Baffle Research

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BAFFLE RESEARCH

R.W 5/25/9

- MEASUREMENT OF BEAM TUBE BACK SCATTERING

  BACK SCATTER AT $\theta_{GR} < 10^{-2}$

  LARGER THAN IN BRO MODEL

  >> REQUIRE BAFFLES WITHIN 100 METERS OF MIRROR

  >> INCREASED # OF BAFFLES IN BEAM TUBE

614	WA	458	LA	h = 6 cm
462		360		h = 8 cm

- REESTIMATE OF BEAM TUBE MOTION

  >> GAMBLE MODEL

  TRANSVERSE MOTIONS — DIFFRACTION MODULATIO

  LONGITUDINAL — BACK SCATTER MODUL.

  $Q \approx 25$

  RESONANCES $5 \rightarrow 100$ Hz

  >> DIRECT MEASUREMENTS

  HIGH Q MODES $240 \rightarrow 270$ Hz ACOUSTIC DR

  HIGH Q MODES AT 35, 40, 55, 65 Hz

  GND NOISE DR

- NET INCREASE IN ESTIMATED

  SCATTERED LIGHT PHASE NOISE $\approx$ 10-3

- NEW ANALYTIC ESTIMATES FLANAGAN, THORNE

  INCLUDES:

  BACK SCATTER FROM LARGER # OF BAFFLES
  M. GAMBLE MODEL OF BEAM TUBE TRANSFER FUNCTI

- PHASE NOISE FROM BEAM TUBE STEEL BAFFLES EXCEEDS GOAL OF 1/10 SQL 10^6 gm

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DESIGN OPTIONS

- LOW BACK SCATTER LOW REFLECTIVITY
  OXIDE COATINGS ON POLISHED S.S.

  + INEXPENSIVE MATERIAL AND FABRICATION
  + LOW OUTGASSING
  O RELATIVELY ROBUST SURFACE
  - λ DEPENDENCE OF SPECULAR REFLECTIVITY
  - NOT LOWEST VALUES OF BRDF AND R

NEXT STEPS

1) VARY OXIDE THICKNESS TO MAINTAIN LOW BACKSCATTER AT GOOD COMPROMISE WITH SPECULAR REFLECTIVITY

2) MEASURE PROPERTIES AT 1.06μ
   BRDF, R, A

SCHEDULE

RESULTS TO BE AVAILABLE MID JULY

- MARTIN BLACK
  - \+ λ INDEPENDENT BACK SCATTER AND SPECULAR
  - \+ LOWEST BRDF AND R OF METAL SURFACES
  - o RELATIVELY ROBUST SURFACE
  - \- Δ COST ~ \$100K → 200K
  - \- POSSIBILITY OF DUST IF NOT PROPERLY MASKED
  - \- POSSIBILITY OF AMU 400-500 OUTGASSING

NEXT STEPS

1) OUTGASSING MEASUREMENT AT PLASMA FUSION CENTER

ESTABLISH

$$J(\text{HYDROCARBONS}) < 10^{-18} \text{ T lit/s cm}^2$$

AT 300 K

BY EXTRAPOLATION FROM J AT 430 AND 400 K USING 10^3 cm^2 MARTIN BLACK

METHOD

INTEGRATION ON COLD TRAP $10^{-8} \rightarrow 10^{-9}$ T lit

GRADUAL WARMING AND RGA MEASUREMENT OF EVOLVED GAS

SCHEDULE

DATA TO BE AVAILABLE END 6/95

BASIC ASSUMPTION:

OUTGASSING REQUIREMENT MORE STRINGENT THAN CONTAMINATION REQUIREMENT

J (TEST) $\Longrightarrow$ 10^{-6} MONOLAYERS / YR

- BLACK GLASS

+ LOWEST BRDF

○ UNKNOWN COST FOR FABRICATION

○ LIKELY TO REQUIRE CAREFUL MECHANICAL/THERMAL DESIGN

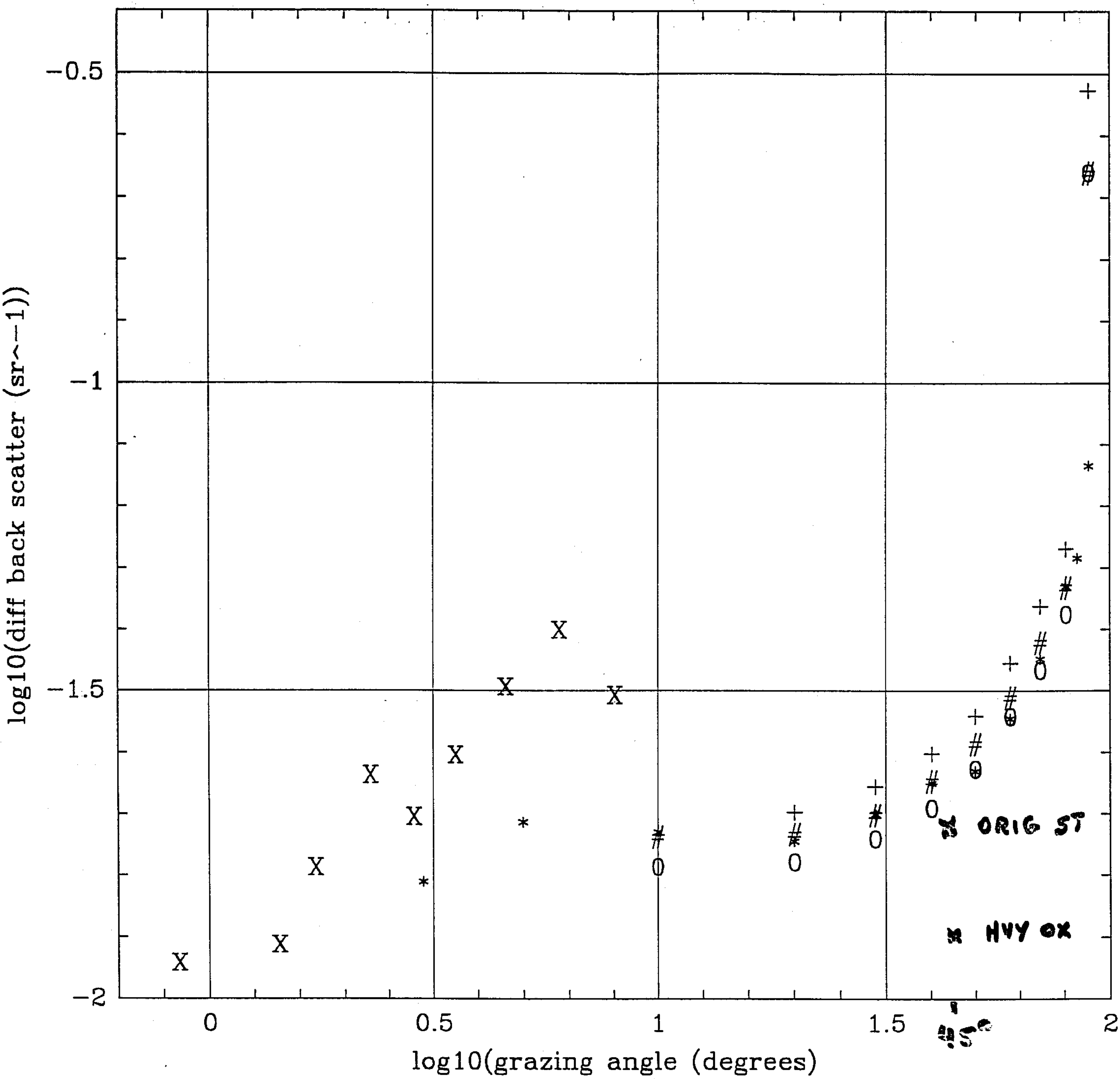
− HAZARD OF BREAKAGE IN FIELD INSTALLATION AND LATER IN TUBE

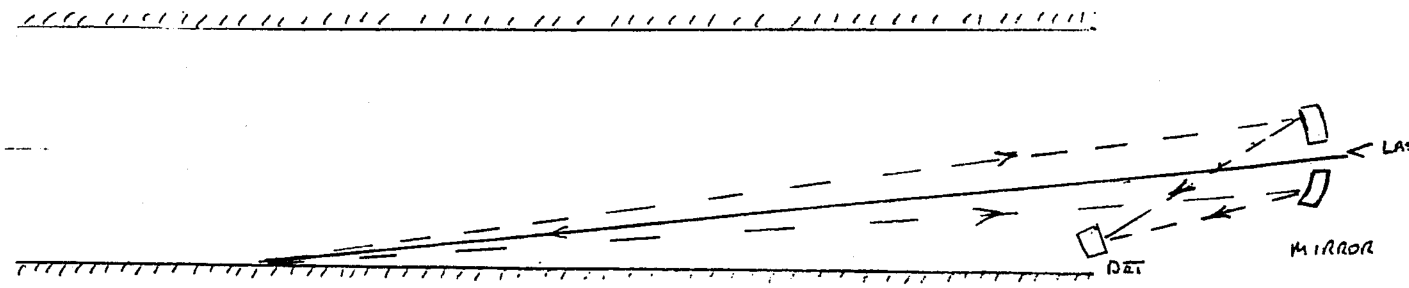
RECOMMENDATION:

ONCE DECISION OF MATERIAL, MOUNTING TECHNIQUE AND FABRICATION METHOD HAS BEEN MADE ALLOW TIME FOR BACK SCATTER MEASUREMENT OF ASSEMBLED BAFFLE MOUNTED IN BEAM TUBE SECTION (GLINTS OFF SERRATIONS?)

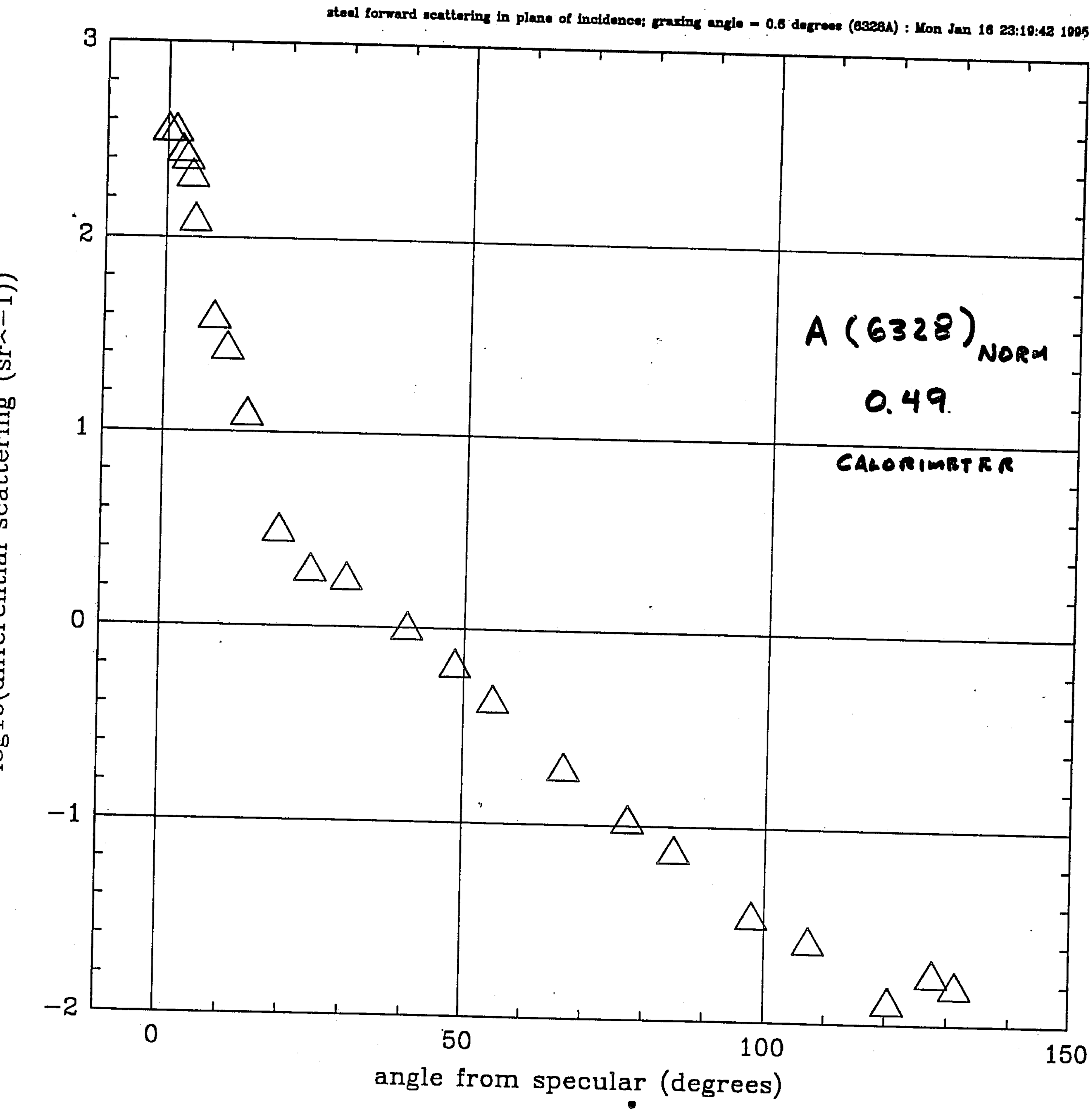
BACK SCATTER

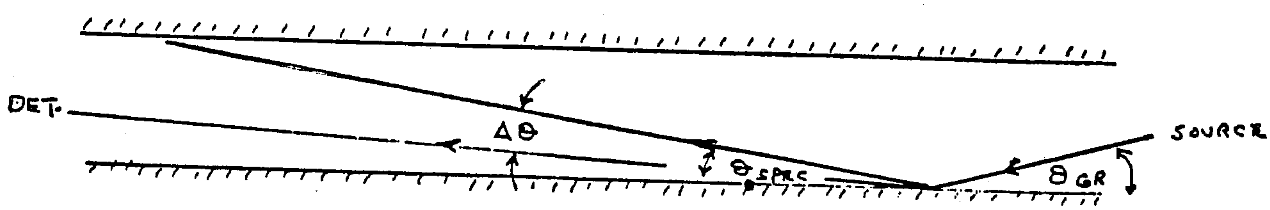
differential back scatter vs grazing angle STEEL:12.5m=*,25m=0,30m=#,35m=+; TUBE = X : Wed Jan 4 00:59:46 1995





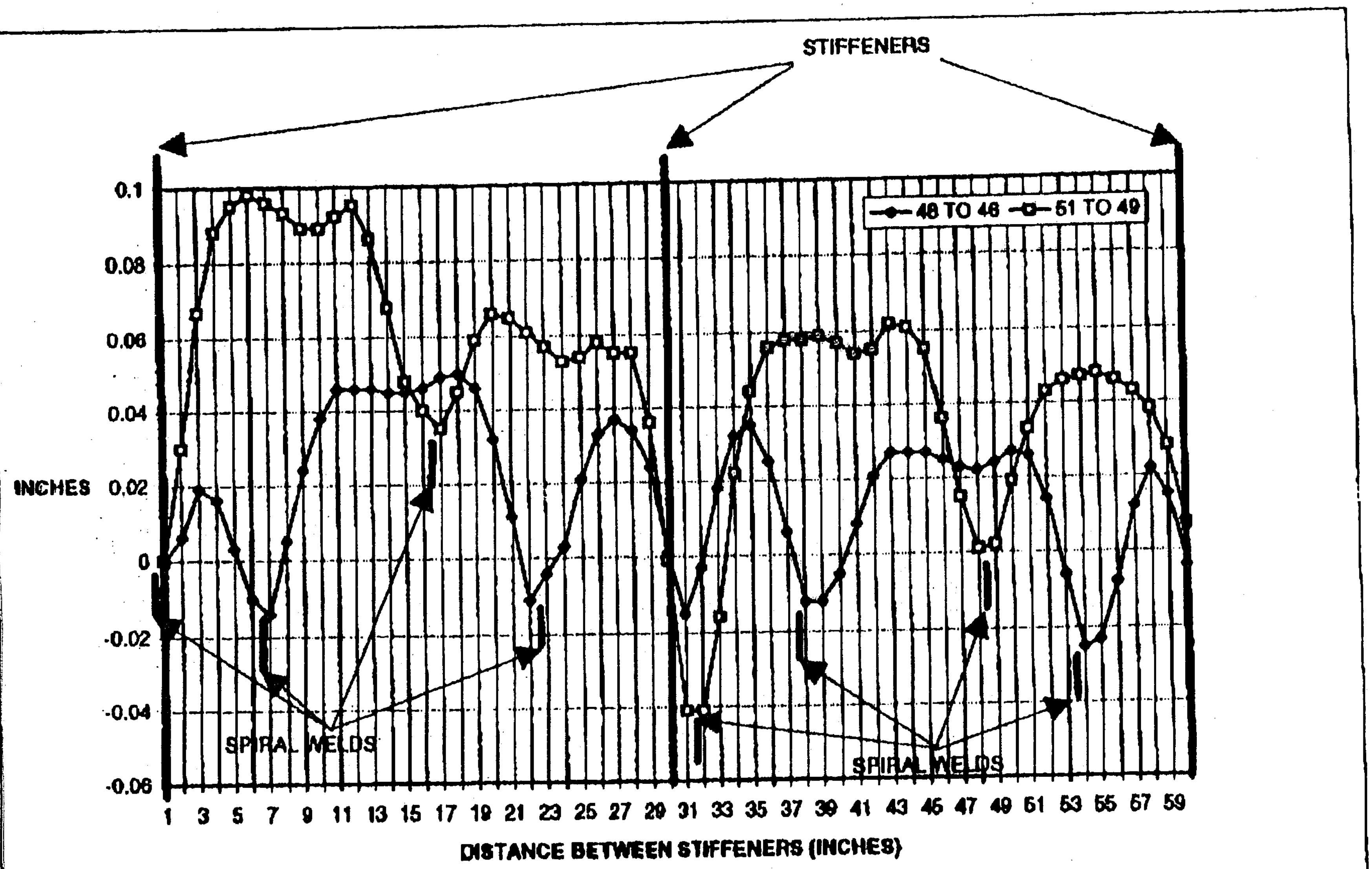
FORWARD SCATTER





LASER
BEAM DIVERGENCE (FULL ANGLE) 1.65×10^{-3} RADIANS

BEAM TUBE PROFILE



PROFILE BEAM TUBE SURFACE BETWEEN STIFFENERS

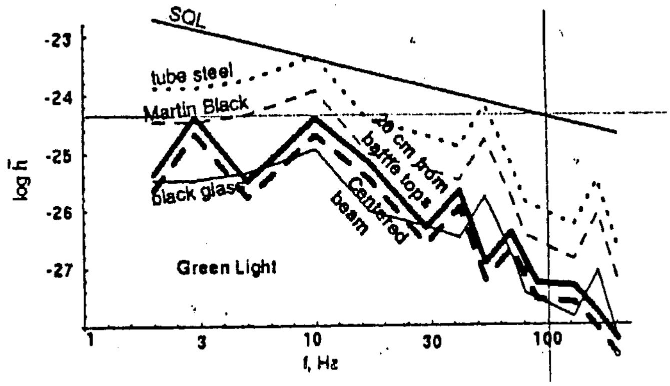


FIG. 8. Diffraction noise (thick curves) for green light, compared to backscatter noise (thin curves), at Hanford with 6cm high baffles and 0.8cm deep serrations. The thick solid curve is for the main-beam axis 20cm away from the nearest baffle tops; the thick dashed curve is for the main-beam axis at the center of the beam tube. The scattering noise is the same as shown in Fig. 6

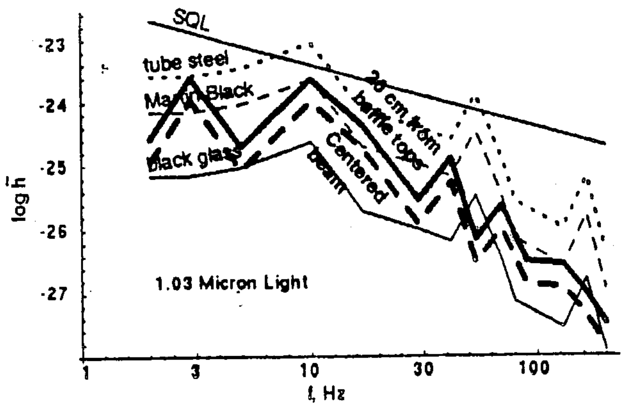
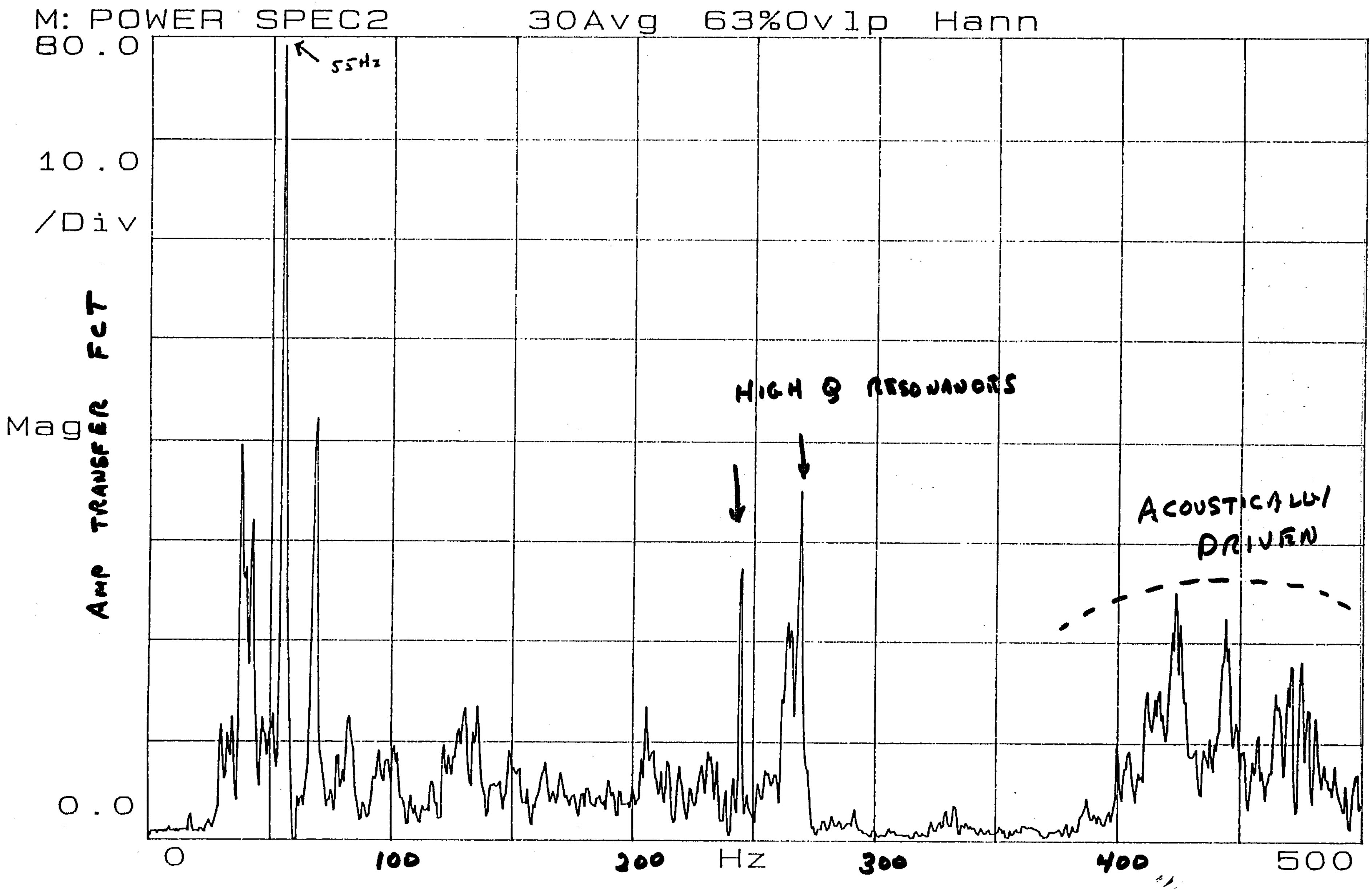


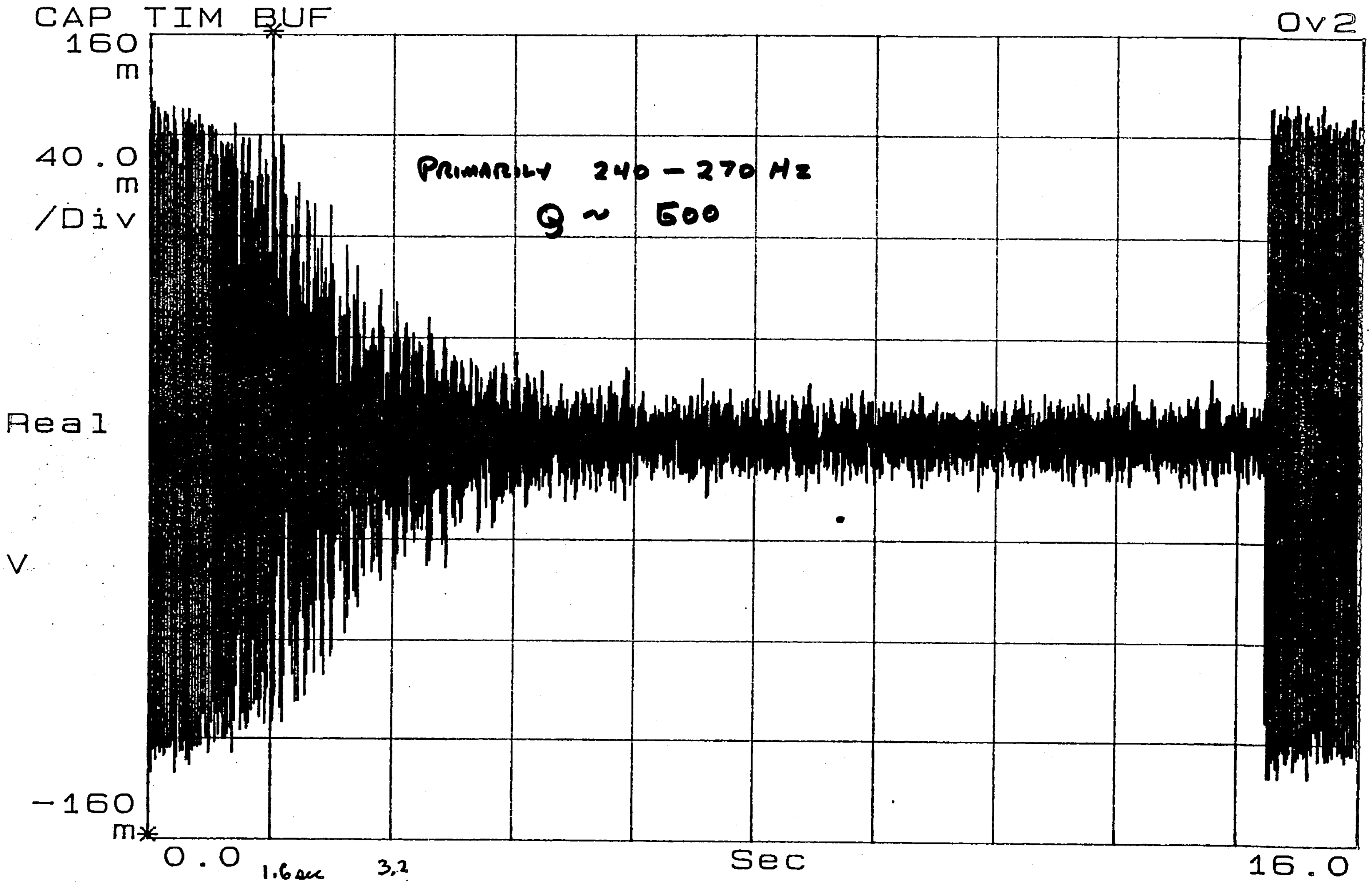
FIG. 9. Diffraction noise (thick curves) for 1.03 micron light, compared to backscatter noise (thin curves), at Hanford with 6cm high baffles and 0.8cm deep serrations. The thick solid curve is for the main-beam axis 20cm away from the nearest baffle tops, the thick dashed curve is for the main-beam axis at the center of the beam tube. The scattering noise is the same as shown in Fig. 7

FLANAGAN + THORNE
4/2/95

Ratio TUBX/GND 18/85

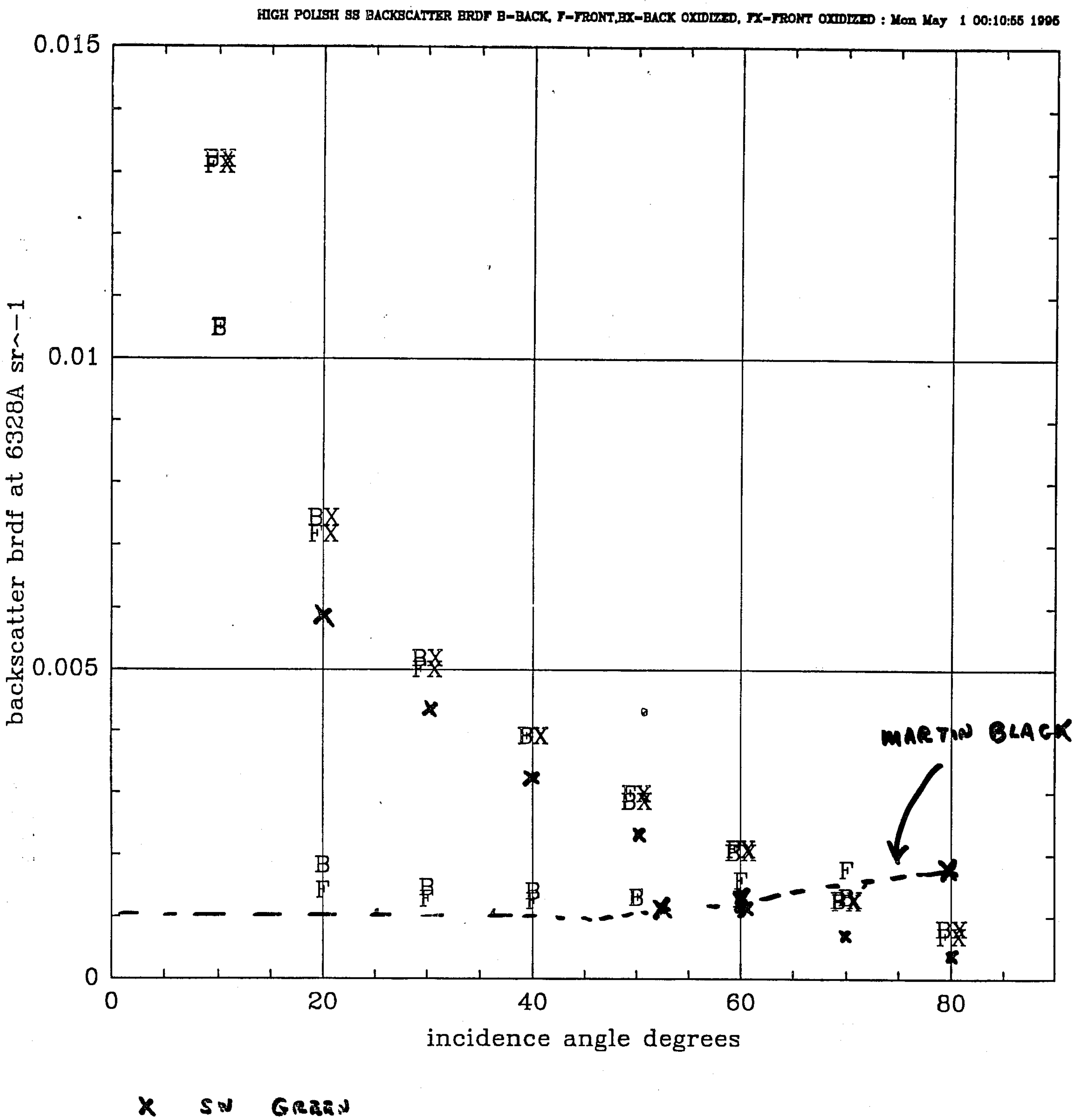


RINGING AFTER IMPACT



HIT NEAR BELLOWS

59:06 TAPE 1



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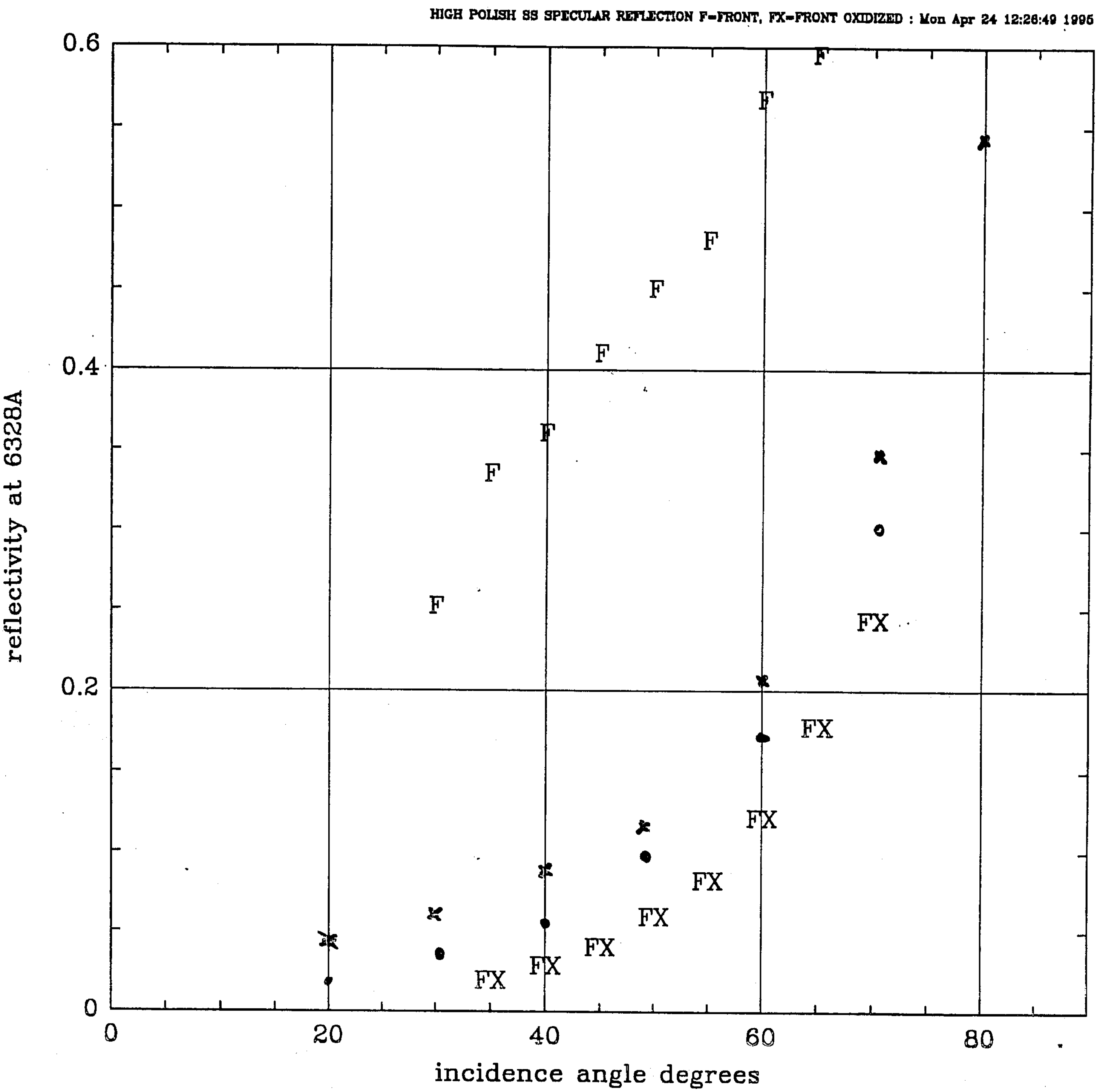

X SW GARREN BIG

• SW SMALL

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