

LLAMA-DAQ

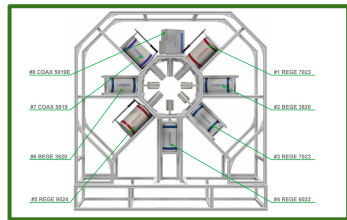
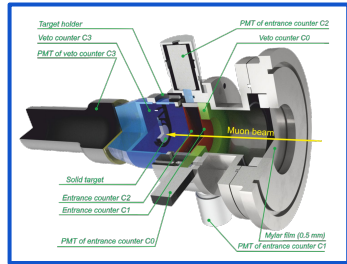
Overview, hardware, trigger scheme

OMC4DBD remote Collaboration meeting
April 25 - 26 2022

Mario Schwarz



DAQ @ PSI 2021: overview



PMT (4x)

Linear Fan-In Fan-Out

Ge (8x)

Linear Fan-In Fan-Out

SIS3316 FADC 125 MHz

Ethernet

DAQ server

SIS3316 FADC 250 MHz

VME / optical

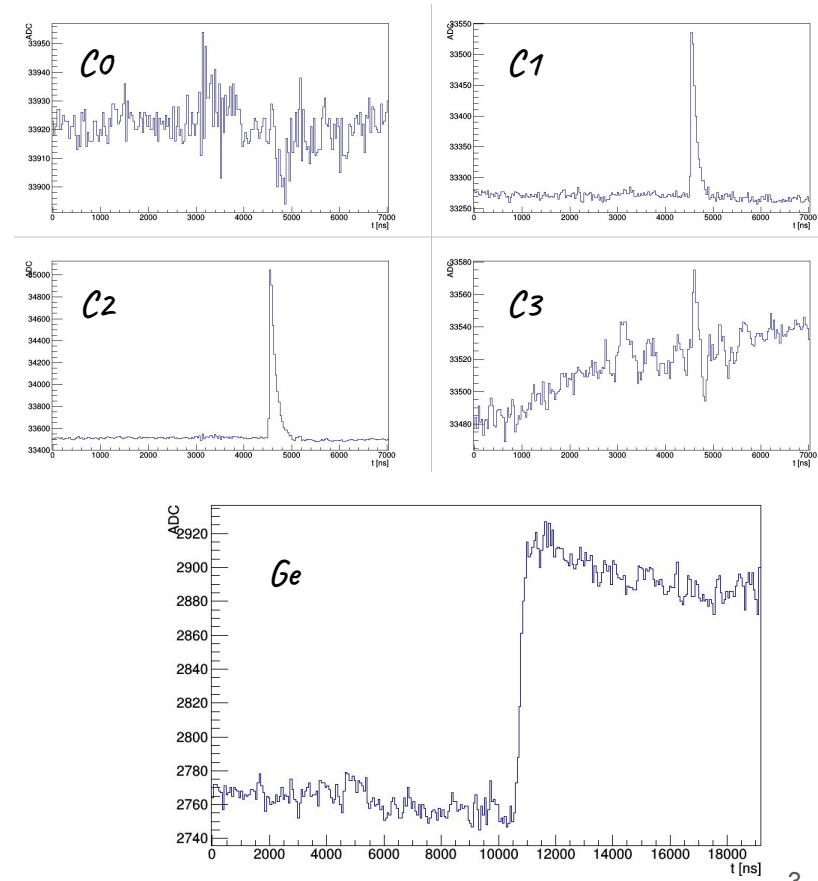
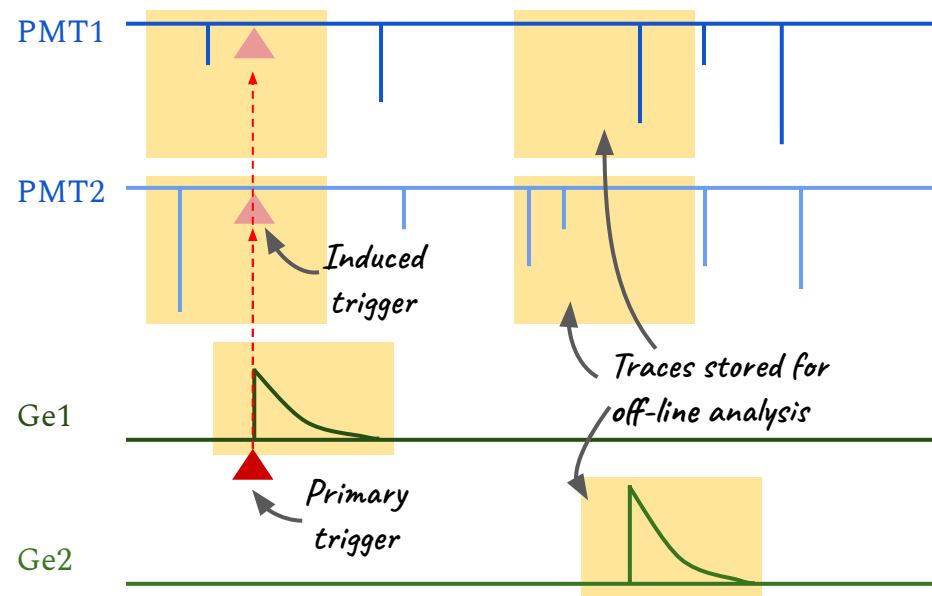
DAQ server

Separate Analysis

LLAMA

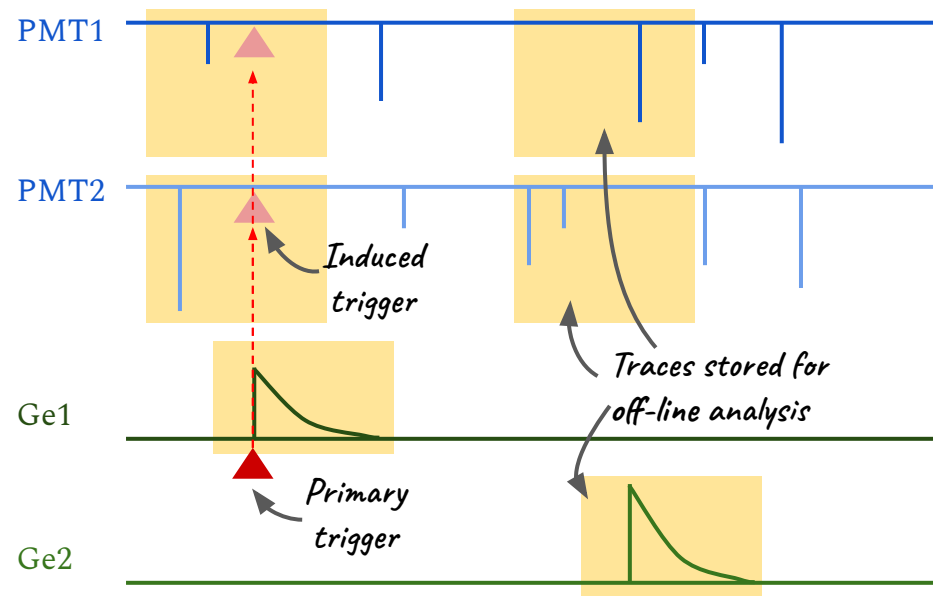
MIDAS

LLAMA



Reduced channels
for simplicity

LLAMA

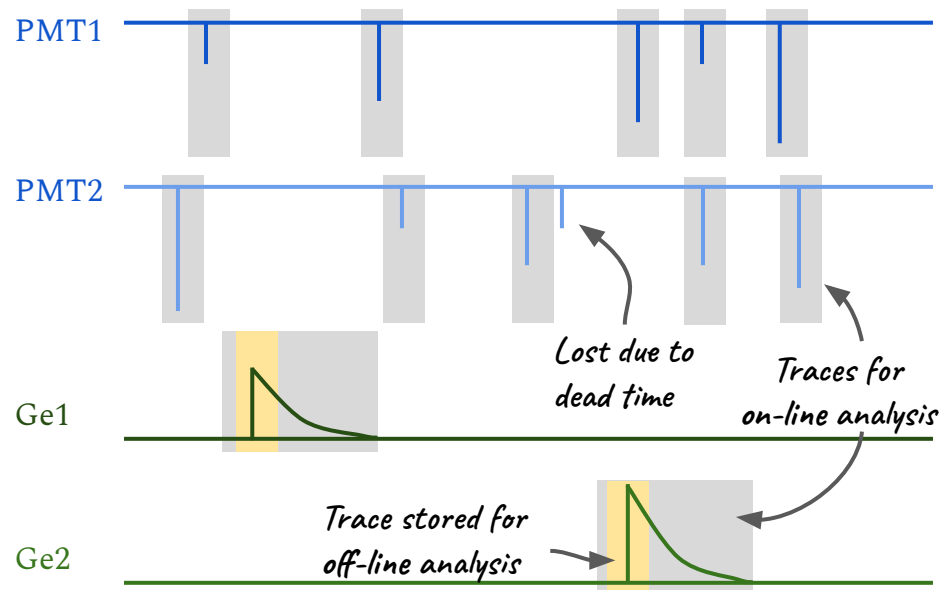


✓ Dead time unproblematic for PMTs

✓ Off-line tuning of energy and time reconstruction

! Need a lot of fast storage

MIDAS



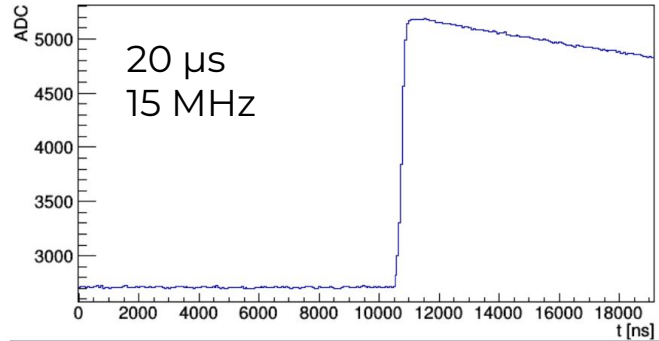
✓ Can handle huge data rates

✓ No need for fast storage server

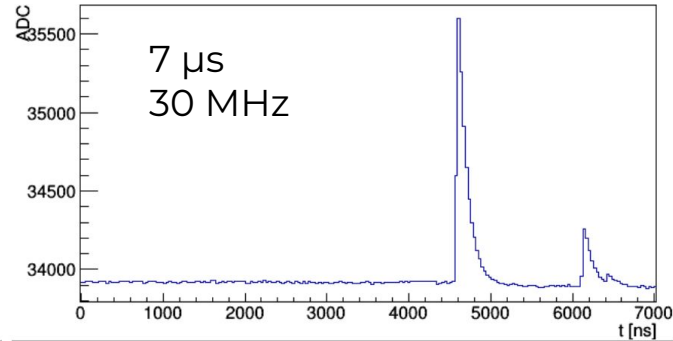
Reduced channels for simplicity

LLAMA traces

Germanium



PMT

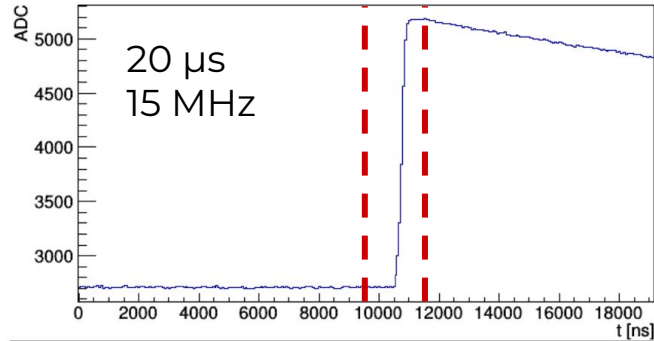


Low Frequency (LF trace)

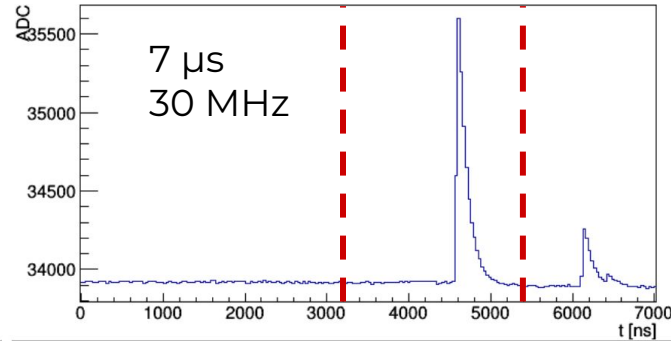
- Ge energy determination
- data reduction

LLAMA traces

Germanium

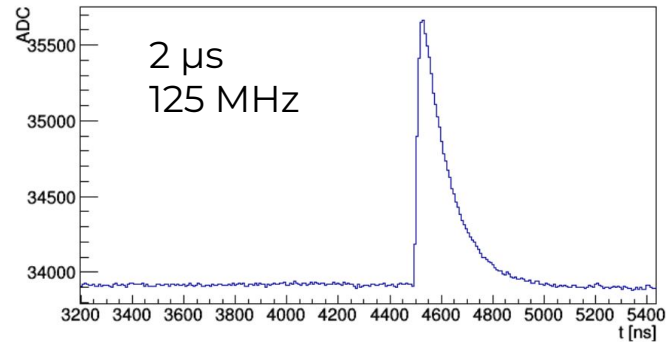
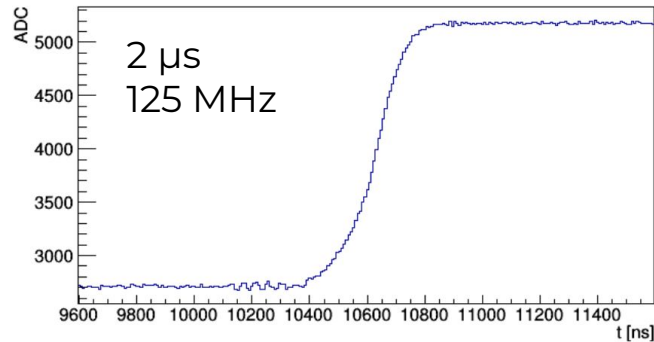


PMT



Low Frequency (LF trace)

- Ge energy determination
- data reduction



High Frequency (HF trace)

- Precise timing

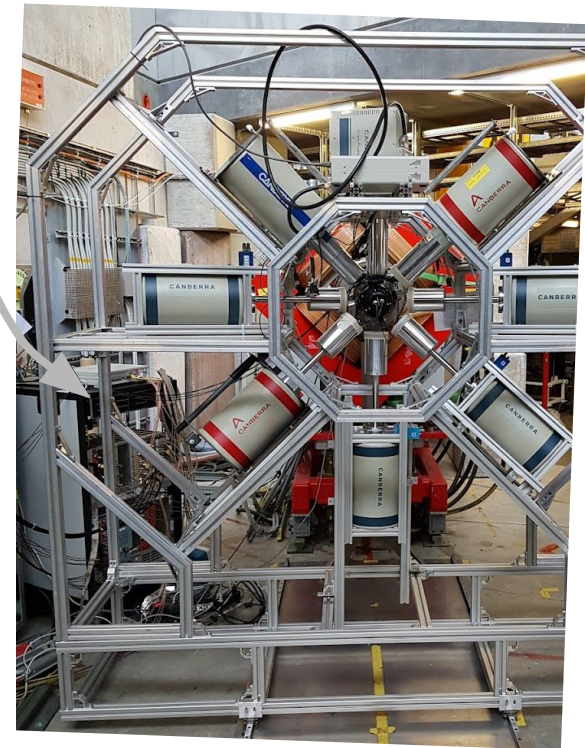
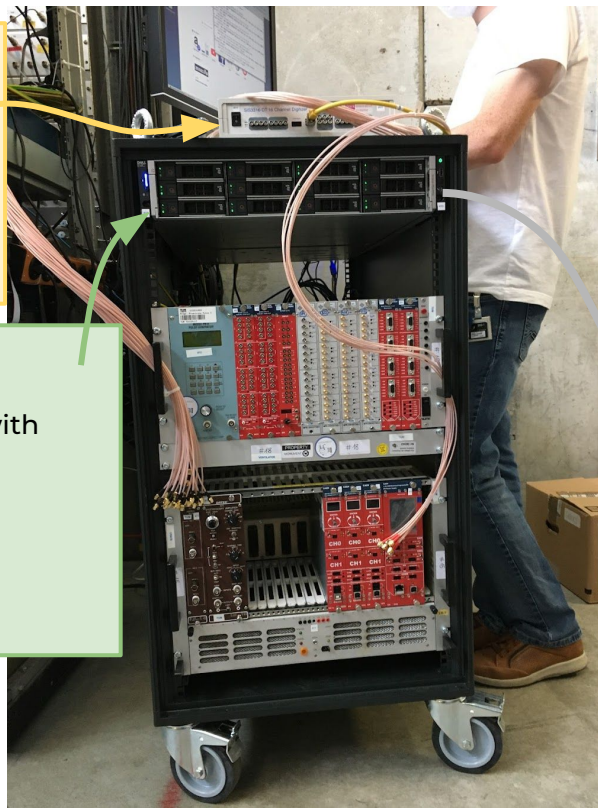
LLAMA-DAQ Hardware

FADC: SIS3316-125-16 from Struck

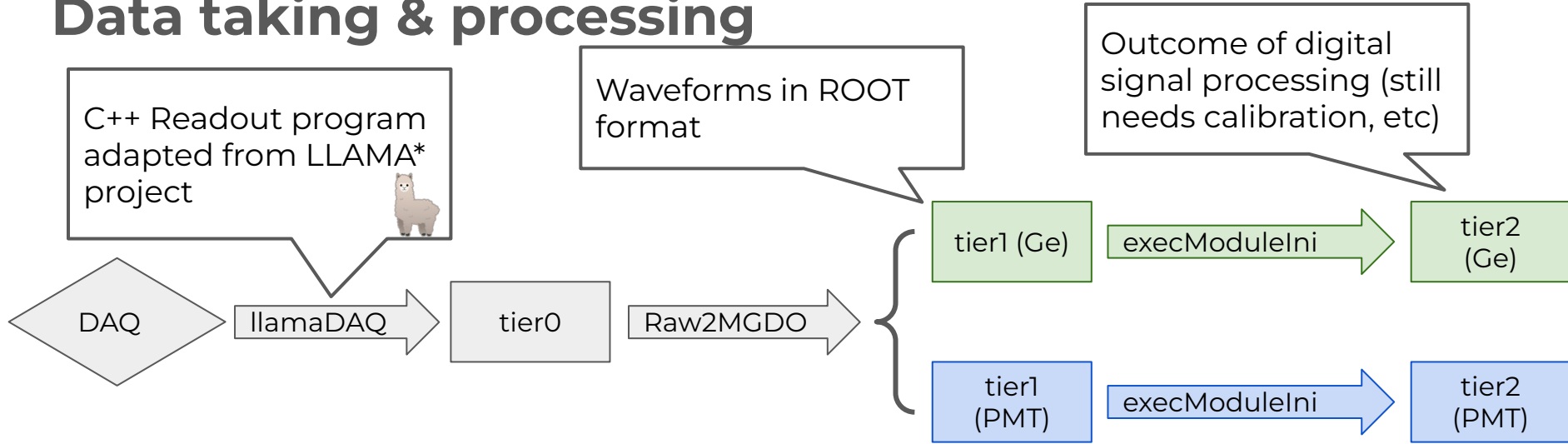
- standalone device
- read out via Ethernet, data rate up to 700 Mbit/s tested
- 16 input channels
- 125 MHz, 16 bit

Server

- dedicated ethernet interface for communication with FADC
- ~ 160 TB on HDDs capable of writing raw data with > 700 Mbit/s
- RAID 6 configuration → redundancy
- Data backed up at TUM now

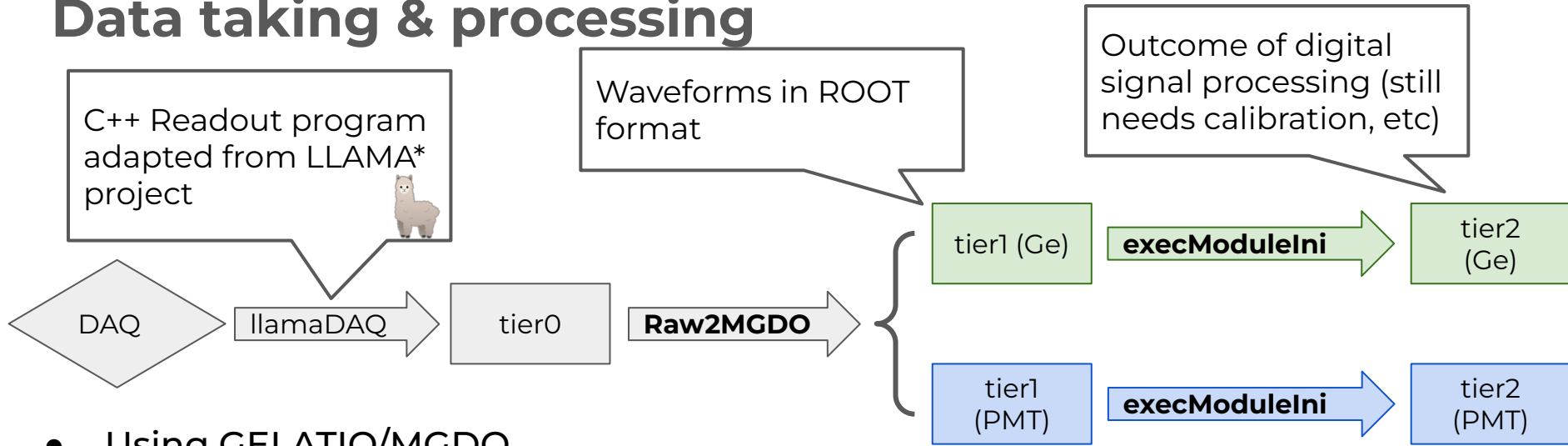


Data taking & processing



* **LEGEND** **L**iquid **A**rgon **M**onitoring **A**pparatus

Data taking & processing



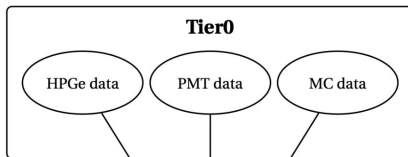
- Using GELATIO/MGDO
- Implementation of custom digitizer module necessary for technical reasons
 - Implemented “ALPACA” and “ALPACAPPM” modules** for Ge and PMT channels
 - available as container in monument server

* LEGEND Liquid Argon Monitoring Apparatus

** Adapted Llama Program for ACcelerator Applications

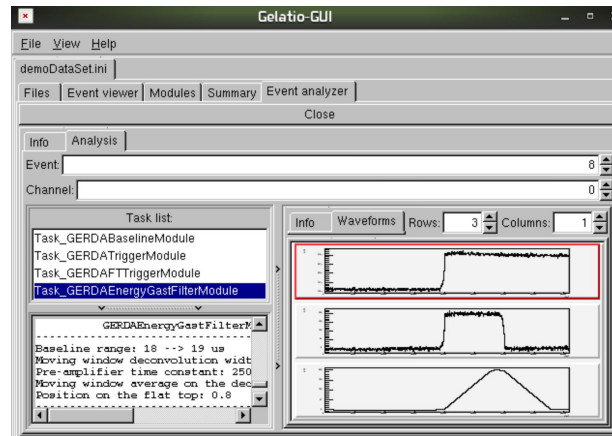
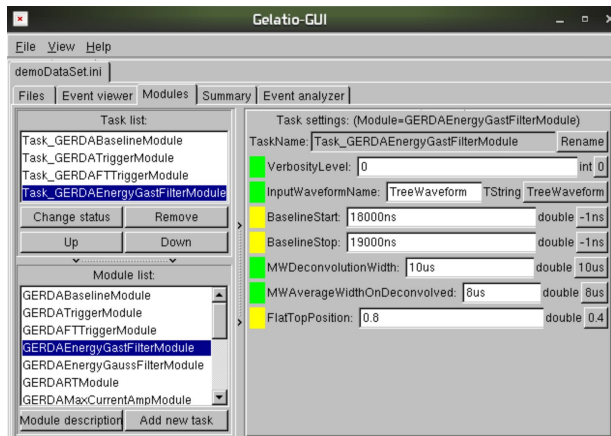
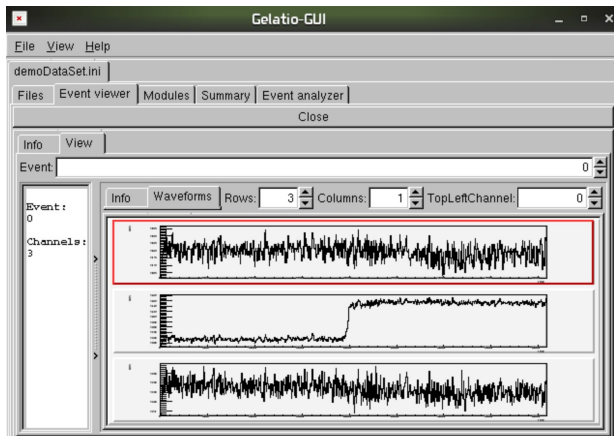
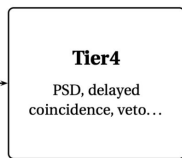
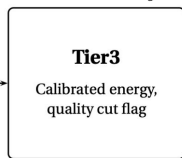
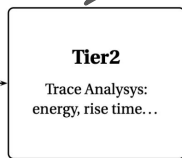
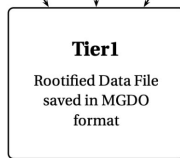
Data structure →
Elisabetta's talk

Data processing à la Gerda



Energy reconstruction in tier2 production
→ **Eli's** talk

Current focus of analysis team
Energy calibration:
→ **Dhanurdhar's** talk



[M Agostini et al 2011 JINST 6 P08013](#)

DAQ Channel map

... of a late run, e.g. Se^{76}

Channel	Device	Triggers PMTs?
1	Ge 1	yes
2	Ge 2	yes
3	Ge 3	yes
4	Ge 4	yes
5	Ge 5	yes
6	Ge 6	yes
7	Ge 7	yes
8	Ge 8	yes
9	Detector 9 (background)	no
10	Proton counter	no
11	Pulser	no
12	<empty>	no
13	C0	-
14	C1	-
15	C2	-
16	C3	-

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Conclusions and Outlook

- ✓ Successfully used LLAMA-DAQ system @ PSI last year
- ✓ Took ~ 90 TB of raw data
- ✓ Processing performed @ readout server (48 threads)
- ✓ Server holds copy of high-level MIDAS data & scripts (thanks, Igor!)

TODO before next beam time:

- ! Need to free up space @ readout server (4.4 TB of 160 TB free...)
 - Will do after high-level analysis is done and properly archived at LRZ
- ! Need new wrapper-program for llamaDAQ:
 - Graphical user interface
 - Incorporation of run logging & easy stop and restart

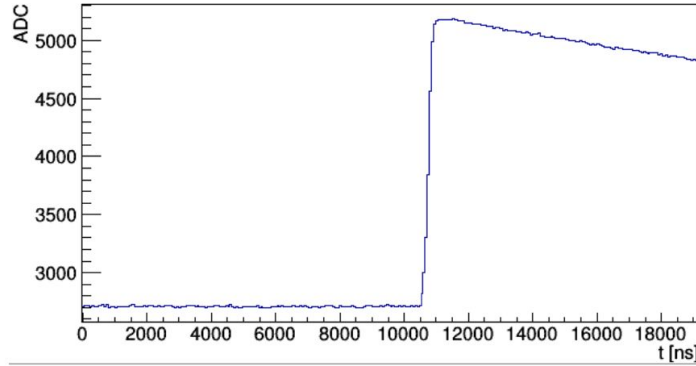
backup

DAQ

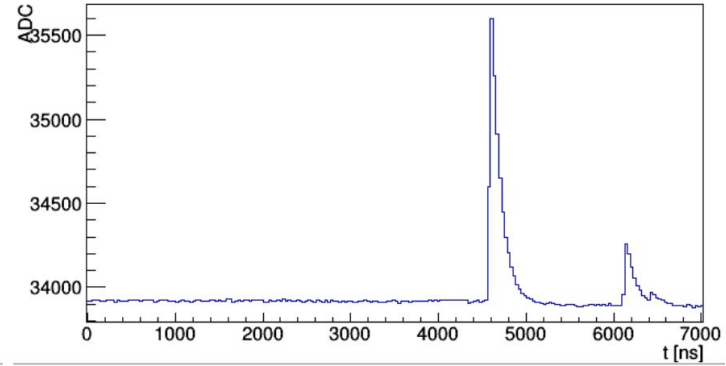
Example traces

LF

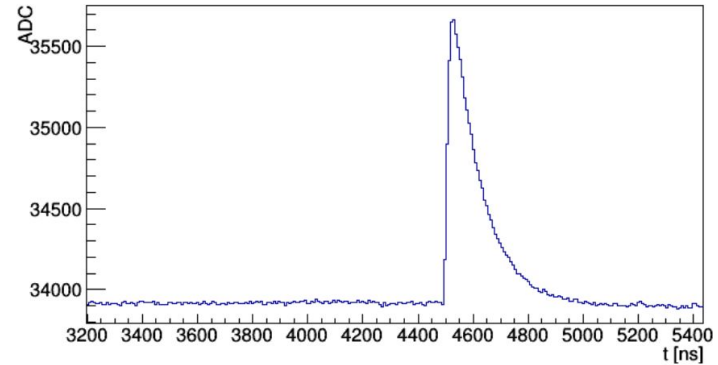
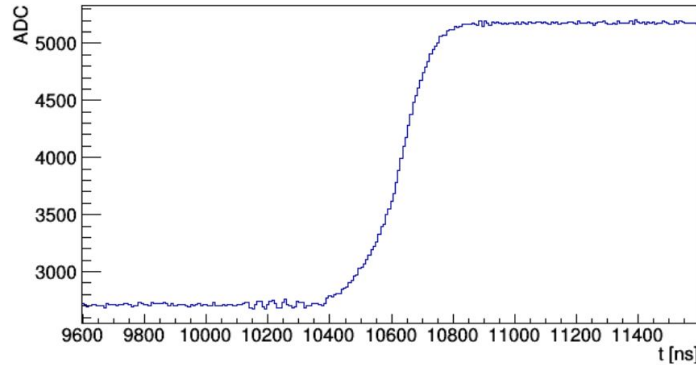
Ge

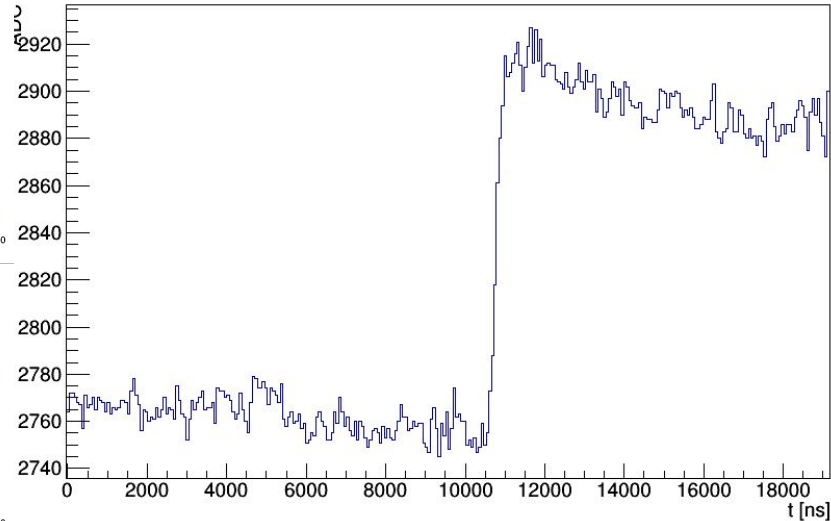
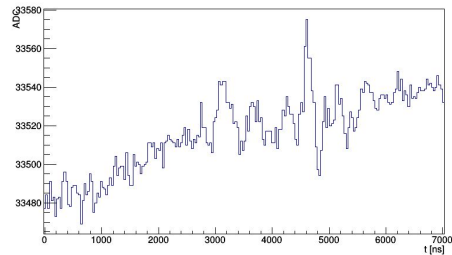
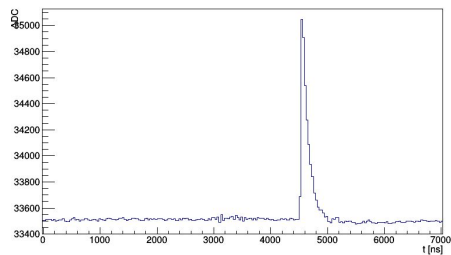
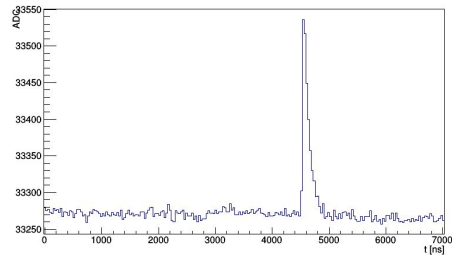
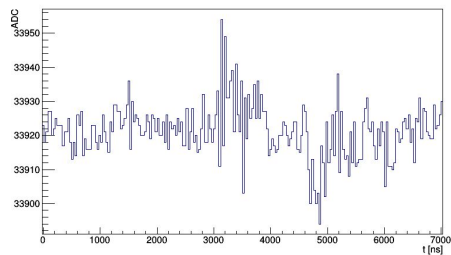


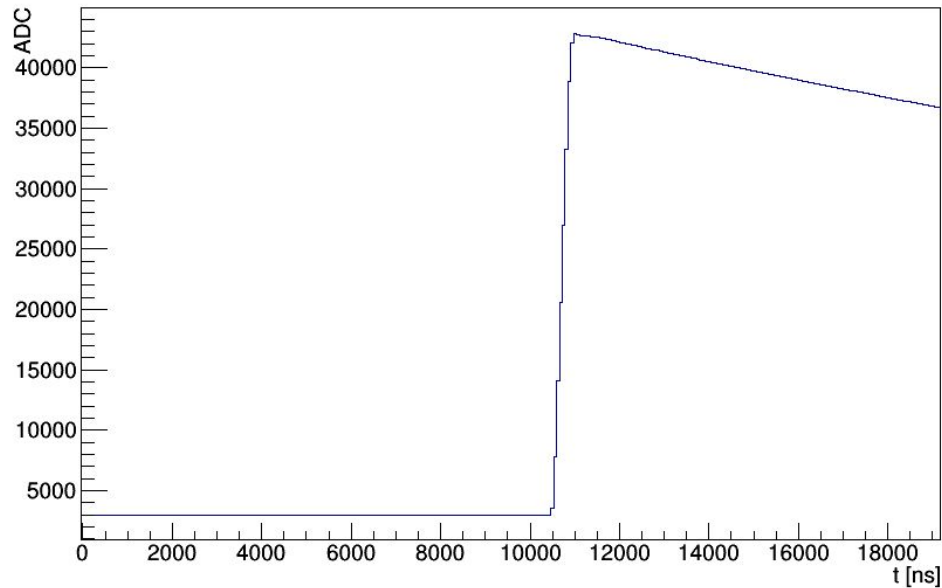
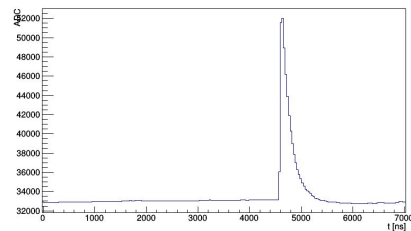
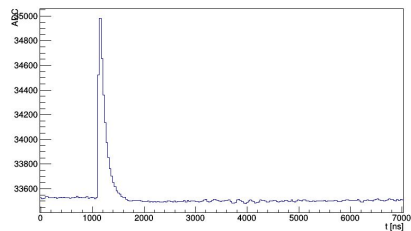
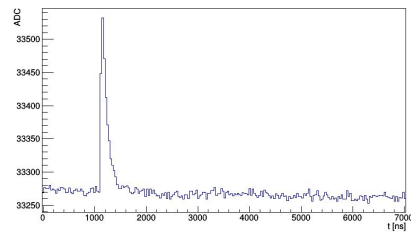
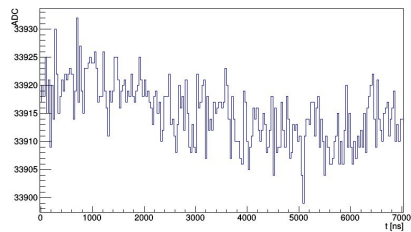
PMT



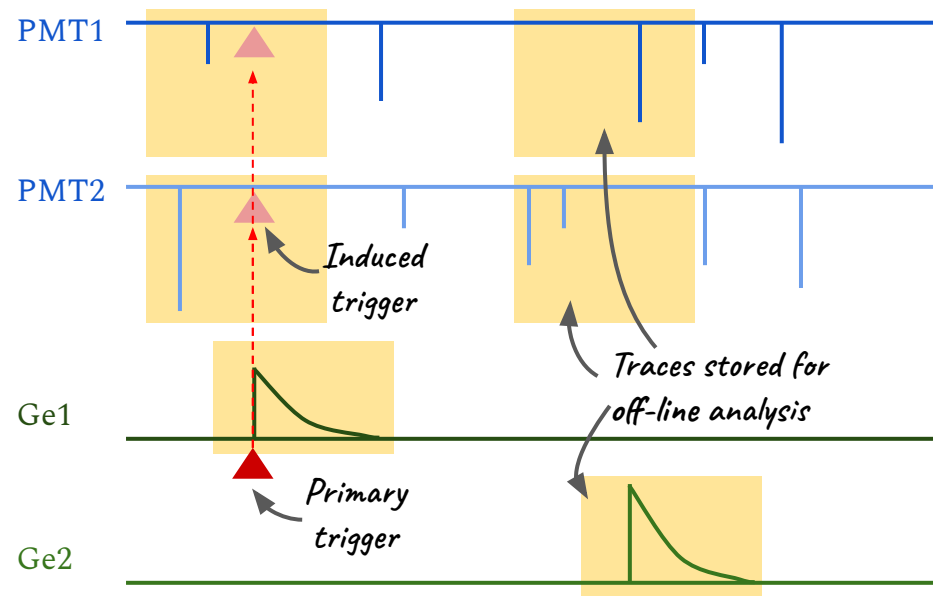
HF







LLAMA

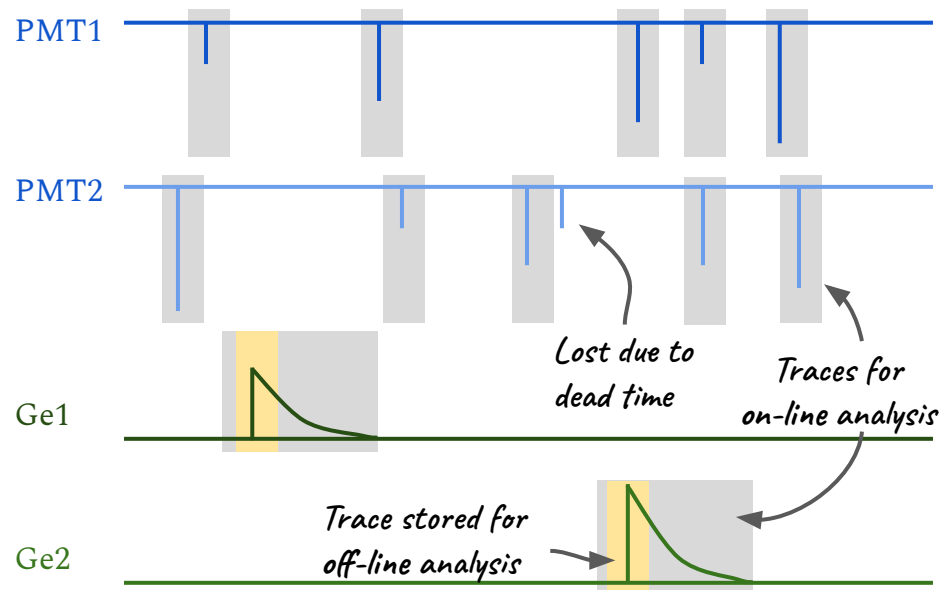


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