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**Supporting information for article:**

**Angular-split/temporal-delay approach to ultrafast protein  
dynamics at XFELs**

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Supplementary Movie S1. Simulated spectra of the dichromator. Power spectra from XFEL Photon Pulse Database are used for this simulation. The photon energy is around 4.96 keV and the SASE pulse duration is about 87 ps at 250 pC/bunch. The incident SASE spectrum is in gray. Due to the asymmetric gain in nonlinear regime, the SASE spectrum appears to be red-shifted to skew towards the low energy side (Schneidmiller and Yurkov, 2013). Similar SASE spectra have been measured near 8.3 keV (Amann et al., 2012; Makita et al., 2015; Zhu et al., 2012). Two components in red and blue of FWHM of 1 eV are selected by the dichromator. The energy dispersion between the split pulses is 5 eV or 0.1%. This simulation demonstrates that the total intensity of each split pulse fluctuates from shot to shot. So does the ratio between them. It is necessary to correct this unevenness for each image of split patterns. However, it would not occur frequently that one or both of the split pulses drop out completely, although a split pulse can be weak sometimes. The multimodal fine structure of each split pulse is confined within its narrow bandwidth of ~1 eV; and the energy dispersion between them remains constant, if the dichromator crystals are stationary. An angular split of  $0.97^\circ$  can be achieved using two diamond (220) crystals (Table 1).