WP19 CEM-GM-ICS FRAS meeting

IT String Test preparation status and readiness for installation

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Outline

IT String Test preparation status and readiness for installation:

- IT String installation, commissioning schedule and infrastructure readiness (Vincent)
- Alignment systems – mechanical supplies (sensors, supports, motorized adapters) (Michel)
- FSI optics (Clara, Mateusz)
- FSI acquisition system (Maciej)
- WPS acquisition system (Roberto)
- Software preparation status (Brad, Mateusz)
- Summary, questions

IT String

IT String schedule:

- Installation of jacks: Wk36/37 (first two weeks of September)
- Installation of HLS network and OF : Wk38/39
- Installation of Q2A and D1 : Wk39
- Installation of Q3 : Wk40/41
- Installation of CP: Wk41/42
- Limited access to mezzanine area during summer

- **All infrastructure and controls/acquisition systems (FSI, WPS, motion controls) should be installed and tested by end of September (ready for Q2A ad D1 installation)**
- **Software blocks necessary for sensor systems validation and motorized adapters commissioning tested and deployed by end of September**

IT String – schedule assumptions

FRAS on IT String Test:

- **Preparation of equipment**:

June	All cables controlled *WPS cable check in progress*
Sept.	All optical fibers controlled
Sept.	FSI acquisition system installed & controlled (July deadline for FSI rack kept)
Summer	WPS electronics installed & controlled
Summer	Motor control/command unit ready
Sept.	WPS ready for installation
Sept. -Nov.	WPS calibration installation
Sept.	HLS calibrated, qualified, ready for installation
Sept.	Other sensors calibrated, qualified, ready for installation
Oct.	Motor assemblies qualified, ready for installation

Vincent

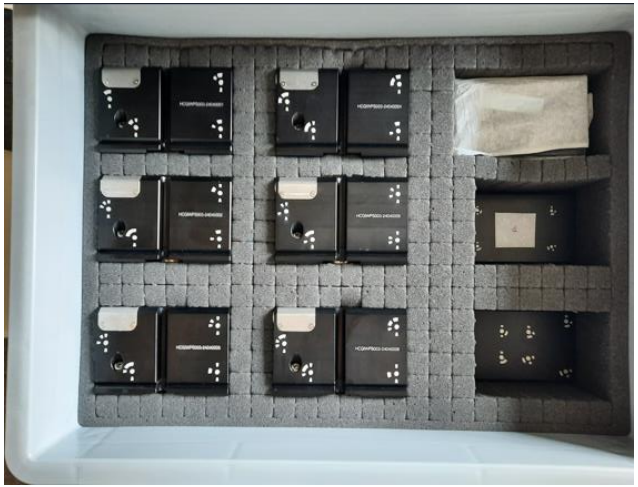
IT String – schedule assumptions

FRAS on IT-String Test:

- **Preparation of mechanical equipment and networks**:
  - Sept. • Wire protection and supports ready for installation
  - Sept. • Hydraulic network installed and validated
  - Sept. • Sensors supports ready for installation
  - Sept. • Stretcher and pulley solutions for WPS

- Commissioning
  - From Sept. • Component by component
  - March. • Full commissioning

Sensors and supports



- Design : Validated
- Procurement :
  - Sensors : In progress
  - Sensor supports : Available
  - WPS protection : In progress – Validation on the Collimator Mock-up
- Reception tests :
  - Reception tests (qualification and fiducialization) to be performed on each sensor before getting them ready for installation

Michel

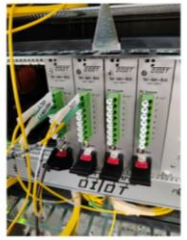
Actuators

- Design :
  - Under final test at SCT
  - Design update following all tests to be performed
- Procurement :
  - Procurement will be done with individual parts – Assembly at CERN
- Reception tests :
  - Load test to be performed using the HPA load bench
  - Full qualification test to be performed using the MRO bench

FSI Optical systems

Clara, Mateusz

- Rack ready for installation, layout prepared. All fibre connections defined
- Most of equipment for FSI rack IT String ordered. Still waiting for part of optical circulators. Lasers (IT String spare, 2xRAC3) arrived
- Modules assembly documentation done, but still some corrections to be added
- Assembly of 2x Optical Patch (Distribution) chassis and Main chassis will start by end of June (after assembly if Collaboration interferometers)
- Deployment and commissioning in rack foreseen in July/August. No delays expected
- Procedures for fibre installation and commissioning to be finalized as fibres fragility is an issue



FSI Rack layout

- 45U with top and bottom ventilation of 230V + DIOT Fan-tray
- Optical connectors → 4U to be installed by EN/EL (132ch)
- FEC Server→ 2U reserved.
- FSI Beam Conditioning → 3U
- FSI Optical Path 1 and 2 → 3U
- DIOT Crate 1 and 2 → 3U
- DIOT fan → 1 unit of 1U

U-Size (")	Rack Module	Dissipation	Estimation (W)
Top of the rack	TOP VENT		
1	Optical connectors		
2			
3			
4			
5	Cable tray		
6	GPU Server	20 W - Server power supply	500
7		70 W - GPU power consumption	
8		300 W - CPU+memory+Ethernet card	
9			
10			
11	Cable tray		
12			
13	FSI Beam Conditioning	18 W - Laser consumption	14
14			
15	Cable tray		
16	FSI Optical Path 1	20 W - EDFA	25
17		35 W - EDFA PS	
18		1.5 W - Power Meter	
19	Cable tray		
20	DIOT Crate 1	312 W - PSU	70
21		1 x 20 W - DIOT System Board + FMC	
22		8 x 5 W = 40 W- DIOT FSI photodetector module	
23	DIOT FanTray		
24	FSI Optical Path 2	20 W - EDFA	25
25		35 W - EDFA PS	
26		1.5 W - Power Meter	
27	Cable tray		
28	DIOT Crate 2	312 W - PSU	70
29		1 x 20 W - DIOT System Board + FMC	
30		8 x 5 W = 40 W- DIOT FSI photodetector module	
45 Bottom of the Rack	BOTTOM VENT	Total dissipation W	704

Maciek

FSI status on IT String

Component	Status	Meeting end-of-June deadline
GPU Server	• Ordered on April 4 with lead time 8-10 weeks (delivery 4-18 June) • Not received yet • Latest news from IT: Last missing component to be delivered by 14 June, shipment around the week of 17 June	• Delivery date not sure • Needs preparation before installation • Mid-July: realistic • End-June: potentially need to take server from SCT/CI space (interrupt tests/development)

DI/OT Photodet Board v3	• **16x PCBs:** 6 delivered, rest to be delivered this week (17-21 June)
	• **16x Front panels:** 6 delivered, rest not before beginning July (further delays likely)
	• **Assembly** to be performed (including writing the procedure)
		• End/Mid-July: realistic to have all
		• End-June:
		  • Assemble/install 6 Photodet boards only
		  • Assemble/install 16 Photodet boards by retrieving front panels from v2

Other hardware	• Received or in stock, except for interlock rely card (not priority)	• End-June: ok
GPU-based computation	• Full preliminary computation implementation expected by 19 June • David off 19.06-08.07	• End-July: realistic • End-June: use version from SCT
Acquisition	• New transmission ready since long • High data throughput to DDR of DI/OT SB has proven problematic (potential reason for sporadic problems in SCT) – mitigation by implementing data compression -> at a final stage (excluding decompressing)	• End-June: realistic
SW+GW+HW Integration	• Integration of new acquisition code, with new GPU computations and new transmission and adding decompression • To be done	• End-July: realistic • End-June: use version from SCT
Installation	• (to be) scheduled, install elements as the become available.	

Maciek

FSI status on IT String

- Delivery of FSI acquisition for IT String with 1s acquisition cycle for 128 ch
  - Initially planned for end-June 2024
  - Realistic: delivery by end-July (delay of 4-5 weeks)
    - Install hardware as soon as available
  - Unrealistic: delivery end-June
    - Contingency plans for delays of different components of the system
    - Implementation of contingency plans for delay of most components - unjustified overhead
- What is the impact of delivering FSI acquisition by end-July?
- An attempt to deliver FSI acquisition by end June
  - Not guaranteed success
  - High overhead/cost: interrupt other installations, additional work to disassemble existing stuff

HiLumi HL-LHC PROJECT

WPS Conditioner status (Electronics card)

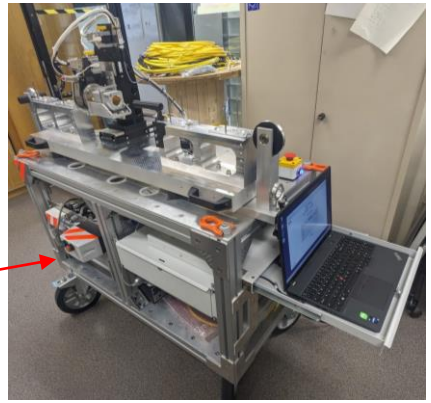
- IT String:
  - Design with ProAsic3 FPGA validated by design office (EDA-04908-V1), in process of production.
  - Estimated overall cost, including mechanical components 31700.20 EUR/ 35 = 905.72 EUR/board.
  - Delivery TBC – bare boards arrived, assembly in progress
- EMC Testing:
  - Postponed, due to damaged amplifier at EMC lab
- RAC3, HL-LHC (rad-tol) design:
  - Component ordering
    - FPGAs ordered in joint procurement with CEM
    - DC/DC converter modules ordered for exploration testing of best rad-tol candidate
    - Remaining components to be ordered once design finalized
  - Design updates
    - IGLOO2 FPGA power usage study
    - Tested replacement LDO (previously tested under radiation) for temperature stability under high load – working.
    - Received DC-DC Converter modules for component level radiation test, awaiting results to determine best candidate
    - In progress of re-routing the board for IGLOO2 FPGA + component replacements
    - To-do: update firmware of FPGA to be compatible with IGLOO2
    - Risk of delay – contingency: use IT string design for 1 year?

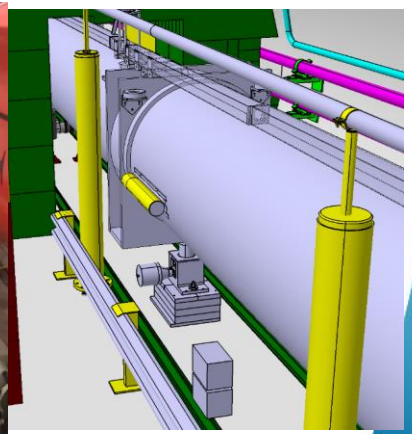
Roberto

WPS Calibration bench

WPS Calibration bench and software

- Bench:
  - All mechanical components assembled
  - Wiring completed
  - Small modification needed for start/stop button to be pushed back (awaiting component delivery)
  - Issue at point 2: bench does not fit – extra concrete block not present in 3d model. Trying to find responsible for it, to cut it/move it (note the metal barrier must always be temporarily uninstalled to move the bench inside)
- Calibration bench software
  - CEM-MTA software testing ongoing
    - Laptop preparation ongoing
    - Issue with incompatibility of Labview with win11 (blue screen of death), now resolved – BIOS setting
    - Integration with CMW for calibration in situ completed, but need full integration testing





FRAS Software

Brad
Mateusz

IT String – mandatory software parts to be deployed before September 2024:

- WPS Sensors: FESA – ready; SCADA – ready; NXCALS logging OK
  - Still some final updates and integration InforEAM calibration coef. required
- Inclinometer: FESA – ready (not yet released); SCADA – ongoing; NXCALS logging - OK
- HLS, Longitudinal sensors: FESA – ready; SCADA – ready; NXCALS logging OK
  - Still some final updates and integration InforEAM calibration constant reading
- Motor controls – single axis control:
  - FESA axis control – ready. Integration and tests of absolute resolver reading to be finalized
  - FESA control wrapper – in preparation
  - SCADA – not ready. SCADA wrapper of axis control to be finalized
- Environmental sensors (temperature, pressure, humidity)
  - To be derived from existing Unicos CPC/Survey FESA objects – FESA/SCADA ready, but updates and integration required
  - Specification (or driver) of Sambuca AI access required (?)

FRAS Software

Brad
Mateusz

IT String – safety functions implementation – summer/autumn 2024:

- Decision of simplification of final approach after discussions with Borja, Brad (https://confluence.cern.ch/display/FRAS/2024.05.29+FRAS+Software+Meeting):
  - Capacitive layer based on LGC (no new sensors needed); FSI – only rotation covered; Resolver – only relative simple calculations
  - Final descriptions of safety functions implementation – ongoing (Vivien, Mateusz). Capacitive – simplified LGC block
- Implementation of the safety functions – analysis and initial development ongoing
- The LGC capacitive PL prototype to be tested on collimator test stand

IT String – block motion control, diagnostic logic:

- Block motion control (grouping axis into component motion control abstractions) – specification to be prepared until end of July. Initial assumptions discussed with BE-ICS
- Diagnostic logic – discussed. To be implemented at later stage, when most of objects will be defined

FRAS Software

Brad
Mateusz

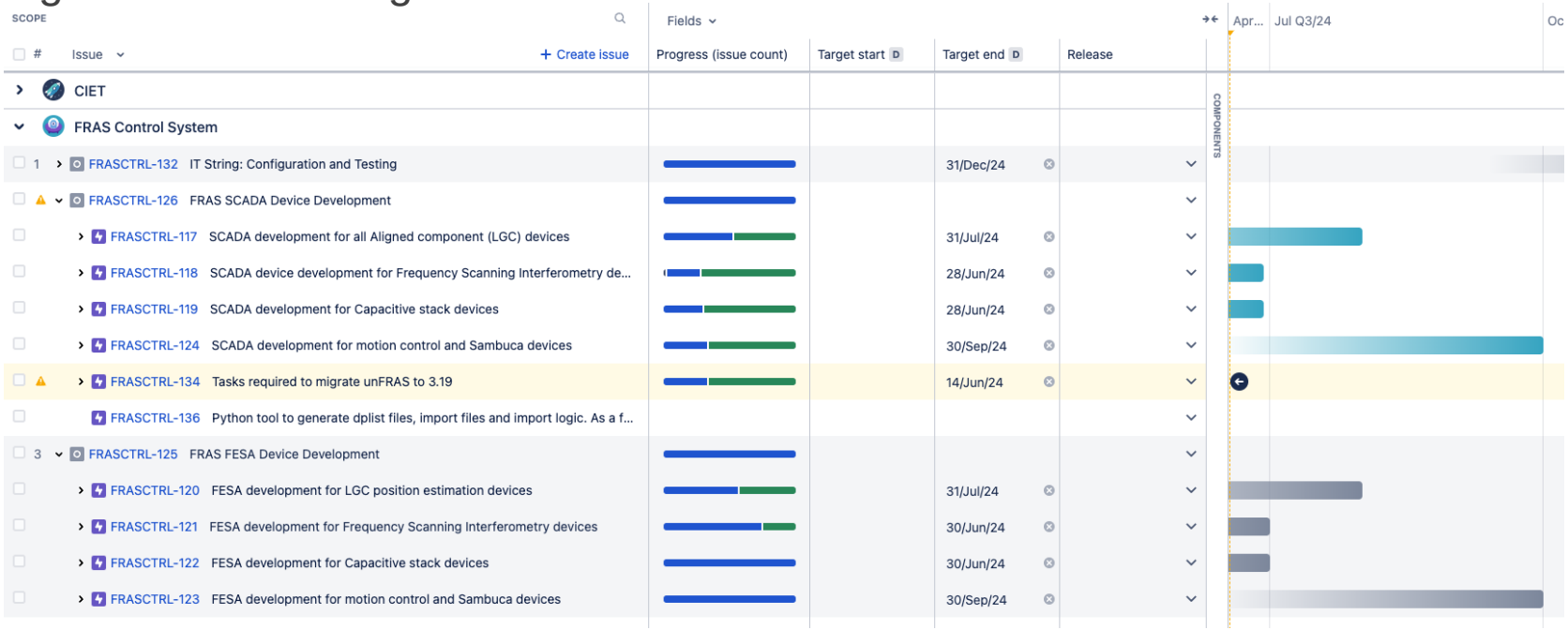
IT String – LGC implementation:

- LGC in external monitoring version operational with WPS, HLS. Tests with inclinometer should arrive soon
  - ‘LGC’ (main object); ‘Aligned objects’ – beta version ready and operational (FESA/SCADA). Data logged to NXCALS
  - ‘Bellow objects’ – development complete, validation pending
  - Housekeeping: will soon upgrade to FESA 8.5.0 to allow modern C++ compiler. This means GM-APC will not need to maintain a branch of LGC with old C++ compiler as was required up to now.
- LGC – magnets deformation and internal monitoring
  - **Deadline to implement deformations measurements and Internal Monitoring - end of 2024**
  - Some supplementary calculations (linear regression for cold mass deformation approximation) might need to be implemented by ICS
  - If until August/September 2024, clear solution will not be elaborated, then for the string tests we will need to apply simplified solution for now. Then in parallel final software options will need to be implemented having more time during 2025..2026
  - Difficult implementation of longitudinal sensor in LGC – APC proposed solution acceptable by HPA

Brad

FRAS Software

Software development now organized using Jira Plans. Target deliveries aligned with IT String deadlines.



Motion controls

Enrica
Mario

- Information on Sambuca racks layout for IT String. Especially we require information how/which rack the Sambuca FEC will be deployed to request the Ethernet/(other services needed by you?)
  - There will be two racks: YJPOS01, YJPOS02.
  - We need Ethernet (two connections per rack), and power supplies.
    Jerome and Vincent might already be in contact for this.
- Expected readiness of absolute reading of resolvers (also when we could be ready in SCT to perform safety layer tests prior to IT String)
  - This feature is already implemented, yet it needs to be tested against to the conventions that we discussed lately.
    It will be ready for testing at the SCT by the end of the summer at the latest.
- Timeline of rack equipment installation + relay box installation.
  - We could start the installation from October and be ready in Q4 this year for both.
- Commissioning requirements and interactions with other teams (time, help from us, etc) w.r.t. defined milestones
  - We can split the commissioning in three phases:
  - Phase 1: internal commissioning. We internally verify that the control system works as expected.
  - Phase 2: mechanics and control validation. We verify that the control systems work well with the mechanics too.
    It involves CEM and GM.
    Phase 3: High level software validation. We verify that the software works well up to the highest level. It involves CEM, GM, and ICS.

Thank you