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Upgraded Bunch Arrival-Time Monitors for the European XFEL Reaching Below 3fs Time Resolution

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Free electron laser facilities, such as the European XFEL and FLASH, have increasingly high demands on the temporal stability of the electron bunches, as pump-probe experiments meanwhile aim for timing stabilities of few femtoseconds residual jitter only.
For a beambased feedback control of the linear accelerator, bunch arrival-time monitors are required that are capable of reaching measurement resolutions better than the stated timing stability goals.
We report on our electro-optical bunch arrival-time monitors now achieving a time resolution better than 3 fs.
This new level of precision is a first step towards the ultimate goal of reaching sub-femtosecond timing stability.
The system has also been upgraded to allow for multi-beam line operation with large variations of the bunch arrival times for the different pulse trains.
The characteristics of the bunch arrival-time monitor system and limitations of the state-of-the-art design will be discussed.

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