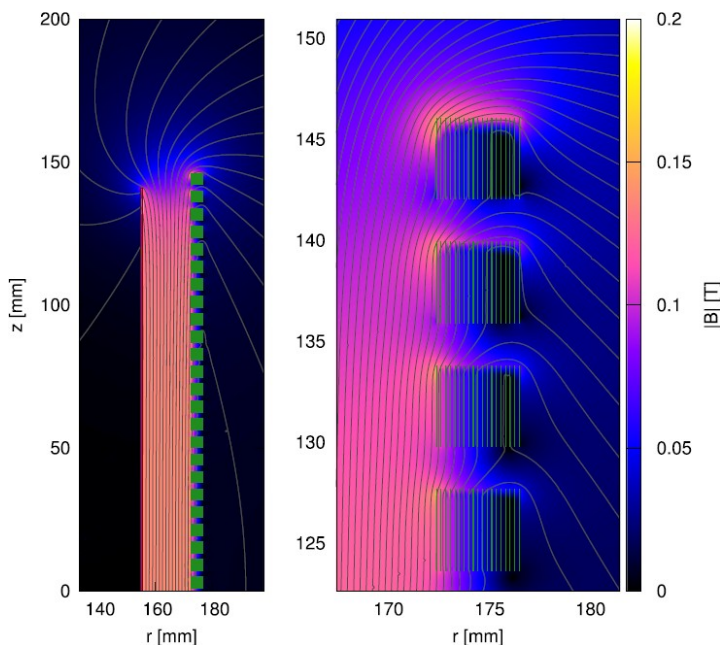


## Computer modelling of 1 MVA and 40 MVA full superconducting transformers

Power transformers using superconducting REBCO coated conductors have many potential advantages over conventional transformers. The ac loss in the windings complicates the cryogenics and reduces the efficiency, and hence it needs to be predicted in its design by numerical calculations. During this project, we modeled a 1 MVA 11 kV/415 V 3-phase transformer. Agreement between calculations and experiments supports the validity of further modeling for a larger tentative 40 MVA 110 kV/11 kV design. The research is led to optimize the 40 MVA transformer and assess its economical feasibility. The modelling has been possible thanks to the previous development of advanced computational tools, which at the publication of the main results (October 2015) was the only one worldwide able to model the high number of turns in transformers (around 2000). The work on transformers has been done under a contract with the Robinson Research Institute, Victoria University of Wellington and has also been conducted with industrial partners (Fabrum Solutions Ltd and SuperPower Inc.). Further work on AC losses has been done in the framework of this project in the context of a fault current limiting transformer supported by SuperPower Inc. in part under USA Department of Energy contract DE-OE0000244,006.



The low-voltage winding (red) suppresses the radial magnetic field in the high-voltage winding (green).

### Articles:

**E Pardo**, M Staines, Z Jiang, and N Glasson: Ac loss modelling and measurement of superconducting transformers with coated-conductor Roebel-cable in low-voltage winding, *Supercond. Sci Technol.* **28** (2015) 114008.

M Staines, L Jolliffe, A Hunze, M Pannu, **E Pardo** and N Glasson: Will we see superconducting transformers in the grid anytime soon? *Electricity Engineers' Association (New Zealand) Conf. and Exhibition preprint*

### Conferences presentations:

**E Pardo**, M Staines, Z Jiang, N Glasson, B Buckley: Modelling and measurement of AC loss in a superconducting transformer, In: ASC 2014, Charlotte (USA).

M Staines, **E Pardo**, L Jolliffe, M Pannu, and N Glasson: Prospects for HTS transformers in the grid: AC loss and economics. In: EUCAS 2015, Lyon (France).

M Staines, L Jolliffe, A Hunze, M Pannu, **E Pardo** and N Glasson: Will we see superconducting transformers in the grid anytime soon?. In: Electricity Engineers' Association (New Zealand) Conf. and Exhibition 2015, 24 - 26 June, 2015, Wellington (New Zealand).