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Estimating orbital elements from VLBI observations and GNSS measurements

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Over the last years, ideas of installing a dedicated Very Long Baseline Interferometry (VLBI) transmitter on board of the second generation of Galileo satellites have been proposed. The mounting of such a transmitter on future satellites raises scientific questions and opens new opportunities of extending the current VLBI research with observations to geodetic satellites. These observations allow combining the satellite and the quasar frame due to the unique opportunity of determining the satellite orbit in the International Celestial Reference Frame (ICRF).

In this contribution, we present the estimation of orbit arcs based on VLBI observations combined with GNSS measurements. For this purpose, schedules including satellite and quasar observations, are created with the scheduling software VieSched++. These schedules are simulated and analyzed with the Vienna VLBI and Satellite Software (VieVS). In the analysis the partial derivatives of the state vector of the satellite with respect to the orbital elements, obtained from the module ORBGEN in Bernese, are used in VieVS for calculating the partial derivatives of the time delay with respect to the orbital elements. This approach allows to estimate the orbital elements from simulated VLBI observations. The quality of the estimated parameters is investigated and assessed based on the mean formal errors and the repeatabilities.
In a further step there is the option to combine the results from VieVS and Bernese at the normal equation (NEQ) level using the ADDNEQ2 and retrieve fully consistent orbital parameters based on VLBI and GNSS observations.