

Coordinated Accelerator R&D in Europe

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1. Future Accelerators for PP in Europe
2. Accelerator R&D : TIARA activities
3. Future Plans
4. Personal vision for PWA

Accelerators for PP in Europe

How are they decided?

European Strategy for PP

Who : CERN Council (MS + Observers)

When : every 6-7 years

First / Last / Next : 2006 / 2013 / 2019-2020

With inputs from

Preparatory Group
12 persons

Inputs (from) and Symposia
(with) all the community

rECFA (European
Committee for
Future
Accelerators)
Who: representing
CERN-MS

SPC (CERN Scientific
Policy Committee)
Who: ad personam

1 week retreat CERN Council + preparatory group ⇒ Draft ES

European Strategy is a very strong Asset for Particle Physics

- Ratified by all CERN – Member States
- Ensure PP **coordination** and **unity** in Europe

Latest European Strategy (ES) Statements

High-priority large-scale scientific activities

*Europe's top priority should be the **exploitation of the full potential of the LHC, including the high-luminosity upgrade** of the machine and detectors with a view to collecting ten times more data than in the initial design, by around 2030. This upgrade programme will also provide further exciting opportunities for the study of flavour physics and the quark-gluon plasma.*

*CERN should undertake **design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines**. These design studies should be coupled to a **vigorous accelerator R&D programme, including high-field magnets and high-gradient accelerating structures**, in collaboration with national institutes, laboratories and universities worldwide.*

The initiative from the Japanese particle physics community to host the ILC in Japan is most welcome, and European groups are eager to participate. **Europe looks forward to a proposal from Japan to discuss a possible participation.**

*CERN should **develop a neutrino programme to pave the way for a substantial European role in future long-baseline experiments**. Europe should explore the possibility of major participation in leading long-baseline neutrino projects in the US and Japan.*

Particle Accelerator R&D

Remarks

Accelerator R&D is partially covered for the needs of Particle Physics

high-field magnets and high-gradient accelerating structures (>100 GeV beams; HL-LHC, FCC, CLIC)

But the ES for PP does not covers explicitly all needs

e.g. R&D for High intensity accelerators, neutrino beams, compact and cheap beam test facilities...

Accelerator R&D is much wider than the needs for PP and other communities are interested

e.g. Synchrotron Light Sources, FEL, Neutron sources (ESS), + many applications for health, environment, energy, industry...

Individual European Countries have their own R&D programmes usually through large organizations, and this should be encouraged, but, in addition, a coordinating structure facilitating and promoting the development of European R&D projects was felt useful



From ESGARD to TIARA

<http://www.eu-tiara.eu/>

Strengthen the role of the European consortium and formalize it through a MoU

Established in 2002 by ECFA

CEA (FR), CERN (INO), CNRS (FR), CIEMAT(SP), DESY (DE), GSI (DE), INFN (IT), PSI (CH), STFC (UK), Uppsala U (SW)*, IFJ-PAN (PL)**



Established in 2015 with CERN council support

* Representing consortium of Nordic institutes

** Representing consortium of Polish institutes

TIARA is a dedicated structure, the purpose of which is to exchange expertise and to facilitate and support the setting-up of joint R&D programmes and education and training activities in the field of Accelerator Science and Technology in Europe.

Concerning TIARA activities, Key Words are:

- Collaborative projects for Accelerator Science and Technology
- Development of R&D infrastructure and access
- Innovation with industry
- Education and Training
- Dissemination and Outreach

Past and on-going activities (History)

	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	
Accelerator R&D																				
P6 CARE (IA)		█																		
P7 EuCARD (IA)							█													
P7 EuCARD2 (IA)												█								
H20 ARIES (IA)																	█			
P6 EUROTEV (DS)		█																		
P6 EURISOL (DS)		█																		
P7 EUROnu (DS)							█													
P7 HiLumi (DS)										█										
H20 EuroCIRCOL (DS)														█		█				
H20 EuPRAXIA (DS)														█		█				
P7 SLHC-PP (PP)						█														
P7 ILC-HiGrad (PP)						█														
P7 TIARA (PP)									█											
P6 EUROLEAP					█															
H20 AMICI (INNOV)																█		█		

**With the 4 recent approvals in H2020, ESGARD/TIARA has overseen the submission of 15 successful projects in the INFRA calls :
Total cost : ~293 M€ with EC contr. ~95 M€**

PWA in ESGARD/TIARA

Early on ESGARD/TIARA has identified PWA as a priority item with a high potential

Type of activities

Date	JRA	Network	Access	Design Studies
2007-2009	Euroleap			
2009-2013	EuCARD/ANAC	EuroNNAc		
2013-2017	EuCARD2/ANAC2	EuCARD2/EuroN NAc		
2017-2021	ARIES/VHGAT	ARIES/EuroNNAc	ARIES/PBT	EuPRAXIA
Total cost	10.9 M€	1.5 M€	1.2 M€	3 M€
EC contr.	4.8 M€	0.9 M€	0.47 M€	3 M€

**Coordinated Advanced Novel Accelerators activities supported by
ESGARD/TIARA**

Total cost : ~16.6 M€ with EC contr. ~9.2 M€

Notes: The figures are in addition to national programmes.
Increase and diversity of activities with time, although still insufficient
However, it provides visibility at the European Commission level

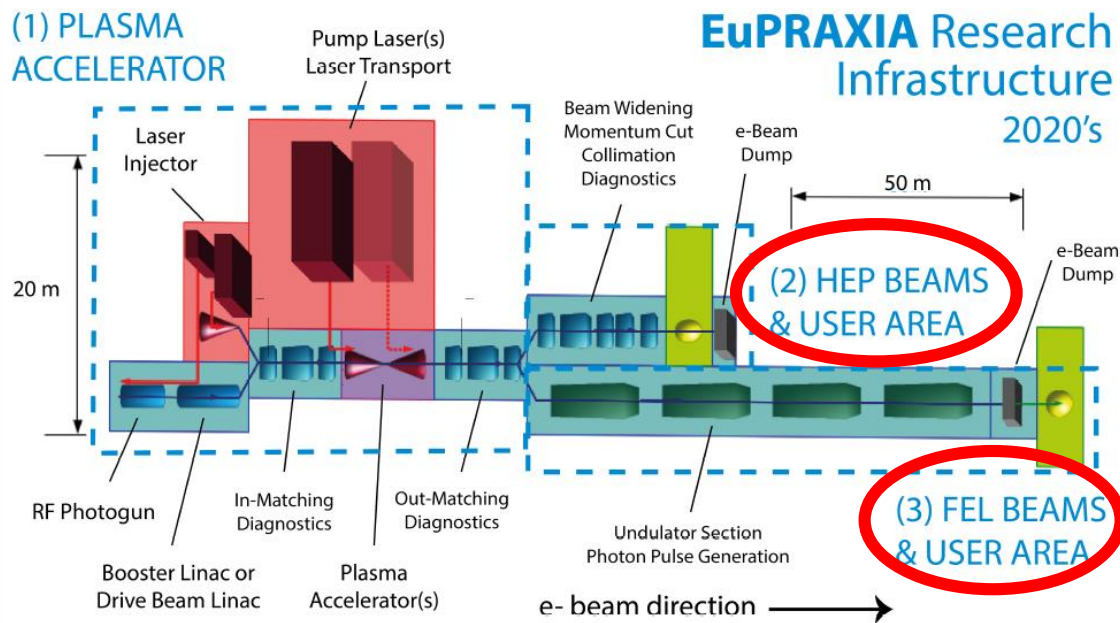


PWA in ARIES



ARIES includes 8 NA, 5 TNA, 5 JRA : Total Cost ~25 M€ (EC funding 10M€)

- **Transnational Access (WP13):** 3 Plasma Beam Test Facilities in European Laboratories, **APOLLON, LPA-UHI100, LULAL**
- **Networking Activities (WP5):** EuroNNAc
 - European Strategy Plasma Accelerators**
 - European Strategy Dielectric Accelerators**
 - European Advanced Accelerator Concepts Workshop (EAAC)**
 - Young Scientist Networking and Academic Standards**
- **Joint Research Activities (WP18):** High Gradient Accelerating Technologies (**2nd largest R&D WP in ARIES**)
 - Total cost for PWA in ARIES 3.9 M€ (1.8 M€ from EC)**



Beam Parameter	Unit	Value
Particle type	-	Electrons
Energy	GeV	1 – 5
Charge per bunch	pC	1 – 50
Repetition rate	Hz	10
Bunch duration	fs	0.01 - 10
Peak current	kA	1 – 100
Energy spread	%	0.1 – 5
Norm. emittance	mm	0.01 – 1
FEL wavelength	nm	1 - 15

- **Conceptual design report for the worldwide first 5 GeV plasma-based accelerator with industrial beam quality and user areas.**
- **Required intermediate step between proof-of-principle experiments and ground-breaking, ultra-compact accelerators for science, industry, medicine or the energy frontier (“plasma linear collider”).**

Young scientists: >20 postdocs and students (being) hired

Start: Nov. 2015; Duration: 4 Years ; EC budget: 3M€

Future Plans within TIARA

Short term(2017):

Oversees the preparation of 2 DS proposals (done)

- **ESSnuSB: Intense neutrino beam using ESS infrastructure**
- **CompactLight: Use of CLIC technology (X-band) for compact FEL**

Medium term (2018-2020):

Enhancing co-innovation with industry

Preparing a Co-Innovation Pilot Action with the EC for WP2018-2020 in H2020 (PWA could be concerned)

Down Select and Oversee the submission of Design Studies

Submission deadline in (September?) 2019

(PWA may be concerned for an energy frontier accelerator)

Long term (FP9, >2020): Enhancing further Accelerator R&D

Preparing a large Pilot Action with the EC for FP9, which could integrate all types of accelerator R&D activities

Medium term (2018-2020): Enhancing co-innovation with industry

A targeted approach (under discussion) would include co-innovation projects with industry for medium and high TRL topics (e.g. projects such as in WP14 of ARIES)

The operational mode is still under discussion, i.e. would it include only well defined projects or projects would be selected subject to internal calls (or both) ?

Under discussion, a workshop with industry in fall to discuss how to enhance co-innovation, i.e. what structure and tool are needed.

Medium term (2018-2020): Down Select and Oversee the submission of Design Studies

Call open to all fields (3M€/DS), i.e. tough competition, but TIARA supported projects did well in the past

Long term: Develop with the EC an ambitious instrument changing paradigm from “IA” to “Integrated Programme”

The “Programme” would cover many activities, allow large flexibility and ensure sustainability of AS&T

Specific projects that would be launched include:

- Establishment of Roadmaps and joint strategy
- Design studies
- R&D in accelerator science
- Development of state-of-the-art technical component
- Thematic Networking
- Upgrade or construction of R&D Infrastructures
- Preparatory Phase
- Education & Training
- Innovation actions with strong industrial involvement
- Specific actions addressing societal issues
- ...

During the Programme, projects should be launched at any time (“open call” mode)

Personal vision for PWA in Europe

Objectives

PWA should become a technology corner stone of AS&T

- *PWA should build a strong, united and coordinated community of developers and users*
 - *PWA should carefully agree and define for which application present technical knowledge and technology is most appropriate and set realistic timescales*
 - i.e. PWA should be careful of NOT “over selling machines” that are still “dreams”: credibility is very important*
 - *PWA should demonstrate that one can use this technology for user dedicated facilities, i.e. a full accelerator system should be operated reliably for users*
- ⇒ *An attractive, yet realistic, roadmap and strategy for accelerators (regularly updated) should be elaborated*
- ⇒ *and should be input and/or integrate national and input to international roadmaps*
- ⇒ *At least one user oriented facility using PWA should be constructed in Europe in the 2020's (should be the showcase of PWA in Europe)*
- ⇒ *A Design Study for an Energy Frontier Accelerator should be launched in the early 2020's*

Personal vision for PWA in Europe

Objectives (cont'd)



PWA community should augment the R&D in a coordinated way and use the available and planned EC instruments

- ***A European PWA R&D roadmap and strategy using the infrastructures in Europe,
i.e. What R&D should be done, who does it and where...***
- ***PWA should be visible at the EC level, not only for getting some funds, but also to gain credibility***
- ***PWA should use the EC tools as lever arms for getting additional national funding,***

Personal vision for PWA in Europe (cont'd)

How to achieve the above objectives

Continue and Amplify collaborative R&D

Why : *to get full system multistage reference simulation code(s)*

to bring the technology to higher TRL

to build up a large community with common R&D objectives

Who : *All communities interested in PWA technologies, including labs, universities and industry*

How : *through **ARIES and future TIARA coordinated initiatives***

Reinforce the coordination with a larger integration of European partners

Why : *to increase visibility and community weight in Europe*

to provide access to existing R&D infrastructures

Who : *All communities interested in PWA technologies, in particular relevant infrastructure owners*

How : *through **ARIES** (EuroNNAc and PBT)*

*through **Education and Training** activities dedicated to PWA*

Personal vision for PWA in Europe (cont'd)

Roadmap and Strategy of PWA with clear priorities before 2019

- Why:**
- to provide a high visibility of PWA in Europe
 - to show coordinated, united and mature community to the decision makers
 - to have PWA strategy partially included in other roadmap/strategy (e.g. PP, Light Source, Laser...)
- Who:** - All communities interested in PWA technologies, including at government levels
- How:**
- through EuroNNAc and dedicated workshops (e.g. EAAC2017...)
 - (**Why not setting up a strategy preparatory group as for PP?**)
 - by being active and participating to national roadmaps

Personal vision for PWA in Europe (cont'd)

Be ready to propose the construction of a user oriented accelerator in Europe in 2018-2019 with credible site(s)

Why : to demonstrate the usability and appropriateness of PWA to provide a clear option for States and decision makers to be included in Roadmap such as ESFRI, PP, Light Sources... to be included in H2020 calls of Preparatory Phases

Who : All partners interested in constructing a user-oriented facility including at government levels

How : through EuPRAXIA, **the success of which is mandatory**

Engage in the preparation of a HE frontier DS proposal

Why : to (possibly) be included in Roadmap such as ESFRI, PP, Light Sources...

to be included in H2020 calls of DS in 2019

Who : All partners interested in studying a user-oriented energy frontier facility, including at government levels

How : Set up a **Task Force**, Down selecting technologies for a proposal!

Personal vision for PWA in Europe (cont'd)



For most of the issues above, TIARA is keen to help


Conclusions

After having established an accelerator R&D strategy, its implementation through several very successful projects in FP6 & FP7, TIARA has enabled to integrate the European expertise (Labs, universities and partially industry) for collaborative Accelerator R&D.

All aspects, from generic R&D (low TRL) to industrialization (high TRL) are covered by the projects supported by TIARA.

PWA has been and is considered as a very important aspect of Accelerator R&D and TIARA continues to support/help this field.

TIARA continues to work toward a successful integration of all AS&T actors in Europe in order to enhance further the impact of Accelerators in Science and Society.



**Accelerator science is a powerful mean
toward scientific, technical and
industrial breakthroughs and innovations...**