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# Drop in Gain of the Australia Telescope Antennas at 86 GHz due to Axial Subreflector Movement

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## 1 Introduction

Recently, I have been asked by Dr M.J. Kesteven to simulate the behaviour of the 22-m-diameter antennas of the Australia Telescope with an axial offset of the subreflector. This study has been done at 86 GHz using a crude "ray-tracing" software that I have designed to use for large antennas (in terms of wavelengths) (see Fig. 1). It is assumed that the illumination on the aperture is constant in amplitude and is only affected by the phase introduced by the ray-tracing. This assumption is reasonable in the case of the shaped antennas of the Australia Telescope and has been used previously in [1] [2].

## 2 Radiation pattern

The radiation pattern of the antenna is shown in Fig. 2 where Fig. 2a shows the pattern with the original geometry, Fig. 2b shows the pattern with an offset of the subreflector of $Dz = 0.2\lambda$, Fig. 2c for $Dz = 0.4\lambda$, Fig. 2d for $Dz = 0.6\lambda$ and Fig. 2e for $Dz = 0.8\lambda$. Calculations for $Dz$ =-0.2, -0.4, -0.6, and -0.8 $\lambda$ were also made and their results are similar to their positive counterparts.

The drop in gain resulting from the subreflector axial offset is shown in Fig. 3.

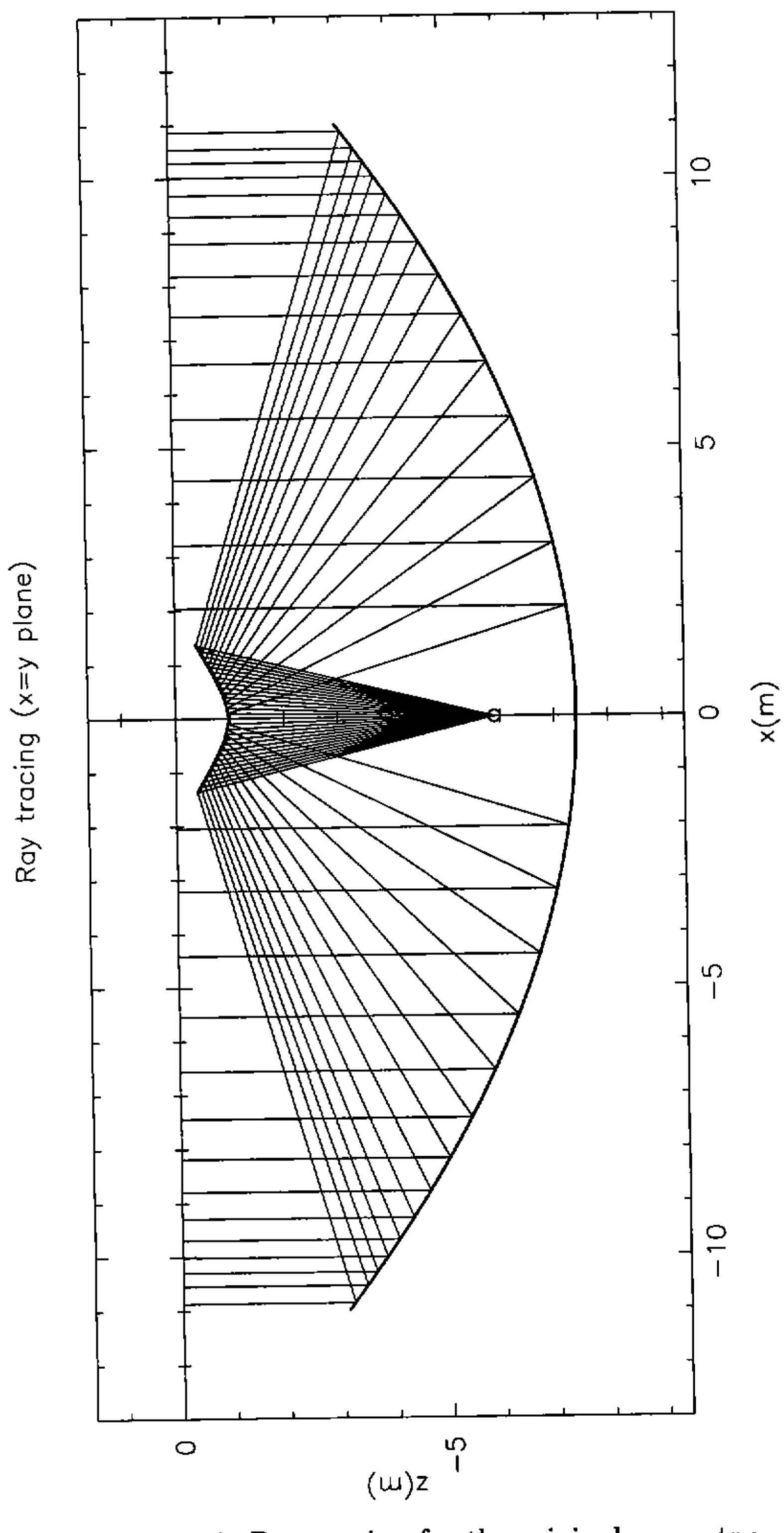
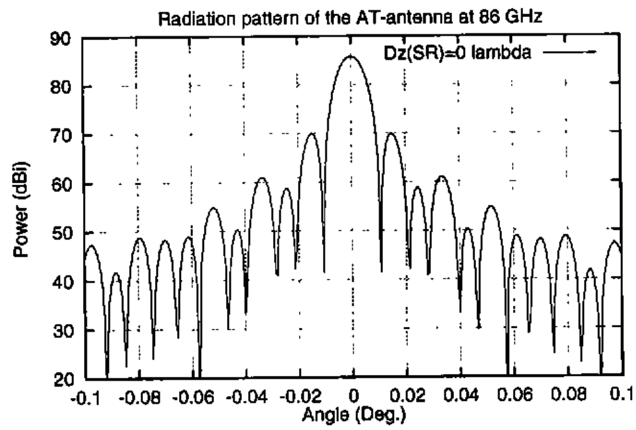
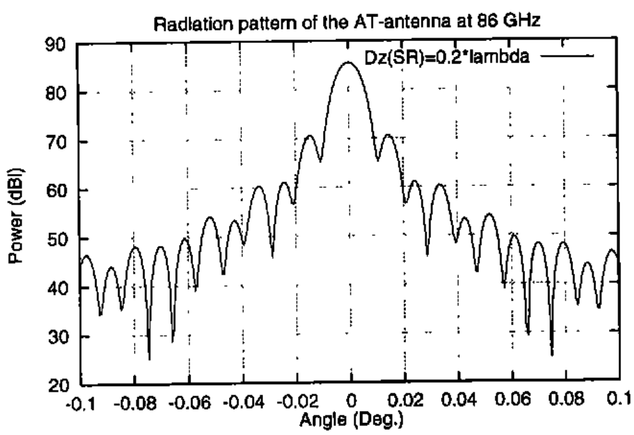


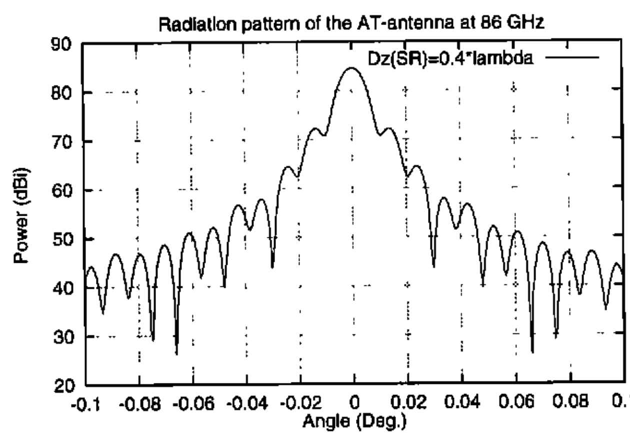

Figure 1: Ray-tracing for the original geometry.



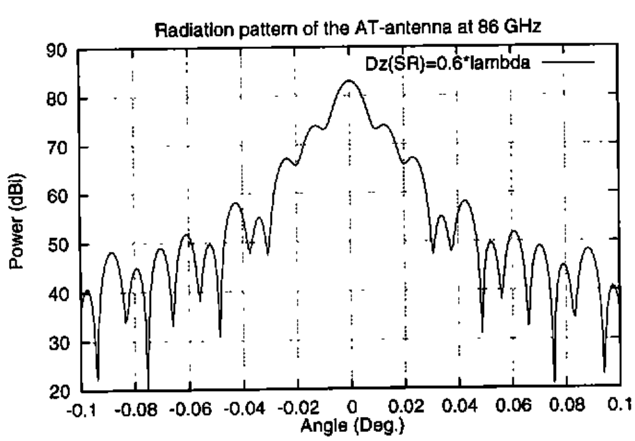

(a)



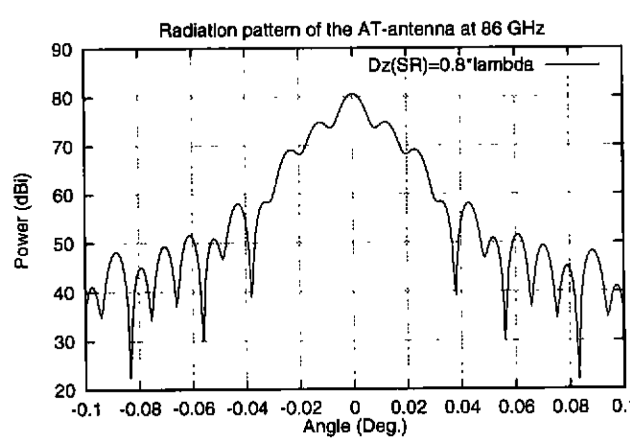

(b)




(c)




(d)




(e)

Figure 2: Radiation pattern at 86 GHz for a) $Dz$=0; b) $Dz$=0.2; c) $Dz$=0.4; d) $Dz$=0.6 and e) $Dz$=0.8 wavelength.

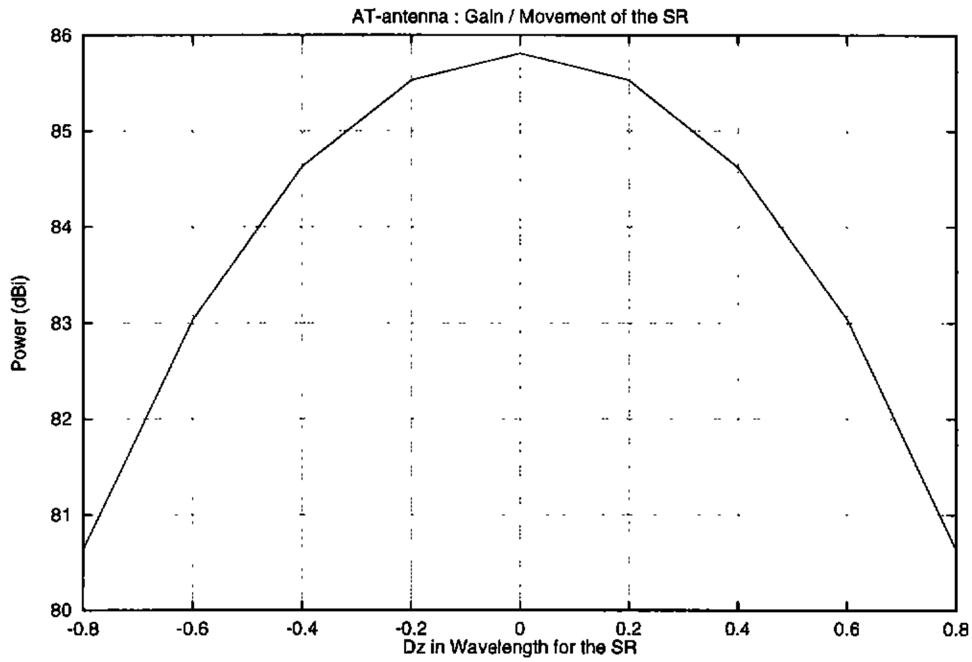



Figure 3: Gain-drop as a function of subreflector movement.

# 3 Conclusions

To use the Australia Telescope at 86 GHz (and above), it is important to ensure that the location of the subreflector is within a fraction of a wavelength from its theoretical position. An important drop in gain could result from an error in subreflector location of even 1 or 2 mm.

# References

[1] Granet C., James G.L., "Beam scanning by feed movement on the AT antennas", RPP No 3645, Jan. 28, 1994.

[2] Granet C., "Beam squint of the Australia Telescope by feed movement", RPP No 3935, July 4, 1997.