

Follow up project RF2.0 + iSAS

Vision: we aim at advancing our RF2.0 and iSAS visions to achieve fully sustainable energy operations in large research infrastructures, by designing, implementing and validating sustainability toolsets (software, hardware, methodological approaches) that can be transfer and implemented to any facility in the world.

Vision: significantly reduce the overall energy consumption of particle accelerators by developing an integrated system-level approach of the technologies successfully developed in the RF2.0 and iSAS projects, which have addressed the energy-use efficiency of respectively the external power delivery to the accelerator and the internal power use of the accelerator

Main Idea: with RF2.0 and iSAS we have focused in introducing novel technological approaches, components and systems to improve the energy efficiency and sustainability of research infrastructures using particle accelerators. The next natural step is to integrate both technologies such as to increase the applicability and readiness of solutions, targeting:

- 1) **TECHNOLOGY**: a higher TRL for individual technological solutions (e.g., SSA, PMs, Undulators, FE-FRT, LLRF controls, FCPs, HOM dumping, thin films...)
- 2) **INTEGRATION**: an integrated energy management software framework (e.g., for HPCs, ESSs) that can be transferred to any RI in a flexible and effective way;
- 3) **VALIDATION**: implementing and testing the integrated solutions in medium-scale facilities, such as PERLE@Orsay, expected to be available around 2027–2028
- 4) **APPLICATIONS**: development of guidelines, training, and teaching materials to accelerate the adoption of the proposed solutions.
- 5) **MONITORING**: standardization of the energy sustainability and efficiency solutions for existing and future RIs.

Deliverables: outside RF2.0 and iSAS projects, there has been no coordination on the adoption of energy-efficient solutions for particle accelerators. This proposal aims at developing advanced integrated tools that are not available to designers and operators, and guidance for adoption in existing and future facilities. For the first time an integrated standardization of energy sustainability solutions for entire particle accelerator systems will be developed, together with energy-efficiency performance monitoring tools. While the applicability of the developed solutions targets a broad range of particle accelerators, they will be validated on accelerator facilities that are in operation or are being designed and constructed.

Impact: adapting a more systematic and standardized approach for the implementation energy-efficient solutions, allows a simpler and faster transfer to industry and society. The final goal of the project is to further develop integrated tools, to validate them in existing and new medium-size facilities, and to develop guidance to enable swift implementation in a

broad range of particle accelerator RIs with a view to optimally achieve sustainability goals from the outset.

Partners: RF2.0 + iSAS partners; Additional partners to be asked → SOLEIL, ESS, ESFRI, Korean and Canadian accelerators (TRIUMF could be an option because Canada is looking stronger to Europe today)