



Toledo, September 23, 2024

Mike Seidel, PSI/EPFL

**Sustainability = Meeting the needs of the present
without compromising the ability of future generations.**

(one of many debated formulations)

**efficient
technologies**

mobility &
business travel

green house
gas emissions

research infrastructure
system efficiency

energy related
research

water
consumption

waste management &
recycling

office/lab energy
consumption

energy
procurement

carbon footprint
of infrastructures

heating & waste
heat recycling

use of materials
and resources

European Projects on Accelerator Efficiency

2014-17: EUCARD-2, WP Energy Efficient Accelerator Technologies

<https://www.psi.ch/enefficient>

2017-21: ARIES, Work Package Efficient Energy Management

<https://www.psi.ch/aries-eem>

2021-25: I.FAST, Work Package Sustainable Concepts

<https://www.psi.ch/scat>



Enhanced European Coordination for Accelerator
Research & Development



ACCELERATOR RESEARCH AND
INNOVATION FOR EUROPEAN
SCIENCE AND SOCIETY



Innovation Fostering in Accelerator Science
and Technology

→ consult websites for link collection to workshops and documentation



ESSRI Workshops
Energy for Sustainable
Science at Research
Infrastructures



7th Workshop
Energy for Sustainable Science
at Research Infrastructures
September 25th to 27th, 2024 - Madrid, Spain.



Scope

CIEMAT, in collaboration with **CERN** (the European Organization for Nuclear Research), the **ESRF** (European Synchrotron Radiation Facility), **DESY** (Deutsches Elektronen-Synchrotron), **PSI** (the Paul Scherrer Institut), **ESS** (The European Spallation Source) and **ERF** (The European Association of National Research Facilities) will host the Seventh Workshop on Energy for Sustainable Science at Research Infrastructures Facilities in

Madrid on 25-27 September 2024 in Madrid.

The main focus of the workshop is identifying challenges and solutions for sustainable research infrastructures, including sharing experiences on new energy-efficient technologies, energy management at research infrastructures, **review how the energy sustainability is faced on the current research projects, analyze life cycle and discuss about future aims and trends.**

The event aims to engage the participation of pre-doctoral students to promote the involvement of the young research staff on the event topics.

Organizing Committee

Jose Manuel Pérez/CIEMAT (Chair); Carlo Bocchetta/ESS; Frederick Bordry/ESSRI; Honorary member; Serge Claudet/CERN; Roberto Losito/ CERN; Juergen Neuhaus/TIM, ERF rep.; Jean-Luc Revol/ESRF; Thomas Roser/ BNL, ICFA rep.; Mike Seidel/PSI, I-FAST rep.; Denise Voelker/DESY

Local Committee

Concepción Oliver/CIEMAT; Diego Obradors/CIEMAT; Joan Casas/ALBA; Luis García-Tabarés/CIEMAT.

<https://agenda.ciemat.es/e/ESSRI2024> (preliminary)



Supported by:



The International Committee
for Future Accelerators



Innovation Fostering in Accelerator Science
and Technology H2020-RIA project.



Centro de Investigaciones Energéticas,
Medioambientales y Tecnológicas

I.FAST WP11 Overview

task 1: Sustainable Concepts for RIs: networking, workshops on selected topics
deliverable: report

- 1) System Efficiency of Accelerator Concepts (N.Catalan Lasheras, CERN)
- 2) Key Technologies and Components for High Efficiency (A.Sunesson [C.Martins], ESS)
- 3) Cross Linking Accelerator R&D with Industrial Approaches (P.Spiller, GSI)
- 4) Ecological Concepts (D. Voelker, DESY)

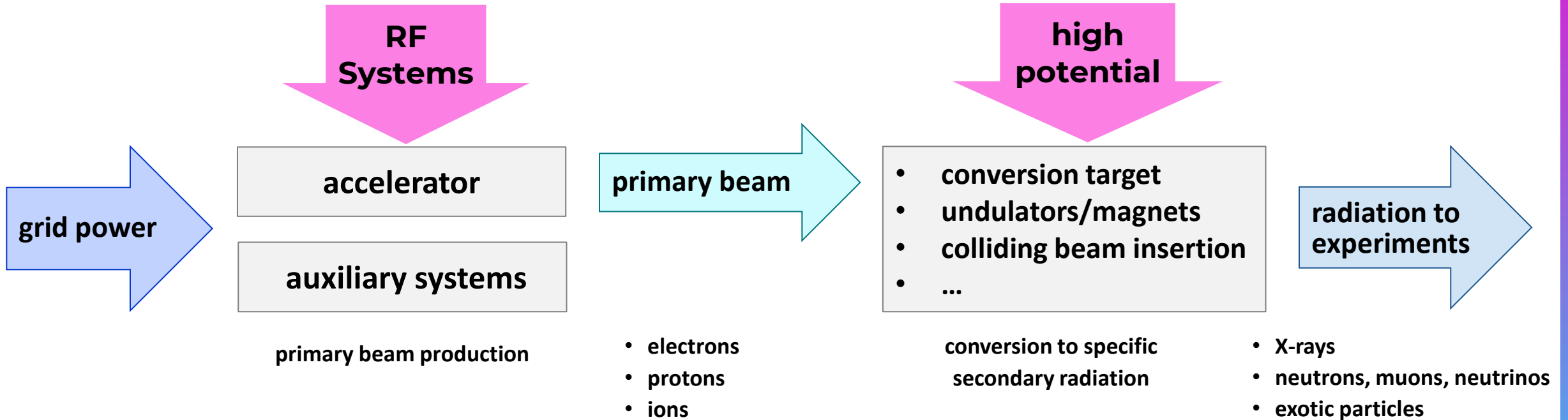
task 2: High Efficiency Klystron (N.Catalan-Lasheras CERN, THALES, ULANC)

- deliverable: industrial prototype
- replacing klystrons in LHC

task 3: Permanent Combined Function Magnets for Light Sources (B.Shepherd, UKRI, DLS, KYMA, DESY)

- deliverable: magnet prototype, applicable for Diamond upgrade
- several advantages of permanent magnets, not just power consumption

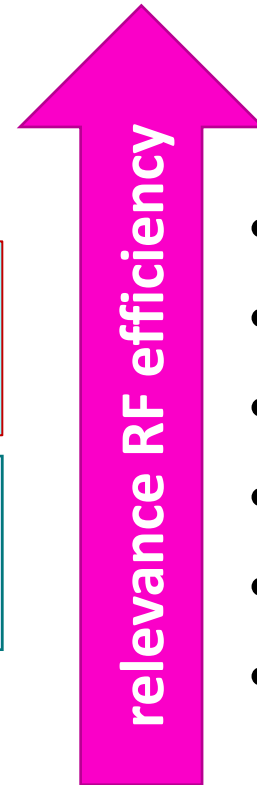
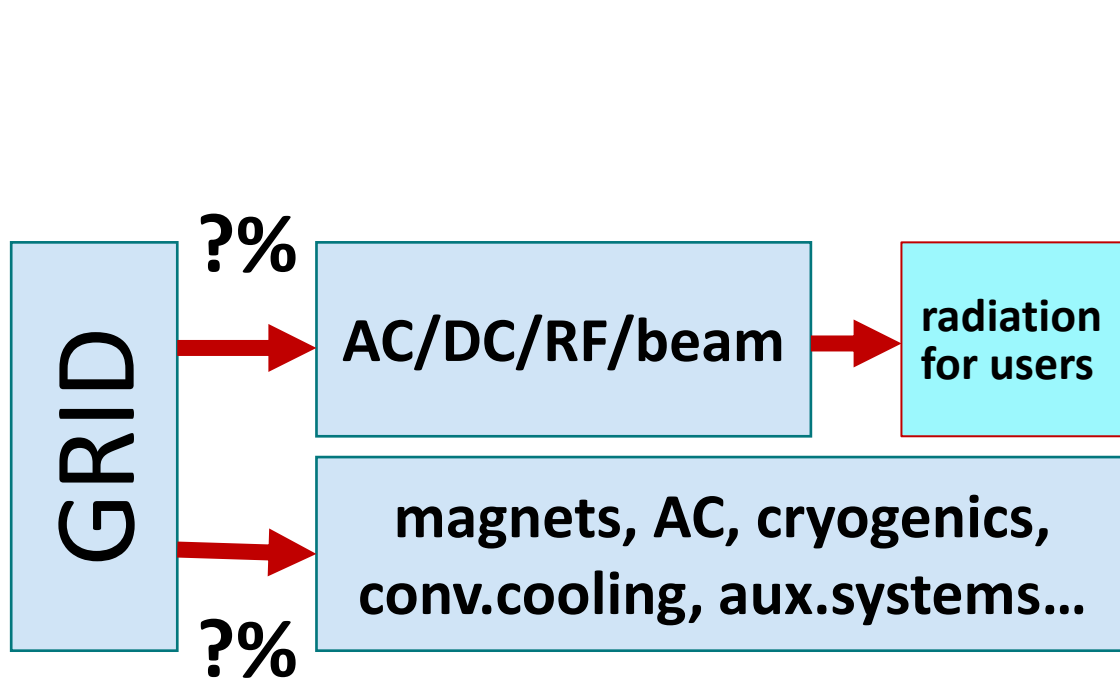
Accelerator driven Research Infrastructures (RI's)



high level goal:

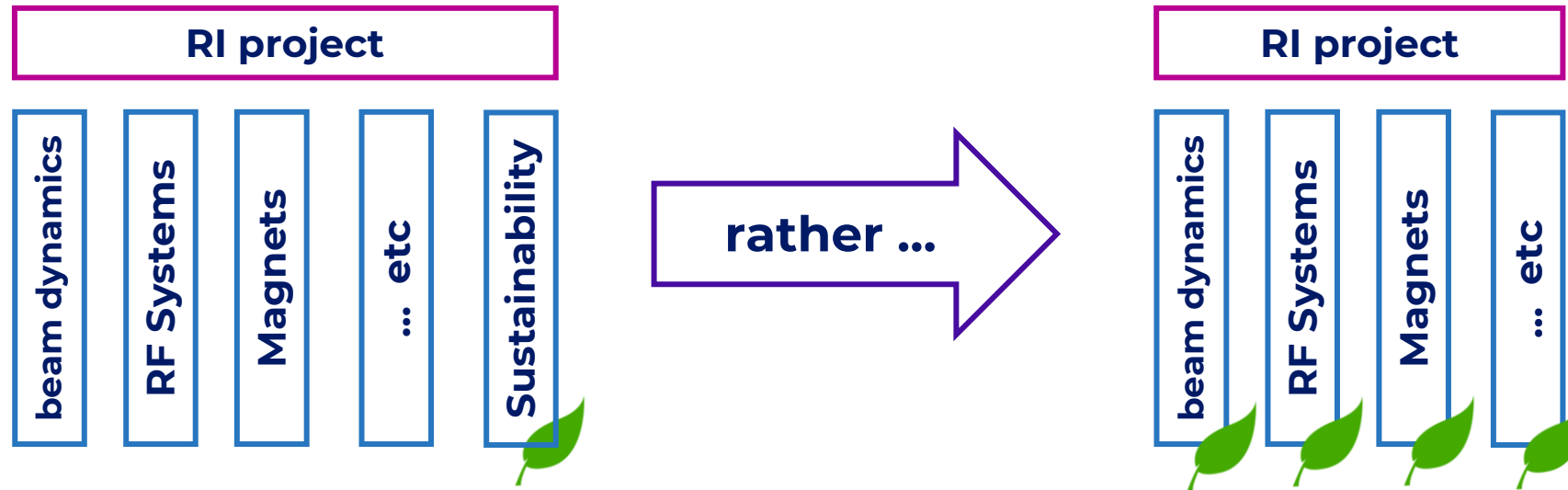
Science output per grid power, per operating/investment cost.

Power flow in various accelerator concepts



- proton drivers (ESS, HIPA)
- linear colliders (CLIC)
- lepton ring colliders (FCC-ee)
- ring light sources (Soleil, SLS)
- hadron ring collider (LHC)
- free electron laser (SwissFEL)

Integrating Sustainability



Competences specific to accelerators must be used to improve efficiency and other sustainability aspects. The accelerator community **will not solve societal challenges such as low-carbon concrete or energy production.**

For RI's, science quality and quantity must remain paramount. Sustainability needs to be balanced against cost and operational complexity. Synergies are welcome, e.g. energy = cost.

RF Sources: Multi Objective Optimization

Requirements: frequency, pulse structure, RF power, # of devices, ...

Technology Selection Criteria:

- market availability, long term support
- minimize overall investment cost, and operating cost
- maximize reliability in operation, serviceability
- **energy efficiency**

Workshop Session Outline

Facilities	6
Klystrons	14
Operation	2
Inductive Output Tubes	4
Solid State Amplifiers	4

Enjoy the Workshop, use opportunities for networking with your colleagues!

Many thanks to Nuria Catalan-Lasheras and Igor Syrathev for organizing and putting together an interesting program.