US LHC Accelerator Research Program
PS2 Task Sheet - Electron Cloud

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The PS2 design presents significant challenges owing to the high current expected in the LHC upgrade program. Preliminary electron cloud build-up studies have been performed at LBNL starting in 2006, and were presented at the LUMI2006 and ECL2 workshop (CERN, 2007), as well as at the LARP meetings CM9 and CM10. The preliminary conclusion is that the ecloud effect may be strong, and is quite sensitive to the bunch spacing scenarios contemplated for the LHC complex upgrade. In addition, there are indications of a sensitivity to the vacuum chamber radius, which may influence the RT/SC option for the PS2.

We propose the following ecloud tasks for the PS2:

1. Refine assessments of electron-cloud build-up (4 person-months)

2. Assess the need to combine space charge with electron-cloud effects in the simulation effort. Assess the feasibility of combining the corresponding simulation codes (2 PM).

3. Explore parameter space, especially those impacting the choice RT vs. SC magnet technology (4 PM)

4. Compare electron-cloud build-up physics at the PS2 against the proposed FNAL Main Injector upgrade. A simulation effort for the MI upgrade was initiated in late 2006, and a number of assessments have been carried out. The comparison between these two machines is likely to shed light into the ecloud build-up dynamics because the two machines are on opposite sides of the Gröbner multipacting condition (3 PM).

5. Assess impact of electron-cloud on the PS2 beam. Start with the quasistatic approximation and gradually extend it to 3D self-consistent simulations, including effects from space-charge, gas desorption and its ionization (12 PM).

6. Assess electron-cloud mitigation mechanisms, such as low-SEY coatings, grooved chambers and clearing electrodes (4 PM).

7. If the above studies indicate a single-bunch instability induced by the electron cloud (as is the case for the present-day SPS), then design and propose a broadband feedback system to mitigate the instability (4 PM).

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