Dynamique de faisceau pour le réglage Low-alpha

As a noteworthy consequence of the optics change, degraded performances with respect to the nominal optics are expected in terms of injection efficiency rate and beam lifetime.

As the injected beam position amplitude ranges around -9 mm, the on-momentum dynamic aperture stays at the limit. It has been demonstrated that the limitation of the dynamic aperture is due to the 4th order coupled resonance $3\nu_x+\nu_z=69$ (Figure 1). Then, the correction of the betatron coupling to zero has been performed during operation.

Moreover, the rotation of the beam in the longitudinal phase space during the injection process makes the off-momentum transverse acceptance especially critical. The one sigma injected beam from the Booster (σ_L = 28 mm) requires after a ¼ of a synchrotron period a +2.4 % energy acceptance. Figure 2 shows the inadequate off-momentum transverse dynamic aperture, which leads to a measured injection rate of 20 to 25 %. The 6D energy acceptance, calculated along the ring, is limited to ± 1 % (Figure 3).

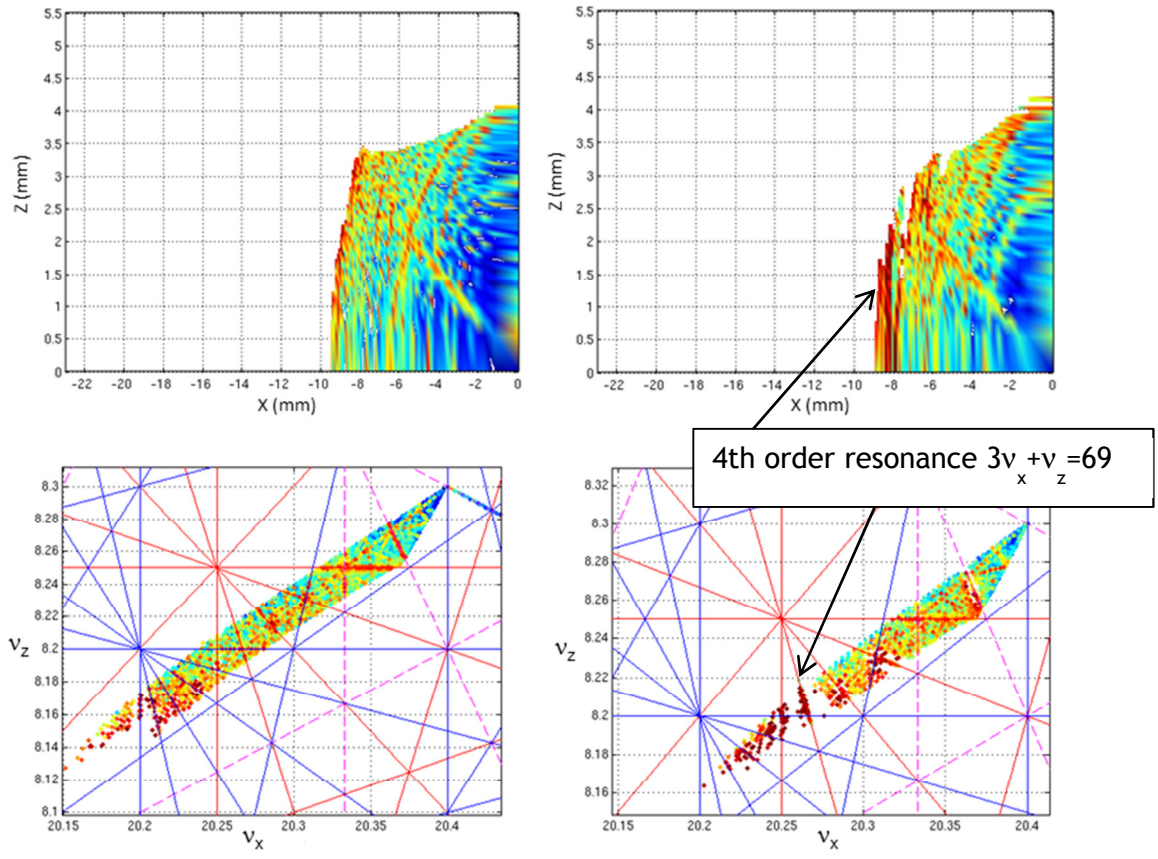

Figure 1: On-momentum dynamic aperture (top) and frequency map (bottom) calculated at the injection point for the low-alpha optics (TRACY III code). The betatron coupling is zero (left) and 0.8 % (right).

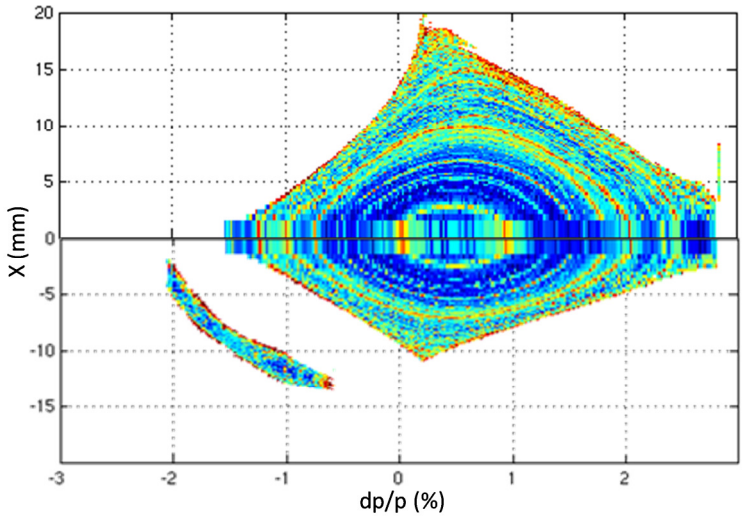

Figure 2: Off-momentum 4D-dynamic aperture calculated at the injection point for the low-alpha optics (TRACY-III).

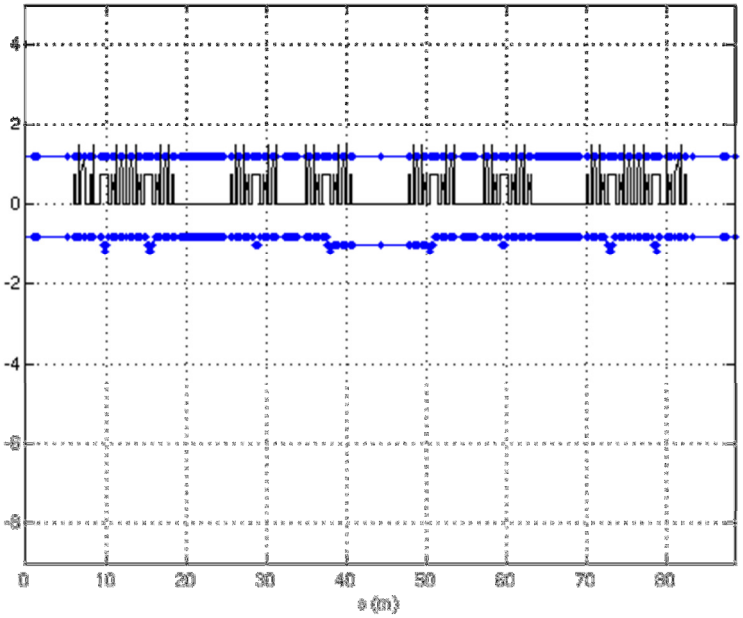

Figure 3: 6D energy acceptance (%) calculated along one super-period of the ring for the low-alpha optics (TRACY-III).