Enhanced accuracy of x-ray spectra reconstruction from filtered diode array measurements, by adding a time integrated transmission grating spectrometer

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A new approach for the spectral reconstruction of time-dependent emission of soft x-ray sources based on the measurement of filtered x-ray diode (XRD) array systems is suggested. The methods use the XRDs measurement together with a co-aligned, time-integrated, spectrally resolved measurement. Two reconstruction methods, based on this approach, are demonstrated using both simulated and measured data. The experimental demonstration used a six XRD array, co-aligned with a transmission grating spectrometer (TGS). Acquiring both: low spectral resolution time resolved, and higher spectral resolution time integrated measurements, respectively. The additional experimental information allows for high accuracy spectral reconstruction, even for plasmas far from local thermodynamic equilibrium (LTE) where the traditional reconstruction methods may miss some important source spectral features. For the new reconstruction methods accuracy is improved to: better than 10% for the energy dependent flux, and 1% of total flux, which is higher than the accuracy of previous methods.[1] In this work we will describe the new methods used to reconstruct the time dependent spectrum, and the experimental system developed for their validation.

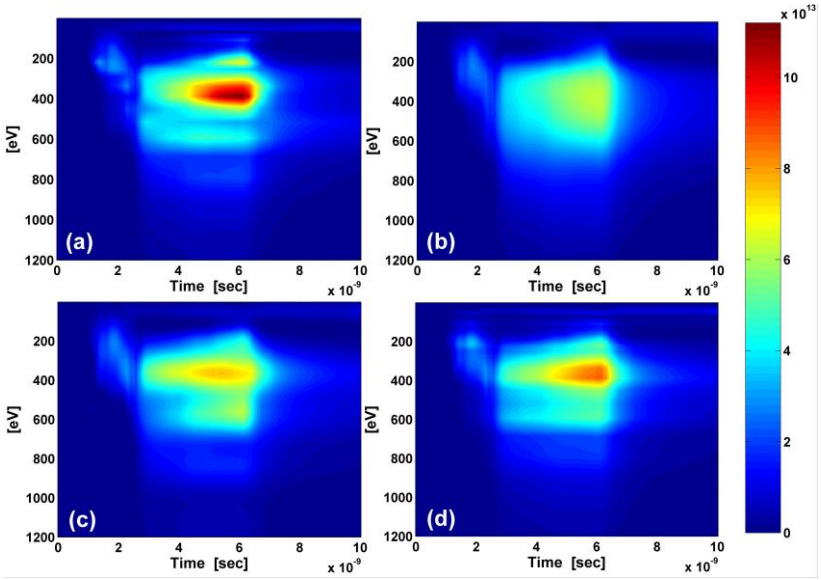

Figure 1: (a) Time-dependent simulated spectra of emission, in W/eV/m^2, from the interaction of a 6 ns laser pulse at 0.8x10^{14} W/cm^2 with a solid gold foil. The reconstructed spectra based on different methods: (b) standard Matrix method, (c) enhanced Matrix method using integrated spectrum, (d) Interpolation method using integrated spectrum.[1]

References

[1] Y. Ehrlich, and Z. Shpilman et al. accepted for publication by Review of Scientific Instruments.