

11th Meeting of the LHC Beam Cleaning Study Group 24.4.2002

Present: *R. Assmann (chairman), I. Baishev, L. Bruno, H. Burkhardt, E. Gschwendtner, J.B. Jeanneret, V. Kain, R. Schmidt, J. Wenninger*

1) Discussion of relevant scattering processes of protons in the collimator material

I. Baishev presented an informal discussion of scattering processes in the collimator jaws. Those scattering processes are of crucial importance for the prediction of cleaning efficiency. We are using two different program routines (STRUCT and K2) for simulations.

Igor pointed out that momentum loss is a very important result of scattering and originates mainly from single-diffractive scattering. dE/dx is much smaller and can almost be neglected at top energy. The slides from Igor will be put on the web for reference, once they have been scanned.

H. Burkhardt suggested a basic comparison between the code from Igor and GEANT4 results. HB and IB will follow up. R. Assmann and D. Kaltchev are working on comparing cleaning efficiency as predicted with K2 and STRUCT scattering routines. R. Schmidt asked about surface roughness. I. Baishev commented that this is not included in the scattering routines.

2) Preliminary look at LHC collimator survival (L. Bruno and M. Sans)

L. Bruno presented very preliminary results on collimator survival in case of a pre-trigger of one LHC dump module. In this case about 15 LHC bunches would impact over a 5 sigma 1-D stretch of the collimator. L. Bruno and M. Sans looked at 1.5 m long Be and C jaws, pointing out that Be can absorb more energy than C (specific heat) but softens above 300 degree Celsius, so it cannot be used at higher temperatures. In comparison C can be used up to 1000 degree Celsius. The mesh for the calculation was set to 0.1 mm or 1/3 sigma. This is sufficient.

The material response for the considered jaws was calculated. Thermal conditions were OK for the considered failure scenario (collimators would not melt). However, for mechanical considerations the temperature rise from beam impact is too high. Both for C and Be the jaw length should be reduced to about half (0.75 m) in order to possibly ensure collimator survival.

This is only a first indication; further studies on detail material damage (shock waves) are required. In particular, it must be considered that the beam impact is very close to the surface and the heated material could cause serious jaw surface deformations or even blow-out of material. Thermal-mechanical studies on the stress close to the surface must be done.

There is no manpower in SL/BT to perform the additionally required studies. To perform the presented studies required already a special effort. The slides are on the web.

3) AOB

R. Assmann presented the y - y' distribution of the tertiary halo after the betatron cleaning insertion. It will be used for preliminary studies of local beam losses (longitudinal distribution, BLM signal). This work is ongoing with V. Kain and E. Gschwendtner.

R. Assmann mentioned the worry from the recent e-cloud workshop that the scattering processes in the collimators could be a source of a strong local electron cloud. This effect is predicted to cause 30% of the e-cloud global wakefield in the SNS.

J.B. Jeanneret asked about the recent report on dump failures at the MPWG. R. Schmidt and J. Wenninger reported on the following failure rates (minutes on the web):

Total dump failure	Once in 100 years
Pre-trigger of one dump module	More than once per year
Asynchronous dump	More than once per year
Internally triggered dumps	28 per beam (56 total)

4) Next meeting

Next meeting will take place 10h30 December 12th, 2001. B. 112, 4C17.