



iFAST 2nd Annual Meeting, April 19, 2023

Mike Seidel, PSI/EPFL

Brilliance x 35 for users Less electricity consumption (-29%)

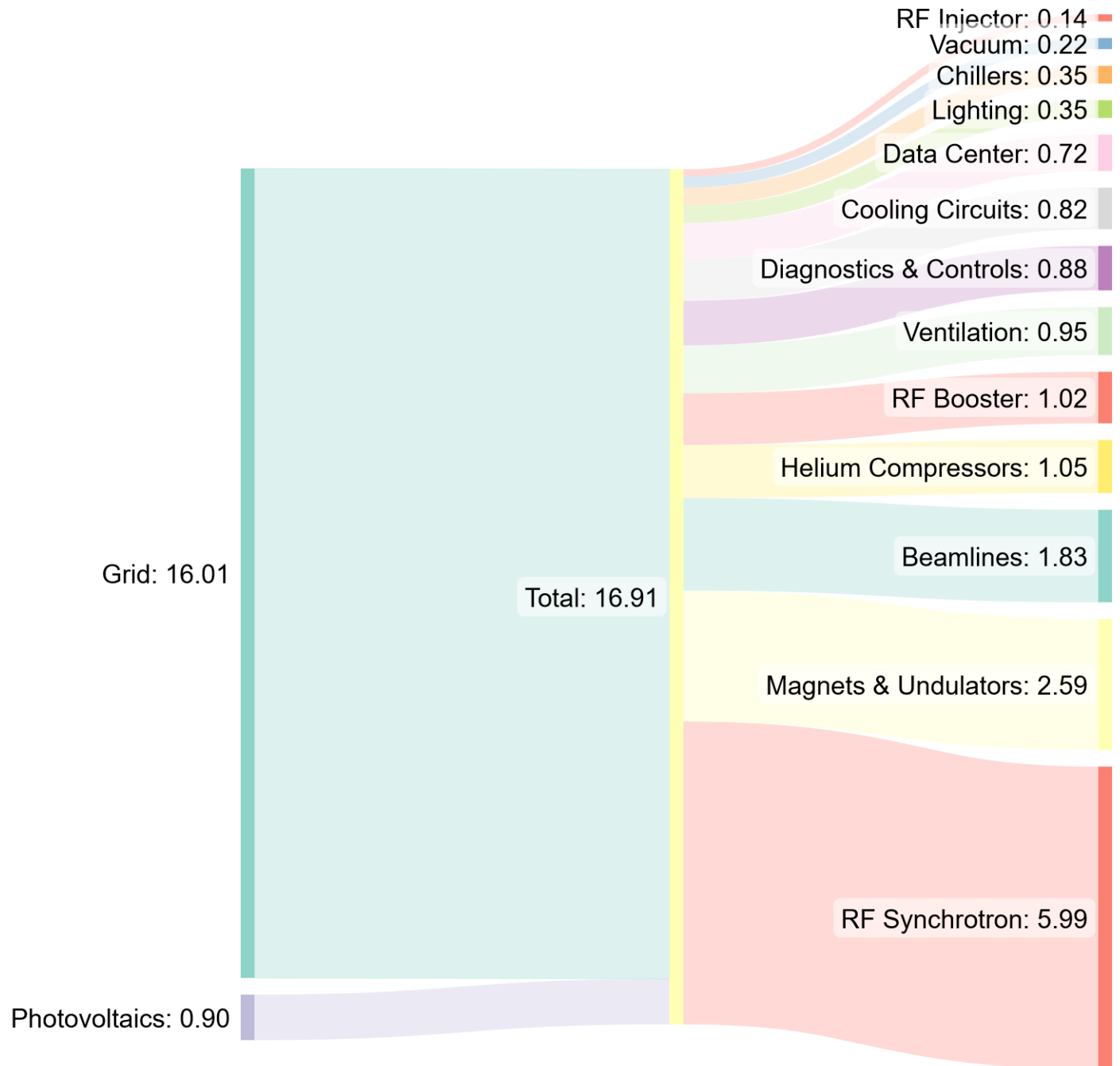
Key savings:

- Electromagnets → Permanent magnets
- Klystrons → Solid state amplifiers (63%)
- standard pumps → modern pumps for cooling

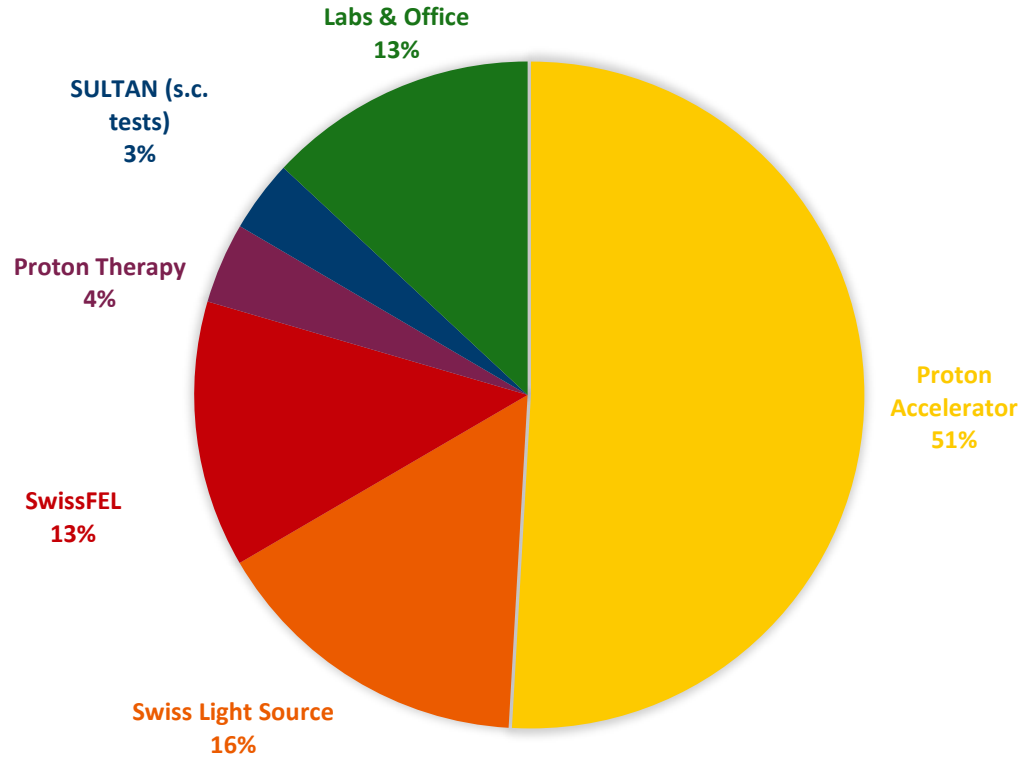


PV on roof of SLS:

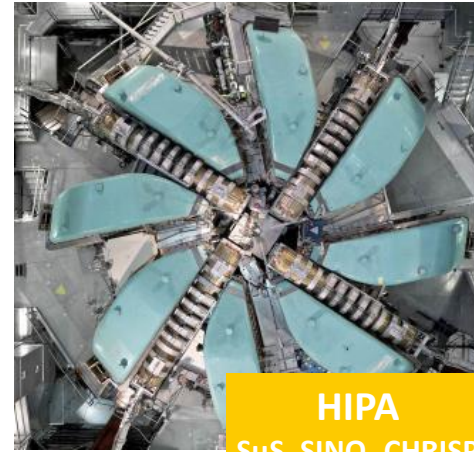
- peak power: 0.9 MW
- energy per year: 0.9 GWh
- in 30y this corresponds to electricity price of 0.18 CHF/kWh (incl. maintenance).



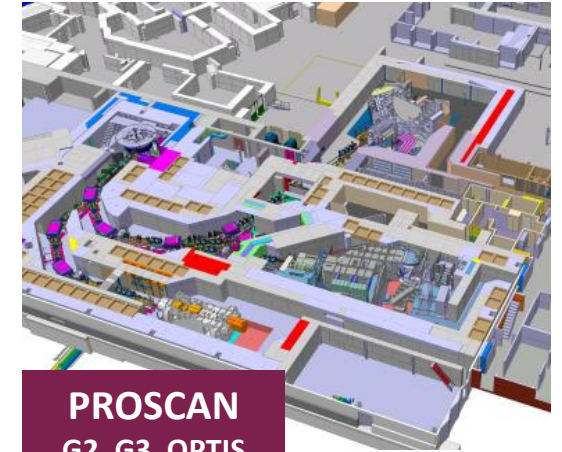
PSI Energy Consumption



Total PSI: 139 GWh/y (2022)



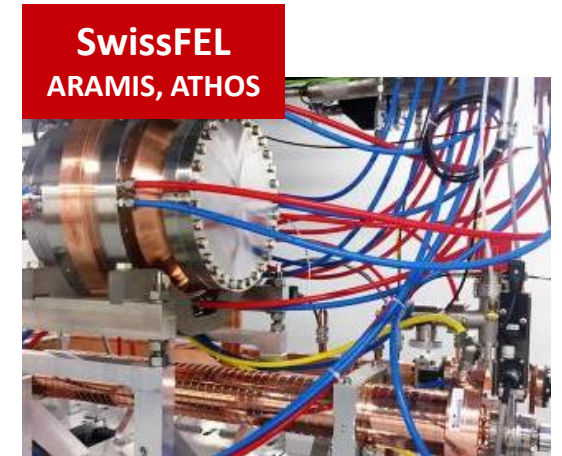
HIPA
S μ S, SING, CHRISP



PROSCAN
G2, G3, OPTIS



SLS
16 beamports



SwissFEL
ARAMIS, ATHOS

electricity: SLS2.0: -30%(!); procure power with low CO₂; photovoltaics: 0.4 → 0.6%;

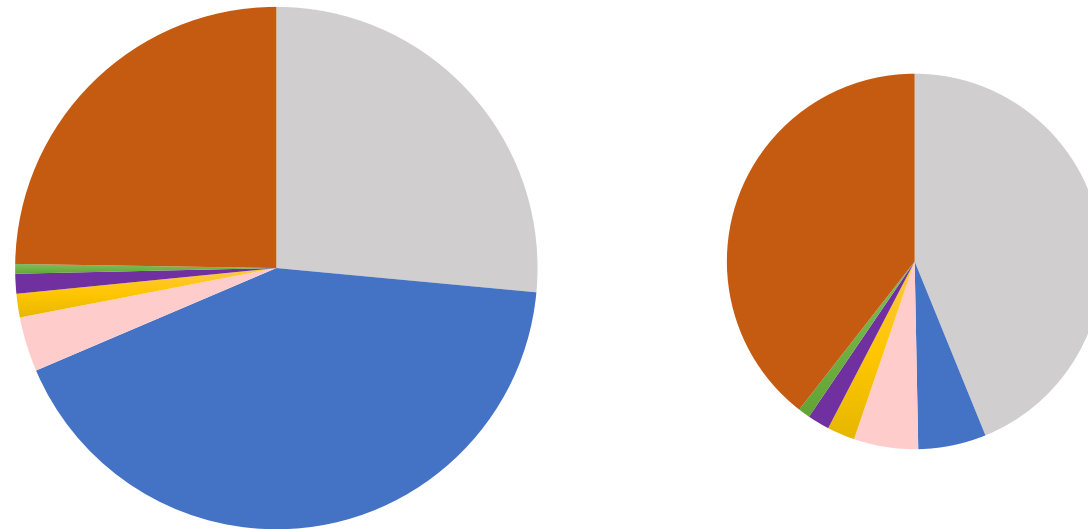
heating: further improve heat recovery – heat pump option; < 50% external sources, but CO₂ free

mobility: 30% reduction of air travel; support public transport / electric cars

PSI CO₂ footprint
snapshots

2019: 8.42 kt

2022: 4.14 kt



■ air travel ■ electricity ■ waste disposal ■ fuel oil ■ PSI vehicles ■ public transport commuters ■ motorized commuters

Challenge:

Transport heat efficiently from SC magnet to cryocooler

Proposed solution (collab. with VDL ETG):

Use pulsating heat pipes (PHP) filled with neon for cooling HTS magnets instead of copper link (heavy, bulky)

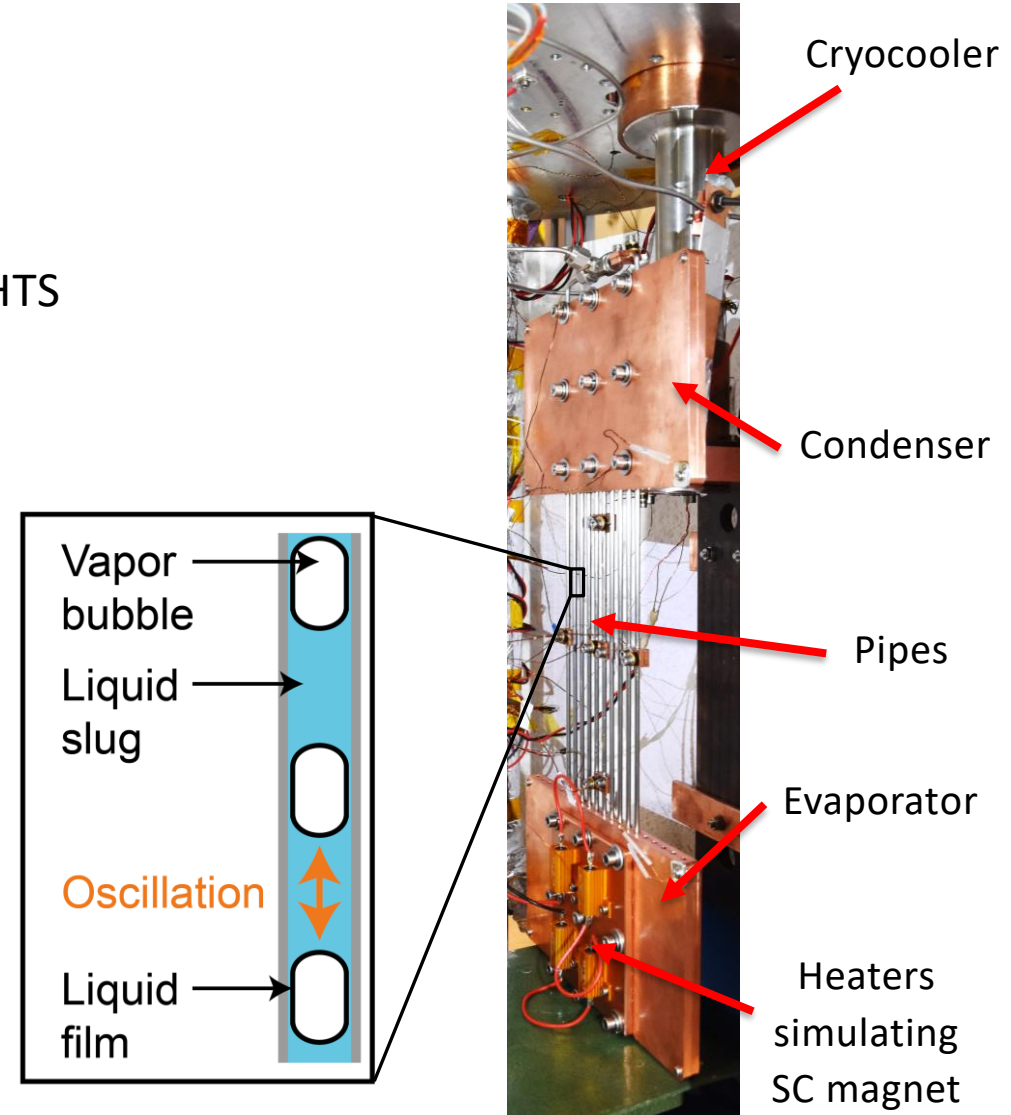
Promising first results:

- Stable operation of 10 and 20 tube neon PHP
- 22 W transferred
- ≈ 40 times better effective thermal conductivity than copper

Main goal 2024:

Cool down and operate HTS coil with neon PHP

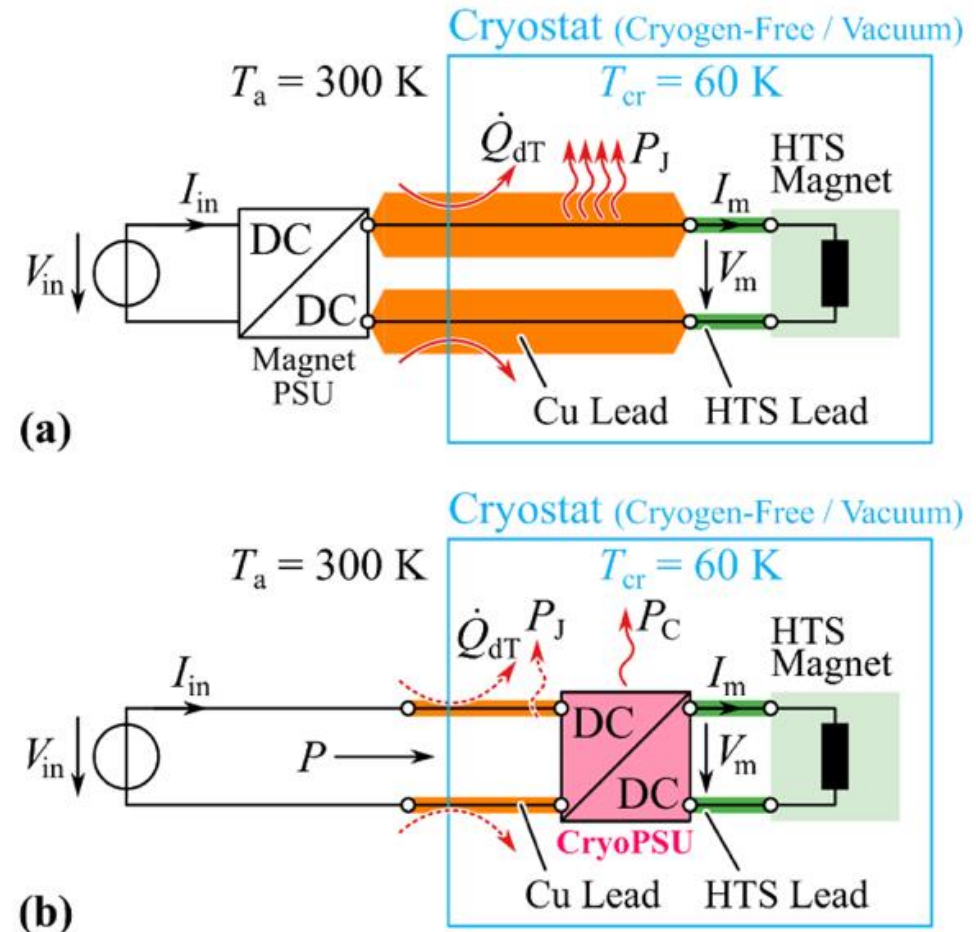
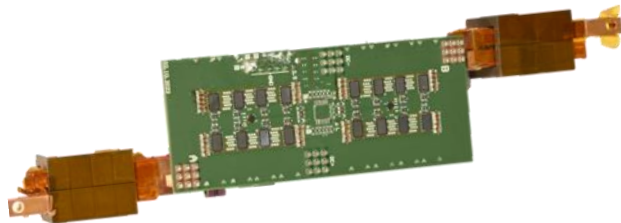
[C.Zoller (PSI), Q.Gorit (VDL) et al]



Cryogenic Power Electronic System

CHART FCCee CPES: project at ETHZ D-ITET/PES

- In support of FCCee HTS4, CPES develops a cryogenic power supply which, in its first iteration, may **reduce heat load to cold source by 70%**.
- First GAN-based submodule tested successfully in LN2.
- Cold-testing and integration studies at PSI cryogen-free test station Q2'24.
- Industrial interest in technology (Airbus).




Courtesy J. Huber, D. Zang


workshop last week:
Efficient Electrical Power Converters
ESS Lund, April 8-9

A.Sunesson et al. (C.Martins)

We had a good workshop with interesting presentations and discussions.

Highlights: Many facilities work with energy strategies, and power converter development provides constantly better and better control of the outputs via novel designs.

 The workshop was not very well attended (15), but the discussions were interesting.



iFast Workshop on Efficient Electrical Power Converters for Accelerator Applications

8.–9. Apr. 2024
ESS
Europe/Stockholm Zeitzone

Geben Sie Ihren Suchbegriff ein

- Übersicht
- Tagesordnung
- Beitragsliste
- Anmeldung
- Teilnehmerliste
- Accommodation
- How to Get to Lund

Update: The workshop originally scheduled from Monday, April 8th to Wednesday, April 10th, will now take place from **Monday to Tuesday (April 8th-9th)**.

Following a series of successful workshops on the initiative of the EU HORIZON program, we would like to announce the next Workshop on Efficient Power Converters. The workshop is part of the iFAST WP11 initiative for "Sustainable concepts and technologies"

We warmly welcome contributors from various domains to join us for this significant event aimed at displaying the recent advances on energy efficient technology for power converters mainly used in accelerators. As in previous events, we expect a number of experts from public and private sector to participate in the meeting and the discussions around the efficiency of solar power, energy optimization, and power converter efficiency.

We encourage prospective contributors to get in touch with the organizer to propose suggestions for contributions.

Suggested topics for contributions include but are not limited to:

- Sustainability
- Efficient Electrical Power Converters
- Solar Power Application
- Direct Feeding of Power Converters from Solar Panels
- Energy Storage

Milestones & Deliverables

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS50	Workshop on energy for sustainable science at research infrastructures, at ESRF	41 - PSI	6	Web site (task 11.1)
MS51	Workshop on efficient RF sources	1 - CERN	13	Web site (task 11.1)
MS52	Workshop on efficient magnet- and RF power supplies	2 - ESS	22	Web site (task 11.1)
MS53	Workshop on sustainable materials and lifecycle management for accelerators	12 - DESY	18	Web site (task 11.1)
MS54	Workshop on industrial approaches for sustainable accelerators	13 - GSI	42	Web site (task 11.1)
MS55	Design review	1 - CERN	12	Web site (task 11.2)
MS56	Magnets constructed and tested	25 - KYMA	25	Magnetic measurements completed (task 11.3)

September 2022, done

July 2022, done

April 2024, done (Milestone report pending)

February 2023, done

October 2023, done

June 2022, done

July 2023

Deliverables related to WP11	
D11.1: Sustainable Accelerators Report. <i>Report on strategies to improve sustainability and reduce environmental impact of accelerators.</i>	M45
D11.2: Klystron prototype completed and validated. <i>Report on the construction of the klystron prototype and on the test results.</i>	M36
D11.3: Prototype adjustable PM quadrupole and combined function magnets. <i>Two prototype PM-based magnets – one quadrupole and one combined-function magnet designed, built and measured.</i>	M28

I.FAST P2 Report

Dear Mike,

Following the announcement during the last Steering Committee Meeting, please find attached the template with the instructions for the preparation of the I.FAST P2 report (**1 November 2022 – 30 April 2024**), specifically prepared for your WP/Task.

As explained at the meeting, the goal is to **send us information** (short summary, progress towards objectives, explanation of work, updates to impact, meetings, milestones, deliverables, publications) **covering the Period 2**. Some figures in the text are as usual welcome, but please respect the space limits indicated in the template. Regarding the Impact part, we have taken examples from the document attached, page 21 to 24 of the GA Annex 1 – Description of work. Feel free to modify the text or add if nothing is written regarding your Task.

The deadline for receiving the document is **30/04/2024**. **You are kindly asked to strictly respect this deadline because the final document has to be imperatively uploaded on the EC web portal by mid-June 2024.**

All templates follow the same legend:

1. **In green**: Instructions about the content
2. **In yellow**: Parts that you should write

Thank you in advance,

Valérie Brunner on behalf of Maurizio Vretenar, I.FAST Project Coordinator

WP11 Deliverable Report, due: Month 45

original aim: document R&D and good practices; What was achieved in WP11?

MS: We should see this not just as a formal requirement, but rather a documentation of our work with a benefit for the accelerator community.

Possible Outline:

- 1.) Motivation and Executive Summary (Mike+All)
- 2.a) Efficient RF Sources (Nuria)
- 2.b) High Efficiency Klystron for LHC (Nuria)
- 3.) Power Converters (Anders / Mike)
- 4.) Cross Linking Accelerator R&D with Industrial Approaches (Peter / Jens)
- 5.) Ecological Concepts (Denise)
- 6.) Permanent Combined Function Magnets for Light Sources (Ben)
- 7.) Conclusions and Key Recommendations

WP11 Deliverable Report - Timeline

April 2024: agreement on content and plan

June 18 (Zoom): Bullet list on content for each section;
round table

October 22 (Zoom): First complete text-draft for iteration;
round table

December: Report ready for delivery.

Comments, Questions ??