



Graphite/Carbon-Carbon Target Implementation

Feasibility Study II, Editors Meeting
January 29-31, 2001

John Haines

Carbon Target Implementation Effort Is Focusing on the Two Most Critical Issues

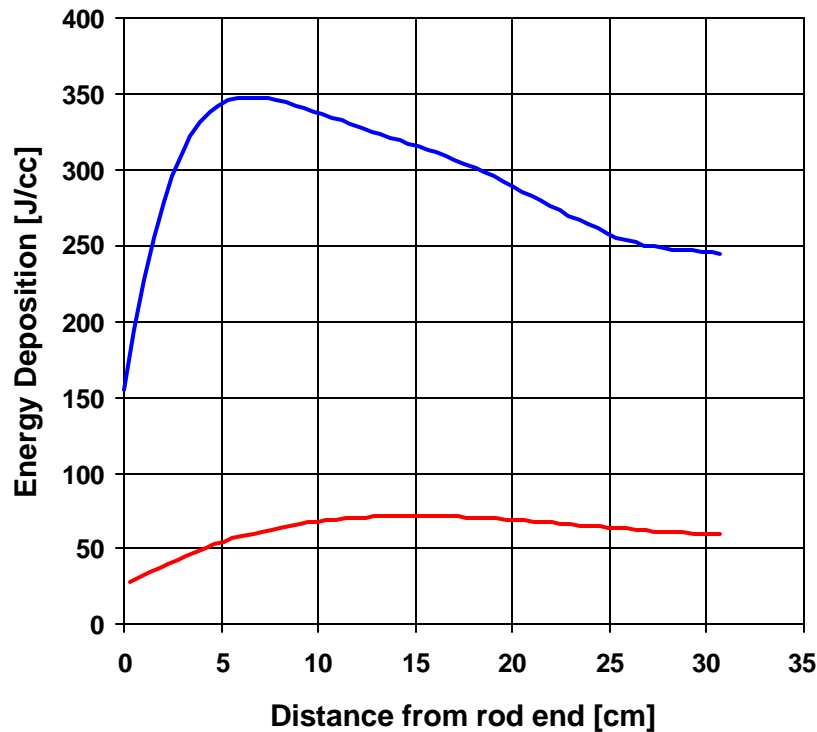


- Thermal Shock
 - Will conduct tests under E951 program
 - Measure strain to benchmark predictions under relevant loading conditions
- Sublimation
 - Pull together test facility from existing equipment
 - Verify sublimation under vacuum conditions to validate test
 - Measure sublimation reduction with helium environment

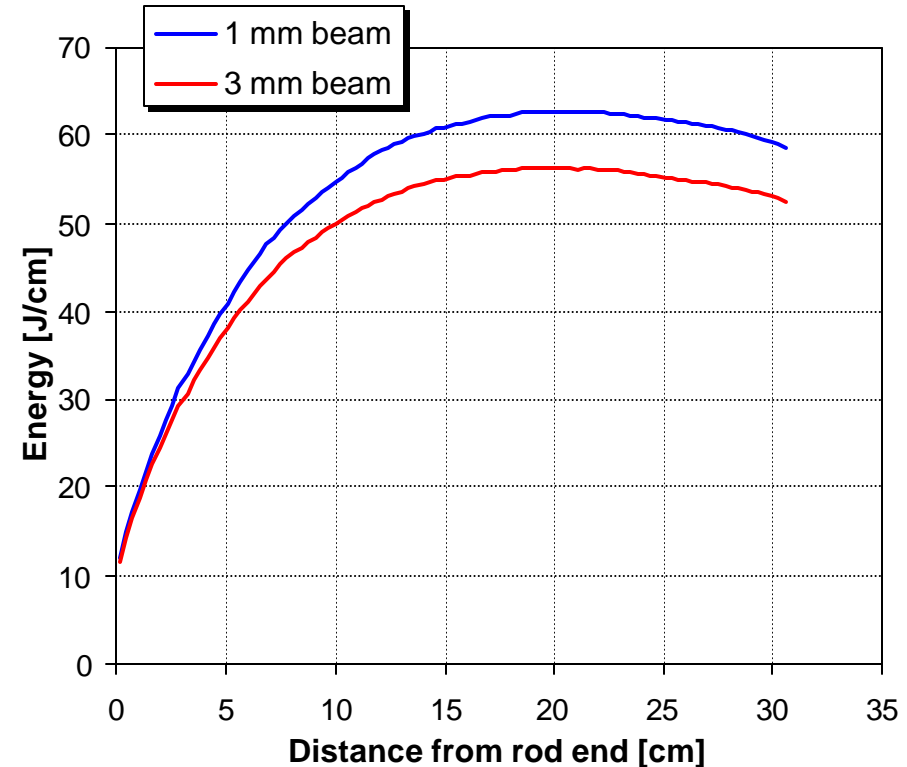
30 cm Long Graphite Target Experiences Peak Energy Density and Peak Area-Averaged Energy Density



Energy Deposition in ATJ Graphite Rod with 1.5×10^{13} - 25 GeV protons



Peak energy deposition on-axis vs. length



Energy deposition integrated over cross-sectional area vs. length

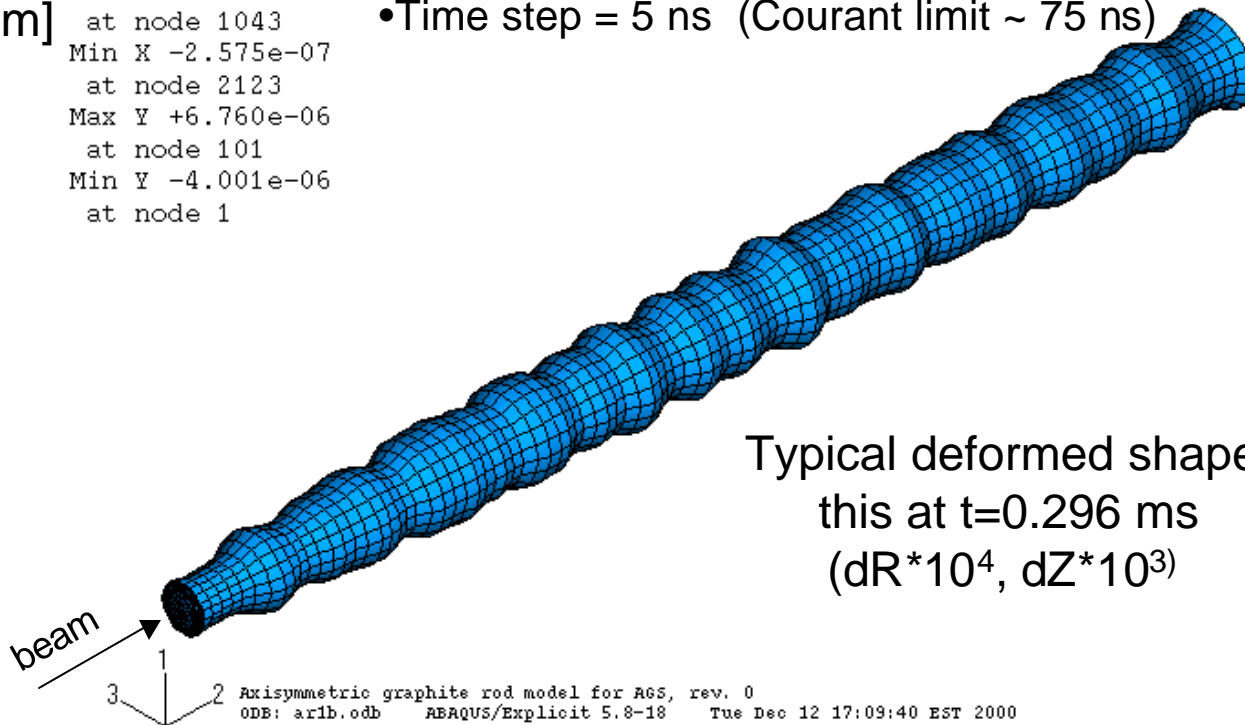
Axisymmetric Simulation of Graphite Rod Energy Deposited in 40 ns



- ATJ graphite rod axisymmetric model
- Isotropic properties used:
 $E=9.6 \text{ GPa}$, $\nu=0.13$, $\alpha=2.46e-6/^{\circ}\text{C}$, $\rho=1.73 \text{ gm/cc}$
 $C_v=690 \text{ J/(kg}^{\circ}\text{C)}$
- Time step = 5 ns (Courant limit ~ 75 ns)

Step: 1 Frame: 74

[m] Max X +7.593e-07
 at node 1043
 Min X -2.575e-07
 at node 2123
 Max Y +6.760e-06
 at node 101
 Min Y -4.001e-06
 at node 1



Typical deformed shape
 this at $t=0.296 \text{ ms}$
 $(dR \cdot 10^4, dZ \cdot 10^3)$

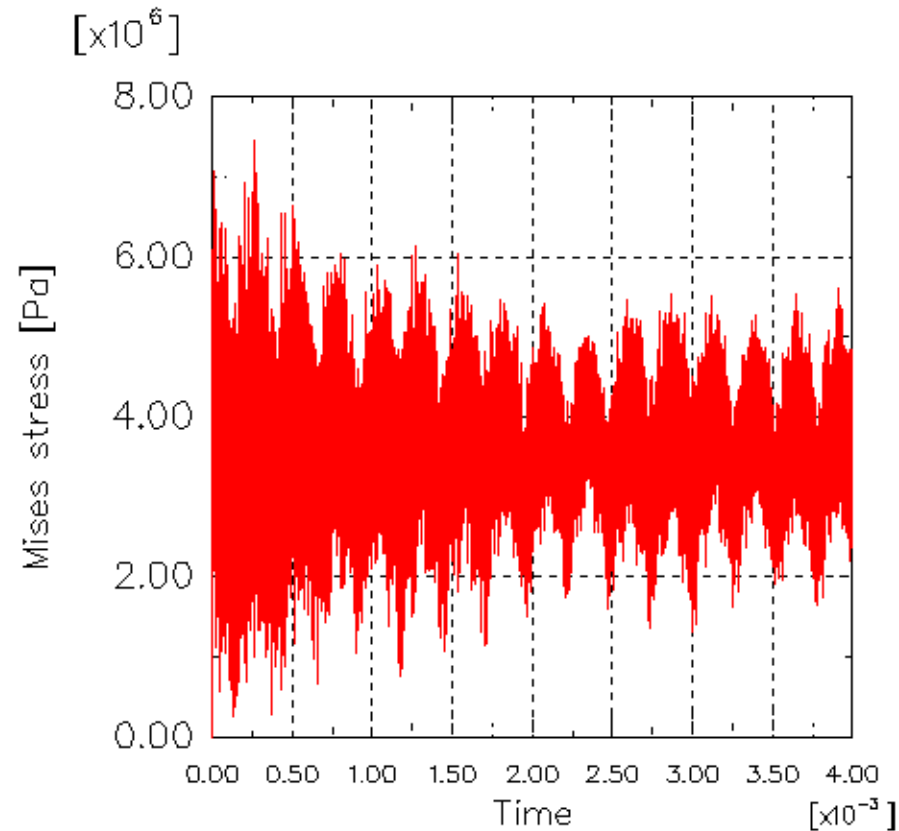
Axisymmetric graphite rod model for AGS, rev. 0
 ODB: ar1b.odb ABAQUS/Explicit 5.8-18 Tue Dec 12 17:09:40 EST 2000
 Step: Ramped temperature rise in 40 ns; 0-4.0 ms, dt=5.E-9 Increment 59200: Step Time = 2.9600E-04
 Deformed Var: U Deformation Scale Factor: x = +1.000e+04 y = +1.000e+03

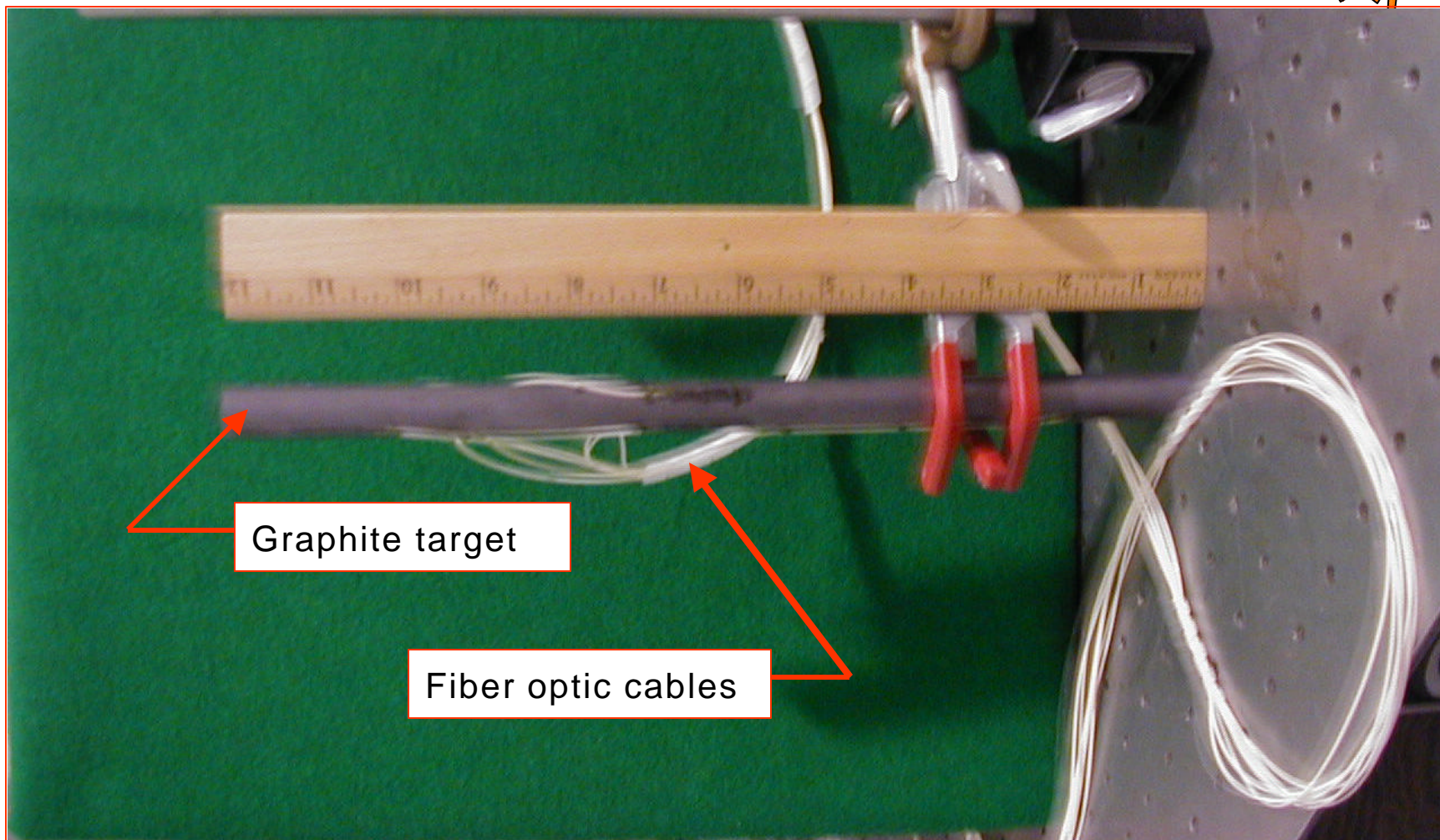
Von Mises Stress at Element Near Location of Maximum Energy Deposition



Maximum stress < 10 MPa

— MISES E: 25 IP: 1 ELSET ER0
XMIN 0.000E+00
XMAX 4.000E-03
YMIN 0.000E+00
YMAX 7.467E+06





Summary of E951 Graphite Target Test Preparations



- Peak energy deposition occurs within first 30 cm of target
 - Maximum stress < 10 MPa, for $\sigma = 1$ mm beam
 - Tensile strength of ATJ graphite > 15 MPa
 - Maximum stress < 2.5 MPa, for $\sigma = 3$ mm beam
- Well defined interface with Charles Finfrock's secondary container and mounting scheme
- Two ATJ graphite targets instrumented and ready to go
- Two carbon-carbon composite targets being machined
 - 115 mm long, 16 mm diameter
- Plan to send staff member to BNL in February to run fiber optic cables, attach strain gages to window test assemblies, and deliver instrumented carbon targets.

Carbon Sublimation Test Plan



- Modifications to existing chamber completed
- Initial heater/specimens fabricated
- Tests will start next week
- Issue report April 23 '01

ATJ Graphite	Vacuum	2000 K
		2300 K
	1 atm He	2000 K
		2300 K
C-C Composite	Vacuum	2000 K
		2300 K
	1 atm He	2000 K
		2300 K