

Measuring and Characterizing Ultrashort Bunches in the Jefferson Lab Free-Electron Laser*, G.A. KRAFFT, P. PIOT, J. SONG, TJNAF; U. HAPPEK, M. JAMES, University of Georgia - The characterization of ultrashort bunches is essential when dealing with free-electron laser driver accelerators. In such high-brightness accelerators, short bunch lengths are required to achieve the high peak current needed for high laser gain. Also, because of the high charge per bunch involved, the bunching process can potentially be altered via space-charge forces. In the high-power free-electron laser of Jefferson Lab, several methods are used simultaneously to monitor the longitudinal distribution. These methods include frequency-based devices that measure the bunch frequency spectrum detecting coherent transition radiation, and time-based methods such as zero-phasing or M_{55} transfer map measurements using the "time-of-flight technique". In this paper we discuss measurements performed with the different devices and compare them with numerical simulations. We also present results of parametric studies of these various devices versus the rf phase of different critical elements in the machine.

* Work performed under the auspices of the US DOE contract #DE-AC05-84ER40150, the office of Naval Research, The Commonwealth of Virginia, and the Laser Processing Consortium.