Skip to main content

Radio Telescopes

About

Telescopes are used to receive radiation originating from distant astronomical objects for example.

For the resolution of a telescope, the diameter of its antenna is decisive. However, building antennas with enormous dimensions is cost-intensive and limited by static issues. An array of several antennas can overcome construction limits for large telescopes. The antennas are distributed over an area and the signals measured by the single antennas are combined by interferometry. This way, effective diameters of several kilometers and even more can be achieved, resulting in an enhanced resolution. To enable the interferometric reconstruction of an "image", the signals must have a common time base. But how to ensure an exact "timestamp" for the individual signals?
Such telescope systems typically use a stable master clock signal, such as a MASER that provides an RF signal as a local time. This local time can also be synchronized with universal world time, which is provided via satellite. But this highly accurate timing signal needs to be distributed to the remote parts of the telescope without introducing any disturbances and timing jitter. Here, Cycle's PULSE timing distribution system offers a state-of-the-art solution.

It transfers the RF signal into the optical regime and distributes it to the antennas via an optical fiber link network. In detail, a Balanced Optical Microwave Phase Detector (BOMPD) precisely synchronizes the master clock signal to a low-noise mode-locked laser that serves as an optical master oscillator (OMO). Then, the optical timing signal is distributed to the clients with polarization maintaining stabilized optical fibers. A feedback system with optical delay lines and Balanced Optical Cross-correlators (BOC) is provided to compensate for environmental fluctuations that influence the signal during transmission. The timing signal can be transferred into a highly accurate time stamp for the received RF signals at the individual antennas. And this way, an optical timing system like PULSE can contribute to exploring the universe.

Used by

esa

References

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