



Space Charge Implementation

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Overview of Space Charge Service

- Required LArSoft branches:
 - LArEvt: feature/herogers_voxelizedSCE
 - Space charge service
 - LArReco: feature/herogers_dxSCE_calibrationCorrection
 - Spatial calibration correction to calorimetry
- Related uboonecode branches:
 - uBEvt: feature/herogers_voxelizedSCE
 - Space charge service
 - uBAAna: feature/herogers_dESCE_calibrationCorrection
 - E-field calibration correction to calorimetry
- Related dunetpc branch:
 - dunetpc: feature/herogers_voxelizedSCE
 - Space charge service and E-field calibration correction to calorimetry
- icaruscode implementation has not been done yet

Overview of changes to LArEvt

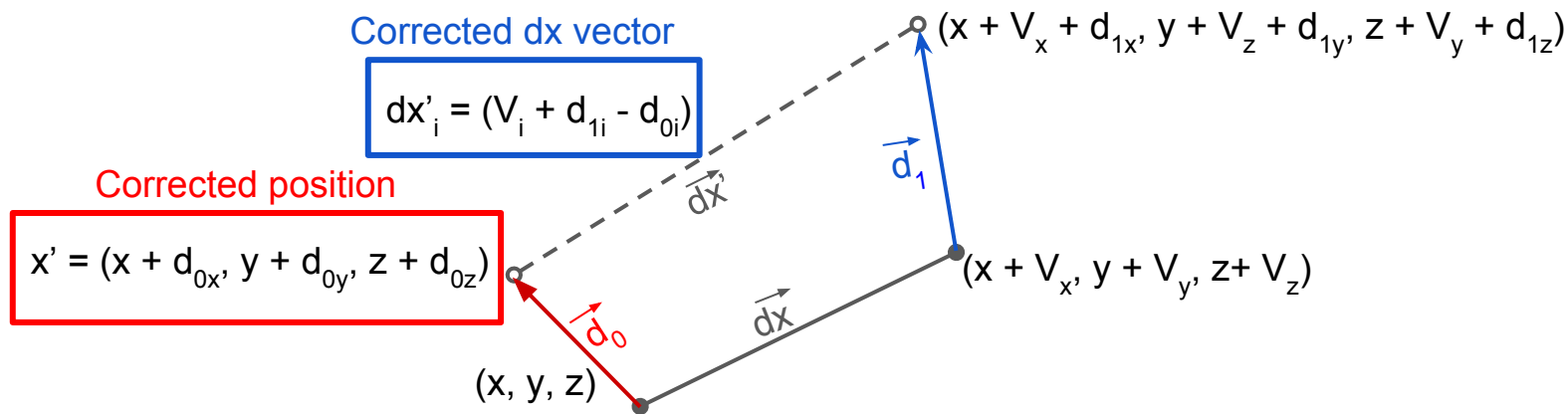
- SpaceCharge/SpaceCharge.h
 - Added four virtual functions: EnableCalSpatialSCE(), EnableCalEfieldSCE(), GetCalOffsetsSpatial(), GetCalOffsetsEfield()
- SpaceCharge/SpaceChargeStandard.h and SpaceCharge/SpaceChargeStandard.cxx
 - Read in two new fcl parameters: EnableCalSpatialSCE, EnableCalEfieldSCE
 - Override Enable...() functions to return value of corresponding fcl parameters
 - Override GetCalOffsets..() functions to return {0., 0., 0.}

Impact to experiments

- MicroBooNE
 - A preliminary version of the ubevt code exists that does not override the larevt functions
 - uboonecode must (and will be) updated with the most recent ubevt version that does override
- DUNE
 - The necessary changes are ready to go on a feature branch of dunetpc
- Others
 - Will need to add *services.SpaceCharge.EnableCalSpatialSCE: false* and *services.SpaceCharge.EnableCalEfieldSCE: false* to reco fcl files?
 - I think these are option fcl parameters
 - I will eventually add same space charge updates to icaruscode
- Changes have been validated using uboonecode and dunetpc

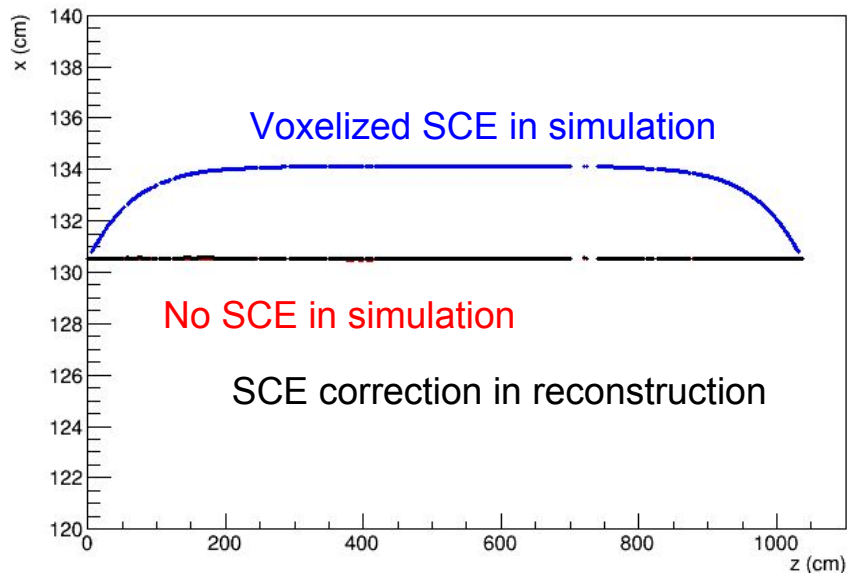
Overview of changes to LArReco

- larreco/Calorimetry/Calorimetry_module.cc
 - Added new fcl parameter: EnableSCE
 - Allows correction to be enabled/disabled separate from the space charge service
 - If *EnableSCE: true* and *services.SpaceCharge.EnableCalSpatialSCE: true*, position vectors (pitch) are spatially corrected
- Impact to experiments: new fcl parameter *EnableSCE*
 - Validated using ubooncode and dunetpc

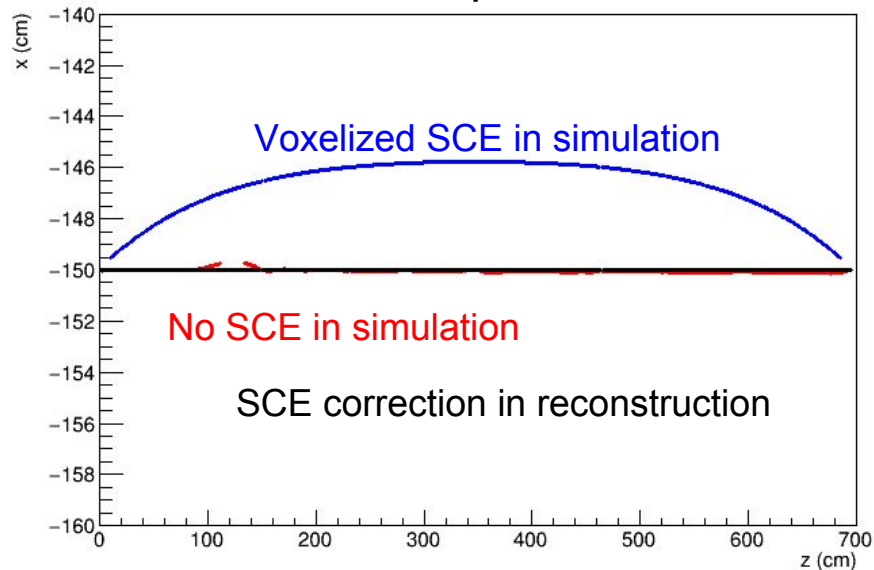


Example validations

uboonecode:



dunetpc:



Conclusion

- Proposed LArSoft branches:
 - LArEvt: feature/herogers_voxelizedSCE
 - LArReco: feature/herogers_dxSCE_calibrationCorrection
- Possible breaking change
 - New fcl parameters:
 - In space charge service: EnableCalSpatialSCE, EnableCalEfieldSCE
 - In calorimetry module: EnableSCE
 - uboonecode function overrides