# Electron cloud meeting #70, 20/8/2019 (indico)

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## Effect of e-cloud magnetic field on proton and electron motion (L. Giacomel)

Lorenzo presented his investigation on the validity of the quasi-electrostatic model for the simulation of electron cloud effects.

- For this purpose he implemented an extension of the PyECLOUD particle in cell module (based on PyPIC), which computes the electromagnetic potentials using the fact that the electron pinch is translating rigidly along the beam pipe (see CERN-ACC-NOTE-2019-0033).
- It is possible to compute the electromagnetic potentials in a boosted frame translating rigidly with the beam. This simplifies significantly the problem, as in this frame the sources and the fields are stationary. Therefore both the scalar and the vector potentials are solution of Poisson problems. These can be computed with the existing solvers in PyPIC.
- Lorentz transformations are then applied to compute the potentials in the lab frame and from these the electric and magnetic fields are computed.
- The motion of the electrons is computed using the Boris tracker. The tracker implemented in PyECLOUD had to be generalized to include the effect of a longitudinal magnetic field.
- Test simulations have shown that the quasi-static approximation has no visible impact on the results when compared to the newly implemented electromagnetic solution.
- In particular it is observed that the magnetic component of the Lorentz force on the electrons is smaller by orders of magnitude compared to the electric one.
- Concerning the force acting on the beam particles, it is possible to show analytically that it is simply proportional to the gradient of the scalar potential. This condition has been directly verified in the numerical implementation as a crosscheck. The simulation also shows that the other terms are quantitatively small.
- The study confirms that the quasi-static model is completely appropriate for e-cloud simulation studies (within the range of beam and machine parameters of interest for CERN).

## Follow-up on Furman-Pivi simulations (G. Iadarola and E. Wulff)

G. Iadarola presented a follow-up on the simulation studies with the Furman-Pivi model. The work has been performed by E. Wulff before leaving CERN.

- We performed simulation studies introducing “rediffused electrons” (see presentation by E. Wulff at EC meeting #68) in our usual surface model
- Rediffused component is introduced in the emission energy spectrum minimizing side-effects on other surface properties (SEY curve shape).

The impact on the heat load and on the SEY threshold is visible but not huge.

- For realistic SEY (<1.4) the non-monotonic dependence of the heat load on the bunch intensity is still present both in dipole and quadrupole magnets.