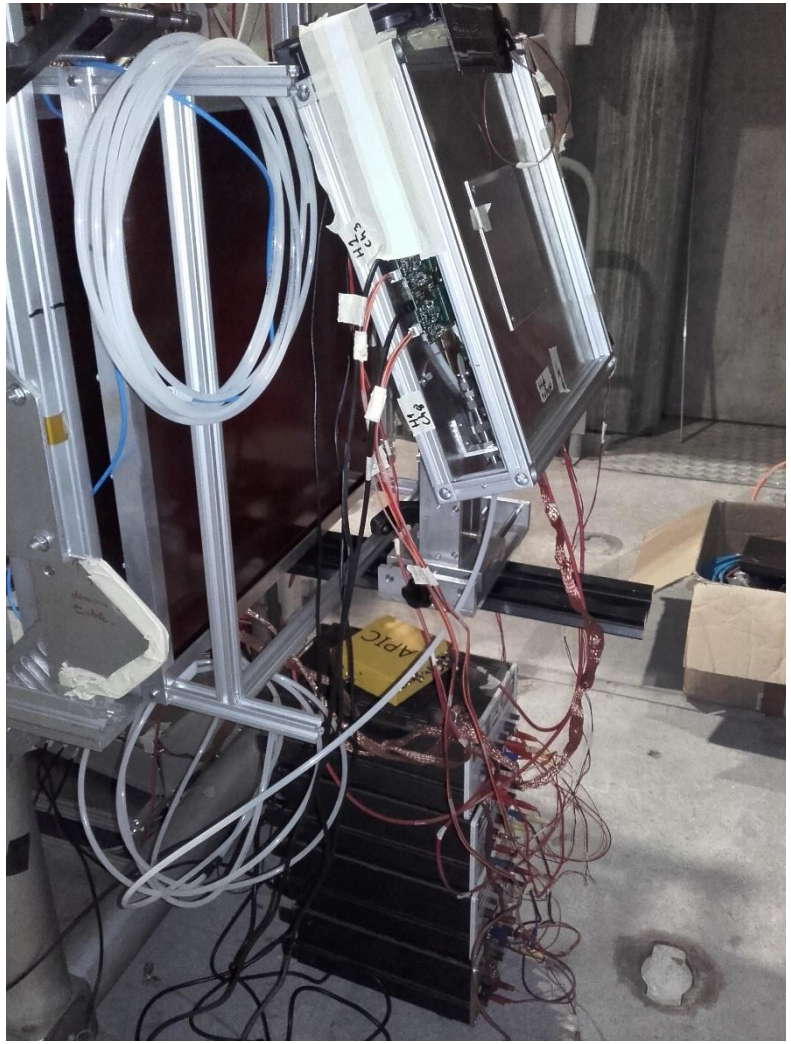
⇨ Test Yan's FEC firmware data throughput improvments

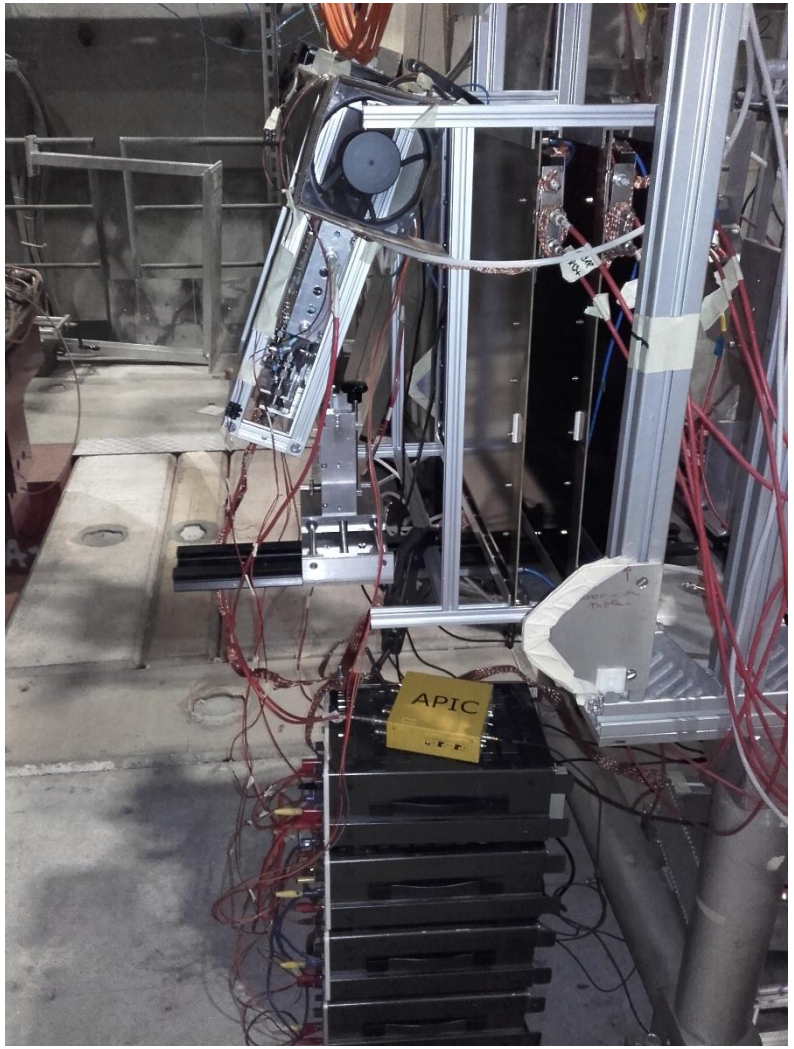


Setup: VMM and GBAR



Setup: VMM and GBAR



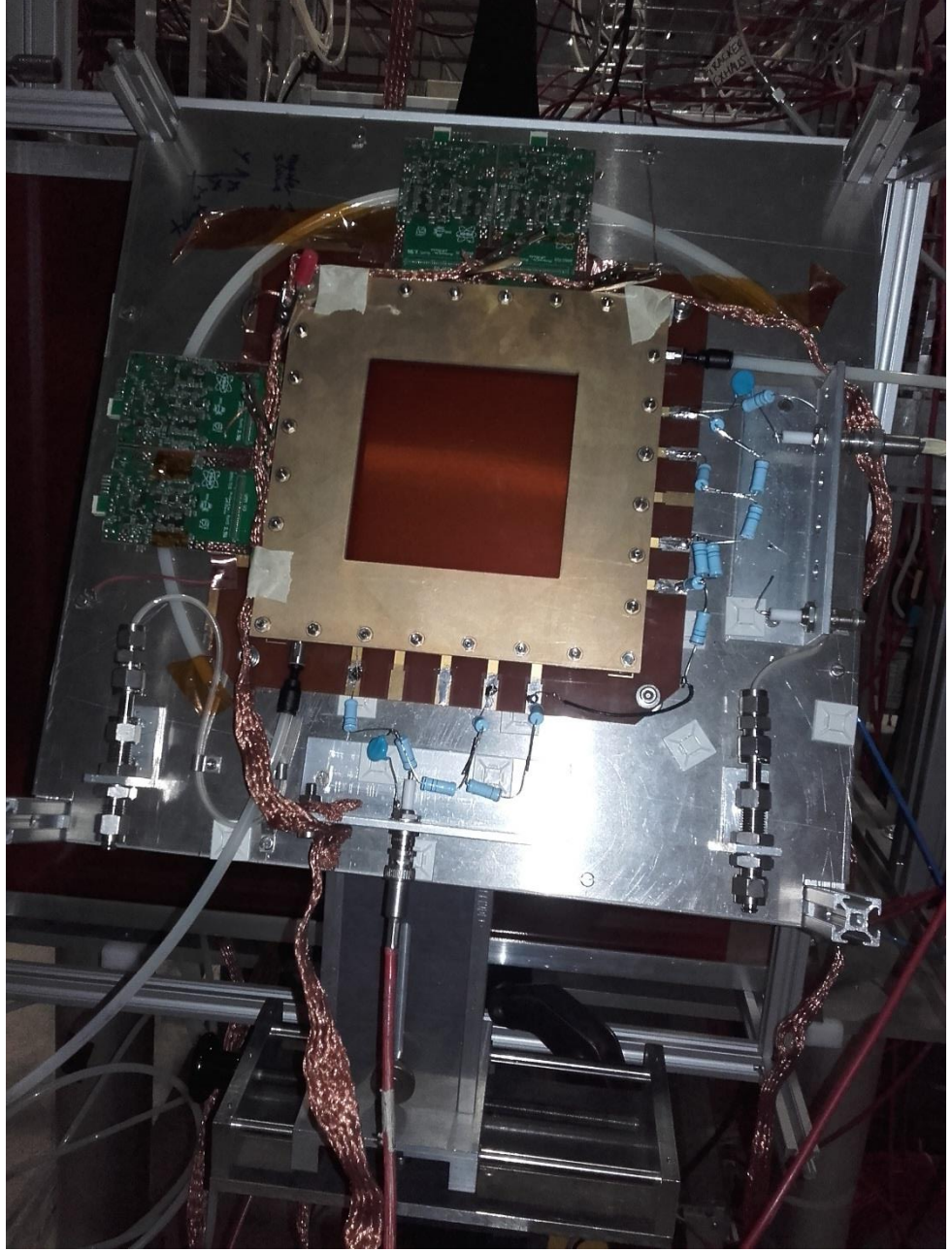


Setup: VMM and GBAR

Standard 3GEM detector with mesh cathode
Cathode + 3GEM voltage divider with filter
3 x VMM3 hybrids
1 x VMM3a hybrid
1 SRS Crate, FECv6, DVM card v3

(APIC, Oscilloscope)

3 multiplexed Micromegas 50 cm x 50 cm
One not working due to leakage current
1 hybrid/detector => 2 hybrids
2 other hybrids on 3GEM detector as reference



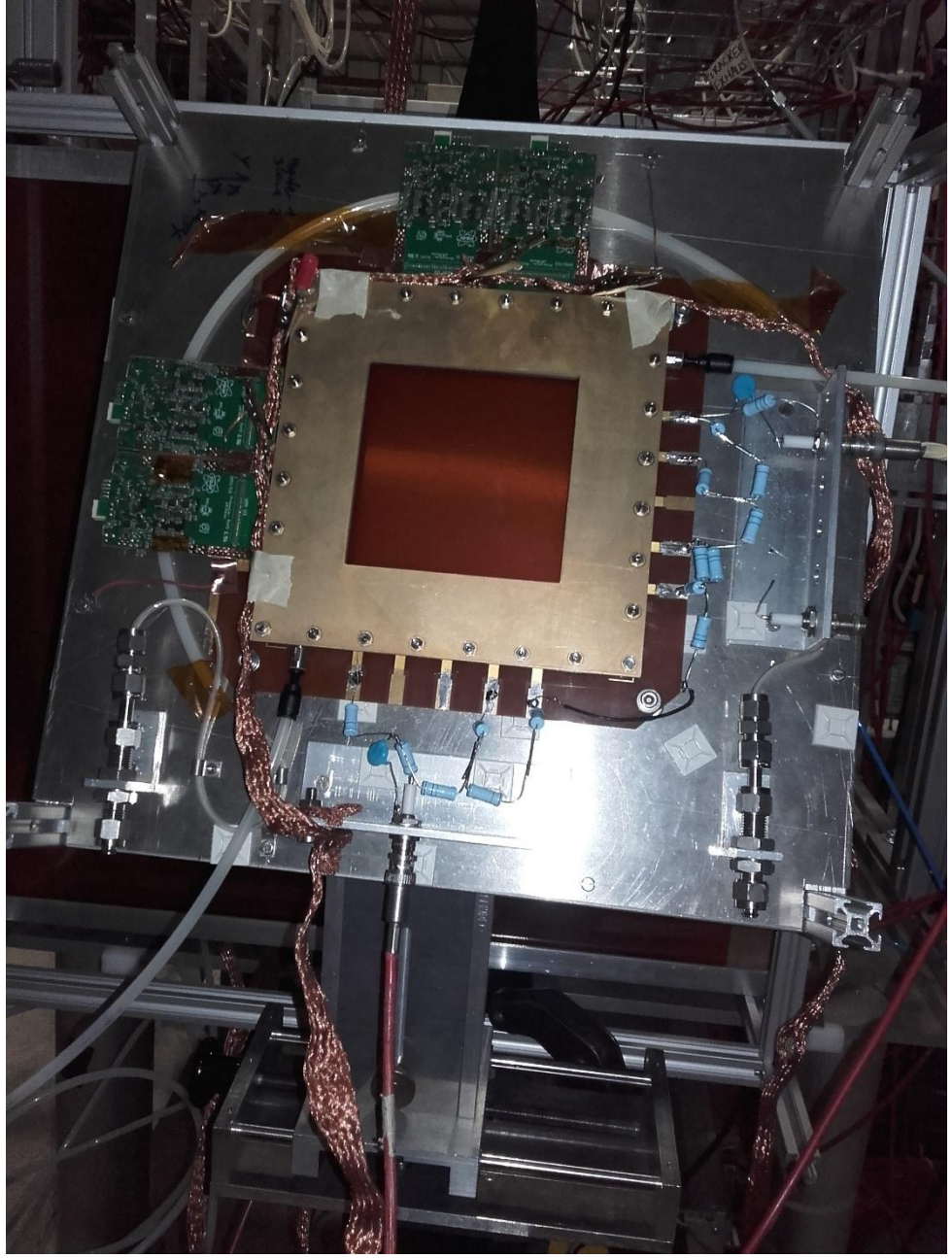
Outcome (VMM part)

Mainly muon beam
-> beam profile ok
-> different parameters, readout speeds (all done before)

High intensity pion beam for 5 minutes
-> not optimised setup for quantitative tests

Data loss with settings as in Budapest (40 MHz SDR)
No Data loss as soon as 40 MHz DDR or higher

Limits of Yan’s firmware and 1 Gb/s Ethernet not reached



The GBAR experiment: Multiplexed 50x50 Micromegas with VMM readout

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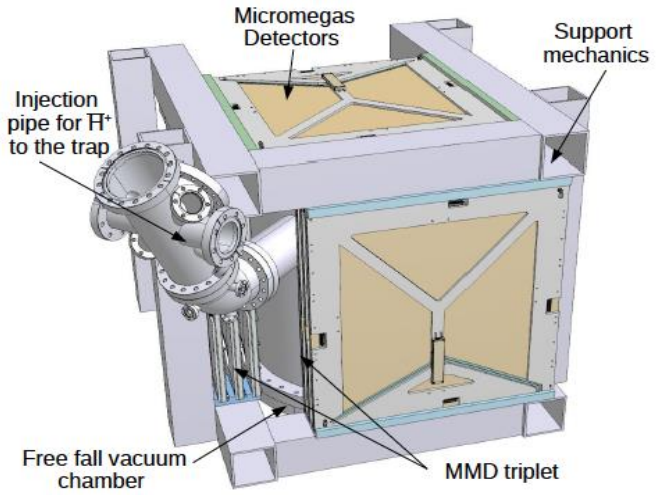
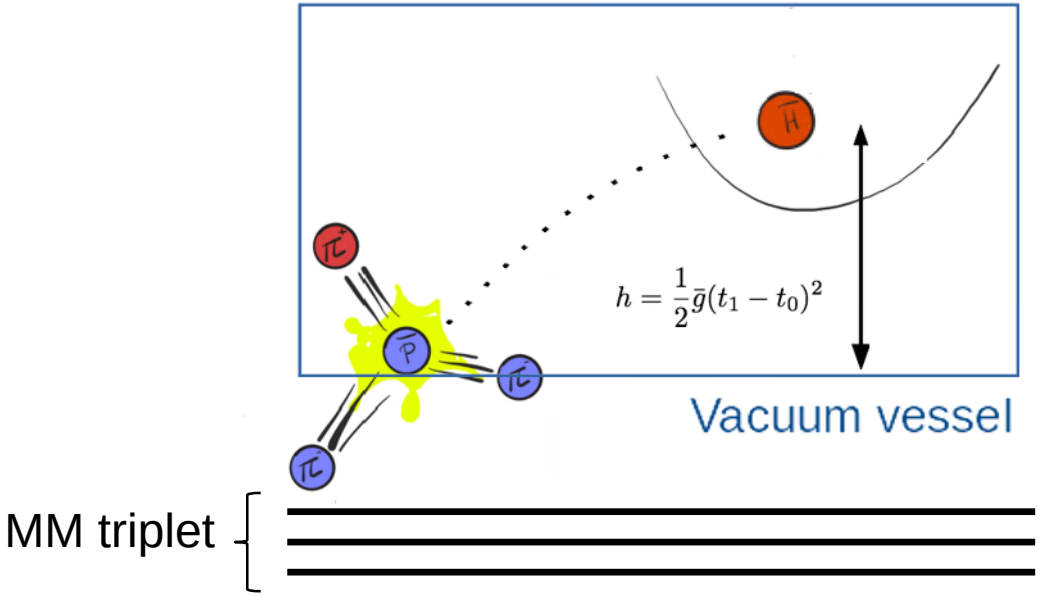
GBAR

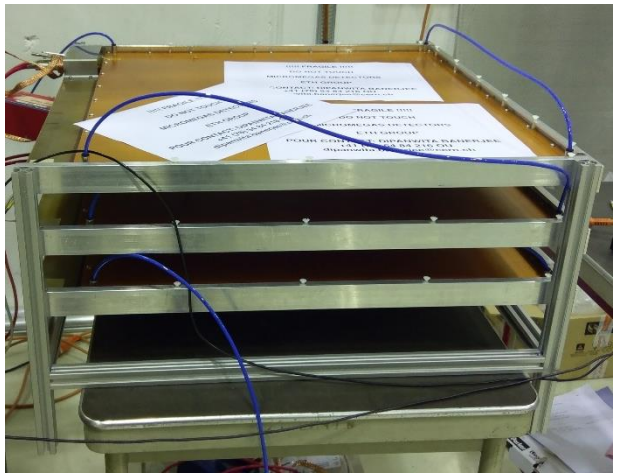
- Goal of GBAR: Free fall experiment with $\overline{H}$ at rest to determine the behaviour of antimatter under gravity.

- Method: Measuring pions coming from antihydrogen annihilation with Micromegas trackers to reconstruct vertex





GBAR detector: 50x50 Micromegas



- Micromegas specifications:
  - 50x50 cm^2 active area
  - XY resistive readout
  - Drift gap: 6mm, Amp gap: 128um
  - 1037 strips per plane, connected to 61 readout channels each (factor 17 multiplexed)
  - 1.1 nF input capacitance

- Tests:
  - Difficulties to see signals with Ar/CO_2 (93/7) and APV25 due to high input capacitance
  - First signals seen with Ar/CO_2 and VMM → beam data needed to see if demultiplexing is possible

Results of beam time

- Signal visible with VMM and Ar/CO_2, but reconstruction of beam spot failed
- Multiplexing relies on the signal being much larger than noise level, distributed over several strips. In y-plane this was the case, but in x-plane not anymore.

- Solutions:
  1) Reduce multiplexing factor to increase average pulse height
  2) Optimize XY readout to have both planes with comparable average pulse height
  3) (Change to other gas mixtures with better gain → difficult due to safety issues)