Chapter 7 - Data Return

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Introduction to Chapter 7

This chapter is a report on the NIMS data return for the G8 orbit. Due to the low downlink data rates available for Galileo Jupiter Operations and other unforeseen and unpredictable events during the G8 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.

Twelve NIMS software reloads were inserted into the G8 Encounter sequence to protect against processor halts. During G8 no NIMS observations were lost due to 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. One final attempt to revive these failed detectors was unsuccessful in reviving them.

The plots on the pages 3 and 4 show the geometry of the NIMS G8 observations using a north trajectory pole projection. The 'returned' observations are in Bold characters and the 'non-returned' in gray.

The spreadsheets on pages 5 through 10 summarize the 'final' playback model for the 'returned' data.

The text on page 11 gives a 'recap' of the G8 playback events which affected which observations were returned.

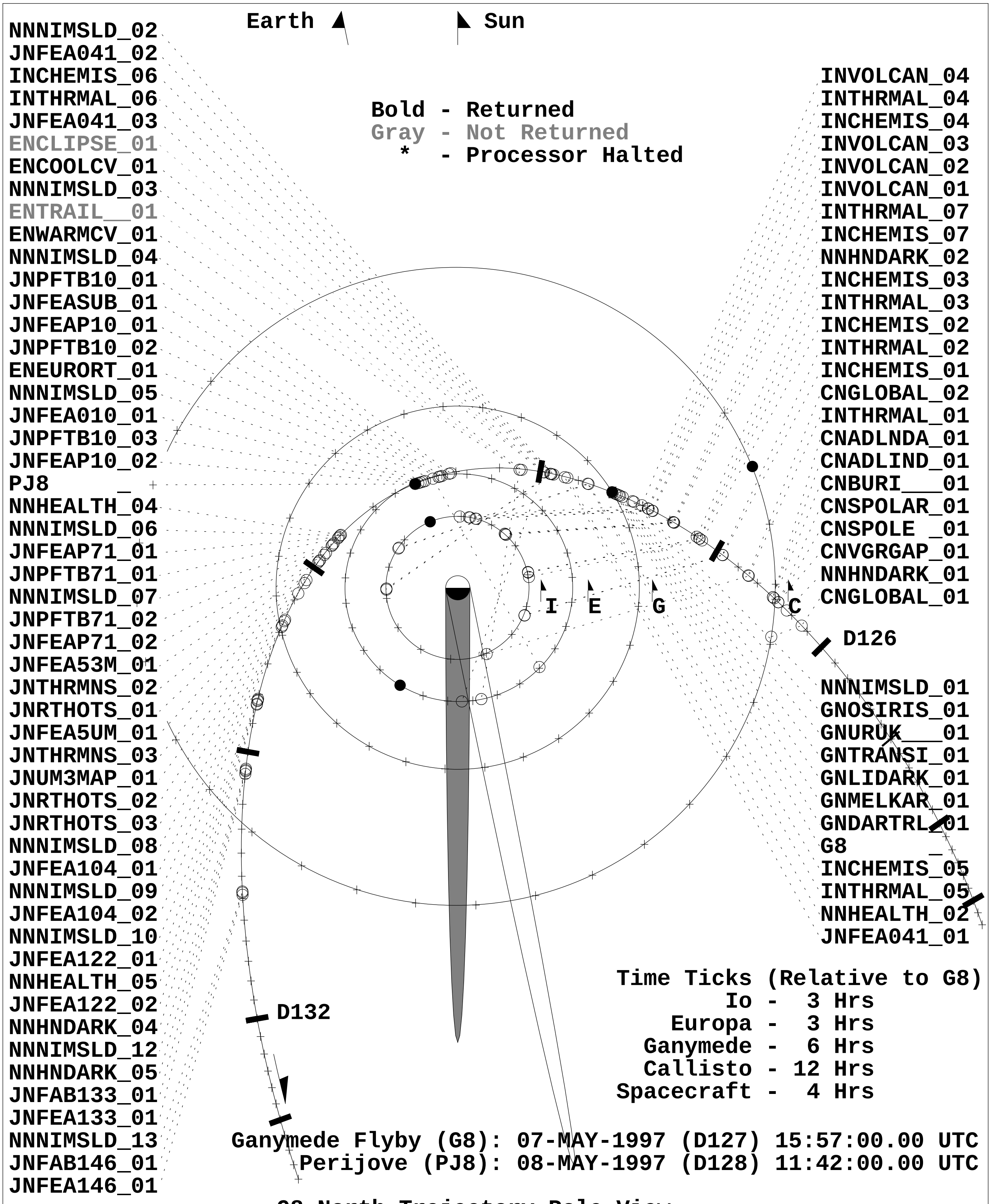
A Timeline of G8 playback events is on pages 12 through 14.

The text on page 15 describes the G8 NIMS 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.

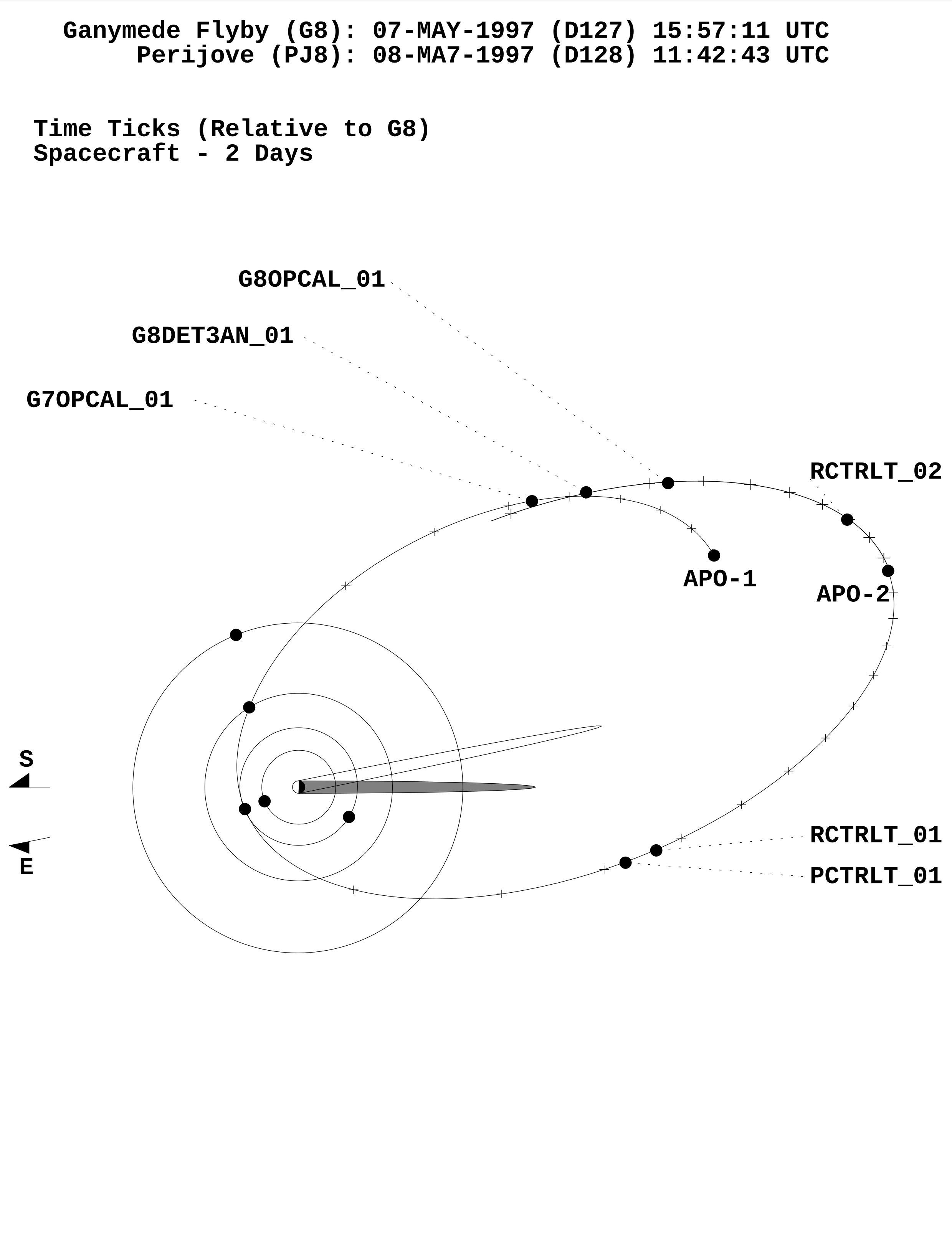
NIMS G8 OBSERVATIONS



G8 North Trajectory Pole View

NIMS - FEL - 02/20/98

NIMS G8 CALIBRATIONS



G8 North Trajectory Pole View, Apoapsis to Apoapsis

NIMS - FEL - 05/06/99

NIMS G8 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format
G8CNGLOBAL01-	CALLISTO GLOBAL COVERAGE	CLM244B	CLM216B	LM	4	0	4	LPU
G8HNDARK__01-	Dark Observation	G8DRK34	G8DRK32	LM	4	0	4	MPW
G8CNSPOLE 01-	CALLISTO SOUTH POLE OBSERVATION	G8CFM102B	G8CFM96B	FM	4	0	4	LPU
G8CNBURI 01-	BURI CRATER COVERAGE	G8CLM244B	G8CLM216B	LM	4	0	4	LPU
G8CNADLIND01-	ADLINDA AREA COVERAGE	G8CLM244B	G8CLM216B	LM	4	0	4	LPU
G8INTHRMAL01-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK228C	LM	4	0	4	LPU
G8CNGLOBAL02-	CALLISTO GLOBAL COVERAGE	G8CLM244B	G8CLM216B	LM	4	0	4	LPU
G8INCHEMIS01-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM216B	LM	2	0	4	LPU
G8INTHRMAL02-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK228C	LM	4	0	4	LPU
G8INCHEMIS02-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM216B	LM	2	0	4	LPU
G8INTHRMAL03-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK228C	LM	4	0	4	LPU
G8HNDARK__02-	NIMS Dark Observation	G8DRK34	G8DRK32	LM	2	0	4	LPU
G8INTHRMAL07-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK228C	LM	4	0	4	LPU
G8INVOLCAN01-	MONITORING OF SELECTED VOLCANIC REGIONS	G8ILMDK244B	G8ILMDK228B	LM	4	0	4	LPU
G8INVOLCAN03-	MONITORING OF SELECTED VOLCANIC REGIONS	G8ILMDK244B	G8ILMDK216B	LM	4	0	4	LPU
G8INCHEMIS04-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM216B	LM	2	0	4	LPU
G8INTHRMAL04-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK216C	LM	4	0	4	LPU
G8INVOLCAN04-	MONITORING OF SELECTED VOLCANIC REGIONS	G8ILMDK244B	G8ILMDK216B	LM	4	0	4	LPU
G8GNOSIRIS01-	Central Dome Crater OSIRIS Area	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNURUK__01-	Uruk Sulcus & Craters & Grooves Furrow	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNTRANSI01-	Transition boundary Sulcus and Grooves	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNMELKAR01-	Ganymede MELKAR observation	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNDARTRL01-	Dark material in Marius Regio Trail Hem	G8GLM442	G8GLM384	LM	3	0	4	MPW
G8INCHEMIS05-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM216B	LM	2	0	4	LPU
G8INTHRMAL05-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK216C	LM	4	0	4	LPU
G8NNHEALTH02-	G8 NIMS Health Observation	G8RCVY3		LM	2	0	4	R/T
G8JNFEA04101-	Jupiter Feature Track 41 deg phase pt 1	G8JFT68C	B_JFT43A	SM	2	1	4	LPU
G8INCHEMIS06-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM216B	LM	2	0	4	LPU
G8INTHRMAL06-	MONITORING OF IO'S NIGHTSIDE	G8ILMDK244C	G8ILMDK216C	LM	4	0	4	LPU
G8JNFEA04103-	Jupiter Feature Track 41 deg phase pt 3	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8ENCOOLCV01-	Europa Coolcv	G8ESM51B		SM	4	1	4	R/T
G8ENWARMCV01-	Europa Warmcv	G8ESM51B		SM	4	1	4	R/T
G8JNPFTB1001-	Jupiter Partial Ftr Trk B 10 deg prt 1	G8JFT68C	B_JFT43A	SM	2	1	4	LPU
G8JNFEASUB01-	Jupiter Campaign Feature sub-spectra	G8JSB253A	G8JSB253A	LM	2	0	4	LPU
G8ENEURORT01-	NIMS Europa Real-Time Observation	G8ELM442/MB		LM	4	0	4	R/T
G8JNFEAP1002-	Jupiter Ftr and Prtl Trk deg prt 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8NNHEALTH04-	G8 NIMS Health Observation	G8RCVY3		LM	2	0	4	R/T
G8JNPFTB7101-	Jupiter Partial Ftr Trk B 71 deg prt 1	G8JFT68C	B_JFT43A	SM	2	1	4	LPU
G8JNFEAP7102-	Jupiter Ftr and Prtl Trk 71 deg part 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFEA53M01-	Jupiter Campaign Feature 5 and 3 um Map	G8J35157	G8J35157	LM	4	0	4	LPU

NIMS G8 DATA RETURN

ACTID	Wave-lengths ret	Obs. cost (tics)	Record Time (sec)	PB Time (sec)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode cycle time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct. Factor (sBOT/BTG)	Pass
G8CNGLOBAL01-	216	497	2110.67	701.00	13.02	4.32	8.667	2	1.83	1.99	2.18	1,2
G8HNDARK__01	32	56	61.00	61.00	0.70	0.70	8.667	0	2.35	0.02	35.25	1
G8CNSPOLE 01-	96	497	2112.00	600.00	13.03	3.70	4.333	0	2.05	1.35	2.74	1,2
G8CNBURI 01-	216	154	646.67	646.67	3.99	3.99	8.667	0	1.94	1.73	2.31	1
G8CNADLIND01-	216	264	1117.33	557.00	6.89	3.44	8.667	0	2.06	1.40	2.45	1,2
G8INTHRMAL01-	228	10	34.67	34.67	0.21	0.21	8.667	2	2.68	0.07	3.02	1
G8CNGLOBAL02-	216	471	2002.00	420.00	12.35	2.59	8.667	2	1.97	1.11	2.34	1,2
G8INCHEMIS01-	216	16	58.00	58.00	0.36	0.36	8.667	2	2.61	0.12	3.11	1
G8INTHRMAL02-	228	13	48.00	48.00	0.30	0.30	8.667	2	2.31	0.11	2.60	1
G8INCHEMIS02-	216	16	60.00	60.00	0.37	0.37	8.667	2	2.29	0.14	2.72	1
G8INTHRMAL03-	228	14	51.33	51.33	0.32	0.32	8.667	2	2.24	0.13	2.53	1
G8HNDARK__02	32	16	61.00	61.00	0.38	0.38	8.667	0	3.07	0.02	24.66	1
G8INTHRMAL07-	228	16	59.33	59.33	0.37	0.37	8.667	2	2.14	0.15	2.41	1
G8INVOLCAN01-	228	15	56.67	56.67	0.35	0.35	8.667	2	2.06	0.15	2.32	1
G8INVOLCAN03-	216	18	68.00	68.00	0.42	0.42	8.667	2	1.96	0.18	2.33	1
G8INCHEMIS04-	216	16	60.00	60.00	0.37	0.37	8.667	2	2.12	0.15	2.52	1
G8INTHRMAL04-	216	16	58.00	58.00	0.36	0.36	8.667	2	2.29	0.13	2.72	1
G8INVOLCAN04-	216	51	210.00	202.68	1.30	1.25	8.667	2	1.57	0.67	1.87	1
G8GNOSIRIS01-	216	160	675.33	336.00	4.17	2.07	8.667	0	1.81	0.96	2.15	1,2
G8GNURUK__01-	216	282	1195.00	873.00	7.37	5.38	8.667	0	1.89	2.39	2.25	1,2
G8GNTRANSI01-	216	108	451.33	451.33	2.78	2.78	8.667	0	2.08	1.12	2.47	1
G8GNMELKAR01-	216	121	508.68	508.68	3.14	3.14	8.667	0	1.81	1.46	2.15	1
G8GNDARTRL01-	384	355	401.33	200.00	4.62	2.30	8.667	0	1.84	1.00	2.30	1,2
G8INCHEMIS05-	216	15	56.67	56.67	0.35	0.35	8.667	0	1.54	0.19	1.83	1
G8INTHRMAL05-	216	14	51.33	51.33	0.32	0.32	8.667	0	1.53	0.17	1.82	1
G8NNHEALTH02-	3											
G8JNFEA04101-	43	25	100.00	100.00	0.62	0.62	2.33	0	1.93	0.20	3.10	1
G8INCHEMIS06-	216	20	74.67	74.67	0.46	0.46	8.667	0	1.42	0.27	1.69	1
G8INTHRMAL06-	216	14	51.33	51.33	0.32	0.32	8.667	0	1.37	0.19	1.63	1
G8JNFEA04103-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.75	0.35	1.78	1
G8ENCOOLCV01-	51							0				1
G8ENWARMCV 01-	51							0				2
G8JNPFTB1001-	43	100	420.00	420.00	2.59	2.59	2.33	0	1.55	1.04	2.49	1
G8JNFEASUB01-	253	86	360.00	180.00	2.22	1.11	8.667	0	1.53	0.71	1.55	1,2
G8JNEURORT01-	408							0				
G8JNFEAP1002-	68	72	300.00	300.00	1.85	1.85	2.33	0	1.56	1.17	1.59	1
G8NNHEALTH04-	3							0				
G8JNPFTB7101-	43	100	420.00	420.00	2.59	2.59	2.33	0	1.71	0.94	2.75	1
G8JNFEAP7102-	68	72	300.00	300.00	1.85	1.85	2.33	0	1.66	1.10	1.69	1
G8JNFEA53M01-	157	87	362.00	362.00	2.23	2.23	8.667	0	1.35	1.01	2.21	1

NIMS G8 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format
G8JNTHRMNS02-	Jupiter Thermal North South Stripe prt 2	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNRTHOTS01-	NIMS Jupiter Real-Time Observation	G8JLM442/MB		LM	4	0	4	R/T
G8JNFEA5UM01-	Jupiter Feature Track 5 Micron Map 2	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNTHRMNS03-	Jupiter Thermal North South Stripe prt 3	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNUM3MAP01-	Three Micron Hotspot Spectral Map	J3M253A	B_J3M100A	LM	4	0	4	LPU
G8JNRTHOTS02-	NIMS Jupiter Real-Time Observation	G8JLM442/MB		LM	4	0	4	R/T
G8JNRTHOTS03-	NIMS Jupiter Real-Time Observation	G8JLM442/MB		LM	4	0	4	R/T
G8JNFEA10402-	Jupiter Feature Track 104 deg phase pt 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8NNHEALTH05-	G8 NIMS Health Observation	G8RCVY3		LM	2	0	4	R/T
G8JNFEA12202-	Jupiter Feature Track 122 deg phs pt 2	G8JFT68C	G8JFT25A	SM	2	1	4	LPU
G8HNDARK__04-	NIMS Dark Observation	G8DRK34	G8DRK32	LM	4	0	4	LPU
G8HNDARK__05-	NIMS Dark Observation	G8DRK34	G8DRK32	LM	3	0	4	LPU
G8JNFEA13301-	Jupiter Feature Track 133 deg phs pt 1	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFEA14601-	Jupiter Feature Track 146 deg phase pt 1	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8NNPCTRLT01-	NIMS Real-Time PCT Calibration	G8PCT252		LM	4	0	4	R/T
G8NNRCTRLT01-	NIMS Real-Time RCT Calibration	G8RCT252		LM	1	0	4	R/T
G8NNRCTRLT02-	NIMS Real-Time RCT Calibration	G8RCT252		LM	1	0	4	R/T
G8NNOPCAL_01	NIMS OPCAL	G8OPCAL120		LM	4	0	4	R/T
G8CNGLOBAL01-	CALLISTO GLOBAL COVERAGE	CLM244B	CLM216B	LM	4	0	4	LPU
G8CNVGRGAP01+	SSI Ride-Along VGR gap fill	G8DRK34	G8DRK32	LM	4	0	4	HIS
G8CNSPOLE 01-	CALLISTO SOUTH POLE OBSERVATION	G8CFM102B	G8CFM96B	FM	4	0	4	LPU
G8CNSPOLAR01+	SSI Ride-Along South Pole Area	G8CFM102B	G8CFM96B	FM	4	0	4	HIS
G8CNADLIND01-	ADLINDA AREA COVERAGE	G8CLM244B	G8CLM216B	LM	4	0	4	LPU
G8CNADLNDA01+	SSI Ride-Along ADLINDA Area	G8CLM244B	G8CLM216B	LM	4	0	4	HIS
G8CNGLOBAL02-	CALLISTO GLOBAL COVERAGE	G8CLM244B	G8CLM216B	LM	4	0	4	LPU
G8INCHEMIS03-	MONITORING OF IO'S DAYSIDE	G8ILM244B	G8ILM228B	LM	2	0	4	LPU
G8INCHEMIS07-	MONITORING OF IO'S DAYSIDE	G8ILM442	G8ILM384	LM	2	0	4	MPW
G8INVOLCAN02-	MONITORING OF SELECTED VOLCANIC REGIONS	G8ILMDK244B	G8ILMDK228B	LM	4	0	4	LPU
G8GNOSIRIS01-	Central Dome Crater OSIRIS Area	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNURUK__01-	Uruk Sulcus & Craters & Grooves Furrow	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNLIDARK01-	Lite Dark Material	G8GLM244J	G8GLM216J	LM	3	0	4	LPU
G8GNDARTRL01-	Dark material in Marius Regio Trail Hem	G8GLM442	G8GLM384	LM	3	0	4	MPW
G8JNFEA04101-	Jupiter Feature Track 41 deg phase pt 1	G8JFT68C	B_JFT25X	SM	2	1	4	LPU
G8JNFEA04102-	Jupiter Feature Track 41 deg phase pt 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNPFTB1001-	Jupiter Partial Ftr Trk B 10 deg prt 1	G8JFT68C	B_JFT25X	SM	2	1	4	LPU
G8JNFEASUB01-	Jupiter Campaign Feature sub-spectra	G8JSB253A	G8JSB253A	LM	2	0	4	LPU
G8JNFEAP1001-	Jupiter Ftr and Prtl Trk 10 deg prt 1	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNPFTB1002-	Jupiter Partial Ftr Trk B 10 deg prt 2	JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFEA01001-	Jupiter Feature Track 10 deg phase	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNPFTB1003-	Jupiter Partial Ftr Trk B 10 deg prt 3	G8JFT68C	G8JFT68C	SM	2	1	4	LPU

NIMS G8 DATA RETURN

ACTID	Wave-lengths ret	Obs. cost (tics)	Record Time (sec)	PB Time (sec)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode cycle time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct. Factor (sBOT/BTG)	Pass
G8JNTHRMNS02-	157	129	542.67	271.00	3.35	1.67	8.667	0	1.34	0.76	2.19	1,2
G8JNRTHOTS01-	408							0				
G8JNFEA5UM01-	157	86	360.00	360.00	2.22	2.22	8.667	0	1.46	0.93	2.39	1
G8JNTHRMNS03-	157	813	3458.00	1738.00	21.33	10.72	8.667	0	1.38	4.75	2.26	1,2
G8JNUM3MAP01-	100	272	1152.67	1152.67	7.11	7.11	8.667	0	1.31	2.11	3.37	1
G8JNRTHOTS02-	408							0				
G8JNRTHOTS03-	408							0				
G8JNFEA10402-	68	25	100.00	48.67	0.62	0.30	2.33	0	1.83	0.16	1.86	1
G8NNHEALTH05-	3							0				
G8JNFEA12202-	68	25.44	100.00	100.00	0.62	0.62	2.33	0	1.80			2
G8HNDARK__04	32	16	61.00	61.00	0.38	0.38	8.667	0	2.25	0.02	18.07	1
G8HNDARK__05	32	16	61.00	61.00	0.38	0.38	8.667	0	2.63	0.02	21.12	1
G8JNFEA13301-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.99	0.31	2.02	1
G8JNFEA14601-	68	25	100.00	100.00	0.62	0.62	2.33	0	2.04	0.30	2.07	1
G8NNPCTRLT01	252											
G8NNRCTRLT01	252											
G8NNRCTRLT02	252											
G8NNOPCAL_01	120											
G8CNGLOBAL01-	216	497	2110.67	1374.00	13.02	8.47	8.667	0	1.92	3.71	2.28	2
G8CNVGRGAP01+	32	190	213.00	213.00	2.45	2.45	8.667	0	1.82	0.09	27.30	2
G8CNSPOLE 01-	96	497	2112.00	1275.00	13.03	7.86	4.333	0	2.06	2.85	2.76	2
G8CNSPOLAR01+	96	137	153.00	153.00	1.76	1.76	4.333	0	2.06	0.34	5.15	2
G8CNADLIND01-	216	264	1117.33	560.00	6.89	3.45	8.667	0	2.05	1.42	2.44	2
G8CNADLNDA01+	216	151	169.00	169.00	1.95	1.95	8.667	0	2.06	0.43	4.58	2
G8CNGLOBAL02-	216	471	2002.00	827.00	12.35	5.10	8.667	2	2.05	2.09	2.44	2
G8INCHEMIS03-	228	17	65.33	65.33	0.40	0.40	8.667	0	1.58	0.23	1.78	2
G8INCHEMIS07-	384	68	74.67	74.67	0.86	0.86	8.667	0	1.83	0.38	2.29	2
G8INVOLCAN02-	228	14	51.33	51.33	0.32	0.32	8.667	0	1.71	0.16	1.93	2
G8GNOSIRIS01-	216	160	675.33	337.00	4.17	2.08	8.667	0	1.83	0.95	2.18	2
G8GNURUK__01-	216	282	1195.00	267.00	7.37	1.65	8.667	0	1.90	0.73	2.26	2
G8GNLIDARK01-	216	84	351.33	351.33	2.17	2.17	8.667	0	1.99	0.92	2.37	2
G8GNDARTRL01-	384	355	401.33	200.00	4.62	2.30	8.667	0	1.85	1.00	2.31	2
G8JNFEA04101-	25	25	100.00	100.00	0.62	0.62	2.33	0	1.66	0.13	4.59	2
G8JNFEA04102-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.74	0.35	1.77	2
G8JNPFTB1001-	25	100	420.00	420.00	2.59	2.59	2.33	0	1.32	0.71	3.65	2
G8JNFEASUB01-	253	86	360.00	180.00	2.22	1.11	8.667	0	1.53	0.71	1.55	2
G8JNFEAP1001-	68	72	300.00	300.00	1.85	1.85	2.33	0	1.51	1.21	1.53	2
G8JNPFTB1002-	68	100	420.00	420.00	2.59	2.59	2.33	0	1.51	1.69	1.53	2
G8JNFEA01001-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.56	0.39	1.59	2
G8JNPFTB1003-	68	100	420.00	420.00	2.59	2.59	2.33	0	1.59	1.60	1.62	2

NIMS G8 DATA RETURN

Activity ID	Observation Title	NIMS Edit Table	NIMS PB Table	Mode	Gain	Grating Start	Grating Offset	Record Format
G8JNFEAP7101-	Jupiter ftr and Prtl Trk 71 deg prt 1	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNPFTB7101-	Jupiter Partial Ftr Trk B 71 deg prt 1	G8JFT68C	B_JFT25X	SM	2	1	4	LPU
G8JNPFTB7102-	Jupiter Partial Ftr Trk B 71 deg prt 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFEA53M01-	Jupiter Campaign Feature 5 and 3 um Map	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNTHRMNS02-	Jupiter Thermal North South Stripe prt 2	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNTHRMNS03-	Jupiter Thermal North South Stripe prt 3	G8J35157	G8J35157	LM	4	0	4	LPU
G8JNFEA10401-	Jupiter Feature Track 104 deg phase pt 1	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFEA12202-	Jupiter Feature Track 122 deg phs pt 2	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFAB13301-	Jupiter Ftr and Prtl Trk A and B 133 deg	G8JFT68C	G8JFT68C	SM	2	1	4	LPU
G8JNFAB14601-	Jupiter Ftr and Prtl Trks A and B 146 de	G8JFT68C	G8JFT68C	SM	2	1	4	LPU

NIMS G8 DATA RETURN

ACTID	Wave-lengths ret	Obs. cost (tics)	Record Time (sec)	PB Time (sec)	Total Bits of Tape BOT (Mbit)	Sel Bits of Tape sBOT (Mbit)	Mode cycle time	Thold	Comp	Total BTG (Mbtg) (4% ohead)	Data Reduct. Factor (sBOT/BTG)	Pass
G8JNFEAP7101-	68	72	300.00	300.00	1.85	1.85	2.33	0	1.60	1.14	1.63	2
G8JNPFTB7101-	25	100	420.00	420.00	2.59	2.59	2.33	0	1.44	0.65	3.98	2
G8JNPFTB7102-	68	100	420.00	420.00	2.59	2.59	2.33	0	1.66	1.54	1.69	2
G8JNFEA53M01-	157	87	362.00	178.50	2.23	1.10	8.667	0	1.36	0.49	2.23	2
G8JNTHRMNS02-	157	129	542.67	268.00	3.35	1.65	8.667	0	1.34	0.75	2.19	2
G8JNTHRMNS03-	157	813	3458.00	1746.00	21.33	10.77	8.667	0	1.39	4.73	2.28	2
G8JNFEA10401-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.85	0.33	1.88	2
G8JNFEA12202-	68	25	100.00	100.00	0.62	0.62	2.33	0	1.95	0.31	1.98	2
G8JNFAB13301-	68	116	485.33	485.33	2.99	2.99	2.33	0	2.13	1.38	2.16	2
G8JNFAB14601-	68	87	363.00	363.00	2.24	2.24	2.33	0	2.24	0.98	2.28	2
Total		**6148**			153.18	101.79			Total	67.93	71.83	
Alloc										67.58	Alloc	
Oversub										0.36		

RECAP OF G8 PLAYBACK EVENTS

NIMS' downlink bits allocation for G8 was about 50% larger than the total bits received for any prior orbit. As a result nearly all of the NIMS data recorded during the encounter was returned to Earth.

G8 was one of only 3 orbits during the Galileo prime mission in which no radiation-induced stoppages of the instrument software were detected or suspected (the others were E4 and E11).

Two distant observations of Europa were undertaken during the encounter period (G8ENCLIPSE_01, G8ENTRAIL__01). To conserve bits, mirror blocking was specified (this records a subset of the standard 20 pixels). An error in the commands led to recording of only dark sky, and as a result these observations were not played back.

The playback process, although made complex by the number of observations and the details of efficiently returning them, went smoothly until 12 June, when the tape recorder went into limited search mode. This continued until commands to terminate the process were received from the ground. This event cost about 6.5 Megabits, and resulted in a down-to-the wire photo-finish in the race to get all the data down.

G8 Playback Events Timeline (04-04-97 to 06-22-97)

04-04-97: NIMS' downlink allocation is 56 Mbits. The observations G7ENCLIPSE01 and G7ENTRAIL_01 are added to the sequence. Wavelength tables called out for many observations still include detector 3 wavelengths. Jupiter feature track observations and Io VOLCAN observations return subsets of the total recorded wavelengths.

04-16-97: NIMS receives an additional 2 Mbits since UVS and PPR have more allocation than they can use. Six Jupiter observation wavelength tables go from 25 bands selected to 68 (the maximum recorded).

04-24-97: New telemetry modeling with 0.3 dB margin increases NIMS' downlink allocation by 10 Mbits. All satellite observations are upped to full spatial coverage and full wavelength coverage. The same goes for Jupiter with one exception, G7JNUM3MAP01, where we will get 40 of 253 wavelengths recorded.

04-30-97: Playback table update. Callisto and Io wavelength tables modified to remove detector 3 wavelengths.

05-04-97: G8 Encounter begins.

05-05-97: Playback table update. Ganymede wavelength tables updated to remove detector 3 wavelengths.

05-06-97: NIMS G8 recording begins with G8CNGLOBAL01.

05-07-97: Playback table update. A technical problem with NIMS wavelength tables. CDS memory has 75 slots for wavelength editing byte groups for any given segment of the playback table. Segments consist of groups of observations in time order; a maximum of 4 segments is held in CDS memory at any given time. To return 216 wavelengths for one observation, 25 byte groups must be uplinked. This means a particular segment can have only 3 NIMS observations. This can make segments very short, with the negative consequence that CDS may whip through all the stored commands before new segments can be uplinked, resulting in CDS' pausing playback and production of fill bits instead of data in the downlink data stream. The solution at this point was to reinstate tables commanding 228 wavelengths for 5 small Io THRMAL and VOLCAN observations. This table requires fewer edit groups but returns some detector 3 wavelengths. Ganymede close approach occurs at 15:57 GMT.

05-08-97: Perijove is reached at 11:42 GMT.

05-11-97: Playback begins.

05-21-97: Playback table update. The following is an excerpt from the memo describing the update for that date.

Dozens of minor modifications of the playback table were made in this update in order to make best use of our allocation and for efficiency reasons. In the latter category are wavelength table changes for CHEMIS03 and VOLCAN02, requested by the coordinators. Returning 228 wavelengths (including det 3) instead of 216 resolves segmentation problems and avoids potentially pausing playback. NIMS observations of satellites with appreciable amounts of dark sky are usually thresholded to improve compression. In this orbit, from G8GNOSIRIS01 forward, thresholding will NOT be used for any observations, with one exception (CNGLOBAL02). We need to receive additional downlink bits in order to bring the pass 2 portion of this down without thresholding. NIMS data obtained during 3 SSI observations of Callisto will now be returned in pass 2 (CNVGRGAP01+, CNSPOLAR01+, CNADLNDA01+). The first of these was recorded with the DARK34 table; the others with standard Callisto FM102 and LM244 tables. For the AWG side: Following Kevin’s instructions we are using a table returning 100 wavelengths (up from 40) for the JNUM3MAP01 observation. To accomplish this we cut back on wavelengths returned (from 68 to 43) for 5 observations (JNFEA04101 and 04103, JNPFTB1001, JNFEAP1002, and JNPFTB7101). The six observations listed above are the only AWG cases where we are not bringing down all recorded wavelengths. Playback of the two Europa observations was deleted from the plan since only dark sky was recorded due to incorrect specification of mirror blocking.

05-28-97: Tape slewing inefficiency has been smaller than predicted. NIMS receives another 0.5 Mb of allocation. This is used to restore G7JNFEA04103 and G7JNFEAP1002 to maximum wavelength coverage (68).

06-03-97: NIMS receives another 1.75 Mbits from office margin.

06-11-97: Playback table update. Five sets of gap-filling playback commands are added to pick up data that was not received in pass 1. The remainder of the office margin is released and NIMS gets 2.5 Mbits. Four new sets of commands were entered to recover the wavelengths that were left behind in pass 1 playback of G7JNFEA04101, G7JNPFTB1001, G7JNPFTB7001, and G7JNUM3MAP01.

06-12-97: The tape recorder pauses playback on top of a boundary between two recorded observations. Some data is present but the time tag is incorrect. When playback resumes the tape recorder goes into limited search, trying to find the bad date it has picked up. It continues this search until commands from the ground terminate playback, at a cost of some 6.5 Mbits of downlink.

<u>G8 Playback Events Timeline</u> (04-04-97 to 06-22-97)

06-13-97: **Cuts must be made due to the loss of allocation due to the limited search event. NIMS cuts out the additional wavelengths playback of G7JNUM3MAP01.**

06-19-97: **Playback is running about 7 hours behind schedule due to undercompression by SSI, amounting to about 1.4 Mbits.**

06-22-97: **Playback terminates. Our last observation arrives intact, with perhaps a few bits trimmed from the end. We are not successful in returning G7HNDARK04 and 05; gaps in data capture by the DSN claimed them in passes 1 and 2.**

NIMS Anomaly Report - G8 Sequence

There were no NIMS anomalies during G8. No processor Halts were detected.

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

Detectors 3 and 8

One last attempt was made to revive detectors 3 and 8 during G8 cruise. Previous tests of detectors 3 and 8 had not powered off the NIMS instrument for longer than 5 minutes. The G8 cruise test (G8NNDET3AN) had the NIMS instrument powered off for 1 hour - adequate time to allow for capacitor discharge and latches to unstick. This was the last planed attempt to revive these two detectors.

The test ran successfully, but detectors 3 and 8 were not revived.

Summary:

1. No NIMS processor Halts were detected during the G8 Encounter.

2. The 12 NIMS software reloads from CDS most likely prevented the potentially disastrous effects of the NIMS processor Halts and protected the NIMS observations during the Encounter.

3. Frequent NIMS realtime observations, both science observations and instrument health monitoring observations, verified that NIMS was functioning normally at various time points throughout the encounter.

4. The error avoidance measures applied to the G8 Encounter as determined in the analysis of the processor halts that occurred in earlier orbits were shown to be the proper response for dealing with the inevitable occurence of radiation-induced NIMS processor halts.

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.