

# Comparing Magnum to Maxwell3D and CST EM Studio

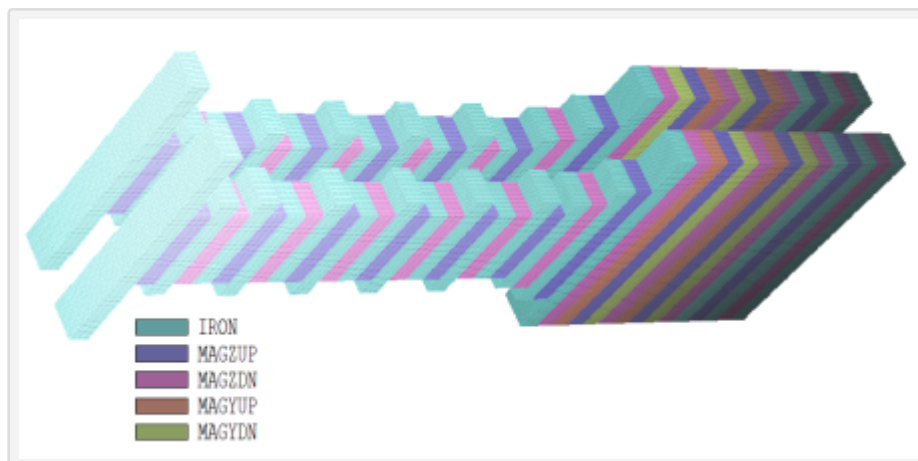
At Field Precision, we face a vexing image problem. Potential customers often assume that because our competitors charge so much more for their 3D magnetic-field codes that their products are better. Therefore, I always enjoy impartial benchmark comparisons because **Magnum** performs equal to or better than the alternatives.

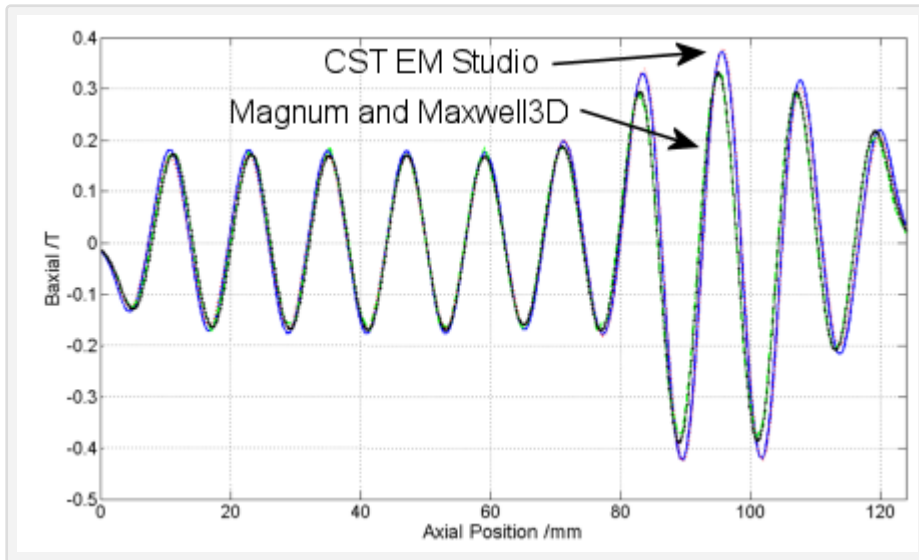
I recently received a report from Jason Wang at the University of California at Davis. He used **Magnum**, **Maxwell3D** and **CST EM Studio** to model the permanent-magnet assembly shown in the first figure. The PPM stack for transporting a high-current sheet electron beam is described in the report G. Scheitrum, *Design and Construction of a W-band Sheet Beam Klystron* (Stanford Linear Accelerator Center, SLAC=PUB-11688, 2005). The device employs displaced poles to provide beam containment in the long direction. It contains 34 iron poles and 48 bar magnets. The second figure shows the numerical results, scans of axial magnetic field along the midplane of the stack. The **Magnum** and **Maxwell3D** results are almost indistinguishable. The **CST EM Studio** numbers exhibit considerable deviations from the predictions of the other two codes.

A more striking difference in the codes shows up in the performance. The **Magnum** calculation used 1767168 nodes and ran for 3941 seconds. On the same computer, it was only possible to use 529163 nodes in **Maxwell3D** because of higher overhead per node. Even with fewer nodes, the run time was 5400 seconds, 37% longer than **Magnum**. **CST-PS** exhibited the worst performance, 10200 seconds for a mesh with 1557468 nodes. A final topic that may be of interest is that **Maxwell3D** and **CST EM Studio** cost over five times as much as **Magnum**!

We have observed a close correspondence between results from **Magnum** and **Maxwell3D** in work with other companies who use both codes. I suggest the following guidelines for anyone considering 3D magnetic field calculations:

- **Magnum** generates physical results that equal or exceed the accuracy of competing products.
- In addition to a lower purchase price, **Magnum** features free updates and no licensing fee.
- Regarding ease-of-use, my sense is that although **Magnum** may be more difficult to learn, setups and modification become highly efficient once the user understands the basic concepts. This is a subjective area, so I suggest downloading the **Magnum** instruction manual (<http://www.fieldp.com/magnum.html>) or arranging a 30-day trial.





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