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Time-Resolved X-ray Line Emission Studies of Thermal Transport in Multiple Beam UV-Irradiated Targets,* P.A. JAANIMAGI, B.L. HENKE, U. of Hawaii, and J. DELETTREZ, M.C. RICHARDSON, LLE, U. of Rochester--Thermal transport in spherical targets irradiated with multiple, nanosecond duration laser beams, has been a topic of much discussion recently. Different inferences on the level of thermal flux inhibition have been drawn from plasma velocity and x-ray spectroscopic diagnostics. We present new measurements of thermal transport on spherical targets made through time-resolved x-ray spectroscopic measurements of the progress of the ablation surface through thin layers of material on the surface of the target. These measurements, made with 6 and 12 UV (351 nm) nanosecond beams from OMEGA, will be compared to previous thermal transport measurements.

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MASTER

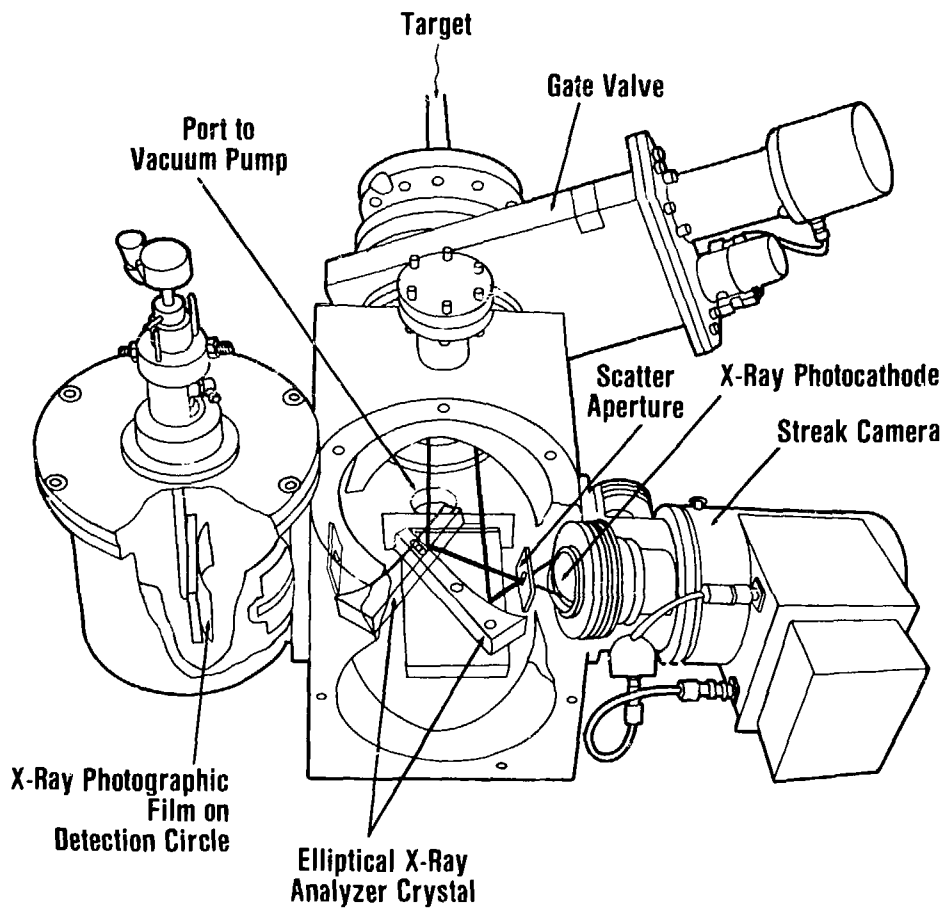
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TIME-RESOLVED X-RAY LINE EMISSION STUDIES OF THERMAL
TRANSPORT IN MULTIPLE BEAM UV-IRRADIATED TARGETS

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- WE NEED TO BETTER OUR UNDERSTANDING OF TRANSPORT IN SPHERICAL GEOMETRY
- TIME-RESOLVED STUDIES PROVIDE FURTHER INSIGHT INTO THE DYNAMIC PROCESSES
- LASER 6 UV BEAMS AT $I = 10^{14}$ TO 10^{15} W/CM²
- TARGETS
 - IMPLODING CH ON GLASS SHELLS
 AL ON GLASS SHELLS
 - SOLID CH ON AL ON CH
- DIAGNOSTIC TIME-RESOLVED X-RAY LINE SPECTROSCOPY



Streak Photographic Elliptic Analyzer X-Ray Spectrograph

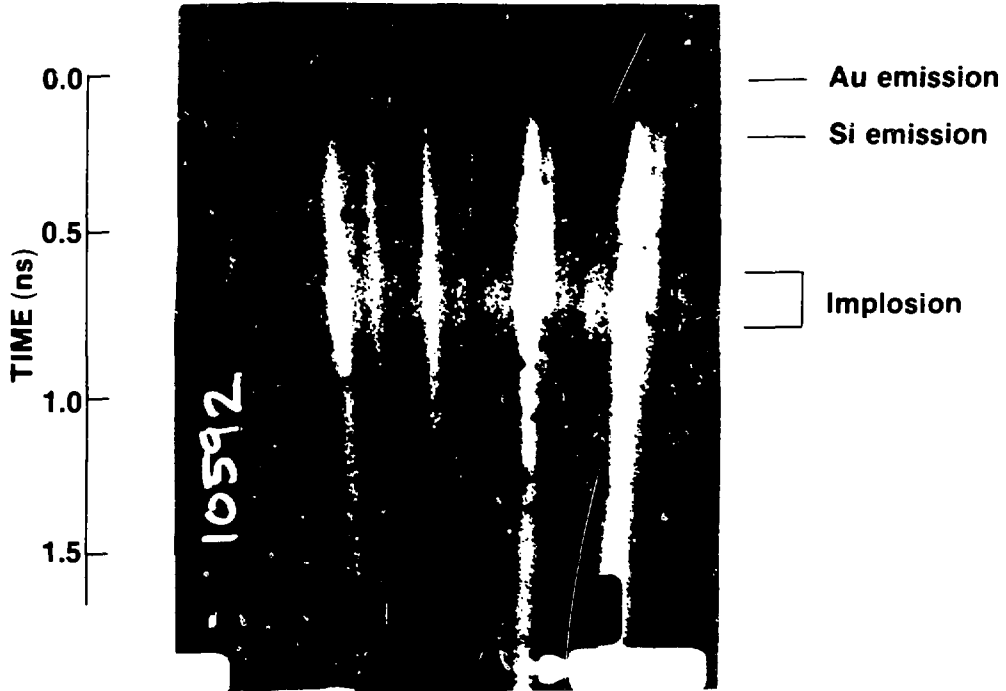
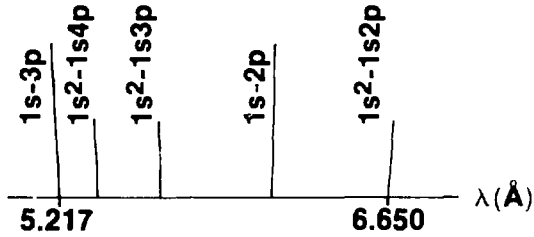
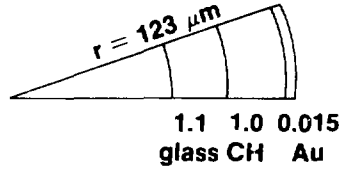


E3252

TIME-RESOLVED X-RAY LINE EMISSION FROM CH-COATED GMB

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LLE 

$I = 2.40 \times 10^{14} \text{ W/cm}^2$
 $\tau = 728 \text{ ps}$

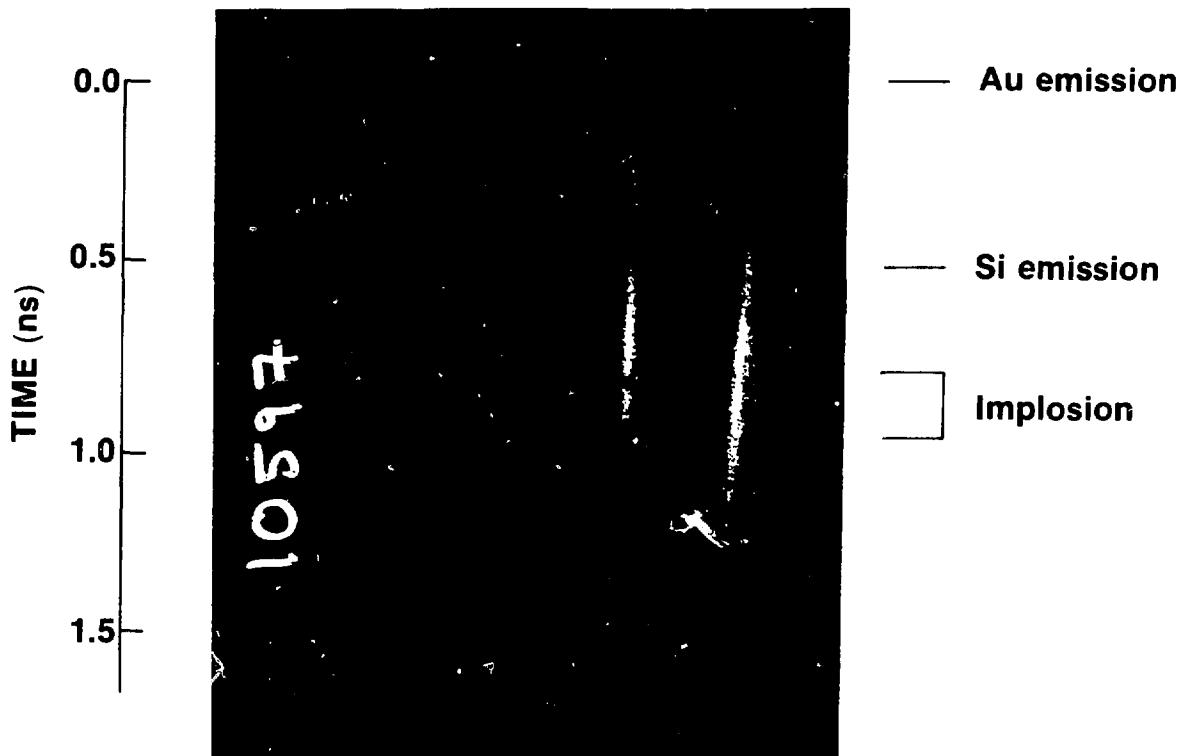
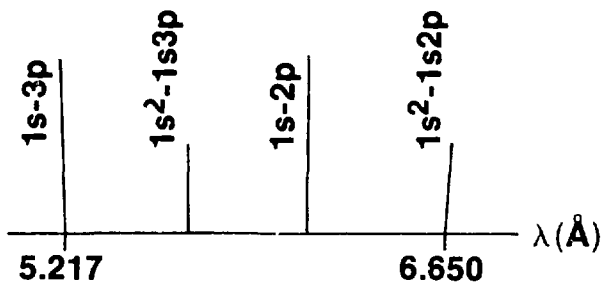
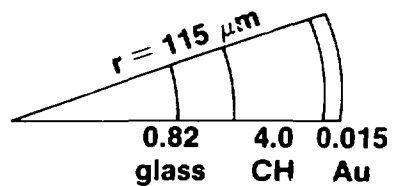


TIME-RESOLVED X-RAY LINE EMISSION FROM CH-COATED GMB

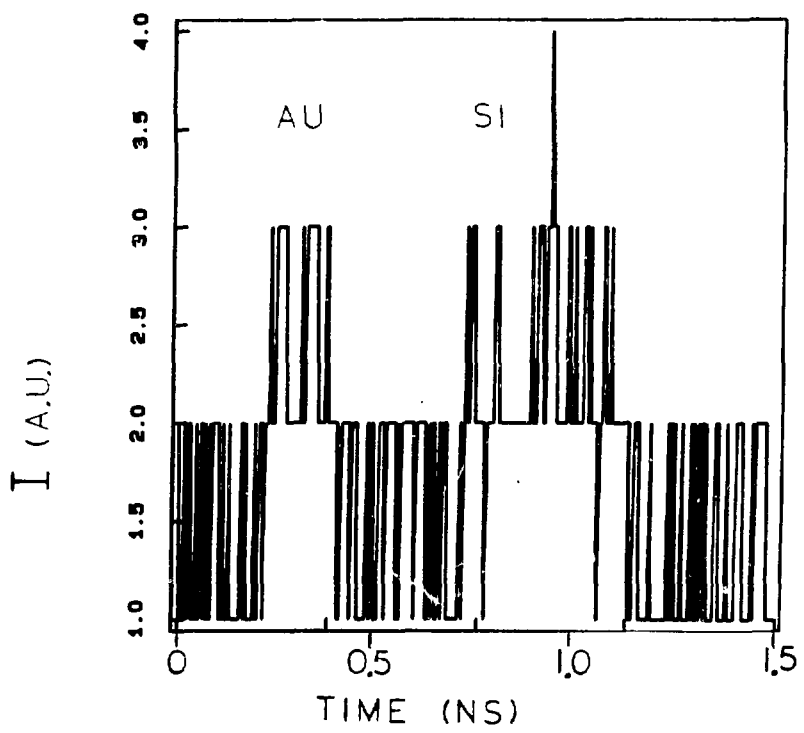
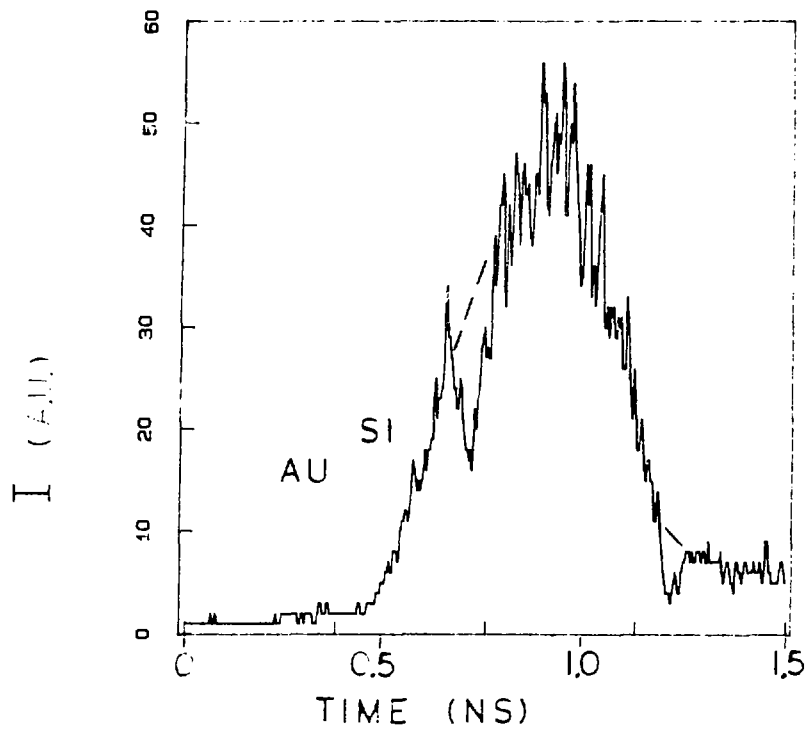
UR
LLE 

$$I = 2.43 \times 10^{14} \text{ W/cm}^2$$

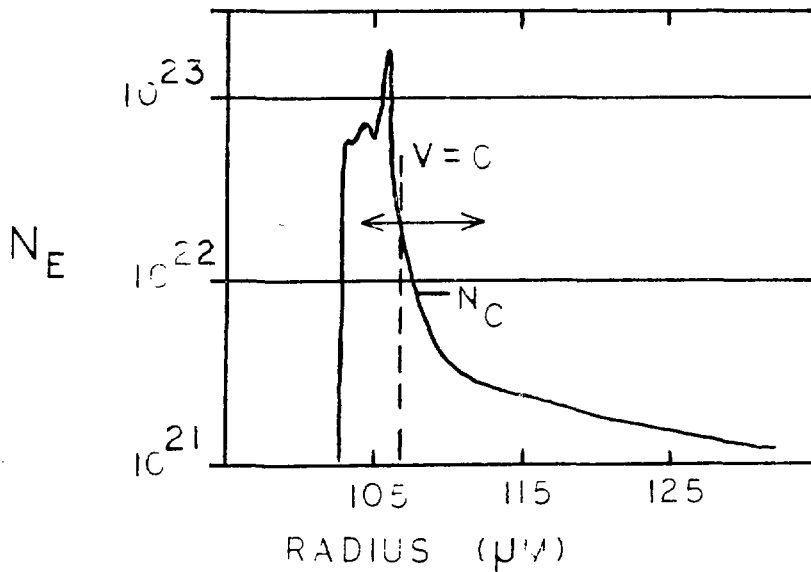
$$\tau = 750 \text{ ps}$$



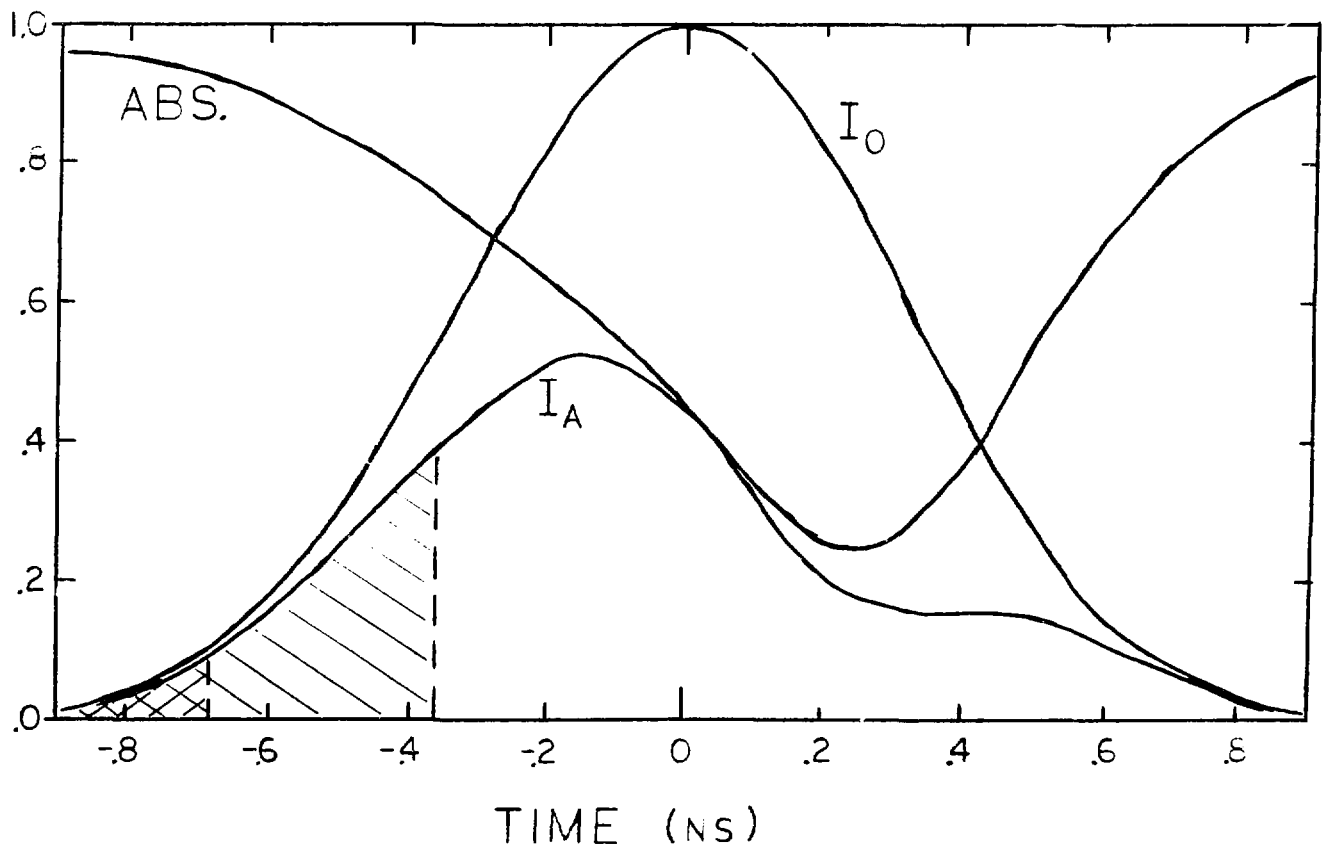
TEMPORAL PROFILES AT E = 2.4 KEV



DEFINE ABLATED MASS

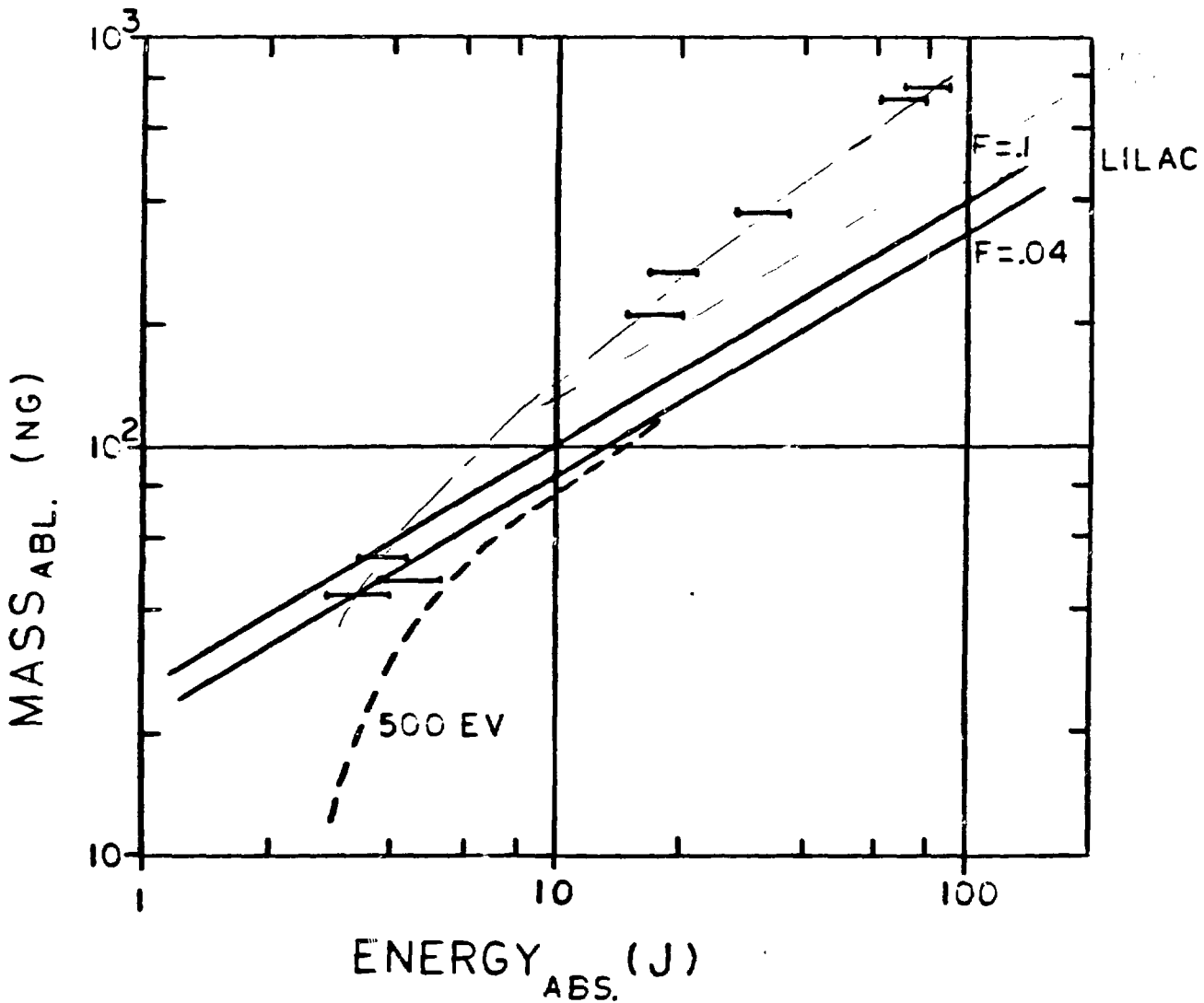


CALCULATE ABSORBED ENERGY

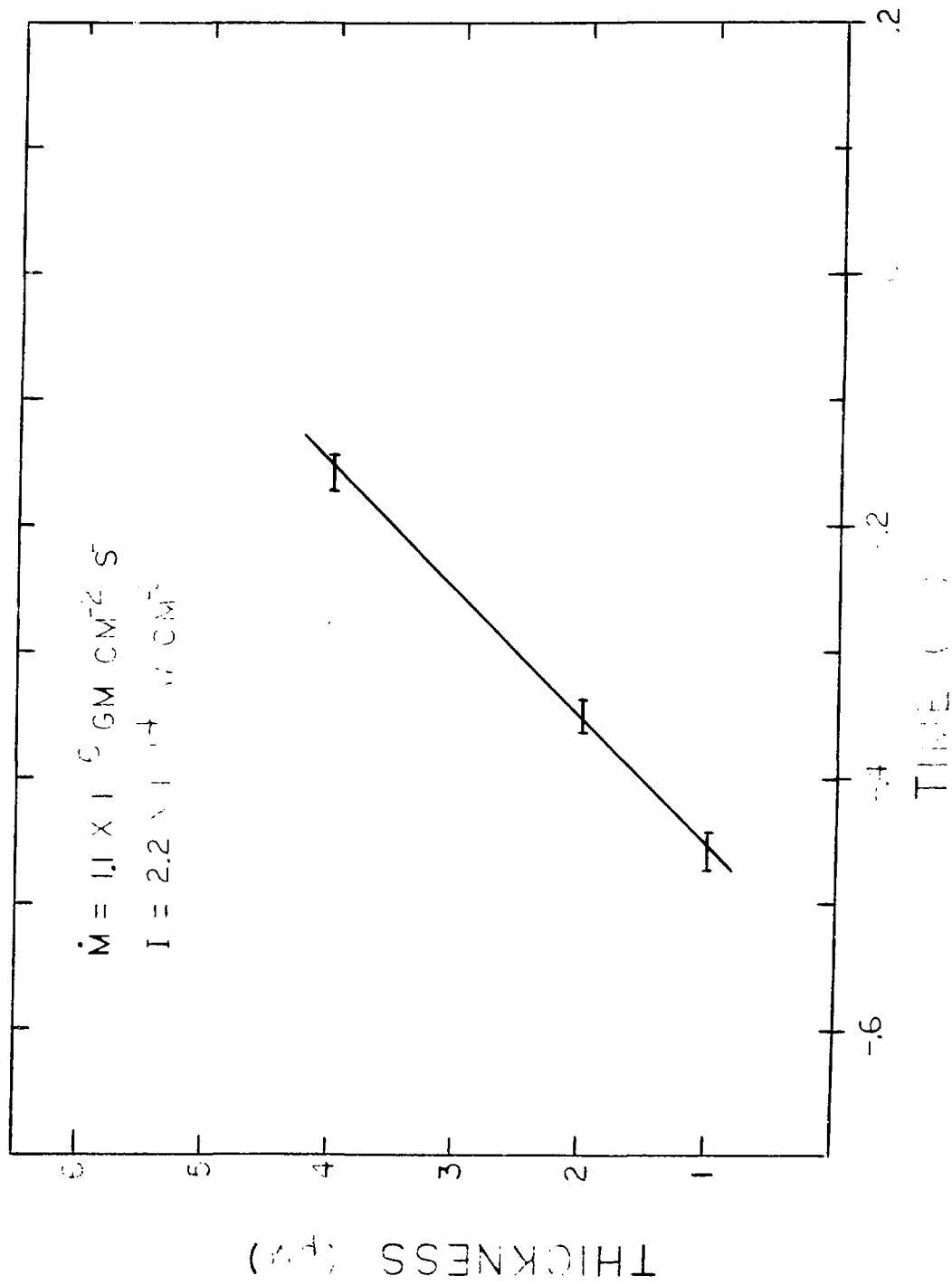


AU/CH/GLASS TARGETS 230 μM

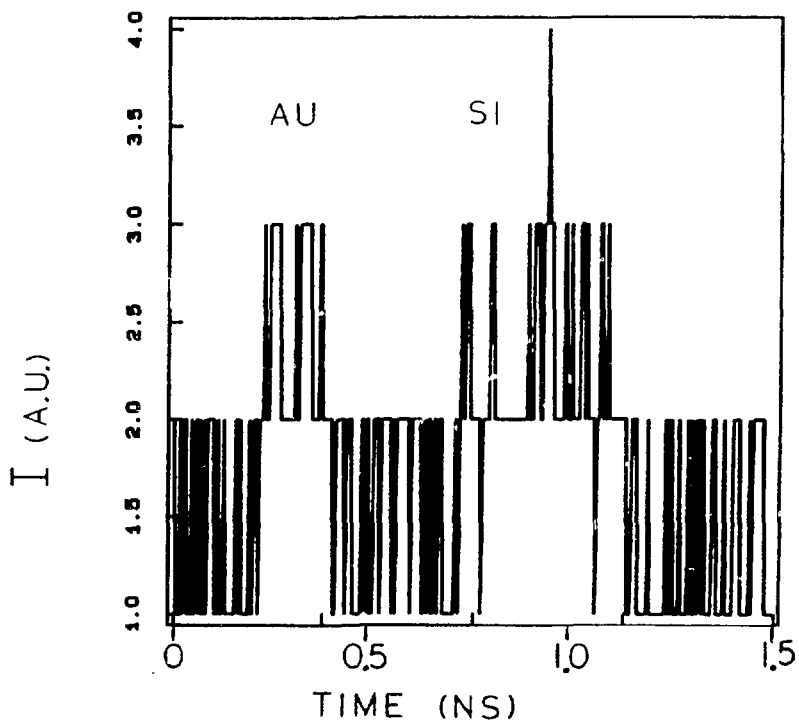
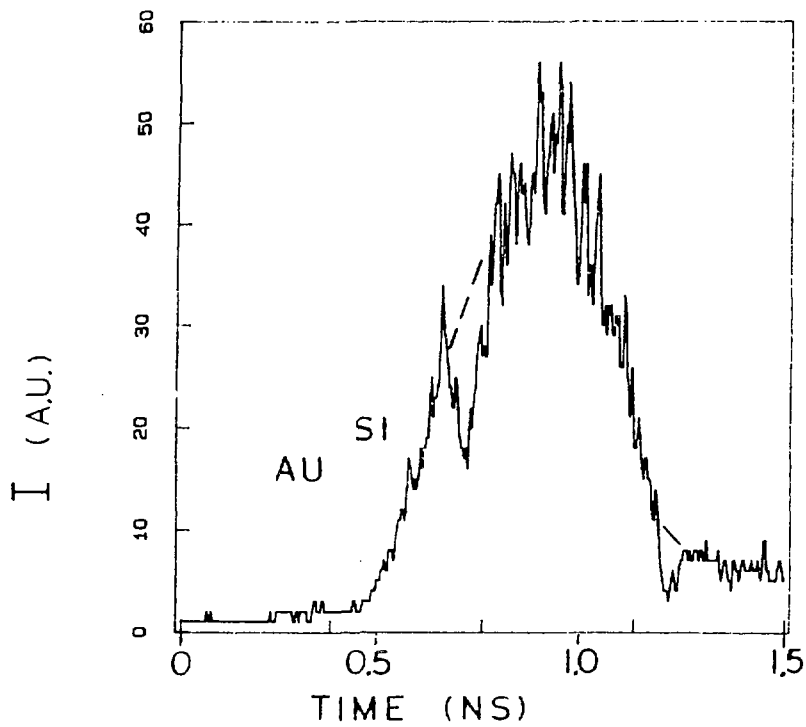
$$I = 2.4 \times 10^{14} \text{ W/CM}^2$$



CH BURNTHROUGH



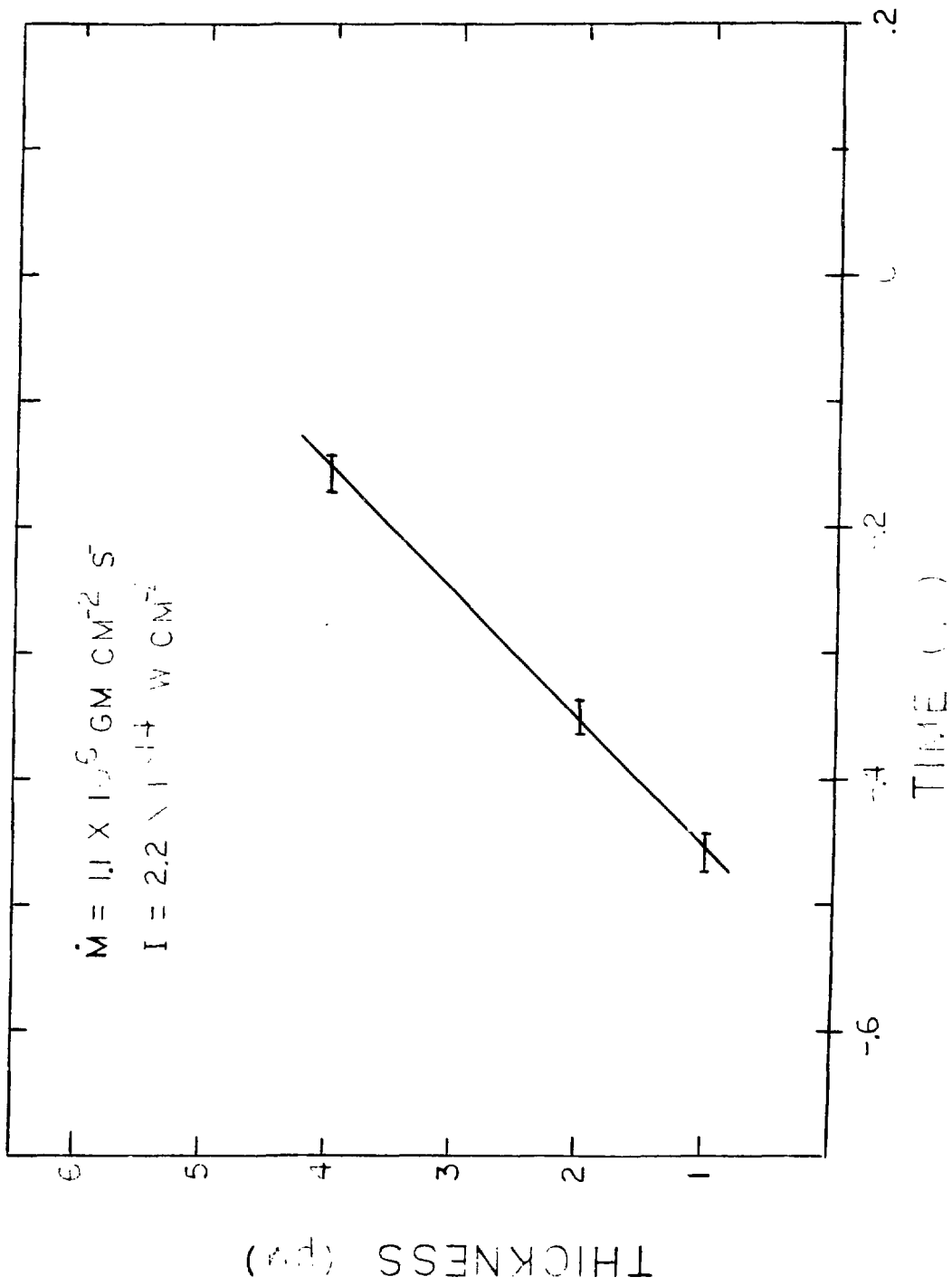
TEMPORAL PROFILES AT E = 2.4 KEV



CH BURNTHRU RICH

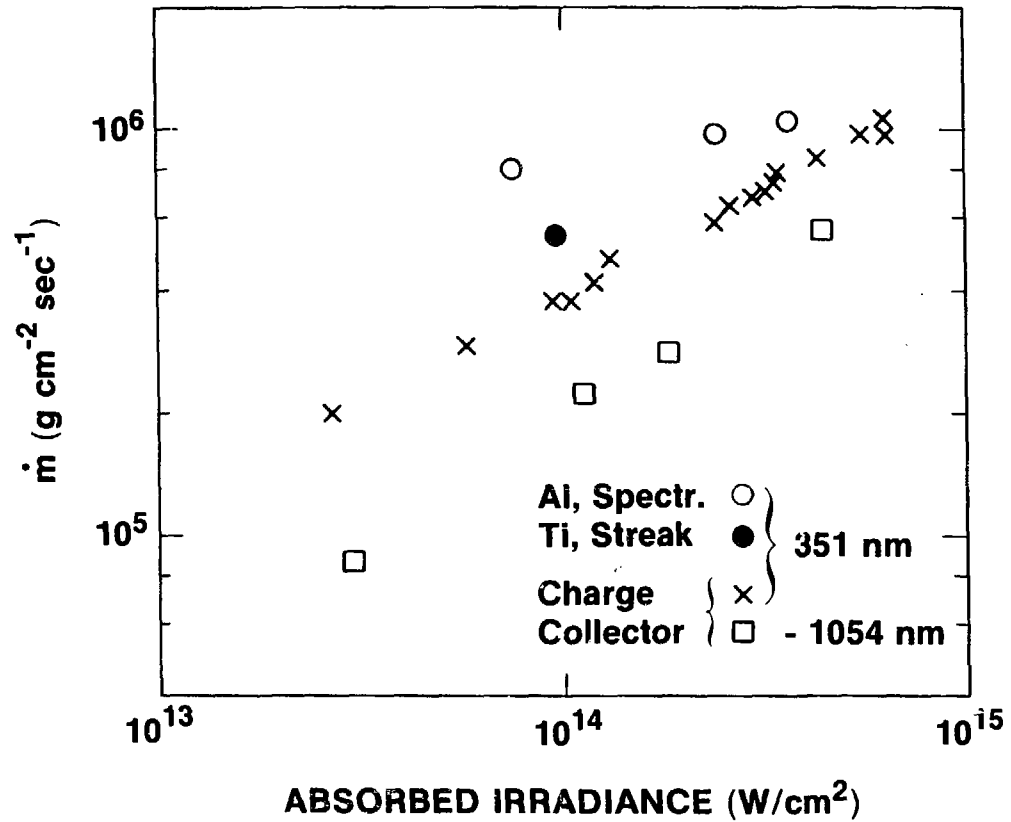
$$\dot{M} = 1.1 \times 10^5 \text{ GM CM}^{-2} \text{ S}^{-1}$$

$$I = 2.2 \times 10^{14} \text{ W CM}^{-2}$$

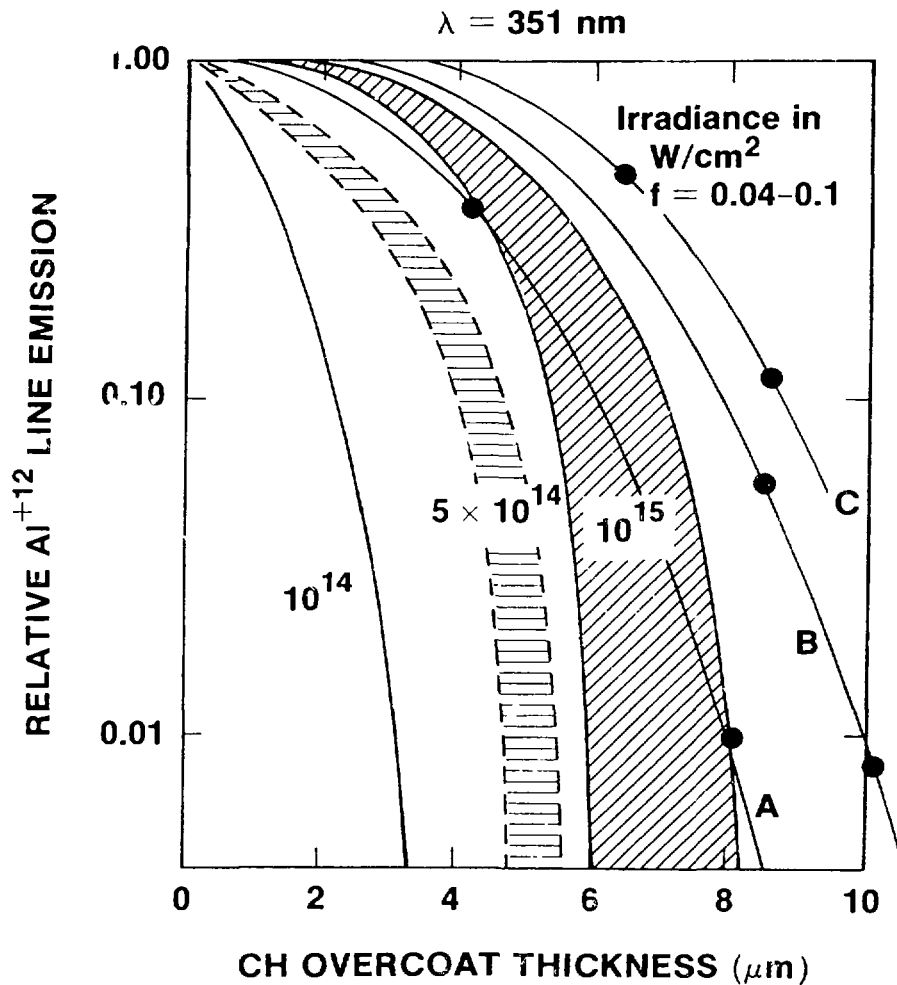


MASS ABLATION RATE IN SPHERICAL IRRADIATION

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LLE 



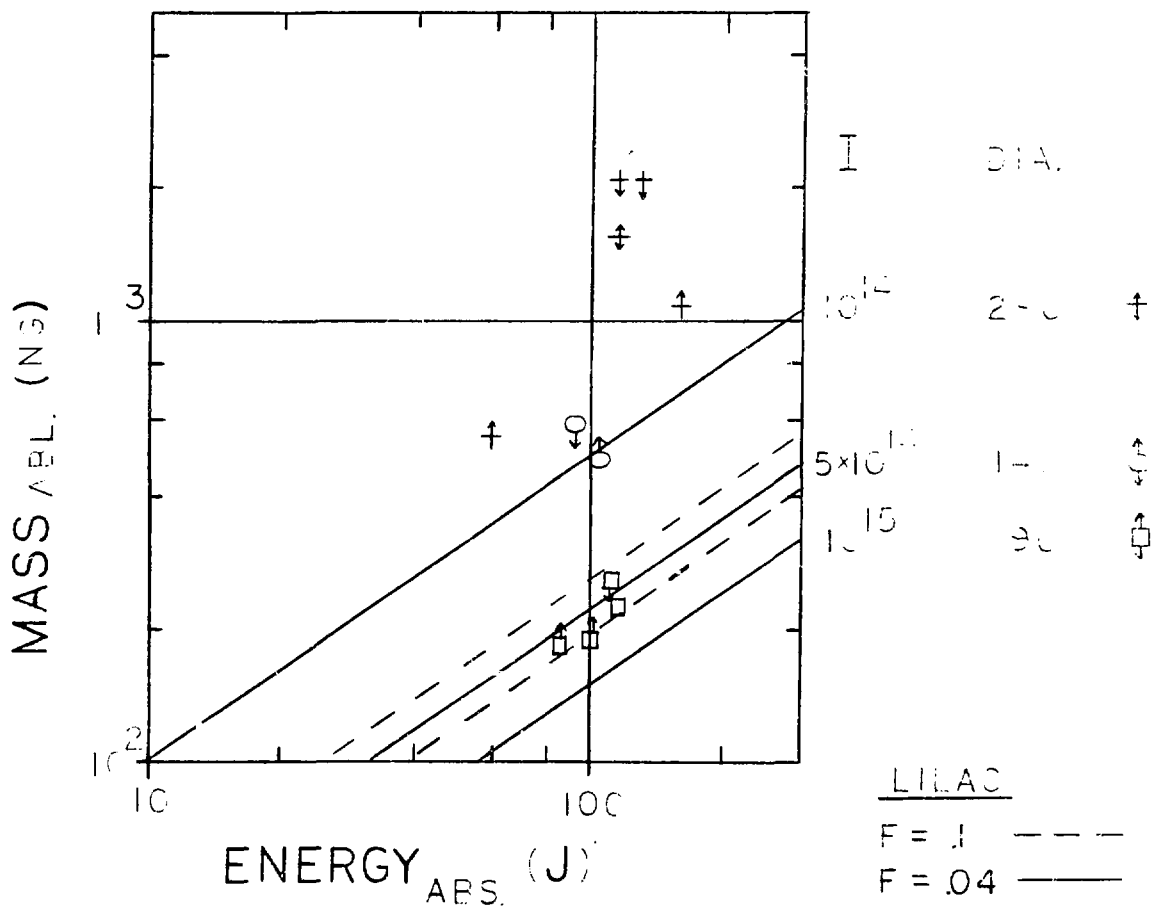
LILAC CALCULATED BURN-THROUGH CURVES; CH OVER ALUMINUM



E2980

CH/Al/CH TARGETS (SOLID)

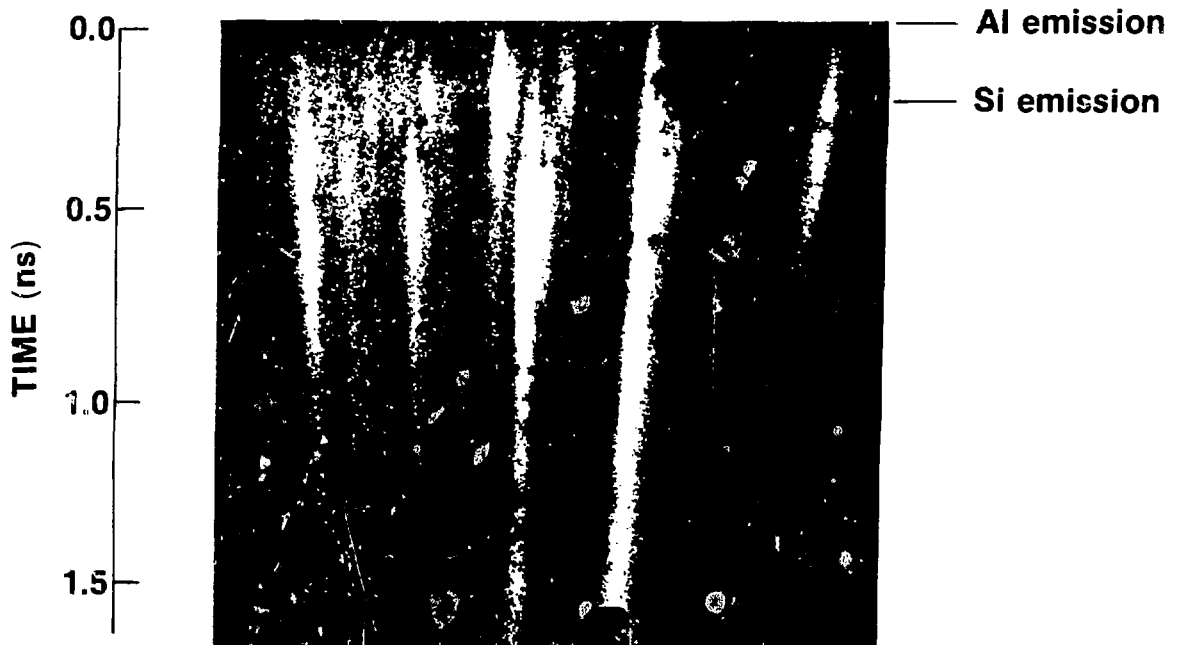
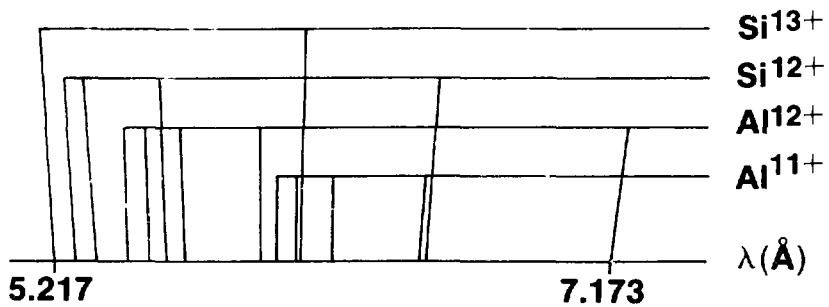
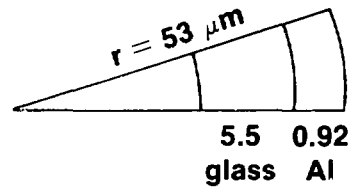
TIME INTEGRATED DATA



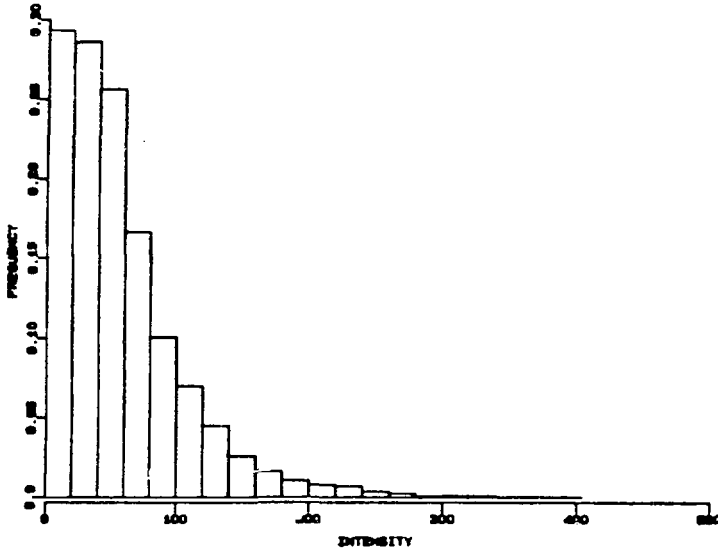
TIME-RESOLVED X-RAY LINE EMISSION FROM Al-COATED GMB

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LLE 

$$I = 1.34 \times 10^{15} \text{ W/cm}^2$$
$$\tau = 615 \text{ ps}$$



BEAM 4-1 FROM UV ETP DATA

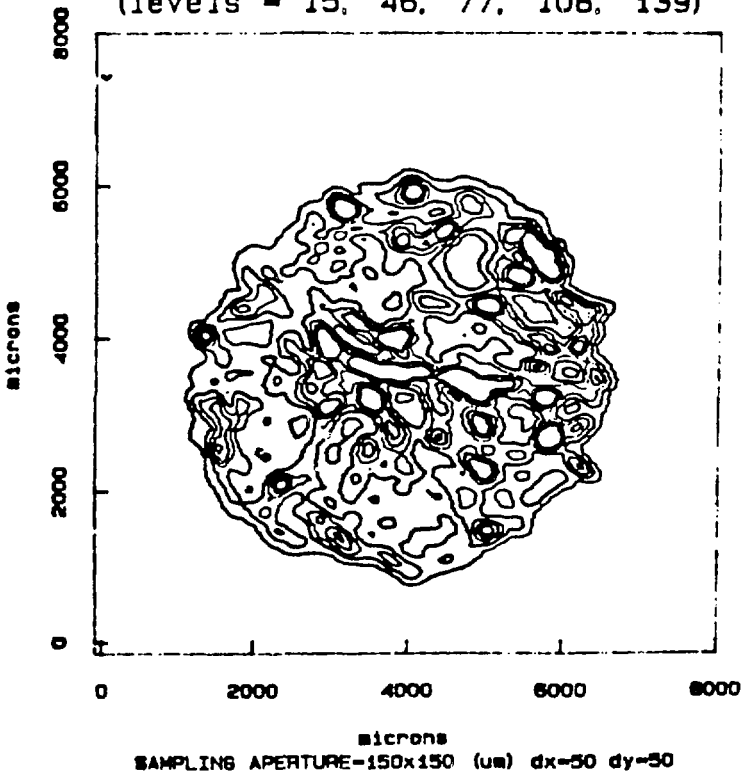


1600 μM FROM
BEST FOCUS

HOT SPOTS

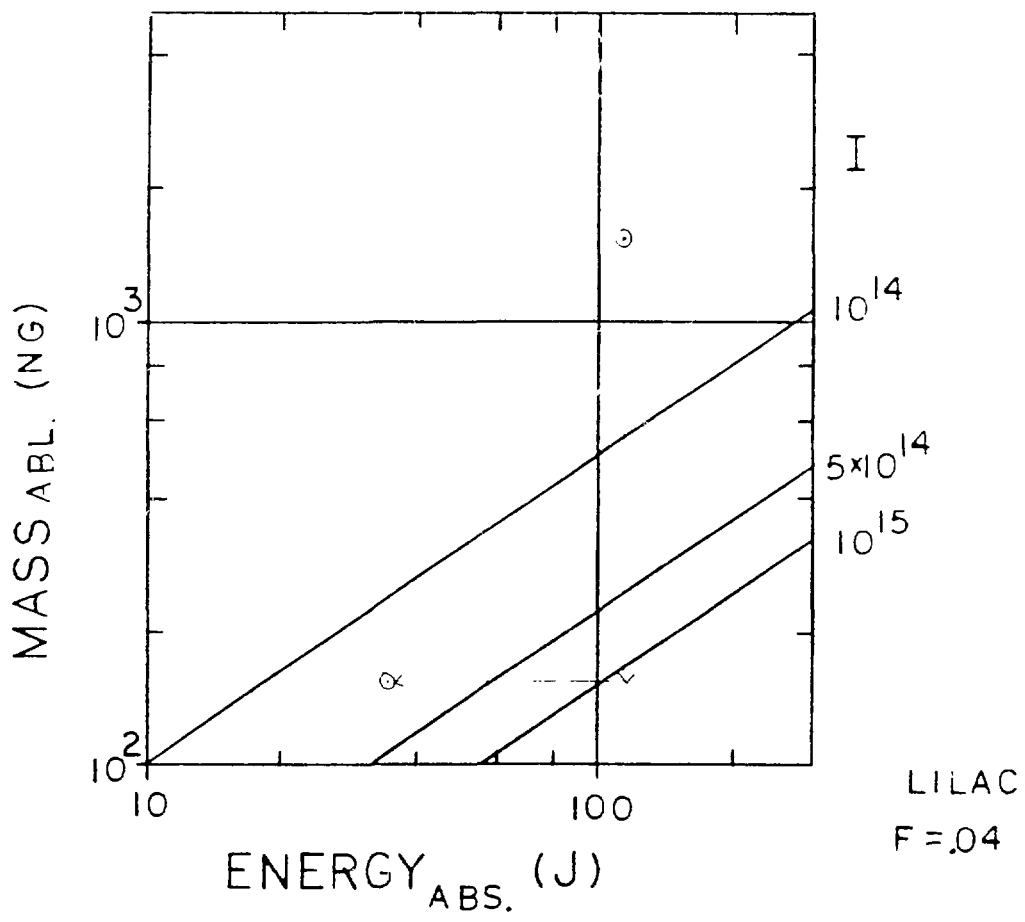
30% ENERGY
IN
10% AREA

CONTOUR OF s3ier9762
(levels = 15, 46, 77, 108, 139)



CH/Al/CH TARGETS (SOLID)

TIME INTEGRATED DATA



S U M M A R Y

- TIME-RESOLVED AND TIME-INTEGRATED BURNTHROUGH DATA AGREE WITH EACH OTHER

- NONUNIFORMITY IS A CONTRIBUTING FACTOR TO THE DISCREPANCY BETWEEN EXPERIMENTS AND CODE SIMULATIONS

- IMPROVE MEASUREMENTS WITH
 - ABSOLUTE TIME FIDUCIAL WITH RESPECT TO THE INCIDENT LASER PULSE

 - MEASUREMENT ABSORPTION AS A FUNCTION OF TIME BY DIAGNOSING THE SCATTERED UV LIGHT

 - BETTER UNIFORMITY WITH 24 BEAM IRRADIATION