Successful test of prototype XGM

Milestone M7.4
for EUCALL workpackage 7
Pulse Characterisation and Control (PUCCA)

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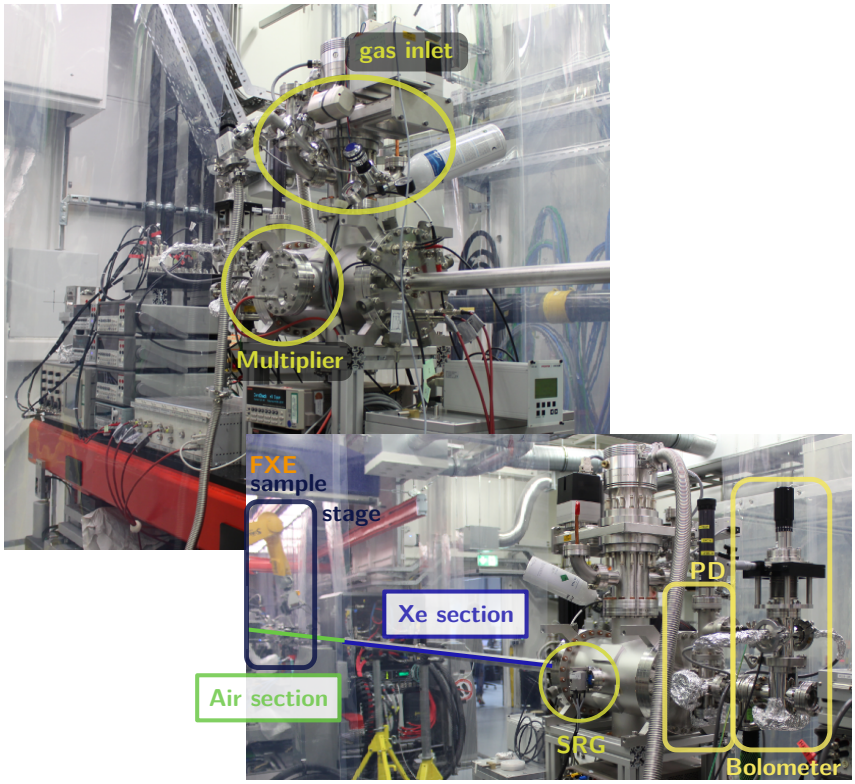

Figure 1: Set-up of the EUCALL XGM prototype at the Femtosecond X-Ray Experiment (FXE) of European XFEL at the end of the experimental hutch. From the FXE sample stage to the XGM the photons from the SASE1 undulator have to pass an air section to be able to place the Large Pixel Detector (LPD) into the beam path and a xenon section in front of the XGM. Behind the EUCALL XGM a set of calibrated photodiodes (PD) [1] provided by the Physikalisch Technische Bundesanstalt (PTB), Berlin, and a bolometer [2–4] from AIST as primary standard and photon dump was installed.

During the commissioning of the Femtosecond X-Ray Experiment (FXE) of European XFEL from July to November 2017 the intensity of the x-ray pulses have been measured on absolute scale using the EUCALL XGM prototype chamber and in addition a high temperature bolometer [2–4] provided by colleagues of PTB and AIST, Japan.

The correlation of the averaged beam intensity between the XGM and the bolometer as well as the pulse resolved capability of the XGM was verified. The new "Huge Aperture Multiplier" (HAMP) concept was tested and proved to be working.

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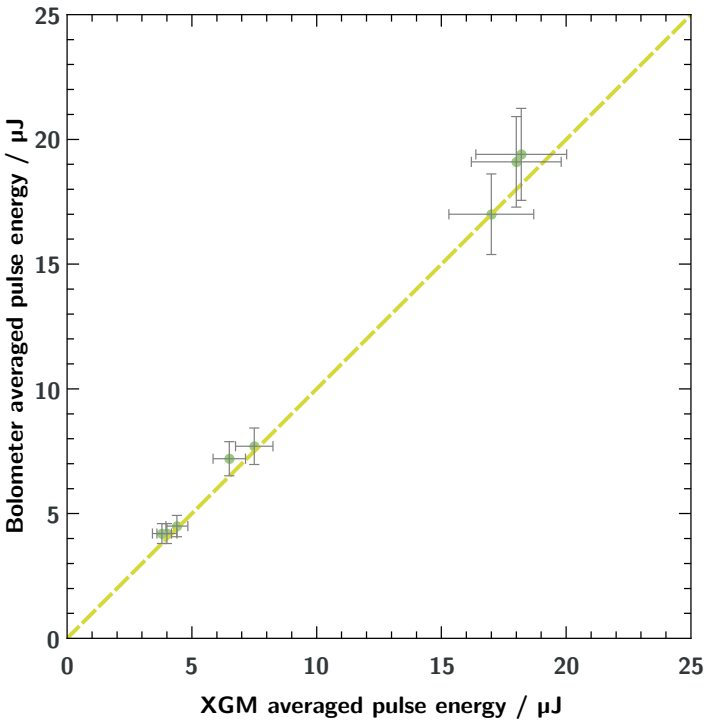

Figure 2: Calibration / corelation of the EUCALL XGM prototype with the bolometer primary standard [2–4].

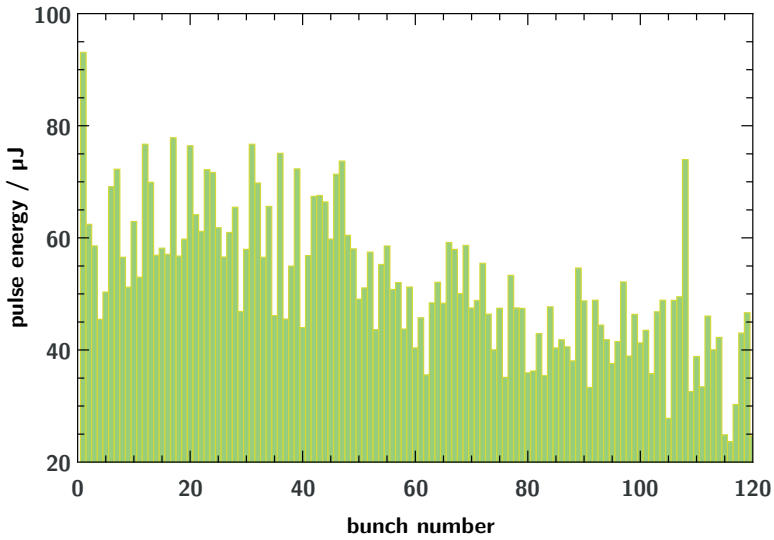

Figure 3: Bunch pattern of 120 pusles with their intensities on absolute scale as measured by the EUCALL XGM prototype.

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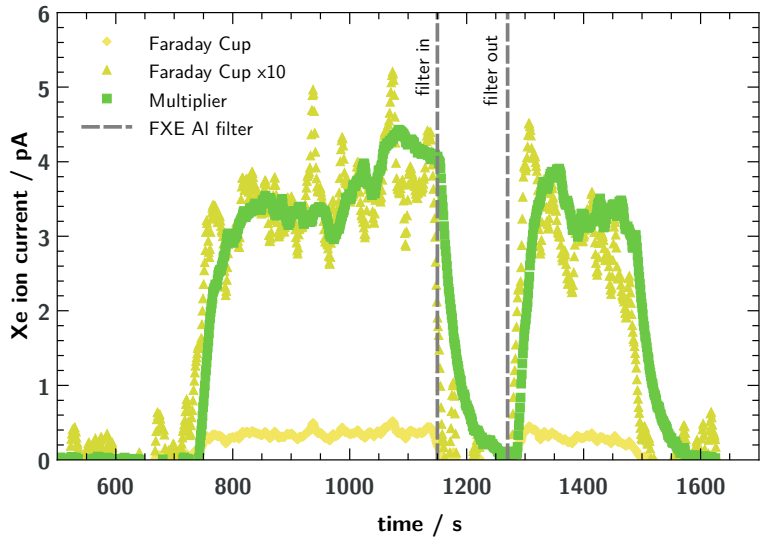

Figure 4: Demonstration of the HAMP concept of the EUCALL XGM prototype. The multiplier stage amplifies the weak signal and follows the primary ion current. Additional careful calibration of the multiplier is needed to obtain results on absolute scale.

References

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[2] T. Tanaka et al., Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment **659**, 528–530 (2011) 10.1016/j.nima.2011.08.039.

[3] T. Tanaka et al., Review of Scientific Instruments **86**, 093104 (2015) 10.1063/1.4929666.

[4] T. Tanaka et al., Metrologia **53**, 98 (2016) 10.1088/0026-1394/53/1/98.

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