JUMPING JIVE

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Final documents

Doc 1: Description of the Institutes

Doc 2: Partnership, Governance and Finances

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1. Rationale and methods

Scientifically and organizationally, there are similarities between the Joint Institute for VLBI ERIC (JIVE) and the International LOFAR Telescope (ILT). Both support a distributed telescope network spread over a number of countries and rely on a central facility for correlation and data curation, quality control and users' interface. The objectives of WP4 in JUMPING JIVE are to carry out an assessment to be presented to the JIVE and ILT governing bodies and stakeholders, describing the possible advantages and disadvantages of a closer operational alignment of these two facilities, and even the merging as a single ERIC. The present document covers the activities carried out in this WP and provides the conclusions from this exercise.

1.1. Gathering of information

The first part of WP4 consisted of an assessment study covering the current structure of JIVE and ILT in order to evaluate similarities and differences between both infrastructures, with a focus on their operational models. The assessment was done via interviews with key people working on operations of both JIVE and ILT. The exercise was followed by a workshop with all the people interviewed. The main results of this exercise were presented in the first deliverable (D4.1) and are summarized in Sections 3 and 4.

The next stage in the collection of information was dedicated to the ERIC legal framework, the ERIC landscape, and the ERIC application process. This included extensive desk research about the ERIC landscape, the regulation and the formation process, participation at national information days focused on the ESFRI and ERIC application process, and consultations with ERIC expert M. Pasterk (ESFRI Forum) and with H. van Langevelde, JIVE director when it was transformed to an ERIC. The results from these consultations were presented in the deliverable D4.2.

1.2. Meetings

Along the course of the project, there have been regular updates and consultations with both the JIVE Council and ILT Board, to discuss the progress in WP4 and its implications for the organisations. Both governing bodies gave their support to this exploratory exercise. The ILT organised an internal working group to assess how an ERIC could benefit the organisation and what form this entity would take, in view of the needs of the ILT. The working group was active over the summer of 2019, the last meeting of the working group took place in September 2019, where the JIVE director (F. Colomer) was also invited. The working group prepared a series of input documents for discussion and decision at the JIVE Council in May 2019 and at the ILT Board in October 2019.

The following sections of this document provide a summary of the information collected during the project and the conclusions reached regarding the future of JIVE and ILT.

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2. Document 1: Description of the institutes

2.1. JIVE-ERIC

JIVE, the Joint Institute for VLBI ERIC (http://www.jive.eu/), is the central organisation in the European VLBI Network (EVN). JIVE implements the core data processing and user services that turn the network of distributed telescopes into a single observatory to study the radio sky at the highest possible resolution. Since 2015, the ERIC (European Research Infrastructure Consortium) replaces the JIVE foundation, which was created in 1993 by the EVN. The Institute is located in Dwingeloo, the Netherlands, and is hosted by ASTRON - the Netherlands Institute for Radio Astronomy.

The current member countries in the JIVE ERIC are France, Latvia, the Netherlands, Spain, Sweden and the United Kingdom. JIVE is also supported by other participating institutes, as contemplated in its statutes. Each member is represented by the following national research councils and facilities:

Table 1: JIVE members and associated organisations

Country	Representative Organisation	Status
The Netherlands	The Netherlands Institute for Radio Astronomy (ASTRON) and the Institutes Organisation of NWO (NWO-I)	Host
France	Centre Nationale de la Recherche Scientifique (CNRS)	Member
Spain	Instituto Geografico Nacional (IGN)	Member
Sweden	Vetenskapsrådet (VR)	Member
United Kingdom	The Science and Technology Facilities Council (STFC)	Member
Latvia	Ventspils Augstskola (VeA)	Member
JIVE is also supported by participating research institutes		
China	National Astronomical Observatories (NAOC)	
Germany	Max Planck Institute for Radio Astronomy (MPIfR)	
Italy	National Institute for Astrophysics (INAF)	
South Africa	National Research Foundation (NRF)	

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2.1.1. The European VLBI Network (EVN) and JIVE

The EVN is a network of radio telescopes located primarily in Europe and Asia, with additional antennas in South Africa and Puerto Rico (see Fig 1), which performs high angular resolution observations of cosmic radio sources. An overview of the network can be found on the EVN webpage[1].

Figure 1: The European VLBI Network

The EVN is a large-scale astronomical facility that offers observing time to astronomers from all over Europe and the rest of the world ("Open Skies" policy). It is the most sensitive VLBI network and the only one that routinely performs real-time observations. The EVN telescopes are in general national facilities in their own countries, with their own observing programs, which get together for joint observations to form the EVN.

The EVN is governed by a Board of Directors (EVN CBD), composed of the directors of the individual EVN telescopes and JIVE. As described in the EVN MoU, among other responsibilities, EVN members guarantee 90 days/year of telescope observing time for the EVN[2].

[1] https://www.evlbi.org
[2] http://www.evlbi.org/evncbd/evncbd.html

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Observation campaigns are organized in three "sessions" of approximately 3-weeks duration, plus 10 days (x24h) of dedicated real-time VLBI (e-EVN), and other Out of Session (OoS) and Target of Opportunity (ToO) projects. Astronomers may submit their proposals for observations in three deadlines, on February, June and October each year. The EVN Program Committee (EVN PC) is the group of expert astronomers, nominated by the EVN Board, who evaluate and rate the proposals solely on scientific merit and submits such priorities to the EVN Scheduler within 6-8 weeks prior to the observing session. JIVE has a member in this committee, who checks the technical feasibility of the proposals.

The EVN User Guide for help with proposing, scheduling, observing and reducing EVN data is available on the EVN website[3]

Observing time is requested through the EVN proposal tool *Northstar*[4] and the users can download their data from the EVN data archive[5]. Data are made public once the 12-month proprietary period has expired (6 months for Target-of-Opportunity observations), as explained in the EVN Data Access Policy[6].

Details on operations and necessary technical developments are handled by the EVN Technical Operations Group (EVN TOG), which ensures smooth operations of such a large and complex VLBI network.

2.1.2. JIVE Science Support group (JSS)

It consists of the Head of Science Support and a number (now 4 postdoctoral fellows) of Support Scientists (SS). They devote a nominal 50% of their time to their own science projects (also using the EVN, therefore pushing its scientific limits), and 50% to network and user support. The JSS takes care of the preparation and processing of the correlator jobs (therefore in coordination with the JIVE Science Operations group) and data quality control. Also maintains the EVN Proposal Tool *Northstar*.

The JSS group advises and helps EVN users, on demand, in any phase of their projects: proposal preparation, scheduling, correlation, data analysis (initial data check and calibration, full pipeline into FITS) and archiving. If the need for support is large, a formal collaboration may be set up, where the SS become members of the research team.

The corresponding sections of the EVN and JIVE websites are created and maintained by the SS. In particular, the EVN Guide contains information useful to the users, including guidelines to calibrate data (see the EVN Data Reduction Guide[7]). Users of the EVN can consult the SS by email, and also have the possibility to visit JIVE to further analyse their projects[8].

[3] http://www.evlbi.org/user_guide/user_guide.html
[4] http://proposal.jive.nl/
[5] http://www.jive.eu/select-experiment
[6] http://www.evlbi.org/user_guide/archive_policy.html
[7] http://www.evlbi.org/user_guide/evn_datareduc.html
[8] http://www.jive.eu/european-vlbi-network-user-support-jive

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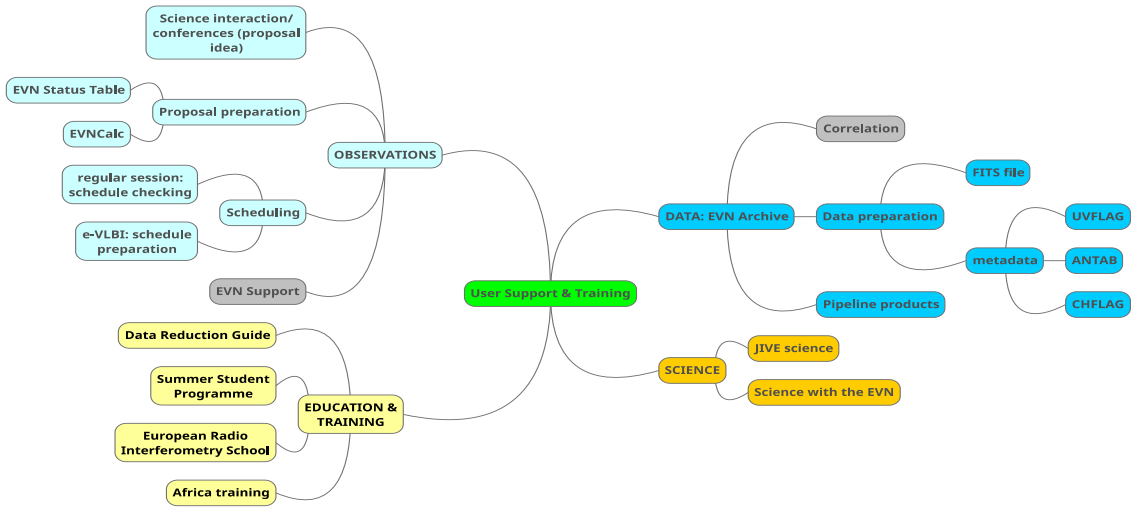
The JSS is involved in training events such as the ERIS school[9] and the ASTRON/JIVE Summer Student Program[10].



The group consists of the Head of JSO and the operators of the correlator but has also access to the Support Scientists of the JSS. The JSO helps the stations in the preparation and operation of the EVN observing sessions. In particular, a “fringe (quality) test” is performed (into a “Network Monitoring Experiment”, NME) before the user experiments are conducted, ensuring the correct setup of the telescopes and providing some calibration information. Later, the whole experiment queue is organized, giving priority to global experiments (those in coordination with other VLBI networks).

Usually, the observing schedules are prepared by the project principal investigators (PIs), except in cases like e-VLBI, which are prepared by the JSO. These corresponding telescope control files are uploaded to a repository (VLBEER) by the JSO, becoming available to all EVN telescope operators.

Observations in the EVN sessions are recorded on disks, or data is transferred by internet to JIVE. In the first case, some limitations may arise due to the required availability of recording media; this is controlled by the JSO (script), who prepares the shipping of disk modules before the sessions. The shipping costs are paid by the stations, except those who are members of JIVE. Usually, all disks are sent from/to the correlator, and not between stations. The EVN PC and the EVN scheduler set the priorities for experiments to be observed or dropped when there are not sufficient disk media available. At the time of the observations, the JSO gives instructions for the recording of experiments

[9] http://www.astron.nl/eris2017/

[10] https://www.astron.nl/summer-research-programme/summer-student-programme-2019

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(for instance, to prevent that experiments that will be processed at different correlators are recorded on the same disk pack).

In the second case, which is becoming the most common, data is not shipped but transferred by the internet (e-transfer), which requires a disk buffer ("Flexbuff") both at the telescope(s) and the correlator.

Once the data are received at JIVE, the JSO prepares the correlator jobs and asks the PI for confirmation of the setup parameters. After the correlation is done, the produced data is sent to the archive, including calibration information, logs (weather, incidents) and an image as processed by the pipeline. These products remain available only to the PI for a proprietary period (see above), and then become public in the EVN archive. A post-correlation email is sent to the PI with all detailed information, and once received and approved (in ~2 weeks), the huge raw VLBI datasets are erased. Data of multi-epoch projects are released only after the proprietary period of the last one is finished.

The EVN correlation at JIVE runs automatically, in presence of an operator (except in evenings and weekends). Specific actions such as fringe checking/clock searching, have to be scheduled to happen during normal labour hours. There is however some internal flexibility that allows attending some ToO, and because of the necessary coordination with the correlator technical maintenance, also with the Technical Operations group (JTO). It must be noted that the correlation of disk-based experiments may take much longer than the actual observing duration for some experiments.

An "automatic response" (trigger) system is in place, built thanks to the EC FP7 NEXPReS project, but is not yet used since several EVN telescopes do not allow remote control or change of their ongoing observations. The JSO also controls the downtime of telescopes for maintenance, which may not happen coordinated in time.

JIVE SO runs the EVN data archive, currently organized by experiment. It includes several utilities, such as a search engine. Upgrades are being studied (such as to incorporate FITS images). Currently, the archive is openly accessible, without specific registration. The archive is being upgraded thanks to the EC H2020 ESCAPE project, to ensure it complies with FAIR principles. Statistics of access are available.

2.1.3. JIVE Technical Operations and R&D group (JTO)

The JTO focuses on maintenance and upgrade of the correlator hardware and software (new modes, data transport, scheduling software, CASA user software, SFXC correlator control code), and large efforts in R&D. The team works in strong relation with the JSO group, following the directions of the JIVE Management Team (MT).

JIVE becomes involved in many projects with strong R&D components, which are essential for the development of activities that are not included in the core business/budget. The list includes:

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Project	Financer	start date	end date	total subsidy	JIVE share	coordinator
NWO-SCARIe	NWO	27/02/2006	31/01/2012	499,632.00	325,235.00	JIVE
EUROPLANET	EU FP7	01/01/2009	31/12/2012	6,000,000.00	35,450.40	CNRS
NWO-ExBoX	NWO	01/05/2009	01/12/2012	372,000.00	186,000.00	JIVE
NWO-JIVE/China	NWO	01/01/2010	31/12/2013	620,000.00	620,000.00	JIVE
KNAW-CEP	KNAW	15/03/2010	15/03/2013	51,200.00	51,200.00	JIVE
NEXPReS	EU FP7	01/07/2010	30/06/2013	3,500,000.00	1,581,240.00	JIVE
ESPACE	EU FP7	01/06/2011	30/05/2015	1,930,256.00	255,800.00	IMCCE
RadioNet3	EU FP7	01/01/2012	31/12/2015	9,500,000.00	2,574,209.44	MPIfR
SKA-NL	NWO	01/01/2014	31/12/2018	13,068,076.00	490,000.00	ASTRON
BlackHoleCam	EU FP7	01/10/2014	30/09/2020	13,975,744.00	366,400.00	Radboud Univ
ASTERICS	EU H2020	01/05/2015	30/06/2013	14,991,194.00	801,275.00	ASTRON
DOME-SA	NWO	01/09/2016	31/12/2018	158,000.00	158,000.00	JIVE
JUMPING JIVE	EU H2020	01/12/2016	31/01/2021	2,983,682.81	1,531,666.67	JIVE
RadioNet4	EU H2020	01/01/2017	31/12/2020	10,000,000.00	1,531,666.67	MPIfR
AENEAS	EU H2020	01/01/2017	31/12/2019	2,999,995.00	4,500.00	ASTRON
ESCAPE	EU H2020	01/02/2019	31/07/2022	15.983.301,25	1.056.000,00	CNRS

2.1.4. JIVE Space Science and Innovative Applications group (SpaSIA)

The group was born as an interface of the EVN to the VLBI Space Observatory Program (VSOP, 1997-2003) and RadioAstron (2011-2019). Current activities include as well near-field VLBI, building tools to track ESA probes (e.g., Huygens on Titan, in 2005; preparing for JUICE in 2022-2030). Relations with ESA are however made by the national space agencies (and JIVE is not). The SpaSIA group coordinates activities involving Dutch universities and international institutes. As of innovative applications, it develops a project to study fundamental physics with VLBI. It also maintains links with the IAU (in synergy with IVS for ICRF3), URSI, or IAA (Astronautics).

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2.2. The International LOFAR Telescope

The Low-Frequency Array (LOFAR) is an array of antennas that observe the sky at frequencies below 250 MHz. LOFAR started as a Dutch project with national funding, for this purpose the consortium LOFAR-CV was created, a legal entity composed of a multidisciplinary group of institutions: Astronomical research institutes, Geophysical R&D institutions, Precision Agriculture R&D, ICT R&D. Initial funding came from the Dutch government through the BISK programme for interdisciplinary research for improvements of the knowledge infrastructure, the Province of Drenthe and by the EZ/KOMPAS programme, partially funded by the EU European regional development fund. Partners contribute to LOFAR development from their own research budgets. The total investment for LOFAR development is, up to now, ~150 MEur.

The International LOFAR Telescope (ILT) is a foundation under Dutch law and is governed by a Board composed of delegates from consortia of institutes, one in each country where there are LOFAR antennas. The ILT operations are led by ASTRON.

There are currently 52 operational LOFAR stations (as of April 2020) that extend up to a maximum distance of approximately 2000 km, between Birr in Ireland and Lazy in Poland. The map in Fig. 2 shows the distribution of LOFAR stations across Europe, including the future station to be rolled out in Medicina (Italy) by 2023. The Netherlands has 38 stations, 24 core stations (densely sampled in a 2 km wide area near Exloo) and 14 remote stations.

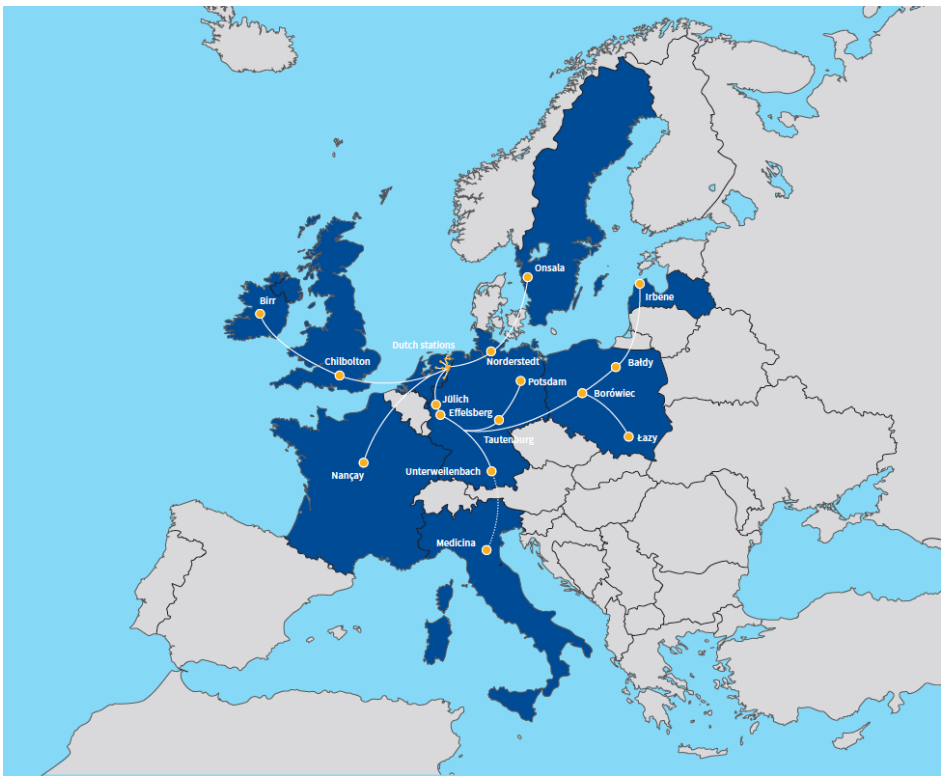

Figure 2: Map of LOFAR stations

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The following Table presents the full list of LOFAR stations including location, owner institution, and date of entry in operations

Table 2: ILT stations including location and owner institution.

Country (Consortium)	Station location	Owner institute	Operational since
The Netherlands (NL-LAC)	Core (24)	LOFAR-CV	2010
	Remote (14)	ASTRON	2010
Germany (GLOW)	Effelsberg	Max Planck Inst. for Radioastronomy	2011
	Unterweilenbach	Max Planck Inst. for Astrophysics	2011
	Tautensburg	Thüringer Landessternwarte	2011
	Potsdam-Bornim	Astrophysikalisches Institute Potsdam	2011
	Norderstedt	University of Hamburg	2011
	Jülich	U. Bochum & Forschungszentrum Jülich	2011
France (FLOW)	Nançay	Paris Observatory & CNRS	2011
United Kingdom (LOFAR-UK)	Chilbolton	Science & Technology Facilities Council	2011
Sweden (LOFAR-SE)	Onsala	Onsala Space Observatory	2011
Poland (POLFAR)	Borowiec	Space Research Centre Polish Academy of Sciences	2015
	Baldy	U. Warmia and Mazury in Olsztyn	2015
	Lazy	Jagiellonian U. Krakow	2015
Ireland (I-LOFAR)	Birr Castle	Trinity College Dublin	2017
Latvia (LOFAR-Latvia)	Irbene	Ventspils University College	2019
Future ILT stations			
Italy (LOFAR-IT)	Medicina	INAF	2023

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2.2.1. Operations

LOFAR has an access policy of partially open skies; it started with an allocation of a minimum of 10% of the observational capacities on the basis of purely scientific criteria; the intention expressed at the formation to increase the open skies component with time has currently led to an open skies fraction of ~80%. Call for proposals are open two times per year. A Programme Committee (PC) decides on the allocation of access to the observational facilities, the decisions are taken on the basis of the scientific quality of the projects. The PC comprises a group between 10 and 16 independent scientists, appointed by the ILT Board on the basis of their scientific expertise.

When a new member joins the ILT, during at least the first 5 years, it is given the possibility to allocate some observing time and data handling resources to projects of interest within its community.

Observation data with LOFAR are collected in real-time by fiber network, correlated and processed in a computing facility, the Donald Smiths Centrum for ICT, University of Groningen (the Netherlands) and archived in the Long-Term Archives in the Netherlands (Amsterdam), Germany (Jülich), and Poland (Poznan). The ICT facility in Groningen and the Long-Term archive in Amsterdam are part of the in-kind contribution of ASTRON to the ILT.

Within ASTRON, the Radio Observatory (RO) was (when the structure of the ILT was assessed for WP4) the department in charge of operating two facilities: LOFAR and the Westerbork Synthesis Radio Telescope (WSRT). The department was led by the Director of the RO, and had three internal groups: Science Operations and Support, Operations and Maintenance, and Software Support. The same operational functionality for ILT, as described below, is in 2021 carried out by staff from several groups within the ASTRON Astronomy and Operations (A&O) department.

2.2.2. ILT Operations: Science Operations and Support group (SOS)

The Science Operations and Support group (SOS) is a vital link between internal Observatory processes and the external astronomical user community. The group is responsible for optimizing the scientific output of the ASTRON-operated observing instruments and telescopes, by on the one hand supporting with their astronomical knowledge the operations, maintenance, and technical development work by internal operators and instrument engineers, and on the other hand supporting with their instrument and technical knowledge the external users/scientists in their research projects.

Telescope Scientists furthermore carry out a high-level personal or collaborative astronomical and/or technical research programme that contributes to the scientific reputation and output of ASTRON. Telescope Scientists are assigned to specific (external) user/astronomer groups for advice and support in using ASTRON's telescopes and facilities at all stages of their research programme, from project planning and proposal writing, specific observing tactics, instrumental specifications and scheduling, to data analysis techniques. Documentation is provided and maintained online on the ASTRON Radio Observatory pages. Additionally, the group is involved in the education and training of users in more

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formal settings (e.g., reporting in “Status Meetings”, lecturing and demonstrating in “Data schools”, hands-on participation in “Busy Weeks” etc.).

Proposals to ILT are submitted in two deadlines, using the NorthStar online tool. The Panel Committee ranks the proposals and distributes the observing time. The SOS team provides support to the Panel Committee by performing technical feasibility assessments of the proposals. Later on, SOS staff prepares the observing schedule. LOFAR data remains property of ILT, PIs are by default granted exclusive rights on the data for a period of 1 yr.

2.2.2.1. ILT Operations: Operations and Maintenance

The group takes care of the operations and maintenance of WSRT (also on EVN mode) and ILT. The team includes operators, maintenance engineers, and system-level engineers. The work includes the maintenance of the stations and operations, but it does not involve the correlator in Groningen (a responsibility of the software support group).

The international stations are run in ILT mode from Monday to Friday; weekends are left for stand-alone mode, where the full stand-alone control is passed on to individual international station owners. Every week, all stations go through a system check and testing, the international partners receive the test results from the maintenance group at ASTRON. Summer time is dedicated to maintenance (while observations continue), with support visits by ASTRON staff to the international stations that require any repair or replacement of components. The maintenance team decides when an international station requires a visit.

2.2.2.2. ILT Operations: Software Support Group

The team includes software developers and system administrators. The group provides support for the software that runs the telescope, provides the scripts to go from ILT to local mode, and further support to local stations. They also coordinate the relations with the computing facility in Groningen. The contacts with the users are done by the SOS team. The team is in charge of administrating software, coordinate standard releases, but does not support data reduction pipelines.

Summary:

The description of JIVE/EVN and ILT/LOFAR in this document allows to identify many areas of common interest, in operations, logistics, and technical developments. Both research infrastructures give service to the astronomical community, in their own frequency range, performing observational projects based solely on scientific merit. There are also some important differences. Noteworthy is that LOFAR stations are operated mostly in round-the-clock observations conducted primarily by ASTRON staff, with limited local site support. The EVN consists of telescopes that, next to having independent programmes, collaborate as a joint network for VLBI observations, for which JIVE offers many services as a central support hub, while other activities and developments are distributed among the EVN partners (in particular the construction, upgrade and maintenance of the individual radio telescopes). The ILT is thus an example of a more centralised operations model for a distributed infrastructure, compared to the EVN and JIVE where the responsibilities are more distributed.

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3. Document 2: Governance and Finances

3.1. JIVE ERIC

JIVE is governed by a Council, composed by two persons (one vote) elected by each of the member countries. The Council has a Chair and a ViceChair.

The JIVE Management Team (MT) consists of the Director and the Heads of the Departments:

- Dr. Francisco Colomer (Director of JIVE)
- Dr. Z. Paragi (Head of Science Support)
- Dr. R.M. Campbell (Head of Science Operations)
- Dra. H. Verkouter (Head of Technical Operations and R&D)
- Prof. L. Gurvits (Head of Space Science and Innovative Applications)

Being an ERIC, JIVE is supported by contributions of the member countries, which constitutes the budget for its "core business" (to run the EVN correlator and support its users). The value of such a contribution is reflected in the JIVE statutes. Additional budget is obtained from participation in competitive projects, from the different EC programs (such as H2020) and other (e.g., Dutch national calls).

The staff is hired by NWO-I, hosted by ASTRON, and seconded to JIVE.

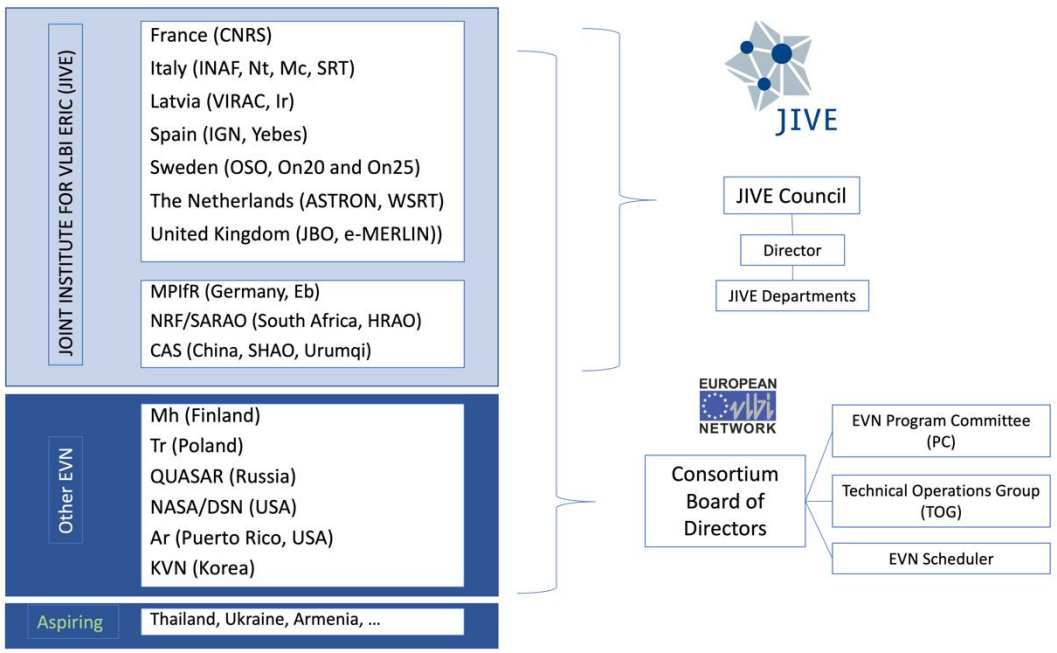

Figure 3: Partnership in JIVE and EVN.

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3.2. ILT and its relation to ASTRON

The ILT foundation was established in 2010 to operate and scientifically exploit the network of LOFAR stations. It is a legal entity (non-profit) under Dutch law with no personnel. The headquarters are located in Dwingeloo, the Netherlands. The ILT is governed by the Executive Board and the Executive Director. Each country has a National LOFAR Astronomy Consortium that represents the interests of the national scientific community at the ILT Board. The Board consists of one representative for each national consortium (except: 2 members delegated from the Dutch consortium NRAAC), and the general director of ASTRON. In 2021, the national consortia are: Germany (GLOW), France (FLOW), Ireland (I-LOFAR), Italy (LOFAR-IT), Latvia (LOFAR-Latvia), Netherlands (NRAAC), Poland (POLFAR), Sweden (LOFAR-SE), UK (LOFAR-UK).

The ILT constitution designates ASTRON, in Dwingeloo (NL), as the operational facility for ILT. The Director of the ILT is appointed by the Executive Board for a period of 5 years, during that period the director is employed by ASTRON. The director is in charge of carrying out the policies defined by the board, the duties include: preparing and implementing the decisions for the executive board, implementing the financial policy of the foundation, entering into and managing the agreements concluded between the ILT foundation and the owners of LOFAR facilities regarding the utilisation of the facilities and the financial resources, looking for prospective new members for the foundation. The director reports about his activities at every board meeting.

To become a member of ILT, the country has to contribute with at least one appropriately maintained LOFAR station connected to the central network. The country national consortium also commits to participate in the costs and efforts of operations; the required yearly operations contribution to ILT is proportional to the number of stations. Another possibility is that the country contributes with the equivalent value of one LOFAR station, plus continued proportional annual operations contribution.

3.3. Differences between the two models of Governance and Finances

JIVE members are countries, whereas the ILT is formed by consortia (one per country). JIVE has ERIC status, ILT is a non-profit organization under Dutch law.

To enter the ILT, one or more interested institutes in a country need to establish (buy and install) one or more LOFAR station(s) that will remain connected to the ILT network for at least 90% of the time. To enter JIVE, new members may use already existing facilities, but the commitment must be made at a state level. While the ILT partners pay a fixed annual contribution according to the number of stations, member contributions to JIVE scale with the local operation costs of their EVN telescope(s).

The highest governance bodies are the JIVE Council and the ILT Board. Their constitution slightly differs, but all country members are represented and have the same voting rights. The Directors have the executive tasks. The director of JIVE is supported by the Management Team, formed by the Heads of each department. The ILT constitution designates ASTRON as the operational institute for all its facilities.

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The two facilities share some of their members, but while ILT has only European partners, JIVE has also partners outside of Europe.

Members	ILT	JIVE
The Netherlands	Y	ERIC member (host)
UK	Y	ERIC member
Sweden	Y	ERIC member
France	Y	ERIC member
Spain	N	ERIC member
Latvia	Y	ERIC member
Germany	Y	Associated
Poland	Y	N
Ireland	Y	N
Italy	Y	Associated
China	N	Associated
South Africa	N	Associated

The telescopes in the EVN network are always controlled locally, while In ILT mode, stations are centrally operated from Dwingeloo (NL). EVN sessions run generally for a limited period of 3 weeks, 3 times per year, while the ILT uses the whole network close to 90% of the time, and stations owners can use their stations the remaining fraction of the time for their own projects.

JIVE and ILT each have a process of peer review for the projects that wish to use observing time (and computing resources in the case of the ILT). EVN has 100% of open skies policy, while the ILT is partially open skies; the national consortia obtain reserved access share of the observing time in return to the investment that represents installing a LOFAR station. This time share decreases with time and consortia are free to give part of their reserved time back to the ILT for allocation by the programme committee.

Both facilities provide a strong user support from the proposal stage to the data analysis, there is a wish to increase their user base. There are different tools available to the users to prepare observations and check the quality of the data. Users can contact the staff to request direct support. Meetings with participation of the users are organised periodically (workshops, schools, scientific symposia).

One of the surprising findings from this comparison study was the modest overlap between the two scientific communities. If contemplating a possible closer future alignment of the two facilities, it will be essential to ascertain the support, and even the need, arising for such alignment from the scientific communities. To stimulate increased mutual awareness and to allow the communities to realise more synergies, WP4 in JUMPING JIVE has allocated funding to facilitate visits of scientists to participate at meetings and workshops on EVN and LOFAR topics. WP4 has also provided funding to support the joint LOFAR-EVN traineeship program, started in 2018 as a collaboration between ASTRON and JIVE[11].

[11] https://old.astron.nl/radio-observatory/news/astronjive-traineeship/astronjive-traineeship

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4. The application for LOFAR ERIC

In October 2019, the ILT Board reviewed and discussed the documentation produced within WP4 of the JUMPING JIVE project, as well as studies and recommendations by an internal ILT Working Group. The ILT Board decided that:

- An ERIC is an appropriate and attractive legal form to take the governance of the international partnership on the LOFAR distributed research infrastructure forward into the LOFAR2.0 era (LOFAR2.0 entails realisation and exploitation of a major collective upgrade project).

- The driving goal for the establishment of the ERIC is to provide an optimal operational and governance model, tailored to the specific needs of the LOFAR partnership and the features of the distributed infrastructure, in preparation for the LOFAR2.0 era.

A LOFAR ERIC preparation Working Group was formed, led by the NL Ministry of Education, Culture, and Science. It had ministry and funding agency representatives of all current ILT partners, as well as participation by the ILT Director and Board. Following the close interaction with JIVE on exploring governance topics in WP4 of JUMPING JIVE, the JIVE Finance & Project Officer (Aukelien van den Poll, who is also the Finance Officer of JUMPING JIVE) was engaged by the ILT Director to provide valuable consulting and other support services to the LOFAR ERIC Working Group.

In June 2021, the Working Group completed its development of LOFAR ERIC Statutes, including a Scientific and Technical Annex, and a Financial Model and Plan, as well as drafts of some future ERIC policy documents. The Working Group requested the NL Ministry to formally invite all partners to join next an Interim LOFAR ERIC Council. The first meeting is planned for September 2021, specifically to decide on submitting the Step 1 ERIC application to the EC. Follow-up meetings of the Interim LOFAR ERIC Council will develop ancillary policies and documents towards Step 2 of the application process, and for adoption at the inception of LOFAR ERIC.

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5. Conclusions

The objective of JUMPING JIVE WP4 was to "*carry out an assessment, to be presented in a discussion document for the JIVE and ILT governing bodies and stakeholders, of the possible merits and pitfalls of a closer operational alignment of these two facilities, and possibly their merging into one ERIC*".

The process had to be carried out with a dynamic approach, since it was not known in advance how the key stakeholders would react and how both organisations would evolve.

It has been realized that at this stage both JIVE (and EVN) and the ILT, have different priorities and different evolution paths.

There is an ongoing discussion internal to JIVE and the EVN regarding the way in which they interact. The work done in WP4 of the JUMPING JIVE package has provided an insightful description of the governance and operational aspects. JIVE-ERIC serves as the operations centre for the EVN, supporting the network and its users from the proposal stage to performing observations, data processing and curation. JIVE has nowadays limited influence regarding upgrades and investments of the facilities that constitute the EVN.

The ILT Board, for its part, has benefitted substantially from the JUMPING JIVE WP4 comparative study. It has decided to embark on an ERIC application for LOFAR, but has considered that, at this time, the most expeditious and risk-free path is to prepare the formation of LOFAR ERIC as an entity in its own right. However, inspired in part by the studies undertaken in WP4 of the JUMPING JIVE project, the ILT Board noted that the ERIC regulations will enable it to enter into partnerships and collaborations of various kinds with other infrastructures in the European (radio) astronomy landscape; that the operating model may evolve over time; and that furthermore, future changes of LOFAR ERIC, in response to evolving partnerships and significant changes in the overall landscape, will not be excluded.

Both JIVE and ILT have expressed that they will remain open to explore a closer collaboration in the future. WP4 of JUMPING JIVE has reinforced a broadly shared understanding of their similarities and differences, and of their joint interests, both with respect to the user communities, and as major infrastructures in the European Research Area, where there are potential trends towards consolidation in the longer term.

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Appendix

CONTRACT JJ WP4:

There will be a single task to carry out two assessment studies, with documents to be made public at the end of the project, to evaluate the overlaps/similarities as well as differences between JIVE and ILT. Each document will start from a description of the current status and then assess how changing internal and external circumstances (national, European, and international) may alter the respective positions of JIVE and ILT in the next decade; the associated opportunities, challenges, and risks will be discussed. Each document will conclude with a study of the possible advantages and risks that specific collaborations between JIVE and the ILT would entail, including a full merger of the two entities into a combined ERIC.

1. The first document will focus on the operational model and core technologies employed by the respective facilities. It will first **describe the current modus operandi**. The document will then proceed to **explore the likely evolution and enhancement paths** of the respective facilities. These will be required in order to stay abreast of expanding technological capabilities as well as growing scientific end-user needs, particularly within the European landscape. The document will conclude with an analysis of the advantages and risks in bringing the JIVE and ILT operational models and technological efforts more closely into alignment.

2. The second document will focus on **institutional partnerships, financing, and governance models**. It will first clearly describe the current governance and partnerships of the respective facilities. The document will then explore plausible national, European, and international developments in the next decade with regard to funding and collaboration on operating large-scale research facilities in radio astronomy, keeping the ESFRI priorities in mind. The document will **assess the possible places and roles of our facilities against the evolution of research infrastructures**. Taking into account, in particular, the substantially overlapping membership of JIVE and the ILT and the ambitions of both organisations to grow (in part) by acquiring new partners in Europe, the document will conclude with an analysis of possible advantages, risks, and challenges, of aligning the JIVE and ILT governance and financing models, including the discussion of a full merger scenario.

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