HOM Simulations with ANSYS

Sam Posen
Cornell University
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ANSYS

- ANSYS is a finite element analysis package developed for engineering applications
- ANSYS recently acquired several companies and now owns some industry-leading codes (HFSS, ICEM CFD, CFX, FLUENT)
- Has several types of analysis for different kinds of physics
- Can send results from one analysis to another
- Can couple some analyses together directly
Analysis Types

• Structural
• Thermal
• Fluid dynamics
• Explicit Dynamics
• Magnetostatics
• High Frequency EMAG
• Low Frequency EMAG
• Joule Heating
• Directly coupled analyses
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Excellent for thermal, structural analyses! Not capable of introducing particles. Not intended for accelerator applications!
Benefits of ANSYS

• Excellent support, documentation
• Low cost academic license for universities
• Well benchmarked
• Versatile – can easily access data at any selection of nodes, load any elements
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Drawbacks of ANSYS

• Program issues (issues as of right now—I’ll talk about the future)
  – Interface not very user friendly
  – Mesher takes a long time

• Requirements of accelerator community not likely to influence development of code
Plans for ANSYS

- ANSYS is switching from its arcane FORTRAN-based system to new “Workbench” environment
- Much more user friendly, fast mesher
- Strong CAD model compatibility
- Built-in optimization algorithms
- Current WB 12.0 no HF simulations, but planned for 13.0 (January) or 14.0 (~1 year later)
Workbench Environment
ERL HOM absorbing tiles had been found cracked and fallen off assembly.

Thought to be thermal expansion mismatch causing stresses when assembly was cooled.
• Found small deflection in assembly when cooled

• Large concentration of stress at edge of tile, near pivot point
ANSYS Example: ERL HOM Tile

• Came up with series of stress relieving cuts

• Cuts reduced maximum calculated stress by more than 80%
Simulations show negligible effect on heat transport.

Contact region held at 80K.

4W surface heat flux on each tile.
Summary

• ANSYS is useful for multiphysics studies
• Not good for particles (wakefields, multipacting)
• Good documentation, support, benchmarks; small $ for universities, versatile
• Upcoming versions of ANSYS supposed to have user-friendly HF simulation capabilities