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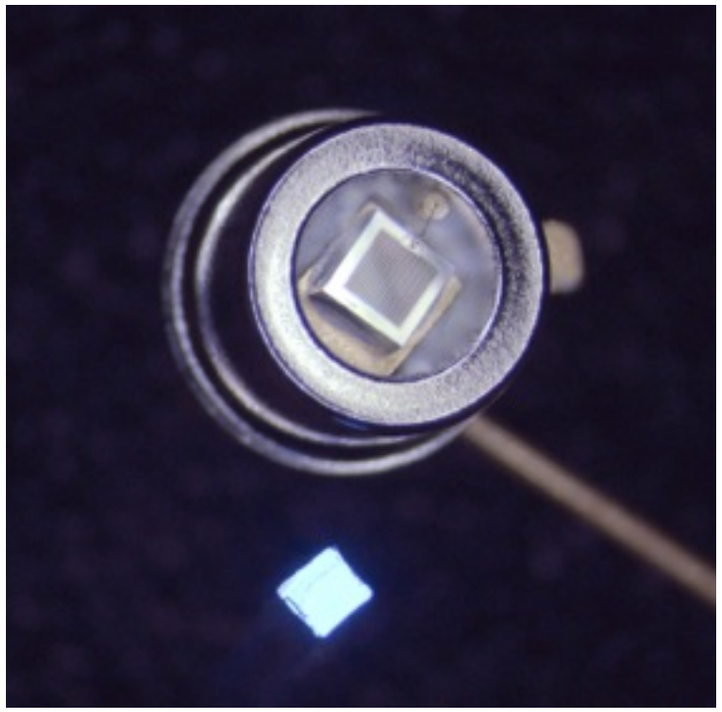

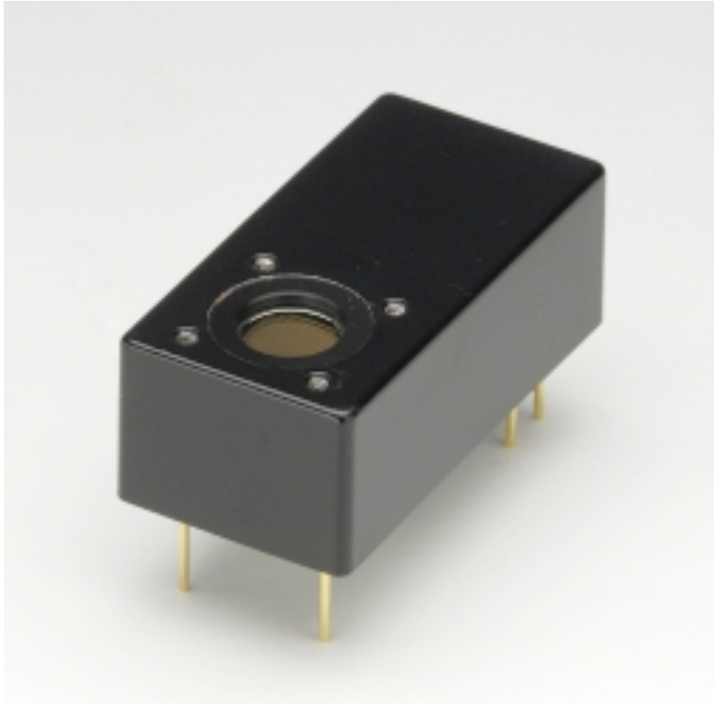

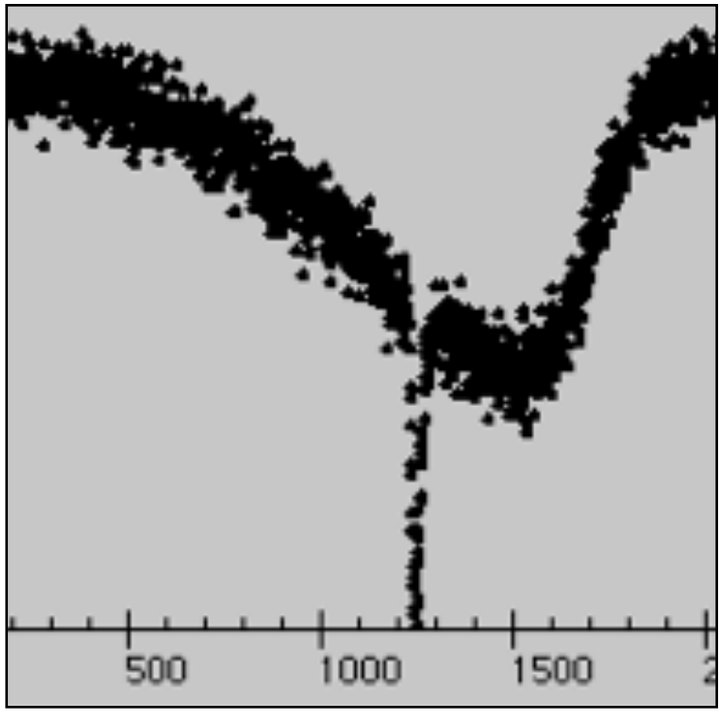

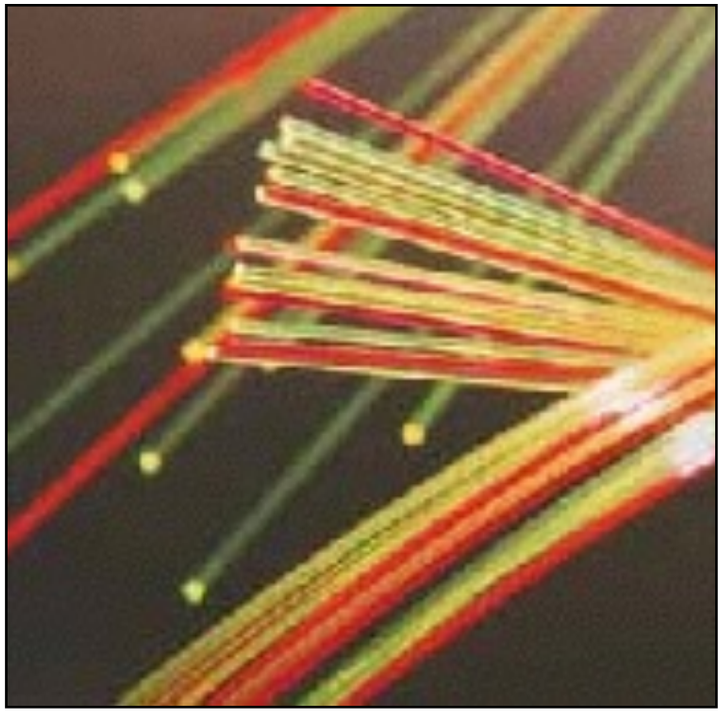

SwissFEL Diagnostics Review, 2013-03-05

Loss Monitors

Rasmus Ischebeck, Florian Löhl, Nick Schlumpf

Loss Monitors

> Task: Measurement of electron beam losses
  > for wire scanners (see Gian Luca's presentation)
  > for machine protection
> Personnel protection system uses different monitors
> Wire scanners: differentiate first and second bunch, and dark current
> Technical Requirements

Full beam loss event	10…200 pC
Wire scanner operation Loss of 1…10% of the beam	0.1…20 pC
Damage threshold (undulators)	7 fC

> Operational Requirements
  > Read-out at 100 Hz
  > Connected to synchronized data acquisition
  > Connected to machine interlock

Distribution in SwissFEL

> 52 Loss Monitors:

  > 23 wire scanners

  > 29 distributed loss monitors for the machine protection system

Section	DBLM	DDLM
SIN	1	3
S10/20/30	13	10
SAR	5	14
SAT (Phase I)	4	2

Work Package Status

> Implementation of charge & loss monitors to be done by an engineer / physicist (open position currently advertised on the PSI web site)

Paul Scherrer Institut (PSI) :: Engineer / Physicist

www.psi.ch/pa/offenestellen/0529-1

X-Ray Attenuation Length | PSI | Back2Wiki | AI Web | Schulen | Injector | WLHA Wiki | Wikipedia | Google CH | RCSB Protein Data Bank

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The Paul Scherrer Institute, PSI, is with 1500 employees the largest research centre for natural and engineering sciences within Switzerland. We perform world-class research in three main subject areas: Matter and Material; Energy and the Environment; and Human Health. By conducting fundamental and applied research, we work on long-term solutions for major challenges facing society, industry and science.

The Diagnostics Section of the Large Research Facilities Department at PSI develops instrumentation for new accelerators and supports the consolidation and the improvement of existing machines. The Advanced Instrumentation Group develops monitors to measure properties of the electron bunches in the recently approved X-ray laser SwissFEL.

In this context we are looking for an

Engineer / Physicist

to lead the realization of the work package "Charge and Loss Monitors" for SwissFEL

Your tasks

- Design monitors to detect losses of these electron bunches along the linear accelerator
- Develop monitors for dark current generated at the photocathode
- Implement charge monitors for relativistic electron bunches
- Support the development of wire scanners for beam profile measurements
- Develop sub-systems that will be integrated in the machine protection system

35

POSITIONS IN THE ETH DOMAIN

- Eawag
- Empa
- EPFL
- ETH Zürich
- WSL

Spontaneous application

Thank you for visiting our 'PSI Offers' Internet platform. Please note that we only employ staff when there are actual open positions available. All spontaneous applications we receive will therefore be specifically compared with our open

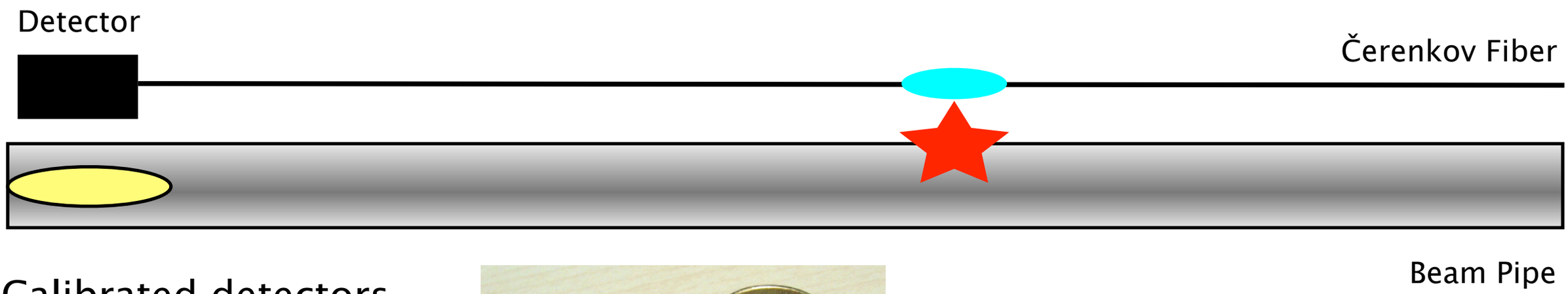
Measurement Principle

> Localized loss monitors (for wire scanners)

> Scintillators

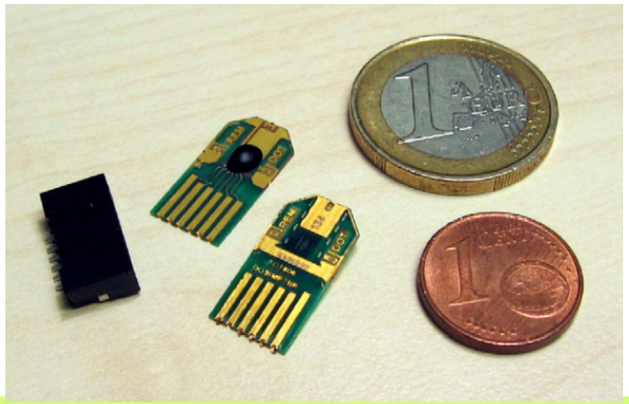
> Distributed loss monitors (for machine interlock)

> Čerenkov light generated in quartz fibers



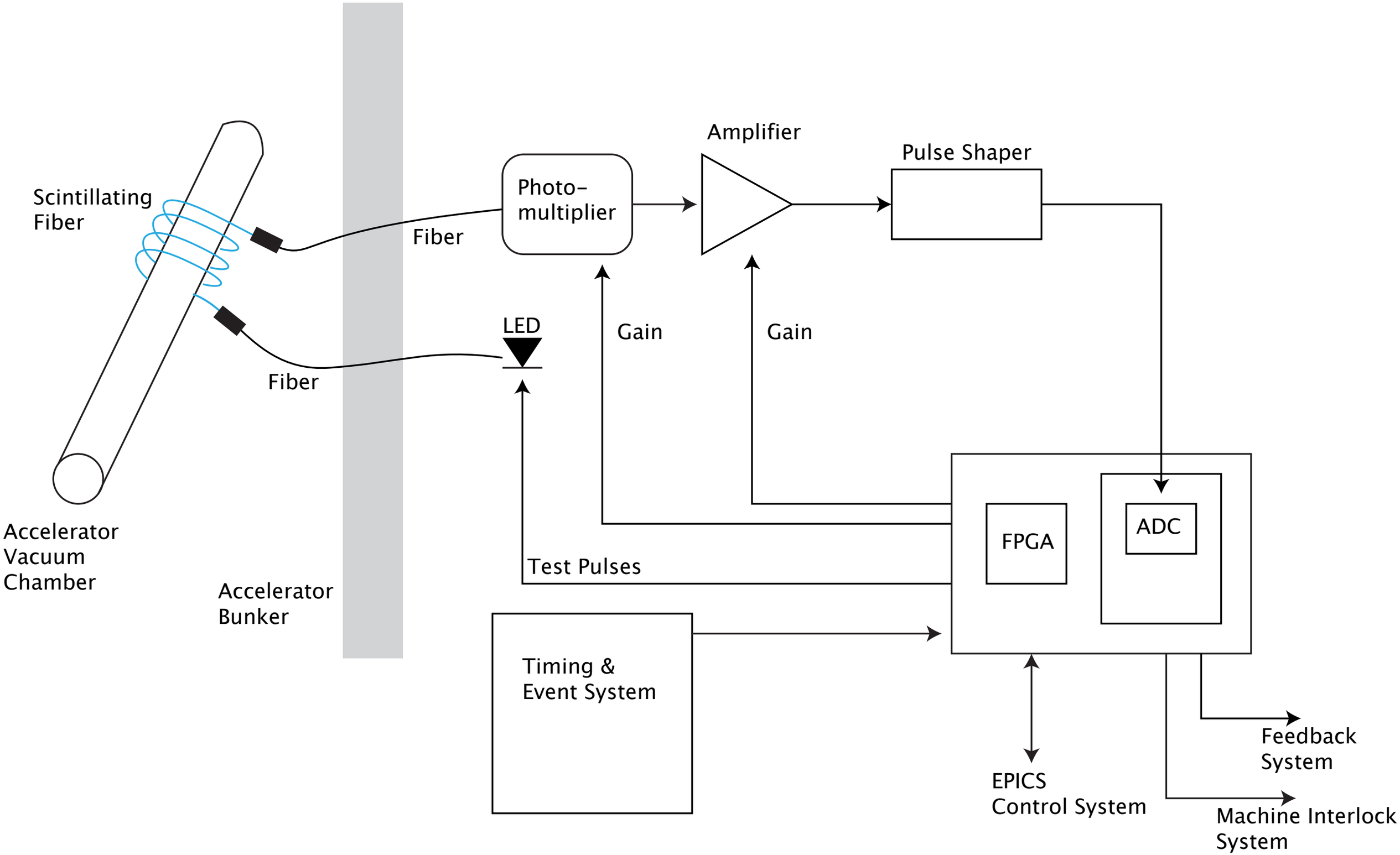
> Calibrated detectors

> RadFETs



—> Lars Fröhlich

Schematic View



Design Considerations

> Fiber-based system

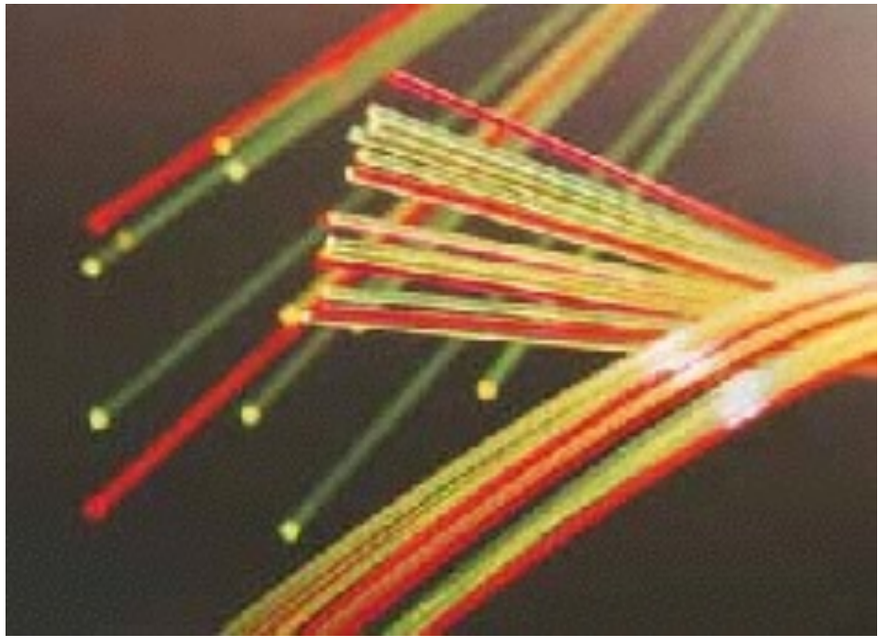
  > Compact, low installation costs

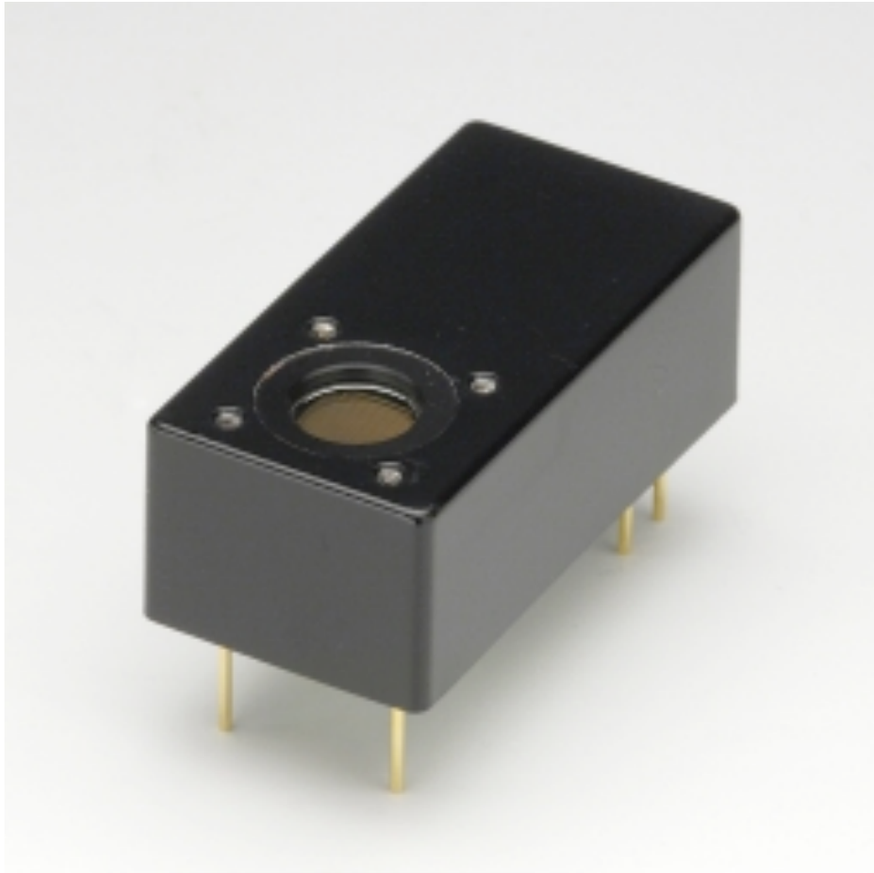
> All electronics outside the accelerator tunnel

> We need a large dynamic range

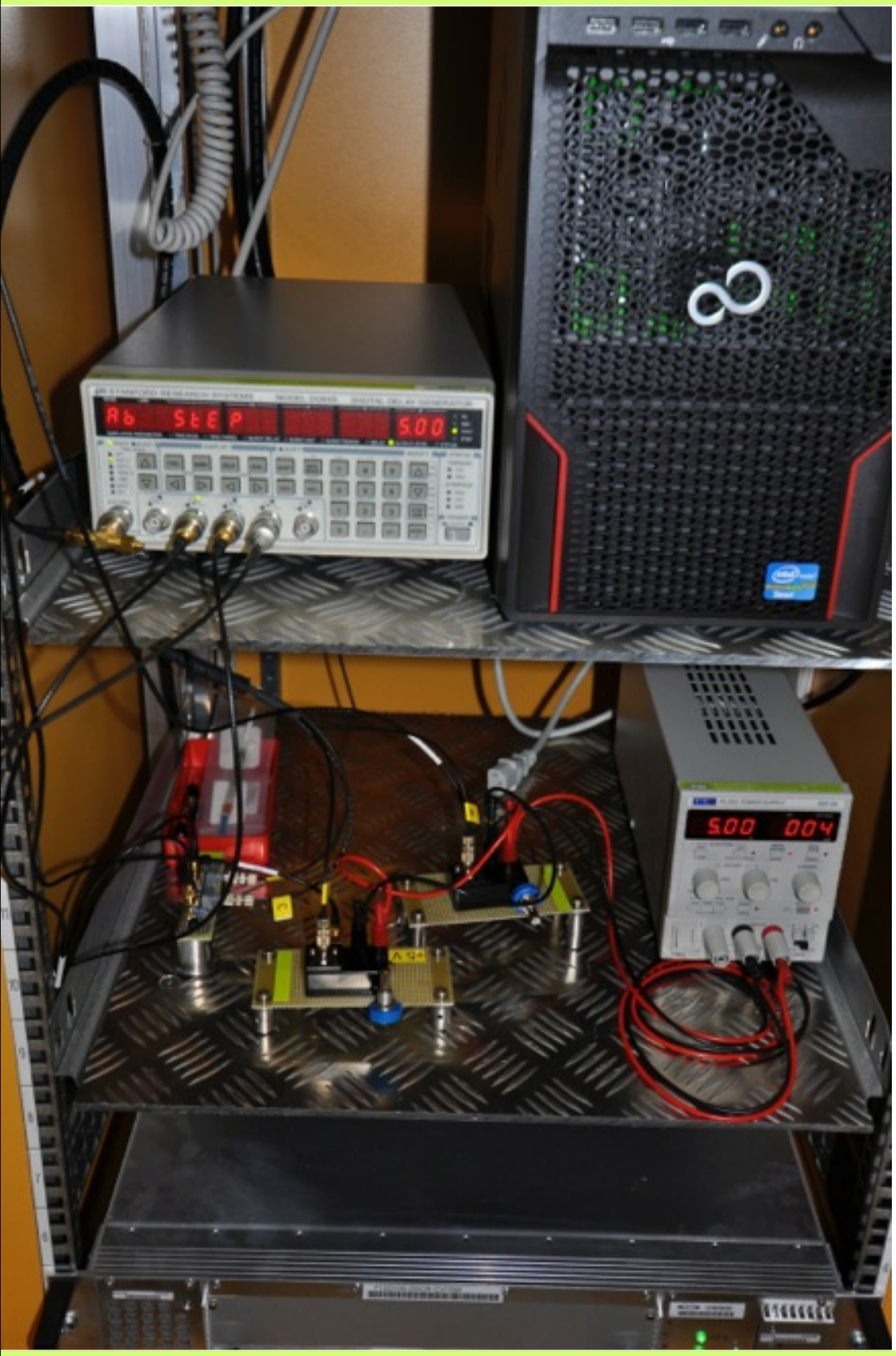
  > Foresee to use vacuum PMTs

> Digitization by fast ADC

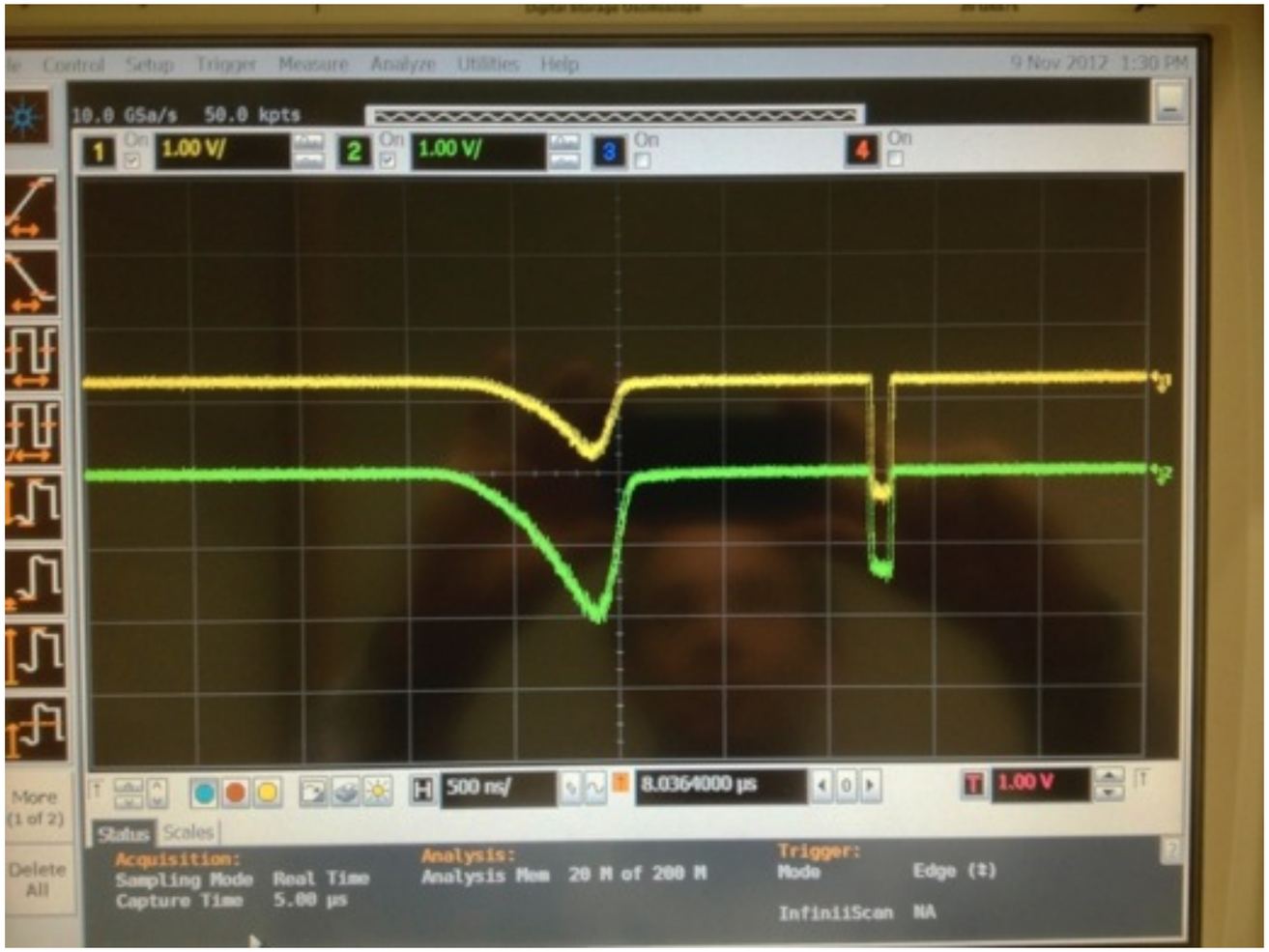




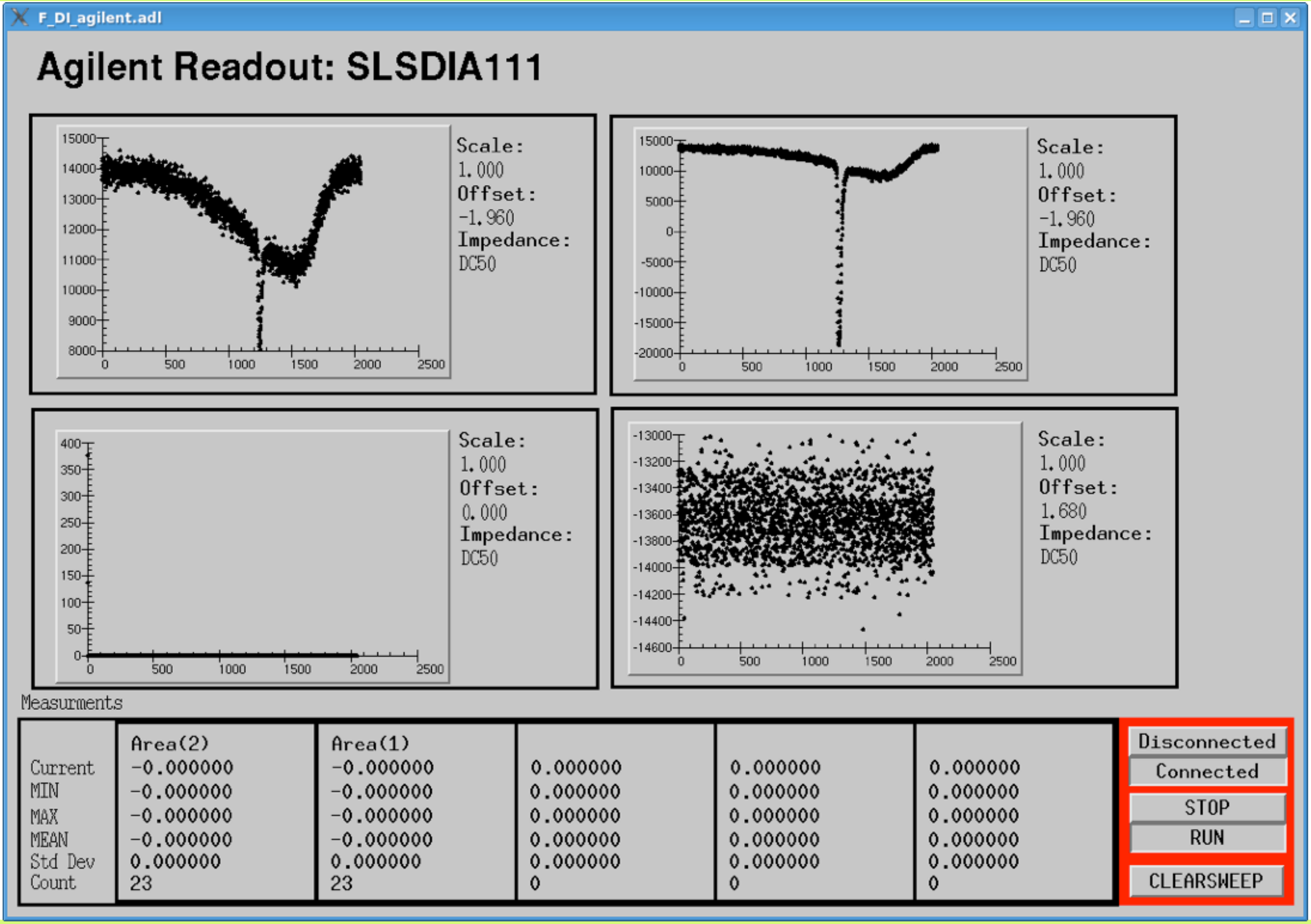
Implementation: Prototype installed in SITF



> Prototype built from optical fibers, photomultiplier tubes and laboratory hardware

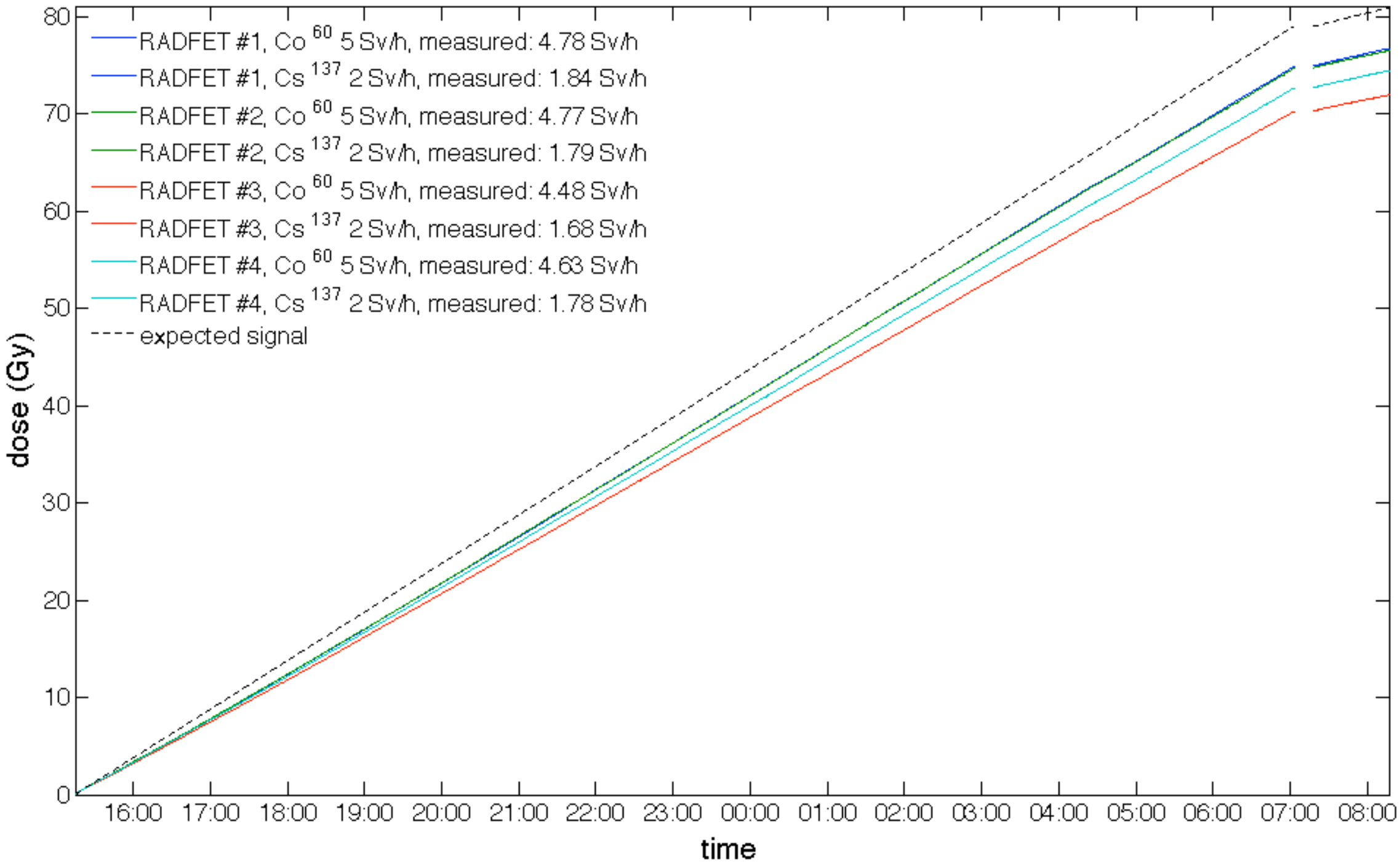


Measurements with the Prototype



Calibration of the RADFETS

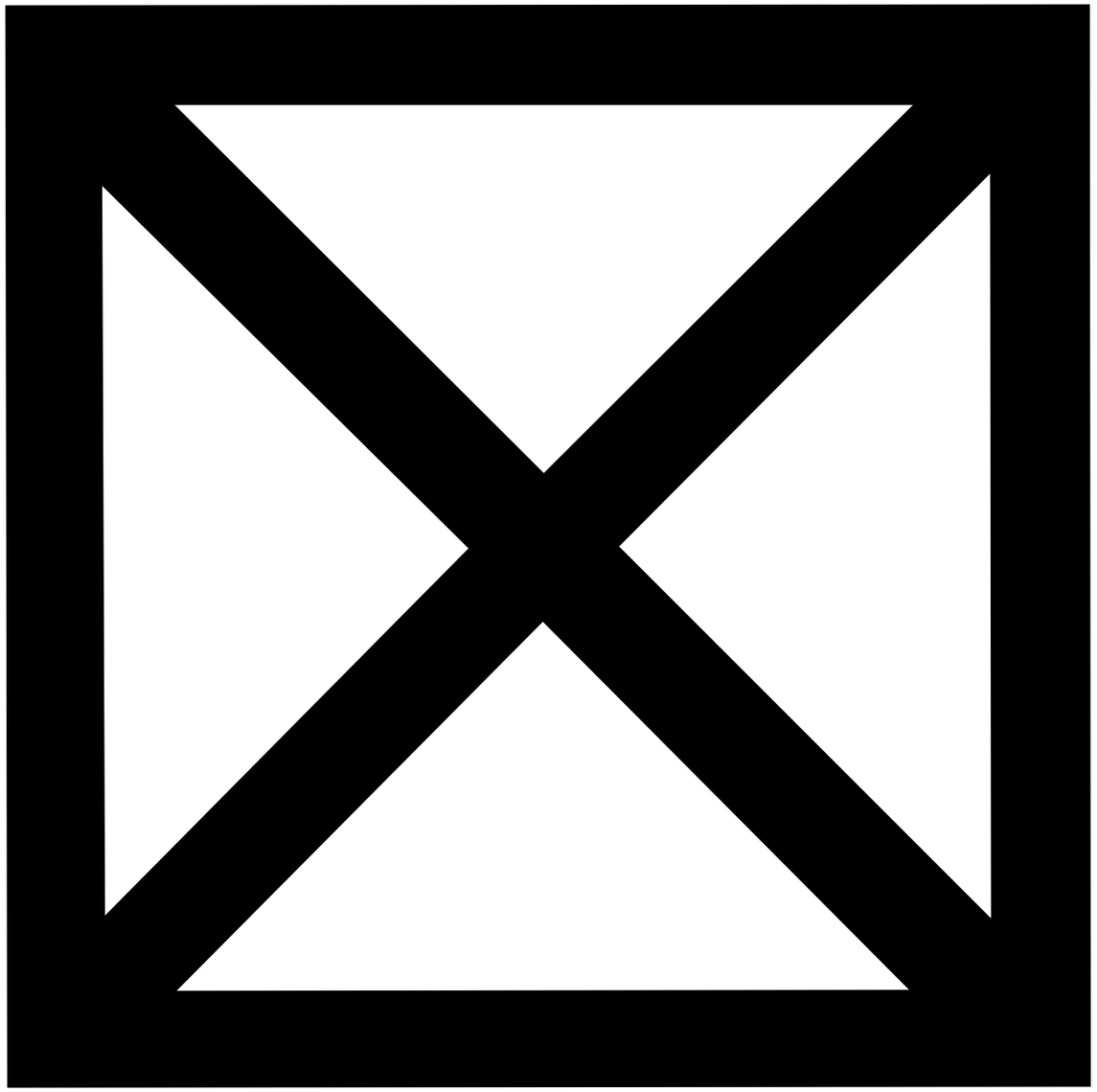
> Calibration at the Eichstelle at PSI



Status / Time Plan

Requirements Defined	01/ 2012 √
Decision on Measurement Principle	01 / 2012 √
Prototyping	2013
Prototype Tested	12 / 2013
Design for Series Production	Q1 / 2014
Ready for Fabrication	Q2 / 2014
Fabrication	Q3 / 2014
System Acceptance Test	Q4 / 2014
Ready for Installation	Q2 / 2015

Resources



Open Issues / Questions to the Committee

> Please evaluate the presented solution with respect to

  > Suitability of the chosen concepts

  > Appropriateness of the design for the given specifications

  > Feasibility of the technical designs

> Assess whether the presented time plans and resource planning is appropriate

  > Time plan

  > Material resources

  > Personnel planning

> Is there a way to achieve the large dynamic range with semiconductor detectors?