# LIU Wire Scanner Status
March 2018

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Mechanics production

- Mechanics production and assembly progressing as-per schedule
  - 26 scanners part-assembled in the store room
  - Vacuum acceptance test plan agreed with TE-VSC
  - Baseline Installation dates agreed with planning
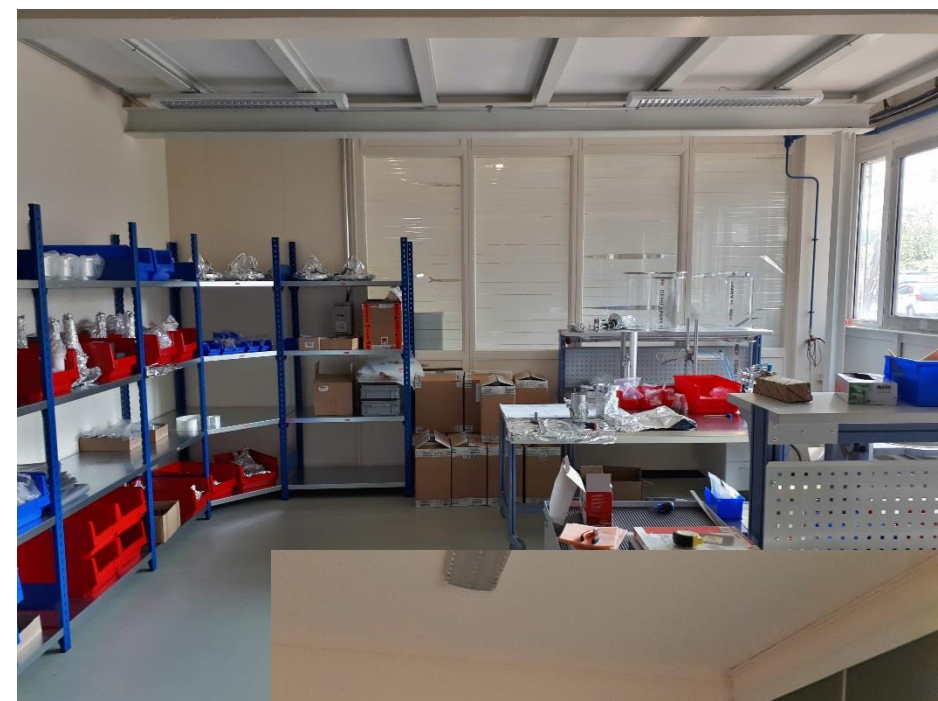
Remaining critical path items

- Vacuum tanks
  - Original contractor stopped operating due to management problem
  - Second lowest bidder accepted to take the contract with similar delivery schedule
    - but CERN agreed to forego the pre-series
  - Close follow-up with MME and BI
- Production of metallic optical discs
  - Signal drop-out problem solved following contractor's visit
  - Production now proceeding

45deg tilted

pico

nano

100 µm	EHT = 10.00 kV	Sample ID = LaserTec 15_outer_45deg.	Anite Perez Fontenla
	WD = 10.3 mm		Date :9 Aug 2018
	Signal A = SE2		Mag = 200 X

100 µm	EHT = 10.00 kV	Sample ID = SPDT 905 after cleaning.	Anite Perez Fontenla
	WD = 13.1 mm		Date :9 Aug 2018
	Signal A = SE2		Mag = 200 X

10 µm	EHT = 10.00 kV	Sample ID = LaserTec 15_outer_45deg.	Anite Perez Fontenla
	WD = 10.3 mm		Date :9 Aug 2018
	Signal A = SE2		Mag = 1.00 K X

10 µm	EHT = 10.00 kV	Sample ID = SPDT 905 after cleaning.	Anite Perez Fontenla
	WD = 13.1 mm		Date :9 Aug 2018
	Signal A = SE2		Mag = 1.00 K X

Budget Status

- Recent BI review of budget and spending profile for the BWS project
  - Overall project budget envelope has not changed
  - Minor changes in spending profile are being implemented in EVM
    - See Lars Jensen for details
- Recent Budget milestone reached
  - Three 'commercial mechanical components' codes (one per machine) have been 100% committed
    - All mechanical commercial components have now been ordered!
    - Further spending on these codes will be blocked

Main Project Milestones

Domain	Milestone	Delivery
Mechanics	Kinematic units components received and ready for assembly	17-Apr-2018
	Assembled kinematic units, ready for assembly with tanks (19x), after calibration	4-Sep-2018
	Vacuum tanks received	14-Sep-2018
	BWS series ready for installation	17-Dec-2018
Control	Design Validation using calibration bench (Bld. 867) of the prototype VFC based control system	Apr-2018
	Validation with the PS scanner prototype in the machine (VME/VFC/basic FESA system)	Sept-2018
	Components ordering and contracting with TE-MPE	May-2018
	Full production assembly launch, after validation with beam	Oct-2018
	Functional tests of complete control crate using calibration bench	Mid-2019
Acquisition	Baseline design	End-2017
	Final design approval following tests with beam	Sept-2018
	Contract placement starts	Jan-2019
	Assembly starts	End-2019
	Ready for installation	Start-2020
Infrastructure	Completion of final cabling requests: waiting for final design approval of acquisition	TBD
	Racks available: Most already available, SPS still work-in-progress	In progress

Baseline decision taken. Final DICs are now submitted

SPS racks still being finalised

PS prototype tests and electronics status/plans

What we have learned since YETS2017 (Details)

- 2 issues stopping the operation of the prototype:

  Angular position errors
       Fixed by Hardware & Firmware modification
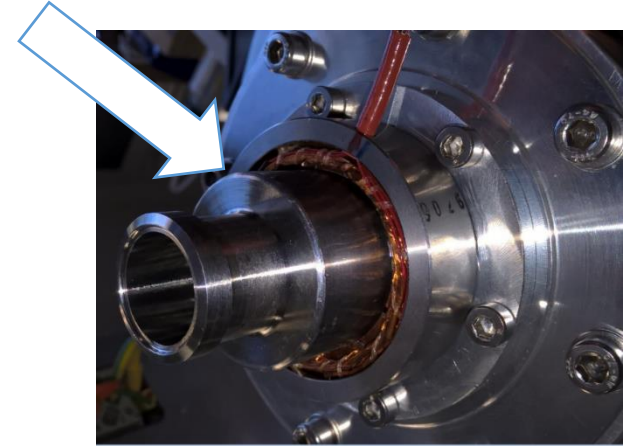
  Motor cable power loss
       Fixed by Hardware & Firmware modification

- Then (preliminary):

  Multi-PMT acquisition can operated without filters wheel
  CK50 provides sufficient bandwidth for bunch by bunch
 Time of flight jitter to hit the beam ~0.5ms

PS Machine development run2018

Date	Nbr scans	Beam types	comment	First outcome	Analysis
2018/06/07	176	LHCPROBE, ZERO	No beam available	Glass disk fixation OK motion stability	completed
2018/06/08	206	LHCINDIV	Go through the cycle with static PMT settings	Possible to measure beams with 2 Multi-PMT configuration	completed
2018/06/11	249	LHCINDIV, LHCPROBE, TOF	Static PMT settings & operational scanners comparison	Different PMT are giving same beam size	On-going
2018/06/13	51	LHC25_BCMS	Nominal beam intensity, static PMT settings	Expected first bunch by bunch processing	to do
total	682				

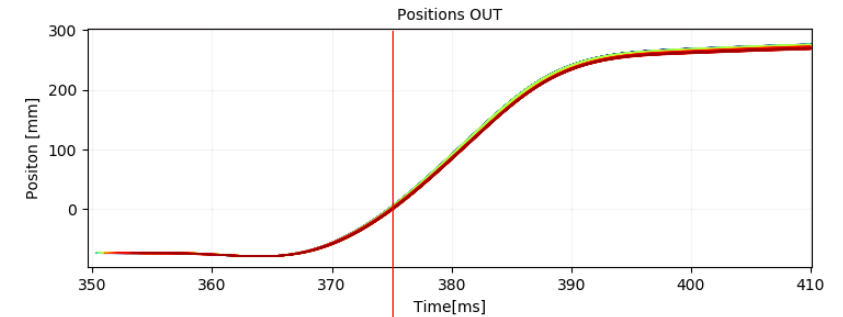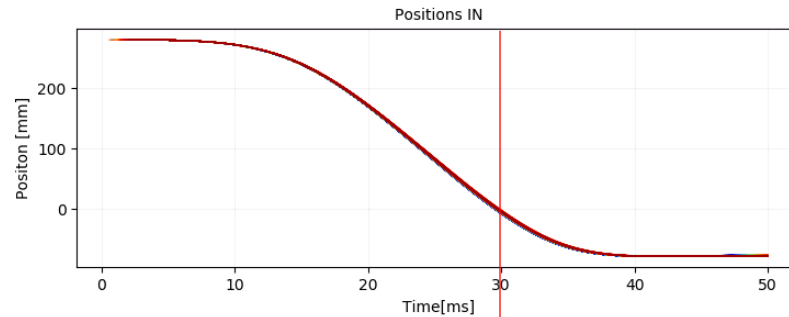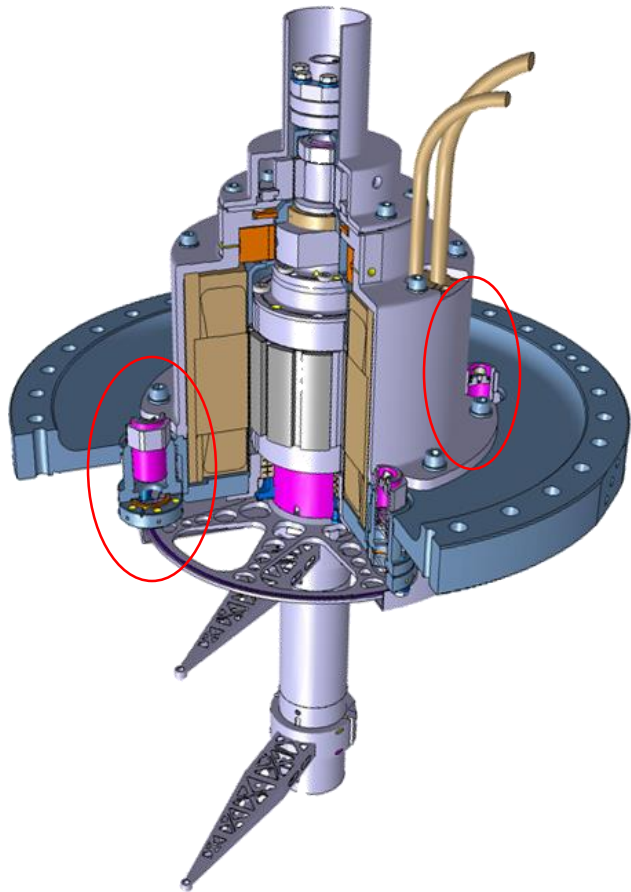# Angular position by the resolver
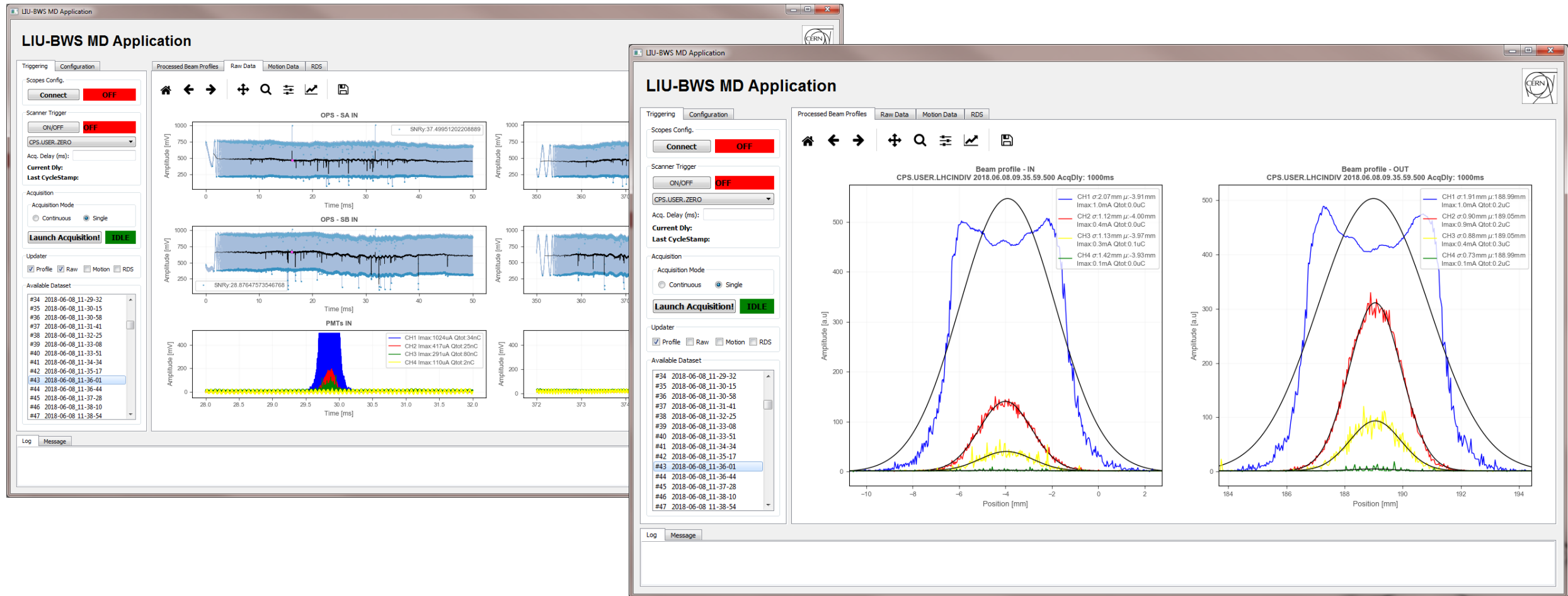# PS MD offline processing of ~500 scans
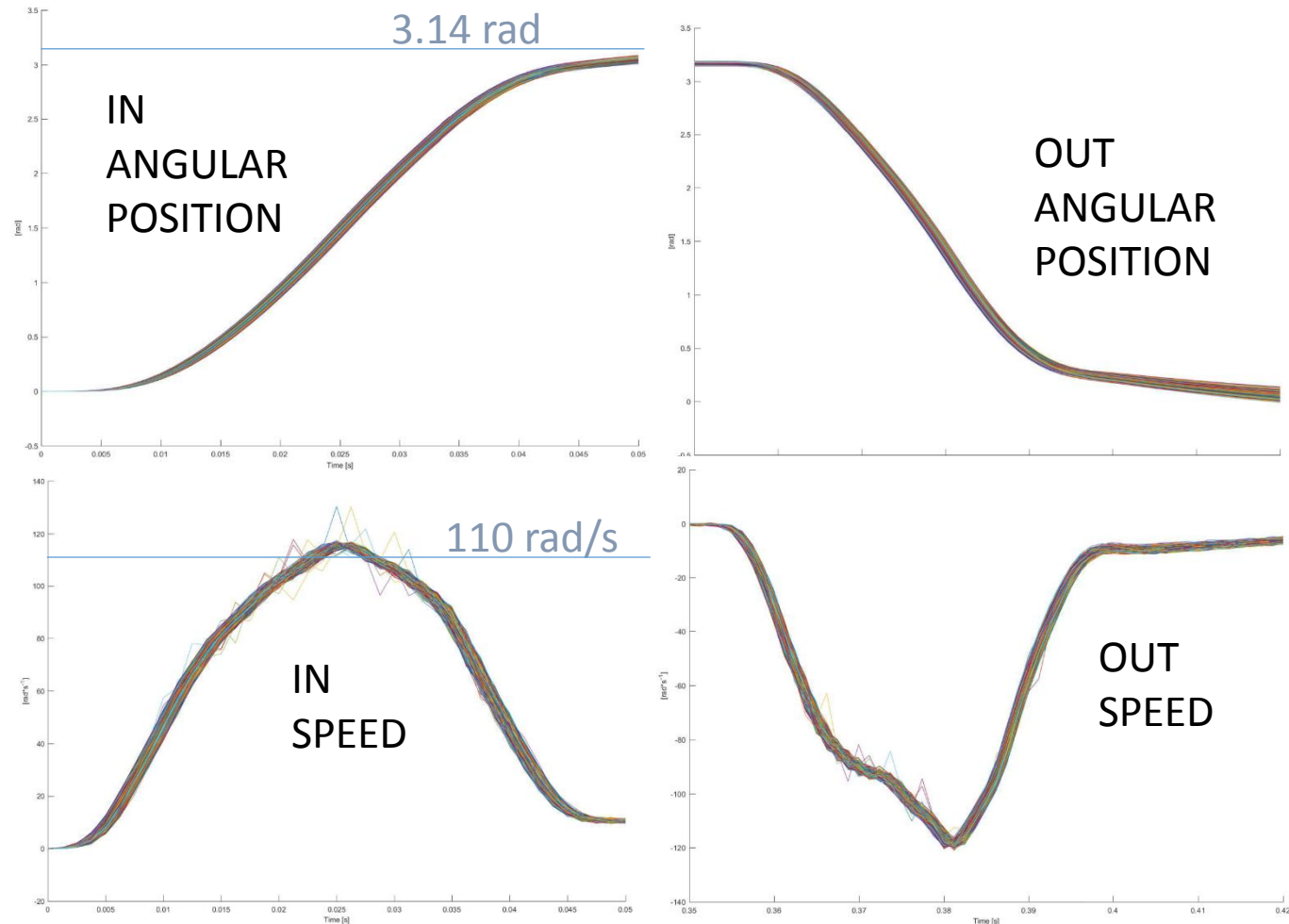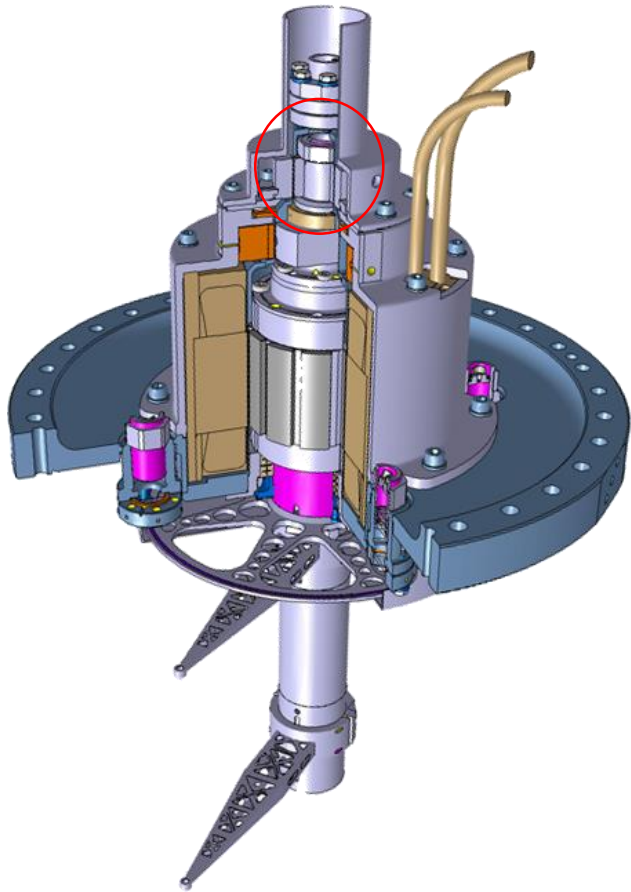
Acquired by the 'Dspace' motion control prototyping platform

Incremental optical position sensor (IOPS)
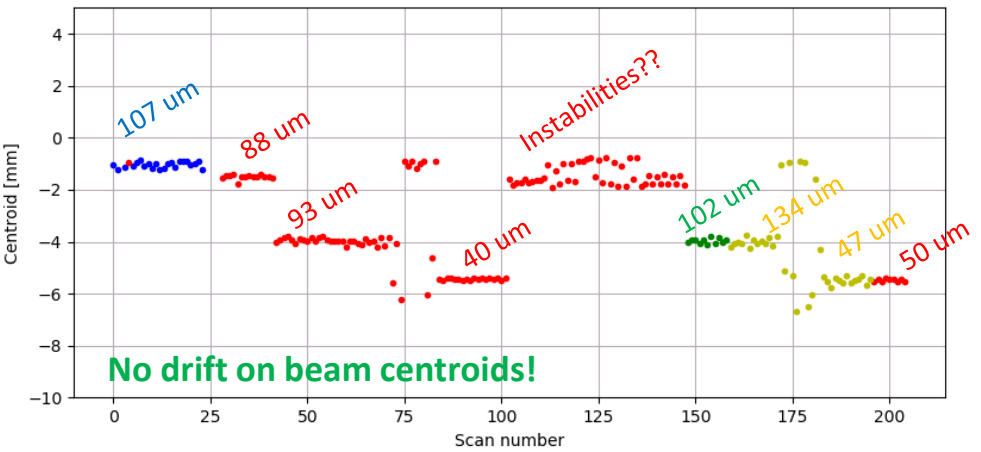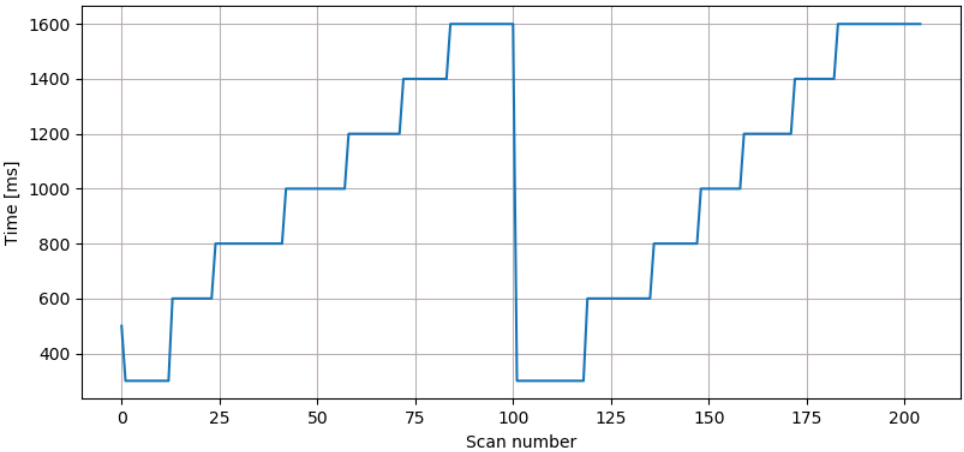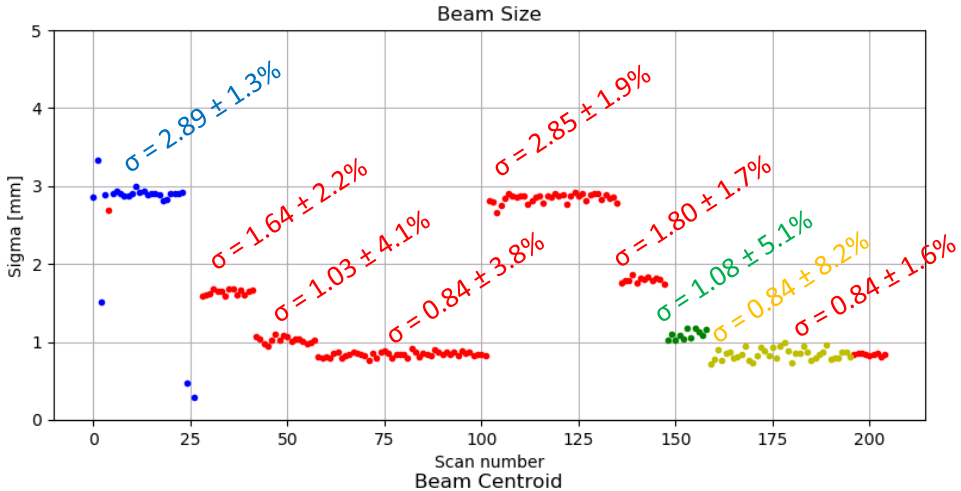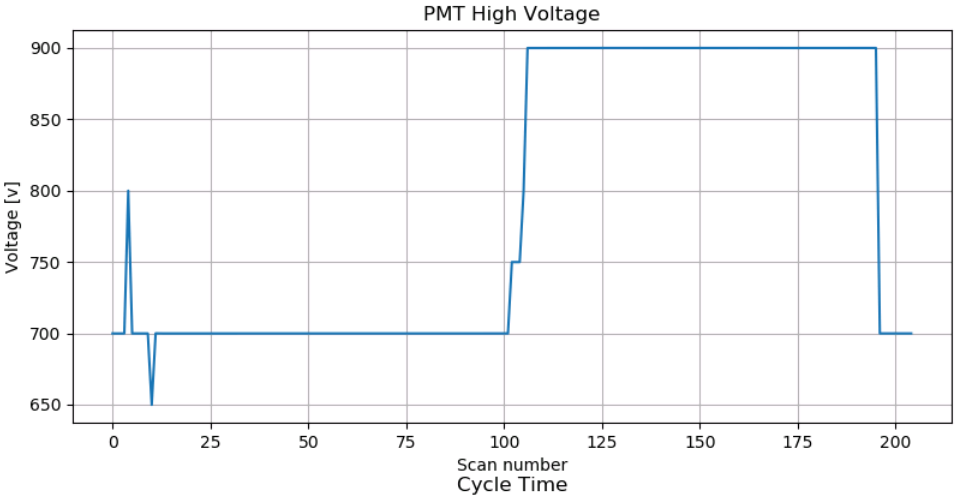# MD offline processing of ~700 scans
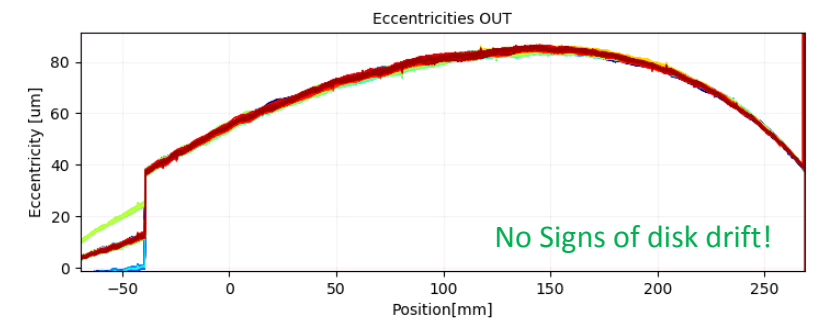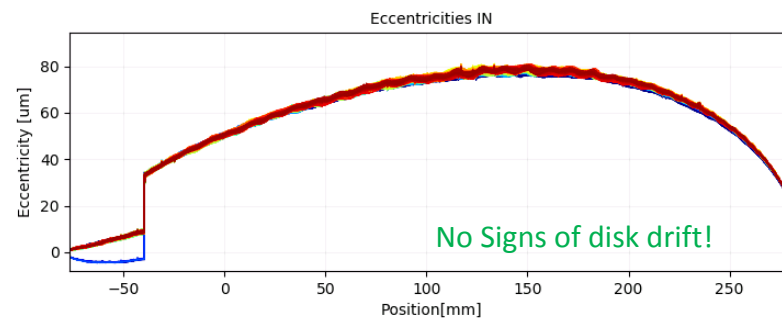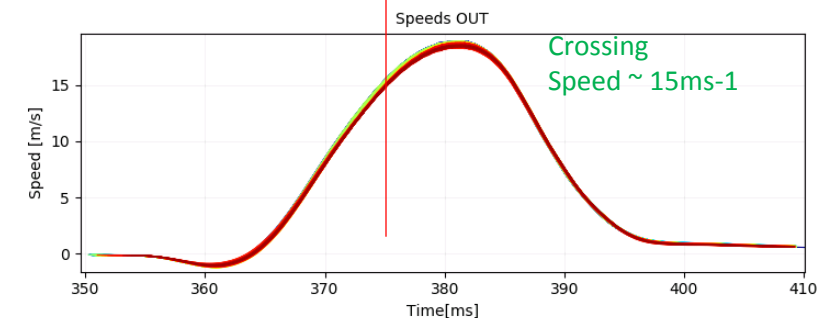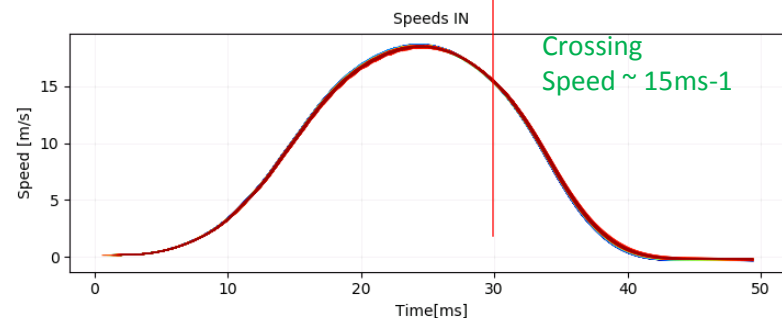
Acquired by the oscilloscope based acquisition system

MD application

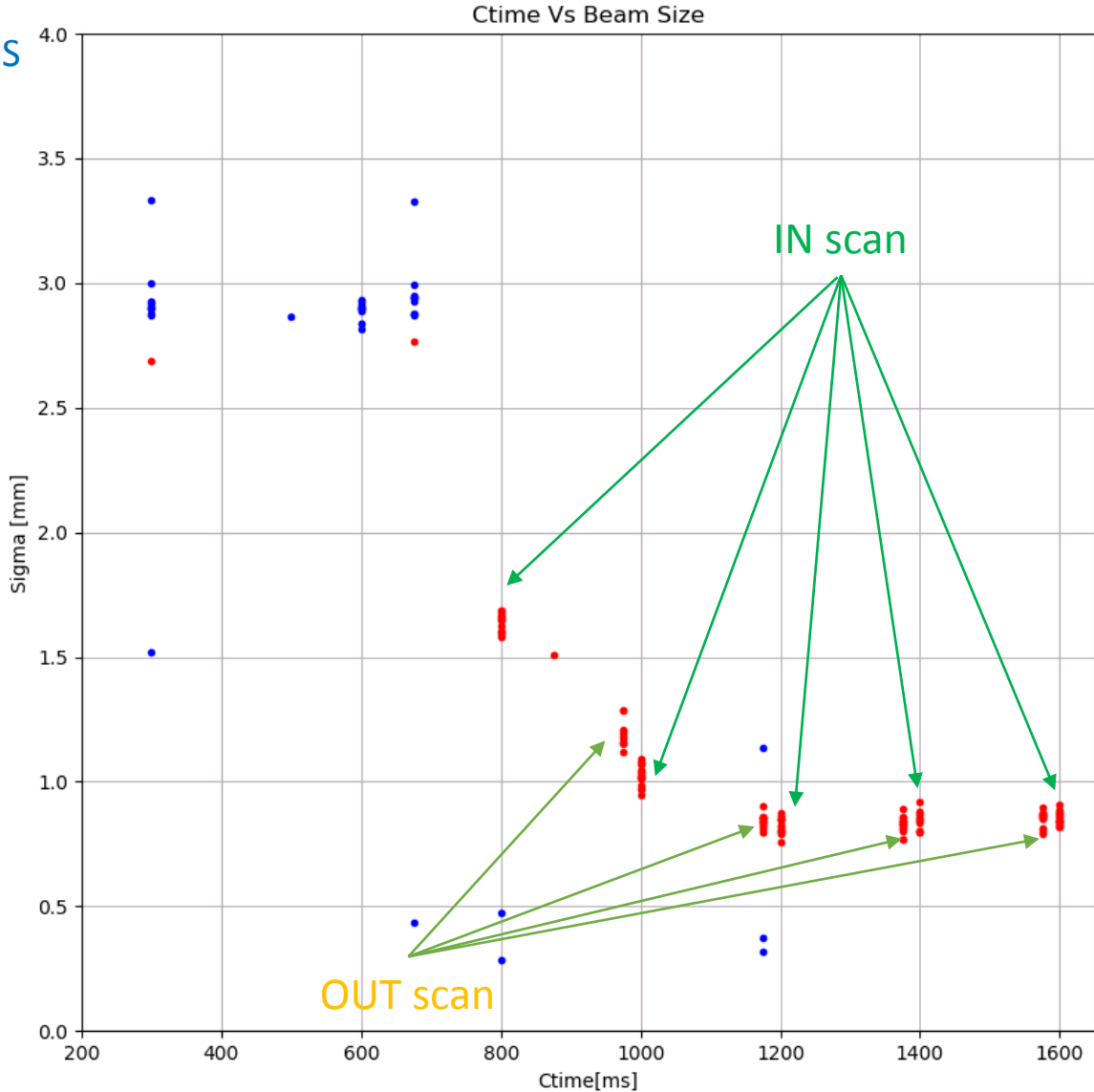# Beam profile processing example (2018/06/11 - LHCINDIV)

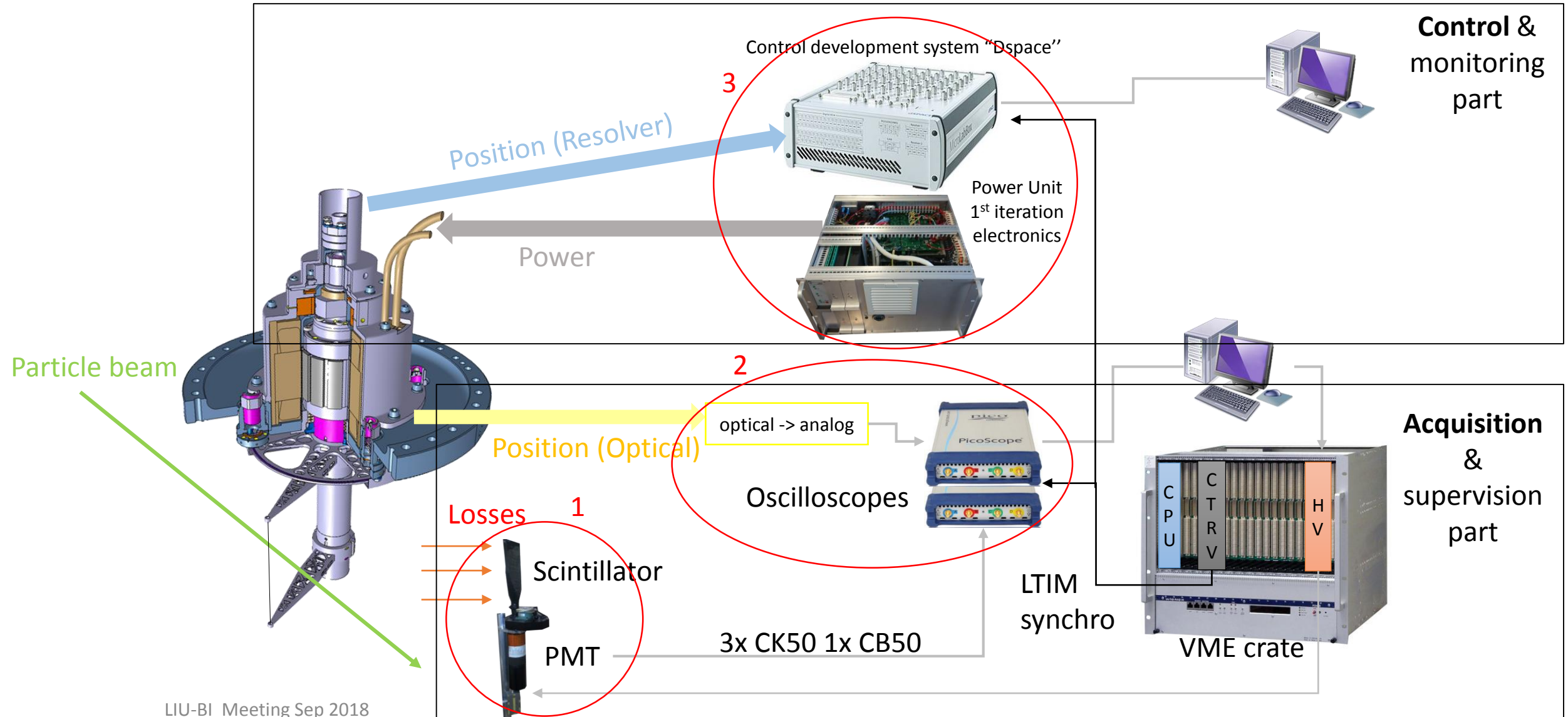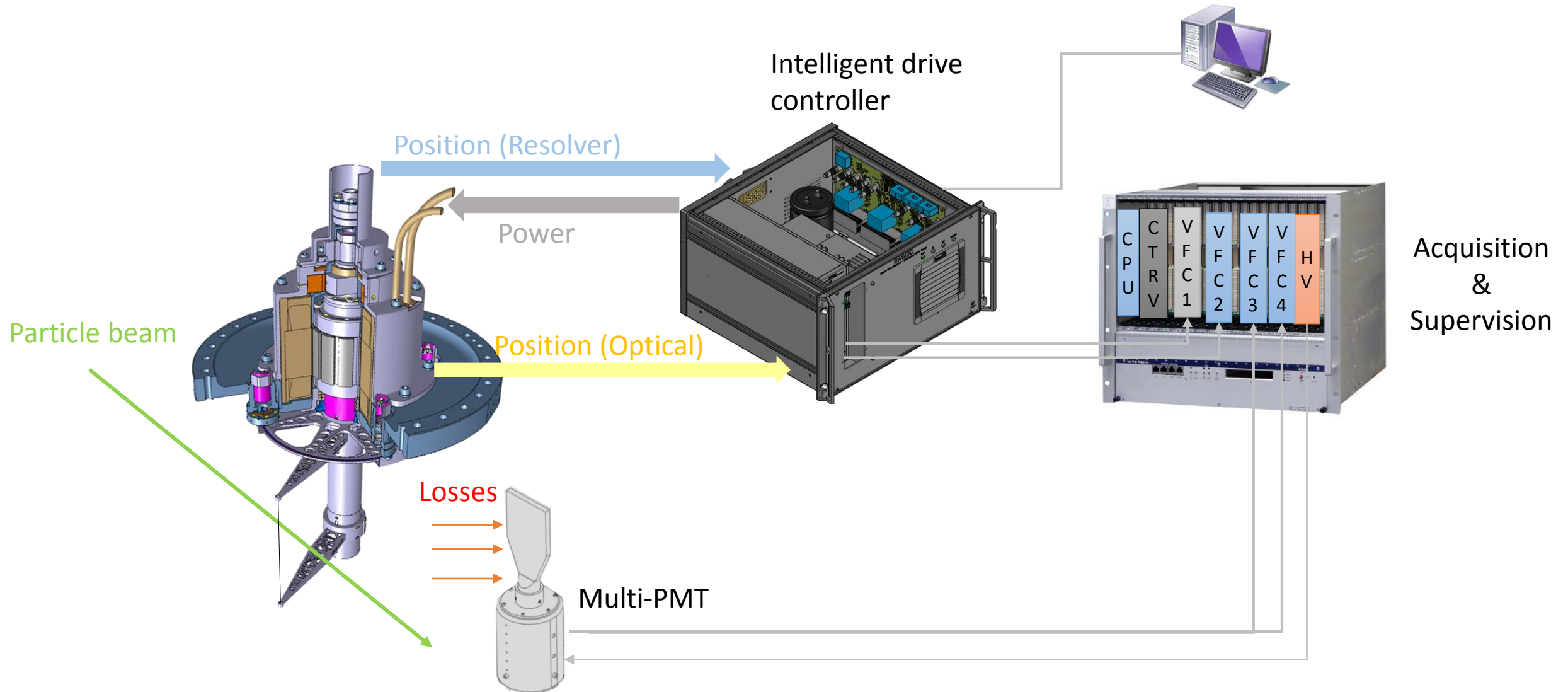# Beam profile processing example (2018/06/11 - LHCINDIV)

LIU-BI Meeting Sep 2018

PS LIU Wire scanner prototype today's configuration

Control & monitoring part

Control development system "Dspace"

3

Position (Resolver)

Power

Power Unit 1st iteration electronics

Particle beam

2

Position (Optical)

optical -> analog

PicoScope

Oscilloscopes

LTIM synchro

Acquisition & supervision part

C P U

C T R V

H V

VME crate

Losses 1

Scintillator

PMT

3x CK50 1x CB50

PS LIU Wire scanner prototype final configuration to test

Intelligent drive controller

Position (Resolver)

Power

Position (Optical)

Particle beam

Losses

Multi-PMT

CPU | CTRV | VFC1 | VFC2 | VFC3 | VFC4 | HV

Acquisition & Supervision

Tests plan for the remaining run2018

1. Multi-PMT 1st complete assembly (tunnel)

2. VME based acquisition of the secondary shower and the incremental optical position sensor (surface)

3. 2nd iteration of the control electronics (surface)

4. Link between the control electronics and the VME crate (surface)
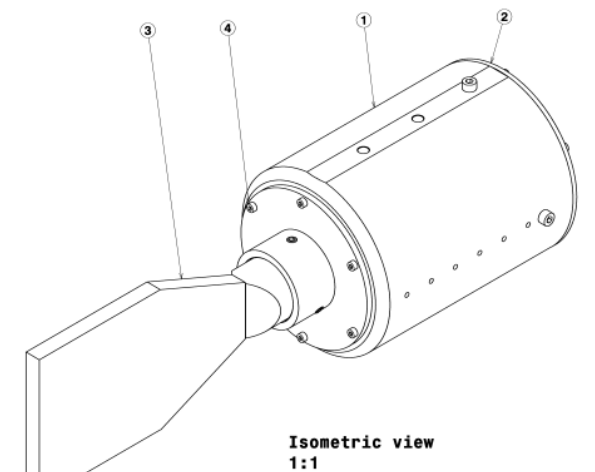
Tests plan for the remaining run2018
1. Multi-PMT 1st complete assembly

- To be installed during TS2
- To be qualified with beam:
  - Printed circuit board (PCB) PMT base with amplifiers
  - Removal of the mechanical filters wheel
  - direct connection scintillator/light guide to PMTs housing

Assembly with filters wheel
(similar configuration as today's OP scanner)
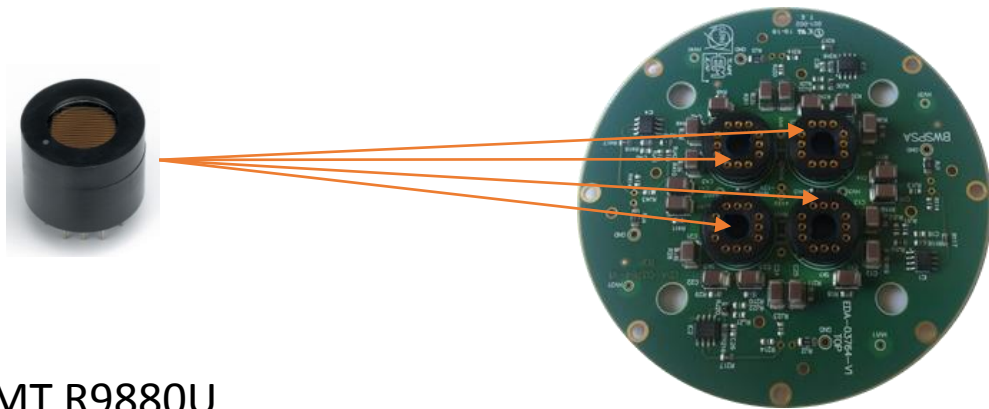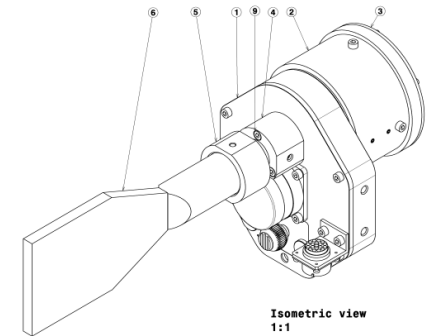
PMT R9880U
similar type as today's system

PSB scintillator configuration shown
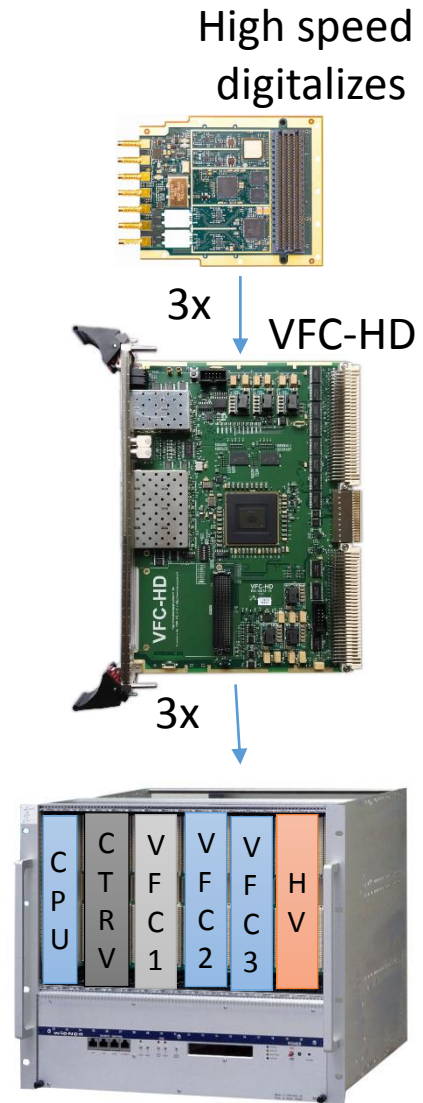
Tests plan for the remaining run2018
2. VME based acquisition PMT & IOPS

For testing:

Higher resolution digitalizes
Analog inputs signal compatibility
FESA based processing of the PMT and IOPS signal

HW:
VME, HV and TIMING already there
3x VFC-HD and mezzanines to install

SW:

FESA class under construction (LTIM already being used)

Based on existing python processing

And later extended to experiment processing of the PMT and IOPS (turn by turn integration, bunch by bunch)
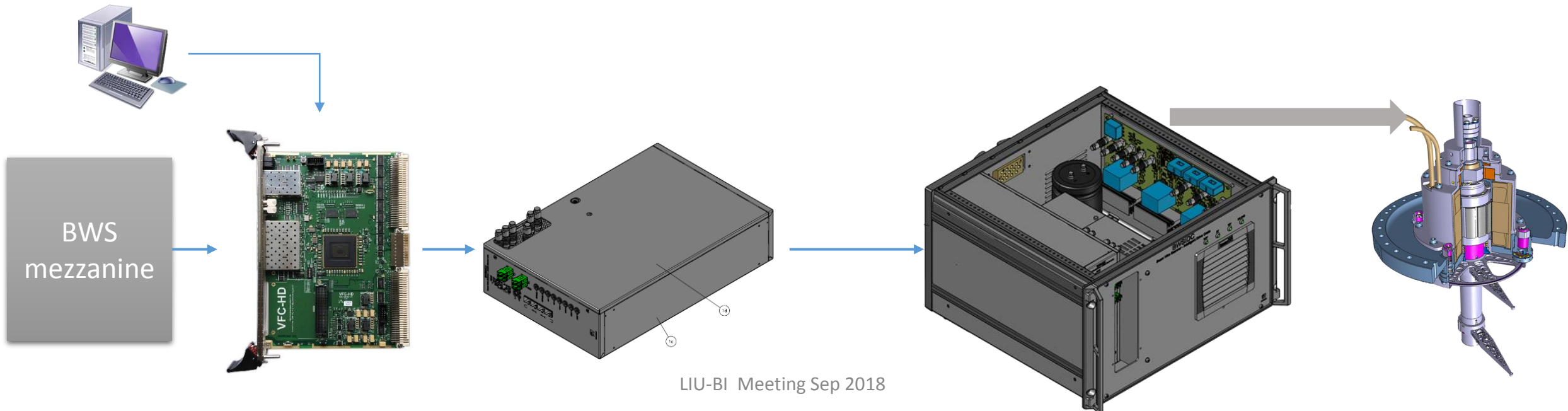
High speed digitalizes

3x   VFC-HD

3x

Tests plan for the remaining run2018
3. 2nd iteration of the control electronics

based on BI common FPGA platform (VFC-HD)
- We will use a stand-alone software to configure the motion
- Then use LTIM pulse synchro for the motion

- Large work on the FW at the moment (motion feedback)
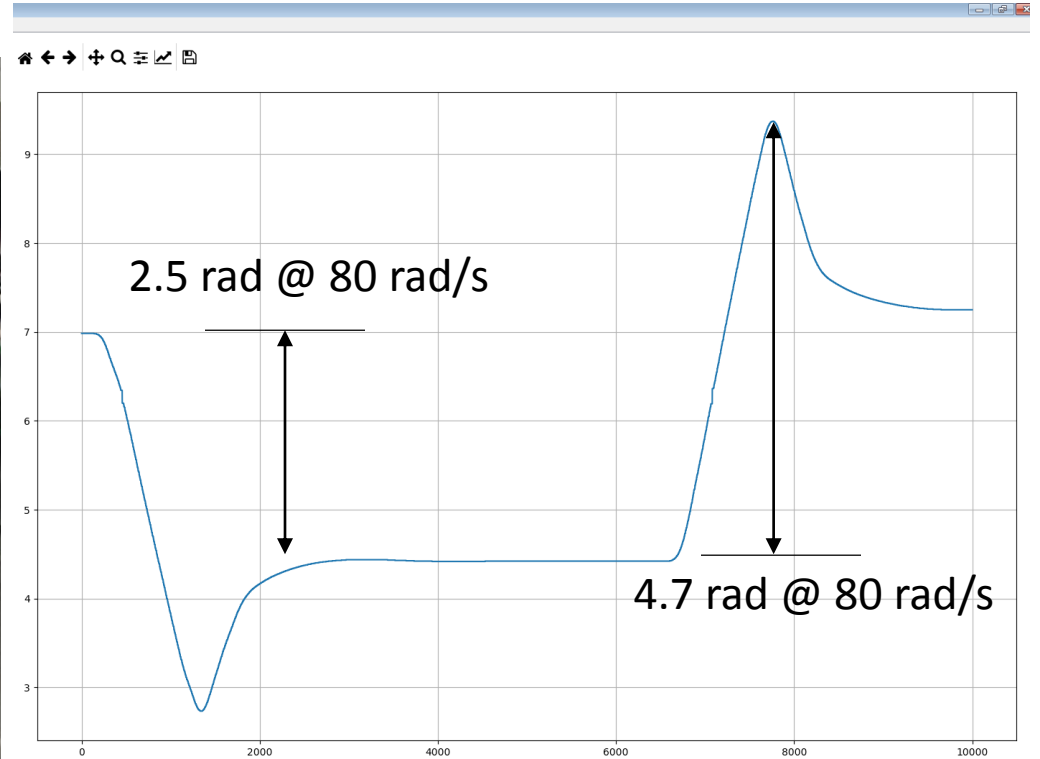
Tests plan for the remaining run2018
3. 2nd iteration of the control electronics

Motor bench   Intelligent drive

VFC-based motion
controller

Development software directly connected to the motion control system

2.5 rad @ 80 rad/s

4.7 rad @ 80 rad/s

Selected result from the 2nd iteration electronics and motor bench
Nominal parameters PS scanner: 3.14 rad @ 110 rad/s

Tests plan for the remaining run2018
4. Link control electronics <->VME

- Will be used to configure motion parameters from a FESA class
- Scan trigger transmitted using this link
- Custom optical link based on GBT low level layers
- FESA class not yet started (waiting for final memory mapping)
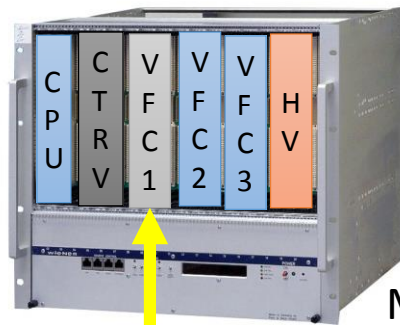
Motion settings + triggers + motion data/IOPS
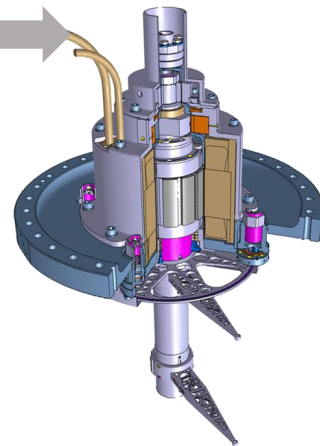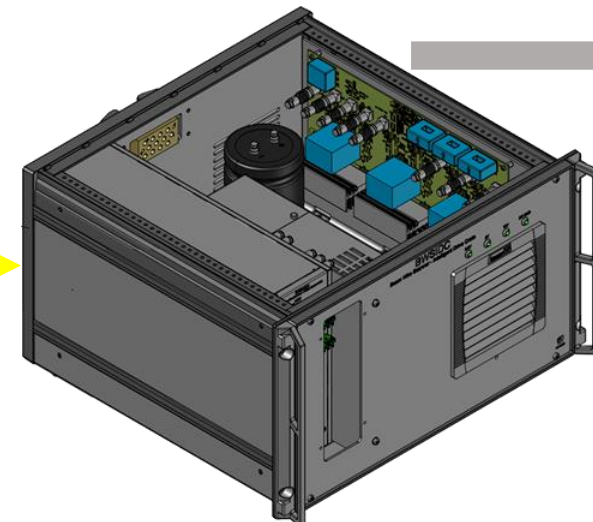
To be tested after run2018

- Control electronics final hardware (3rd iteration):
  -> 3 PCB boards ready for prototype (Design office done)
  -> Very close to the 2nd iteration that will be tested with beam
     Lots of changes done 'by hand' on the PCB boards
  -> We believe that the laser calibration bench will asses correctly the future performance of the motion

- Acquisition hardware:
  -> if we change the digitalizers mezzanines
  -> PMT analog signal conditioning