

Sub-FS Resolution with the Enhanced Operation of the X-band Transverse Deflecting Cavity using an RF pulse compression SLED Cavity

P.Krejcik, G.B. Bowden, S. Condamoor, Y. Ding, V.A. Dolgashev, J.P. Eichner, M.A. Franzi, A.A. Haase, J.R. Lewandowski, T. Maxwell, S.G. Tantawi, J.W. Wang, L. Xiao, C. Xu

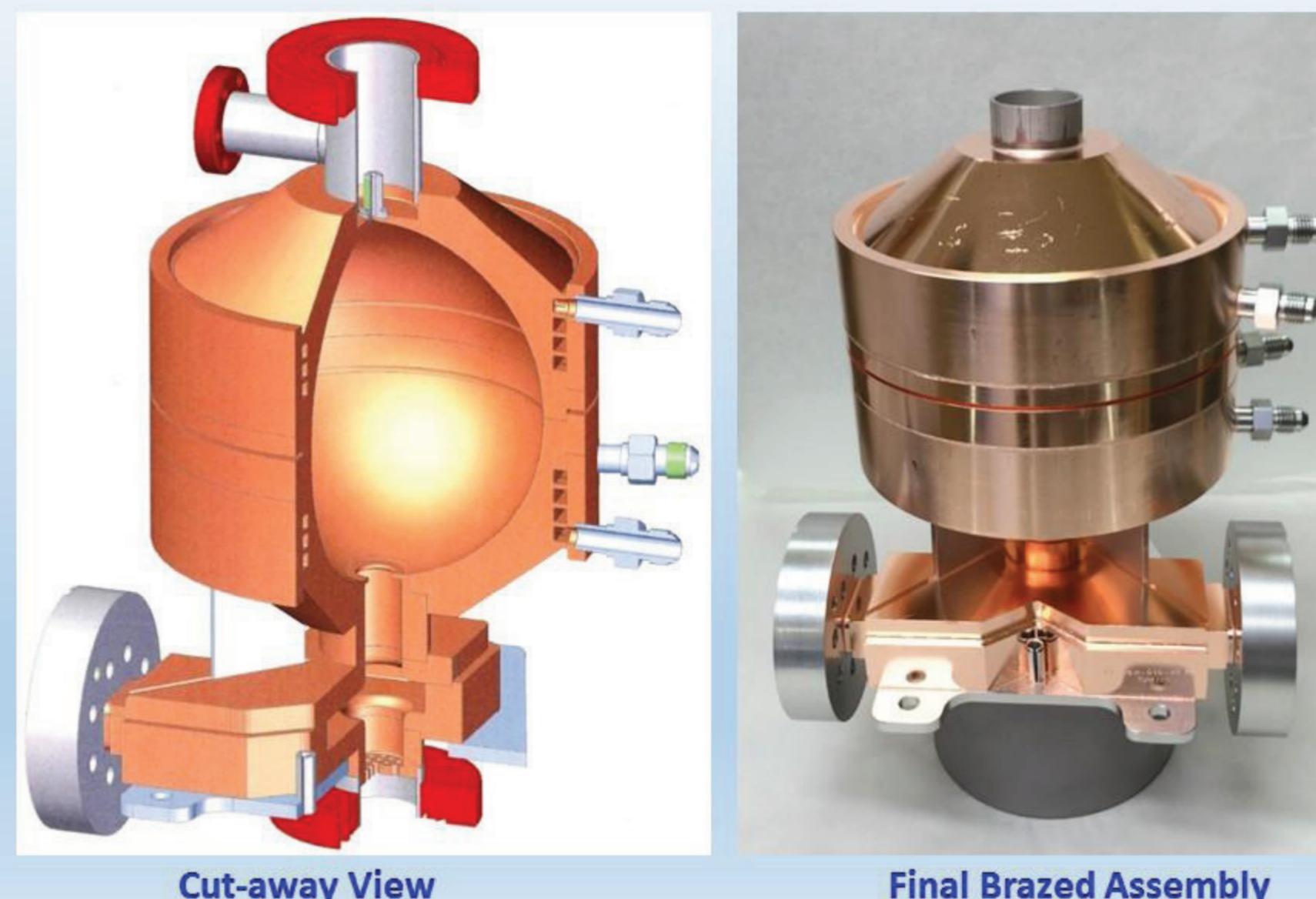
SLAC National Accelerator Laboratory, Menlo Park, California.

Abstract

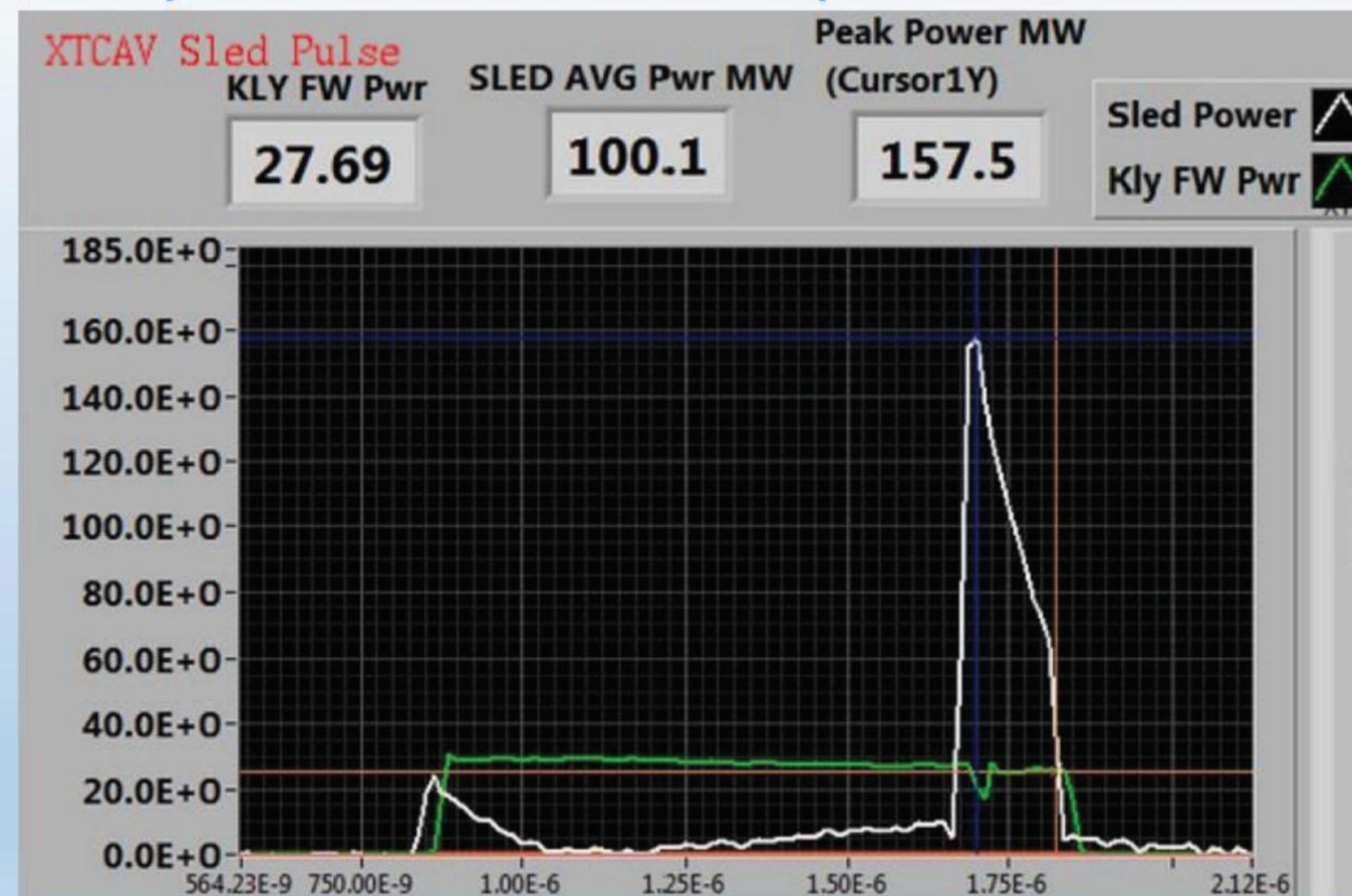
The successful operation of the x-band transverse deflecting cavity (XTCAV) installed downstream of the LCLS undulator has been further enhanced by the recent addition of an RF pulse compression "SLED" cavity that doubles the temporal resolving power of this powerful diagnostic system for measurement of the longitudinal profile of both the electron bunch and the x-ray FEL pulse. RF pulse compression has allowed us to use the existing SLAC X-band klystron with nominal output power of 50 MW and extend the RF pulse length by a factor 4 to give us 4 times the peak power after compression. A new, innovative SLED cavity was designed and built at SLAC to operate efficiently at X-band (1). The elegant design uses a small spherical cavity combined with a polarizing mode coupler hybrid. We report on the installation, commissioning and beam measurements demonstrating the sub-femtosecond resolution of the XTCAV system.

1. J.W. Wang et.al., "R&D of a Super-compact SLED System at SLAC", in Proc. 7th International Particle Accelerator Conference (IPAC'16), Busan, Korea, May 2016, paper MOOC01, pp. 39-41, ISBN: 978-3-95450-147-2.

X-band SLED Cavity & Coupler Assembly
- Designed by Juwen Wang

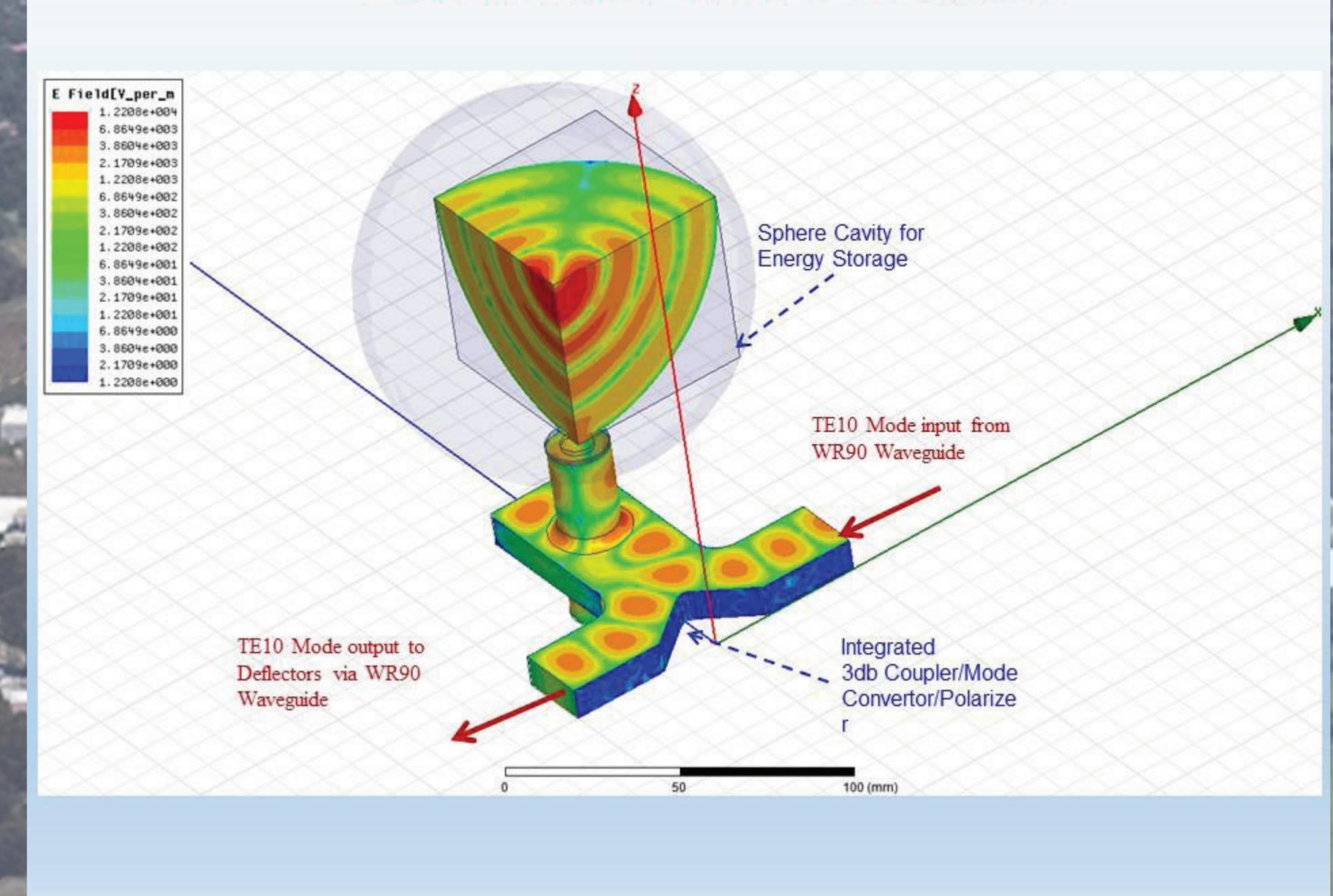


Klystron and SLED output Waveforms

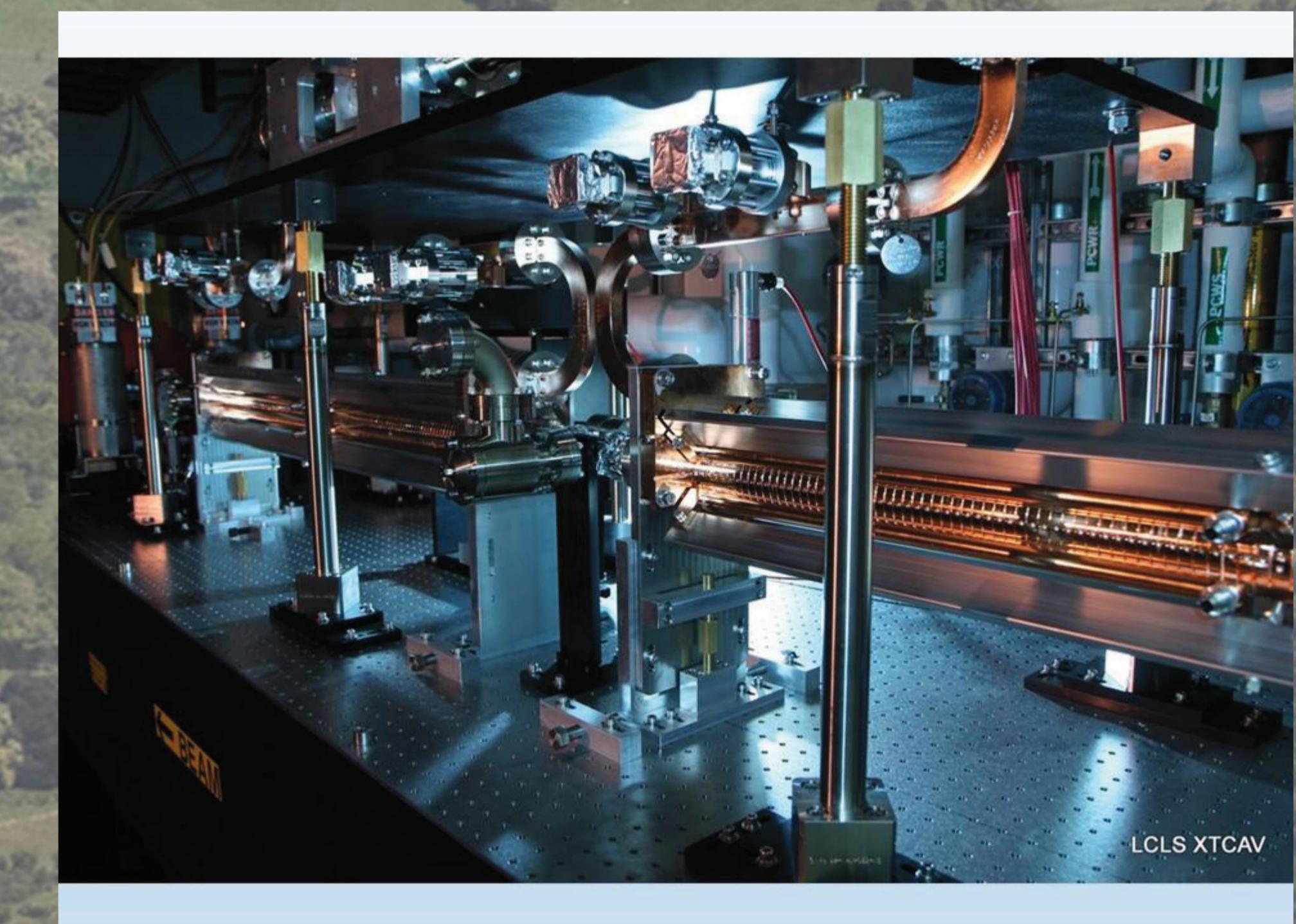
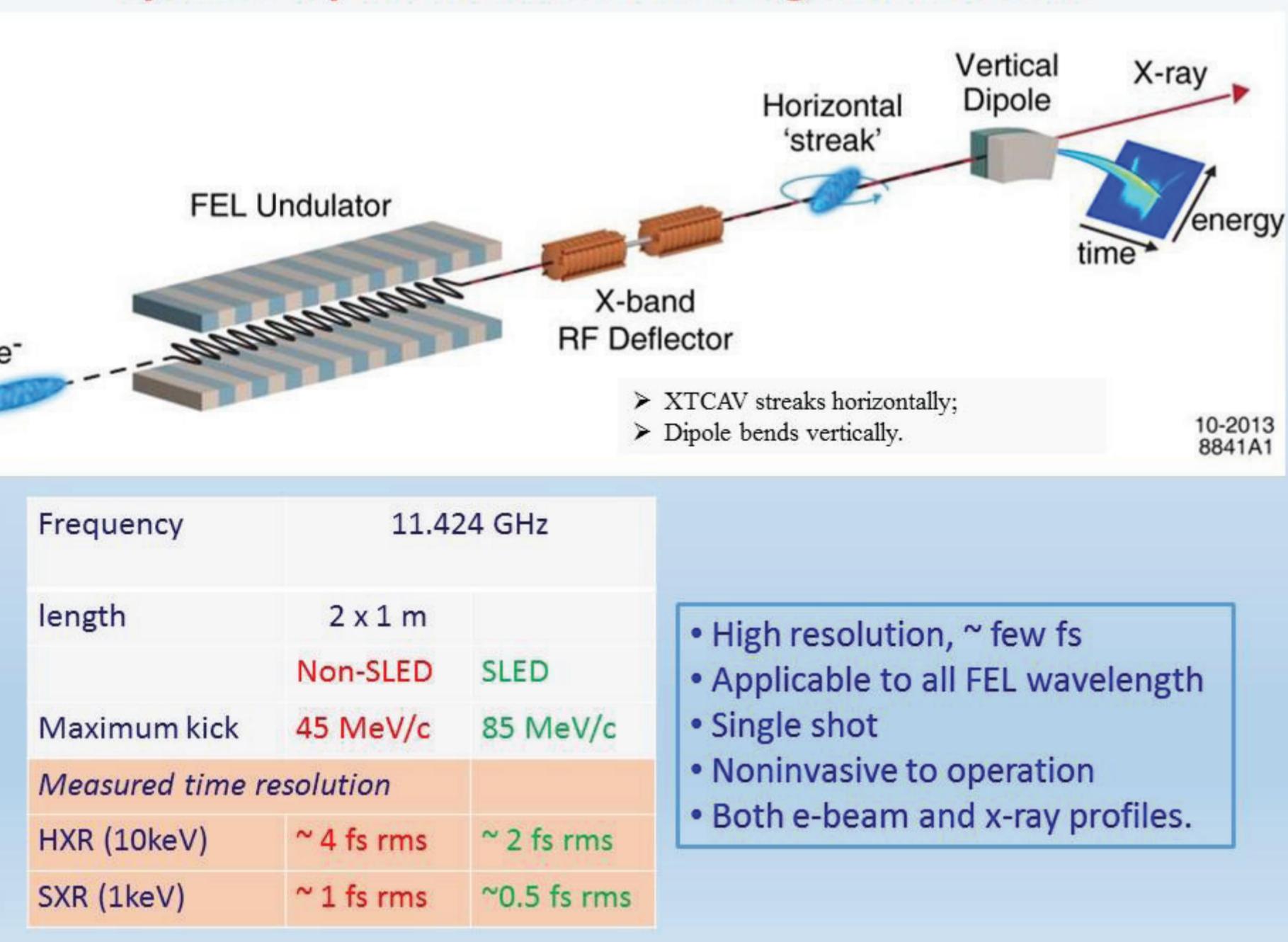


RF pulse compression raises pulse power by factor ~ 4

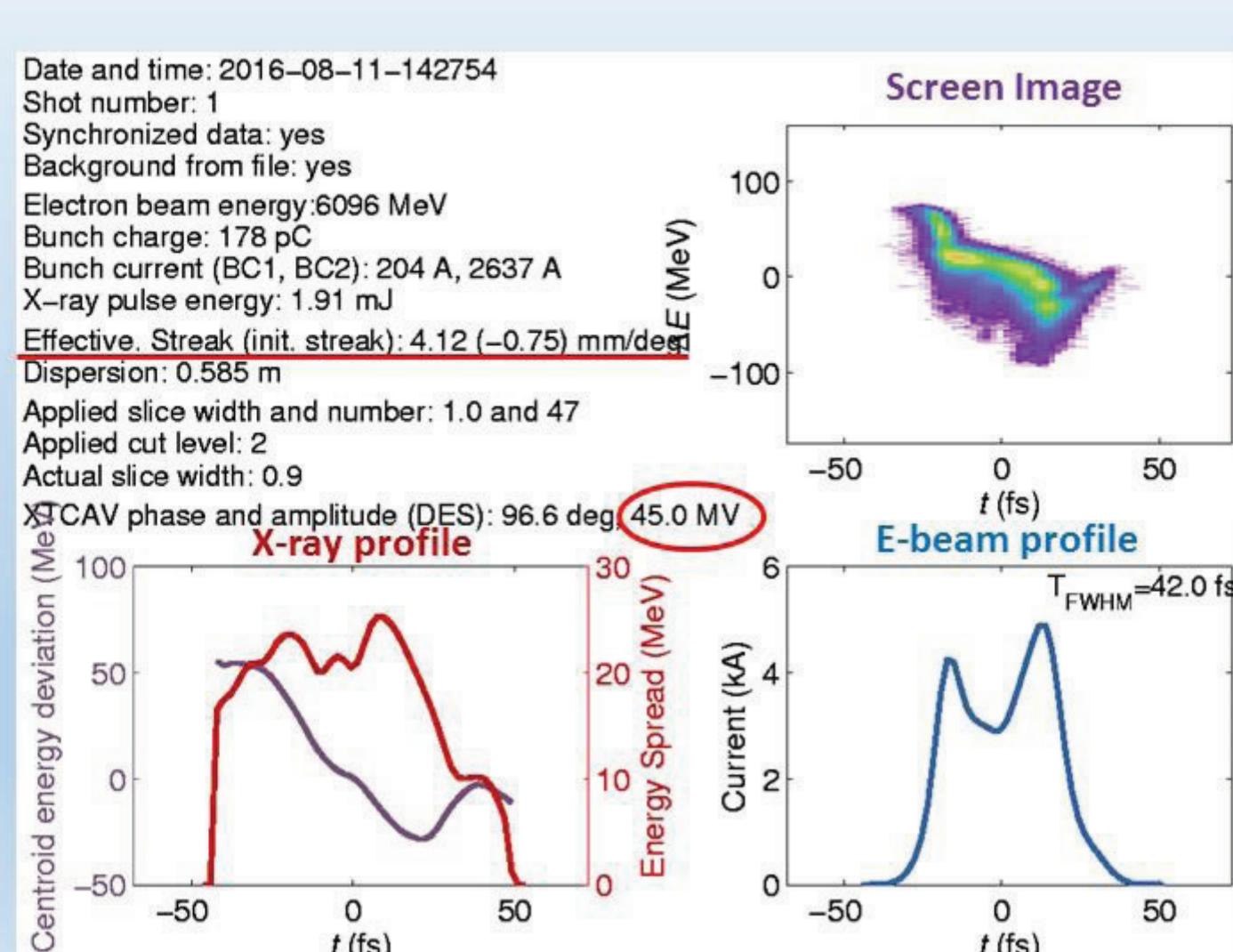
Mode Animation of the SLED System



System Layout for Deflector Diagnostic at LCLS



Beam Streaking Results
low resolution non-SLED mode



Beam Streaking Results
high resolution SLED mode

