Genotoxic effects are one of the most interesting aspects in the risk assessment of human exposure to ionizing and non-ionizing electromagnetic radiation, due to the close correlation between DNA damage and cancer occurrence. Since lymphocytes are a well-known biological system playing a key role in the defense mechanisms and are easily obtainable from peripheral blood, they have been used as a biological model for studying potential genotoxic effects of THz radiation. Among the cytogenetic techniques allowing to test DNA damage at cellular and molecular level induced by various chemical and physical agents, the cytokinesis-block micronucleus technique (MN) is a very sensitive and simple indicator of chromosome damage, which also provides information on cell cycle progression.

To study the potential genotoxic effects of THz radiation, whole blood samples from healthy donors have been employed and for each donor three lymphocyte cultures have been set up: a control, an exposed sample (established with exposed blood) and a sham exposed sample (established with blood in the same lab where the exposure was performed). The millimetre-wave (mm-wave) radiation was generated by a Free Electron Lasers (FEL) available at ENEA. This source operates in the spectral range between 70 and 200 GHz with a maximum peak power of about 10 kW and a peculiar temporal structure of the pulses. After a brief description of the ENEA Compact FEL and of the THz beam delivery line, we report on the spectroscopic measurements performed to design the irradiation set-up, on the construction of the THz delivery system and on the irradiation protocol for the MN assay on human lymphocytes cultures.

Irradiation experiments were performed at frequencies in the range 120 – 140 GHz with a relative bandwidth of about 20 GHz. The results obtained so far indicate that the environmental conditions at the FEL laboratory do not influence the biological parameters investigated, as shown by comparing control and sham exposed cultures. They also indicate that, under the experimental conditions adopted, e.m. radiation in the range between 120 and 140 GHz does not affect micronucleus frequency and cell cycle kinetics in peripheral blood human lymphocytes, as shown by comparing sham exposed cultures with exposed ones.