THE PARKES – TIDBINBILLA INTERFEROMETER

R.P.Norris, M.J.Batty, M.J.Kesteven,
K.J.Wellington
CSIRO Division of Radiophysics
PO Box 76, Epping, NSW 2121,
Australia

ABSTRACT. The Parkes – Tidbinbilla Interferometer is a radio-linked interferometer using the 64-m telescope at Parkes together with one of the NASA antennas (34-m or 64-m) at Tidbinbilla. With a baseline of 275km, it is currently the world's longest real-time interferometer, and is usable at frequencies of 1.6, 2.3, and 8.4 GHz to give angular resolutions of 0.13, 0.09, and 0.03 arcsec respectively, with a sensitivity of 1–2 mJy rms in 5 minutes at a bandwidth of up to 10MHz.
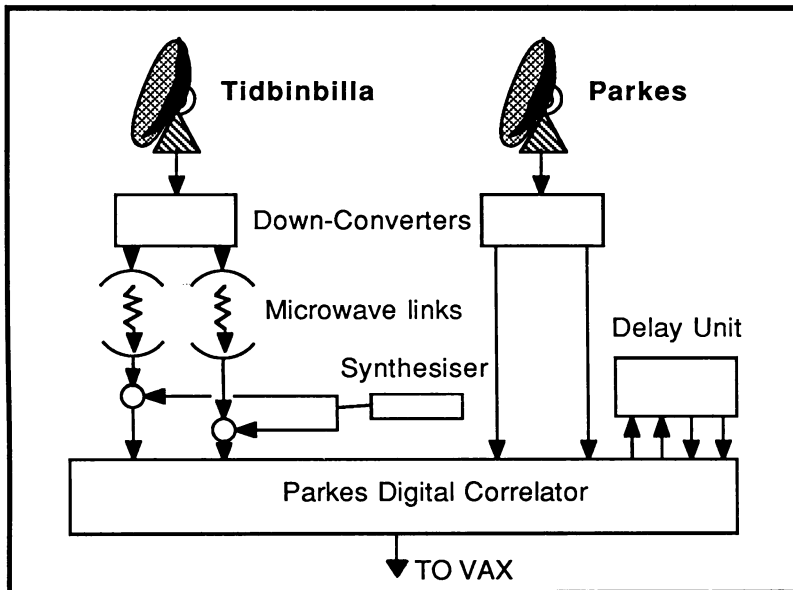
Figure 1. The Parkes-Tidbinbilla Interferometer

1. INTRODUCTION

The Parkes – Tidbinbilla Interferometer (PTI), was conceived largely as a prelude to the Australia Telescope (AT), and as such is useful both as a test-bed on which to tackle some of the problems that we will encounter on the AT, and also as a first step towards the construction of a frame

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of reference of calibration sources for the AT. In addition it constitutes a powerful instrument with which to tackle some current astronomical problems. First fringes were obtained on the PTI in a limited mode in June 1985 (Norris et al., 1985). Since then the system has been upgraded so that it uses two channels, each of which can be used at bandwidths up to 5MHz. Local oscillators at Parkes are locked to a Rubidium standard.

2. THE INSTRUMENT

A novel feature of the PTI is that many of the interferometer functions which have traditionally been implemented in hardware (before correlation) are instead software-based (after correlation). Only coarse phase and delay tracking necessary to prevent decorrelation in the 2-s integration time need be applied before correlation.

The IF signal from the Tidbinbilla antenna is sent to Parkes on microwave links installed by NASA for the Voyager-Uranus encounter. At Parkes, the two signals from Tidbinbilla are mixed with a 0.15 MHz tone derived from a Rockland Model 5100 synthesiser, which is adjusted every second by the on-line software to accomplish a first-order phase tracking. To prevent random long-term drifts,the phase of the synthesiser is set to zero at the start of each 'scan' (typically 10 minutes). The resulting phase steps, together with fine phase variations, are subsequently removed in software.

Coarse delay tracking is achieved by a circulating- RAM delay unit with a resolution of several μs. The two cross-correlation functions (XCFs) are then allowed to drift throught the 1024-channel correlator, and the online software selects two 256-channel XCFs, thereby tracking the delay to a resolution of 1 delay channel. The resulting XCF is then Fourier transformed into the frequency domain, where fine delay tracking is performed by applying a phase gradient to the complex spectrum.

3. THE SCIENCE

Current projects being tackled on the PTI include:
1. Observations at 2.3 and 8.4GHz of SN1987A
2. Astrometric measurements of calibrator sources
3. Determination of pulsar proper motions
4. Studies of OH maser sources
5. Searches for compact nuclei in active galaxies and flat-spectrum quasars.

REFERENCE

Norris, R.P., Batty, M.J., Kesteven, M.J., & Wellington, K.J., 1985, Proc. Astr. Soc. Austr., **6**, 137.