Contribution ID: **73** Type: **not specified**

A new lattice for the beta-beam decay ring to enlarge the stability limit

Thursday, 4 August 2011 14:30 (15 minutes)

The beta-beam concept relies on the production, by beta decay of radioactive ions of a very high flux, of an electron neutrino and anti-neutrino beam towards a distant detector. After production and acceleration in an accelerator complex consisting of a rapid cycling synchrotron, the CERN PS and the CERN SPS, the radioactive isotopes are injected into a long racetrack-shaped ring, called the decay ring, where they orbit until they decay or are lost. The required intensities to store in the decay ring to reach the aimed neutrino fluxes are very high. Among the collective effects, the head tail effect, caused by transversal resonance impedance, is one of the main issues: the beam was shown to be unstable with the previous decay ring lattice.
To mitigate these effects, we reduced the transition gamma by removing the injection from the arc to put it in a chicane located in one of the long straight sections. To make an amplitude detuning by inserting octupoles in the lattice could increase the stability limit. But the cost is a reduction of the dynamic aperture. After presenting the new lattice with a smaller transition gamma, we shall discuss about the needed octupoles for an amplitude detuning and their impact on the dynamic aperture.

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Session Classification: WG3 Accelerator Physics