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## Development and calibration of a Multi-Leaf Faraday Cup for the determination of the beam energy of a 50 MeV electron LINAC in real time

The Physikalisch-Technische Bundesanstalt (PTB), Germany's national primary standard laboratory, operates a custom-designed electron LINAC for the generation of high energy electron and photon radiation for research in the field of dosimetry for radiation therapy. The beam energy of this LINAC is variable in the range from 0.5 MeV up to 50 MeV.

The preparation of a beam at a LINAC is an optimization problem with several parameters. The energy of the beam depends simultaneously on several variable settings. All parameters which influence the RF power (as e.g. via the high voltage at the modulator) as well as the number of charged particles in a bunch to be accelerated (as e.g. via the gun emission) also change the energy of the beam.

To measure the beam energy during the preparation or optimization of the beam, a Multi-Leaf Faraday Cup (MLFC) was developed and installed instead of the beam dump at the end of the accelerator structure. This MLFC allows pulse-resolved measurement of beam energy and power in real time, so that the influence of the manipulated variables on the energy can be immediately assessed during beam optimization. This drastically shortens the time required to create a new setting (list of all parameters) for a new desired combination of beam energy and power.

The MLFC consists mainly of 128 electrically isolated Al plates where the thickness of the stack is sufficient to stop a 50 MeV electron beam. After each beam pulse, the charge collected by the individual Al plates is recorded sequentially. For this purpose, an electronic system based on inexpensive current integrators has been specially developed. The range of the electrons and thus the distribution of the charge on the Al plates depends on the energy.

The MLFC was calibrated with monoenergetic electron beams. The MLFC was attached to the output of a 180-degree magnetic spectrometer at the beam line. Several characteristics of the charge distribution measured by the MLFC were then recorded as a function of the known beam energy. The MLFC was then installed at the end of the accelerator structure. Using a computer program, the characteristics of the charge distribution recorded by the MLFC are now determined in real time and the corresponding energy resulting from the previously determined calibration function is displayed for each beam pulse.

In this work we show example data from the calibration and compare the features and capabilities of the current MLFC with 128 leaf with those of a previously self-developed MLFC with only 4 leaves.

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