# Chapter 7 - Data Return

## Contents

## Introduction to Chapter 7

This chapter is a report on the NIMS data return for the E15 orbit. Due to the low downlink data rates available for Galileo Jupiter Operations and other unforeseen and unpredictable events during the E15 Encounter and Cruise, not all NIMS data recorded on the tape recorder or selected in real-time were returned. The previous 6 chapters nominally describe the planning and intention of the NIMS observations for this orbit, except the obstab section in chapter 4 which was updated to give the latest parameters for the data that were actually returned.

There were fifteen autonomous reloads of the NIMS RAM code from CDS during the E15 encounter, one just before each science observation. No observations were lost due to NIMS processor halts. The approach that we are taking to avoid data loss due to processor halts has proven to be very successful.

Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission.

AACS had a fault trip causing the outbound portion of the E15 encounter to be executed in Cruise mode. Also, star scanner noise near perijove caused anomnalous scan platform motion.

Spacecraft safing during the E16 encounter caused a good portion of E15 data not to be recorded over in E16. Thus, additional E15 data were returned during E16 playback.

The plots on the pages 3 and 4 show the geometry of the NIMS E15 observations using a north trajectory pole projection. The 'returned' observations are in Bold characters and the 'non-returned' in gray. The observations with an asterix were taken with the NIMS software halted.

The spreadsheets on pages 5 through 8 summarize the 'final' playback model for the 'returned' data.

The text on page 9 gives a 'recap' of the E15 playback events which affected which observations were returned.

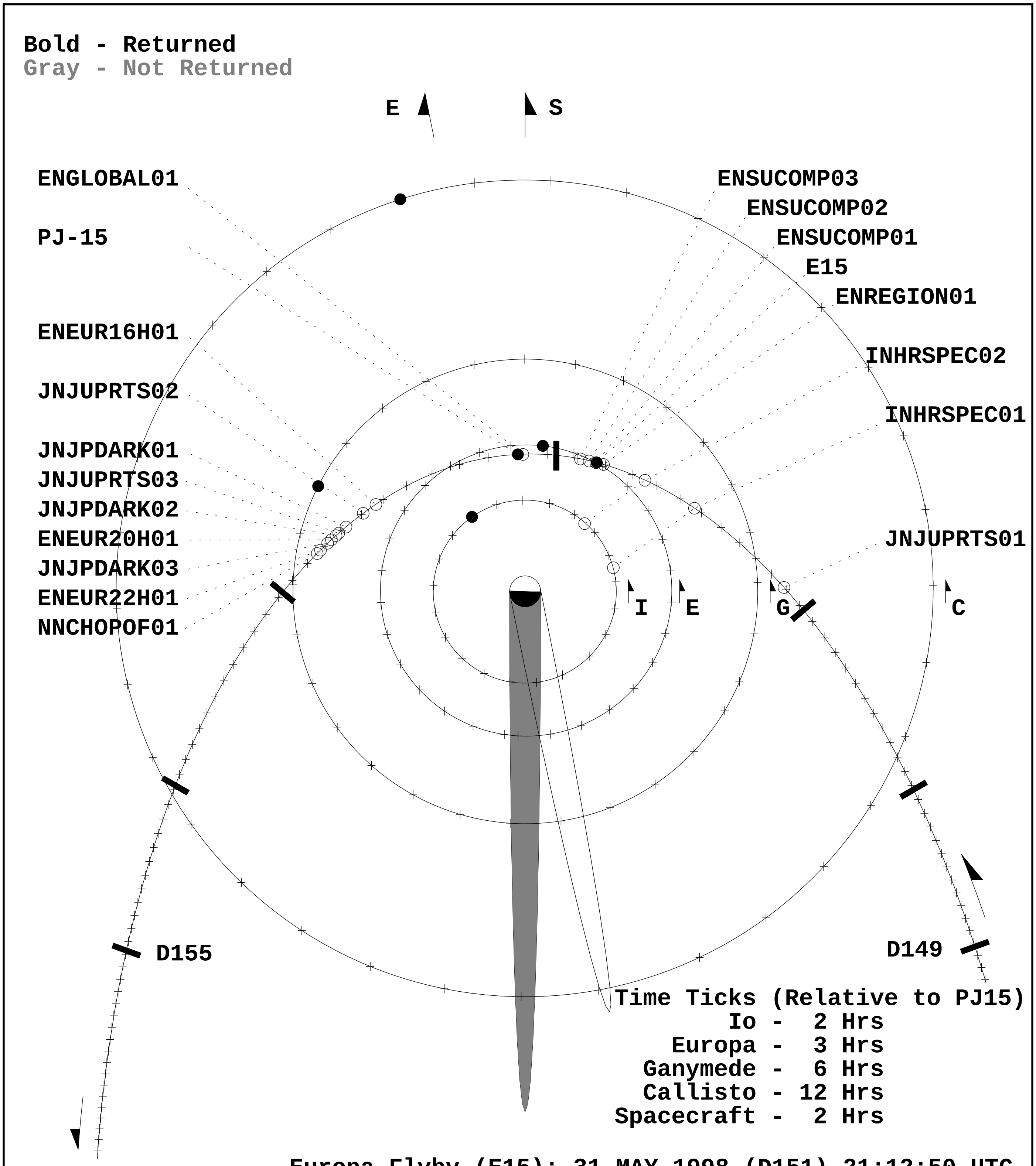
A Timeline of E15 playback events is on pages 9 through 14.

The text on page 15 describes the E15 NIMS and AACS Anomalies.

The text on page 16 gives a brief discussion of the NIMS data files. Additional information about NIMS data formats, data types, data labels and data access is given on pages 17 and 18.

The text on page 19 is a guide to understanding the NIMS MASK.

# NIMS E15 OBSERVATIONS




Europa Flyby (E15): 31-MAY-1998 (D151) 21:12:50 UTC
Perijove (PJ15): 01-JUN-1998 (D152) 02:35:37 UTC

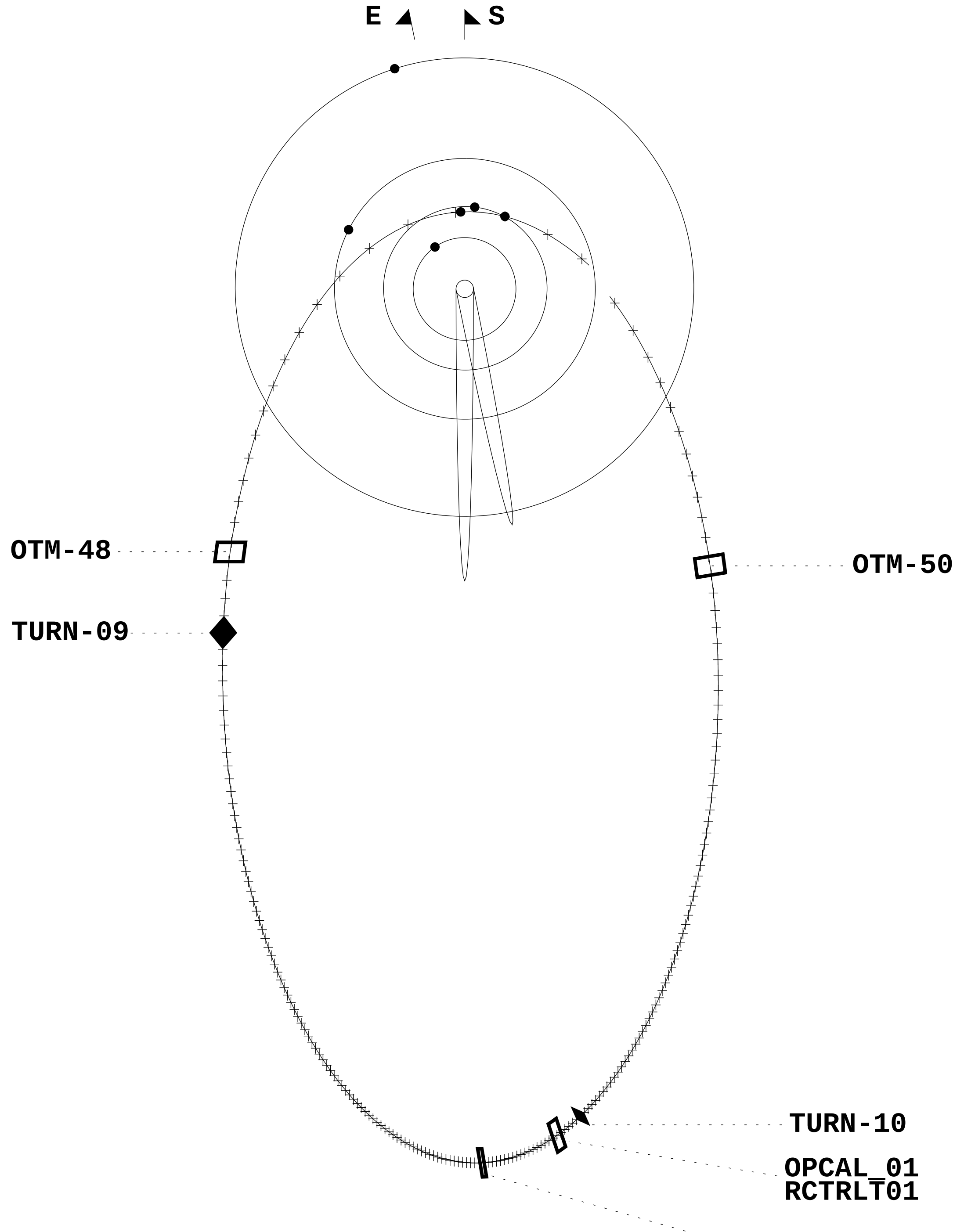
E15 North Trajectory Pole View

NIMS - FEL - 12/06/99

# NIMS E15 CRUISE CALIBRATIONS

Europa Flyby (E15): 31-MAY-1998 (D151) 21:12:50 UTC
Perijove (PJ15): 01-JUN-1998 (D152) 02:35:37 UTC
Apojove (AJ15): 25-JUN-1998 (D176) 16:00:00 UTC

Time Ticks (Relative to E15)
Spacecraft - 6 Hours




E15 North Trajectory Pole View, Perijove to Perijove

# NIMS E15 DATA RETURN

| Activity ID | Observation Title | NIMS Edit Table | NIMS PB Table | Mode | Gain | Grating Start | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| 15JNJUPRTS01* | Jupiter Realtime Observation | E15JLM442 | R/T | LM | 4 | 0 | 4 | R/T | DA |
| 15INHRSPEC02- | Io Monitoring at High Spectral Resolution | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |
| 15ENREGION01- | Europa Regional Observation | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DE |
| 15ENSUCOMP01- | Europa Surface Composition | E15ELM442 | E15ELM360 | LS | 3 | 0 | 4 | MPW | DF |
| 15ENSUCOMP02- | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP03- | Europa Surface Composition | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DH |
| 15ENGLOBAL01- | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENGLOBAL01- | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENEUR16H01- | Europa 16 Hour Map | E15ELM442 | E15B_ELM240T | LM | 4 | 0 | 4 | MPW | DK |
| 15JNJUPRTS02* | Jupiter Realtime Observation | E15JLM442 | R/T | LM | 4 | 0 | 4 | R/T | DC |
| 15JNJPDARK01- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DN |
| 15JNJUPRTS03* | Jupiter Realtime Observation | E15JLM442 | R/T | LM | 4 | 0 | 4 | R/T | DJ |
| 15ENEUR20H01- | Europa 20 Hour Map | E15ELM442 | E15B_ELM240T | LM | 4 | 0 | 4 | MPW | DL |
| 15ENEUR22H01- | Europa 22 Hour Map | E15ELM240V | E15B_ELM168V | LM | 3 | 0 | 4 | LPU | EM |
| 15NNRCTRLT01- | NIMS RCT Real-Time Calibration | E14RCT252 | R/T | LM | 1 | 0 | 4 | R/T | XE |
| 15INHRSPEC01- | Io Monitoring at High Spectral Resolution | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC02- | Io Monitoring at High Spectral Resolution | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |
| 15ENREGION01- | Europa Regional Observation | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DE |
| 15ENSUCOMP01-gf | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DF |
| 15ENSUCOMP01- | Europa Surface Composition | E15ELM442 | E15ELM360 | LS | 3 | 0 | 4 | MPW | DF |
| 15ENSUCOMP02-gf | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP02- | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP03- | Europa Surface Composition | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DH |
| 15ENGLOBAL01-gf | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENGLOBAL01- | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENGLOBAL01- | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENEUR16H01-gf | Europa 16 Hour Map | E15ELM442 | E15B_ELM240T | LM | 4 | 0 | 4 | MPW | DK |
| 15ENEUR16H01- | Europa 16 Hour Map | E15ELM240V | E15B_ELM168V | LM | 3 | 0 | 4 | LPU | EK |
| 15JNJPDARK01-gf | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DN |
| 15JNJPDARK02- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DO |
| 15ENEUR20H01-gf | Europa 20 Hour Map | E15ELM442 | E15B_ELM240T | LM | 4 | 0 | 4 | MPW | DL |
| 15ENEUR20H01- | Europa 20 Hour Map | E15ELM240V | E15B_ELM168V | LM | 3 | 0 | 4 | LPU | EL |
| 15JNJPDARK03- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DP |
| 15ENEUR22H01- | Europa 22 Hour Map | E15ELM442 | E15B_ELM240T | LM | 4 | 0 | 4 | MPW | DM |
| 15INHRSPEC01- | Io Monitoring at High Spectral Resolution | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC02-gf | Io Monitoring at High Spectral Resolution | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |

# NIMS E15 DATA RETURN

| Activity ID | Mode | Record Format | Wave-lengths ret. | Record Time (sec.) | PB Time (sec.) | Selected Bits of Tape sBOT (Mbits) | Total Bits of Tape BOT (Mbits) | Mode Cycle (sec) | Thold | Comp | Total BTG Mbits (4% ohead) | Data Reduct Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15JNJUPRTS01* | LM | | 360 | | | | | | | | | | |
| 15INHRSPEC02- | LM | MPW | 360 | 1260 | 408 | 4.70 | 14.52 | 8.667 | 2 | 1.46 | 2.41 | 1.95 | 1 |
| 15ENREGION01- | LM | MPW | 360 | 1140 | 632 | 7.28 | 13.13 | 8.667 | 0 | 1.25 | 4.37 | 1.67 | 1 |
| 15ENSUCOMP01- | LM | MPW | 360 | 1200 | 575 | 6.62 | 13.82 | 8.667 | 0 | 1.48 | 3.36 | 1.97 | 1 |
| 15ENSUCOMP02- | LM | MPW | 360 | 1200 | 615 | 7.08 | 13.82 | 8.667 | 0 | 1.33 | 4.00 | 1.77 | 1 |
| 15ENSUCOMP03- | LM | MPW | 228 | 600 | 265 | 3.05 | 6.91 | 8.667 | 0 | 1.22 | 1.19 | 2.57 | 1 |
| 15ENGLOBAL01- | LM | MPW | 228 | 1800 | 182 | 2.10 | 20.74 | 8.667 | 0 | 1.20 | 0.83 | 2.53 | 1 |
| 15ENGLOBAL01- | LM | MPW | 228 | 1800 | 458 | 5.28 | 20.74 | 8.667 | 0 | 1.26 | 1.99 | 2.65 | 1 |
| 15ENEUR16H01- | LM | MPW | 240 | 290 | 286 | 3.29 | 3.34 | 8.667 | 0 | 1.25 | 1.32 | 2.50 | 1 |
| 15JNJUPRTS02* | LM | | 360 | | | | | | | | | | |
| 15JNJPDARK01- | LM | LPU | 80 | 600 | 300 | 1.85 | 3.70 | 8.667 | 0 | 1.30 | 0.44 | 4.18 | 1 |
| 15JNJUPRTS03* | LM | | 360 | | | | | | | | | | |
| 15ENEUR20H01- | LM | MPW | 240 | 266 | 251 | 2.89 | 3.06 | 8.667 | 0 | 1.51 | 0.96 | 3.02 | 1 |
| 15ENEUR22H01- | LM | LPU | 168 | 245 | 234 | 1.44 | 1.51 | 8.667 | 0 | 1.53 | 0.62 | 2.34 | 1 |
| 15NNRCTRLT01- | LM | R/T | 252 | | | | | | | | 0.14 | | |
| 15INHRSPEC01- | LM | MPW | 360 | 1260 | 182 | 2.10 | 14.52 | 8.667 | 0 | 1.67 | 0.94 | 2.23 | 2 |
| 15INHRSPEC02- | LM | MPW | 360 | 1260 | 390 | 4.49 | 14.52 | 8.667 | 2 | 1.49 | 2.26 | 1.99 | 2 |
| 15ENREGION01- | LM | MPW | 360 | 1140 | 507 | 5.84 | 13.13 | 8.667 | 0 | 1.25 | 3.50 | 1.67 | 2 |
| 15ENSUCOMP01-gf | LM | MPW | 360 | 1200 | 34 | 0.39 | 13.82 | 8.667 | 0 | 1.48 | 0.20 | 1.97 | 2 |
| 15ENSUCOMP01- | LM | MPW | 360 | 1200 | 575 | 6.62 | 13.82 | 8.667 | 0 | 1.41 | 3.52 | 1.88 | 2 |
| 15ENSUCOMP02-gf | LM | MPW | 360 | 1200 | 54 | 0.62 | 13.82 | 8.667 | 0 | 1.33 | 0.35 | 1.77 | 2 |
| 15ENSUCOMP02- | LM | MPW | 360 | 1200 | 420 | 4.84 | 13.82 | 8.667 | 0 | 1.33 | 2.73 | 1.77 | 2 |
| 15ENSUCOMP03- | LM | MPW | 228 | 600 | 343 | 3.95 | 6.91 | 8.667 | 0 | 1.30 | 1.44 | 2.74 | 2 |
| 15ENGLOBAL01-gf | LM | MPW | 228 | 1800 | 282 | 3.25 | 20.74 | 8.667 | 0 | 1.25 | 1.23 | 2.63 | 2 |
| 15ENGLOBAL01- | LM | MPW | 228 | 1800 | 458 | 5.28 | 20.74 | 8.667 | 0 | 1.25 | 2.00 | 2.63 | 2 |
| 15ENGLOBAL01- | LM | MPW | 228 | 1800 | 182 | 2.10 | 20.74 | 8.667 | 0 | 1.25 | 0.80 | 2.63 | 2 |
| 15ENEUR16H01-gf | LM | MPW | 240 | 290 | 49 | 0.56 | 3.34 | 8.667 | 0 | 1.25 | 0.23 | 2.50 | 2 |
| 15ENEUR16H01- | LM | LPU | 168 | 290 | 286 | 1.76 | 1.79 | 8.667 | 0 | 1.42 | 0.81 | 2.17 | 2 |
| 15JNJPDARK01-gf | LM | LPU | 80 | 600 | 21 | 0.13 | 3.70 | 8.667 | 0 | 1.30 | 0.03 | 4.18 | 2 |
| 15JNJPDARK02- | LM | LPU | 80 | 600 | 300 | 1.85 | 3.70 | 8.667 | 0 | 1.26 | 0.46 | 4.05 | 2 |
| 15ENEUR20H01-gf | LM | MPW | 240 | 266 | 15 | 0.17 | 3.06 | 8.667 | 0 | 1.58 | 0.05 | 3.16 | 2 |
| 15ENEUR20H01- | LM | LPU | 168 | 266 | 252 | 1.55 | 1.64 | 8.667 | 0 | 1.58 | 0.64 | 2.42 | 2 |
| 15JNJPDARK03- | LM | LPU | 80 | 600 | 486 | 3.00 | 3.70 | 8.667 | 0 | 1.27 | 0.73 | 4.08 | 2 |
| 15ENEUR22H01- | LM | MPW | 240 | 245 | 234 | 2.70 | 2.82 | 8.667 | 0 | 1.47 | 0.92 | 2.94 | 2 |
| 15INHRSPEC01- | LM | MPW | 360 | 1260 | 243 | 2.80 | 14.52 | 8.667 | 2 | 1.47 | 1.43 | 1.96 | 3 |
| 15INHRSPEC02-gf | LM | MPW | 360 | 1260 | 130 | 1.50 | 14.52 | 8.667 | 2 | 1.46 | 0.77 | 1.95 | 3 |
| | | | | | | | | | | | 46.68 | **Total** | |
| | | | | | | | | | | | 45.11 | **Alloc** | |
| | | | | | | | | | | | 1.57 | **Over/Under** | |

# NIMS E16 DATA RETURN

| Activity ID | Observation Title | NIMS EDIT Table | NIMS PB Table | Mode | Gain | Grating Start | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| 16INHRSPEC01 | Io Monitoring at High Spectral Resolution | E16ILM243C | E16ILM228C | LM | 2 | 0 | 4 | LPU | |
| 16JNJUPRTS01 | Jupiter Realtime Observation | E16JLM442 | | LM | 2 | 0 | 4 | R/T | |
| 16JNHOTMAP01 | NIMS Jupiter Hotmap | E16JHT238A | E16JHT238A | LM | 2 | 0 | 4 | LPU | |
| 16HNDARKCL01 | | E16HN442 | E16HN408 | LM | 1,2,3,4 | | | MPW | |
| | NIMS Software Reload | | | | | | | | |
| 15ENSUCOMP02-gf | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP02- | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENGLOBAL01-gf | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENGLOBAL01- | Europa Global | E15ELM442 | E15B_ELM228C | LM | 4,3 | 0 | 4 | MPW | DI |
| 15ENEUR16H01C- | Europa 16 Hour Map | E15ELM442 | E15ELM120T | LM | 4 | 0 | 4 | MPW | DK |
| 15ENEUR16H01D- | Europa 16 Hour Map | E15ELM240V | E15ELM72V | LM | 3 | 0 | 4 | LPU | EK |
| 15JNJPDARK01A- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DN |
| 15JNJPDARK02A-gf | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DO |
| 15JNJPDARK02A- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DO |
| 15ENEUR20H01B-gf | Europa 20 Hour Map | E15ELM240V | E15ELM168V | LM | 3 | 0 | 4 | LPU | EL |
| 15JNJPDARK03A- | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DP |
| 15JNJPDARK03A-gf | Jupiter Dark Observation | E15J5M253B | E15J5M80B | LM | 4 | 0 | 4 | LPU | DP |
| 15ENEUR22H01C- | Europa 22 Hour Map | E15ELM442 | E15ELM120T | LM | 4 | 0 | 4 | MPW | DM |
| 15ENEUR22H01D- | Europa 22 Hour Map | E15ELM240V | E15ELM72V | LM | 3 | 0 | 4 | LPU | EM |
| | | | | | | | | | |
| 15INHRSPEC01- | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC01- | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LS | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC02-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |
| 15INHRSPEC02- | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |
| | | | | | | | | | |
| 16INHRSPEC01 | Io Monitoring at High Spectral Resolution | E16ILM243C | E16ILM228C | LM | 2 | 0 | 4 | LPU | |
| 16HNDARKCL01 | | E15HN442 | E15HN408 | LM | 1,2,3,4 | | | MPW | |
| | | | | | | | | | |
| 15ENREGION01-gf | Europa Regional Observation | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DE |
| 15ENSUCOMP02-gf | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP02-gf | Europa Surface Composition | E15ELM442 | E15ELM360 | LM | 3 | 0 | 4 | MPW | DG |
| 15ENSUCOMP03CD- | Europa Surface Composition | E15ELM442 | E15ELM132C | LM | 4,3 | 0 | 4 | MPW | DH |
| 15ENGLOBAL01J-Q- | Europa Global | E15ELM442 | E15ELM132C | LM | 4,3 | 0 | 4 | MPW | DI |

# NIMS E16 DATA RETURN

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 15ENEUR16H01A-gf | Europa 16 Hour Map | E15ELM442 | E15ELM360 | LM | 4 | 0 | 4 | LPU | EK |
| 15JNJPDARK01B- | Jupiter Dark Observation | E15J5M253B | E15J5M149B | LM | 4 | 0 | 4 | LPU | DN |
| 15JNJPDARK02B- | Jupiter Dark Observation | E15J5M253B | E15J5M149B | LM | 4 | 0 | 4 | LPU | DO |
| 15ENEUR20H01C- | Europa 20 Hour Map | E15ELM442 | E15ELM120T | LM | 4 | 0 | 4 | MPW | DL |
| 15ENEUR20H01D- | Europa 20 Hour Map | E15ELM240V | E15ELM72V | LM | 3 | 0 | 4 | LPU | EL |
| 15JNJPDARK03B- | Jupiter Dark Observation | E15J5M253B | E15J5M149B | LM | 4 | 0 | 4 | LPU | DP |
| | | | | | | | | | |
| Extended Playback Required Pass Number Reset to 1 | | | | | | | | | |
| | | | | | | | | | |
| 15INHRSPEC01-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC01-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC01-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DB |
| 15INHRSPEC02-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |
| 15INHRSPEC02-gf | Io Monitoring at High Spectral Resolutio | E15ILM442 | E15ILM360 | LM | 2 | 0 | 4 | MPW | DD |

NOTES: The complexity of E16 playback resulted in the use of several schemes for numbering the separate portions of the observations. Final data product nomenclature will differ from that employed here. This spreadsheet is a record of the separate parts commanded to be played back, in time order of playback.

gf= Gap fill

# NIMS E16 DATA RETURN

| Activity ID | Mode | Record Format | Wave- lengths Returned | Record Time (sec.) | PB Time (sec.) | Selected Bits of Tape sBOT (Mbits) | Total Bits of Tape BOT (Mbits) | Mode Cycle (sec) | Thold | Comp | Total BTG Mbits (4% OHEAD) | Data Reduct Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16INHRSPEC01 | LM | LPU | 228 | 184.00 | 181.00 | 1.110 | 1.13 | 8.667 | 0 | 2.32 | 0.43 | 2.60 | 1 |
| 16JNJUPRTS01 | LM | | 360 | | | | | | | | | | |
| 16JNHOTMAP01 | LM | LPU | 238 | 1468.0 | 70.00 | 5.180 | 9.06 | 8.667 | 0 | 99.00 | 0.00 | 1.35 | 1 |
| 16HNDARKCL01 | LM | MPW | 408 | 667 | 485 | 5.59 | | 8.667 | 0 | 2.71 | 1.75 | 3.19 | 1 |
| | | | | | | | | | | | | | |
| 15ENSUCOMP02-gf | LM | MPW | 360 | 1200 | 212.2 | 2.44 | 13.82 | 8.667 | 0 | 1.33 | 1.38 | 1.77 | 2 |
| 15ENSUCOMP02- | LM | MPW | 360 | 1200 | 88 | 1.01 | 13.82 | 8.667 | 0 | 1.33 | 0.57 | 1.77 | 2 |
| 15ENGLOBAL01-gf | LM | MPW | 228 | 1800 | 195 | 2.25 | 20.74 | 8.667 | 0 | 1.20 | 0.89 | 2.53 | 2 |
| 15ENGLOBAL01- | LM | MPW | 228 | 1800 | 204.6 | 2.36 | 20.74 | 8.667 | 0 | 1.26 | 0.89 | 2.65 | 2 |
| 15ENEUR16H01C- | LM | MPW | 120 | 290 | 286 | 3.29 | 3.34 | 8.667 | 0 | 1.40 | 0.59 | 5.60 | 2 |
| 15ENEUR16H01D- | LM | LPU | 72 | 290 | 282 | 1.74 | 1.79 | 8.667 | 0 | 1.25 | 0.39 | 4.46 | 2 |
| 15JNJPDARK01A- | LM | LPU | 80 | 600 | 306 | 1.89 | 3.70 | 8.667 | 0 | 1.30 | 0.45 | 4.18 | 2 |
| 15JNJPDARK02A-gf | LM | LPU | 80 | 600 | 20 | 0.12 | 3.70 | 8.667 | 0 | 1.26 | 0.03 | 4.05 | 2 |
| 15JNJPDARK02A- | LM | LPU | 80 | 600 | 316 | 1.95 | 3.70 | 8.667 | 0 | 1.26 | 0.48 | 4.05 | 2 |
| 15ENEUR20H01B-gf | LM | LPU | 168 | 266 | 20 | 0.12 | 1.64 | 8.667 | 0 | 1.50 | 0.05 | 2.29 | 2 |
| 15JNJPDARK03A- | LM | LPU | 80 | 600 | 86 | 0.53 | 3.70 | 8.667 | 0 | 1.27 | 0.13 | 4.08 | 2 |
| 15JNJPDARK03A-gf | LM | LPU | 80 | 600 | 30 | 0.19 | 3.70 | 8.667 | 0 | 1.27 | 0.05 | 4.08 | 2 |
| 15ENEUR22H01C- | LM | MPW | 120 | 245 | 234 | 2.70 | 2.82 | 8.667 | 0 | 1.50 | 0.45 | 6.00 | 2 |
| 15ENEUR22H01D- | LM | LPU | 72 | 245 | 234 | 1.44 | 1.51 | 8.667 | 0 | 1.53 | 0.26 | 5.46 | 2 |
| | | | | | | | | | | | | | |
| 15INHRSPEC01- | LM | MPW | 360 | 1260 | 636 | 7.33 | 14.52 | 8.667 | 0 | 1.30 | 4.23 | 1.73 | 3 |
| 15INHRSPEC01- | LM | MPW | 360 | 1260 | 146 | 1.68 | 14.52 | 8.667 | 0 | 1.40 | 0.90 | 1.87 | 3 |
| 15INHRSPEC02-gf | LM | MPW | 360 | 1260 | 40 | 0.46 | 14.52 | 8.667 | 2 | 1.30 | 0.27 | 1.73 | 3 |
| 15INHRSPEC02- | LM | MPW | 360 | 1260 | 303.3 | 3.49 | 14.52 | 8.667 | 0 | 1.30 | 2.02 | 1.73 | 3 |
| | | | | | | | | | | | | | |
| 16INHRSPEC01 | LPU | MPW | 228 | 184.00 | 180.00 | 1.110 | 1.13 | 8.667 | 0 | 1.60 | 0.62 | 1.80 | 3 |
| 16HNDARKCL01 | LM | MPW | 408 | 667 | 242 | 2.79 | | 8.667 | 0 | 2.70 | 0.88 | 2.35 | 3 |
| | | | | | | | | | | | | | |
| 15ENREGION01-gf | LM | MPW | 360 | 1140 | 20 | 0.23 | 13.13 | 8.667 | 0 | 1.25 | 0.14 | 1.67 | 4 |
| 15ENSUCOMP02-gf | LM | MPW | 360 | 1200 | 30 | 0.35 | 13.82 | 8.667 | 0 | 1.33 | 0.19 | 1.77 | 4 |
| 15ENSUCOMP02-gf | LM | MPW | 360 | 1200 | 30 | 0.35 | 13.82 | 8.667 | 0 | 1.33 | 0.19 | 1.77 | 4 |
| 15ENSUCOMP03CD- | LM | MPW | 132 | 600 | 598 | 6.89 | 6.91 | 8.667 | 0 | 1.25 | 1.52 | 4.55 | 4 |
| 15ENGLOBAL01J-Q- | LM | MPW | 132 | 1800 | 1092 | 12.58 | 20.74 | 8.667 | 0 | 1.25 | 2.77 | 4.55 | 4 |

# NIMS E16 DATA RETURN

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15ENEUR16H01A-gf | LM | MPW | 360 | 290 | 50 | 0.58 | 3.34 | 8.667 | 0 | 1.25 | 0.35 | 1.67 | 4 |
| 15JNJPDARK01B- | LM | LPU | 149 | 600 | 595 | 3.67 | 3.70 | 8.667 | 0 | 1.37 | 1.55 | 2.36 | 4 |
| 15JNJPDARK02B- | LM | LPU | 149 | 600 | 605 | 3.73 | 3.70 | 8.667 | 0 | 1.43 | 1.51 | 2.47 | 4 |
| 15ENEUR20H01C- | LM | MPW | 120 | 266 | 262 | 3.02 | 3.06 | 8.667 | 0 | 1.45 | 0.52 | 5.80 | 4 |
| 15ENEUR20H01D- | LM | LPU | 72 | 266 | 263 | 1.62 | 1.64 | 8.667 | 0 | 1.53 | 0.30 | 5.46 | 4 |
| 15JNJPDARK03B- | LM | LPU | 149 | 600 | 595 | 3.67 | 3.70 | 8.667 | 0 | 1.49 | 1.43 | 2.57 | 4 |
| | | | | | | | | | | Total | 28.17 | (MBTG) | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| 15INHRSPEC01-gf | LM | MPW | 360 | 1260 | 50 | 0.58 | 14.52 | 8.667 | 0 | 1.30 | 0.33 | 1.73 | 1 |
| 15INHRSPEC01-gf | LM | MPW | 360 | 1260 | 18 | 0.21 | 14.52 | 8.667 | 0 | 1.30 | 0.12 | 1.73 | 1 |
| 15INHRSPEC01-gf | LM | MPW | 360 | 1260 | 52 | 0.60 | 14.52 | 8.667 | 0 | 1.30 | 0.35 | 1.73 | 1 |
| 15INHRSPEC02-gf | LM | MPW | 360 | 1260 | 73 | 0.84 | 14.52 | 8.667 | 0 | 1.30 | 0.49 | 1.73 | 1 |
| 15INHRSPEC02-gf | LM | MPW | 360 | 1260 | 44 | 0.51 | 14.52 | 8.667 | 0 | 1.30 | 0.29 | 1.73 | 1 |
| | | | | | | | | | | Total | 1.58 | (MBTG) | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| gf= Gap fill | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

## RECAP OF E15 PLAYBACK EVENTS

**Although the Galileo spacecraft dropped into safe mode a couple of days before the start of the E15 encounter, the sequence was recovered and nearly all of it executed as planned. Excellent NIMS observations of Io and Europa were recorded in E15, which was the last encounter to be flown primarily in inertial mode. Following perijove, problems with the gyros dropped the spacecraft into cruise mode and safed the scan platform. Impact on the subsequent distant Europa and Jupiter observations was minimal. There was no evidence of any NIMS software stoppages during E15.**

**NIMS' E15 downlink allocation of about 40 Mbits was significantly larger than that for E12 or E14. Nonetheless not all of the recorded data could be returned with the resources available. The safing of the spacecraft in E16 permitted us to bring down the rest (see the E16 NIMS guide).**

**The following timeline details the most signifigant events of the E15 playback period. Most of the text below is excerpted from messages issued at the time.**

### E15 Playback Events Timeline (04-10-98 to 07-19-98)

**04-10-98: NIMS downlink bits allocation is 40.604 Megabits.**

**04-20-98: NIMS downlink bits allocation is 40.043 Mbits.**

**05-06-98: NIMS downlink bits allocation is 39.564 Mbits due to refinements in telemetry modeling.**

**05-07-98: The playback table delivered today has correct wavelength edit tables commanded and all known time corrections (to correspond to the SEF) applied.
E15 data recording includes a new strategy of changing instrument gain states during single observations. This was suggested by Gary Hansen for particular Europa observations. It is implemented in 15ENGLOBAL01 and in 15ENSUCOMP03.
In addition to 5 close-in Europa observations and 6 distant ones, E15 includes 2 Io observations (15INHRSPEC01, 02), 3 Jupiter dark observations, 3 realtime Jupiter observations, and an RCT calibration.
A software patch to overcome the problems with one of the spacecraft gyros is under development. If this is accomplished successfully, all NIMS E15 observations except 15ENGLOBAL01 will be taken in inertial mode, avoiding the problem of uncompensated spacecraft wobble during data recording. Cruise mode is commanded near perijove to minimize further degradation of the gyro electronics.**

**05-20-98: E15 begins on 30 May. The playback table delivered today is ready to fly. Changes this week included a few timing adjustments and pass number changes, particularly for the 20 and 22 hour distant Europa observations.**

E15 Playback Events Timeline (04-10-98 to 07-19-98)

05-29-98: (J. Erickson) The Galileo spacecraft is presently in safing, due to an error in the construction of the Europa-15 approach maneuver sequence. On May 28 the spacecraft executed the majority of the maneuver, before the sequence error caused the spacecraft to abort the on-board sequence and safe itself. The flight team is presently reconfiguring the spacecraft to allow the uplink of the encounter sequence on the evening of May 29. It is expected that the encounter activities beginning on May 30 will be unaffected by the safing event.

05-30-98: E15 encounter begins.

05-31-98: Europa close approach occurs at 21:12 UTC.
At 21:32:48 the spacecraft is commanded from inertial mode to cruise mode, to minimize radiation damage during the Jupiter close approach period.

06-01-98: Perijove occurs at 02:35 UTC, while NIMS is recording 15ENGLOBAL01. At 08:37 the spacecraft is commanded from cruise mode back to inertial mode, prior to the distant Europa observations. Forty minutes later, a problem with the gyros (described in more detail below) dropped the spacecraft back into cruise mode once more.

06-04-98: (K. Schimmels) E15 Playback is running slightly ahead of schedule. The first update for E15 playback will be next week - you may affect segments 4 and beyond.
Allocations have been updated to reflect the following:
OTM-48 - we will resume playback about 7 hours earlier than planned - this gives us about 1.4 MB additional playback.
Release of 3.0 MB of inefficiency margin.
Release of extra 1.2 MB of SPOT margin which was being held for gyro activities.
Total released by OPG percentages: 5.6 MB
NIMS allocation is 41.385 Mbits.

06-05-98: (J. Erickson) The Galileo spacecraft is operating normally. The primary activity over the past week has been the Europa -15 Encounter on May 30/31 and June 1, and the beginning of the playback of that data. Additionally, the post Europa-15 maneuver scheduled for June 5 is executing nominally. The Europa-15 encounter sequence executed properly, and the updated attitude control system flight software is operating as planned. This corrects the problems previously seen with the spacecraft gyros. On June 1, a minor attitude control system problem arose during the end of the encounter sequence. In an event similar to one that occurred August 28, 1993, the attitude control system stopped controlling observation pointing with gyro control, but instead began relying on star input. This is a very rare event, happening only twice since launch.

A standard gyro performance and calibration test was executed on June 3, and the results indicate that the performance of the troublesome gyro is unchanged. This calibration, as well as later ones, will be used for updating gyro scale factors.

**06-07-98:** (J. Erickson) The encounter on May 30-June 1 executed as planned with one minor exception. The encounter was executed in inertial mode through the Europa closest approach, the gyros and INSs were turned off for the perijove pass, then the gyros/INSs were turned back on for post perijove observations. After the spacecraft was in inertial mode with the gyros off for 40 minutes, fault monitor 28 (no gyro data in inertial) tripped and aborted the spacecraft out of inertial mode and safed the scan platform. An additional change in spacecraft state indicated the INSs and accelerometers were also off post fault.
The accelerometers and INSs have since both been commanded back on without incident. AACS investigation into the cause of the FM28 trip is ongoing. The subsequent gyro performance test showed the gyros are at post E-14 performance, and OTM-48 has executed nominally. At this time, this appears to be a repeat of the unresolved event that occurred at the Ida encounter.

**06-10-98:** We received an additional 2 Mb of downlink allocation this week. Reserves that were held to help with gyro anomaly analysis were released, with some additional bits from the playback inefficiency portion of the office reserves. As a result we make additions and fine-tuning changes to nearly half of the observations remaining.
For Jupiter, the timing of 15JNJPDARK03 was altered so that all three of these observations would return about the same longitudes (154-160). We will bring down 5 Rims of each one.
For Io, we plan to bring down 3 Rims (central 60% of one scan) of 15INHRSPEC01, which was recorded in long spectrometer mode. The balance of 15INHRSPEC02 will also come down in pass 2.
For Europa, we increased (to 100%) the spatial data return of 15ENSUCOMP03 (228 wavelengths). For 15ENGLOBAL01 we will bring down all of both equatorial scans, but only 2 Rims of each of the polar scans.
There was no evidence of instrument software halts in E15.

**06-17-98:** E15 playback is coming along well. Compression for 15ENSUCOMP01 was good at 1.51, saving some bits that we can use elsewhere. There are a few missing packets in this observation that we may wish to replay later.
We made changes to the pass 2 compression estimates (data reduction factors) to reflect actual pass 1 performance.

In addition we made some significant changes to the playback plan for 15ENGLOBAL01. For the two scans covering the polar regions, following Gary Hansen's advice, we are not playing back the first (largely dark) Rim. We are able to increase playback to include Rims 2-4 for each of the polar scans thanks to compression savings. In addition we are not commanding thresholding for these, since the available table is not appropriate for the gain state employed.

06-24-98: Since there have been no releases of margin bits, and since playback is progressing on schedule, there were no updates to the E15 table this week. Next week we will generate additional commands for gap filling for 15ENSUCOMP01 and 02. 15ENREGION01 was retargeted to 7 N 185 W where Gary Hansen's plots show lots of non-ice material. It was recorded in gain state 3. The signal at the short wavelength end is strong and did not saturate, and there is lots of spatial variation, including intersecting linea. This appears to be a very nice observation at 3.4 km/pixel resolution. The second half will come down in pass 2.
The MWG is proposing a trade of bits. They have about 1.5 Mb "extra" in the present orbit and would like to trade this for 1.5 Mb of our bits in E18.

06-25-98: (M. Segura) The SOHO spacecraft declared a spacecraft emergency this morning due to problems during their latest manuever. There is a rumor floating around that the thrusters malfunctioned and are still firing. Contact has been lost with SOHO and our playback has been impacted. We lost our 14 pass yesterday/early today - but PB was paused so we experienced no data loss. SOHO's view periods are unfortunately very similiar to ours so the loss of downlink over the next few days could be great.
In a meeting this morning, the group (coordinators for all teams and Brian decided to let segment 5 continue and not pause playback. This decision was based on the facts that we have no idea which passes SOHO will take and pausing playback could cause more downlink to be lost that just marching along.

06-26-98: (K. Schimmels) There will NOT be an update to Segment 7 today. We will send it from pbt.e15pch as is. The gaps we expect to receive in playback data have all been received, and have been queried on the realtime server. We lost a total of 263 playback VCDUs, which is 0.93 MB. NIMS, UVS, PPR, and AACS experienced lost data from Segments 5 and into Segment 6, and all of this data is recoverable in Pass 2.

**Therefore, SPOT will cover the cost of these losses using margin bits. Teams' allocations will be increased by whatever the cost was of the data gaps they have due to SOHO. The updated allocations will be available on Tuesday at noon. If we have any more unexpected losses due to SOHO, changes will have to be made in Segment 8 and beyond.**

**06-30-98:** **(K. Schimmels) 1.709 MB is being released from the SPOT margin, currently at 2.82 MB, to cover the total cost of the SOHO losses. The remaining SPOT margin is 1.11 MB.**

**07-01-98:** **A considerable number of changes were required this time to adapt to changing conditions. Due to emergency recovery activities connected with the problems with the SOHO spacecraft, we lost about 1.7 Mb of downlink late last week. About 1.2 Mb of this was NIMS data being played back while the DSN was listening elsewhere. The losses could have been considerably larger. Fortunately there was sufficient office margin available to cover the loss, and accordingly we received 1.2 Mb to enable us to replay the lost data.**
**In another development we traded 1.5 Mb of our downlink allocation in E18 for 1.5 Mb held by the MWG in the present orbit. We intended to use all of this to bring down the remaining 5 Rims of 15ENSUCOMP02. However, other developments changed the plan.**
**New information on actual E15 compression values arrived this morning. Compression was poorer than expected on 15ENSUCOMP03, 15ENGLOBAL01, 15ENEUR16H01, and 15JNJPDARK01. This modified the compression estimates for pass 2 playback of those observations, and for the gap fill singles. As a result, instead of having 1.5 Mb for 15ENSUCOMP02, there was only 0.6 Mb available to expand this observation.**
**Ten new sets of playback commands were added to the playback table to recapture data lost due to the SOHO problem, and to pick up a few other small gaps. Thanks to Bob Mehlman for providing up to date compression figures, and to Bob and Frank for precise data gap times. It is likely that in next week's update we will only be able to affect the last few observations (those in segment 11). If more margin becomes available then we will be able to expand the Jupiter dark side observations that are presently only 50% selected.**

**07-08-98:** **Today's is the final update for the E15 table.**
**Playback will terminate on 19 July. We were able to convince the project that a third pass over the first part of the tape, to pick up some large gaps in 15INHRSPEC02, would be a good idea (although this triggered some soul-searching on their part).**

**E15 Playback Events Timeline** (04-10-98 to 07-19-98)

2.2 Mb of downlink capability was released this week, 1.0 to us and 1.2 to SSI. Some of this was office margin, some was inefficiency margin, and about 0.5 was contributed by PPR. The factors that enabled us to go after our 15INHRSPEC02 gaps included SSI's uncertainty about their compression. They dedicated their 1.2 Mb to giving themselves "insurance" that their last observation would in fact make it down. If all goes as predicted, that 1.2 Mb will cover the time required for us to slew across 3000 tics of tape and get to our observation. On the other hand, if they undercompress significantly, we may never get to 15INHRSPEC02.
In addition to filling our gaps, I was able to increase playback of 15JNJPDARK03 by 3 Rims, to a total of 8, out of the 10 recorded. In addition NIMS contributed about 0.03 Mb to UVS to enable them to bring down some Io data collected at the same time as 15INHRSPEC02.

07-08-98: Inspection of 15ENGLOBAL01 reveals major misalignments of adjacent scans on the limb and elsewhere. Attempts to correlate these with scan platform mis-slews begin with requests to AACS. The mis-slews are attributed to radiation effects.

07-09-98: Thanks to Playback Coordinator Kathy Schimmels for pointing out that we could add some additional playback commands for our third pass through the tape. Following some discussion we decided to play back 4 Rims (about 80%) of one of the long map mode scans of 15INHRSPEC01. Although this observation has lower resolution than 15INHRSPEC02, it covers a range of longitudes where new hot spots may be present. This observation may confirm the presence of new activity on Io.

07-19-98: Playback terminated.
NIMS downlink total was 46.68 Mbits, 1.5 Mbits over our allocation and 6 Mbits more than our total allocation in May.

## NIMS Anomaly Report - E15 Sequence

There were no NIMS processor halts detected during the E15 Encounter. Detectors 3 and 8 are still not functioning and are expected to be lost for the rest of the mission.

Also, due to problems with the gyros, the spacecraft was in AACS Cruise mode for the outbound portion of the encounter time period.

### E15 AACS Anomaly

Two AACS anomalies occurred during E15. The first AACS anomaly was during the Cruise mode period near perijove and affected the NIMS observation 15ENGLOBAL01. The second AACS anomaly occurred not long after perijove. This second anomaly caused AACS to drop out of Inertial mode into Cruise mode for the outbound portion of the encounter. Thus, all NIMS E15 outbound observations were taken in Cruise mode.

The first anomaly occurred during perijove when AACS was in Cruise mode. AACS was commanded to Cruise mode for about 10 hours during the E15 perijove period while the spacecraft was inside of Europa’s orbit. This was done so as not to use the faulty gyros in the high radiation environment. So, pointing was maintained using the star scanner alone. Unfortunatly, the high radiation environment also affected the star scanner. The high background noise in the star scanner caused errors in the attitude estimate. AACS tried to correct the scan platform pointing using the erroneous attitude estimates, which made the scan platform move in sudden spurts, producing torque-spike-like behavior. This anomaly greatly affected the pointing for the NIMS observation 15ENGLOBAL01. It is impossible to accurately reproject the data for this observation.

The second anomaly occurred at about 1998-152/09:22 about 40 minutes after AACS had been commaned to Inertial mode after the E15 perijove Cruise mode period. An AACS fault was tripped, causing the scan platform to be safed and AACS to drop back into Cruise mode. AACS remained in Cruise mode during the outbound portion of the E15 encounter period. The result of this was that all E15 outbound NIMS observations were taken in Cruise mode. 8 NIMS observations were affected.

## NIMS Archived EDRs and CUBEs

**The NIMS data are stored in EDRs (Experimental Data Records) produced by JPL-MIPS (Multi-mission Image Processing System). The NIMS Phase2 EDR is described in the NIMS EDR SIS (Software Interface Specification) Number 232-08. The same information is available in both human and machine-readable form in the PDS (Planetary Data System) structure files EDRHDR.FMT and EDRDATA.FMT in the LABEL directory of the NIMS EDR CD-ROM. Each observation has at least one EDR. The EDR file name is derived from the 12 character observation name plus a single character which allows an observation to be broken up into multiple EDRs. The EDRs have a Vicar label, followed by a PDS/ISIS label, binary header records and the data records. For archiving on CD-ROM, the Vicar labels are detached from the EDR (but kept separately on CD) and the file is renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 EDR name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter and the suffix EDR. For example, the MIPS EDR G1GNGLOBAL01A.1 becomes G1G001.EDR. More information about NIMS EDRs can be found in the VOLINFO.TXT file on the EDR CD-ROM.**

**NIMS EDR data typically require considerable processing before they are readily amenable to science analysis. Normally, the EDRs are processed into spectral image cubes by one of several sets of software. MIPS systematically processes the EDRs into CUBEs (band sequential image files) and MASKs (spatial/spectral summary images) which are distributed on the NIMS CUBE CD-ROMs. Information about the structure of the NIMS CUBEs can be found in the VOLINFO.TXT file on the CUBE CD-ROM. The name of the CUBE file is derived from the input EDR filename. For archiving on CD-ROM, the CUBE files are renamed so as to conform to the 8.3 DOS file-naming convention. The 8.3 CUBE name consists of a 2 character orbit identifier, a single character target identifier, a 3 digit counter, a single character cube-type identifier, a single character data unit-type (DN, radiance or IOF) and the suffix QUB. For example, the MIPS IOF radiance cube for the observation G1GNGLOBAL01A.1 (G1G001) becomes G1G001CR.EDR. The summary MASKs on the CD-ROM have the same 6 character name as the EDR name with the suffix JPG or GIF to denote its graphics format.**

## NIMS Data Format - Data types - Data Labels - Data Access

### Data Format

**All data files have PDS labels. The raw data (EDR) file contains time-sequential, 16 bit integers. Reduced data files (TUBES and CUBES) may be viewed as images or spectra. They contain VAX real numbers, are band sequential (BSQ - the images are stacked in band order) and have geometry information appended as backplanes after the last NIMS band.**

### Data Types

**Mask files contain summary images (3 band BSQ) and spectra of up to six selected regions that provide a quick indication of data location, data quality and spectral content. A Guide to understanding the NIMS mask is available.**

**Cube files contain data that have been projected and resampled. The core data are BSQ - spatial in the first two dimensions, and spectral in the third. Cubes of the satellites are projected in point-of-view, and, with few exceptions have no photometric correction applied. Cubes of Jupiter are (generally) projected as simple cylindrical. Cubes of Europa, Ganymede, and Callisto have been despiked. The cubes are available both in radiance and I/F (intensity divided by flux) form.**

**Tube files contain data in (almost) time order and normally have a NIMS-related 20 pixel spatial dimension (20 x n or n x 20). Projection coordinates are contained in backplanes, but the data have not been resampled. The data are in units of radiance and no despiking has been applied. All data in cubes are also available in tube form. Some data (such as spatially undersampled data) appear in tube form only.**

**A spike file contains a list of pixels that have been identified as spikes, but not replaced, in the tube. Spike files can be used to remove spikes from both tube and EDR files.**

**EDR files contain the most primitive form of the data available. They should be used only for advanced data analysis. The format is complex and the files do not form images or spectra without prior processing.**

## Data Labels

A data label (PDS form) is attached to the front of each file (except masks, which have an attached VICAR label and a detached PDS label). The labels are in ASCII keyword=value format and contain pointers to various data objects in the file, descriptions of the data objects and descriptions of the observation associated with the file. A history object in similar format follows and describes the processing steps that produced the file. Much of this information is necessary for understanding and viewing the cube. In particular, the label contains the offset to the cube, the dimensions of the cube, axes labels, and explicit wavelength information.

## Data Access

Software for processing this data is called ISIS and is available for DEC VAX VMS, SUN Solaris, DEC Alpha Digital Unix, Silicon Graphics Unix and PC LINUX systems. The Unix versions are available from the USGS Astrogeology team. Images from NIMS cubes and tubes can be viewed with any image display program which allows an offset from the beginning of the file to the selected image. Packages tested include ISIS, VICAR, ENVI, SAO IMAGE, and NASAVIEW. ISIS and ENVI (and soon NASAVIEW) additionally display spectra. The ISIS viewer is named CV (UNIX) or QL3 (VMS).

Labels may be displayed with some editors (eg DOS edit), and with most "type" and "search" functions. Some editors do not recognize the PDS line termination conventions. The label may be listed by the ISIS function LHLIST (VMS) or LABEL (UNIX).

Software for converting EDRs to cubes exist in both ISIS (DEC VAX VMS) and VICAR (DEC Alpha VMS) versions only. A primitive list of values in an EDR may be obtained with the program EDRDMP2.

## Understanding the NIMS Mask

The NIMS mask is designed to provide a quick summary of the contents of a NIMS data cube (or tube). It displays a view of both the spatial and spectral content of the data.

The mask has four regions. Starting from the upper left and proceeding clockwise: a spatial display; six or fewer representative spectra; annotation; and a spectral histogram.

The spatial display of an observation which has been projected and resampled (a cube) has a maximum size of 600x600 pixels. This is overlaid with surface coordinates and is embedded in a 700x700 grid of pixel coordinates. It is accompanied by two 1-dimensional histograms describing the raw image and the image stretched for display. The data image can range from a simple combination of up to 3 NIMS bands displayed in the RGB planes, to complicated arithmetic functions of NIMS bands displayed in the RGB planes. (The formulas appear as annotation below the histograms.) The graphics directly below the image show the input and output data histograms for the three color planes. The "shortest" color for each bin displays in front. The image also contains from one to six numbered rectangles, which show the from which averaged spectra (displayed on the right) were taken.

The spatial display of an observation in time sequence (a tube) is a graphic showing a footprint of the observation over a grid of surface coordinates on the target body. Numerals 1-6 on the graphic mark the locations of the average spectra displayed on the right.

The spectra to the right of the image may display either BDRF or radiance (or both). If both are displayed, then a vertical "radiance fence" line will appear where the breakpoint occurs. This permits display of both atmospheric data, which have significant reflectance and thermal components, and I/F satellite surface data which have strong absorptions at longer wavelengths (such as water spectra.) The spectra are labelled with wavelength in microns and location in both pixel and latitude-longitude space.

The annotation provides information about the observation, including its name, a brief description, its geometry, instrument and projection parameters. TCA is the time from Galileo's closest approach to the target body.

The 2-dimensional spectral histogram in the lower left corner shows the number of pixels at a given radiance for each wavelength. If a surface contains spatial mixtures with significantly different spatial fractions for several components, the spectra of the components will be evident in this display.