HZDR Seminar on

WEDNESDAY, March 10 at 10:00 CET

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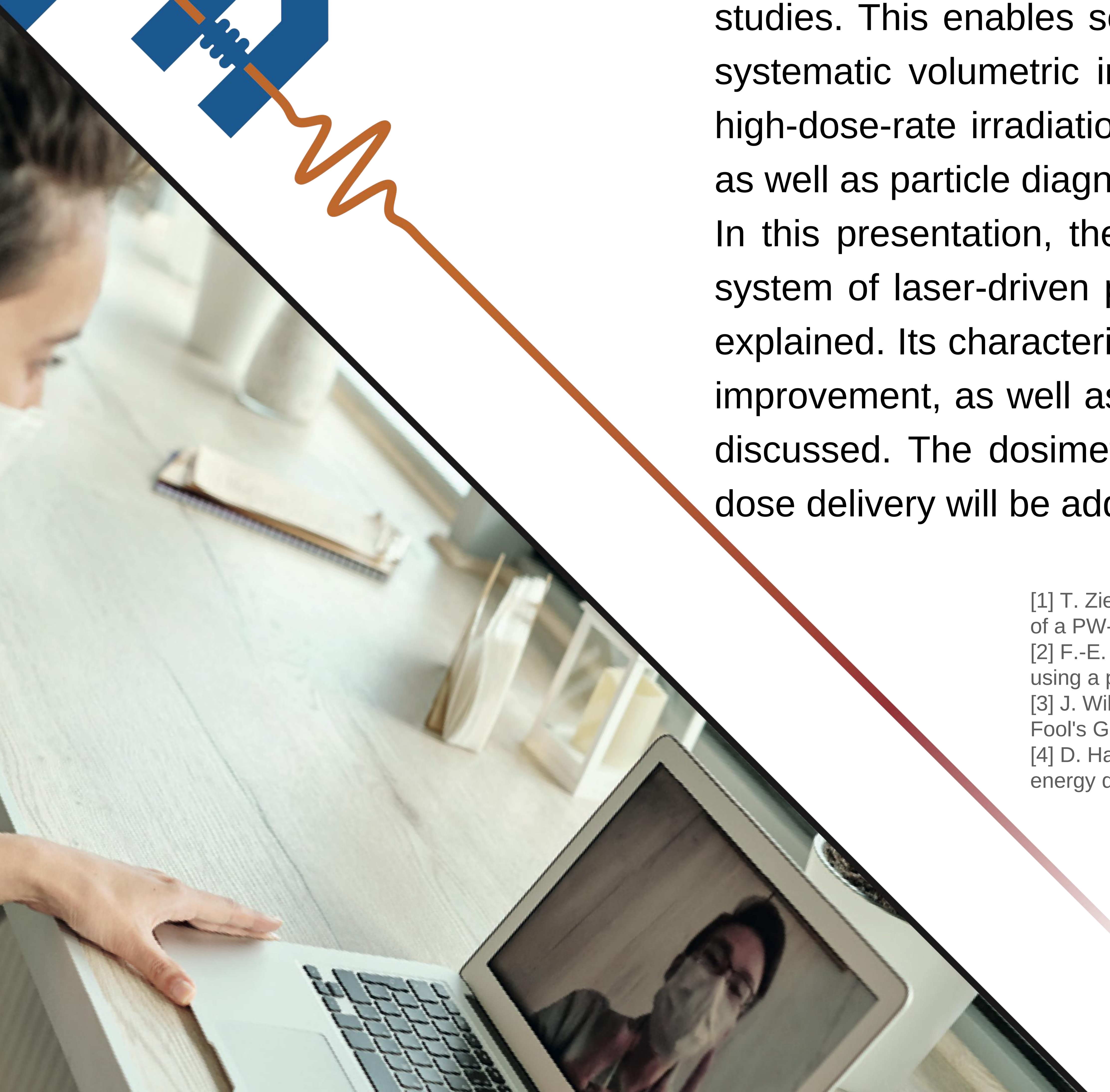
Fully characterized and online monitored beamline for high-dose-rate laser-proton irradiation experiments

Laser-driven proton pulses provide unique properties like ns pulse structure and instantaneous dose rate (10^9 Gy/s), but — inherently broadband and highly divergent — pose a challenge to established beamline concepts for application-adapted irradiation field formation, particularly for three-dimensional cases.

A highly efficient and tunable dual pulsed solenoid beamline was implemented at the Draco PW facility [1] to generate volumetric dose distributions tailored to specific applications [2]. This beamline setup is complemented by a complex detector suite for beam monitoring and dosimetry, adapted to the ultra-high dose rates, capable of %-level precision dose delivery to samples as required for systematic irradiation studies. This enables sophisticated experiments ranging from systematic volumetric in-vivo tumor irradiations to volumetric high-dose-rate irradiations in the proposed FLASH regime [3] as well as particle diagnostics commissioning [4].

In this presentation, the complex and versatile dose delivery system of laser-driven protons using pulsed solenoids will be explained. Its characterization, technological development and improvement, as well as recent experimental activities, will be discussed. The dosimetry suite as a vital part of the precise dose delivery will be addressed in more detail one week later.



[1] T. Ziegler, *et al.,* Proton beam quality enhancement by spectral phase control of a PW-class laser system, https://arxiv.org/abs/2007.11499 (2020)
[2] F.-E. Brack, *et al.*, Spectral and spatial shaping of laser-driven proton beams using a pulsed high-field magnet beamline, Scientific Reports, **10:9118**, (2020)
[3] J. Wilson, *et al.*, Ultra-High Dose Rate (FLASH) Radiotherapy: Silver Bullet or Fool's Gold?, Frontiers in Oncology, **9:1563**, (2020)
[4] D. Haffa, *et al*, I-BEAT: Ultrasonic method for online measurement of the energy distribution of a single ion bunch, Scientific Reports, **9:6714**, (2019)