The Sabina Terahertz/Infrared beamline @ SPARC-Lab

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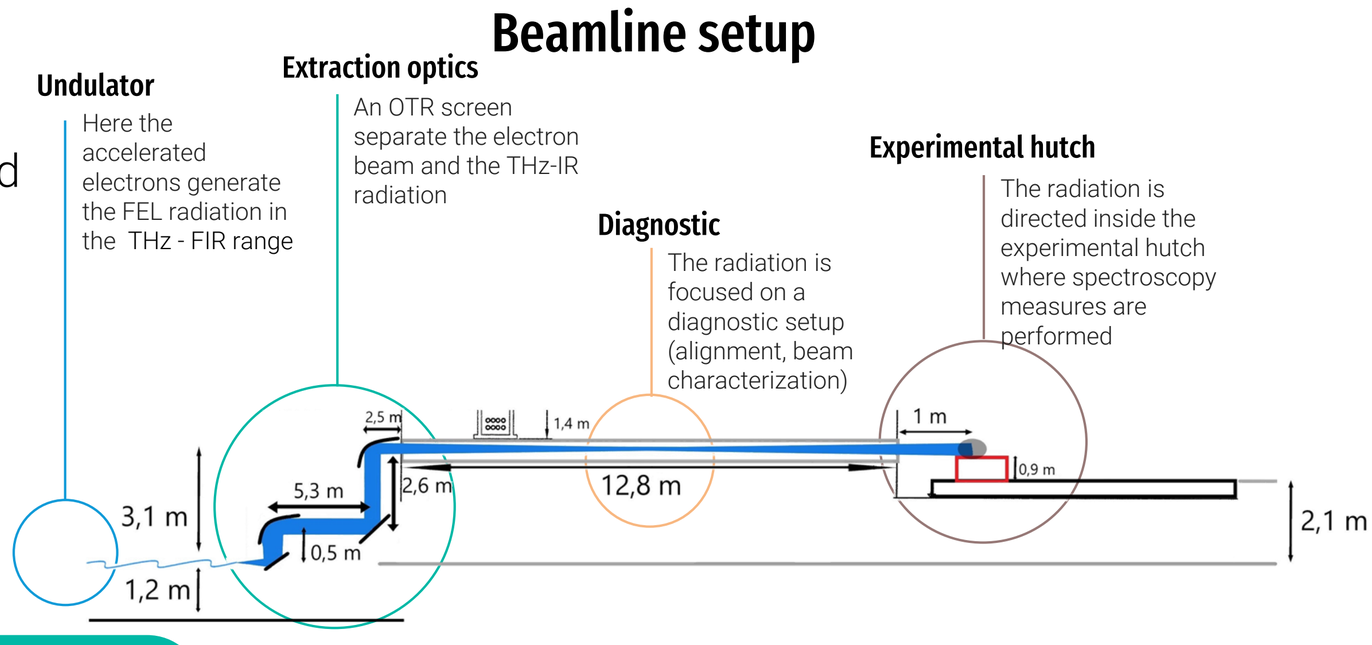
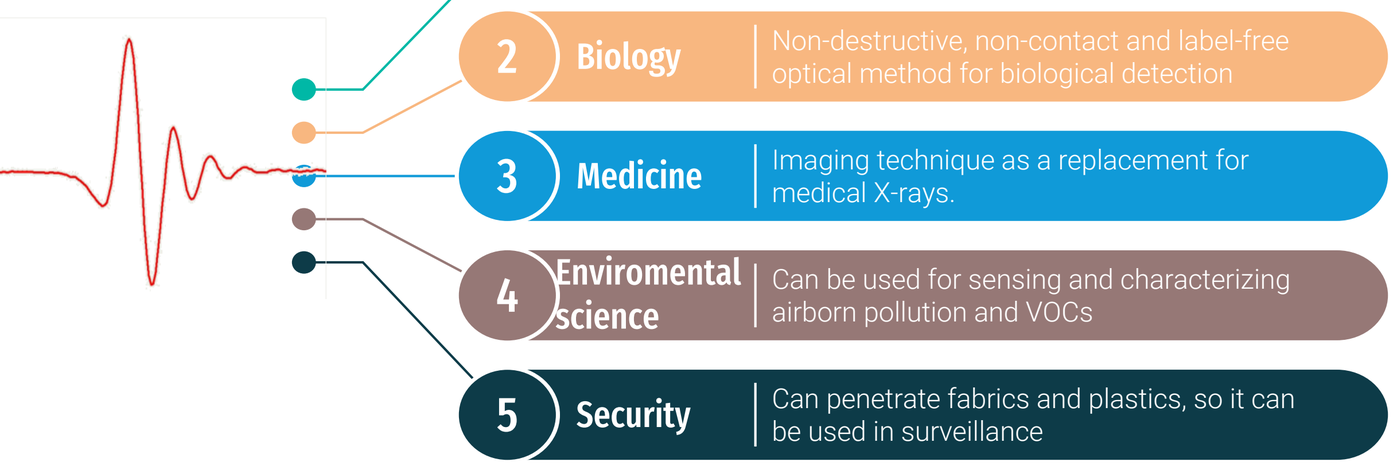
Following the EU Terahertz (THz) Road Map[1], high-intensity, ps-long, THz)/Infrared (IR) radiation is going to become a fundamental spectroscopy tool for probing and control low-energy quantum systems ranging from graphene, and Topological Insulators, to novel superconductors[2,3]. The Sabina beamline will cover the Terahertz (THz)- Infrared (IR) spectral region.

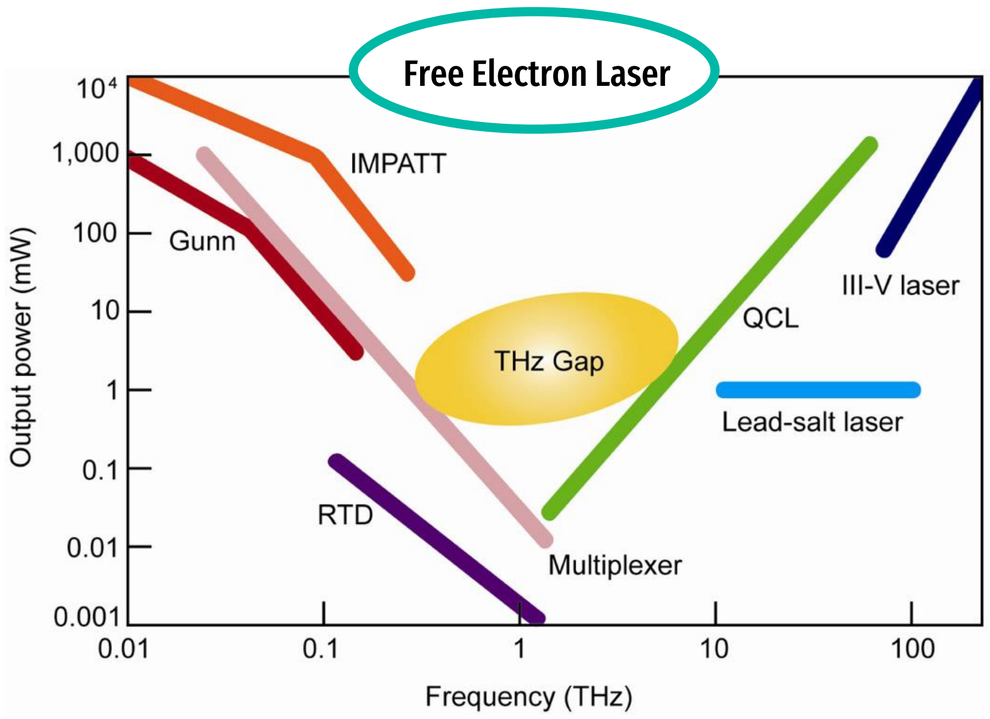
Beamline setup



Why THz/IR spectroscopy?



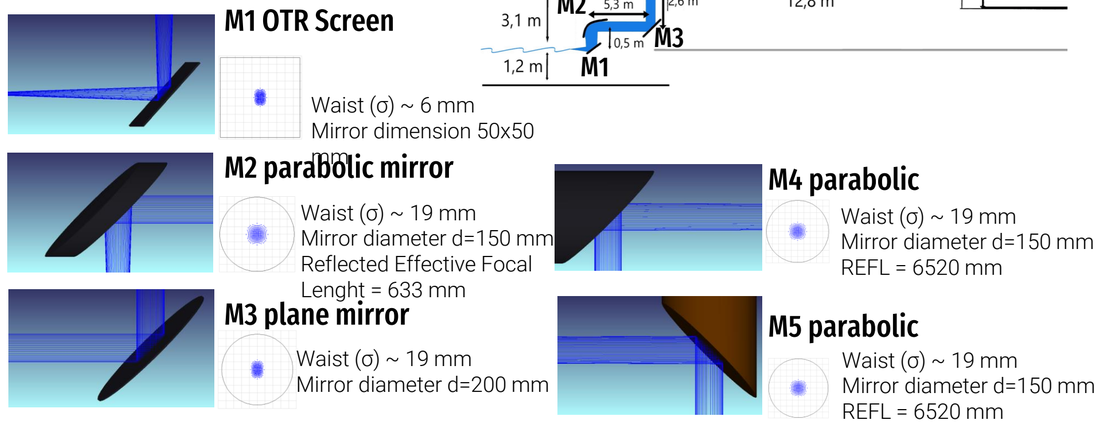
This frequency range can be used for characterization of lightweight molecules, carrier concentration and mobility. So this radiation is useful for material science, environmental science and biology. Terahertz/FIR radiation can penetrate some distance through body tissue like x-rays, but unlike them is non-ionizing, so it is of interest as a replacement for medical X-rays. It can also penetrate fabrics and plastics, so it can be used in surveillance, such as security screening.



The terahertz gap is a frequency band in the terahertz region of the electromagnetic spectrum between radio waves and infrared light for which practical technologies for generating and detecting the radiation are inefficient and unfeasible. A THz/FIR Free Electron Laser can cover this frequency range with a high power output (>10^5 mW)

In the framework of the SABINA project a novel THz/IR beamline based on an APPLE-X undulator emission will be developed at the SPARC-Lab facility at LNF-INFN. Light will be propagated from the SPARC-Lab to a new user lab facility nearly 20 m far away.

Optics specs



This beamline will cover a broad spectral region from 3 THz to 30 THz, showing ps- pulses and energy of tens of μJ with variable polarization from linear to circular. The corresponding electric fields up to 10 MV/cm, are able to induce non-linear phenomena in many quantum systems. The beamline, open to user experiments, will be equipped with a 5 T magnetic cryostat, and will be synchronized with a fs laser for THz/IR pump, VIS/UV probe experiments.

[1]S.S. Dhillon et al., J. Phys. D: Appl. Phys. 50, 043001 (2017);
[2]F. Giorgianni et al., Nature Commun. 7, 11421 (2016);
[3]P. Di Pietro et al., Phys. Rev. Lett. 124, 226403 (2020);

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