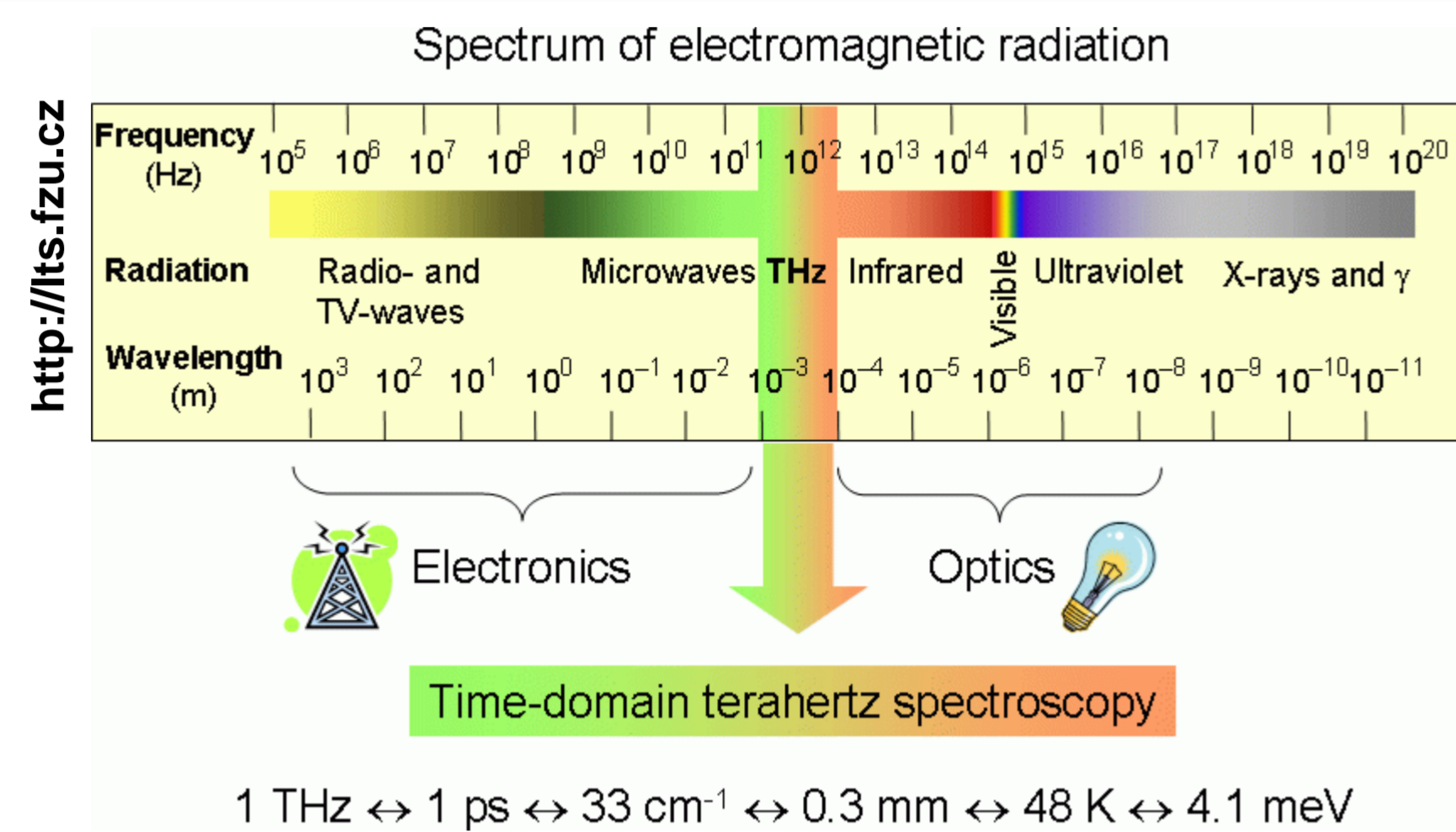


Bunch Shape Measurement with Electro-optical Sampling in an Electron Accelerator

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THz radiation



Application of THz radiation:

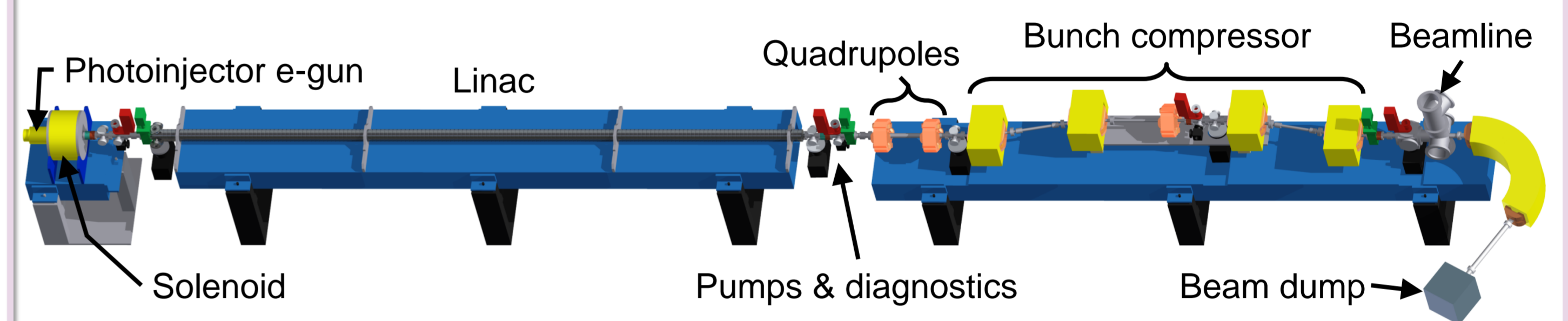
- Medical imaging – THz radiation is non – ionizing so it doesn't damage the tissue (penetrate up to several mm).
- Telecommunication – very high transmission rates might be achieved (up to 10^{11} bits·s⁻¹)
- Security purposes - terahertz radiation passes through plastics and clothes.

FLUTE ("F_{ern}infrarot L_{inac}- U_{nd} T_{est}-E_{xperiment}") – is a new linac-based THz source being designed in the Karlsruhe Institute of Technology (KIT) in close collaboration with the Paul Scherrer Institute (PSI) in Switzerland.

Final electron energy	42	MeV
Electron bunch charge	0.1-3	nC
Electron bunch length	50-400	fs
Spectral bandwidth	0.05-8	THz
Pulse repetition rate	10	Hz

Table 2: FLUTE key parameters

FLUTE will be able to provide high-field THz pulses for various scientific applications. Also it might be used as a test facility for the study of important open questions in accelerator physics.



A diagnostic system for short bunch shape measurement is needed for FLUTE.

Main problems:

- Adapting laser synchronization
- Research in crystal materials to improve temporal resolution (bunches are shorter than at ANKA)
- Study temporal resolution limits

ANKA Storage Ring

- Circumference 110.4m
- RF-frequency: 499.69 MHz
- Filling pattern: single- or multi-bunch

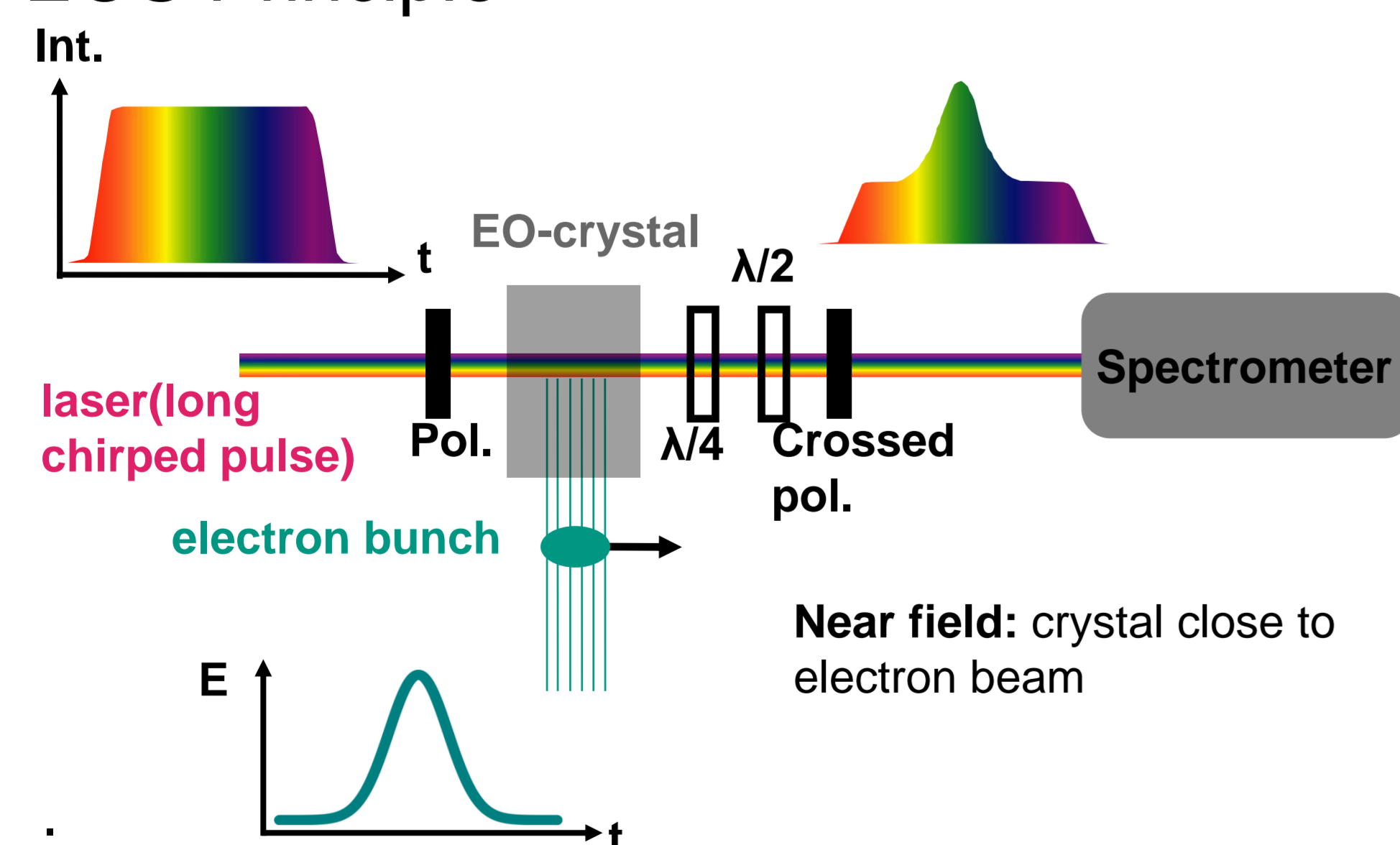
	Beam Energy, GeV	Bunch length, ps
Normal operation mode	2.5	45 (for 2.5 GeV)
Low- α -mode	1.3 – 1.6	2 (for 1.3 GeV)

Table 1: ANKA key parameters

ANKA machine is able to produce coherent synchrotron radiation in THz regime.

EOS system being implemented for ANKA

EOS Principle



Schematic set up of spectral decoding (EOSD): The electro-optical crystal becomes birefringent when a strong electric field is near modulating the electric field of the electron bunch onto the probing laser pulse.

