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A METHOD FOR GREATLY REDUCED EDGE EFFECTS AND CROSSTALK IN CCT MAGNETS

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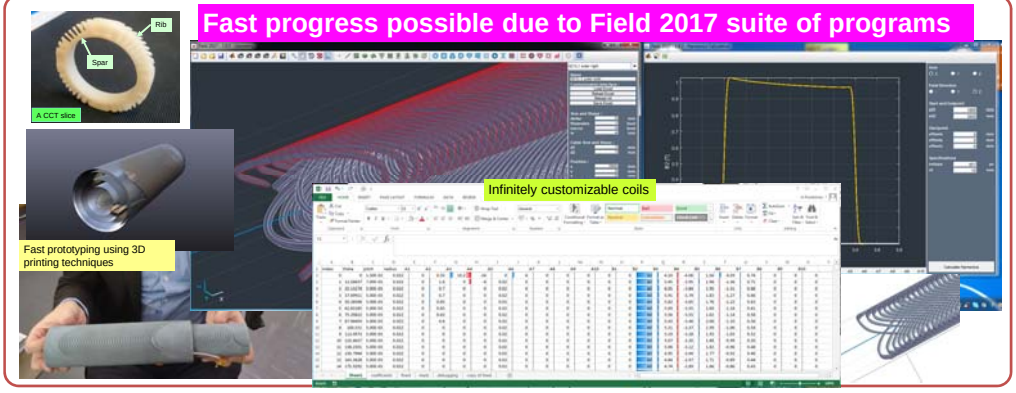
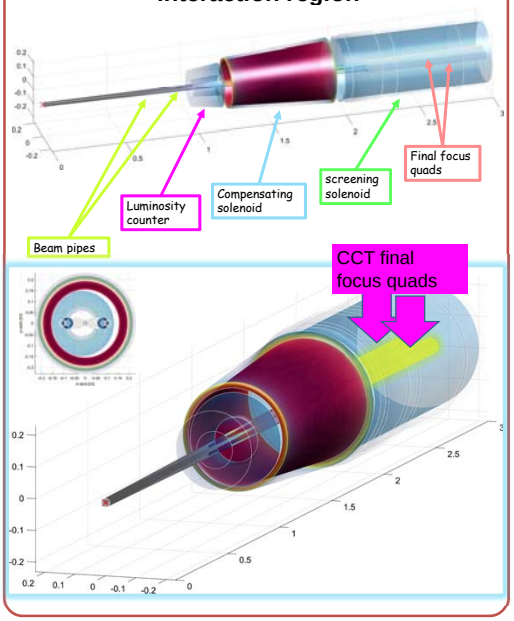
Abstract

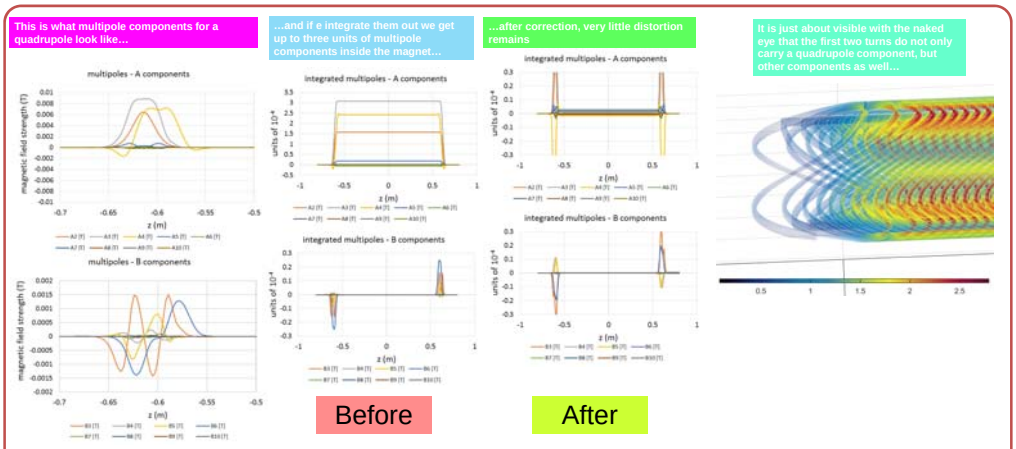
Iron-free CCT magnet design offers many advantages, one being the excellent field quality and the absence of multipole components. However, edge effects are present, although they tend to integrate out over the length of the magnet. Many modern accelerator applications, however, require that these magnets are placed in an area of rapidly varying optics parameters, so magnets with greatly reduced edge effects have an advantage. We have designed such a magnet (a quadrupole) by adding multipole components of the opposite sign to the edge distortions of the magnet. A possible application could be the final focus magnets of the FCC-ee, where beam sizes at the entry and exit point of the magnets vary by large factors. We have then used this technique to effectively eliminate cross talk between adjacent final focus quadrupoles for the incoming and outgoing beams.

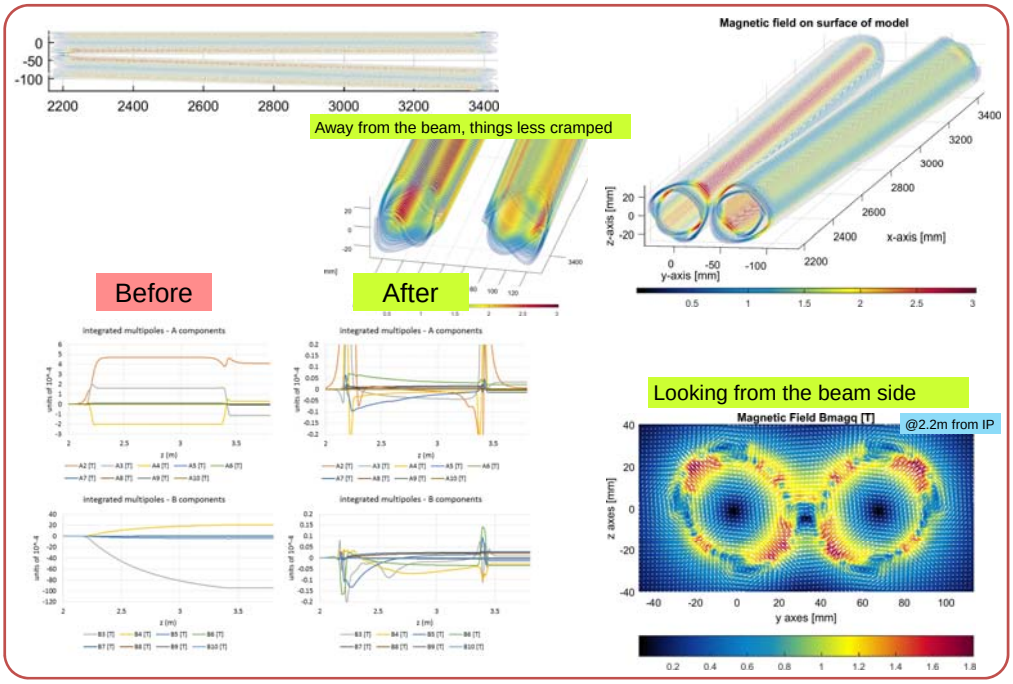
Fast progress possible due to Field 2017 suite of programs



A possible application: FCC-ee interaction region







CONCLUSIONS

CCT magnets offer a versatility seldom associated with magnet design. Any multipole arrangement can be designed and implemented. We have first demonstrated that the inevitable edge effects of our test CCT quadrupole magnet (and therefore any CCT magnet) can be eliminated to below 0.1 units. We have further demonstrated that in an iron-free environment we can generate a two perfect parallel powered quadrupoles that have a gap of only 2 mm at one tip and 4 cm at the other. Again, the correction is such that residual multipole components can be kept well below 0.1 units. This design eliminates the need for a large number of corrector magnets and might be important in an application where space is very limited and optics performance crucial, like the interaction region of the FCC-ee study.

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