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This Document Contains

18 Pages.

Density/Luminance
Evaluation Report
Mission 1042

10 August 1967

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FOREWORD

This report includes an analysis of the density and luminance statistics of the original negative from Mission 1042.

The detailed photographic evaluation by the processing station was published separately on 17 July 1967, Document Control Number [redacted]

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DENSITY/LUMINANCE ANALYSIS

INTRODUCTION

Summary

This report presents an analysis of the density of the processed original negative film record. Estimates were made of the luminance levels of the scenes photographed and the suitability of the exposure and process level used.

Sampling of Data

This data is collected from a representative sample of the photography which is not cloud or water covered. From each of the frames, the minimum and maximum densities containing discernible information were measured and recorded. These data were then analyzed to yield the density and luminance summary here.

Included are:

1. Density Tolerance Analysis.
2. Density/Luminance Profile.
3. Index Record Summary.

Process Curves Used in Analysis

To insure the greatest possible accuracy in the analysis of the film record, process curves based on the R-2 sample are used for establishing the tolerance limits and calculating luminances.

Density Tolerance Analysis

For each process curve, the densities corresponding to a gradient of 1.2 on the toe and shoulder are used as the density tolerance limits for frames processed at that level. Frames for which the minimum and/or maximum densities are outside these 1.2 gradient limits are out-of-tolerance for one of the reasons explained below.

Each sampled frame is assigned to one of several quality categories within the three major classifications of: (I) Satisfactory Exposure, (II) Unsatisfactory Exposure, and (III) Beyond System Capability. Classification into these categories is based on measurements of minimum and maximum densities and process level. In the brief description which follows, the numerical identity corresponds to the Density Tolerance Analysis, in which the percentages in each category are listed.

I. Satisfactory Exposure - within capability of processing to bring minimum and maximum density of a frame within density tolerance extremes.

IA. Within Tolerance - frames completely within density tolerance extremes.

IB. Out-of-Tolerance - those frames which would have been in-tolerance if processed at a different level.

IB1. Over-processed - out-of-tolerance frames which would have been within tolerance if processed at a lower level.

IB2. Under-processed - out-of-tolerance frames which would have been within tolerance if processed at a higher level.

II. Unsatisfactory Exposure

IIA. Overexposure - frames for which the highest density corresponds to exposure above the point on the shoulder of the primary level characteristic curve where the gradient is 1.2.

IIA1. Best Processed, Overexposed - overexposed frames processed at primary level.

IIA2. Over-processed, Overexposed - overexposed frames processed at intermediate or full level.

IIB. Underexposure - frames for which the lowest density corresponds to exposure below the point on the toe of the full level characteristic curve where the gradient is 1.2.

IIB1. Best Processed, Underexposed - underexposed frames processed at full level.

IIB2. Under-processed, Underexposed - underexposed frames processed at primary or intermediate level.

III. Beyond System Capability

IIIA. Beyond System Latitude - frames which have a larger log E range than the log E range of the in-tolerance density extremes.

IIIB. Out of Phase - frames within system latitude but for which only one density extreme (minimum or maximum) would be within the in-tolerance density limits for any process level.

Density/Luminance Profile

The following paragraphs describe the various parts of the Density/Luminance Profile.

Density Tolerance Analysis. The categories described above are combined into six major groups for the Density/Luminance Profile and for mission-to-mission comparison. The following list of the six major groups used on the graph shows which categories are combined into each group.

I Within Tolerance Limits IA

II Underexposure IIB1

III Under-processed
The sum of IB2 and IIB2

IV Overexposure IIA1

V Over-processed
The sum of IB1 and IIA2

VI Beyond Latitude
The sum of IIIA and IIIB

NOTE: In the above six group summary, frames which are both incorrectly exposed and incorrectly processed are included only once--in an incorrectly processed group.

Density Summary. The eight bar graphs under the label "Density Summary" show the minimum and maximum density distributions of the sampled frames for each of the three process levels and the total density distributions for the film record.

Processing Summary. The "Processing Summary" is a graphical representation of the Process Breakdown. It shows the percentage of the mission processed at each level.

Luminance vs. Solar Altitude. The "Luminance versus Solar Altitude scattergrams depict the variation of luminance values as a function of solar altitude.

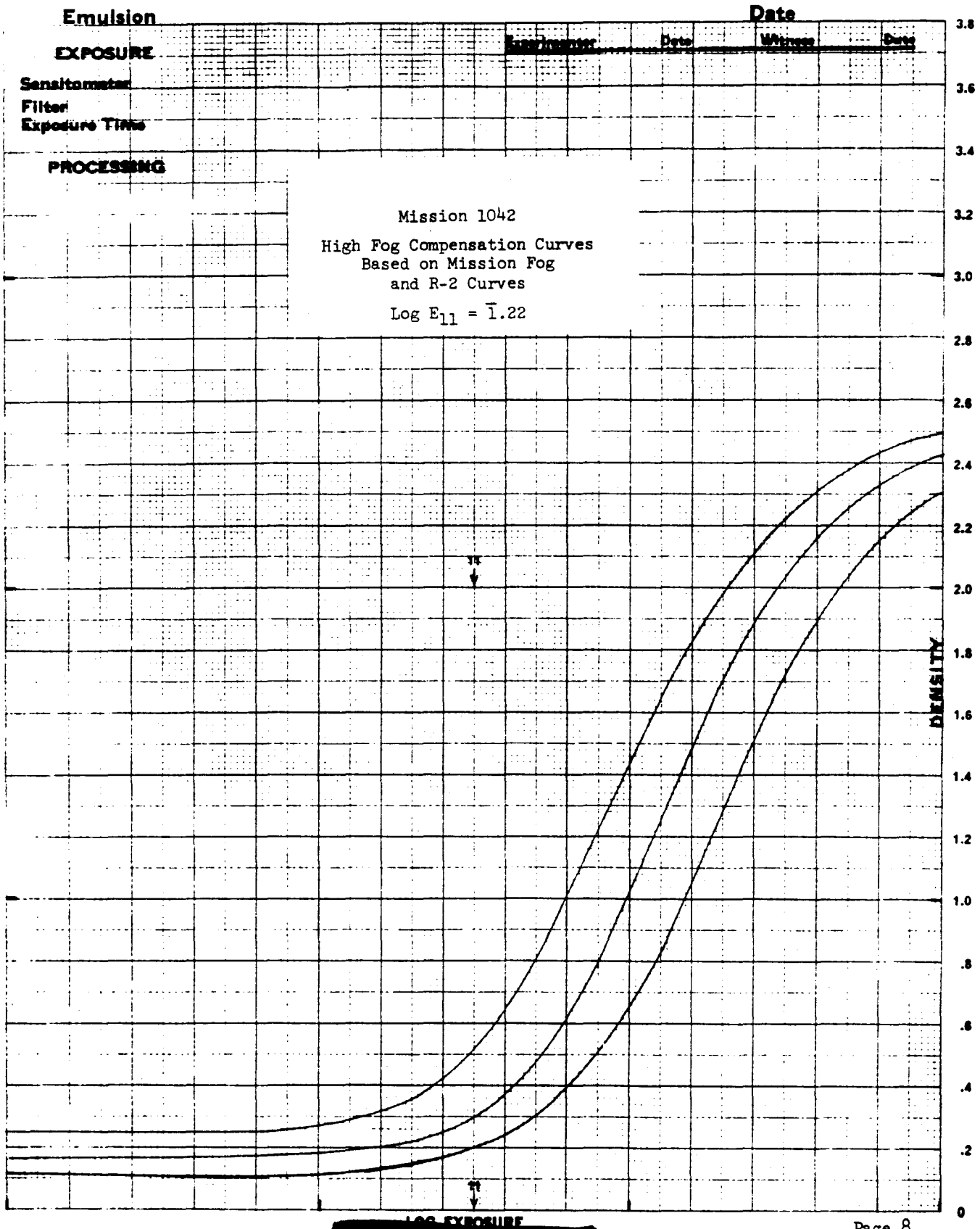
Frequency vs. Solar Altitude. The "Frequency versus Solar Altitude" chart shows the percent of mission photography taken at each solar altitude.

Luminance Distribution. The "Minimum Luminance Distribution" is the percentage frequency distribution of the log minimum luminance obtained from photography taken at solar altitudes greater than 10 degrees. The "Maximum Luminance Distribution" is the percentage frequency distribution of the log maximum luminance obtained from photography taken at solar altitudes greater than 10 degrees.

B-Ratio. The "B-Ratio" is defined as the maximum luminance of a scene divided by the minimum luminance of the same scene. The graph presented is for the B-ratio data obtained for photography taken above 10 degrees solar altitude.

Compensation for High Fog Values

The mathematical model technique developed to estimate actual process curves based on the R-2 sample (when available) and the average fog level actually measured on a mission was utilized for the 3404 main record to determine Density Tolerance and Luminance data. The process curves used in these calculations are shown on page 8.


Emulsion
Date
EXPOSURE
Sensitometer
Date
Witness
Date
Filter
Exposure Time
PROCESSING
Mission 1042
High Fog Compensation Curves
Based on Mission Fog
and R-2 Curves
Log E_{11} = $\bar{1}$.22
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
DENSITY
LOG EXPOSURE

CONCLUSIONS

1. The luminance values were lower than those of Mission 1041 and higher than those of Mission 1038. These values are in agreement with the anticipated seasonal variations, i.e., luminances are higher in May (Mission 1041) and lower in January (Mission 1038) than they are in June (Mission 1042).

2. The overall exposure was much less satisfactory than in any other recent mission when judged by the 1.2 gradient criteria in conjunction with the fog compensation curves discussed above. The following table compares the percentage of frames judged to be underexposed by the current 1.2 gradient method and the 0.4 and 0.5 density criteria used prior to Mission 1037.

	Percentage of Frames Considered Underexposed				
Judgment Criteria	-1 Fwd	-1 Aft	-2 Fwd	-2 Aft	Overall
0.4	2.2	8.6	2.5	0.0	3.3
0.5	21.4	32.8	22.5	10.8	21.9
0.56*	50.6	50.4	48.2	38.9	47.0

3. Less than 1% of the frames considered to be out of tolerance was correctable by a processing change.

4. The film latitude was adequate for the majority of the frames sampled.

* 1.2 gradient.

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DENSITY TOLERANCE ANALYSIS

MISSION 1042-1, -2

		%				
		-1 FWD	-1 AFT	-2 FWD	-2 AFT	TOTAL MISSION
I.	SATISFACTORY EXPOSURE	49.4	49.4	51.3	61.1	52.5
	A. Within Tolerance	47.4	48.7	51.3	60.2	51.9
	B. Out-of-Tolerance					
	1. Over-processed	0.0	0.0	0.0	0.0	0.0
	2. Under-processed	2.0	0.7	0.0	0.9	0.9
II.	UNSATISFACTORY EXPOSURE	50.6	50.4	48.2	38.9	47.0
	A. Overexposure					
	1. Best (Primary) Process	0.0	0.0	0.0	0.0	0.0
	2. Over-processed	0.0	0.0	0.0	0.0	0.0
	B. Underexposure					
	1. Best (Full) Process	50.6	50.4	47.1	38.7	46.7
	2. Under-processed	0.0	0.0	1.1	0.2	0.3
III.	BEYOND SYSTEM CAPABILITY	0.0	0.2	0.5	0.0	0.2
	A. Beyond System Latitude	0.0	0.2	0.5	0.0	0.2
	B. Out of Phase	0.0	0.0	0.0	0.0	0.0

DENSITY TOLERANCE LIMITS

CRITERIA USED FOR ANALYSIS: 1.2 GRADIENT

W-23A FILTER (FWD SYSTEM) and W-21 FILTER (AFT SYSTEM)

PROCESS	LOWER DENSITY	UPPER DENSITY
PRI.	0.46	2.11
INT.	0.47	2.14
FULL	0.56	2.13

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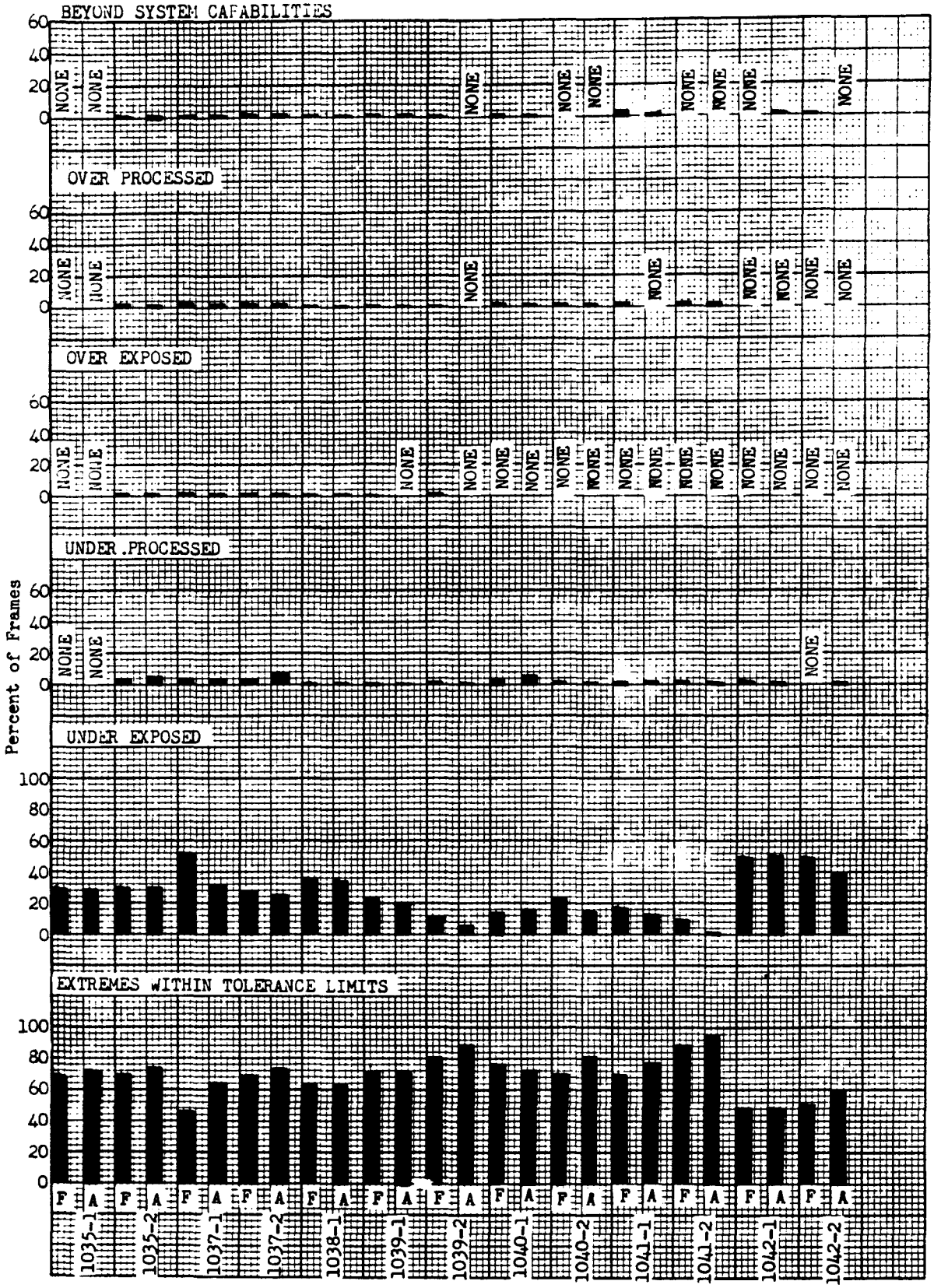
DENSITY TOLERANCE LIMITS BASED ON 1.2 GRADIENT



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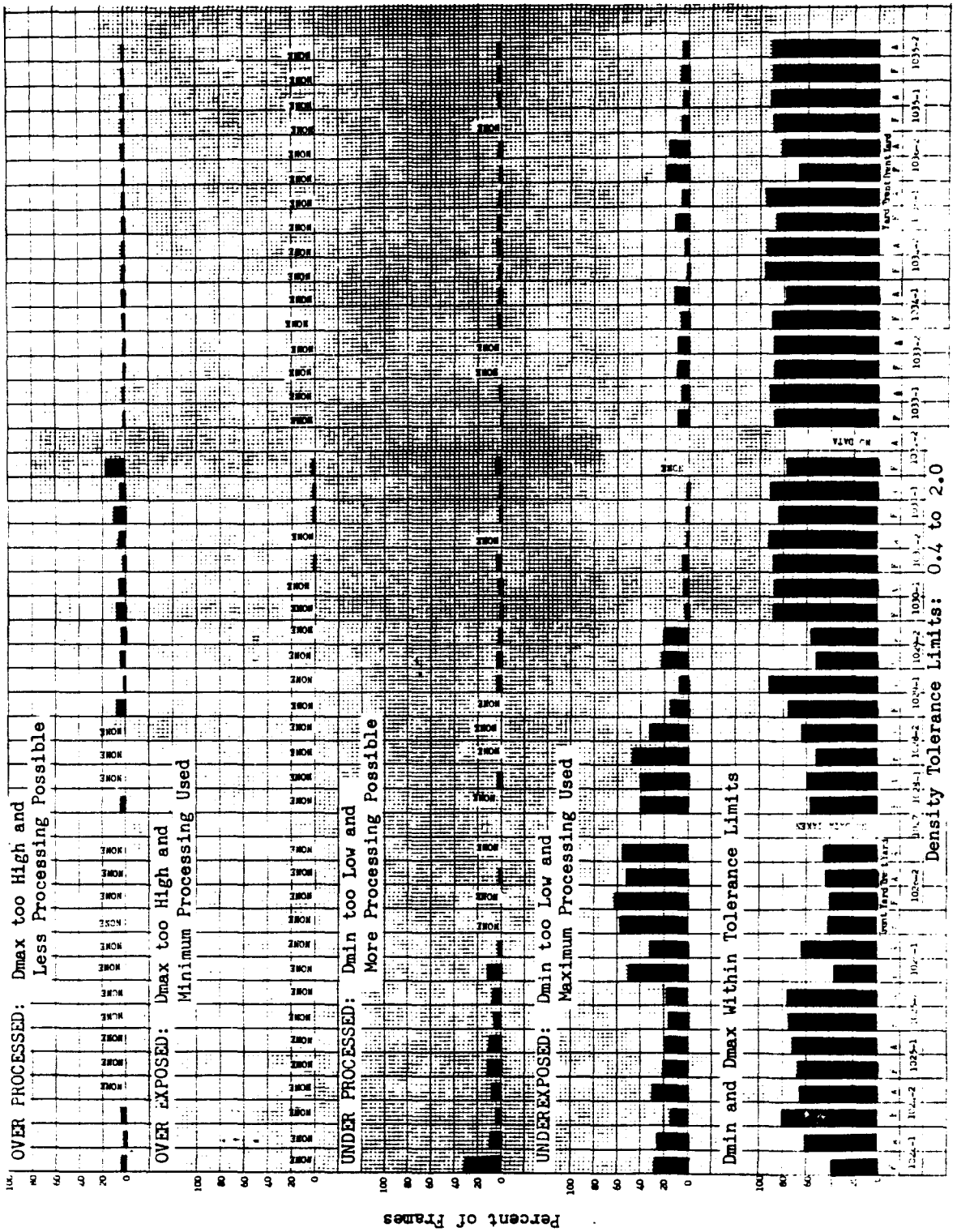
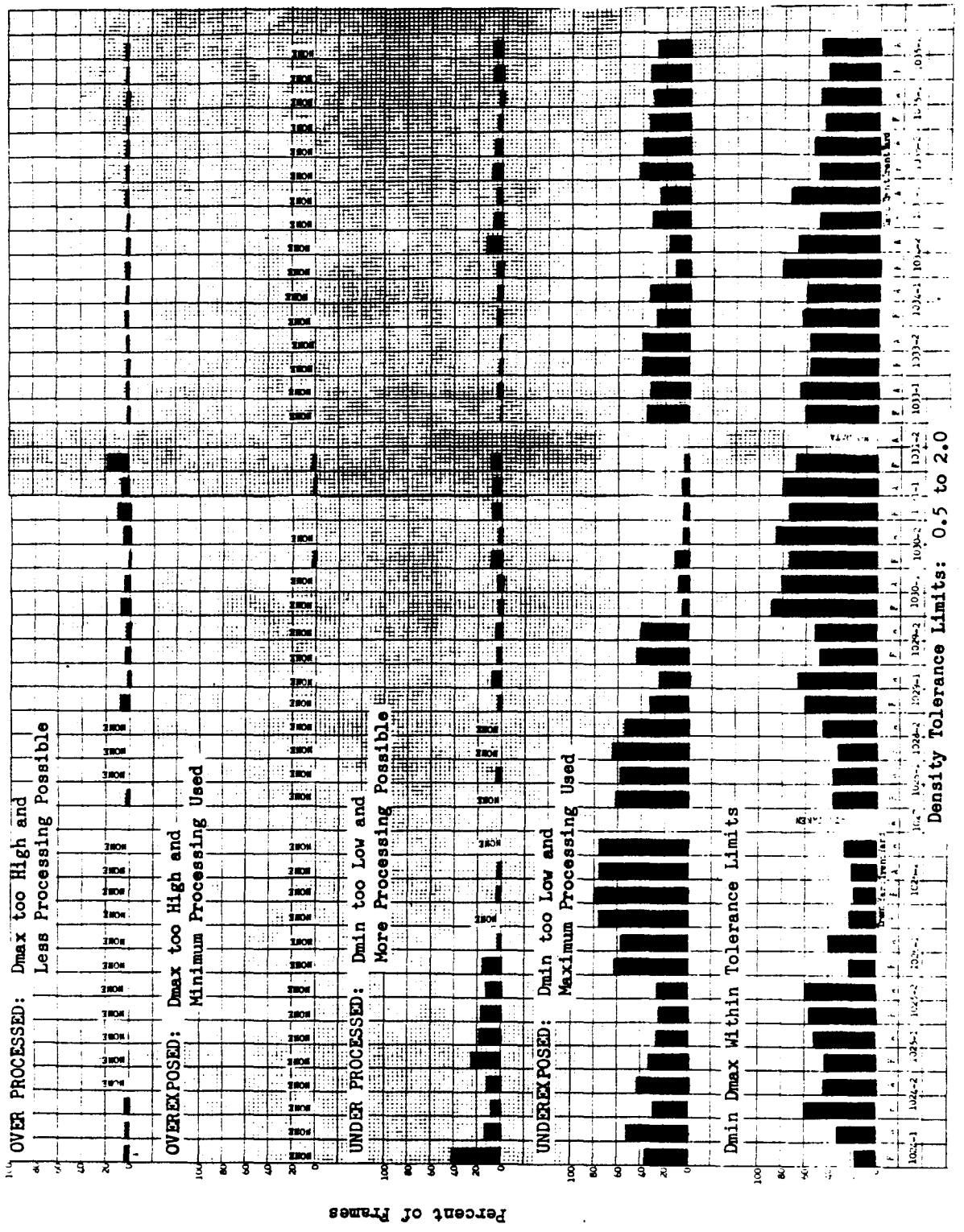
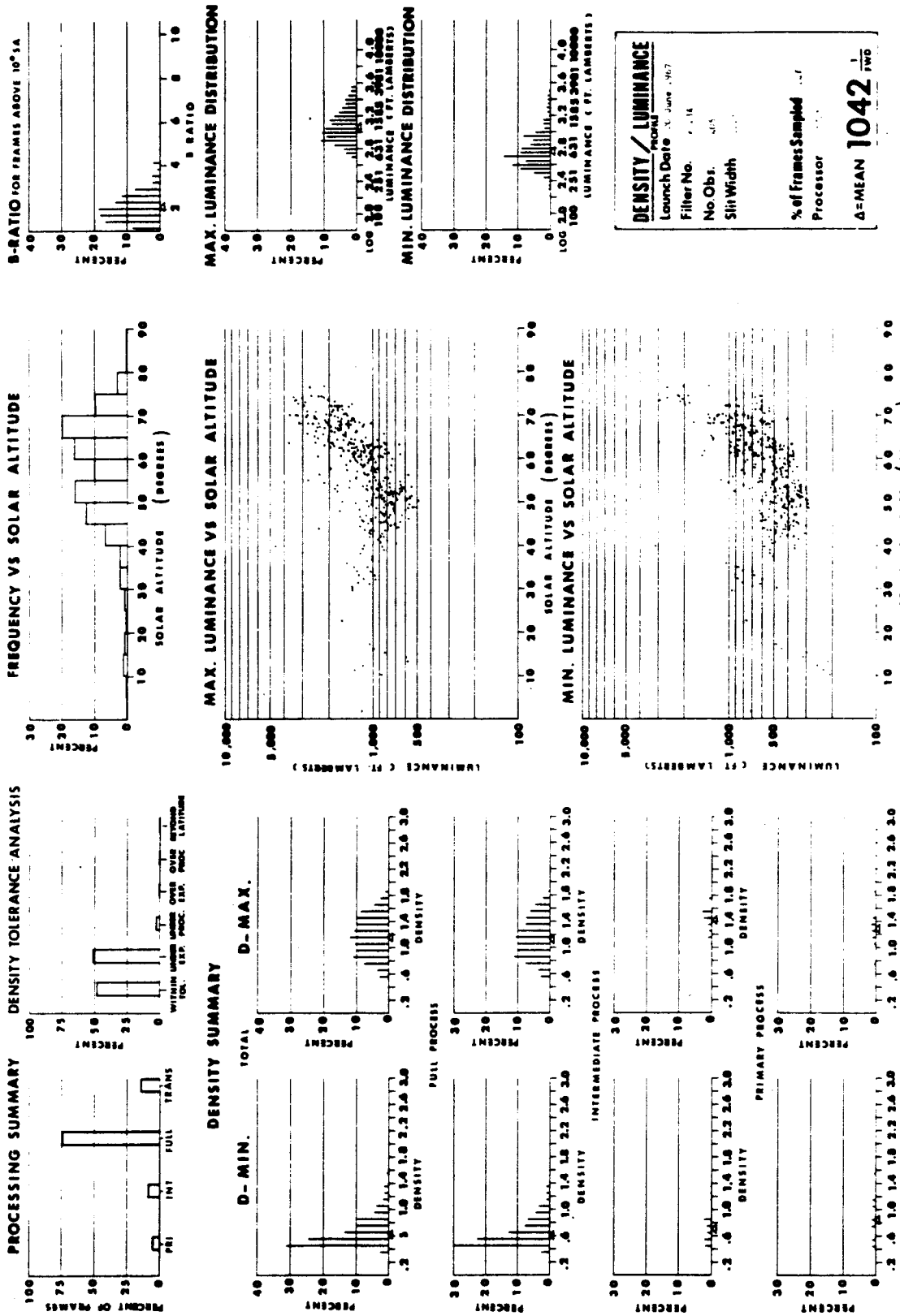


Analysis of Frames Out of Tolerance Using Two Criteria (1000-Series Missions)



Analysis of Frames Out of Tolerance Using Two Criteria (1000-Series Missions)


B-RATIO FOR FRAMES ABOVE 10^5 A
PERCENT
B RATIO
MAX. LUMINANCE DISTRIBUTION
MIN. LUMINANCE DISTRIBUTION
LUMINANCE (FT. LAMBERTS)
DENSITY/LUMINANCE
Launch Date
Filter No.
No. Obs.
Slit Width
% of frames Sampled
Processor
Δ=MEAN 1042
FREQUENCY VS SOLAR ALTITUDE
SOLAR ALTITUDE (DEGREES)
MAX. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE VS SOLAR ALTITUDE
DENSITY TOLERANCE ANALYSIS
WITHIN TOL.
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UNDER PROC.
OVER EXP.
OVER PROC.
BEYOND LATITUDE
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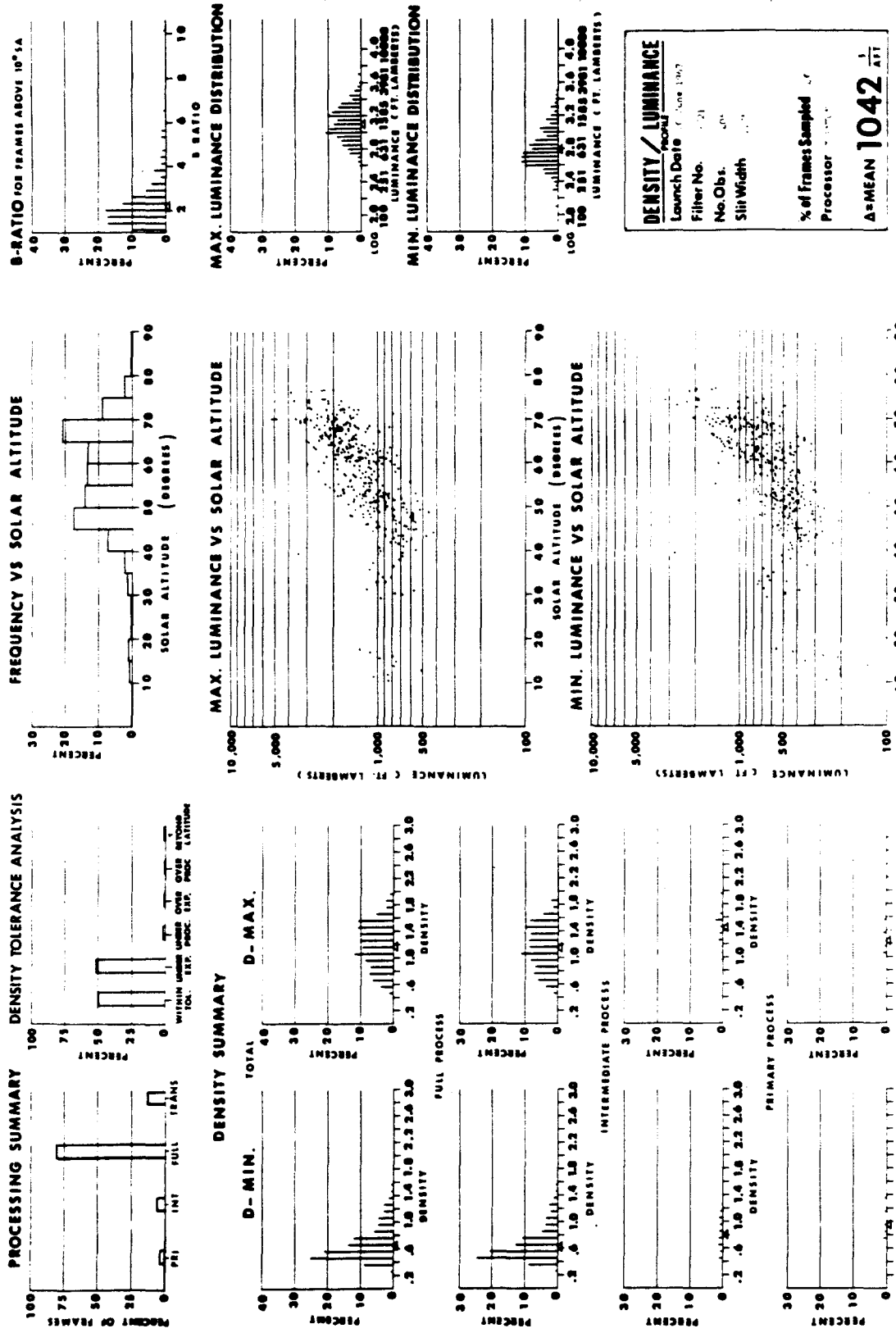
PRI
INT
FULL
TRANS
DENSITY SUMMARY
D-MIN.
D-MAX.
TOTAL
FULL PROCESS
INTERMEDIATE PROCESS
PRIMARY PROCESS
DENSITY


B-RATIO FOR FRAMES ABOVE 10° SA
MAX. LUMINANCE DISTRIBUTION
MIN. LUMINANCE DISTRIBUTION
DENSITY / LUMINANCE
Launch Date
Filter No.
No. Obs.
Slit Width
% of Frames Sampled
Processor
Δ=MEAN 1042
FREQUENCY VS SOLAR ALTITUDE
MAX. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE VS SOLAR ALTITUDE
SOLAR ALTITUDE (DEGREES)
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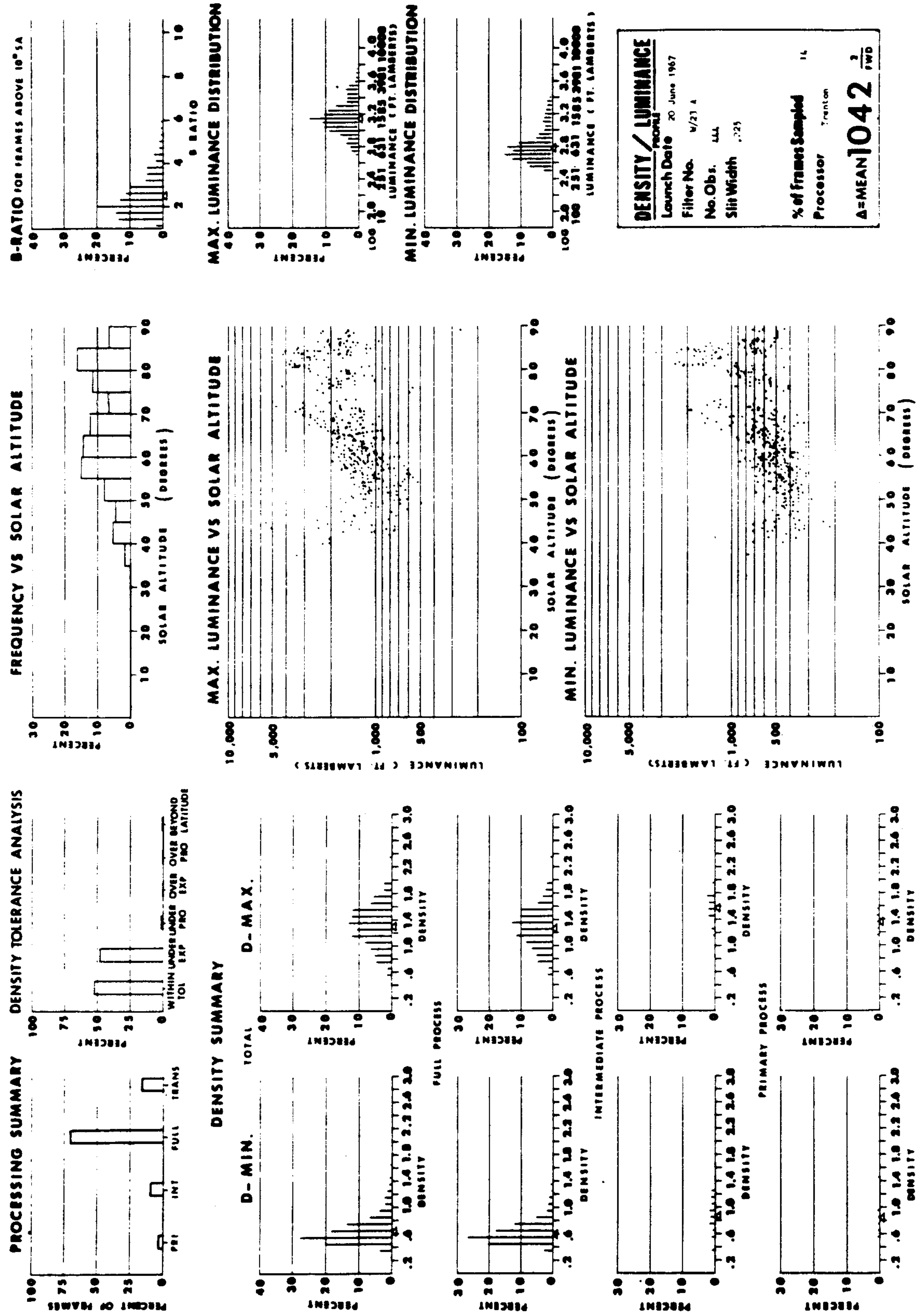
DENSITY TOLERANCE ANALYSIS
DENSITY SUMMARY
D-MIN.
TOTAL
D-MAX.
FULL PROCESS
INTERMEDIATE PROCESS
PRIMARY PROCESS
DENSITY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MIN. LUMINANCE DISTRIBUTION
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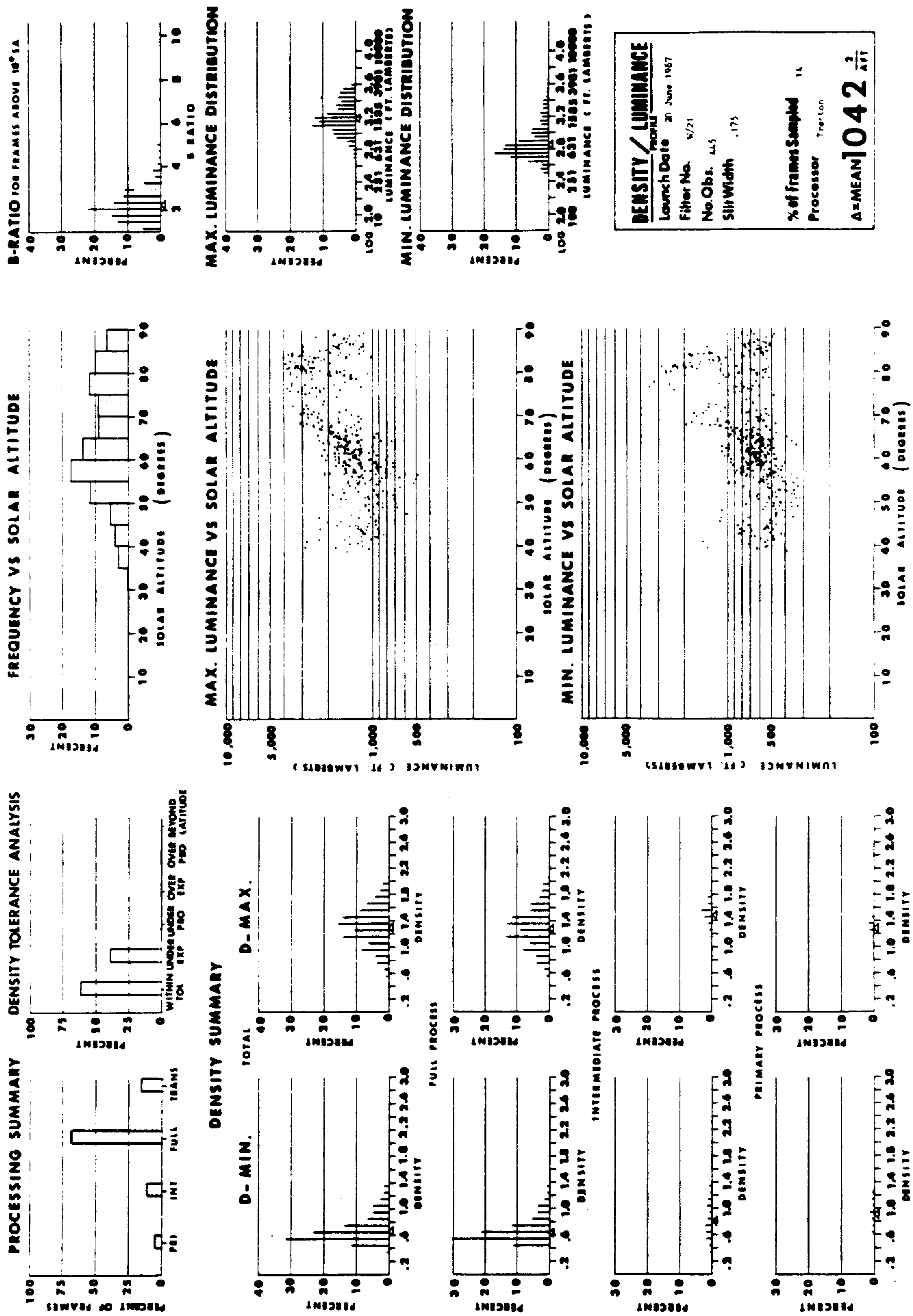
D-MIN.
D-MAX.
MAX. LUMINANCE VS SOLAR ALTITUDE
MIN. LUMINANCE VS SOLAR ALTITUDE
DENSITY / LUMINANCE PROFILE
Launch Date 20 June 1967
Filter No.
No. Obs.
Slit Width
% of Frames Sampled
Processor Trenton
Δ=MEAN 1042 2 FWD


PROCESSING SUMMARY
DENSITY TOLERANCE ANALYSIS
DENSITY SUMMARY
D-MIN.
D-MAX.
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MIN. LUMINANCE VS SOLAR ALTITUDE
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MIN. LUMINANCE DISTRIBUTION
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Launch Date
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No. Obs.
Slit Width
% of Frames Sampled
Processor
Δ=MEAN
1042

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MISSION 1042

THIS

PORTION

UNAVAILABLE