# Chapter 7 - Data Return

## Contents

## Introduction to Chapter 7

This chapter is a report on the NIMS data return for the I27 orbit. Due to the low downlink data rates available for Galileo Jupiter Operations and other unforeseen and unpredictable events during the I27 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.

The cruise portion of I27 was too short in duration to return all of the data recorded during the I27 encounter. Some of the I27 data were not recorded over during the G28 encounter and were later returned during G28 cruise.

There were twelve autonomous reloads of the NIMS RAM code from CDS during the I27 encounter, one just before each science observation. No software halts were detected during I27. The approach that we are taking to avoid data loss due to processor halts has proven to be very successful.

NIMS engineering started reporting anomalous values after a CDS bus reset event after NIMS had stopped taking science data. This was most likely due to a loss of RTI synch between NIMS and CDS due to the bus reset. The spacecraft went into safing after another bus reset event occurred during data playback. The sequence was recovered without loss of science data.

The NIMS grating became stuck some time between C22 and I24. NIMS can now return only 17 (of 408) wavelengths. This has caused a drastic change in NIMS science capabilities. Detectors 1, 2 and 7 now have very low sensitivity. Detectors 3 and 8 are still not functioning. NIMS now returns only 12 useful wavelengths. Interesting science can still be carried out given the current condition of the insturment.

The plots on the pages 3, 4 and 5 show the geometry of the NIMS I27 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 6 through 13 summarize the 'final' playback model for the 'returned' I27 data returned during I27 and G28 cruise.

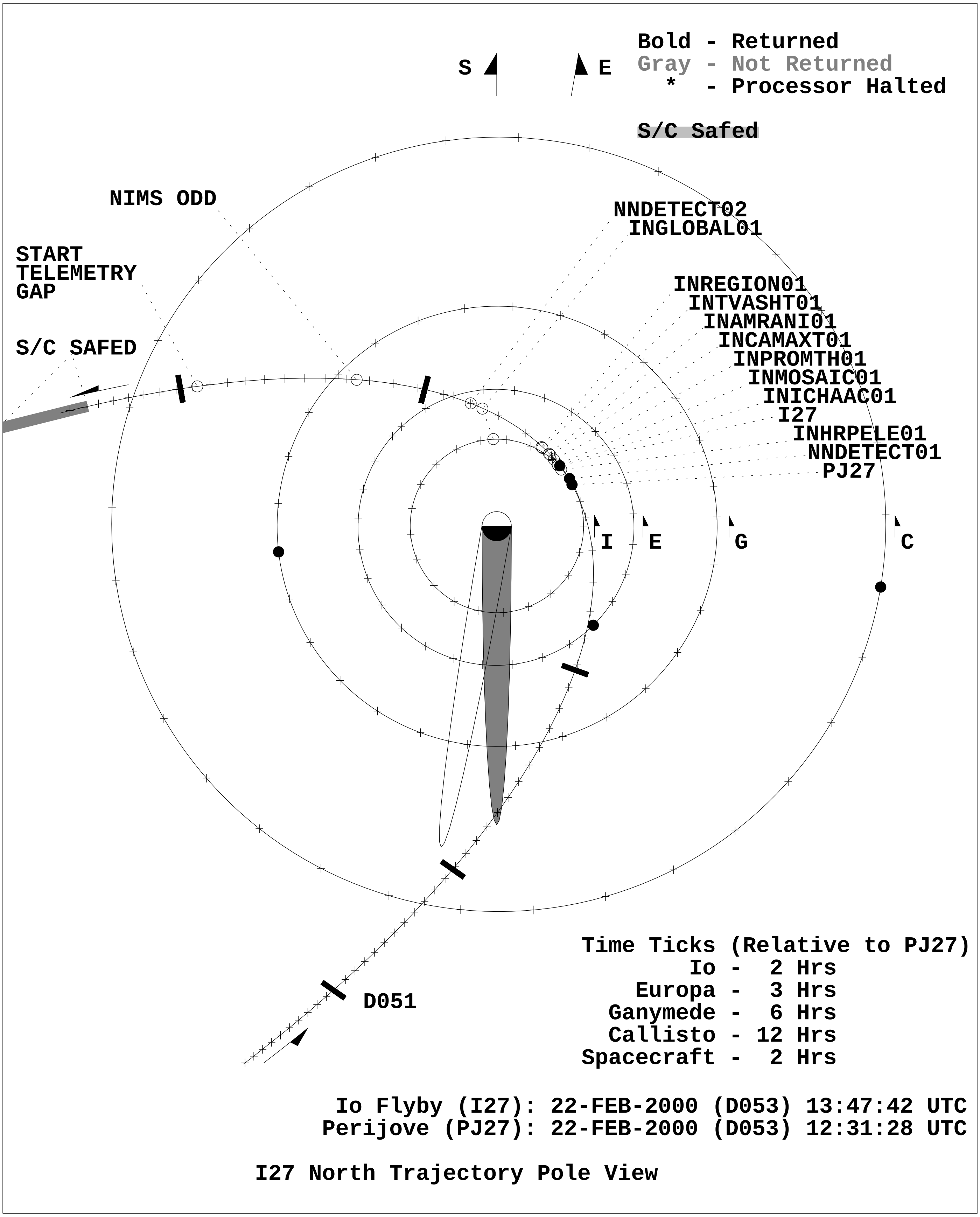
The text on page 14 gives a 'recap' of the I27 playback events which affected which observations were returned.

A Timeline of I27 playback events is on pages 14 through 24.

The text on pages 25 and 26 describes the I27 NIMS and Spacecraft Anomalies.

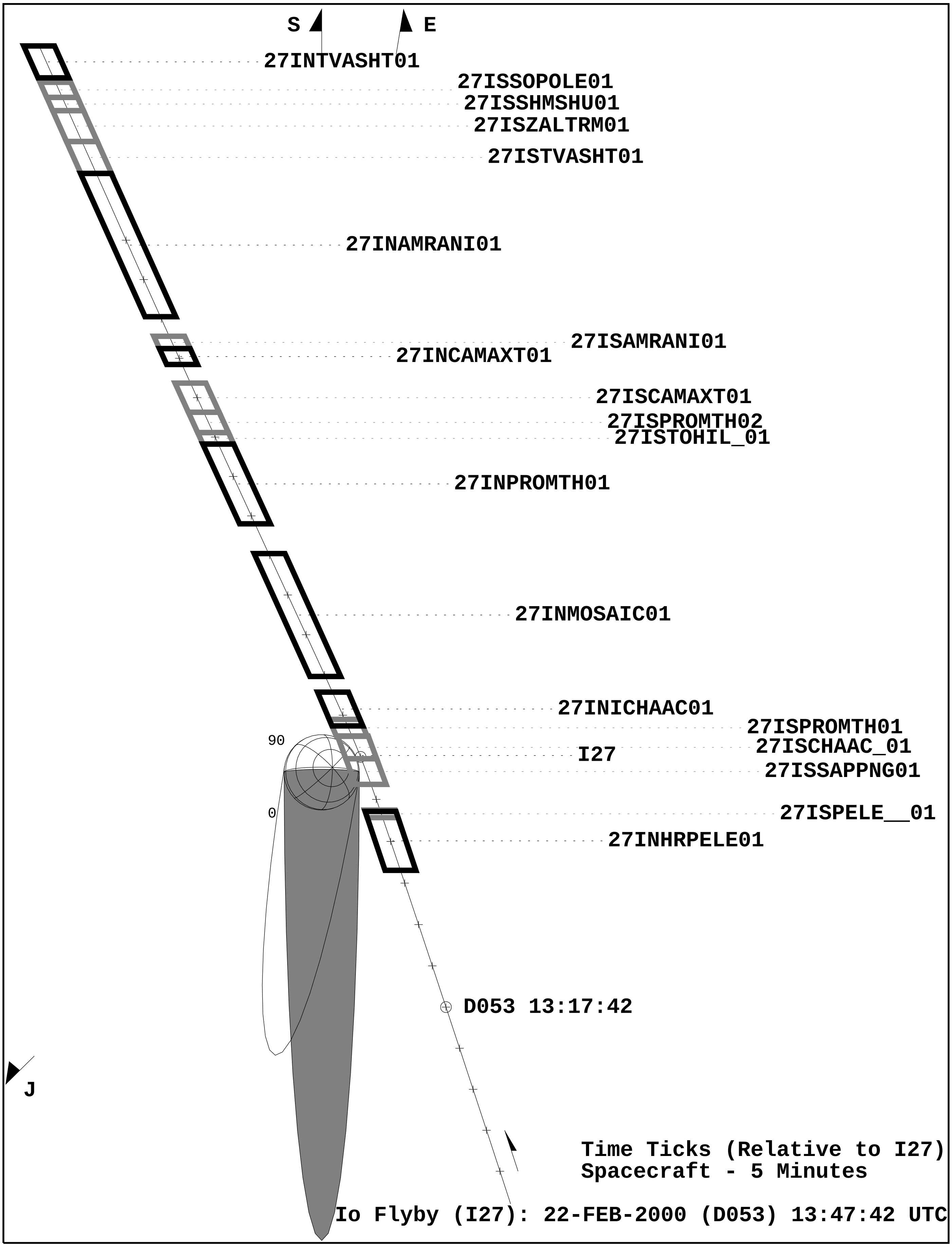
The text on page 27 gives a brief discussion of the NIMS data files. Additional information about NIMS data formats, data types, data labels and data access is given on pages 28 and 29.

# NIMS I27 OBSERVATIONS



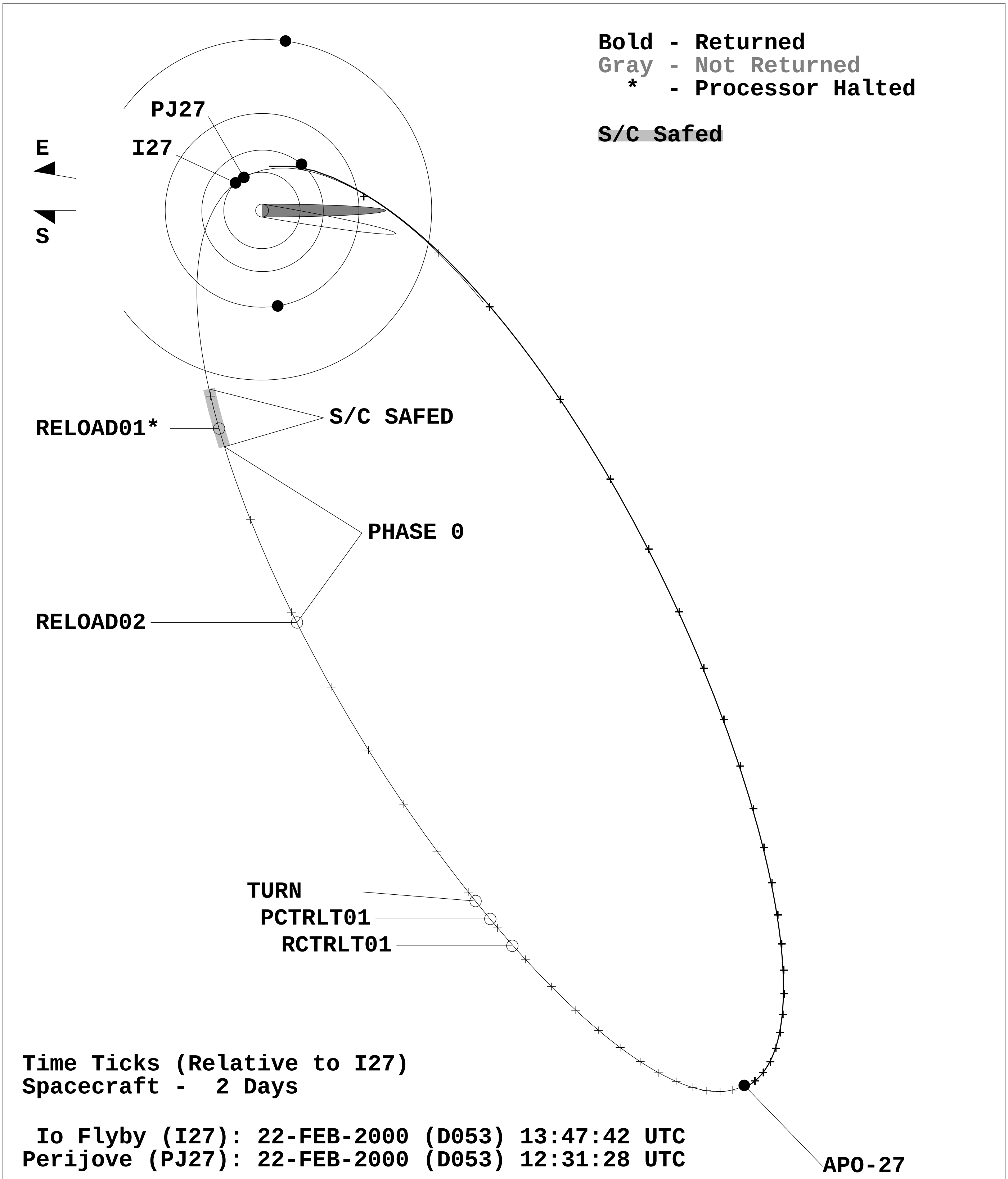

NIMS - FEL - 01/22/01

# NIMS & SSI I27 IO FLYBY OBSERVATIONS




I27 North Trajectory Pole View, +/-01 Hour NIMS - FEL - 01/27/00

# NIMS I27 CALIBRATIONS




I27 North Trajectory Pole View

NIMS - FEL - 01/10/00

# NIMS I27 DATA RETURN

| Activity ID | Observation Title | NIMS Edit Table | NIMS PB Table | Mode | Gain | Grating Strat | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 27INHRPELE01- | Io Pele Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INICHAAC01- | Io Chaac Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INMOSAIC01- | Io Mosaic Obs | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INPROMTH01- | Io Prometheus Observation | I27ILM442 | I27ILM36 | LM | 2 | 0 | 4 | MPW | |
| 27ISCAMAXT01- | Io Camaxtli Observation | I27ILM442 | I27ILM36 | LM | 2 | 0 | 4 | MPW | |
| 27INCAMAXT01- | | I27ILM442 | I27ILM36 | | 2 | | | | |
| 27INAMRANI01- | Io Amirani Observation | I27ILM442 | I27ILM36 | LM | 2 | 0 | 4 | MPW | |
| 27ISTVASHT01- | Io Tvashti Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27ISZALTRM01- | Io Tvashti Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INTVASHT01- | Io Tvashti Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INREGION01- | Io Regional Obs | I27ILM442 | I27ILM120A | LM | 2 | 0 | 4 | MPW | |
| 27NNDETECT02- | Grating Step Test P2 | I27ILM442 | I27ILM144 | | | | | | |
| 27NNRELOAD01- | NIMS Software Reload | I27ILM442 | I27ILM144 | | | | | | |
| 27NNCHOPOF01- | NIMS Chopper Off | I27ILM442 | I27ILM144 | | | | | | |
| 27NNPCTRLT01- | PCT Calibration | I27PCT252 | R/T | LM | 4 | 0 | 4 | R/T | |
| 27NNRCTRLT01- | RCT Calibration | I27RCT252 | R/T | LM | 1 | 0 | 4 | R/T | |
| 27NNROPCAL01 | NIMS OPCAL | I27OPCAL48 | R/T | LM | 4 | 0 | 4 | R/T | |
| 27INHRPELE01- | Io Pele Observation | I27ILM442 | I27ILM36S | LM | 2 | 0 | 4 | MPW | |
| 27INHRPELE01-gf | Io Pele Observation | I27ILM442 | I27ILM180 | LM | 2 | 0 | 4 | MPW | |
| 27ISPELE__01- | Io Tvashti Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27ISPROMTH01- | Io Tvashti Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INICHAAC01-gf | Io Chaac Observation | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INMOSAIC01-gf | Io Mosaic Obs | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INMOSAIC01- | Io Mosaic Obs | I27ILM442 | I27ILM144 | LM | 2 | 0 | 4 | MPW | |
| 27INREGION01-gf | Io Regional Obs | I27ILM442 | I27ILM120A | LM | 2 | 0 | 4 | MPW | |
| 27INREGION01- | Io Regional Obs | I27ILM442 | I27ILM120A | LM | 2 | 0 | 4 | MPW | |
| 27INGLOBAL01- | Io Global Obs | I27ILM442 | I27ILM36T | LM | 2 | 0 | 4 | MPW | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

# NIMS I27 DATA RETURN

| Activity ID | Mode | Record Format | Wave-lengths Returned | Record Time (sec) | PB Time (sec) | Selected Bits to Tape sBOT (MBITS) | Total Bits to Tape BOT (Mbit) | Mode Cycle (sec) | AACS Mbits c 2.5 | Comp | Total BTG (Mbits) (w/4% ohead) | Data Reduct. Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27INHRPELE01- | LM | MPW | 144 | 303 | 303 | 3.49 | 3.49 | 8.667 | 0.02 | 1.13 | 0.927 | 3.77 | 1 |
| 27INICHAAC01- | LM | MPW | 144 | 122 | 117 | 1.35 | 1.41 | 8.667 | 0.01 | 1.29 | 0.313 | 4.30 | 1 |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 499 | 5.75 | 9.70 | 8.667 | 0.03 | 1.24 | 1.391 | 4.13 | 1 |
| 27INPROMTH01- | LM | MPW | 36 | 573 | 132 | 1.52 | 6.60 | 8.667 | 0.01 | 1.08 | 0.106 | 14.40 | 1 |
| 27ISCAMAXT01- | LM | MPW | 36 | 102 | 100 | 1.15 | 1.18 | 8.667 | 0.01 | 1.19 | 0.073 | 15.87 | 1 |
| 27INCAMAXT01- | LM | MPW | 36 | 120 | 116 | 1.34 | 1.38 | 8.667 | 0.01 | 1.13 | 0.089 | 15.07 | 1 |
| 27INAMRANI01- | LM | MPW | 36 | 1,120 | 132 | 1.52 | 12.90 | 8.667 | 0.01 | 1.06 | 0.108 | 14.13 | 1 |
| 27ISTVASHT01- | LM | MPW | 144 | 41 | 37 | 0.43 | 0.47 | 8.667 | 0.00 | 1.13 | 0.113 | 3.77 | 1 |
| 27ISZALTRM01- | LM | MPW | 144 | 50 | 43 | 0.50 | 0.58 | 8.667 | 0.00 | 1.17 | 0.127 | 3.90 | 1 |
| 27INTVASHT01- | LM | MPW | 144 | 220 | 218 | 2.51 | 2.53 | 8.667 | 0.01 | 1.14 | 0.661 | 3.80 | 1 |
| 27INREGION01- | LM | MPW | 120 | 2,708 | 2001 | 23.05 | 31.20 | 8.667 | 0.12 | 1.14 | 5.055 | 4.56 | 1 |
| 27NNDETECT02- | | | | | | | | | | | | | |
| 27NNRELOAD01- | | | | | | | | | | | | | |
| 27NNCHOPOF01- | | | | | | | | | | | | | |
| 27NNPCTRLT01- | | | | | | | | | | | | | |
| 27NNRCTRLT01- | | | | | | | | | | | | | |
| 27NNROPCAL01 | | | | | | | | | | | | | |
| 27INHRPELE01- | LM | MPW | 36 | 303 | 283 | 3.26 | 3.49 | 8.667 | 0.02 | 1.50 | 0.163 | 20.00 | 2 |
| 27INHRPELE01-gf | LM | MPW | 180 | 303 | 12 | 0.14 | 3.49 | 8.667 | 0.00 | 1.13 | 0.046 | 3.01 | 2 |
| 27ISPELE__01- | LM | MPW | 144 | 33 | 30 | 0.35 | 0.38 | 8.667 | 0.00 | 1.20 | 0.086 | 4.00 | 2 |
| 27ISPROMTH01- | LM | MPW | 144 | 67 | 57 | 0.66 | 0.77 | 8.667 | 0.00 | 1.20 | 0.164 | 4.00 | 2 |
| 27INICHAAC01-gf | LM | MPW | 144 | 122 | 18 | 0.21 | 1.41 | 8.667 | 0.00 | 1.29 | 0.048 | 4.30 | 2 |
| 27INMOSAIC01-gf | LM | MPW | 144 | 842 | 172 | 1.98 | 9.70 | 8.667 | 0.01 | 1.25 | 0.476 | 4.17 | 2 |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 260 | 3.00 | 9.70 | 8.667 | 0.01 | 1.25 | 0.719 | 4.17 | 2 |
| 27INREGION01-gf | LM | MPW | 120 | 2,708 | 123 | 1.42 | 31.20 | 8.667 | 0.01 | 1.14 | 0.311 | 4.56 | 2 |
| 27INREGION01- | LM | MPW | 120 | 2,708 | 715 | 8.24 | 31.20 | 8.667 | 0.04 | 1.14 | 1.806 | 4.56 | 2 |
| 27INGLOBAL01- | LM | MPW | 36 | 1,179 | 770 | 8.87 | 13.58 | 8.667 | 0.04 | 1.15 | 0.578 | 15.33 | 2 |
| | | | | | | | | | | | 13.359 | **Total** | |
| | | | | | | | | | | | 12.999 | **Allocation** | |
| | | | | | | | | | | | 0.36 | **Over/Under** | |

# NIMS G28 DATA RETURN

| Activity ID | Observation Title | NIMS Edit Table | NIMS PB Table | Mode | Gain | Grating Start | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 27INICHAAC01- | | I27ILM442 | G28ILM144Comp | LM | 2 | 0 | 0 | MPW | |
| 27INMOSAIC01- | | I27ILM442 | G28ILM144Comp | LM | 2 | 0 | 0 | MPW | |
| 27INPROMTH01- | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| 27INTOHIL_01+ | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| 27INPROMTH02+ | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| 27INCAMAXT01+ | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| 27INCAMAXT01- | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| 27INAMRANI01- | | I27ILM442 | G28ILM360 | LM | 2 | 0 | 0 | MPW | |
| | | | | | | | | | |
| 28GNCALDRA01+ | | G28GLM442 | G28GLM360 | | 2 | | | | |
| 28GNFEATRE01 | Ganymede Hi-Res Feature | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28GNSMOOTH02+ | | G28GLM442 | G28GLM360 | | 2 | | | | |
| 28GNBRTDRK02+ | | G28GLM442 | G28GLM360 | | 2 | | | | |
| 28GNNICHOL02+ | | G28GLM442 | G28GLM360 | | 2 | | | | |
| 28GNARBELA02+ | | G28GLM442 | G28GLM360 | | 2 | | | | |
| 28GNLMSCAN01 | Ganymede Limb Scan | G28GLM442 | G28GLM360 | LM | 4 | 0 | 4 | MPW | |
| 28GNGLOBAL01 | Ganymede Global Composition Map | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28ENECLPSE01 | Europa Eclipse Obs | G28ELM442 | G28ELM360 | LM | 4 | 0 | 4 | MPW | |
| 28JNNEBRLT01 | Jupiter NEB R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNNTZRLT01 | Jupiter NTZ R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNNEBRLT02 | Jupiter NEB R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNNTZRLT02 | Jupiter NTZ R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNNEBRLT03 | Jupiter NEB R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNNTZRLT03 | Jupiter NTZ R/T OBS | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE01 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE02 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE03 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE04 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE05 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNAURORA02 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA04 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA05 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK01+ | | G28JLM442 | G28JLM360 | | 2 | | | | |
| 28JNGLOBAL02 | Jupiter Global Observation | G28JGM17A | G28JXM15 | XM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK02+ | | G28JLM442 | G28JLM360 | | 2 | | | | |

# NIMS G28 DATA RETURN

| Activity ID | Observation Title | NIMS Edit Table | NIMS PB Table | Mode | Gain | Grating Start | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 28JNAURORA08 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK03+ | | G28JLM442 | G28JXM15_NGM | | 2 | | | | |
| 28JNFEATRK03+ | | G28JLM442 | G28JXM15_NGM | | 2 | | | | |
| 28JNAURORA09 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNEQBLGE06 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE07 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE08 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE09 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| 28JNEQBLGE10 | Jupiter Equatorial Bulge | G28JLM442 | R/T | LM | 2 | 0 | 4 | R/T | |
| | | | | | | | | | |
| 28NNRCTRLT01- | RCT Calibration | G28RCT252 | R/T | LM | 1 | 0 | 4 | R/T | |
| 28NNROPCAL01 | NIMS OPCAL | G28OPCAL48 | R/T | LM | 4 | 0 | 4 | R/T | |
| 28NNPCTRLT01- | PCT Calibration | G28PCT252 | R/T | LM | 4 | 0 | 4 | R/T | |
| | | | | | | | | | |
| 27INPROMTH01+ | | I27ILM442 | G28ILM144Comp | | 2 | | | | |
| 27INMOSAIC01-gf | | I27ILM442 | G28ILM144Comp | | 2 | | | | |
| 27INMOSAIC01- | | I27ILM442 | G28ILM288 | | 2 | | | | |
| 27INMOSAIC01-gf | | I27ILM442 | G28ILM144Comp | | 2 | | | | |
| 27INPROMTH01-gf | | I27ILM442 | G28ILM360 | | 2 | | | | |
| 27INCAMAXT01+gf | | I27ILM442 | G28ILM360 | | 2 | | | | |
| 27INAMRANI01-gf | | I27ILM442 | G28ILM360 | | 2 | | | | |
| 28GNFEATRE01-gf | Ganymede Hi-Res Feature | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28GNLMSCAN01 | Ganymede Limb Scan | G28GLM442 | G28GLM360 | LM | 4 | 0 | 4 | MPW | |
| 28GNPERRIN01 | Ganymede Perrine Region | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28GNGLOBAL01-gf | Ganymede Global Composition Map | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28GNGLOBAL01 | Ganymede Global Composition Map | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28ENECLPSE01-gf | Europa Eclipse Obs | G28ELM442 | G28ELM360 | LM | 4 | 0 | 4 | MPW | |
| 28JNAURORA01 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA02-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA03 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA04-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNGLOBAL01 | Jupiter Global Observation | G28JGM17A | G28JXM15 | XM | 2 | 0 | 4 | MPW | |
| 28JNAURORA05-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA06 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK01+gf | | G28JLM442 | G28JLM360 | | 2 | | | | |

# NIMS G28 DATA RETURN

| Activity ID | Observation Title | NIMS Edit Table | NIMS PB Table | Mode | Gain | Grating Start | Grating Offset | Record Format | PSID |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| 28JNAURORA07 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK02+gf | | G28JLM442 | G28JLM360 | | 2 | | | | |
| 28JNAURORA08-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNFEATRK03+gf | | G28JLM442 | G28JXM15_NGM | | 2 | | | | |
| 28JNGLOBAL03 | Jupiter Global Observation | G28JGM17A | G28JXM15 | XM | 2 | 0 | 4 | MPW | |
| 28JNAURORA10 | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| | | | | | | | | | |
| 27INMOSAIC01-gf | | I27ILM442 | G28ILM144Comp | | 2 | | | | |
| 28GNLMSCAN01-gf | Ganymede Limb Scan | G28GLM442 | G28GLM360 | LM | 4 | 0 | 4 | MPW | |
| 28GNGLOBAL01-gf | Ganymede Global Composition Map | G28GLM442 | G28GLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA04-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNGLOBAL01-gf | Jupiter Global Observation | G28JGM17A | G28JXM15 | XM | 2 | 0 | 4 | MPW | |
| 28JNAURORA07-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| 28JNAURORA10-gf | Jupiter Northern Aurora Mapping | G28JLM442 | G28JLM360 | LM | 2 | 0 | 4 | MPW | |
| gf = gap fill | | | | | | | | | |
| (+) = ridealong with SSI | | | | | | | | | |

# NIMS G28 DATA RETURN

| Activity ID | Mode | Record Format | Wave-lengths Returned | Record Time (sec) | Playback Time (sec) | Selected Bits to Tape sBOT (MBITS) | Bits to Tape BOT(Mbit) | Mode Cycle (sec) | AACS Mbits c 2.5 | Comp | Total BTG Mbits (w/4% ohead) | Data Reduct. Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27INCHAAC01- | LM | MPW | 144 | 122 | 117 | 1.35 | 1.41 | 8.667 | 0.01 | 1.29 | 0.313 | 4.30 | 1 |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 842 | 9.70 | 9.70 | 8.667 | 0.05 | 1.23 | 2.366 | 4.10 | 1 |
| 27INPROMTH01- | LM | MPW | 360 | 573 | 573 | 6.60 | 6.60 | 8.667 | 0.03 | 1.22 | 4.058 | 1.63 | 1 |
| 27ISTOHIL_01+ | LM | MPW | 360 | 102 | 27 | 0.31 | 1.18 | 8.667 | 0.00 | 1.28 | 0.182 | 1.71 | 1 |
| 27ISPROMTH02+ | SAFE | MPW | 15 | 102 | 45 | 0.52 | 1.18 | 0.333 | 0.00 | 1.30 | 0.324 | 1.60 | 1 |
| 27ISCAMAXT01+ | LM | MPW | 360 | 102 | 100 | 1.15 | 1.18 | 8.667 | 0.01 | 1.24 | 0.697 | 1.65 | 1 |
| 27INCAMAXT01- | LM | MPW | 360 | 120 | 116 | 1.34 | 1.38 | 8.667 | 0.01 | 1.20 | 0.835 | 1.60 | 1 |
| 27INAMRANI01- | LM | MPW | 360 | 1120 | 1120 | 12.90 | 12.90 | 8.667 | 0.06 | 1.18 | 8.200 | 1.57 | 1 |
| | | | | | | | | | | | | | |
| 28GSCALDRA01+ | SAFE | MPW | 15 | 102 | 28 | 0.32 | 1.18 | 0.333 | 0.00 | 3.03 | 0.087 | 3.73 | 1 |
| 28GNFEATRE01 | LM | MPW | 360 | 484 | 483 | 5.56 | 5.58 | 8.667 | 0.03 | 2.36 | 1.768 | 3.15 | 1 |
| 28GSSMOOTH02+ | LM | MPW | 360 | 102 | 10 | 0.12 | 1.18 | 8.667 | 0.00 | 2.54 | 0.034 | 3.39 | 1 |
| 28GSBRTDRK02+ | LM | MPW | 360 | 102 | 10 | 0.12 | 1.18 | 8.667 | 0.00 | 2.64 | 0.033 | 3.52 | 1 |
| 28GSNICHOL02+ | LM | MPW | 360 | 102 | 10 | 0.12 | 1.18 | 8.667 | 0.00 | 2.57 | 0.034 | 3.43 | 1 |
| 28GSARBELA02+ | LM | MPW | 360 | 102 | 44 | 0.51 | 1.18 | 8.667 | 0.00 | 2.41 | 0.158 | 3.21 | 1 |
| 28GNLMBSCN01 | LM | MPW | 360 | 720 | 360 | 4.15 | 8.29 | 8.667 | 0.02 | 2.27 | 1.370 | 3.03 | 1,2 |
| 28GNGLOBAL01 | LM | MPW | 360 | 720 | 360 | 4.15 | 8.29 | 8.667 | 0.02 | 1.82 | 1.709 | 2.43 | 1,2 |
| 28ENECLPSE01 | LM | MPW | 360 | 63 | 60 | 0.69 | 0.73 | 8.667 | 0.00 | 1.34 | 0.387 | 1.79 | 1 |
| 28JNNEBRLT01 | LM | RT | 360 | 480 | 480 | 0.00 | 0.00 | 8.667 | 0.03 | | | | |
| 28JNNTZRLT01 | LM | RT | 360 | 420 | 420 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNNEBRLT02 | LM | RT | 360 | 480 | 480 | 0.00 | 0.00 | 8.667 | 0.03 | | | | |
| 28JNNTZRLT02 | LM | RT | 360 | 420 | 420 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNNEBRLT03 | LM | RT | 360 | 480 | 480 | 0.00 | 0.00 | 8.667 | 0.03 | | | | |
| 28JNNTZRLT03 | LM | RT | 360 | 420 | 420 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE01 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE02 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE03 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE04 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE05 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNAURORA02 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 1.10 | 1.233 | 1.47 | 1 |
| 28JNAURORA04 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.19 | 0.619 | 2.92 | 1 |
| 28JNAURORA05 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.25 | 0.603 | 3.00 | 1 |
| 28JSFEATRK01+ | LM | MPW | 360 | 102 | 219 | 2.52 | 1.18 | 8.667 | 0.01 | 2.27 | 0.834 | 3.03 | 1 |
| 28JNGLOBAL02 | XM | MPW | 15 | 343 | 340 | 3.92 | 3.95 | 0.333 | 0.02 | 2.52 | 1.264 | 3.10 | 1 |
| 28JSFEATRK02+ | LM | MPW | 360 | 357 | 355 | 4.09 | 4.11 | 8.667 | 0.02 | 2.41 | 1.273 | 3.21 | 1 |

# NIMS G28 DATA RETURN

| Activity ID | Mode | Record Format | Wave-lengths Returned | Record Time (sec) | Playback Time (sec) | Selected Bits to Tape sBOT (MBITS) | Bits to Tape BOT(Mbit) | Mode Cycle (sec) | AACS Mbits c 2.5 | Comp | Total BTG Mbits (w/4% ohead) | Data Reduct. Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28JNAURORA08 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.21 | 0.614 | 2.95 | 1 |
| 28JSFEATRK03+ | XS | MPW | 15 | 357 | 173 | 1.99 | 4.11 | 0.1667 | 0.01 | 3.37 | 0.961 | 2.07 | 1 |
| 28JSFEATRK03+ | XM | MPW | 15 | 357 | 182 | 2.10 | 4.11 | 0.333 | 0.01 | 2.63 | 0.648 | 3.23 | 1 |
| 28JNAURORA09 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.21 | 0.614 | 2.95 | 1 |
| 28JNEQBLGE06 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE07 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE08 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE09 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| 28JNEQBLGE10 | LM | RT | 360 | 300 | 300 | 0.00 | 0.00 | 8.667 | 0.02 | | | | |
| | | | | | | | | | | | | | |
| 28NNRCTRLT01 | LM | RT | 252 | | | | | 8.667 | | | | | |
| | LM | RT | 48 | | | | | 8.667 | | | | | |
| 28NNPCTRLT01 | LM | RT | 252 | | | | | 8.667 | | | | | |
| | | | | | | | | | | | | | |
| 27ISPROMTH02+ | LM | MPW | 144 | 67 | 33 | 0.38 | 0.77 | 8.667 | 0.00 | 1.30 | 0.088 | 4.33 | 2 |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 45 | 0.52 | 9.70 | 8.667 | 0.00 | 1.20 | 0.130 | 4.00 | 2 |
| 27INMOSAIC01- | LM | MPW | 288 | 842 | 93 | 1.07 | 9.70 | 8.667 | 0.01 | 1.20 | 0.536 | 2.00 | 2 |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 19 | 0.22 | 9.70 | 8.667 | 0.00 | 1.20 | 0.055 | 4.00 | 2 |
| 27INPROMTH01- | LM | MPW | 360 | 573 | 26 | 0.30 | 6.60 | 8.667 | 0.00 | 1.20 | 0.187 | 1.60 | 2 |
| 27ISCAMAXT01+ | LM | MPW | 360 | 102 | 8 | 0.09 | 1.18 | 8.667 | 0.00 | 1.20 | 0.058 | 1.60 | 2 |
| 27INAMRANI01- | LM | MPW | 360 | 1120 | 179 | 2.06 | 12.90 | 8.667 | 0.01 | 1.18 | 1.311 | 1.57 | 2 |
| 28GNFEATRE01 | LM | MPW | 360 | 484 | 16 | 0.18 | 5.58 | 8.667 | 0.00 | 2.36 | 0.059 | 3.15 | 2 |
| 28GNLMBSCN01 | LM | MPW | 360 | 720 | 369 | 4.25 | 8.29 | 8.667 | 0.02 | 2.32 | 1.374 | 3.09 | 1,2 |
| 28GNPERRIN01 | LM | MPW | 360 | 483 | 480 | 5.53 | 5.56 | 8.667 | 0.03 | 2.16 | 1.920 | 2.88 | 2 |
| 28GNGLOBAL01 | LM | MPW | 360 | 720 | 10 | 0.12 | 8.29 | 8.667 | 0.00 | 1.83 | 0.047 | 2.44 | 1,2 |
| 28GNGLOBAL01 | LM | MPW | 360 | 720 | 368 | 4.24 | 8.29 | 8.667 | 0.02 | 1.83 | 1.737 | 2.44 | 1,2 |
| 28ENECLPSE01 | LM | MPW | 360 | 63 | 7 | 0.08 | 0.73 | 8.667 | 0.00 | 1.34 | 0.045 | 1.79 | 2 |
| 28JNAURORA01 | LM | MPW | 360 | 160 | 154 | 1.77 | 1.84 | 8.667 | 0.01 | 2.22 | 0.599 | 2.96 | 2 |
| 28JNAURORA02 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.14 | 0.634 | 2.85 | 2 |
| 28JNAURORA03 | LM | MPW | 360 | 160 | 160 | 1.84 | 1.84 | 8.667 | 0.01 | 2.16 | 0.640 | 2.88 | 2 |
| 28JNAURORA04 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.31 | 0.587 | 3.08 | 2 |
| 28JNGLOBAL01 | XM | MPW | 15 | 303 | 300 | 3.46 | 3.49 | 0.333 | 0.02 | 2.44 | 1.152 | 3.00 | 2 |
| 28JNAURORA05 | LM | MPW | 360 | 160 | 10 | 0.12 | 1.84 | 8.667 | 0.00 | 2.25 | 0.038 | 3.00 | 2 |
| 28JNAURORA06 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.25 | 0.603 | 3.00 | 2 |
| 28JSFEATRK01+ | LM | MPW | 360 | 102 | 18 | 0.21 | 1.18 | 8.667 | 0.00 | 2.27 | 0.069 | 3.03 | 2 |

# NIMS G28 DATA RETURN

| Activity ID | Mode | Record Format | Wave-lengths Returned | Record Time (sec) | Playback Time (sec) | Selected Bits to Tape sBOT (MBITS) | Bits to Tape BOT(Mbit) | Mode Cycle (sec) | AACS Mbits c 2.5 | Comp | Total BTG Mbits (w/4% ohead) | Data Reduct. Factor (sBOT/BTG) | Pass |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28JNAURORA07 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.37 | 0.572 | 3.16 | 2 |
| 28JSFEATRK02+ | LM | MPW | 360 | 357 | 16 | 0.18 | 4.11 | 8.667 | 0.00 | 2.41 | 0.057 | 3.21 | 2 |
| 28JNAURORA08 | LM | MPW | 360 | 160 | 16 | 0.18 | 1.84 | 8.667 | 0.00 | 2.21 | 0.063 | 2.95 | 2 |
| 28JSFEATRK03+ | XS | MPW | 15 | 357 | 96 | 1.11 | 4.11 | 0.1667 | 0.01 | 3.37 | 0.533 | 2.07 | 2 |
| 28JNGLOBAL03 | XM | MPW | 15 | 320 | 317 | 3.65 | 3.69 | 0.333 | 0.02 | 2.68 | 1.108 | 3.30 | 2 |
| 28JNAURORA10 | LM | MPW | 360 | 160 | 157 | 1.81 | 1.84 | 8.667 | 0.01 | 2.21 | 0.614 | 2.95 | 2 |
| | | | | | | | | | | | | | |
| 27INMOSAIC01- | LM | MPW | 144 | 842 | 198 | 2.28 | 9.70 | 8.667 | 0.01 | 1.20 | 0.570 | 4.00 | 3 |
| 28GNLMBSCN01 | LM | MPW | 360 | 720 | 36 | 0.41 | 8.29 | 8.667 | 0.00 | 2.32 | 0.134 | 3.09 | 3 |
| 28GNGLOBAL01 | LM | MPW | 360 | 720 | 12 | 0.14 | 8.29 | 8.667 | 0.00 | 1.83 | 0.057 | 2.44 | 3 |
| 28JNAURORA04 | LM | MPW | 360 | 160 | 11 | 0.13 | 1.84 | 8.667 | 0.00 | 2.31 | 0.041 | 3.08 | 3 |
| 28JNGLOBAL01 | XM | MPW | 15 | 303 | 17 | 0.20 | 3.49 | 0.333 | 0.00 | 2.44 | 0.065 | 3.00 | 3 |
| 28JNAURORA07 | LM | MPW | 360 | 160 | 10 | 0.12 | 1.84 | 8.667 | 0.00 | 2.37 | 0.036 | 3.16 | 3 |
| 28JNAURORA10 | LM | MPW | 360 | 160 | 10 | 0.12 | 1.84 | 8.667 | 0.00 | 2.21 | 0.039 | 2.95 | 3 |
| | | | | | | | | | | | 46.975 | Total | |
| | | | | | | | | | | | 51.760 | Allocatation | |
| | | | | | | | | | | | -4.785 | Over/Under | |

## RECAP OF I27 PLAYBACK EVENTS

I27 contained excellent Io observing opportunities and was subject to significant downlink bits constraints. After the encounter executed successfully, a strategy to improve the total I27 data return was implemented. This involved carrying over 1 track of I27 data for playback in G28. This strategy led to a significant increase in the I27 data that could be returned.

NIMS did not experience any software stoppages in I27 during the encounter. However, following initiation of playback, the spacecraft went into safe mode, causing NIMS to shut down at the same time. This event was diagnosed and a recovery plan was implemented very rapidly, resulting in the loss of only about 1.75 Megabits of downlink capability.

Although the total data returned for NIMS in I27 was only a little over 13 Mbits, the high quality of the observations made this one of the premier Io orbits of the mission.

The following timeline details the most signifigant events of the I24 playback period. Most of the text below is excerpted from messages issued at the time.

### I27 Playback Events Timeline (02-01-00 to 05-05-00)

**02-01-00:** A summary of NIMS I27 observation objectives:
Io is the sole target for NIMS observations during I27. NIMS made two observation of Io during closest approach. First was a nightside observation of Pele to map thermal emission from the hot spot at high spatial resolution (down to about 1 km/pixel). The following observation was a dayside jail-bar across the Chaac region (at about the same resolution) covering the strangely-colored "golf course" discovered in earlier orbits by SSI.
The five subsequent observations look at key areas of Io as the spacecraft recedes from the target. 27INMOSAIC01 is a two-swath mosaic across the Chaac region. 27INPROMTH01 is a single-swath across the Prometheus hotspot region. With SSI we look at the Camaxtli hot spot in 25INCAMAXT01. The Amirani hot spot was observed in a three swath mosaic in 27INAMRANI01. 27INTVASHT01 is a single swath mosaic across the Tvahstar caldera complex.
At still greater distances are two larger observations, 27INREGION01 (which covers the Prometheus and Bosphorus Regio regions), and 27INGLOBAL01, which features pole-to-pole coverage at relatively good resolution, at a very low phase angle.

**<u>I27 Playback Events Timeline</u> (02-01-00 to 05-05-00)**

**02-01-00:** (K. Schimmels) I27 allocations, etc. are shown below. A few notes: We took a large (12 MB, 11%) hit to science capability late in the game due to station losses. This will most likely NOT come back to us. This is primarily the reason why everyone is over allocation now. Try to resolve these overages in the next playback table delivery if possible (EOD tomorrow).

| I27 Totals: | Alloc. | Total |
|---|---|---|
| NIMS | 13.283 | 17.810 |

**02-08-00:** (K. Schimmels) AACS charges (with reduced NIMS AACS) are: NIMS: 0.217 Mb.

**02-08-00:** Tomorrow at 9:30 SSI will present a "plan" for preserving 1 track of I27 data for playback in G28 (with accompanying loss of some G28 recording).
Here is a brief review of our current status and options regarding I27 data.
Our current allocation lets us get about 20% of what we will record to tape, BUT since we are oversampling due to the fixed grating, we can cut our wavelengths back by half (to FM) without serious consequences for the science. Not returning detectors 1, 2, 7 helps a bit more, getting us to our present state. We now plan to get data for 12 detectors for all observations currently selected. We do not have enough allocation to select any of 27INGLOBAL01, and we can bring down only one scan (of 3) for 27INREGION01.
It is possible that we will lose another 16% of our I27 allocation due to DSN negotiations. This would effectively reduce our REGION01 playback to zero.
As we discussed last week, we could reduce our detectors coverage further, to 9-17 plus one for albedo (detector 6?). This would save 17% across the board and let us get a second scan of 27INREGION01 (assuming we do not suffer the 16% penalty mentioned previously).
Bottom line, it is unlikely that we will get our full spatial coverage of 27INREGION01, or see any part of 27INGLOBAL01, as things now stand. Any increases in spatial coverage will come at the loss of spectral channels.

**02-09-00:** (D. Bindschadler)
Subj: Proposed changes to G28 encounter sequence
The SPOT team met with Proj. Scientist (TVJ) today (2/9/00) to discuss issues of a possible carryover of I27 data into G28. Herb Breneman made a presentation of a strawman plan put together by the SSI Team in order to allow for such carryover.
After the discussion, Torrence agreed that the plan was essentially consistent with overall GMM science priorities. Also, the operational complexities required by this plan appear to be broadly consistent with SPOT capabilities over the next few months.

## <u>I27 Playback Events Timeline</u> (02-01-00 to 05-05-00)

Below is an outline of the modified G28 plan, as presented by Herb and then modified in the course of our discussions. Science coordinators should communicate the relevant portions of this with their teams and make sure that there are no significant science concerns that have been neglected. Coordinators and integrators need to assess the impact of the proposed plan on their workload so that we are sure it is supportable.
The SSI proposal is to record only 3 tracks of data during the G28 encounter period (approximately DOY 140 through 165), allowing Track 4 of the I27 record sequence (the post C/A track) to be carried over into G28. The primary rationale for this change is the science value of the I27 SSI and NIMS data, coupled with the relatively small amount of bits to ground (~88 MBTG) available for all I27 playback.

**02-11-00:** Today's is the final update before uplink. E26 playback ends on 19 February, and I27 playback begins on the 23rd. The preliminary schedule shows the first NIMS data coming down on 14 March.
A plan to restructure G28 data recording in order to preserve valuable I27 Io data on track 4 for playback during G28 has been proposed. Since both SSI and NIMS favor this strategy, it will probably be implemented, unless some presently unforseen consequence prevents this. The playback table delivered today has not been modified to conform to the proposed plan. We expect that there will be another opportunity to modify the playback table before our first playback commands go active.
The principal consequence for NIMS of the proposed plan will be to shift playback of roughly 90% of the data for the following observations from I27 to G28. The affected observations are: 27INPROMTH01, 27INCAMAXT01, and 27INAMIRANI01. This will permit us to bring back a greater portion of the spatial coverage of 27INREGION01 during I27. To accomplish this the next playback table delivered will differ significantly from this one.
A considerable number of timing changes were made this time, to fine-tune and optimize the data return. In some cases, for instance, the durations of the scan platform motion and the recording of data do not coincide exactly. Savings were accomplished by commanding for return only the recorded data obtained during scan platform slewing. These and other changes permitted us to increase our data return for 27INREGION01 by a little over a RIM. We are now bringing down the full first scan over the target during the first playback pass, with a portion of the second scan commanded for pass 2.

**02-17-00:** (K. Schimmels) We had another slight decrease in this last round of station allocations - about 0.89 MB.
Your new allocations are reflected below.

| I27 Totals: | Alloc. | Total |
|---|---|---|
| NIMS | 14.831% | 12.630 |

## I27 Playback Events Timeline (02-01-00 to 05-05-00)

**02-20-00:** I27 encounter begins at 04:00 UTC.

**02-22-00:** Perijove occurs at 12:31 UTC, followed by Io close approach at 13:47 UTC.

**02-22-00:** (J. Erickson) The Galileo spacecraft is operating normally. Background radiation (as measured by our star scanner) still appears to be within normal limits and peaked at around 910 pulse counts. As of this time more than 95% of the planned observations have been completed, and the encounter appears to be a success. Playback begins on 2/23.

**02-22-00:** (R. Mehlman) Only 3 SCLKs have been received from the encounter. All have been good. The first preceded our first observation. The second was just before recording of INREGION01 began, but right after the reload preceding it, so tells us nothing. The third was almost 3 hours after INGLOBAL01, telling us that no halts occurred during that observation. I'm afraid there is no way to tell if any halts occurred during the other observations before we start playback -- unless, of course, some lost SCLKs show up.

**02-24-00:** (J. Erickson) The Galileo spacecraft is presently in safing, with both CDS strings operating, and other subsystems normal. The safing is believed to be a CDS despun bus reset, the third of this encounter. During encounters, the spacecraft is now equipped with a software routine that detects a despun bus reset and enables the CDS to "ignore" it and continue the encounter without interruption. However, this software routine must be disabled during tape recorder playback, which began last night. We haven't previously seen a bus reset happen at this distance from Jupiter, as it occurred at about 29 Rj (Jupiter radii). We are about to begin recovery, and expect to complete the process this evening.

**02-25-00:** (J. Erickson) This was another picture perfect encounter, with normal execution of all planned activities. Close approach to Io was at 6:32 a.m. PST ground receipt time, at an altitude of 198 km. Remote sensing observations and fields and particles recordings of Io were completed without incident. A radio science near-occultation of Jupiter was recorded at the DSN normally. Playback began 2/23/00 at approximately 12:22 p.m. PST ground receipt time. Radiation levels were about average, with no problems identified. The peak radiation level was around 900 (measured by the star scanner in pulse counts), significantly lower than the maximum of 1400 seen in previous GEM orbits. During the encounter a pair of standard bus resets occurred and was handled normally by the on-board recovery software without any effect on the planned sequence. The first occurred at approximately 1:38 a.m. on 2/22/00, and the second occurred during a window from 5:30 p.m. to 6:30 p.m. on 2/22/00 PST ground receipt time.

Subsequent to the encounter, a third bus reset hit the spacecraft at 4:45 a.m. on 2/24 PST ground receipt time, forcing it into safing. The flight team diagnosed the problem and the spacecraft was brought back into normal operations at 9:30 p.m. PST ground receipt time. Playback will resume on 2/26.

02-25-00: (J. Erickson) It looks like we have lost about 3+ megabits of playback capability due to the problem. This is a first time in orbital operations we've seen one of these resets out of the usual radiation environment. Something else to watch. And we're approaching another milestone. G-28 will put us over the three times radiation design limit. Wow! What's that old Timex commercial - "Takes a lickin, but keeps on . . ."
Because of the s/c anomaly that resulted in safing earlier today, commands have been approved to turn PLS HV back on. MAG is currently off, but the MAGON real time command package is available and will be requested as appropriate in the near future. NIMS will also need to be turned on and its Phase 2 flight software reloaded. The next scheduled activity for NIMS is a PCT calibration on DOY 71.
I27 playback was initiated yesterday and appeared nominal at that time. Planned science activities that have been interrupted by today's anomaly and safing include:
(1) playback, (2) EUV realtime acquisition of Io Torus data, (3) DDS RTS data collection, and (4) MAG optimal averager data collection (returned via MRO).
A new playback table will need to be developed and uplinked in order for I27 playback to proceed.

02-25-00: (K. Schimmels) Playback terminated during safing on Thursday. Playback will reinitiate Saturday at 12:09 PM. Playback is being done in a first-in/first-out fashion this orbit (at least at this point). We are starting pass 1 with track 2 and playing back I27 data in order. Playback had begun prior to safing, and the PPR RCT Calibration as well as some of the first PPR Jupiter Limb 01 observation were already on the ground. The new playback table picks up a new segment 1 with the very next observation - PPR Jupiter Limb 02.

02-25-00: (M. Segura) The latest news about the spacecraft safing is as follows: The time has been refined to DOY 55 ~ 12:00 SCET. The cause is believed to be simultaneous bus resets on both the CDS A and B strings.
Recovery commands were sent late yesterday afternoon and early evening which resulted in the OTM being planned right on schedule. The I27 cruise load will uplink late today/early tomorrow and go active around noon Saturday.
Now on to NIMS status:

There was a significant drop in the power supply, grating, and mirror currents at ~ DOY 54/05:39 scet while all temperatures remained in nominal ranges. This state continued until the safing event which turns the instrument off. The curious thing about this behavior is that the phase 2 clock values kept updating but not with the 2 rim offset from CDS time - only 1 rim difference was observed. There appeared to be no change in s/c power states at the time NIMS telemetry showed a drop in current and no conflicting or competing activities in the sequence.
The next NIMS activity was to be the final reload and chopper off activity on DOY 56 (which got wiped out because of the safing). Typically, when the phase 2 software gets corrupted and crashes, the current values drop to zero and the clock values stop updating. However in the past few orbits, the clock value in channel S1931 had continued to update even after a crash. With this in mind, we were waiting anxiously for the phase 2 reload to occur and the current telemetry channels to "reset".
Due to the safing, we've lost the ability to determine if the reload would have successfully fixed the telemetry or if we truly have another instrument anomaly. The best approach to attempt to make that assessment in the current situation is to turn the instrument back on - and not immediately reload the phase 2 software and monitor the currents for a period of time.
Our recovery plan has the instrument power coming on ~ 12:30 or so Saturday with a reload occurring 48 hours later. I will be in to monitor the currents on Saturday afternoon and will send an e-mail with an update once I've confirmed that the instrument power is back on.

**03-01-00:** The table delivered today includes changes that reflect the new strategy of carrying over some I27 data for playback in G28. We have 4 observations on track 4 that will not be overwritten during G28 recording. In today's table we have cut back the wavelengths coverage for these observations from 144 to 36, and we have trimmed the playback time for 27INPROMTH01 and 27INAMIRANI01 to about 2 RIMS only. As a result our downlink bits spent on these observations in I27 will only be about 0.4 Mbits. The "preview" data we will obtain for Prometheus and Amirani covers the areas of the hot spots but not the surroundings.
Thanks to the above cuts we can now bring down the full spatial area coverage of 27INREGION01 at 144 wavelengths. The first two (higher-resolution) scans will come down in pass 1 and the last scan will come down in pass 2. We presently have no indications of any software crashes during I27 recording, but it remains a possibility that one of these occurred during the recording of one or more of our observations. Beyond the loss of our data, the only consequence of a stoppage would be an acceleration through the playback schedule.

**<u>I27 Playback Events Timeline</u> (02-01-00 to 05-05-00)**

**Although we lost a couple of Mbits of downlink due to the spacecraft safing, our allocations have not been reduced significantly. It still appears that the first NIMS data will come down around the 15th of March.**

**03-02-00: (K. Schimmels) Playback is currently about 10% complete, and is on schedule. We are playing back the MWG Torus observation. As of 2 PM, tape position is Track 2, Tic 1273. Losses to playback due to safing were 1.75 MB, and were taken from margin. Engineering data was taken from extra playback at the end of the OTM. Margin remains at 0.25 MB, plus 3.7 MB inefficiency margin.**

**03-10-00: (J. Erickson)**

**1. The mini-gyro test after I27 yielded the following results:**
**-1x axis went from 54.25 to 72.03% error**
**(current scale factor mismatch of 9.72 points)**
**-2x axis went from 14.23 to 19.48% error**
**(current scale factor mismatch of 1.38 points)**
**-1y axis went from 19.16 to 27.79% error**
**(current scale factor mismatch of 4.74 points).**

**Scale factors were updated for the post-E26 maneuver and don't reflect the annealing in E26 cruise. The mismatch was considered acceptable for the post-I27 maneuver but will likely be updated after the maxi-gyro test scheduled for March 27.**

**03-22-00: (F. Leader) re: 27INHRPELE01**
**Even the thermal detectors (15,16 and 17) are saturated near the centers of hot spots of Pele (What is the lowest temperature that could saturate these detectors ?). Only detector 4 is not saturated at all points and detector 5 has a few saturated points. This obs was in gain state 2.**
**I highly recommend returning detectors 1,2 and 7 for this observation in pass 2 to try to get temperature range limits on the hottest regions and also fine structure. This is recorded on track 3 and will be over-written in G28.**

**03-22-00: The table delivered today includes 8 new sets of playback commands. Half of these are for filling gaps, and half will bring down small amounts of SSI ridealong data from the observations 27ISPELE__01, 27ISTVASHT01, 27ISZALTRM01, and 27ISPROMTH01. We cut back on the sampling coverage of 27INREGION01 in order to bring down the ridealongs and gap fills. The number of samples ("grating steps") per detector was reduced from 12 to 10. So far the data is compressing well and further reductions did not turn out to be necessary. The gap fill for 27INICHAAC01 is straightforward but that for 27INHRPELE01 is not. High temperatures on the target produced significant saturation in nearly all detectors so in pass 2 we will go after the data for detectors 1, 2, and 7.**

There is a gap in the pass 1 portion which will be filled using a table that selects all 15 detectors with 12 samples each. Some technical details on the timing of the singles are footnoted below.
The SSI observation names are in many cases the same as in the NIMS data requests. In pass 1 we had two sets of singles with the title, 27INCAMAXT01-, one for our own recording and one for SSI ridealong data, at slightly different times. For subsequent ridealongs, I changed the following - to + to indicate the "ridealong" status.
Notes on the 27INHRPELE01 gap fill singles times:
Detector 1, 2, 7 playback before the gap ends at 5399308:87 (day 53 13:37:09.333)
"All detectors" playback over the gap starts at 5399308:88 (13:37:10.000)
"All detectors" playback over the gap ends at 5399309:15 (13:37:22.000)
Detector 1, 2, 7 playback after the gap starts at 5399309:25 (13:37:28.666)

**02-29-00:** (K. Schimmels) New additions to the bit family are below. Treat them with loving care, as they are small :) 0.8 MB is being released this week. This accounts for addt'l playback expected during pauses to come, and due to lower inefficiencies expected.

| Team | Addt'l BTG | New Alloc |
|---|---|---|
| NIMS | 0.119 | 12.749 |

**03-30-00:** I have delivered a new table for tomorrow's update. There are 3 new sets of singles, PSIDs EP, EQ, ER. These fill gaps in the pass 1 playback of 27INMOSAIC01. We received a small amount of new allocation from the remaining office/inefficiency margin.
If all goes well we should see data from 27INREGION01 on Saturday. If compression is lower than predicted here it could force us to make cuts in next week's update.
Rosaly indicates that we obtained excellent Io observations in I27. For several of these, the other 95% of the data will come down in G28, as one track of tape will be carried over.

**03-31-00:** (K. Schimmels) Playback is currently about 68% complete, and is on schedule. We are playing back the 27ISSOPOLE01 observation. As of 10 AM 3/31, tape position is Track 1, Tic 2943.

**04-06-00:** The new table contains 7 new sets of commands, with PSIDs DJ to DP. These fill gaps in our pass 1 playback of 27INREGION01. Although compression has been running pretty much as predicted, filling this large number of gaps has brought us up to and slightly beyond our total downlink allocation. To compensate we have trimmed a little over 1 RIM from the first part of the second scan of 27INMOSAIC01. This area has not revealed any prior hot spot activity.

<u>I27 Playback Events Timeline</u> **(02-01-00 to 05-05-00)**

**04-07-00:** **(K. Schimmels) Playback is currently about 81% complete, and is running about 1 day ahead of schedule. We are playing back the 27ISSAPPNG01 observation. As of noon 4/7, tape position is Track 3, Tic 1997. 2 new segments were added in pass 2, at the very end due to NIMS wavelength restrictions. Resuming playback early gained us 0.33 MB in capability. Most of this has been released prior to this week (in anticipation) to allow teams to do something useful with the BTG. No additional margin was released this week.**

| Team | % alloc | Alloc(MBTG) | Usage(MBTG) | Unused MBTG |
|---|---|---|---|---|
| NIMS | 14.831% | 12.749 | 12.464 | 0.285 |

**04-12-00:** **Last week we trimmed a little bit off 27INMOSAIC01. We can't change that now. However we just received some additional office margin and have about .5 Mbits to play with. We have a nice Io global on tape. There was some discussion of going for dark sky off the target to derive new dark values. However I think we can get this objective and more by the following approach. We used a 36 wavelength (3 samples, 12 detectors) for previewing Prometheus, Amirani, etc. I got the impression that the resulting products were interesting and useful. If we go after the global using this table, we can get about 2/3 of it down with our current allocation. Any objections? Other suggestions? Question 2. Which 2 scans - north, equatorial, south? The central longitude is 170 and the body is 98% illuminated.**

**04-12-00:** **We received .25 Mbit of additional allocation from a release of office margin this week, and the accounting of bits received shows us with .285 Mbits unused. Thus in this update we are able to fill a small gap at the end of pass 1 playback of 27INREGION01 (by moving our pass 2 NIMPBK single 300EK earlier in time). In addition we are adding new singles (DQ) to return the equatorial and southern scans of 27INGLOBAL01, at 36 wavelengths. We may be over our current allocation by a tiny amount this week, but we have one more opportunity to adjust the table next week, so if a trim is required we can accomplish it then. We are requesting every 4th RIM of AACS to help with the pointing of 27INGLOBAL01 as well.**

**04-12-00:** **(R. Lopes) I have now prepared a "playback design" that you (and Elias) will love...we cut the beginning of the eastern parts of the middle and south scans, then return a bit of the northern scan around Tvashtar (If you look in the design at the top numbers, which I think are cone angle, the Tvashtar region will be between 152.7 and 152.46). Now, isn't that a good compromise?**

**<u>I27 Playback Events Timeline</u> (02-01-00 to 05-05-00)**

**04-13-00:** **Playback is currently about 90% complete, and is running about 1 day ahead of schedule. We are currently slewing on track 4 towards the 27INAMRANI01- observation. As of 10 AM 4/13, tape position is Track 4, Tic 2879. 1 new segment was added in pass 2, at the very end due to NIMS addition of INGLOBAL. 0.25 MB of margin was released to NIMS for use in INGLOBAL, and SSI, as last on the tape, has packed out the last two observations with lots of pad.**

**04-17-00:** **(E. Barbinis) I generated the wavelength table that you requested and I left a copy of it on your chair. The name of the new wavelength table is ILM36T.PBK. It gets the 12 working detectors every 8 grating steps (steps 0, 8 and 16).**

**04-18-00:** **Due to looming jury duty, this table has been delivered a day early. It is the final update for I27. The only changes involved the timing of our playback of 27INGLOBAL01. Two new sets of singles, PSIDs DR and DS, were added, while DQ was modified. Following Rosaly's instructions we are returning 2:48 of the upper scan, centered on the longitude of Tvashtar. Longitude values for the center points of each mirror scan range from 100-170 W. To obtain this we cut a similar quantity of data from the eastern portion of the central scan. As you may know the recording of the 3rd scan was incomplete due to sequencing tradeoffs. It turns out that we will get about the same amount of longitudinal coverage for both the center and southern scans, from longitude 150 W to the limb (near 250 W). The wavelength table for this observation was modified to return the first, eighth, and 16th grating steps for each detector (samples spaced evenly in time).**

**04-19-00:** **(K. Schimmels) Playback is currently about 96% complete, and is slightly behind schedule (~6 hrs). We are currently playing back the NIMS INREGION observation, and just entered Segment 15. As of 6:30 PM 4/19, tape position is Track 1, Tic 5303. Playback terminates on Thursday, April 27 at approximately 2:47 PM PDT. (00-118/21:47 SCET-UTC). SSI has packed out the end of playback with extra BTG, and we should just barely get into the 27ISGLOCOL01 observation. If there is extra playback at the end, they'll use it all up.**

**04-27-00:** **Playback terminated.**

**05-05-00:** (J. Erickson) In the last two weeks, the spacecraft turned to a new attitude for maintaining communication, conditioned the RPM, terminated playback for conjunction, and slewed the tape to the center (tic 3114). The +X RTG current dropped 1 DN, as predicted, on DOY 121. Both stars 2 and 3 of the 3 star set are occasionally dropping out at this attitude, presumably due to star scanner browning making the stars appearing dimmer than predicted. Star 1, which is now Altair, has not dropped out at all. Telemetry data was received through Monday 5/01; due to conjunction, no data has been received on subsequent passes. Mimimum SEC angle occurs on Sunday 5/07, after which the spacecraft starts heading out of conjunction, although we do not expect to see any more telemetry until approximately 5/13 at the earliest. The command loss timer has been set to time out on DOY 143 (May 22), so that any receiver problems during conjunction will not cause safing and cancel the onboard sequences. Playback terminated on Thursday the 27th, prior to entry into solar conjunction. When playback terminated, approximately 0.3 Mbit of SSI data is thought to have been in the MUB. This was unable to drain prior to entry into conjunction (i.e., RTE 10 bps with downlink at either 8 bps or FILL) because of the DSN station losses on the 27th. The data should remain in the MUB until DOY 138 when the s/c exits conjunction, and the G28A sequence begins. This situation does raise an issue for G28A RTS. Because of the non-zero MUB at the beginning of G28A and the very limited downlink available, there will be a MUB overflow of RTS data for ~4 hours. Because the MUB uses a "first-in, first-out" process, there is no concern over the playback data. SPOT is currently looking at our options for dealing with this situation (which include allowing the overflow to occur).

## NIMS Anomaly Report - I27 Sequence

The NIMS grating became stuck prior to the I24 encounter. The grating continued to be stuck for the I27 encounter. This development caused a drastic change in NIMS operations. Detectors 1, 2 and 7 now have very low sensitivity. Detectors 3 and 8 are still not functioning. NIMS now returns only 12 useful wavelengths.

There were no NIMS processor halts detected during the I27 Encounter.

The spacecraft safed during the I27 encounter about 2 days after I27 perijove.

### Stuck Grating (from the I24 NIMS Guide)

At I24, NIMS experienced a fundamental change in the way that it operates. Sometime between C22 and I24, the NIMS grating became stuck at a position corresponding to a pshift of about 14.5. This unusual grating position produces wavelengths for each detector far shorter than previously used. With the stuck grating, NIMS is permanently in a "fixed grating" mode. At this new grating position, Detectors 1, 2 and 7 return very low DN, as their new wavelengths are outside of the passband of their blocking filters and therefore are of minimal use. As before, detectors 3 and 8 are still not functioning.

There is no ground calibration for the wavelengths corresponding to this pshift. Flight calibration was derived from the I24 RCT and PCT calibrations. Details of this new flight calibration will be discussed in the as yet unpublished NIMS calibration report.

The spectral capability of the NIMS instrument shrank from 408 wavelengths to 17 wavelengths with the stuck grating. Now all commanded modes, Long Map, Full Map, Short Map or Fixed Map, select the same 17 wavelengths. Two effects of the stuck grating have been put to good use: spatial editing and noise reduction.

Even though the grating is stuck, the grating cycle still plays an important role. The playback edit table can now be used for spatial data editing. In Long Map mode, each mirror scan can be selected or deselected using the playback edit table. This allows a range of spatial density versus areal coverage choices.

If an observation is performed in Long Map mode at the Long Map scan rate, the 24 mirror scans over a single grating cycle can be averaged together to increase the signal to noise level. The adverse effects of the high levels of radiation-induced noise encountered close-in to Jupiter are greatly alleviated by this averaging.

### Response to Stuck Grating Anomaly (I27)

At I27 the cause of the stuck grating was not known (and is still not clearly understood). No attempts were made during I27 to unstick the grating.

# NIMS Anomaly Report - I27 Sequence

## Processor Halts

No NIMS processor halts were detected during I27.

## NIMS Engineering Anomaly

Anomalous NIMS Engineering telemetry were received during the outbound portion of the I27 encounter well after NIMS had stopped taking science data and before the scheduled NIMS chopper off and the spacecraft safing event. A standard CDS bus reset event occurred at about D054/00:00. NIMS may have lost RTI synch with CDS at that time, which could account for the anomalous engineering.

There was a significant drop in the power supply, grating and mirror currents detected at D054/15:45 which probably continued until the safing event. Power supply current dropped from 201 to 24 DN, grating current from 81 to 1 DN, and mirror current from 136 to 24.

At D054/17:53 the NIMS hardware status block engineering read 11, which translates to gain state 4, Ecal on. Ecal was not commanded.

The NIMS SCLK at D054/12:39 was offset by only 1 Rim from the reporting SCLK time, instead of the nominal 2 Rim difference.

All of the above occurred after the CDS bus reset. We were waiting for the NIMS planned chopper off and software reload scheduled for D056/01:56 to see if the reload would reset these engineering channels to their nominal values, but the spacecraft safing event at D055/12:00 prevented the reload from executing as scheduled.

## Spacecraft Anomaly

During the I27 encounter a pair of standard bus resets occurred and were handled normally by the on-board recovery software without any effects on the planned sequence. The first occurred at about D053/09:38 and the second at about D054/00:00. A third reset hit the spacecraft at about D055/12:00 after playback had been initiated. The combination of DMS activity and bus reset forced the spacecraft into safing. The flight team brought the spacecraft back to normal operations at about D056/05:30. NIMS was powered on at D057/20:21. The NIMS phase 2 software was reloaded at D059/20:24.

**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.

**NIMS Data Format - Data types - Data Labels - Data Access**

**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.