BEST18M-RAS the first Hungarian VLBI station

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We ITU registered BEST-18M-RAS, to host the first Hungarian radio telescope for cm & mm band observations. The site selection and approval was based on climatological, geographical, geophysical, and sociological research besides radio spectrum monitoring and attenuation modelling. Based on its technical parameters and expected measurement capabilities BEST-18M-RAS, as a new Central-European station, could be operated as important partner of the GMVA and the planned LEVERAGE radio interferometer system. We also mention our efforts to design a station with a minimised ecological footprint.

LOW RFI

Typical characteristics of a radio quiet location are

- reasonable shielding offered by the terrain surrounding the site;
- a large enough distance from large cities and/or industrial centres and airports, as well as from busy roads.

Our pycraf (Winkel 2015, 2024; Giovanardi 2022) simulation results show a relatively small sized zone where broad band car radars may endanger the observations.

Attenuation by terrain 180 dB →

Fig.2a Pycraf 77GHz attenuation map.

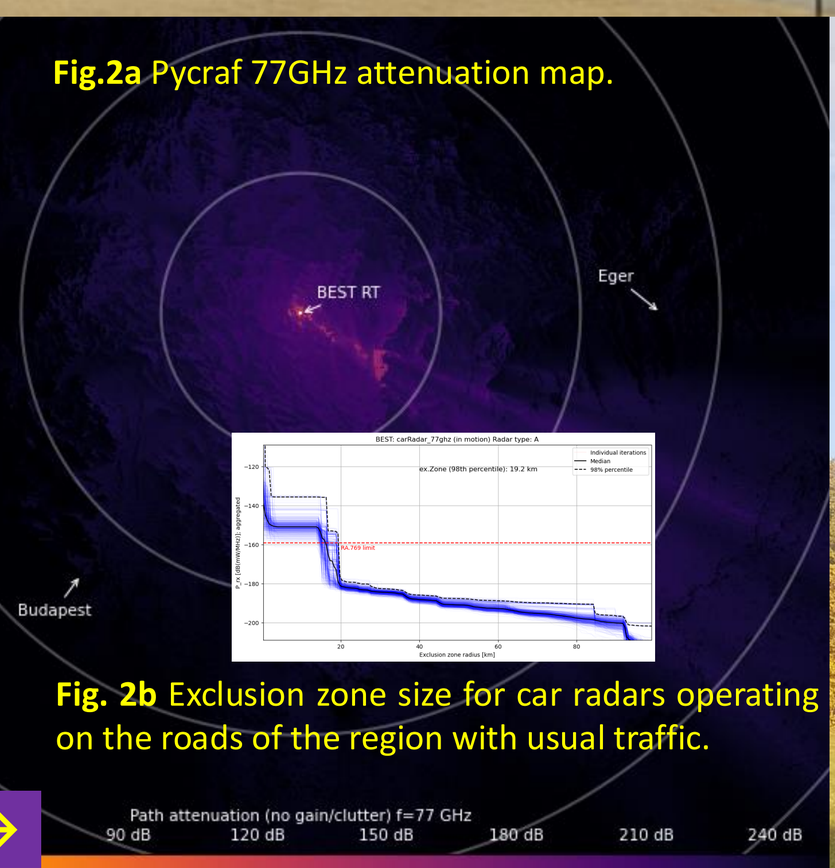

Fig. 2b Exclusion zone size for car radars operating on the roads of the region with usual traffic.

SPECTRUM MONITORING

We carried out series of 48 hours long monitoring measurements at several sites scanning the 20 MHz -18 GHz frequency range with a resolution of 1kHz using a state-of-the-art technology monitoring vehicle. Repetitions supported our site selection.

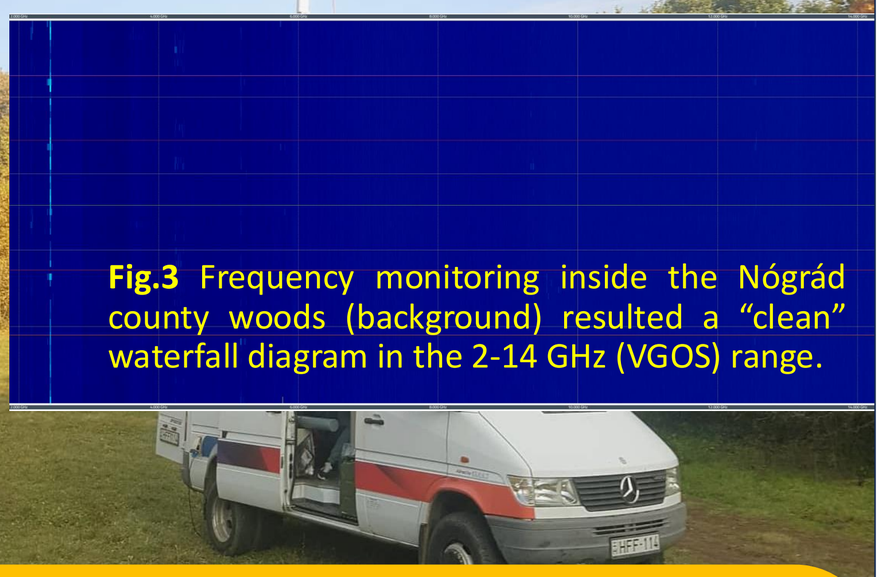

Fig.3 Frequency monitoring inside the Nógrád county woods (background) resulted a "clean" waterfall diagram in the 2-14 GHz (VGOS) range.

ENVIRONMENT

A detailed analysis of climatological records was supplemented with our on-site meteorological monitoring measurements. Expected wind speeds, cloud coverage, precipitation derived.
Results of our soil mechanics tests, research on aquifers and groundwater, as well as a study of seismic records were considered.

LOW ECOLOGICAL FOOTPRINT

We investigated the local flora and fauna, natural waters and soil, re-forestation possibilities, checked the means of energy consumption minimization and green energy generation possibilities.
Collaboration with local forestry ensures minimizing our ecological footprint and helps preserving the biodiversity. These steps were also important building our social relations. Local people are very determined to protect their natural environment "Green Nógrád" the most forested county in Hungary.

SIMULATIONS:

u-v coverages for a source at 44-degree declination; tracks are calculated for the new ngVLA long-baseline antenna design with elevation limit at 7 degrees. The BEST-18M-RAS station

- extends the long baselines of the LEVERAGE array to 750+ km
- closes gaps on the ~5000km scale for the ngVLA+LEVERAGE
- adds shorter baselines to S-Africa for joint obs. with SKA VLBI
- For LEVERAGE see Kadler et al. 2024, 2025

Fig.4a LEVERAGE+BEST

Figures: Matthias Kadler, 2025

Fig.4b ngVLA+SKA+EVN+LEVERAGE+BEST

ACKNOWLEDGEMENT

Recently our work led to the ITU registration of BEST-18M-RAS, a possible site to host a Hungarian radio telescope for cm-mm band observations in the future. We acknowledge the continuous technical support of NMHH (esp. Irén Bálint & Diána Daczi), the local support by first of all Dr. Kinga Petro (Hunginvest Ltd.), the communities and majors of Bercel & Buják, Tibor Batta and Gábor Borbély respectively and of Nógrád County (János Barna, Zsolt Becsó, Nándor Skuczi), Péter Sárik (Buják Forestry Directorate), and of the Ministry of Foreign Affairs & Trade of Hungary.

References:

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