

- Combined function Magnets for Diamond ddba.
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Low emittance rings

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Lattice and Magnets

Half ddba cell shown:-

Gradient Dipoles, mechanical tolerances.

Quadrupoles reasonably strong but not too challenging.

Sextupoles, strong and small bore, still need to include the majority of correctors.

Extra correctors (not shown), space very limited, looking at over bellows location.



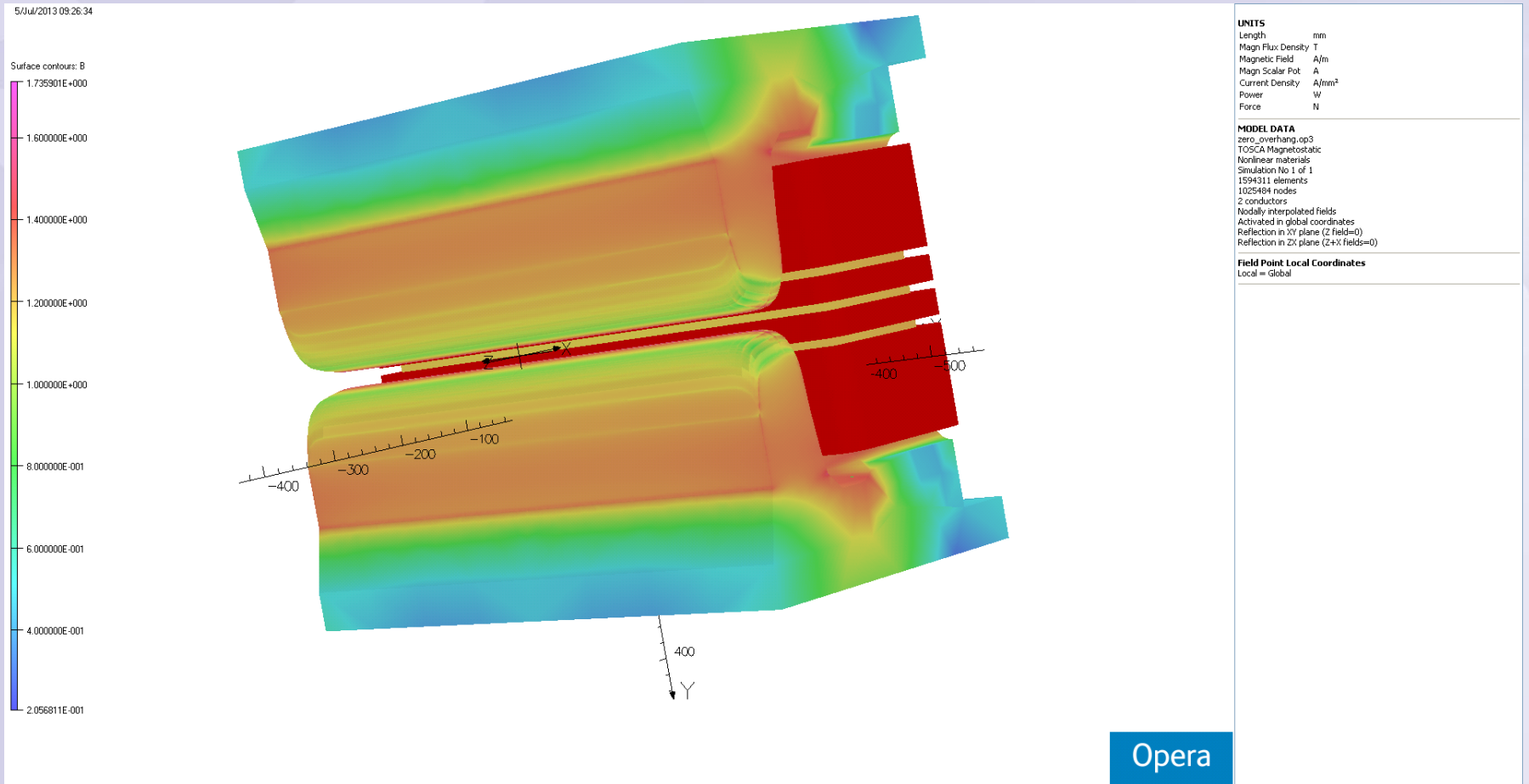
Combined function dipoles

- 2 lengths with different gradients
- 0.8 T with -14 Tm^{-1} 66cm and -15 Tm^{-1} 96cm
- Longitudinal space, coils mounted on back leg and flush with pole length.

Effective length of magnet with current roll off is $\sim 102\%$ of steel length

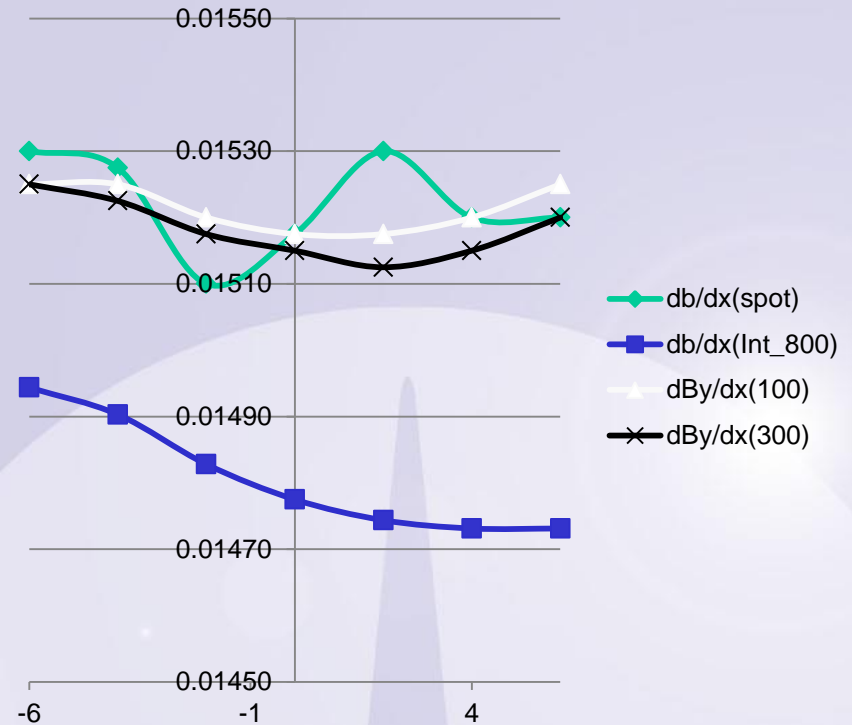
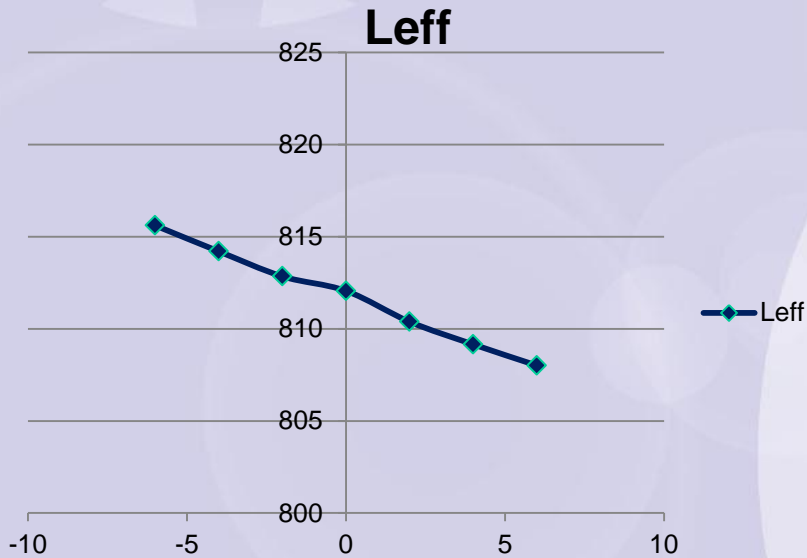
- Must be possible to change in situ.
- Magnet will need to split in two, coils would not be possible to fit through gap even if mounted on pole.
- Pole stability needs to be good there may need to be non-magnetic bracing.
- Currently modelled with $\sim 90\%$ of the Atorns coming from the existing main dipole circuit with additional trim coils.

Model to assess effects of end profiles and back leg coils



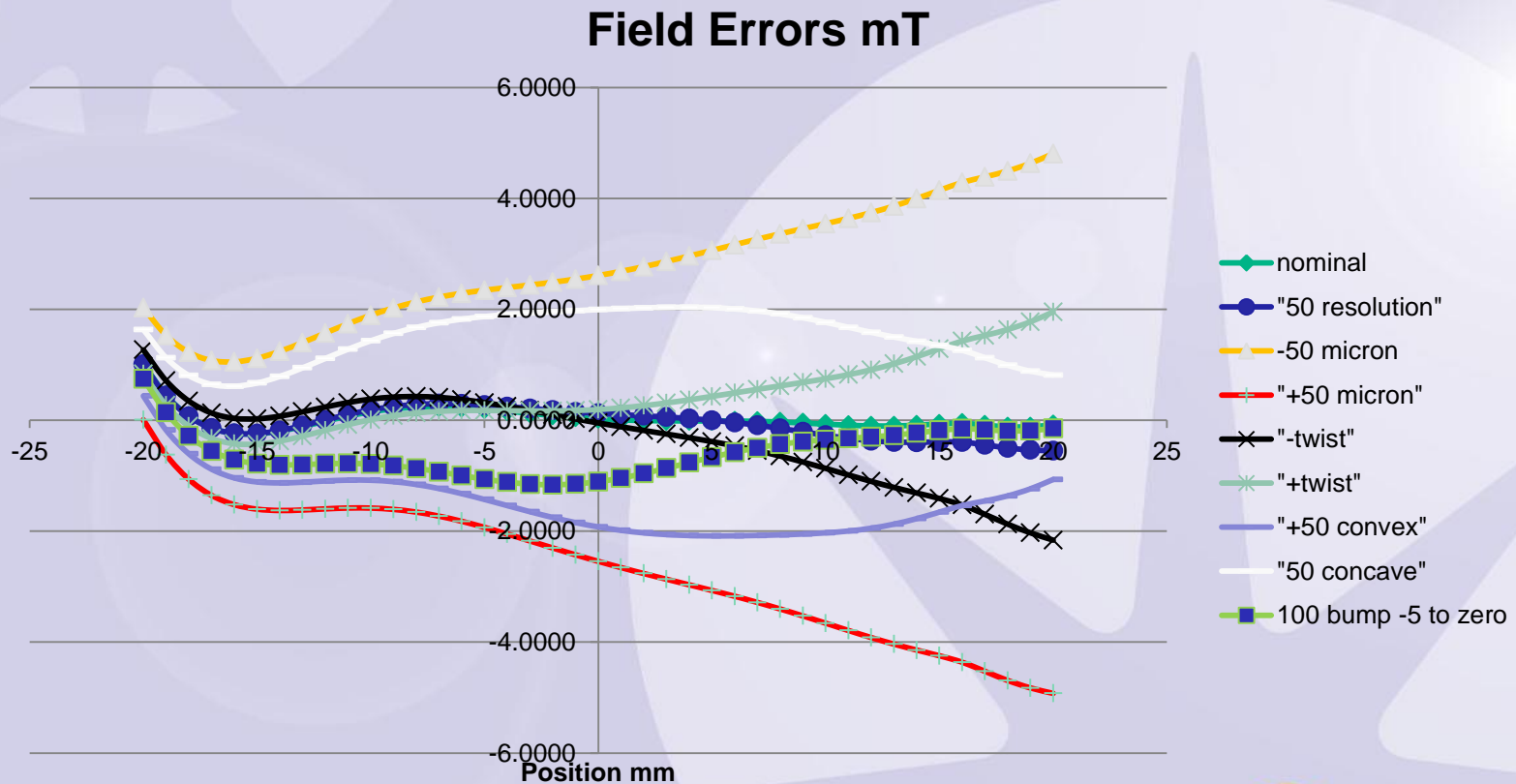
3D effects

Current end profile results in systematic variation in effective length.

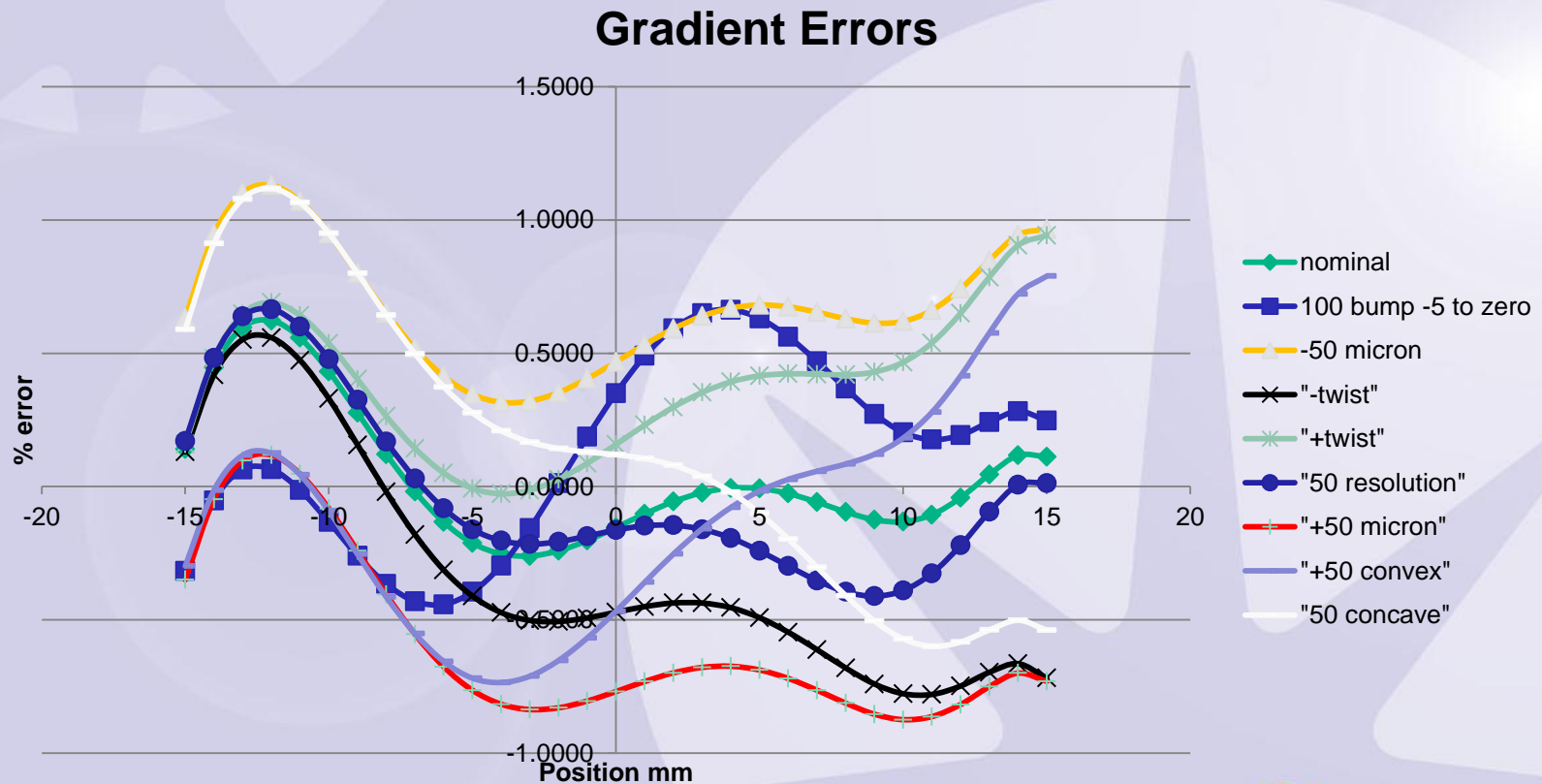


There is variation in the gradient along the magnet length, and when compared spot values to integrated effects

Effect of mechanical errors of fields (2D calculations)

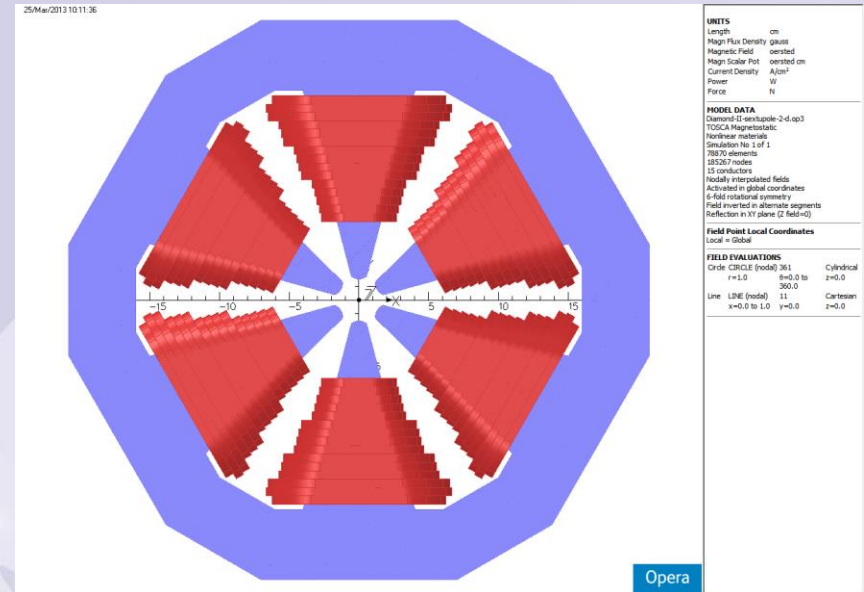


Same calculations shown as gradient %deviation from -15Tm^{-1}



Sextupole with correctors

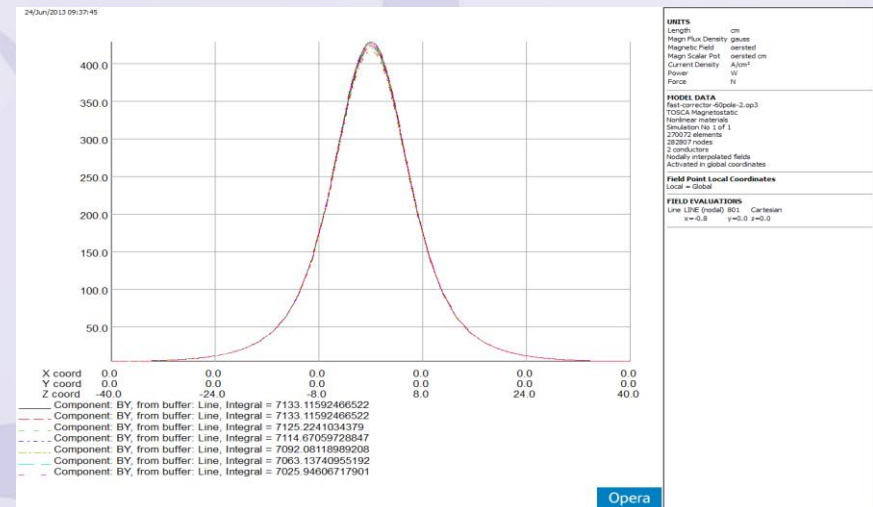
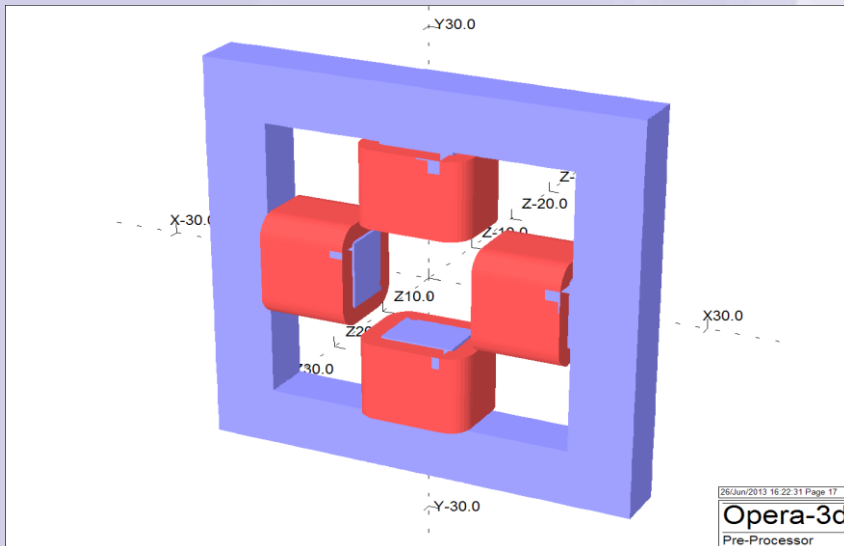
- 4000 Tm^{-2}
- 3 lengths 0.2, 0.25, 0.3 m
- H & V steering + Skew Quad function.
- Quality $\Delta g/g \sim 10^{-2}$
- Steerers using same design power supply as existing ones, coils not yet fitted into design.
- Checking with 3D modelling that the corrector and sextupole fields are decoupled



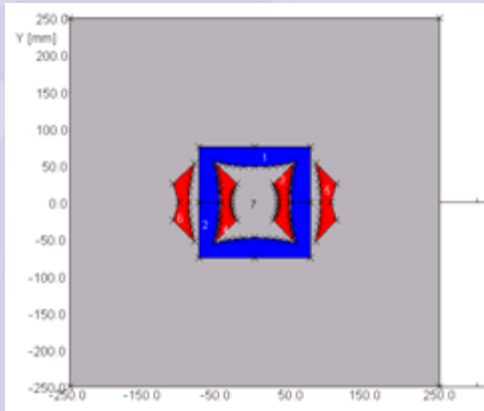
Courtesy S Mhaskar

2 axis corrector

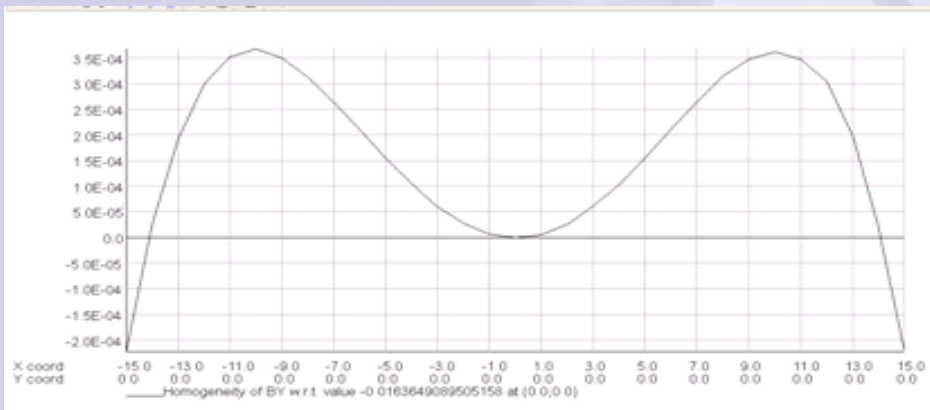
- Physical length 100 mm.
- Probably positioned over bellows:- aperture 140 mm.
- All end field: how will this interact with surroundings.
- What is the required field quality?
- What is really the required strength
- Design very similar to one already in use in 2 locations in Diamond.



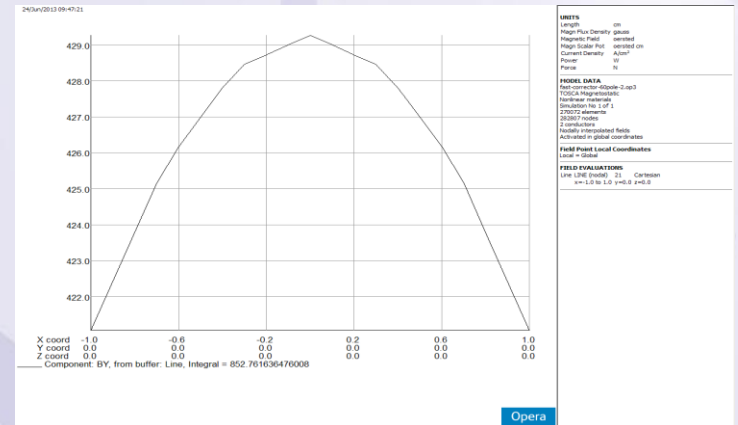
Alternative design...



Modified windowframe (above)



The field quality is better, but the strength is insufficient and it does not seem to be possible to increase significantly. The magnet grows too fast.



Crossed poles (previous slide)

Summary

- Dipoles :- Only -15Tm^{-1} modelled.
- 3D models with Curvature and end profiles not yet combined.
- No Modelling yet of means to correct harmonics resulting from tolerance in build.
- 50 micron defects correlate to a change of 0.5% in gradient.
- Quadrupoles look complete.
- 2 axis corrector: Can the field be improved.
- Sextupoles, needs to be remodelled slightly larger to integrate corrector windings.