LHC Collimation Project

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MME Mechanical & Materials Engineering

EN ENGINEERING DEPARTMENT

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Thermal calculations on passive absorbers for IR7 magnets

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HiColDEM Meeting #17

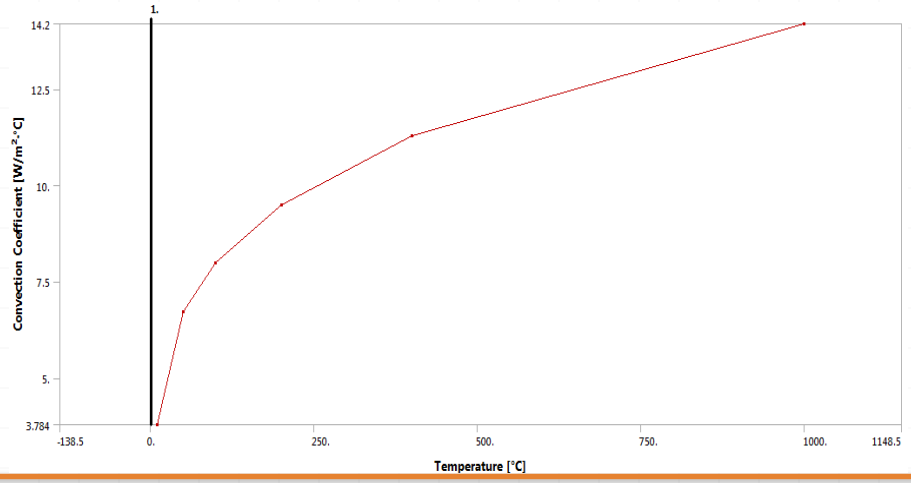
7th February, 2018

Outline

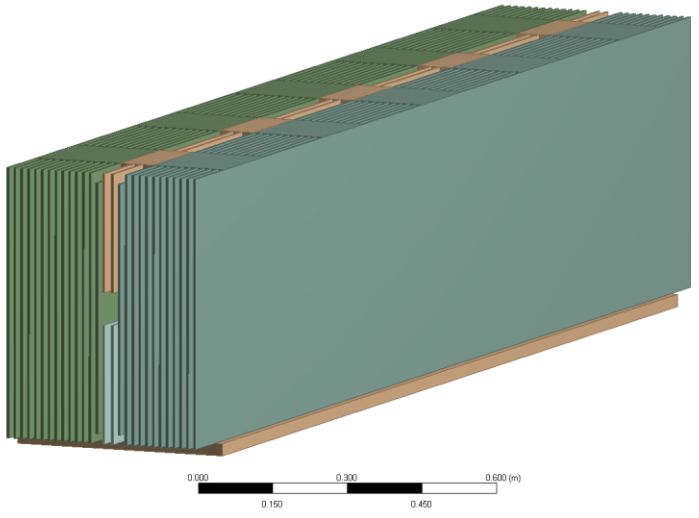
- Analysis description
- Results
  - **Case 1: Old FLUKA maps**
  - **Case 2: New FLUKA maps**
- Conclusion

Analysis Description

- Steady-State thermal ($T_0 = 22°C$)
- Hypotheses:
  - Losses: 7.9E11 p/s
  - Material: Cast Iron (k =52 $\frac{W}{m\,°C}$)
  - Beam pipe hosting section: 44 x 66 mm
  - Heating- jackets: 5 mm
  - BC: Nat. conv. on fins + ext. (A ~ 48 m^2)
    $\dot{q}_{air} = 8\,\frac{W}{m^2\,°C}$ @ T = 100 °C

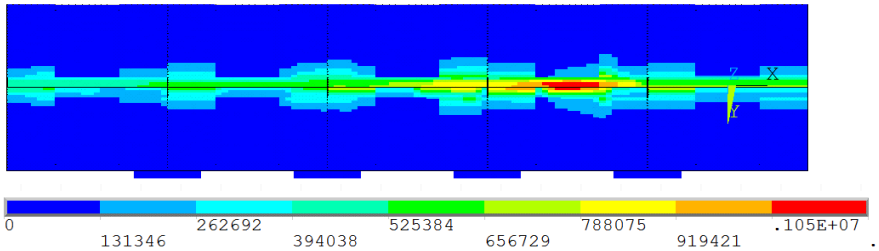


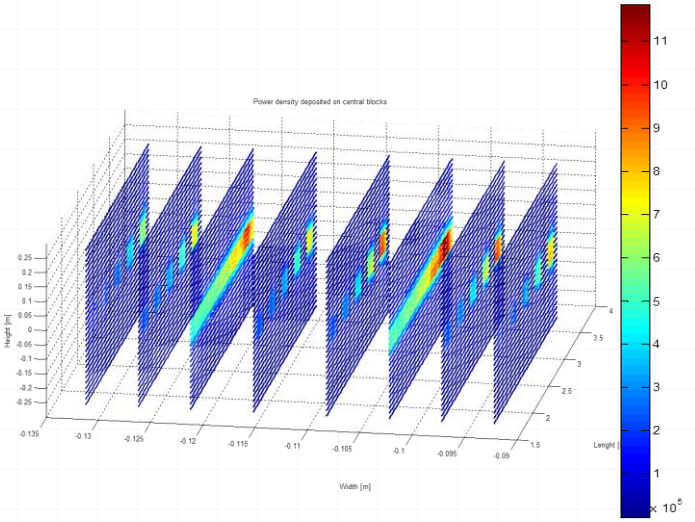
- Outer block: 200 x 550 x 2000mm
  $P_{peak} = 1.01\ E6\,\frac{W}{m^3}$; $P_{tot} = 5977\ W$
- Middle block: 170 x 550 x 200mm
  $P_{peak} = 1.01\ E6\,\frac{W}{m^3}$; $P_{tot} = 5387\ W$
- Central blocks: 44 x 247 x 200mm
  $P_{peak} = 1.18\ E6\,\frac{W}{m^3}$; $P_{tot} = 3786\ W$
- Perfect thermal contacts btw blocks



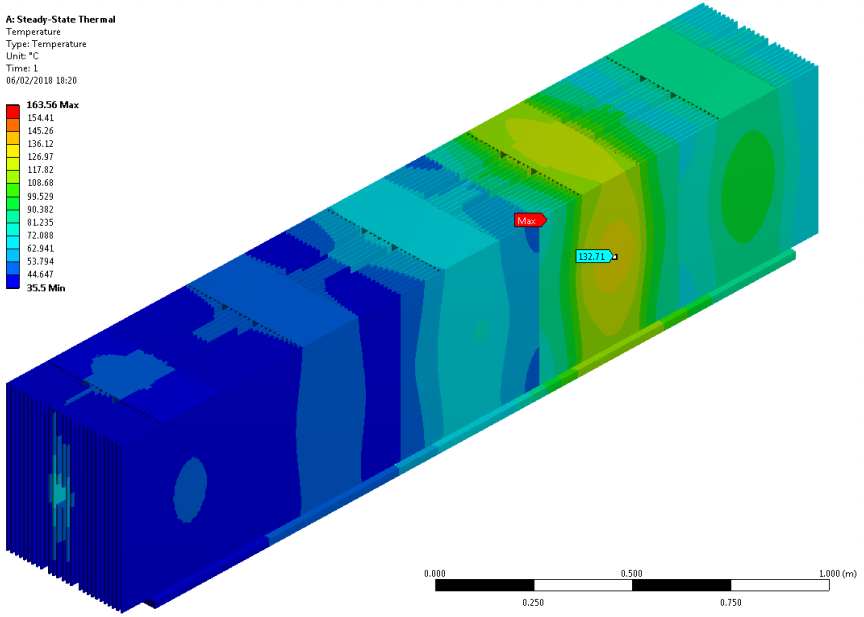
Results

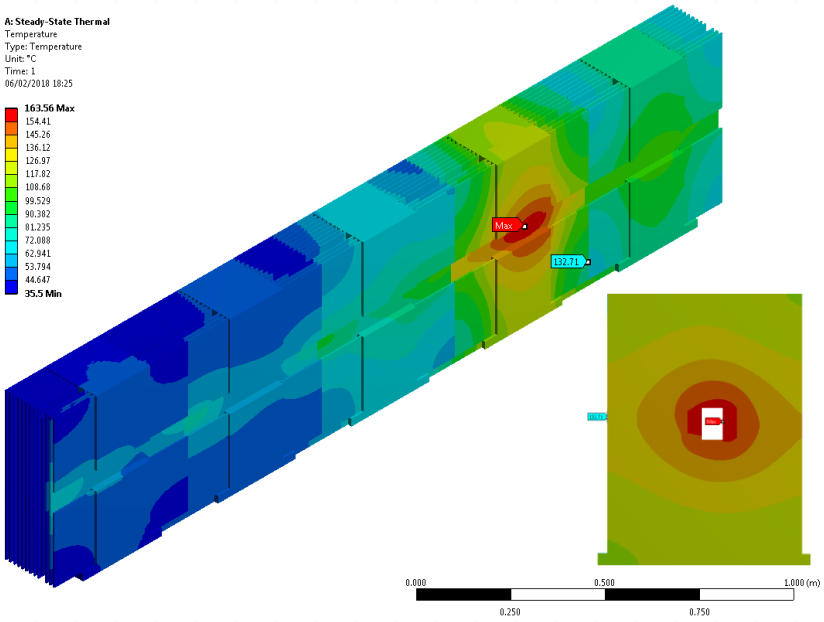
- **Case 1: Old FLUKA maps**
  - **Heat deposition (Theory $P_{peak} = 1.18\ \text{E6}\ \frac{W}{m^3}$):**





  - **Temperature field ($T^{max}_{BULK} = 164\ °C, T^{max}_{SURF} = 133\ °C$)**

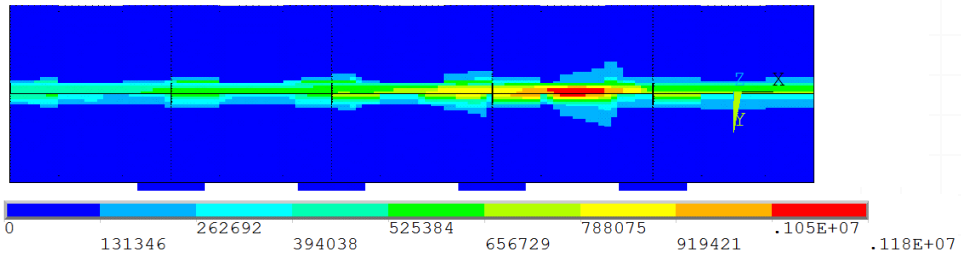




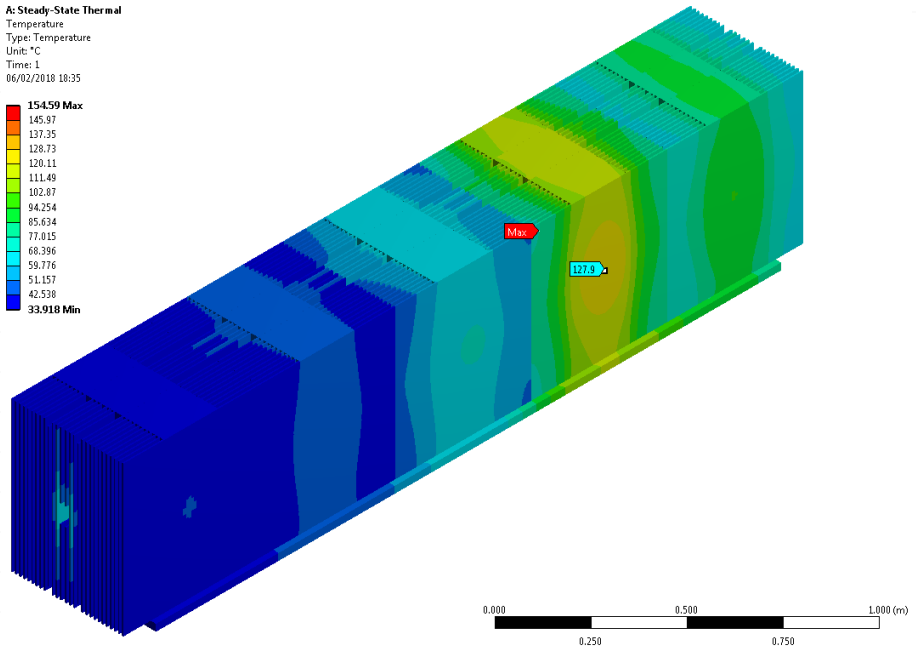
Results

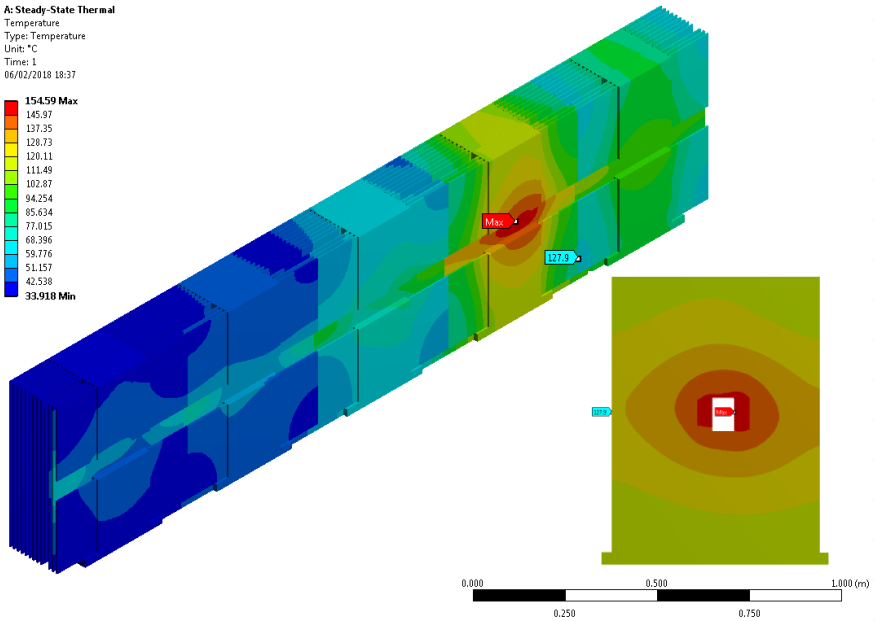
- **Case 2: New FLUKA maps**

- **Heat deposition (Theory $P_{peak} = 1.18\ \text{E6}\ \frac{W}{m^3}$):**

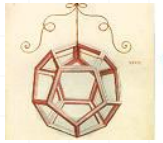


- **Temperature field ($T^{max}_{BULK} = 155\ °C, T^{max}_{SURF} = 128\ °C$)**





Conclusions



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- Material: Cast Iron
- Beam pipe hosting section: 44 x 66 mm
- Heating- jackets thickness: 5 mm
- Losses: 7.9E11 p/s
- $P_{peak} = 1.18 \times 10^6 \frac{W}{m^3}$; $P_{tot} = 15\ \mathrm{kW}$
- $T_{BULK}^{max} = 155\ °C$, $T_{SURF}^{max} = 128\ °C$

Thanks for your attention