

Monitoring of Radio Astronomy Systems

Kristaps Blumbergs

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SUMMIT²⁶
OCTOBER 7 ■ 9, 2026
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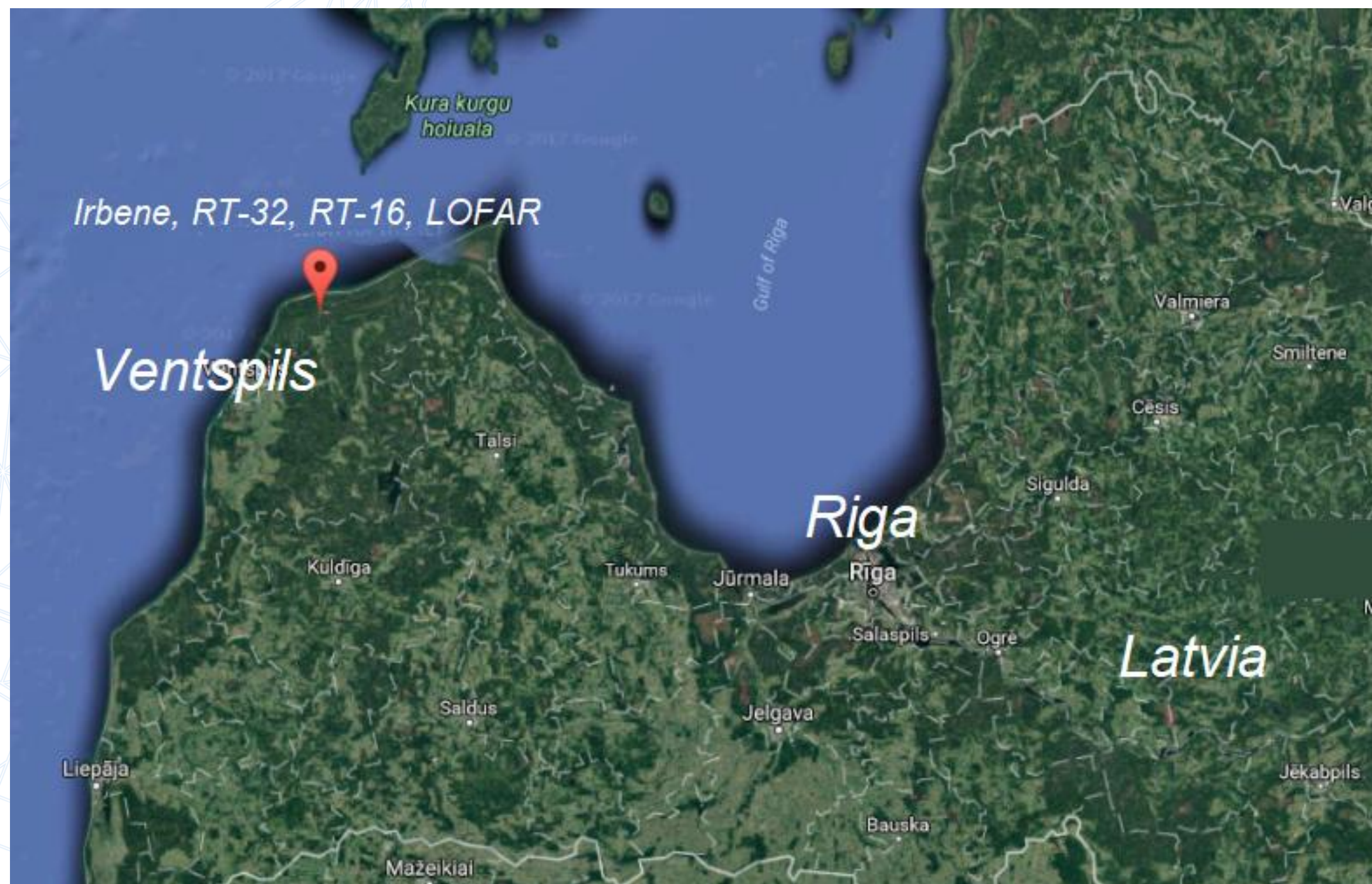
Engineering Research Institute Ventspils International Radio Astronomy Centre (VIRAC) of Ventspils University of Applied Sciences (VUAS)



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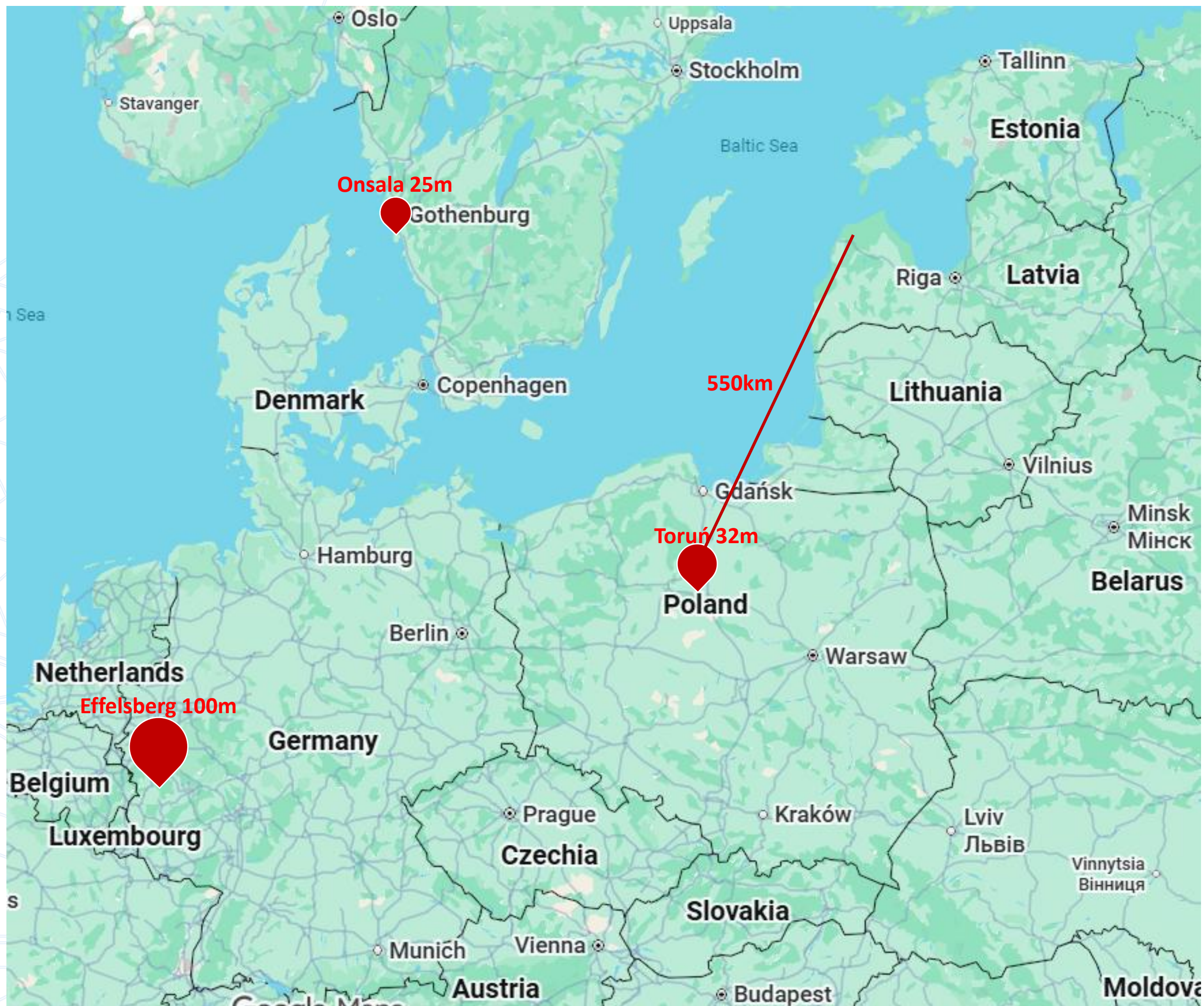
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VIRAC History Timeline Pre-Scientific Use

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Secret military
space centre
established

1950. g.



1960. g.

1970. g.

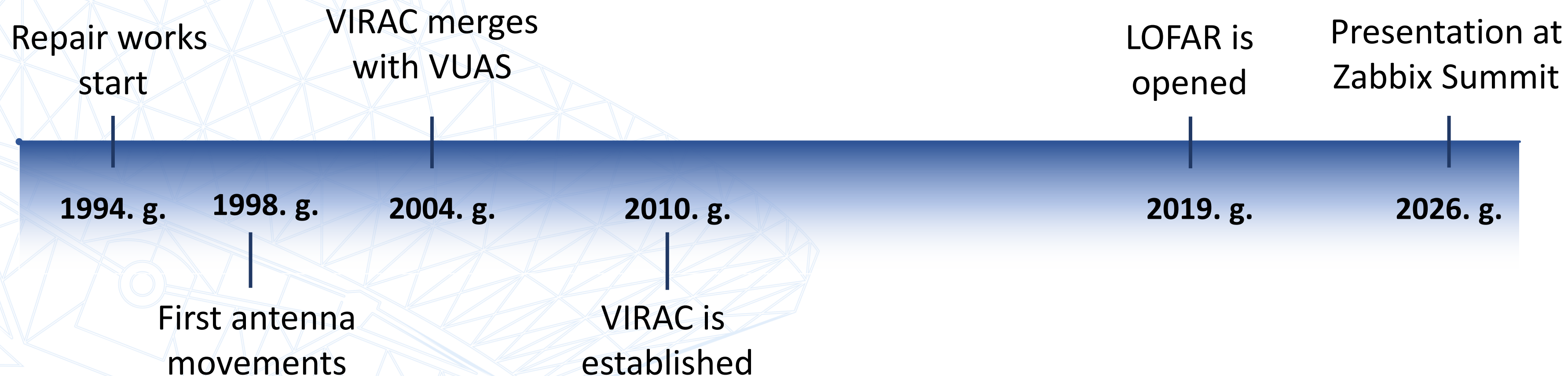
Army withdraws
from the site

1994. g.



VIRAC History Timeline with Scientific Use

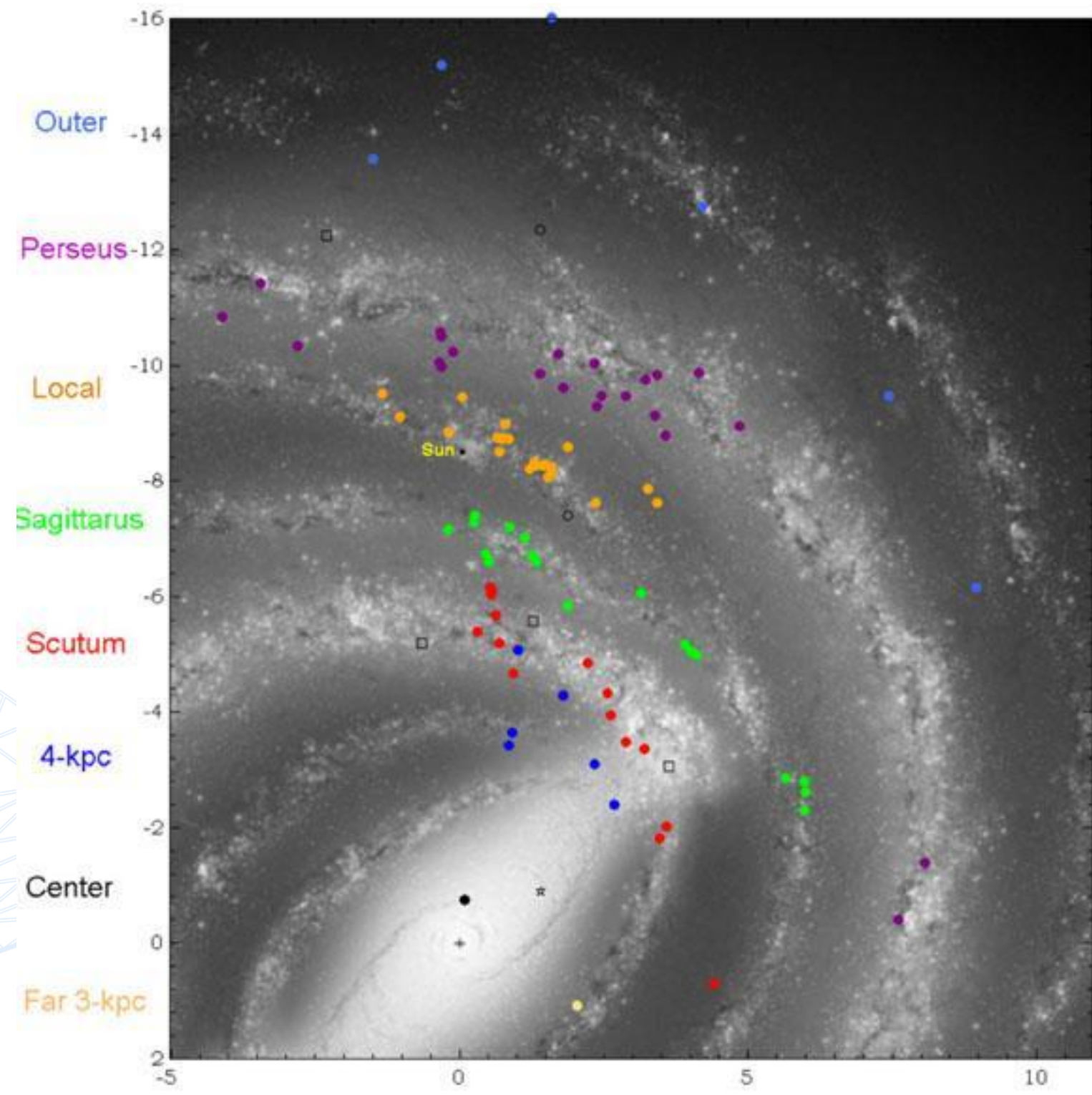
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Galactic Maser monitoring



Source: Reid & Honma (2014).



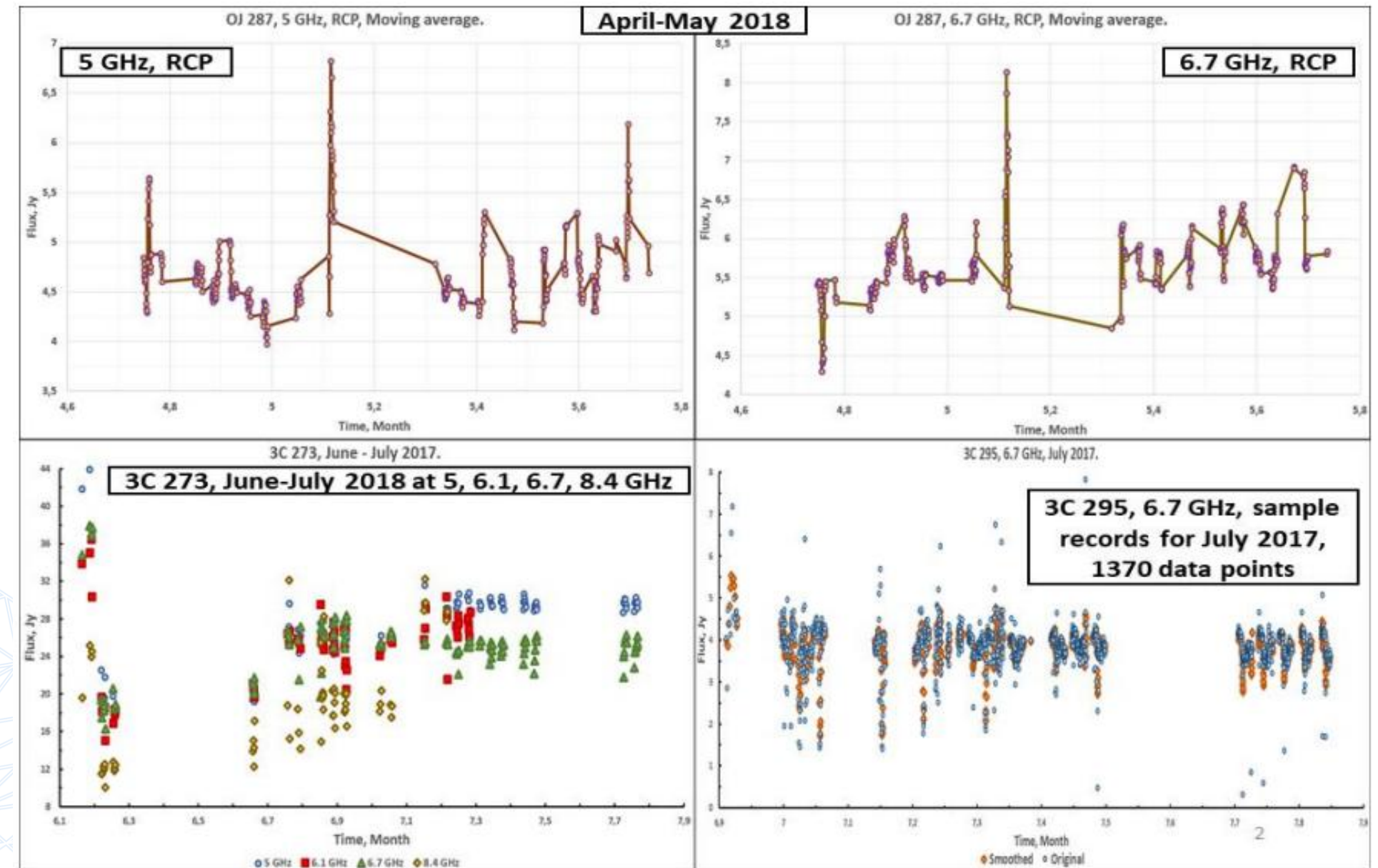
Source: Reid & Honma (2014).

Active Galactic Nucleus (AGN) Variability Studies



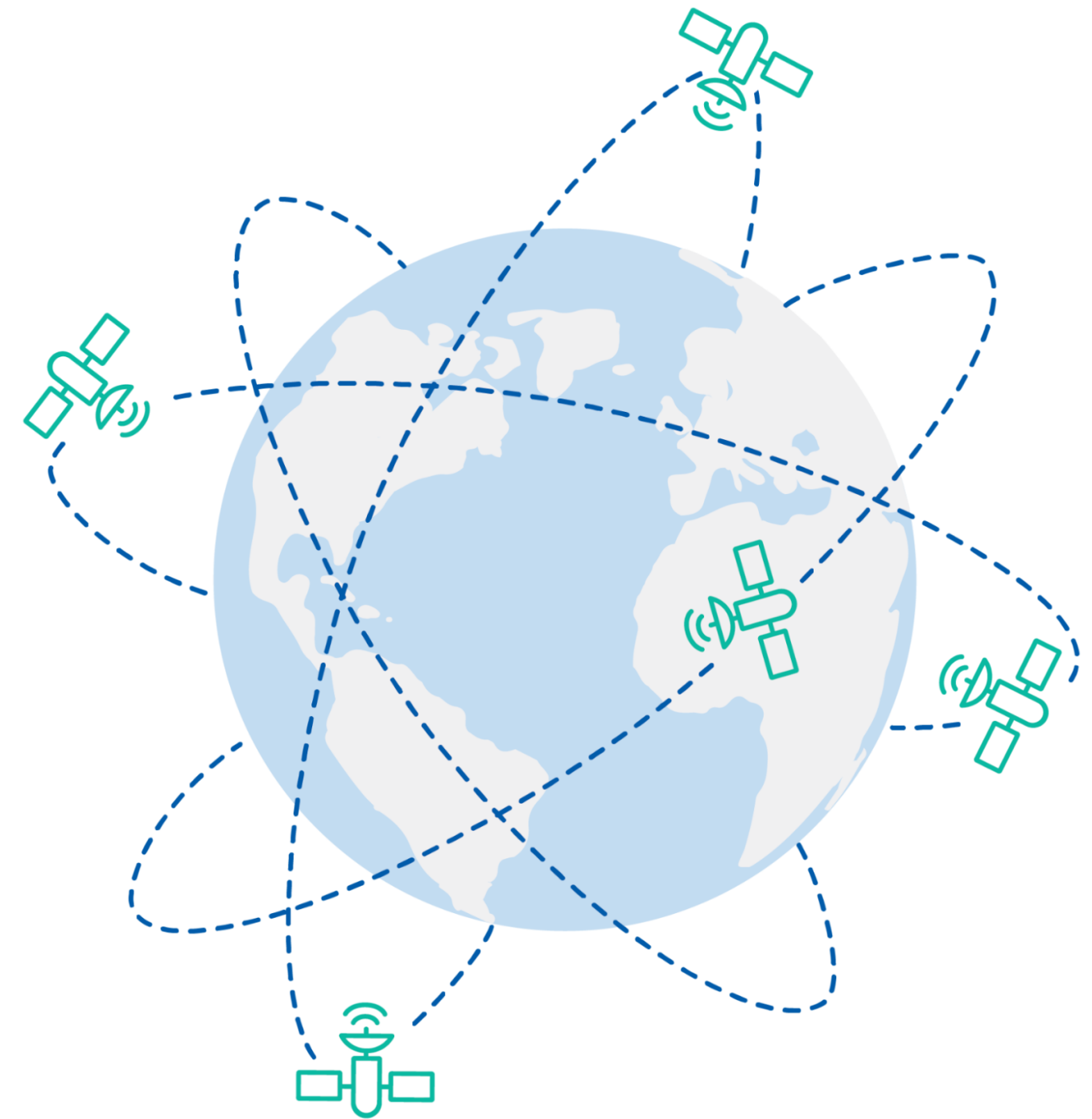
Whirlpool Galaxy (M51 / NGC 5194) — NASA/Hubble Space Telescope.

Source: NASA Science, *The Whirlpool Galaxy*.



Bezrukovs et al. (2018), Fig. 2. AGN intra-day and inter-day variability studies with VIRAC radio telescopes.

Global Navigation Satellite System (GNSS) –based observations



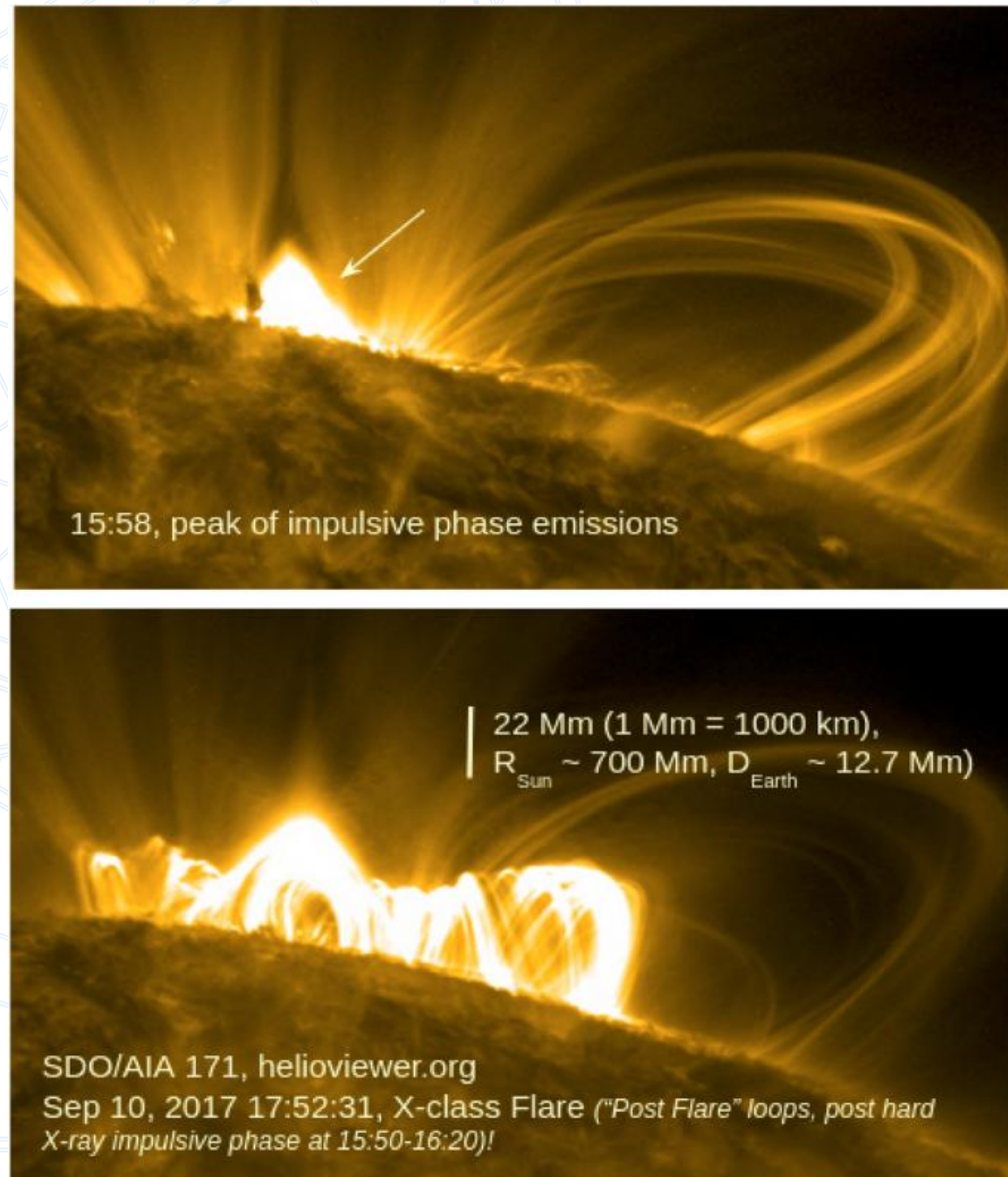
Source: Advanced Navigation, “Global Navigation Satellite System (GNSS) and Satellite Navigation Explained,” 2023.

SSA activities and space debris monitoring



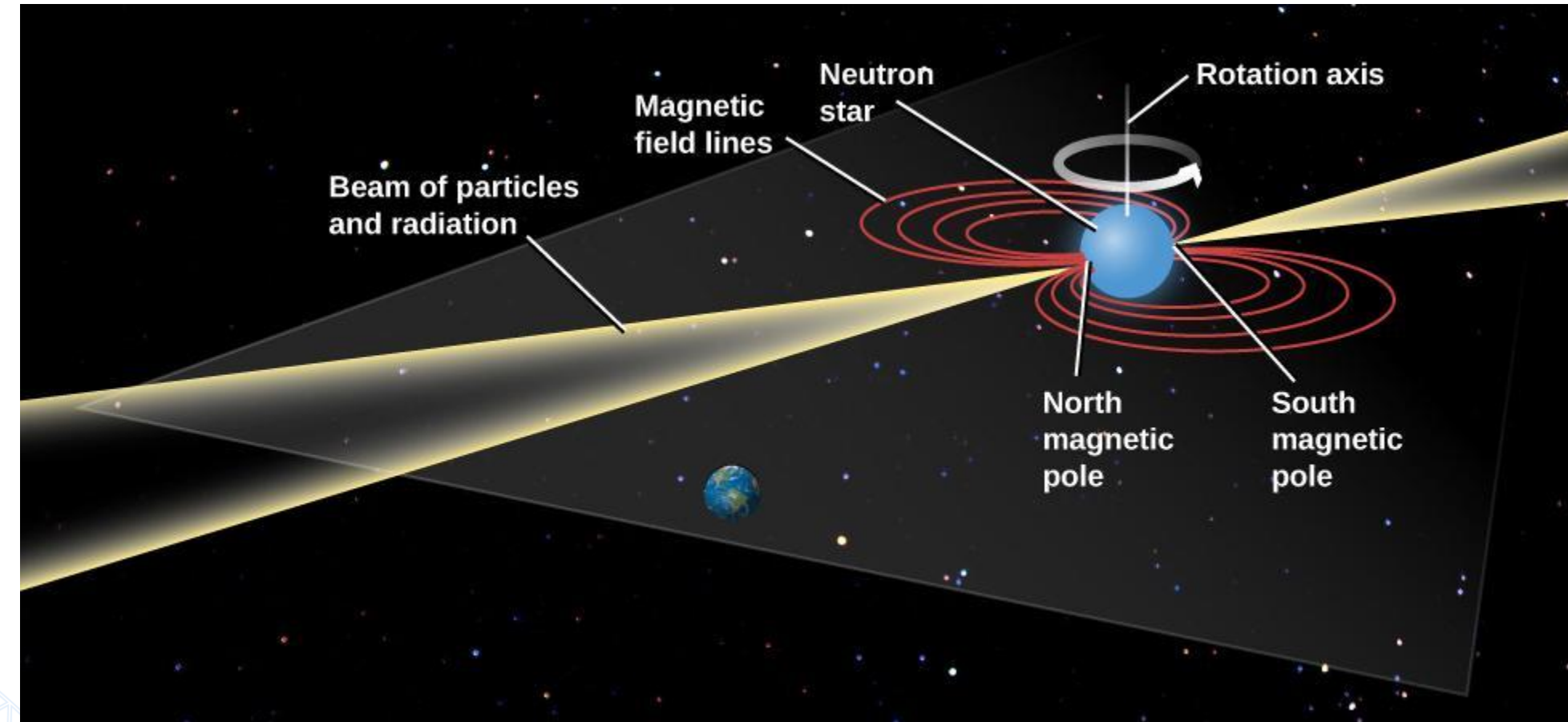
Source: ESA – European Space Agency, “Distribution of space debris in orbit around Earth,” 2019.

Search for stellar flares/sun observations



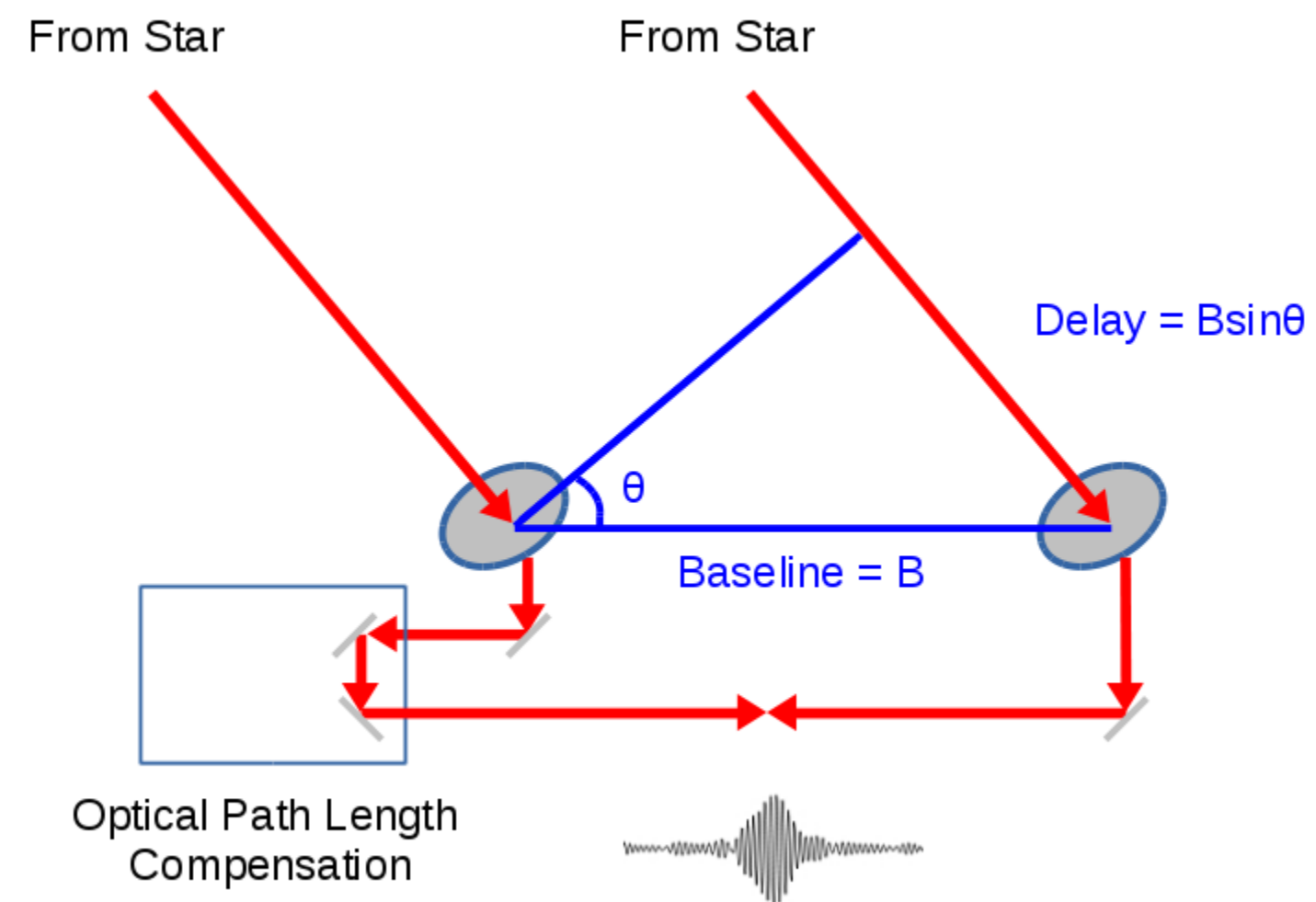
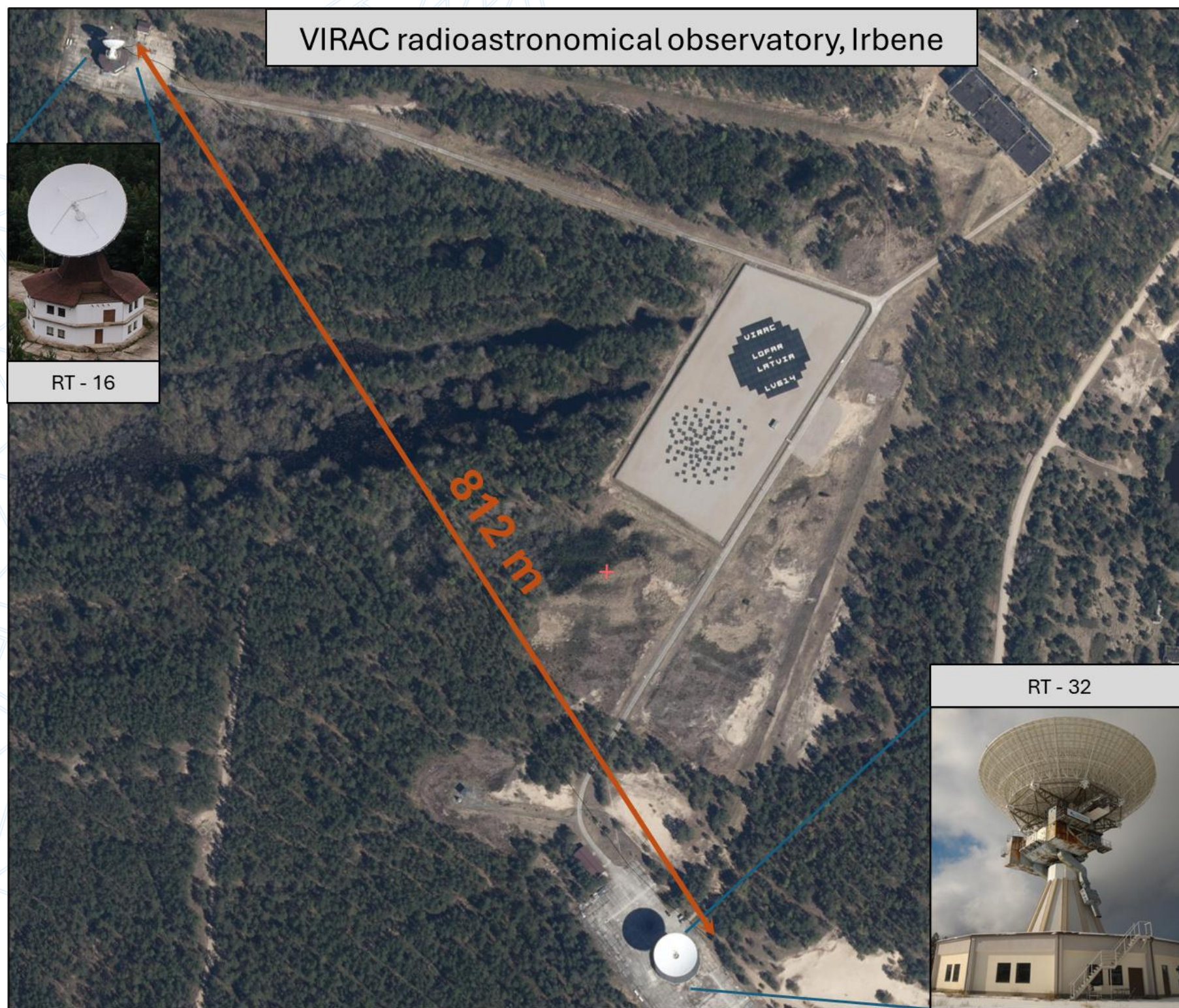
Source: Kowalski (2024), Fig. 3, *Living Reviews in Solar Physics*, 21, 1.

Pulsar observations



Source: OpenStax, *Astronomy 2e* (2022), Fig. 1.

The Irbene single-baseline radio interferometer



Source: CHARA, Georgia State University, "Basics of Interferometry."

Radio telescope **RT-32**
32 meters Cassegrain antenna



Azimuth maximum velocity:
2.8 deg/sec 5 deg/sec
Elevation maximum velocity:
1.8 deg/sec 5 deg/sec
Azimuth range:
-328 - +328 deg
Elevation range:
2.7 – 90 deg
Az/El pointing precision: ~10 arcsec
Surface accuracy (RMS):
1.0 mm 0.1 mm
Working frequency range:
0.3 – 22 GHz 1.4 – 40 GHz

Radio telescope **RT-16**
16 meters Cassegrain antenna



Irbene is a rare and unique radio astronomy facility

32m and 16m antennas

Two powerful, fully steerable antennas enabling sensitive and versatile radio observations.

800m local baseline

An 800 m separation enables high-resolution interferometric observations.

Great scientific potential

A unique Latvian platform for advancing radio astronomy, space science, and international research.

Unusual history

A former Soviet military facility transformed into an international scientific research centre.



Necessity for server, system monitoring, and automatic reporting

Observations

To make sure observations have been operating smoothly, manual checkups were necessary to understand if something has gone wrong.

Server, system health

Sometimes, unknowingly, servers entered an offline state even though they were powered on. Monitoring their status and usage was necessary to prevent further damages.

Necessity for server, system monitoring and automatic reporting

Automatic reporting

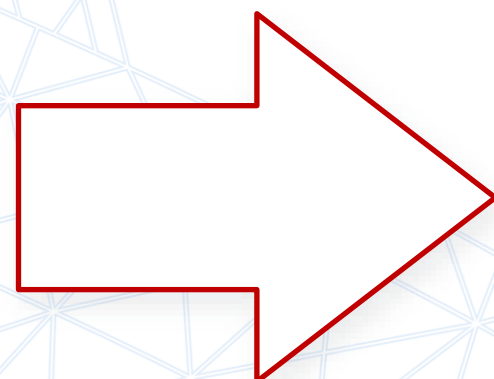
Immediate reporting of servers was necessary to quickly solve problems and potential issues. Most of the time these problems were found out doing manual checkups or, in the worst case, someone informed about them hours later.

Information visualization

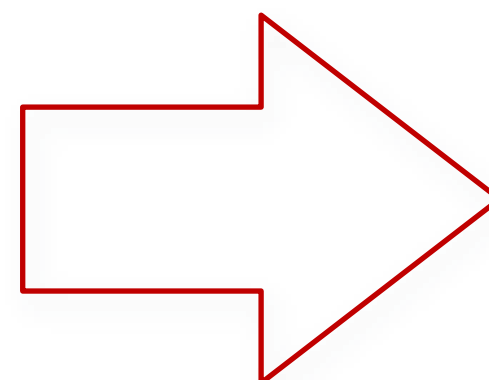
The information retrieved was rarely able to be displayed visually every time new scripts were developed, creating a lack of cohesiveness.

How we found Zabbix

Task for automatic reporting of high temperature values for observation system



Talked to a friend from a different department who mentioned they use Zabbix



Learned that it is also used in VUAS

The beginnings of Zabbix in VIRAC

Simple setup

First came the server and a few agents

First emails

E-mails about servers going offline were quickly sent

SNMP, service templates

For different servers SNMP was necessary, and most of the time ready templates are used for simple setups

Allow `system.run[]`, UserParameters

To get specific data we enabled `system.run[]`, and defined a few UserParameters.

Scheduled reports, dashboards

Created different dashboards and created scheduled reports

Custom widgets

To visualize problems/issues in a more understandable way, custom widgets were developed.

UserParameters

UserParameter=raid.status.md0, cat /proc/mdstat | grep -A1 '^md0 ' /proc/mdstat | grep -Eo '\[[U_]+\]'

UserParameter=ping[*], timeout 3 ping -c 1 -W 1 \$1 >/dev/null 2>&1 && echo 1 || echo 0

UserParameter=monit.value[*], curl -s <http://x.x.x/xx> | recode html | grep -Po 'black;">.+?' | cut -c 9- |
cut -d "<" -f 1 | sed "\$1!d"

Scheduled Reports



ZABBIX

<< >

IrbeneMonitoring

Dashboards

Monitoring

Services

Inventory

Reports

Data collection

Alerts

Users

Administration

Support

Integrations

Help

User settings

Sign out

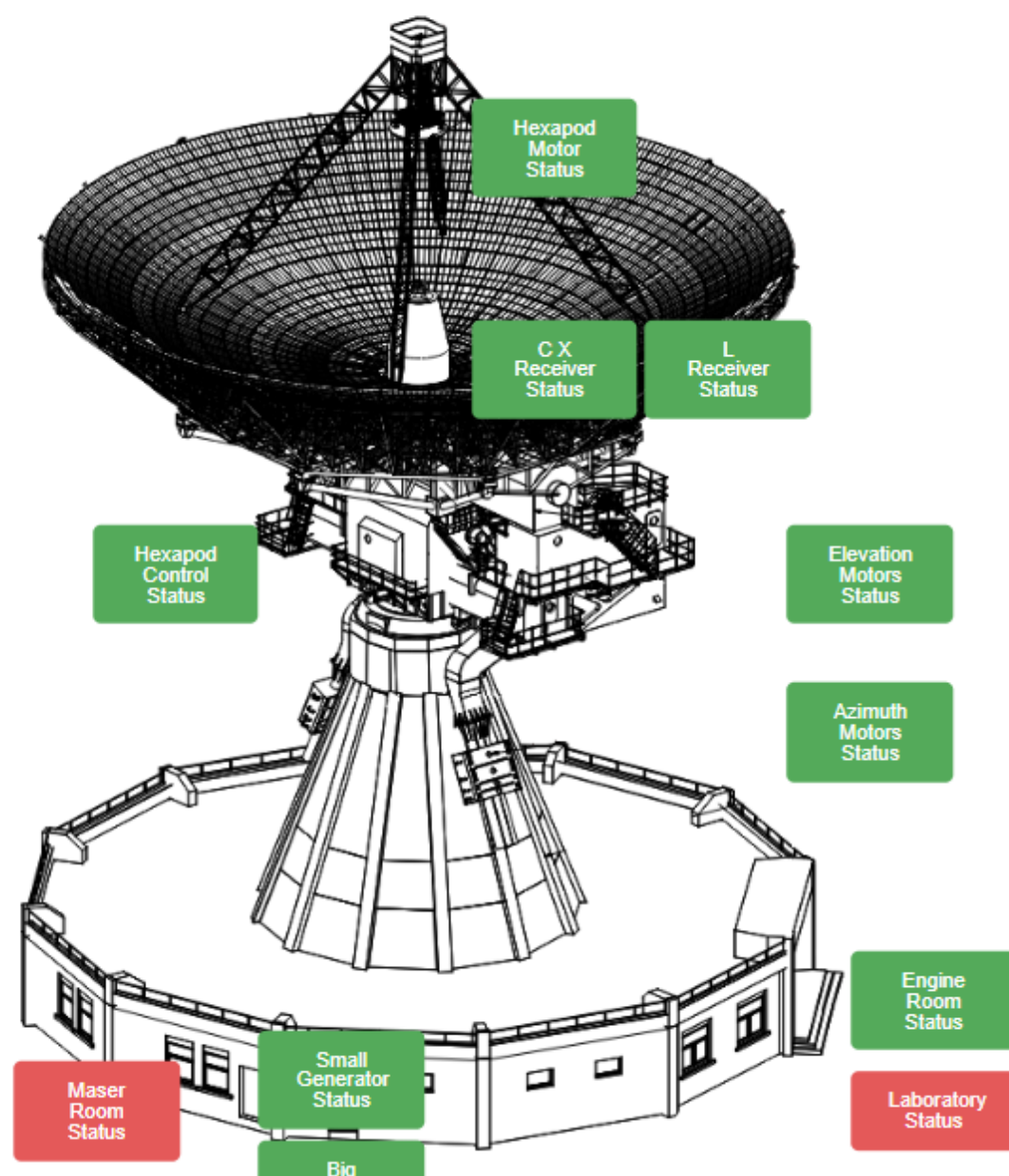
RT32

All dashboards / RT32

Dashboard Navigation

RT-32	RT-16
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Telescope Information



Top items

Items	Zabbixserver
RT-32 az mot0 temp	19.30 °C
RT-32 az mot0 util	0.00 %
RT-32 az mot1 temp	20.20 °C
RT-32 az mot1 util	0.00 %
RT-32 el enc temp	
RT-32 el mot0 temp	16.00 °C
RT-32 el mot0 util	0.00 %
RT-32 el mot1 temp	14.90 °C
RT-32 el mot1 util	0.00 %
RT-32 In id 11	
RT-32 In id 12	
RT-32 In id 13	
RT-32 In id 21	
RT-32 In id 22	
RT-32 In id 23	

Information Display

ELEVATIONMOTORS		
RT-32 el mot0 temp	16	°C
RT-32 el mot0 util	0	%
RT-32 el mot1 temp	14.9	°C
RT-32 el mot1 util	0	%

Custom Calendar

Team calendar

13 events this week

Week

Month

New event

NEW EVENT

Antenna

RT-32

Priority

Start

09/20/2026 09:00 AM

End

09/20/2026 10:00 AM

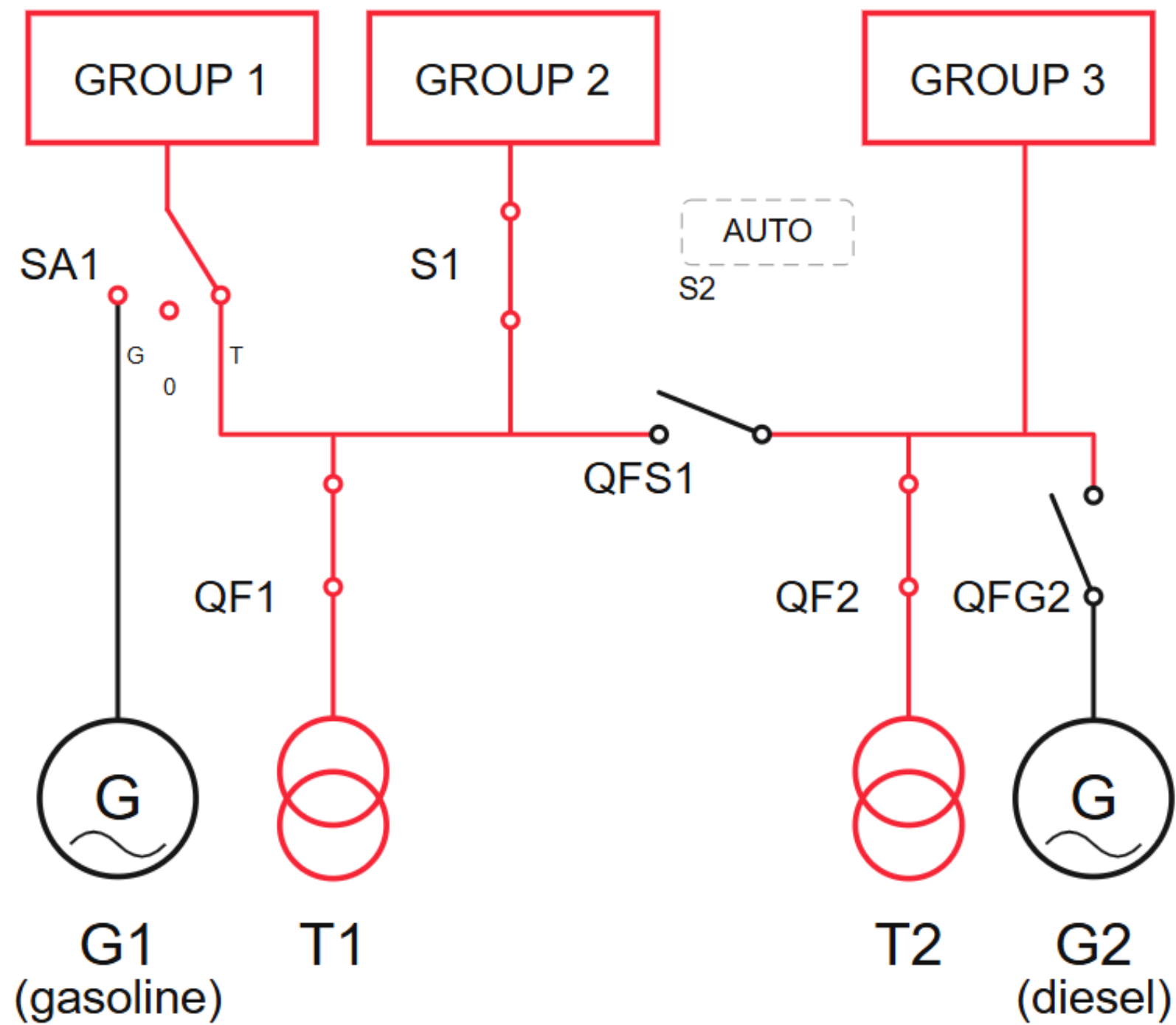
Type

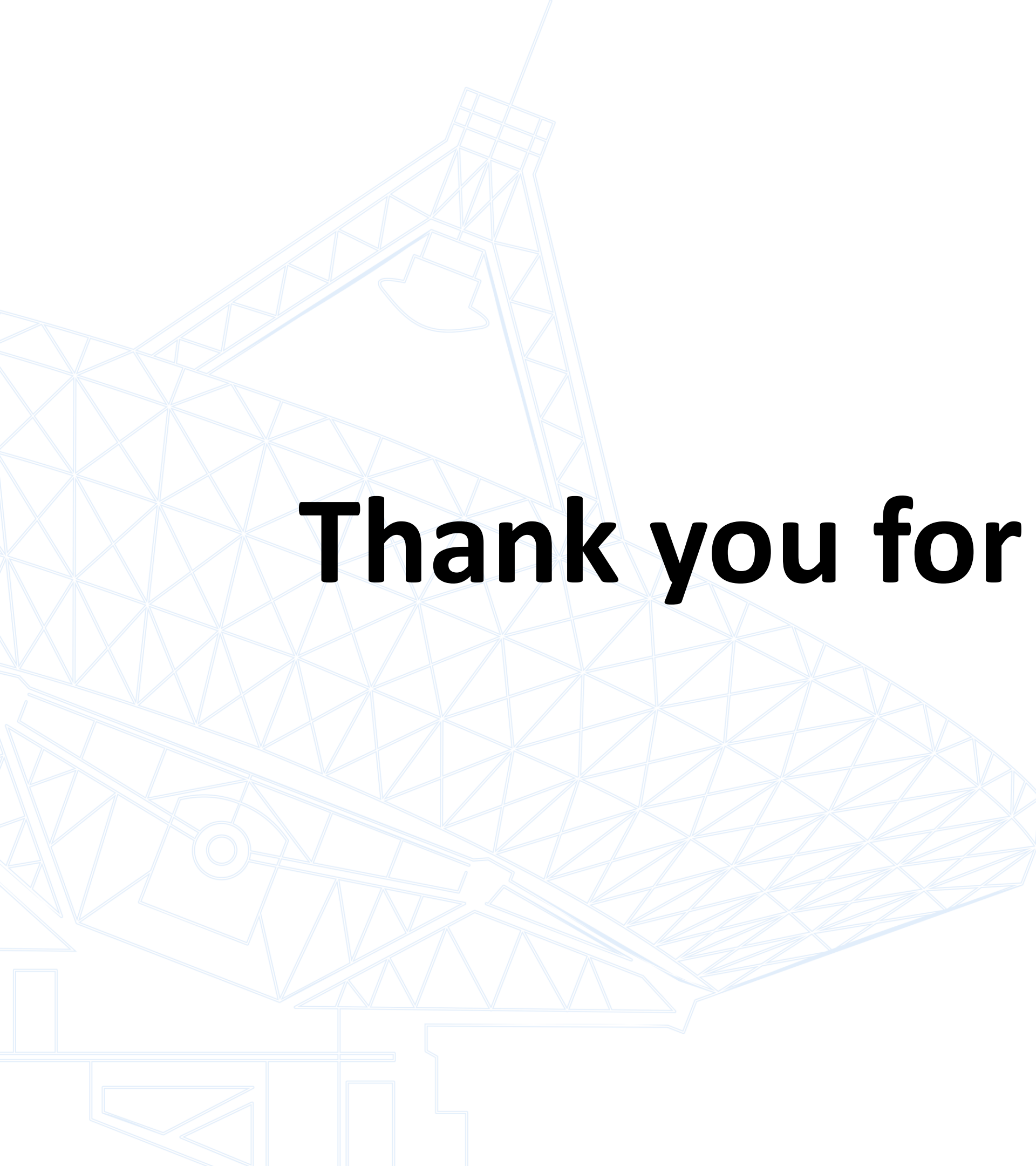
Note

Cancel

Save

Powerflow





Thank you for your attention!