






ARIES-TNA-Experiments within WP11

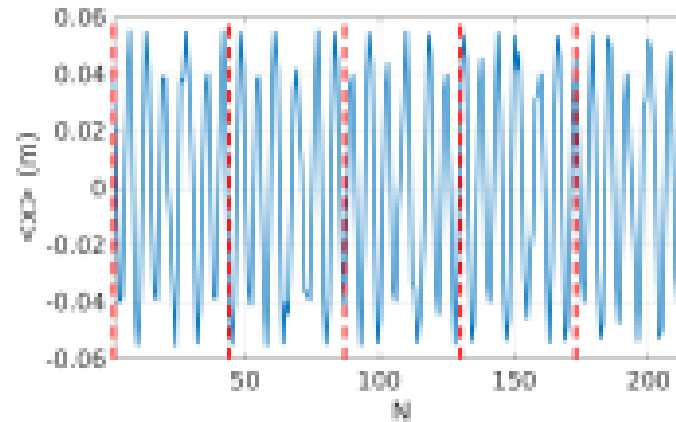
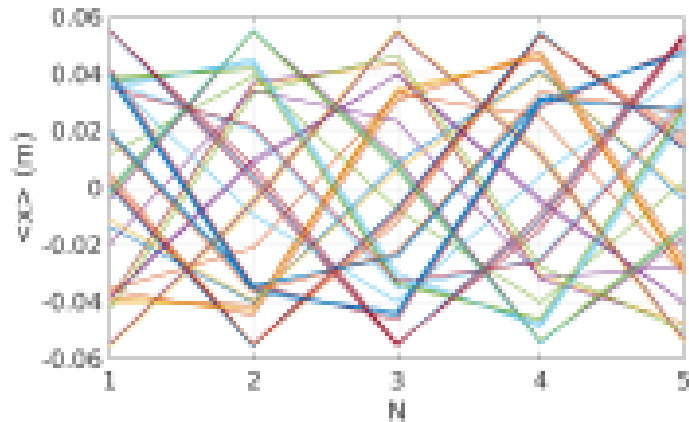
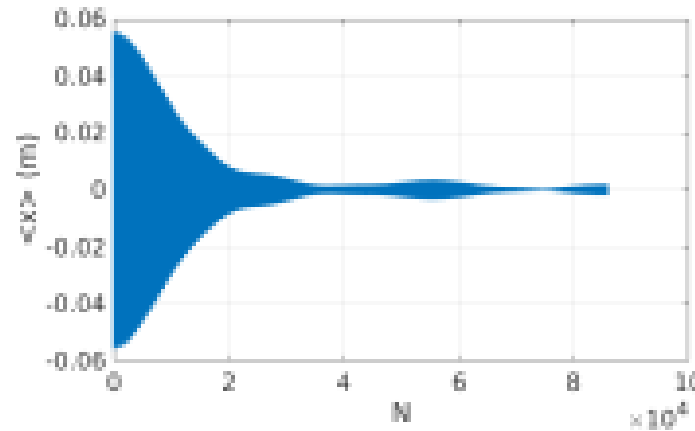
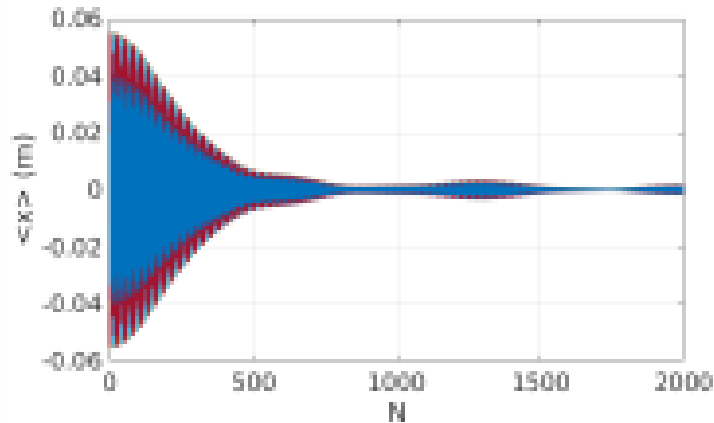
5 Accelerator Test Facilities for ARIES Trans National Access

- WP11.1**  **KARA at KIT: Karlsruhe Research Accelerator,**
a synchrotron storage ring up to 2,5 GeV electron energy
- WP11.2**  **FLUTE at KIT: Ferninfrarot Linac- und Test-Experiment**
will accelerate ultra-short e-bunches up to 50 MeV
- WP11.3**  **IPHI at CEA: Injector of Proton for High Intensity**
accelerates a 100-mA continuous beam up to 3 MeV
- WP11.4**  **ARES at DESY: Accelerator Research Experim. at SINBAD**
will accelerate ultra-short e-bunches up to 155 MeV
- WP11.5**  **VELA at STFC: Versatile Electron Linear Accelerator**
ultra-high performance injector up to 50 MeV, 250 pC

Robert Ruprecht, Florian Burkart, Anthony Gleeson, Michael Nasse,
Jerome Schwindling, Marcel Schuh et al.

R. Ruprecht, 4th ARIES Annual Meeting, 2021-04-21

- Optics characterisation at KARA including the **high wiggler field**

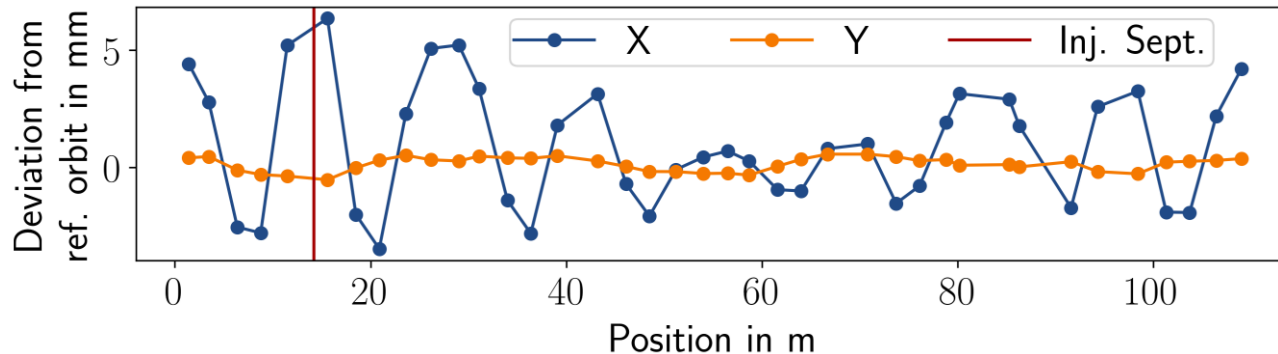
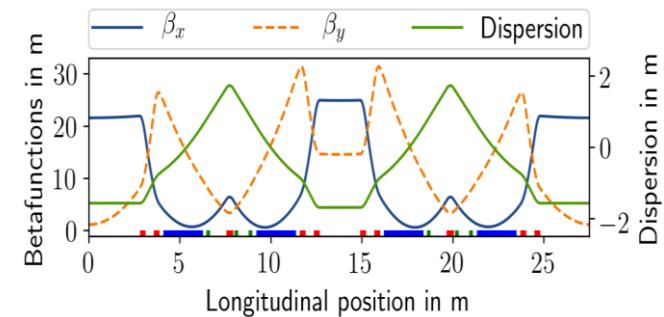


- Tune and chromaticity measurements based on turn by turn orbit data using NAFF
- Presented at the 1st ARIES Annual Meeting by P. Zisopoulos

NAFF = Numerical Analysis of Fundamental Frequencies allows a fast convergence to the tunes in the order of $1/N^4$

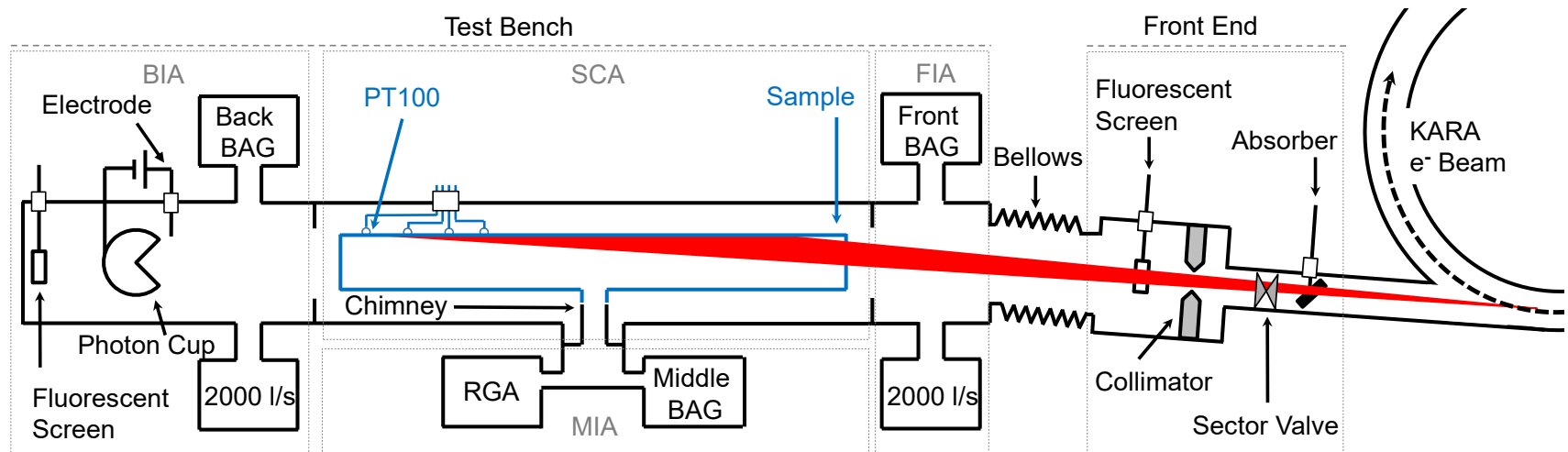
P. Zisopoulos et al., https://indico.cern.ch/event/699219/contributions/2929063/attachments/1654466/2647866/ARIES18_Zisopoulos.pdf

- Collaboration with WP 7: **Beam dynamics studies in negative momentum compaction factor regime in an e⁻ storage ring**
- Joint measurement campaign with SOLEIL and PSI
 - Established negative alpha optics at 500 MeV
 - Operation with different tunes, chromaticity and alpha
 - Measured off energy injection orbit at negative alpha condition:



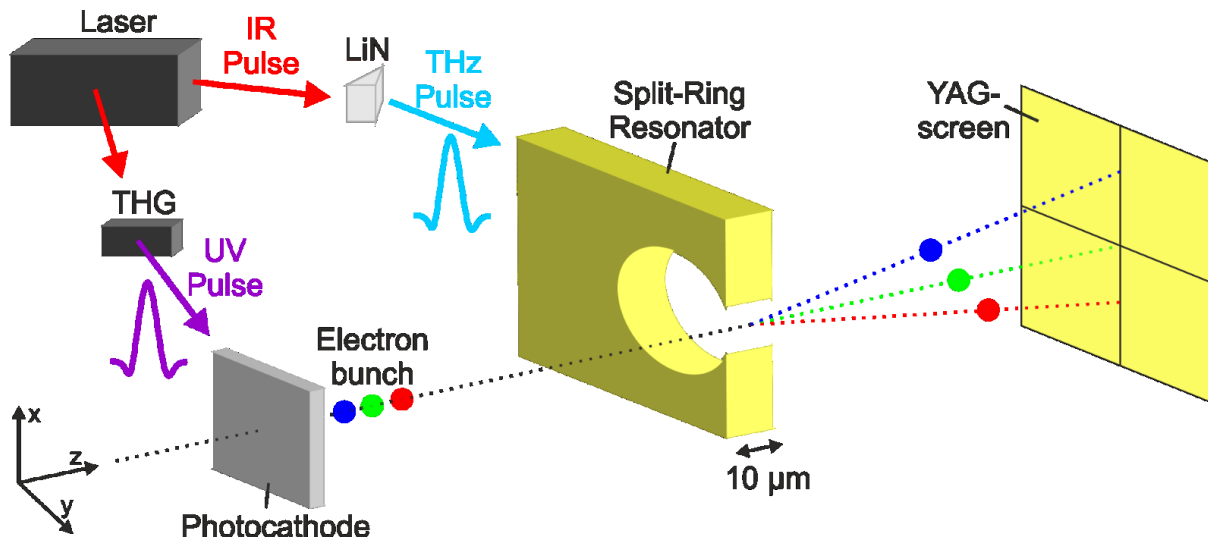
- Continued investigation in the frame of WP7

- **BESTEX at KARA**
 - Three **FCC-hh Beam Screen prototypes** including the baseline design have been tested so far at BESTEX
 - Upgrade used: Implemented liquid Nitrogen cooling to test under cryogenic conditions

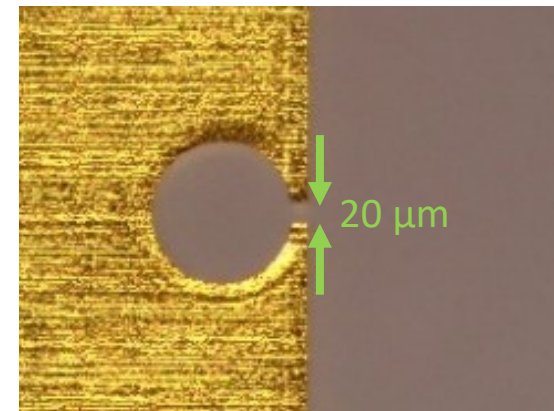
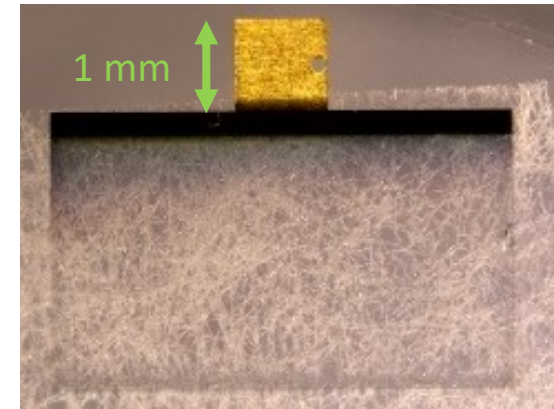


Split Ring Resonator (SRR) experiment

- Goal: single shot longitudinal diagnostics based on THz-driven streaking using a SRR amplifier
- International collaboration with the University of Bern and PSI
- Principle:



Courtesy M. Nabinger

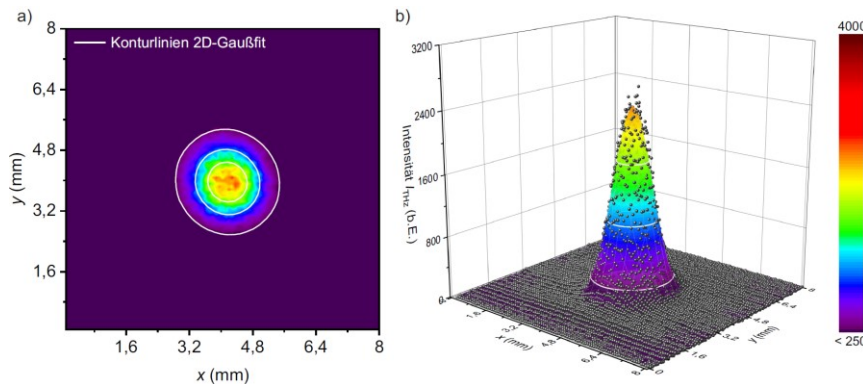


Photos M.J. Nasse

TNA [h]	2021	overall
FLUTE	20	340

Status of SRR experiment

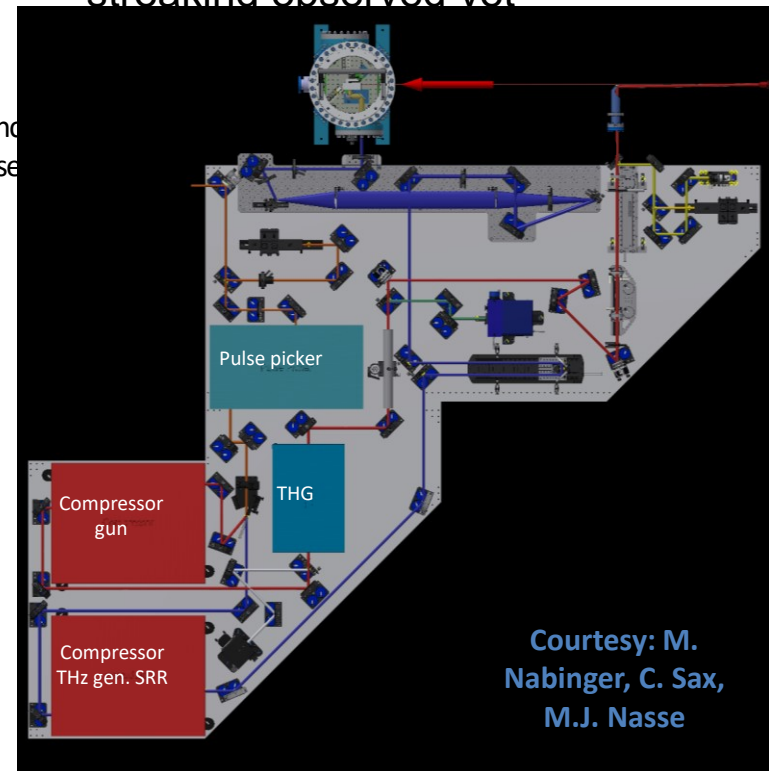
- THz generation module successfully set up and tested reaching a conversion efficiency of 0.027% [5]
- THz generation integrated in photoinjector optical setup in experimental hall



Outlook: control transversal and longitudinal laser beam shape with spatial light modulators [6]



- First test experiment done, no streaking observed yet



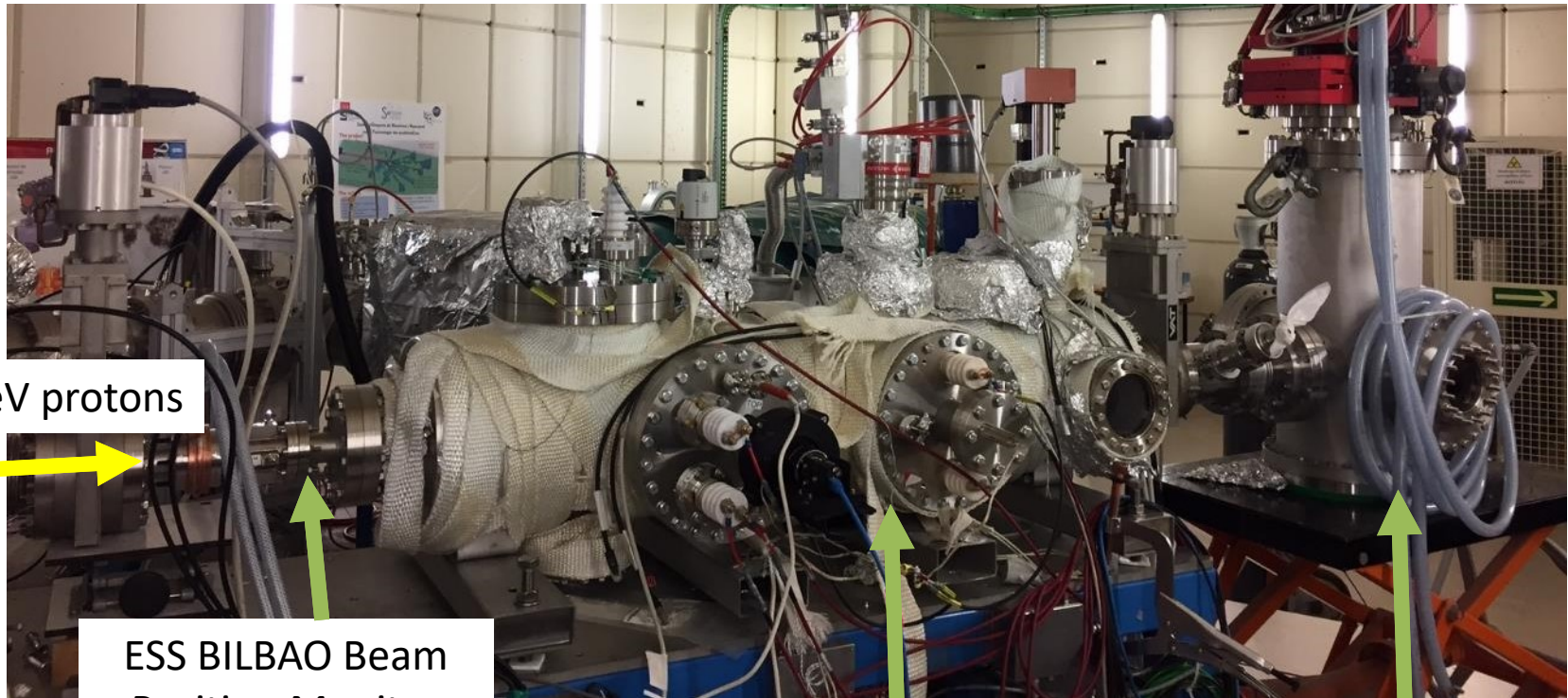
Courtesy: M. Nabinger, C. Sax, M.J. Nasse

- [1] J. Fabiańska et. al., *Sci. Rep.* 4, 5645 (2014)
- [3] M. Yan et al, *IPAC 2018*, WEPAL029 (2018)
- [5] M. Nabinger, master thesis KIT (2021)

- [2] V. Schlott et al, *IBIC 2017*, TUPCC16 (2017)
- [4] M.J.Nasse et al., *IPAC2019*, MOPTS018 (2019)
- [6] C. Sax, master thesis KIT (2021)

ARIES-WP11.3 IHPI, CEA

- The accelerator IPHI was running during 4 weeks in September – October 2018 to accommodate experiments including tests of the **BPM + electronics from Bilbao + ESS (TNA)**

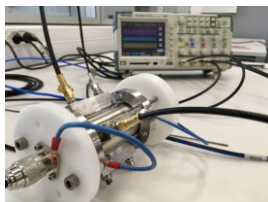


3 MeV protons

ESS BILBAO Beam
Position Monitor

Profile monitors for
ESS

Emittance meter for
MYRTE / MYRRHA



- Since then, most time devoted to tests of neutron production using Beryllium targets in view of the French compact neutron source project SONATE
- 1st version of the target operated during ~ 100 hours at ~ 3.5 kW (500 W/cm²)
- A 50 kW version has been developed and will be tested in 2021
- Because of this program and lack of TNA users, IPHI is not involved in TNA extension



Beryllium target + cooling inside
½ moderator + shielding

Work financed by a grant from
the Ile – de – France region



ARES Linac at DESY

- Normal conducting S-band electron linac @ DESY in operation
- Facility for **Accelerator Components R&D & novel acceleration techniques** testbed (e.g. DLA, beam instrumentation).
- Installation of bunch compressor and PolariX Xband TDS foreseen mid 2021 – needed for the production and characterization of **ultra-short pulses**.
- **First internal users end of 2020 / beginning of 2021.**
- **Ready for first TNA users (in 2021) depending on Corona restrictions.**

Target parameters / commissioning parameters

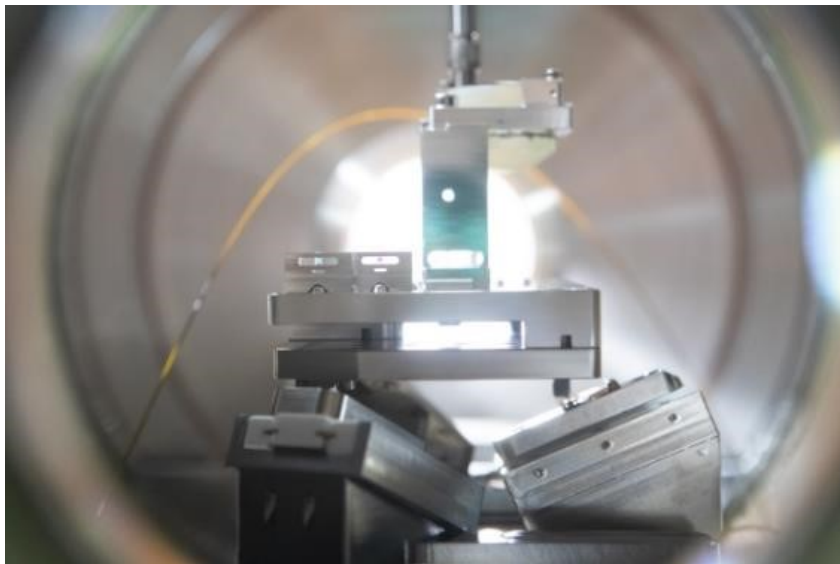
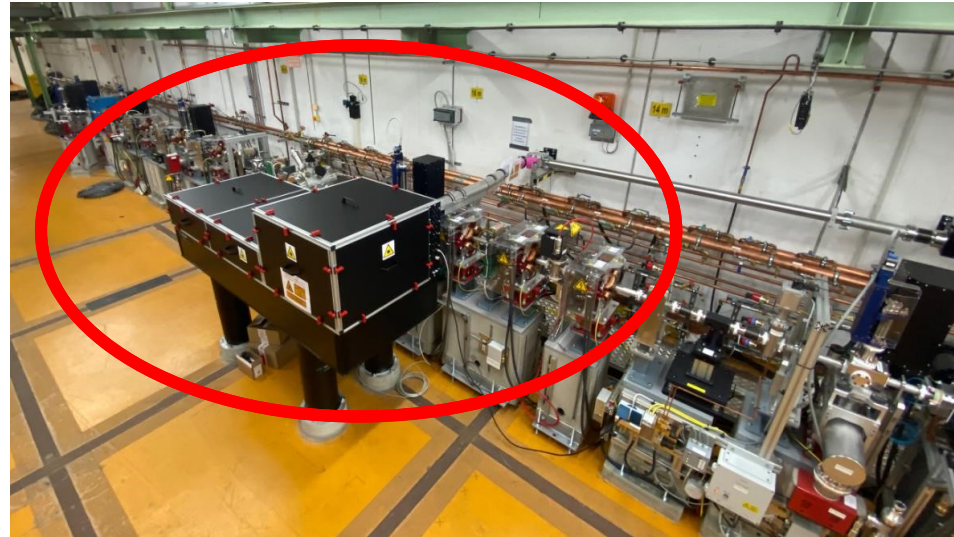
50 – 155 MeV	50 – 156 MeV
0.5 – 200 pC	0.1 – 100 pC
Single pulse @ 50 Hz	10 Hz
few fs / sub-fs pulse length	130 fs (w/o bunch compression)
norm. emittance: < 0.8 mm*mrad	< 0.5 mm*mrad



Relative **energy stability** measured: **1e-05 at 155 MeV over 16h**

ARES experimental area

Triplet focussing & steerer magnets
Beam Screens, BPMs
2 μm Ho:YLF laser amplifier system
(2.2 mJ pulse energy)



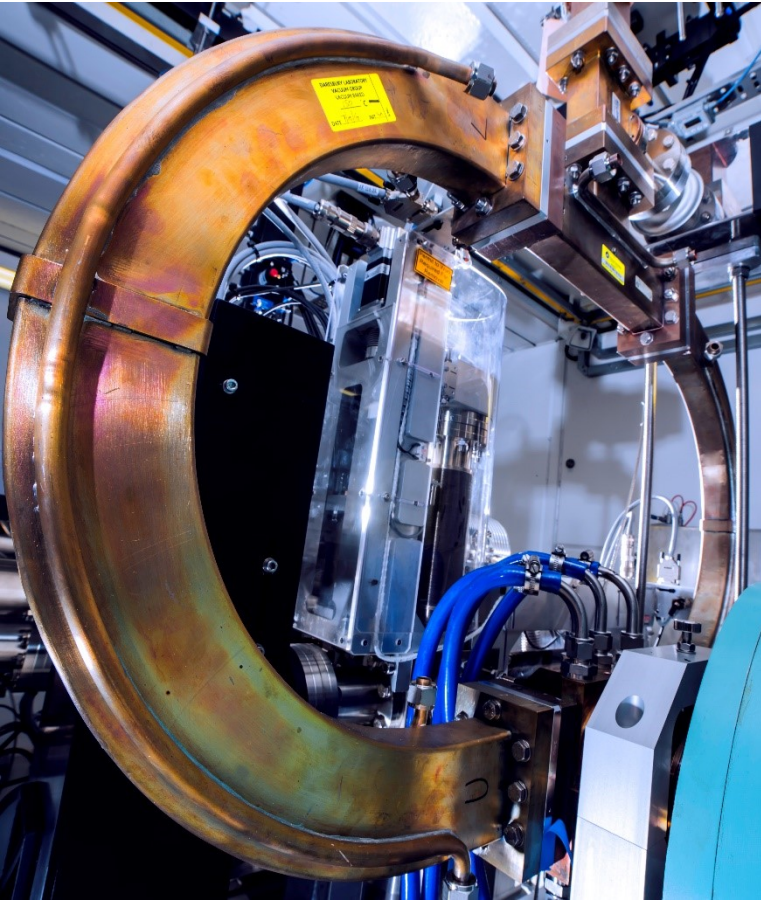
Experimental chamber with high-precision,
UHV-compatible hexapod.
Interaction point equipped with beam screens.

210h units expected until the end of TNA in 2022

TNA [h]	2021	overall
ARES	0	0

ARIES-TNA-Experiments within WP11.5

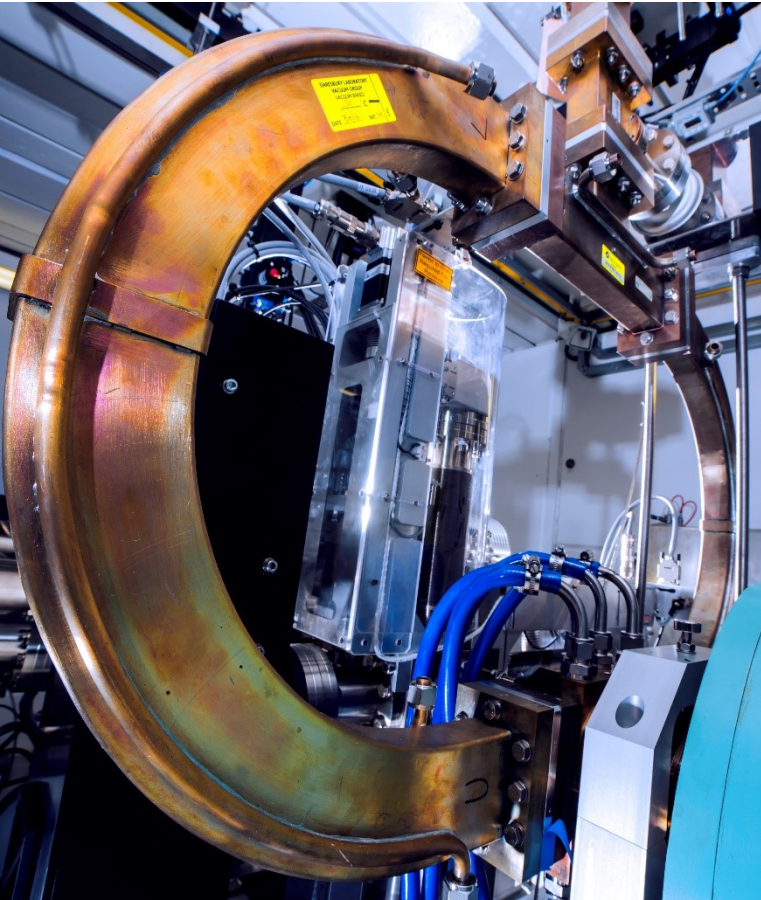
VELA: Status



- Total TNA units delivered so far: 80
- The 2021 machine re-start has been further delayed due to ongoing issues with the electron gun RF system. Once these are overcome, significant optimisation time will be necessary to determine the beam specification for user exploitation
- Resumption of user beamtime, including remaining TNA, not anticipated before September 2021 at the earliest
- VELA operations have continued throughout the Covid-19 pandemic, but at very significantly reduced levels

ARIES-TNA-Experiments within WP11.5

VELA: Status



- Currently, external researchers are able to attend site and conduct experiments, subject to UK national Covid-19 guidance and local UKRI safety restrictions
- A VELA/CLARA user meeting will be held virtually on 16th July to provide information on machine updates and resumption of beam exploitation
- Focus for the next twelve months: recommission VELA, make available for TNA in late-2021, further promotion of TNA programme

TNA [h]	2021	overall
VELA	0	80

ARIES-WP11: examples for publications

P. Zisopoulos et al., 1st ARIES Annual Meeting (2018)
https://indico.cern.ch/event/699219/contributions/2929063/attachments/1654466/2647866/ARIES18_Zisopoulos.pdf

L. A. González et al, DOI: 10.1103/PhysRevAccelBeams.22.0832014

M. Yan et al, IPAC 2018, WEPAL029 (2018)

M. J. Nasse et al., IPAC2019, MOPTS018 (2019)

A. I. Papash et al., ‘New Operation Regimes at the Storage Ring KARA at KIT’, in Proc. of IPAC2019, Melbourne, Australia, 19-24 May 2019, Melbourne, Australia, Jun. 2019, pp. 1422–1425, doi: [10.18429/JACoW-IPAC2019-TUPGW016](https://doi.org/10.18429/JACoW-IPAC2019-TUPGW016).

P. Schreiber et al, DOI:10.23732/CYRCP-2020-009.297
Proceedings of the ICFA mini-Workshop on Mitigation of Coherent Beam Instabilities in Particle Accelerators, Zermatt, Switzerland, 23–27 September 2019






P. Schreiber et al., ‘Status of negative momentum compaction operation at KARA’, CERN Yellow Reports: Conference Proceedings, vol. Vol. 9, p. 297 Pages, Dec. 2020, doi: [10.23732/CYRCP-2020-009.297](https://doi.org/10.23732/CYRCP-2020-009.297).

ARIES-TNA-Experiments within WP11

Overview, Boundary Conditions, and Outlook:

Corona Virus Covid 19: lock-downs, no travelling in EU, worldwide

- Only remote users in 2020 up to now
- KARA and FLUTE can deliver TNA as planned
- SINBAD is under construction/commissioning
- VELA with technical delay, start-up in Q3-2021
- IPHI closed ARIES-TNA after 4 years

	ARIES-TNA WP 11	users 2020 remote [h]	TNA for users in 4 years, all [h]
	KARA (ANKA)	912	2188
	FLUTE	80	320
	IPHI	0	72
	ARES (SINBAD)	0	0
	VELA	0	80