EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS

EUPRAXIA COLLABORATION BOARD

Antonio Falone 16.04.2021





Outline

- Eupraxia PWFA Pillar @ INFN-LNF, organization and project management plan
- Work Breakdown Structure
- Schedule and management methodologies



The phase 0 of the PWFA pillar is implemented through the EuPRAXIA@SPARC_LAB Project.

- Funding already secured
- Project team established
- Scientific Advisory Committee in place



Project Management Plan for the TDR phase is about to be approved



Phase 0 PWFA Pillar (a.k.a. EuPRAXIA@SPARC_LAB) Project scope

- Design and construction of the building that will host the facility
- R&D to reach the required TRL in:
 - Plasma Beam Driven acceleration scheme (@ SPARC_LAB Facility)
 - R&D on X-Band RF technology (@TEX Facility)
- Implementation of PWFA Accelerator @ 1GeV:
 - Plasma stage
 - Full RF X-Band option



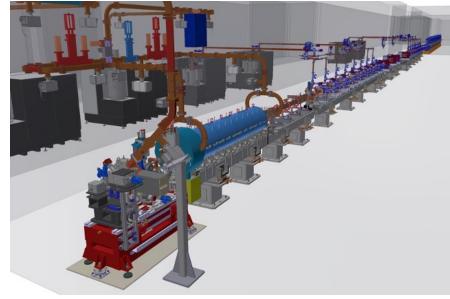
Phase 0 PWFA Pillar (a.k.a. EuPRAXIA@SPARC_LAB) Project scope



Rendering EuPRAXIA building



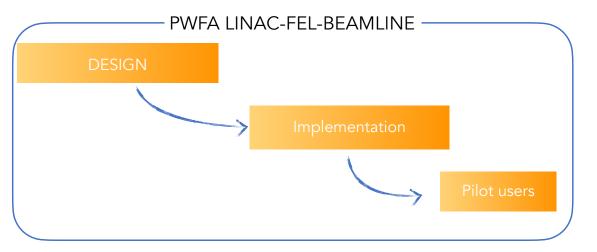
X-Band test stand facility - TEX

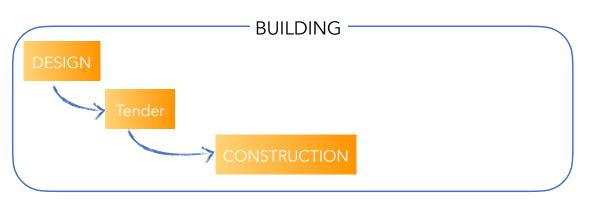


3D Layout of the machine

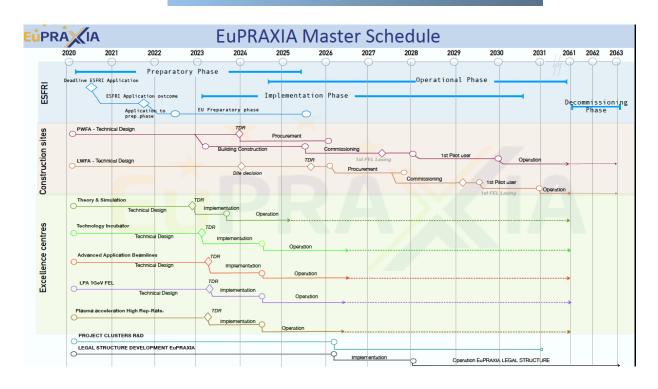


Phasing approach.

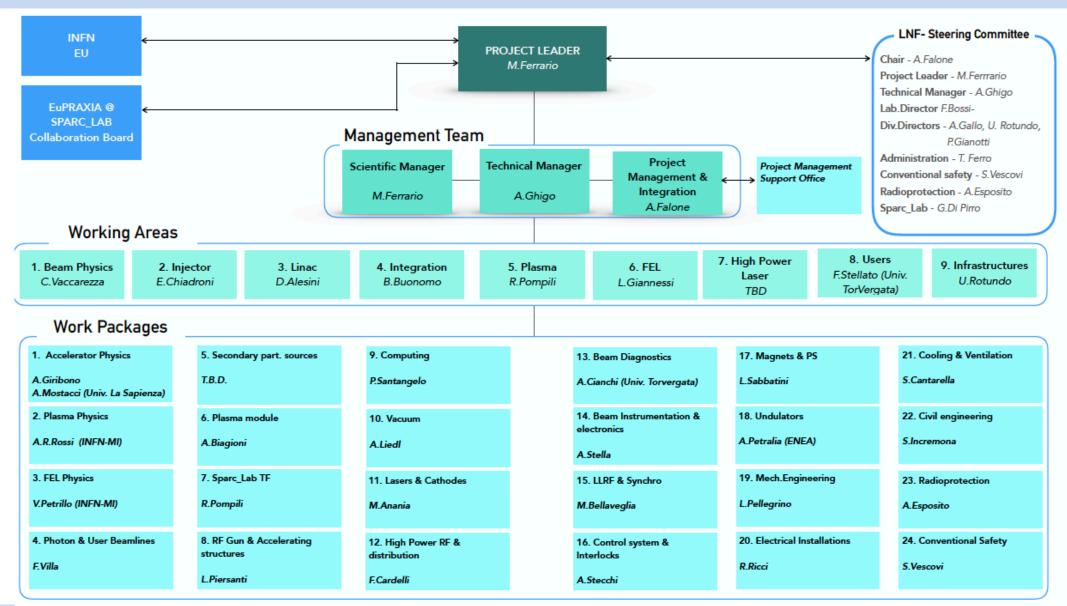




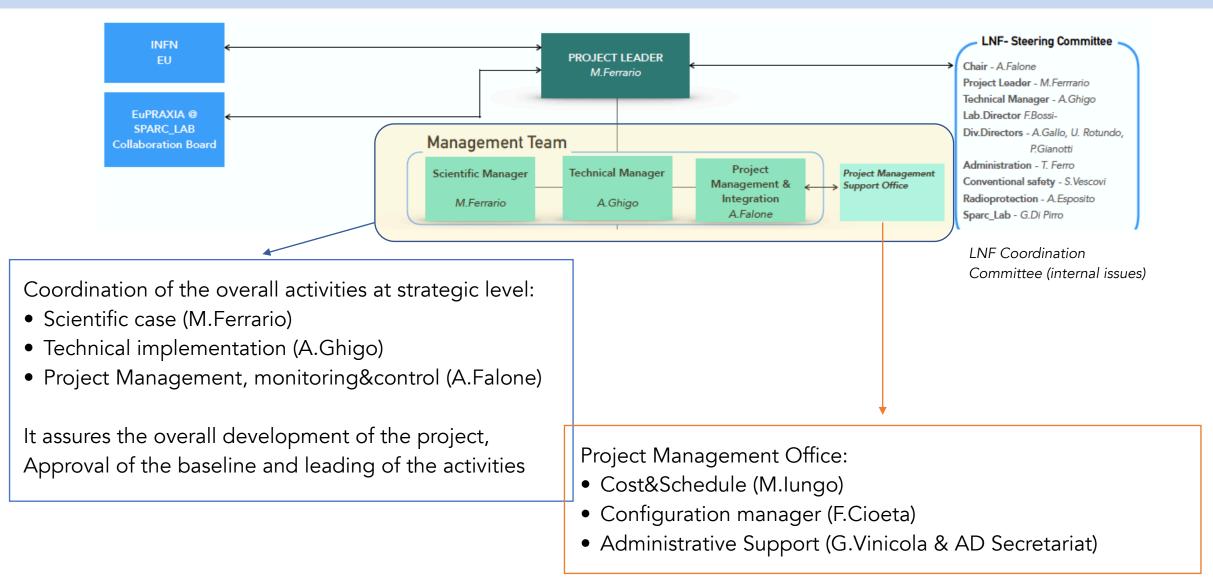
Design & implementation phases are consistent with the European initiative



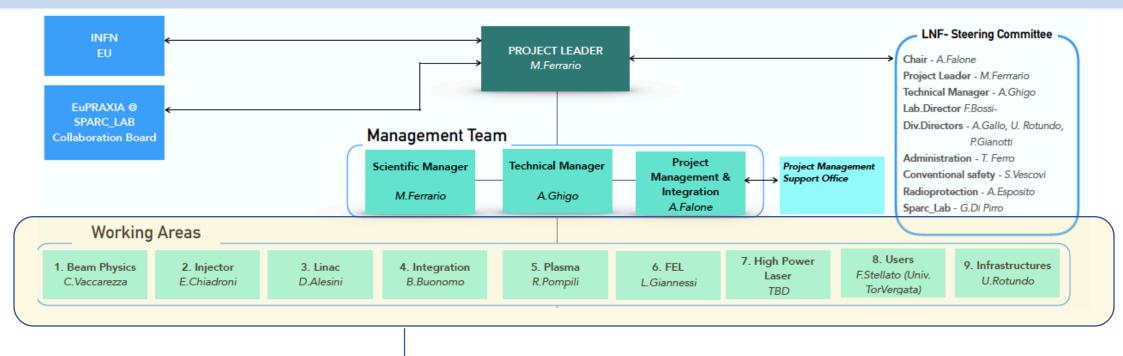












9 Working areas covering all the topic of the project.

Act as internal steering board of the project

Validate the technical choices (to be approved by the management team) Coordinate the whole activities of the corresponding work-package.

High level of the WBS.

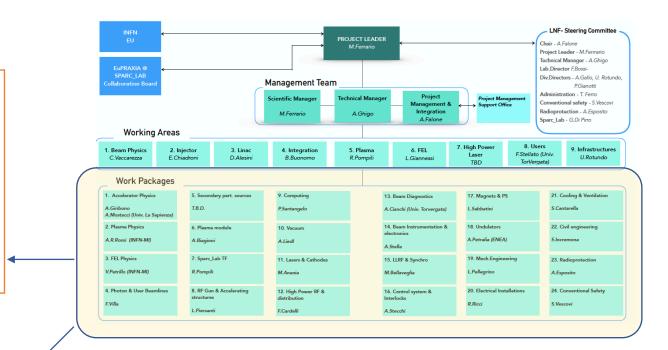


24 Work packages that covers detailed aspects of the project, organized as follow:

1-7: Physics & User

8-19: Machine implementation (RF, Power supply, etc...)

19-24: Infrastructure & civil engineering



Each work package has a defined set of deliverables expected and responsibilities assigned expressed in a dedicated quality management document.



The correlation between a working area and work packages is expressed in the Responsibility Assignment Matrix - RAM

		WA 1	WA 2	WA 3	WA 4	WA 5	WA 6	WA 7	WA 8	WA 9
		Beam Physics	Injector	Linac	Integration	Plasma	FEL	High Power Laser	Users	Infrastructure
WP 1	Accelerator Physics	x	X	X		X	X	X		
WP 2	Plasma Physics	X				X		X		
WP 3	FEL Physics	x					X	x		
WP 4	Photon & User Beamlines	X					X	X	X	
WP 5	Secondary Part.Source							X	X	
WP 6	Plasma module	X				X		X		
WP 7	Sparc_lab TF					X				
WP 8	RF Gun & Acc.Structure	X	X	x						
WP 9	Computing	X								
WP 10	Vacuum		X	x	X	Х		X		
WP 11	Laser & Cathodes		х					X		
WP 12	High Power RF & Distribution		X	x	x					
WP 13	Beam Diagnostics	X	X	x	x	X	X		X	
WP 14	Beam Instrumentation & Electronics		X	x	x					
WP 15	LLRF & Synchro		х	X	X					
WP 16	Control system & Interlocks	X	X	x	x	X	X	X	X	х
WP 17	Magnets & PS	х	х	x	X		x			
WP 18	Undulators						x			
WP 19	Mech.Engineering		х	X	X					х
WP 20	Electrical Installation				x					х
WP 21	Cooling & Ventilation		х	x	x					х
WP 22	Civil Engineering									х
WP 23	Radioprotection									х
WP 24	Conventional Safety									х



Work Breakdown Structure - WBS

All the work needed to get the TDR ready has been structured and decomposed in a detailed WBS.

For sake of simplicity only a High Level WBS is presented here:

WA.01	Beam Physics			
WA.02	Injector			
WA.03	LINAC			
WA.04	RF & PS Integration			
WA.05	Plasma			
WA.06	FEL			
WA.07	High power laser			
WA.08	Users			
WA.09	Infrastructures			

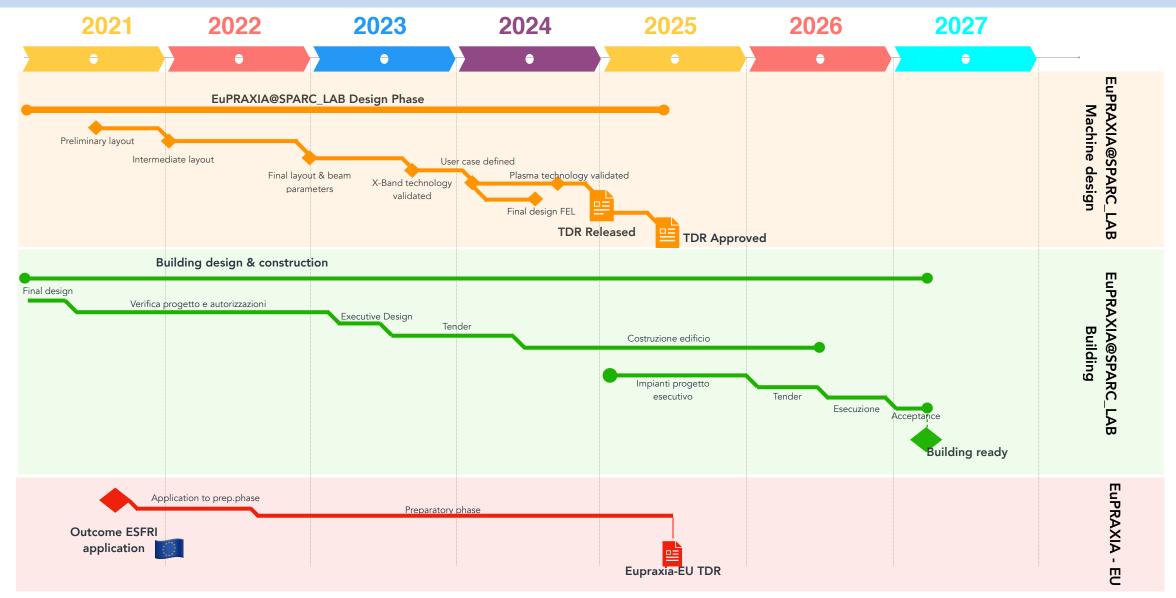
This can be used as a guideline to set-up a functional Work-Breakdown Structure for the Project Cluster of EuPRAXIA.

Maybe some modifications can be implemented.

RAM Matrix can be also implemented to highlight crosscorrelation between different project cluster.



High Level Planning





Detailed schedule

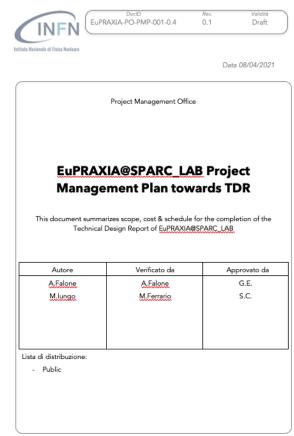
a	WA	Nome attività	Durata	Inizio	Fine	Predecessori	Costo 19	2020 2021 2022 2023 2024 2025 2026 2027 1 14 11 12 13 14 11 11 12 13 14 11 11 11 11 11 11 11 11 11 11 11 11
1	WA1	S2E Simulations	640 g	ven 01/01/21	gio 15/06/23		€205.000,00	SZE Simulations
17	WA1.M1	Preliminary machine baseline approved	0 g	ven 18/06/21	ven 18/06/21	4;7	€0,00	18/06/2021 Preliminary machine baseline approved
8	WA1.M2	Intermediate machine baseline approved	0 g	ven 03/12/21	ven 03/12/21	9	€0,00	03/12/2021 Intermediate machine baseline approved
9	WA1.M3	Final layout and beam parameters ready	0 g	ven 04/11/22	ven 04/11/22	18FI+12 mes	€0,00	04/11/2022 Final layout and beam parameters ready
0	WALING	That layout and beam parameters ready	0 8	Veii 04/11/22	VEII 0-4/11/22	1011112 11163	€0,00	
1		I-1-d		04 /04 /24	02/42/22			Injector
_	WA2	Injector	501 g	ven 01/01/21	ven 02/12/22		€2.045.000,00	TI T
5	WA2.M1	RF GUN prototype ready	0 g	lun 05/12/22	lun 05/12/22	26	€0,00	05/12/2022 • RF GUN prototype ready
36	WA2.M2	Injector designed	0 g	ven 02/12/22	ven 02/12/22	27	€0,00	02/12/2022 • Injector designed
17	WA2.M3	PC Laser developed & designed	0 g	gio 17/11/22	gio 17/11/22	30	€0,00	17/11/2022 PC Laser developed & designed
8	WA2.M4	LLRF & Synchronization system designed	0 g	mar 03/05/22	mar 03/05/22	32;33;34	€0,00	03/05/2022 ♦ LLRF & Synchronization system designed
9							€0,00	
0	WA3	Linac	728 g	ven 01/01/21	mar 17/10/23		€1.365.000,00	Linac
2	WA3.M1	Layout RF Module completed	0 g	ven 03/12/21	ven 03/12/21	61	€0,00	03/12/2021 ◆ Layout RF Module completed
3	WA3.M2	Waveguide Layout ready	0 g	mer 01/06/22	mer 01/06/22		€0,00	01/06/2022 Waveguide Layout ready
4	WA3.M3	HP Test on X-Band WG System finalised	0 g	ven 19/05/23	ven 19/05/23	72	€0,00	19/05/2023 ♦ HP Test on X-Band WG System finalised
5	WA3.M4	X-Band Accelerating sections validated	0 g	ven 19/05/23	ven 19/05/23	80	€0,00	19/05/2023 ♠ X-Band Accelerating sections validated
6							€0,00	
7	WA4	Integration RF & Power Supplies	880 g	ven 01/01/21	gio 16/05/24		€1.500.000,00	■ Integration RF & Power Supplies
11	WA4.M1	2nd X-Band Klystron tested	0 g	mar 18/10/22	mar 18/10/22	91	€0,00	18/10/2022 2nd X-Band Klystron tested
)2	WA4.M2	Full Specs Klystron tested	0 g	ven 03/11/23	ven 03/11/23	93	€0,00	03/11/2023 🌢 Full Specs Klystron tested
)3	WA4.M3	Modulator room layout and utilities	0 g	ven 16/06/23	ven 16/06/23	94	€0,00	16/06/2023 ♠ Modulator room layout and utilities
04	CIVI.PMVV	modulator room layout and utilities	υg	ven 10/00/23	ven 10/00/23	54		10,00, EDED Williams 10011 myour and delities
		N	000 -	04 /04 /04	-1- 05 (00 (5 5		€0,00	Plasma
05	WA5	Plasma	960 g	ven 01/01/21	gio 05/09/24	110	€800.000,00	04/11/2022 Long Capillary plasma characterization
15	WA5.M1	Long Capillary plasma characterization	0 g	ven 04/11/22	ven 04/11/22	110	€0,00	
16	WA5.M2	Plasma section final design	0 g	ven 06/09/24	ven 06/09/24	114	€0,00	06/09/2024 ♦ Plasma section final design
17							€0,00	
18	WA6	FEL	760 g	ven 01/01/21	gio 30/11/23		€200.000,00	♥ FEL
52	WA6.M1	Design 14 nm option	0 g	ven 21/04/23	ven 21/04/23	126	€0,00	21/04/2023 Design 14 nm option
53	WA6.M2	Design 50-180 nm option	0 g	ven 06/10/23	ven 06/10/23	137	€0,00	06/10/2023 Design 50-180 nm option
54	WA6.M3	Design 3nm option	0 g	ven 06/10/23	ven 06/10/23	148	€0,00	06/10/2023 🄷 Design 3nm option
55	WA6.M4	Design 30-180nm option	0 g	ven 21/04/23	ven 21/04/23	151	€0,00	21/04/2023 Design 30-180nm option
56							€0,00	
57	WA8	USER	720 g	ven 01/01/21	gio 05/10/23		€225.000,00	♥ USER
66	WA8.M1	Design optical elements	0 g	ven 03/12/21	ven 03/12/21	161	€0,00	03/12/2021 ♦ Design optical elements
67	WA8.M2	Final design use end station	0 g	ven 06/10/23	ven 06/10/23	165	€0,00	06/10/2023 ♦ Final design use end station
68		•					€0,00	
69	WA9	Infrastructures	380 g	ven 01/01/21	gio 16/06/22		€100.000,00	Infrastructures
73			2208		B.0 23/00/22		€0,00	
74	Project Office	Project Office	1120 g	ven 01/01/21	gio 17/04/25		€0,00	Project Office
81	PO.M1	Project Management Plan TDR		ven 01/01/21 ven 26/02/21	ven 26/02/21	175	€0,00	26/02/2021 Project Management Plan TDR
32	PO.M2		0 g			177		28/01/2022 • Project Management Plan Implementation Phase
		Project Management Plan Implementation Phase	0 g	ven 28/01/22	ven 28/01/22		€0,00	28/01/2022 Cost book implementation phase
33	PO.M3	Cost book implementation phase	0 g	ven 28/01/22	ven 28/01/22	177	€0,00	
34	PO.M4	TDR READY	0 g	ven 01/11/24	ven 01/11/24	179	€0,00	01/11/2024 • TDR READY
35	PO.M5	TDR Approved	0 g	ven 18/04/25	ven 18/04/25	180	€0,00	18/04/2025 ♦ TDR Approved
36							€0,00	
87		External constraints	1381 g	gio 01/04/21	ven 17/07/26		€0,00	External constrain
38	ESFRI.M1	Hearings & Critical questions	2 mes	gio 01/04/21	mer 26/05/21		€0,00	
89	ESFRI.M2	Outcome Roadmap application	0 g	ven 01/10/21	ven 01/10/21		€0,00	01/10/2021 Outcome Roadmap application
00	BLDG.010	Tender for construction	12 mes	lun 21/08/23	ven 19/07/24		€0,00	Tender for construction
1	BLDG.020	Building construction	24 mes	ven 19/07/24	gio 21/05/26	190	€0,00	<u> </u>
92	BLDG.030	Building handover	2 mes	ven 22/05/26	gio 16/07/26	191	€0,00	Building handover
3	BLDG.M1	Building Ready	0 g	ven 17/07/26	ven 17/07/26	192	€0,00	17/07/2026 & Building Ready
94	BLDG.040	Utilities executive design	12 mes	sab 09/12/23	gio 07/11/24		€0,00	Utilities executive design
15	BLDG.050	Tender utilities	8 mes	ven 08/11/24	gio 19/06/25	194	€0,00	Tender utilities
16	BLDG.060	Utilities works	6 mes			195	€0,00	Utilities works
97				ven 20/06/25	gio 04/12/25			Utilities acceptance
98	BLDG.070 BLDG.M2	Utilities acceptance	2 mes	ven 05/12/25	gio 29/01/26	196	€0,00	17/07/2026 Building & utilitie
		Building & utilities ready	0 g	ven 17/07/26	ven 17/07/26	197;193	€0,00	17/07/2026 🍑 Building & utilitie



Project Management Plan for the TDR Phase

Document to be approved soon by INFN management regarding the overall management process of the project In particular:

- Schedule (high level and detailed)
- ●R&D Cost
- Cost-Baseline
- •Manpower
- Risk assessment
- Project Management Monitoring&Control methodology
- Project Communication Plan





Risk Assessment Methodology

Probability and Impact guidelines have been prepared and will be used for a global risk assessment strategy

For each potential event a risk level is assigned and depending on the severity different actions can be implemented

RISK LEVEL	DESCRIPTION	ACTIONS
RISK > 15.	CRITICAL	Risk requiring immediate mitigation actions
10 <risk<15.< td=""><td>HIGH</td><td>Risk to be monitored and controlled. Contingencies must be allocated.</td></risk<15.<>	HIGH	Risk to be monitored and controlled. Contingencies must be allocated.
6 <risk<10.< td=""><td>MODERATE</td><td>Risk accepted but some contingencies might be required.</td></risk<10.<>	MODERATE	Risk accepted but some contingencies might be required.
RISK<6.	LOW	NO ACTIONS ARE REQUIRED> Risk accepted as it is.



Monitoring&Control Methodologies

In order to assess the real advancement with respect to the approved baseline different tools will be applied.

Two project review assessment will be done per year (6 months basis) in which the following will be evaluated:

- Number of deliverables produced vs Number of deliverable expected
- Actual cost vs estimated cost
- Number of items procured vs expected ones
- Close follow up of activities in the critical path
- Technical and scientific achievements



Conclusions

Project Management methodologies and tools are being applying for EuPRAXIA@SPARC_LAB.

These can be further extended, upgraded and implemented in order to cope with the EuPRAXIA Challenges.

Additional professional figures will be required (EU Grant manager, scientific secretariat, outreach, etc...)

Any feedback or suggestions from every member is more than welcome.