The Instrumentation platform

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Outline

- Scope & Specs
- Front-end
- Software
- Status
- Session
Scope

• Excellent beam performance
  – Timing reference (<10-ps bunch width)
  – Charge accuracy (< 2×10^{-3} RMS)
  – Spatial accuracy (transverse size = 500 µm)
  – Low straggling (high energy)

• High performance tools for R&D
  – Adaptive setting
  – Single user interface
  – Remote control
  – Fast signal digitizer: charge, ps timing + possible trace recording-processing
Specifications

Dosimetry:
- Calorimeter + beam sensing + calibration

**Beam**
- Calorimeter
- Detector 60 kg max
- Beam sensing

**Y range:** ± 150 mm
**X range:** ± 100 mm
In a nutshell

Detector under test
Calorimeter

PC controlled 2-axis trolley

Beam coarse detection

Spectrometer
radius = 40 cm

Profiler (Timepix)
Cherenkov counter (Quartz)

Power supplies: low and high voltage
Cables
32 digitization signals (WaveCatcher)

Switch (Ethernet + power)

DAQ + slow control

- Scripting (Python, etc.)
- DCOD = NARVAL + ENX
- Web server + interfaces
- Possible online signal processing

Cables
1 Ethernet cable
1 power cable

Switch (Ethernet + power)
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What kind of electronics?

- Versatility $\rightarrow$ signal digitizer
- Ease of use $\rightarrow$ embedded shaping & processing
- Implementation $\rightarrow$ off the shelf + user interf.
- Channels for the users $\rightarrow$ 32 in total

WaveCatcher (D. Breton, E. Delagnes et al., IEEE-TNS 2014)

Run in-beam test at the ALTO accelerator facility with 64 channels
The WaveCatcher Family

- Based on the SAMLONG chip: 3.2 GS/s, 500 MHz, 12 bits, 1024 samples, 2 channels
- Autonomous plug and play desktops with USB and secured Gbit UDP interfaces (copper or optical link).
- Powerful software and C libraries available (Windows and Linux).
- In constant evolution thanks to users’ feedback.
- A new version of SAMLONG is in production: reduced noise level targeting 14 bits of dynamic range and integrated DAC for ps time INL calibration.
WaveCatcher Documentation

Many talks about use of WaveCatchers can be found on the WASIW2018 workshop web site: [http://wpsist.lal.in2p3.fr/wasiw2018](http://wpsist.lal.in2p3.fr/wasiw2018)

https://owncloud.lal.in2p3.fr/public.php?service=files&t=56e4a2c53a991cb08f73d03f1ce58ba2
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Development principle

• Start with existing drivers and interfaces (tinker mode)
• Core based on general purpose DAQ framework (quality mode)
  – Safe concurrent processes
  – Priority on data recording
  – Display does not affect the acquisition nor the recording
• Extensions through projects: code re-use
Control command

• Integrated into the global system: shared development

• Goals
  – Robustness
  – Quality
  – Easy integration

• Available material (power supplies) to reduce the driver and interface development
The software framework

- Event selection (« trigger software »)
- Possible offline validation
- Possible use of the same framework for the analysis

Web interface for the data display

Parallel threads

Web interface for the slow control
• **ANDROMEDE** (IN2P3 platform)

**XYZ moving table**

- 2 XY deviations

**Flot de données 1**

- 5 lenses, 3 XY deviations

**Flot de données 2**

- 1 lens, 2 XY deviations

**Camera integration**

**2018-10-10: PRAE workshop – Instrumentation – genolini@ipno.in2p3.fr**
Code re-use #2

- 64-channel WaveCatcher-based DAQ
- In-beam test for stripped Si detector + preamp
• Scope & Specs
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Status

Separator: postponed

Connexion to the upstream beam profile

Timepix: Postponed → Insertable screen + camera

☑ BGO+PMT

☑ Collimator

☑ Translation table (2 D)

DAQ:
☑ 8-ch WaveCatcher
☐ 32-ch WaveCatcher

Power supplies:
☑ existing drivers,
☐ Web interface (partial)

Platform for Research and Applications with Electrons
Will be used to test ProRad’s detectors in 2019
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Session introduction

• Beam imaging
  – Fast Silicon Detectors for beam monitoring in proton therapy: preliminary results by Dr. Anna Vignati (INFN Torino)
  – The CpFM: a high-sensitivity charged particles flux-monitor for accelerators physics by Dr. Sébastien Dubos (LAL Orsay)
  – Timepix detector operation at CERN accelerator facilities by Andrii Natochii (LAL Orsay / CERN)

• Application
  – Electron channeling at PRAE for the investigation of Zitterbewegung and/or internal clock by Dr. Denis Dauvergne (LPC Clermont-Ferrand)
Thank you for your attention

Enjoy the session!