Electronics and DAQ for the GEM Detector

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MAGIX Collaboration Meeting 2017

Hardware

Electronics Periphery

HV Power Supply

- Need 7 channels per module or voltage divider
- Up to 4 kV
- Trip control
- Current monitoring ~50pA

Gas-Flow and -Quality Control

- Flowmeter
- Moisture and oxygen sensors

Current Control

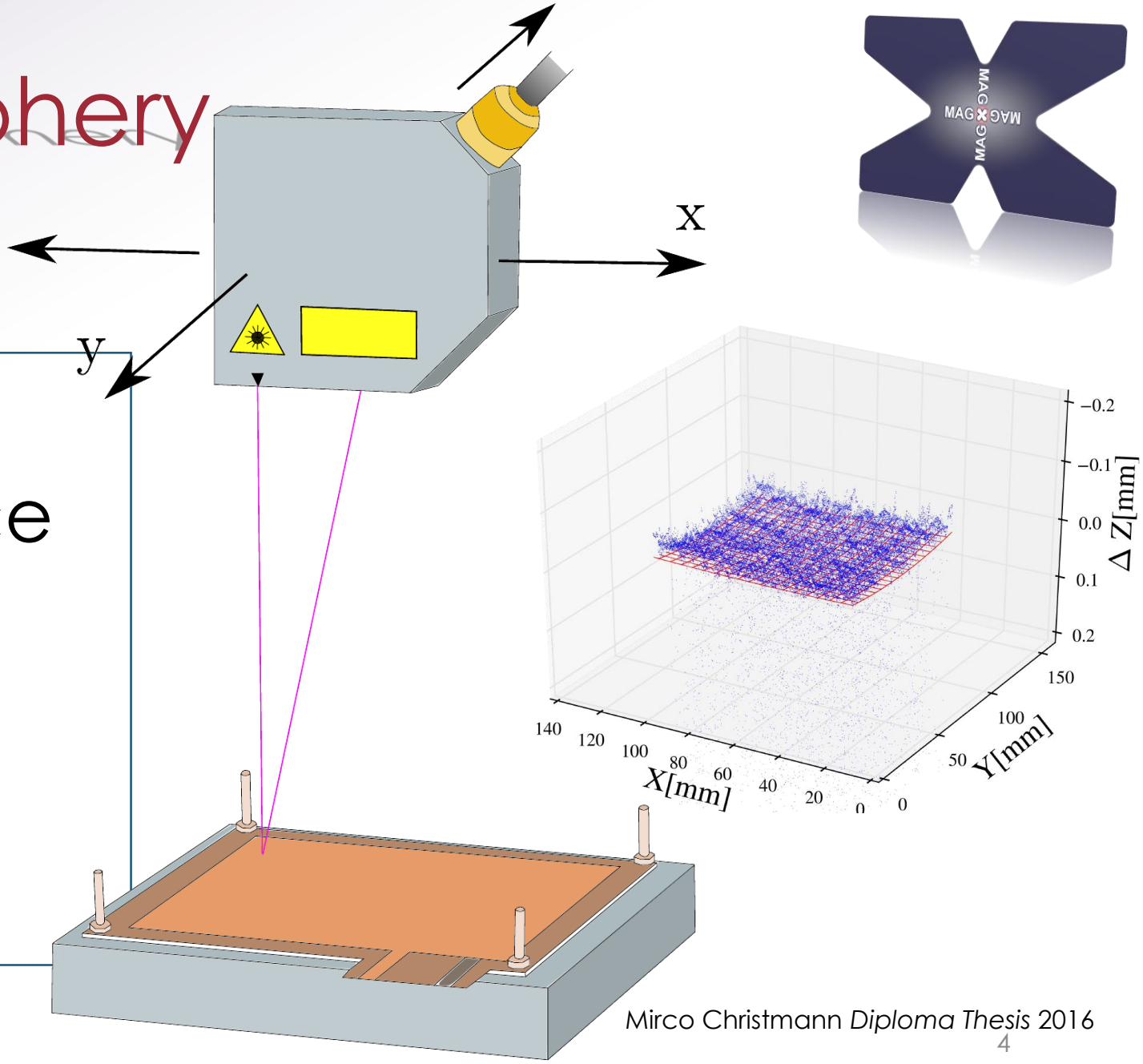
- Measure leakage current with a pico amperemeter

Mirco Christmann *Diploma Thesis* 2016

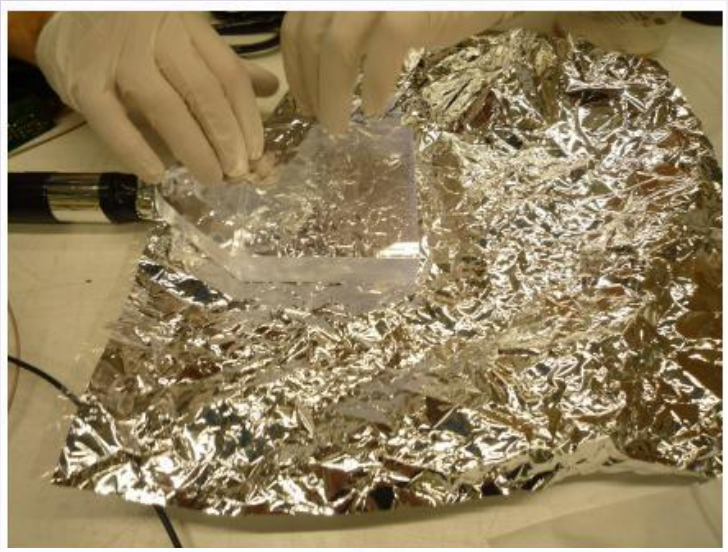
Electronics Periphery

Profile Laser

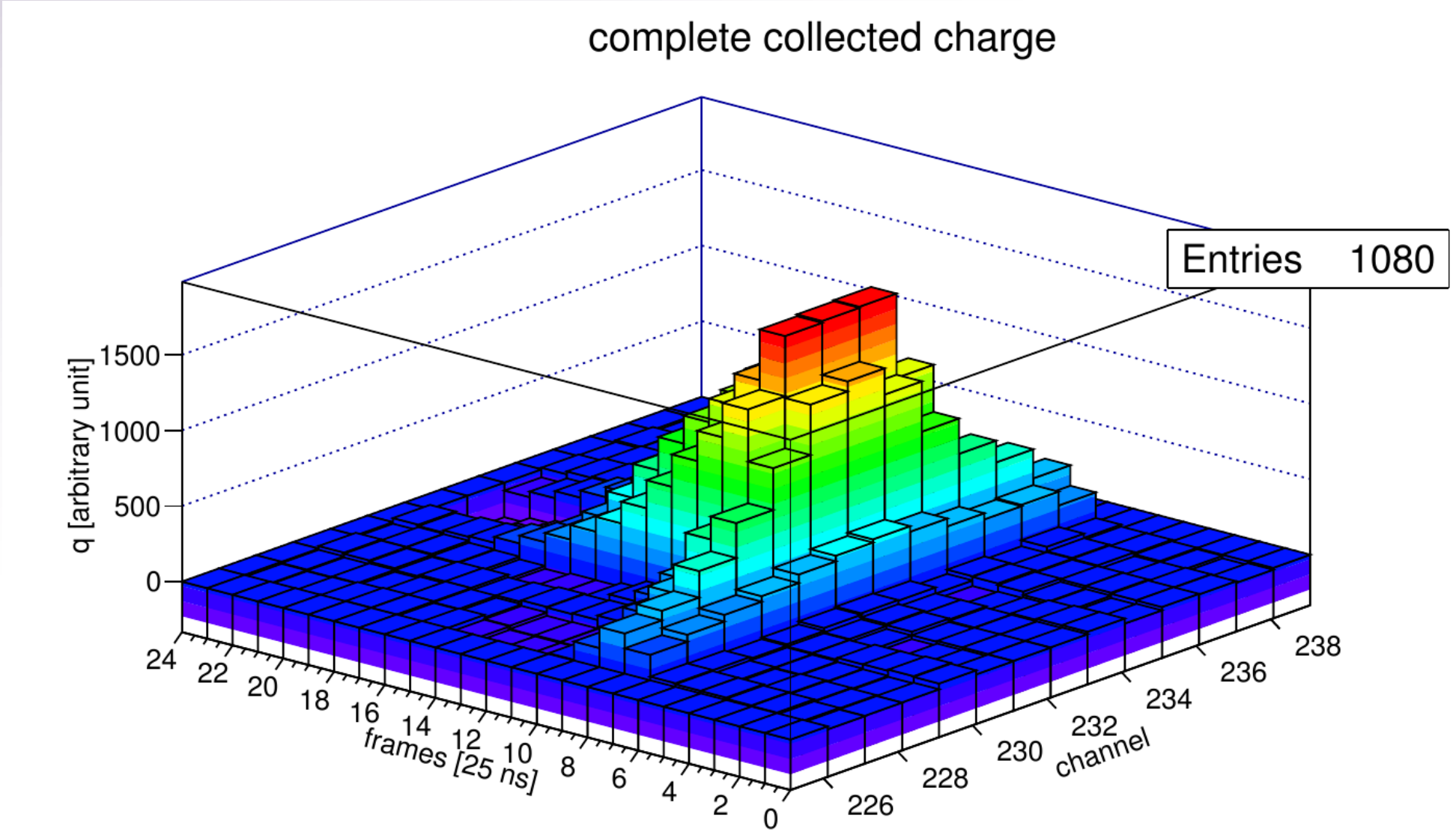
- Accurate distance measurement
- ~ 1.8 x 0.8 m^2
- Quality control of stretching



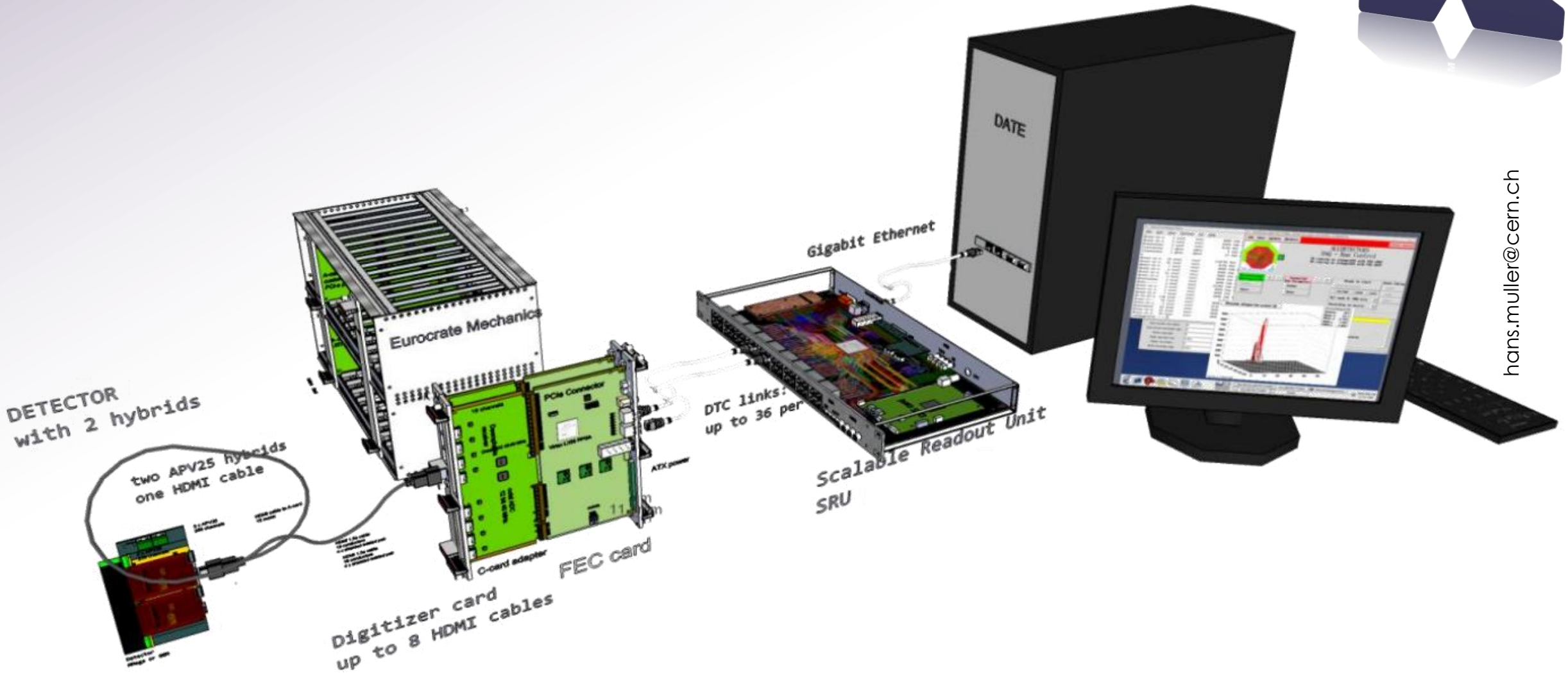
Trigger



Signals


complete collected charge
Entries 1080
q [arbitrary unit]
1500
1000
500
0
24
22
20
18
16
14
12
10
8
6
4
2
0
frames [25 ns]
226
228
230
232
234
236
238
channel

SRS – Scalable Readout System



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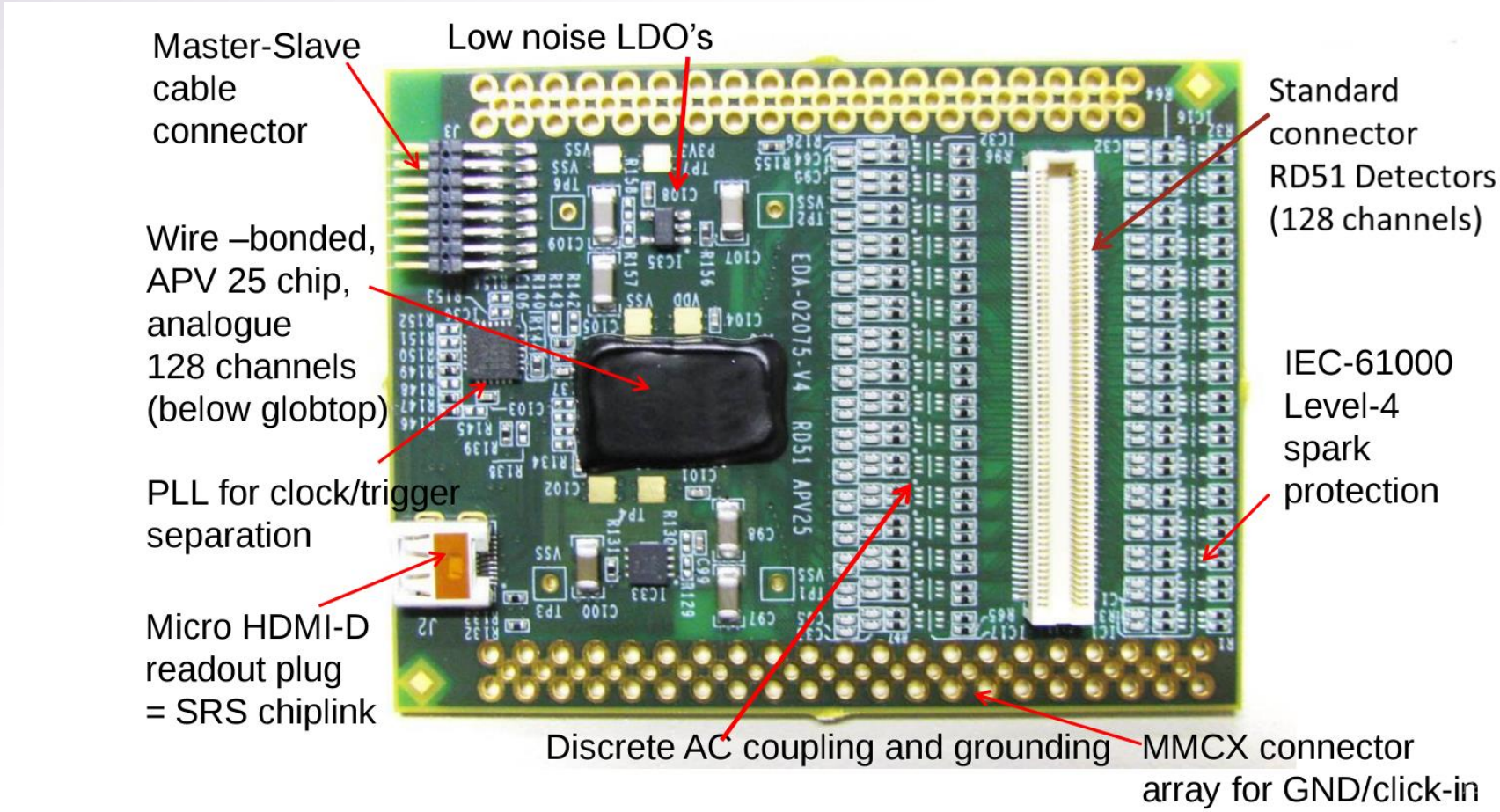
APV25 – Frontend Card



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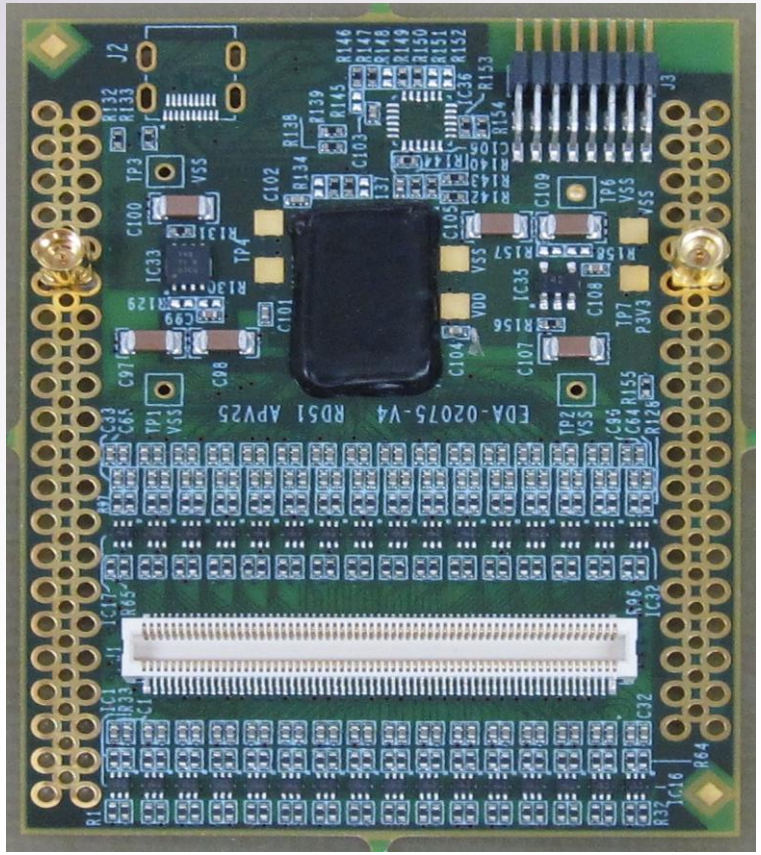
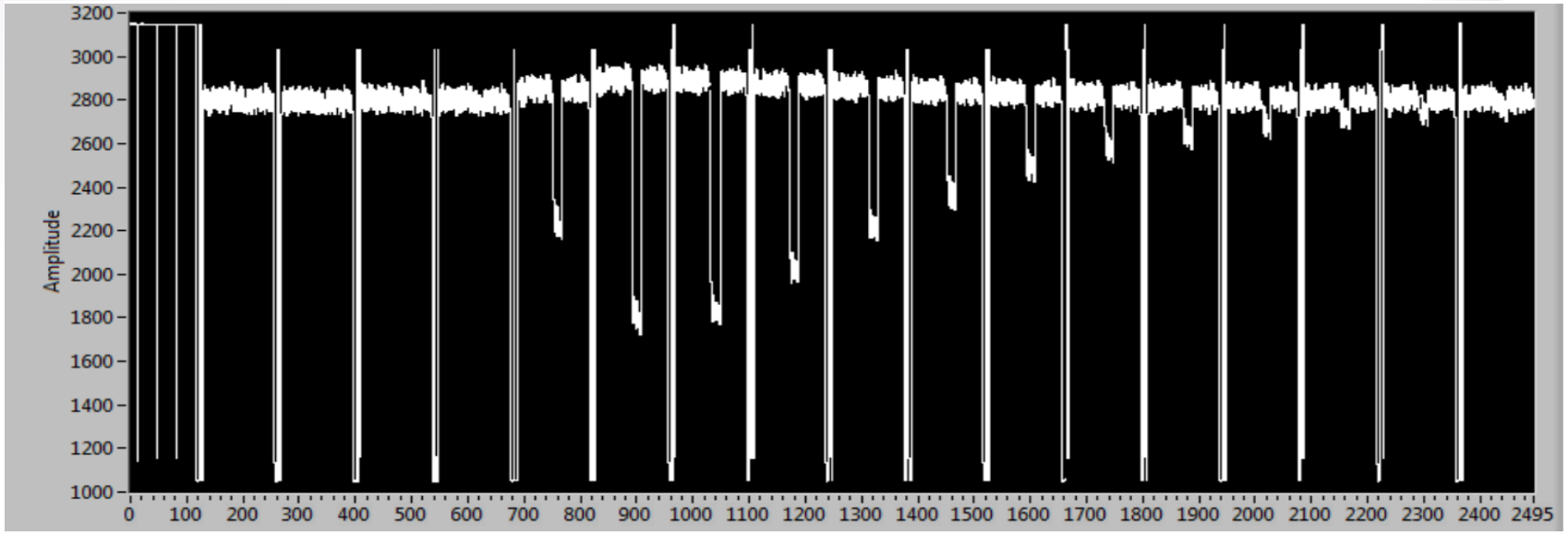
APV25 – Frontend Chip





128 Channels

40 MHz

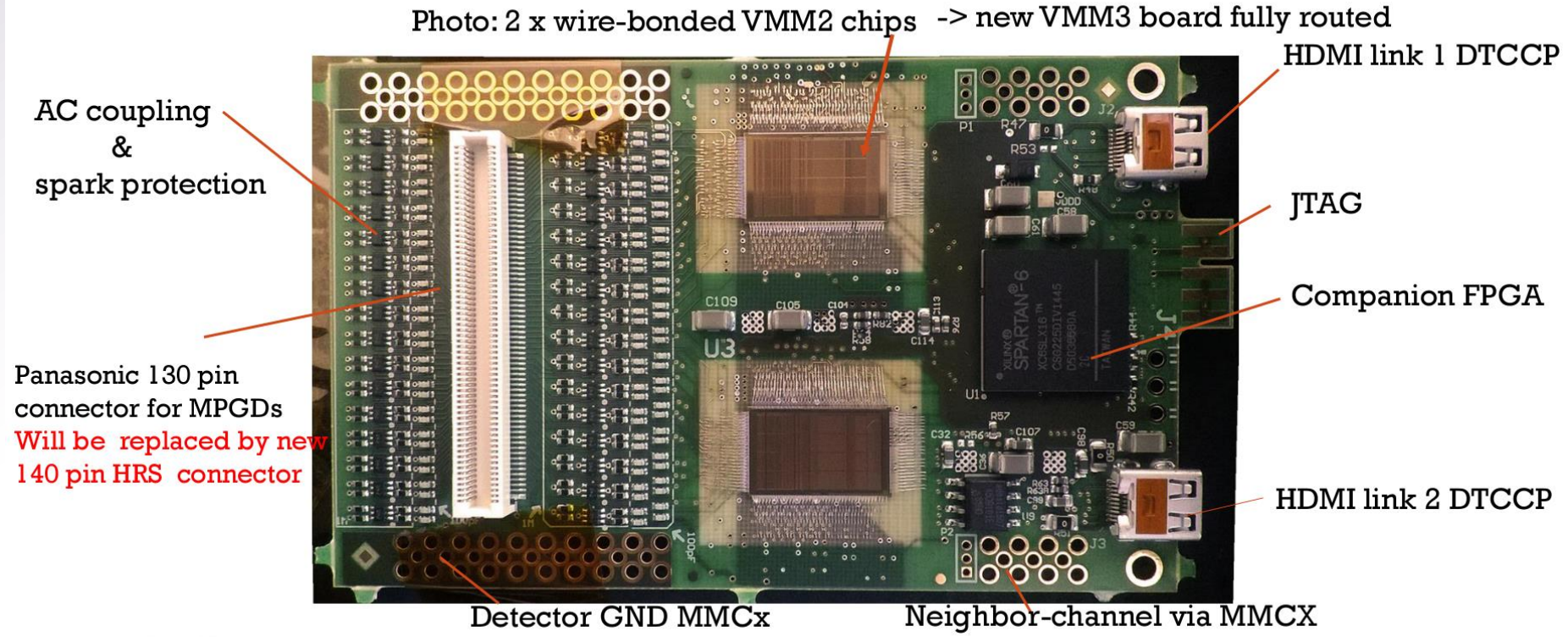
192 steps data matrix

No trigger

APV25 – Problems

- Waveforms -> Nice for R&D
- Not capable of required rates
- Highest rate achieved ~7 kHz
- We need O(MHz)
  -> new frontend chip VMM

VMM3



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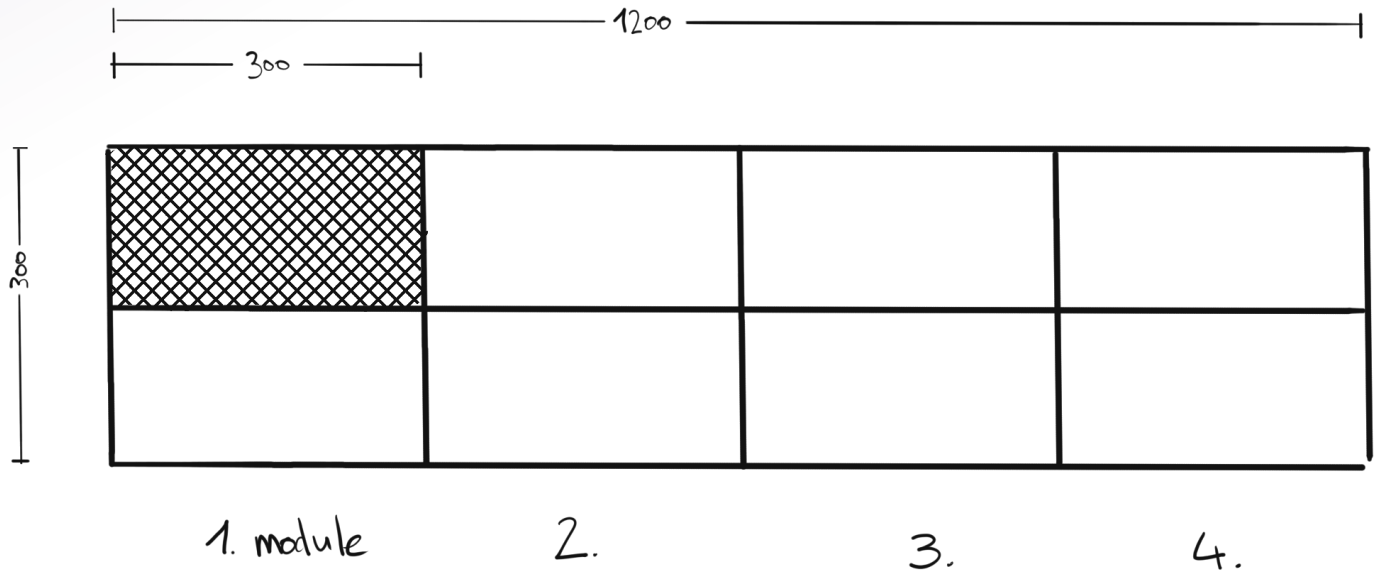
Final Detector Requirements

1 section

- 1500 channels
- 12 APVs/VMMs

1 module

- 8 sections
- 10 k channels
- 96 APVs/VMMs



Software

SRS - Configuration

SRS SDC

- Scalable Detector Control
- Developed at NTUA

APV

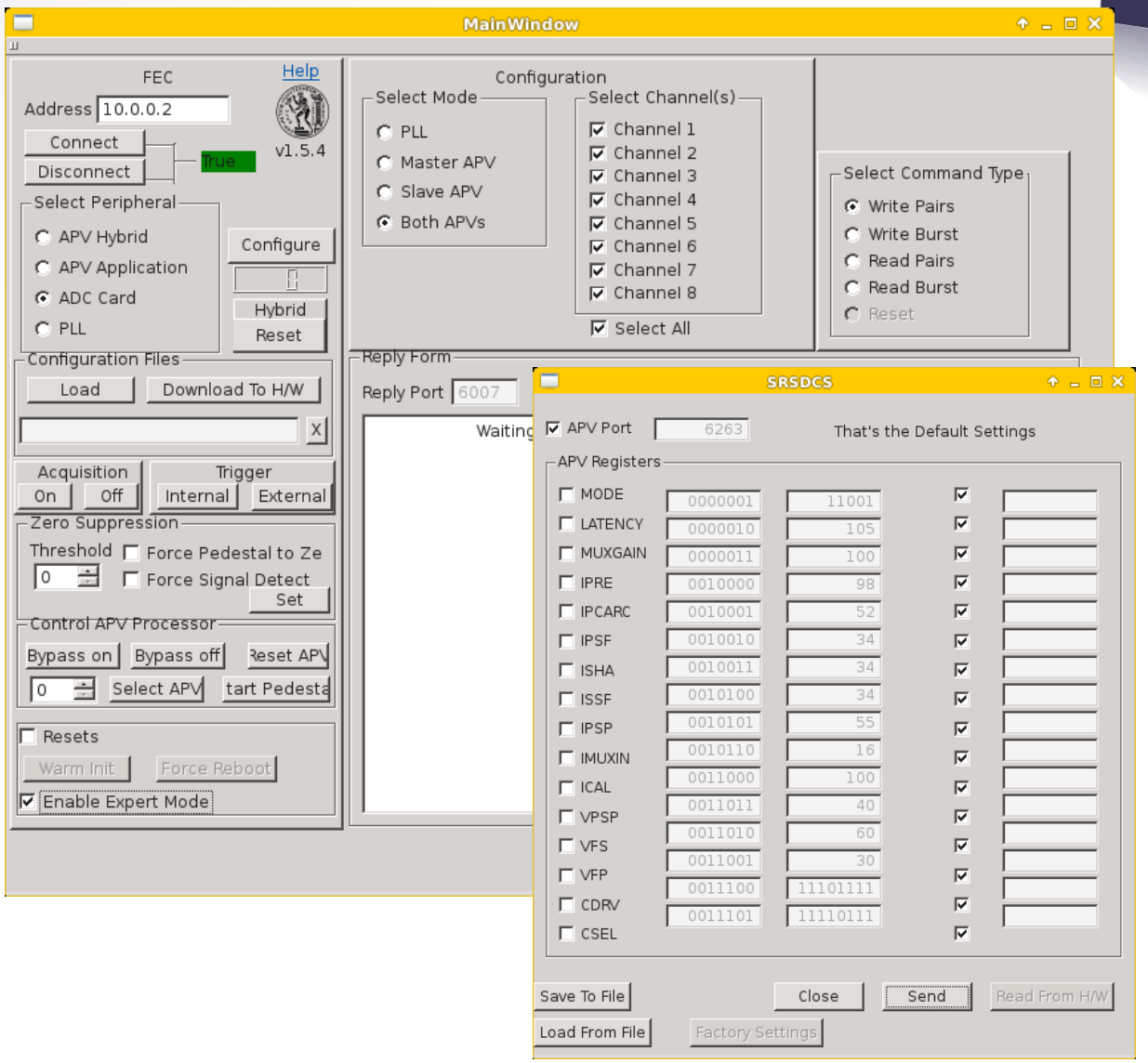
- Set baseline
- Set gain
- Set latency

FEC

- Set active APVs
- Set trigger mode

TODO

- Include to our slow control
  -> Stefan L.



DAQ – mmdaq2

- Developed for Micromegas
- Based on root
- Load pedestals for APVs
- Monitor analog input
- Nice online statistics

Working Setup

- We have a fully working DAQ
- Now:
  - Write own slow control
  - Set up own DAQ
  - Get hands on VMMs

SFB 1044

PRISMA

THANK YOU FOR YOUR ATTENTION!

http://magix.kph.uni-mainz.de

Massachusetts Institute of Technology

University of Ljubljana

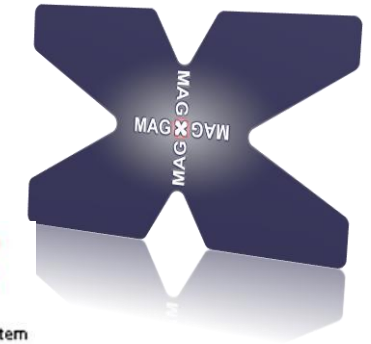
Westfälische Wilhelms-Universität Münster

Johannes Gutenberg Universität Mainz

JG|U

Backup

APV - VMM



APV (ANALOGUE)

APV (250 nm CMOS)

- Pipeline depth: max. 192 clocks
- Trigger latency: max. 3 us
- Noise: < 500 e- intrinsic >750..1400 e- on detector
- dynamic range: 25 fC
- Detector capacity: 18… < 60pf
- ADC ext. 4096/1000 [counts/baseline]
- Gain: fixed CSA gain 100uA/mip, 5 output signal gains (in step of 20%)
- Timing jitter : ½ (1/fc) [+- 12ns]
- Shaping times: 50 ns adjustable to 80 ns
- max readout rate: 7 kHz

VMM (DIGITAL)

VMM (130nm CMOS)

- Pipeline depth: 64 digital frames (peak)
- Trigger latency: (self triggered) or L0 (12.8us)
- noise : < 400 e- on 10x10 detector reported
- dynamic range: expect >> 25 fC
- Detector capacity: 30pF …. < 1nF
- ADC: embedded, 10 bit
- Gains: 8 CSA gains [0.5..16mV/fC]
- Timing jitter: 20 bit t-stamp, 1ns resolution
- Shaping times: 4 [25… 200ns]
- max readout rates: estimated 4 MHz/ch