

FEASIBILITY STUDY FOR THE FOCALISATION OF THE NEW 40m RADIOTELESCOPE OF CENTRO ASTRONÓMICO DE YEBES

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This paper presents a first study of the focalisation of the new 40m. radiotelescope of Centro Astronómico de Yebes (Spain) which may operate at S, X, K and millimetre bands with a multiband feed system with minor mechanical changes on a classical Cassegrain type radiotelescope. The geometry of this Cassegrain antenna radiotelescope consists of a 40m paraboloidal main reflector with $f/D=7.915$.

Some millimetre radio astronomy antennas, of the classical Cassegrain-type, are also used for geodesic VLBI measurements, which are done simultaneously at X-band (8,2/9.0 GHz) and S-band (2.2/2.4 GHz). In these not dedicated VLBI antennas, it is usual to take monthly observations that extend for a couple of days or so. Generally, VLBI usage of millimetre radio telescopes requires very large X and S bands feed horns because of the small angle that the hyperboloidal subreflector subtends from the Cassegrain focus, even when the millimetre hyperboloidal reflector is temporally changed by a larger one. So these frequency bands are the most critical in the design of the radiotelescopes and in the process of focalisation in order to select the minimum size of the feed horns and the appropriate focalisation elements, such as lenses and mirrors.

Gaussian Beam analysis has been employed to study the behaviour of the fields reflected and subtended in the receiving cabin of the radiotelescope. Different solutions and combinations of ellipsoidal, hyperboloidal, paraboloidal and lenses are used to place the receivers in the limited size of the cabin. First, the main parameters of the fundamental Gaussian Beam Mode are calculated according to the desired horn in each band. Those non optimal solutions because of the sizes of the different focusing elements and the sizes of the feed horns are neglected. By doing so, with the optimal solutions for each band presented in this paper, it has been extensively employed to calculate the electromagnetic behaviour of the fields in the receiving cabin a study of the propagation of the higher order modes.