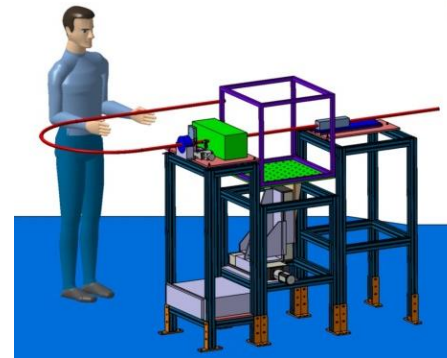


Platform for Research  
and Applications  
with Electrons



# The Instrumentation platform



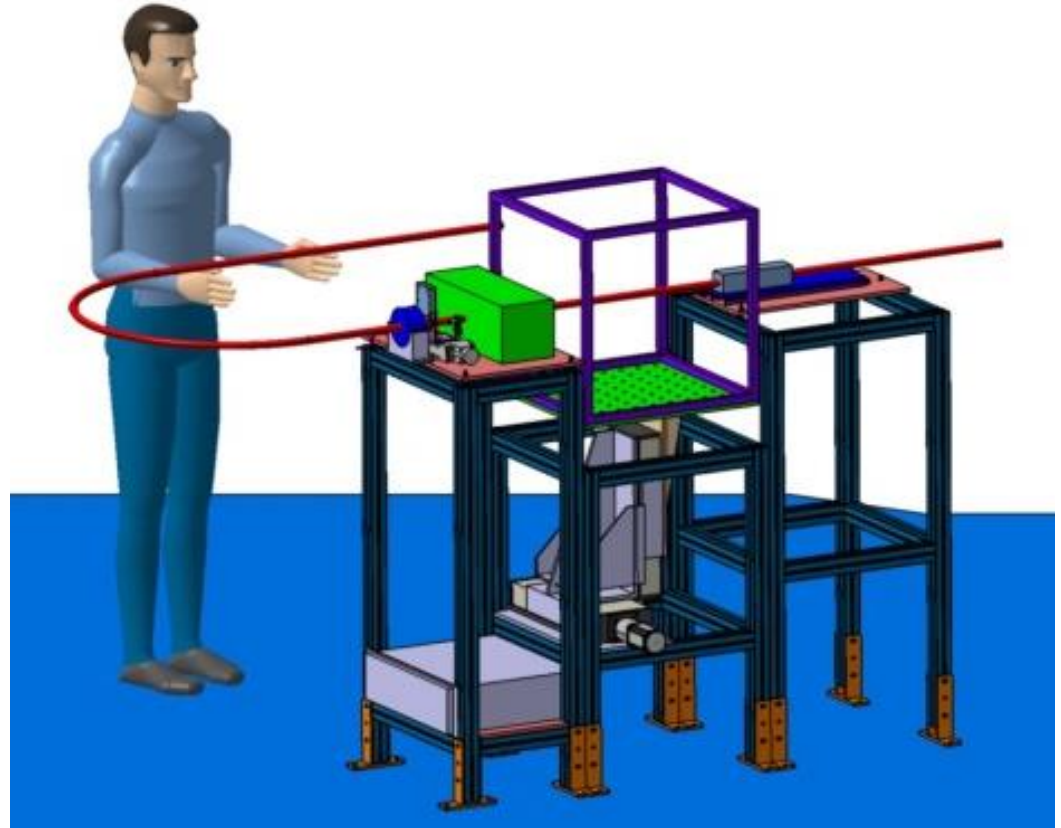
B. Genolini, J.-L. Coacolo, C. Le Galliard, V. Puill  
[genolini@ipno.in2p3.fr](mailto:genolini@ipno.in2p3.fr)

[PRAE Workshop](#), Orsay, France, Oct. 8-10 2018



# Outline

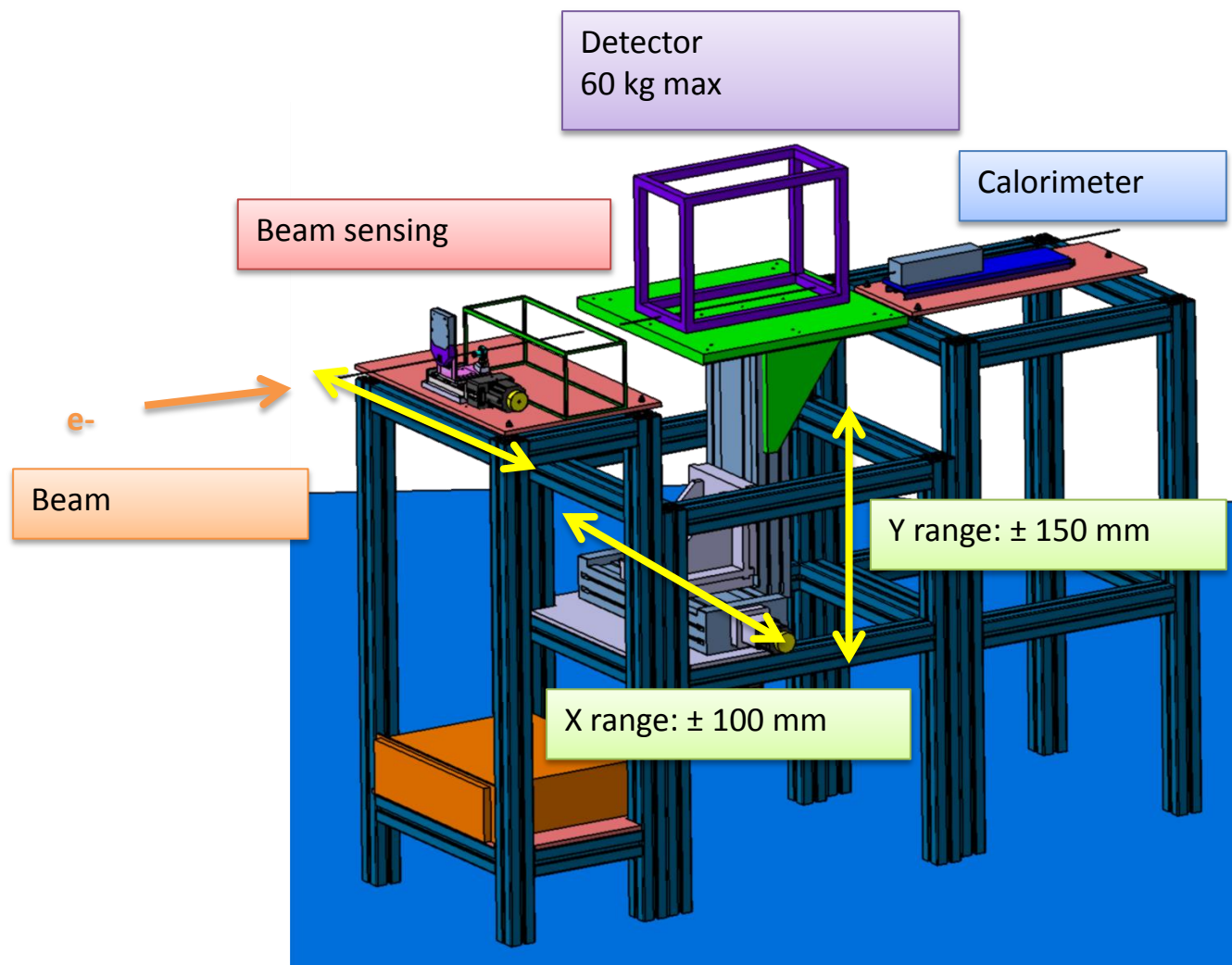
- Scope & Specs
- Front-end
- Software
- Status
- Session



# Scope

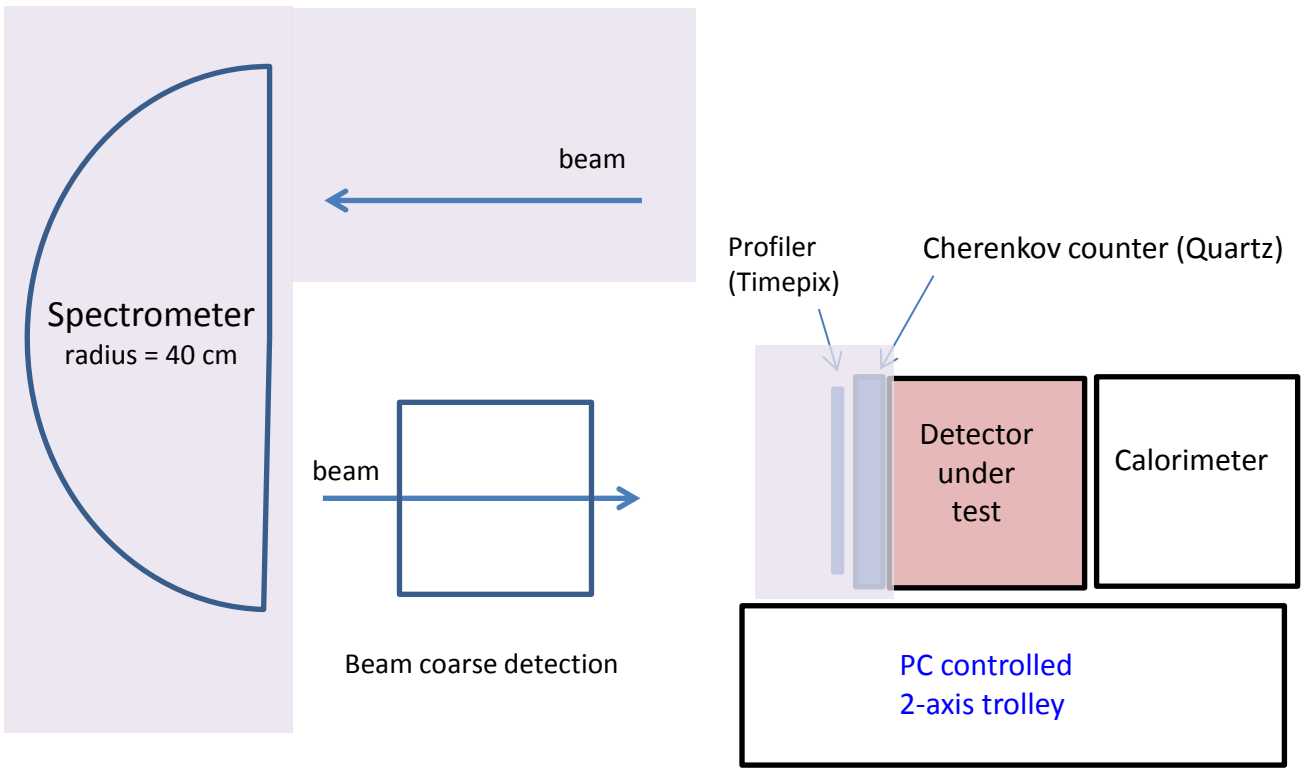
- **Excellent beam performance**
  - Timing reference (<10-ps bunch width)
  - Charge accuracy (<  $2 \times 10^{-3}$  RMS)
  - Spatial accuracy (transverse size = 500  $\mu\text{m}$ )
  - Low straggling (high energy)
- **High performance tools for R&D**
  - Adaptive setting
  - Single user interface
  - Remote control
  - Fast signal digitizer: charge, ps timing + possible trace recording/processing

# Specifications



Dosimetry:  
Calorimeter  
+ beam sensing  
+ calibration

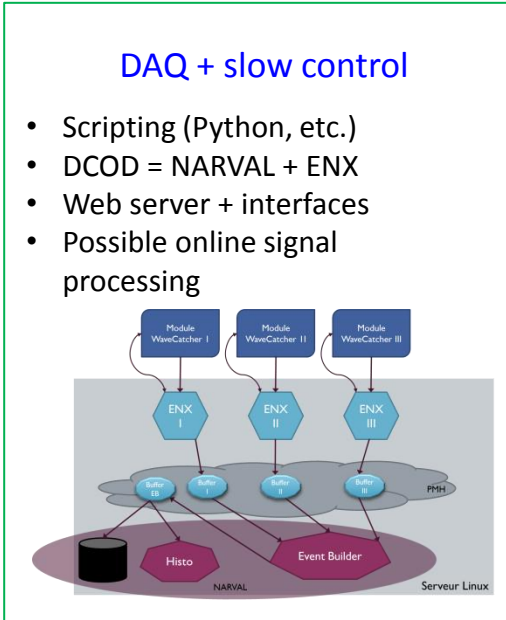
# In a nutshell



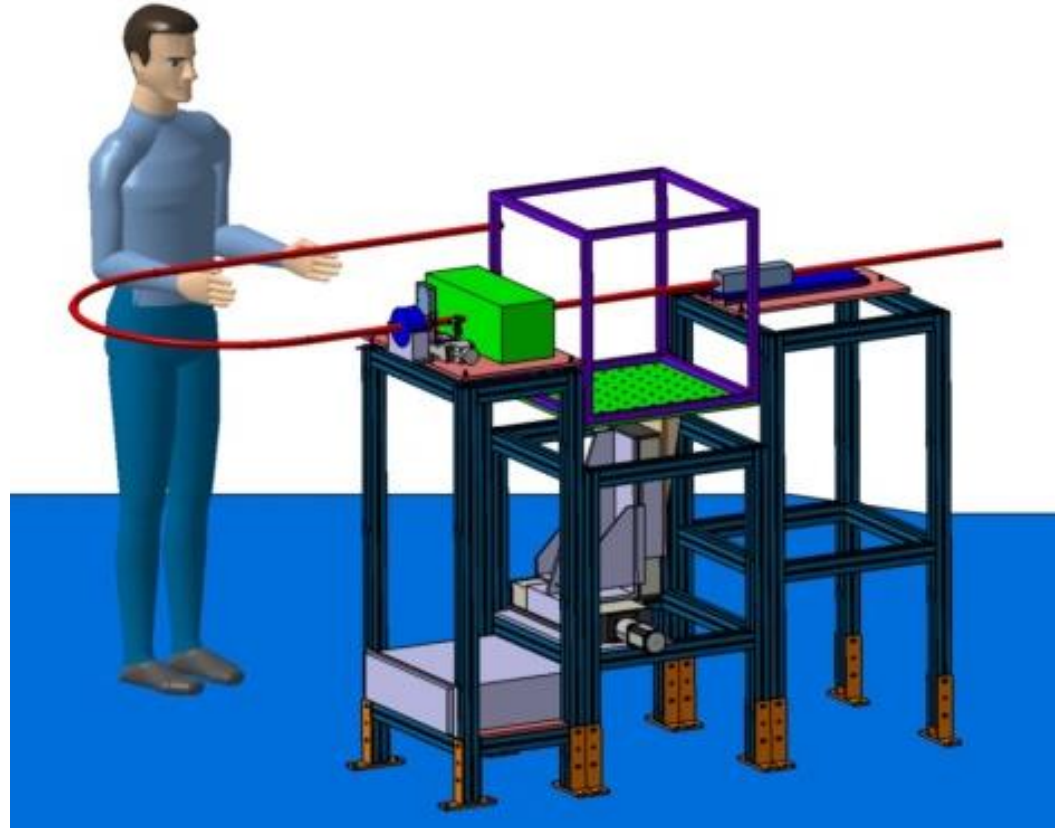
Power supplies: low and high voltage  
 Cables  
 32 digitization signals (WaveCatcher)



1 Ethernet cable ←→  
 1 power cable



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



# What kind of electronics?

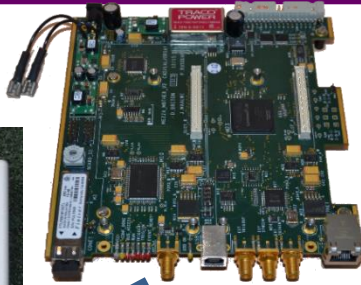
- Versatility → signal digitizer
- Ease of use → embedded shaping & processing
- Implementation → off the shelf + user interf.
- Channels for the users → 32 in total

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

Motherboard



4-channel mezzanine



16+2-channel board



64-channel mini-crate



8-channel Module



x2

16+2-channel Module

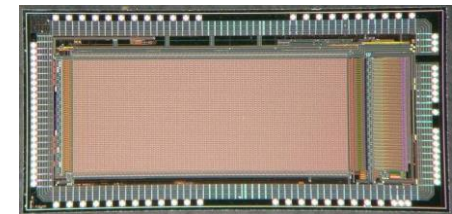


2-channel Module



- 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

The SAMLONG chip

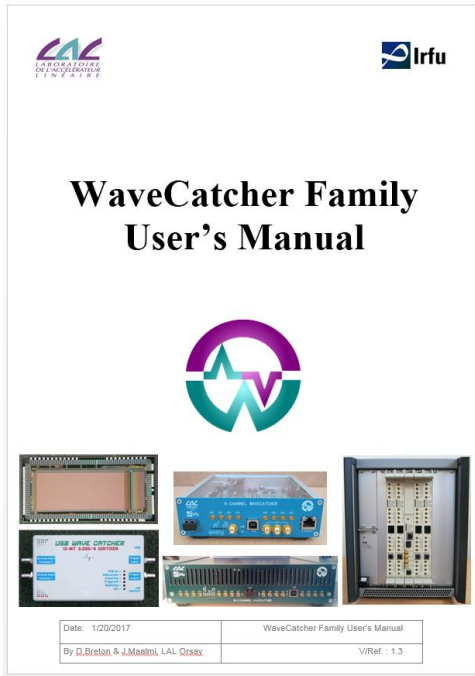




# WaveCatcher Documentation

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



## Hardware



**WaveCatcher Family User's Manual**

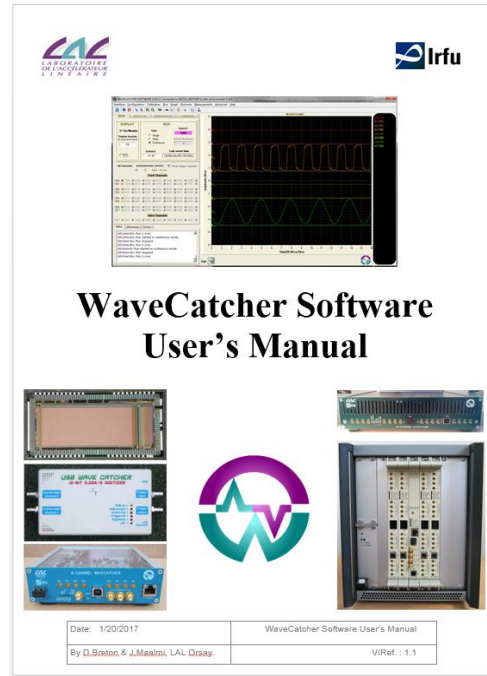
Logos: CAC (Centre d'Accès aux Coordonnées de l'Institut de Physique Nucléaire de Clermont-Ferrand), Lrfu

**WaveCatcher Family User's Manual**

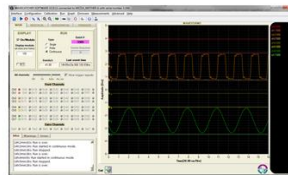
Date: 1/20/2017	WaveCatcher Family User's Manual
By D.Breston & J.Maalimi, LAL Orsay	VIRef.: 1.3

## Control & Readout Software





**WaveCatcher Software User's Manual**

Logos: CAC, Lrfu

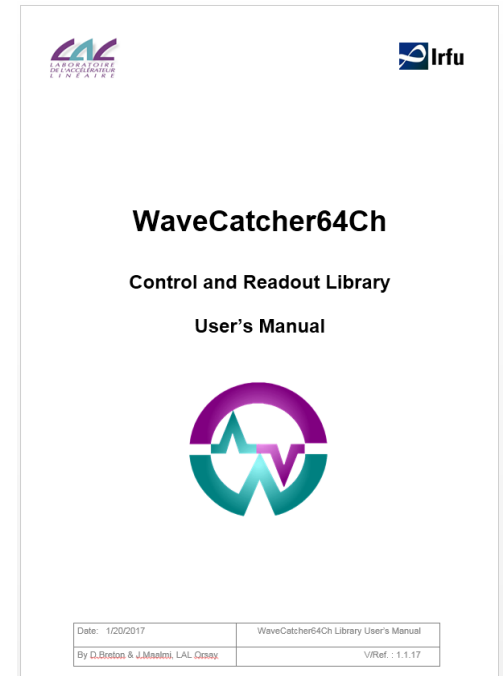


**WaveCatcher Software User's Manual**

Date: 1/20/2017	WaveCatcher Software User's Manual
By D.Breston & J.Maalimi, LAL Orsay	VIRef.: 1.1


## C Library (Windows & Linux)



**WaveCatcher64Ch Control and Readout Library User's Manual**

Logos: CAC, Lrfu

**WaveCatcher64Ch Control and Readout Library User's Manual**



Date: 1/20/2017	WaveCatcher64Ch Library User's Manual
By D.Breston & J.Maalimi, LAL Orsay	VIRef.: 1.1.17

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

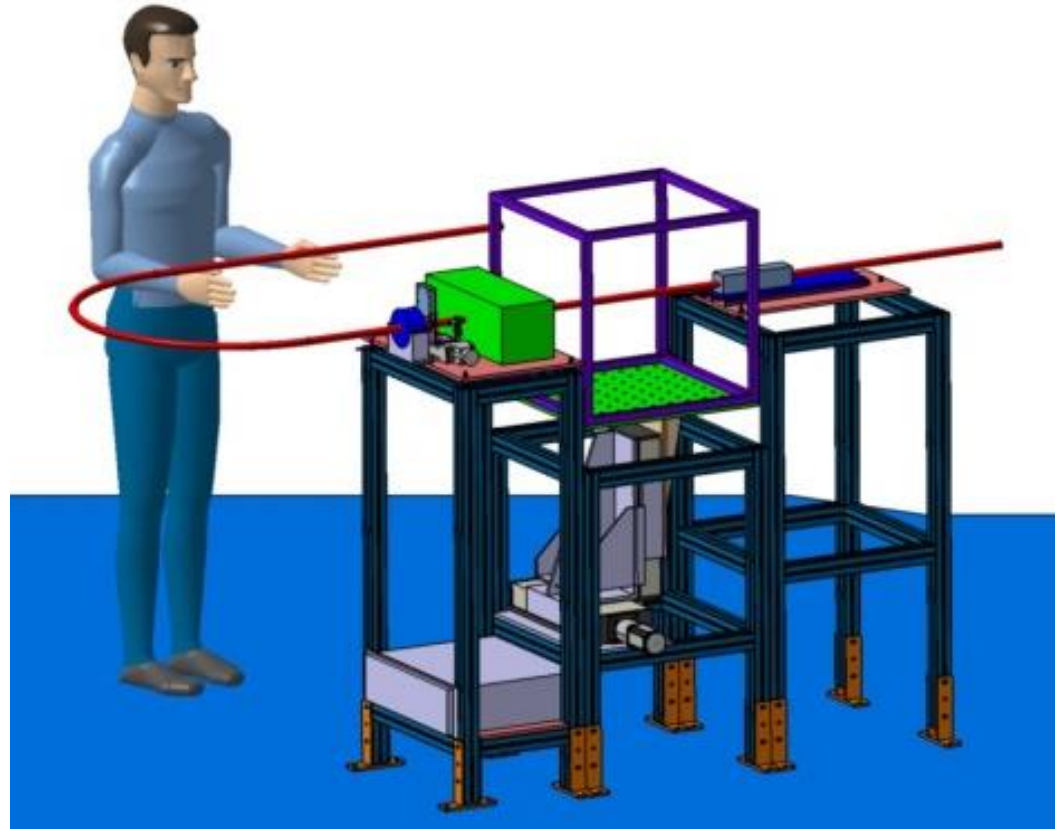


**WaveCatcher and SAMPIC International Workshop**  
 February 7-8, 2018  
 LAL Orsay, France

Logos: WaveCatcher, SAMPIC, Eiffel Tower, Marie Curie portrait

Vertical text on right: Bruno Mezyer, LAL Orsay

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



# 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

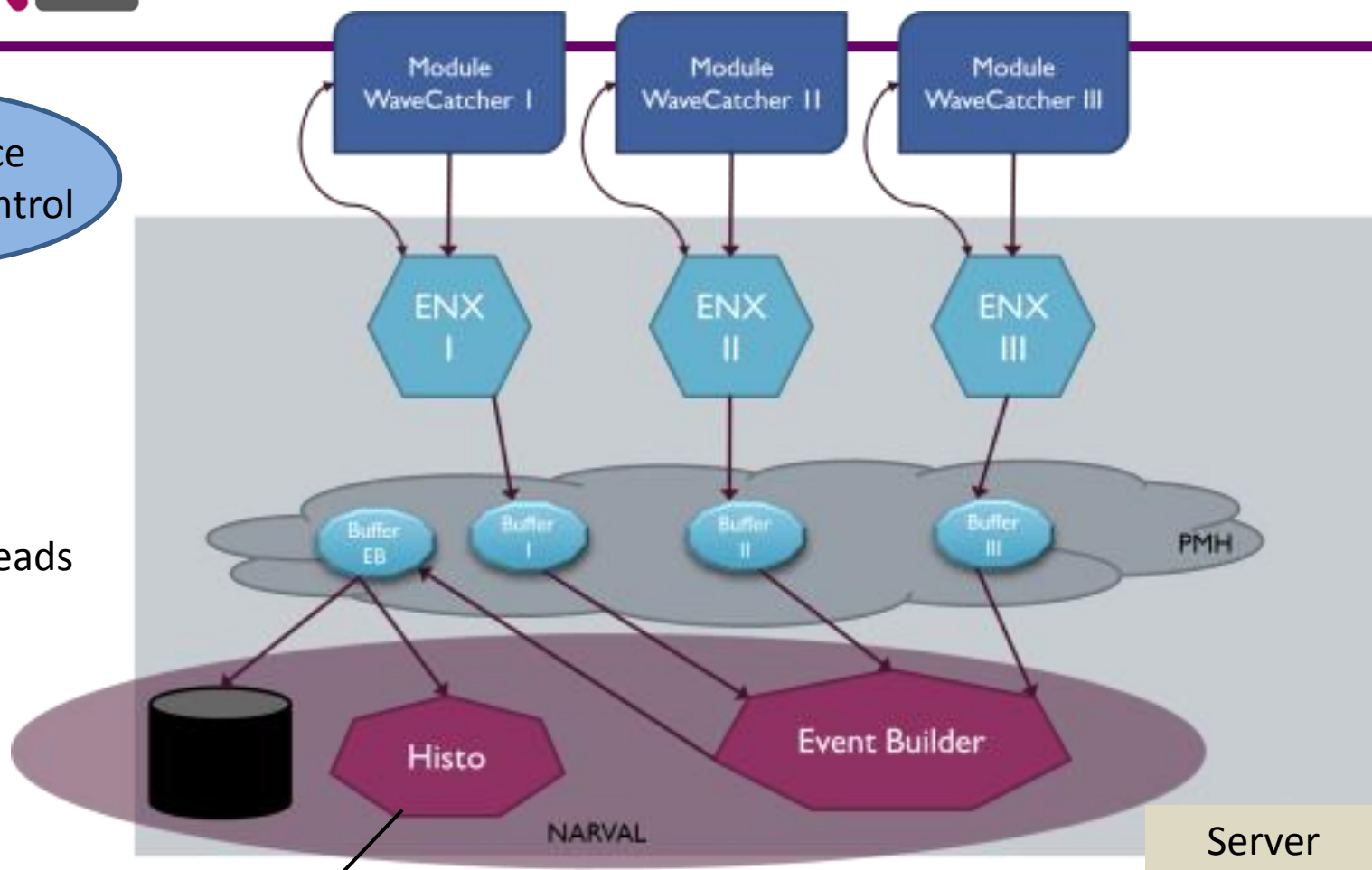
# Control command

- 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

Web interface  
for the slow control

Parallel threads

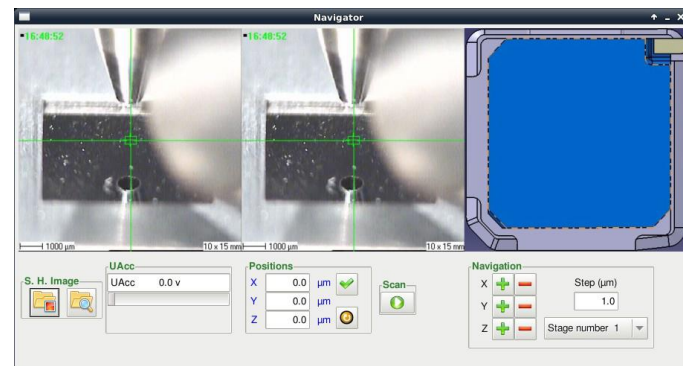
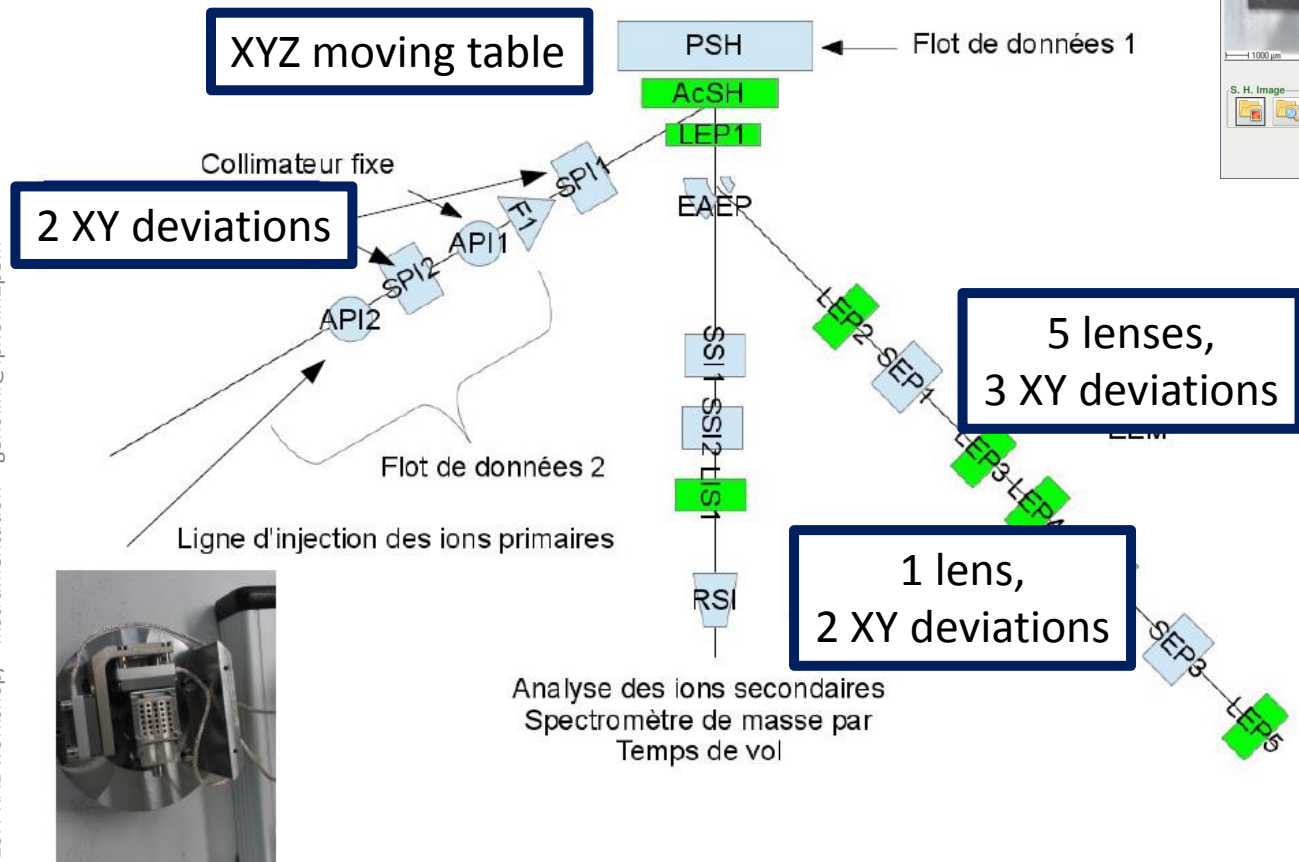


Web interface  
for the data display

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

# Code re-use #1

- ANDROMEDE (IN2P3 platform)

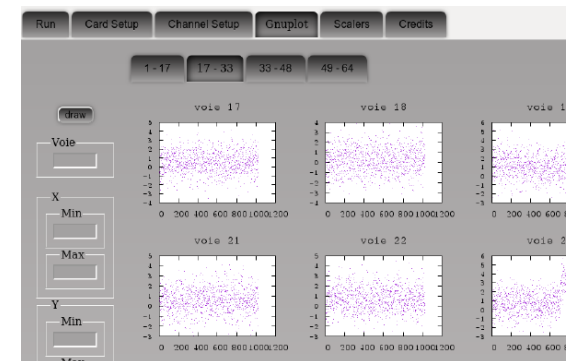
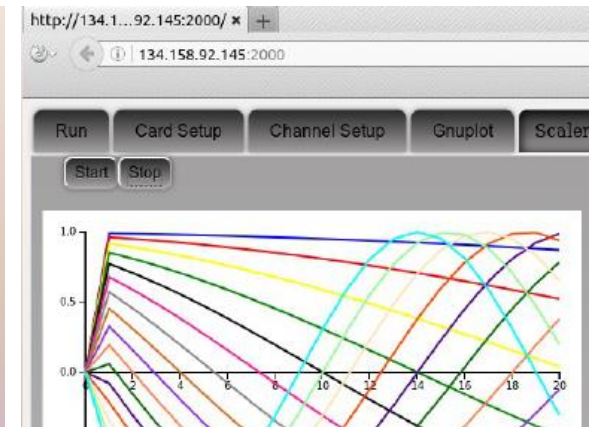
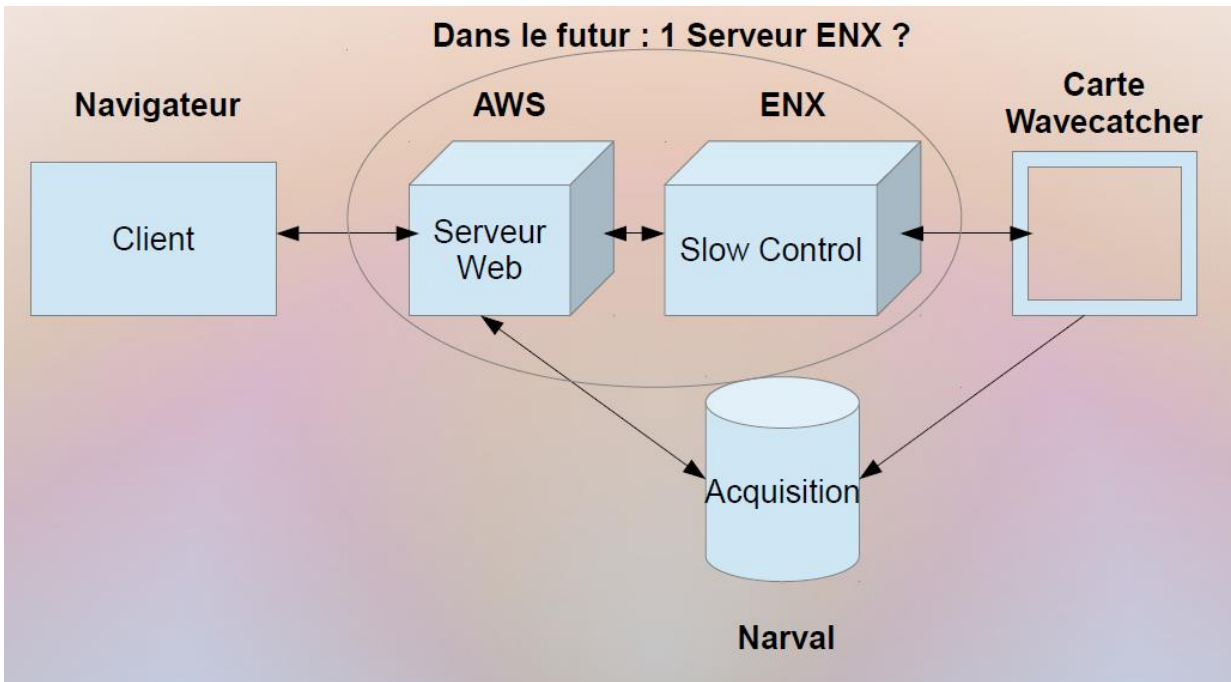


Camera integration

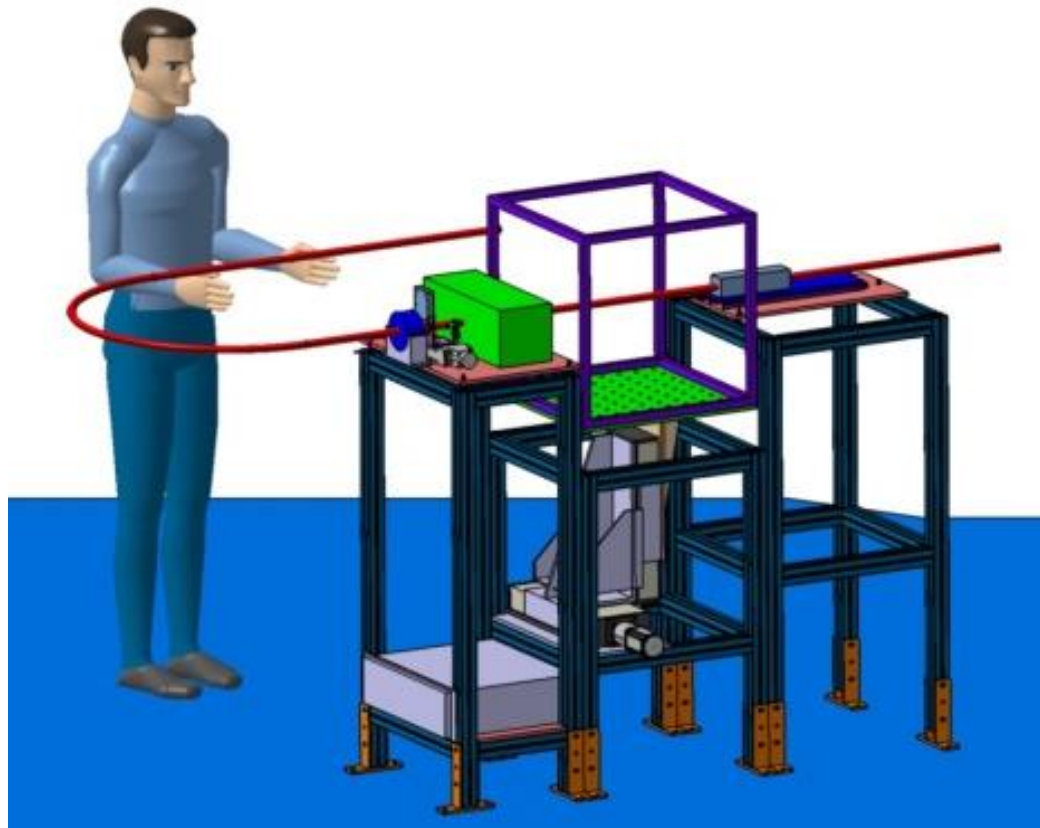
# Code re-use #2

- 64-channel WaveCatcher-based DAQ
- In-beam test for stripped Si detector + preamp

Dans le futur : 1 Serveur ENX ?

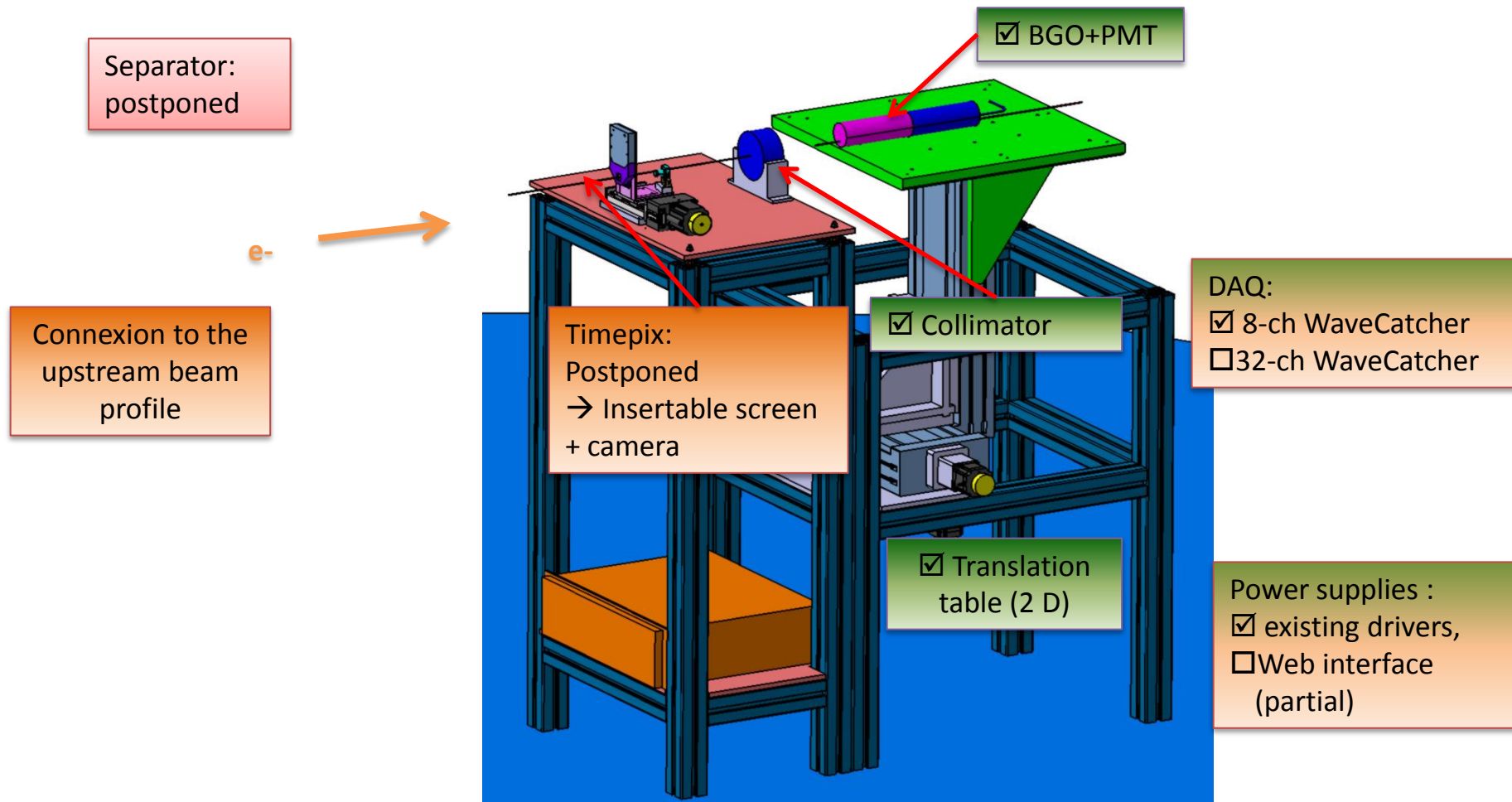


- Scope & Specs
- Front-end
- Software
- **Status**
- Session





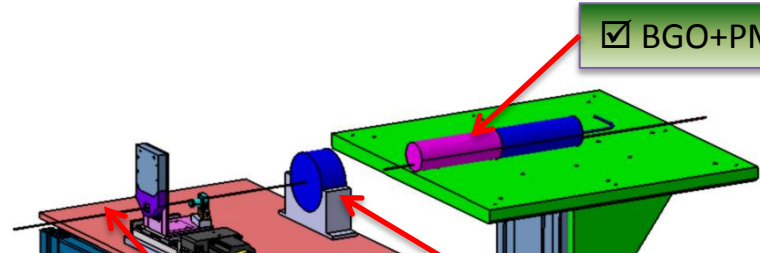
# Status



# Status

Separator:  
postponed

BGO+PMT



Connex  
upstre  
pr

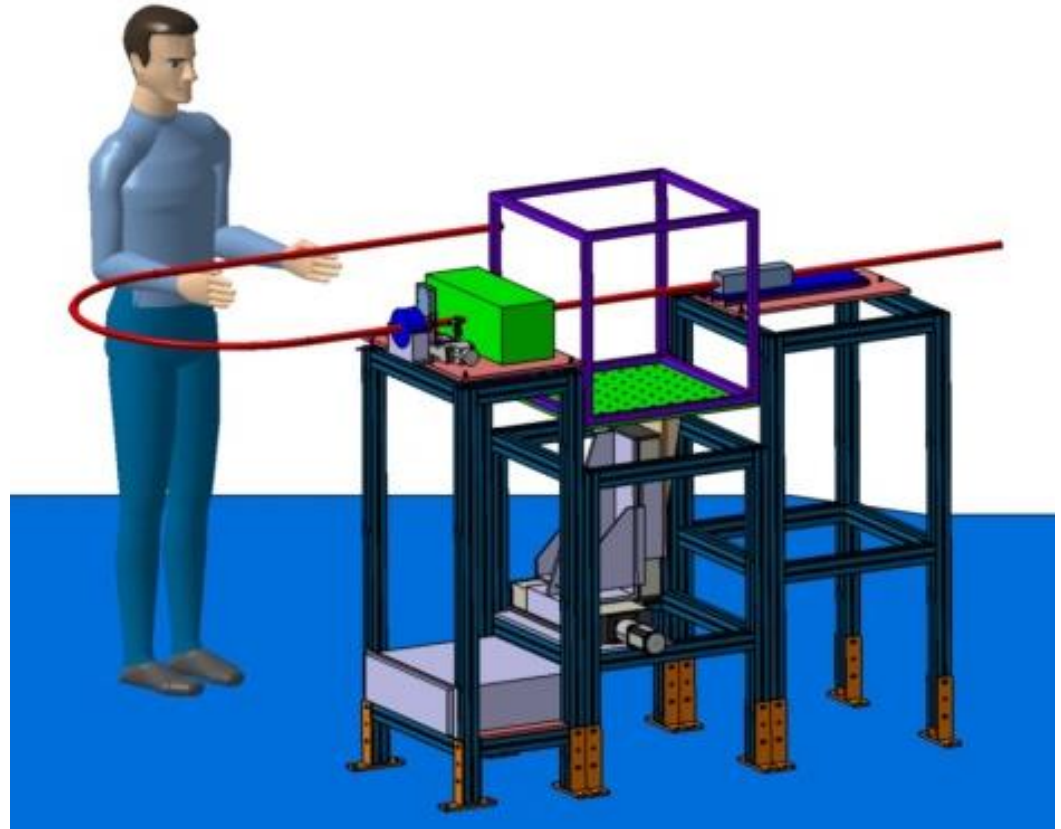
Will be used to  
test ProRad's detectors  
in 2019

WaveCatcher  
WaveCatcher

supplies :  
...ing drivers,  
...web interface  
(partial)



- Scope & Specs
- Front-end
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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!