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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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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

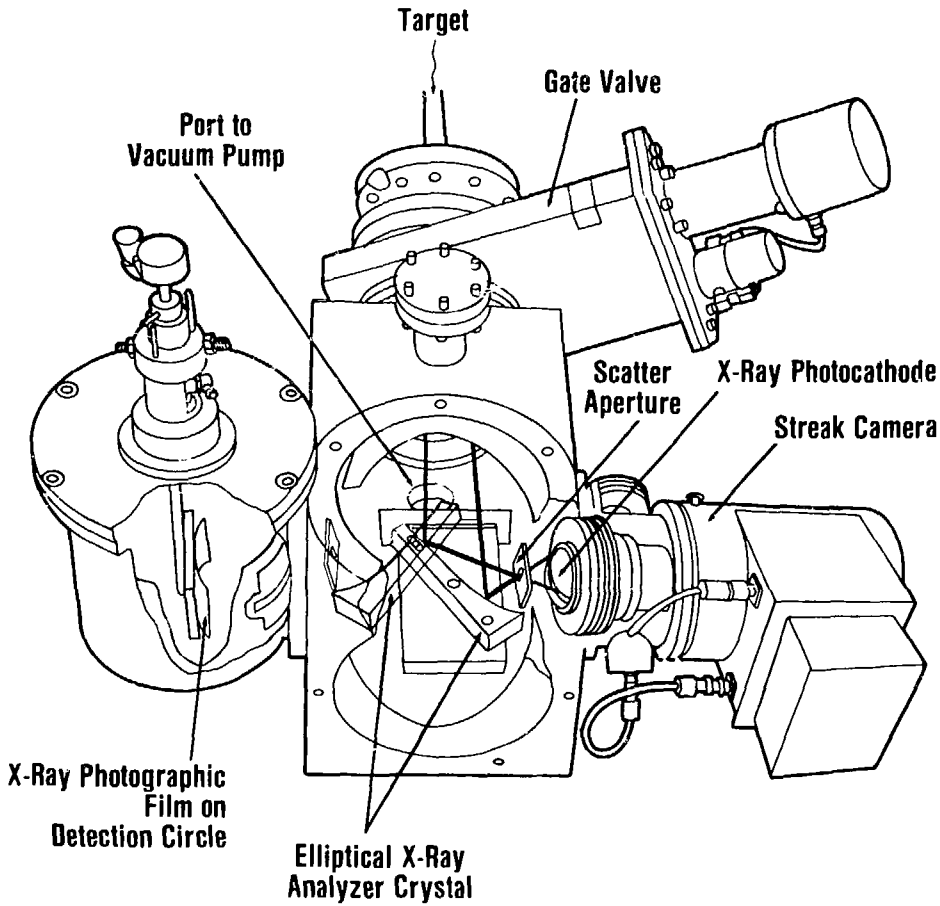
- LASER — 6 UV BEAMS AT $I = 10^{14}$ TO 10^{15} W/CM^2

- 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

UR LLE

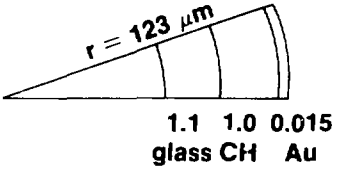


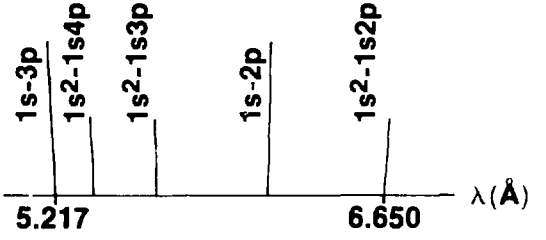
E3252

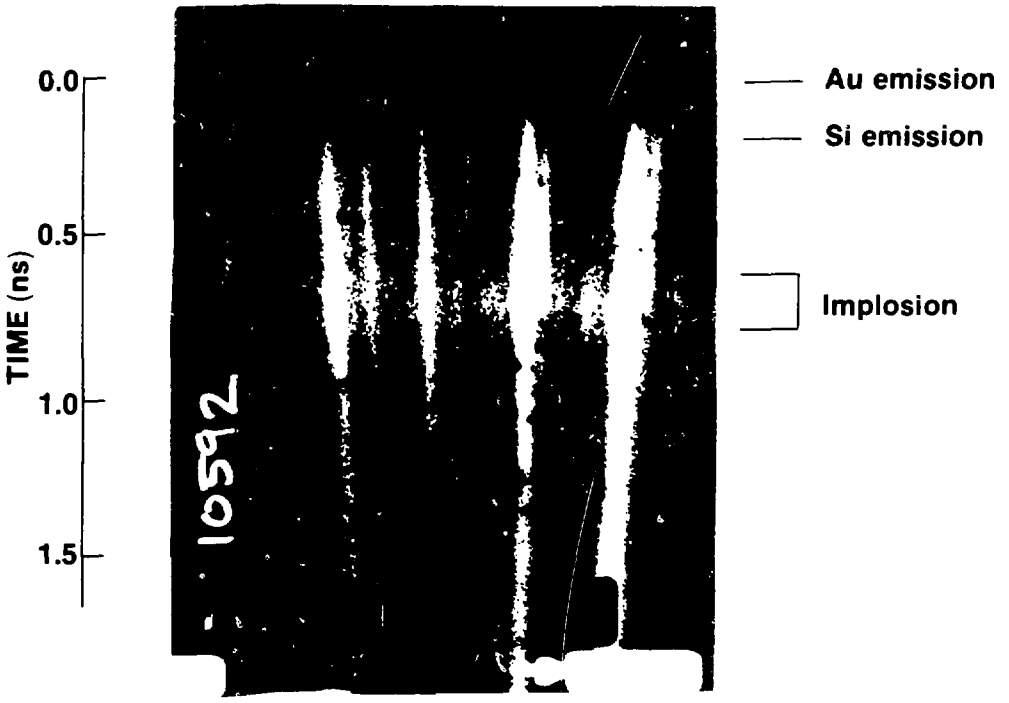
TIME-RESOLVED X-RAY LINE EMISSION FROM CH-COATED GMB

UR
LLE

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







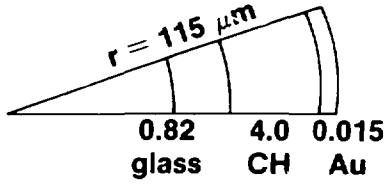
E3210

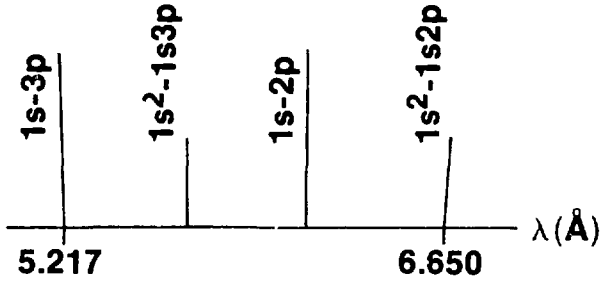
TIME-RESOLVED X-RAY LINE EMISSION FROM CH-COATED GMB

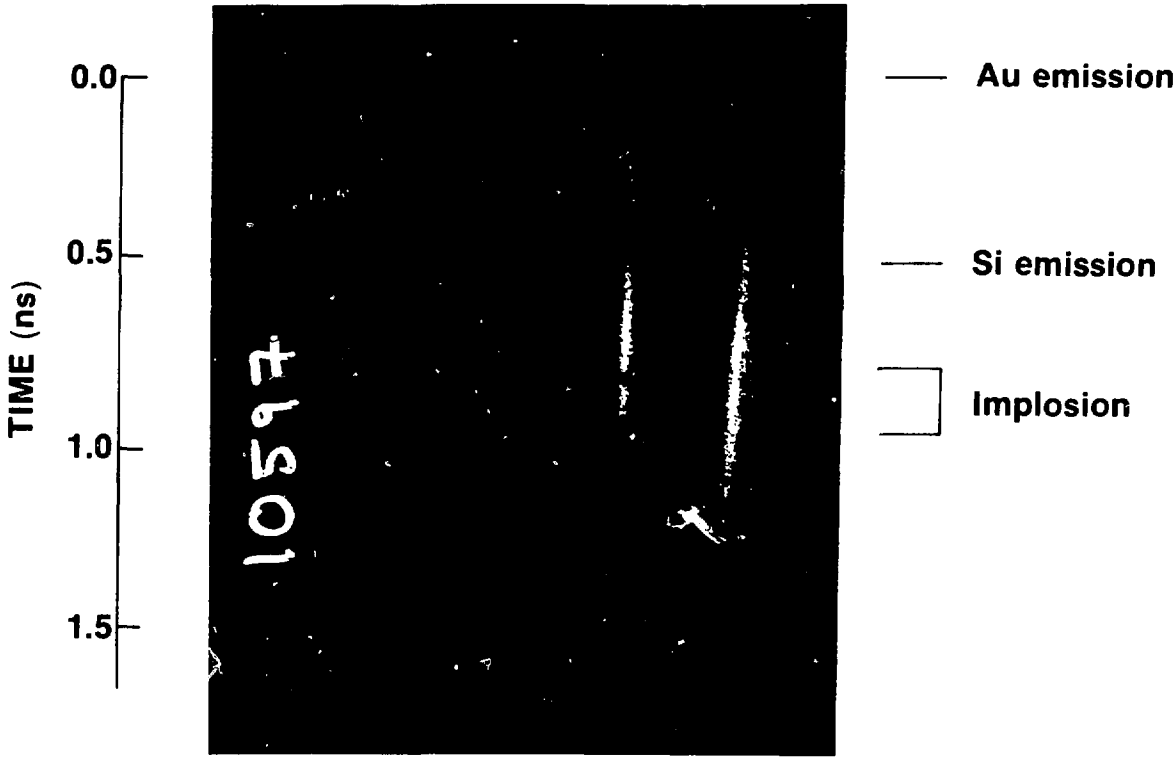
UR LLE

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

$\tau = 750$ ps

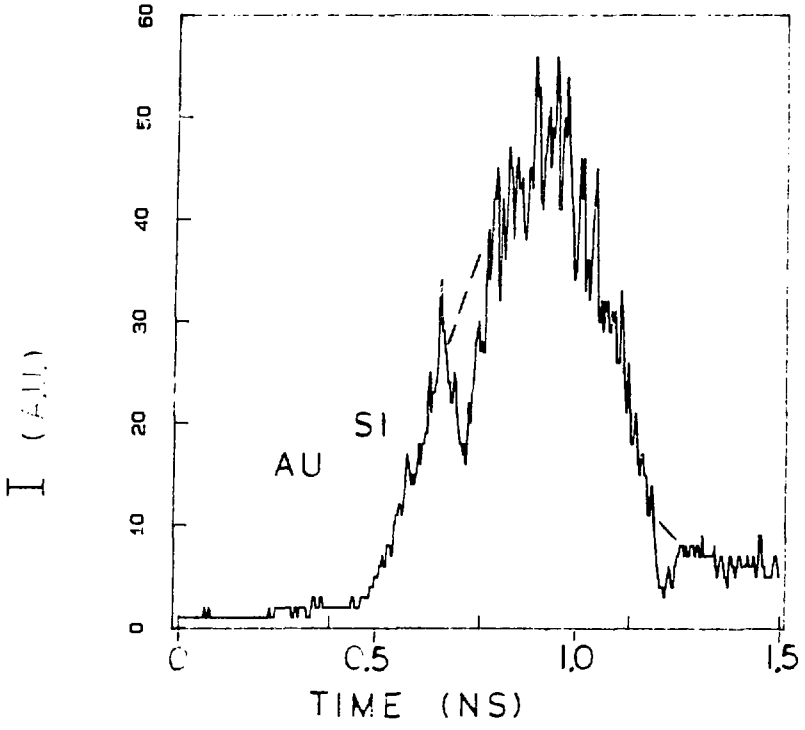


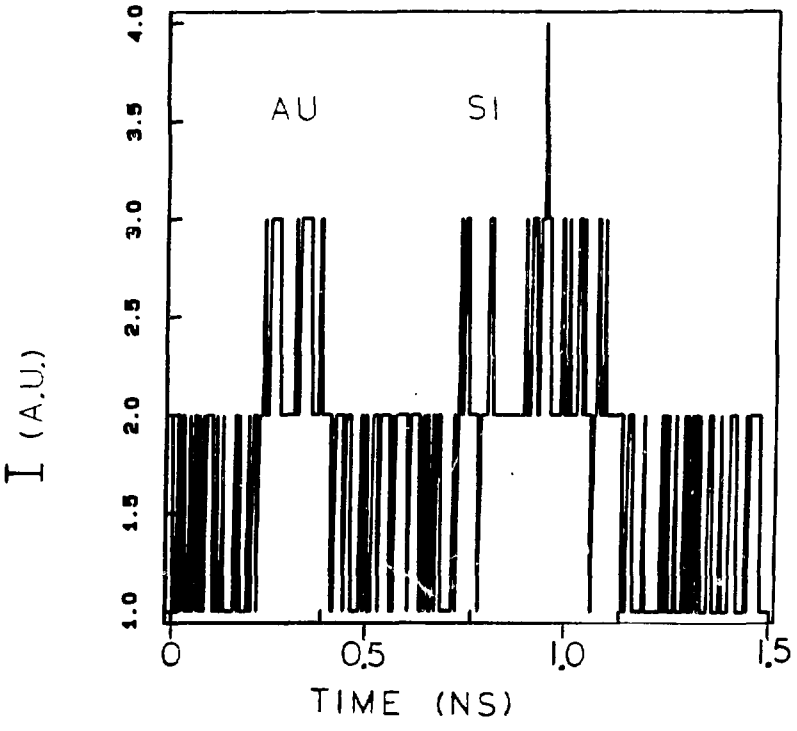




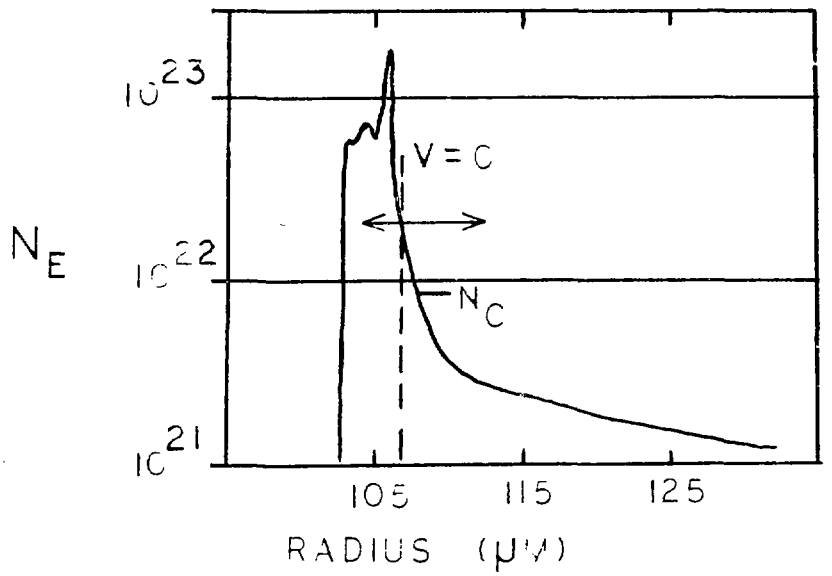
E3211

TEMPORAL PROFILES AT E = 2.4 KEV

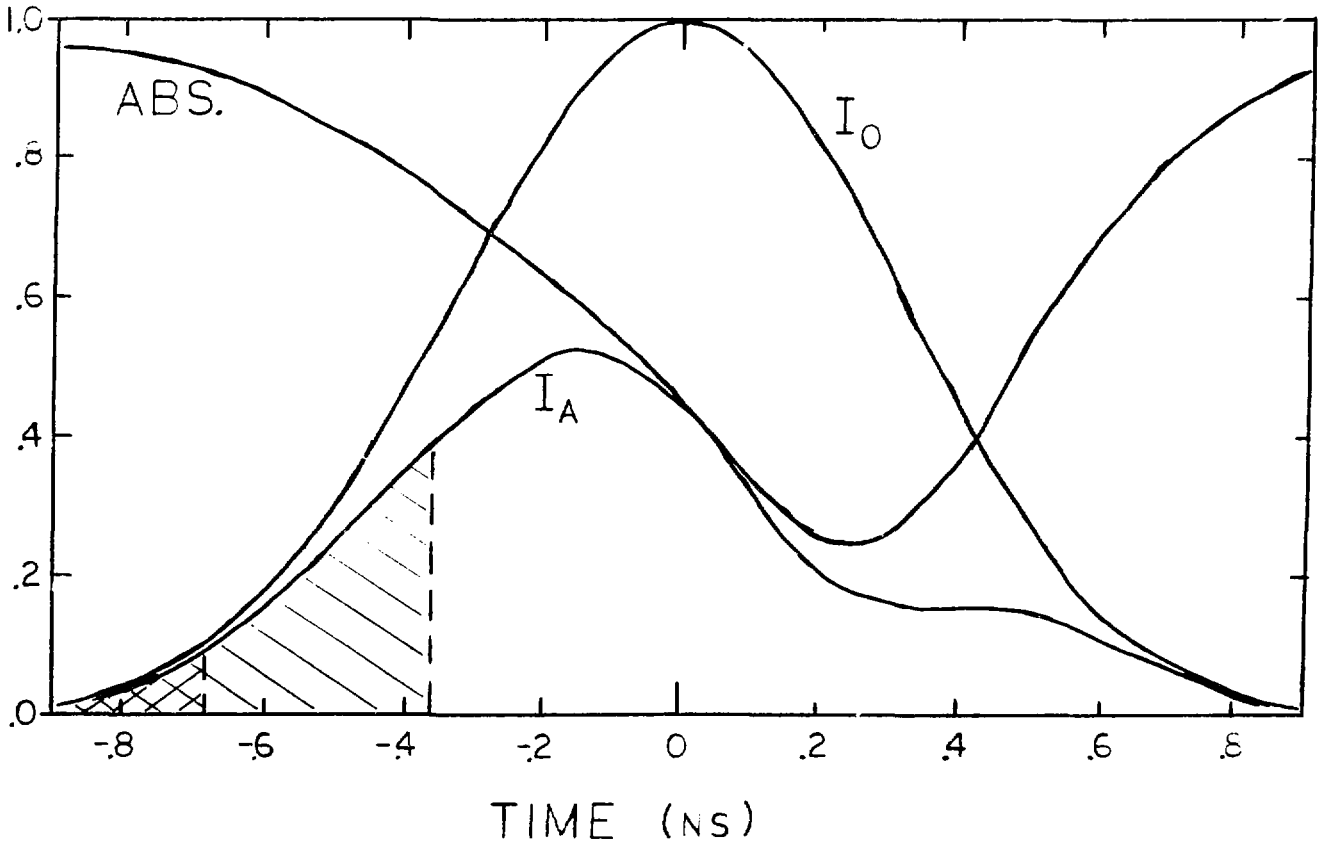




DEFINE ABLATED MASS

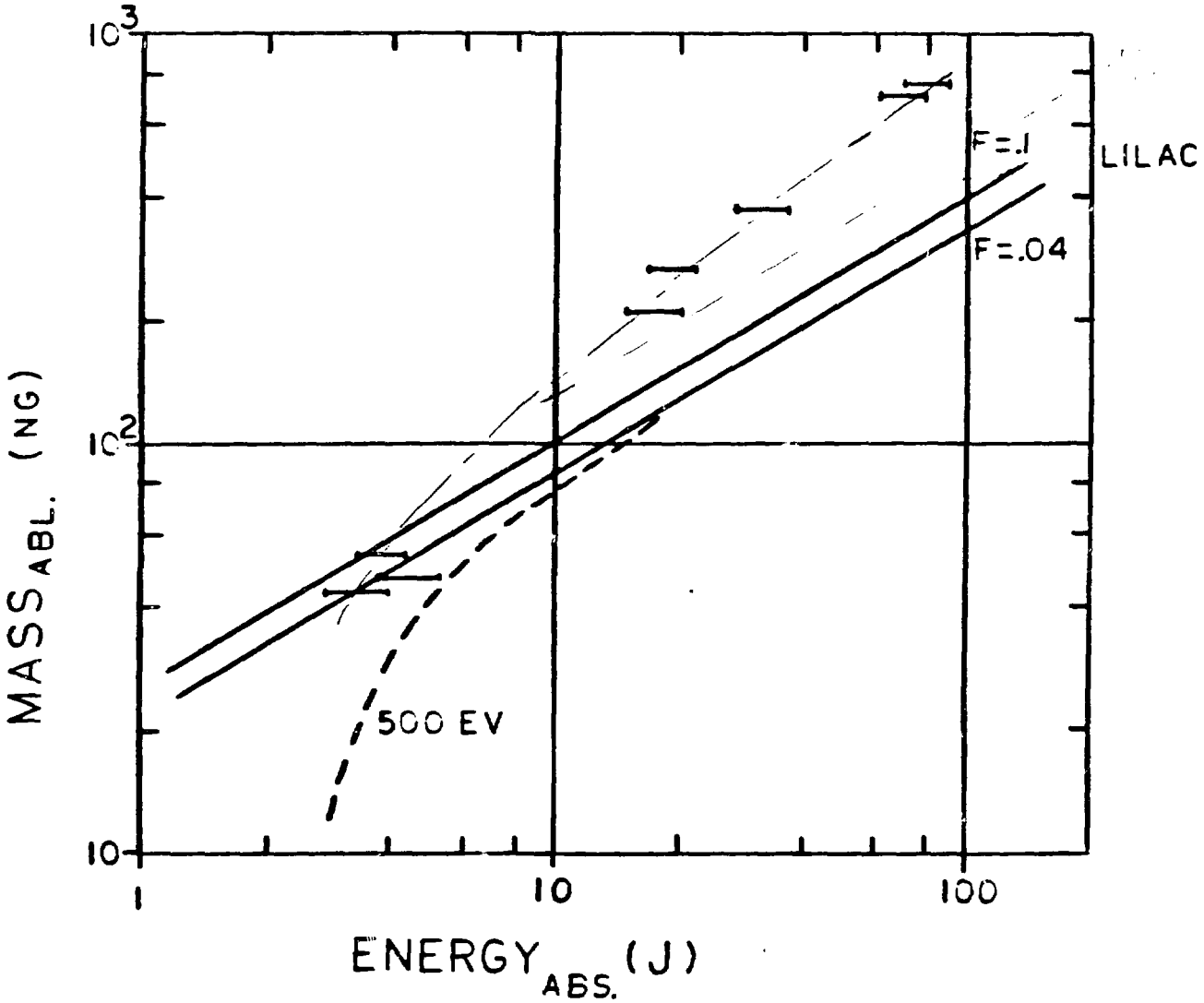


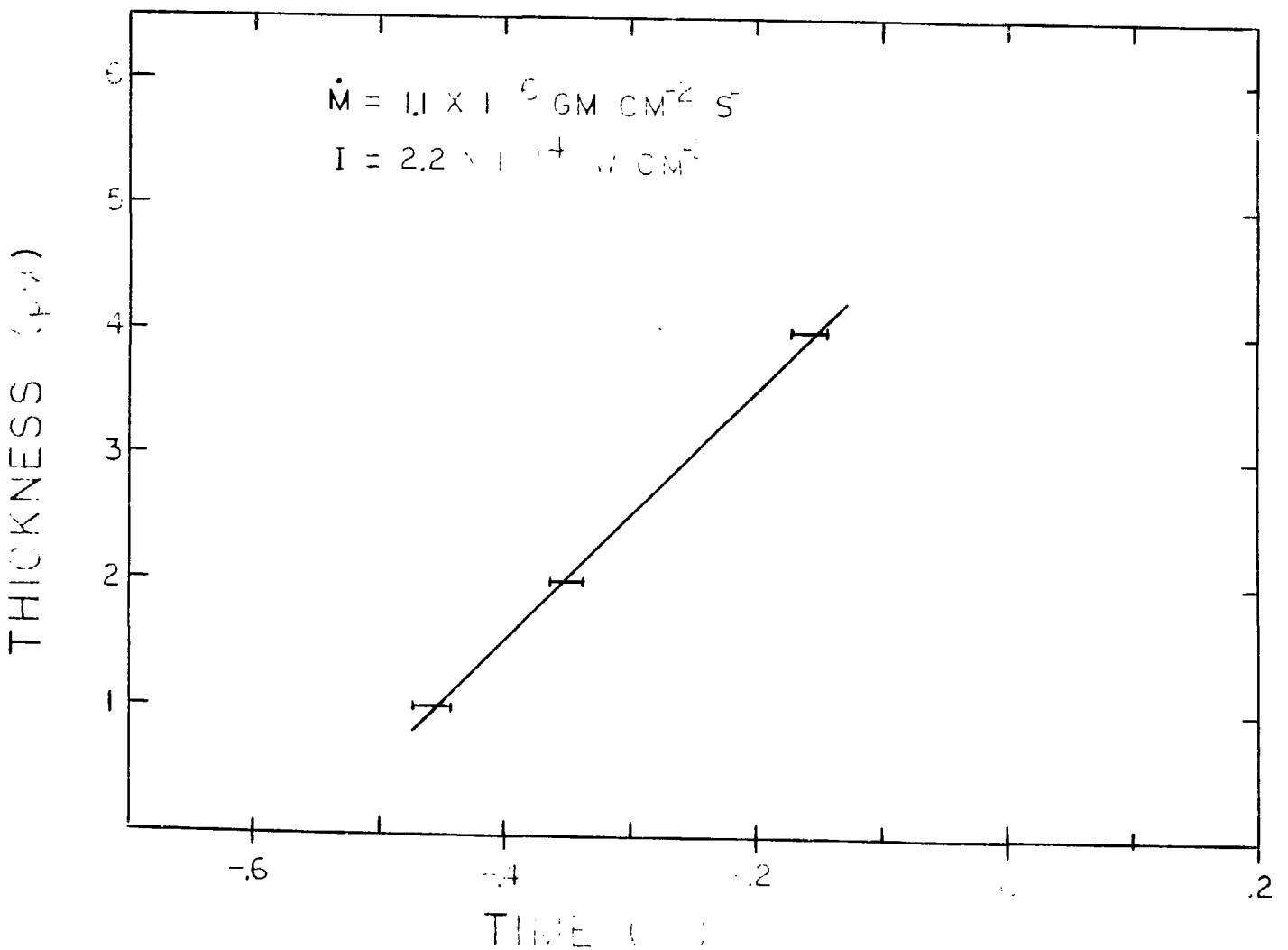
CALCULATE ABSORBED ENERGY



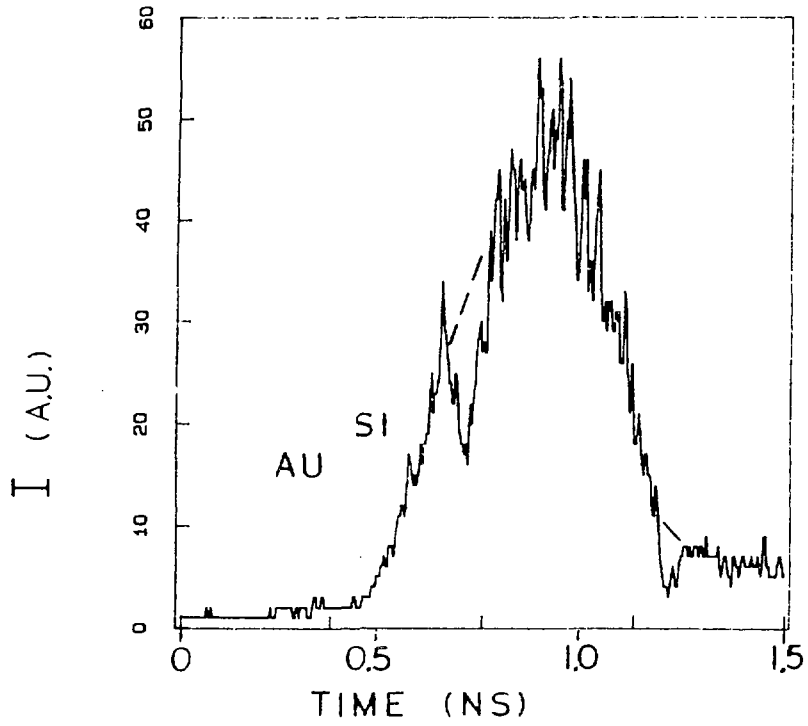
AU/CH/GLASS TARGETS 230 μM

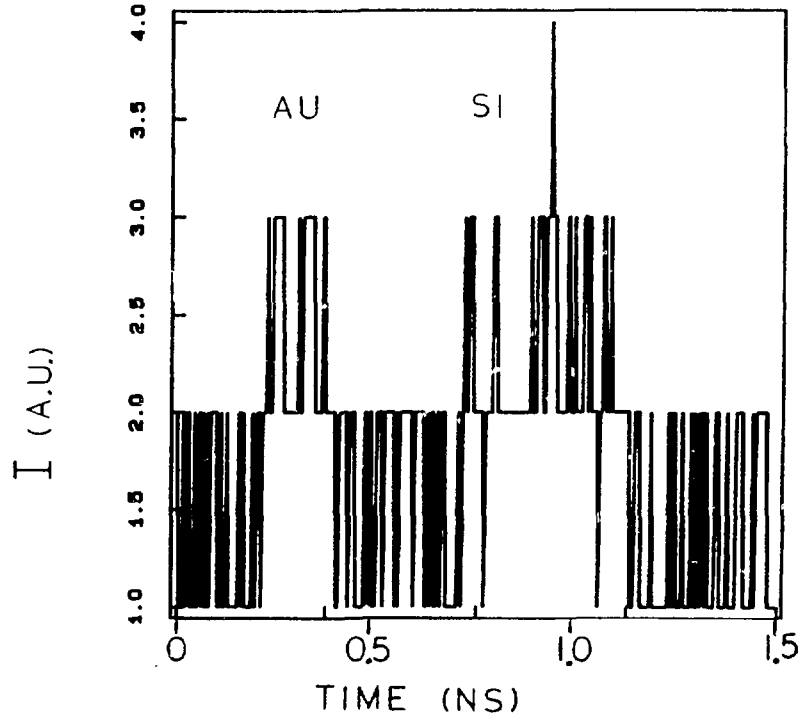
$I = 2.4 \times 10^{14}$ W/CM^2

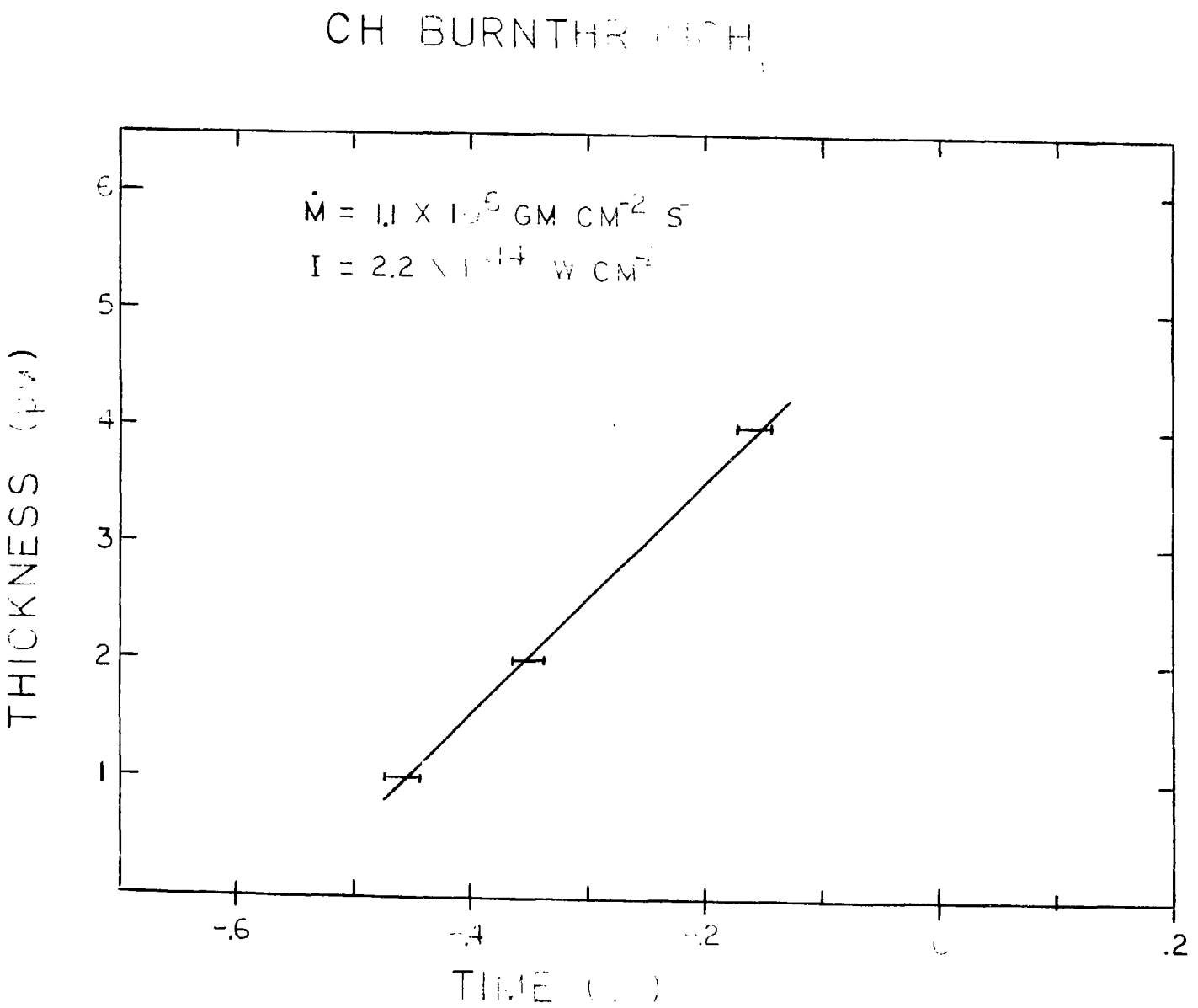



CH BURNTHR
$\dot{M}$ = 1.1 X 1
GM CM
S
I = 2.2
W CM
THICKNESS
-.6
-.4
.2
.2
TIME

TEMPORAL PROFILES AT E = 2.4 KEV

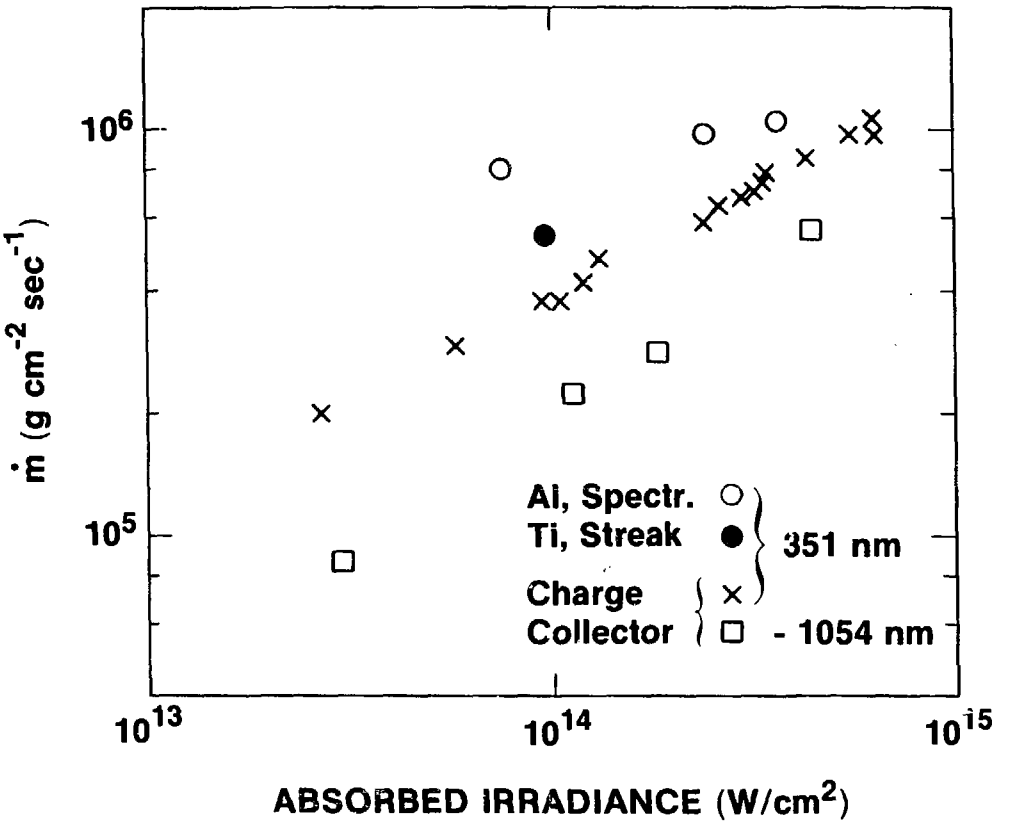





CH BURNTHR
$\dot{M}$ = 1.1 X 10^5 GM CM^-2 S^-
I = 2.2 X 10^14 W CM^-2
THICKNESS (
TIME (
1
2
3
4
5
6
-.6
-.4
-.2
0
.2

MASS ABLATION RATE IN SPHERICAL IRRADIATION

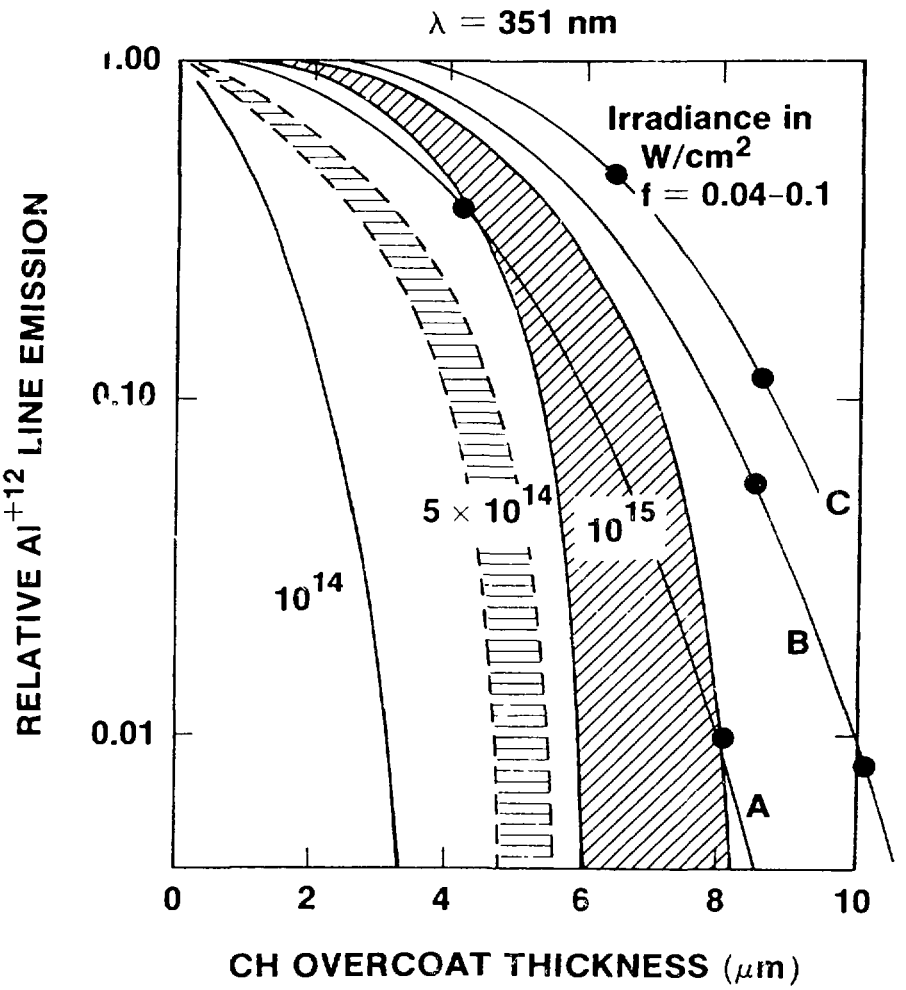
UR LLE



E2736

LILAC CALCULATED BURN-THROUGH CURVES; CH OVER ALUMINUM

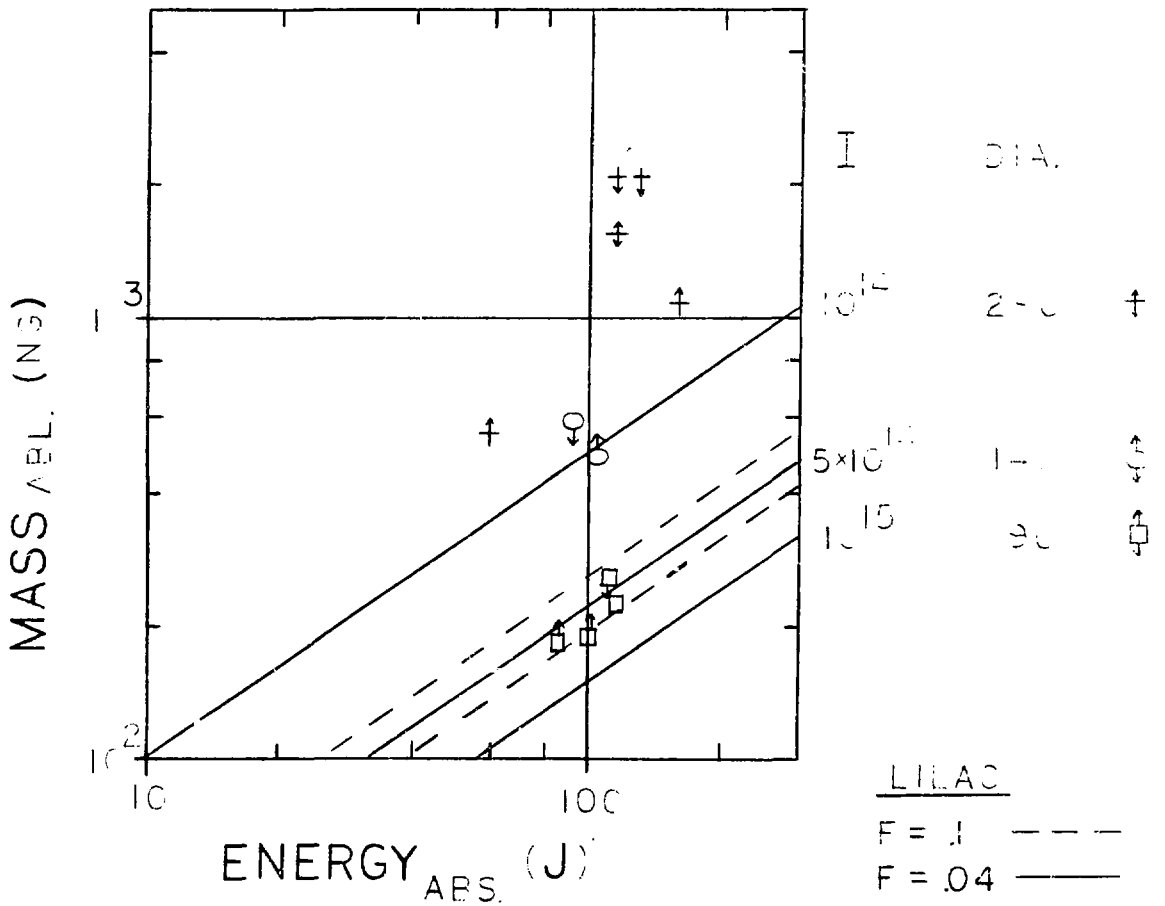
UR LLE



E2980

CH/Al/CH Targets (Solid)

Time Integrated Data

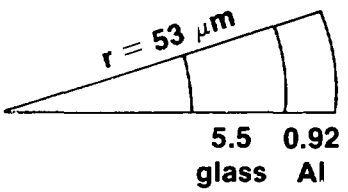


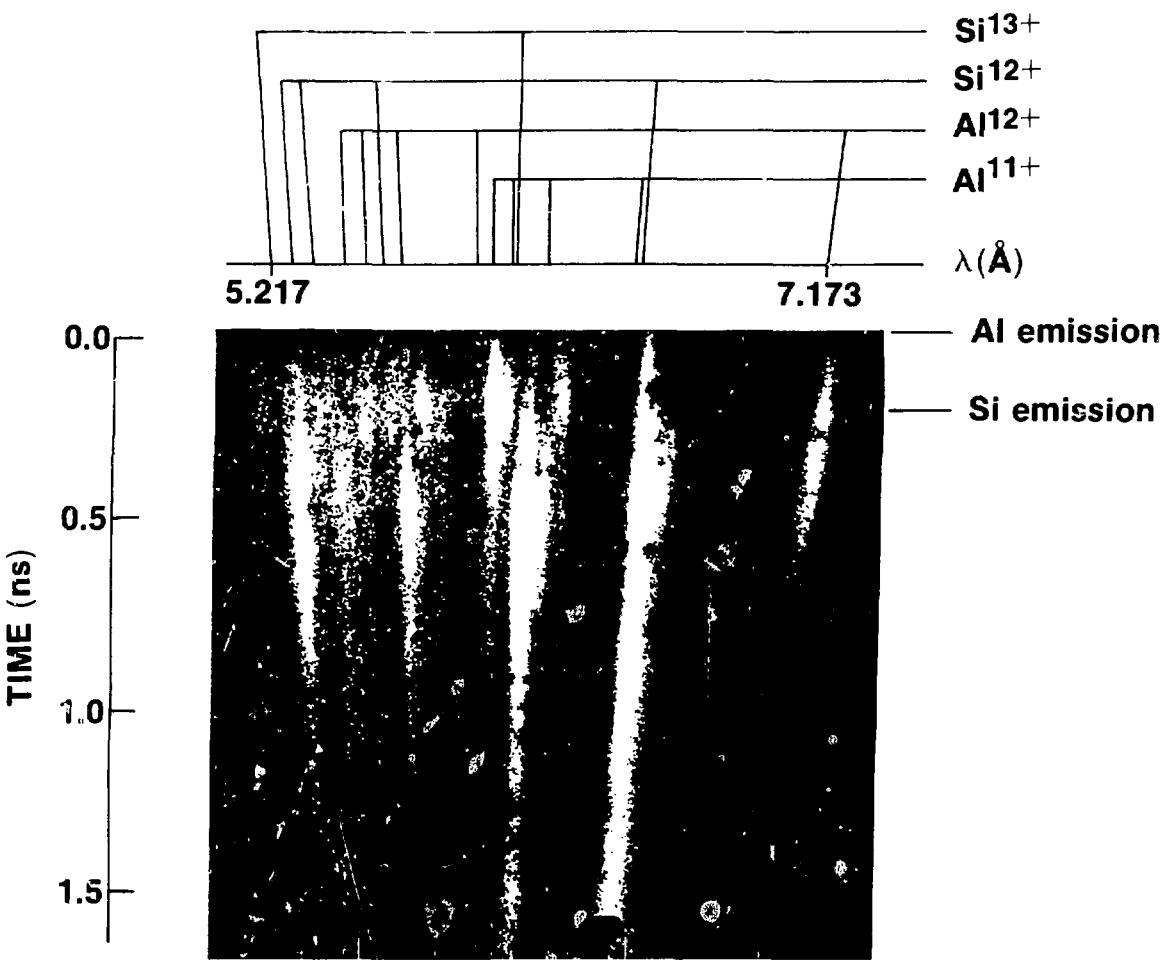
TIME-RESOLVED X-RAY LINE EMISSION FROM Al-COATED GMB

UR LLE

$I = 1.34 \times 10^{15}$ W/cm^2

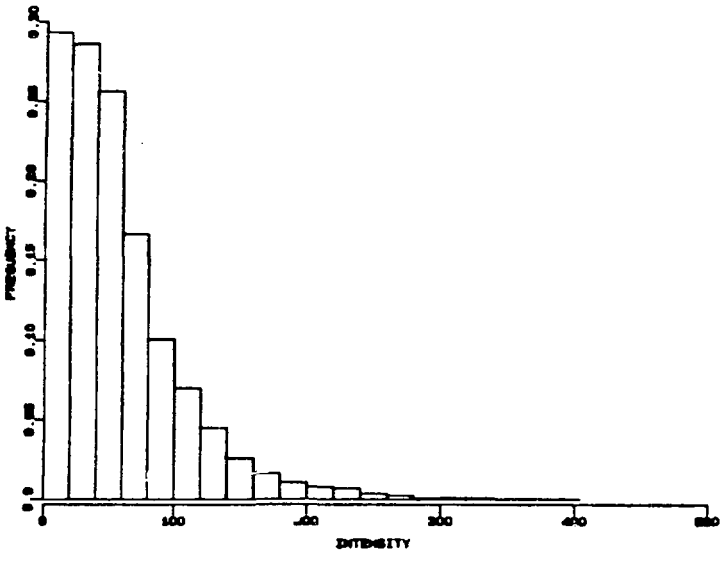
$\tau = 615$ ps





E3212

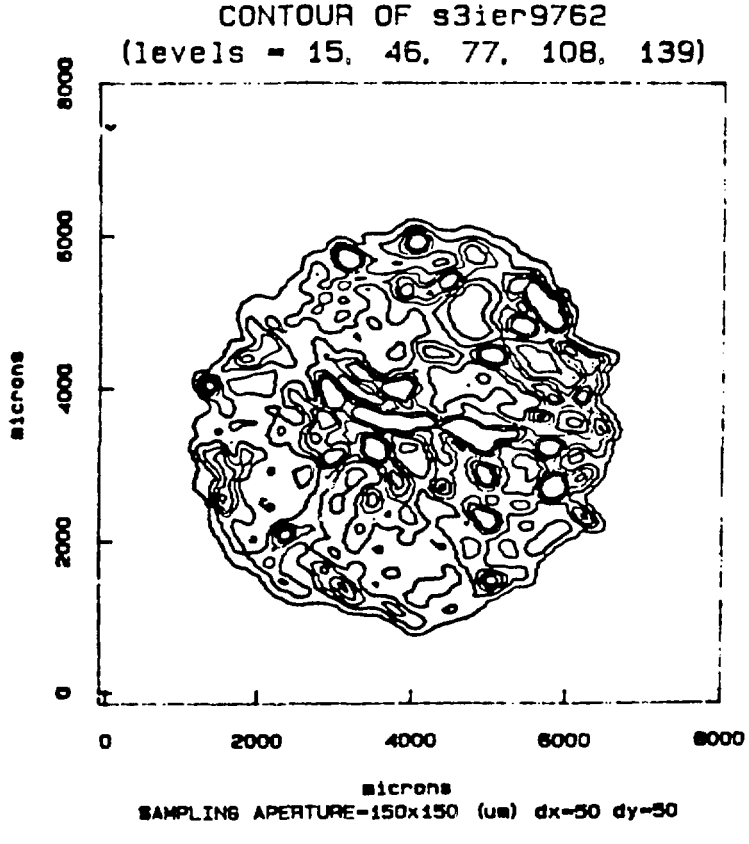
BEAM 4-1 FROM UV ETP DATA



1600 μM FROM BEST FOCUS

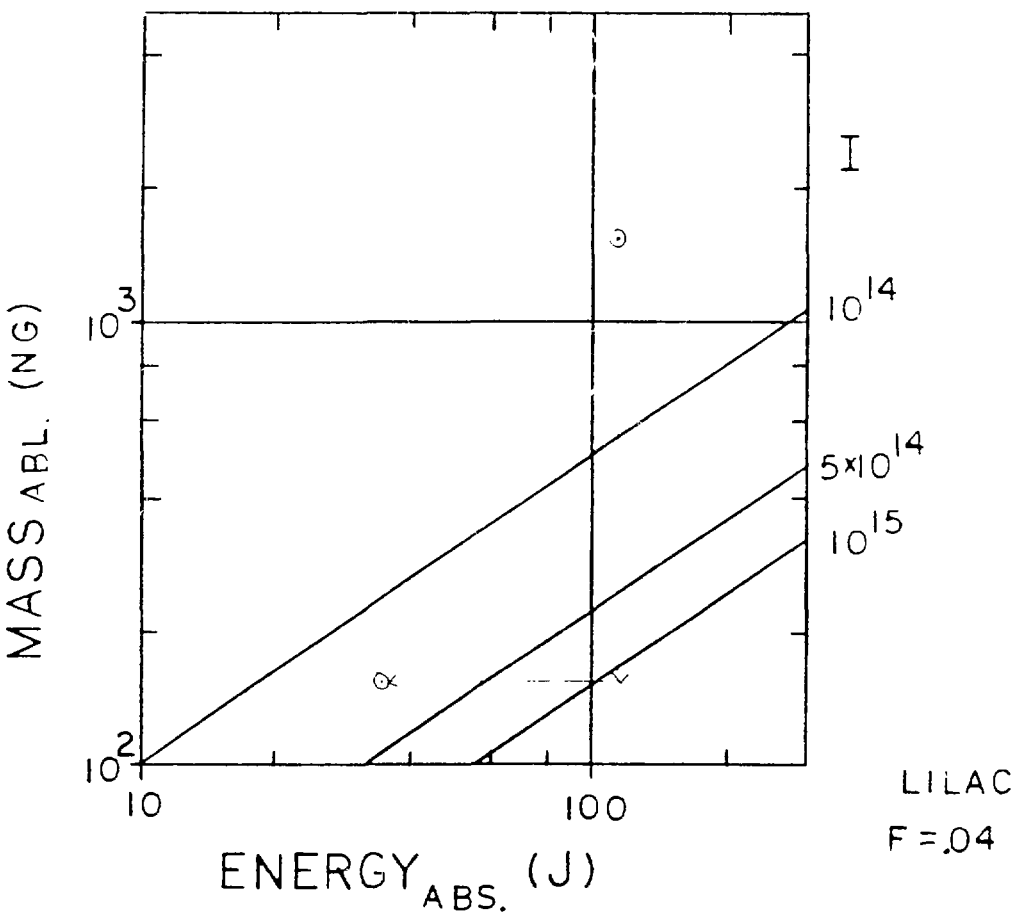
HOT SPOTS

30% ENERGY IN 1C% AREA



CH/Al/CH Targets (Solid)

Time Integrated Data



SUMMARY

- 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