

THE TIARA COLLABORATION: SHAPING TWO DECADES OF EU SUPPORT FOR COORDINATED ACCELERATOR R&D

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Abstract

European accelerator research involves over 150 institutions –research and technology infrastructures, universities and industry– making impactful R&D reliant on large, well-structured collaborations among all innovation actors. The European Commission’s framework programmes can play a strategic role in enabling these collaborations, but their effectiveness requires a coherent organization at the community level.

Founded in 2002 as ESGARD, the TIARA – Test Infrastructure and Accelerator Research Area – collaboration was established to foster and coordinate participation in European Commission calls. To date, TIARA has supported over 25 projects, ranging from design studies for new infrastructures to ESFRI-linked initiatives, securing €180 million in EC funding over 21 years, supplemented by over €245 million in contributions from partners.

INTRODUCTION

Particle accelerators are central to Europe’s scientific and industrial leadership, but their full potential depends on a cohesive, strategic approach to technology development. TIARA plays a pivotal role by orchestrating collaboration among Europe’s accelerator communities, ensuring advancements are both cutting-edge and aligned with shared priorities. Its mission is twofold: to unite stakeholders, research institutions, and industry, and to streamline responses to European calls, thereby reinforcing Europe’s sovereignty in this critical domain. In an era where technological autonomy and collective excellence are paramount, TIARA is crucial to maintaining Europe’s competitive edge in accelerator science.

THE TIARA CONSORTIUM

ESGARD

The seed for TIARA was the European Steering Group for Accelerator R&D (ESGARD), established in 2002 by R. Aleksan of CEA, following a recommendation by ECFA, to improve education in accelerator science and to increase support for coordinated accelerator R&D activities in Europe. Its immediate goal was the preparation of a coherent set of proposals European Commission funding within its 6th Framework Programme for research and innovation. This effort led to the highly successful CARE (Coordinated Accelerator Research in Europe) Integrating Activity, approved in 2003, which implemented a strong accelerator R&D programme from 2004 to 2009.

The TIARA-PP Project

The success of CARE and the need for a more structured framework for accelerator R&D in Europe with EC support led to the launch in 2011 of the TIARA Preparatory Phase. This was an EU project dedicated to the definition and preparation of a permanent coordinated European framework for coordination of accelerator R&D initiatives, benefiting scientific fields reliant on advanced accelerators or related technologies. Its purpose was to foster joint projects, share expertise in cutting-edge accelerator technologies, and ensure pan-European coordination to secure Europe’s leadership in accelerator science while promoting balanced scientific and technological progress.

The project’s ultimate goal of integrating national and international accelerator R&D infrastructures into a single distributed European facility proved overly ambitious, but TIARA-PP succeeded in delivering high-level analyses, including: establishing an advisory mechanism and organizational framework for accelerator technology developers, identifying potential collaborators, surveying Europe’s infrastructure needs, developing funding models, formulating recommendations to advance accelerator science and technology, estimating operational and investment costs, and defining Key Accelerator Research Areas along with their critical requirements. TIARA-PP hence delivered one of Europe’s most comprehensive analyses of accelerator R&D infrastructures and technologies.

The TIARA Implementation

In TIARA-PP, the optimal collaboration structure for sustainability was explored, leading to the proposal of a consortium based on a Memorandum of Understanding (MoU). The TIARA Collaboration Consortium was officially established in June 2015 following the MoU’s signature. The MoU aimed to create a Consortium of European Research Institutions managing major R&D infrastructures in the European Particle Accelerator Research Area. Its purpose was to foster expertise exchange and support joint R&D programs, as well as education and training in Accelerator Science and Technology across Europe.

Since 2015, TIARA has operated with its Collaboration Council convening three times annually. Over time, the consortium’s objectives have adapted to the evolving needs of research and technological infrastructures. Its primary focus has been to ensure a coherent and relevant community response to EU calls for various work programs by supporting and advising proposals. TIARA has also served as the unified voice of the accelerator developer

community and its infrastructures, maintaining ongoing dialogue with the European Commission’s Research and Technology Office (EC-RTD) to establish itself as a recognized and cohesive community of technology developers. In 2025, TIARA MoU was renewed, guaranteeing its continuation at least 10 more years

TIARA’S STRATEGIC MISSION

TIARA’s mission is to promote and extend the association of European accelerator development laboratories and universities, fostering partnerships and ties with industry. It supports diversifying equipment and expertise in fields where sufficient capacity already exists, while fostering the development and skills where capacity is insufficient.

TIARA’s vision focusses on advancing new accelerators and their associated instrumentation for both fundamental and applied research—spanning particle and nuclear physics, synchrotron and neutron research, fusion, fission, and energy—as well as addressing industrial needs (such as ion implantation, radioisotope production, and semiconductor lithography) and medical applications (including hadron and flash therapy). To achieve this, TIARA’s actions aim to improve Europe’s competitiveness in particle accelerator technologies, covering a broad spectrum of fields: vacuum, radiofrequency, precision mechanics, cryogenics, control electronics, lasers, AI-driven tools, materials or superconductivity, among others. Sustaining and developing top-tier expertise and infrastructures, along with training and consolidating developer communities, constitute essential ingredients to strengthening the EU’s capabilities in accelerator science and its related technologies.

Since 2015, TIARA has aligned its mission with EC-promoted programs, serving as the unified voice for accelerator developers and main user communities. TIARA’s European coordination has adapted to key challenges: fragmented funding across misaligned themes and short timeframes (up to four years) has forced activities into segmented projects, splitting technology development, design studies, and translational access—even when integration was essential—while its strengthened engagement with other communities has proven vital for Europe’s technology strategy and clarified TIARA’s global role.

Given the field’s growing complexity, no single European country can independently sustain all required specialized facilities and expertise. TIARA’s updated mission is to bridge resources, federate communities where no coordination bodies exist, and ensure effective coordination where such structures are already in place.

PROJECTS SUPPORTED BY TIARA

It is important to highlight the research projects reviewed and supported by TIARA. Throughout its existence, the consortium provided the community with a discussion platform and early notifications to ensure active participation of relevant actors, as well as the coherence and consistency in submitting proposals to EC calls. Table 1 lists the accelerator projects supported and reviewed by TIARA that

received funding through the various EC Framework Programs' calls.

The funding summed by the projects in Table 1 amounts to 428.51 million euros, of which 182.98 million euros are EC-funded, and 245.53 million euros are in-kind contributions from the research partners. A singular case was the integrated-vision projects.

Table 1: Projects Supported by TIARA since 2015.

F. P.	Call thematic area	project	Time frame
FP7	Preparatory Phase	ILC-Hi-Grad	2008-2011
	Preparatory Phase	TIARA	2012-2015
	Integrated Action	EuCARD	2009-2012
	Integrated Action	EuCARD2	2013-2017
	Design Study	EUROnu	2009-2012
	Design Study	HiLumi	2012-2016
H2020	Future Emerging Tech.	Fusumatech	2018-2019
	Marie Skłodowska Curie	EASYTrain	2017-2020
	Integrated Action	ARIES	2018-2021
	Integrated Action	HITRIplus	2021-2024
	(INNOV)	IFAST	2021-2025
	Design Study	Eu-roCIRCOL	2016-2019
	Design Study	EuPRAXIA	2016-2019
	Coord. and Support Action	AMICI	2017-2020
	Design Study	ESSnuSB	2018-2021
	Design Study	Compact-Light	2018-2021
	Design Study	FCC-IS	2021-2024
HE	INFRA SERV	EuroLABS	2022-2025
	INFRADEV-2022	RITIFI	2023-2026
	INFRADEV-2022	MuCol	2023-2026
	INFRADEV-2022	ESSnuSB+	2023-2026
	INFRA TECH-2023	iSAS	2024-2028
	INFRA TECH-2023	PACRI	2025-2029
	Excellence Hubs for Widening countries	IFIGENEIA	2025-2029
	INFRA TECH-2025-01	iRIS	2026-2030
	INFRA TECH-2025-01	HTS4SRI	2026-2030
	INFRA TECH-2025-02	EPITA	2026-2030
	INFRA TECH-2025-04	TwinRISE	2026-2030
INFRADEV-2025-05	COORDINA-INNOV	2026-2028	

The series of projects EUCARD and EUCARD-2 [1] -ARIES [2] -IFAST [3] -EPITA [4] represents a coherent 12-year effort to maintain a coordinated strategy in fundamental research and provide limited support to essential

activities despite reduced resources. Two key achievements emerge from these integrated projects. First, they enabled modest cascade funding for internal programs, serving as a pilot to demonstrate the potential for larger-scale, long-term internal funding management, a community ambition since 2011. Second, they strengthened industry involvement, not just as suppliers but as partners in early-stage research, a trend EPITA aims to consolidate by entrusting a work package to an industrial partner. These projects thus have been vital in sustaining a minimal global R&D strategy for accelerator technology. Until 2025, TIARA provided support for this mission, culminating in backing EPITA to prioritize technologies across accelerator research fields—a pilot step toward operational trans-field roadmapping.

COMPOSITION

Eleven institutions signed the TIARA MoU in 2015: CEA (F), CERN (International Organization), CIEMAT (ES), CNRS (F), DESY (DE), GSI (DE), INFN (IT), PSI (CH), STFC (UK), University of Upsala, on behalf of a consortium of n Scandinavian institutions (SE), and IFJ-PAN (PO). In 2023, two new institutions joined the Consortium, RTU (LT) (on behalf of a consortium of a Baltic institutions) and ESS (International Organization). The 2025 TIARA MoU, signed by the 13 major European accelerator research institutions, remains open to new members, with plans to expand to other European regions.

THE ACCELERATOR SCIENCE AND TECHNOLOGY NETWORK

The ASc&T User and Developer Fields

TIARA's mission operates within a global ecosystem at the forefront of accelerator science and its applications. In Particle Physics, it aligns with the European Strategy for Particle Physics, engaging the European Committee for Future Accelerators (ECFA), the Large Laboratory Directors Group (LDG), and CERN. For advanced light sources and X-ray Free Electron Lasers (XFELs), TIARA collaborates with the International XFEL Advisory Committee and the League of European Accelerator-based Photon Sources (LEAPS), alongside laboratories like DESY and the European XFEL. In neutron science, it works with the European Spallation Source (ESS), the Institute Laue-Langevin (ILL), and the League of advanced European Neutron Sources (LENS). In particle therapy, TIARA is setting out links with the Particle Therapy Co-Operative Group (PTCOG). For fusion research, it coordinates with Fusion for Energy (F4E) and EIROFORUM. In nuclear fission, it engages with the MYRRHA Accelerator-Driven System (ADS) project at SCK CEN (Mol, Belgium).

This interconnected framework allows TIARA to help shaping the future of accelerator technologies, photon science, analytical research, medical applications, fusion, and fission globally. Additionally, TIARA collaborates with the Accelerator Industry and Partners Forum (AIPF [5]) to foster dialogue and partnerships between research institutions

and industry, driving innovation and next-generation accelerator solutions.

Synergies with Related Communities

Over time, synergies with other technology developer communities across the European Research Area have grown increasingly vital. This is especially evident in Horizon Europe, where there is a push for a more coordinated strategic roadmap, particularly for technology development and translational access in research infrastructures. The accelerator community was better prepared for this challenge, thanks to its early positioning through the coherent strategy of integrated projects like ARIES and IFAST. Specifically, IFAST was designed as a powerful tool to pilot coordination with other technology communities. The three projects funded under INFRAINN0V-04-2020—LEAPS-INNOV, AIDAInnova, and I.FAST—demonstrated that European-level collaboration offers clear benefits: pooling expertise across facilities, engaging high-tech industries, and promoting the transfer of technology results from Research Infrastructures to broader societal applications.

CONCLUSIONS

During its decade of lifetime, the TIARA consortium has served to the Accelerator Science and Technology community in the several research fields to have a common point where discuss plans for new technology development, design studies or access to facilities. It has also provided a platform for coordination with other established technology development initiatives, shaping this community's further towards implementing more efficient R&D&I mechanisms in the coming years.

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