Linac4 Beam Coordination Committee - Meeting 6 held on 20 October 2009

Present: Oliver Aberle; Giulia Bellodi; James Billen; Pierre Bourquin; Christian Carli; Rocio Chamizo; Frank Gerigk; Klaus Hanke; Thomas Hermanns; Alessandra Lombardi; Stephan Maury; Bettina Mikulec; David Nisbet; Uli Raich; Suitbert Ramberger; Federico Roncarolo; Carlo Rossi; James Stovall; Michael Struik; Giovanna Vandoni.

1. Minutes of the last meeting

The minutes of the last meeting have been approved with the following changes:

T. Zickler explains that the steerer for the DTL is smaller because it has to provide only a small correction field. In other intertank areas where the required integrated field is much higher, the aperture is smaller and the magnet is longer in order to deliver the required field strength.

K. Hanke remarks that for the pick-ups so far 0.1 deg phase resolution have been assumed; this has been in the specs elaborated by the Beam Instrumentation Working Group, and this figure has also been presented at the diagnostics review as well as at the general.

2. Follow-up of action items

Since the last meeting, T. Zickler and K. Hanke provided updates to actions as recorded in a file attached to the agenda.

3. Measurements program and user specifications for the movable test bench (G. Bellodi)

The user specifications for linac4 test bench diagnostics are described in the EDMS document 1004908. For the commissioning scenario a list of required transverse and longitudinal measurements has been described. On this basis the layout has been defined as being composed of two sections: a straight beam line and a spectrometer line. Apart from measurements of the energy spread, the spectrometer line will be used for average energy and RF point setting in complement to a TOF technique (and thus providing calibration of the pick-ups). The lines consist of a retractable slit, a halo and a bunch shape monitor on the straight line, and a bending dipole and two quadrupoles in the spectrometer line. Several beam current and beam position monitors (pick-ups) are distributed on the lines as required, with SEM grids and dumps at the end of each line. The length of each of the lines is close to 4 m. The dumps have to be designed with accident scenarios in mind. In particular if the control over the quadrupoles is lost, the beam size could go down to 5×5 mm. However interlocks should stop the beam line after 3-4 pulses.

3.1. Discussion

K. Hanke asks if the pick-ups on the test bench are different from Linac4. U. Raich responds that they are different as the requirements are different; the pick-ups on the Linac4 have to fit in the available tight space. The design dimensions have a direct influence on the device parameters e.g. the resolution. The design of the Linac4 units is still in progress.

S. Maury asks if the dump is a special design and likewise not the one of Linac4.

G Bellodi replies that the dumps for the diagnostics test bench are dedicated ones, hence their design will be different from the main Linac4 dump. For commissioning use the inline dump will see the full beam, whereas the dump at the end of the spectrometer line would only see either a pencil beam (with slit retracted) or a beam with reduced intensity (when the slit is inserted) and could be thus built to less tight specifications. However, since the spectrometer line might be used for some laser wire testing experiments, the same specifications (as for the inline dump) will be adopted for both. U. Raich comments that for testing the laser wire scanner, the full beam would be required.

B. Mikulec asks which interlock system would be used as the Linac4 interlock system would not be available yet. C. Rossi comments that a local dedicated interlock system would be used.

U. Raich comments that the Feschenko monitor will be delivered with a Labview software to be used on the test stand. The idea is to rewrite this software for a Linac4 installation in case the device should be installed permanently (in the dump line after the PIMS) however the electronics will be chosen from the beginning to be compatible with our control system. The software needs to be adapted in order to make the system reliable and compatible with the other monitors. G. Bellodi comments that it remains to be checked if the Labview program is ok for the commissioning measurements. U. Raich further mentions that the emittance scanner would not be installed in the Linac4 and can thus use Labview without any foreseen rewrite.

Concerning a preliminary list of software applications required for commissioning, K. Hanke would like to know what the purpose of the general purpose dual parameter scanner is. G. Bellodi responds that this would be an application to display correlations between any 2-3 variables (for example showing how LEBT transmission varies as a function of the solenoids settings through a value scan). K. Hanke remarked that he needs a complete list of software requirements with dates in order to be able to make sure that all is developed in time.

Action: Software requirements need to be defined with K. Hanke (**G. Bellodi**).

S. Maury would like to know the minimum intensity of a pencil beam that could be measured. U. Raich comments that this depends on the instrumentation that would be used. For SEM grides this could be very low but has to be checked in each case as EMC interferences next to quads could limit this value. As a reference on Linac3, beams down to ~40 μA can be measured. Pick-ups are more critical for intensity measurements.

4. Movable test bench: mechanical design and magnets (C. Rossi)

The schedules and configurations of the beam line for the different test bench locations has been presented as well as measurement techniques that should be tested in preparation for Linac4 commissioning. The dipole magnet will be provided by a collaboration with CEA and CNRS while the required quadrupoles will be spares of the Linac stock. The study of the integration has shown points of interference in several locations; the interference with the transport area is probably acceptable as the test bench is the last element in the line however the slit arm and the dipole magnet interfere with the cable trays. The orientation of an arm for the movable slit should be checked and changed if possible.

4.1. Discussion

D. Nisbet asks how the movable test bench would be transported. C Rossi responds that this is under study with the transport section. The two main girders would probably be transported separately. One particular issue is the off centre gravity of the dipole magnet.

5. Movable test bench: instrumentation (U. Raich)

Based on the layout the instrumentation is discussed. The drawings of the pick-ups are basically ready and currently the 0.1 deg phase resolution is under study. Beam physics data are used as excitation for a study with CST particle studio. The resulting induced voltages on the pick-up plates are fed into a simulation of the electronics. It turned out that a 20 deg RMS bunch length as would be found on pick-up 1 can be resolved whereas an 80 deg RMS bunch length as on pick-up 3 cannot be resolved anymore. The drawings of the pick-ups shall be approved by the end of 2009 and all devices should be ready by the end of 2010.

The transformers will have a beam pipe made of ceramics. 4 layers of shielding as EMC measure are foreseen. The transformers will have a 100 ns resolution. The Feschenko monitor is being built by INR, Moscow. The design has been checked at CERN and no interferences have been found. The emittance meter and SEM grid is currently installed on the 3 MeV test stand and consists of a slit and grid in two tanks that can be separated depending on requirements. The emittance meter will be installed only for a short time and dismantled after the commissioning. A re-design of the slit part is needed because of the higher energies (up to 12 MeV) the slit will have to withstand as compared to the source where it is currently installed. It would be important to know if the in/out-mechanism is required as this could considerably reduce the mechanical interference. The halo monitor is the most advanced design as it is ready and was tested with beam. A take-over of responsibility for this equipment still needs to be organised within the BI group.

5.1. Discussion

G. Vandoni requests that the pumping ports would be checked. It would be better to concentrate pumping where there is particular outgassing, e.g. close to the Feschenko monitor.

Action: The integration of a pumping port on the Feschenko monitor shall be studied (**U. Raich**).

S. Maury asked why an in/out mechanism would be required on the SEM grid. U. Raich responded that in principle one could have a fixed SEM grid as it is located at the end of the line, but as tests with full beam were envisaged, he prefers to install the in/out mechanism in order to protect the SEM grid from higher intensities.

C. Rossi asks if the CDD approval procedure would also be used for drawings in BI. U Raich responds that this is the case.

6. AOB

Concerning the progress of the design of the intertank areas, A. Lombardi informs us that the steerer of the intertank area between the DTL cavities 2 and 3 has to be of a stronger type than is currently foreseen which might have repercussions on the general design of this area. As the pick-up might not fit into the steerer, the area might

have to be extended by one cell length using an additional EMQ with a pick-up inside. The area is still under study.

Suitbert Ramberger

Next meeting: Tuesday 17 November, 16:00, room 354 1-001