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REMOTE OPTICAL MEASUREMENTS ABOVE THE
DANISH WADDEN AREA

by

D. SPITZER

Netherlands Institute for Sea Research, Texel, The Netherlands

and

S. FOLVING

University of Copenhagen, Department of Geography, København
Denmark

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INTRODUCTION

(S. Folving)

The data presented in this report are the preliminary results of the airborne spectral measurements performed during the Danish Wadden Sea Remote Sensing Project - 81.

The project which is lead by Prof. Dr. N. Kingo Jacobsen, Department of Geography, University of Copenhagen, has been financed by the Danish Nature Science Research Council and the Danish Space Science Research Council.

The project is partly run in cooperation with Dr. N. Højerslev, Department of Physical Oceanography, University of Copenhagen and with the Netherlands Institute for Sea Research.

The main aim of the Danish Wadden Sea R.S. project is to investigate the correspondence between satellite image data and numerous ground (sea) - truth measurements in order to

investigate the utility of various satellite data to monitor and map oceanographic -, biological - and sedimentological themes and to map topography of tidal flats; as especially the dynamic interactions are of interest. In this context it was of very great interest to investigate the utility of air-borne spectral measurements also, both as a mean to ease the calibration of the satellite data, but, also as a mean to collect spectral reflections from different types of tidal flats as well as different watermasses. Repeated measurements on the same spot during different stages in the tide have given an excellent opportunity to estimate the dynamic aspects.

During the whole fieldcampaign the weather conditions in the area were measured and automatically registered every 10th minute. Each time a R.S. spectral measurements was performed, the person standing on the ground made subjective weather report, and changes in weather conditions were, when discernible, noticed in the flight logging.

The main characteristics of the weather has been given for every flightperiode in this report as an average from two automatic weather stations weighted by the fieldcrew reports. (A special report on the weather will appear on a later stage when data about the tide has been prepared; this report will also include an interpretation of satellite images from various weathersatellites).

Broadly speaking, the weather during the field work was dominated by low pressure with cyclones and fronts passing the area. The winds were predominantly western, strong, and clouds covered most of the sky during the periode. The visibility was very varying both due to the frontal characteristics and due to the sun haze. Only two days gave an

opportunity to carry out measurements under cloudfree conditions, but during these two days the wind was extremely turbulent.

MEASUREMENTS (D. Spitzer)

Measurements of the downwelling irradiance and of the upwelling radiance were performed between 400 and 720 nm employing the Optical Multichannel Analyser (OMA) in combination with a two-directional (up and down) optical system, monochromator, SIT detector, CRT display and a desktop computer. The slitwidth of the monochromator was set to 0.2 mm. Before and after the measurements, the geometrical and spectral characteristic of the whole setup (irradiance collector with filters and lightguide, lens system, filters and lightguide for the radiance measurements, monochromator, detection system) have been calibrated using standard radiation sources. The upwelling radiance was measured within a field of view of 6° . The direction of view was 15° from nadir at the azimuth away from the sun.

The whole system and the data acquisition were controlled by a HP 9825A desktop computer.

The flight altitude was 150 m, the speed 105 knots, unless other specified.

Subsequent measurements of upwelling radiance L_u , downwelling irradiance E_d and of the background signal were performed above each sampling-site following the sign given by the operator in the aircraft. All signals have been 25 times accumulated which means that the scanned area was about 20m $\times$ 60 m large. Simultaneous time registration of the measuring procedure (real time clock) and of the sampling are essential for the later comparison between the remote measurements and the sea (ground) truth data.

The weather conditions during the flight were registered

both by the operator in the aircraft and at the sampling-site.

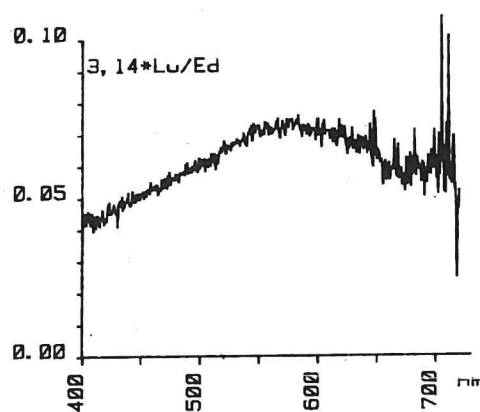
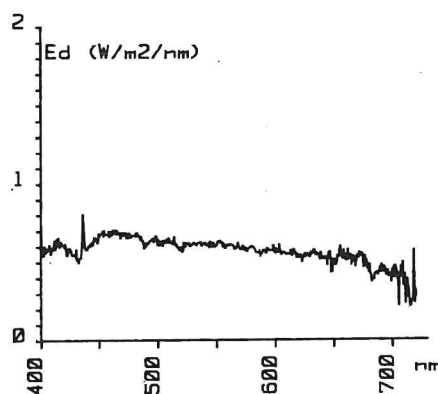
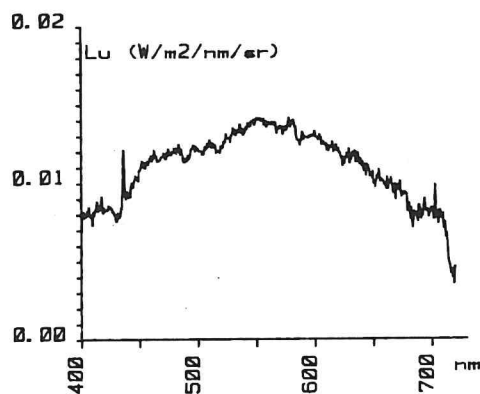
Measurements were performed above the tidal flats, shore and coastal waters.

In the following figures the spectra of the upwelling radiance L_u , downwelling irradiance E_d and the ratio $\pi L_u/E_d$ are presented. The local time and date of the measurements are indicated.

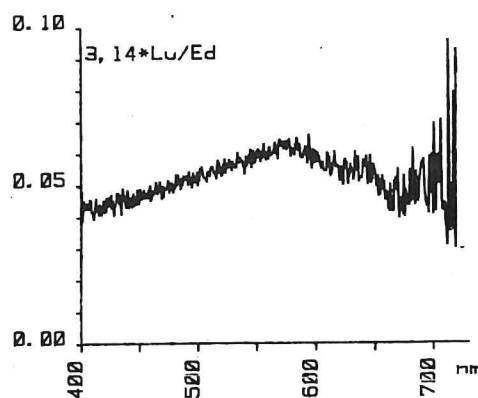
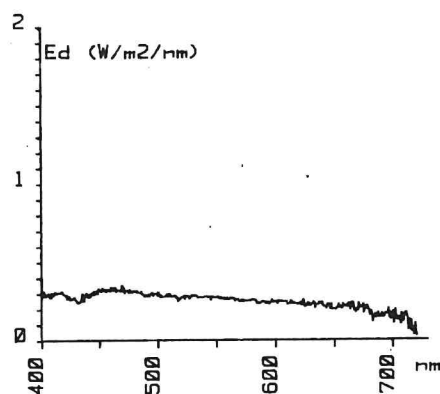
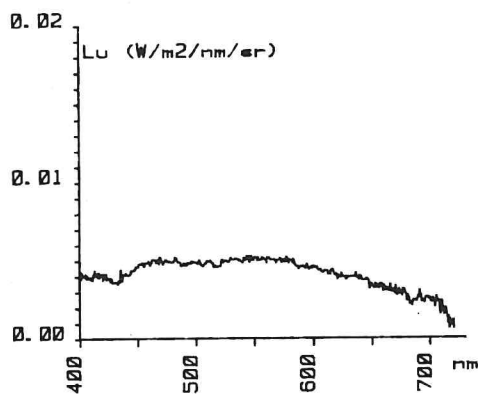
Error of the spectral measurements is estimated to be within 15%.

Acknowledgements.—The authors wish to thank the pilot A. Droog for cooperation during the measurements. L. Nykjaer and K. Rappoldt are acknowledged for processing the data.

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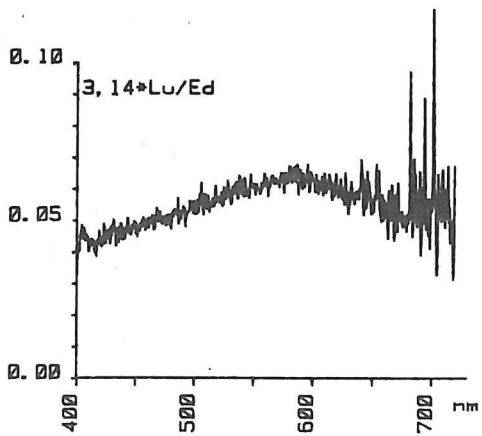
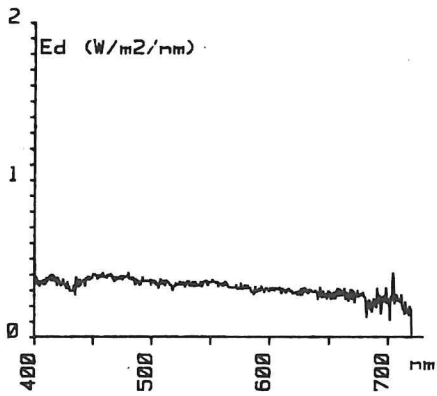
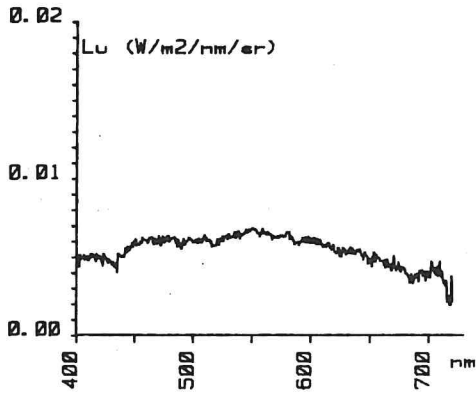
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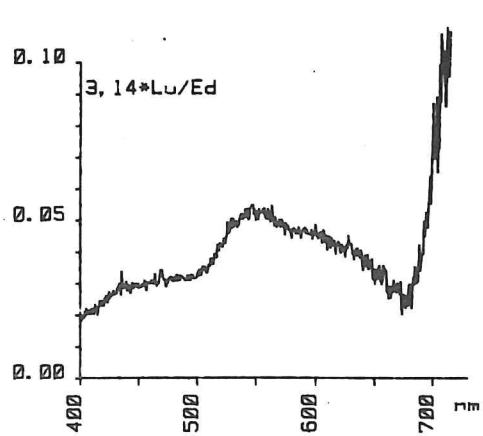
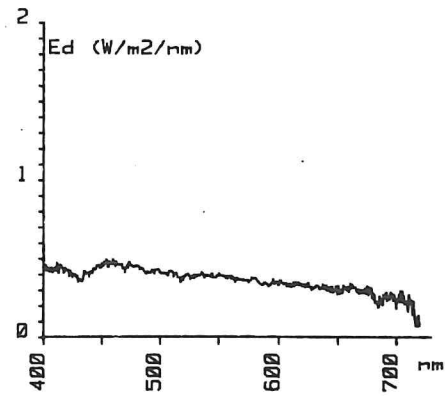
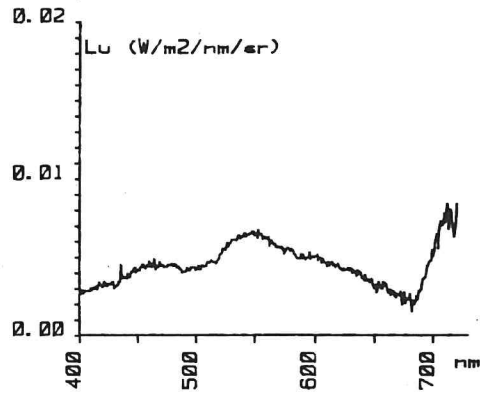
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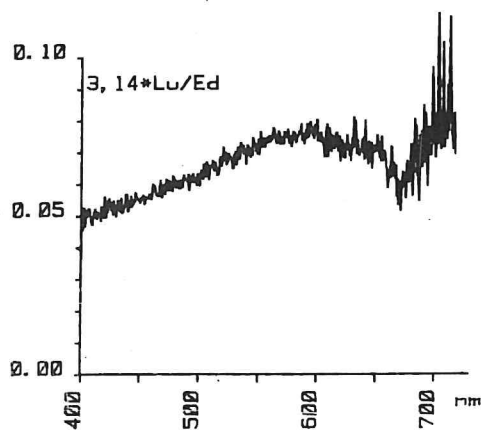
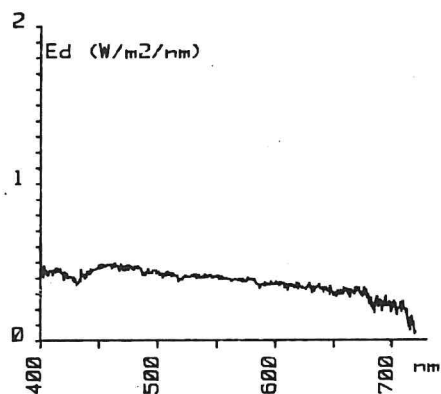
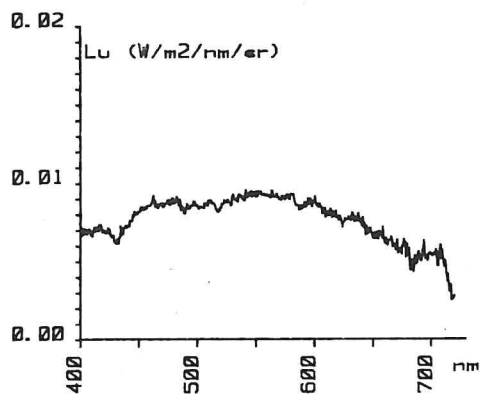


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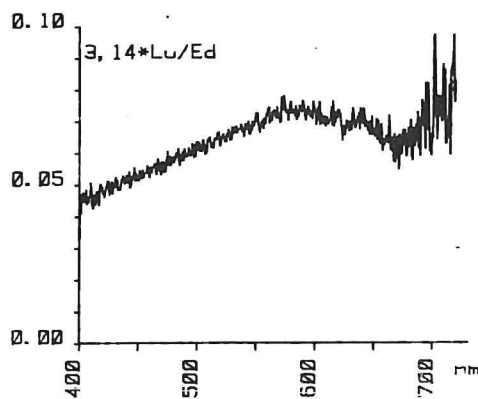
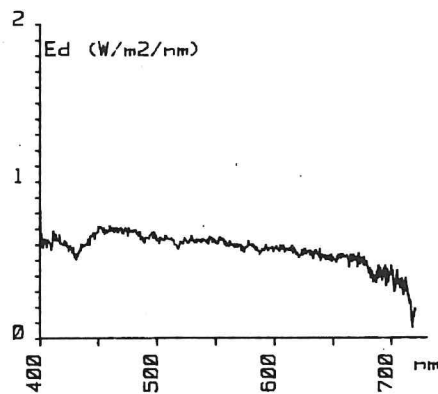
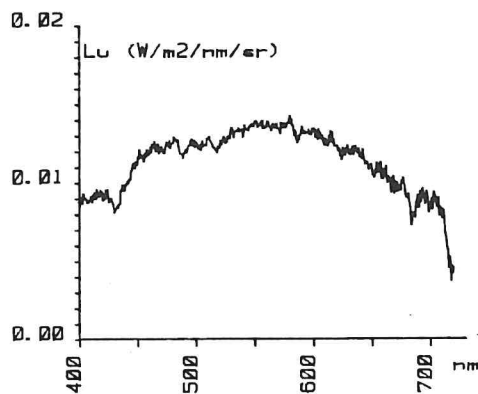
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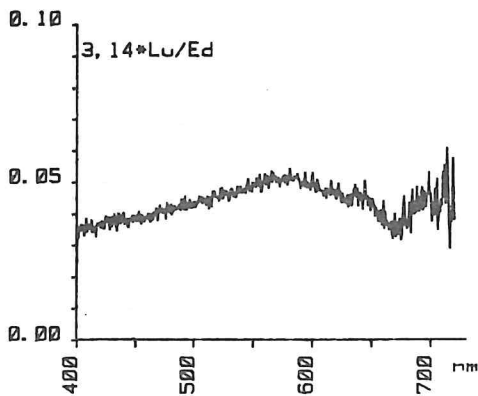
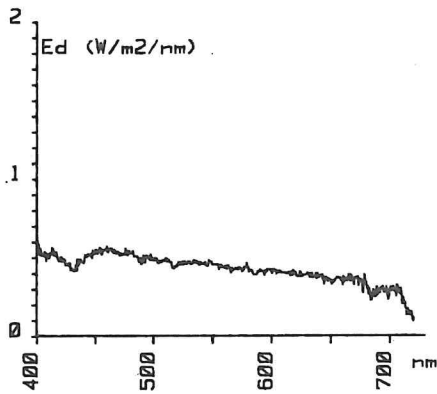
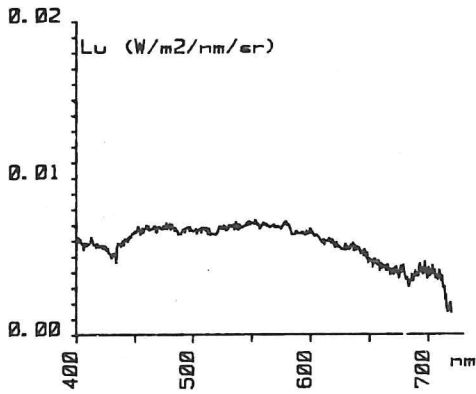
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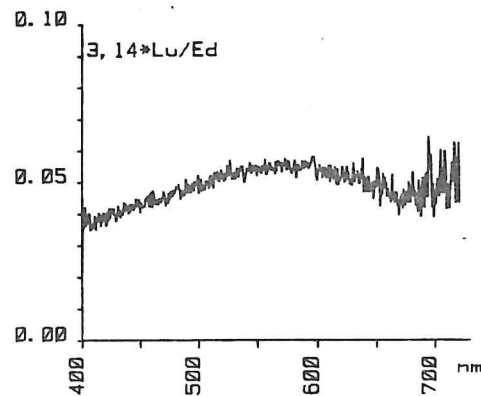
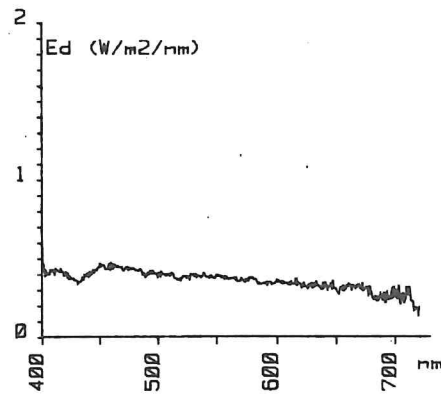
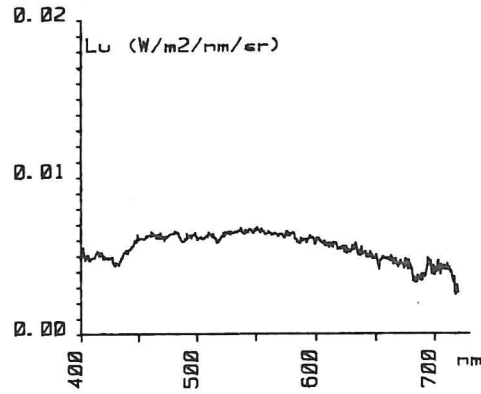
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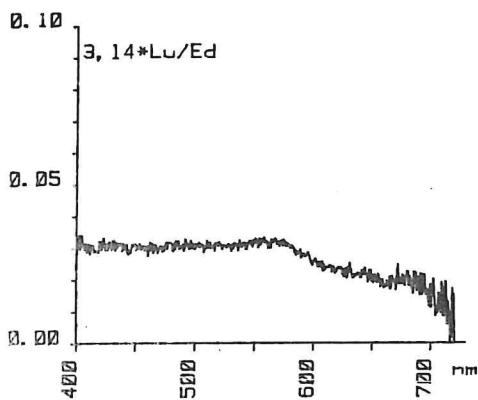
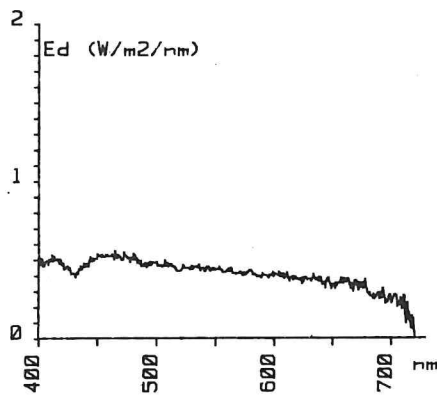
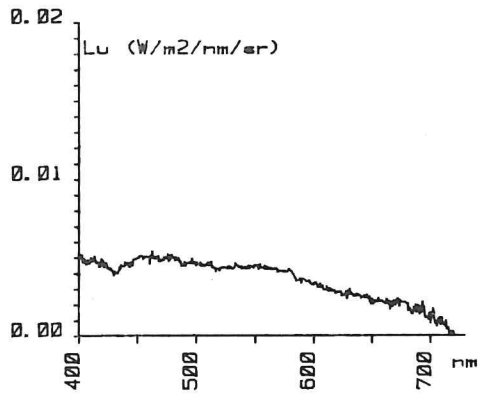
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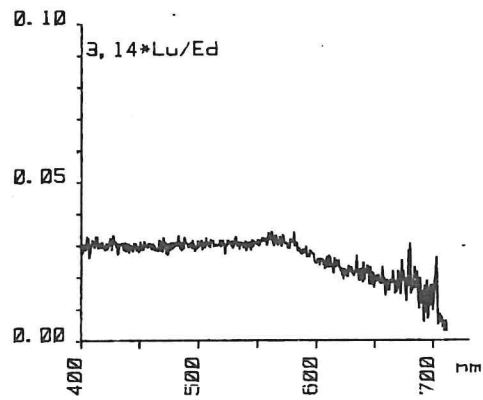
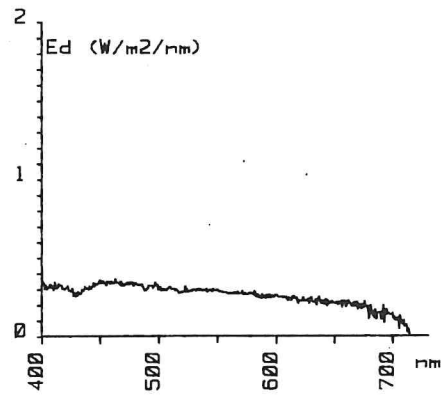
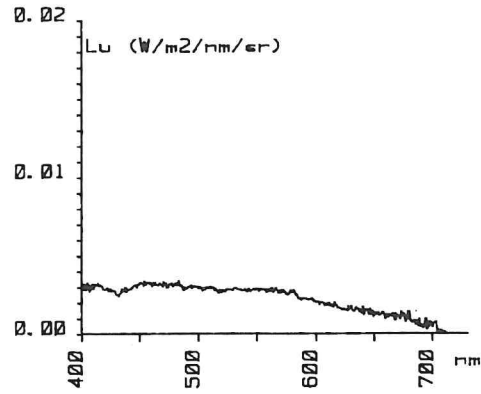
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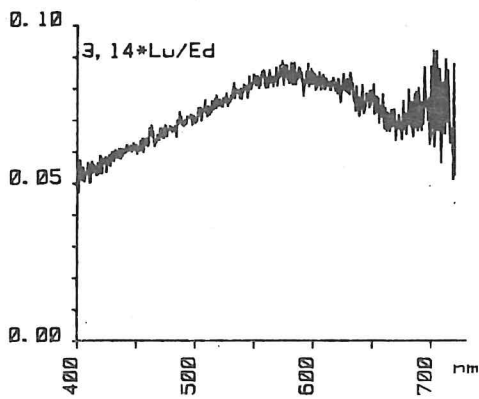
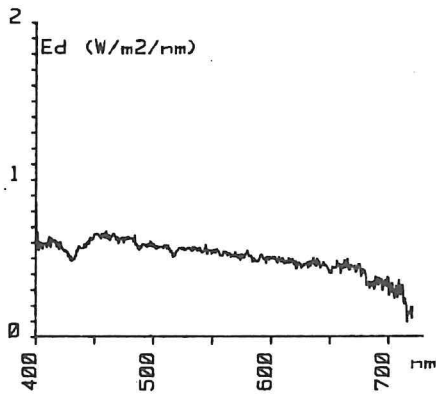
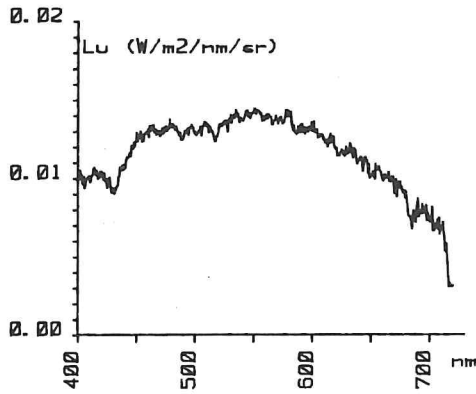
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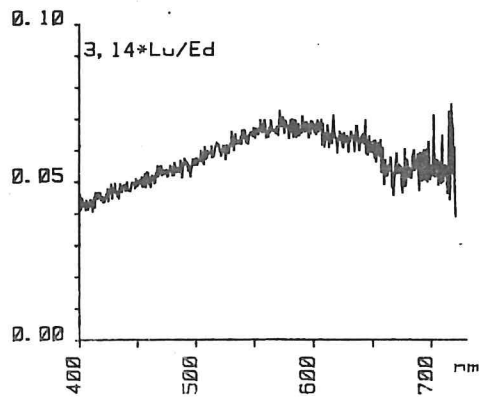
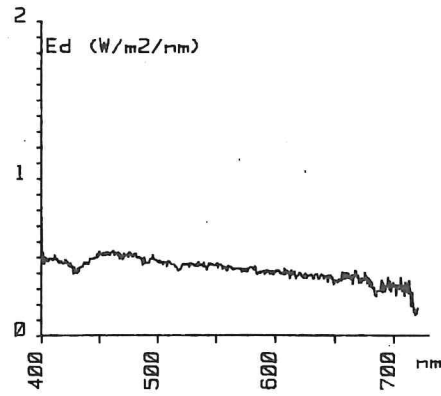
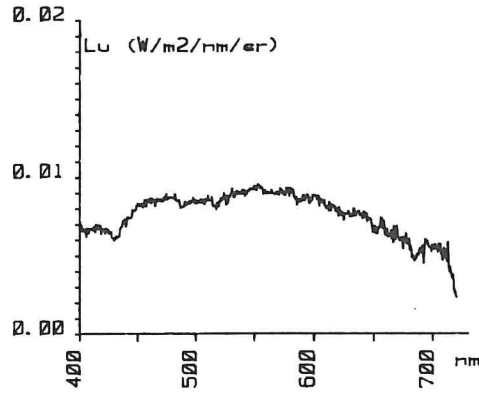
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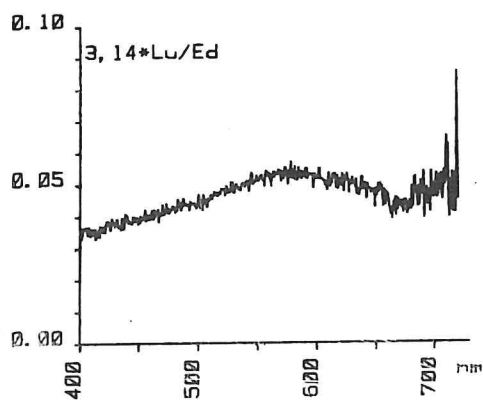
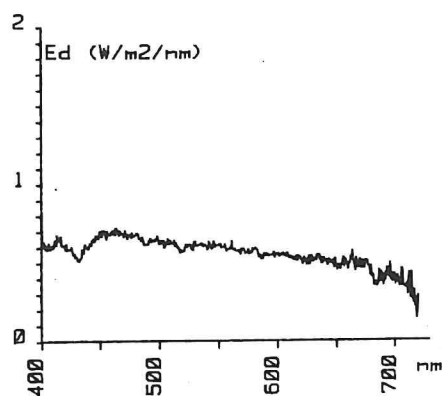
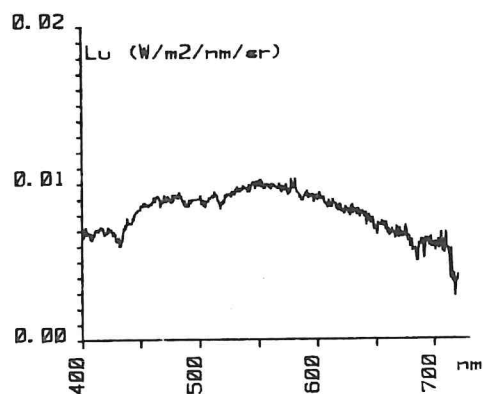
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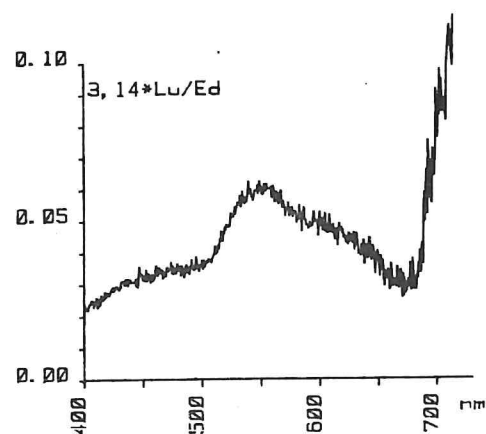
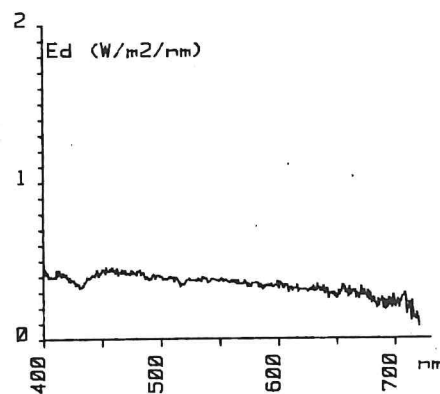
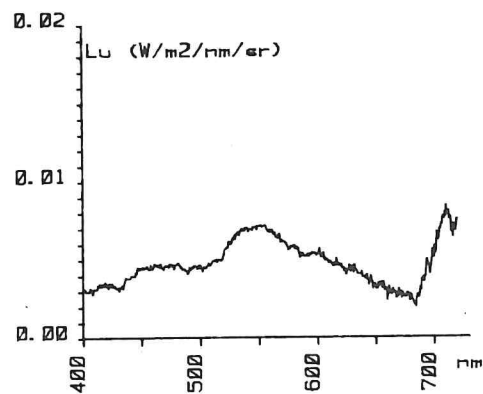
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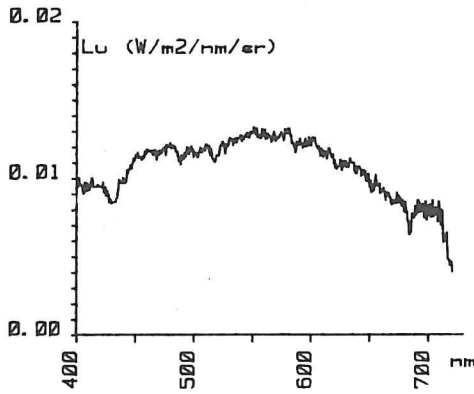
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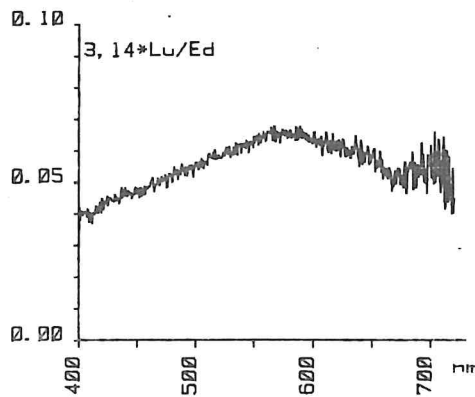
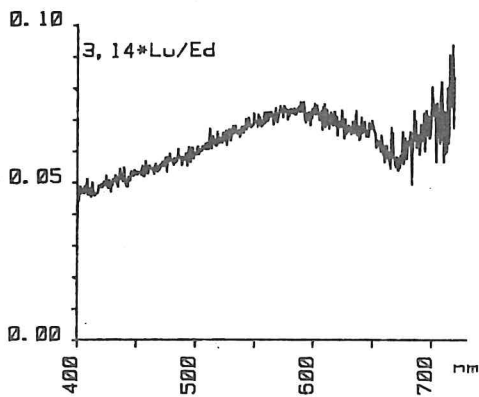
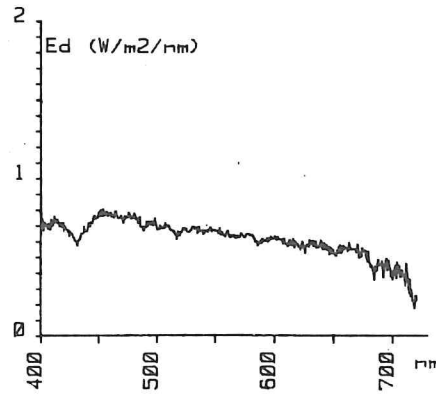
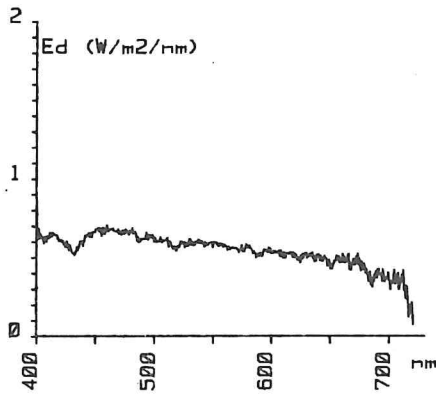
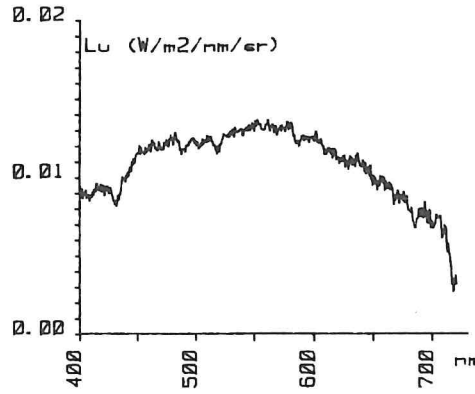
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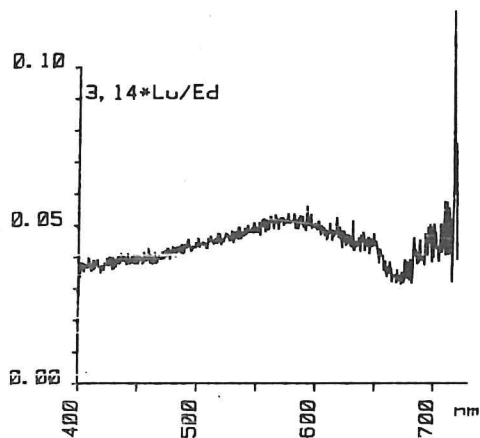
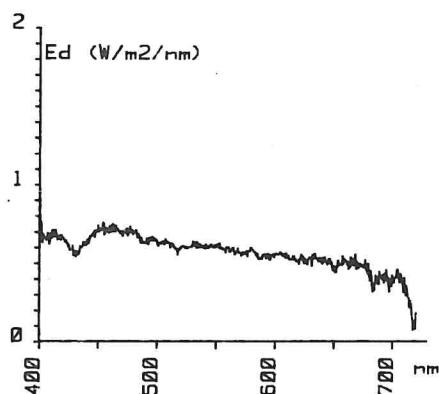
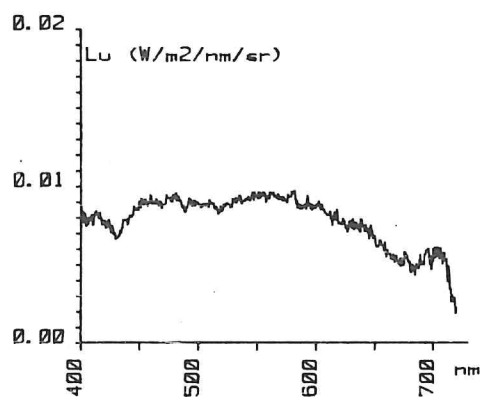
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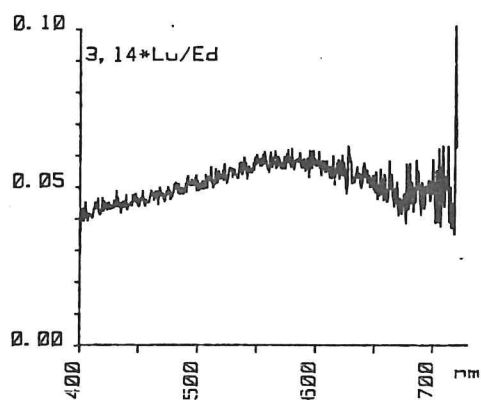
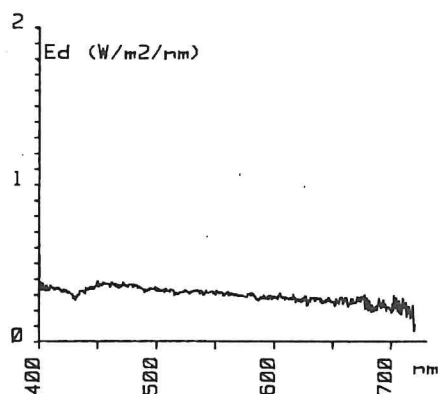
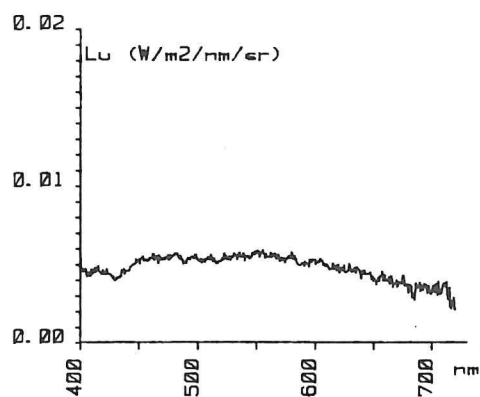
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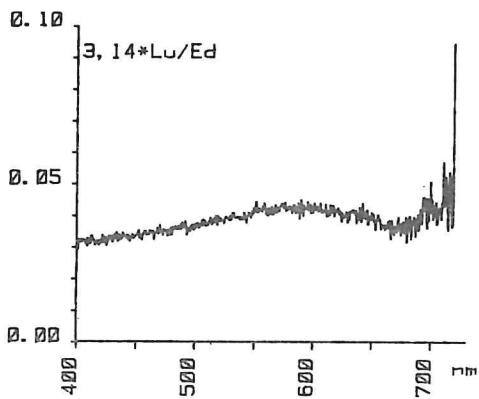
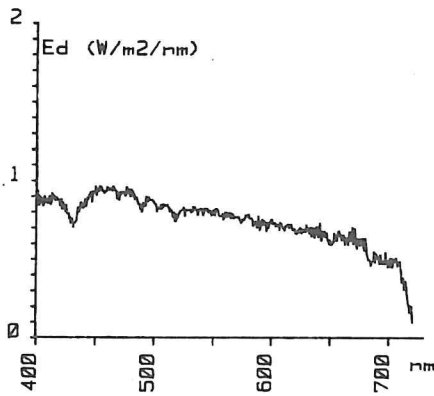
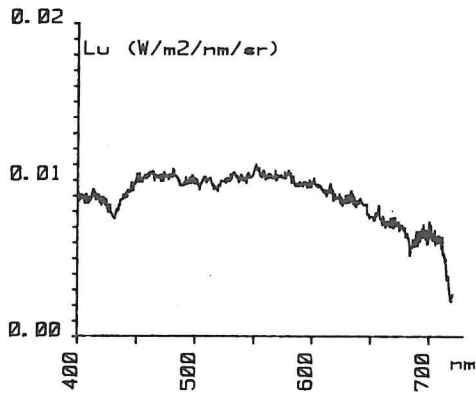
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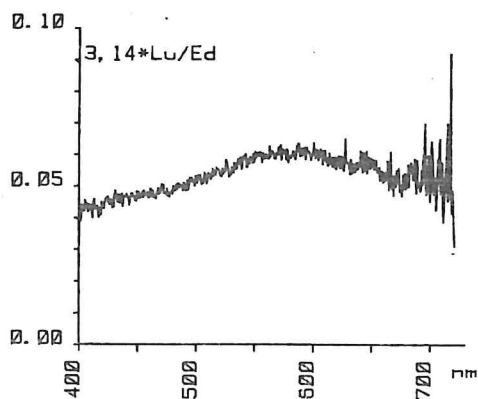
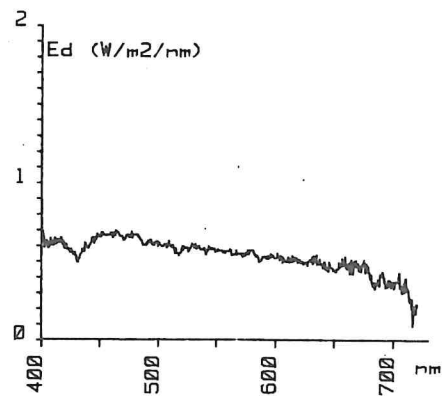
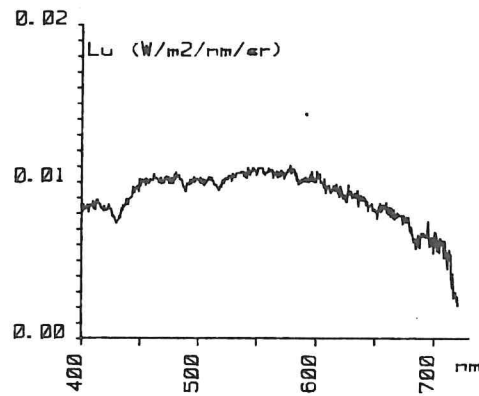
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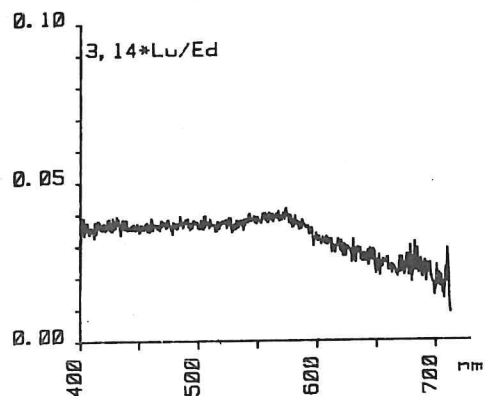
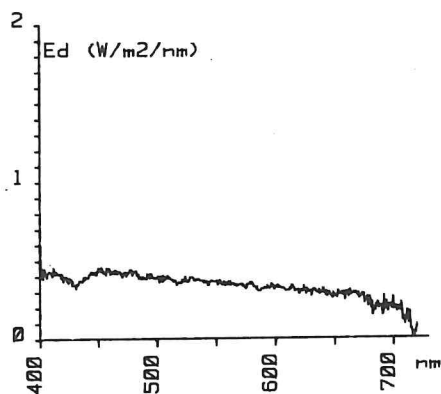
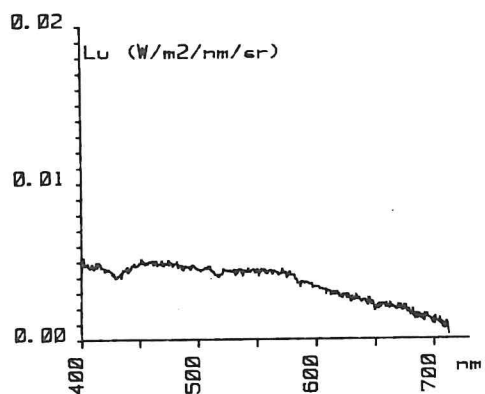
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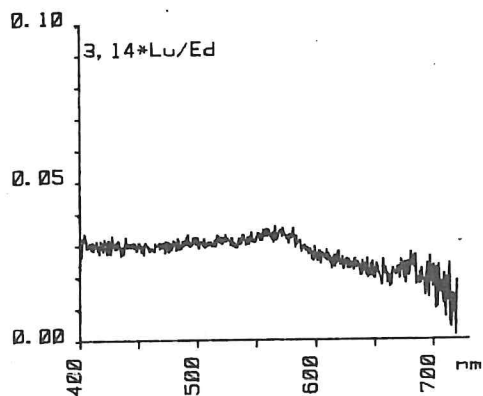
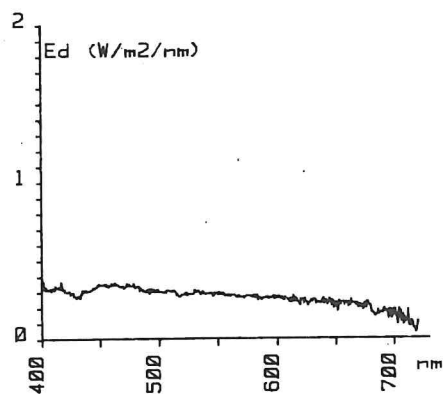
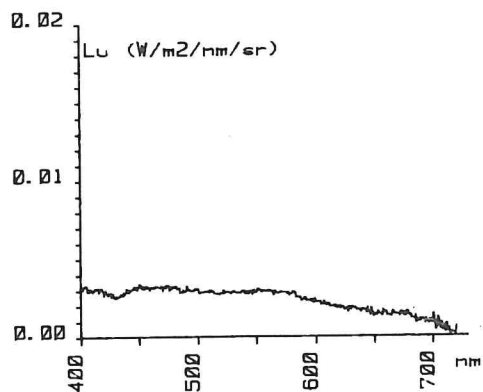
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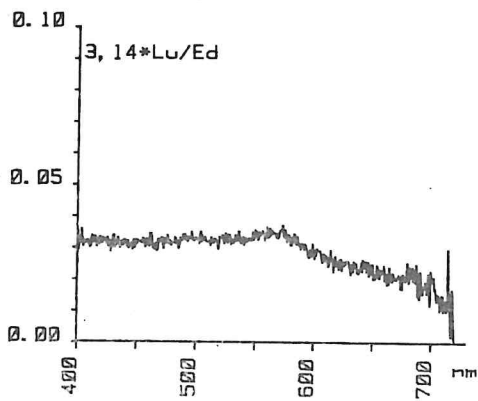
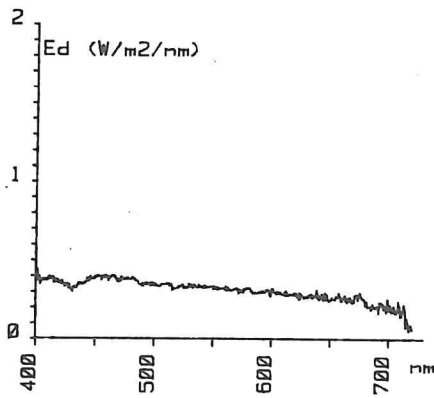
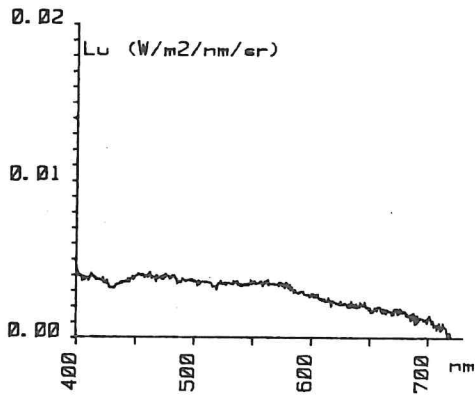
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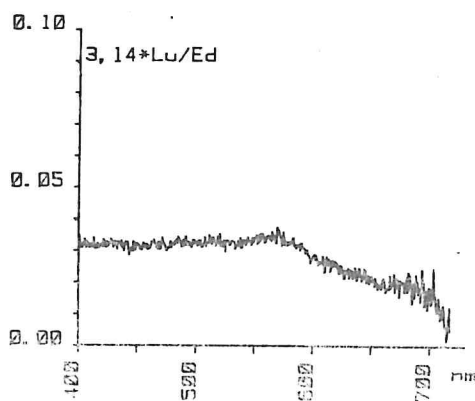
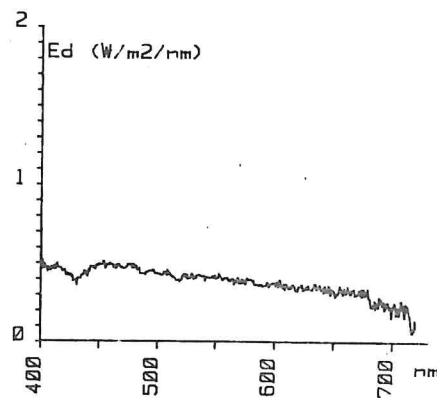
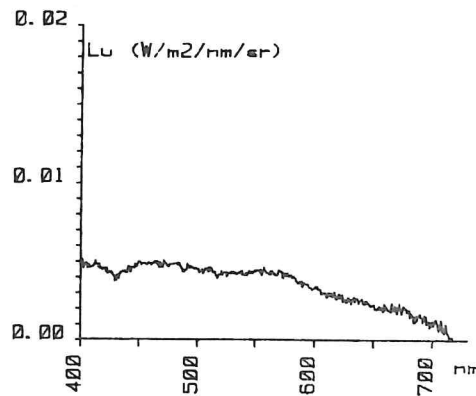
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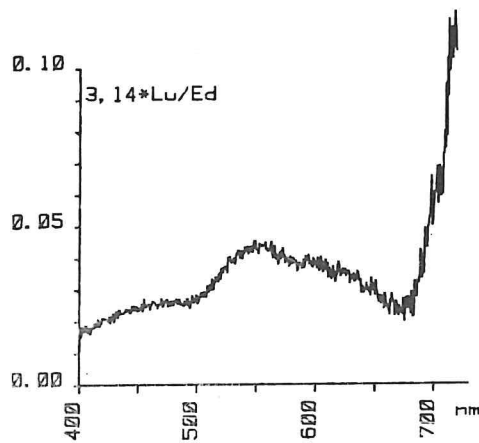
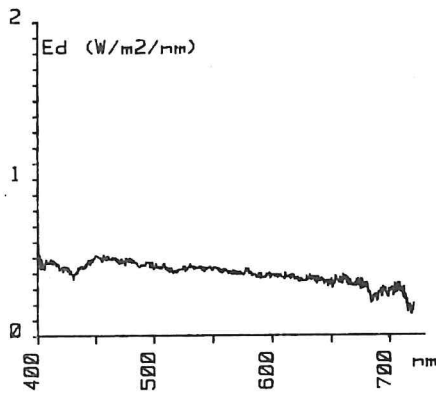
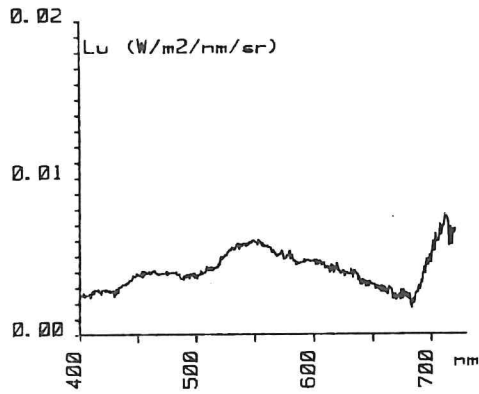
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Time 11: 59 Flight: Tape 1
Track 1, File 5

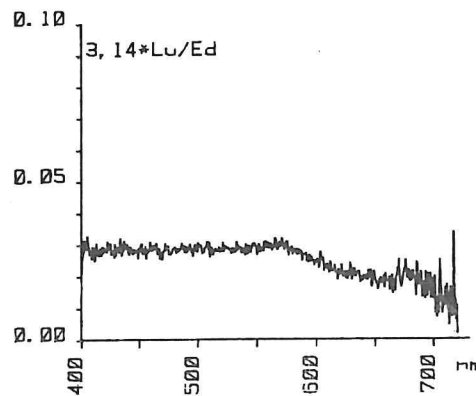
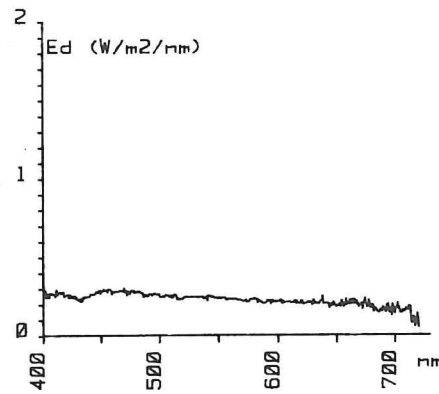
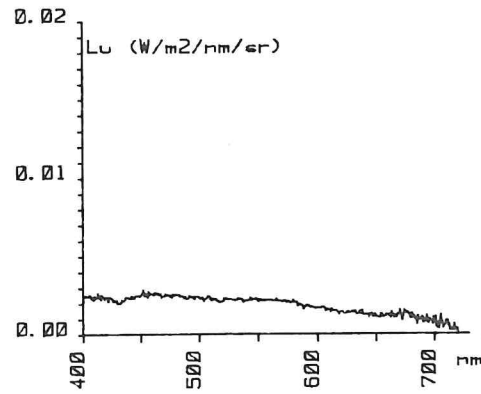
Number 24 Date 18/ 6

Time 12: 1 Flight: Tape 1
Track 1, File 6

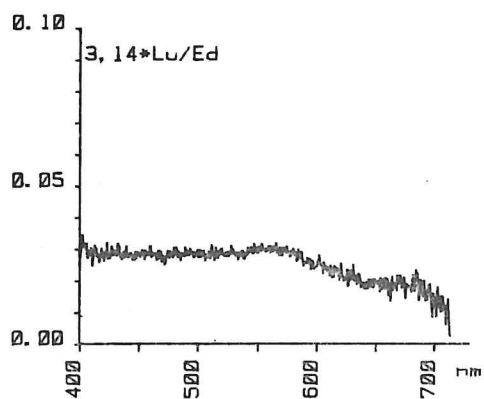
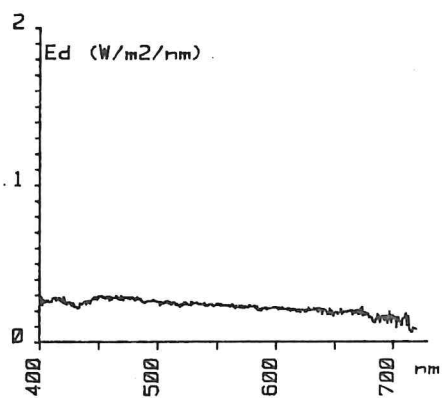
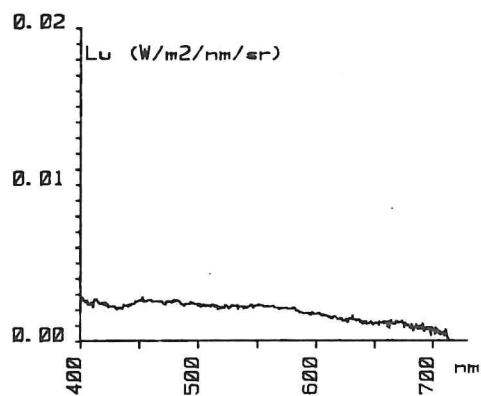
Number 25 Date 18/ 6

Time 12: 4 Flight: Tape 1
Track 1, File 7

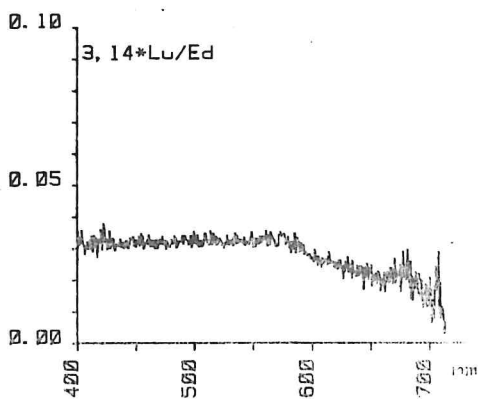
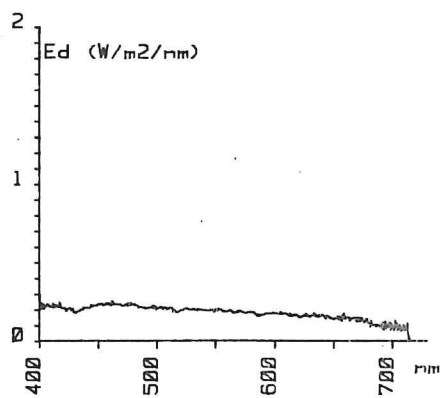
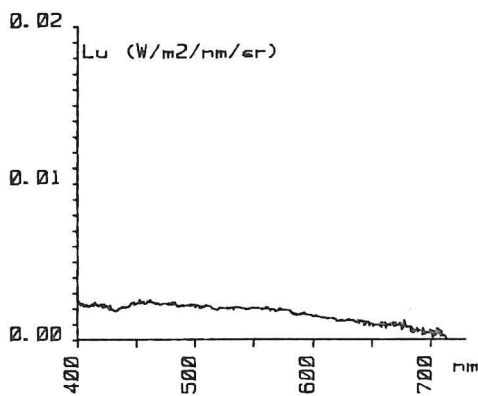
Number 26 Date 18/ 6

Time 16: 15 Flight: Tape 2
Track 0, File 1

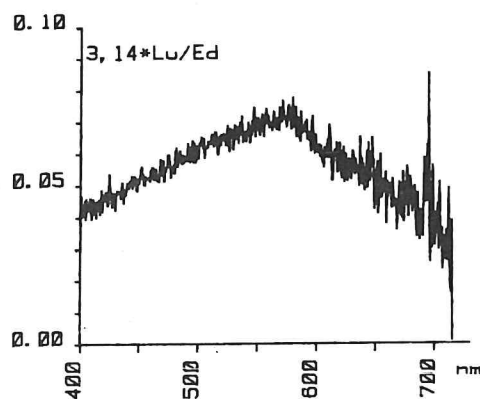
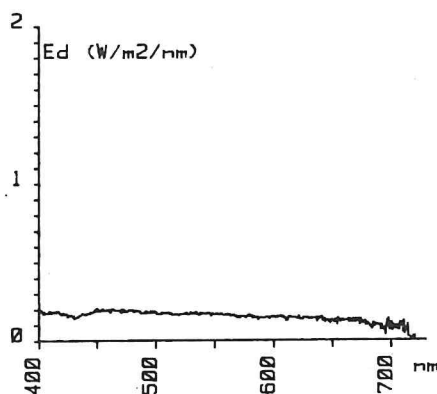
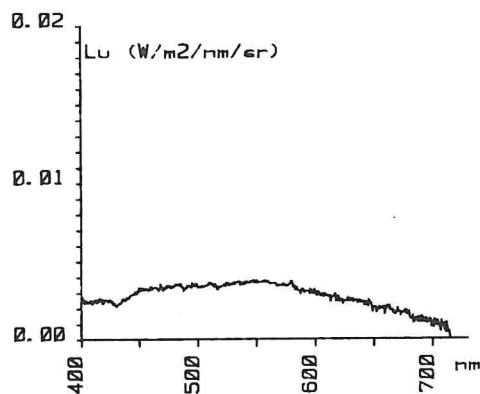
Number 27 Date 18/ 6

Time 16: 17 Flight: Tape 2
Track 0, File 2

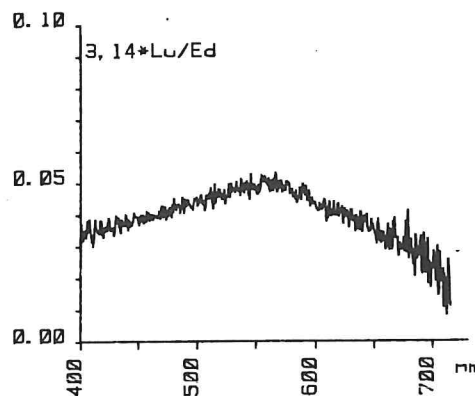
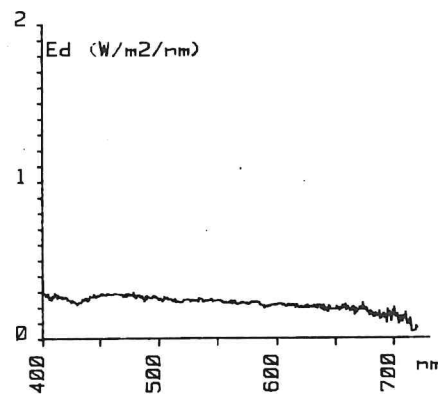
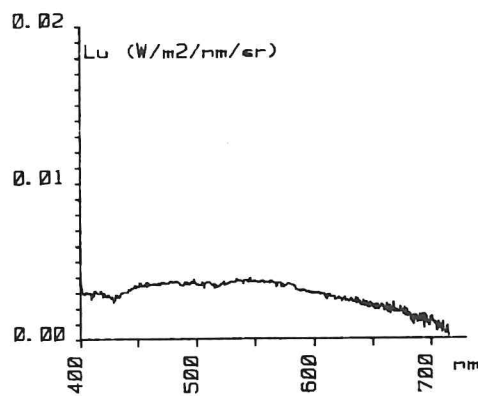
Number 28 Date 18/ 6

Time 16: 20 Flight: Tape 2
Track 0, File 3

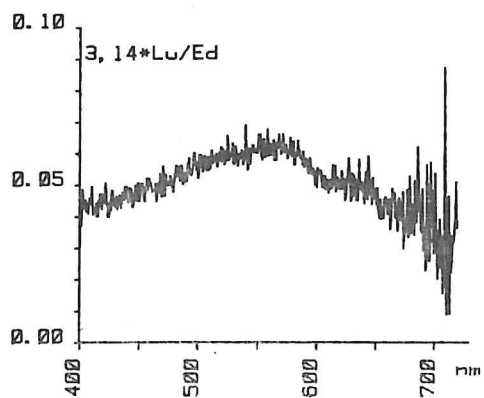
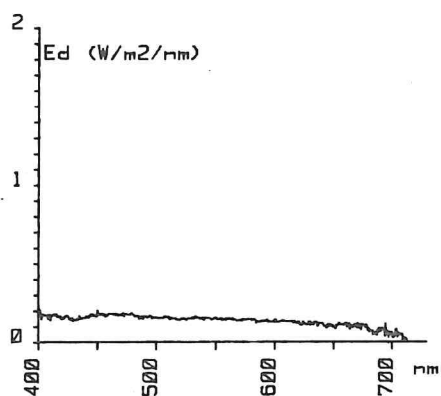
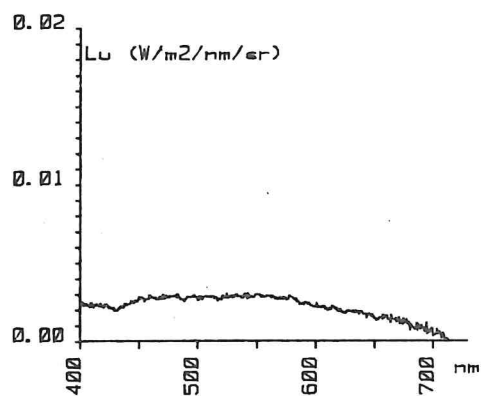
Number 29 Date 18/ 6

Time 16: 25 Flight: Tape 2
Track 0, File 4

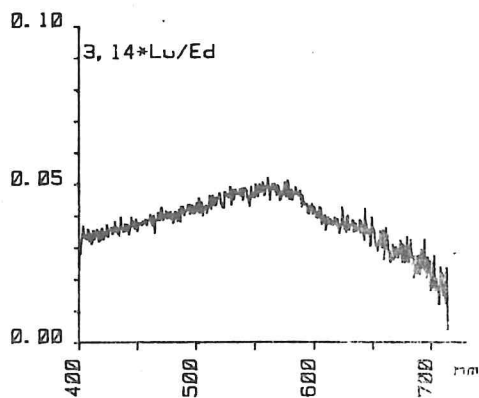
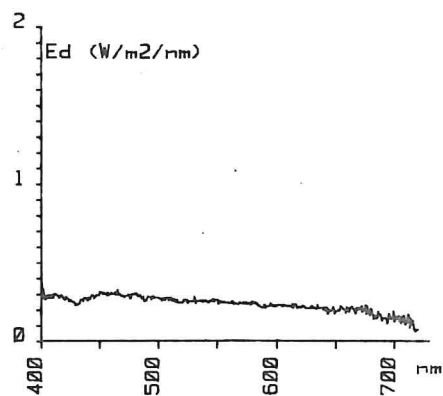
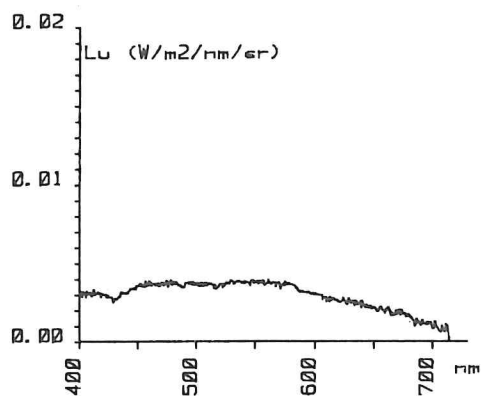
Number 30 Date 18/ 6

Time 16: 28 Flight: Tape 2
Track 0, File 5

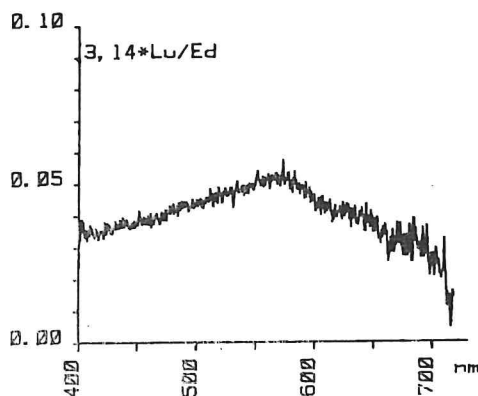
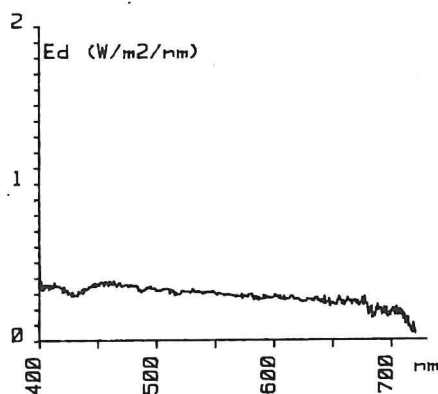
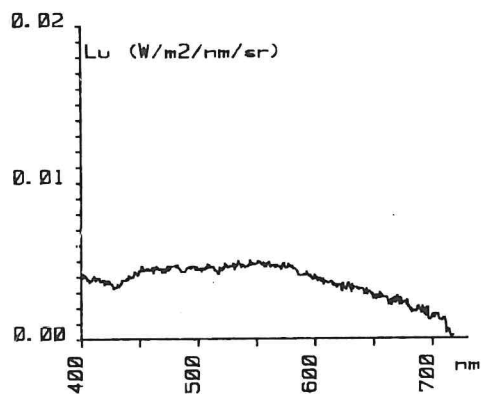
Number 31 Date 18/ 6

Time 16: 30 Flight: Tape 2
Track 0, File 6

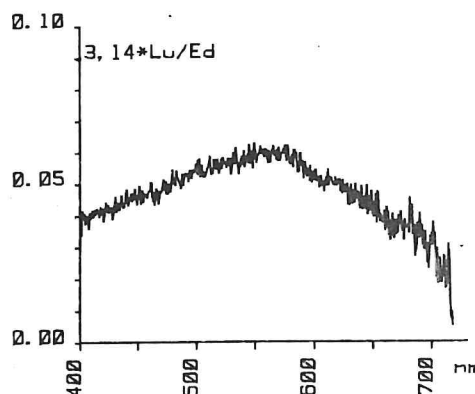
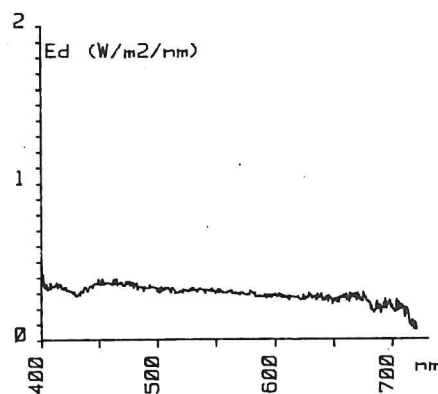
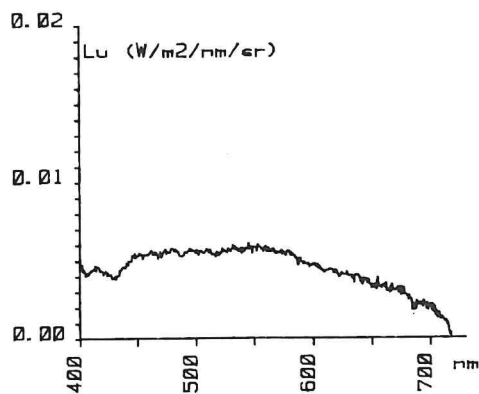
Number 32 Date 18/ 6

Time 16: 34 Flight: Tape 2
Track 0, File 7

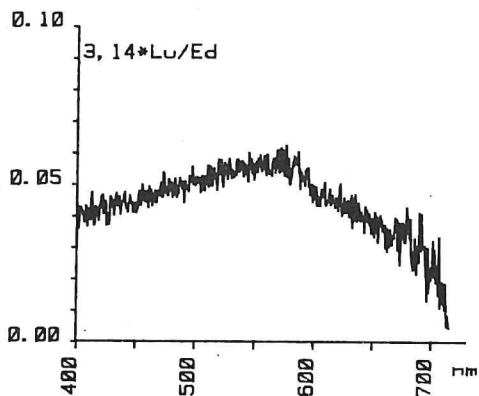
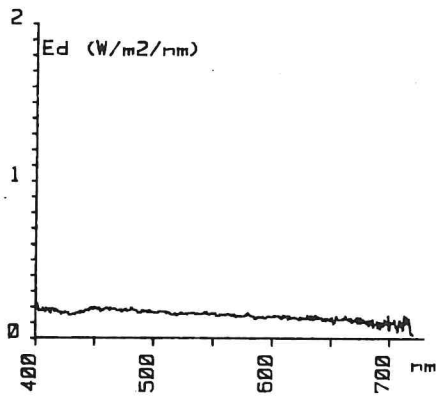
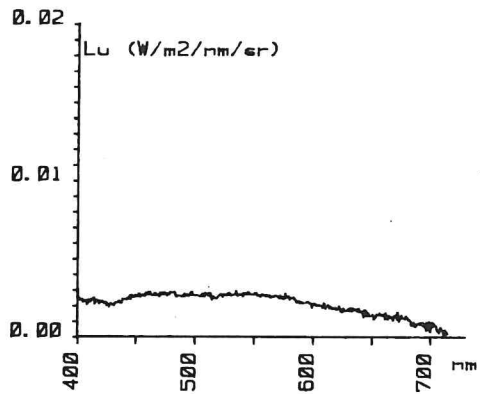
Number 33 Date 18/ 6

Time 16: 37 Flight: Tape 2
Track 0, File 8

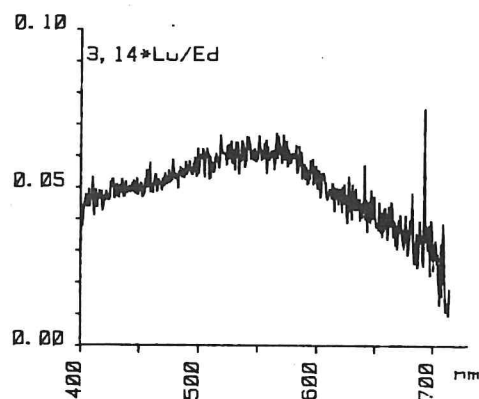
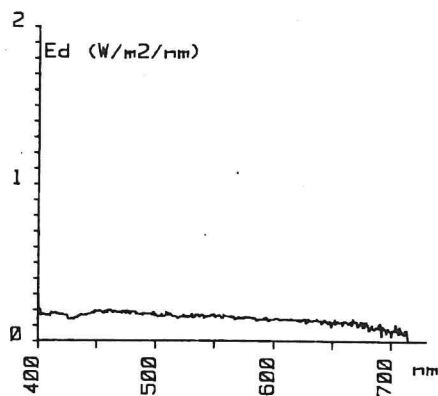
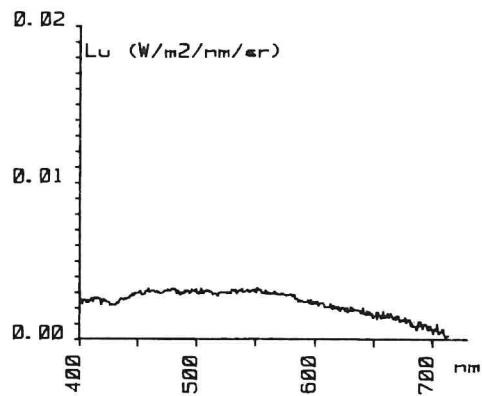
Number 34 Date 18/ 6

Time 16: 42 Flight: Tape 2
Track 0, File 9

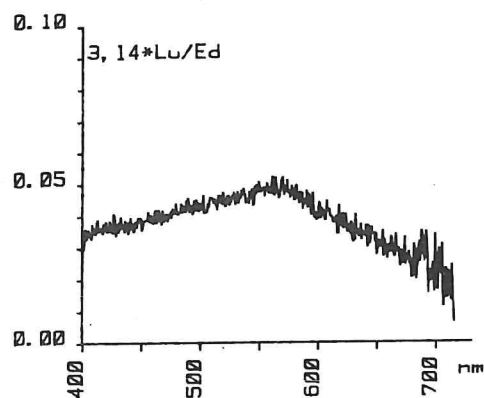
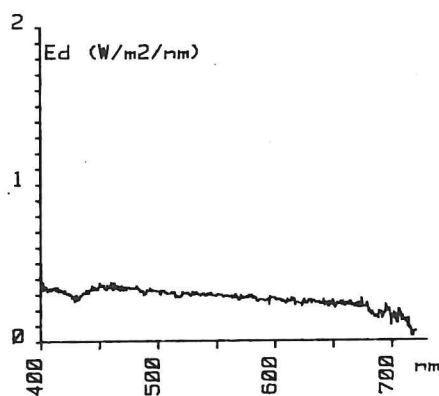
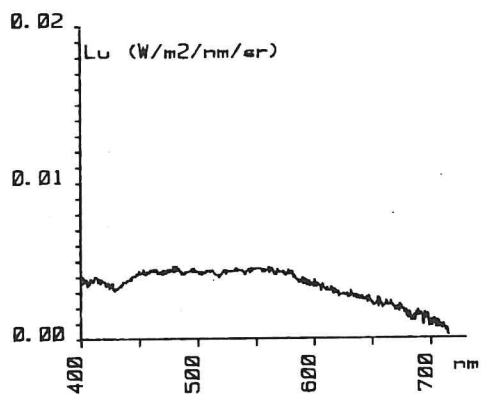
Number 35 Date 18/ 6
Time 16: 45 Flight: Tape 2
Track 0, File 10



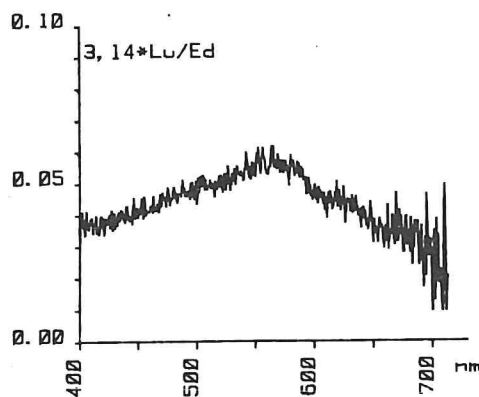
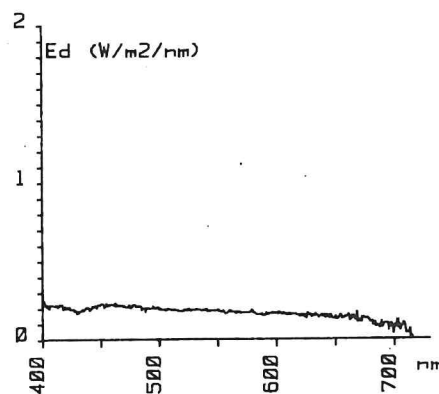
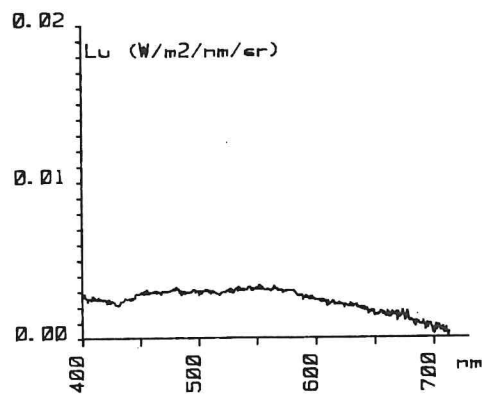
Number 36 Date 18/ 6
Time 16: 47 Flight: Tape 2
Track 0, File 11



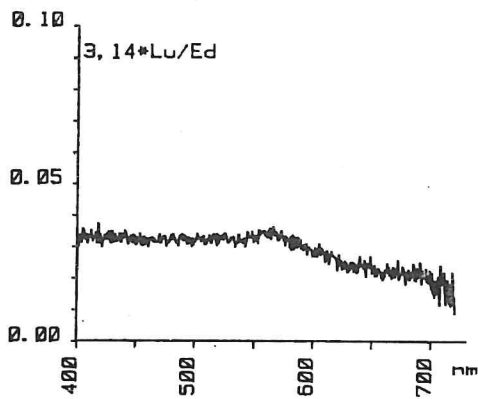
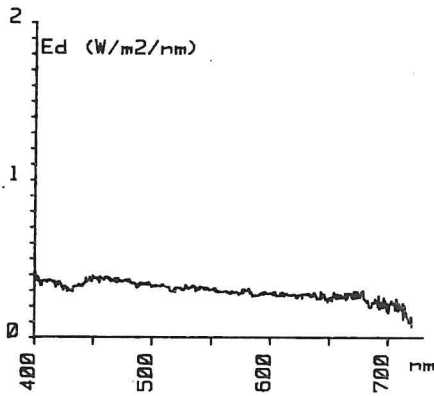
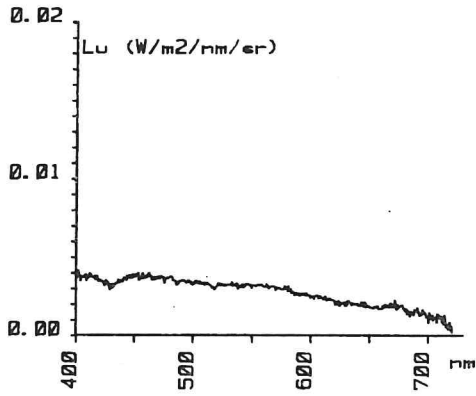
Number 37 Date 18/ 6

Time 16: 55 Flight: Tape 2
Track 0, File 12

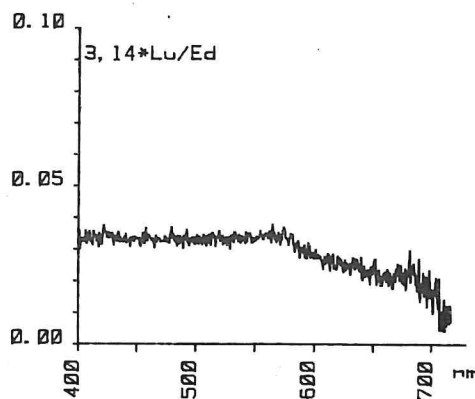
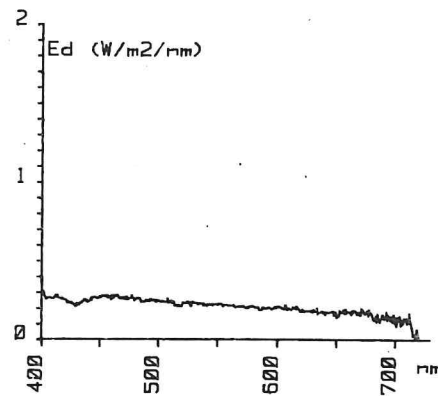
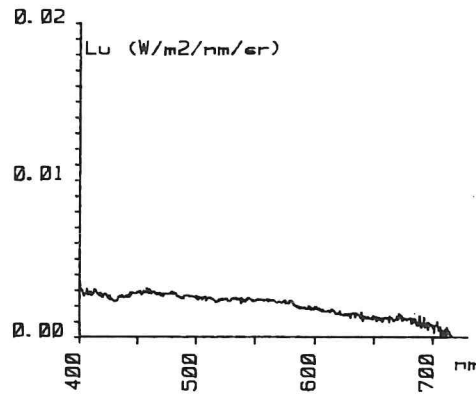
Number 38 Date 18/ 6

Time 16: 58 Flight: Tape 2
Track 0, File 13

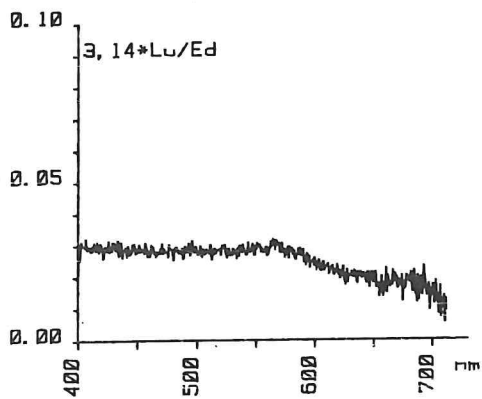
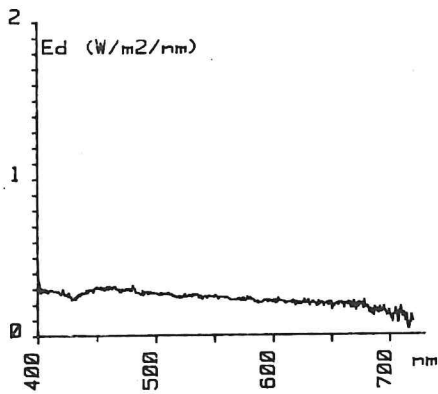
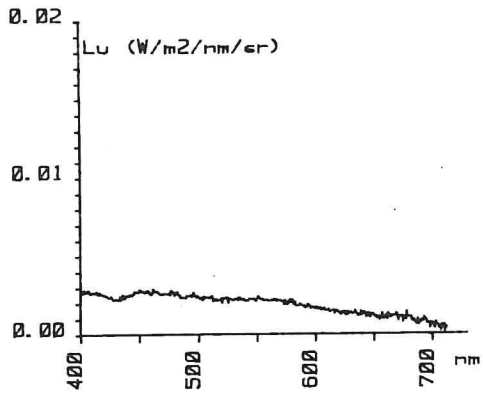
Number 39 Date 18/ 6

Time 17: 7 Flight: Tape 2
Track 0, File 14

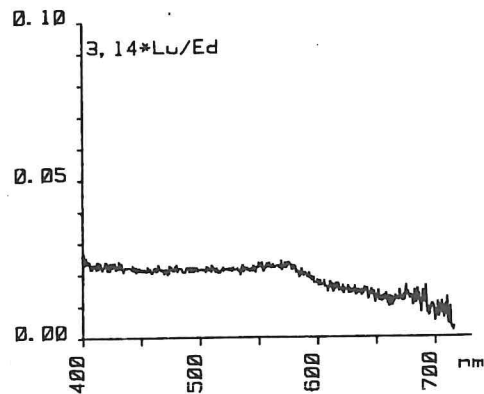
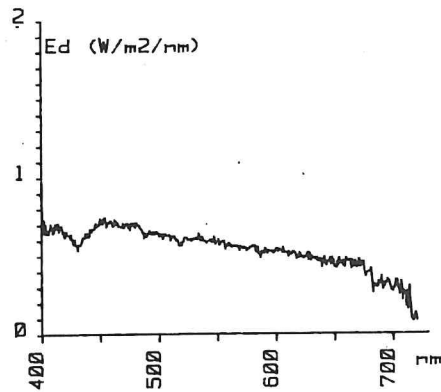
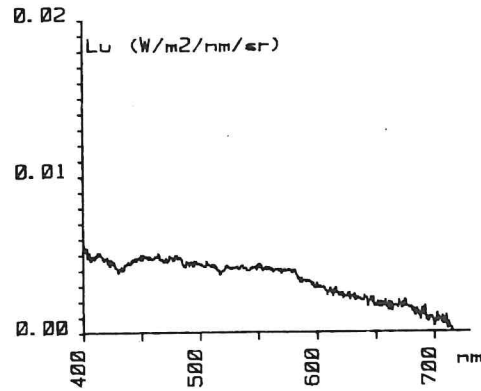
Number 40 Date 18/ 6

Time 17: 10 Flight: Tape 2
Track 0, File 15

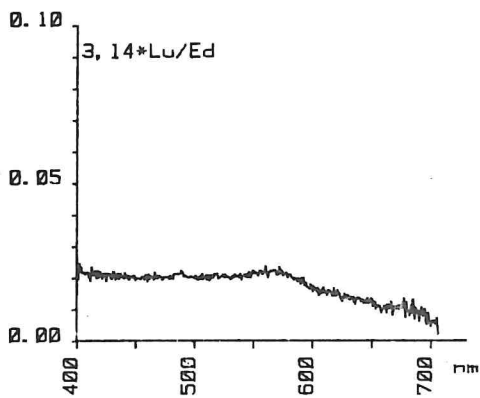
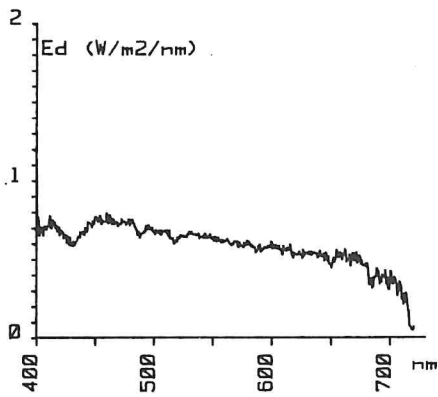
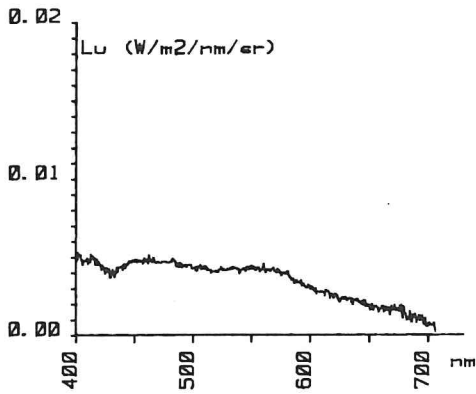
Number 41 Date 18/ 6
Time 17: 12 Flight: Tape 2
Track 0, File 16



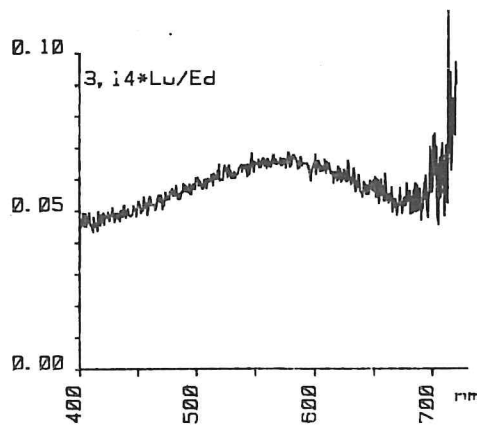
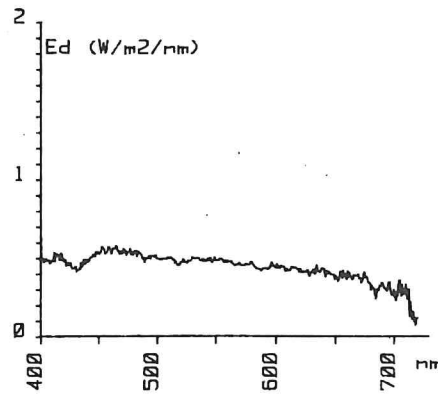
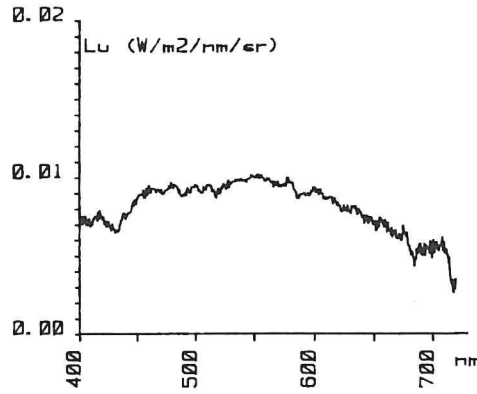
Number 42 Date 88/ 88
Time 88: 88 Flight: Tape 2
Track 1, File 4



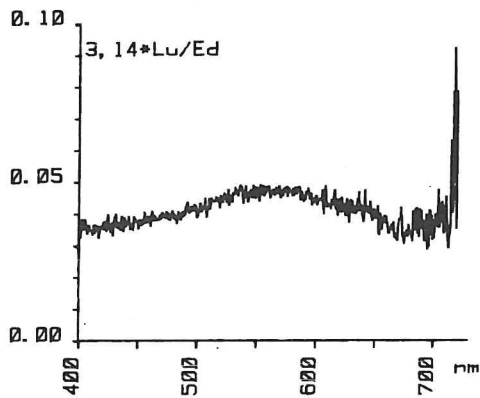
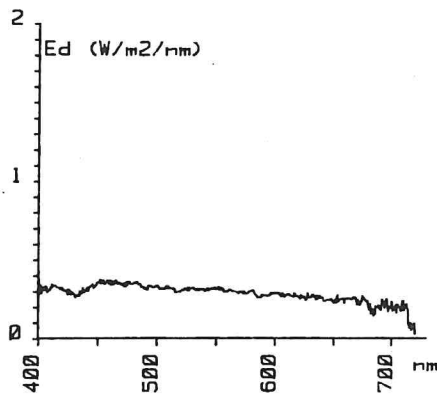
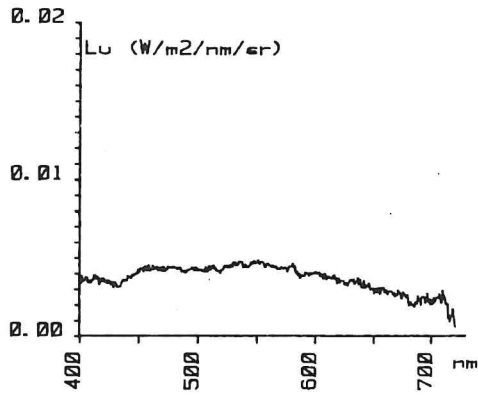
Number 43 Date 88/ 88
 Time 88: 88 Flight: Tape 2
 Track 1, File 5



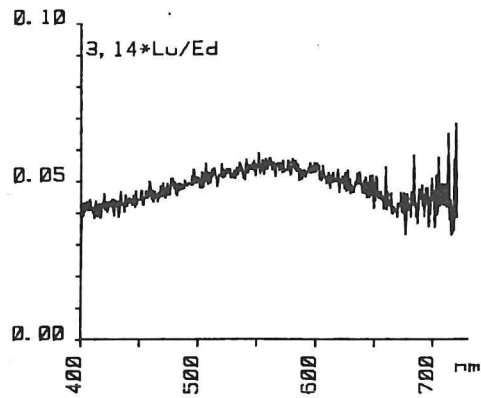
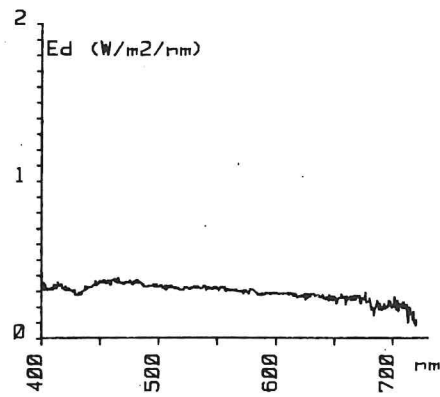
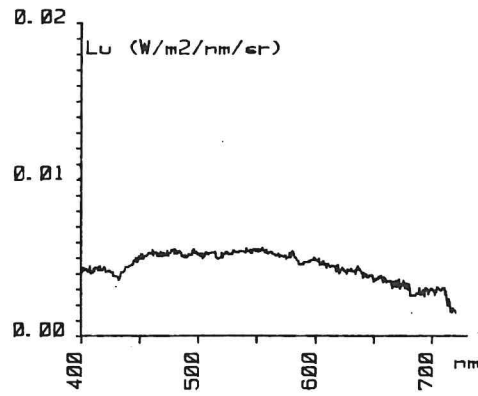
Number 44 Date 20/ 6
 Time 10: 24 Flight: Tape 3
 Track 0, File 1



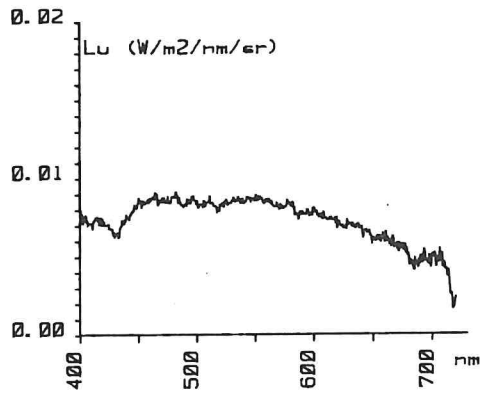
Number 45 Date 20/ 6

Time 10: 29 Flight: Tape 3
Track 0, File 2

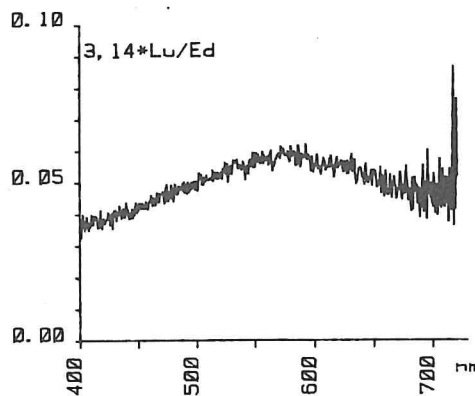
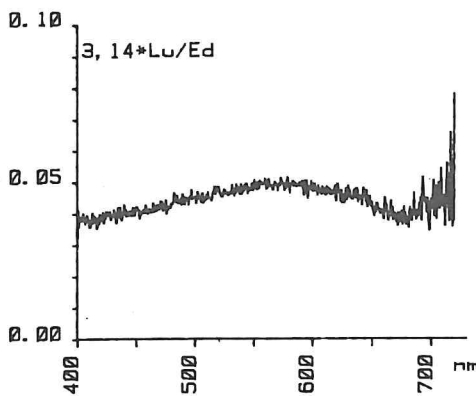
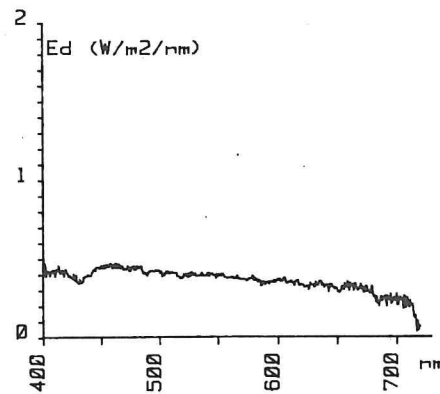
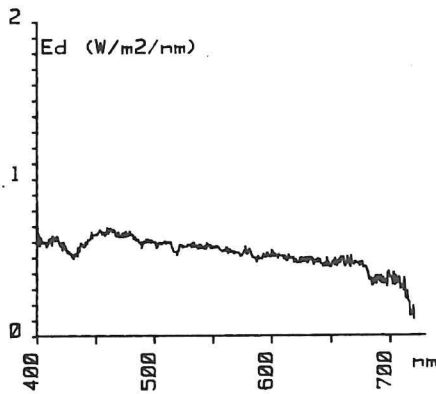
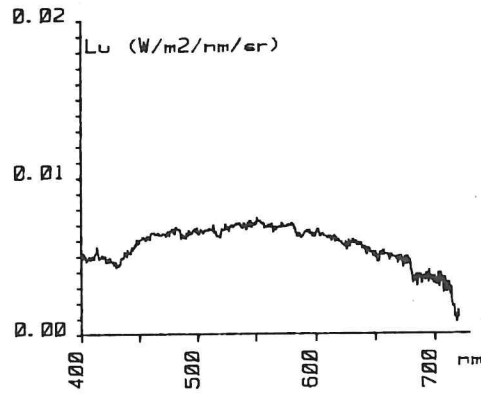
Number 46 Date 20/ 6

Time 10: 36 Flight: Tape 3
Track 0, File 3

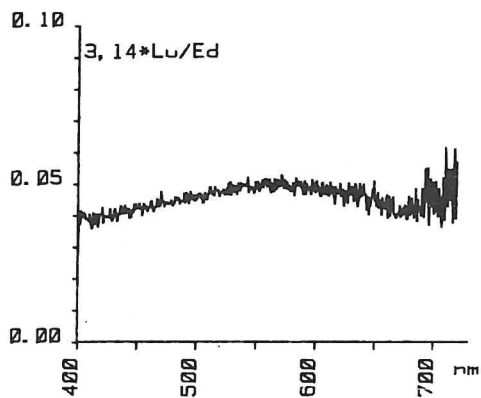
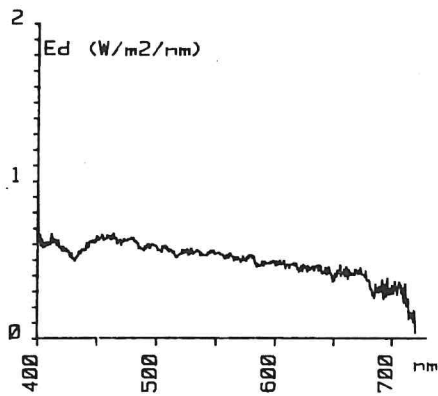
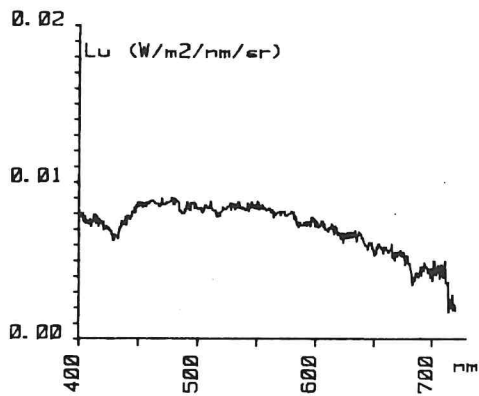
Number 47 Date 20/ 6

Time 10: 39 Flight: Tape 3
Track 0, File 4

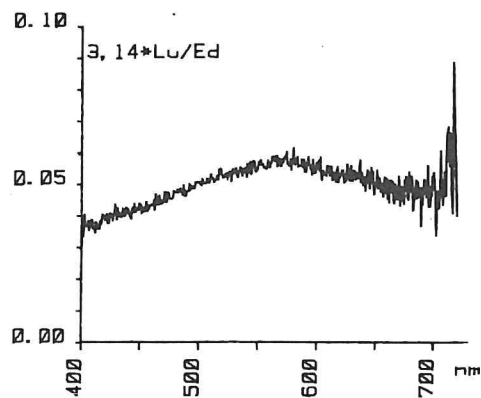
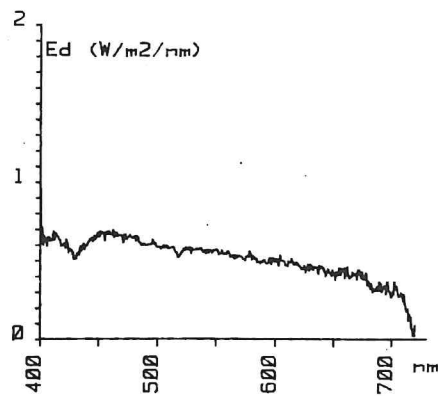
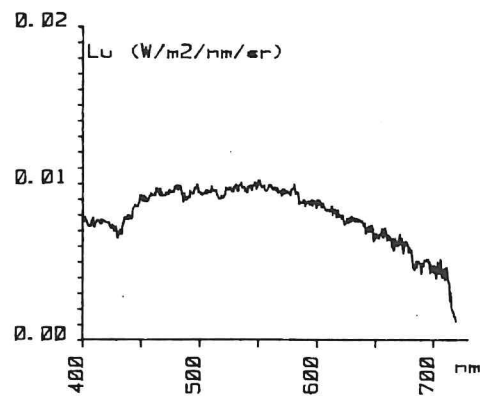
Number 48 Date 20/ 6

Time 10: 43 Flight: Tape 3
Track 0, File 5

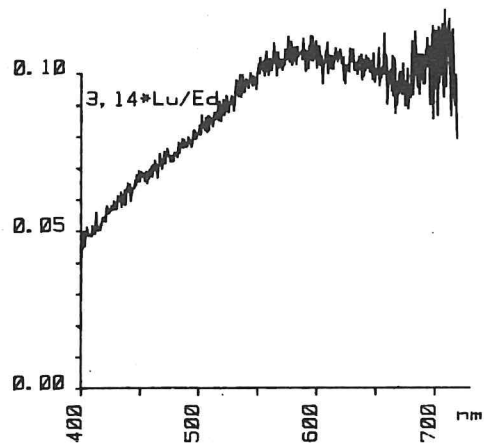
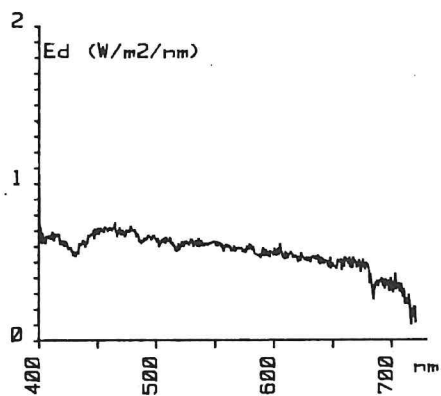
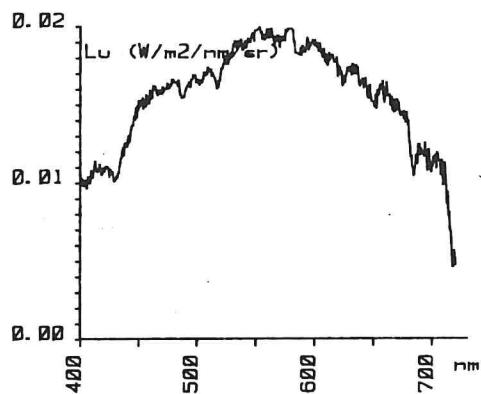
Number 49 Date 20/ 6

Time 10: 49 Flight: Tape 3
Track 0, File 6

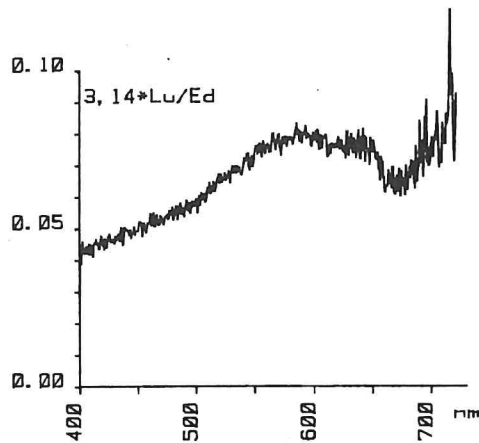
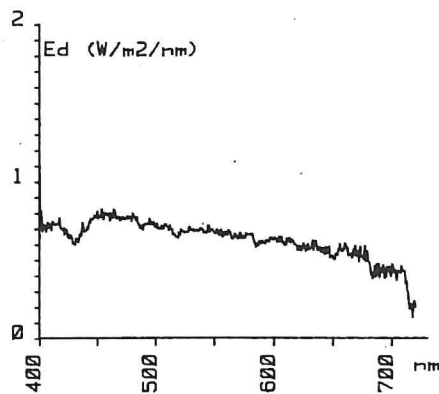
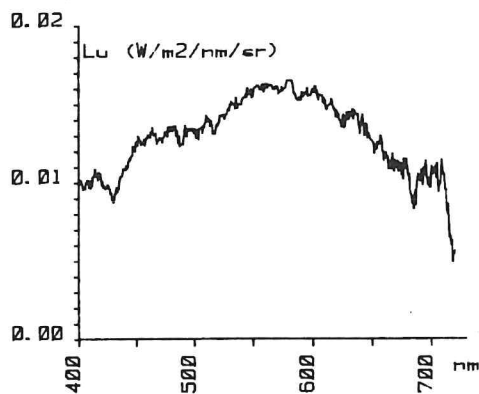
Number 50 Date 20/ 6

Time 10: 52 Flight: Tape 3
Track 0, File 7

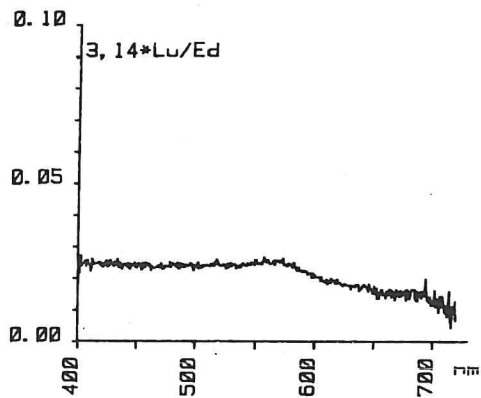
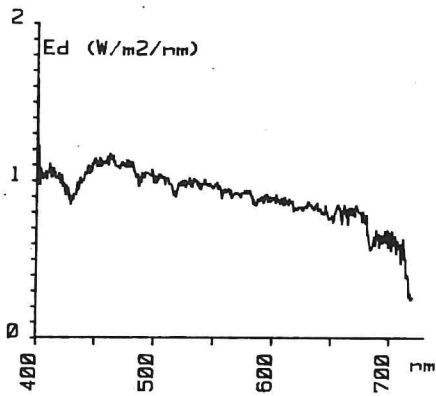
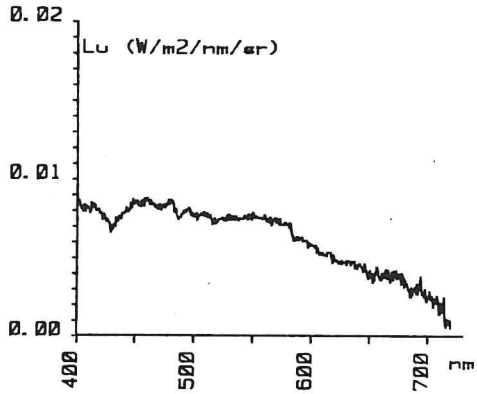
Number 51 Date 20/ 6
 Time 10: 58 Flight: Tape 3
 Track 0, File 8



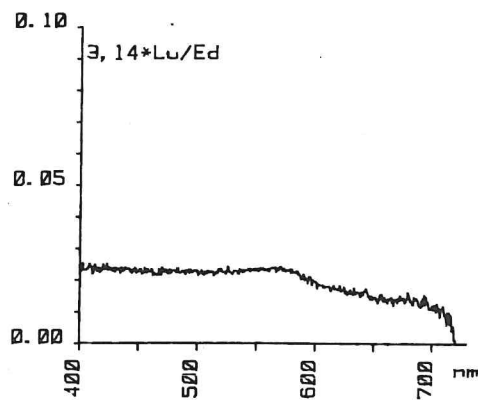
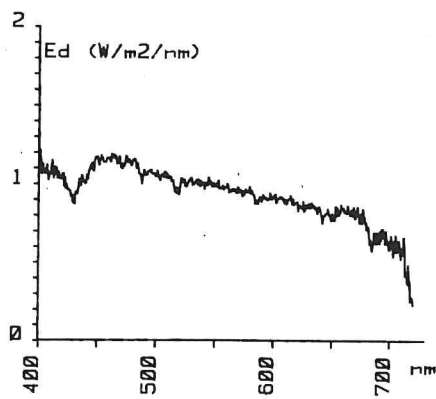
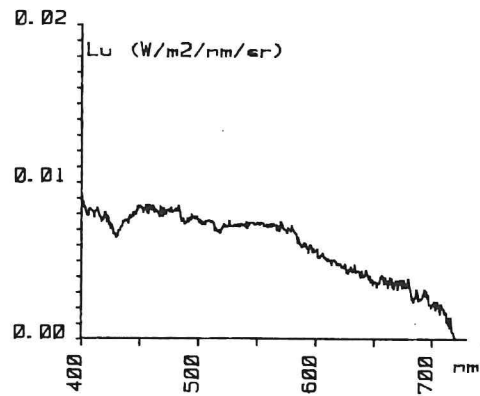
Number 52 Date 20/ 6
 Time 11: 0 Flight: Tape 3
 Track 0, File 9



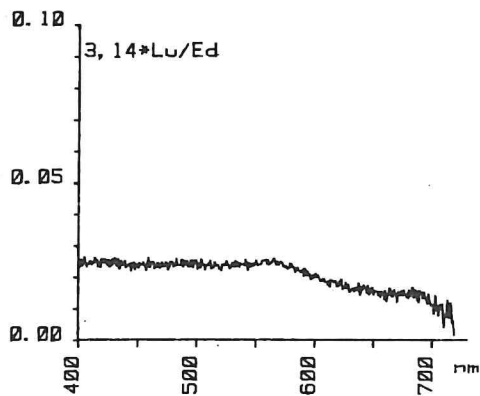
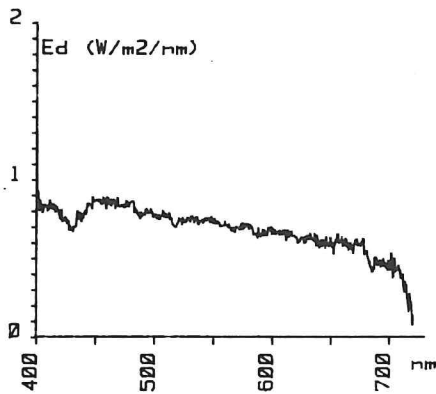
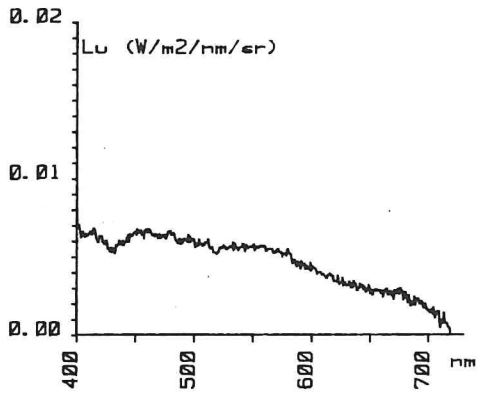
Number 53 Date 20/ 6
Time 11: 24 Flight: Tape 3
Track 0, File 10



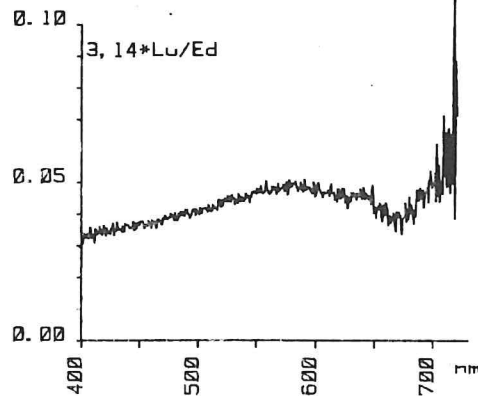
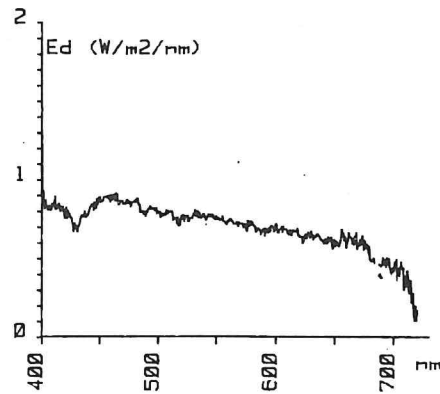
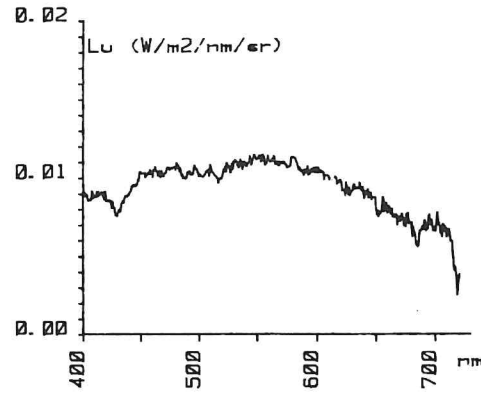
Number 54 Date 20/ 6
Time 11: 26 Flight: Tape 3
Track 0, File 11



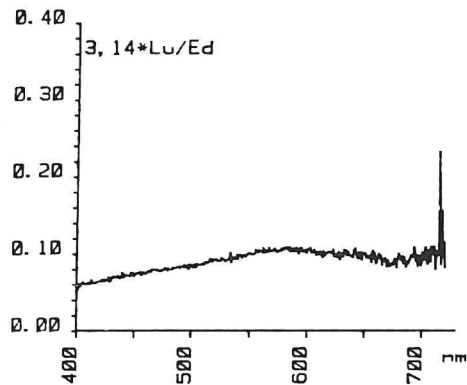
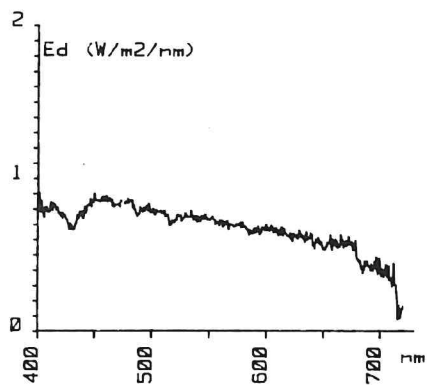
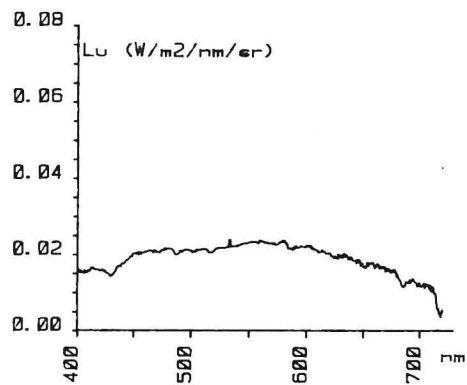
Number 55 Date 20/ 6

Time 11: 33 Flight: Tape 3
Track 0, File 12

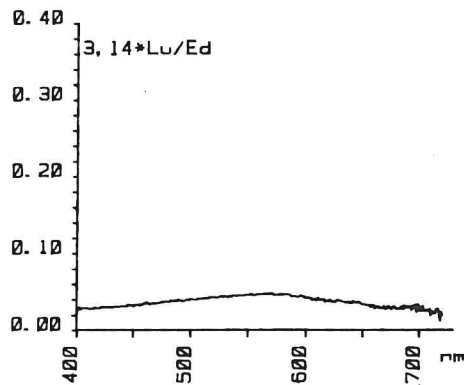
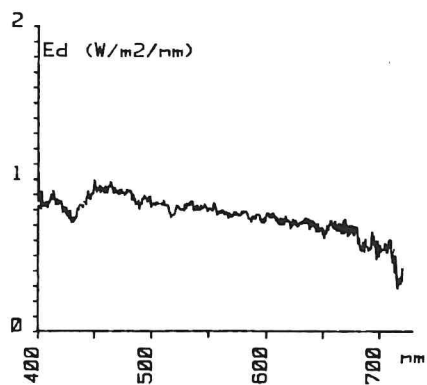
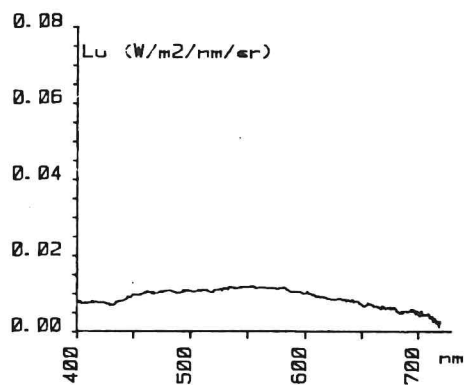
Number 56 Date 20/ 6

Time 11: 38 Flight: Tape 3
Track 0, File 13

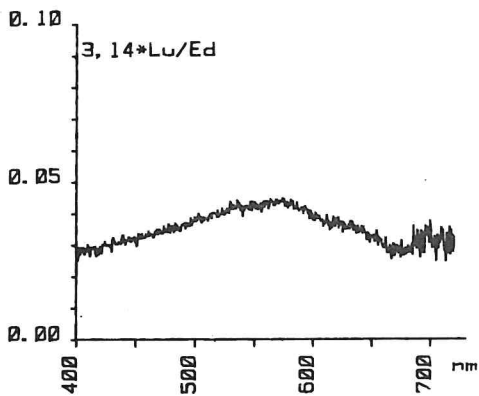
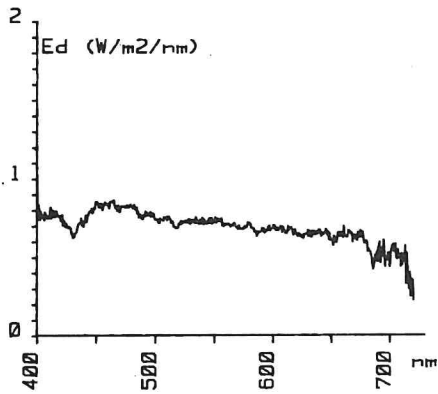
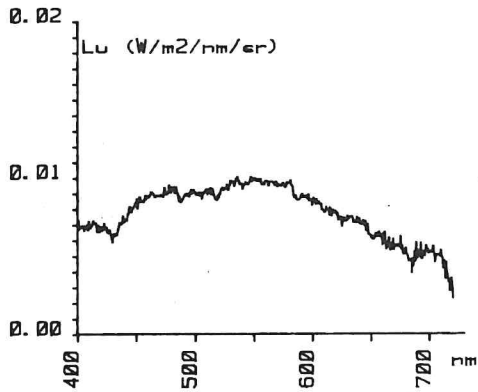
Number 57 Date 20/ 6

Time 11: 44 Flight: Tape 3
Track 0, File 14

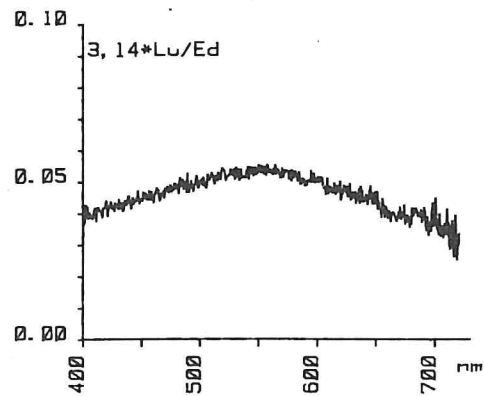
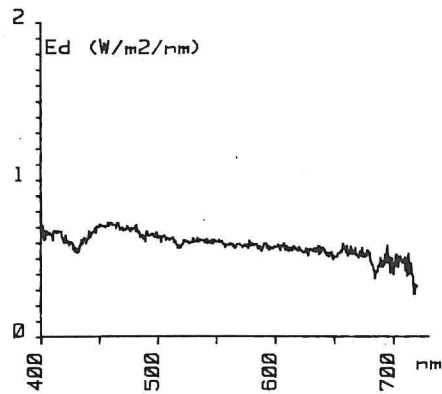
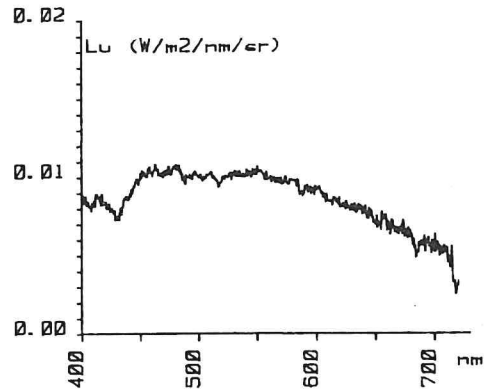
Number 58 Date 20/ 6

Time 16: 11 Flight: Tape 3
Track 1, File 0

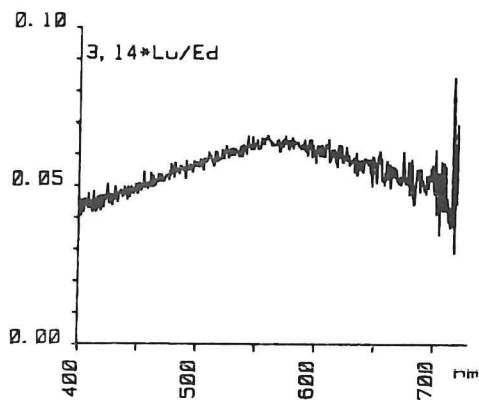
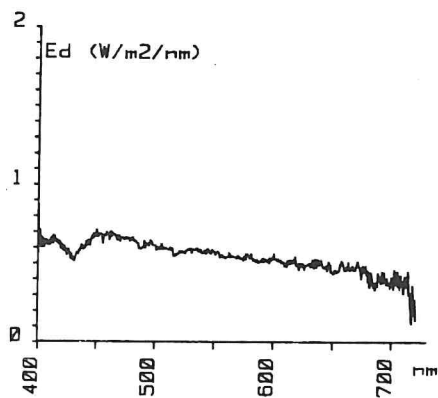
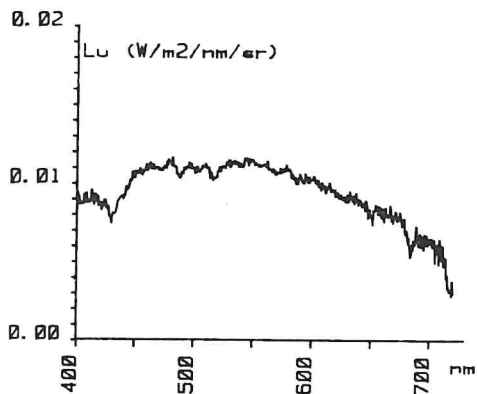
Number 59 Date 20/ 6

Time 16: 15 Flight: Tape 3
Track 1, File 1

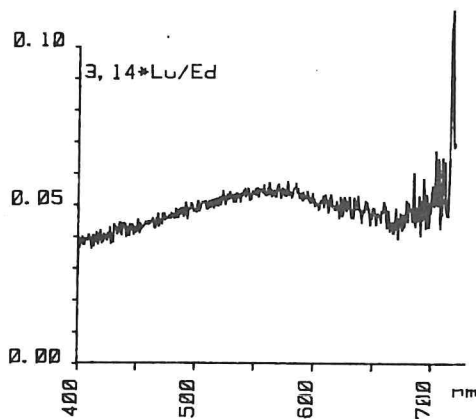
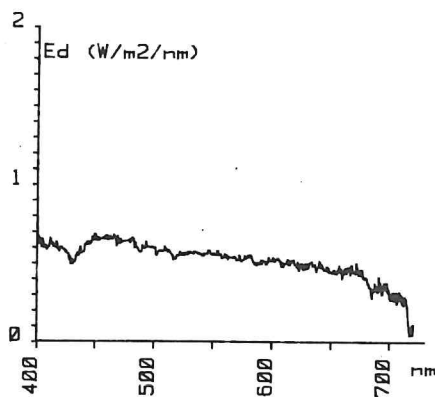
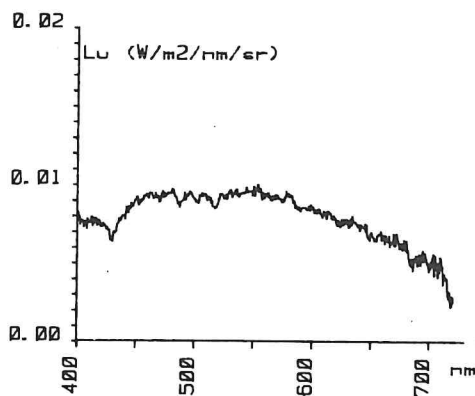
Number 60 Date 20/ 6

Time 16: 18 Flight: Tape 3
Track 1, File 2

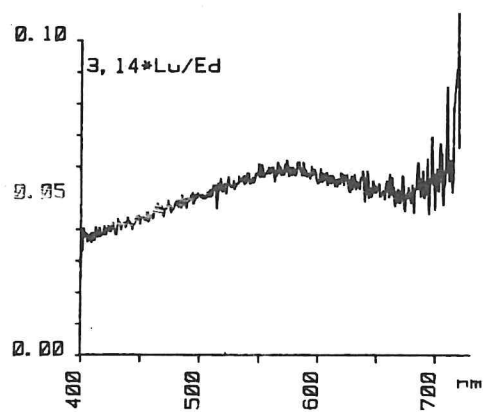
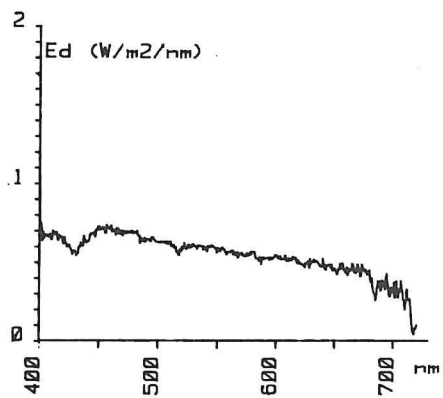
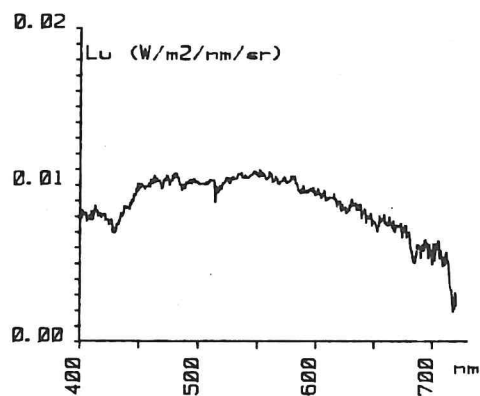
Number 61 Date 20/ 6

Time 16: 20 Flight: Tape 3
Track 1, File 3

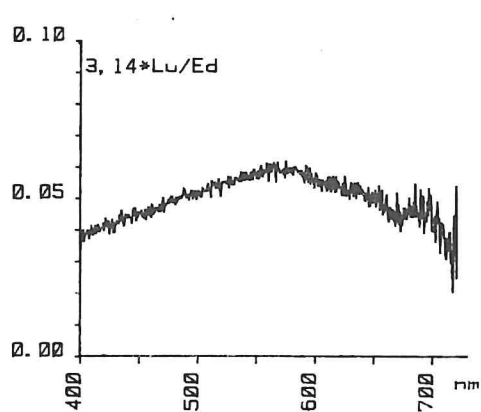
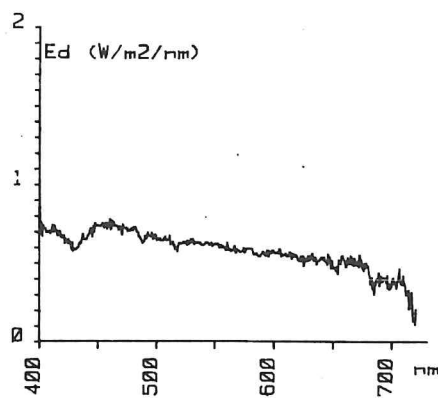
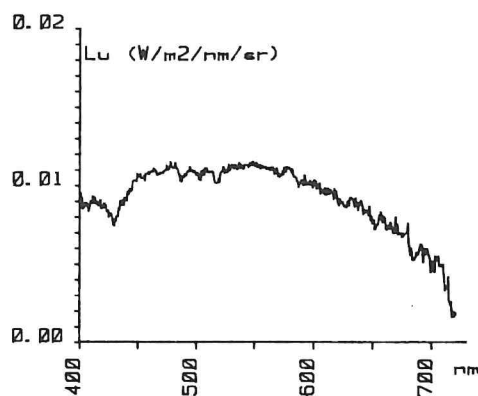
Number 62 Date 20/ 6

Time 16: 26 Flight: Tape 3
Track 1, File 4

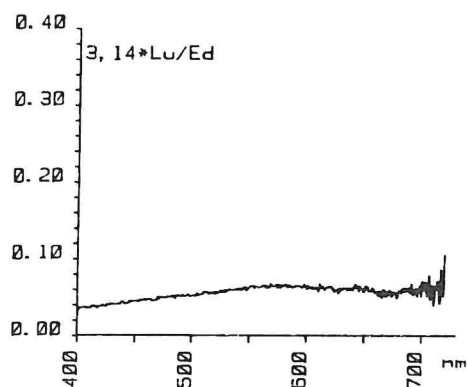
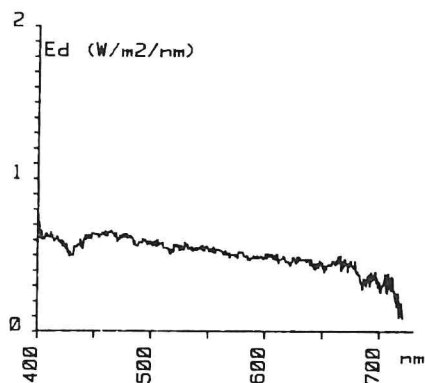
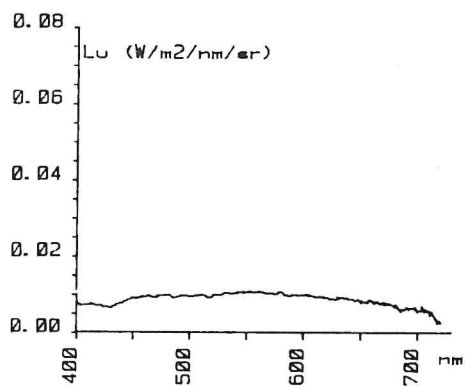
Number 63 Date 20/ 6

Time 16: 30 Flight: Tape 3
Track 1, File 5

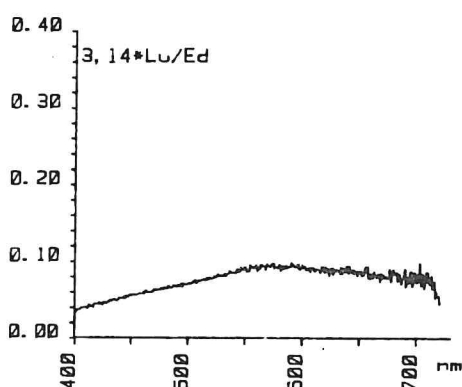
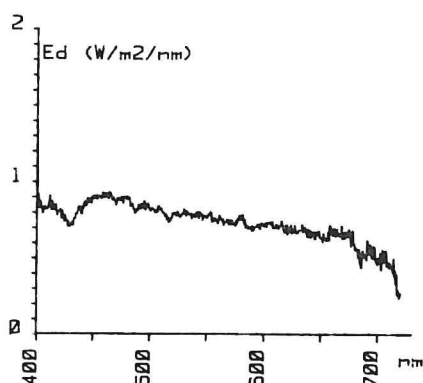
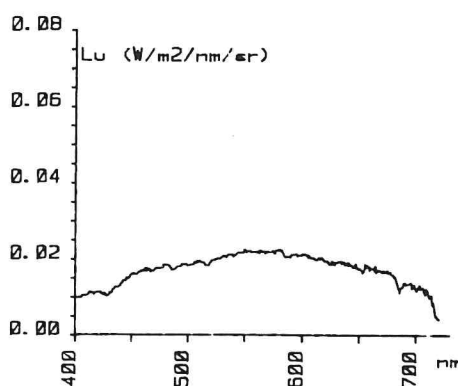
Number 64 Date 20/ 6

Time 16: 32 Flight: Tape 3
Track 1, File 6

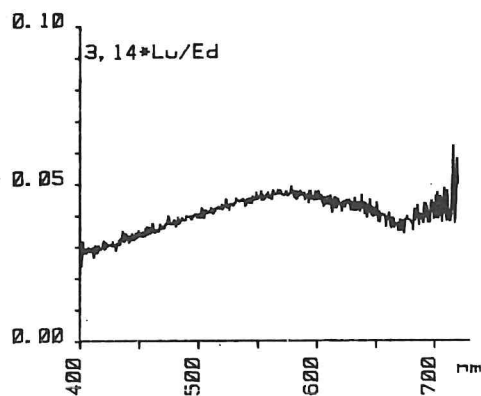
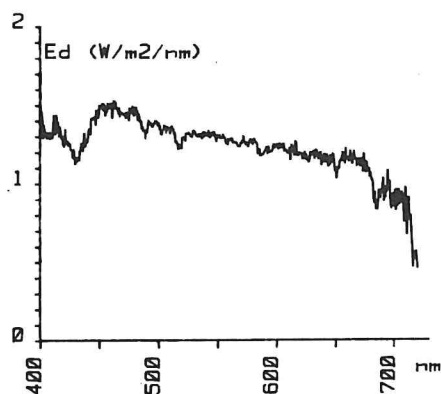
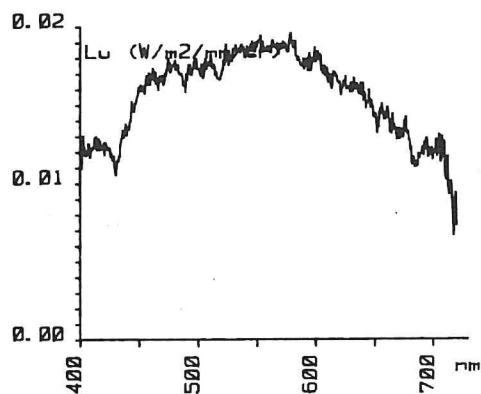
Number 65 Date 20/ 6

Time 16: 35 Flight: Tape 3
Track 1, File 7

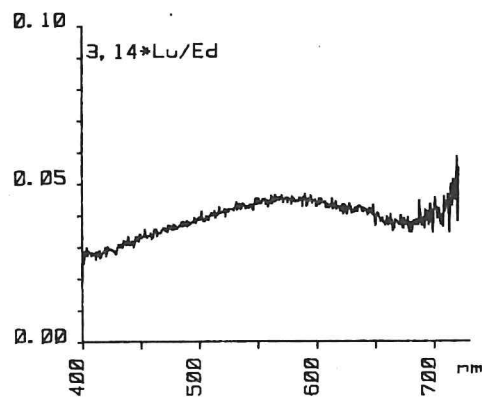
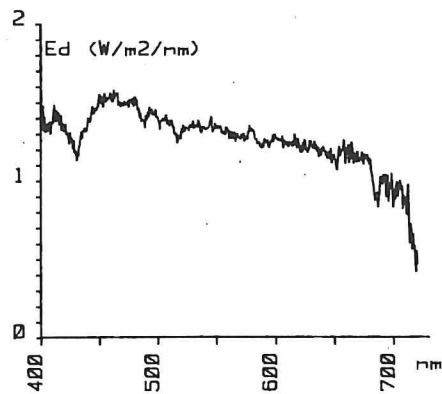
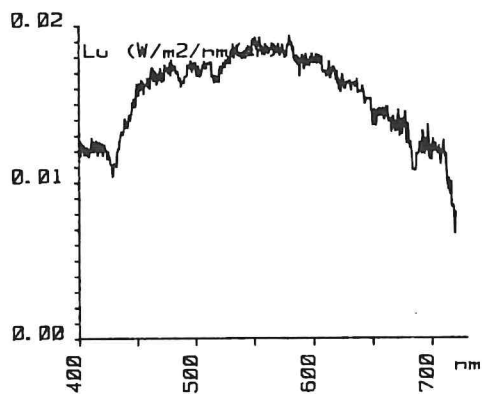
Number 66 Date 20/ 6

Time 16: 40 Flight: Tape 3
Track 1, File 8

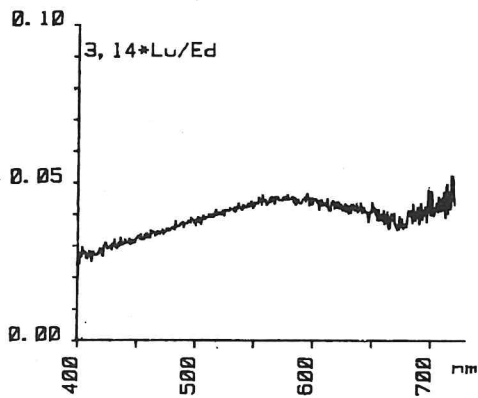
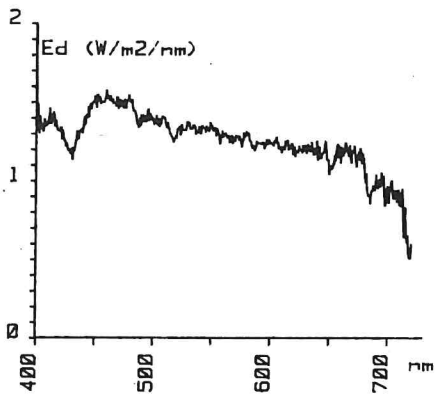
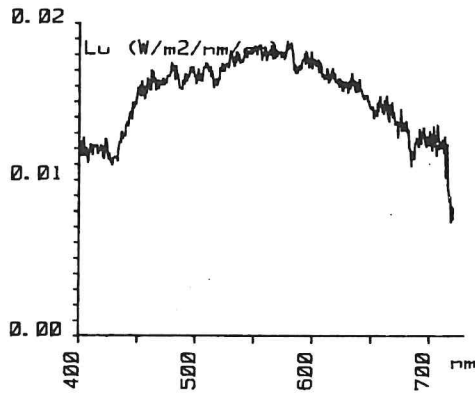
Number 67 Date 22/ 6

Time 11: 42 Flight: Tape 4
Track 0, File 1

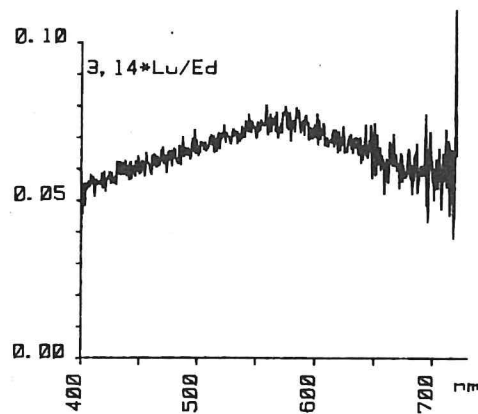
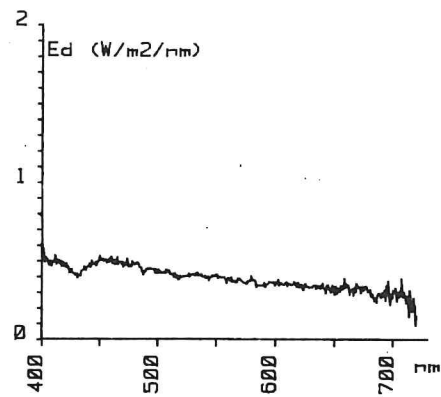
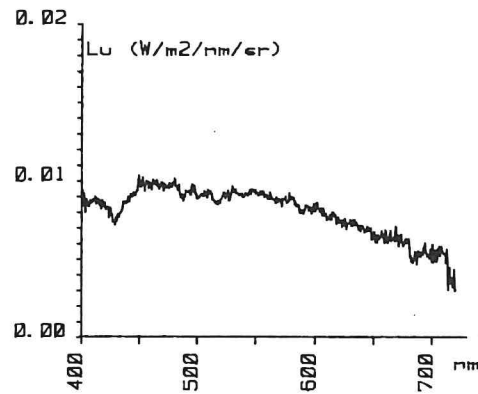
Number 68 Date 22/ 6

Time 11: 45 Flight: Tape 4
Track 0, File 2

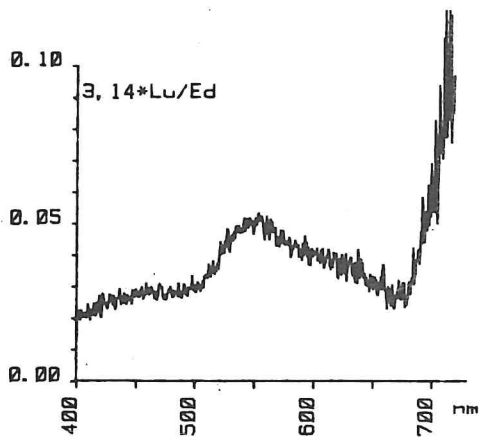
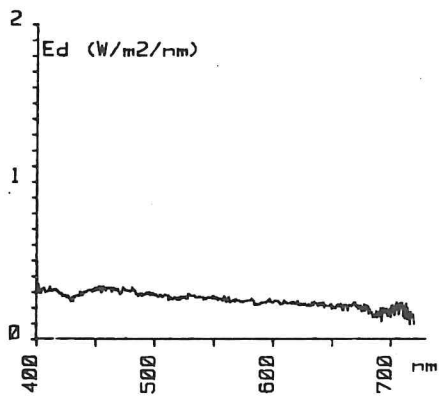
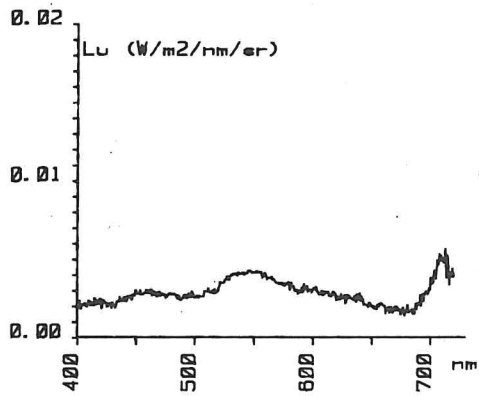
Number 69 Date 22/ 6
Time 11: 48 Flight: Tape 4
Track 0, File 3



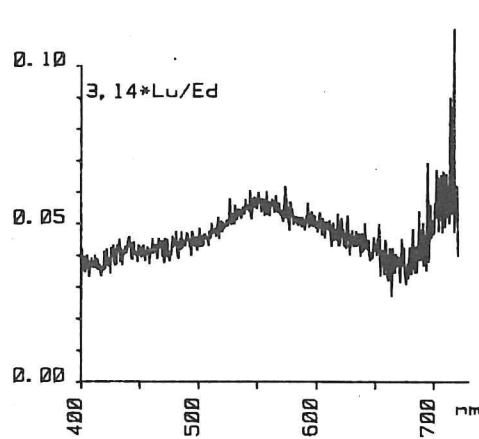
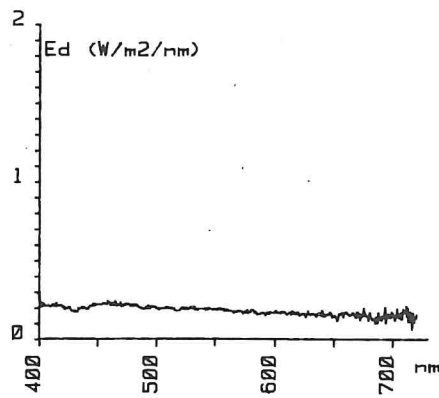
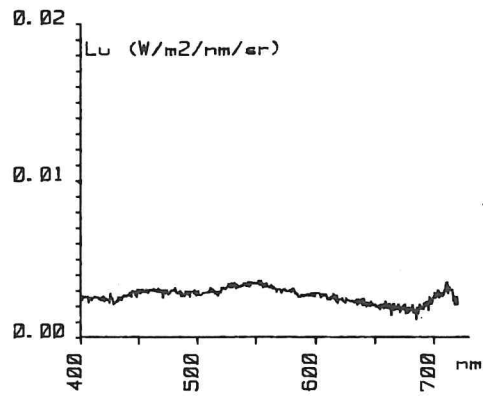
Number 70 Date 22/ 6
Time 11: 50 Flight: Tape 4
Track 0, File 4



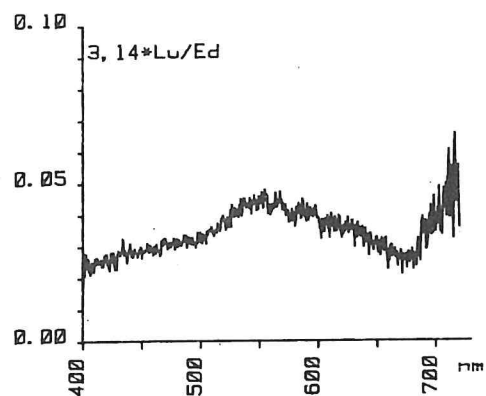
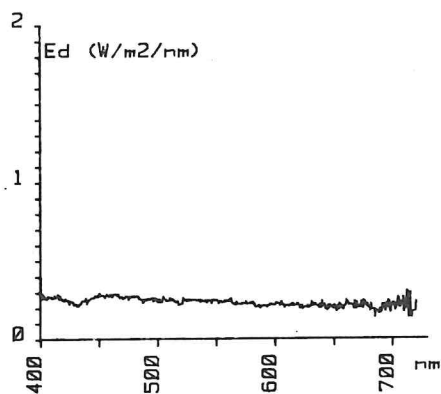
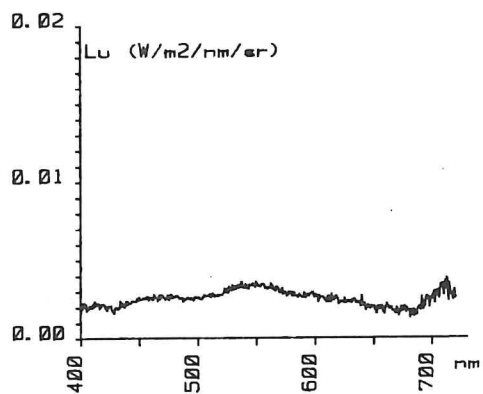
Number 71 Date 22/ 6
Time 11: 54 Flight: Tape 4
Track 0, File 5



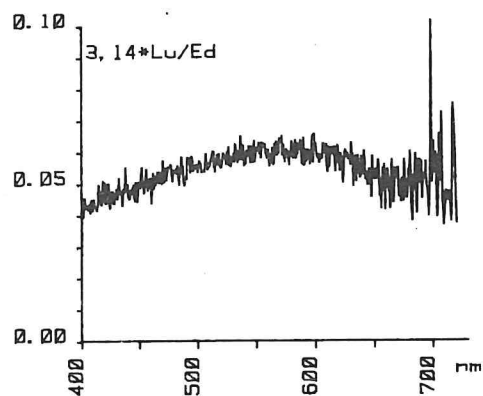
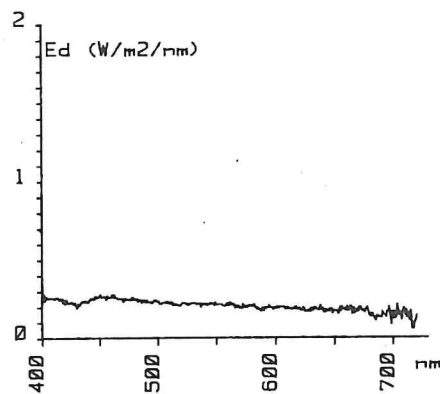
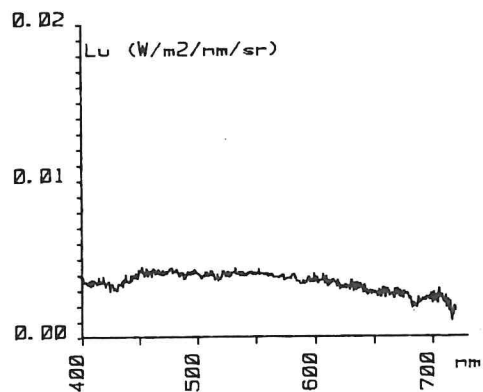
Number 72 Date 22/ 6
Time 11: 57 Flight: Tape 4
Track 0, File 6



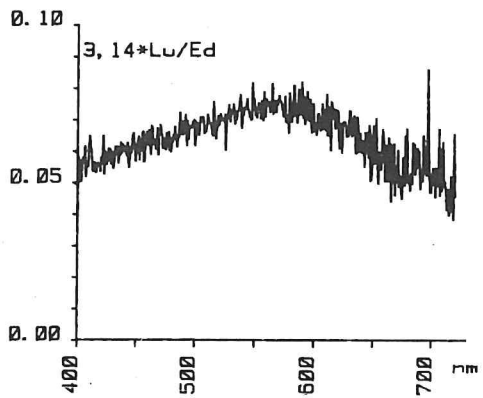
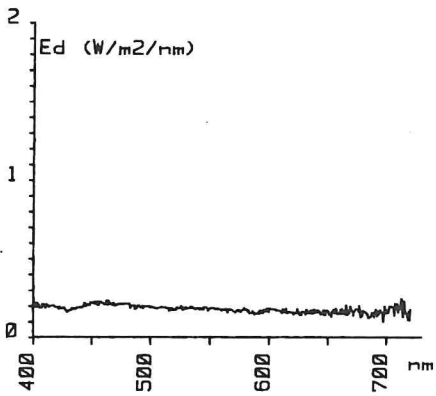
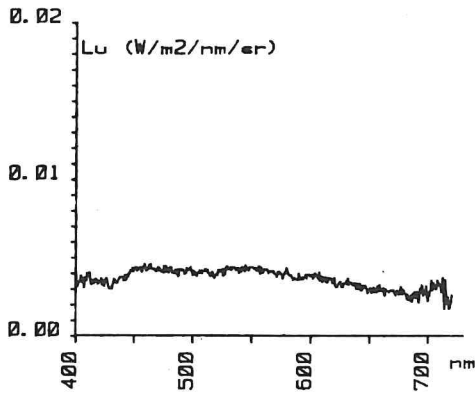
Number 73 Date 22/ 6

Time 12: 0 Flight: Tape 4
Track 0, File 7

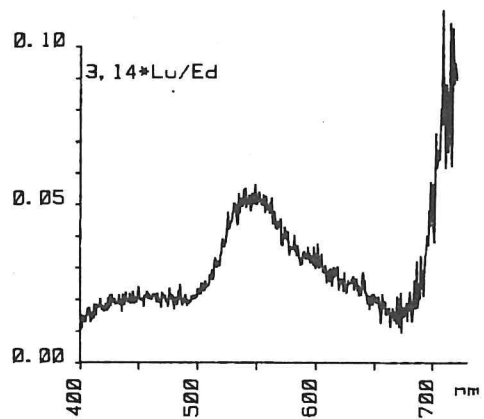
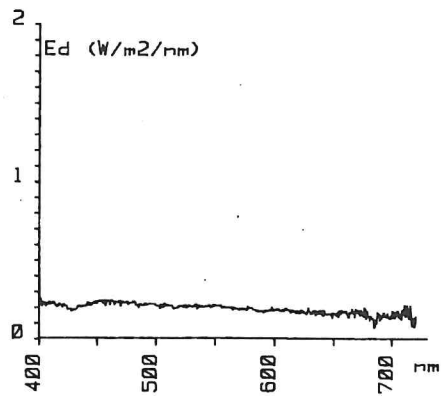
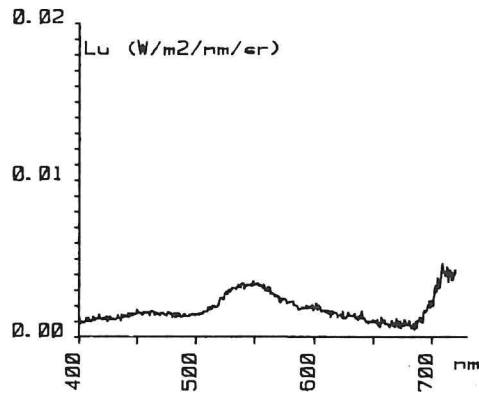
Number 74 Date 22/ 6

Time 12: 4 Flight: Tape 4
Track 0, File 8

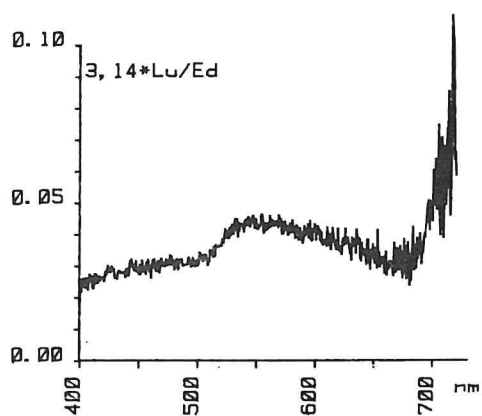
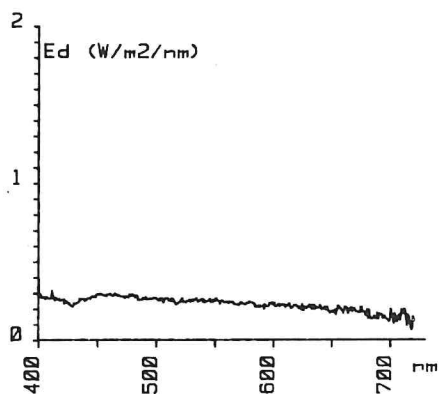
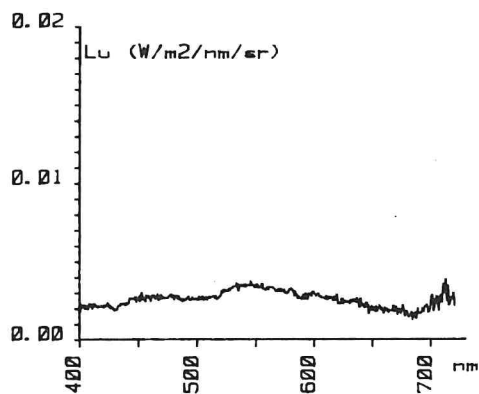
Number 75 Date 22/ 6

Time 12: 7 Flight: Tape 4
Track 0, File 9

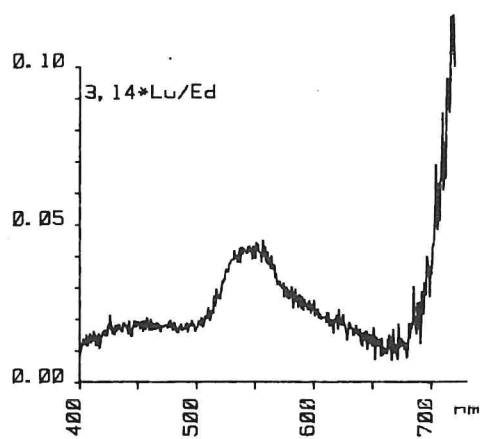
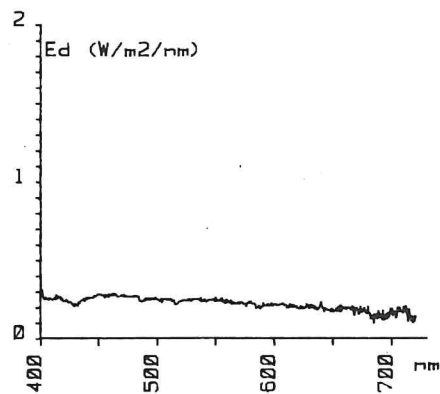
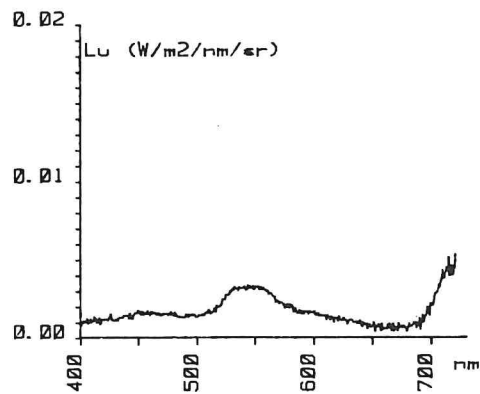
Number 76 Date 22/ 6

Time 12: 9 Flight: Tape 4
Track 0, File 10

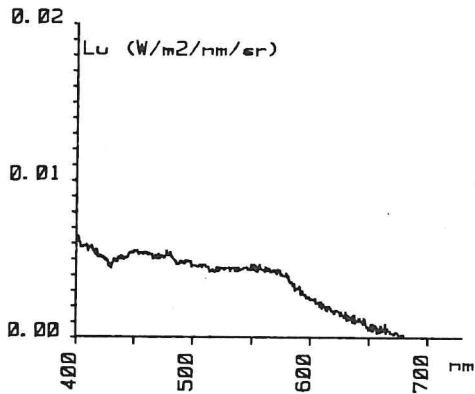
Number 77 Date 22/ 6
Time 12: 12 Flight: Tape 4
Track 0, File 11



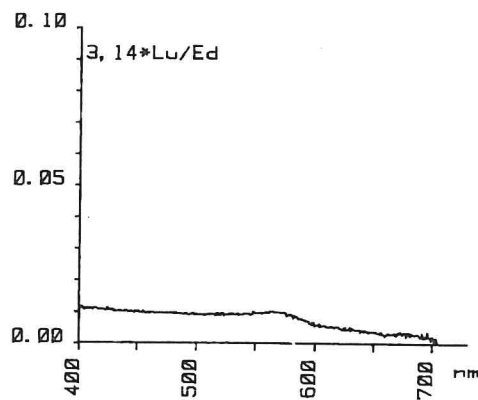
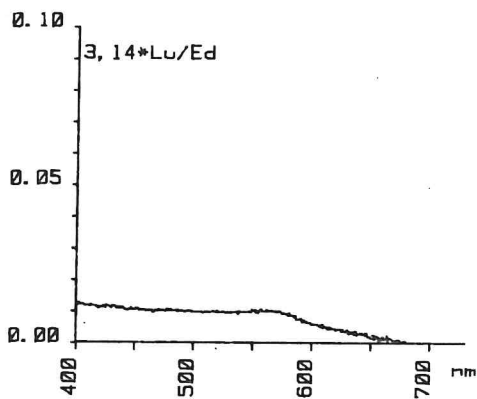
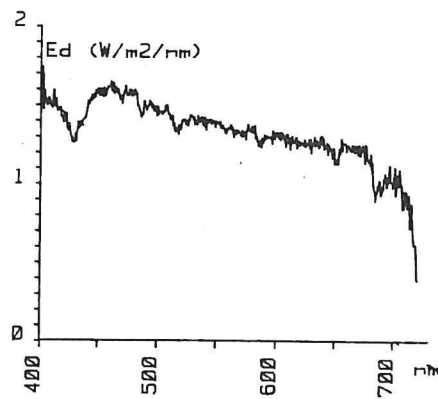
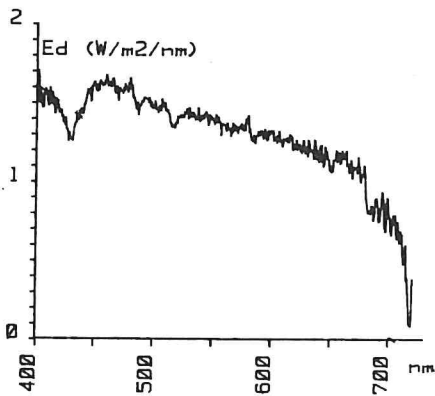
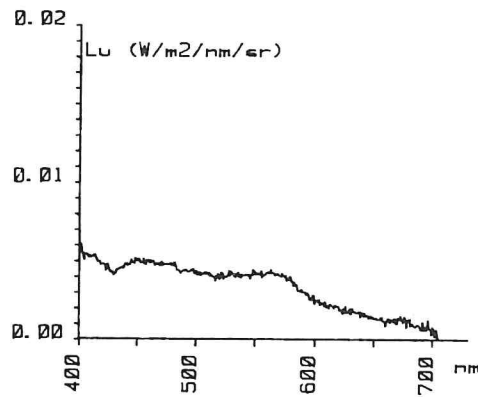
Number 78 Date 22/ 6
Time 12: 15 Flight: Tape 4
Track 0, File 12



Number 79 Date 22/ 6

Time 12: 40 Flight: Tape 4
Track 0, File 13

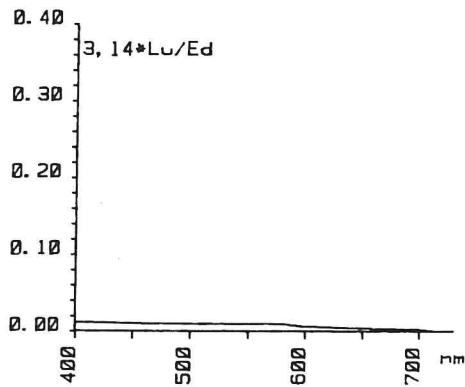
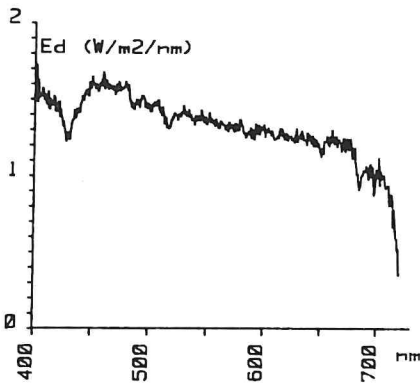
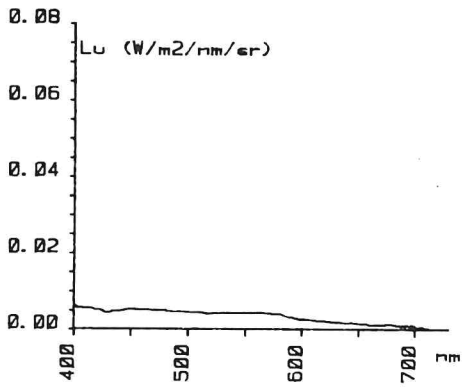
Number 80 Date 22/ 6

Time 12: 44 Flight: Tape 4
Track 0, File 14

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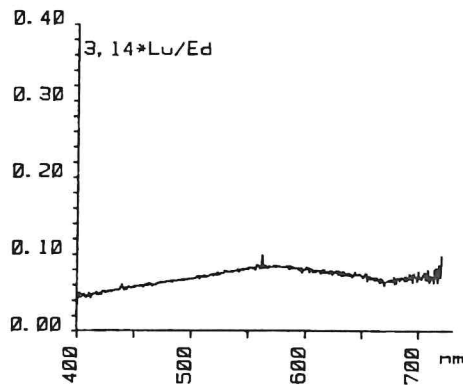
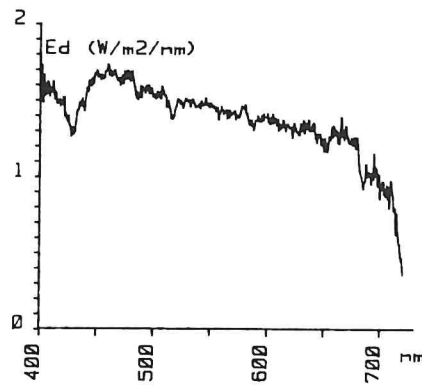
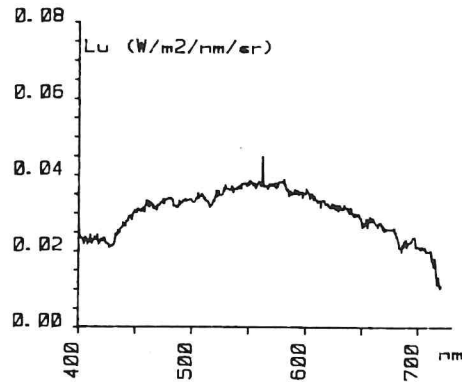
Number 81 Date 22/ 6

Time 12: 46 Flight: Tape 4
Track 0, File 15

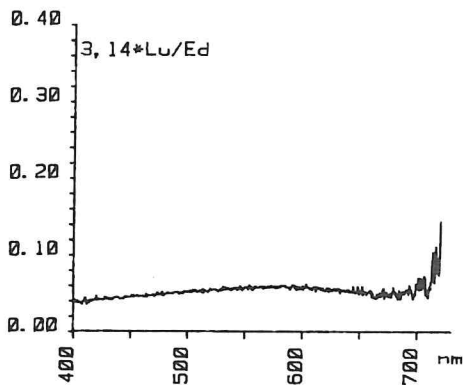
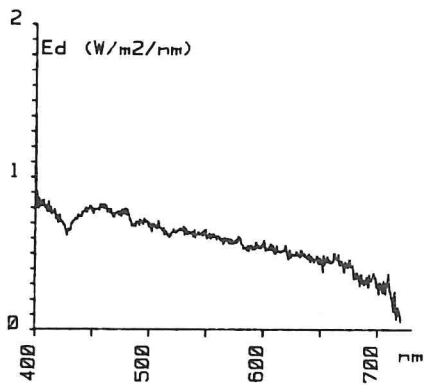
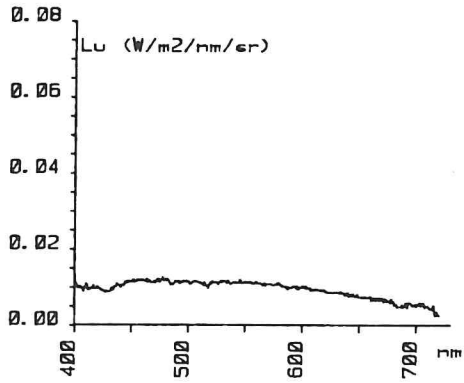


Number 82 Date 22/ 6

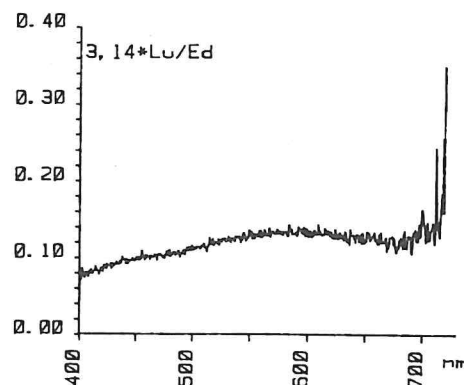
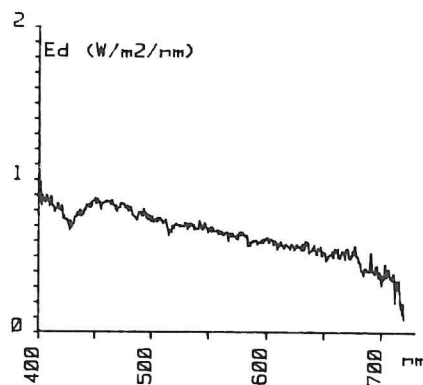
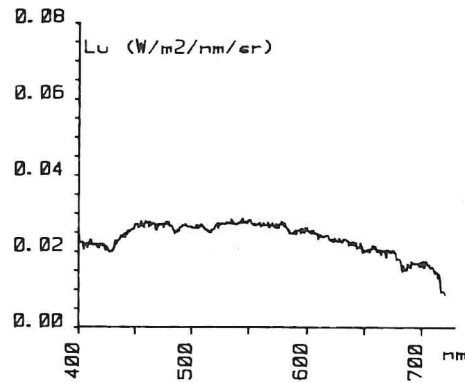
Time 12: 56 Flight: Tape 4
Track 1, File 0



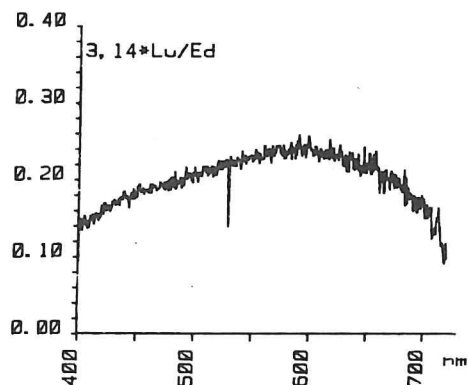
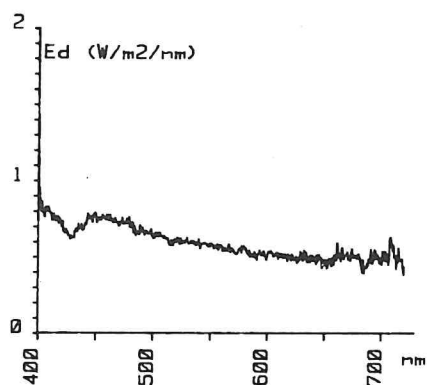
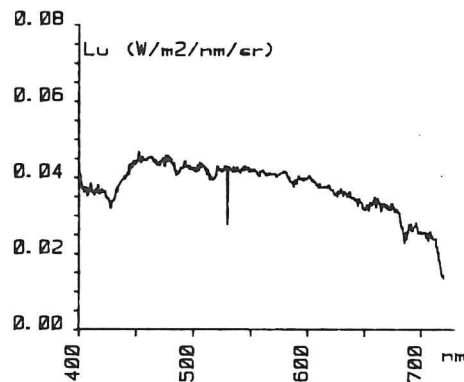
Number 83 Date 22/ 6
Time 12: 59 Flight: Tape 4
Track 1, File 1



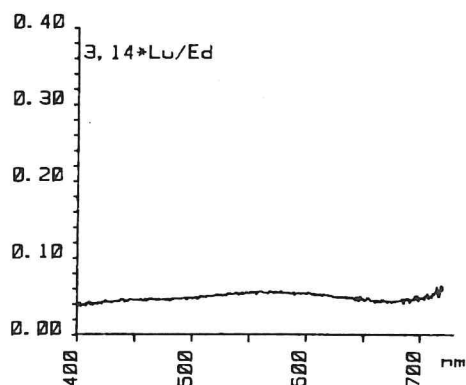
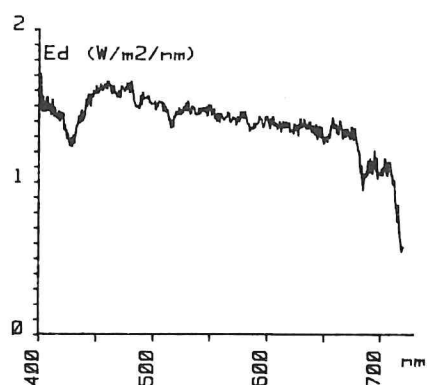
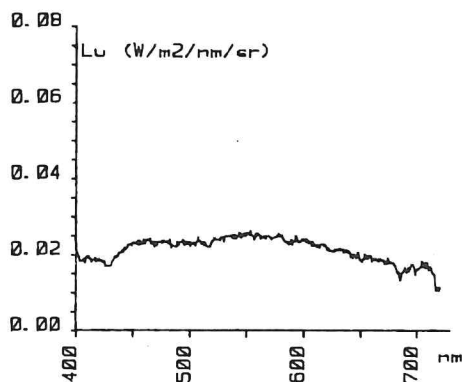
Number 84 Date 22/ 6
Time 13: 2 Flight: Tape 4
Track 1, File 2



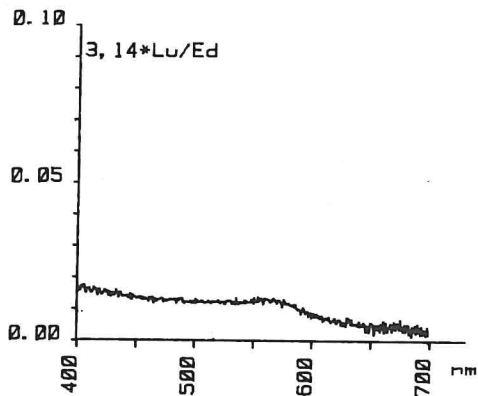
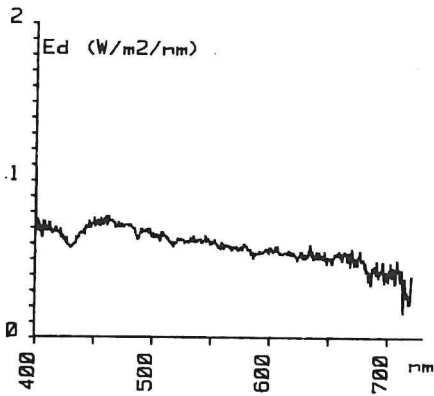
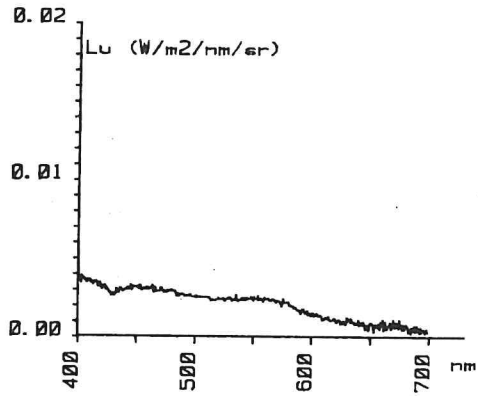
Number 85 Date 22/ 6

Time 13: 5 Flight: Tape 4
Track 1, File 3

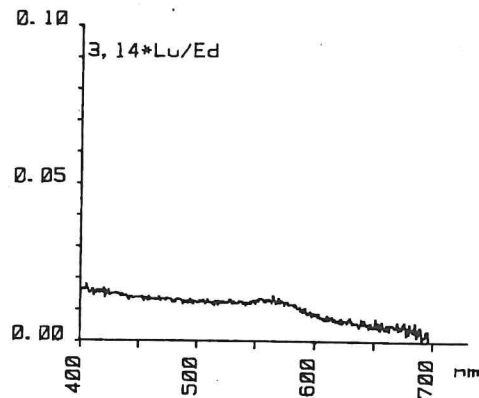
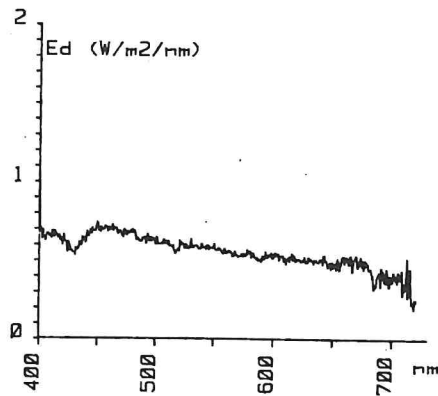
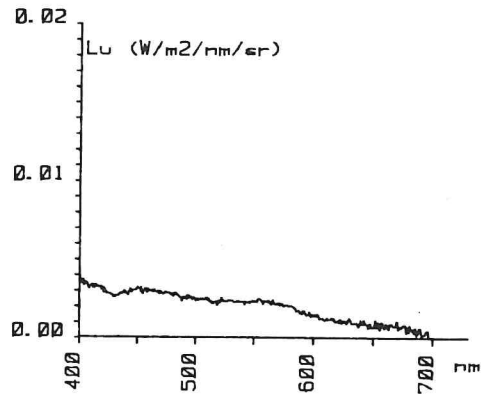
Number 86 Date 22/ 6

Time 13: 9 Flight: Tape 4
Track 1, File 4

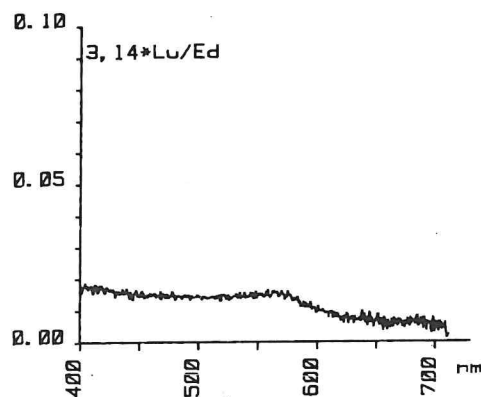
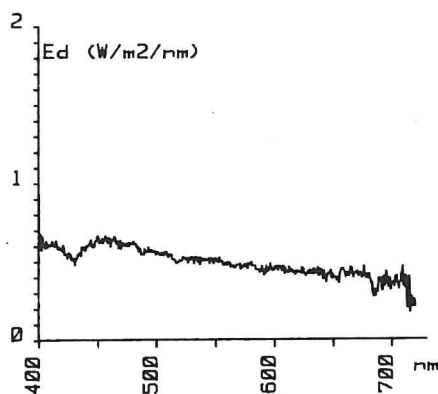
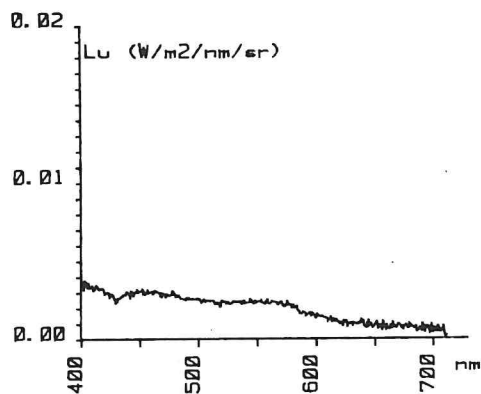
Number 87 Date 22/ 6

Time 17: 0 Flight: Tape 4
Track 1, File 5

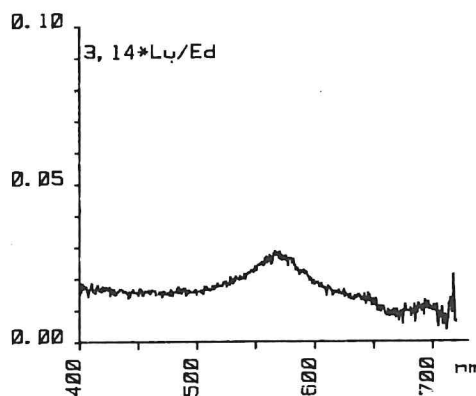
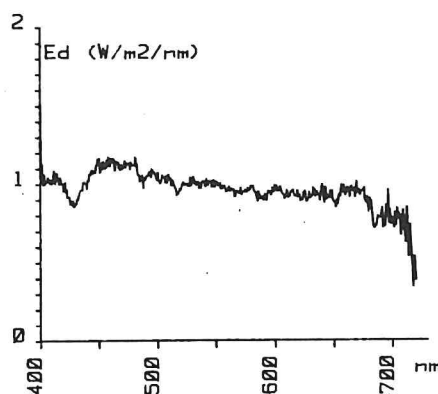
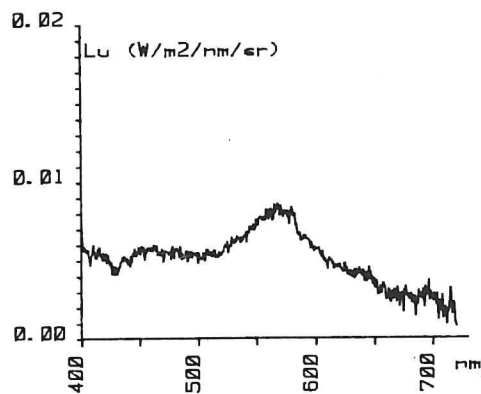
Number 88 Date 22/ 6

Time 17: 3 Flight: Tape 4
Track 1, File 6

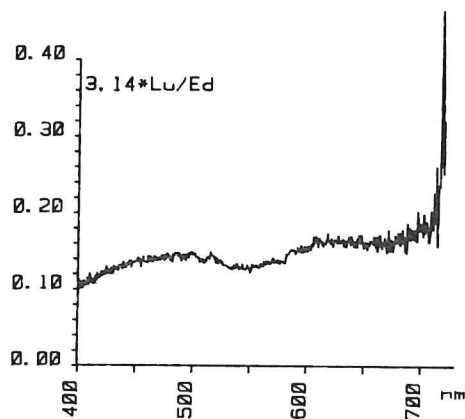
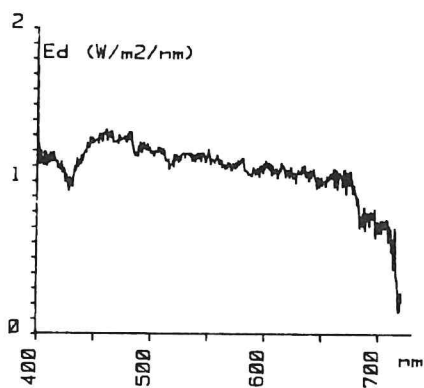
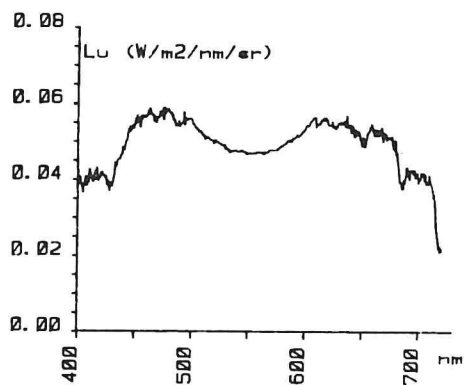
Number 89 Date 22/ 6
Time 17: 5 Flight: Tape 4
Track 1, File 7



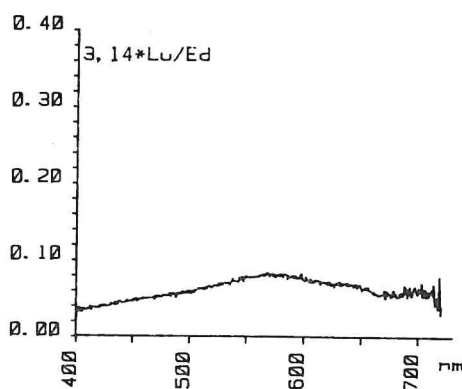
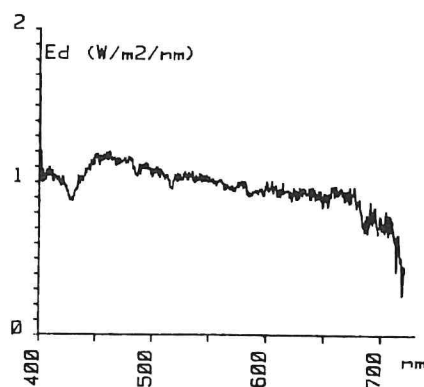
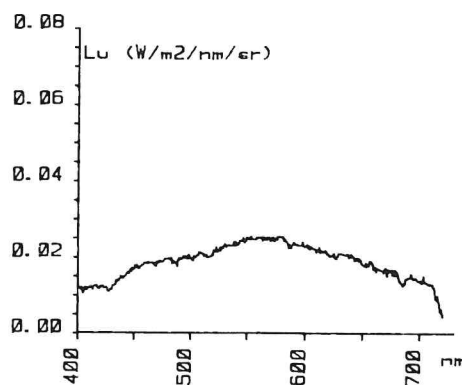
Number 90 Date 22/ 6
Time 17: 10 Flight: Tape 4
Track 1, File 8



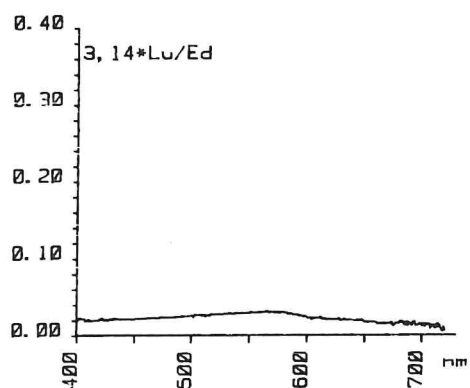
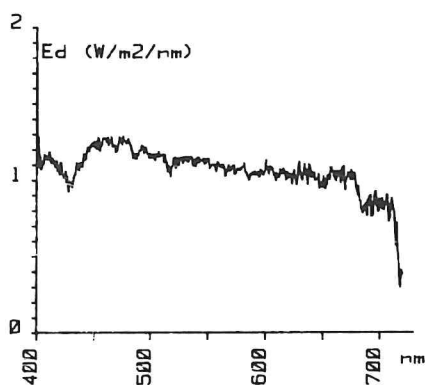
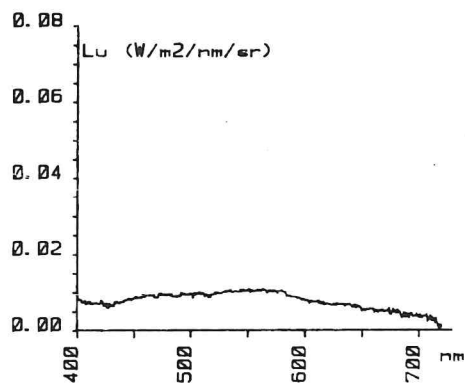
Number 91 Date 22/ 6
Time 17: 14 Flight: Tape 4
Track 1, File 9



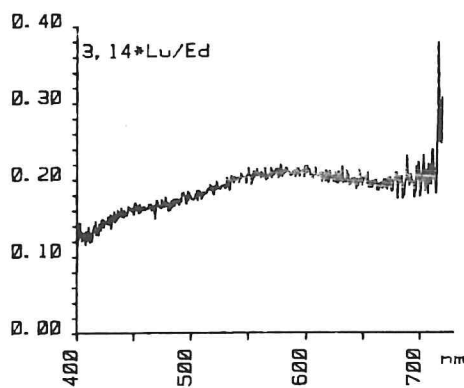
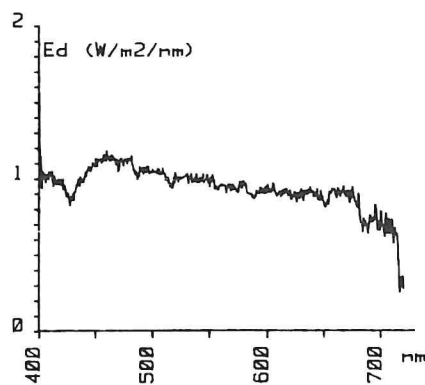
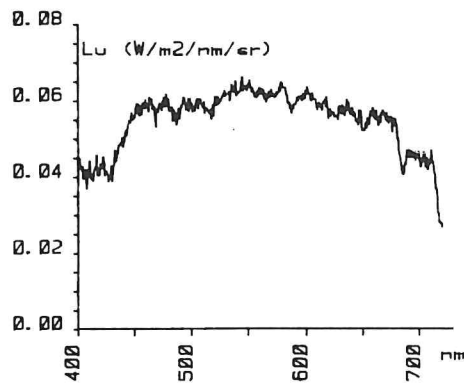
Number 92 Date 22/ 6
Time 17: 17 Flight: Tape 4
Track 1, File 10



Number 93 Date 22/ 6
Time 17: 19 Flight: Tape 4
Track 1, File 11



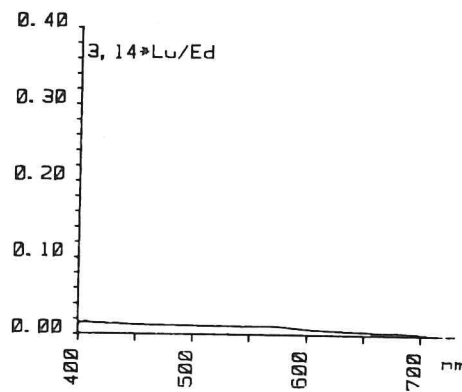
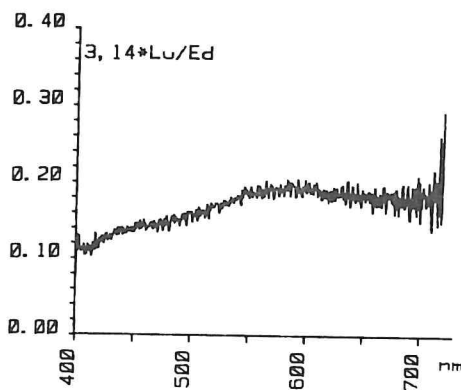
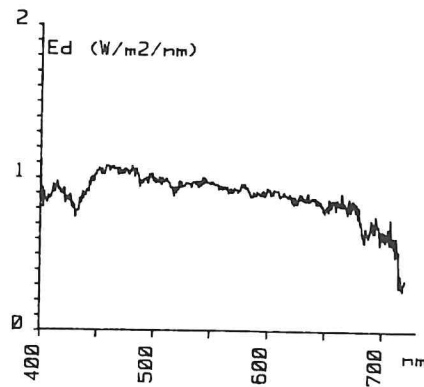
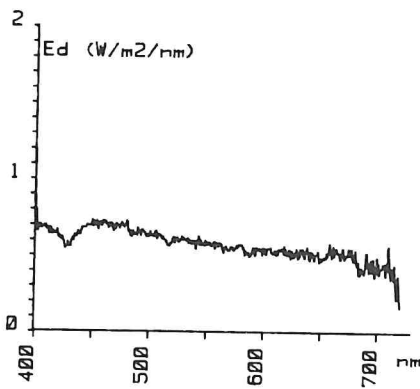
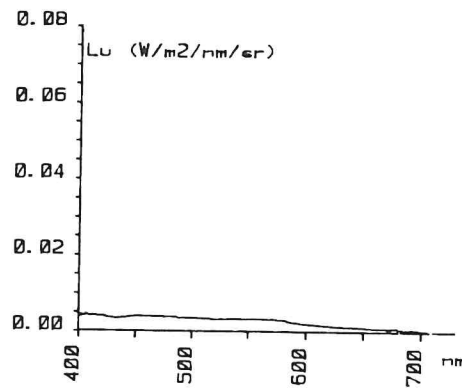
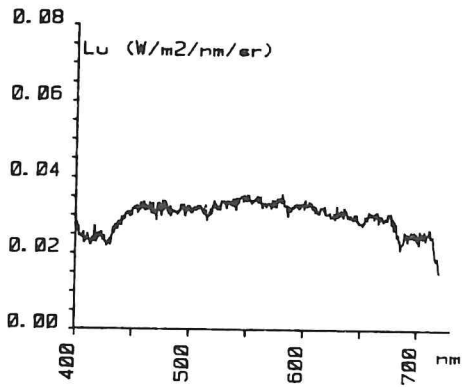
Number 94 Date 22/ 6
Time 17: 24 Flight: Tape 4
Track 1, File 12



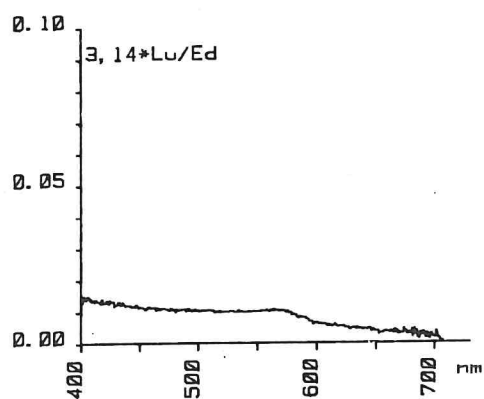
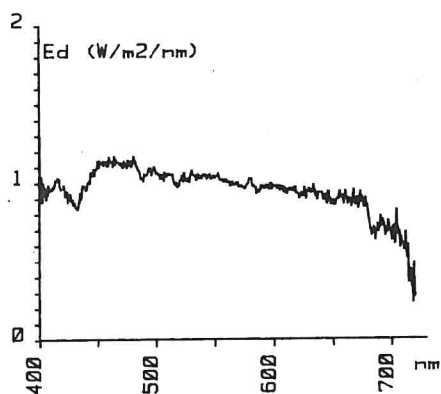
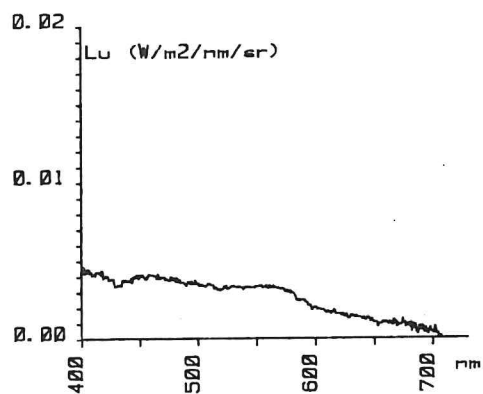
Number 95 Date 22/ 6

Time 17: 31 Flight: Tape 4
Track 1, File 13

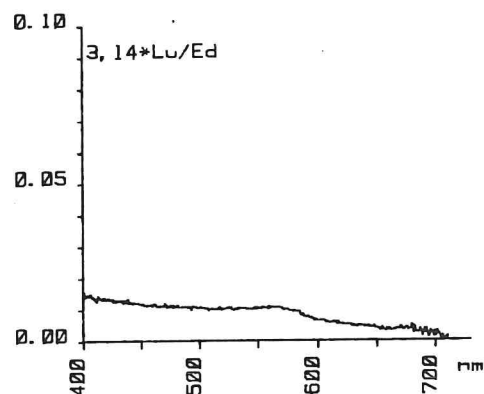
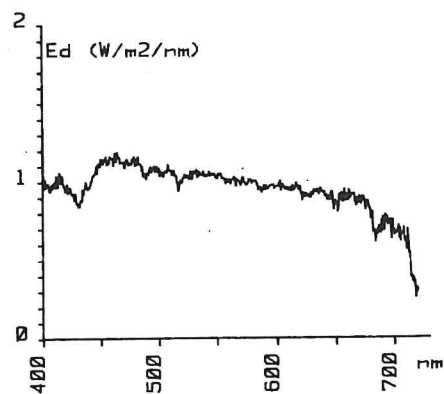
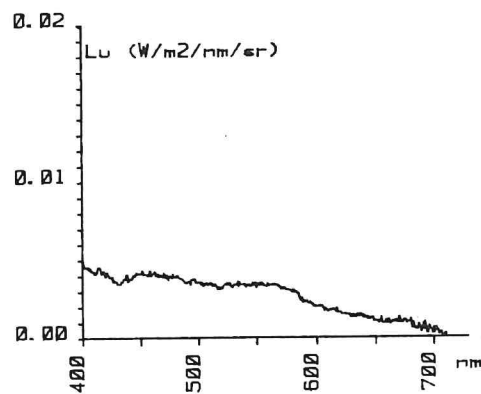
Number 96 Date 23/ 6

Time 9: 27 Flight: Tape 5
Track 0, File 1

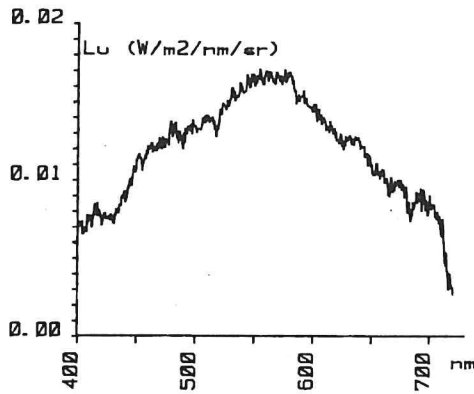
Number 97 Date 23/ 6

Time 9: 30 Flight: Tape 5
Track 0, File 2

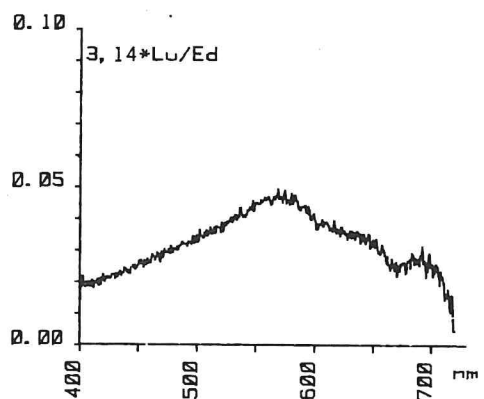
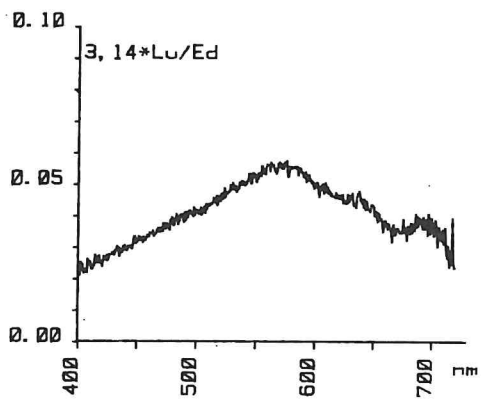
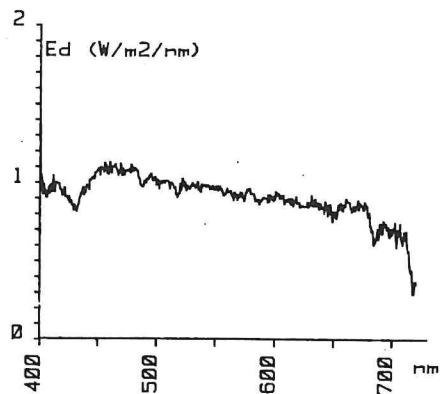
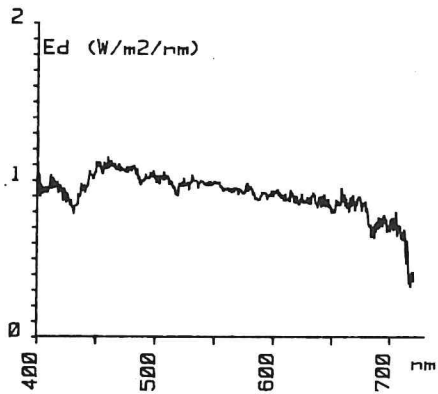
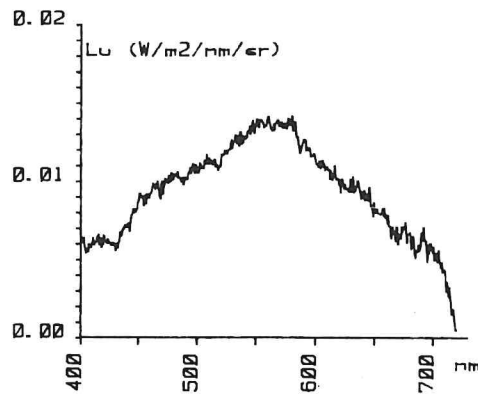
Number 98 Date 23/ 6

Time 9: 33 Flight: Tape 5
Track 0, File 3

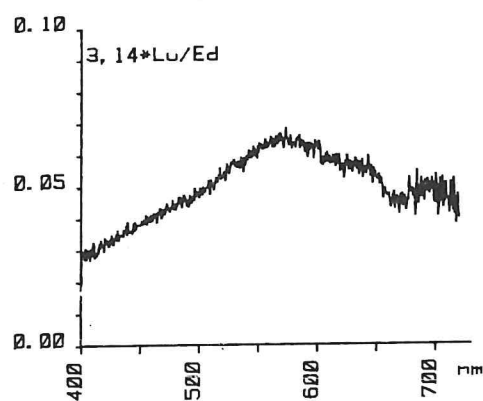
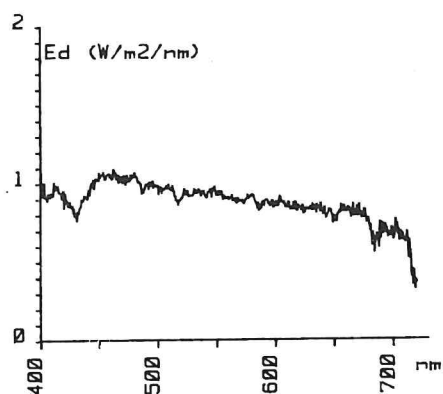
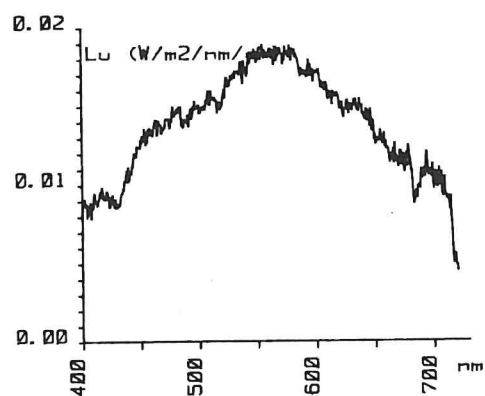
Number 99 Date 23/ 6

Time 9: 42 Flight: Tape 5
Track 0, File 4

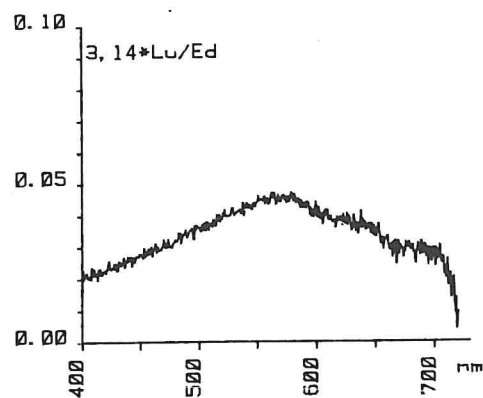
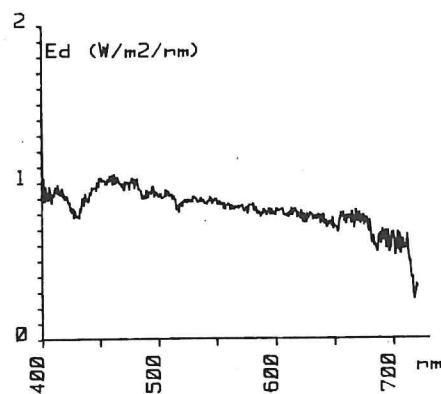
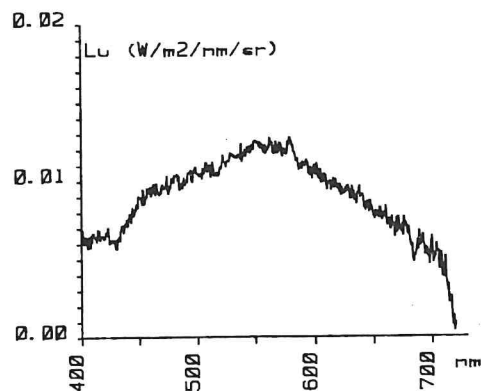
Number 100 Date 23/ 6

Time 9: 47 Flight: Tape 5
Track 0, File 5

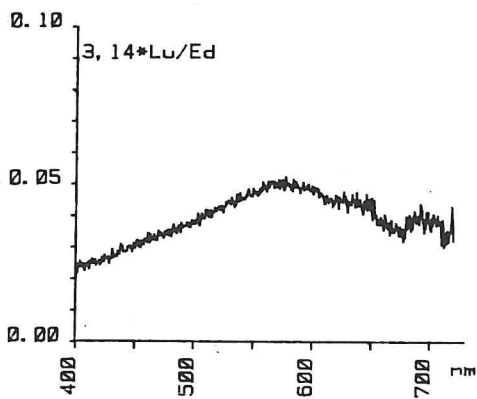
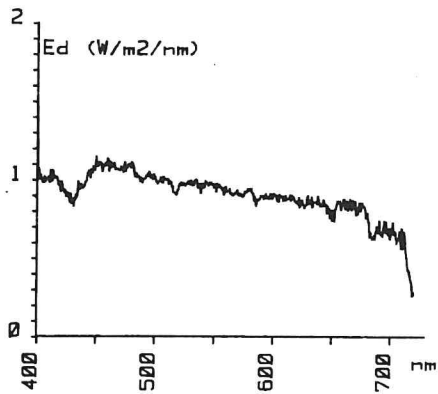
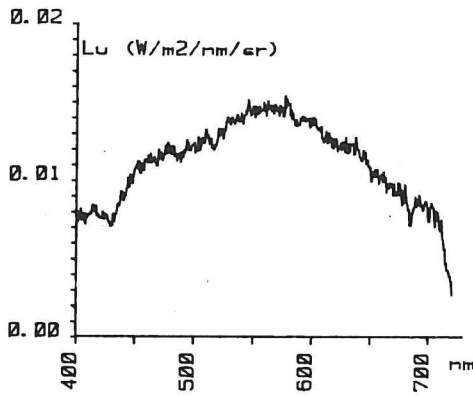
Number 101 Date 23/ 6

Time 9: 52 Flight: Tape 5
Track 0, File 6

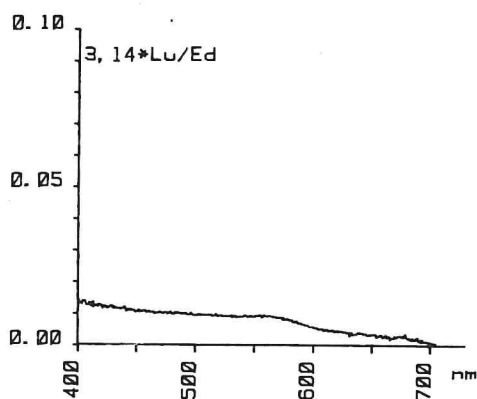
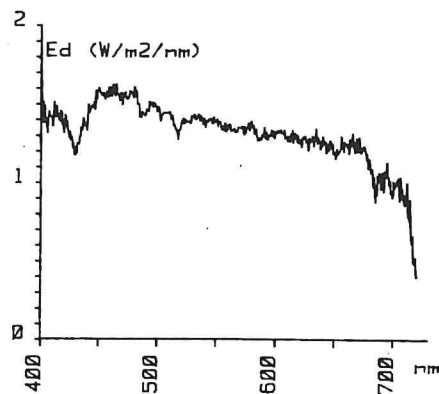
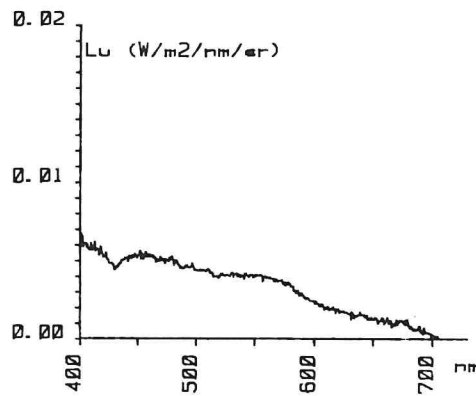
Number 102 Date 23/ 6

Time 10: 2 Flight: Tape 5
Track 0, File 7

Number 103 Date 23/ 6

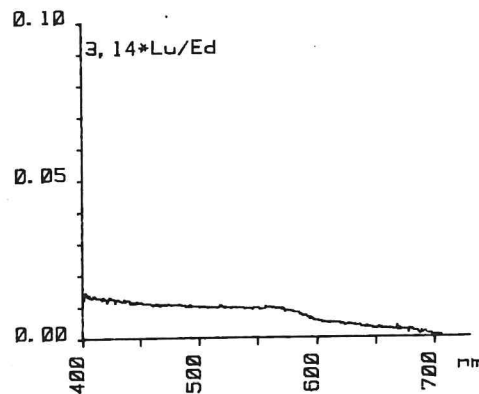
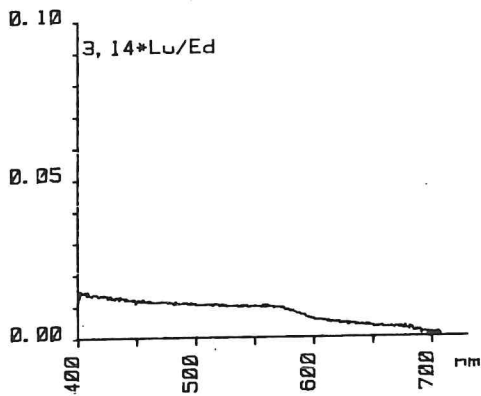
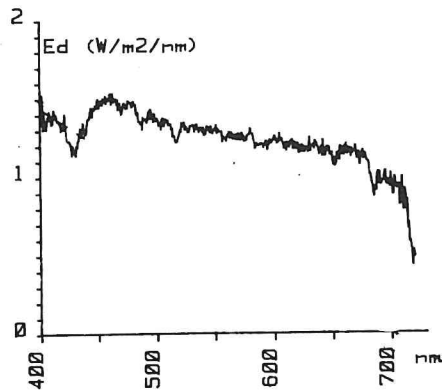
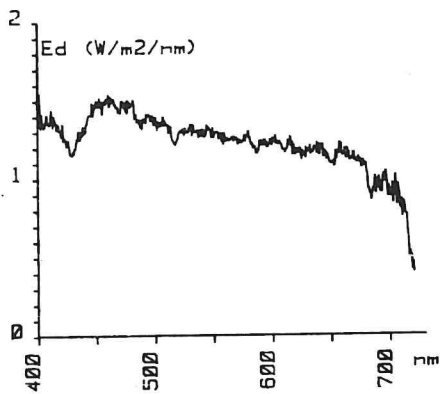
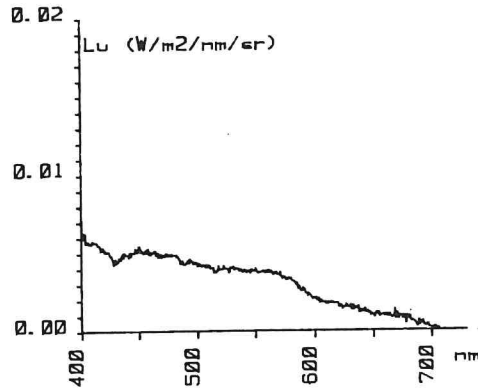
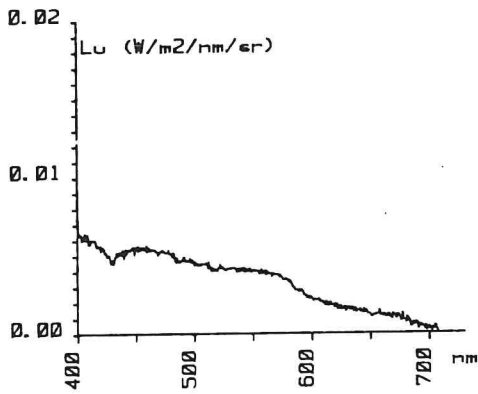
Time 10: 7 Flight: Tape 5
Track 0, File 8

Number 104 Date 23/ 6

Time 12: 3 Flight: Tape 5
Track 0, File 9

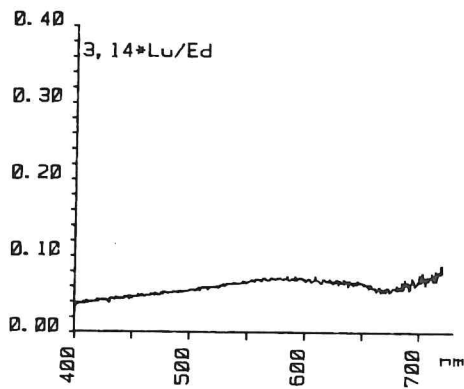
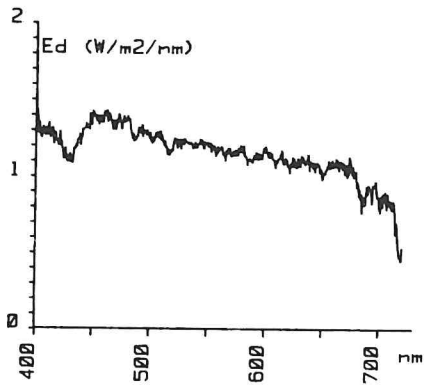
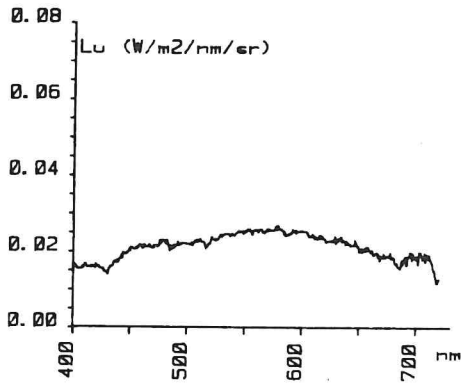
Number 105 Date 23/ 6
Time 12: 6 Flight: Tape 5
Track 0, File 10

Number 106 Date 23/ 6
Time 12: 9 Flight: Tape 5
Track 0, File 11



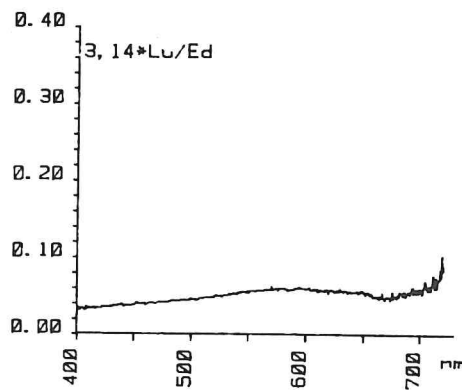
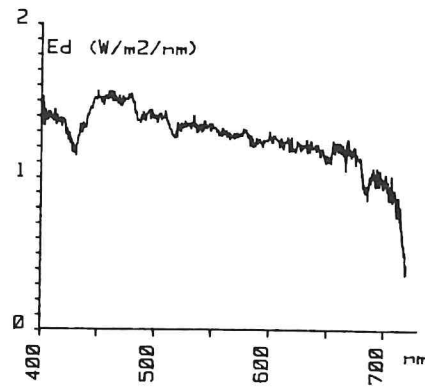
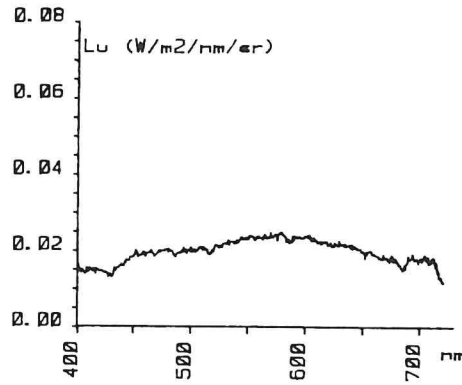
Number 107 Date 23/ 6

Time 12: 17 Flight: Tape 5
Track 0, File 12

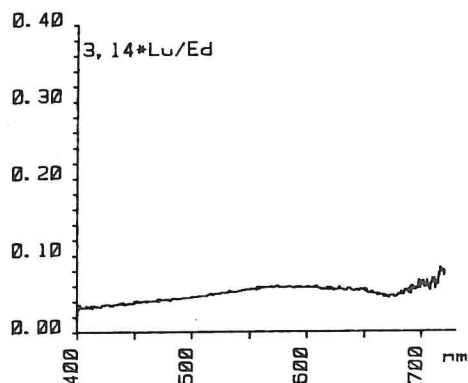
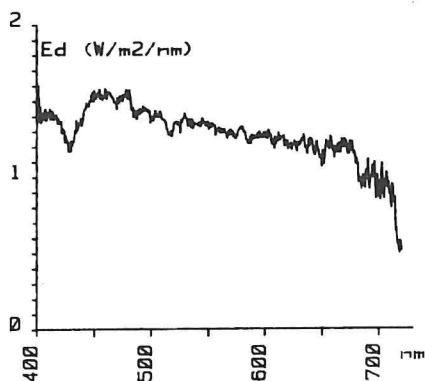
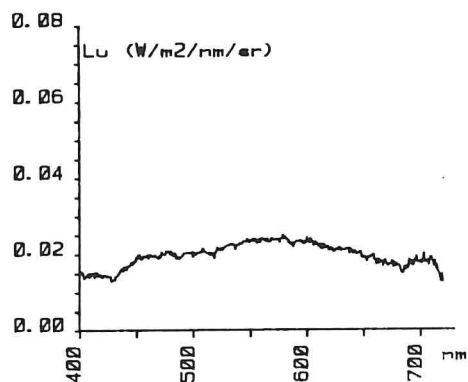


Number 108 Date 23/ 6

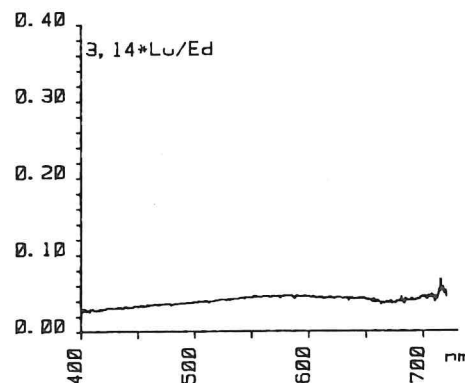
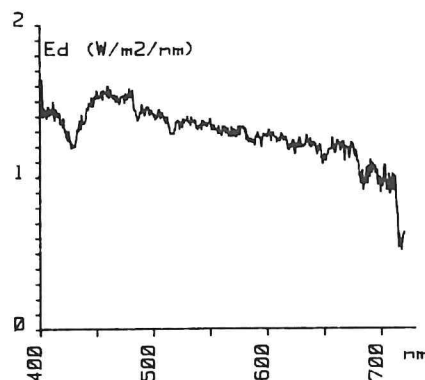
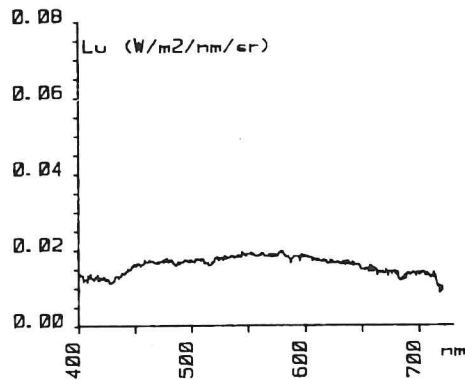
Time 12: 21 Flight: Tape 5
Track 0, File 13



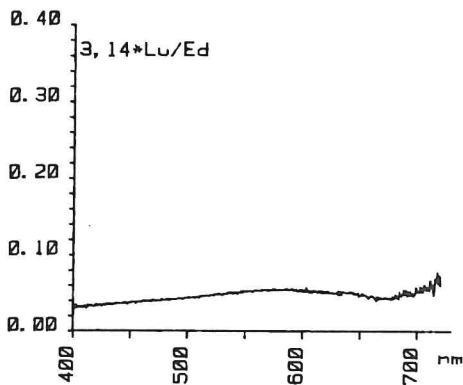
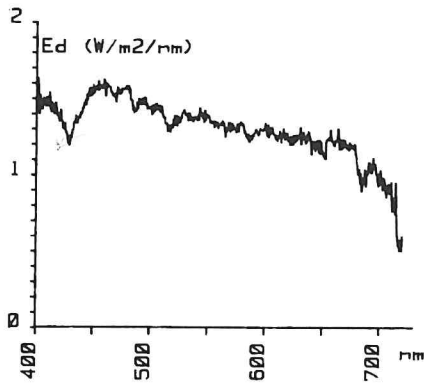
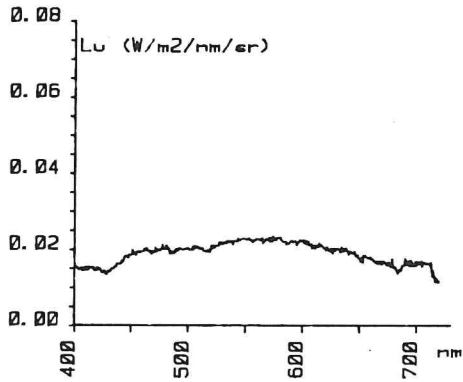
Number 109 Date 23/ 6

Time 12: 25 Flight: Tape 5
Track 0, File 14

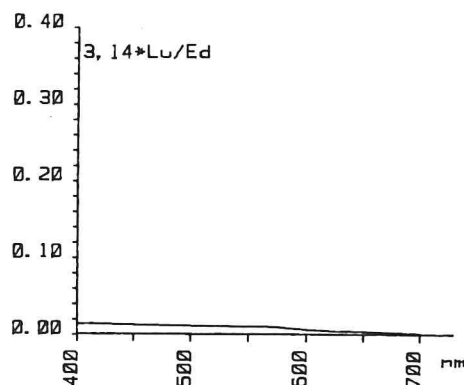
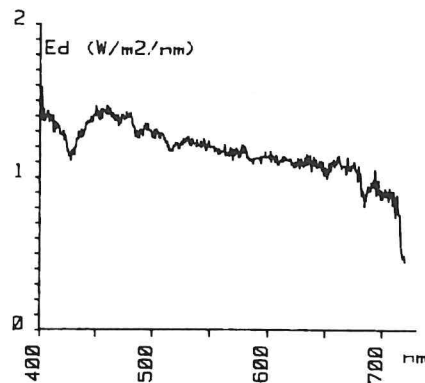
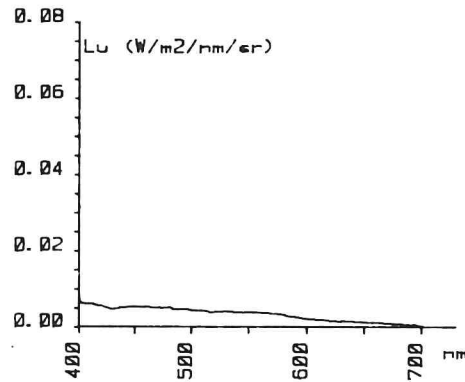
Number 110 Date 23/ 6

Time 12: 31 Flight: Tape 5
Track 0, File 15

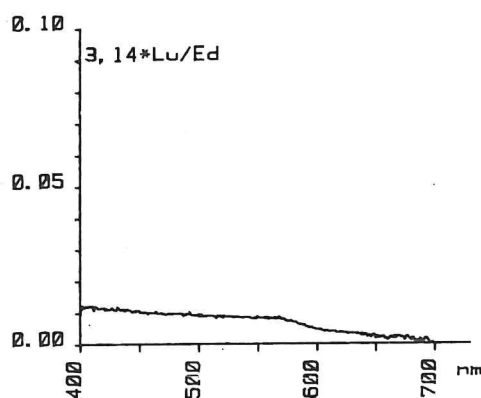
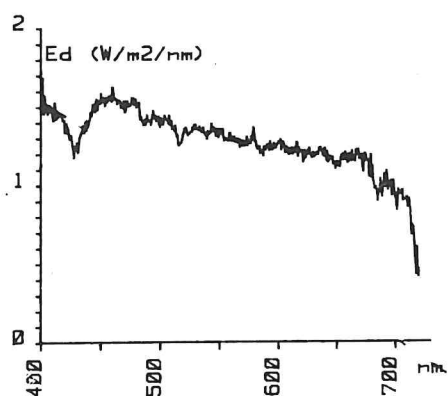
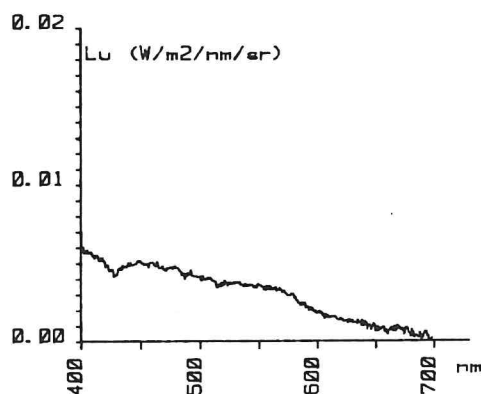
Number 111 Date 23/ 6

Time 12: 35 Flight: Tape 5
Track 0, File 16

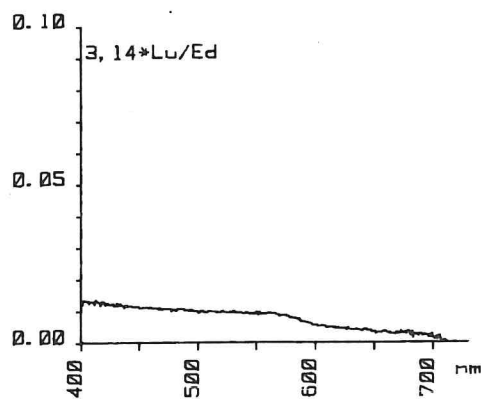
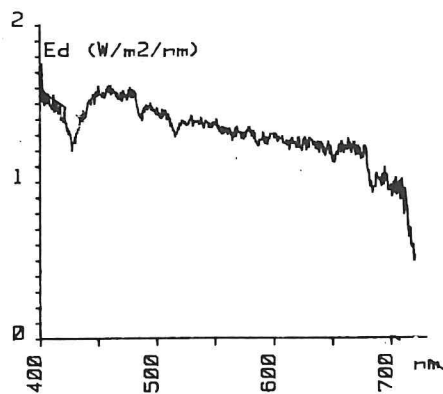
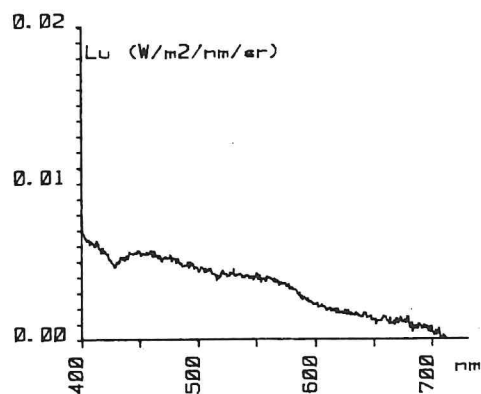
Number 112 Date 23/ 6

Time 13: 4 Flight: Tape 5
Track 0, File 17

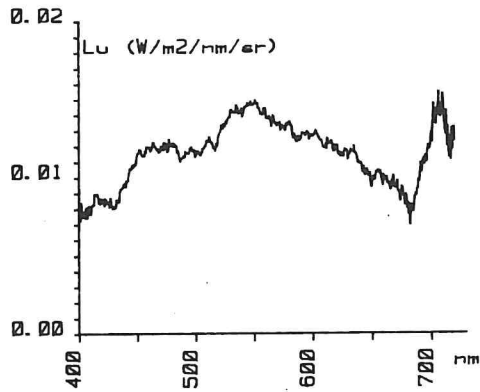
Number 113 Date 23/ 6

Time 13: 7 Flight: Tape 5
Track 1, File 0

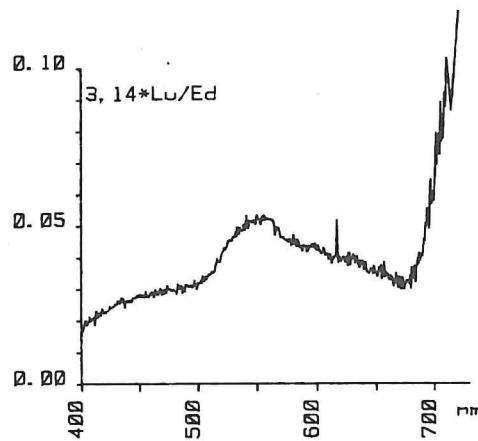
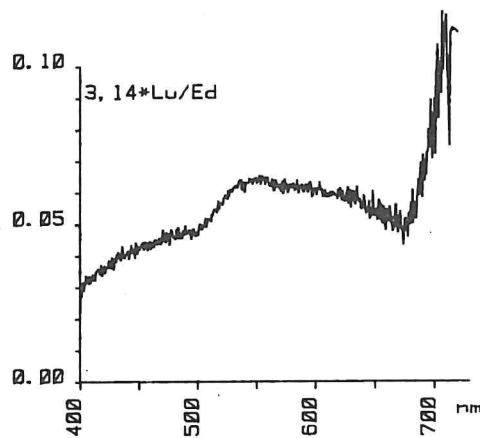
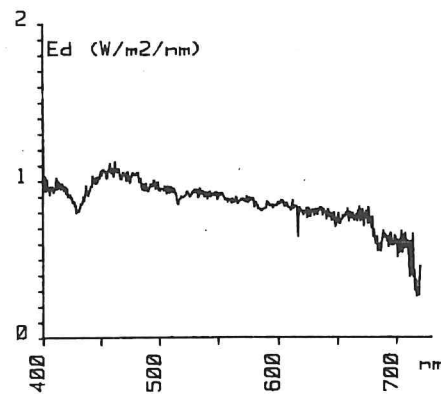
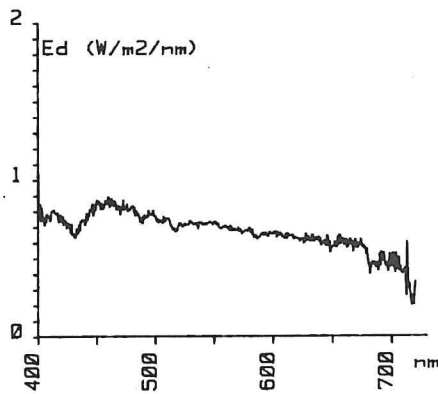
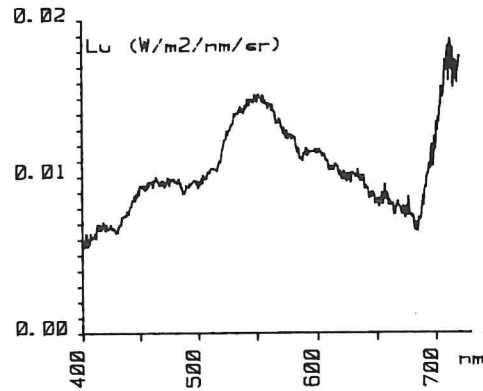
Number 114 Date 23/ 6

Time 13: 10 Flight: Tape 5
Track 1, File 1

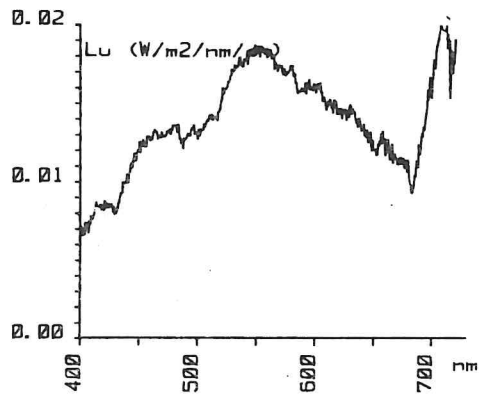
Number 115 Date 24/ 6

Time 13: 41 Flight: Tape 6
Track 0, File 1

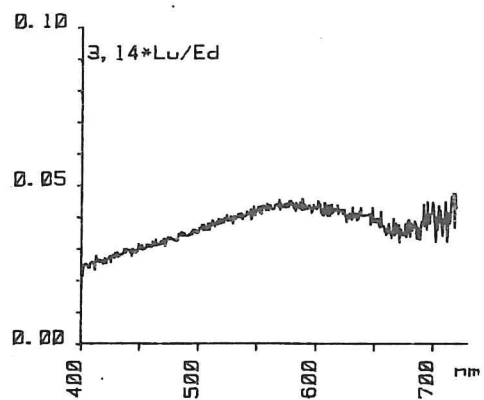
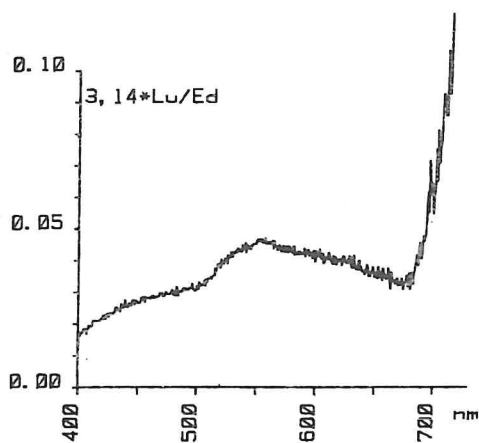
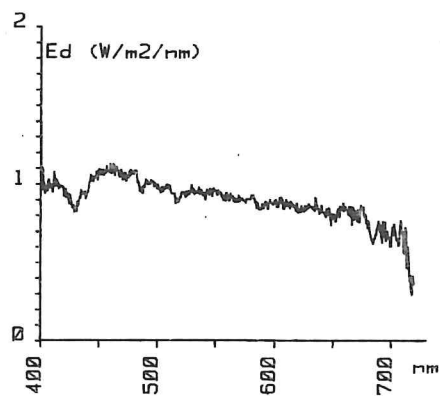
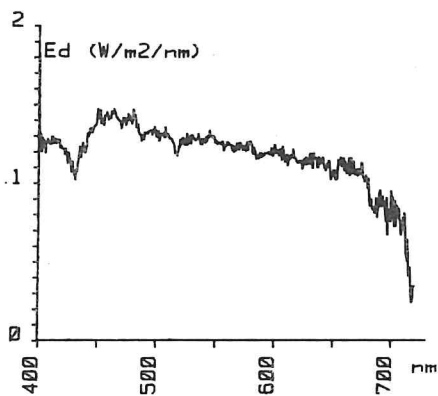
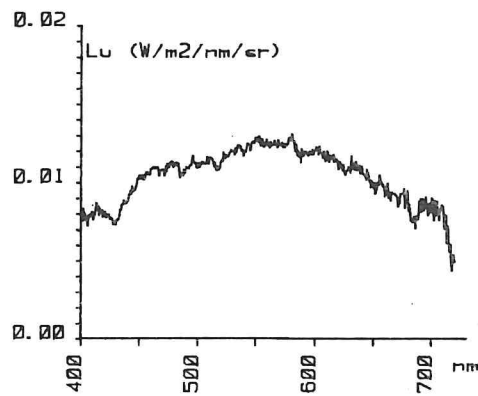
Number 116 Date 24/ 6

Time 13: 44 Flight: Tape 6
Track 0, File 2

Number 117 Date 24/ 6

Time 13: 47 Flight: Tape 6
Track 0, File 3

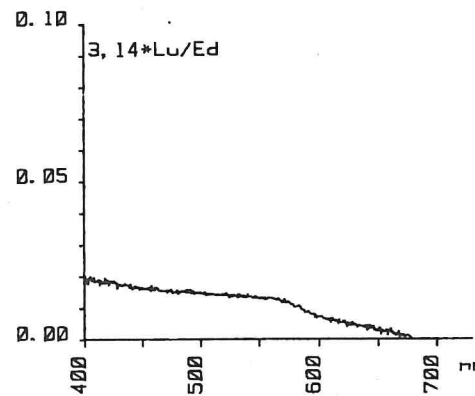
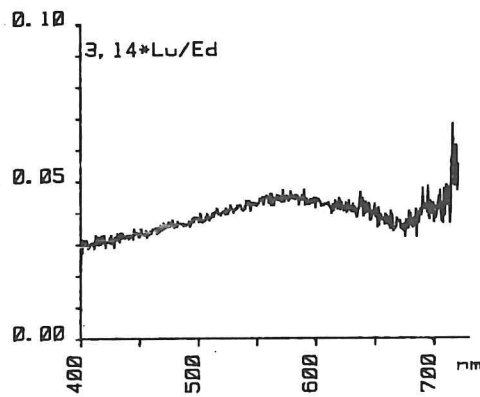
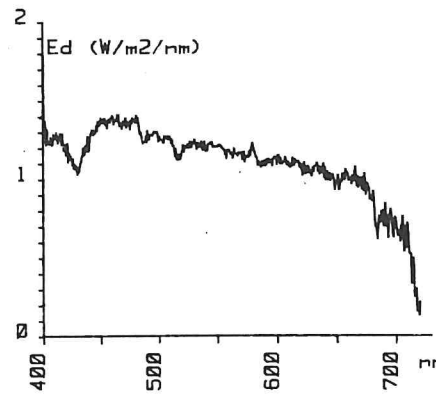
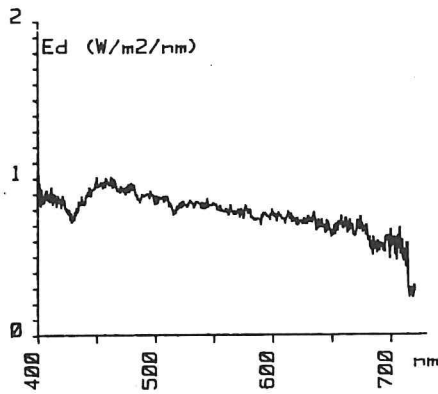
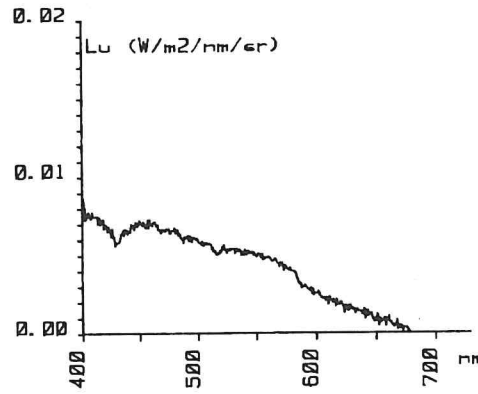
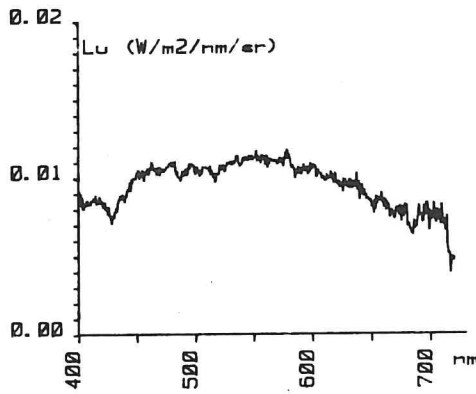
Number 118 Date 24/ 6

Time 13: 55 Flight: Tape 6
Track 0, File 4

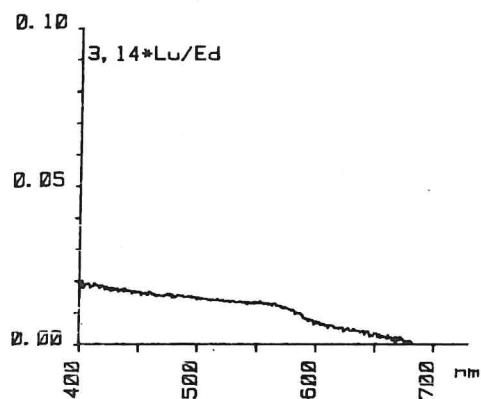
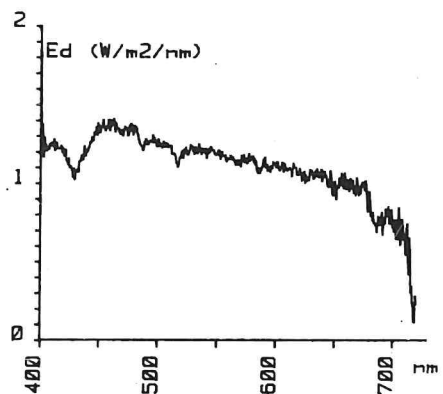
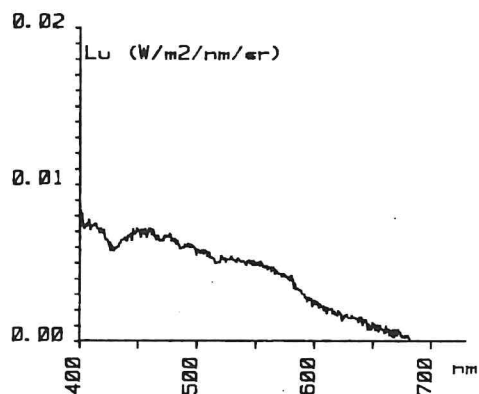
Number 119 Date 24/ 6

Time 13: 58 Flight: Tape 6
Track 0, File 5

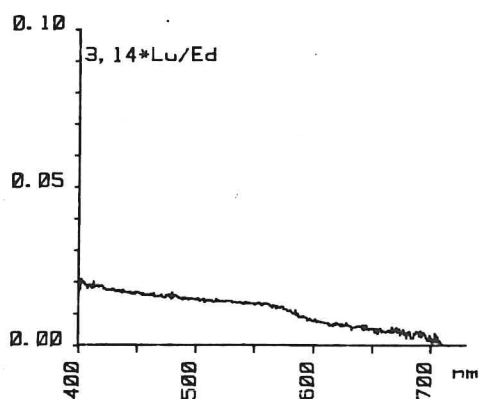
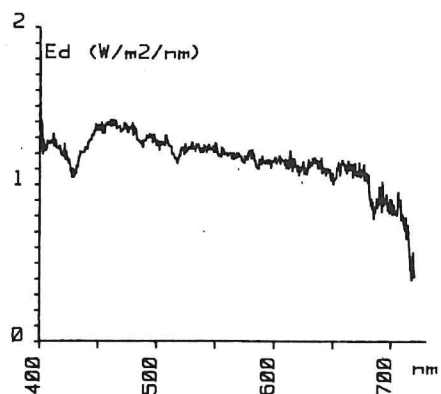
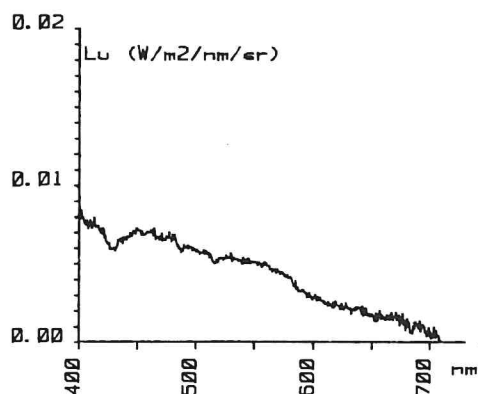
Number 120 Date 24/ 6

Time 15: 13 Flight: Tape 6
Track 0, File 6

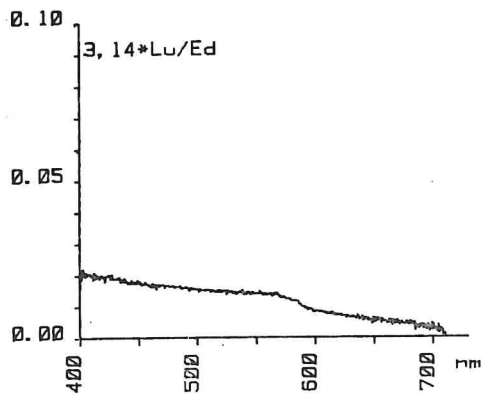
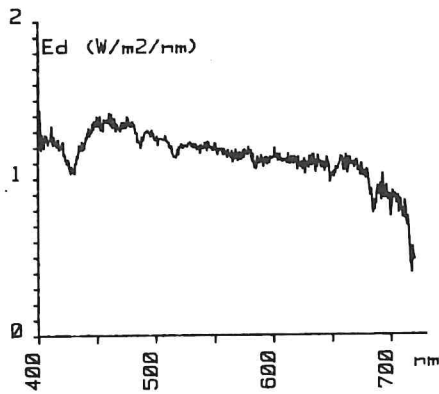
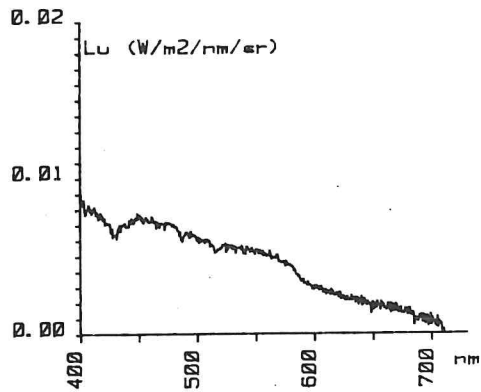
Number 121 Date 24/ 6

Time 15: 16 Flight: Tape 6
Track 0, File 7

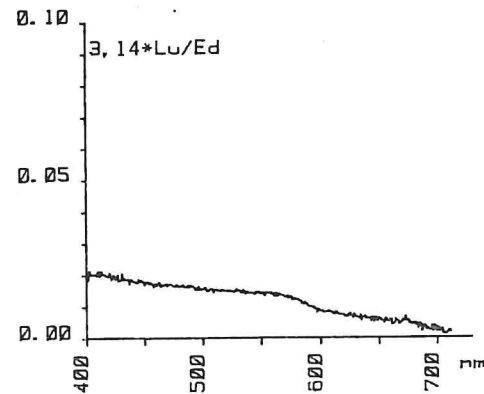
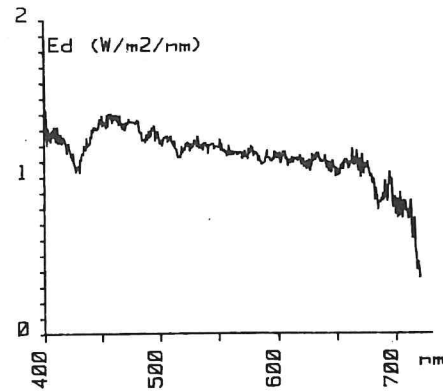
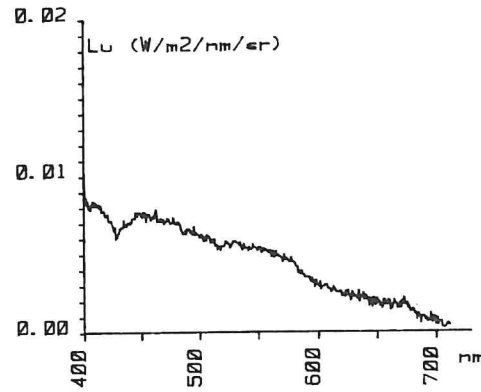
Number 122 Date 24/ 6

Time 15: 18 Flight: Tape 6
Track 0, File 8

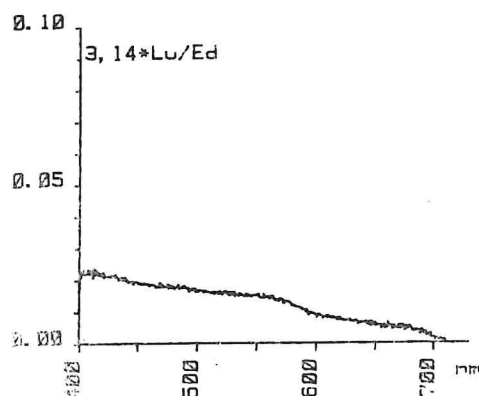
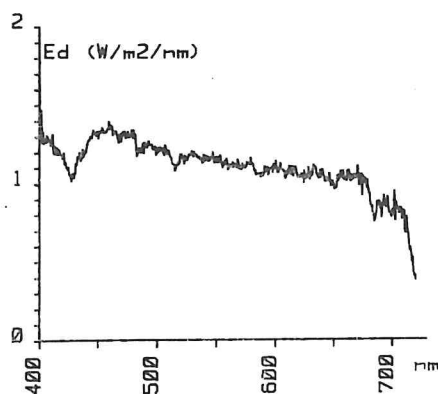
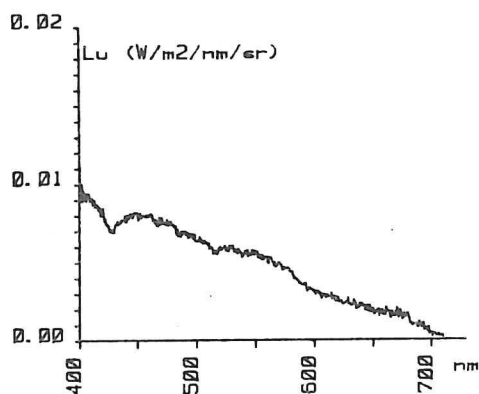
Number 123 Date 24/ 6

Time 15: 21 Flight: Tape 6
Track 0, File 9

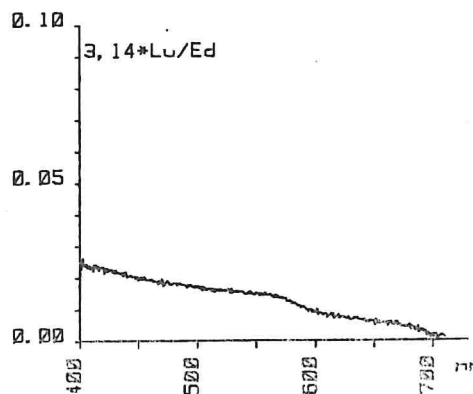
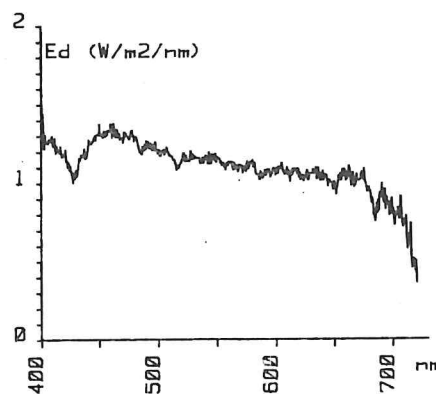
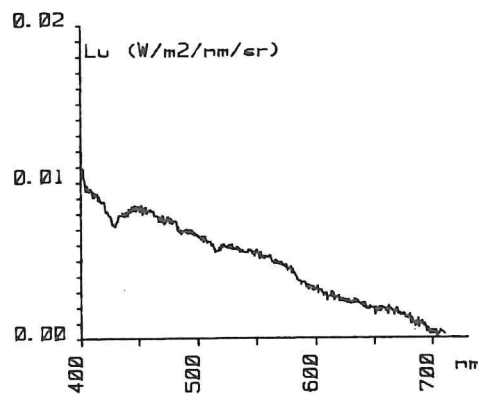
Number 124 Date 24/ 6

Time 15: 24 Flight: Tape 6
Track 0, File 10

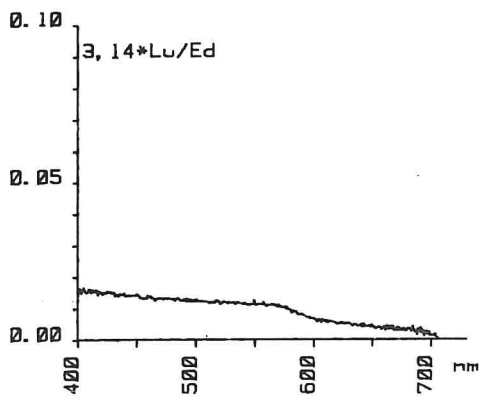
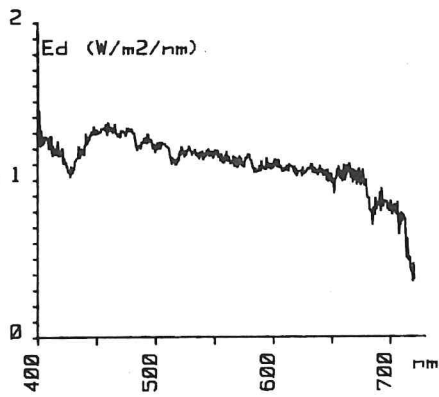
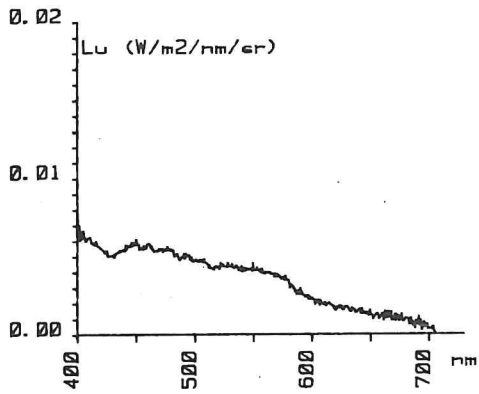
Number 125 Date 24/ 6

Time 15: 28 Flight: Tape 6
Track 0, File 11

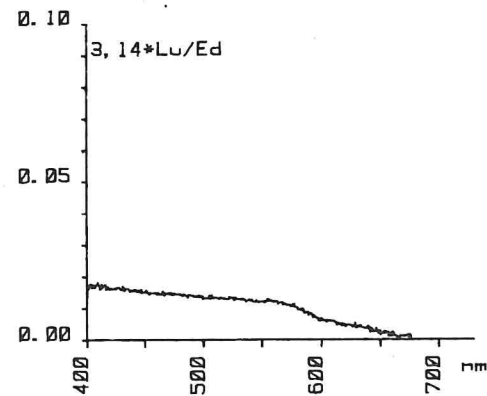
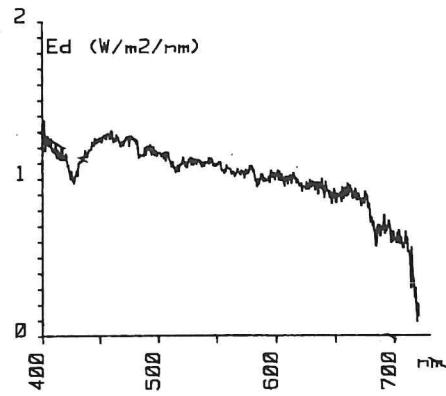
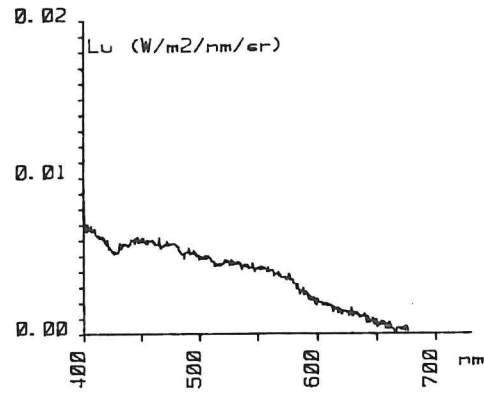
Number 126 Date 24/ 6

Time 15: 32 Flight: Tape 6
Track 0, File 12

Number 127 Date 24/ 6

Time 15: 37 Flight: Tape 6
Track 0, File 13

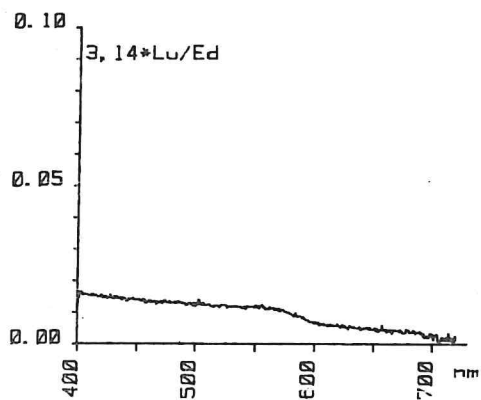
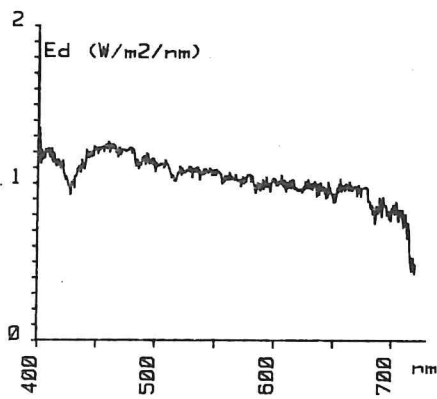
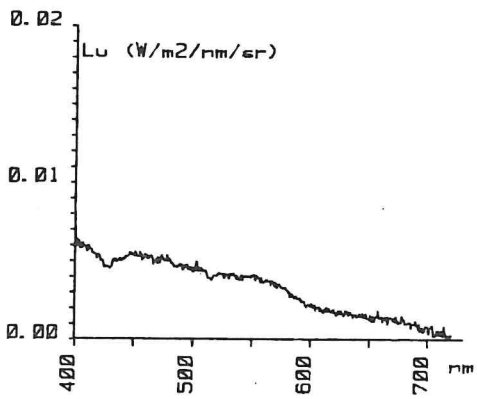
Number 128 Date 24/ 6

Time 15: 43 Flight: Tape 6
Track 0, File 14

70

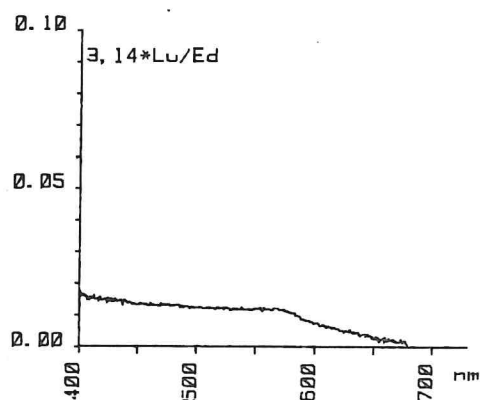
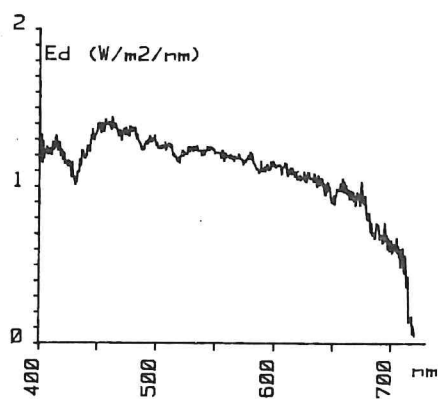
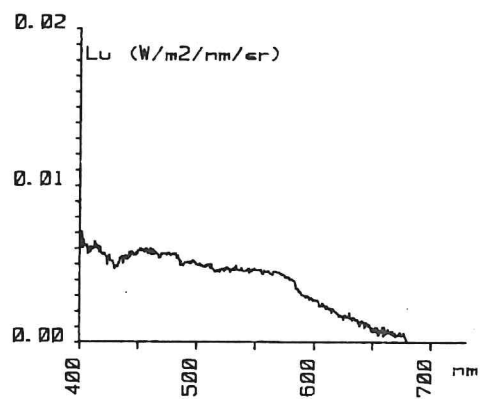
Number 129 Date 24/ 6

Time 15: 46 Flight: Tape 6
Track 0, File 15

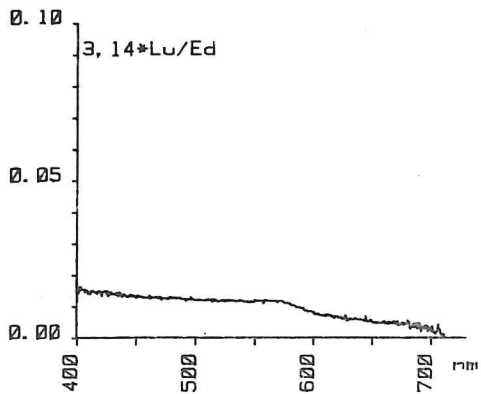
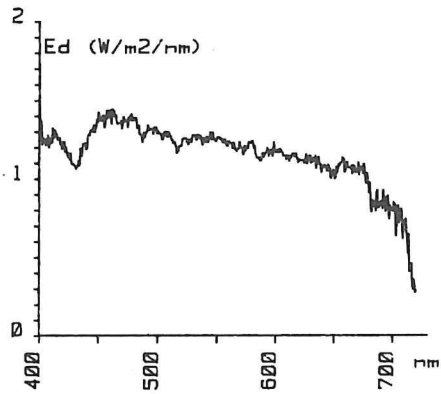
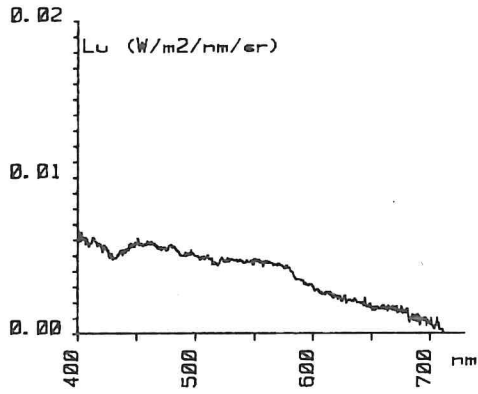


Number 130 Date 25/ 6

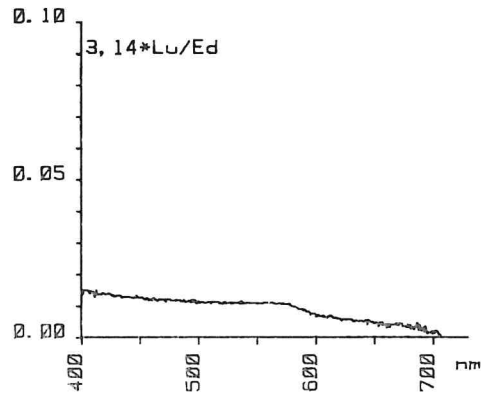
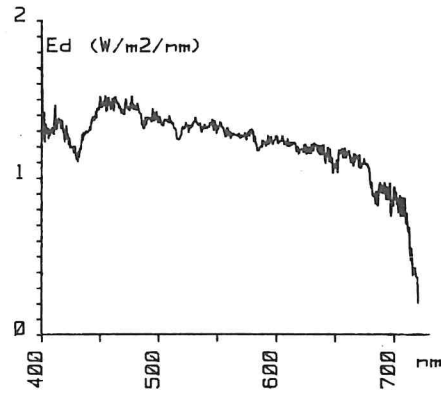
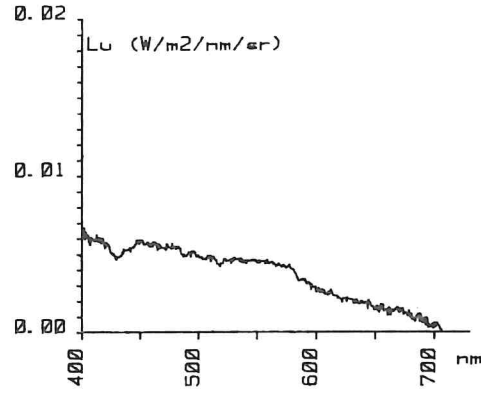
Time 11: 23 Flight: Tape 7
Track 0, File 1



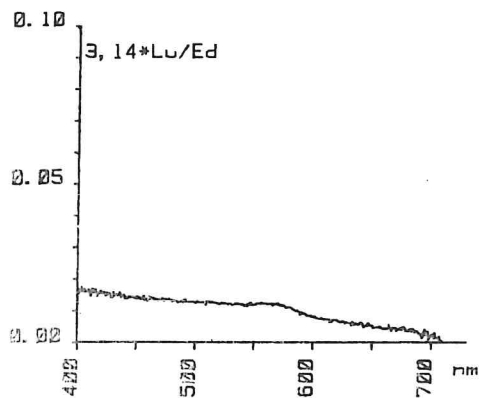
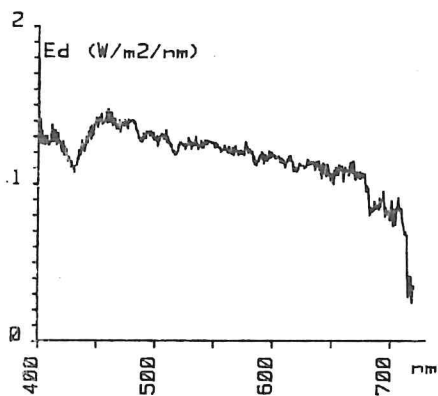
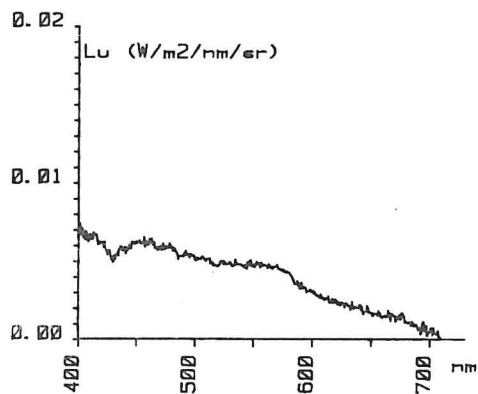
Number 131 Date 25/ 6

Time 11: 26 Flight: Tape 7
Track 0, File 2

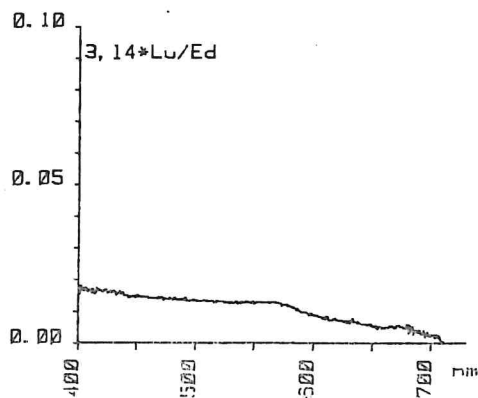
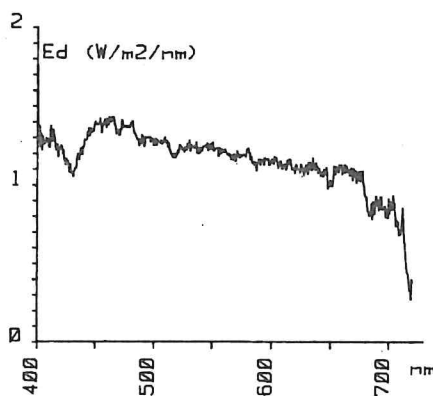
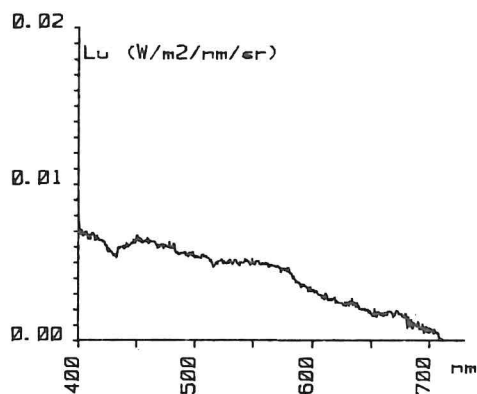
Number 132 Date 25/ 6

Time 11: 30 Flight: Tape 7
Track 0, File 3

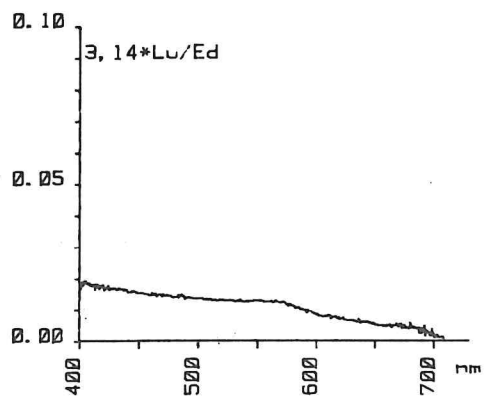
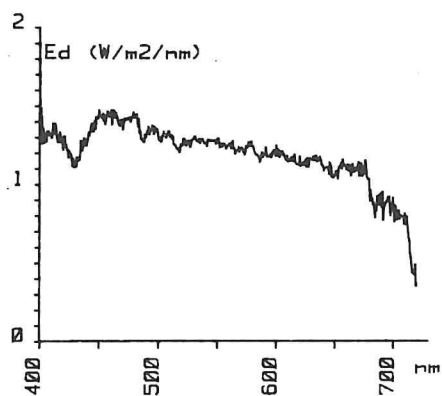
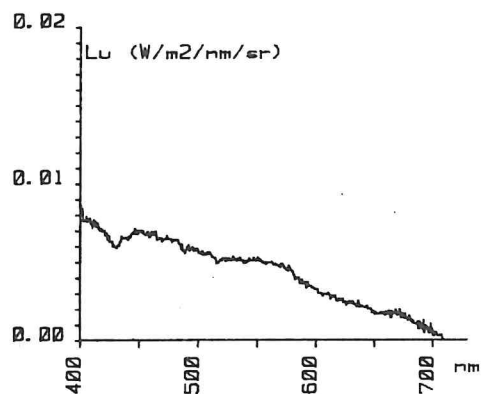
Number 133 Date 25/ 6

Time 11: 33 Flight: Tape 7
Track 0, File 4

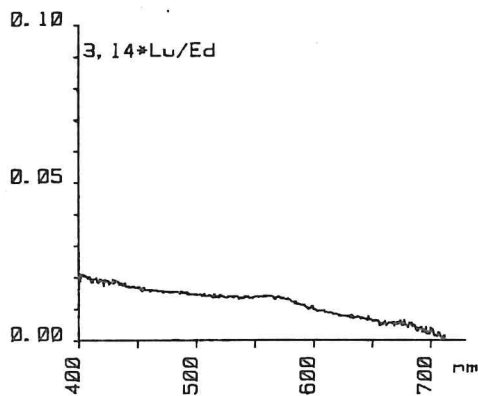
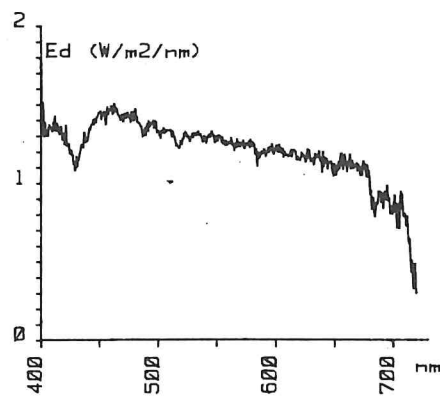
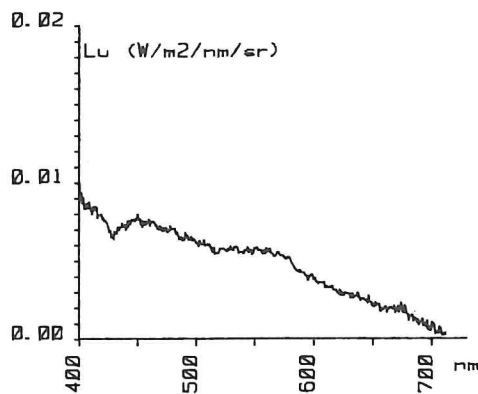
Number 134 Date 25/ 6

Time 11: 37 Flight: Tape 7
Track 0, File 5

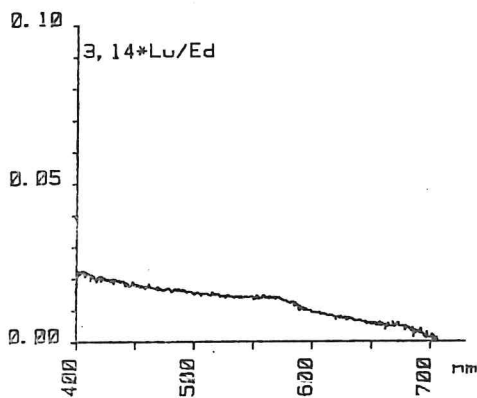
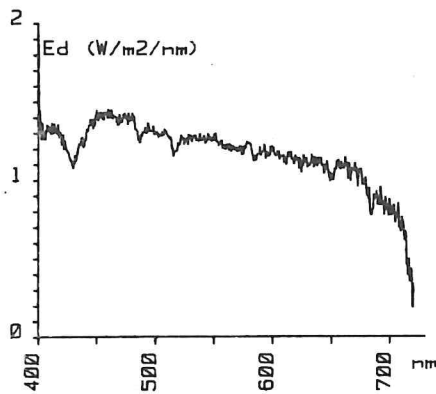
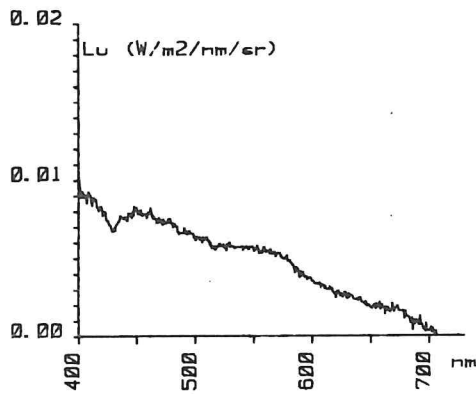
Number 135 Date 25/ 6

Time 11: 41 Flight: Tape 7
Track 0, File 6

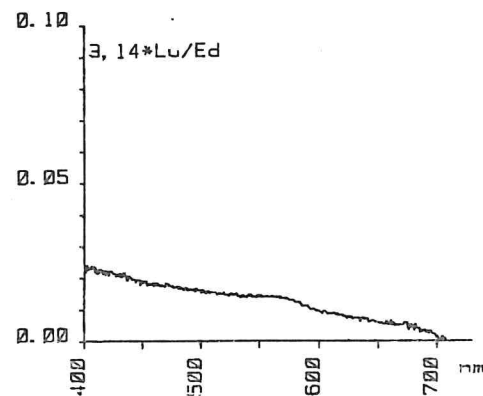
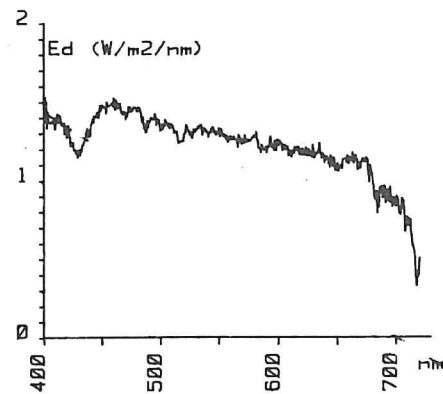
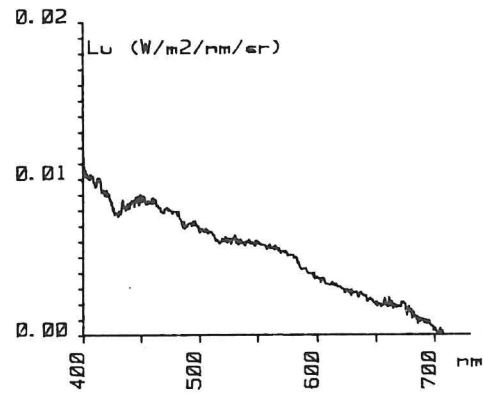
Number 136 Date 25/ 6

Time 11: 44 Flight: Tape 7
Track 0, File 7

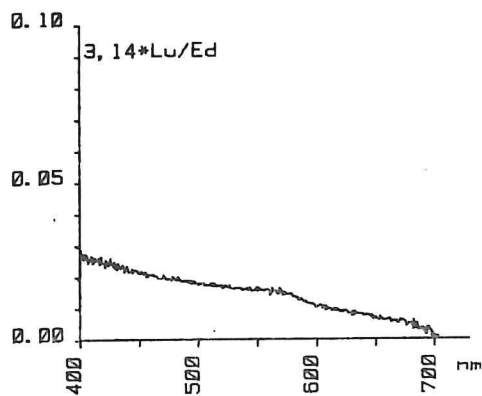
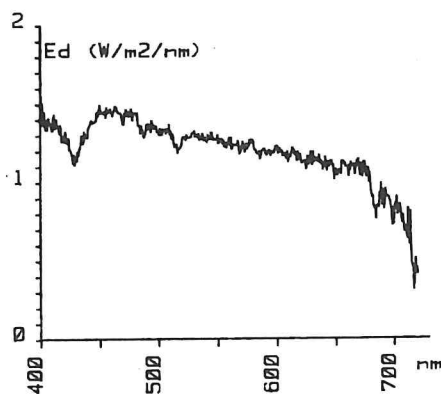
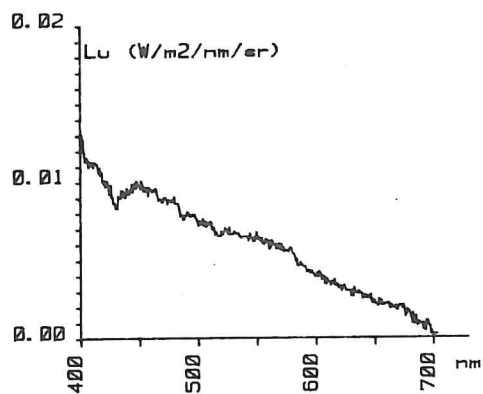
Number 137 Date 25/ 6

Time 11: 48 Flight: Tape 7
Track 0, File 8

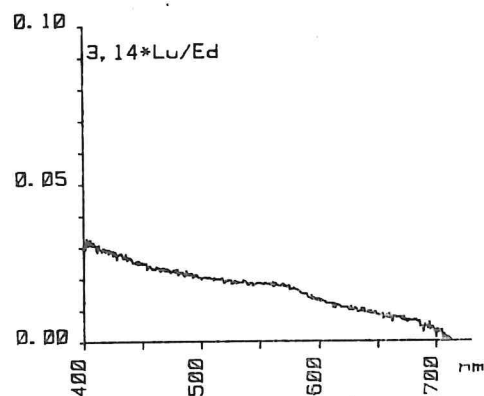
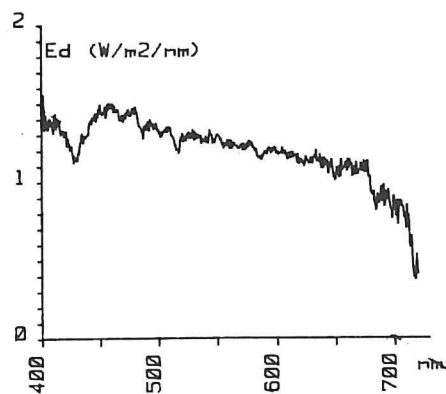
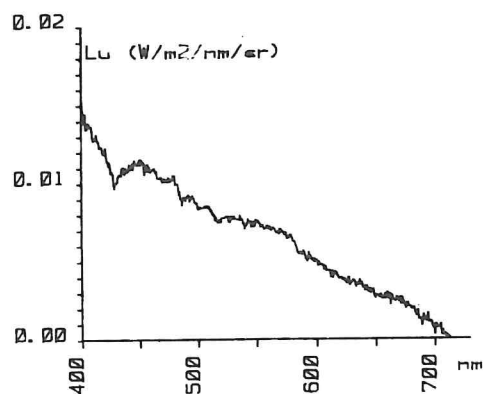
Number 138 Date 25/ 6

Time 11: 52 Flight: Tape 7
Track 0, File 9

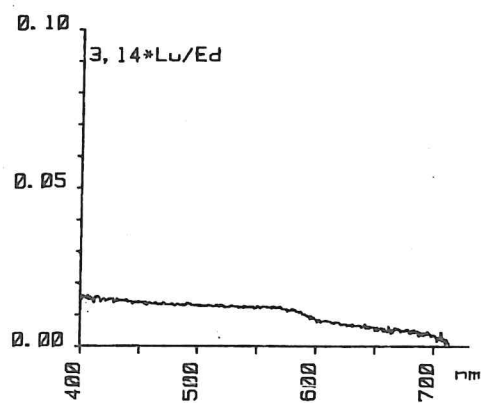
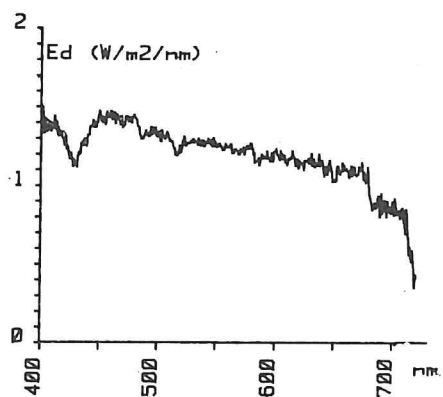
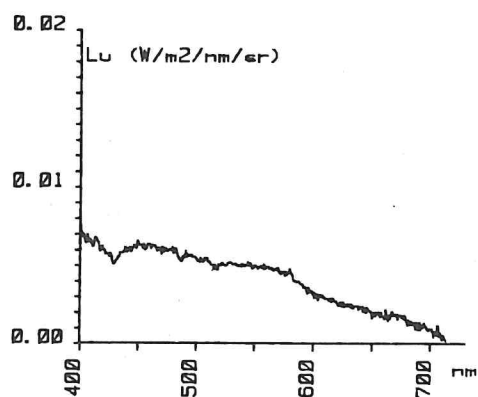
Number 139 Date 25/ 6

Time 11: 57 Flight: Tape 7
Track 0, File 10

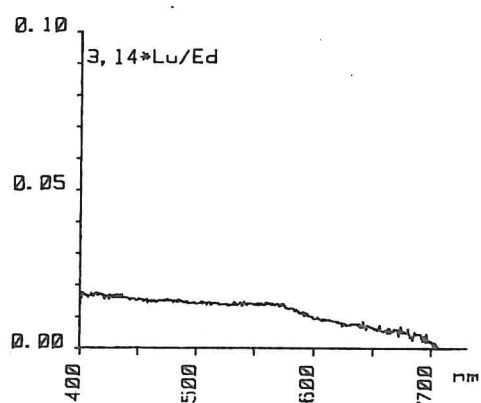
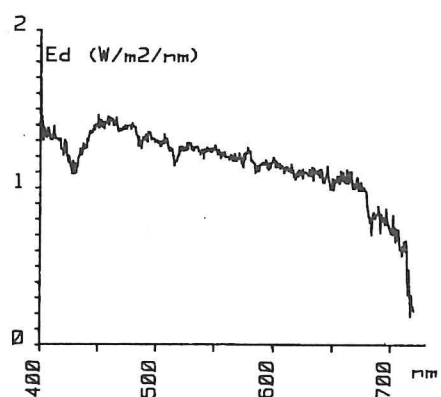
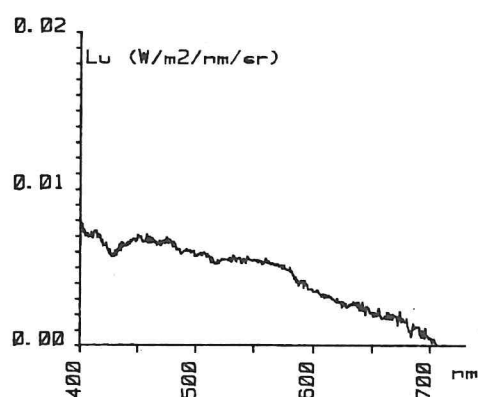
Number 140 Date 25/ 6

Time 12: 2 Flight: Tape 7
Track 0, File 11

Number 141 Date 25/ 6

Time 12: 7 Flight: Tape 7
Track 0, File 12

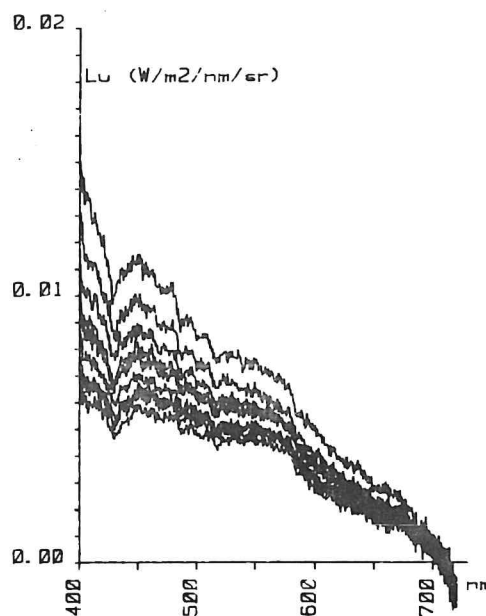
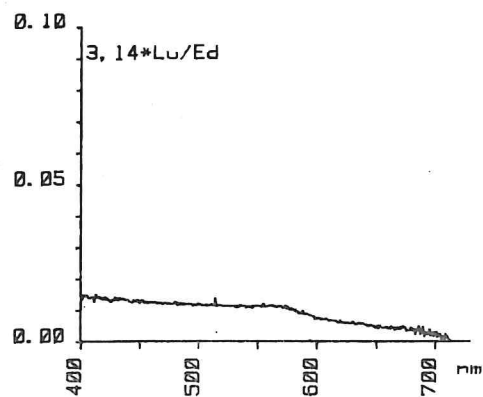
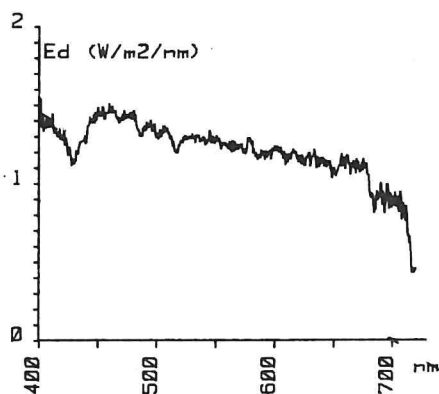
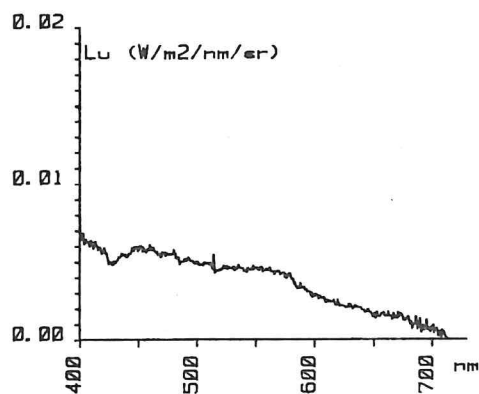
Number 142 Date 25/ 6

Time 12: 10 Flight: Tape 7
Track 0, File 13

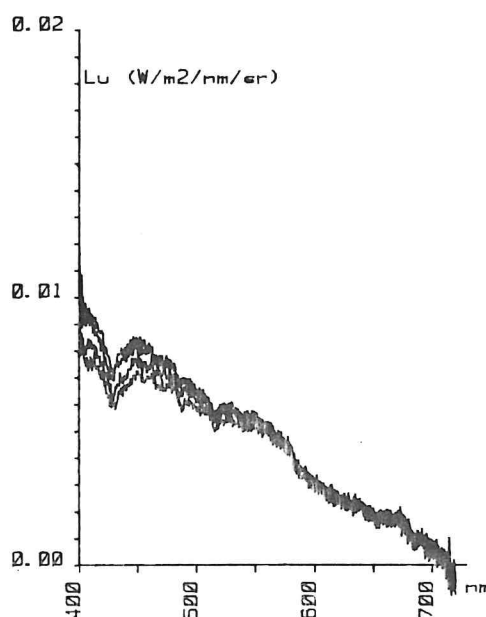
Number 143 Date 25/ 6

Time 12: 14 Flight: Tape 7
Track 0, File 14

25/6 11:30 - 12:02



24/6 15:18 - 15:32



GROUND, SEA AND WEATHER CONDITIONS

Date: 18th June 9.30 am - 00.10 pm.

Wind: 6-8 m s⁻¹, (NW)

Visibility: 5-10 km (varying)

Clouds: 500-1000 m, 7/8 - 8/8, (dark alto cumulus)

Time	Description of site
9.30	tidal flat, wet
9.34	tidal flat, wet
9.40	tidal flat, wet
9.47	tidal flat, with plants
9.52	tidal flat with mussels
9.55	water covered tidal flat
10.00	tidal flat, wet
10.04	water covered tidal flat
10.18	North Sea
10.24	North Sea
10.30	water covered tidal flat
10.33	tidal flat, wet
11.14	tidal flat, wet
11.20	tidal flat, with plants
11.24	tidal flat
11.26	water covered tidal flat
11.30	tidal flat
11.35	tidal flat, wet
11.37	tidal flat, wet
11.45	tidal flat, wet
11.54	North Sea
11.56	North Sea
11.59	North Sea

12.01 North Sea
12.05 marsh

Date: 18th June, 04.15 am - 05.15 am

Wind: 4-5 m s⁻¹, (W → NW)

Visibility: 3-5 km, hazy

Clouds: ~ 500-1000 m, 8/8 - dark

Time	Description of site
16.15	North Sea
16.17	North Sea
16.20	North Sea
16.25	turbid water
16.28	turbid water
16.30	turbid water
16.34	turbid water
16.37	water (turbid)
16.42	turbid water
16.45	turbid water
16.47	turbid water
16.55	turbid water
16.58	water (turbid)
17.07	North Sea
17.10	North Sea
17.12	North Sea

Date: 19th June, 09.15 am - 10.13 am

Wind: 6 m s⁻¹, (NW)

Visibility: more than 10 km, clear

Clouds: 8/8 > 1000 m, 2/8-3/8 lower, drifting light clouds

Time	Description of site
9.45	beach, sand
9.48	beach, sand
9.51	tidal flat, sand
9.54	beach, sand
10.05	North Sea
10.08	North Sea

Date: 20th June, 10.05 am - 11.03 am

Wind: 10 m s⁻¹, very turbulent, (NW)

Visibility: ~ 10 km, lightly hazy

Clouds: > 1000 m 7/8-8/8, lower 4/8 light drifting

Time	Description of site
10.24	tidal flat, wet
10.29	turbid water
10.36	tidal flat
10.39	tidal flat
10.43	very turbid water over tidal flat
10.49	tidal flat, wet
10.52	turbid water
10.58	beach, sand
11.00	beach, sand with thin water film
11.24	North Sea
11.26	North Sea
11.33	North Sea
11.42	tidal flat
11.44	beach, sand

Date: 20th June, 04.10 pm - 05.10 pm

Wind: 12 m s^{-1} , turbulent (NNW)

Visibility: 25 km, but hazy near ground

Clouds: 4/8-5/8 cumulus, clear blue sky

Time	Description of site
16.11	very turbid water
16.16	turbid water
16.18	turbid water
16.20	turbid water
16.26	turbid water
16.30	turbid water
16.32	turbid water
16.35	turbid water
16.40	water covered beach sand

Date: 22nd. June, 11.30 am - 01.06 pm

Wind: 2 m s^{-1} , first $\frac{1}{2}$ hour, increasing to 7 m s^{-1} ,
sea land breeze (NW $\rightarrow$ WNW)

Visibility: > 25 km, clear

Clouds: 2/8-3/8 cumulus, blue sky, no haze

Time	Description of site
11.42	tidal flat
11.45	tidal flat
11.48	tidal flat
11.50	tidal flat with vegetation and water
11.54	tidal flat with vegetation and water
11.57	marsh
12.00	marsh

12.04	tidal flat
12.07	tidal flat with vegetation
12.09	marsh
12.13	marsh
12.15	spring wheat
12.40	North Sea
12.44	North Sea
12.46	North Sea
12.56	shore line
12.59	tidal flat
13.02	beach, sand
13.05	beach, sand
13.09	marsh

Date: 22nd June, 05.00 pm - 05.50 pm

Wind: 6 m s⁻¹ (NNW)

Visibility: > 10 km, weak haze

Clouds: 4/8 (= 1/8 cumulus 1/8 cirrus 2/8 altostratus)

Time	Description of site
17.00	North Sea
17.03	North Sea
17.05	North Sea
17.10	shore
17.14	beach, sand
17.17	tidal flat
17.19	water covered tidal flat
17.24	beach, sand
17.31	beach, sand

Date: 23rd June , 09.10 am - 10.10 am

Wind: 2 m s⁻¹, (SE)

Visibility: > 25 km very weak haze

Clouds: 0

Time	Description of site
9.27	North Sea
9.30	North Sea
9.33	North Sea
9.42	tidal flat with water
9.47	tidal flat, water covered
9.52	tidal flat, water covered
10.02	tidal flat, wet
10.08	tidal flat, wet

Date: 23rd June, 11.50 am - 01.15 pm

Wind: 2-3 m s⁻¹ (S)

Visibility: > 25 km, but hazy

Clouds: 0

Time	Description of site
12.03	North Sea
12.07	North Sea
12.09	North Sea
12.18	tidal flat
12.22	tidal flat, wet
12.25	tidal flat, wet
12.31	tidal flat, wet
12.35	tidal flat, wet
13.05	North Sea
13.07	North Sea
13.11	North Sea

Date: 24th June, 01.40 pm - 03.30 pm

Wind: 4-5 m s⁻¹, (SSE)

Visibility: ~ 20 km, hazy

Clouds: 4/8 Stratus + 1/8 cumulus

Time	Description of site
13.41	dune with plants
13.44	dune, plant covered
13.48	spruce covered dune
13.55	tidal flat, wet
13.58	turbid shallow water
15.14	North Sea
15.16	North Sea
15.18	North Sea
15.21	North Sea (700 ft.)
15.25	North Sea (700 ft.)
15.29	North Sea (1000 ft.)
15.32	North Sea (1300 ft.)
15.38	North Sea
15.43	North Sea (sun angle 25° in front)
15.47	North Sea (sun angle 25° from behind)

Date: 25th June, 11.20 am - 00.20 pm

Wind: 4-5 m s⁻¹, (NW)

Visibility: ~ 20 km, but somewhat hazy

Clouds: very few cumulus, patches of cirrus (< 1/8 total)

Time	Description of site
11.24	North Sea
11.27	North Sea

11.30	North Sea
11.34	North Sea (660 ft.)
11.38	North Sea (700 ft.)
11.41	North Sea (900 ft.)
11.45	North Sea (1100 ft.)
11.49	North Sea (1300 ft.)
11.53	North Sea (1600 ft.)
11.57	North Sea (1900 ft.)
12.03	North Sea (2200 ft.)
12.08	North Sea
12.11	North Sea (sun 30 ^o in front)
12.14	North Sea (sun 30 ^o from behind)
