BULK MAGNETISATION  (5 participants)

• Jc(B) usually a macroscopic approximation using average properties based on some local measurements of small sample(s) $\rightarrow$ then apply Kim or Kim-like model

• For improved modelling:
  – More fundamental data is needed over a large range of B and T. In general, many modellers use some simple approximations for Jc(B,T)
  – At lower temperatures, microscopic properties (cracks, dislocations, etc.) have a large influence on the magnetisation process, but not much data exists
  – Jc as a function of position is very important, but there don’t exist any non-destructive testing methods to evaluate this

• A demand to better understand the physics of bulk superconductor magnetisation, including flux pinning and movement
  – Studies on MgB2 bulks, being more homogeneous, can assist understand this issues overall.

• Less difficulties than tape-/coil-based modelling
  – Meshing & number of elements better due to the simpler geometry and better aspect ratio
  – But now 3D models are being developed, which are more computationally intensive.

• A need for 3D arrays of multiple bulks to model practical devices.

• In 3D models, worry about applying the power law in three axes.
  – There may be issues with flux cutting (Archie) and flux line dynamics may be very complicated, including microscopic nature and anisotropy
  – Current models tend to use simple reduced Jc or ignore current along other axes than the plane of the “main” supercurrent providing the trapped field

• SOFTWARE/MODELS USED:
  H formulation, Campbell’s equation, A-V formulation
  COMSOL, Open source/self code, FlexPDE

• “Slow magnetisation” models (analogous with DC models)
  “Fast magnetisation” models (like AC)
  – These different models require different considerations – some are time-dependent, some are thermal
  – Developments in tape/coil modelling – which has had many developments in recent times – can assist greatly in optimising bulk superconductor models