

THE SHM HYDROGEN ATOMIC CLOCK FOR SPACE APPLICATIONS

DEVELOPMENT AND TEST OF THE PEM PHYSICS PACKAGE

L.G. Bernier, A. Jornod, H. Schweda, R. Gentsch, G. Busca

Observatoire Cantonal de Neuchâtel, Observatoire 58, Neuchâtel, 2000 Switzerland

tel (+41) (32) 889 68 70, fax (+41) (32) 889 62 81

e-mail : Laurent-Guy.Bernier@on.unine.ch

Abstract

A compact Space-borne active Hydrogen Maser (SHM) frequency standard is being developed by the Observatory of Neuchâtel under the Swiss PRODEX program of ESA. The SHM instrument will be flown on the Radioastron (RA) mission in 2000 to be used as the reference clock for orbital Very Long Baseline Interferometry (VLBI) and for the red-shift experiment CRONOS.

The SHM design is based on a miniature sapphire loaded microwave cavity which makes possible an active hydrogen maser with a 1.7 liter storage volume for atomic hydrogen within a 50 kg space qualified instrument.

A preliminary measurement of the SHM instrument frequency stability using breadboard electronics has yielded an Allan deviation of $\sigma_y(1000s) = 3 \times 10^{-15}$ which is already close to the $\sigma_y(1000s) < 15 \times 10^{-15}$ instrument specification. An extensive program for the design verification by test & analysis of the PEM-PP was performed in 1997 and is now near completion.

Potential space applications of a compact active hydrogen maser instrument include scientific experiments related to relativity, precise ranging and navigation, time dissemination and synchronization. Present plans are to push miniaturization even further with the development of a 35 kg active hydrogen MAser for Navigation (MAN) for GNSS applications.

•
•
•
•
•
•

•
•
•
•
•
•

