

Nondestructive High-Accuracy Charge Measurement of the Pulses of a 27 MeV Electron Beam from a Linear Accelerator

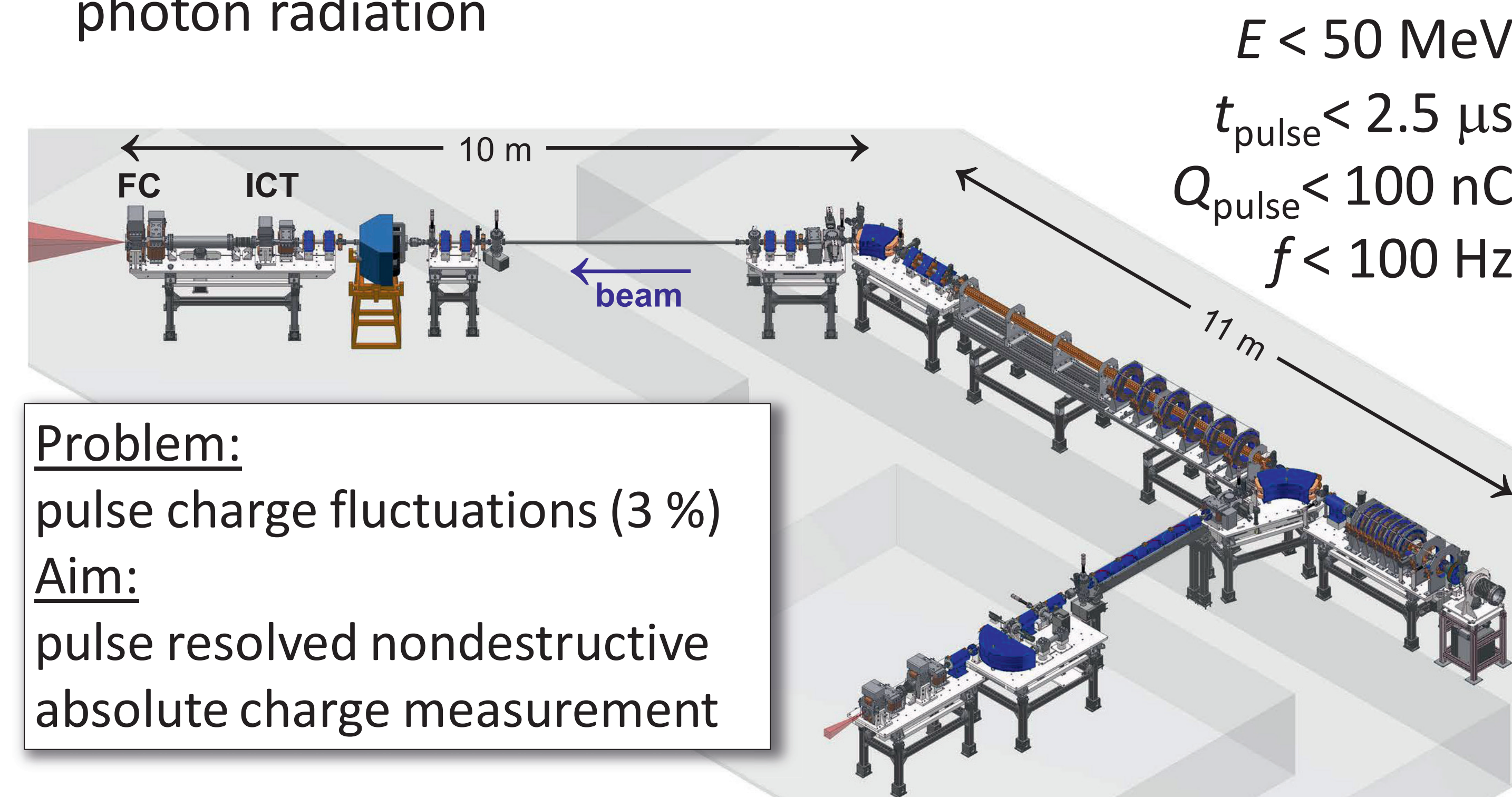
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Abstract

- non-intercepting absolute measurement of the charge of single beam pulses from a 0.5 to 50 MeV electron LINAC with high accuracy (relative uncertainty <0.1%)
- calibration of a Bergoz integrating current transformer (ICT) against a temporarily installed Faraday cup (FC)

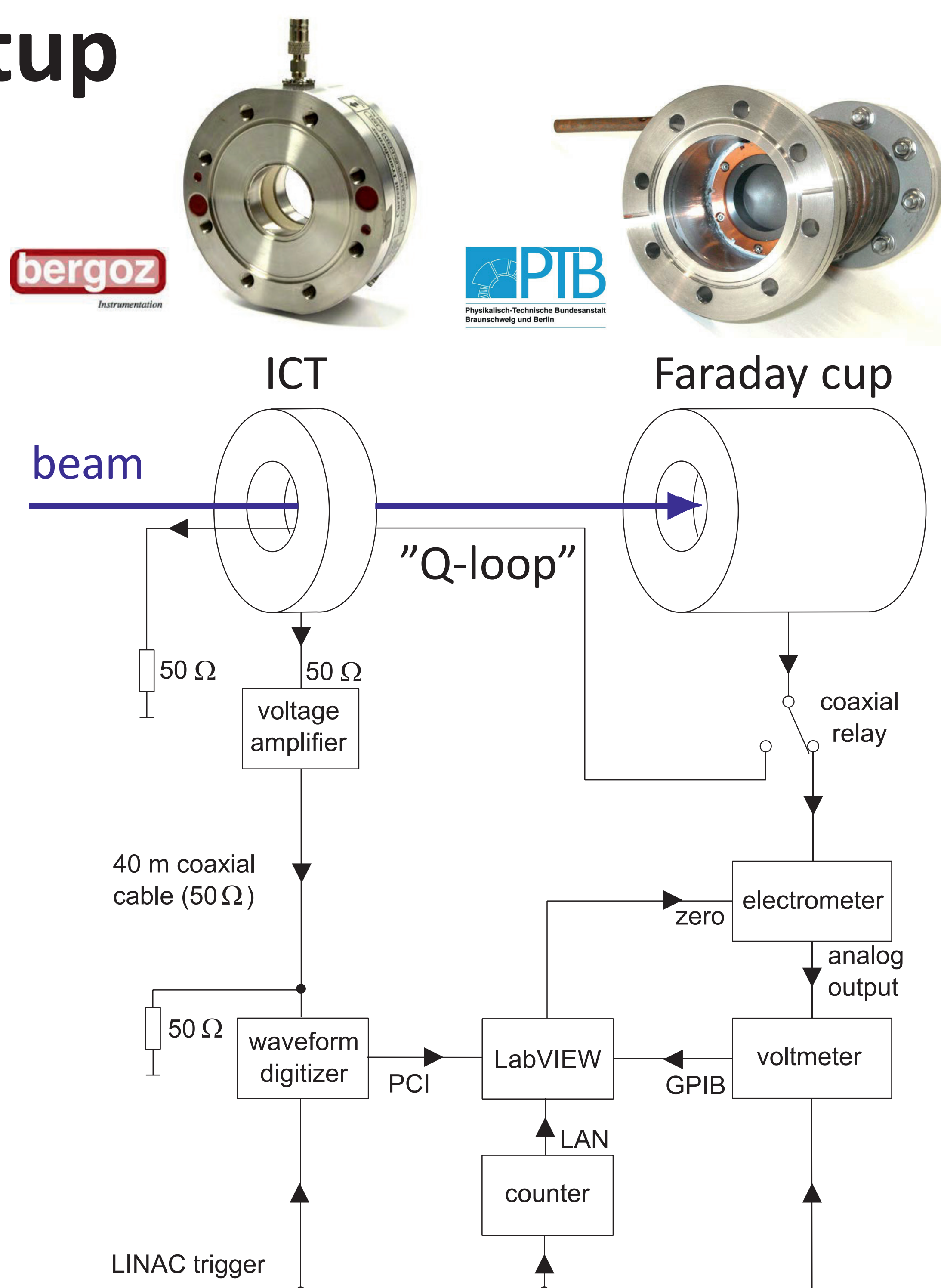
Purpose

- pulsed electron beam shot on a metal target for generation of bremsstrahlung
- crucial quantity: charge per beam pulse \rightarrow dose of photon radiation

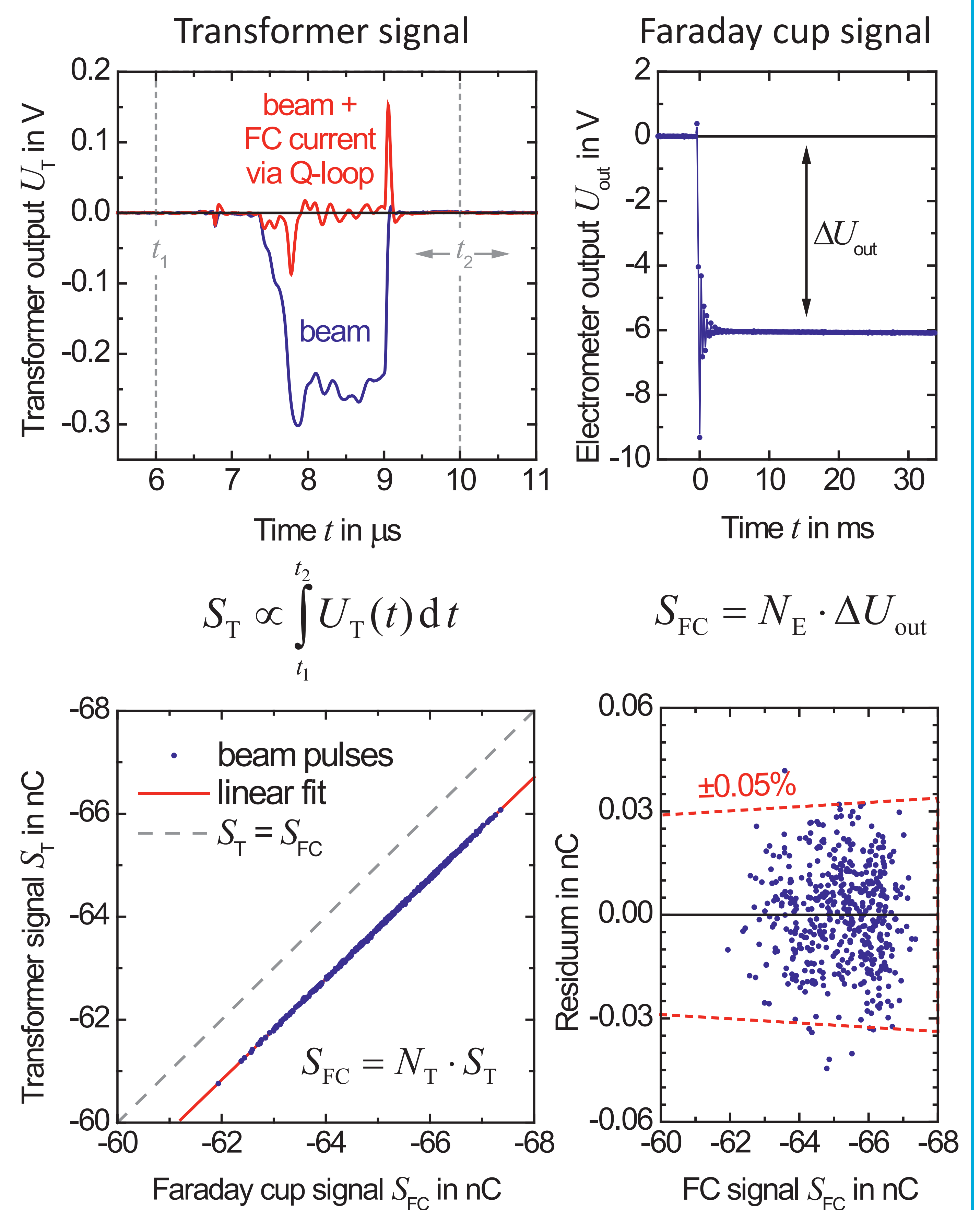


PTB's LINAC for research in dosimetry for radiation therapy

Setup

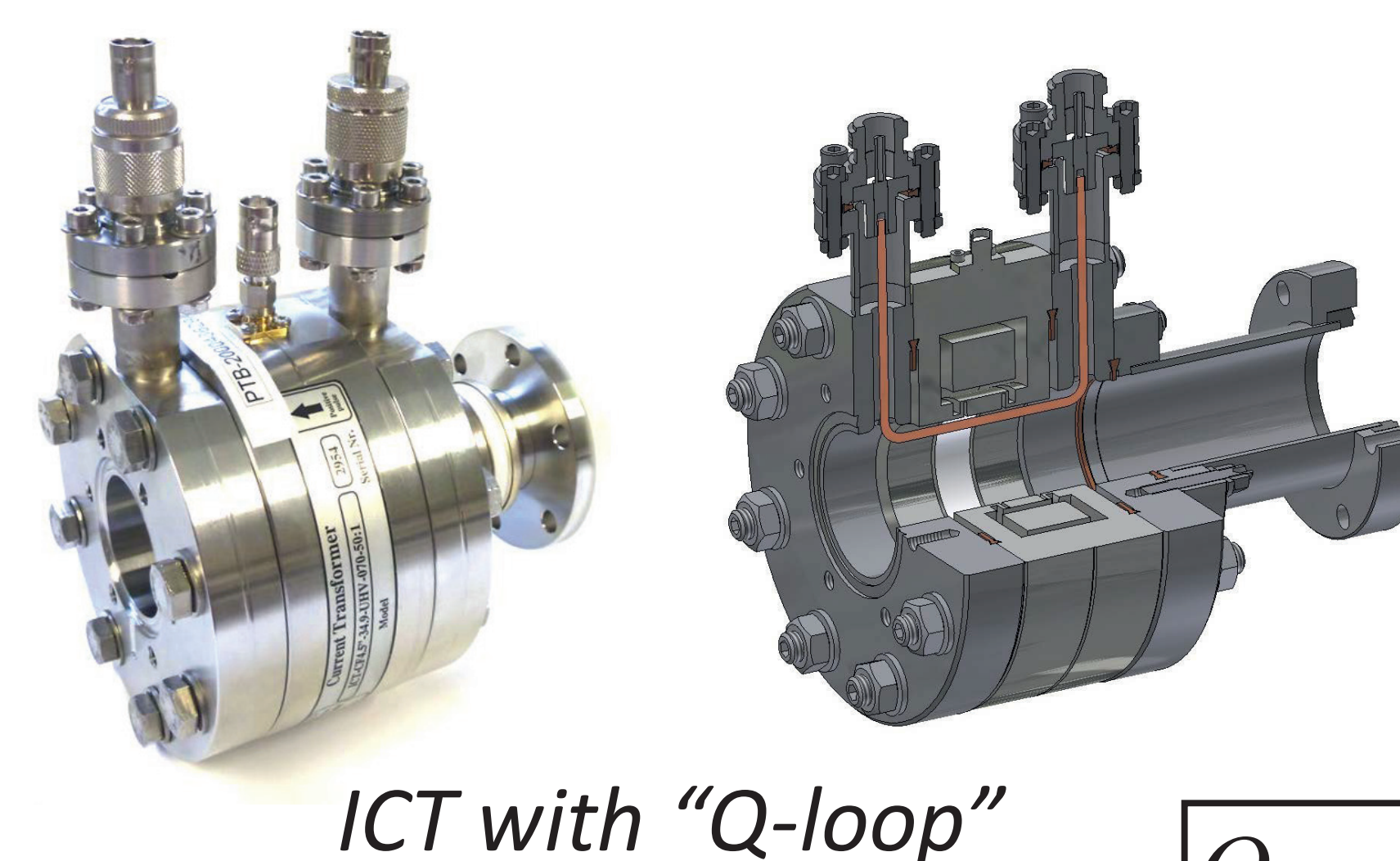


Calibration



Collection Efficiency

- from cancellation measurement as proposed by Pruitt, *Nucl. Instr. Meth.* 92 (1971) 285
- FC current returned through ICT via "Q-loop"



$$\eta = 1 - S_T^{\text{return}} / S_T$$

$$\eta(27 \text{ MeV}) = 0.9921$$

$$Q_{\text{pulse}} = S_{\text{FC}} / \eta = N_T \cdot S_T / \eta$$

Conclusion

- charge of each single beam pulse can be measured nondestructively with a relative uncertainty < 0.1%
- measurement traceable to PTB's primary standards