

## Minutes PSB Upgrade WG Meeting 9<sup>th</sup> February 2016

**Participants:** S. Albright, E. Benedetto, A. Blas, F. Boattini, J. Coupard, L. De Mallac, J. Devine, G.P. Di Giovanni, A. Floriduz, V. Forte, R. Froeschl, G.M. Georgiev, G. Guidoboni, M. Haase, K. Hanke, D. Hay, M. Kowalska, B. Mikulec, A. Newborough, J. Sanchez-Alvarez, J. Tan, W. Weterings.

Agenda (<https://indico.cern.ch/event/492362/>):

- [1. Approval of Minutes](#)
- [2. Communications](#)
- [3. Follow-up of Open Actions](#)
- [4. Status of the PSB Transverse Feedback](#)
- [5. AOB](#)

### 1. Approval of Minutes

- The minutes of the last LIU-PSB WG meeting #166, available [here](#), have been approved.

### 2. Communications

- **Chamonix:**
  - The LIU session was very well received.
  - One of the recommendations was to make sure that the beam parameters between LIU and HL-LHC are matched.
  - A summary of the presentations done in Chamonix this year is planned for the beginning of March 2016.
  - Next meeting in Chamonix is planned for the 23<sup>rd</sup> January 2017.
- **Baseline 2016:**
  - The new baseline for 2016 is finally out and it includes the new work-unit about the work of DC cabling whose budget is estimated to be about 0.5 MCHF.
- **Beam Intercepting Devices:**
  - A meeting was held with M. Calviani and his team to review the planned work for EN-STI in the framework of the LIU-PSB project.
  - The list of items to be delivered by EN-STI will be reviewed sometime in June 2016.

### 3. Follow-up of Open Actions

- E. Benedetto on "Study collimation and losses in the PSB rings" → A document detailing the specification of the PSB scrapers after LS2 has been submitted for approval, <https://edms.cern.ch/document/1578463/0.1>. **Action Closed**
- F. Roncarolo/J. Tan on "Prepare a document for approval about the specifications for the H0/H- current monitor electronics." → J. Tan reported that the document will be submitted for approval by the end of this week. The specifications of the FESA class will be described in a separate document.

- F. Boattini on "Provide the specifications for the maximum operational current of the power converters of the upgraded MPS." → F. Boattini replied that several documents are in preparation. Some of them require additional simulation and will be submitted for approval later. B. Mikulec asked if there is a plan to prepare a document to describe the B-Train specifications. K. Hanke remarked that indeed during his talk in Chamonix L. Bottura asked to closely review the B-Train system for the LIU-PSB. → Open Action.

Assigned to	Due date	Description
M.Buzio	2016-04-15	Provide document describing the specifications of the B-Train system.

#### 4. Status of the PSB Transverse Feedback

- A. Blas presented the latest status of the PSB transverse feedback system, see [here](#).

#### SUMMARY:

- The PSB Transverse Feedback system (TFB) is mainly composed of a pick-up in Section 4L5 which measures the beam position and serves as an input to process a corrective force that is applied using a kicker located in section 3L1. The goal is to damp beam instabilities.
- **In the updated system it will be possible to combine digitally signals from external sources for tune measurements or for transversally exciting/blowing-up the beam (for optics and tune measurements).**
- **The updated PSB TFB is designed to damp transverse instabilities from 160 MeV to 2.0 GeV, with an intensity up to 2.5E13 ppp and a bandwidth up to 20 MHz.**
- **In the new TFB digital electronics the ADC is specified up to 105 MHz and 117 MHz would be required for the PSB. The board was anyway successfully tested up to 120 MHz.**

#### Activities Already Completed:

- The new PLC system and new water cooling distribution system is up and running.
- The new PSB electrical distribution was installed.
- The new OASIS system with multi-triggering acquisition for remote signal monitoring is already installed.

#### Ongoing Activities:

- Upgrade the control crates, which is expected by June 2016 (J. Betz/A. Dworak).
- Design and install a new digital loop processing circuit, which is planned for May 2016 (A. Blas).
- New FESA class and OP interface to be prepared by M. Jaussi by April 2016.
- **PSB TFB Power Amplifiers:**
  - **The design of the power amplifiers was originally targeted for 400 W and the person in charge will NOT be able to make it on time.**

- **A crash program was launched and the design was handed to M. Paoluzzi and his team. The deadline for the hardware readiness is currently set for July 2017.**
- **A prototype for 800 W already exists and it seems to perform well, but the current bandwidth at low frequency is 10 times lower than requested.** Once this issue is addressed, the PCB design and the chassis should be finalized.
- **The final production is 40 amplifiers blocks of 400 W.**
- **The deadline of end of July 2017 for the hardware readiness is close to the end of EYETS and it seems a very tight deadline. → Open action to clarify the deadline with M. Paoluzzi and his team**
  - A. Blas mentioned that the increase in power is not needed for the standard operation of the PSB TFB, but only for the optics measurements.

Assigned to	Due date	Description
M.Paoluzzi	2016-06-30	Provide feedback about the estimated deadline for delivery of the 800W power amplifiers for the PSB TFB. The current estimated date is July 2017.

- **The pickup head amplifiers require a new design and the availability is planned for December 2016.**

#### Detailed Description

- The PSB Transverse Feedback system (TFB) is mainly composed of a pick-up in Section 4L5 which measures the beam position and serves as an input to process a corrective force that is applied using a kicker located in section 3L1. The goal is to damp beam instabilities.
- **In the updated system it will be possible to combine digitally signals from external sources for tune measurements or for transversally exciting/blowing-up the beam (for optics and tune measurements).**
- The current PSB TFB damps transverse instabilities from 50 MeV to 1.4 GeV, with an intensity up to  $1.1E13$  ppp and a bandwidth (BW) up to 13 MHz.
- **The updated PSB TFB is designed to damp transverse instabilities from 160 MeV to 2.0 GeV, with an intensity up to  $2.5E13$  ppp and a BW up to 20 MHz.**
- In order to **fulfill the new PSB TFB requirements, two upgrades are crucial:**
  - **Increase of the power amplifiers from 100 W to 800 W.** This requirement came from the ABP Group in order to be able to measure the PSB optics. A similar increase in power implies **new power supplies, new power loads and new electrical mains distribution.**
  - Design and install **new PU head amplifiers.**
- Other approved upgrades are:
  - Install a PLC control system for the power parts and the new water cooling system.
  - Install an OASIS system.
  - Reshuffle the 14 electronic racks and upgrade the control crates, modules and interface to the operation.
  - Design and install a new digital loop processing circuit.
  - New FESA class and OP interface.

- The PSB TFB processing, for any ring and plane, works as following:
  - The PU receives the signal from the beam position, removes the offset from the closed orbit, introduces an automatic delay to compensate for the time of flight to the kicker and finally an amplification is applied.
  - Currently, given the short delay, the betatron phase is not adjusted for all the range of the tunes and an error up to 40 degrees is possible. **This possible mismatch in betatron phase will be addressed with the new digital system.**
  - In the new digital system it will be also possible to excite the beam. The **excitation is implemented as a sum of sine waves vectors whose harmonic numbers and amplitudes can be set independently, providing high flexibility in the configuration.**
  - A clock to tag the revolution time will be implemented. This feature is needed in case there is more than one bunch in the machine and one would like to excite one bunch without interfere with the other(s).
    - **This implies some compromise for the PSB as the ADC is specified up to 105 MHz and 117 MHz would be required for the PSB. The board was anyway successfully tested up to 120 MHz.**

### Activities Already Completed:

- The new PLC system and new water cooling distribution system is up and running, thanks to the work done by L. Arnaudon and his team:
  - Several new features are available such as leak detection, auto-shutdown electric valves, sensors for pressure, flow and temperature, pressure limitation.
- The new PSB electrical distribution was installed and now consists of 3-phases, while before was a single phase and installed under-floor. The work was done by R. Necca and his team.
- The new OASIS system with multi-triggering acquisition for remote signal monitoring is already installed (A. Radeva).

### Ongoing Activities:

- Upgrade the control crates, which is expected by June 2016 (J. Betz/A. Dworak).
- Design and install a new digital loop processing circuit, which is planned for May 2016 (A. Blas).
- New FESA class and OP interface to be prepared by M. Jaussi by April 2016.
- **The PU head amplifiers require a new design:**
  - To cope with higher beam current and radiation → The work is done in collaboration with the R2E team to estimate radiation dose and selecting proper components.
  - The simulations including the PU was done and the components and circuit topology selected.
  - Tests to evaluate the board with radiation-hard amplifiers has to be done to define the final PCB design.
  - The work is carried by A. Meoli and the **availability is planned for December 2016.**
- **PSB TFB Power Amplifiers:**
  - **The design of the power amplifiers was originally targeted for 400 W and the person in charge (R. Louwerse) will NOT be able to make it on time. → A crash program was launched and the design was handed to M. Paoluzzi and his team. The deadline for the hardware readiness is currently set for July 2017.**

- E. Benedetto remarked that a power of 800 W was requested the first time in 2013. A. Blas added that probably this may have been an unfortunate mis-understanding from his group as at the time they assumed it to be an option under study more than an official requirement.
- **M. Haase added that a prototype for 800 W already exists and it seems to perform according to the requested specifications, but clearly some additional work is needed to complete the design.**
- **The BW at low frequency for the current prototype is 10 times lower than requested.** Once this issue is addressed, the PCB design and the chassis should be finalized.
- **The final production is 40 amplifiers blocks of 400 W.**
- **K. Hanke and B. Mikulec commented that end of July 2017 is close to the end of EYETS and it seems a very tight deadline. → Open action to clarify the deadline with M. Paoluzzi and his team**
  - A. Blas mentioned that the increase in power is not needed for the standard operation of the PSB TFB, but for the optics measurements.
- **Additional worries come from:**
  - **The availability of the RF-CS team for the creation of FESA classes and OP interface due to lack of manpower.**
  - **Availability of the RF-IS team for the design and construction of power amplifiers.**

#### Questions:

- B. Mikulec asked if both TFB systems (old and new) are going to be available after EYETS, in particular given that the deadline for the power amplifiers to be ready is tight.
  - A. Blas confirmed that **the plan is to have both systems available and only after the new system is reliably working, the old one will become obsolete.**
- E. Benedetto asked if the production of the power amplifiers could be staged and new amplifiers could be added only when available.
  - A. Blas replied that while this would be indeed an reasonable solution this is not practical because once one has to combine the power amplifiers and the combiner is an impedance transformer and one cannot simply combine the power amplifiers as the output impedance will not be the requested 50  $\Omega$
- E. Benedetto asked if A. Blas is satisfied with the present accessibility of the tunes measurement which should serve as an input to the PSB TFB. A. Blas replied that the information available currently seems to be fine and anyway this is not a high-priority issue right now for the project.

#### 5. AOB

- The next meeting is planned for the 23<sup>rd</sup> February 2016.
- R. Froeschl reported that RP Group is discussing the beam parameters/material of the PSB scrapers after LS2 with the relevant experts. The material selected is graphite. It has to be checked with J. Hansen about the vacuum chambers and few additional details.
- K. Hanke mentioned that it was reported to him that the POPS is currently running in degrading mode and this looks a bit worrisome since a similar system will be installed for the PSB (POPS-B). F. Boattini replied that the information is incorrect as there were issues with

the POPS restart which were tracked back to a malfunctioning card. Once the card was replaced, POPS restarted functioning as normal.

- J. Coupard reported that the first part of the HST installation will be completed in the next weeks. W. Weterings confirmed it should be done by middle of March 2016.
- J. Coupard reported that the next LIU-PLI meeting (<http://indico.cern.ch/event/495754/>) will be dedicated to review the available and missing documentation to coordinate the activities during the technical stops.
- A. Newborough reported that there is an ongoing discussion with the Transport Group about the handling of BT.BHZ10 and BTM.BHZ10, as the magnets are slightly larger than requested by the Transport Group. A report by C. Bertone is scheduled for the next LIU-PSB WG meeting.
- J. Devine introduced a new fellow A. Floriduz working with him in the EN-EL Group.
- J. Devine reported that the order for the overhead containment protection system for the rack in BRF2 has been placed. D. Hay asked if the integration was done and J. Devine confirmed it is the case.
- E. Benedetto mentioned that there is an ongoing discussion with F. Roncarolo and the BI Group about the number of wires for the matching monitor to see if they can be reduced.
- B. Mikulec reported that the hardware checkout of the PSB machine started. And it is going well so far.
- W. Weterings reported that J. Borburgh mentioned he may need only 2 RF bypasses for the BSW magnets.
  - There will be no need for insulating flanges, but it should be enough to buy new flanges, which would require an additional budget of 25 kCHF.
  - On the other hand, J. Hansen already bought the needed vacuum equipment for the RF bypasses.
- G.M. Georgiev reported that during the YETS about 3000 cables were identified as obsolete and have been disconnected.
- **J. Tan raised the question concerning pulling cables for a possible Linac4 connection. Most of the beam instruments in BI Group have been pushed to deliver the hardware by end 2016. So the hardware will be available and the cables need to be pulled. K. Hanke agreed that it has to be clarified with the management the details of the readiness for end-2016, if this includes full cables connection or simply hardware readiness. → Open Action.**

Assigned to	Due date	Description
K.Hanke	2016-03-08	Clarify the details about the readiness for Linac4 connection if this includes pulling and connecting cables or only the hardware has to be ready to be installed.