I. Shmeld, Vl. Bezrukovs, A. Aberfelds, M. Bleiders, A. Orbidans, J. Šteinbergs, K. Šķirmante
Ventspils University College, Engineering Research Institute
«Ventspils International Radio Astronomy Centre» (VIRAC)
(mail to: ivarss@venta.lv)
M. Gawroński, R. Feiler
Toruń Centre for Astronomy, Nicolaus Copernicus University, Poland

First galactic maser interferometric observations in Irbene - Torun baseline

Ventspils International Radio Astronomy Centre (VIRAC, Latvia) operates with two radio telescopes RT-16 and RT-32 accordingly with 16 and 32 m fully steerable Cassegrain type antennas. The main receiving systems of both telescopes are cryogenic receivers with 4.5 – 8.8 GHz frequency range, additionally, in 2019 radio telescope RT-32 will be equipped with new L band receiver. On the both antennas data registration units are suitable for interferometric observations. The Nicolaus Copernicus University Department of Radio Astronomy in Torun, Poland, operates 32 m radio telescope, which also works in similar bands - L, C and M and regularly participate in the VLBI observations. VIRAC also has a high performance computer cluster with installed SFXC software correlator developed at JIVE.
In this poster we highlight the results of first VLBI test observations with baseline Irbene – Torun. Overview of VIRAC current level in the software developments related to the VLBI data processing is also given.

VIRAC, Irbene

RT-16

16 meters
Cassegrain antenna

RT-32

32 meters
Cassegrain antenna

Torun

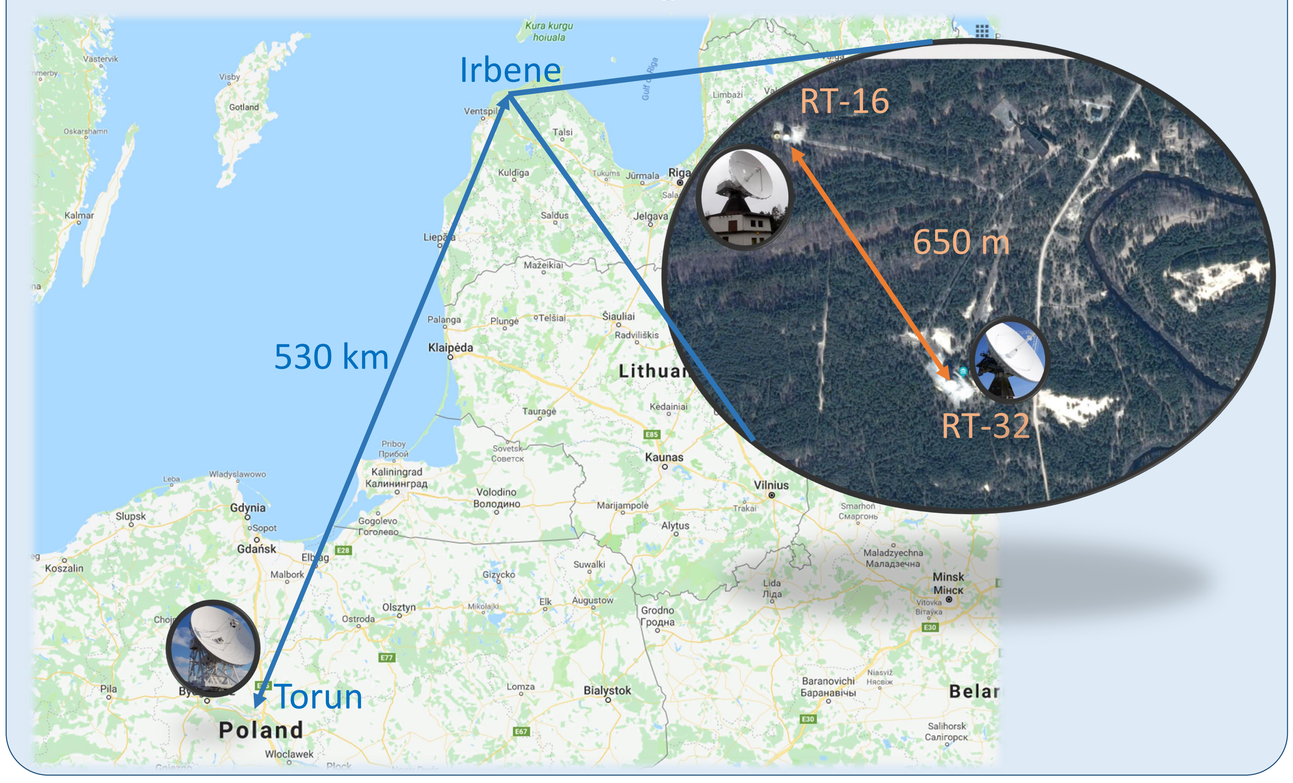
RT-4

32 meters
Cassegrain antenna

Antenna and receiver performance (SEFD = system noise in Jy)

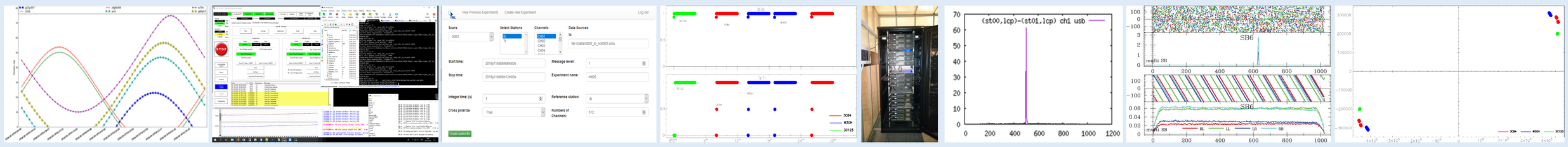
Wavelength, cm	SEFD(zenith), Jy		
	Irbene RT-16, 16 m	Irbene RT-32, 32 m	Torun RT-4, 32 m
6 cm	623	273	220
5 cm	569	333	650

VIRAC and Torun as a small interferometer with typical baseline length 530 km



VIRAC interferometric observations and data processing pipeline and first observations

VIRAC team SCHED, pySCHED	VIRAC RT-32, RT-16 Torun RT-4, other VLBI stations	VIRAC FlexBuff	VIRAC Cluster, SFXC	VIRAC team, j2ms2, tConvert	VIRAC team, AIPS, CASA, home made tools	
Experiment planning and scheduling	VLBI Observations	Data acquisition and storage	Correlation	Preprocessing, transformation to *. MS and *. FITS	Results interpretation and analysis	



In the April 2018 we made short test interferometric observations of methanol maser W3OH with two radio telescopes Irbene RT-32 and Torun RT-4. The purpose of the experiment was to learn how to plan observations and make all data processing steps. In this experiment VIRAC team create a schedule for each telescope, collect recorded data on our FlexBuff server, made data correlation using SFXC correlator installed on VIRAC cluster and convert measurements sets to the FITS files suitable for subsequent interpretation in the AIPS or CASA.
Pictures above demonstrate performed steps, from left to right: 1) Scheduling – source and time selection. 2) Observing – Irbene telescope control system. 3) Data acquisition and correlation - user friendly web tool for VLBI data management and correlation control. 4) Data quality test - there are lost flux at beginning of recordings for Torun telescope. 5) VIRAC cluster nodes. 6) First fringes for Irbene and Torun. 7) Cross correlation data – amplitudes and phases for W3OH and continuum source. 8) UV plot for Irbene and Torun baseline.

After modernization program carried out during the years 2014 – 2015 and developing the appropriate data reduction program both VIRAC telescopes are suitable for maser lines observations in the frequency range 4.5 – 8.8 GHz and from 2019 in 1.6 GHz. Additionally to the other possible fields of research by means of these telescopes such as maser variability monitoring, search for new maser sources, may be use of both radio telescopes as small baseline interferometer for exact measurements of maser sources coordinates and sizes. However it seems that it is necessary to add one or two additional Baltic region radio telescopes (e.g. Torun 32 m telescope) in order to monitor motion dynamics of sources with characteristic distances tens of *mas* between spectral features. Further improvement and developing of data reduction software is also to be continued.

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