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## **Real-time measurements of the RF-path of an electro-optical bunch arrival-time monitor with integrated planar pickup-structure with low-charge electron beams at ELBE**

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Ultra-low-charge operation of free-electron lasers down to 1 pC or even lower, requires adequate diagnostics for both, the users and the operators. For the electro-optical bunch-arrival time monitor a fundamental design update is necessary to yield single-digit fs precision with such low charges. In 2023 a vacuum sealed demonstrator for a novel pickup structure with integrated combination network on a printed circuit board was built for operation of the free-electron laser ELBE at HZDR. Together with a new low-pi-voltage ultra-wideband traveling wave electro-optical modulator, this concept reaches an estimated theoretical jitter charge product of 9 fs pC. As a proof-of-concept measurements done at ELBE with the pickup demonstrator were carried out: In this contribution we analyze the effects of the variation of different beam properties, e.g., charge and position.

### **Footnotes**

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