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**An early beam separation scheme for the LHC \***

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**Abstract :**

The high nominal luminosity of the LHC requires a large number of bunches spaced by about 7.5 m. To prevent more than one head-on collision in each interaction region, a crossing angle of 0.285 mrad is necessary. A side effect of this crossing angle is the increase of the effective transverse beam cross-section, thereby decreasing the luminosity by some 16%. For the LHC upgrade, depending on the focusing scenarios, this loss significantly increases and largely offsets the potential gain of a stronger focusing. In this paper we analyze a strategy to circumvent this difficulty, based on an early beam separation using small dipoles placed at a few meters from the interaction point, deep inside the detectors. This allows quasi co-linear head-on collisions at the crossing point only. From the beam dynamics point of view, the essential constraint is to control the long-range beam-beam interactions in a scenario where the normalized beam separation is not constant. In this paper the criteria of the analysis and the performance improvement obtained with the scheme are discussed. The strength of the dipoles is estimated as well as the impact on the detectors structure.

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