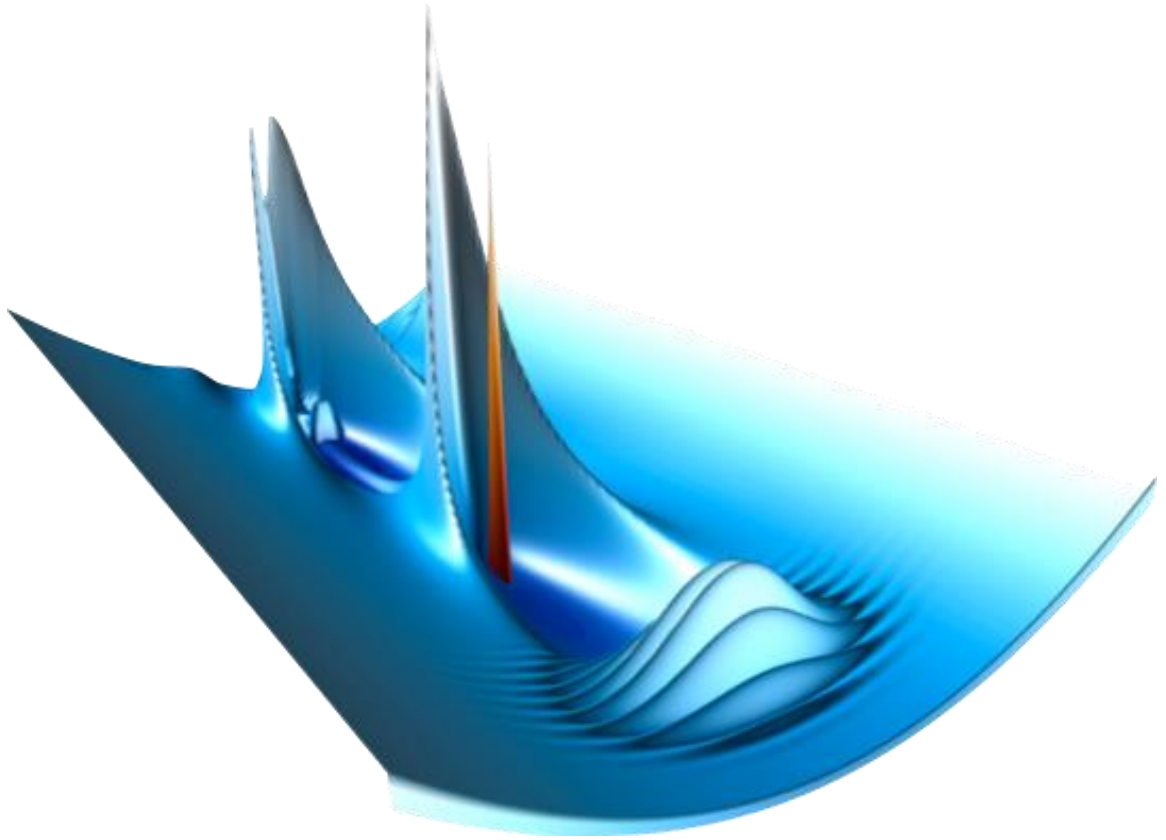
WP2: Physics and Simulation



CEA/IRFU Team

- **Alban Mosnier (WP2 Leader)**
  - Accelerator physicist, expertise in beam dynamics (and instabilities), Linacs (design, SRF), project coordination
  - Immersed in new acceleration techniques, especially LWFA since two years
  - Interests: beam dynamics and simulations for plasma acceleration of electrons
- **CEA/Irfu Team :** Antoine Chancé (WP5), Phi Nghiem, Alban Mosnier, Xiangkun Li (post-doc, WP2 & WP5) + PhD student (not yet selected)

Current registered WP2 contributors

CEA			
	Alban Mosnier	WP Leader	alban.mosnier@cea.fr
	Phi Nghiem		phu-anh-phi.nghiem@cea.fr
	Xiangkun Li	from Sept 2016	
IST (Instituto Superior Técnico)			
	Luis Oliveira e Silva	WP Co-Leader	luis.silva@ist.utl.pt
	Jorge Vieira	WP Expert	jorge.vieira@ist.utl.pt
	Ricardo Fonseca		ricardo.fonseca@tecnico.ulisboa.pt
	Joao M. Dias		joao.m.dias@tecnico.ulisboa.pt
	Ujwall Sinha		ujjwalsinha@tecnico.ulisboa.pt
	Joana Martins		jlmartins@ist.utl.pt
DESY			
	Ralph Assmann		ralph.assmann@desy.de
	Elena Svystun		elena.svystun@desy.de
	Angel Ferran Pousa		angel.ferran.pousa@desy.de
	Thomas Heinemann		thomas.heinemann@desy.de
ICL (Imperial College London)			
	Aakash Sahai	PDRA	a.sahai@imperial.ac.uk
INFN			
	Massimo Ferrario		massimo.ferrario@lnf.infn.it
	Alberto Marocchino		alberto.marocchino@lnf.infn.it
CNRS-LPGP			
	Gilles Maynard		gilles.maynard@u-psud.fr
JUS (Jiao Tong University Shangai)			
	Min Chen		minchen@sjtu.edu.cn
	Lule Yu		luleyu@sjtu.edu.cn
USTRATH (University of Strathclyde)			
	Zheng-Ming Sheng		zhengming.sheng@strath.ac.uk
	Feiyu Li		feiyu.li@strath.ac.uk
	Maria Weikum		maria.weikum@strath.ac.uk
ELI-Beamlines			
	Danila Khikhlukha	plasma physicist	Danila.Khikhlukha@eli-beams.eu

Collected from WP Contacts List on Wikipraxia
https://vocal-external.liv.ac.uk/sites/eupraxia/wikipraxia/Wiki%20Pages/WP%20Contacts%20List.aspx

+ additions from IST and NFN

WP2 description

- Extensive simulations will be carried out across the EuPRAXIA consortium to optimize the plasma, laser and electron beam parameters for both, the plasma injector and the accelerating modules. This will include injection from a conventional linac, as well as using self-injection from a laser-driven plasma cell.
- Start-to-end simulations are planned to determine optimum sets of plasma modules and beam parameters. The investigations will target the achievable final energy and bunch charge, but also the energy spread and transverse emittance of the electron bunches.
- Acceptable tolerance levels will be evaluated by studying the effects from various error sources including laser intensity, plasma density, as well as spatial and temporal tolerances.
- Tasks
  - Task 2.1. Coordination and Communication
  - Task 2.2. Machine model
  - Task 2.3. Start-to-end simulations and optimization
  - Task 2.4. Tolerance budget
  - Task 2.5. Final performance

Tasks 2.2

- **Task 2.2. Machine model**
  - Identify both layout options for external injection from a conventional linac (RF photo-injector and booster linac) and for self-injection from a laser-driven plasma cell
    - Main interaction with WP3 (LPA strcture) and WP5 (electron beam)
  - Identify optics solutions from injector to accelerating plasma module
    - Main interaction with WP3 and WP4 (laser)
  - Identify plasma channel configuration and parameter range (length, diameter, electronic density, …)
    - Main interaction with WP3
  - Identify electron beam transfer lines from plasma accelerator to both applications (FEL undulator and HEP dector)
    - Main interaction with WP5 and WP6 (FEL) WP7 (HEP & other apps)
  - Identify alternate layout for electron injection into and acceleration in beam-driven plasma cells
    - Main interaction with WP5 and WP9 (beam-driven plasmas)

Tasks 2.3 & 2.4

- **Task 2.3. Start-to-end simulations and optimization**
  - Perform extensive simulations with PIC codes (at least two codes for comparison), starting from 1D or 2D for fast preliminary results and optimization to full 3D simulations

    → short presentation of codes used in session 6-3
  - Determine optimum sets of plasma modules and beam parameters
    - Main interaction with WP3
- **Task 2.4. Tolerance budget**
  - Specify tolerances of the critical elements:
    laser beam (laser spot, pointing, etc) plasma cells (plasma density, density profile, alignment, etc) electron beam (incoming beam offset and angle, etc) and focusing magnets of the transfer lines (misalignment, field quality, etc)
- **Task 2.5. Final performance**
  - Evaluate the system performance in terms of beam energy, energy spread, transverse emittance bunchlength with ideal conditions at the exit of the application transfer lines
  - Evaluate the performance spoiling in presence of various errors (according to the tolerance budget)

Milestones

Milestone number	Milestone title	Lead beneficiary	Due Date (months)	Means of verification
MS6	M2.1 WP2 personnel in place	12 - CEA	12	Organisation and information available on Intranet
MS12	M2.2 Report defining tolerance	12 - CEA	18	published on intranet
MS13	M2.3 Simulation tools and theory set up	12 - CEA	18	Activity report
MS18	M2.4 Preliminary simulations set up	12 – CEA	24	Activity report
MS30	M2.5 Start to end Simulations	12 - CEA	36	Activity report