LIU Wire Scanner Project

Ray Veness, for the LIU WS Team

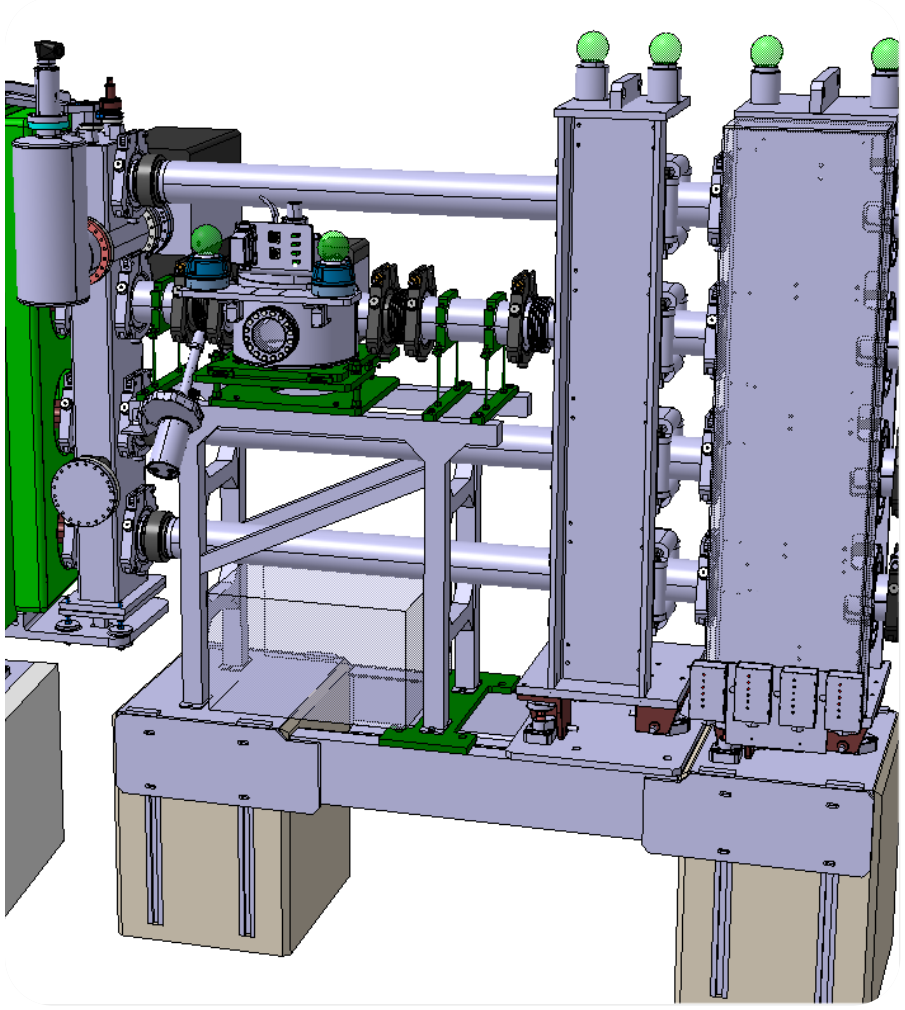
Slides from

JL Sirvent, D.Gudkov,

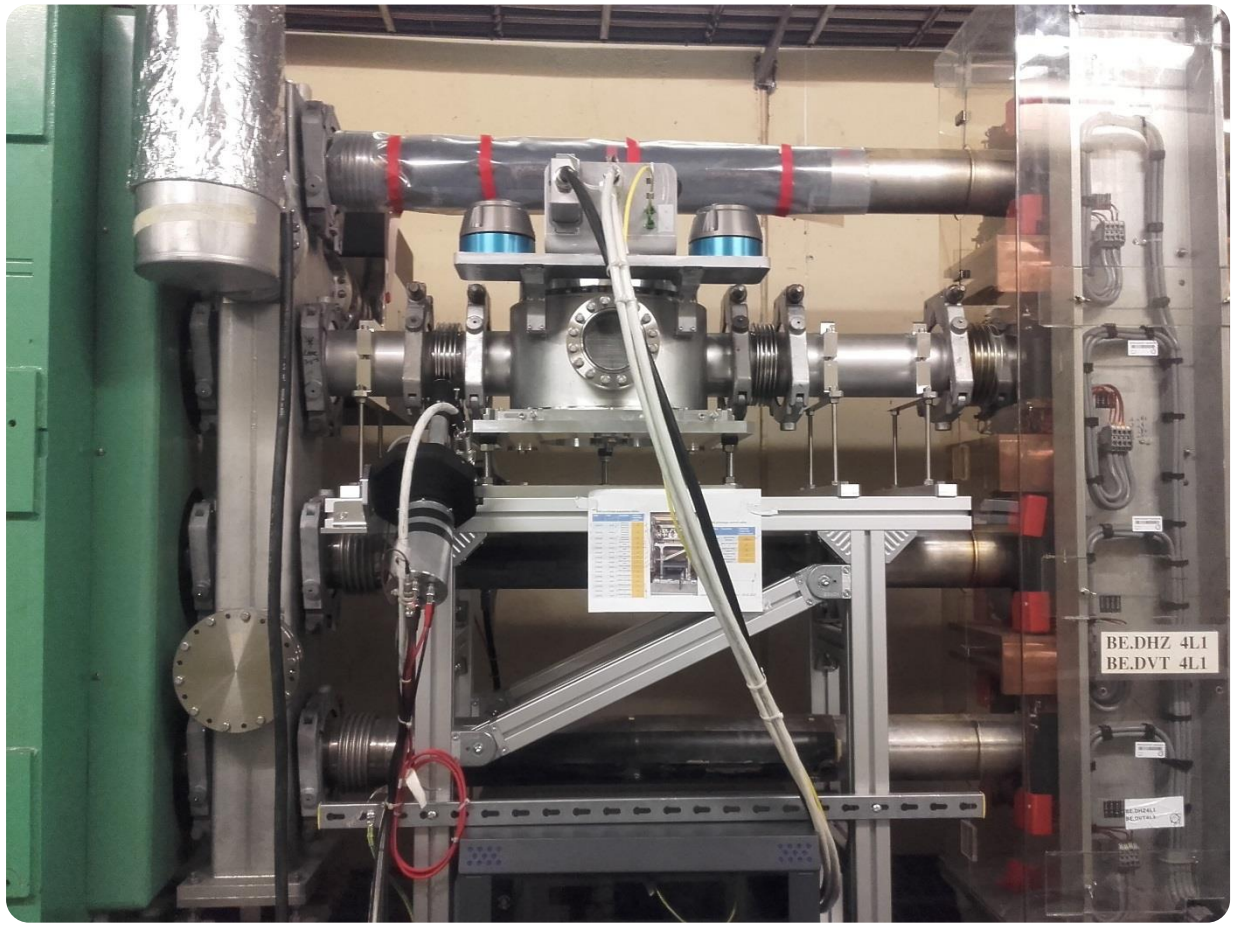
Status of PSB prototype

- Installed in EYETS 16-17
  - ‘Final’ mechanics,
  - development control system,
  - development acquisition systems
- Tests with beam, more than 900 scans recorded in June 2017
  - Benchmarking with the operational scanner
  - Validated mechanical design (with exception - see next slide)
  - Testing of prototype acquisition systems
- Intervention in TS3 to swap the instrument with the spare
  - Instrument assembled and tested by VSC (awaiting final OK to install)
  - Now on the test bench for calibration and burn-in tests

New fast wire scanner prototype in PS Booster (4L1)



Prototype installed in PS Booster on 15.03.2017
Ready for operation

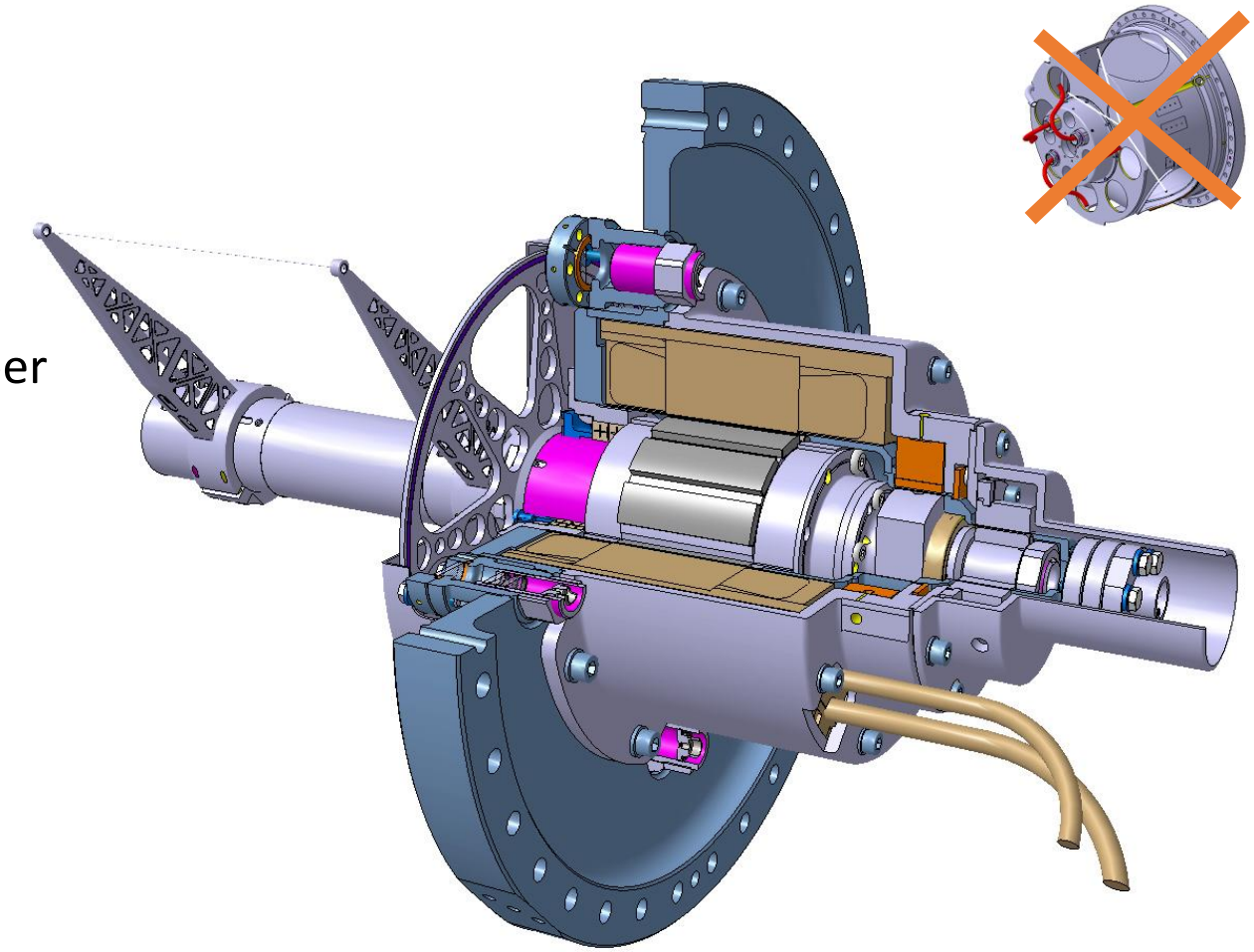


New fast wire scanner. Kinematic Unit

- **Interchangeability**
  - One design of kinematic unit for all machines
  - Interchangeability of components

- **Design and Production Features**
  - Both shaft supports located in the stepped chamber
  - No drum
  - Direct drive
  - Cantilevered shaft
  - Magnetic auto-return device (magnetic brake)
  - Standard CF flange DN273
  - Optimised design of forks (reduced deformation)
  - Optimized design of optical encoder disc

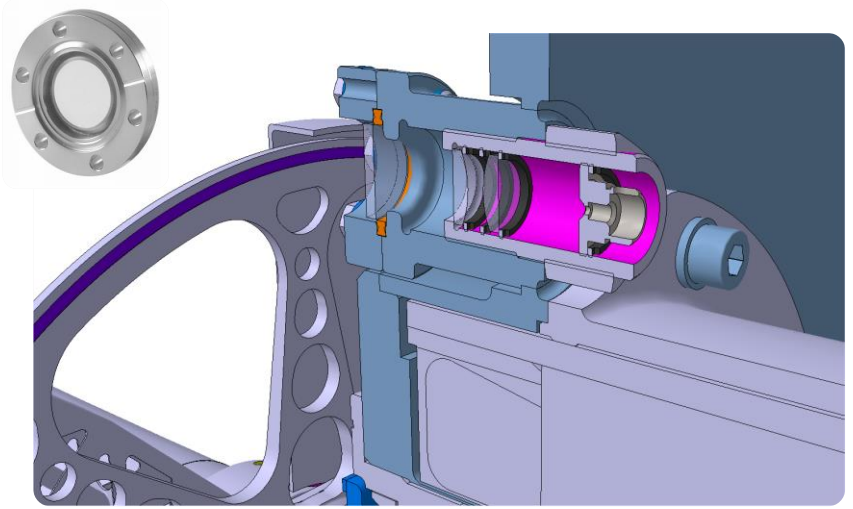
- **Vacuum**
  - Optical encoder focusers are outside vacuum
  - Hybrid bearings (SS races, ceramic balls)
  - Vacuum compatible motor supplied directly from subcontractor (CERN qualified)
  - Increased stepped chamber wall thickness (0.4 mm vs. 0.3 mm)



Designed in collaboration with EN-MME (N. Chritin, A. Demougeot)

Shaft Angular Position Measurements. Optical Position Sensor

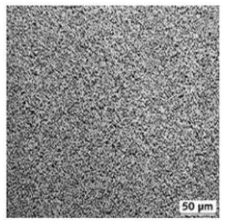
- Optical encoder disk located inside vacuum
- Follows the shaft movement
- Lens system and optical fiber are located outside the vacuum volume
  - Trapped volumes avoided
  - Reduced outgassing load
- Focal distance adjustment possibility by means of fine pitch thread
  - Access from outside without venting
- Glass disk with chrome encoder pattern deposition (baseline)
  - So far better optical properties
  - Disk holder required (2 additional parts)
  - Higher inertia
- Metal disk with laser engraved encoder pattern (preferred upgrade)
  - Optical properties are comparable with glass disk (by recent tests)
  - Laser engraving in collaboration with Dundee University
  - Lower inertia due to optimised design
  - Installation directly on the shaft
- Bakable up to 200 ^{o}C (metal disk)



roughness of optical track: Rt0.04
Optical slits pitch 0.02 mm.

Al microstructure

RSP6061



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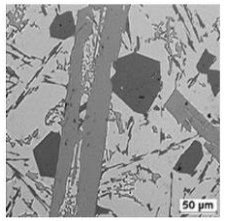
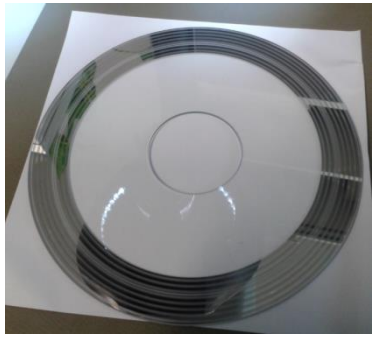
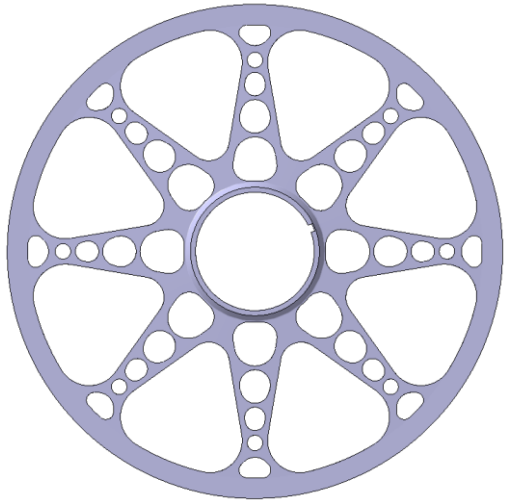
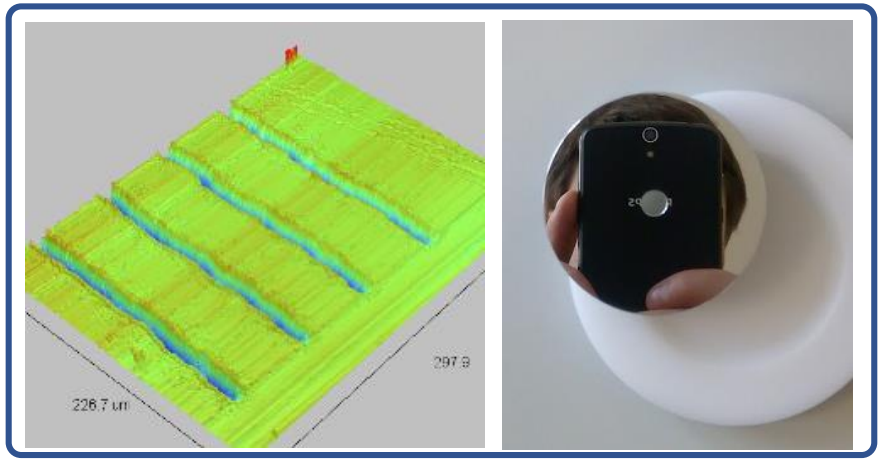






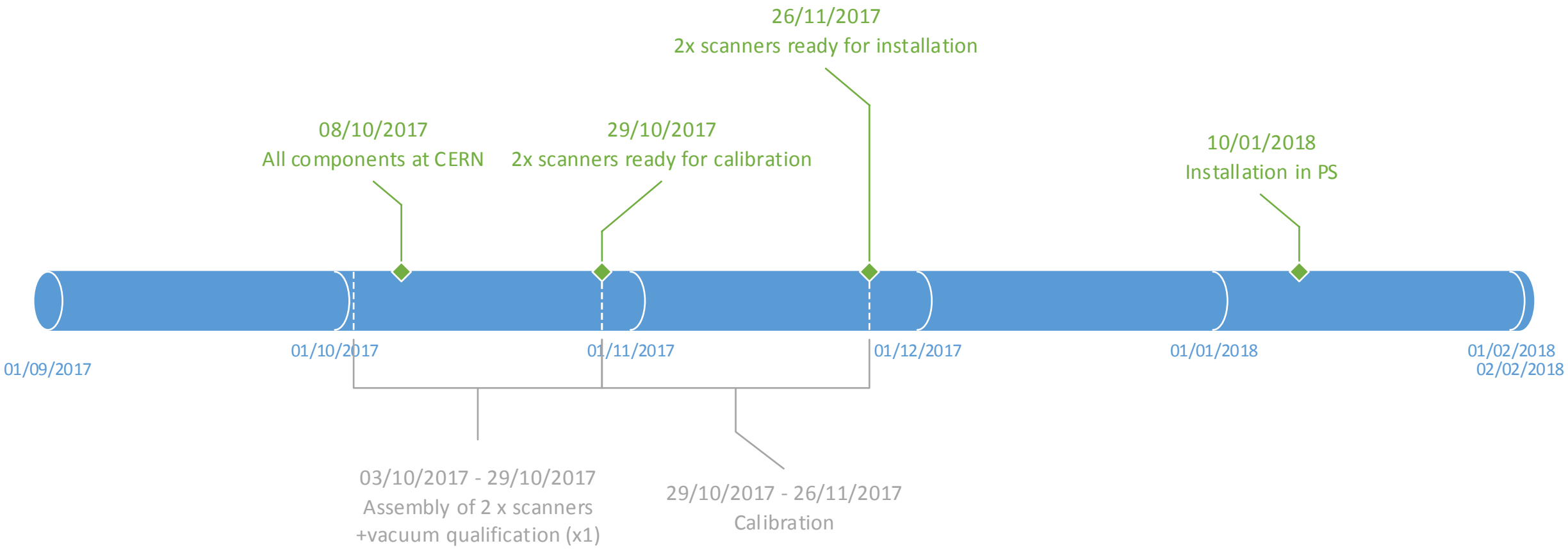


…Acquisition will be discussed by Federico…

PS Prototype

- On-schedule for installation in YETS 17-18
  - Mechanics arriving
  - ECR approved by IEFC
  - Control and acquisition will be available – deciding what to use
- Instruments and tanks will be used as spares for series
  - No significant changes to designs.

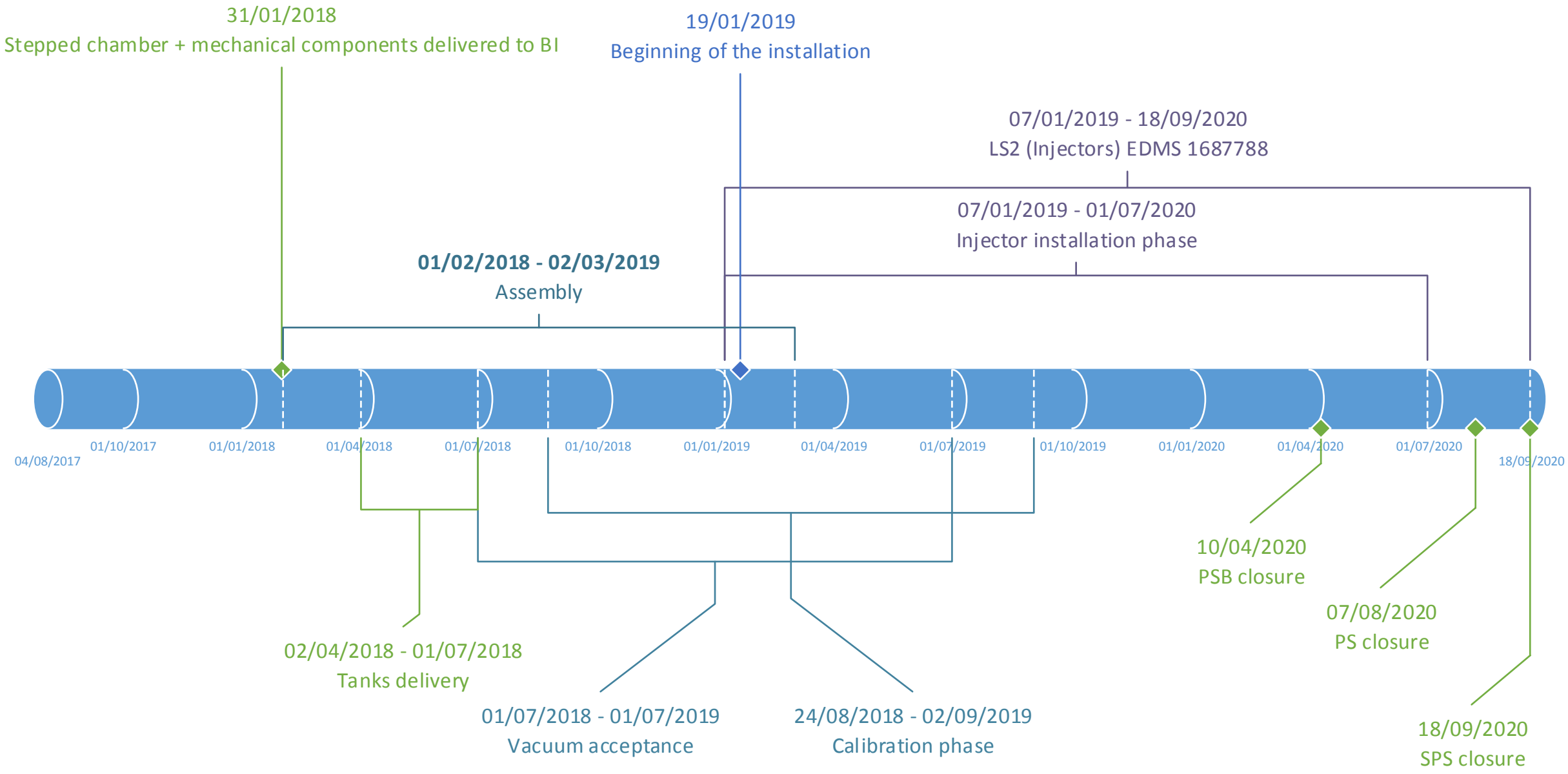
PS Prototype Assembly and installation planning



LIU Series production

- Control system
  - Prototype under production for installation in the PS
  - Series will be launched first Semester 2018, based on PS experience
- Mechanics
  - Specification committee for vacuum tanks passed on 17/8/17
  - Production of all components now in progress
  - Expect to be able to start assembly first quarter 2018
  - Still on schedule to be ready for early LS2
- Acquisition system
  - Final review to decide on baseline will be held xxx

LIU Series: Installation planning

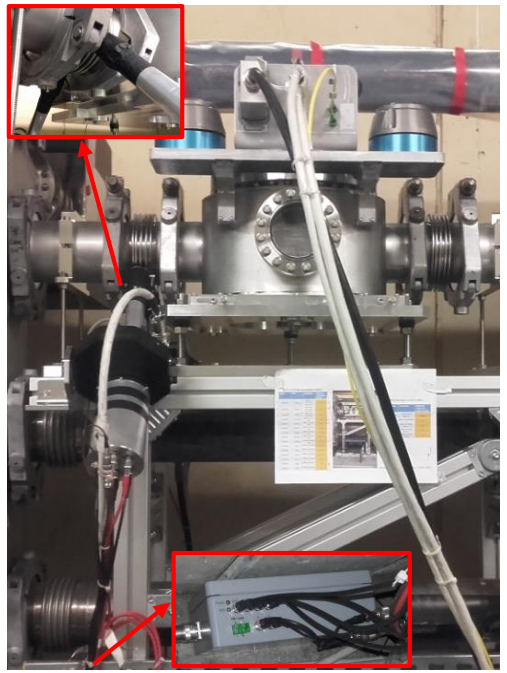


Recent results from PSB prototype testing

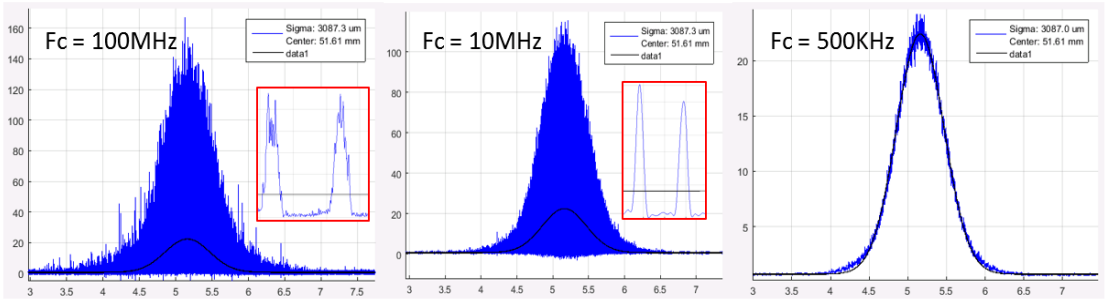
3. PSB Prototype Beam Tests:
3.1 Precision on beam width determination

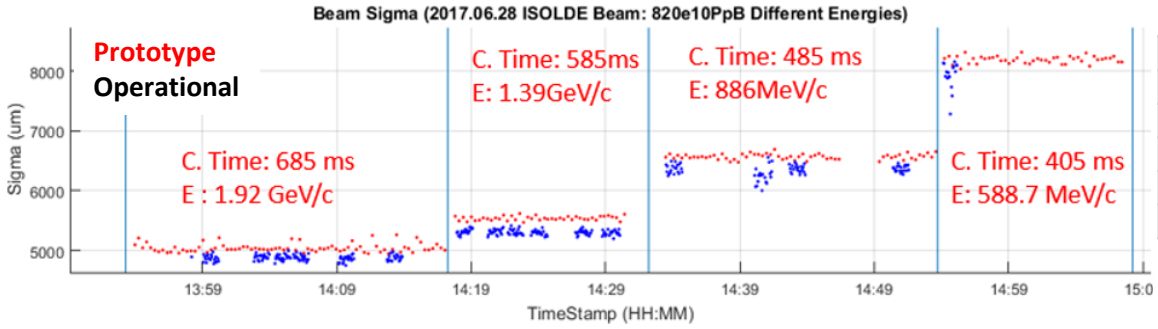
- Beam Sigma spread comparison for prototype and operational (Ring 3 Horizontal)
- LHC25 and ISOLDE beams at different energies.
- Many points per sigma in both scanners : 200 – 500
- **Successful Prototype operation:**
  - Similar performance for LHC25ns (Dominated by amplitude statistics in both BWS?)
  - Beam sigma errors→ **Prototype ± 0,7% , Operational ±1,3%** (ISOLDE).

Detectors detail



ICECAL_V3 FE detail



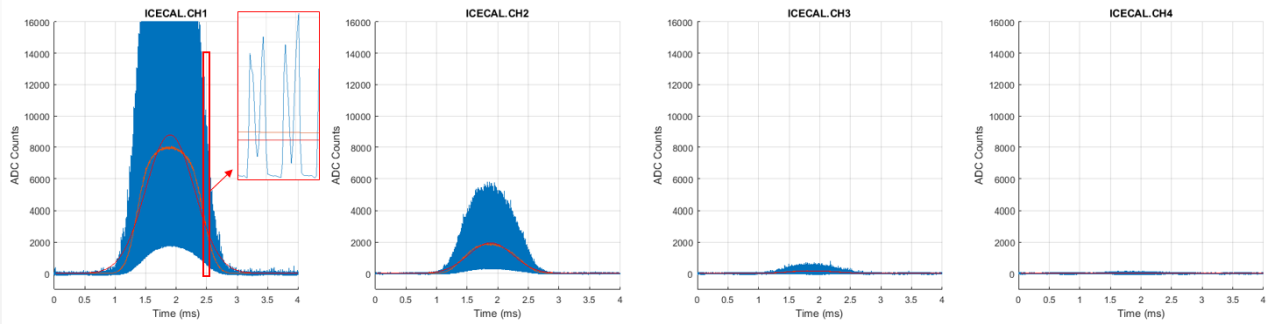


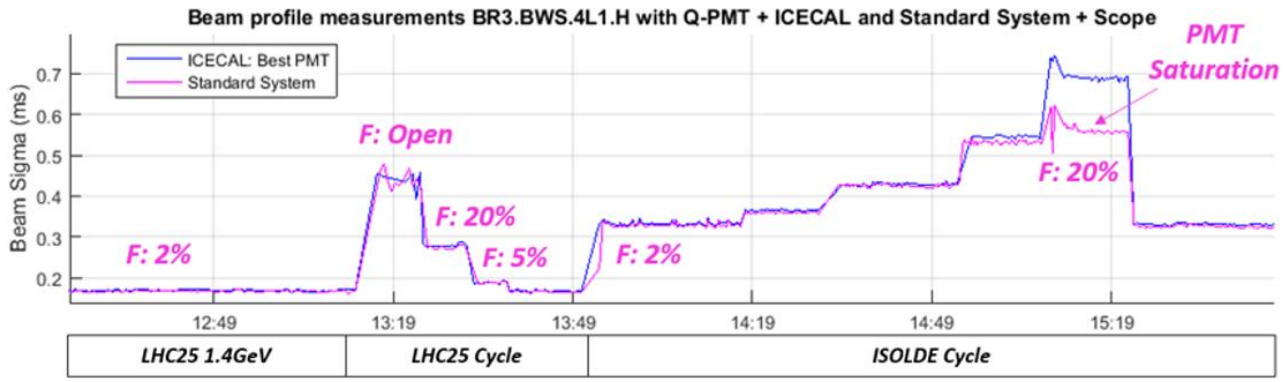
Beam Type	Operational	Prototype
LHC25 1.4GeV	2559 ± 31, 1.2%	2569 ± 37, 1.4%
ISO 588 MeV/c	8021 ± 125, 1.6%	8245 ± 52, 0.6%
ISO 886 MeV/c	6354 ± 88, 1.4%	6571 ± 46, 0.7%
ISO 1.39 GeV/c	5302 ± 44, 0.8%	5538 ± 38, 0.7%
ISO 1.92 GeV/c	4880 ± 53, 1.1%	5025 ± 34, 0.7%

Beam sigma measurement (um) and spread during MD in um and %.

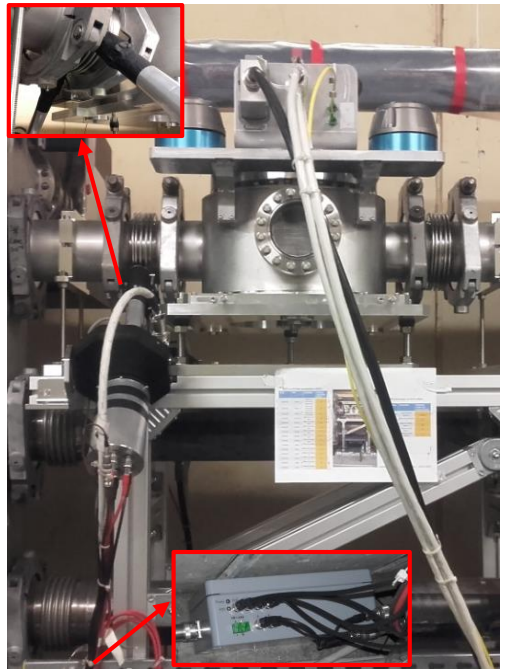
3. PSB Prototype Beam Tests:
3.1 HDR acquisition system evaluation

- **Aim:** Ease BWS operation and avoid tuneable parameters (HV+Filter selection).
- Prototype equipped with two secondary acquisition systems:
  - A) **Standard**: Single channel acquired on surface.
  - B) **HDR** Based on Q-PMT detector: 4 channels acquired on tunnel with ICECAL FE.





Detectors detail



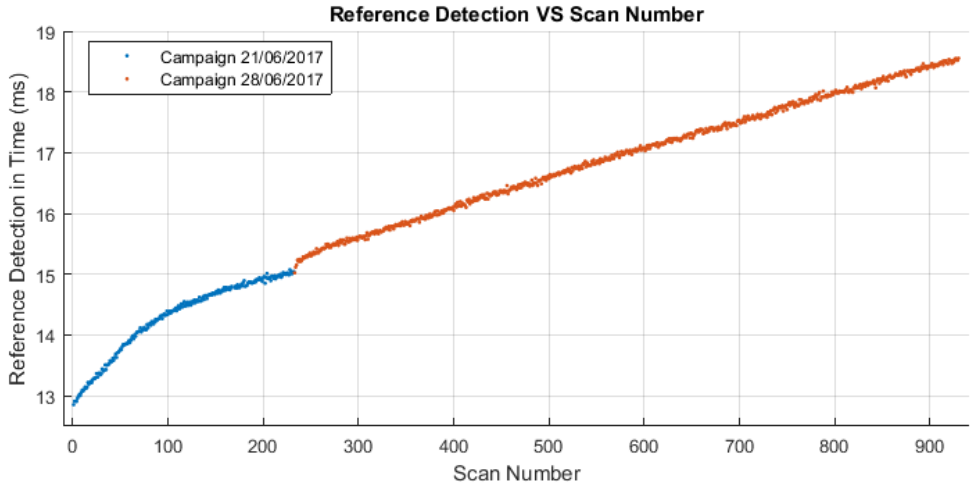
ICECAL_V3 FE detail

Scint. photon yield varied by **1e3**:

- **STD** → Required filter changes
- **HDR** → **Static configuration**
  → **PMT Saturation free**

3. PSB Prototype Beam Tests:
3.1 Identified issues and actions

- **Issue:**
  - Not operated since then → Glass Disk was slipping into the BWS holder.
  - Initial calibration table not valid anymore. Incorrect beam projections.
  - Data shown was corrected by software (but potentially biased by this effect)



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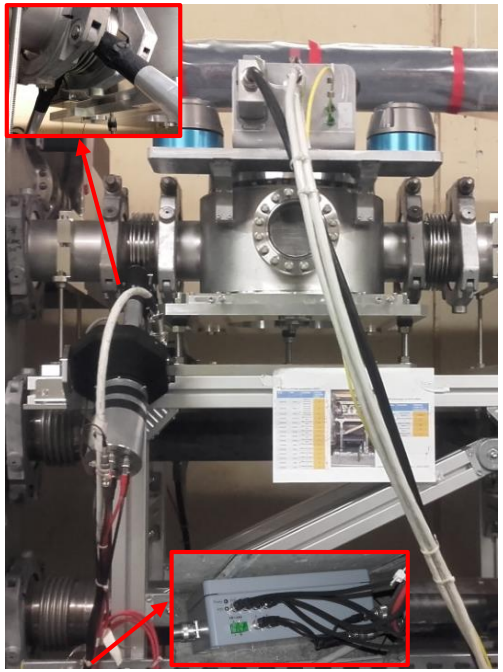

ICECAL_V3 FE detail

- **Actions:**
  - New BWS with improved disk holder is prepared to be installed on next TS (19/09/2017)
  - Scanner is under testing prior to installation → Calibration and performance assessment on optical bench.
  - Small Scintillators to be substituted by bigger ones → Expected Improved amplitude statistics.

end