LLR- Activities in Wettzell

U. Schreiber, J. Mueller[1]
Forschungseinrichtung Satellitengeodaesie
Fundamentalstation Wettzell
D - 8493 Koetzting

R. Dassing, N. Brandl, K. H. Haufe, G. Herold, R. Kahn, K. Roettcher, R. Stoeger
Institut fuer Angewandte Geodaesie
Fundamentalstation Wettzell
D - 8493 Koetzting

Abstract

Following the idea of a fundamental station, the Wettzell Laser Ranging Station was designed to range to all types of satellites and to the moon [1]. After obtaining the first lunar echos in October 1990, the system's operation was improved. A short report of lunar ranging activities is given.

1 Ranging to the moon in Wettzell

The WLRS was put to routine operation in the beginning of 1991. It was taking over the task of the old Sylvania Ranging System (SRS). In the beginning it was ranging to LAGEOS and the two ETALON satellites. However, the design was such that it should also allow ranging to the moon. This was shown very early, when in February of 1990 the first ranges from Meteosat P2 were obtained. Unfortunately it took more than half a year to stabilize the operation of this part of the ranging realtime software. For the measurements to the moon a cooled PMT (RCA C 31034a) and a spectral Fabry- Perrot bandpass of 1.5 $\AA$ width around a centerwavelength of 532 nm is used. The laser energy was measured to be 180 mJ with a pulse duration of 200 ps. As the telescope aperture is only 75 cm and the location of the WLRS is on an altitude of only 600 m, there is a poor signal to noise ratio for these measurements. For these reasons the WLRS is usually employing a semipulsetrain for lunar ranging. The semitrain contains 5 individual pulses, the first 3 of them are contributing most to the energy budget. The semipulsetrain gives the additional advantage of producing a known pattern of lunar returns within the random noise from other sources. Ranging to the moon from Wettzell is challenging as the noise counts are usually hiding the lunar returns. This requires a complex post ranging examination procedure, carried out at the Technical University of Munich, to analyse the measurements. At Wettzell LLR has a very high ranging priority. However there were only very few nights during the last year permitting lunar ranging. In these nights hardly any passage of LAGEOS or ETALON was lost as it takes only a few minutes to switch the WLRS from lunar mode to satellite mode and the lunar ranging was interrupted for a short while.

[1]Techn. Universitaet Muenchen, Arcisstr. 21 D - 8000 Muenchen 2

2 Echos from the moon

In figure 1 a successful measurement is shown. Clearly the pattern of the used semitrain can be seen. The high noise rate is also evident. There is a fixed spacing in time between the individual pulses in the semitrain. This separation is depending on the length of the laser cavity and can be measured independendly. For the WLRS laser the pulses are 6.902 ns apart. This relation can be used to fold the lunar returns from the second and the third pulse of the semitrain onto the main pulse to increase the number of returns in the normal point.

3 Status of the WLRS

The WLRS proofed it capability for lunar ranging. However, the ranging to the moon is very complicated and not very well supported by the ranging software, which only provides elementary features. At the present efforts are made to increase the signal to noise ratio and to support blind tracking. The goal is a more efficient use of the few useful observation nights per year in Wettzell.

We would like to thank the lunar ranging team in Grasse (France) for for their help.

References

[1] Schlueter, W.; Hauck, H.; Dassing, R.; Schreiber, U.; Mueller, J.; Egger, D.; *Wettzell Laser Ranging System (WLRS) — First Tracking Results to Satellites and to the Moon, paper presented at the Crustal Dynamics Project Meeting, held in Pasadena, spring 1991.*

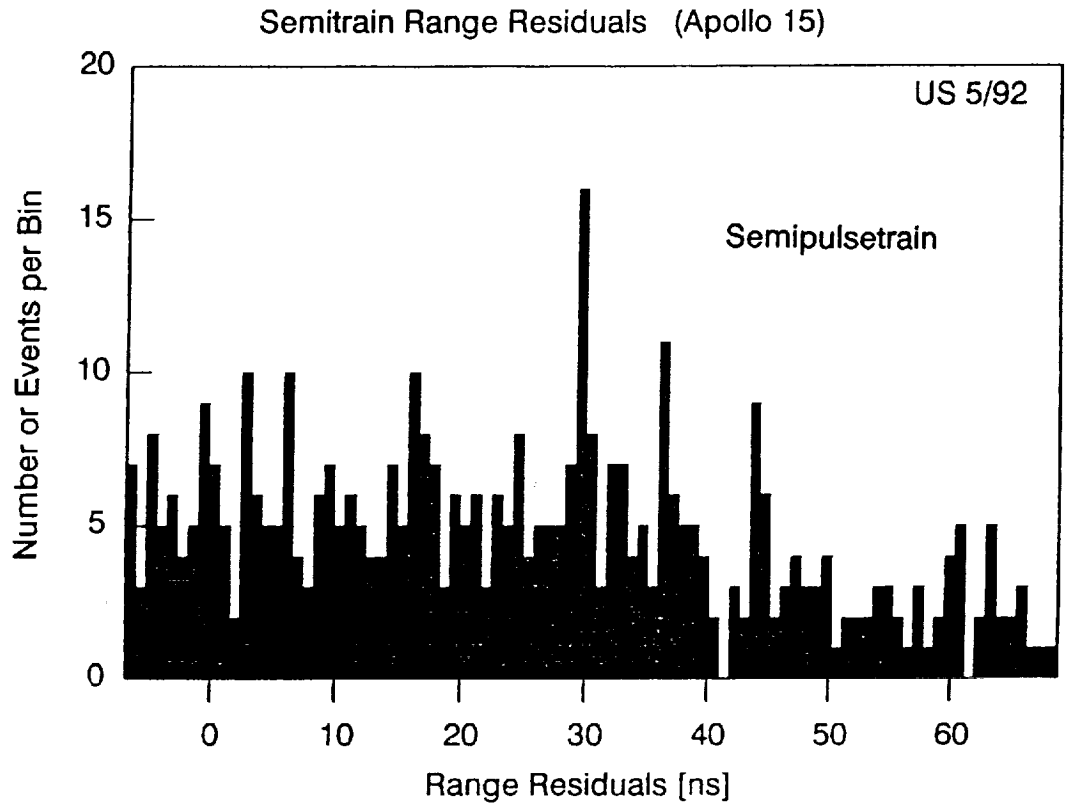

Figure 1: Histogram of the 'semitrain ranges' to APOLLO 15 during the night of Nov. 25th 1991. The session lasted 15 minutes

Fixed Station

Upgrades/Developments