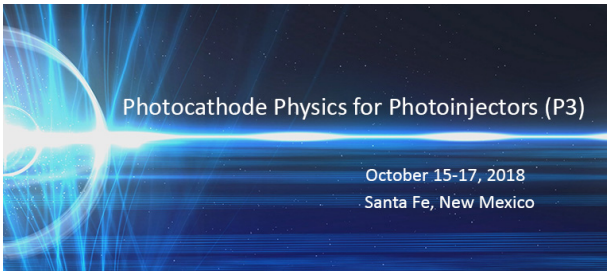

Contribution ID: **67** Type: **not specified**

The Modeling of Delayed Photo-Emission Processes in PIC Codes

Wednesday 17 October 2018 11:35 (20 minutes)

The high quantum efficiency of modern cesiated Semiconductor photocathodes is a consequence of the deeper penetration depth of the drive laser, a smaller (or absent) surface barrier, and - critically - the tendency of the dominant scattering mechanism during electron transport to the surface to be less effective at draining the initial energy of the photoexcited electron. As a consequence, a time delay exists between when groups of electrons are photoexcited and when they are emitted. The present work develops a theoretical model that divides the photoexcited electrons into an unscattered ("Shell") and scattered ("Sphere") groups and evaluates the delayed emission characteristics for each. The emission algorithms are incorporated into Particle tracking codes (Particle-in-Cell and meshless codes) that are able to characterize the consequences of delayed emission on current oscillations, emittance growth, space charge effects, and off-peak emission. These effects are increasingly important when the pulse width of the drive laser is very short and the active cathode region very small, as for x-ray Free Electron Lasers. Lastly, complications to the emission model due to surface roughness effects, and emission delays due to electrons with a few to many scattering interactions, are generalizations of the methodologies under development for which the interaction with space charge forces is particularly acute and consequential, but for which any prediction of effects must be obtained through simulation. The development of a predictive time-dependent photoemission model incorporating non-prompt emission effects and submicron geometric effects, the development of an emission library for use by third party codes, and its insertion into an advanced beam optics codes such as the MICHELLE code is presented.

Presenter: Dr PETILLO, John

Session Classification: Session 10

Track Classification: Session 10: Theory and Computation - continued