WS Acquisition system, 29 and 30 Nov 2016, Lund

Minutes

Attendees:

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All the presentation and relevant documentation can be found on the Indico page of the meeting (https://indico.esss.lu.se/event/701/).

More details on the standard motion controller can be find at: https://ess-ics.atlassian.net/wiki/display/MCAG/Open+Source+Motion+Control

1. Mechanical design and installation

- The mechanical design of the MEBT WS was presented, comments were made on the in vacuum cable to connect the wire to the feedtrought, shielded cable is a preferable solution to avoid noise issue.
- The interface between the MEBT WS and the acquisition system is well defined; a particular attention on the signal cable installation should be made in order to avoid any issue while the WS is moving.
- The WS limit switches have been discuss (see following sections for more details), it is recommended that the position of the end limit switch(s) should be set in order to allow enough space for the acceleration/deceleration of the motor velocity.
- It will be a benefit to avoid gearing on the WS.
- Vibrations might be an issue to keep the WS actuator in the parking position without a brake, the solution shall be considered for the MEBT and cold linac WS.

- A proposal for the installation of a patch panel on the LWU has been presented, depending on the choice of the motor, the proposal might change to install a patch panel directly on the WS axis. ESS Bilbao will propose a similar solution for the MEBT WS.
- In the elliptical section, a fiber patch panel will be used to connect the WLS fiber to the clear fiber.

- The WS Analog Front End (AFE) must be install as close as possible to the wire. Radiation maps, downstream the warm linac, have been provided. It has been decide that in the cold linac the AFE module will be installed on the floor close to the LWU support (see Fig. 1), ESS Bilbao will look at a similar solution for the MEBT.

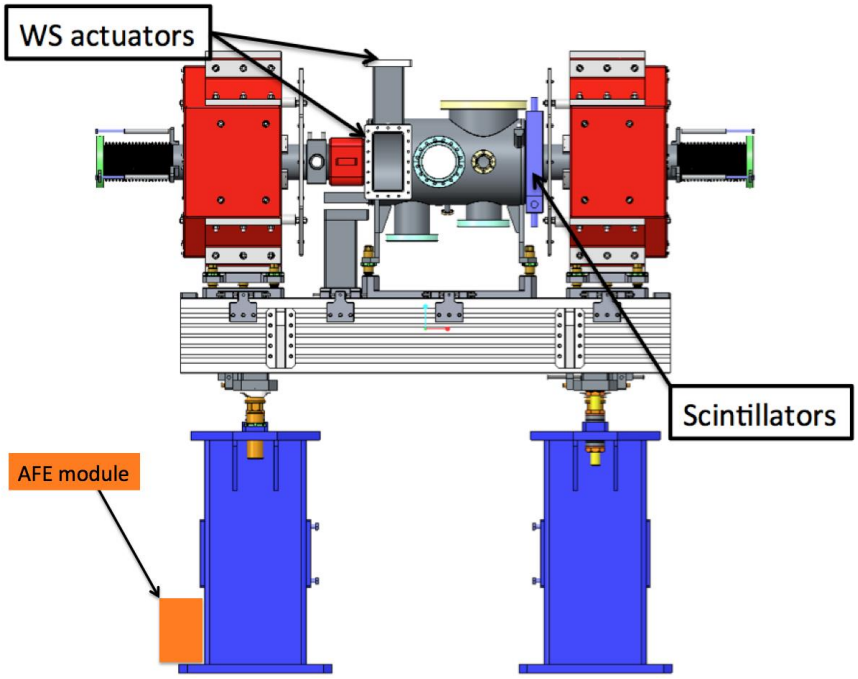

Figure 1 Position of the AFE module in the LWU, beam is going from left to right

- Additional shielding might be needed, it is the responsibility of ESS to study this option.

- The ESS cable database has been presented as well as the cooling scheme for the rack cooling. More details on the electronic rack can be found on the indico page of the PDR of the ESS Electrical Racks (https://indico.esss.lu.se/event/701/).
- It was found that the length of the cable is about 60 meters form the location of the WS in the tunnel to the rack in the klystron gallery. A particular attention on the cable shall be taken in order to avoid signal degradation.
- Due to the proximity of the RF waveguide, Elettra recommends to shield the signal cables in the stub to avoid interference.
- The cable will be certainly pull without connector, form the gallery to the tunnel. The connector will be installed in the tunnel, a test procedure should be considered to verify the pin-to-pin connection and the cable integrity.
- Elettra will pick up cables on the list provide by ESS and propose alternative if some specifications are mot met.

2. Motion control

- The operation of the WS was described, to insure good performance of the WS, the motor position and the signal from the beam shall be synchronized. The date can be time correlated after the measurement.
- The motion controller shall receive a trigger from the timing system in order to measure the wire position, moving at constant speed, at each beam pulse. The position data will available after the scan.

- Absolute position of the wire is not mandatory for the WS application, high relative accuracy is needed to meet the WS specifications, a resolver is enough to meet the specification and should be less sensitive to radiation
- Installing Precision limit switches and a linear encoder will be beneficial for the performance of the WS. Elettra proposed a resistive linear encoder for the WS application (ATEK resistive encoder LTM-V/LTM-A).
- The type of motor, brake, switches, encoder/resolver should be decided in the next months in order to choose the right motion controller module(s)
- Cable length of the cable (~60 meters) might be an issue for the motor and the resolver.
- The motion controller will be controlled with the CPU installed in the uTCA crate, as consequence the motion controller and the uTCA might be installed in the same rack

3. MPS and local protection

- The Machine Protection System (MPS) was presented as well as the protection function for interceptive device
- The strategy for the global protection was agreed, it requires on the WS system a limit switch dedicate for the MPS system. The protection logic will be centralized fro all interceptive devices (WS, EMU,FC, vacuum valves…)
-

A strategy for the local protection of the WS was discuss:

- Since the wire integrity checking is implemented in the AFE, the reliability of the functionality is too low due to the radiation environment, as consequence the functionality will not be interlocked
- In the cold linac, if the wire breaks, the remaining part of the wire will be far for the beam centre and will not interact with the beam. This statement shall be also confirmed for the MEBT WS.
- A failure of a WS, if the actuator is the parking position, will not cause machine downtime since the WS is not used during neutron production runs
- If the motor (or more generally the motion) of the WS fails with the wire inside the beam pipe, the MPS protection layer is enough and there is no need for extra layer of protection
- All the failure presented above, as well as the status of the different sub system of the WS should be used to define an health status of the WS on the software level. The status shall be acknowledge to the operator and to the Beam Interlock system
- In the cold linac, the WS consists in 2 separated axis moving in the same plane. An interlock must be implemented to avoid collision of the 2 axis. It has been proposed to install this interlock directly on the motion controller. For this an extra switch, marking the parking position, might be implemented on each actuator of the cold linac WS.

4. WS standard platform and software

- Elettra reports good progress on the software development with an emulator, the next step, to start as soon as possible, is to continue the work with a fully equipped uTCA crate and a timing generator.

- It was agreed that the prototype will be develop with a Struck digitizer board (see test report on the indico page) used for the ESS BPM application.
- Timing and support for the digitizer will be provided by ESS, drivers are already implemented and available for IK partner.
- The final version of the hardware will use an IOxOS FMC carrier board, small effort is expected to make the transition to this final board.
- The final digitizer is not chosen, a market survey will be perform in the next months to find good candidates (see action list).
- The specifications for the digitizer FMC are:
    - ✓ 4 channels FMC or more
    - ✓ 18/20 bits resolution
    - ✓ Sampling rate equal to 5 MHz
    - ✓ Low noise level (<<0.1%)
    - ✓ Single or differential input

- The motion controller with the final module is not available yet, but a lab set up with an integrated CPU can be sent to the IK partner in the next months.

5. Decisions

- Location of the AFE has been decided for the cold linac WS.
- Motor shall be equipped with a resolver
- Precision Limit switch and linac encoder should be installed on the WS actuator
- Local protection has been defined and should be implemented directly in the motion controller

Postponed decision:

- Need for a dedicated PLC for the WS application

6. Action list

- Implement timing on the motion controller (**MC group and ICS**), due date **31/01/2017**
    - ✓ Needed for time synchronization of the data

- Implement anti-collision interlock on the motion controller (**MC group and ICS**), due date **31/01/2017**
    - ✓ If this task is successful, the dedicated PLC can be removed

- Define motion control standard component for the WS application (**ESS, ESS Bilbao, Danfysik**), due date **15/02/2017**
    - ✓ Define the motor power and type
    - ✓ Define the type and number of switch need for motion control (excluded MPS switch)
    - ✓ Define the resolver
    - ✓ Define the encoder
    - ✓ Define if a brake is needed

- Define the MPS limit switch (**ESS protection group**), due date: **09/01/2017**

- Send a fully equipped uTCA crate with timing generator to Elettra (**ICS and BI**), due date: **02/01/2017**

- Send a motion control unit to Elettra (**ICS** and MC group?), due date: **01/03/2017**
  - ✓ *Final version*

- Choose the final FMC digitizer (**Elettra and BI**), due date: **01/03/2017**
  - ✓ ESS will contact CAENELS and ask for a modification of their pico ampermeter