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PLASMA RESEARCH
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EuPRAXIA

Coming soon…
Diagnostics conceptual design for a Eupraxia-like (lite) machine

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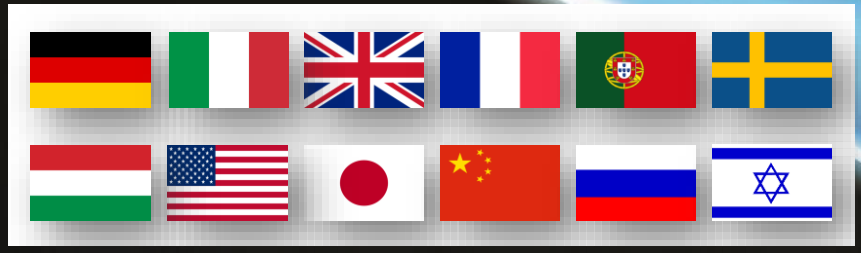

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General statements

- 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 μm
  - The bunch size is also very small, down to few μm
  - 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

Beam size

- 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 um

Longitudinal diagnostics

- 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

Charge and trajectory

- 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

More details

- This afternoon in WP5