Q2pF 3-d Design Studies

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BROOKHAVEN NATIONAL LABORATORY
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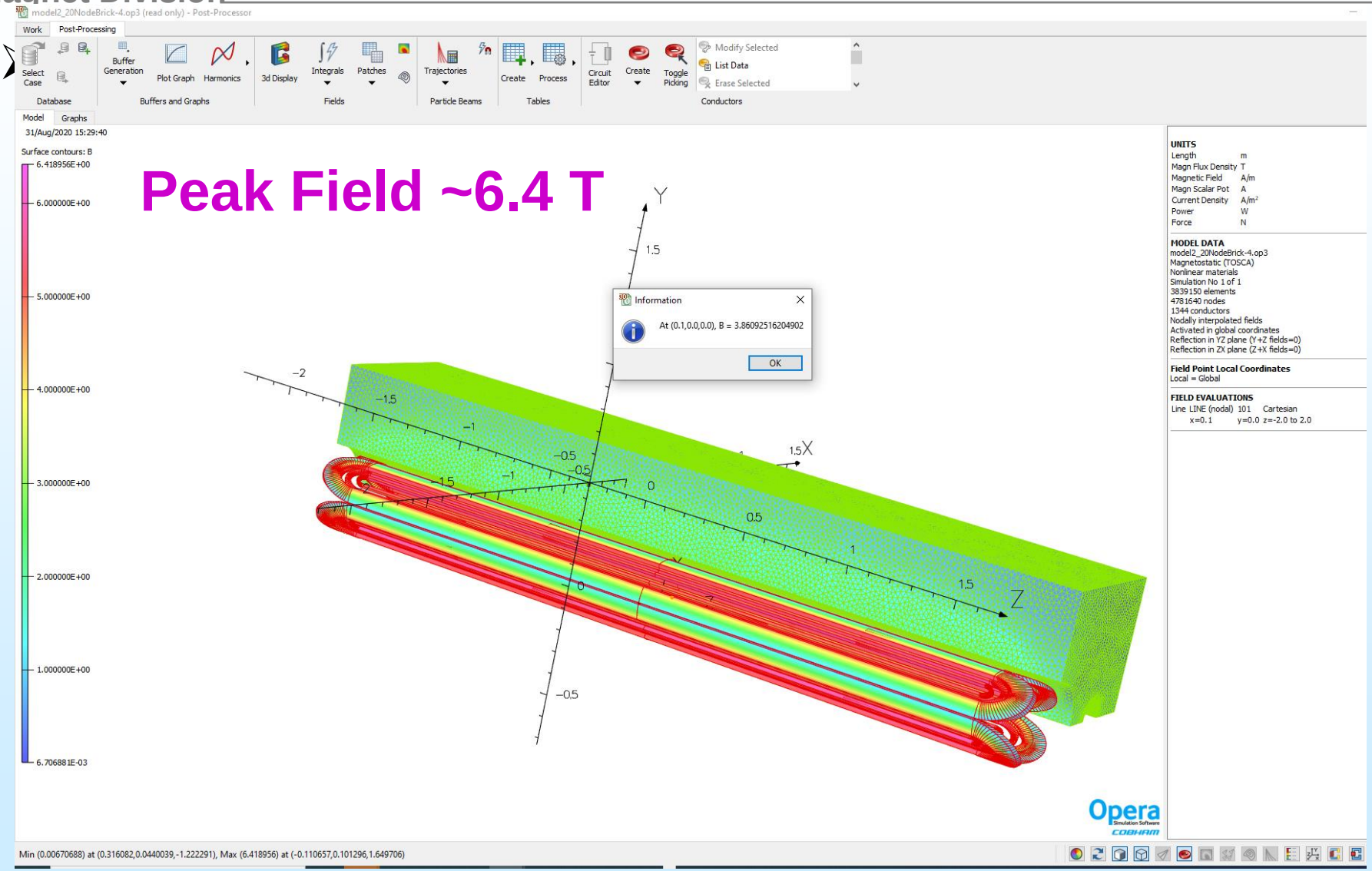
Office of Science
U.S. DEPARTMENT OF ENERGY

Overview

- **Design studies of two Q2pF 3-d designs.**
- **Observation: Two different designs have significantly different peak fields**
- **Where is the difference?**
  - **First suspect – the ends**
  - **Other differences also found**

OPERA Design A

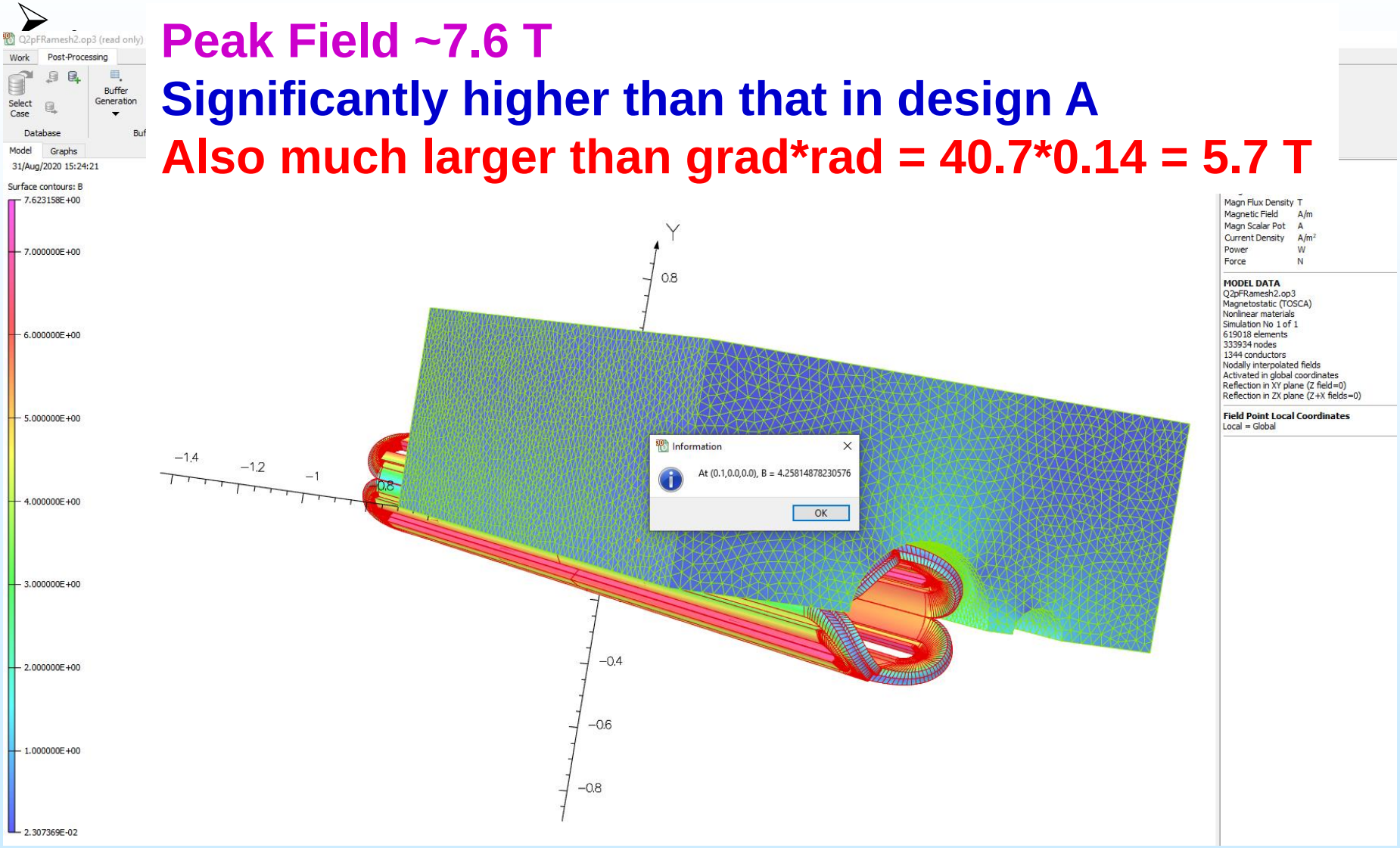


OPERA Design B

Peak Field ~7.6 T

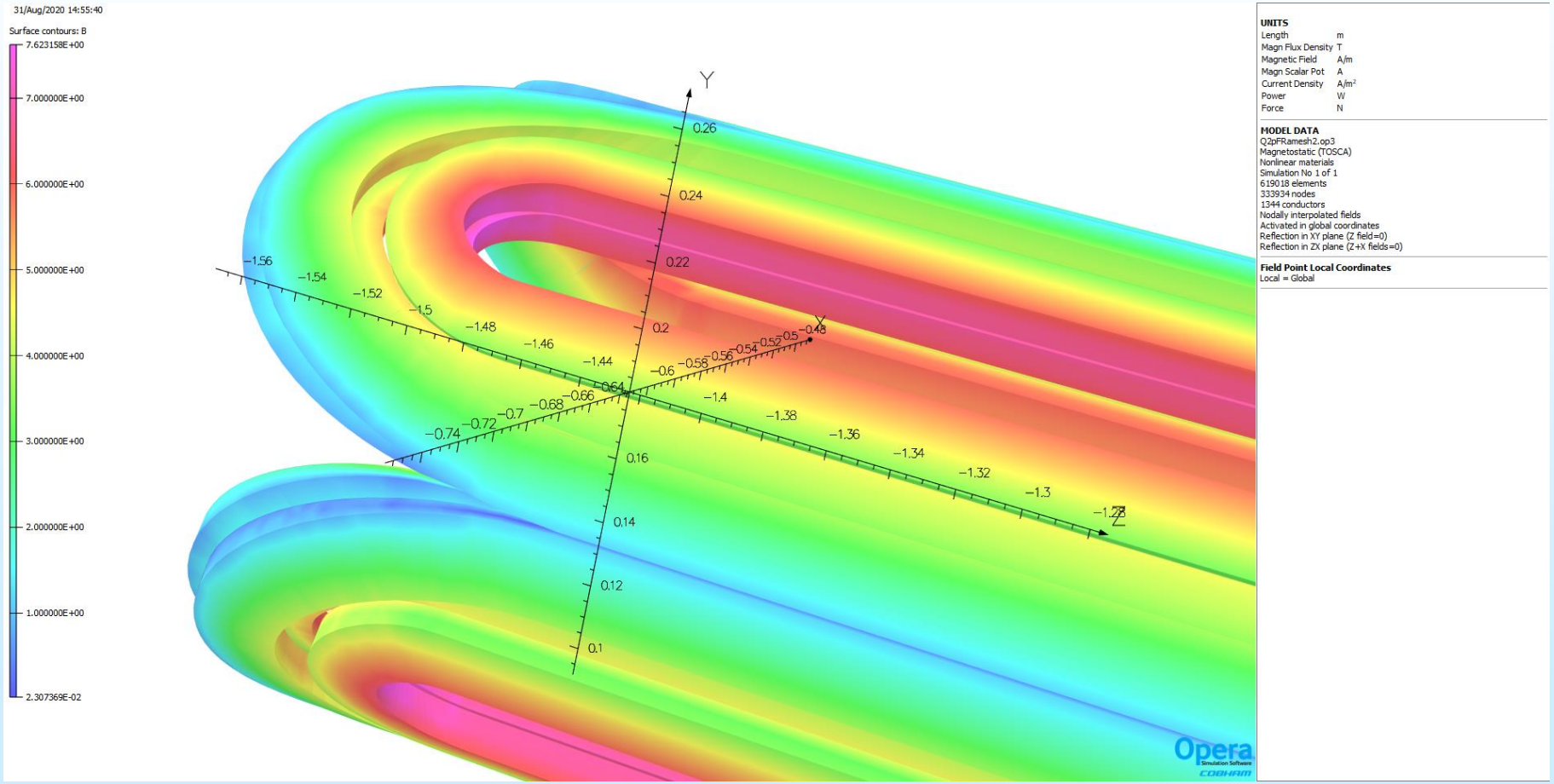
Significantly higher than that in design A

Also much larger than grad*rad = 40.7*0.14 = 5.7 T



Design B : Ends (1)

Ends appear to have relatively high peak field

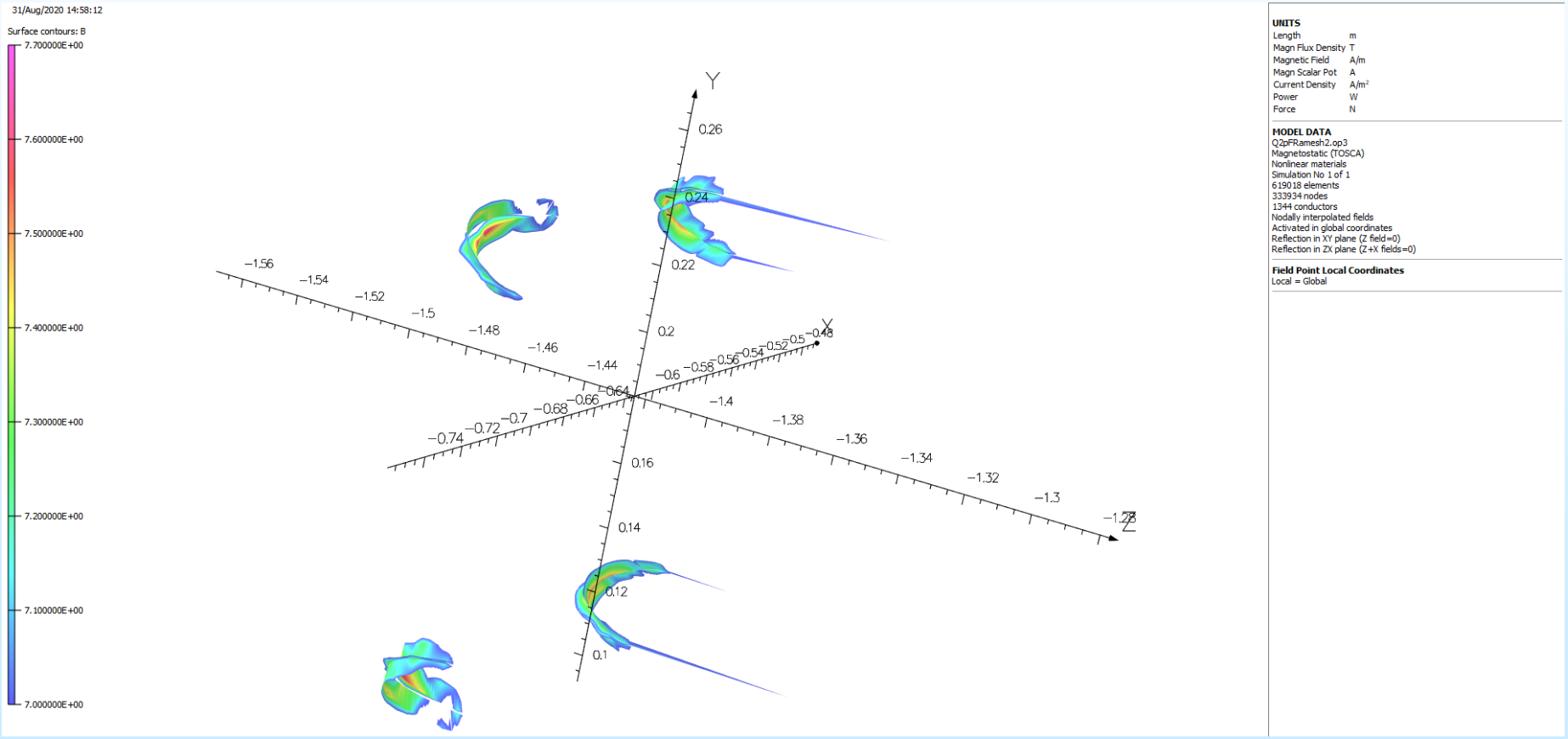


Design B : Ends (2)

Ends appear to have relatively high peak field

(range 7 to 7.7 T all in ends…

This is a large enhancement; must be avoided)

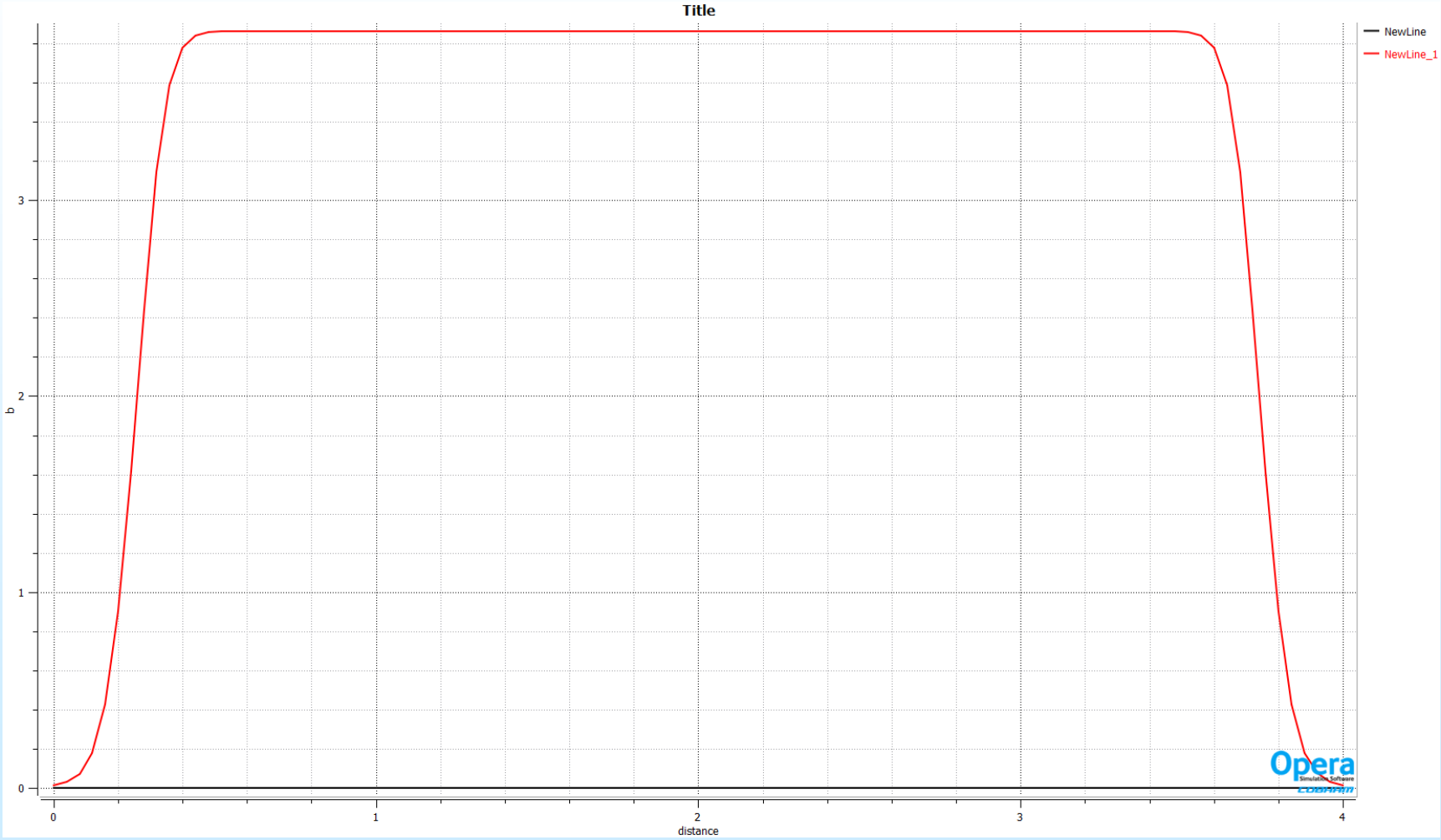


Other differences

- **Comparison made at the different field (field gradient)**

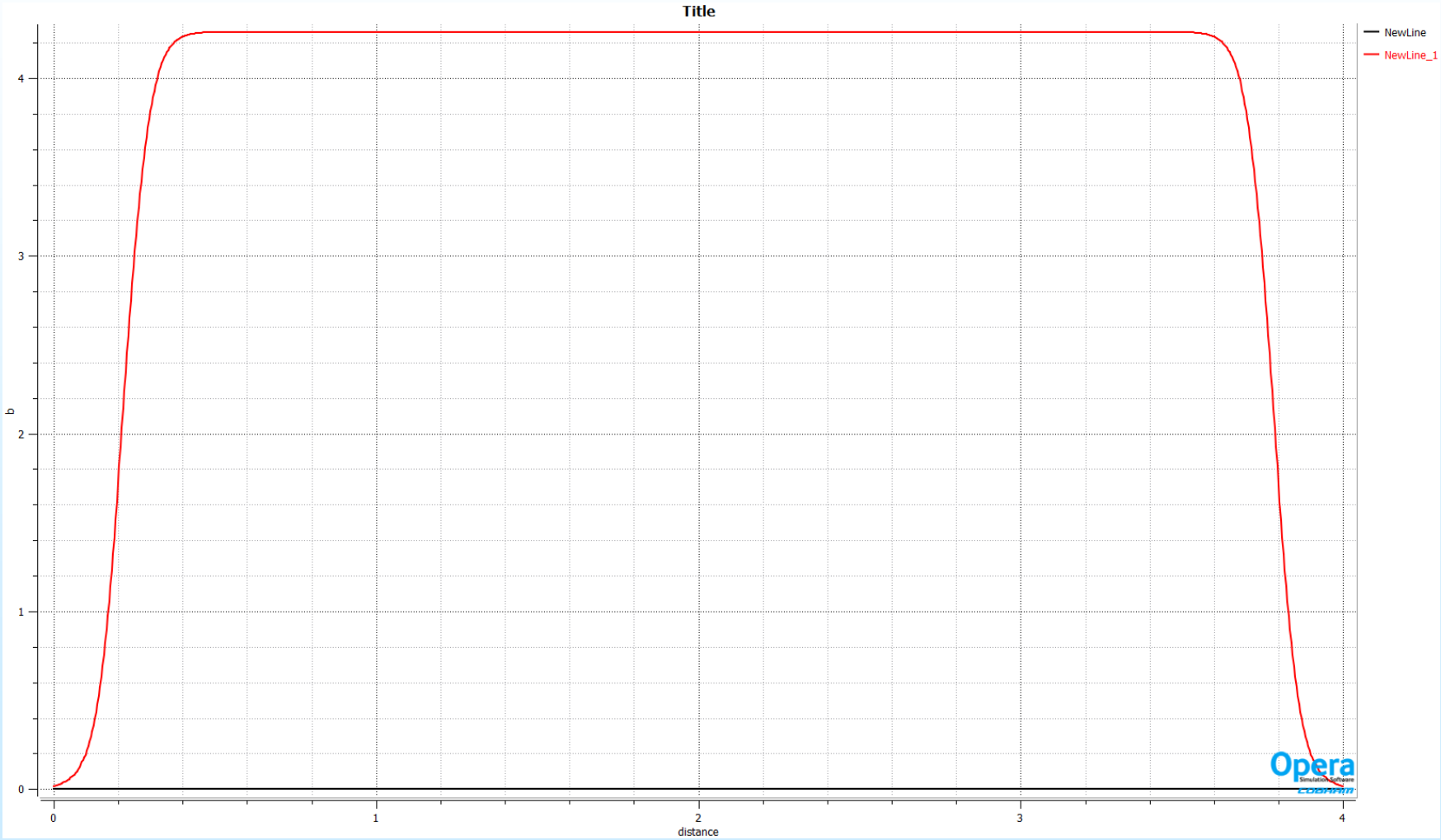
Design A: B vs z at x= 0.1 m

- ~3.8 T



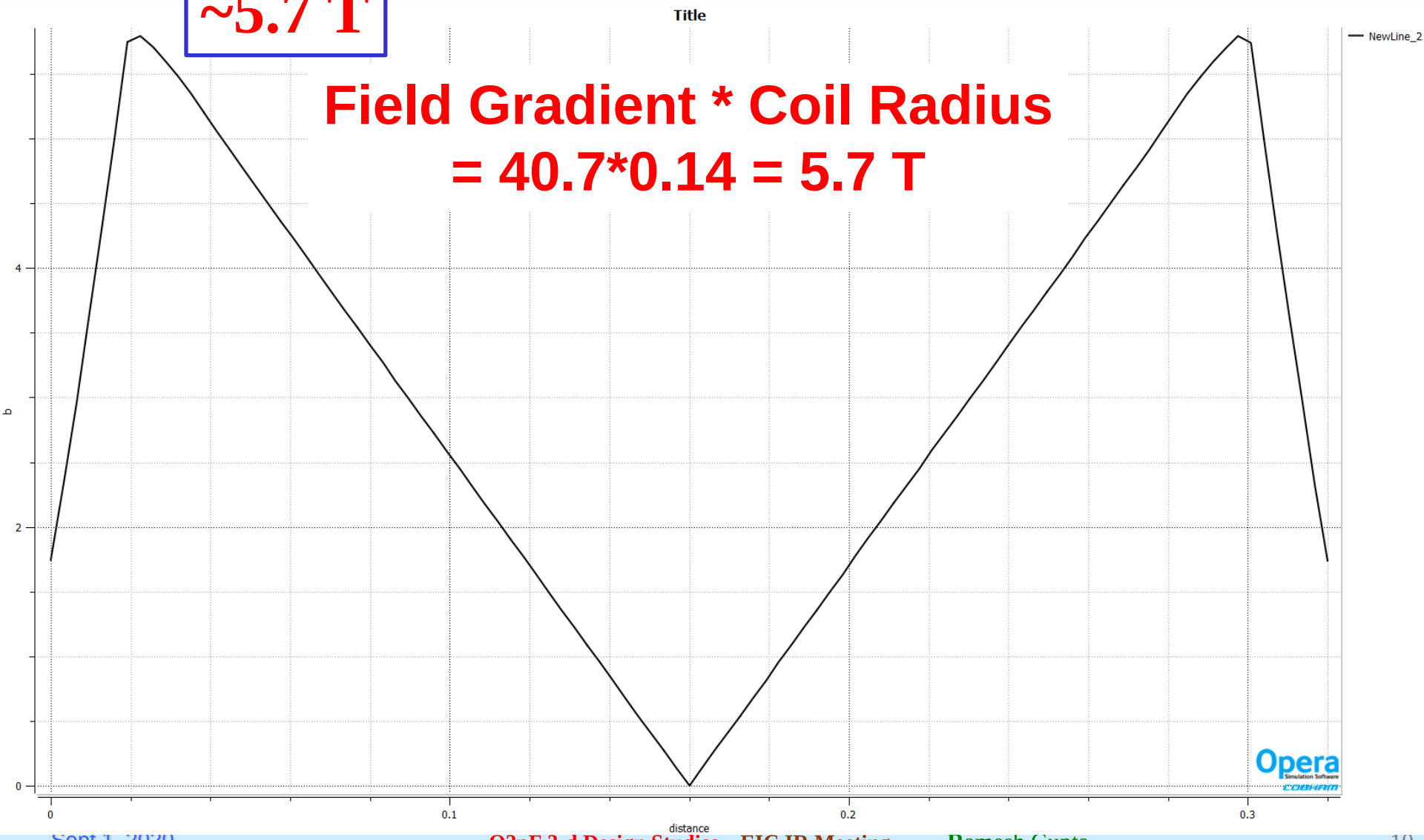
Design B: B vs z at x= 0.1 m

- ~4.3 T (much higher than that in Design A)

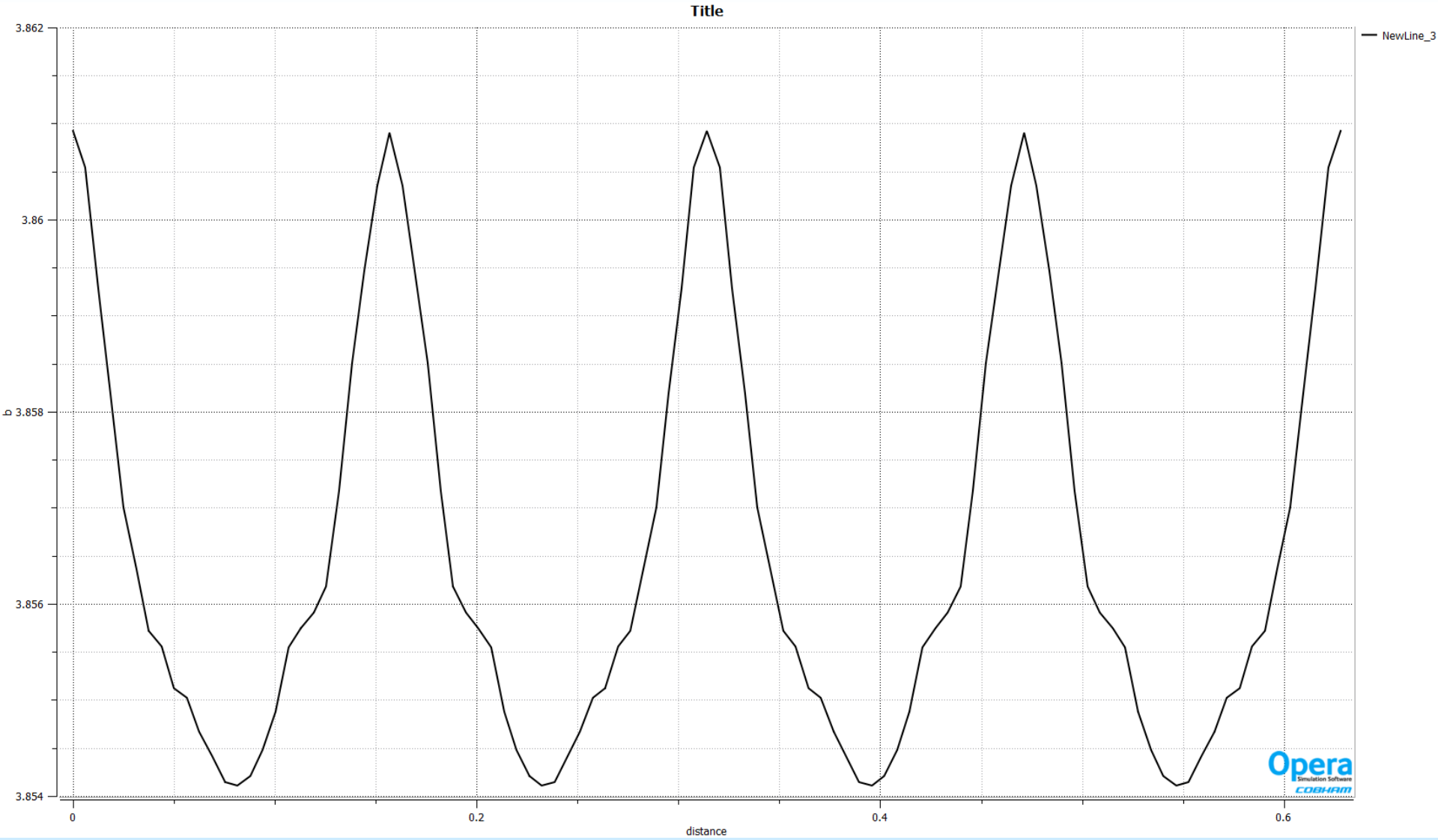


Design B: Field at midplane

~5.7 T

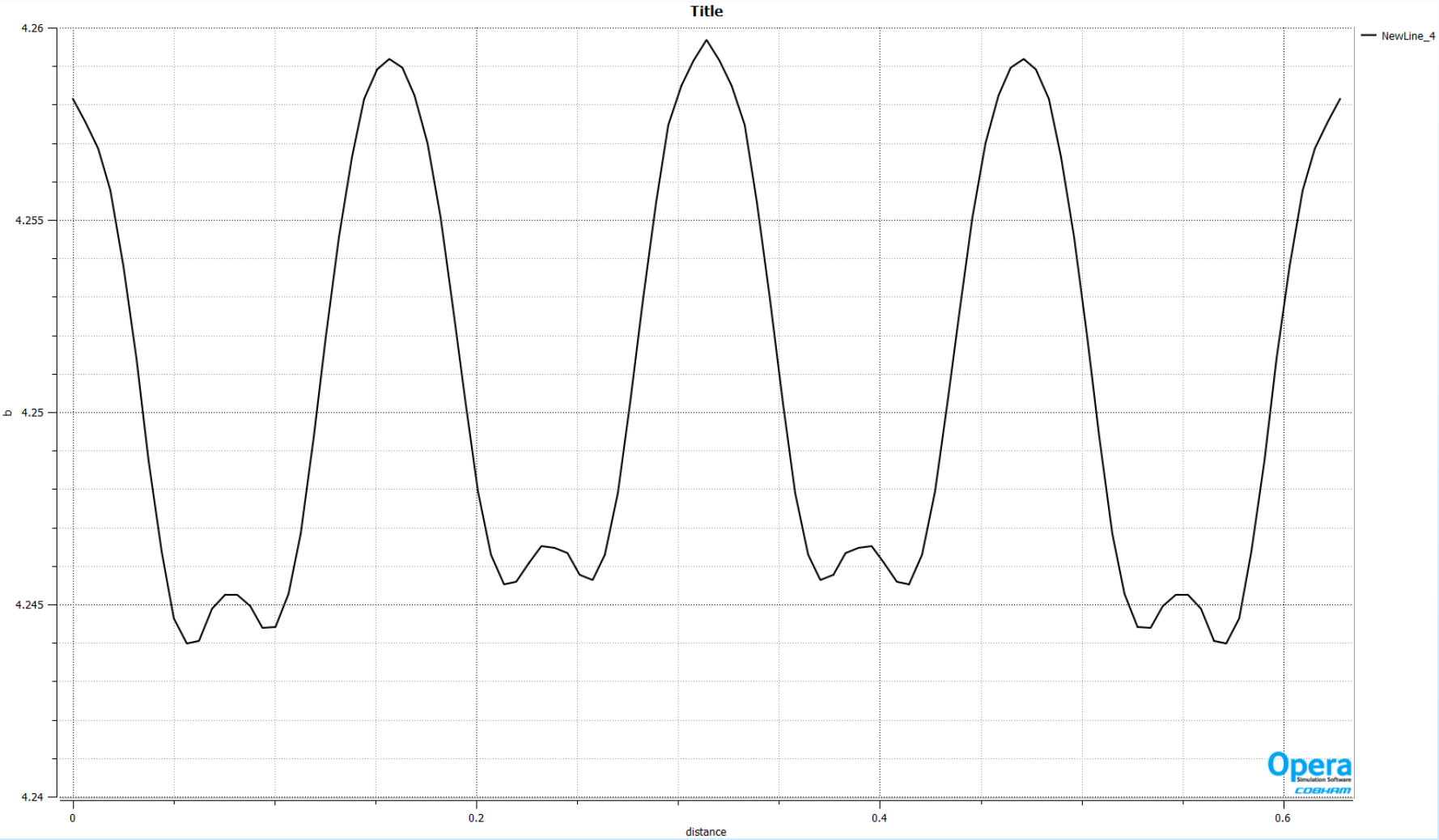


Design A: B vs theta at R = 0.1 m

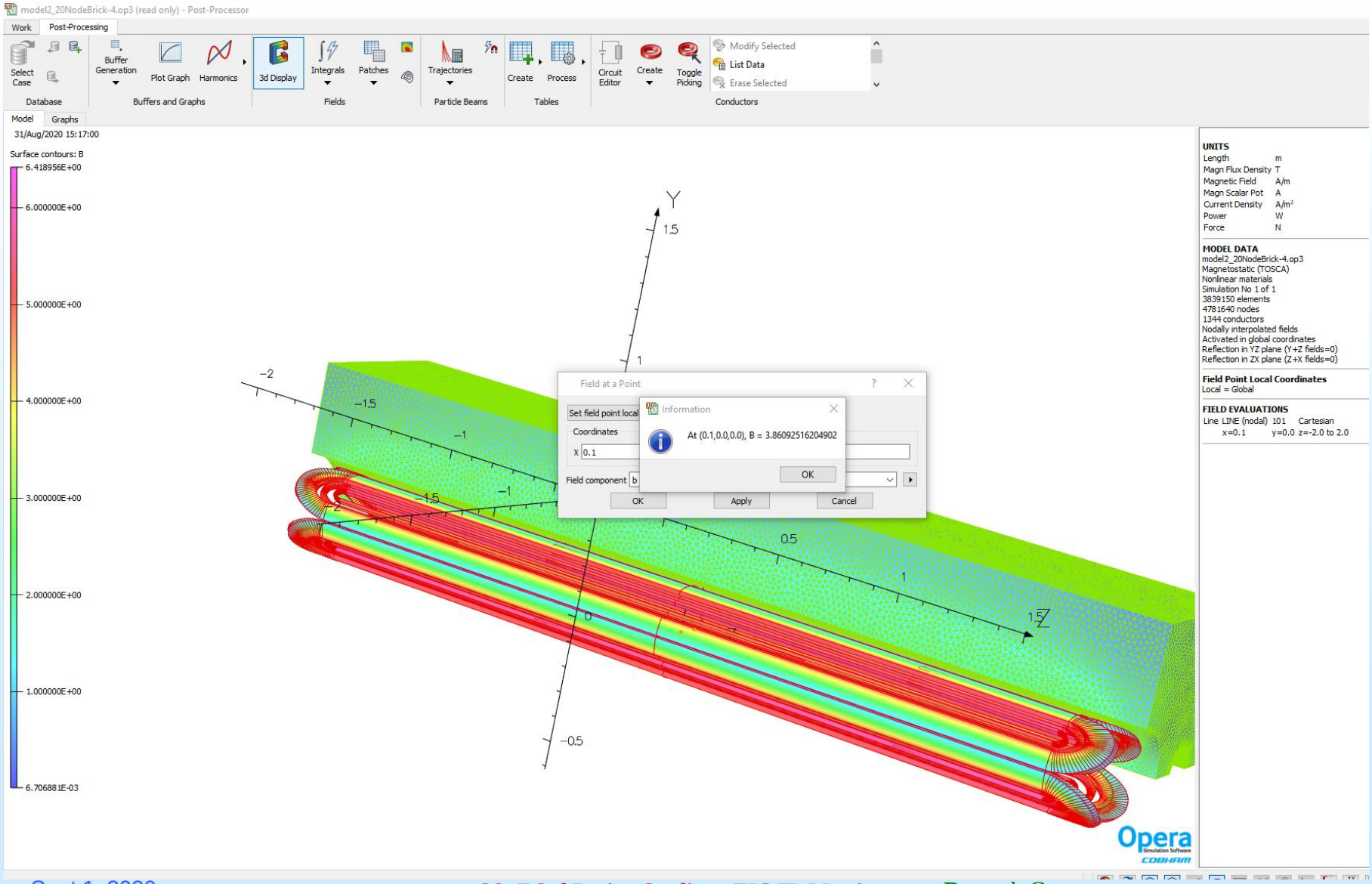


Design B: B vs theta at R = 0.1 m

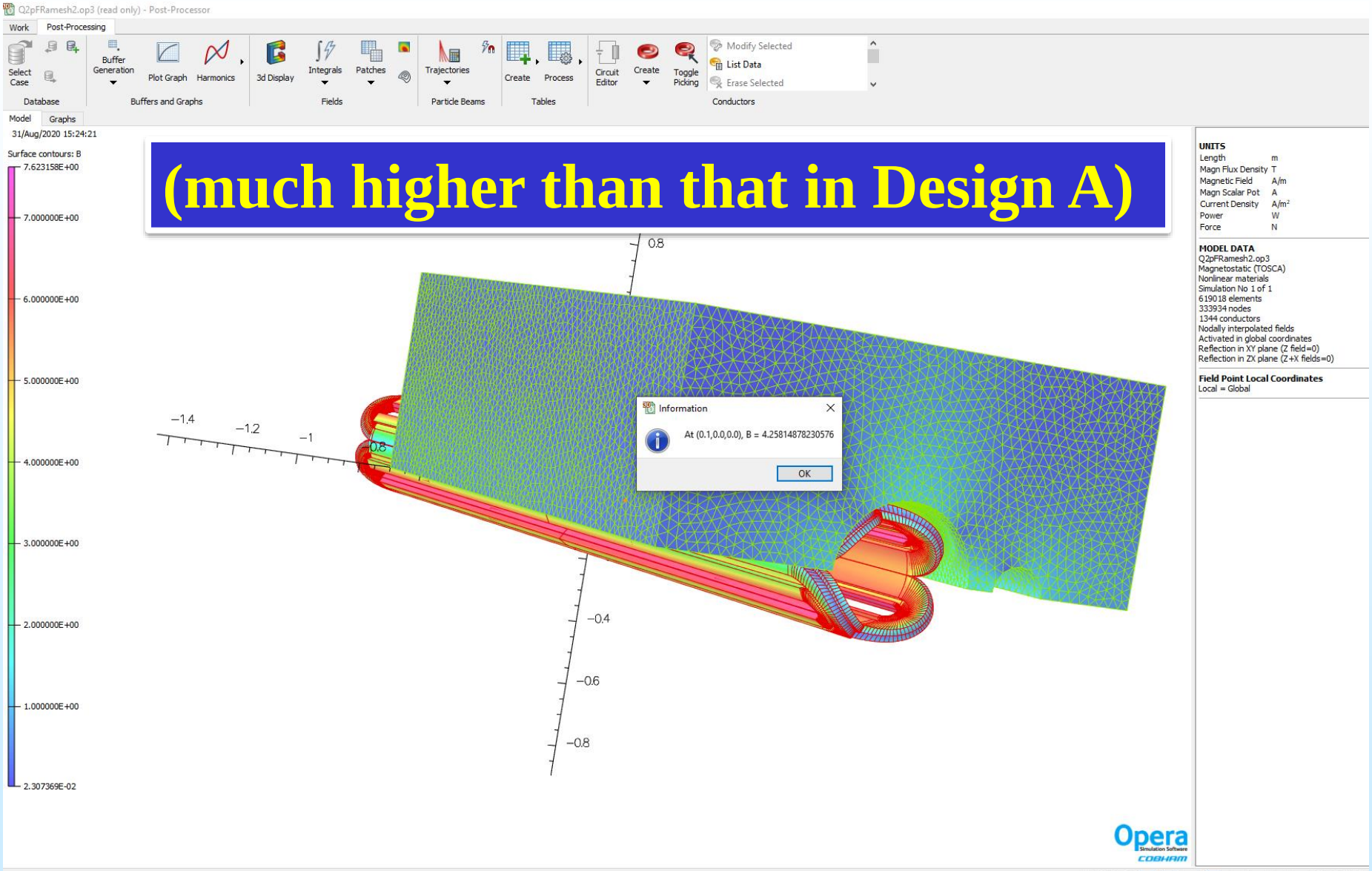
(much higher than that in Design A)



Design A: B(0.1,0,0)=3.86 T



Design A: B(0.1,0,0)= 4.25 T



Summary

- Large peak fields in the ends must be avoided
- Since ends generally have a more complex and less robust structure, the peak field in the ends should be lower than the peak field in the body of the magnets
- Design A and Design B are compared at different field gradient

- Next step: optimize end designs