



I-FAST kick-off meeting: 04th May 2021

Riccardo Bartolini, DESY

WP7: Overview

High brightness accelerators for light sources:

Scope:

WP7 pursues the R&D on new technical solutions for the design and construction of **light sources**, exceeding the performance of present machines.

The research embraces both **storage ring based synchrotron light sources** and **free electron lasers** **by Linacs**.

Fostering networking activities foster the exchange and dissemination of new ideas, building on the previous EU networks funded within the ARIES and EuCARD2 projects.

Supporting R&D and prototype on cutting edge technological aspects, critical path technologies, compact, and sustainable accelerators (**Tasks 7.3-7.4-7.5**).

advanced dipole magnets (longitudinal variable field) to reduce hor. emittance

high gradient C-band RF gun and high gradient X-band RF structure to compact

WP7: Tasks

Task 7.1: Coordination and communication (R. Bartolini, DESY)
Beneficiaries: DESY

Task 7.2: Enabling technologies for ultralow emittance rings (A. Mochihashi, **NETWORK**)
Beneficiaries: DESY, CERN, SOLEIL, DLS, INFN, KIT, PSI, KYMA

Task 7.3: Variable dipole for the upgrade of the ELETTRA storage ring (Y. Papadimitrakis)
Beneficiaries: CERN, CIEMAT, ELETTRA, KYMA

Task 7.4: Very high gradient RF gun operating in the C-band RF technology (D. Schaeffner, **PROTOTYPE**)
Beneficiaries: INFN, COMEB, PSI, VDL-ETG

Task 7.5: CompactLight prototype accelerating structures (G. D'Auria, ELETTRA)
Beneficiaries: ELETTRA, CERN, INFN, VDL-ETG, COMEB, TMD

Task 7.2: Ultra low emittance rings

Scope:

Task 7.2 aims at strengthening the networking activity in the accelerator community on topics related to the major technological challenges faced in the design, construction and operation of ultra-low emittance rings.

- Organise general and topical workshops on the technology enabling the design and construction of future ultra-low emittance rings
- support exchange of staff for visits and common experiments
- produce progress reports on the status of the R&D in the technology areas of relevance for ultra low emittance rings, most notably magnets, vacuum, injection.

Continuing a well established tradition of LER

1th Low Emittance Rings Workshop, 12-15 January 2010 CERN - participants 70

<https://ler2010.web.cern.ch/>

2th Low Emittance Rings Workshop, 3-5 October 2011 Heraklion, Crete

<https://lowering2011.web.cern.ch/>

3th Low Emittance Rings Workshop 8-10 July 2013 Oxford University

<https://indico.cern.ch/event/247069/overview> (**EuCARD-2**) - participants 80

4th Low Emittance Rings Workshop, 17-19 September 2014, INFN-LNF Frascati

<https://agenda.infn.it/event/7766/> (**EuCARD-2**) - participants 67

5th Low Emittance Rings Workshop, 15-17 September 2015 ESRF, Grenoble

<https://indico.cern.ch/event/395487/overview> (**EuCARD-2**)

6th Low Emittance Rings Workshop, 26-28 October 2016, Synchrotron SOLEIL

<https://www.synchrotron-soleil.fr/en/events/low-emittance-rings-workshop-2016> (**EuCARD-2**)

7th LER Workshop, 15-17 January 2018 CERN (**ARIES**)

<https://indico.cern.ch/event/671745/>

8th LER Workshop 26-30 October 2020 INFN-LNF Frascati (**held remotely**)

(**ARIES**)

<https://agenda.infn.it/event/20813/overview> - participants 160

Courtesy S. Guiducci



Task 7.2: Ultra low emittance rings

Task. 7.2 is divided in five sub-tasks:

Novel injection schemes in small dynamic apertures (PSI, SOLEIL). Fast switches for fast pulsers and fast kickers or stripline. This will target novel injection schemes and the transparent top-up operation. **Strong involvement with industrial partners** is foreseen in pushing the performance of fast pulsers.

Advanced magnet concepts (CERN, KYMA) to develop dipoles with longitudinal gradient, permanent magnet (PM) dipole and quadrupole for green facilities with high gradient small apertures magnets, combined PM multipoles (e.g. sextupoles and octupoles) for **space saving and sustainability**.

Vacuum systems in small apertures (DLS, SOLEIL, CERN) to develop feasible ultra-vacuum systems based on small radius pipes, NEG (or other novel) coating and new surface treatments. This will include the evaluation of the impedance effects of such vessels.

RF and diagnostics for beam control of ultra-low emittance rings (INFN) to develop feedback systems, orbit stability, harmonic cavities design and analysis, and diagnostics for ultra-small beam size.

Task 7.2: Ultra low emittance rings

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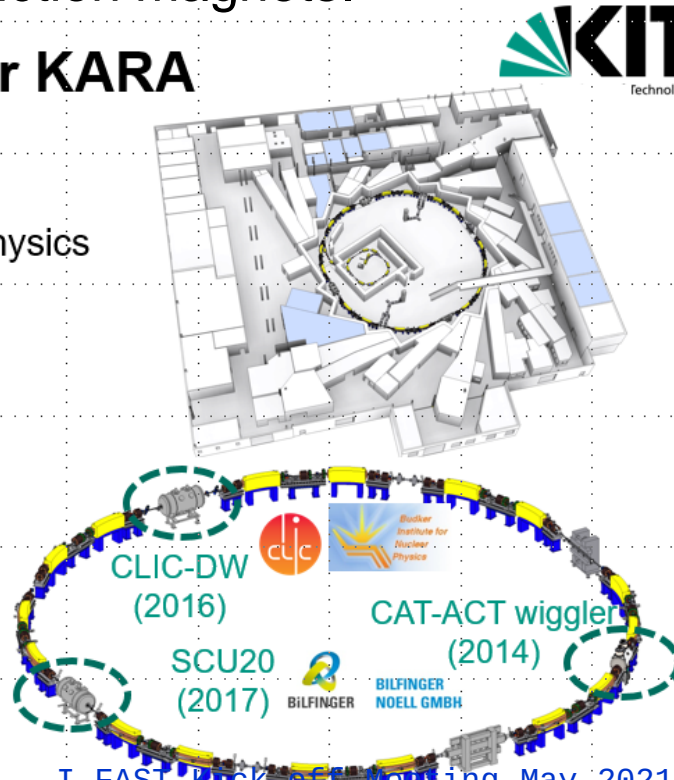
Experimental tests (KIT, CERN) to be carried out on the major technical challenges: impedance; NEG characterization at dedicated beamlines with tests at SOLEIL, DLS, KIT; injection; beam based alignment of complex combined function magnets.

Karlsruhe Research Accelerator KARA

- From ANKA „users facility“ to **KARA „accelerator test facility“**
 - **Misson:** research & development of beam physics and technology
 - **Additionally,** KARA operates as a synchrotron radiation light source

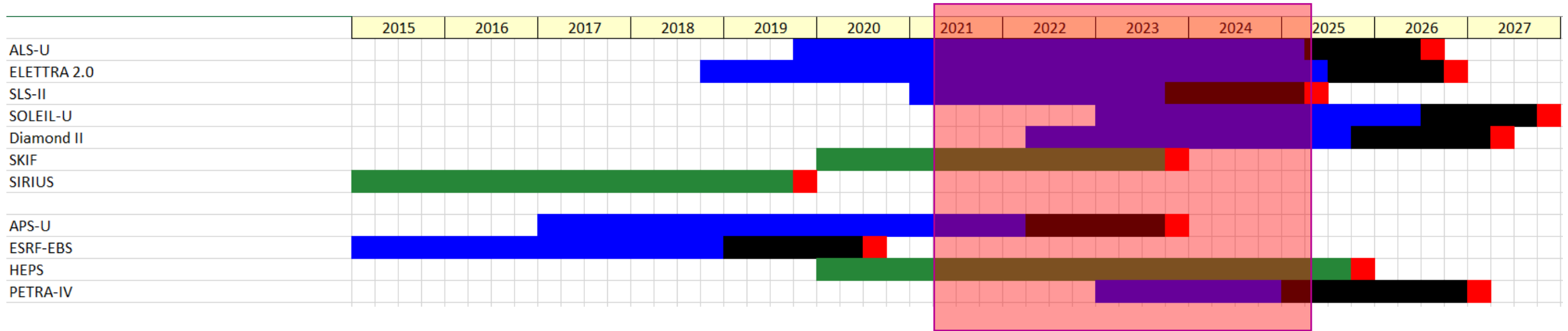
- Key parameters of **KARA**
 - Beam energy: 0.5 – 2.5 GeV
 - Beam current: up to 200 mA
 - Circumference: 110 m
 - 500 MHz RF system
 - RMS bunch length: 50 to few ps

- Outstanding features
 - **Superconducting undulators**



- SCUs development
- Low alpha operation
- CSR
- off-energy injection
- NEG coating studies

Many facilities or upgrades are planned in the



Green bars: green field projects

Black bars: dark period

Red bar: restart of user mode (friendly users in many cases)

Timeline since official project approval

In some cases (APS-U) procurement started before official approval

Congestion of programmes in 2024-2025 will potentially create procurement risks to all project

I-FAST time span

Conclusions

WP7 will support the development of new solutions for the production of high energy electron beams in the form of networks and demonstrators.

The activities have started in all Tasks

pre-meetings were organised ahead of this kick-off meeting
regular meeting scheduled for Task. 7.2 (A. Mochihashi)

Virtual mini-workshop on girders and alignment

10-11 May 2021
Europe/Berlin timezone

Overview

Participant List

The next generation of light source aims at delivering electron beams with unprecedented brightness and emittance properties. A crucial requirement in these projects is the accuracy in the alignment and positioning control of the magnetic elements on the girder and the girders in the tunnel. While many beam based tools have been developed and successfully tested, the requirement in the mechanical engineering and alignment of such elements is still a major concern and a technology challenge. Different solutions are adopted by different light sources.

The scope of the dedicated topical mini-workshop is to review the best practices in the design, construction and alignment of girders and their elements, including aspects related the assembly procedures and logistics.

A mini-workshop on girders and alignment to review the technical solutions for girder design and magnets support and alignment

Presentations from all major projects
ESRF-EBS, PETRA IV, SIRIUS,
APS-U,
ALS-U, SLS-II, SOLEIL, ELETTRA

