



**Rutherford Appleton Laboratory involvement  
with  
Next European Dipole**

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## NED collaboration

Future accelerators will require large aperture high performance dipoles. In line with this requirement there is a Collaboration of European institutions **NED** with the broad aim of developing a high field ( $\sim 15\text{T}$ ) dipole using Nb<sub>3</sub>Sn technology

## NED Magnet Design and Optimisation

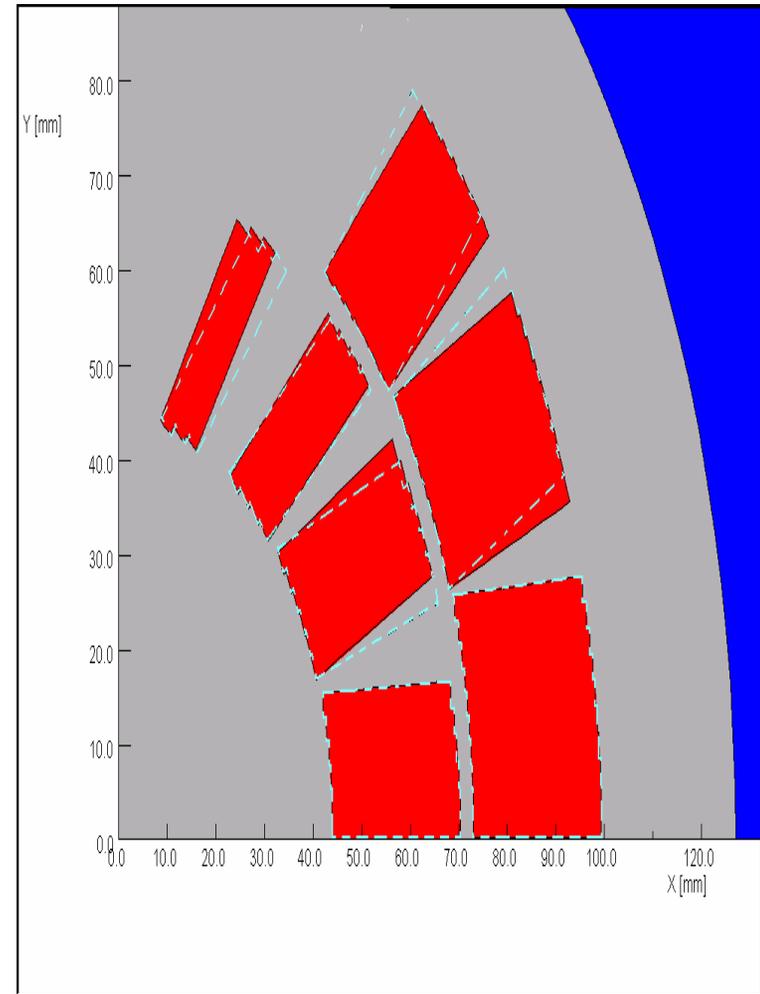
The **MDO** group is tasked with looking at all potential dipole designs, the goal is to

- Optimise each design
- Compare all the final designs
- Determine the most favourable technology for **NED**
- Carry out the above in line with the rest of the **NED** collaboration

## RAL involvement in Magnet Design and Optimisation

Optimisation of 15T COS-theta and helical dipoles for use with Nb<sub>3</sub>Sn technology

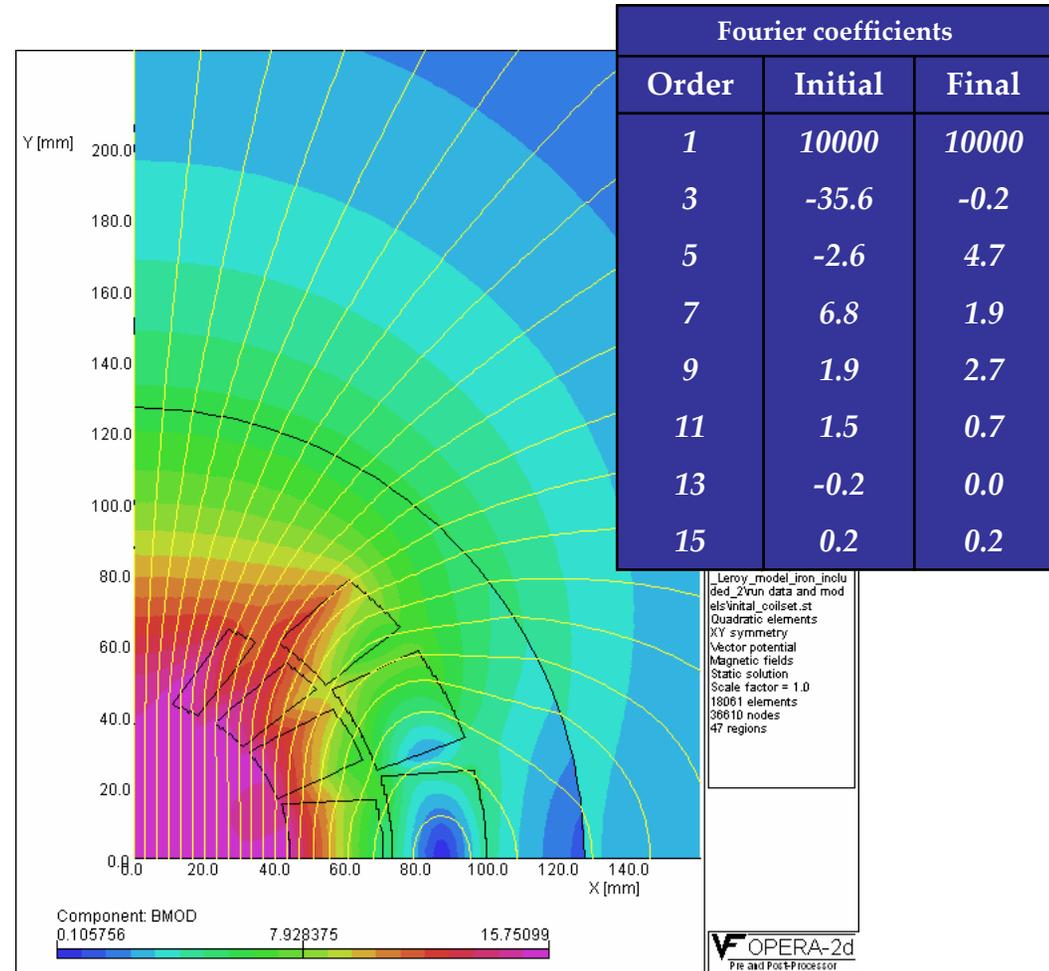
- Work is in collaboration with John Simpkins at Vector Fields.
- VF are developing general optimiser code for use with their 2d and 3d software.
- RAL is using the code for the magnet optimisation process along with ANSYS for mechanical analysis



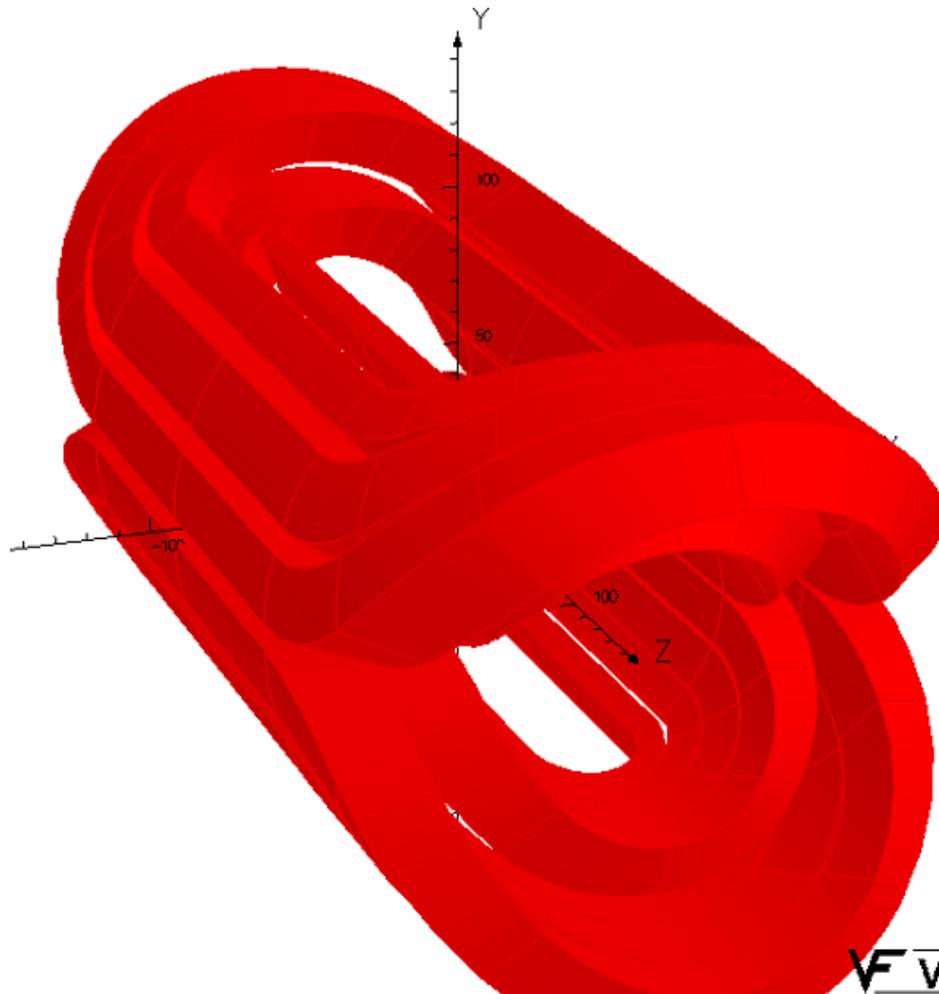


## Cos-theta dipole

- Field homogeneity
  - Address using opera 2d in optimisation loop
  - Include nonlinear solution for iron poles
  - Key stoned conductor variable current distribution
- Very high compressive stress on conductor
  - Minimise stress in magnet using 2d stress analysis in optimisation loop



Optimising field homogeneity



## Cos-theta dipole

- Complex end winding geometry
  - Minimise stress and end effects using VF 3d in the optimisation loop

## Helical dipole

- Complex 3d geometry
  - Address using VF 3d in optimisation loop
  - To improve field homogeneity
  - Look at reducing stress in conductor using VF 3d stress package