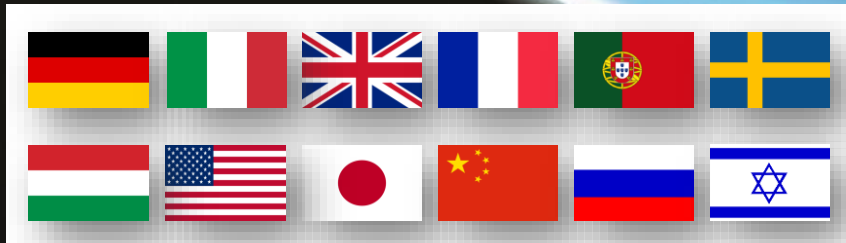


EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



High Gradient Laser Plasma Accelerating Structure WP3: update and plans for ECW

B. Cros, 19th June 2017



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 653782.

- **WP3 milestone report MS3.1**
 - **Design plasma structures:** injector & accelerator (1st task of WP3) completed with this report: plasma components for LPI and LPAS were analysed and current performances compared to Eupraxia design parameters
 - Contributions from CNRS, ICL, U. Oxford, CNR

1. **Gas cells** as stable media for LPI
2. **Waveguides** for LPAS: channel-GICT can be used
3. **Laser quality** and stability essential for reliable operation
4. Efforts on **plasma** (density) **stabilisation** required: more experimental data necessary
5. LPI: **combination of schemes** (III and density gradient) for control of electron bunch
6. Acceleration of externally injected electrons: more experimental **data necessary**

- Tomorrow Tuesday 20th, 10:30-11:15
- These preliminary conclusions will be discussed, as well as future actions before the final proposal for LP injector design

- In the 2 next tasks of WP3 (MS reports in October 2017):
 - pre-selected schemes will be analyzed in detail for **experimental implementation** in the beamline
 - **diagnostics** (plasma, accel field, electrons, laser)
- Topics to discuss with other WP at the collaboration week:
 - Simulations for selected schemes (WP2)
 - Laser parameters, quality and stability (WP4, WP2)
 - Electron coupling and diagnostics (WP5, WP2)
 - Plasma development and compatibility (WP4, WP9, WP14)

Task 3.3: Design plasma structure

3.3.1 : Determine requirements for plasma structure along with beam combining

3.3.2 : Study specific tasks

3.3.2a : Laser focussing

3.3.2b: Laser plasma alignment and control

3.3.2c: Vacuum system (gas load, sputtering)

3.3.2d: Activation (chamber, local shielding)

3.3.2e: Laser beam removal from electron axis

MS20: M3.2 REPORT Design for interaction chambers proposed

Task 3.4: Diagnostics

3.4.1: plasma diagnostics

3.4.2: plasma wave diagnostics

3.4.3: diagnostics of electrons in the plasma

3.4.4: laser diagnostics around focus, in/out plasma

MS21: M3.3 REPORT Design for implementation of proposed diagnostics

Task 3.5: design multistage LPA

3.5.1: Designing successive plasma structures, identifying scalability parameters

3.5.2: Laser plasma coupling

3.5.2a: Plasma mirrors

3.5.2b: other options

3.5.3: Engineering issues for stability, timing and overlap

MS26: M3.2 REPORT Design for multi-stage coupling proposed

- MS20: end October 2017
- MS21: end October 2017
- MS26: end July 2018

D3.1: Report on the design of plasma structures

- End October 2018

Active contributions are needed for these tasks

- In Pisa we have identified a list of contributors
- For the first report, only a few of them have effectively contributed
- Active participation and contributions are needed urgently to prepare next October reports (otherwise light, incomplete or delayed reports are foreseen)

Wednesday 21st June 14:00 -15:30 : WP3 meeting

- Discussion on the constraints defining the **general implementation**
 - Type and length of plasma for each stage
 - Laser beam focusing and coupling (input/output) for each stage
 - Electron beam focusing and coupling for each stage
 - Plasma chamber characteristics
- Discussion with **WP9** on **plasma source development** for PWFA (M Ferrario, J Osteroff)

Wednesday 21st June 16:00-18:00 : WP3-WP5 joint meeting

- **Electron diagnostics**
 - 1600 (20mn) Diagnostics conceptual design of EuPRAXIA-like machine (A. Cianchi, Roma2)
 - 1620 (20mn) 6D characterization of witness beam before injection (B. Marchetti, DESY)
 - 1640 (20mn) Beam Diagnostics for Plasma Accelerators (**J. Wolfenden** , CI)
 - Discussion on plasma-based devices for e-beam diagnostics
 - 1700 (15mn) **WP14**: Challenges in diagnostics of ultrahigh 6d-brightness and laser insertion/removal (B. Hidding, U. Strathclyde)
- **Compatibility with plasma** implementation
- Plasma source (LWFA or PWFA) and diagnostics
- Radiation diagnostics

Thursday 22nd June 9:00-10:30 : WP2-WP3-WP4 joint meeting: specs tolerance

Discussion on laser requirements and specifications :

- pulse duration, need of pulse trains option in the laser
- laser beam quality at focus and coupling to plasma
- energy requirements for injector/accelerator

Thursday 22nd June 11:00-12:30 : WP3-WP4 joint meeting : Implementation

- Diagnostics implementation
- Laser focusing and diagnostics before interaction
- Laser plasma alignment and control
- Vacuum system (gas load, sputtering)
- Activation (chamber, local shielding)
- Laser beam removal from electron axis and diagnostics after interaction

Thursday 22nd June 16:30-18:00 : WP3 meeting conclusions

- Summary of discussions: preparation of Friday report/output
- Organization of contributions for future reports