Applications of amorphous track structure models for correction of ionization quenching in organic scintillators exposed to ion beams

The scintillation response of organic plastic scintillators irradiated with heavy ions is investigated with the open-source code ExcitonQuenching. The software relies on amorphous track structure theory to account for the radial energy deposition by secondary electrons (EDSE) in ion tracks. The kinematic Blanc model is applied to evaluate the ionization quenching for a given ion by taking the decay time, light yield, and density of the scintillator into account.

ExcitonQuenching predicts the scintillation response without a priori knowledge of any measured response curves in contrast to other EDSE models, such as the correction method due to Birks, which rely on free fitting parameters for each ion. ExcitonQuenching is validated against published measurements of the Pilot-U scintillator exposed to several ions. The agreement with experimental data is between 5% and 9% for ions with atomic number but deviates significantly for heavier ions.