Configuration and Status of the Israeli THz Free Electron Laser

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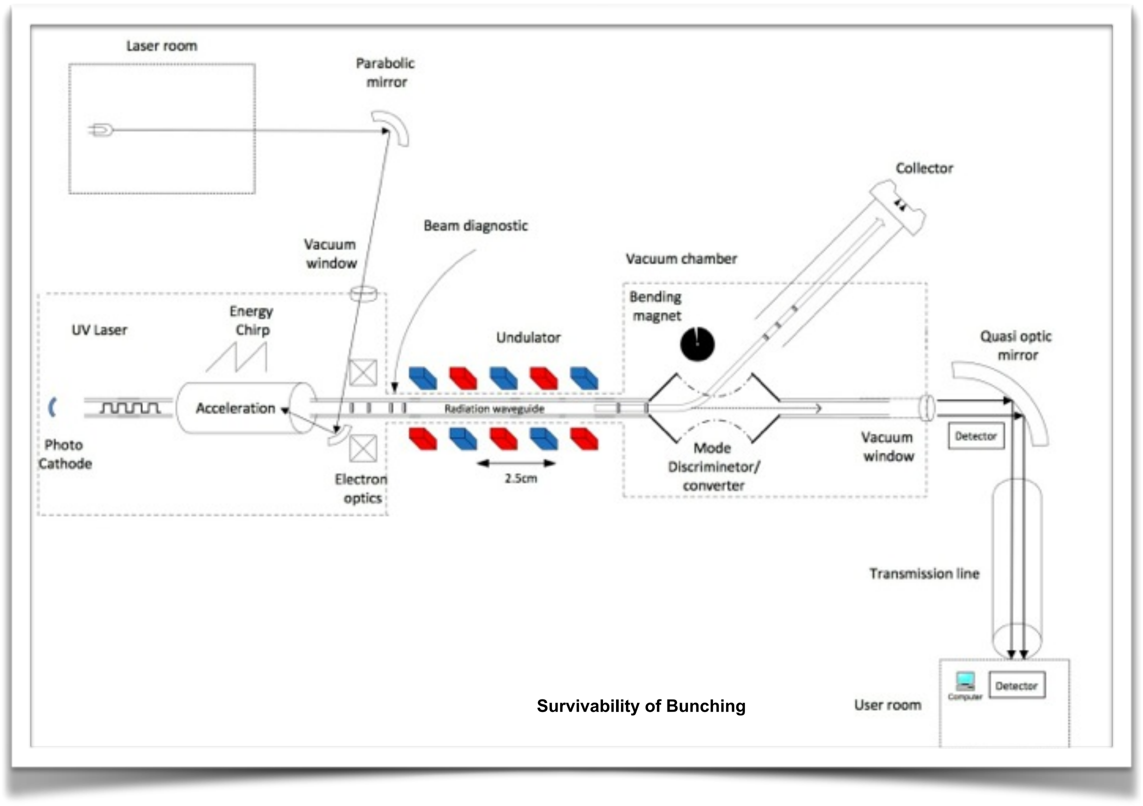
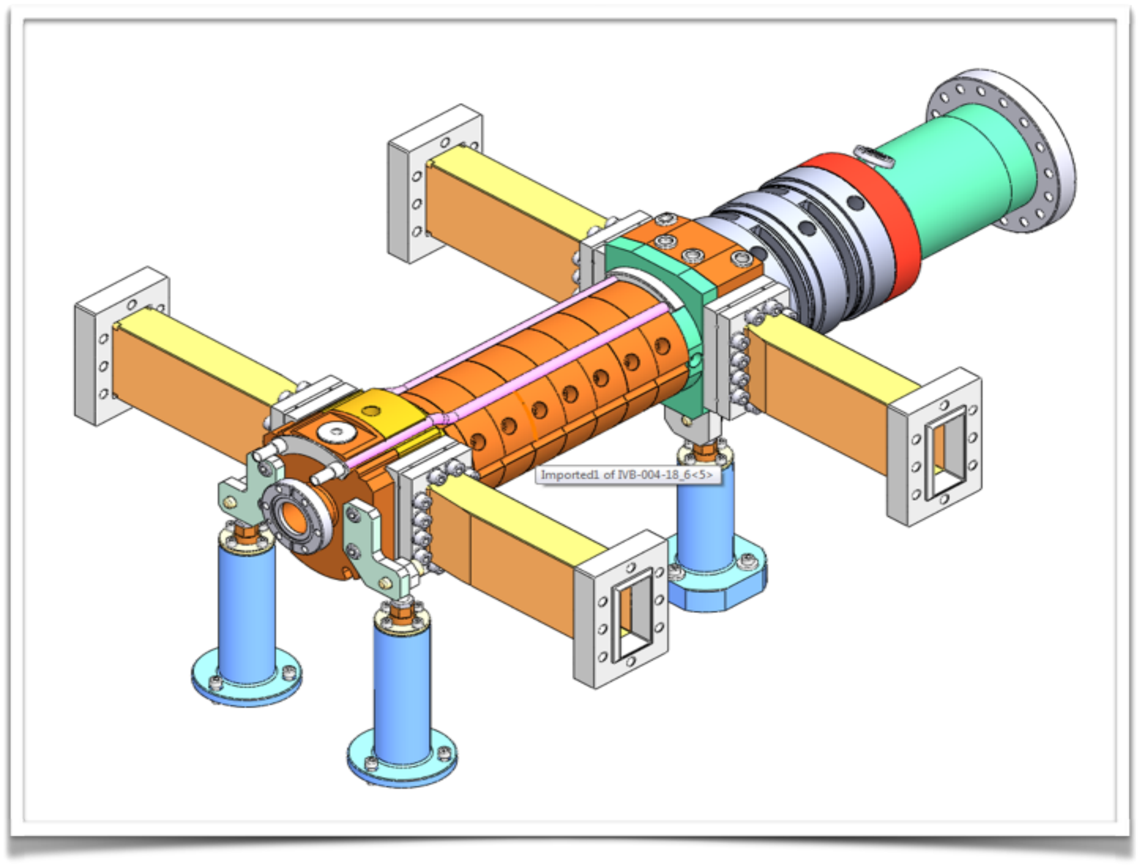
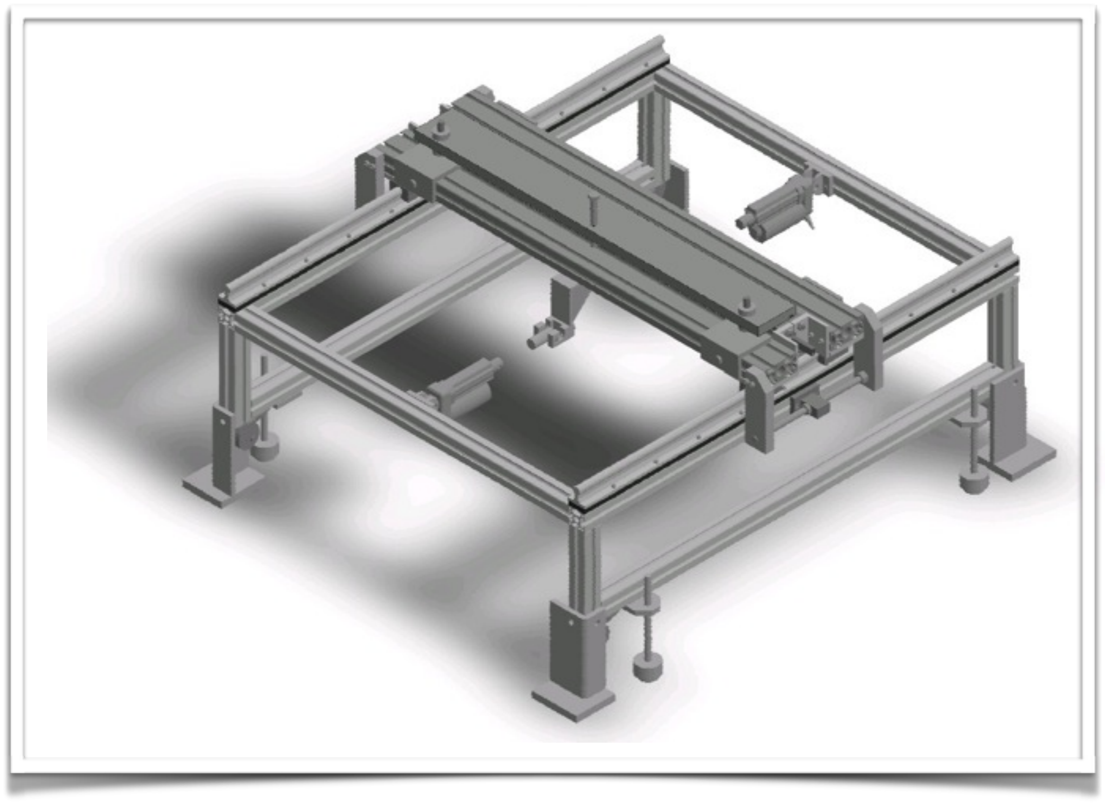
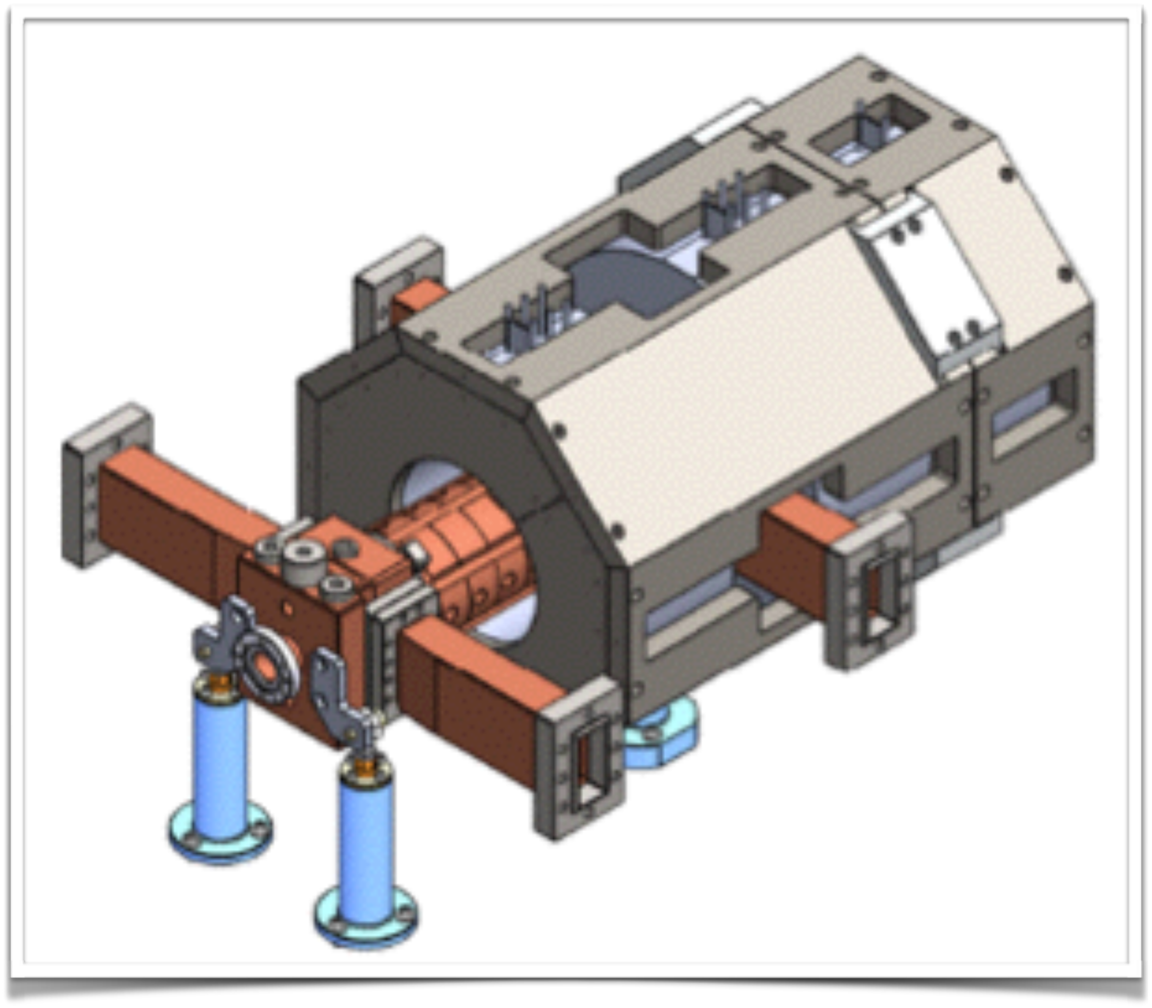
A THz FEL is being built in Ariel University. This project is a collaboration between Ariel University, and Tel Aviv University,. Upon completion it is intended to become a user facility. The FEL is based on a compact photo cathode gun (60 cm) that will generate an electron beam at energies of 4.5 - 6.5 MeV. The pulses are planed to be of 300 pico Coulomb for a single pulse, and of up to 1.5 nano Coulomb for a train of pulses. The FEL is designed to emit radiation between 1 and 5 THz. It is planned to operate in the super radiance regime. The configuration of the entire system will be presented, as well as theoretical and numerical results for the anticipated output of the FEL, which is in excess of 150 KW instantaneous power. The bunching of the electron bean will be achieved by mixing two laser beams on the photo-cathode. The compression of the beam will be achieved be introducing an energy chirp to the beam and passing it through a helical chicane. We plan on compressing the single pulse to less than 150 femto seconds. The status of the project at the time of the conference will be presented.

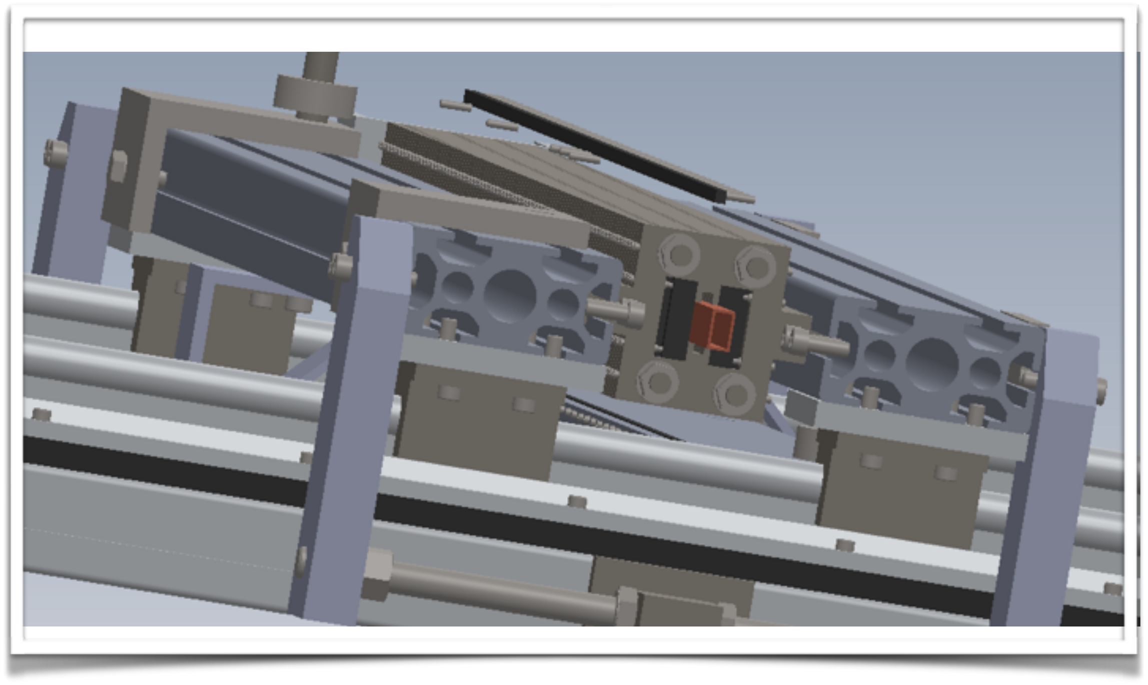






Parameter	Value
Pulses / Second	*100*
Electron pulse duration	*120 - 130 Femto Seconds*
Radiation pulse duration	*6.7 – 19.8 pSec*
Charge / Pulse	*300 Pico coulomb*
Radiation Wavelength	*0.3 – 0.1 mm*
Pulse instantaneous power	*55 – 175 kW*
Electron Beam Energy	*5.5 - 6.5 MeV*
Wiggler Period	*20 mm*





A. A single transverse mode (TE_{01}) simulations

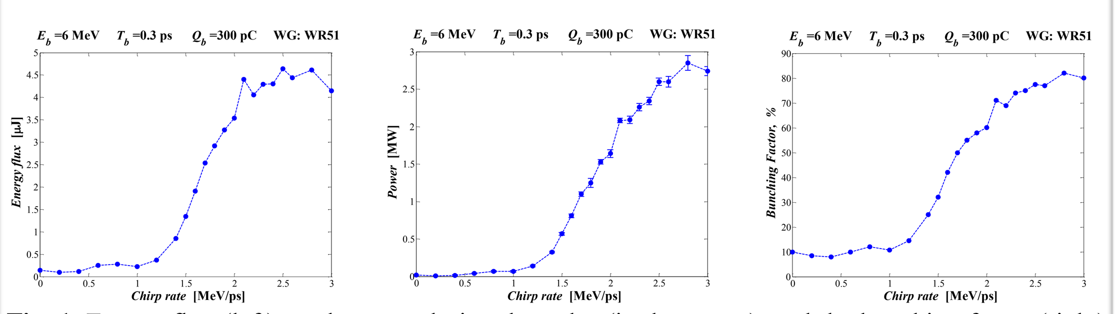


Fig. 1. Energy flux (left), peak power during the pulse (in the center), and the bunching factor (right) as functions of the chirp rate. For 0.3ps e-beam pulse duration, each 1 MeV/ps of chirp rate corresponds to 300keV maximum difference of the electrons' energies.

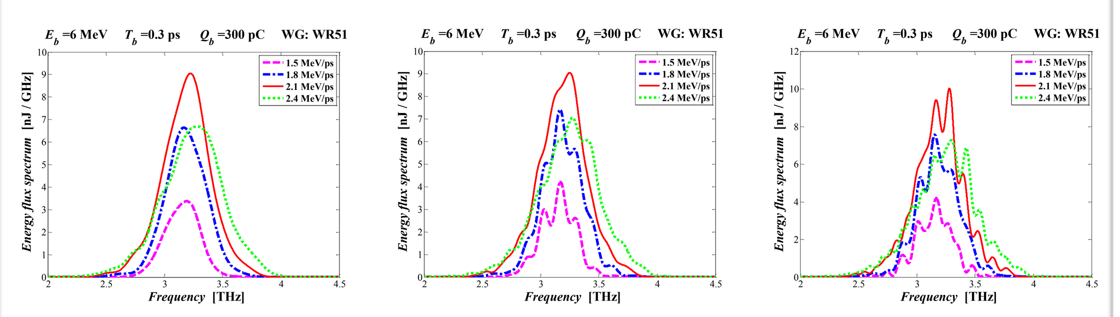


Fig. 2. Spectrum of the radiation emitted after the first 20, 30 or 40 periods of the wiggler (the left, the center and the right pictures, respectively). An effective, enhanced coherent emission takes place at a first stage (first 20 periods) when a proper chirp rate is introduced (~2.1 MeV/ps), while incoherent, noisy radiation is present in the following