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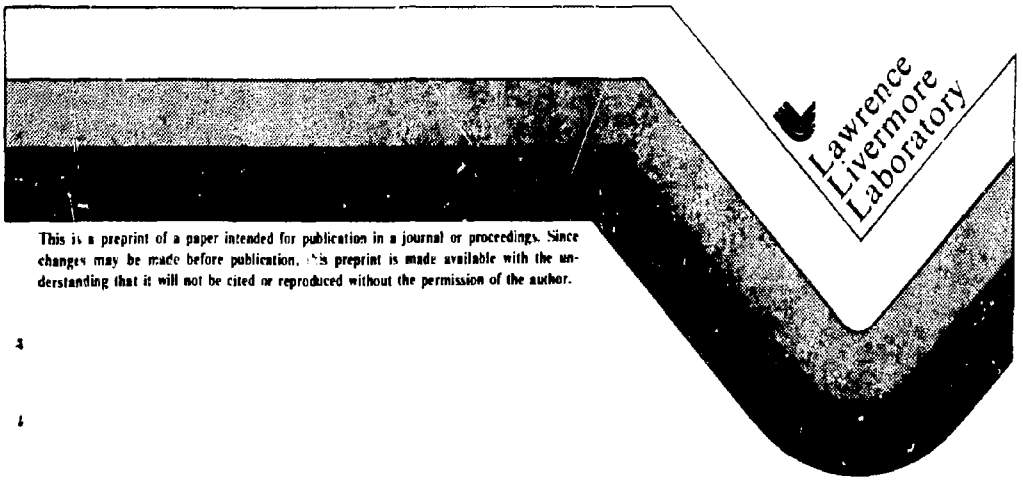

TMX-AXISYMMETRIC MAGNET-SET DESIGN STUDY*

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Studies are currently being made to design an axisymmetric modification to the TMX-Upgrade experiment.[1] The existing TMX-Upgrade quadrupole plug and transition magnet sets are replaced by the circular coils of an axisymmetric plug.

The existing TMX-Upgrade magnet set is shown in Fig. 1. The circular coils are sectioned to show the quadrupole magnets and the flux bundle. The two end cells of this magnet set are MHD stable minimum-B plugs.

From a mechanical design viewpoint, an axisymmetric design is attractively simple. One of the axisymmetric designs under consideration is the "Modified Cusp." Figure 2 shows a magnet set for this design. The coils are sectioned to show their cross section. The magnetic field calculations are made using the EFFI[2] magnetic field code. Figures 3-5 are EFFI output for the modified cusp magnet set shown in Fig. 2. The flux bundle in this design has a wall of annular shape. Figure 3 shows a representation of one-half of the magnet set with the flux bundle. Figure 4 shows a detail of the modified cusp plug. Figure 5 shows the field magnitude along the field lines. The power required for this magnet set is 32 MW.

In general, the engineering of any axisymmetric magnet configuration involves the consideration of the points listed in Table 1.

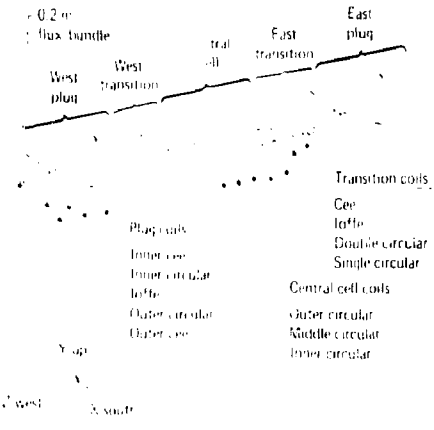

FIG. 1. TMX-Upgrade magnet set.

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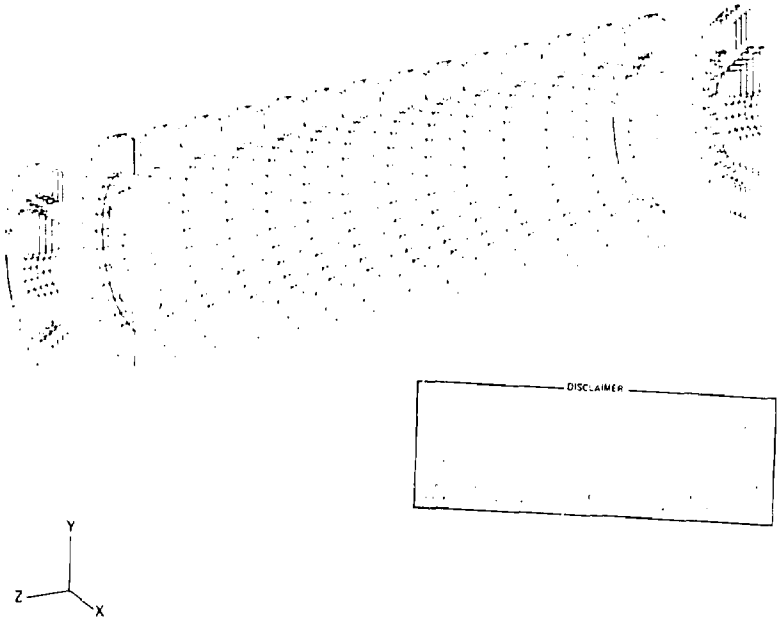

FIG. 2. TMX axisymmetric, modified-cusp, magnet set.

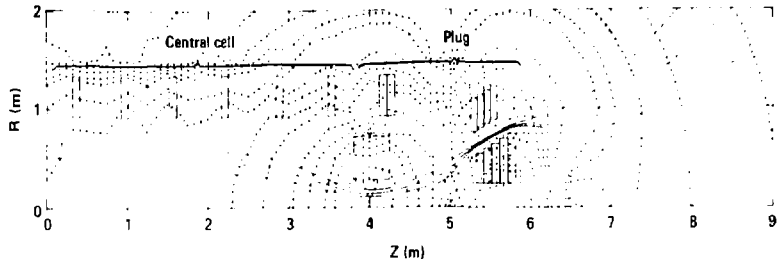

FIG. 3. TMX axisymmetric modified cusp.

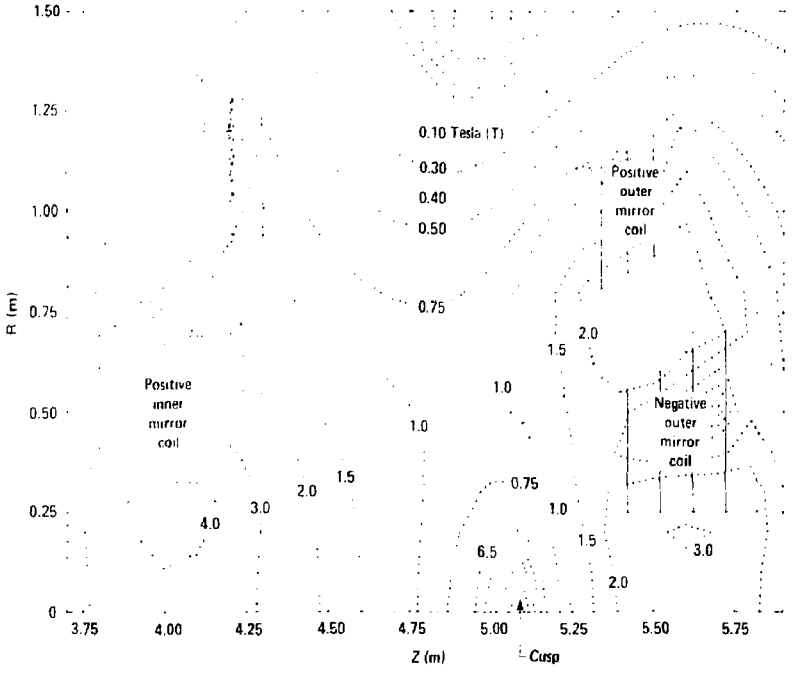

FIG. 4. TMX axisymmetric modified cusp, plug detail.

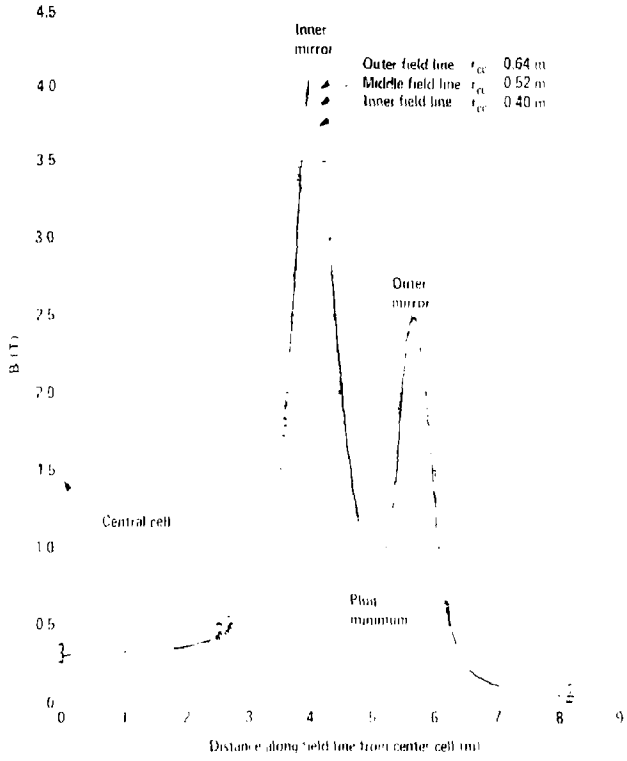

Fig. 2. Field magnitude along field line.

Table 1. Magnet design considerations.

Engineering Considerations	Physics Considerations
• Neutral-beam access	• Magnetic-field profile and magnitude
• ECRH microwave access	• Thickness of the flux-bundle cross section
• Diagnostic access	• Adiabaticity in the end cells
• Coil supports	• MHD stability: flute interchange
• Power requirements	• MHD stability: ballooning interchange
• Available space	

References

1. R. [illegible] Dong, "TMX Upgrade Magnet Set Geometry Design," 9th Symposium on Engineering Problems of Fusion Research, Chicago, Ill., October 26-29, 1981 (UCRL-85979).

2. S. T. Sackett, EFFI-A Code for Calculating the Electromagnetic Field, Force, and Inductance in Coil Systems of Arbitrary Geometry, UCRL-52402, Lawrence Livermore National Laboratory, Livermore, Calif., March 29, 1978.