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# Shielding in 300 - 1000 G Background Field

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Abstract:

Efficiency of shielding is very dependent on the volume to be shielded and on the shape of the iron shield. This is preliminary data for shielding in uniform field of 300 - 1000 G which covers the values of field flux density in the experimental hall in the median plane of the magnet outside the vacuum vessel. The objective of the study is to figure out the thickness of the shield to bring the field down to less than 50 G level.

GEM Technical note

To: Distribution
From: Martovetsky N.N.

12 May, 1992

## SHIELDING IN 300 -1000 G BACKGROUND FIELD

Efficiency of shielding is very dependent on the volume to be shielded and on the shape of the iron shield. This is preliminary data for shielding in uniform field of 300 - 1000 G which covers the values of field flux density in the experimental hall in the median plane of the magnet outside the vacuum vessel. The objective of the study is to figure out the thickness of the shield to bring the field down to less than 50 G level.

Figure 1 shows the contours of the constant field. It is seen that in 300 G field to shield a cylindrical volume with the z-axis parallel to the magnet axis and H=1 m and R=0.5 m one need about 2 cm of iron to get maximum field inside less than 32 G (units of field in all Figures are in Tesla). Here and in further plots only one quarter of the cross sections is shown.

To shield a spherical volume with 1 m in diameter in the same background field of 300 G one need less than 2 cm thick shield. With 2 cm shield one can obtain level of 3 G inside the shielded volume (see Fig.2).

Fig.3 shows contours of the constant field inside the spherical iron shield with 1 m in diameter and 4 cm thick. The maximum field inside is 3.3 G. The mass of the shield is about of 1 t. Fig. 4 shows that 2 cm thick spherical shield can not shield this volume sufficiently and has maximum of 170 G field inside.

Fig. 5 shows that 4 cm thickness of the shield is not enough to shield the objects below 50 G in 1000 G background field. Maximum value is 140 G inside.

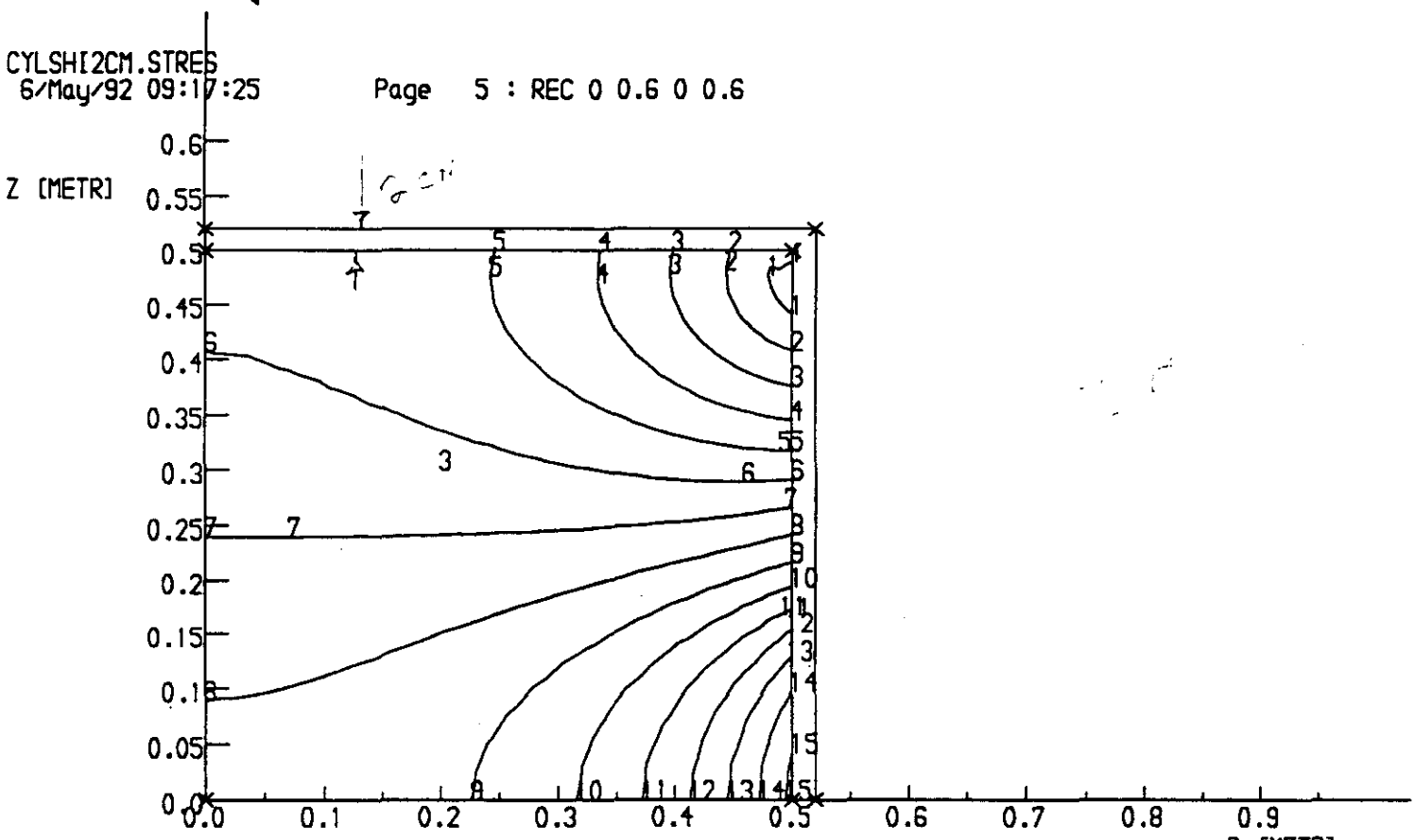
Fig. 6 shows that 6 cm of iron allows to shield 1000 G field having 6 G inside the shielded volume. The total mass of the shield is about 1.5 t.

### Conclusion

This study shows that passive shielding of relatively small volumes (about 0.5 $m^3$ in our case) is possible to very low values of

the field inside. Spherical or ellipsoidal type of the shield is preferred. Shielding in 1000 G or more field becoming more difficult due to saturation of iron and require substantial thickness of the walls of the shield.

300G




Component: BMOD
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Static Solution Mesh 1791 Elements 3 Regions

VF/PE2D.8

Fig. 1.

300 G

Total mass of shield ≈ 0.5 t

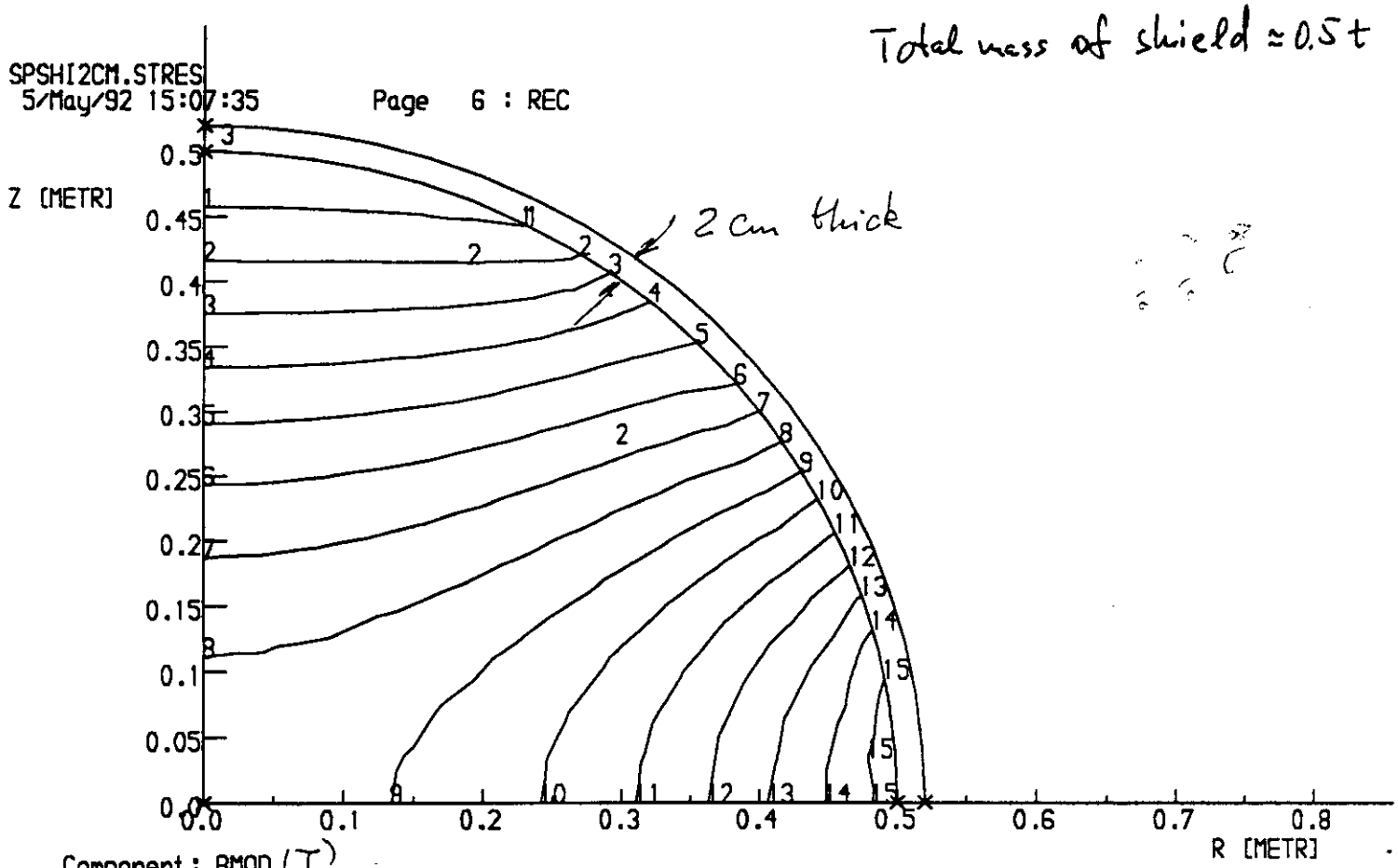
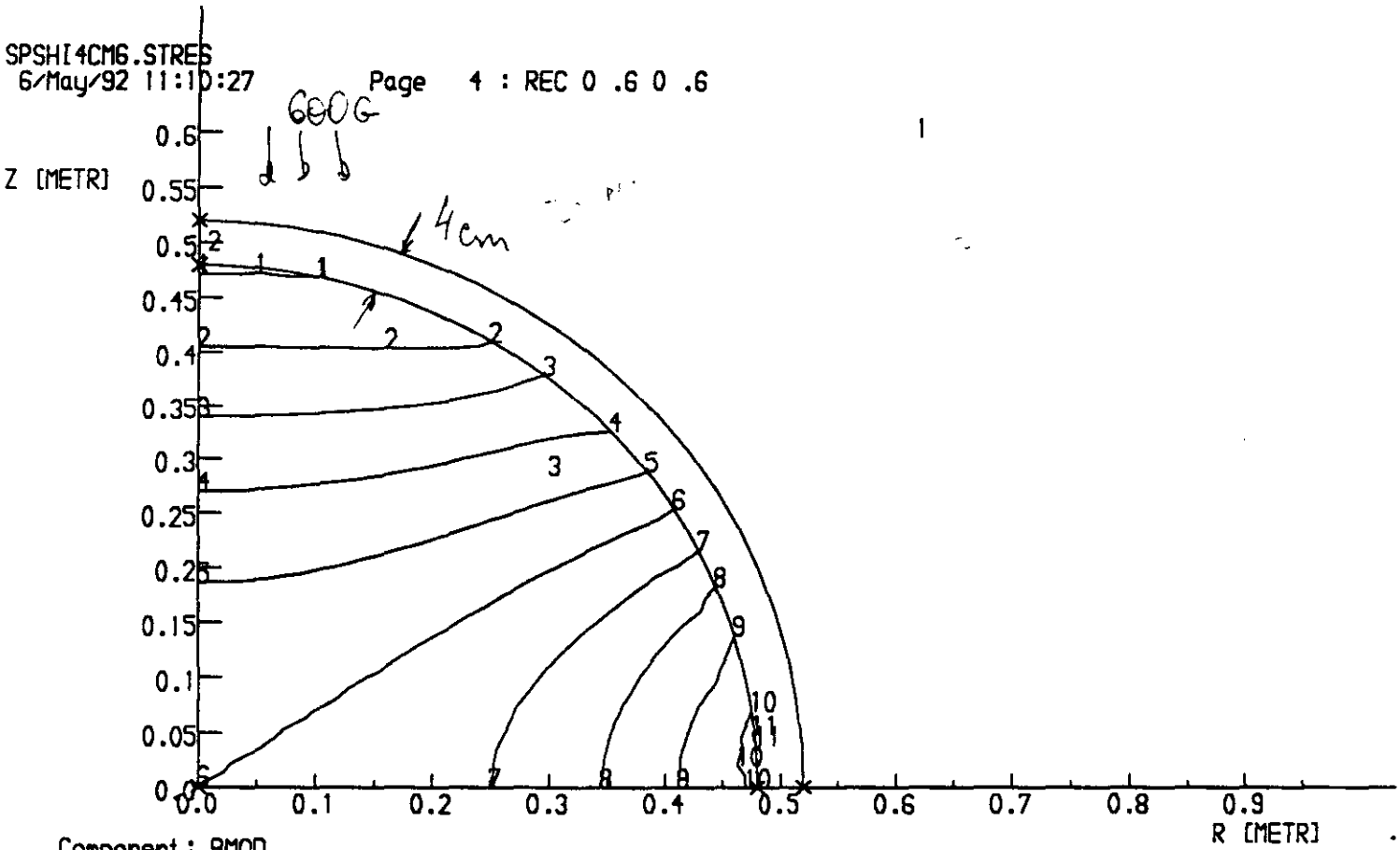



Fig. 2




Component: BMOD
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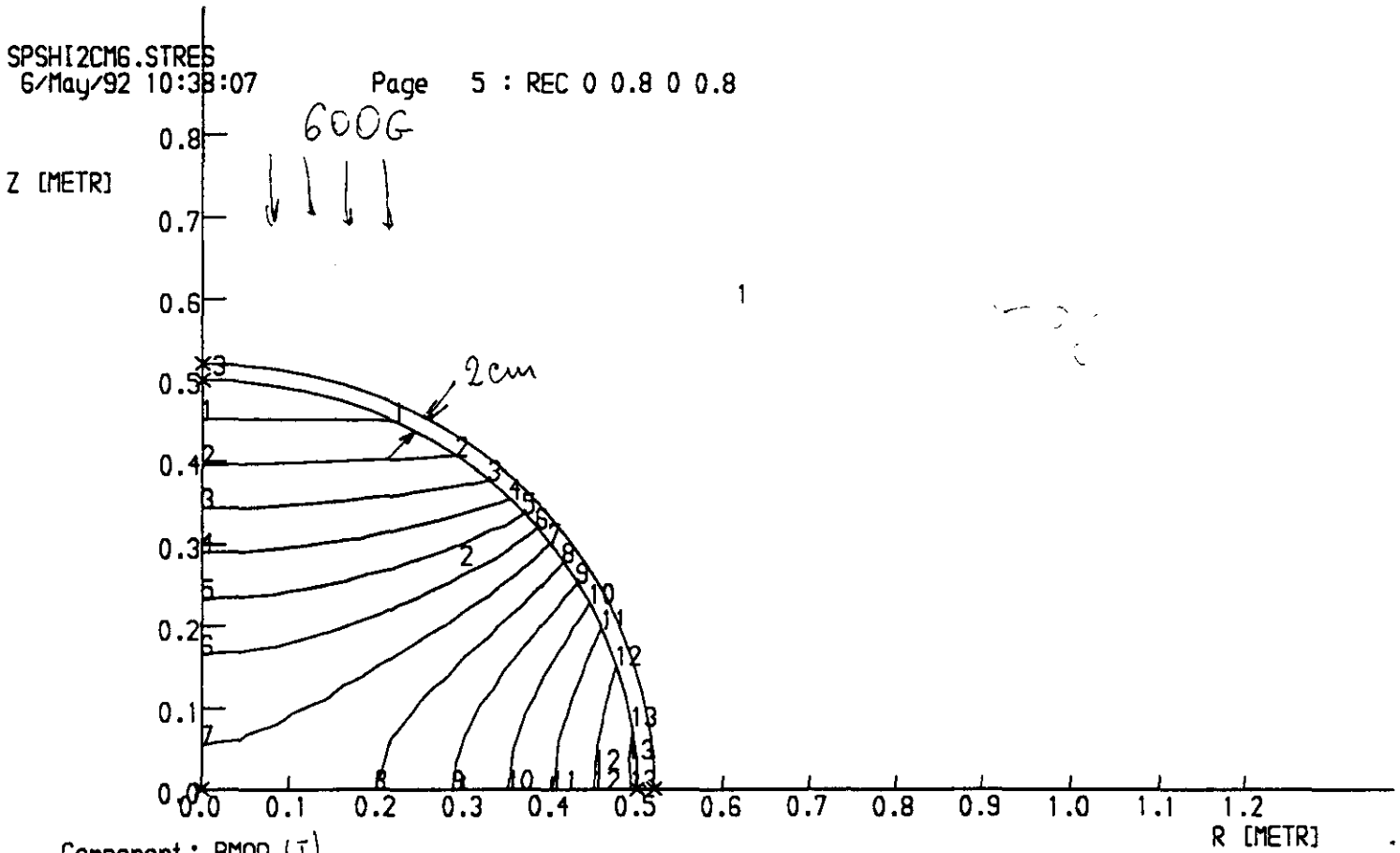
Static Solution Mesh 1314 Elements 3 Regions

VF/PE2D.8

Fig. 3

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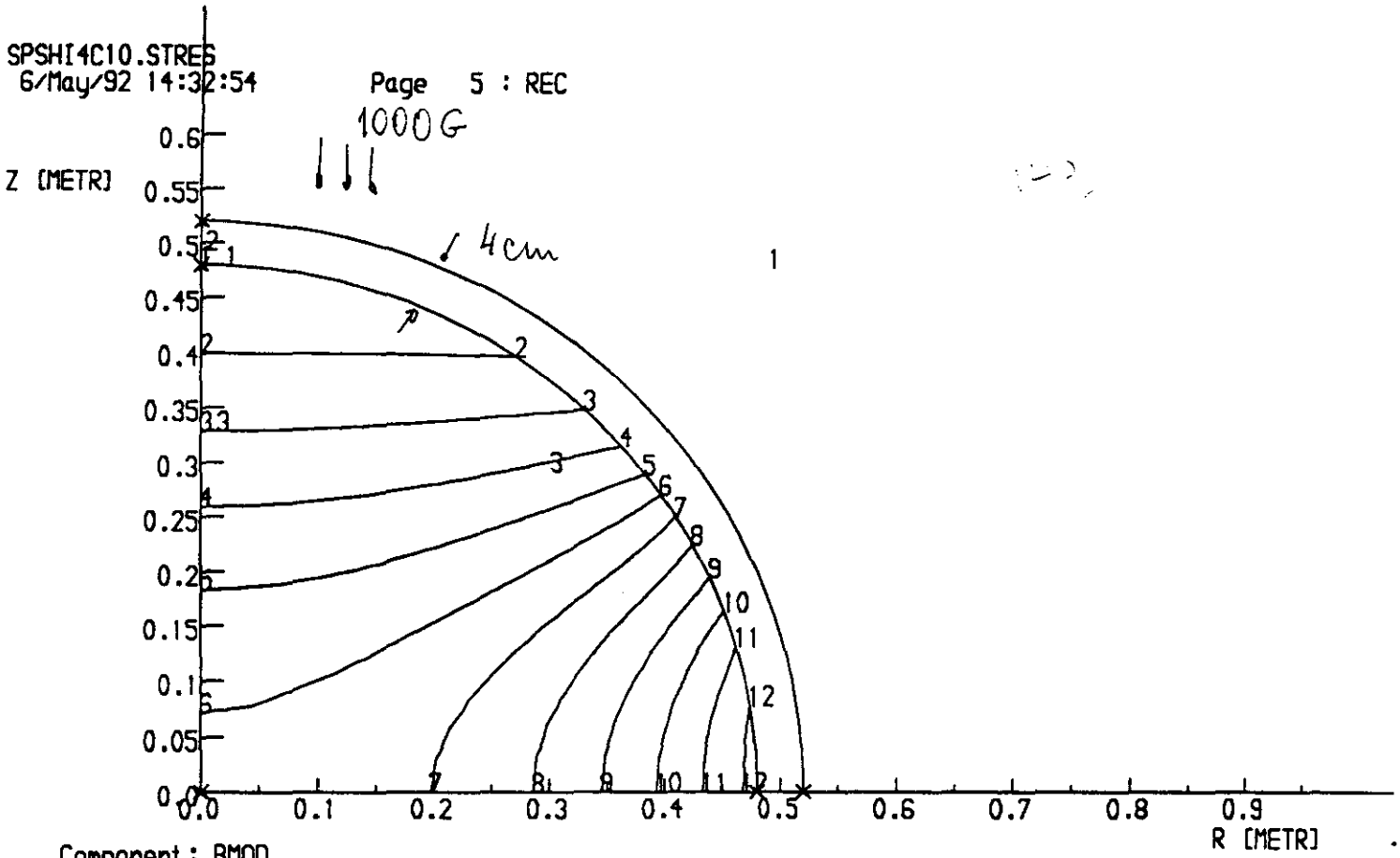
Static Solution Mesh 1116 Elements 3 Regions

VF/PE2D.8

Fig. 4

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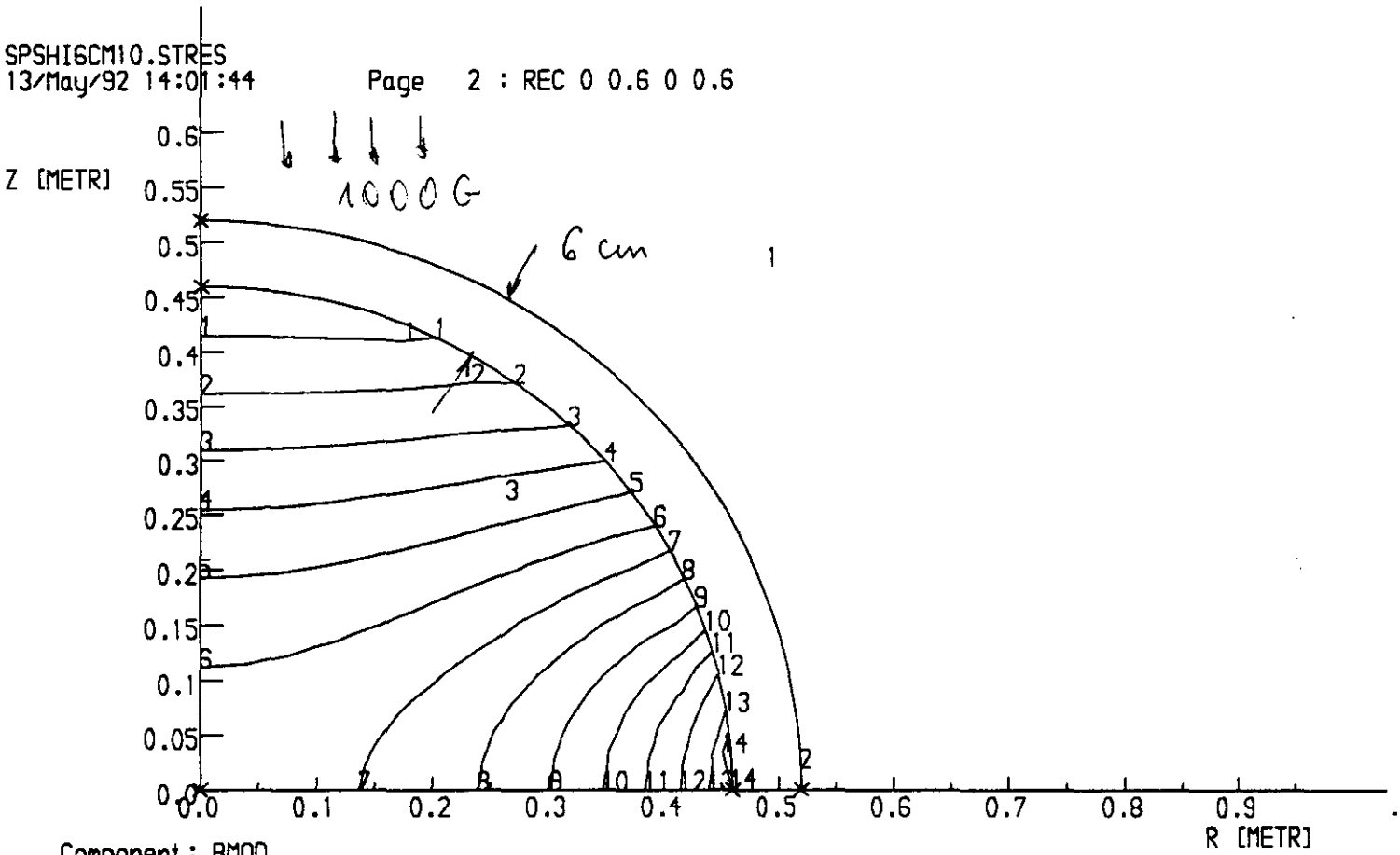
Static Solution Mesh 2031 Elements 3 Regions

VF/PE2D.8

Fig. 5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13/May/92 14:01:44
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R [METR]
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Static Solution Mesh 1515 Elements 3 Regions
VF/PE2D.8

Fig.6