

WP5: Electron Beam Design and Optimization

INFN (E. Chiadroni), CEA (A. Chance), UROM, DESY, ULIV, USTRATH, SOLEIL, UHH

Work package number	WP5			Start date or starting event:				M1
Work package title	Electron Beam Design and Optimization							
Participant number	2	12	13	1	10	5	8	14
Participant short name	INFN	CEA	UROM	DESY	ULIV	USTRATH	SOLEIL	UHH
Person-months per participant	36	24	0	18	0	0	0	0

- **Objectives**

- ▶ optimization of the witness bunch properties at the entrance of the plasma accelerating structure, crucial for the LWFA performance, and at the end of the line to fit the user needs. In addition, also the driver bunch properties will be studied to take into account also alternative electron beam driven plasma structures

- **Task 5.1:** Coordination and Communication

- **Task 5.2:** Electron Beam for Injection (External RF Injector)

- **Task 5.3:** Electron Beam Manipulation

- ▶ Beam transport from the source (either external RF injector or plasma injector (WP3)) to the plasma
- ▶ Transfer line from the plasma accelerating structure to Pilot Application beam line (WP2, WP6, WP7, WP9)

- **Task 5.4:** Electron Beam Diagnostics and Practical Issue

- ▶ The relative time of arrival jitter of the two beams, i.e. laser and electron,
 - timing system between the electron beam and the laser pulse (WP14)

- M 5.1: Personell recruitment [M12]
 - Post-doc assigned
- M 5.2: Preliminary RF accelerator specifications [M12]
 - Project report (WPs involved: 5,2,3,6,7,9,12,14)
- M 5.3: Specification of the transfer line from the RF injector to the plasma [M24]
 - Project report
- M 5.4: Definition of diagnostics before and after the plasma channel [M40]
 - Project report

	Y1	Y2	Y3	Y4
Team hiring				
Workshop RF accelerator				
Photoinjector design [D30]				
Beam handling [D42]				
Design report with cost study [D48]				

- ◉ WP2: Physics and Simulations
- ◉ WP3: High Gradient Laser Plasma Accelerating Structure
- ◉ WP6: FEL Pilot Application
 - ▶ Design transfer line
- ◉ WP7: High Energy Physics and other Pilot Applications
 - ▶ Design transfer line
- ◉ WP9: Alternative e-Beam Driven Plasma Structure
 - ▶ RF injector requirements for PWFA
- ◉ WP10: Use of Other Novel Technologies
 - ▶ Study other novel injector concepts
- ◉ WP12: Accelerator Prototyping and Experiments at Test Facilities
 - ▶ ...
- ◉ WP14: Hybrid Laser-Electron-Beam Driven Acceleration
 - ▶ Timing and synchronization issues

The wish parameter list strongly depends on the beam parameters for the given application

- Charge: from few pC to hundreds pC level
 - Cathodes
 - robustness, fast response (to allow pulse shaping), high QE, low intrinsic emittance
- Rep. rate: kHz
 - ...
- Peak current: Rep. rate: kA
 - Preferably two compression stages: hybrid compression
 - Low energy RF compression
 - rectilinear trajectories (no CSR which dilutes emittance), integrated in emittance compensation scheme
 - High energy magnetic compression
 - Jitter (e-beam to external laser): ~ 10 fs
- Energy \sim GeV, energy spread $\sim 0.1\%$
- emittance: $\sim \mu\text{m}$

- INFN
 - ▶ E. Chiadroni (20%), Post-Doc to be hired (50%)

- CEA
 - ▶ A. Chance