Minutes PSB Upgrade WG Meeting 30th of August 2012

Present: K. Hanke, V. Raginel, B. Mikulec, A. Newborough, R. Froeschl, W. Bartmann, J-M. Lacroix, G. Mason, A. Sarrió Martínez, A. Perillo Marcone, P. Bonnal, R. Folch, P. Vojtyla, C. Maglioni, C. Carli, M. Calliani, V. Venturi, R. Losito, J. Tan, A. Bertarezzi, S. Sgobba, R. Garoby, B. Riffaud, P. Sievers.

Agenda:

1. Approval of Minutes

The minutes of the last meeting were approved.

2. Communications.

K. Hanke reported from the LIU meeting:

- For 2012, the spending are for most of the WP lower than the planned budget.
- It was asked to report any need of storage for large raw material during LS1. A. Sarrió Martínez said that part of BTM and BTY will need to be stored during the dismantling of the old PSB dump and the installation of the new dump.

3. Dump design presentation.

A. Perillo Marcone presented the design of the future PSB dump (see presentation). The assumptions on the beam parameters used for the design are conservative, the parameters of the NORMGPS beam are the most critical:

- *Max beam intensity*: 1E14 particles per pulse
- *Beam energy*: 2 GeV
- *Pulse length*: 0.94 us
- *Pulse period*: 2.4 s (1.2 s per cycle but dumped one out of two cycles)
- *Total Average beam power*: 13.35 kW
- *Min beam size (1σ, H x V)*: 13 x 13 mm
- *Max beam size (5σ, H x V)*: 169 x 177 mm (@ 1 GeV)
- *Yearly dose*: 5E19 particles
- *Life time*: 25-30 years

The new dump will be installed in October 2013 at the same location than the old dump. The limitations of space for the dump and the new shielding are 5m long and 1m diameter.

The material chosen for the dump is Copper C18150 (CuCr1Zr). Glidcop has a higher maximal service temperature, but costs twice more than the chosen Copper (37 k€). **It was proposed to run some tests at the service temperature on some representative samples provided by the suppliers.**

The shielding is in steel, care should be taken to prevent the corrosion between the copper of the dump core and the steel of the shielding. One should check what is the best solution between an anti-corrosion coating or stainless steel. As a rather large gap is foreseen between the dump core and the shielding, a third neutral material as spacer/support structure will solve the issue.

The proposed solution for cooling of the dump is forced air flow. The air velocity has to be around 10-15 m/s to obtain a cooling of 30 W/m^2.K, and Q has to be around 2000 m3/h to get a delta temperature inferior of 20°C.The air extraction solution is preferred to the air blowing solution because the air would be cooler at the front of the dump and the air flow coming out of the dump could be controlled, in both case the delta temperature of the air is around 17°C.

- Fan electronics must be radiation resistant if located close to the dump area.
- **Humidity of the incoming air is unknown. It could lead to condensation and then corrosion.**

Assigned to	Due date	Description	State	Result	
G.Mason	30-Sep-2012	Give a statement about humidity around the dump area	open		edit

- **The efficiency of air cooling and temperature of the dump core can be improved by optimizing the geometry (deeper fins, shaping of the front and the back of the dump core) and/or by increasing the mass flow of air (~300 W/m^2)**
- A spare fan would be installed in case of failure. **The Fan operation has to be linked with the safety interlock, it has to be switched off when the PSB is in access mode (to avoid flushing the people passing by the dump area with activated air). This should be discussed with responsible of the access system.**

The FLUKA simulations show that the relevant average deposited power in the dump is around 9.5kW and that less than 1.5kW escapes radially in the shielding. Reviewers asked to check that such a power in the shielding is not critical. Each pulse (NORMGPS) rises the temperature of the core of the dump (NORMGPS) by +12°C with a compression of around 25 MPa, and after 6 hours (steady state) the dump core reaches a temperature of 187°C with a compression of around 39MPa. The chosen Cu alloy allows a maximal temperature of 300°C and a compression of 200 MPa. It was said that deeper fins on the first 30 cm of the dump and a higher air mass flow would bring down the temperatures substantially, and lower temperatures are more comfortable for corrosion and fatigue. **The temperature of the dump will be monitored and**

has to be linked to the beam interlock system. If the ventilation fails an alarm or interlock must be raised. As the temperature has to be interlocked, the measurement sensor(s) must also be assured to be at the higher temperature location(s) and likely to be redundant.

It was also said not to forget about thermal shocks and vibrations. Although it will be possibly small and initially compressive, after some time the stress wave will propagate out radially and in the wake negative stresses will occur around the center.

It has to be checked by EN-STI whether the vacuum window at exit of beam pipe withstands the new beam parameters.

Assigned to	Due date	Description	State	Result	
A.PerilloMarcone	30-Sep-2012	Check whether the vacuum window at exit of beam pipe withstands the new beam parameters	open		edit

4. Cooling and Ventilation Constraints.

G. Mason presented the Cooling Constraints on the PSB dump (see presentation). The dump heat load after LS2 will be around 9.4 kW, but until then it will be less than 3.4 kW. CV proposed for the air cooling system an Air Handling Unit (filter & fan only) with an approximate size of 600 W x 600 H x 900 L, the preferred solution for CV is the extraction solution. Some issues are still open:

- Identify a location for the AHU, possibly ducted in from somewhere more accessible than the dump area.
- The pressure drop needs to be kept at a realistic value of <200-300 Pa to be able to specify low fan speeds for higher reliability.
- Spare units may be space prohibitive.
- The additional heat is released into the tunnel and must be managed by the existing ventilation system, but it needs to be checked at least for the time between LS1 and LS2. The PSB ventilation system will be renewed during LS2.

5. Radio Protection Constraints.

R. Froeschl presented the Radiation Protection Constraints for the new PSB dump (see presentation).

- To reduce the dose rate on ground level above the transfer tunnel to ISOLDE, the RP recommendation is to replace at least the 2 last concrete rings of the shielding with Iron/Steel or Copper.
- Activation of the dump core: copper and standard stainless steels are roughly equivalent from the RP point of view, so the decision should be driven by the performance and costs.
- Activation of the shielding:

    - Shielding rings directly surrounding the dump should be made of Copper/ Iron/ Standard stainless steel.
    - To reduce the dose rate to intervening personal, the first ring towards the tunnel should be made of Concrete or Marble.
- Air activation:
    - The extracted air will be blow into the tunnel. It has to be checked how the air from the dump will be extracted/distributed into the tunnel.
    - **Currently the main contributor to the air activation is the passage of the beam from the beam pipe to the dump. RP should provide the number on the current air activation.** To reduce the air activation, a beam pipe could go from the dump to the beam window.

Assigned to	Due date	Description	State	Result	
R.Froeschl	30-Sep-2012	Provide values of the current air activation in the dump area to P. Vojtyla	closed	RP report under HSE approval	edit

The next LIU-PSB meeting will be held on Thursday 13th of September at 10h30 in 865-1-D17

-- VivienRaginel - 07-Sep-2012