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Sandia National Laboratories

EMPIRE AND GAZEL VALIDATION WITH RKA AND SPHINX GAS CELL ELECTRON BEAM PROPAGATION EXPERIMENTS

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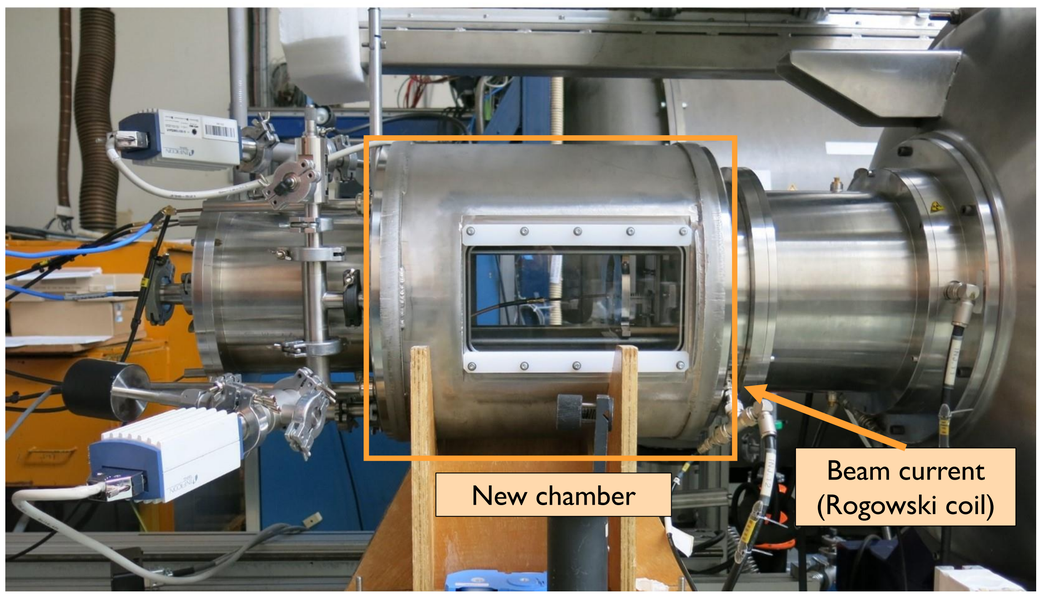
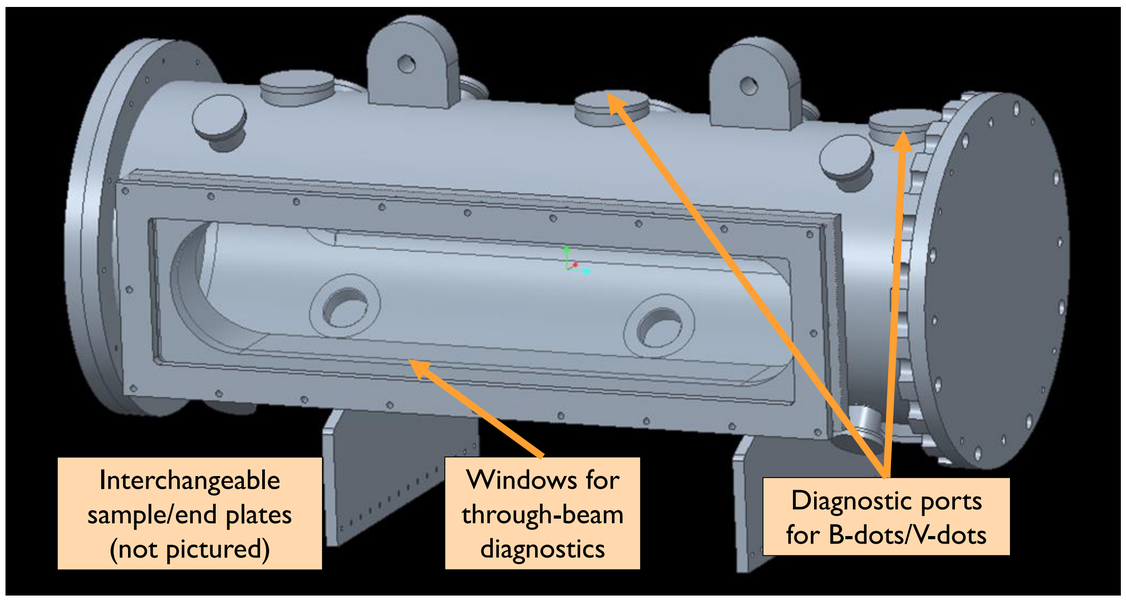
The goal of this joint open effort between CEA and SNL is to validate high energy beam transport through a background gas for new plasma physics codes at the two labs utilizing pulsed power experimental platforms. Part of this effort includes benchmarking between EMPIRE and GAZEL. New gas cells have been commissioned to enable additional diagnostic capabilities.

RKA

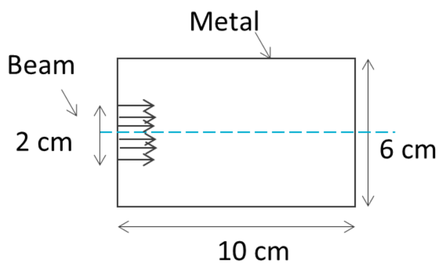


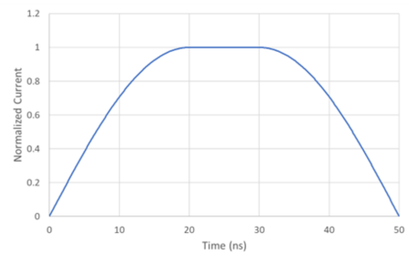
SPHINX

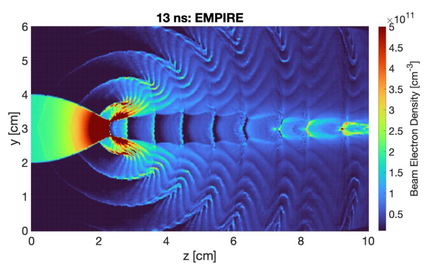


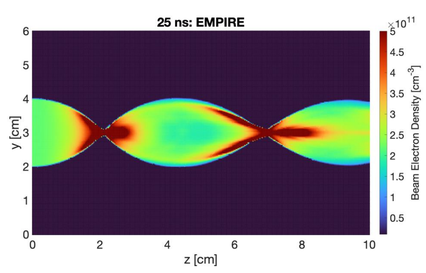
GAZEL & EMPIRE: Beam-in-box Problem Benchmark

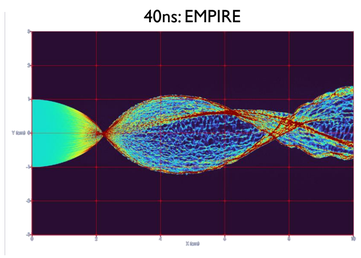
- 2D planar geometry
- Electron beam energy : 0.5 MeV
- Maximum current : I_{max} = 180 kA/m
- I(t) = I_{max} sin(π/2*min(1,t/τ)) for t < τ = 20 ns rise time
  = I_{max} for τ < t < τ + 10 ns
  = current fall symmetrical to the rise for t > τ + 10 ns
- Argon pressure : 0.1mbar at 293 K
  - Include e+Ar ionization collisions only – no thermalizing elastic (or e-e) collisions
- No external magnetic field
- EMPIRE simulations are fully kinetic – secondary electrons and ions are treated with computational particles
- GAZEL simulations are hybrid – ions are a thermal fluid

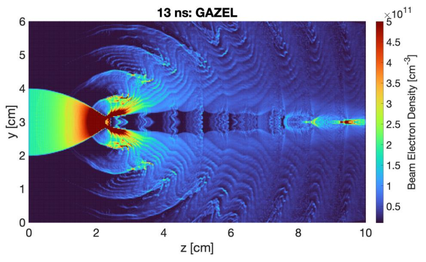


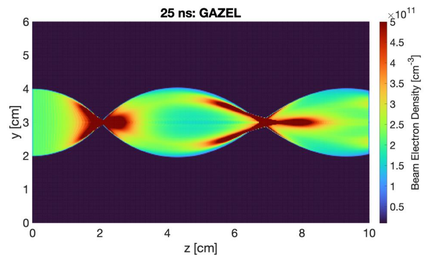


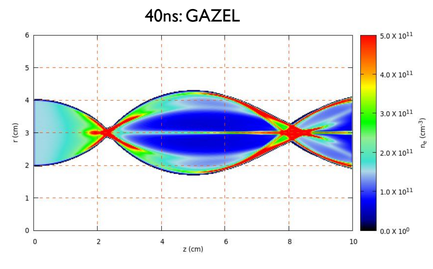






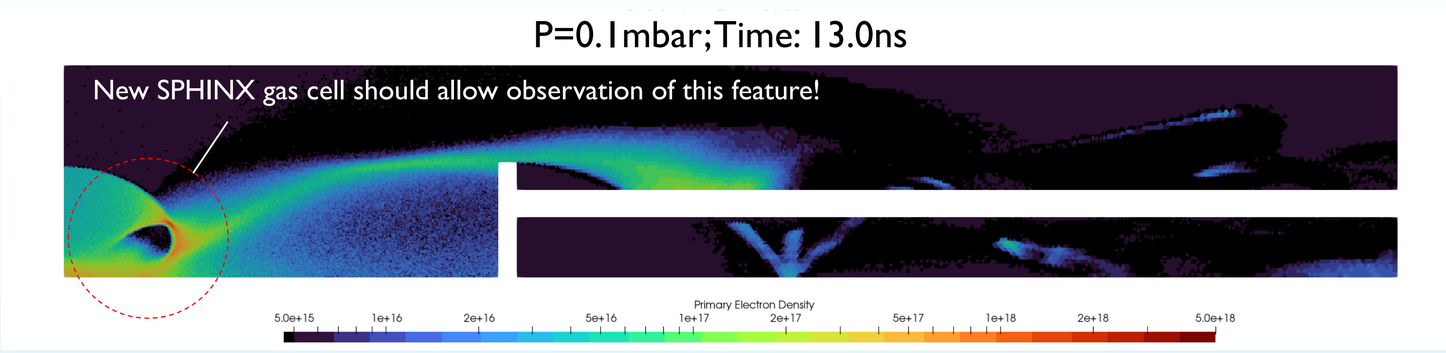






Future Work

- Experiments on SPHINX and RKA
- Compare EMPIRE simulations of SPHINX and RKA with experimental data using new gas cell and diagnostics
- GAZEL simulations matching RKA configuration



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