BUCKY Simulations of Z and RHEPP Experiments

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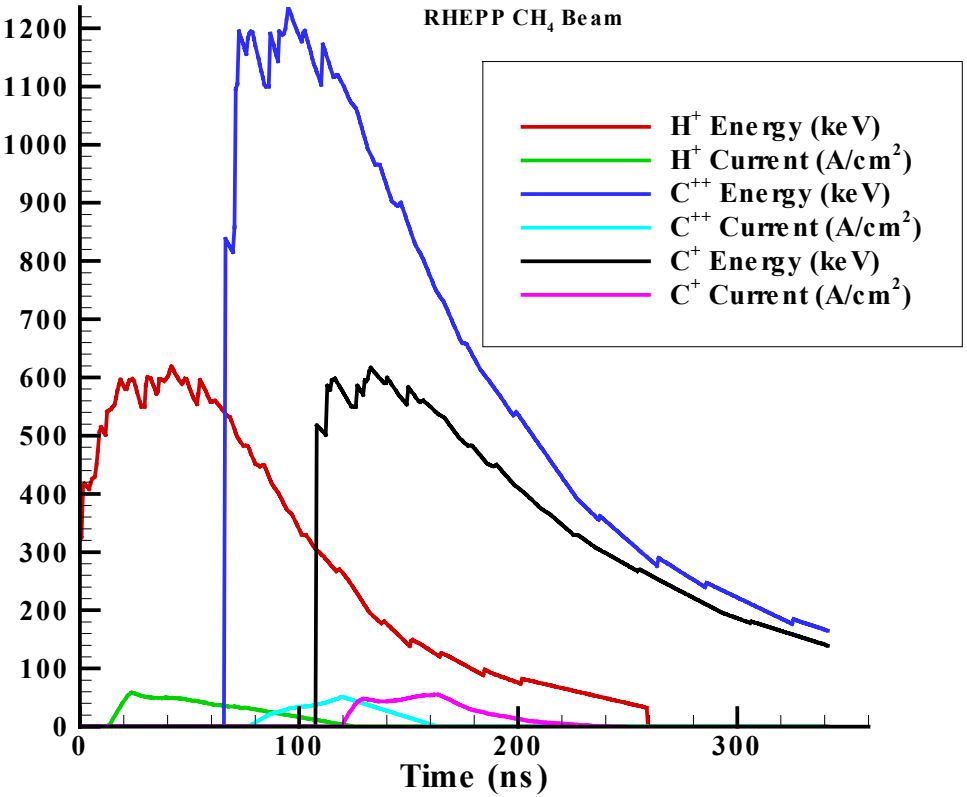
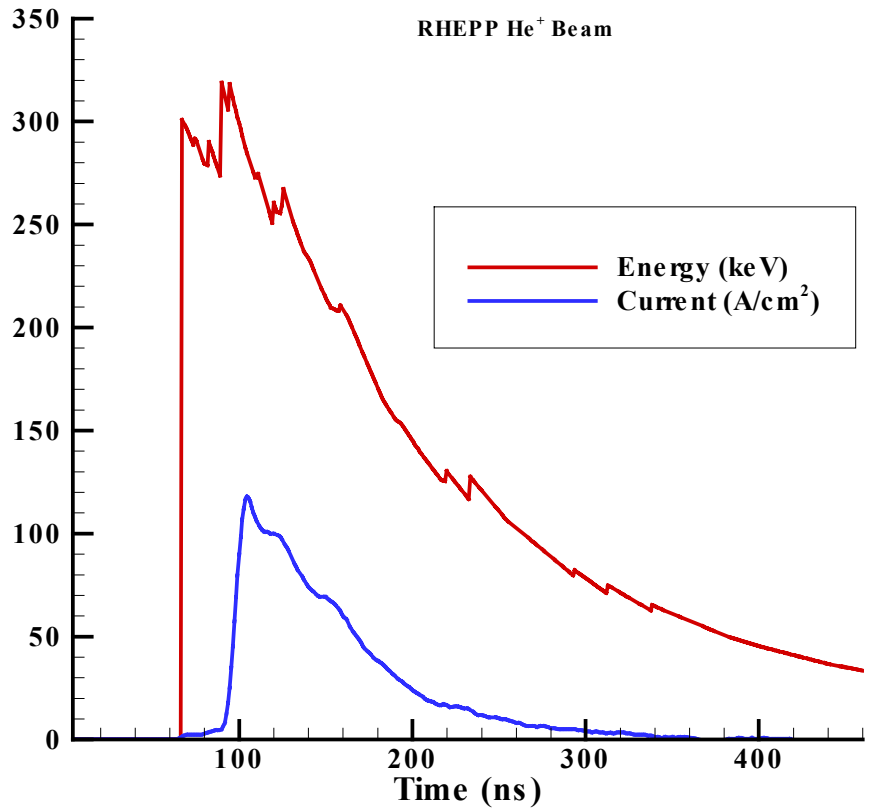
Pre-shot BUCKY Calculations for Z and RHEPP

- Pre-shot BUCKY calculations performed for range of Z and RHEPP parameters.
- BUCKY calculations for CH and He RHEPP beams on Graphite, W, Re and W-25Re.
- Be filtered and un-filtered Z x-rays on Graphite.

RHEPP Ion Spectra for CH_4 and He Shots

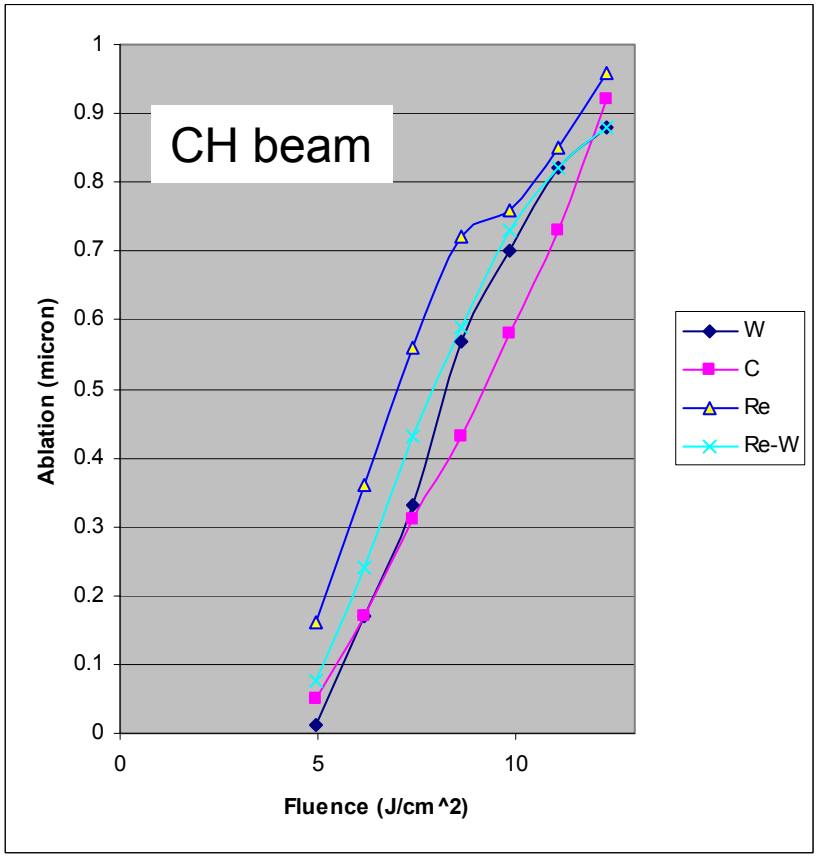


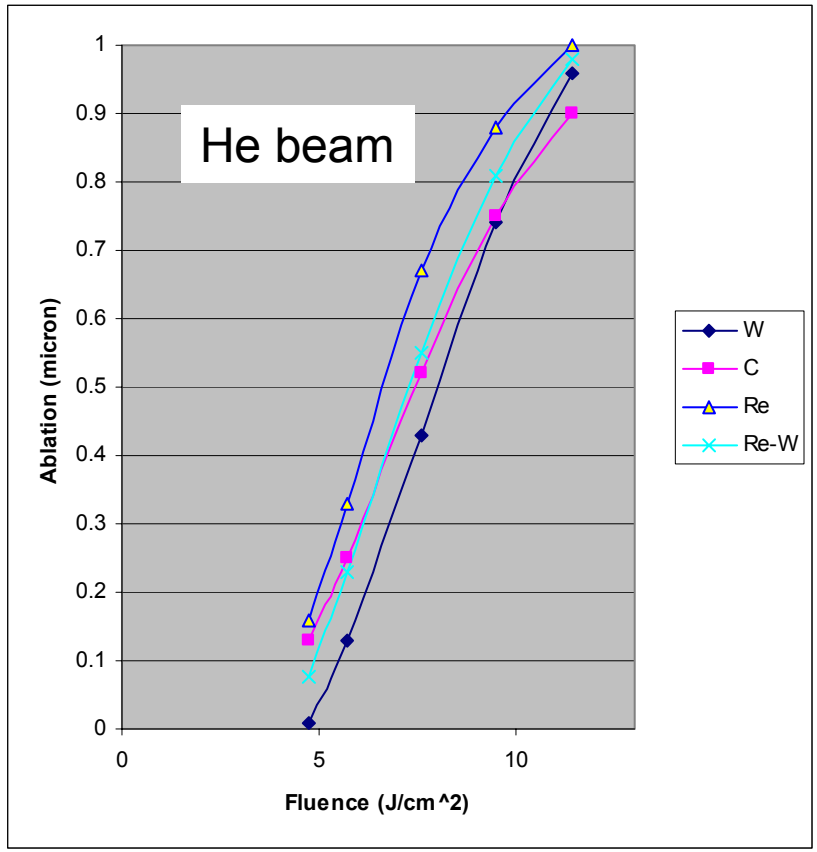


RHEPP CH beam peak energies:
C^{++}: 1.2 MeV
C^{+}: 600 keV
H^{+}: 600 keV

RHEPP He beam peak energies:
He^{+}: 325 keV

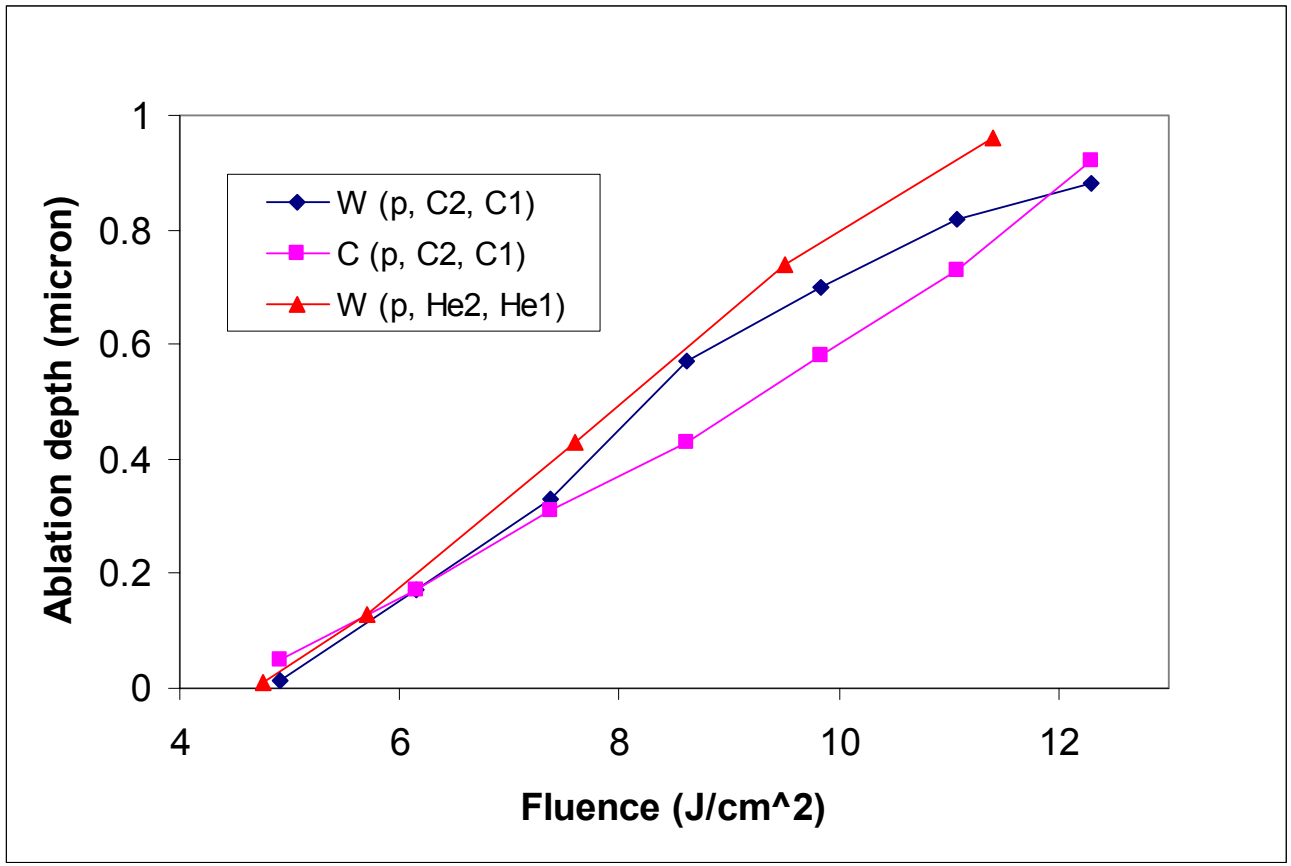
Predicted Ablation Depth As a Function of Fluence for CH_4 and He RHEPP Beams on Graphite, W, Re, and W-25Re





Poor thermal conductivity for Re leads to enhanced ablation.

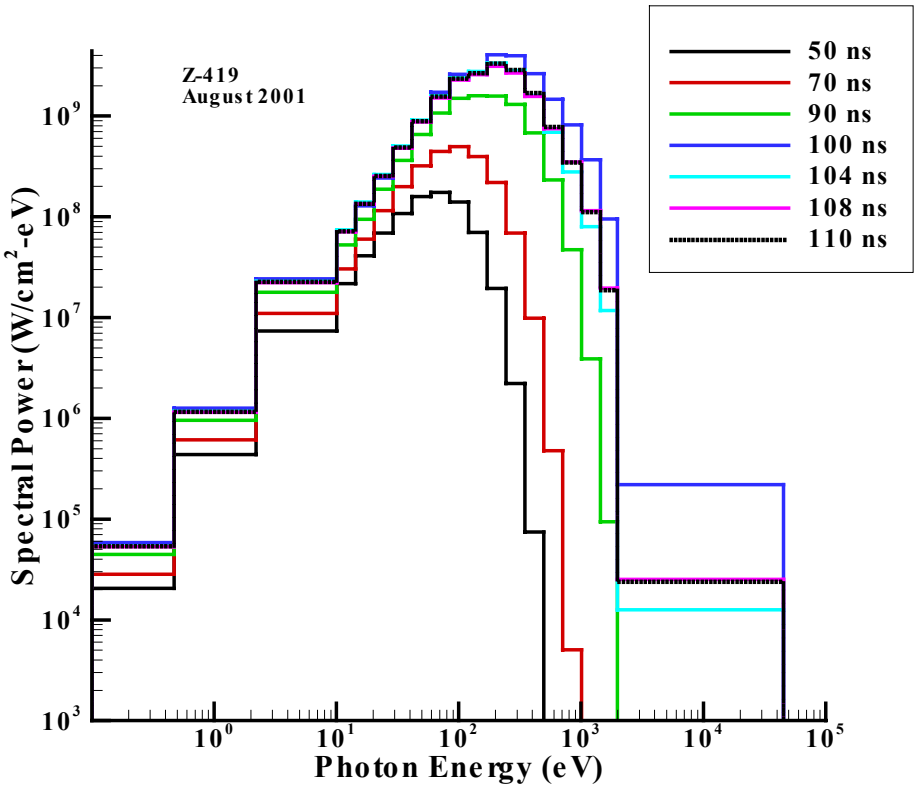
W Irradiated with RHEPP CH and He and Graphite Irradiated with CH All have a Threshold for Ablation of 5 J/cm^2.



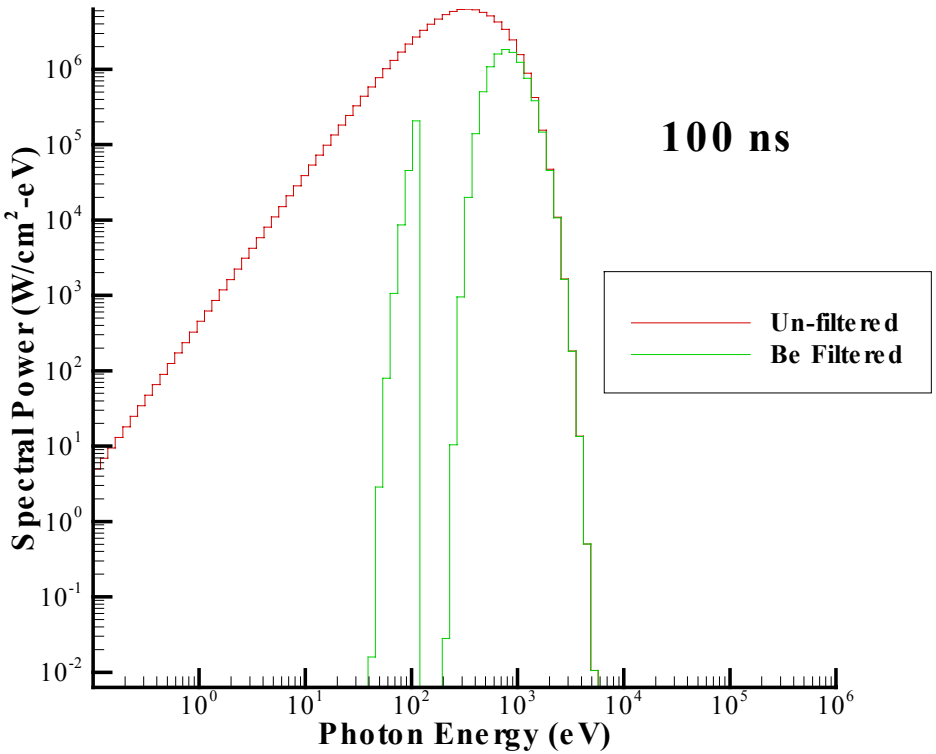
He RHEPP Beams Ablate More W Than CH; Graphite and W Respond to CH Similarly

Filtering of Z W-Wire-Array X-Rays Can Move Spectrum Closer to Direct-Drive Threat Spectrum

Un-Filtered Z at Various Times

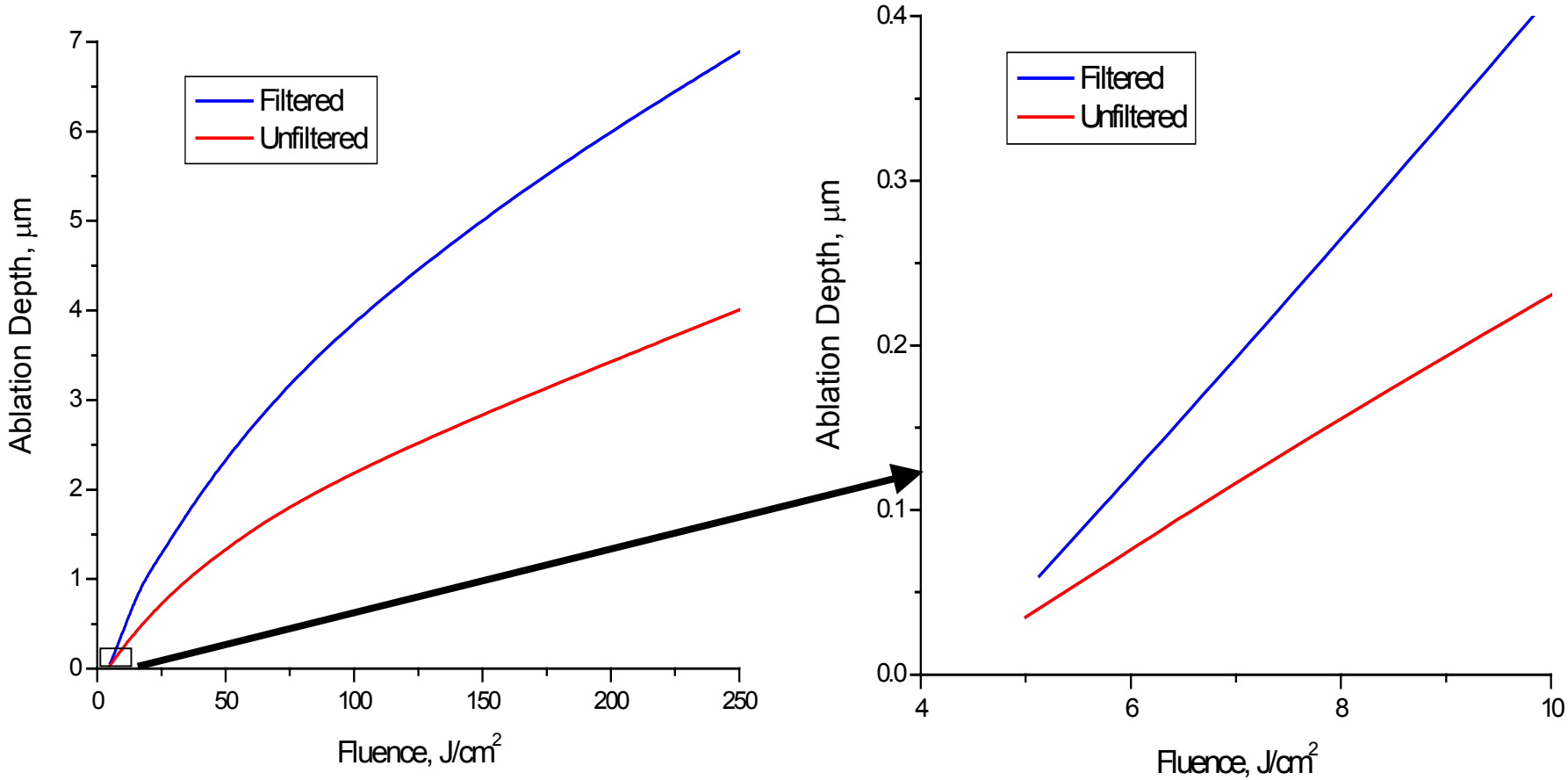


Filtered and Un-Filtered Z



Un-filtered Z X-rays have a large < 50 eV component, particularly at early times. Be and other filters remove this.

BUCKY Simulation of Z X-Ray Ablation Experiments of Graphite: Un-filtered Versus Be-Filtered

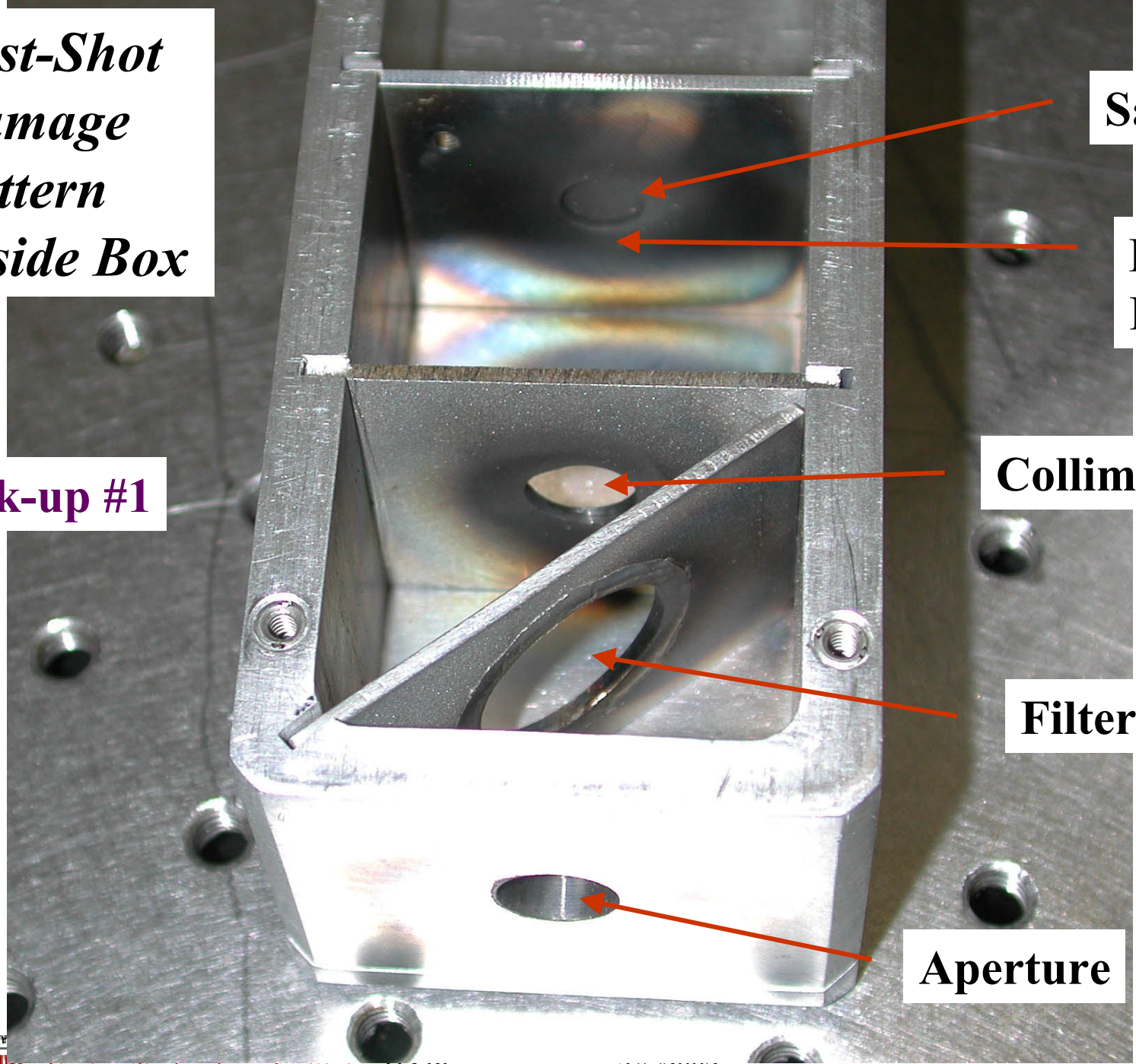


BUCKY predicts that Be-Filtered Z X-rays will be more damaging to graphite at a given fluence. Carbon has an absorption edge at 490 eV.

Summary: Pre-shot BUCKY Calculations for Z and RHEPP

- Pre-shot BUCKY calculations performed for range of Z and RHEPP parameters.
  - BUCKY predicts CH and He RHEPP beams should see a threshold for ablation in W of 5 J/cm^2. Graphite has a lower threshold for He than for CH_4. Re has more ablation for both beams because of its poor conductivity.
  - Be filtering of Z x-rays increases the ablation to Graphite at a given fluence.

Post-Shot Damage Pattern Inside Box



Back-up #1

BUCKY is a Flexible 1-D Lagrangian Radiation-Hydrodynamics Code: Used to model first wall heating, vaporization and re-condensation

Back-up #2

- 1-D Lagrangian MHD (spherical, cylindrical or slab).
- Thermal conduction with diffusion.
- Applied electrical current with magnetic field and pressure calculation.
- Radiation transport with multi-group flux-limited diffusion, method of short characteristics, and variable Eddington.
- Non-LTE CRE line transport.
- Opacities and equations of state from EOSOPA, IONMIX or SESAME.
- Thermonuclear burn (DT,DD,DHe3) with in-flight reactions.
- Fusion product transport; time-dependent charged particle tracking, neutron energy deposition.
- Applied energy sources: time and energy dependent ions, electrons, x-rays and lasers.
- Moderate energy density physics: melting, vaporization, and thermal conduction in solids and liquids.
- Benchmarking: x-ray burn-through and shock experiments on Nova and Omega, x-ray vaporization, RHEPP melting and vaporization, PBFA-II Kα emission, …
- Platforms: UNIX, PC, MAC

Sample BUCKY Simulation of Z X-Ray Ablation Experiments

Back-up #3

- VISRAD (Prism Computational Sciences) calculation of source geometry for Z shot 783.
- Assumed Sample is in far-field where $I \propto 1/r^2$.
- Slab BUCKY (Univ. of Wisconsin) simulation.