E-cloud simulation studies for the 16L2 region

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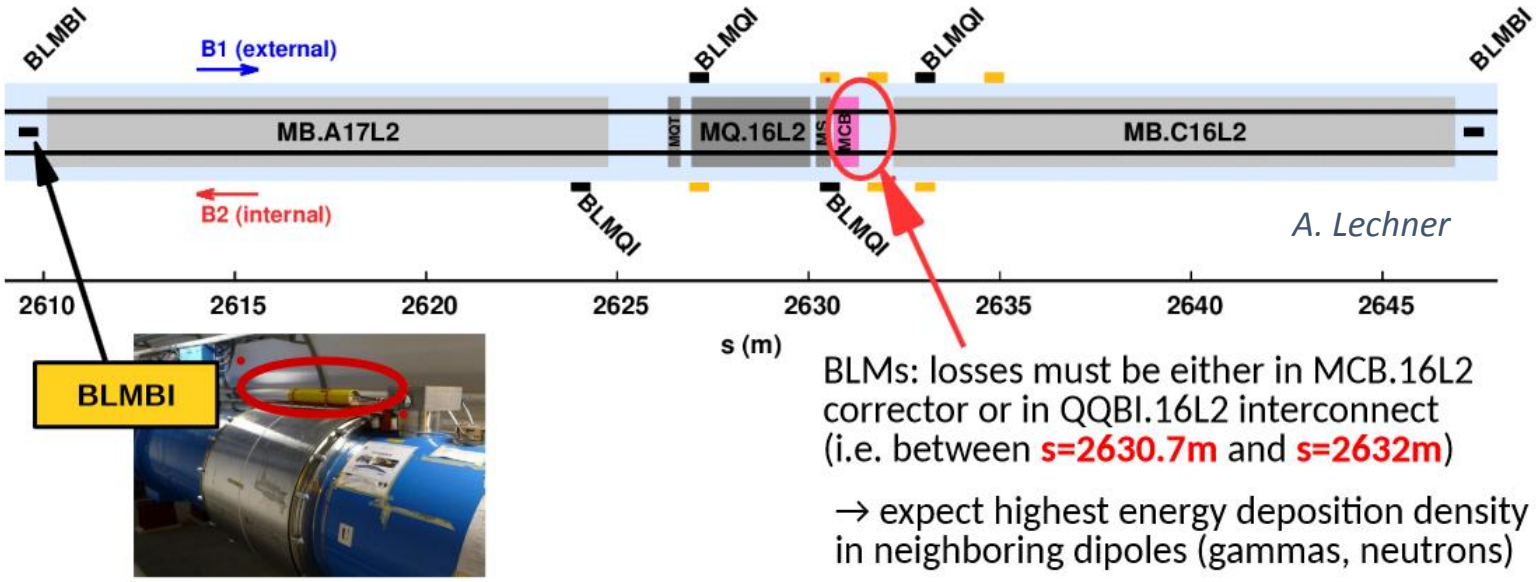
The “sensitive” region

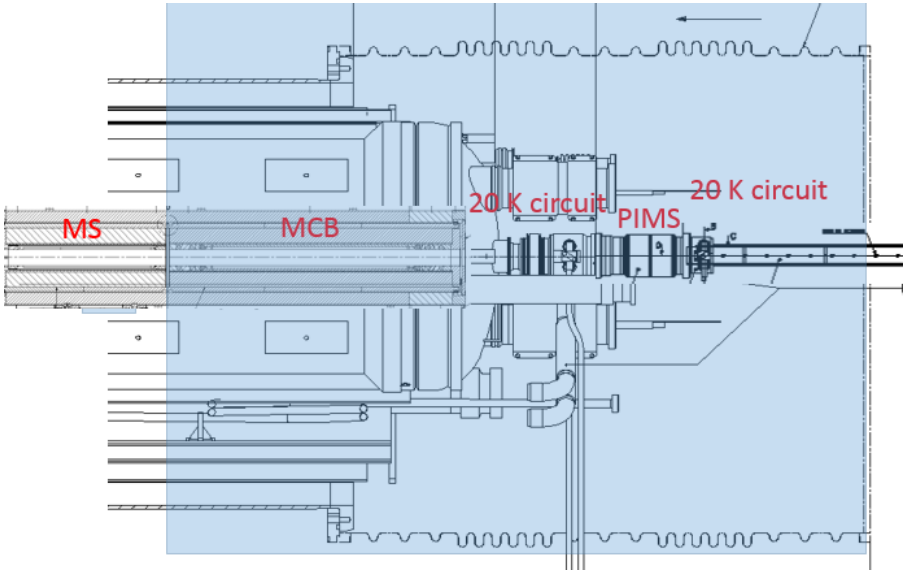
Most likely we have “frozen air” on the cold surfaces → flakes can de-touch and interact with the beams (losses, instabilities)



A. Lechner

BLMs: losses must be either in MCB.16L2 corrector or in QQBI.16L2 interconnect (i.e. between **s=2630.7m** and **s=2632m**)

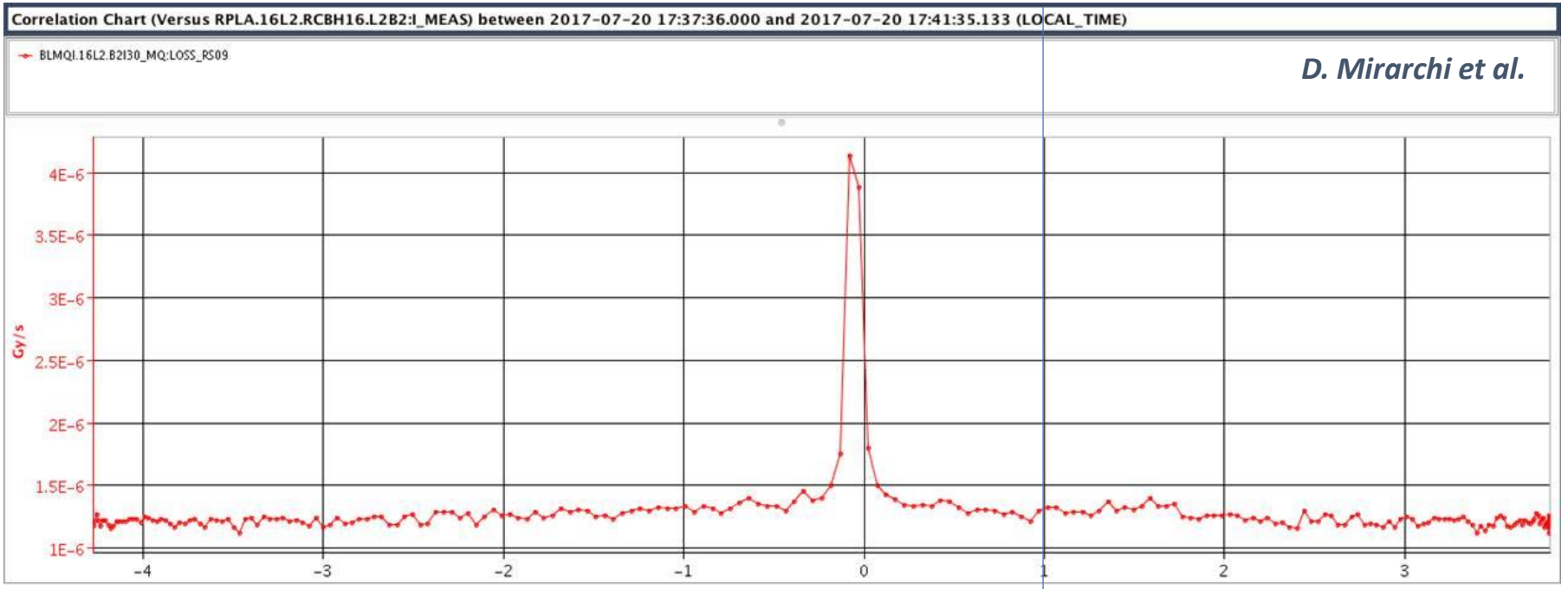
→ expect highest energy deposition density in neighboring dipoles (gammas, neutrons)



From B. Salvant
@ ABP Information Meeting

Effect of the dipole corrector

Before the beam screen “flashing” a dependence of the losses on the current in the nearby dipole corrector was observed

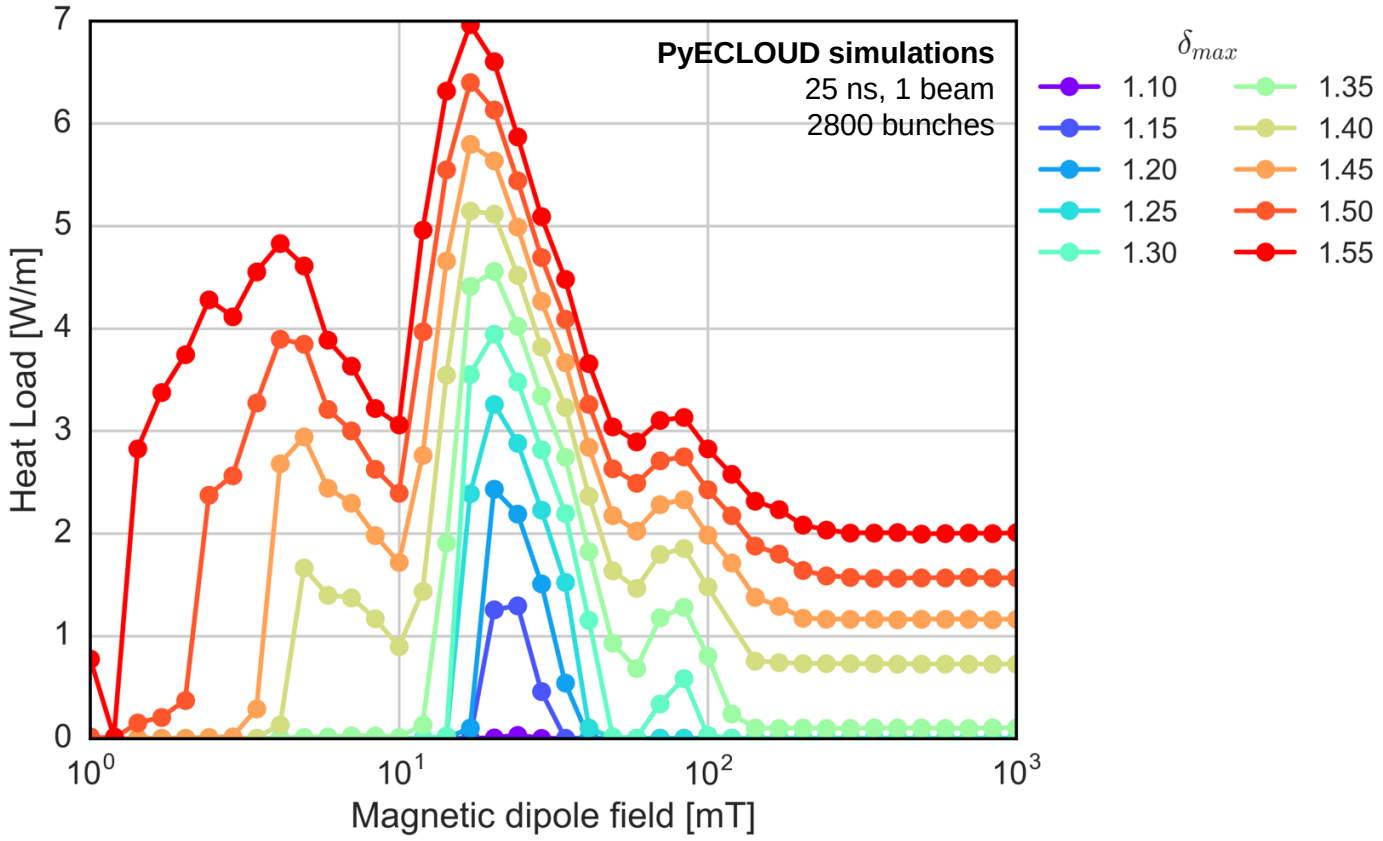


I_{MCB}= 1 A
B = 50mT

Simulation study #1: dipole corrector scan

Do we expect an impact of these small fields on the e-cloud buildup?

→ **YES**

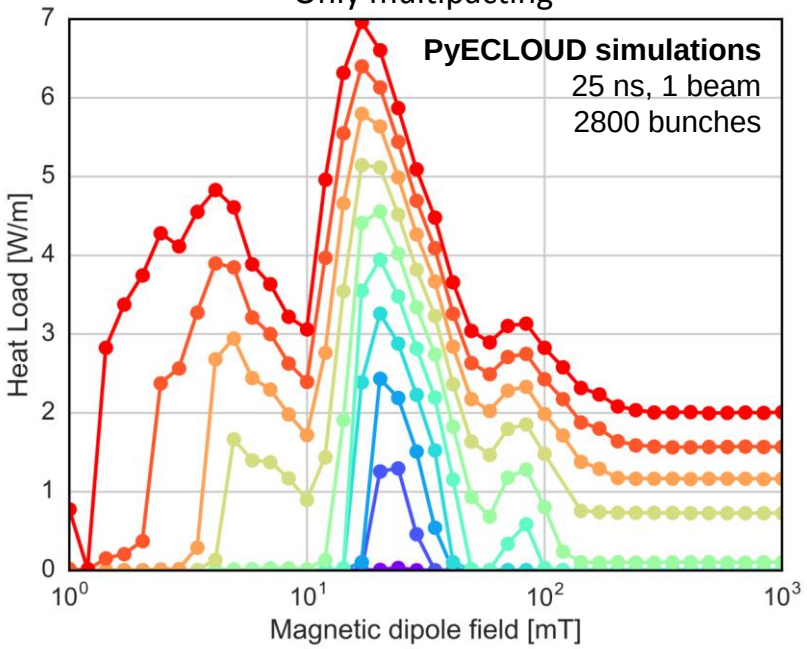


Simulation study #2: dipole corrector scan (photoelectrons)

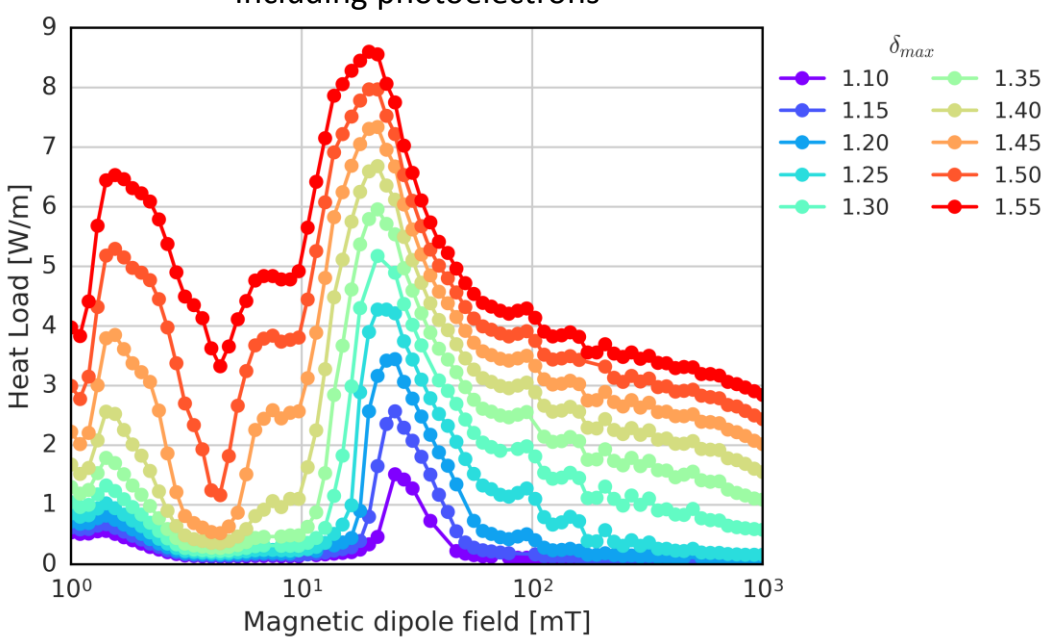
Does the situation change in the presence of photoelectrons?

→ **Mainly for low currents**

Only multipacting



Including photoelectrons

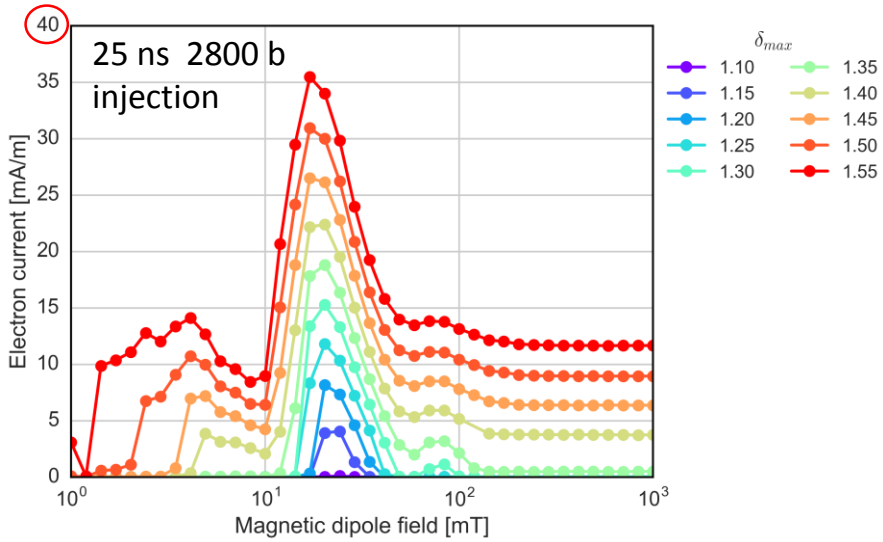


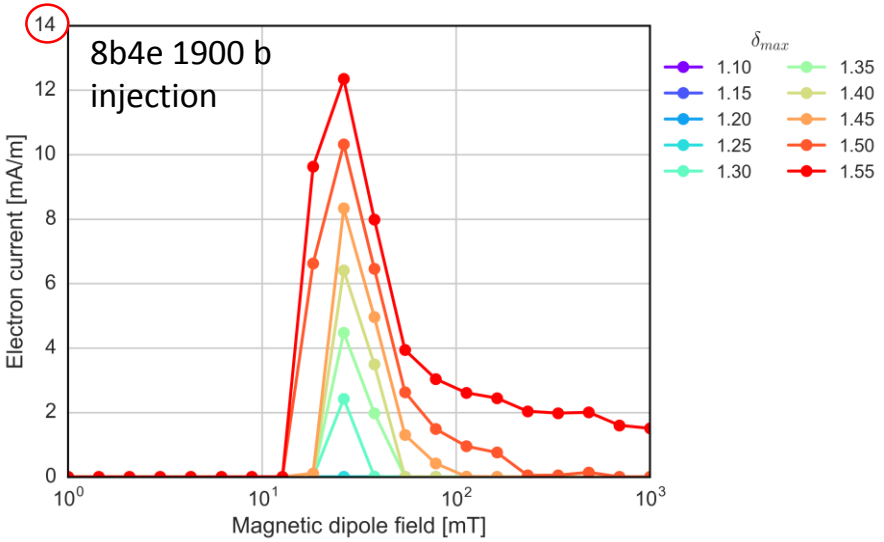
Simulation study #3: dipole corrector scan (8b+4e)

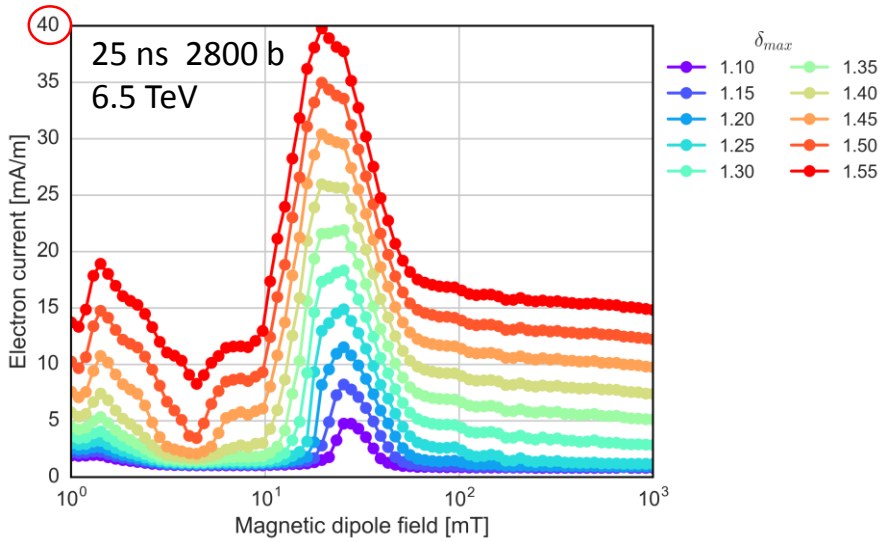
What happens with the 8b+4e scheme?

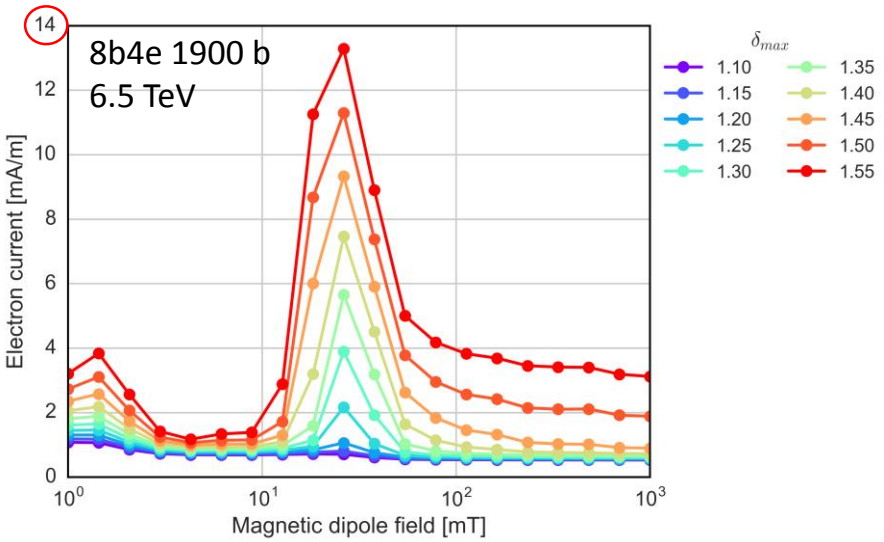
→ **The effect is significant**

→ **A clear improvement is observed also in the machine (e-cloud might have a role in the process, by charging the flakes?)**





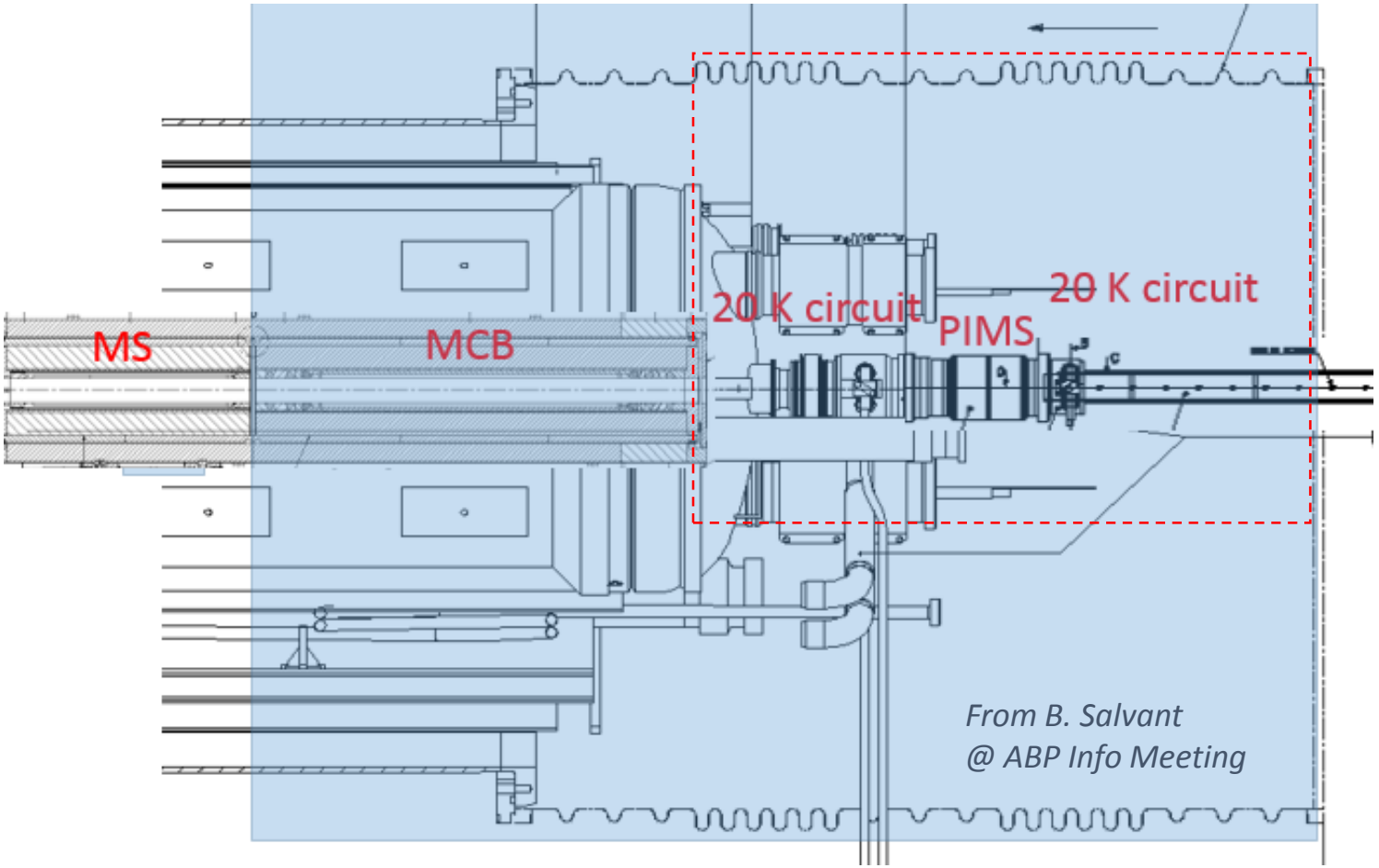




After the flashing

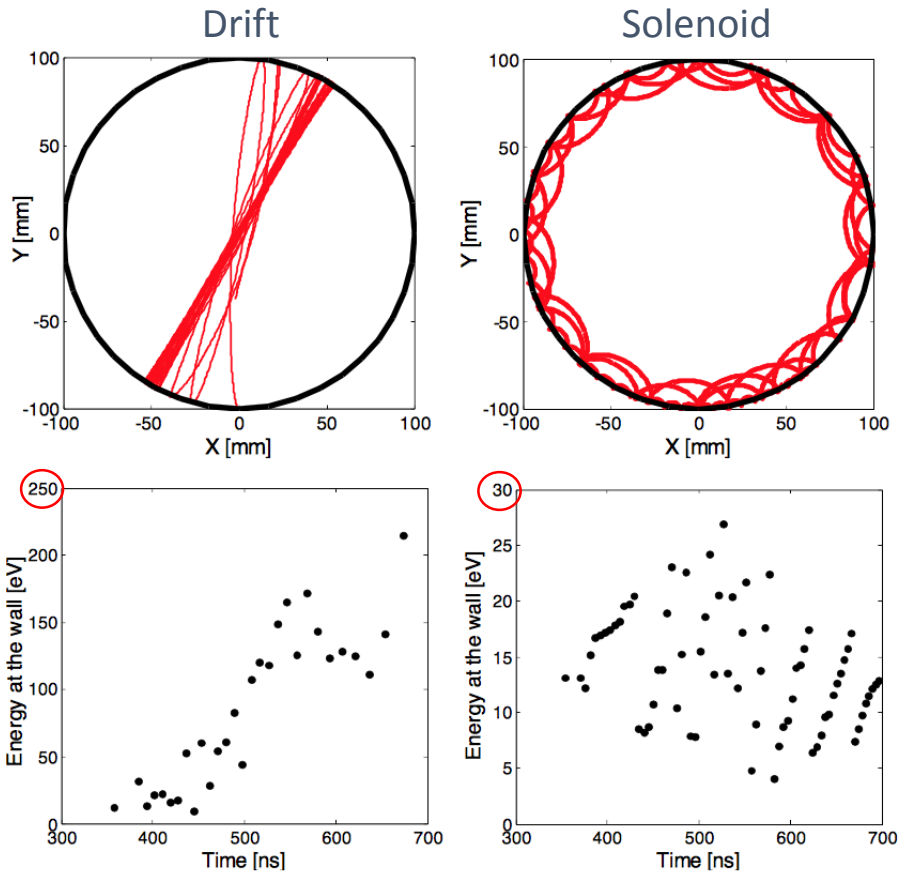
After the “flashing” of the beam screen situation became worse and the effect of the corrector became much less visible

- → Air possibly moved to the interconnection region (which might have stayed cold during the “flash”)
- → It is a drift region, can we mitigate the e-cloud there by installing a solenoid around the cryostat?



E-cloud suppression by solenoidal field

- Widely used technique (also at SPS and LHC).
- Principle: deflect secondary electrons bak on the surface before they are accelerated by the next bunch passage



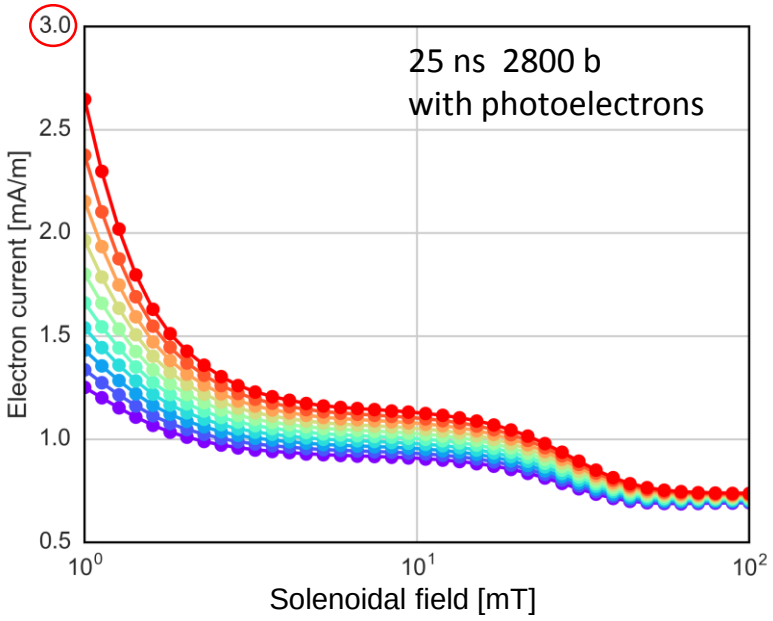
From L. Wang et al, "Solenoid effects on an electron cloud"

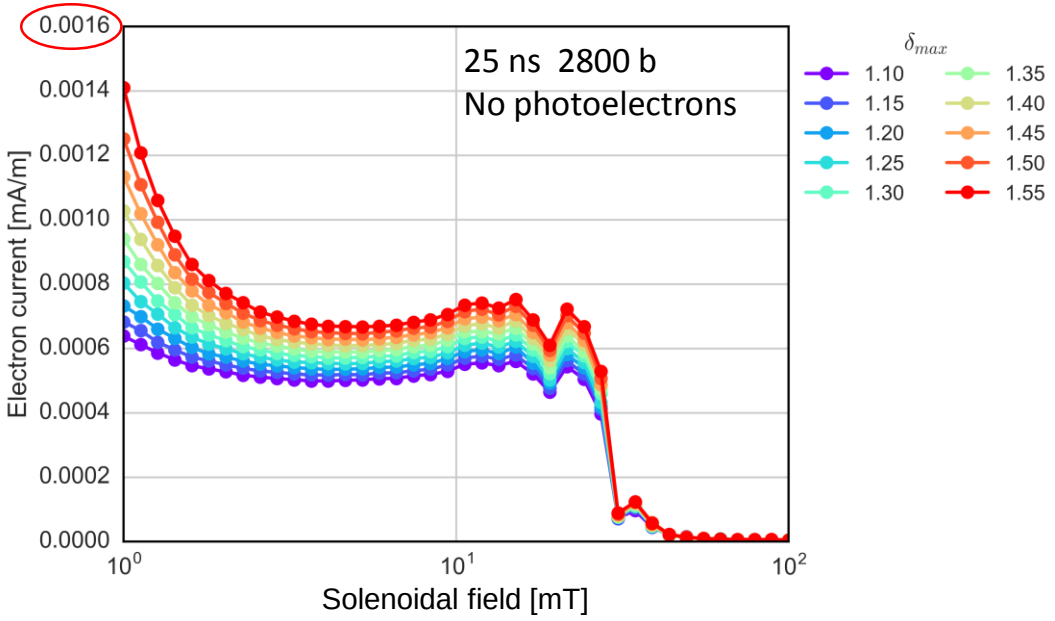
- Solenoid field ($|B_z|>0$) could not be simulated with the present "optimized" Boris tracker in PyECLOUD
- Needed to revive and test an older, slower but more general implementation (done by Philipp and Annalisa) still present in the code (but sleeping since a long time)

Simulation study #4: effect of the solenoidal field

What longitudinal fields do we need to suppress the e-cloud?

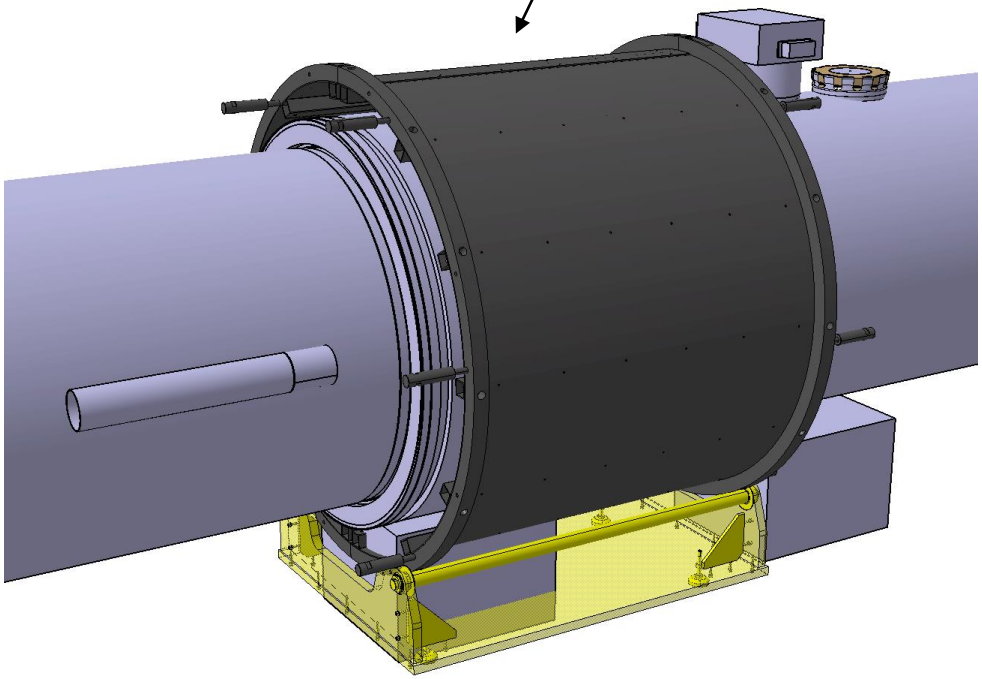
→ 5-10 mT to have a significant reduction (achievable with a resistive air-cooled solenoid)





Proposal and feasibility study

rotating aluminum support structure, in two halves



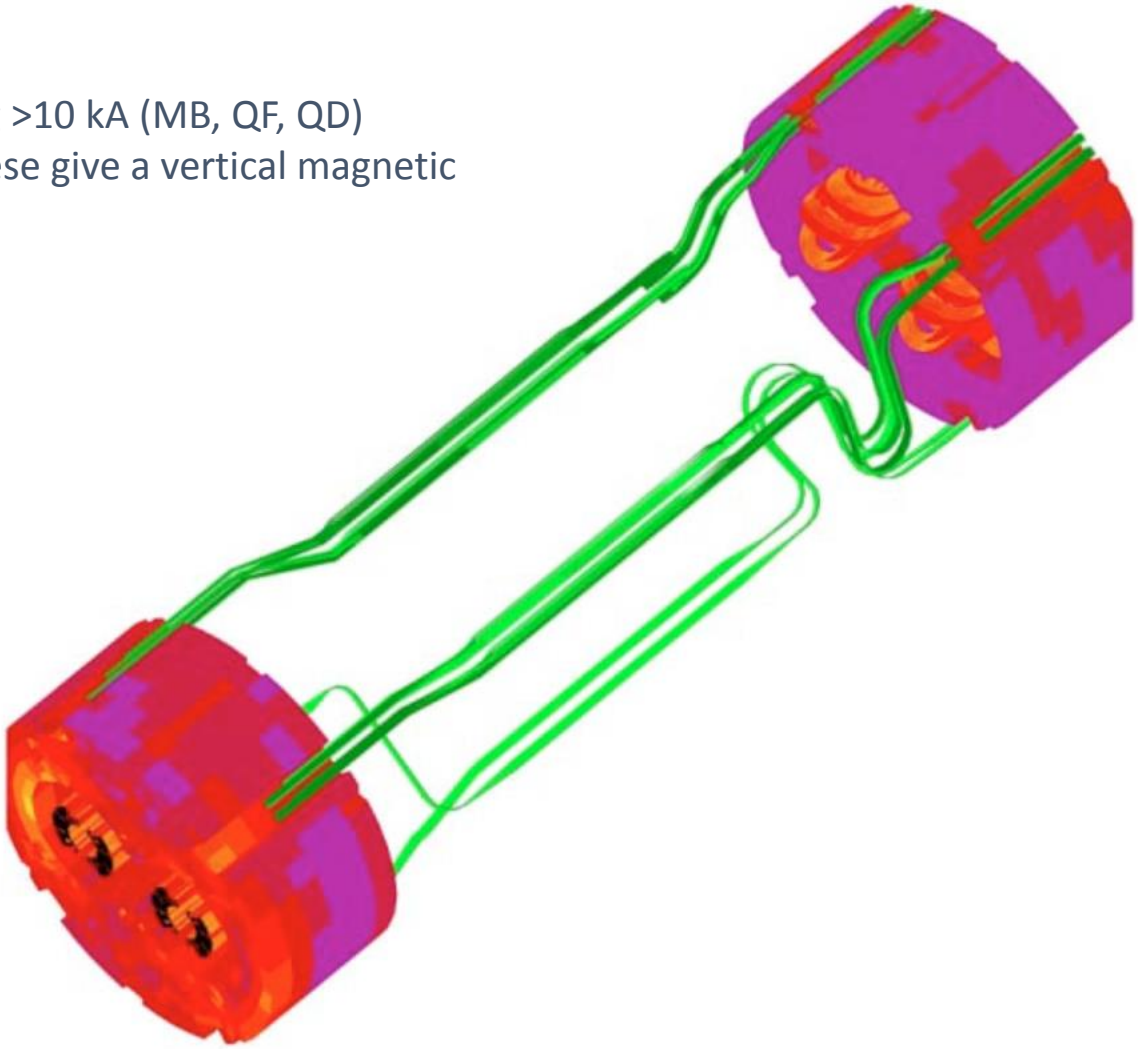
2 layers, 137 turns total

Driven by G. Arduini and A. Milanese

The interconnection is not really a field free region

We have 3 bus-bars carrying >10 kA (MB, QF, QD)

→ At the beam location these give a vertical magnetic field of about 5 mT

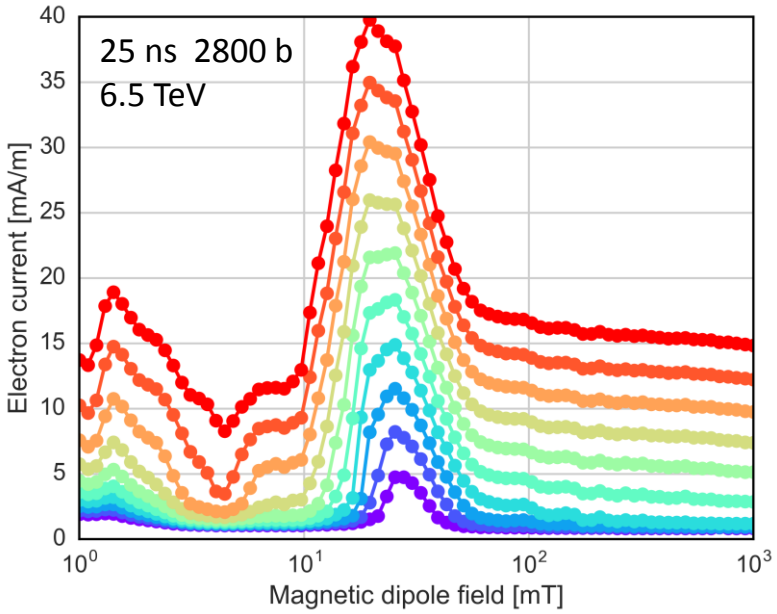


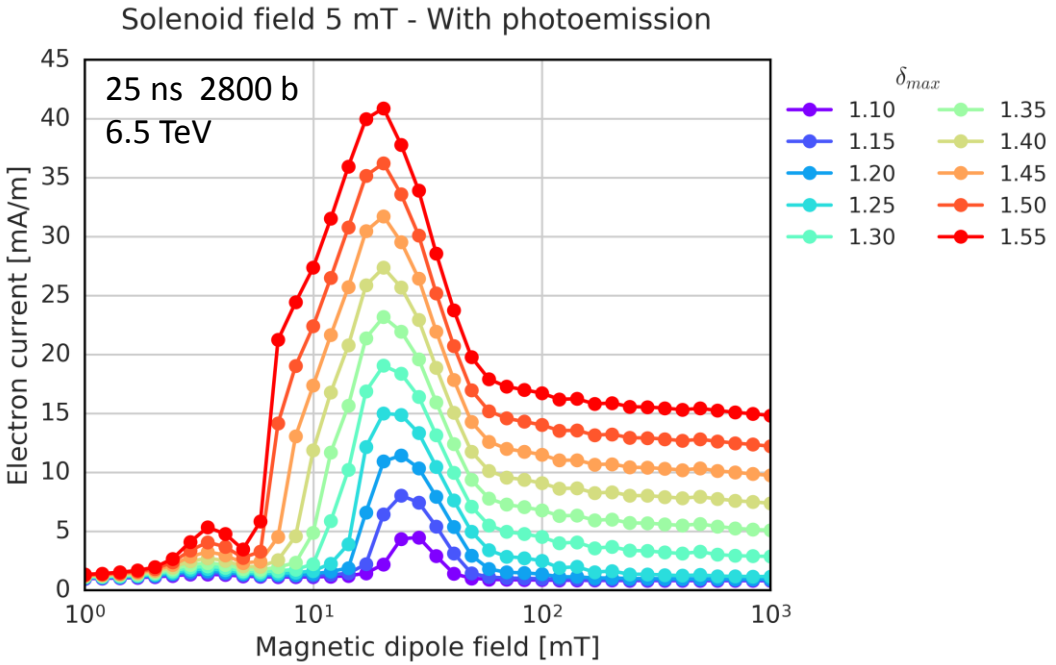
A. Devred et al., "First computation of parasitic fields in LHC dipole magnet interconnects", EPAC06

Simulation study #5: effect of solenoid + dipole

Is the solenoid still effective in the presence of a dipolar field:

→ Yes, as long as the two fields are comparable





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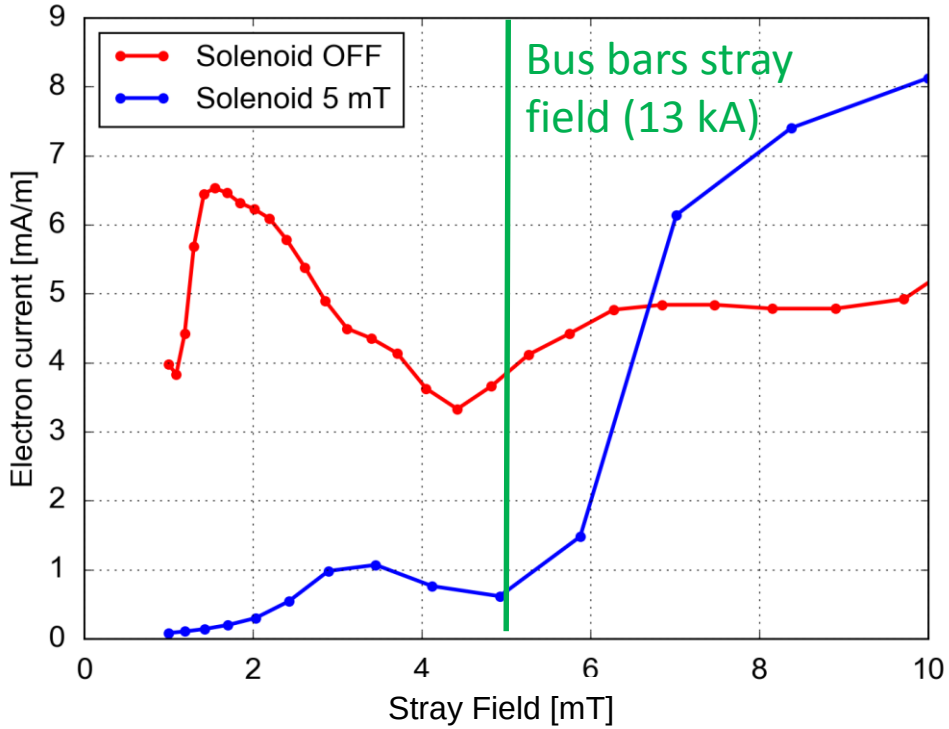

Summary

- **Study #1:** for small dipolar fields, changes in B are expected to have a big impact on the e-cloud buildup
- **Study #2:** photoelectrons can play an important role at these small field
- **Study #3:** 8b+4e scheme expected to have an impact also in the presence of photoelectrons
- **Study #4:** A “feasible” solenoid can significantly mitigate the e-cloud suppression
- **Study #5:** The solenoid still works in the presence of a small dipolar magnetic field (busbars) as long as the two fields are comparable

Thanks for your attention!