The ARIES Transnational Access

Status at Mid-Term

Mid-term Review

25 September 2019

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ARIES: the Transational Access concept

- In our previous programmes (EuCARD, EuCARD-2) TA had a very limited role.
- In the new ARIES, we wanted to open, support, and internationalize the access to the advanced test stands required to test new accelerator technologies.
- Test stands are usually funded by the different national laboratories; the idea was to share them at the European level, to optimise their use and at the same time to create connections between laboratories and teams.
- As you will see in the following, in same cases this strategy has been (very) successful, in other cases less.

The CERN superconducting magnet test stand

Transnational Access in ARIES

Access provider short name	Short name of infrastructure	Installation		Installation Country code	Type of access	Unit of access	Unit cost (UC) €	Min. quantity of access to be provided	Access costs		Estimated number of users	Estimated number of user projects
		Nr	Short name						On the basis of UC	As actual costs		
CERN*	MagNet	1	MagNet@CERN	IO	TA-uc	1h	0.00	1,920	1,548,825.60	-	40	8
UU	FREIA	1	Gersemi	SE	TA-ac	1h	-	2,880	-	183,212.80	56	8
CERN*	HiRadMat	2	HiRadMat@SPS	IO	TA-uc	1h	0.00	200	654,000.00	-	20	5
GSI	UNILAC	1	M-branch	DE	TA-uc	1h	274.79	480	131,900.00	-	48	8
KIT	KIT-ATP	1	KIT-ANKA	DE	TA-uc	1h	416.22	480	199,787.04	-	64	8
KIT	KIT-ATP	2	KIT-FLUTE	DE	TA-ac	1h	-	320	-	100,975.00	40	8
CEA	IPHI	1	IPHI	FR	TA-ac	1h	-	1,440	-	267,144.00	72	12
DESY*	SINBAD	1	SINBAD	DE	TA-ac	1h	-	630	-	257,500.00	36	9
STFC	VELA	1	VELA	UK	TA-ac	1h	-	336	-	198,737.87	56	14
UU	FREIA	2	HNOSS	SE	TA-ac	1h	-	2,880	-	199,585.15	44	4
CERN*	XBox	3	XBox@CERN	IO	TA-uc	1h	0.00	6,000	750,080.00	-	64	4
CNRS	LULI	1	APOLLON	FR	TA-ac	1h	-	180	-	695,456.25	48	6
CEA	LIDyL	2	LPA-UHI100	FR	TA-uc	1h	117.00	640	74,880.00	-	40	4
UL	LULAL	1	LULAL	SE	TA-uc	1h	170.00	480	81,600.00	-	36	6
											Total no. of users** = 664	

14 Test Facilities grouped by technology in 5 Workpackages, offering a wide and complementary range of access.

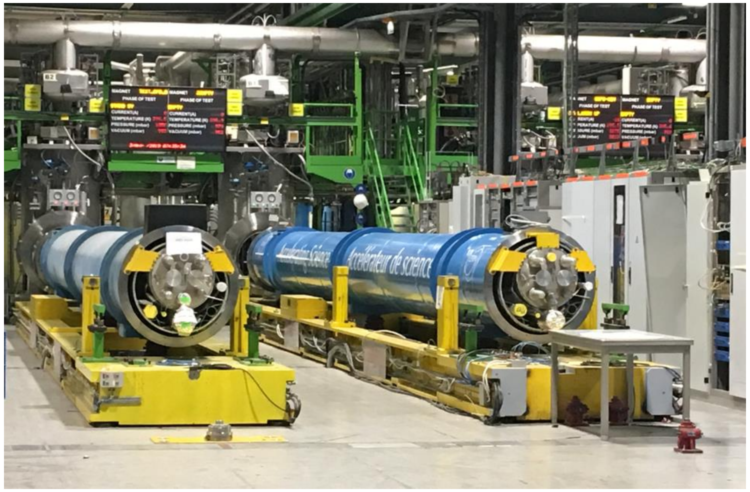
- Magnet testing: CERN SM18 and FREIA at Uppsala.
- Material testing: HiRadMat at CERN and M-branch at GSI.
- Beam testing: protons and RF at IPHI (CEA), high current electrons in ANKA (KIT), variable electron beams at VELA (CI), short electron bunches at FLUTE (KIT) and when operational at SINBAD (DESY).
- RF testing at FREIA (Uppsala) and at the XBOX at CERN.
- Plasma acceleration testing at the Apollon laser (CNRS), UHI100 laser (CEA-CNRS) and Lund Laser Centre.

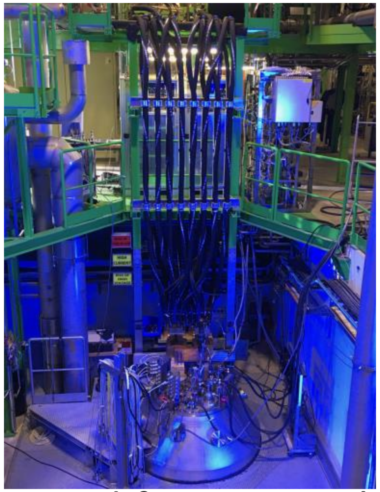
Each WP has a common User Selection Panel (with the only exception of Materials)

WP9 – *TNA : MagNet*

TNA is composed by two laboratories: CERN (CH) and FREIA (S).

- MagNet (@CERN) is operational
- GERSEMI (@FREIA) is starting Hardware Commissioning with possible testing by the end of the year.





5 projects were submitted for approval
4 approved and 1 in evaluation process
4 of them has been already performed tests

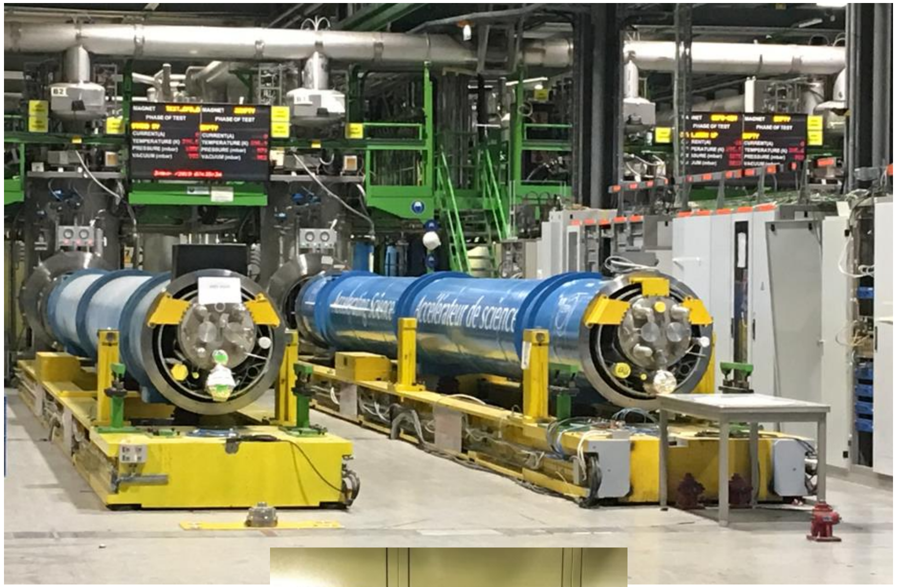
Facility	No. of projects Y1	Total no. of projects Annex 1	No. of users Y1	Total no. of users Annex 1	No. of access units Y1	Total no. of access units Annex 1
MagNet	4	8	27	40	944	1,920
Gersemi	0	8	0	56	0	2,880

ARIES

Highlight: Automated HV Testing of Sc Coils

To automat High Voltage Testing of Superconducting Coils

<u>Dr. Varadine</u> is proud of ***his students*** having developed a system that turned to be efficient in the test and found users at bug laboratories



- New release has been tested in November
- Hardware and software renewed
- New functionalities (safety & HV feature) implemented

This equipment, developed by MSc students found users:@ GSI for SFRS magnets and @ CERN SM18 for HL-LHC magnets!!

They uses any cryostat(horizontal or vertical) with any magnet.
288 Accesses

Test @ MagNet

Status of WP10 (TA) – *Material Testing*

Progress:

- **CERN-HiRadMat:** 2018 was a great achievement for the HiRadMat team with the highest yearly number of experiments completed since the start of the facility operation in 2012. It is important to note that out of the 10 experiments, 40% received TNA support. 38 Researchers primarily from Europe, but also from the US, Japan and Russia, gained access to the facility amounting to more than 1500 Transnational Access hours (during 2017-2019).
- **GSI-UNILAC** resumed operations mid February 2019 until mid April 2019. The foreseen access units are already delivered within this run. Discussions with the management has been started for a simple extension with respect to the expected beam time block in 2020.

Status of contractual obligations (Milestones, Deliverables):

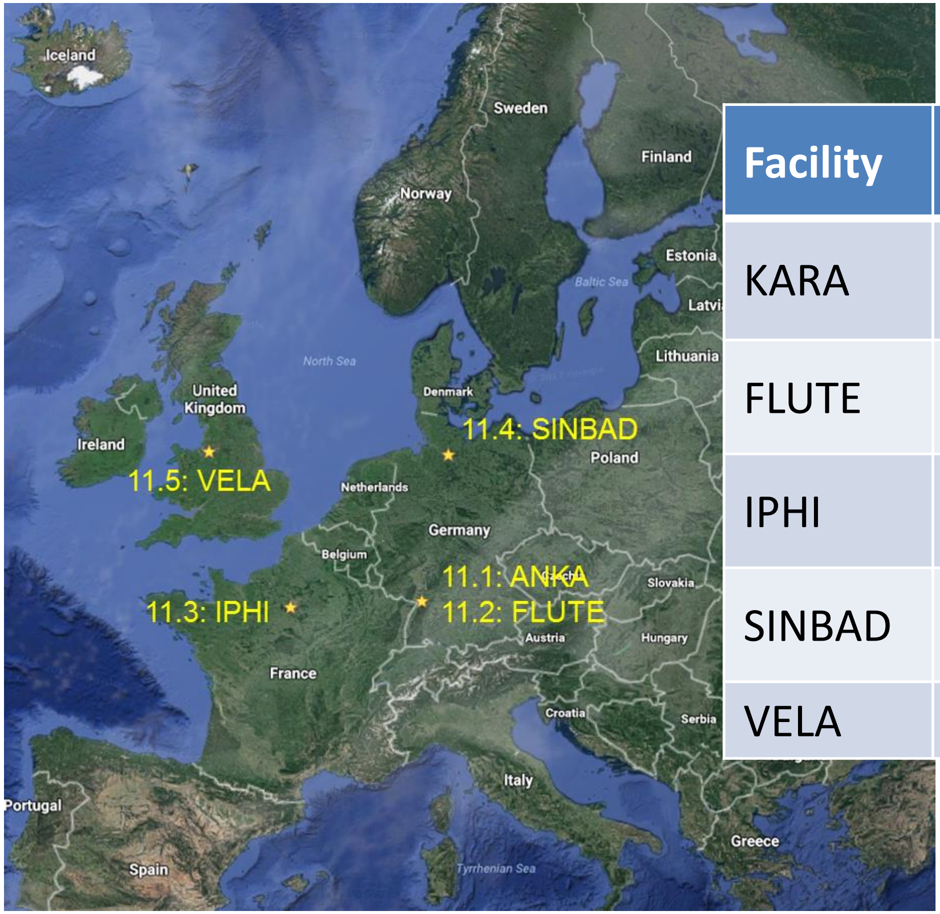
HiRadMat - CERN	User-projects			Users supported	Units of access (1 h)
	Submitted	Selected	Supported		
Year 1 (M1-M24)	6	6	5	38 (23*)	1544**
Foreseen for project (M1-M48)	5			20	200

* With financial support

** 25% budget overrun expected

M-branch - GSI	User-projects			Users supported	Units of access (1 h)
	Submitted	Selected	Supported		
Year 1 + 2 (M1-M48)	3	3	3	27 (12*)	512
Foreseen for project (M1-M48)	8			48	480

Facilities in WP11



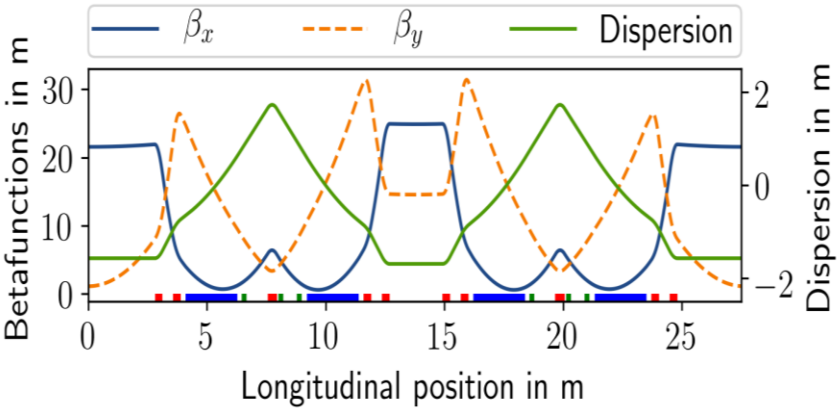
Facility	Part	(Foreseen) characteristics
KARA	e	0.5 – 2.5 GeV, bunch length 50 down to few ps
FLUTE	e	41 MeV, 1 → 300 fs, 10 Hz
IPHI	p	3 MeV, peak current ~ 60 mA, 5% dc
SINBAD	e	100 MeV, few fs, < 50 Hz
VELA	e	6 MeV → 40 MeV, 10 → 100 Hz

- All facilities now running but SINBAD (first beams Spring 2019)

ARIES WP7 uses storage ring KARA

- Ongoing TNA together with WP 7:

Beam dynamics studies in negative momentum compaction factor regime in an electron storage ring: first results:

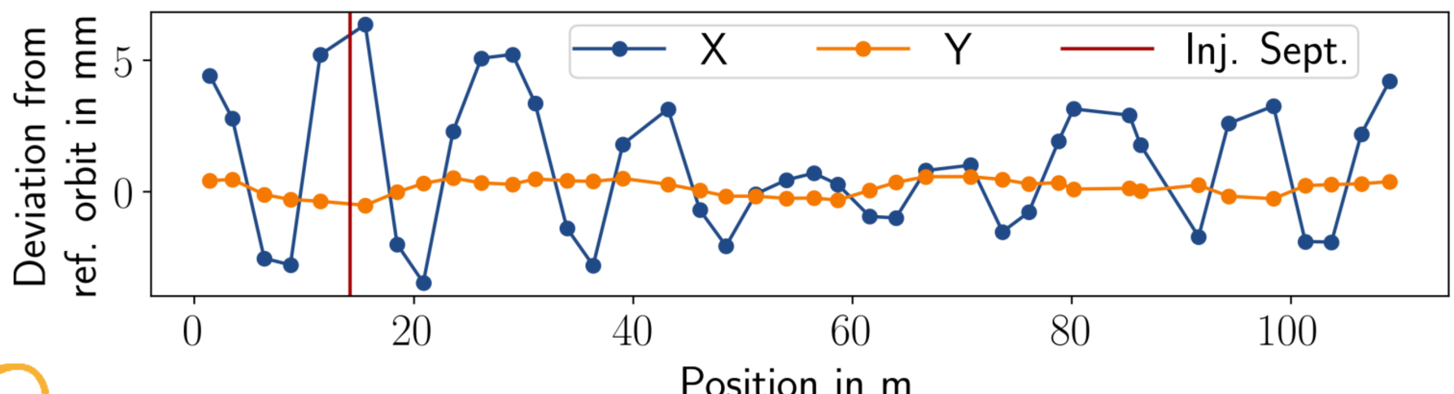


✓ **Injection into negative alpha optics at 500 MeV (up to 6.8 mA)**

✓ **Operation with different tunes, chromaticity and alpha**

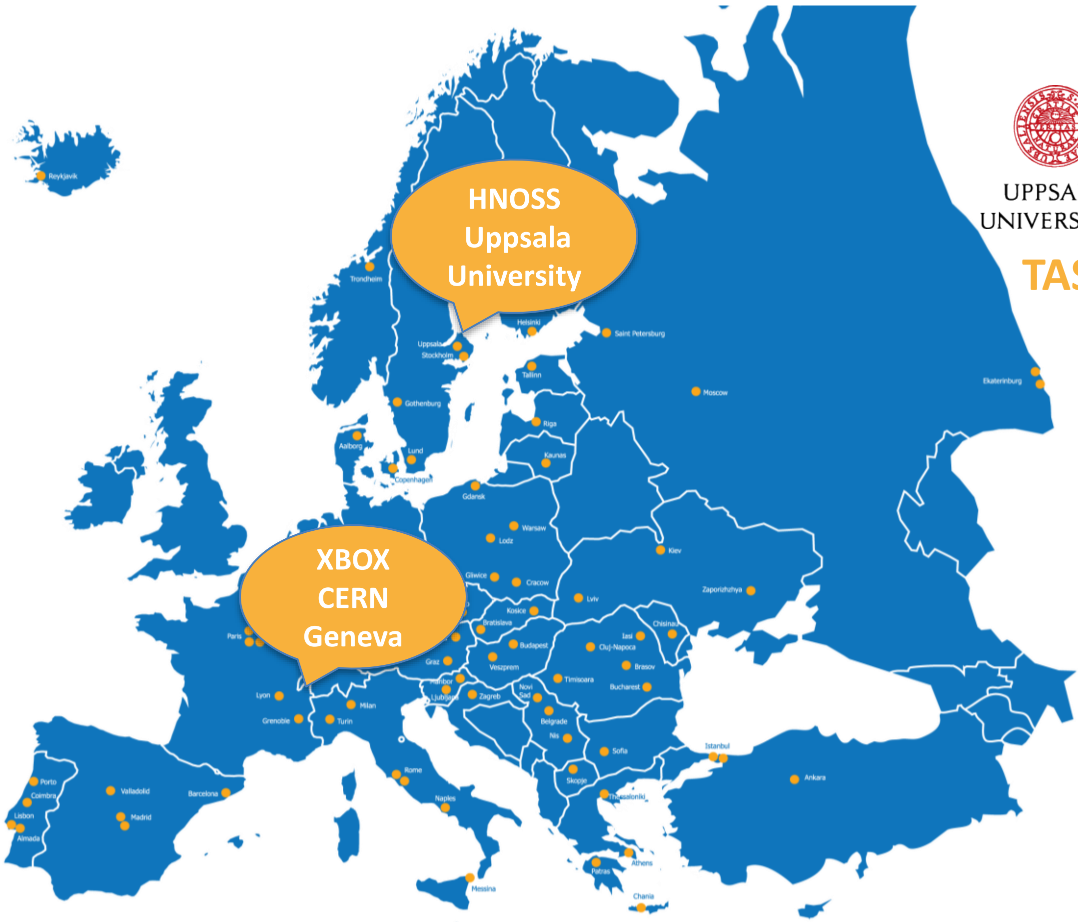
✓ **<u>Measured</u> injection orbit at negative alpha condition**

It seems injection bump needed due to septum stray field



<u>Outlook:</u> beam characterization, etc.

WP12 RF Testing Facilities



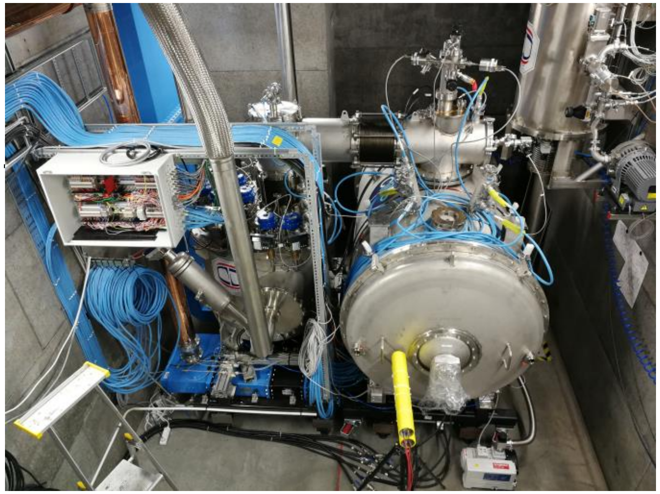
TASK 12.1 HNOSS

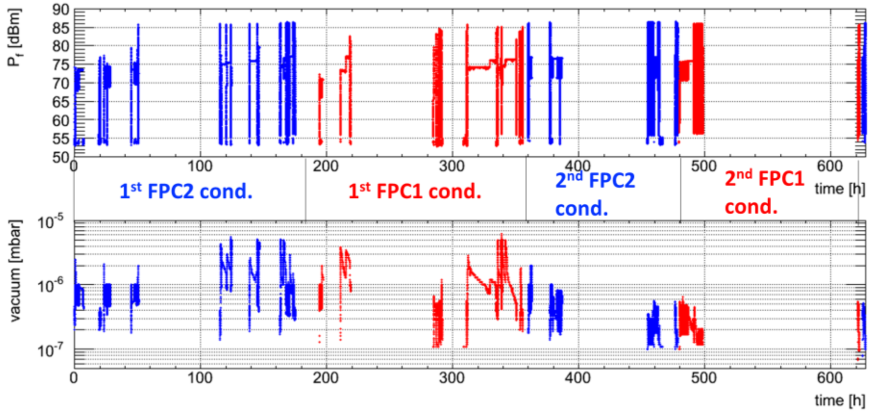
TASK 12.2 XBOX

The TNA within WP12 groups **TWO** facilities devoted to testing of superconducting RF cavities and normal conducting RF cavities.

WP12.1 HNOSS - Project #2

- Double-spoke cavity cryomodule & valve box
  - from IPN Orsay, prototype for ESS
  - validation valve box in Dec. 2018 & Jan. 20
    - use simulator to validate operation
    - thermo-acoustic (Taconis) oscillations
      - → installed RLC circuit
  - cryomodule run just started
- Results
  - warm RF conditioning
    - several multipacting bands
      - strength depends on pulse length, 1st/2nd conditioning…
  - cold RF conditioning
    - no multipacting
  - this week: cavity conditioning





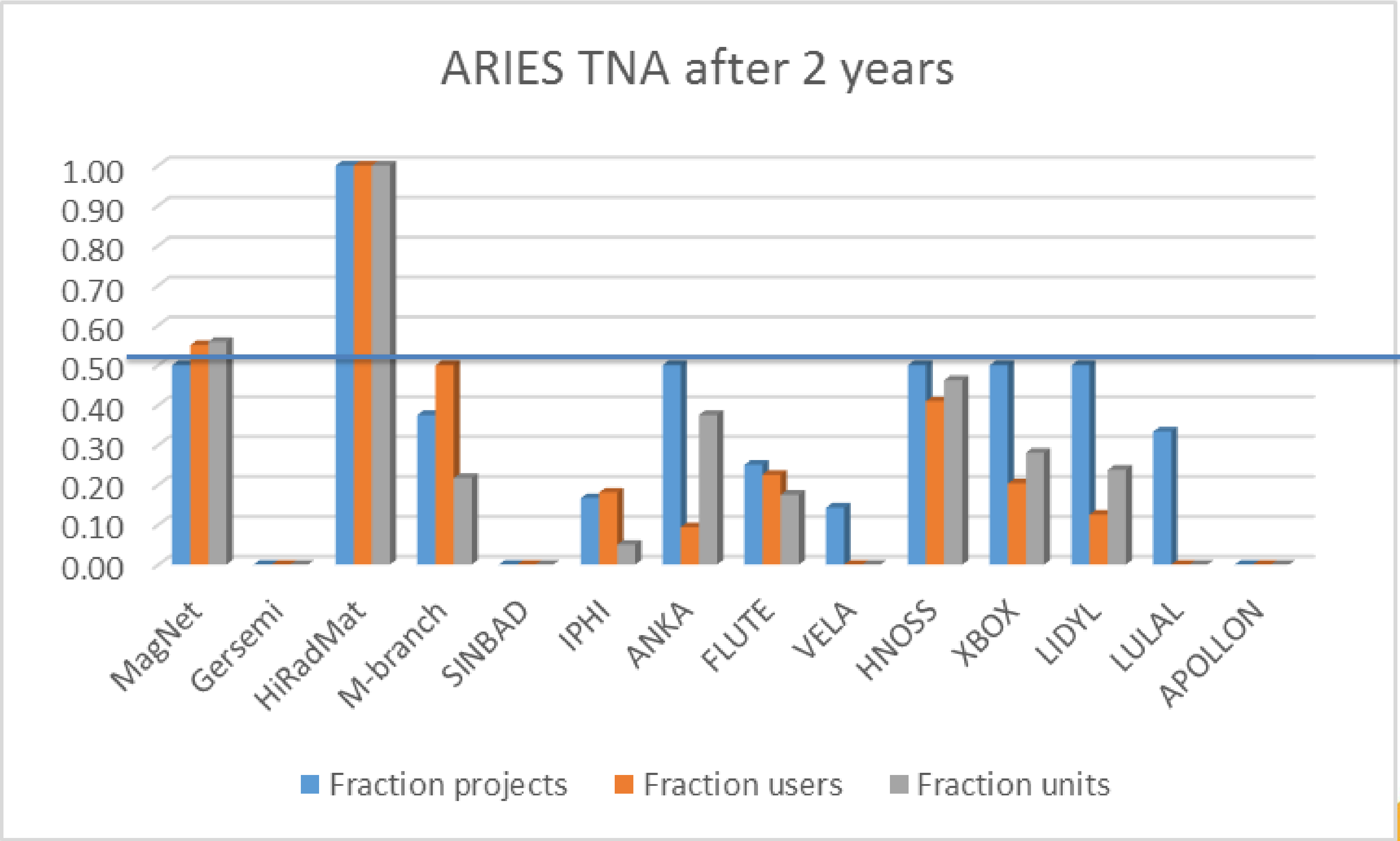
Transnational access summary at M24

Out of the 14 facilities:
- 6 are correctly progressing
- 1 has largely exceeded its goals (and is now in shutdown)
- 4 did not start access (1 is starting now at M30)
- 3 have low or very low access

WP	Facility	Projects n°	Ann. 1	Users n°	Ann. 1	Access units	Ann. 1	Fraction projects	Fraction users	Fraction units	
WP9	MagNet	4	8	22	40	1072	1920	0.50	0.55	0.56	ok
	Gersemi	0	8	0	56	0	2880	0.00	0.00	0.00	not started
WP10	HiRadMat	6	5	38	20	1632	200	1.20	1.90	8.16	high
	M-branch	3	8	24	48	104	480	0.38	0.50	0.22	ok
WP11	SINBAD	0	9	0	36	0	630	0.00	0.00	0.00	not started
	IPHI	2	12	13	72	112	1440	0.17	0.18	0.08	very low
	ANKA	4	8	10	64	216	480	0.50	0.16	0.45	ok
	FLUTE	2	8	9	40	76	320	0.25	0.23	0.24	low
	VELA	2	14	16	56	80	336	0.14	0.29	0.24	low
WP12	HNOSS	2	4	18	44	1330	2880	0.50	0.41	0.46	ok
	XBOX	2	4	13	64	1680	6000	0.50	0.20	0.28	ok
WP13	LIDYL	2	4	5	40	152	640	0.50	0.13	0.24	ok
	LULAL	2	6	0	36	0	480	0.33	0.00	0.00	not started
	APOLLON	0	6	0	48	0	180	0.00	0.00	0.00	not started
		31	104	168	664	6454	18866	0.30	0.25	0.34	

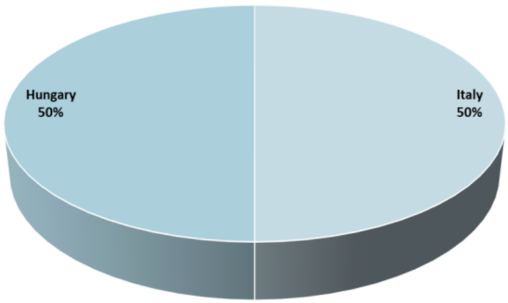
The arrows shows new facilities supposed to start operation in 2016/19

TNA graph

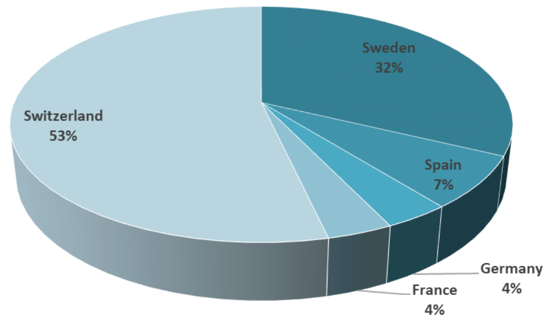

ARIES TNA after 2 years
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
MagNet
Gersemi
HiRadMat
M-branch
SINBAD
IPHI
ANKA
FLUTE
VELA
HNOSS
XBOX
LIDYL
LULAL
APOLLON
Fraction projects
Fraction users
Fraction units

Distribution of users by home country

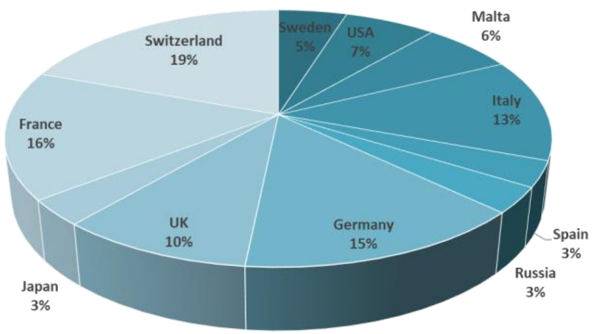
Distribution of users by home institute country in WP9



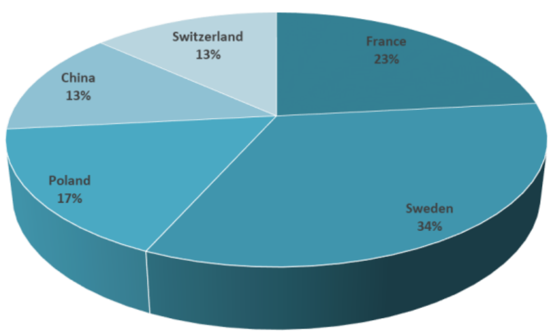
Distribution of users by home institute country in WP11



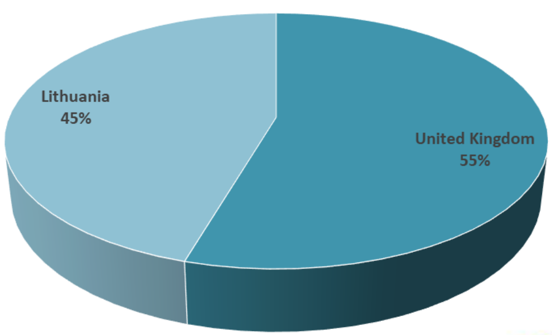
Distribution of users by home institute country in WP10



Distribution of users by home institute country in WP12



Distribution of users by home institute country in WP13



What happened

We have been overambitious, and our ambitions have been limited by two facts:

1. Some of the advanced test stands were too advanced – prone to technical problems that have delayed their start-up and operation.
2. While facilties that were operating in the past have an established user base, for new facilities it takes time (and effort) to advertise and to attract users.

While we can do nothing for the technical problems, we have invested a lot of effort in advertising our facilities: web site, article in Acc. News, poster shown at conferences and meetings, leaflet, direct contacts,…

Perspectives for the underperforming TA

- Gersemi at Uppsala Univ.: the leak on the cryostat should be repaired this month. 3 projects already approved and ready to start. Will hopefully start soon but will probably not be able to reach the target.
- Sinbad at DESY: start of the facility was expected in spring 2019. Commissioning is being completed, and is actually only few months late. However, there are no experimental requests at the moment.
- APOLLON at CNRS: waiting for the nuclear safety permission to start operation. Some teams are ready to start but the initial date cannot be predicted.
- LULAL at Lund Univ.: has finally completed upgrade of laser energy. Two experiments are approved and ready to start in November.

The situation is improving, but still some TA's will likely not reach their goal.

Some others will instead exceed their goal. Is a compensation possible, and is there any rule for this compensation?