Summary on Discussion on Screens for the Linac4 Dump Line and LBE Line

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1. Base Line

The aim of this discussion has been to continue the communication between the beam dynamics simulation and the beam instrumentation parts on the requirements and constraints for the screens, which shall in future measure the beam sizes as input for the emittance measurements in the Linac4 dump line and in the LBE line. For each line three screens are required. Two out of these six must provide a resolution of 50 um, while the remaining four screens need a resolution of 200 um. Readout cameras must be selected accordingly.

2. Screens and Readout System

In order to meet the required specifications standard CHROMOX screens (chrome doped aluminum oxide) can be selected. Previous studies have shown that the beam pulse length must be limited to about 100 us to avoid a melting of the screen material through the impact of the beam on the screen.

As the signals from these screens are emitted isotropically, a mirror system can be installed to allow for a convenient positioning of the readout cameras. For the latter it is planned to buy commercial equipment coping with the required resolutions. Given the parameters for resolution, radiation-hard objects can be chosen to avoid too frequent interventions.

Concerning information on the level of radiation and back-scattered particles at the positions where the screens and cameras are planned to be installed, simulations studies are on-going in the beam intercepting devices group. R. Chamizo should be contacted for details.

A single screen comprises typically an array of 300x300 pixels. For all emittance measurements beam sizes of less than 1 mm must be scanned with the screens of 50 um resolution. Hence, even including some steering errors a full beam size can be measured along the direction of interest, i.e. horizontal/vertical beam size for horizontal/vertical emittance determination, with an array of 300 pixels. However, at the same time the orthogonal transverse plane becomes significantly larger (up to almost 10mm (RMS) in the most extreme case). This will most probably not fit into an array of 300 pixels. Additionally, not only for the 50 um-screens but also for the second 200 um-screens the beam sizes for the plane not of interest for emittance determination could maybe be problematic as well (at least for the Linac4 dump line). **Therefore, further discussions on that topic are needed to find a solution.**

3. In/Out Mechanism

During the beam sizes measurement only one monitor may be placed in the beam at the same time. Otherwise upstream located monitors would distort beam size measurements (or any other kind of beam diagnostics) downstream. Hence, each single screen must be retractable. Operating times between 1s and 10 s for moving the screen into or out of the beam can be achieved. However, any very fast system creates vibrations on fragile material like bellows etc., which might cause them to break, so that a ppm-operation could have the draw-back of less reliability and could require more interventions.

For standard operating conditions a fast system is not needed, while for the commissioning phase a system with an operating time of a few seconds (significantly less than 10s) is appreciated. A ppm-system does not seem to be required, but the beam dynamics group should be consulted to finally answer this question. The time for moving the screens mainly determines the deadtime for measurements and should be reported to adapt the interlock-system accordingly.

It was additionally noted that the beam instrumentation in the transfer line between Linac4 and PS Booster is also not capable of ppm-operation. Therefore, similar information for the interlock-system (dead-time,

maximum allowed beam pulse length, etc.) should be provided as well.

4. Support Structure

The support structure will be designed and fabricated by the BI-team. This allows to build a decent system respecting all kinds of requirements like cables for signal routing between screen and camera, shielding of equipment etc.

5. Time-Line

The design of the a system (screen, camera and support structure) is estimated to take about six months, while for all fabrication also six months should be reserved (conservative assumption).

-- ThomasHermanns - 19-Apr-2010

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