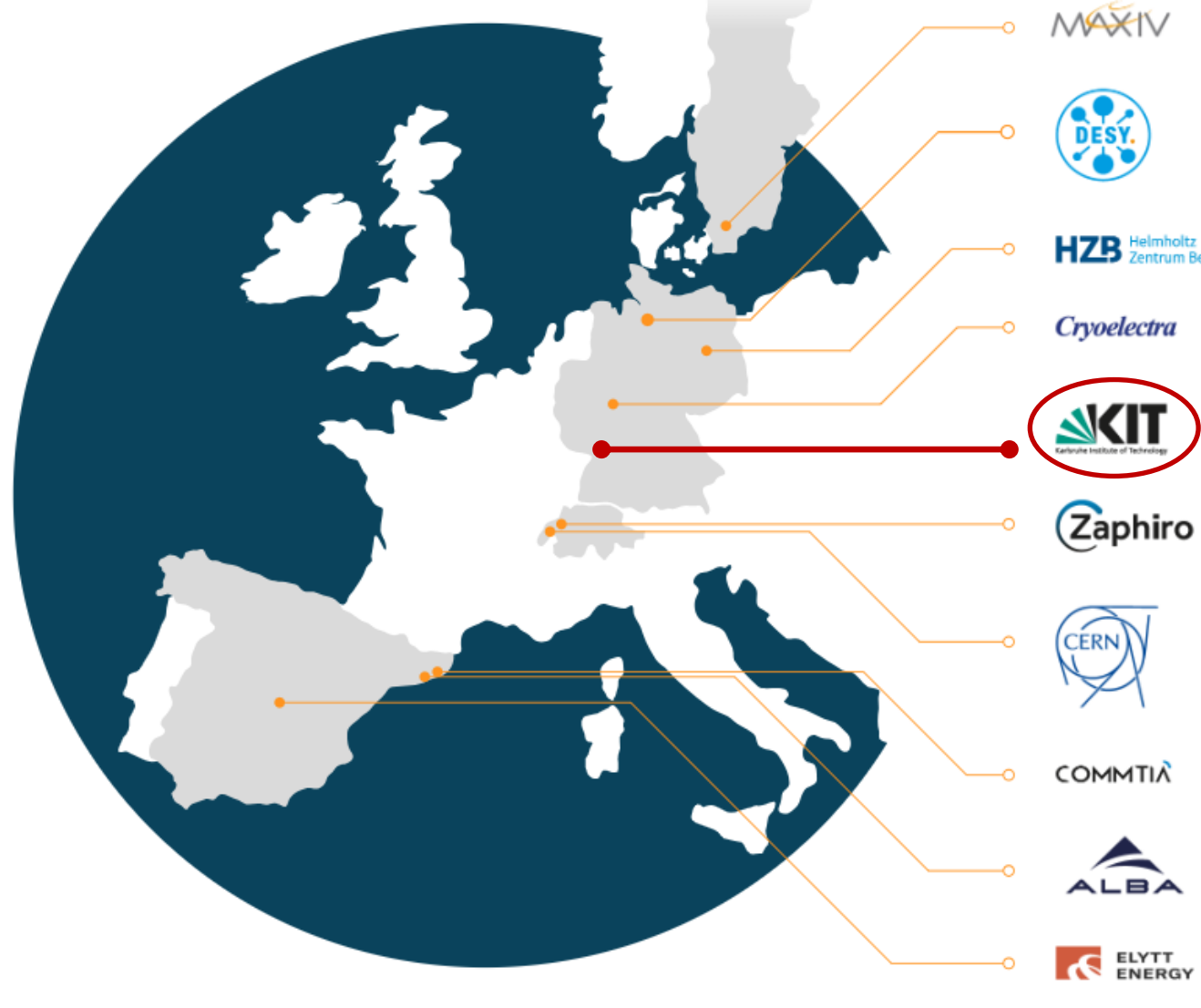


Sustainability for accelerators: the RF2.0 approach

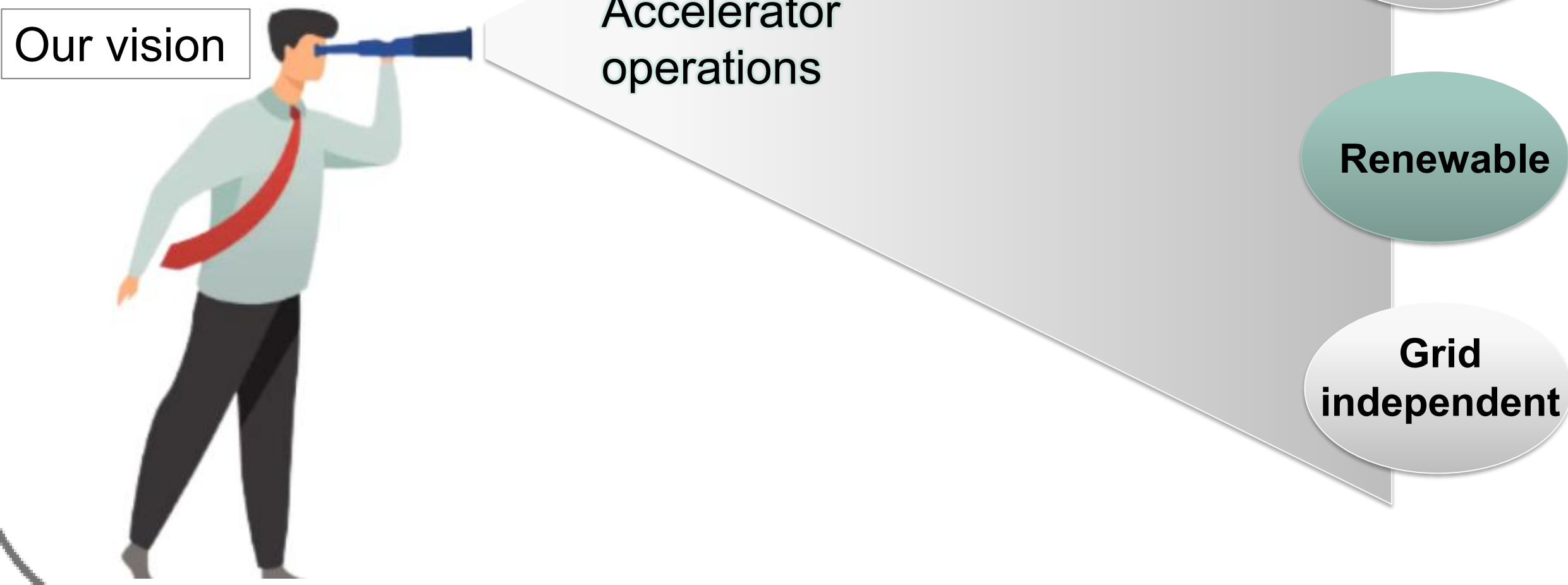
Falastine Abusaif, Giovanni De Carne

From KIT TEN to the EU

- Research Facility 2.0 (RF2.0).
- 10 Partners: 6 accelerators & 4 high-tech SMEs.



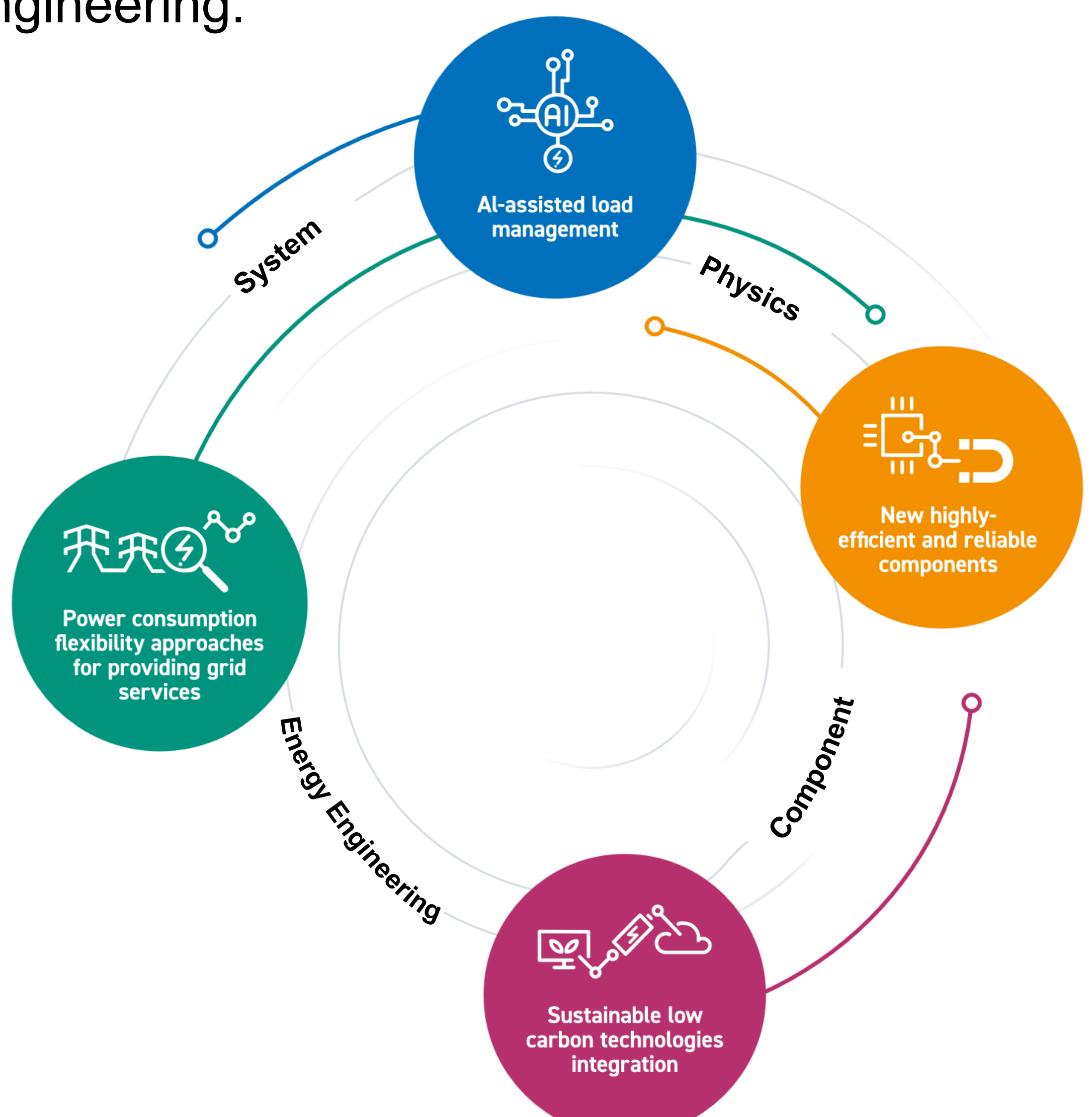
Coordinated by KIT



Our vision

Approach

- From component to system level.
- Involving both the physics and the energy engineering.



System

Physics

Component

Energy Engineering

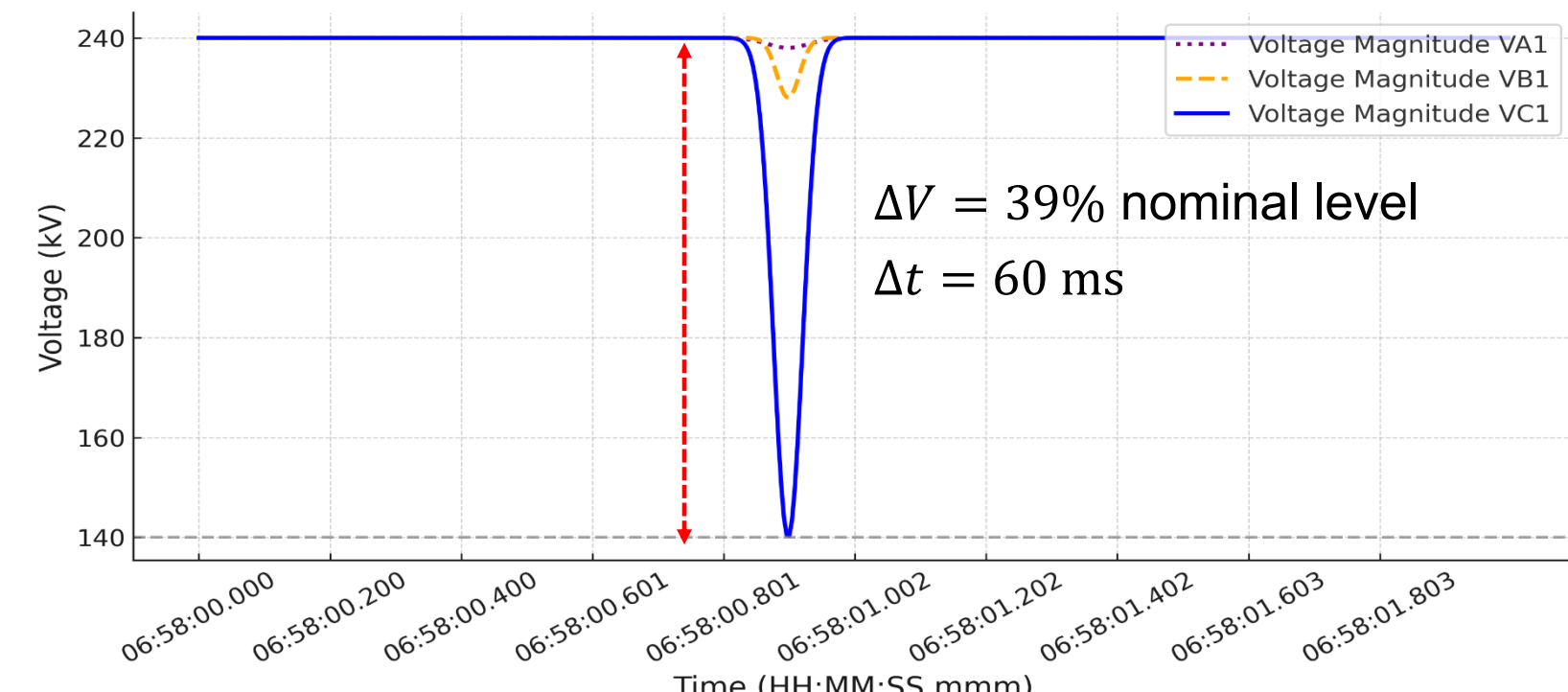
AI-assisted load management

New highly-efficient and reliable components

Power consumption flexibility approaches for providing grid services


Sustainable low carbon technologies integration

Initial achievements



$\Delta V = 39\%$ nominal level
 $\Delta t = 60$ ms

The first voltage disturbance signal recorded with the PMU in BE1 on 13.09.2024 at 06:58 a.m. causing a stop of the accelerator



The main BE1 substation/CERN where first PMU was deployed

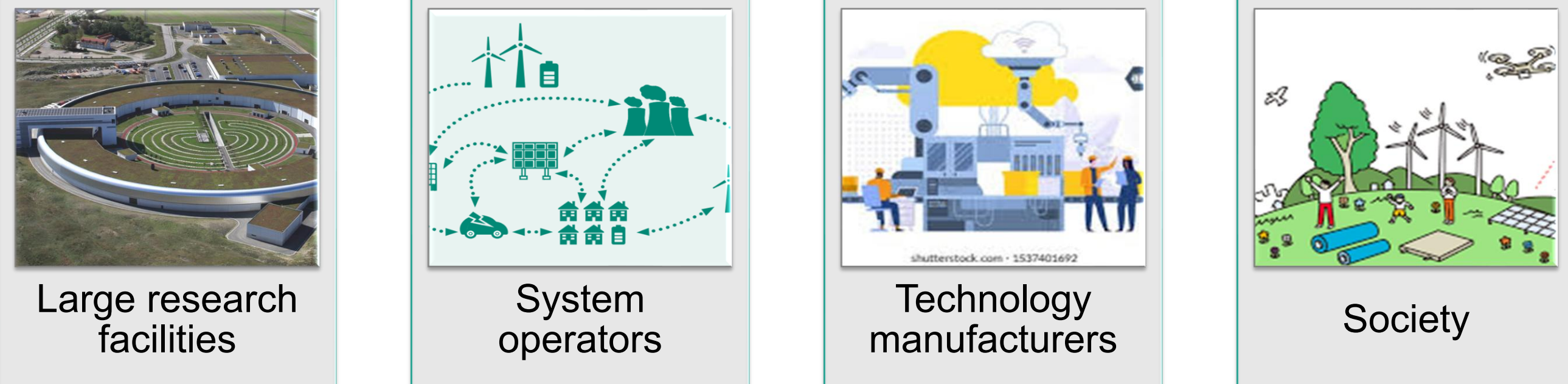
Main Metric	Quantifying unit	Example
Energy/operation	kWh/operation-hour	Total energy consumption of an accelerator in a year
GHG/operation	CO2e/operation-hour	Reduce frequency of servers according to provisioning with renewable energy
Material/operation	kg/operation-hour	LCA to analyse costs of all demonstrator magnets' inputs
Energy/science	kWh/scientific output capacity	Minimize TAT: $TAT = TAT_{min}$, theory
GHG/science	CO2e/scientific output capacity	Shift computing jobs to times when renewables are abundant
Material/science	kg/scientific output capacity	Minimize component's volume per unit

The first developed set of high-level sustainability metrics for energy-efficient RIs

nominal field: $\frac{V}{Field_{max}} \leq \frac{V_{ref}}{Field_{max, ref}}$

Impact

- Large research facilities.
- System operators.
- Technology manufacturers.
- Society:
 - Sustainability awareness.
 - Reduced operation costs (public & private facilities).
 - Benchmarking & open-access data.
 - Training of public managers by means of demonstrators, schools, and workshops.



Large research facilities

System operators

Technology manufacturers

Society



RESEARCH FACILITY
TOWARDS A MORE ENERGY-EFFICIENT
AND SUSTAINABLE PATH

This work is part of the Research Facility 2.0 project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101131850 and from the Swiss State Secretariat for Education Research and Innovation (SERI). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or SERI. Neither the European Union nor SERI can be held responsible for them.