

EUROPEAN  
PLASMA RESEARCH  
ACCELERATOR WITH  
EXCELLENCE IN  
APPLICATIONS



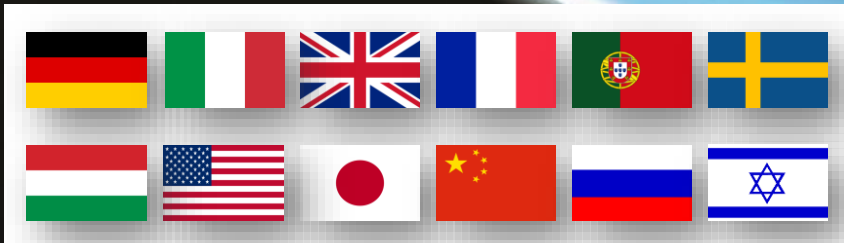
Coming soon...

## Diagnostics conceptual design for a Eupraxia-like (lite) machine

Alessandro Cianchi

University of Rome Tor Vergata and INFN

With a lot of contributions from Enrica Chiadroni, Nicolas Delerue, Claire Simon, David Alesini, Alessandro Gallo, Massimo Ferrario, James Rosenzweig



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

- Conventional accelerators diagnostics is not a big challenge
- An X-band accelerator is very compact, small, and also the diagnostics must be compact as well.
- There are several challenges for the diagnostics in the PWFA regime:
  - The bunch length is very small, down to few  $\mu\text{m}$
  - The bunch size is also very small, down to few  $\mu\text{m}$
  - SINGLE SHOT!
- For the conventional accelerator there are well-known solutions
- Diagnostics after the plasma acceleration will be affected by
  - Capture Optics
  - Driver contamination
  - Lack of single shot emittance diagnostics

- Fundamental to measure the envelope and properly match the beam in the different accelerator sections
- Used to measure energy and energy spread in spectrometer also
- Fundamental in several other measurements
- Compact design is required
- COTR mitigation problem: solution available
  - But not for small beam size smaller than few  $\mu\text{m}$

- X-band RFD (limited to few fs)
- EOS (Electro Optical Sampling used also with time of arrival monitor), limited to about 40-50 fs
- Coherent radiation spectrum (hopefully single shot, some developed, others in progress): not limited in principle
- More to come: ??
  - TDP (Transverse Deflecting Plasma) limited to hundreds of as

- Bergoz Turbo- ICT (down to 50 fC, up to 300 pC) for the charge
- Stripline BPM or button BPM for S band linac
- Cavity BPM (likely C or X band) for the rest of the machine
- Possibility to use the X band structures as BPM
  - Use of the dipole mode to estimate the beam position
  - Needs to be calibrate vs conventional BPM
  - Used in Califes@CERN
  - Developed at NLC

- This afternoon in WP5