Approval of SPS prototype: geometric collimator impedance

Approval criterion: consider SPS prototype in OPEN position

- heat load should be small (i.e., well below cooling capacity) for all beams to be circulated in the SPS after summer 2004,
- effective coupling impedances should be small (negligible) compared to the rest of the SPS impedance.

We consider only geometric collimator impedance, since resistive wall impedance is negligible in open conditions.
Results refer to a 2 mm lateral gap between collimator jaws and tanks.
The contact resistance of the RF contacts will be reviewed separately.

Assuming SS for tank walls and back side of the jaws, and collimator in open conditions, simulations with GdfidL indicate a maximum power loss of about 100 W for an LHC type beam with nominal bunch spacing and intensity, filling half of the SPS ring.

The highest total beam current to be circulated in the SPS (CNGS beam) corresponds to about 5 LHC bunch trains, filling slightly less than half of the SPS circumference. Therefore the previous heat load provides an upper bound for the CNGS beam, having longer bunches (and smaller bunch spacing).

To obtain an upper bound for the impedance, consider collimators in closed position (2.6 mm full-gap). GdfidL simulations are being performed for collimators in open position. The broad-band longitudinal impedance is found to be $Z/n \sim 1\,\mathrm{m}\Omega$, i.e., completely negligible compared to the rest of the SPS impedance (several Ω). The broad band transverse impedance is estimated to $135\,\mathrm{k}\Omega/\mathrm{m}$, also negligible compared to the rest of the machine. The real longitudinal impedance due to narrow resonances (trapped modes below cut-off frequency) is estimated to be about $30\,\mathrm{m}\Omega$.

In conclusion, we can approve the installation of the SPS collimator prototype from the point of view of the geometric impedance.