Photon Diagnostic Station For TAC IR-FEL Test Facility

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Introduction

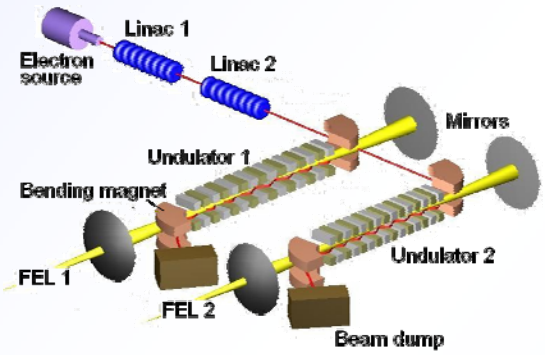
The Turkic Accelerator Center (TAC) project was started as a regional facility for accelerator based fundamental and applied research [1]. The work has been ongoing by ten Turkish Universities collaboration with the support of State Planning Organization (DPT).

The (TAC) project will include:
- light sources (synchrotron radiation and free electron laser)
- electron-positron collider
- GEV scale proton accelerator

As a first step of the project, a linac-based infrared free electron laser (IR-FEL) will be constructed as a TAC test facility to produce tuneable, coherent light with high flux which is around 10^{15} photons/s.eV and high brightness by the end of 2010.

TAC IR-FEL Test Facility

The TAC IR-FEL test facility will be an oscillator FEL that provides the laser beams in mid and far infrared region. It includes electron source, two RF modules to get 15 to 40 MeV electron beam and two undulators to obtain laser beam in the wavelength region of 1 to 200 microns.



The schematic view of the TAC IR-FEL test laboratory

General layout for the main parameters for the TAC IR FEL can be given as follows:
- Wavelength region: between 1-200 micron
- Pulse structure: around ps
- Micro pulse energy: around 13 MHz (S.c. RF)
- Average power: few W
- Average flux: around 10^{15} photons/s.eV

Despite the strong competition from conventional lasers , the FEL is recognized as important tool for various scientific applications. Today, there are about 40 FEL facilities wordwide. The TAC IR-FEL test facility will be the first and unique one for Turkey and our region.

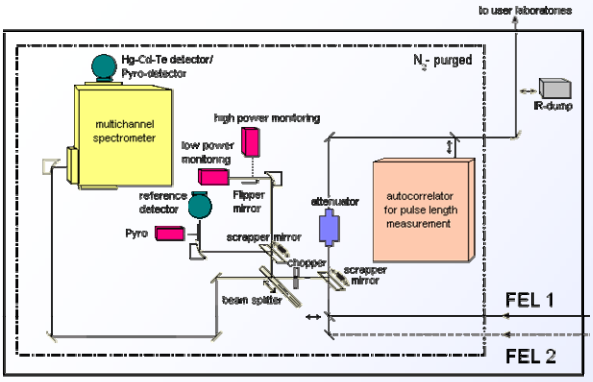
In this presentation, the general plan for the TAC IR-FEL photon beam diagnostic station will be introduced.

Photon Diagnostic Station

The optical beam diagnostic station has been designed to properly characterize laser beam for user experiments and to diagnose beam properties for tuning of the undulators (undulator 1 and undulator 2).

The IR-FEL photons generated by two undulators will be transported to the experimental hall through the respective two photon beam lines by using reflective optics. The high reflectivity IR mirrors coated with Al, Au, Ag will be use to transport and focus the beam with other optical lenses.

The diagnostic station will be located in the experimental hall. Both FEL beam lines will be merged on the diagnostic table and delivered to eight user laboratories. Mirrors, crystal optics and beam splitters will be employed on a granite table to guide the photon beams to separate spectrometer and different kind of detectors.



The optical components and devices on the diagnostic table

The TAC IR-FEL diagnostic table has been designed similar to that of the ELBE radiation source in Dresden[2]. According to this design:
- A non-collinear background free autocorrelator will be used to characterize the optical micro pulse duration. By using a CdTe single-crystal for second harmonic generation, a broad wavelength coverage will be obtained.
- A Czerny-Turner type spectrometer which contains a turret with three different gratings will be used for the spectrum measurements.
- A long wavelength MCT (HgCdTe) detector and a Pyro detector will be used in the diagnostic system for gain and loss measurements with higher sensitivity in the whole range of the FEL spectrum.
- A thin metal attenuators will be used to reduce average FEL power for the users.

Acknowledgment

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References

[1] S. Sultansoy et al., “The Status of Turkic Accelerator Complex Proposal”, Proceedings of PAC 05, p. 449.
[2] W. Seidel et al., “Remote Controlled IR- Diagnostic Station For the FEL at Rossendorf ”, Proceedings of FEL 06, p. 341.