



Contribution ID: 2176 Contribution code: TUPL084

Type: **Poster Presentation**

Analysis of monochromatic properties of crystals under transient thermal loading

Tuesday, 9 May 2023 16:30 (2 hours)

The self-seeded free-electron laser (FEL) is developing towards advanced FEL modes such as ultra-short pulse, multi-color and high intensity, and the influence of thermal loading instantaneously loaded on monochromatic elements will not be ignored. Therefore, it is necessary to quantitatively describe the changes in X-ray optical properties of crystals caused by transient thermal loading through an analytical model. In this paper, a method for transient thermal-optical analytical modeling and simulation is introduced. Based on this method, we analyzed the deformation of the monochromator in an ultra-short time scale, and calculated the influence of the FEL pulse on the monochromatic signal generated by forward Bragg diffraction with different pulse duration and two-pulse. This work is significant to the future research of self-seeded FEL in ultrafast and two-color direction.

Funding Agency

Footnotes

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Session Classification: Tuesday Poster Session

Track Classification: MC2: Photon Sources and Electron Accelerators: MC2.A06: Free Electron Lasers