

# THE EuPRAXIA FACILITY

## Preliminary study concept

The EuPRAXIA study is considering at the moment several combinations between acceleration schemes in order to reach its baseline parameters. In total there are nine different scenarios, of which the most promising ones will be selected in 2019:

Case 1 – LWFA with internal injection

- A. Acceleration to 1 GeV and staging to 5 GeV
- B. Acceleration to 5 GeV directly

Case 2 – LWFA with external injection from RF accelerator

- A. Acceleration to 1 GeV and staging to 5 GeV
- B. Acceleration to 5 GeV directly

Case 3 – LWFA with external injection from laser plasma injector

- A. Acceleration to 1 GeV and staging to 5 GeV
- B. Acceleration to 5 GeV directly

Case 4 – PWFA

- A. Acceleration to 1 GeV
- B. Acceleration to 5 GeV

Case 5 – Hybrid scheme

Laser Wakefield Acceleration and staging to a Plasma Wakefield Accelerator with acceleration to 3 GeV.

The figures below provide a schematic diagram of each of the nine scenarios in the study.

## Facility structure

1) Power sources (RF electron linacs and high-power laser systems)

2) Accelerator machine:

- Plasma structures,
- Transport lines,
- Instrumentation for monitoring and control.

3) Experimental areas

- Free-electron lasers (FEL),
- High-energy physics (HEP) and other pilot applications.

The total footprint of the facility is 250 m

## Output parameters

The baseline parameters for the electron beam output are defined by the main applications of EuPRAXIA: free-electron lasers, high-energy physics detector applications, and other pilot applications.

Laser driver (Cases 1, 2, 3 & 5):	
Wavelength	800 nm
Energy	100 J
Pulse length (FWHM)	100 fs
Repetition rate	10-100 Hz

Laser injector (Case 3):	
Wavelength	800 nm
Energy	5 J
Pulse length (FWHM)	30 fs
Repetition rate	10-100 Hz

	From RF	From LWFA
Energy	160 MeV	150 MeV
Charge	50 pC	100 pC
Bunch length	38 fs	5 fs
Peak current per bunch	3 kA	20 kA

Electron beam driver (Case 5):	
Energy	1 GeV
Charge	100 pC
Bunch length	10 fs
Peak current per bunch	10 kA

	Cases 1 – 4	Case 5
Energy	5 GeV	3 GeV
Charge	100 pC	30 pC
Bunch length	5 fs	3 fs
Peak current per bunch	20 kA	10 kA
Total energy spread (RMS)	5%	5%
Transverse normalized emittance	1 mm mrad	1 mm mrad
Transverse beam size (RMS)	0.32 $\mu\text{m}$	0.41 $\mu\text{m}$
Transverse divergence (RMS)	0.32 mrad	0.41 mrad
Jitter, beam to global reference (RMS)	10 fs	10 fs

