The Sub: Status Report

Submersible cryostat for cold-electronics testing and pulse-shape investigations

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Overview

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1. Goals of The Sub
2. System description: cryostat and electronics
3. Performance and first results
4. Outlook

The Sub: Goals

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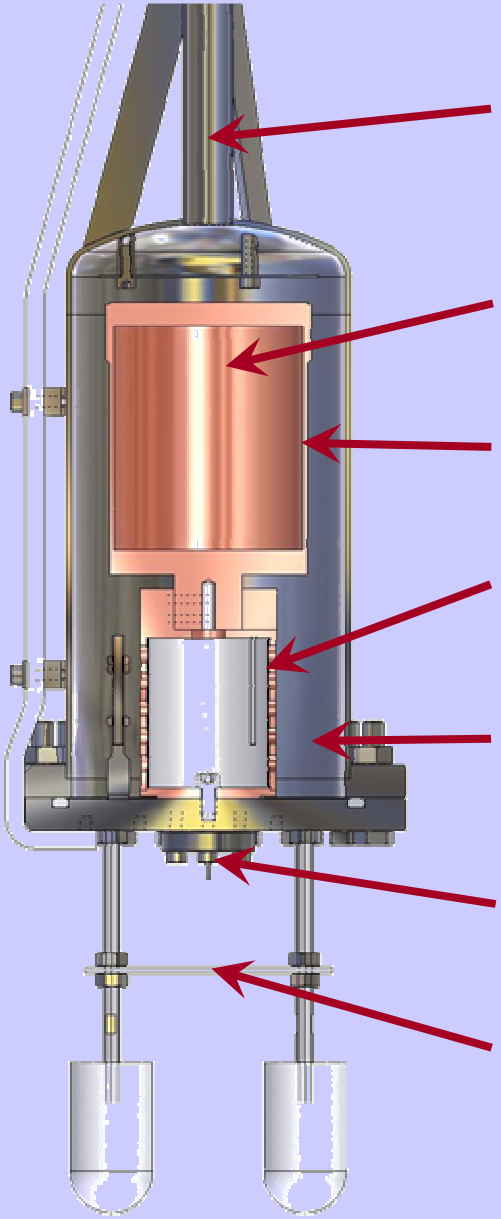
1. **Test front-end electronics in liquid argon with p-type Ge-crystal,**
   with Ge-detector operated in vacuum cryostat and preamplifiers working in cryogenic liquid.

2. **Study pulse-shape discrimination using a coaxial unsegmented p-type detector with Phase I FE electronics.**
   Single-site vs. multi-site events discrimination with detector setup analogous to GERDA Phase I, including the 5m long transmission lines from preamplifiers.

The Sub: Description



pumping tube with pressure gauge

Canberra p-type Ge-crystal, active mass: 0.5 kg

Si crystal holder

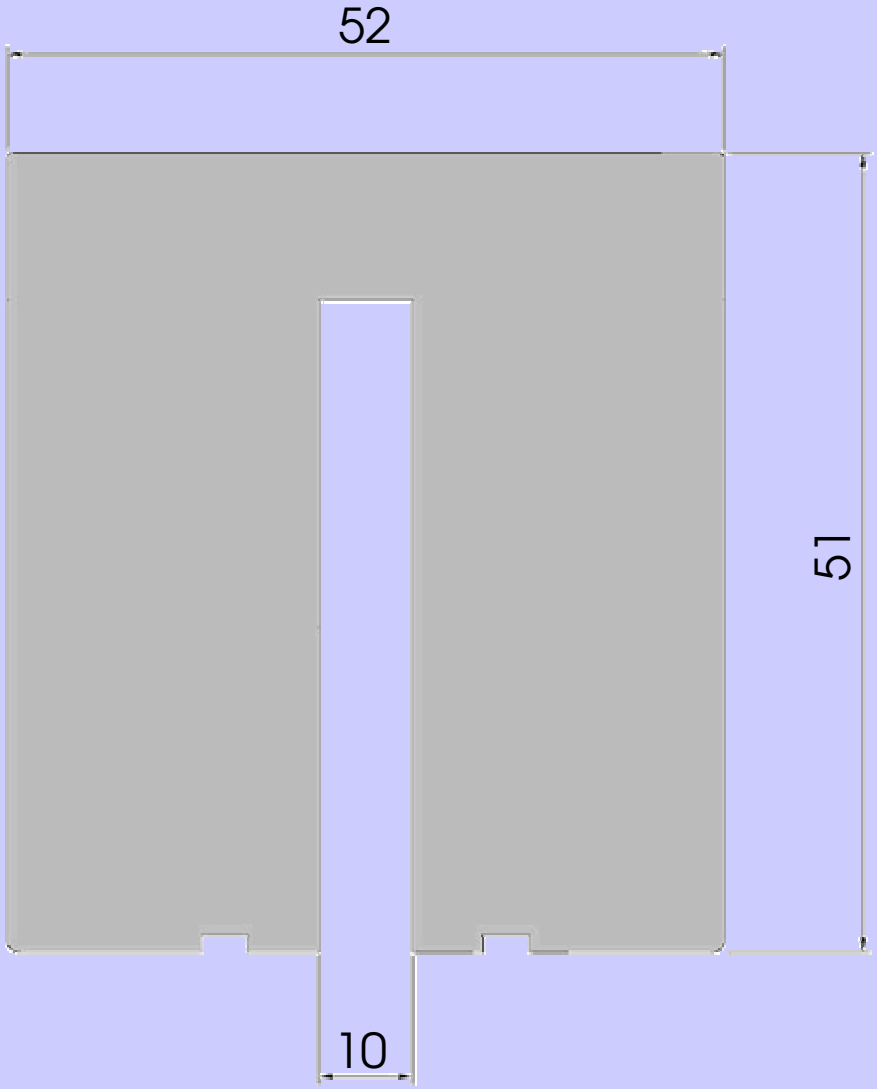
thermal connection to the cryostat

vacuum chamber

HV and signal feed-throughs

plate for front-end electronics (electronics not shown)

The crystal



Crystal mounted on the cryostat flange.

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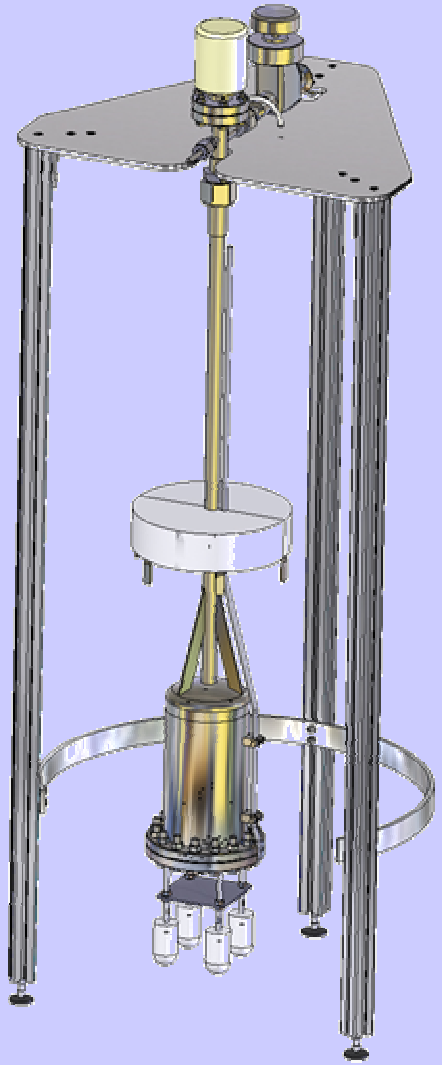
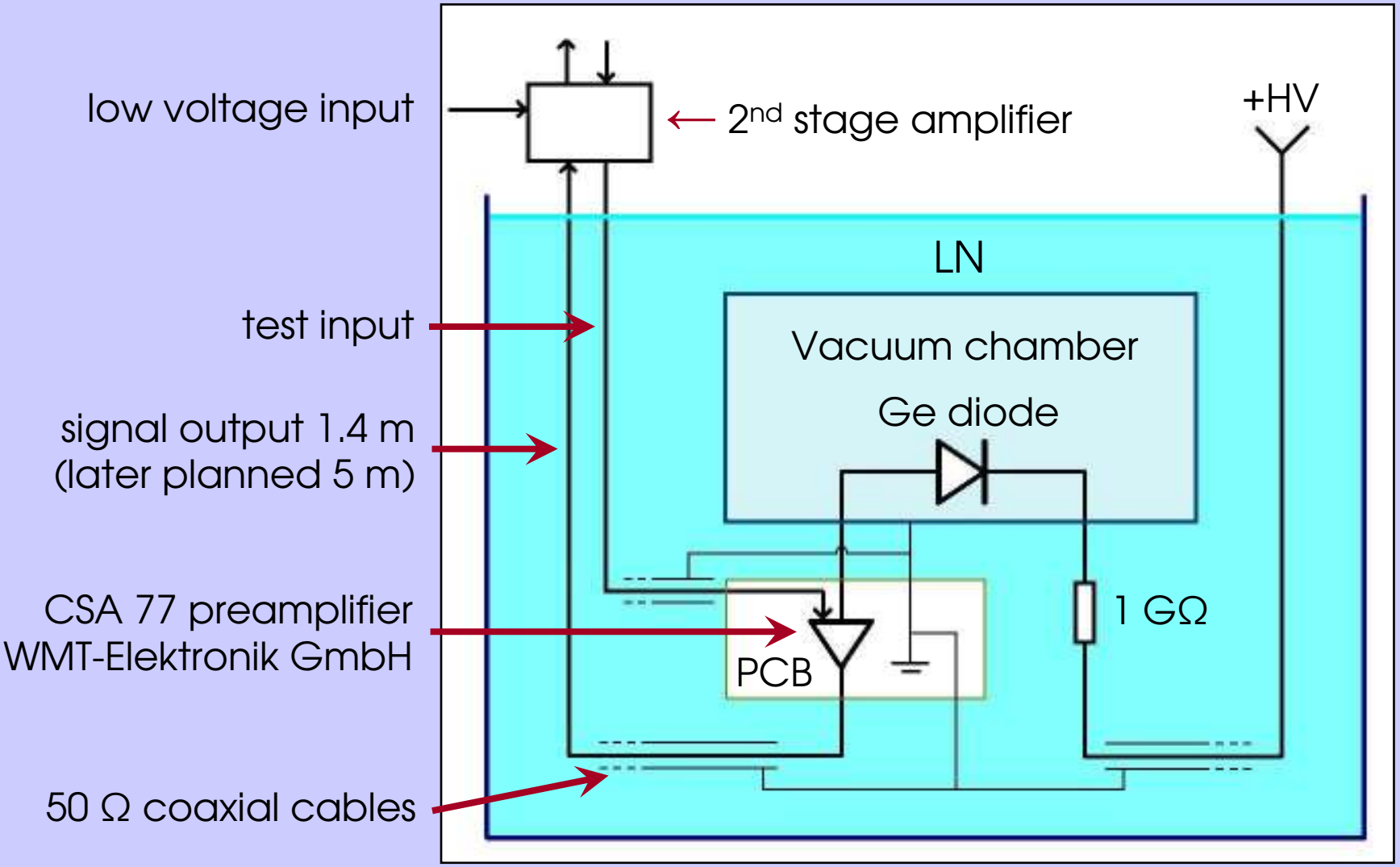
The Sub setup in Low-level laboratory



Front-end electronics layout



CSA-77 preamplifiers

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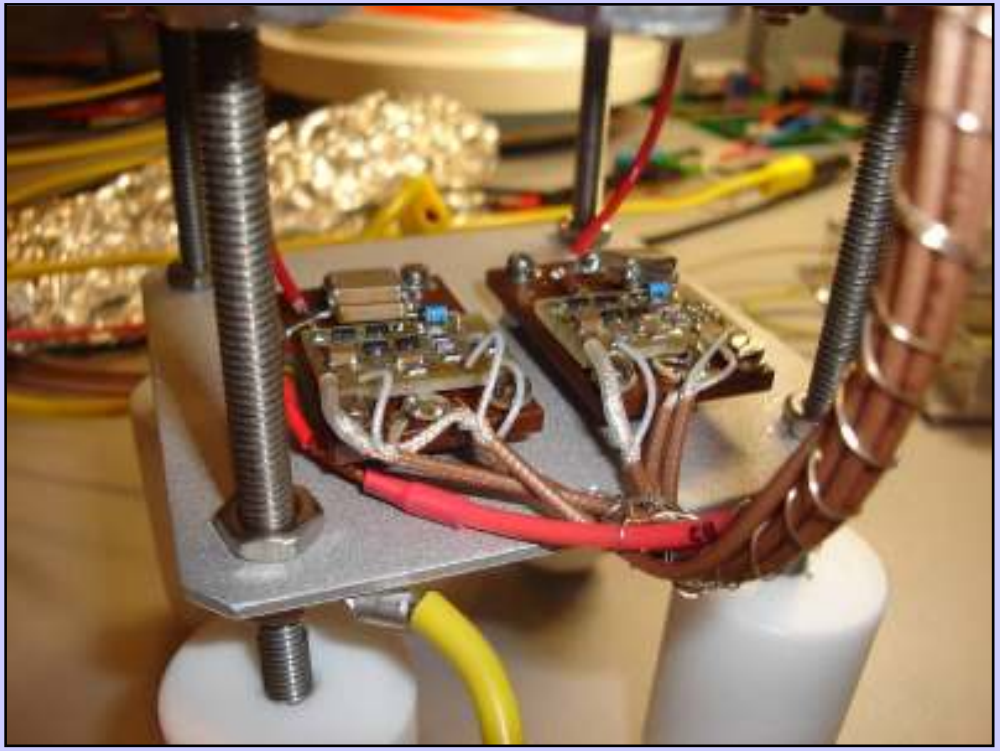
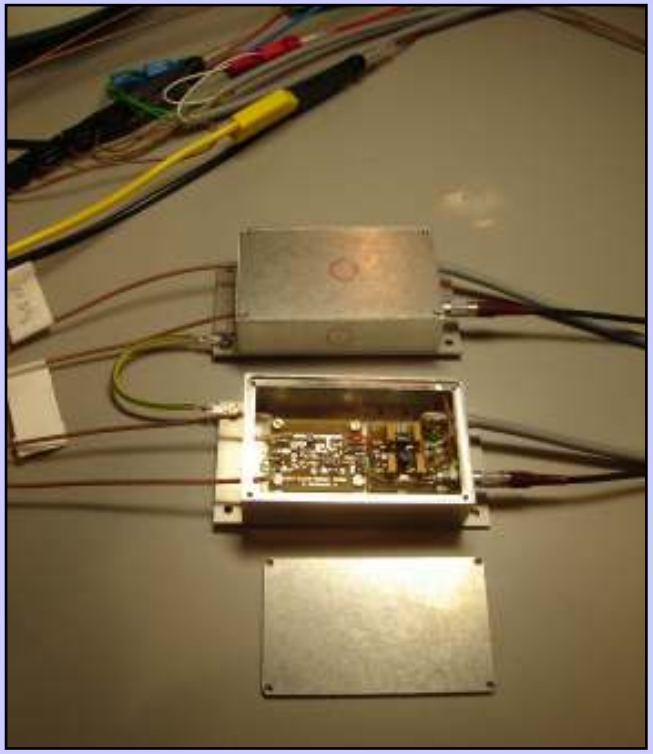


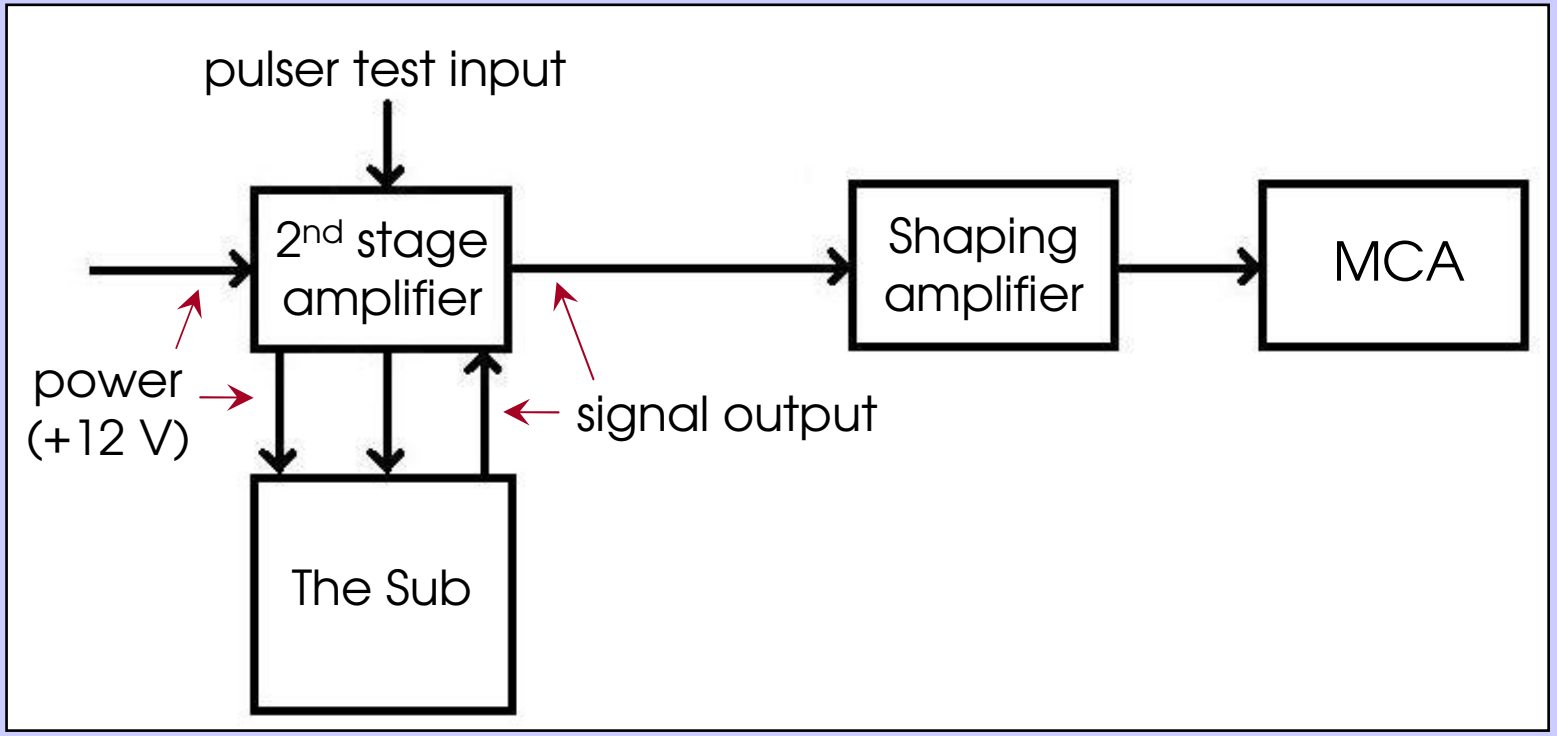
The CSA-77 preamplifiers installed below the cryostat.



The main amplifier boxes.

- two preamplifiers: HV and signal side readout planned
- currently only standard single channel readout is used

Data acquisition layout



- pulse-shape recording:
  Struck SIS 3301 FADC with 14-bit resolution
  sampling rate: 100 MHz
- digitized shaping for pulse-height spectra recording

First results with 33pF capacitor

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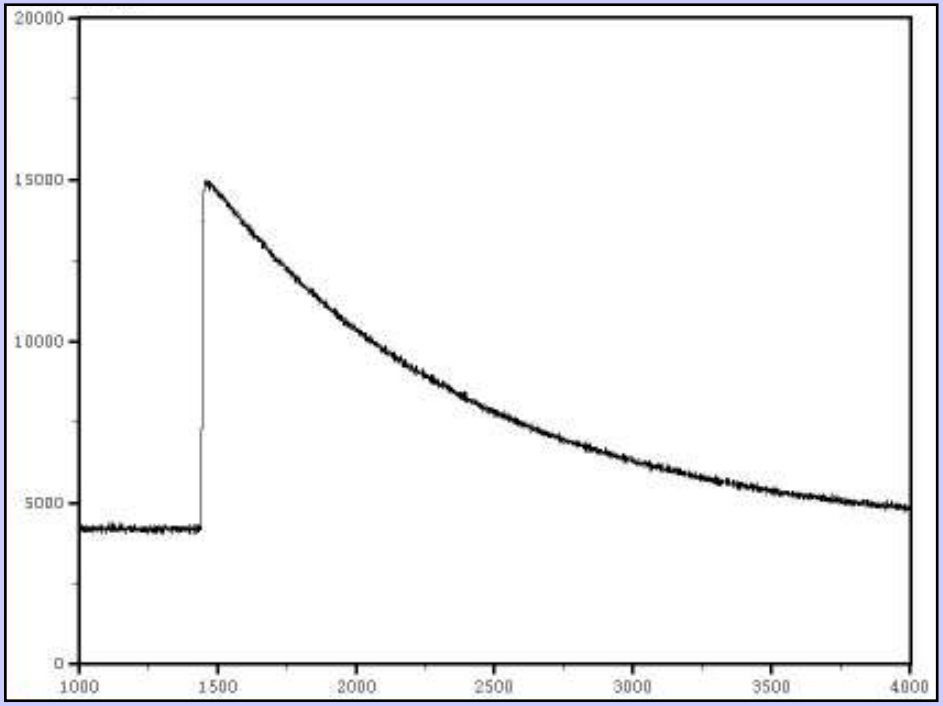
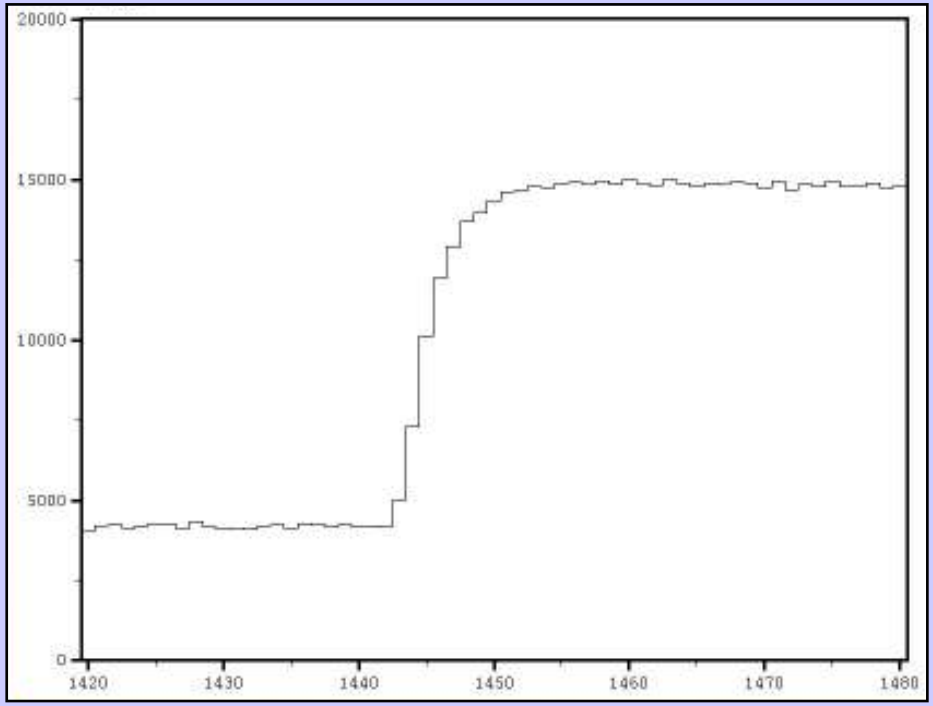
FADC pulse shape: pulser





- measurement performed using test pulse with 50ns rise time
- detector substituted by 33pF capacitor mounted on the PCB

First results with 33pF capacitor

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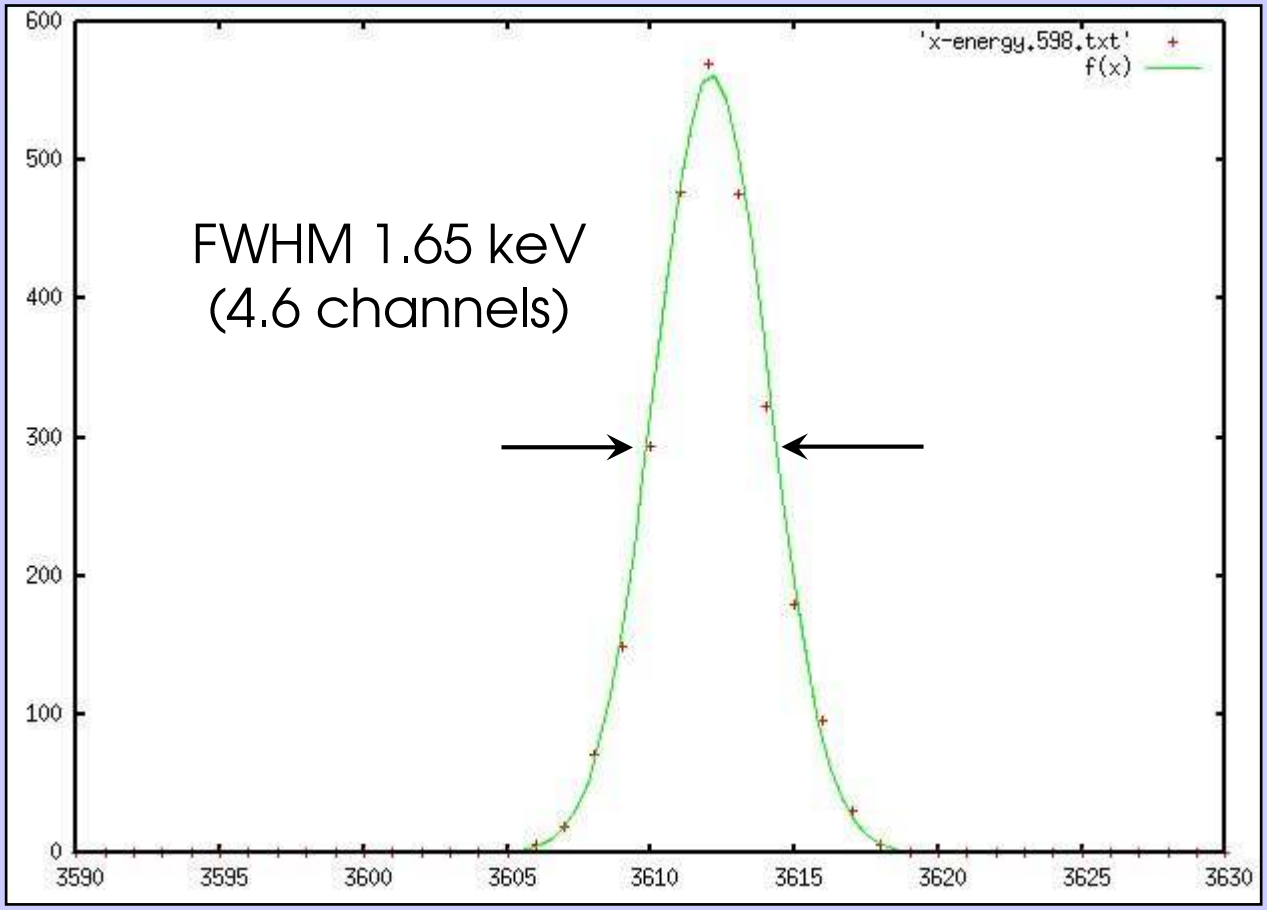
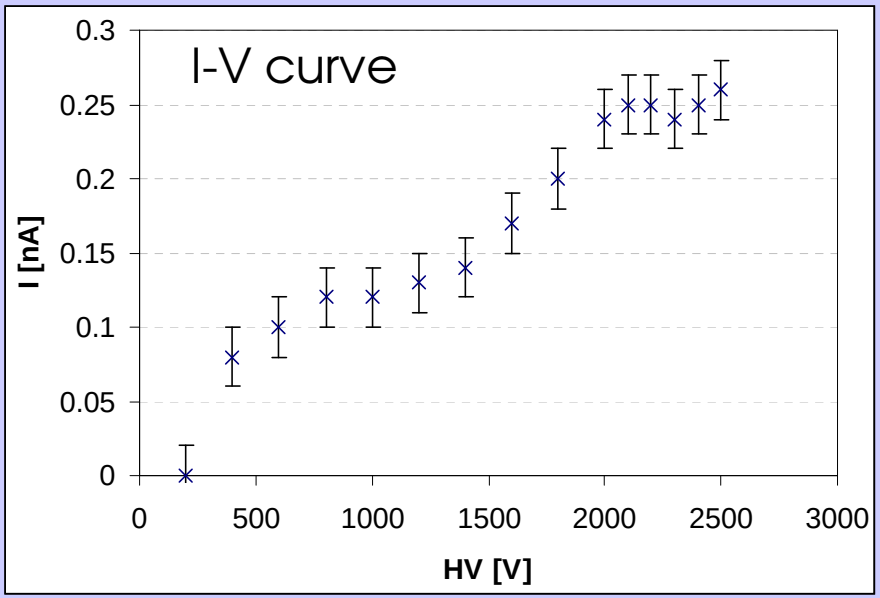
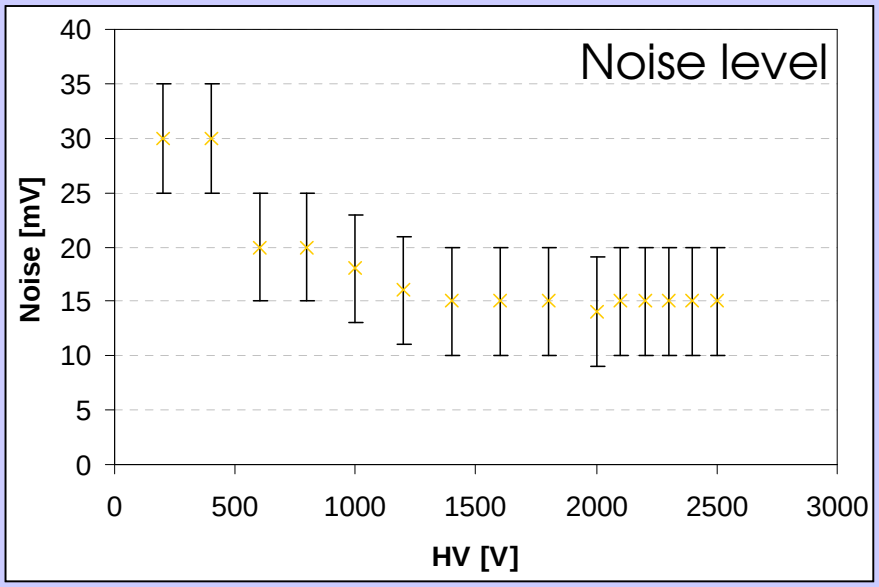
Pulser FADC spectrum:



- recorded with 1.6 μs shaping time

Performance with Ge-crystal



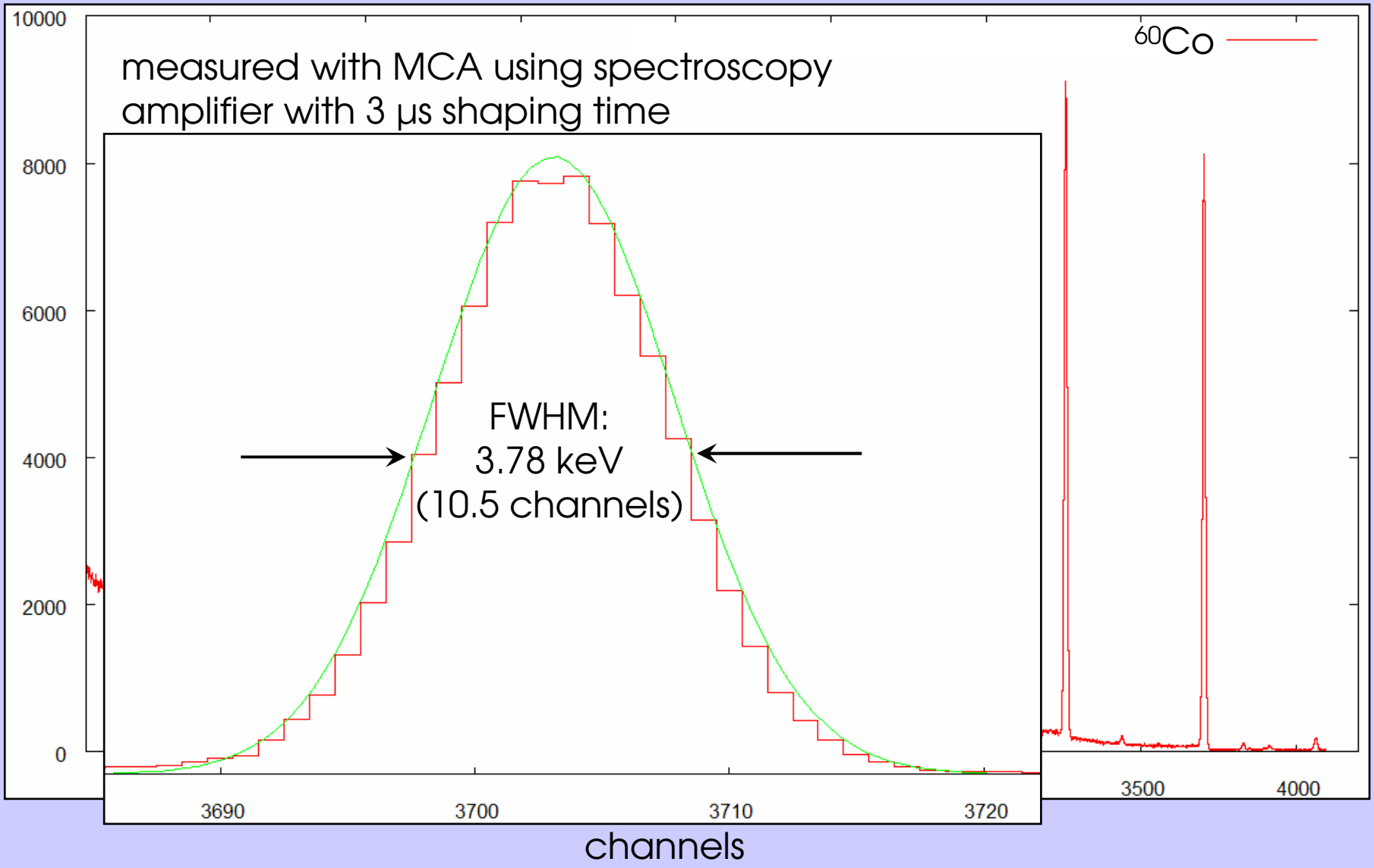


First time HV applied on the detector:

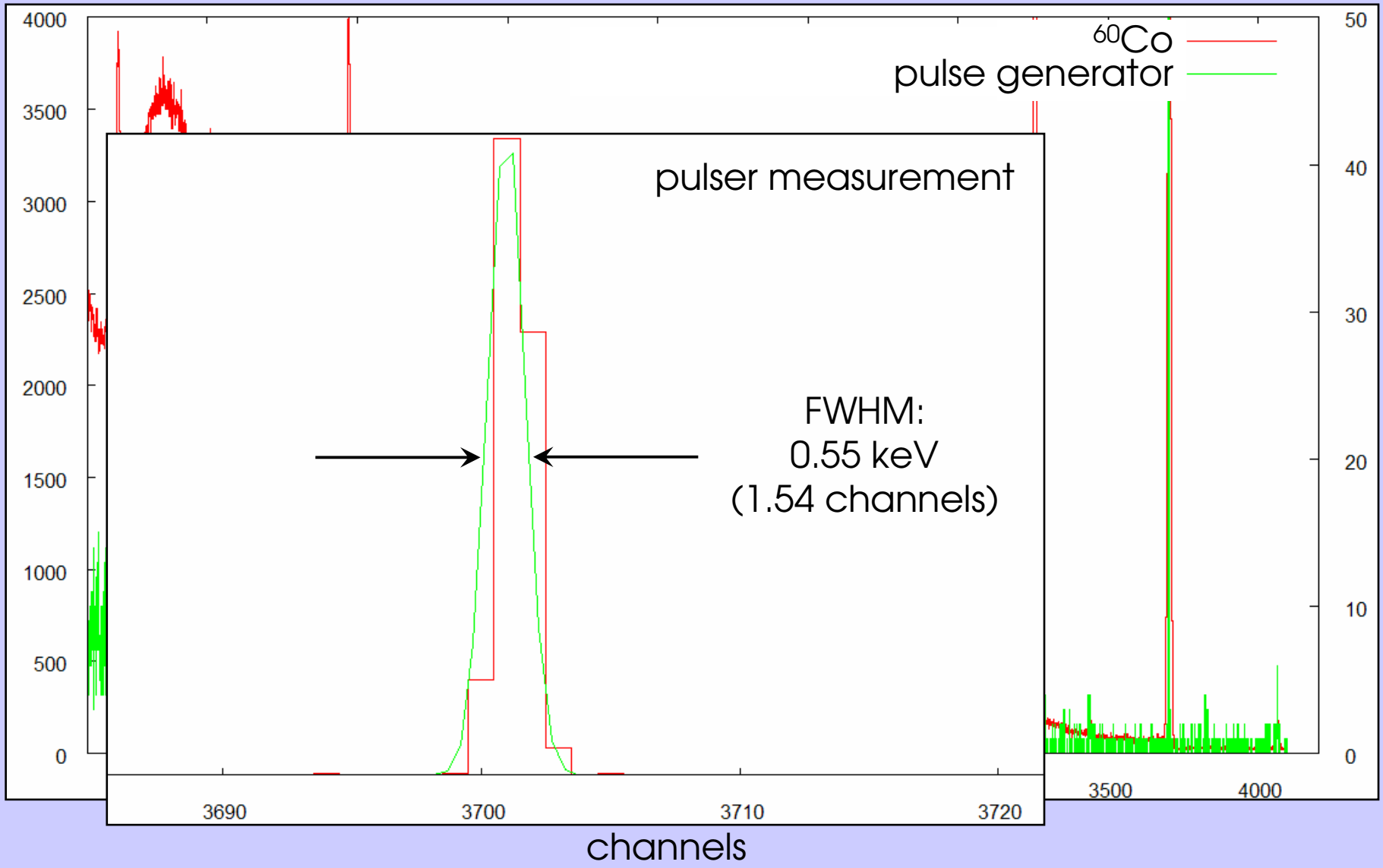
- leakage current measured with pA-meter
- baseline noise of signal output after shaping amplifier measured with oscilloscope
- full depletion reached at ~1500 V
- detector operating voltage: 2500 V

- measurements were done with another preamplifier than the previous pulser test

First results with Ge-crystal



First results with Ge-crystal



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First pulse-shapes

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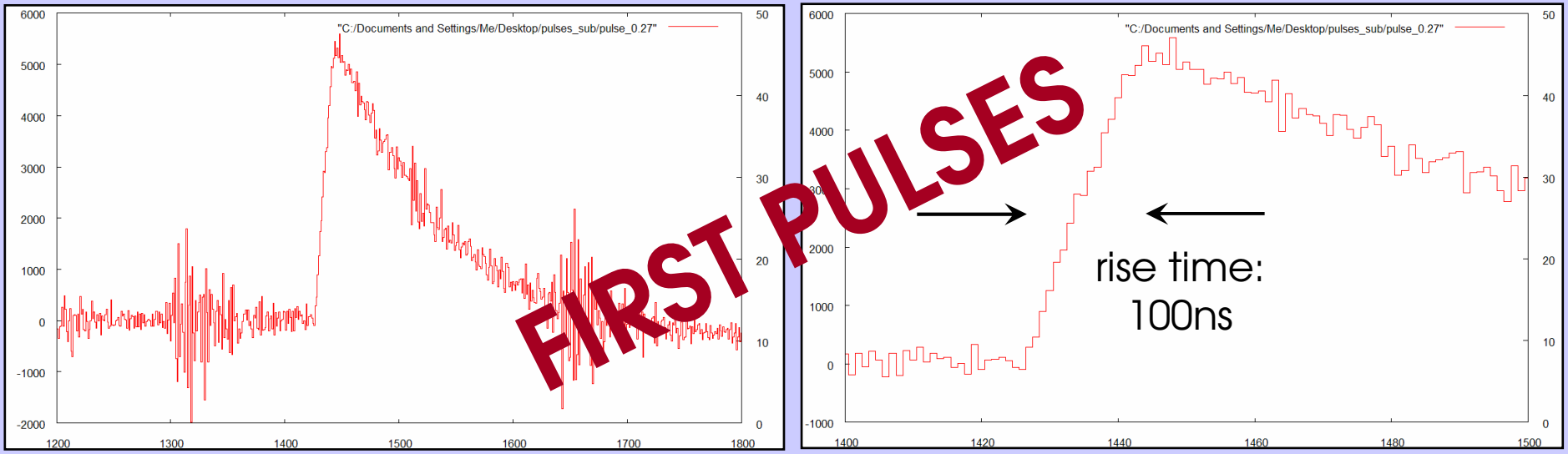

Outlook

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1. understand source of present high-frequency noise and find ways to eliminate it
2. record pulse-shapes of single-site and multi-site events (DEP, coincidence measurements, FE-peak) and test discrimination methods
3. tests of different Phase I FE electronics solutions - in coordination and collaboration within TG-3

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Appendix

Appendix

Heating and pumping of
the cryostat.

Appendix

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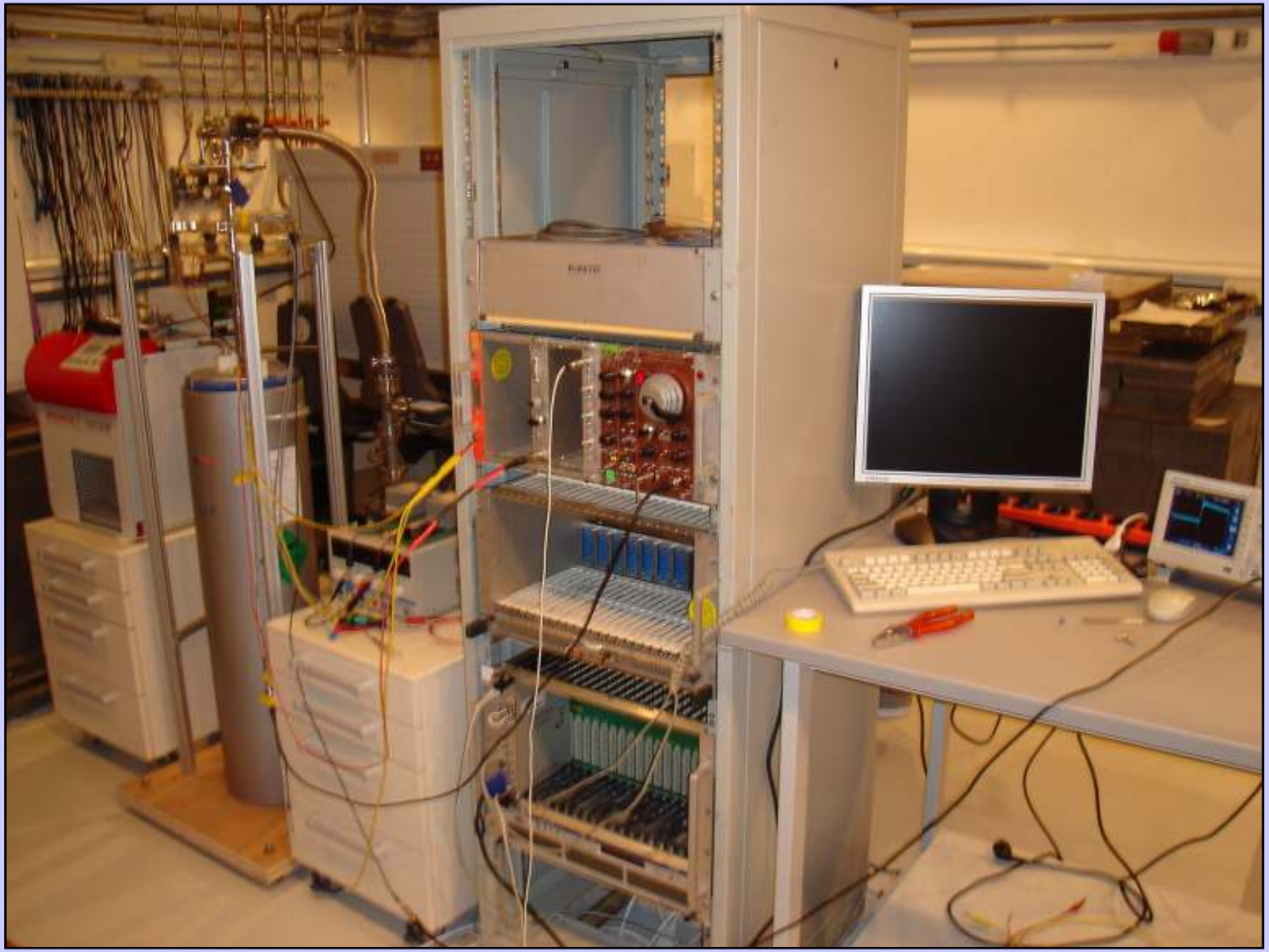
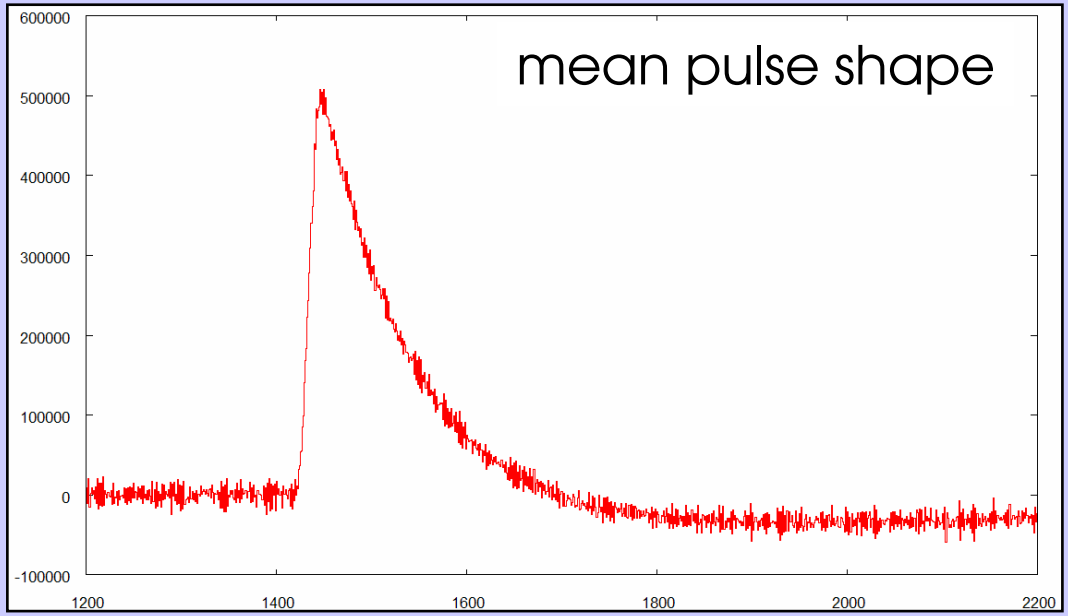


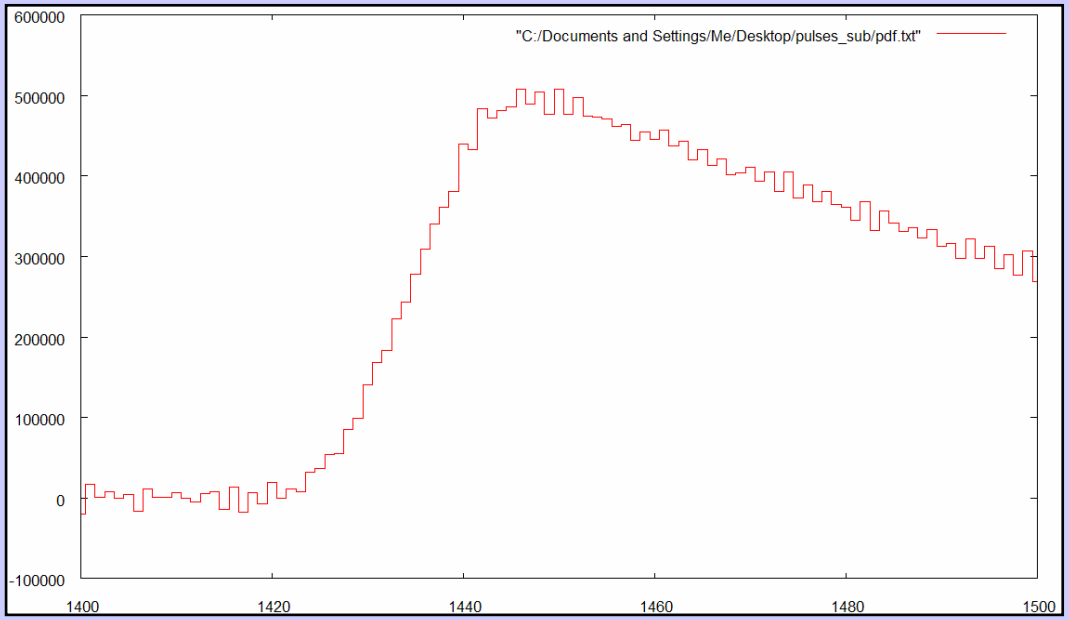
Whole setup with the electronics rack in low-level lab.

Appendix

Measurements with ^{60}Co source.

Appendix


mean pulse shape
600000
500000
400000
300000
200000
100000
0
-100000
1200
1400
1600
1800
2000
2200


"C:/Documents and Settings/Me/Desktop/pulses_sub/pdf.txt"
600000
500000
400000
300000
200000
100000
0
-100000
1400
1420
1440
1460
1480
1500