Solar Probe Plus

A NASA Mission to Touch the Sun

Integrated Science Investigation of the Sun
Energetic Particles

Preliminary Design Review

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Assembly, Integration, and Test

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Outline

- EPI-Hi Assembly, Integration, and Test Flow
- EPI-Lo Assembly, Integration, and Test Flow
- EDTRD Test Levels:
  - Acoustic
  - Vibration
  - Thermal-Vacuum profile
  - Observatory Environmental Testing
- Summary

Typical Test Flow for Components and Instruments (EDTRD)

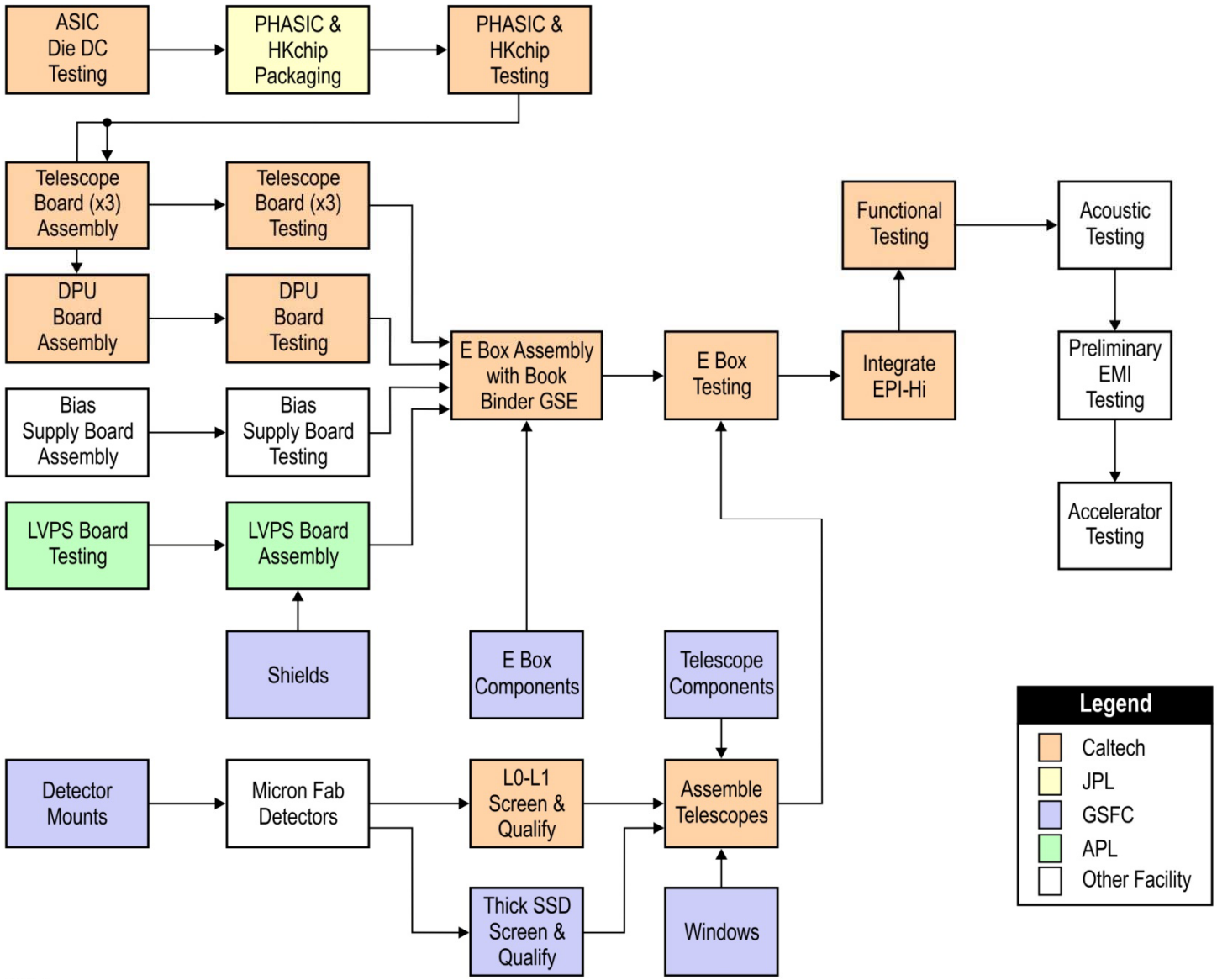
Test	Subsystem / Instrument Requirement
Magnetic Field (test magnetic hardware)	X[b]
Hermeticity (tanks, cooling system)	*
Comprehensive Performance Test	X
EMI/EMC	X
Initial Optical Alignment	*
Mass Properties	X[a]
Pre Vibration Survey	X
Sinusoidal Vibration	X
Random Vibration	X
Pressure Profile	
Shock (self induced)**	*
Acoustic	*
Strength	X
Post Vibration Survey	X
Deployments	*
Performance Test	X
Thermal Vacuum Balance	*
Thermal Vacuum Cycle	X
Bake-out	X
Final Optical Alignment	*
Comprehensive Performance Test	X

X Test is required

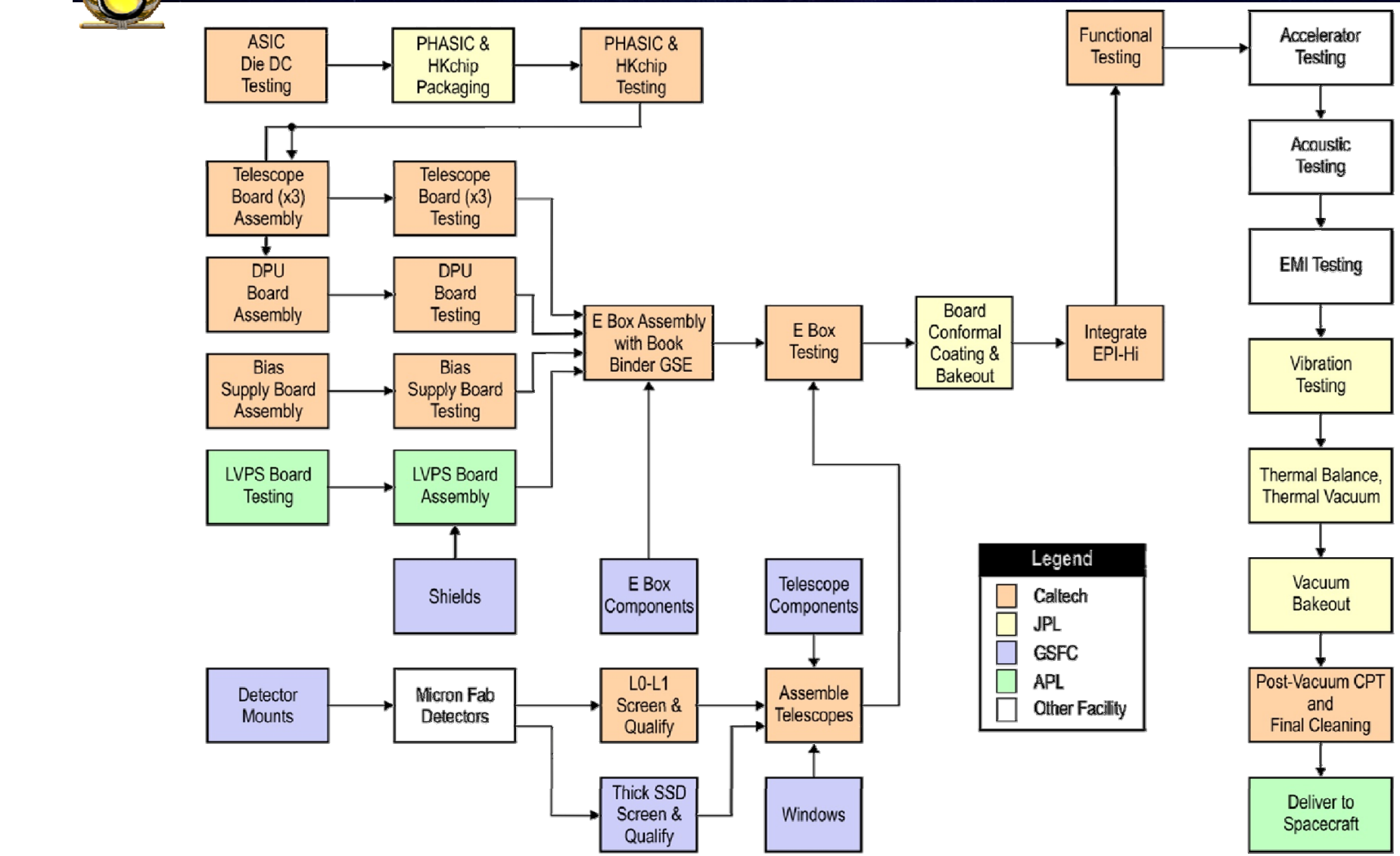
* Test is conditionally required, see relevant sections

Not Performed on ISIS

EM EPI-Hi Assembly, Integration, & Test

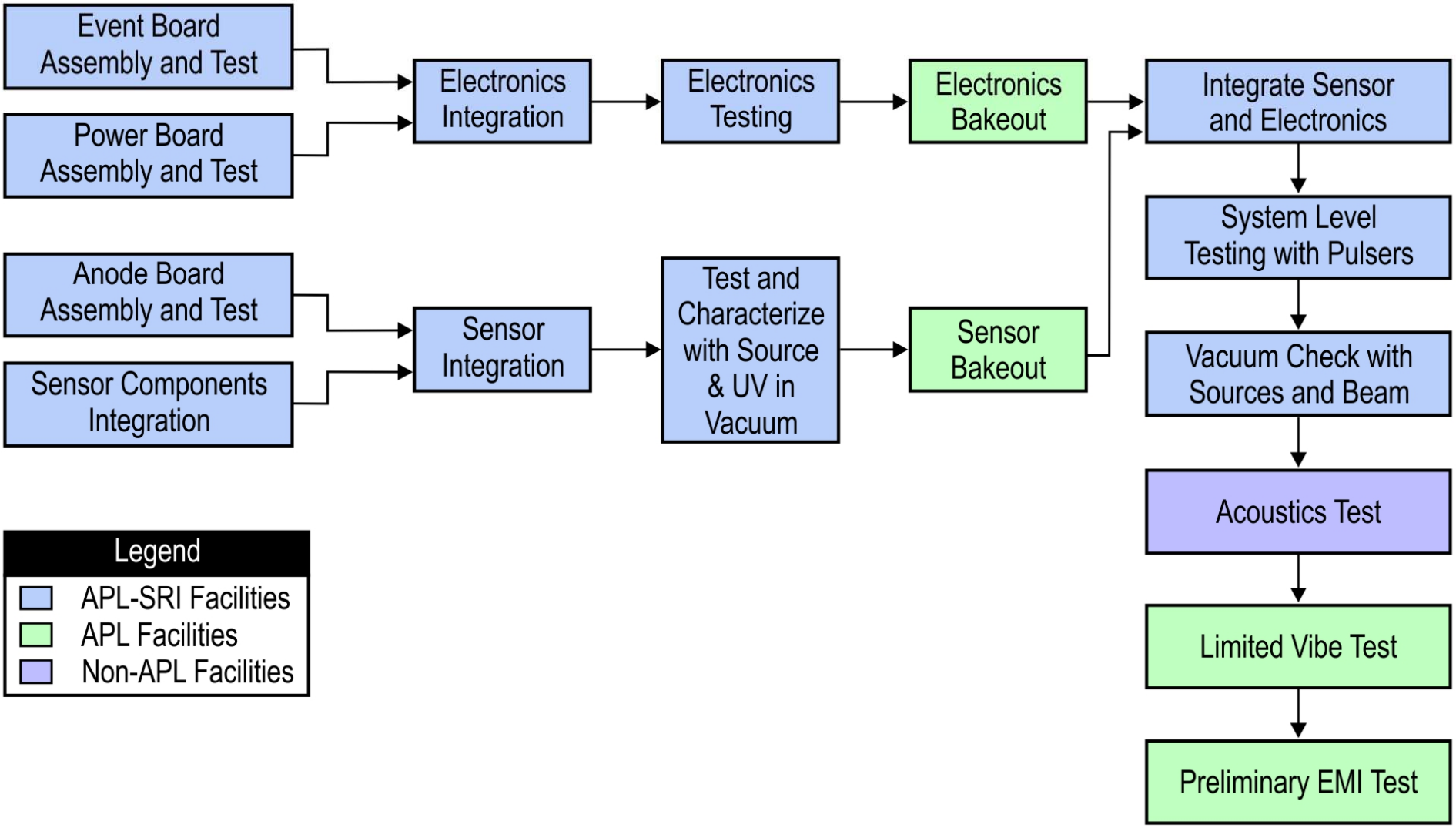


FM EPI-Hi Assembly, Integration, & Test

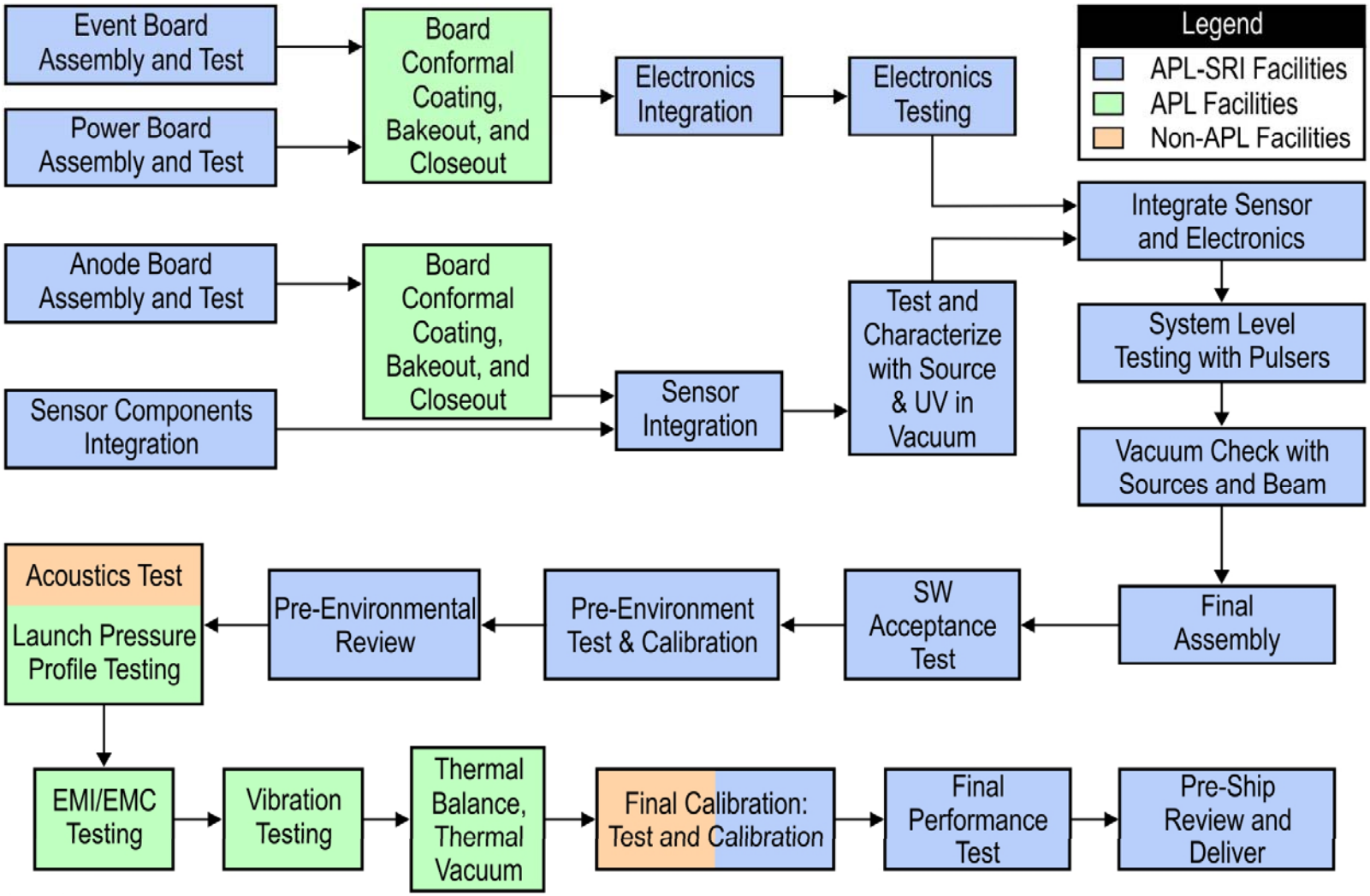


Performance Tests performed between Qualification Tests

EM EPI-Lo Assembly, Integration, & Test



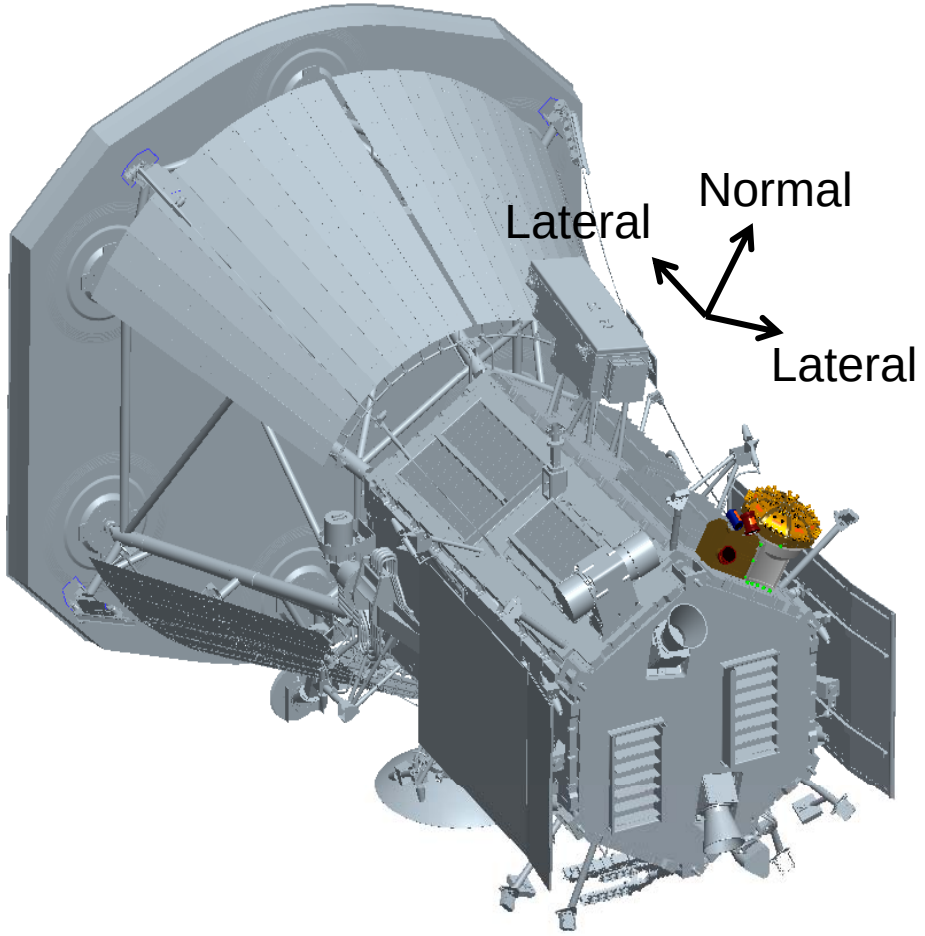
FM EPI-Lo Assembly, Integration, & Test



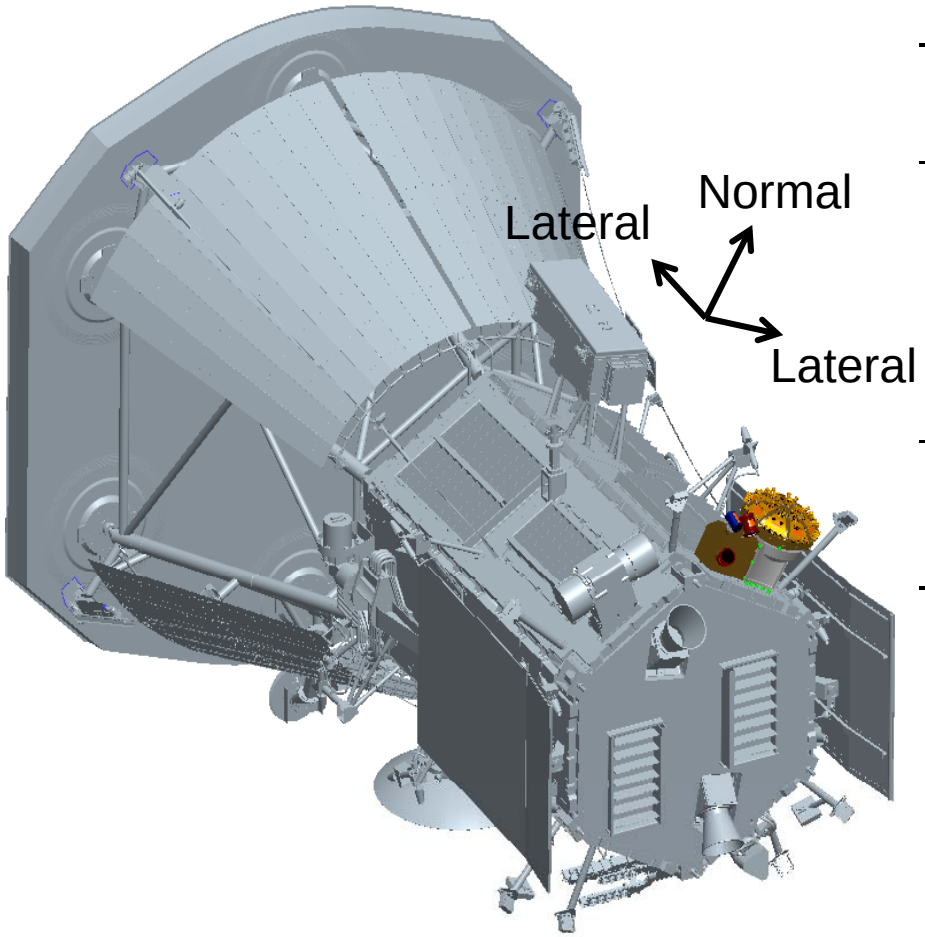
Performance Tests performed between Qualification Tests

Normal Vibration Levels

Side Panels Mounted Components & Subsystems Normal To Panel			
Frequency (Hz)	**Qualification (G^2/Hz)**	**Protoflight (G^2/Hz)**	**Acceptance (G^2/Hz)**
20	0.01	0.01	0.01
60	1.25	1.25	0.63
200	1.25	1.25	0.63
350	0.04	0.04	0.04
500	0.04	0.04	0.04
2000	0.01	0.01	0.01
Overall Grms	16.4	16.4	12.6
Duration (mins)	2	1	1



Lateral Vibration Levels



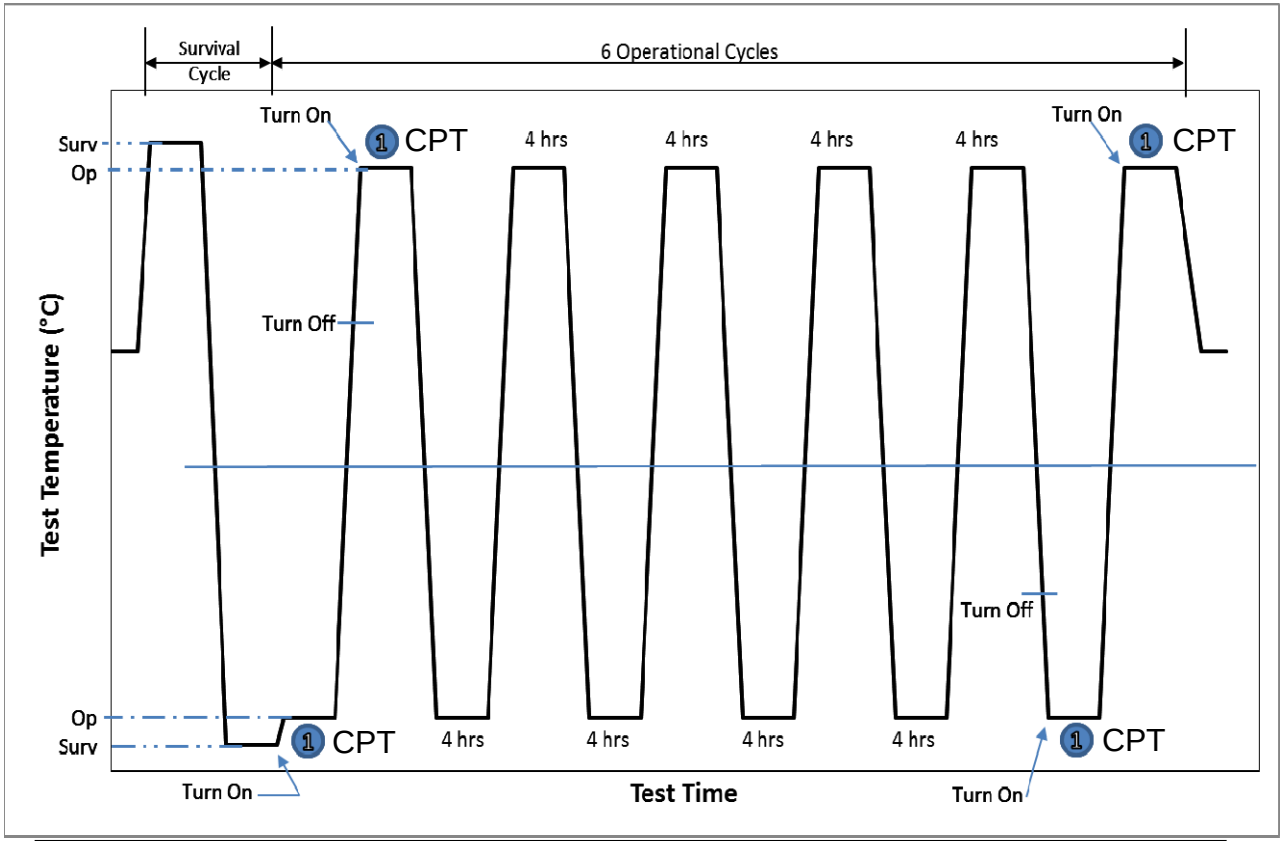
Side Panels Mounted Components & Subsystems Lateral To Panel			
Frequency (Hz)	**Qualification (G^2/Hz)**	**Protoflight (G^2/Hz)**	**Acceptance (G^2/Hz)**
20	**0.01**	**0.01**	**0.01**
35	**0.04**	**0.04**	**0.04**
500	**0.04**	**0.04**	**0.04**
2000	**0.01**	**0.01**	**0.01**
Overall Grms	**6.8**	**6.8**	**6.8**
Duration (mins)	**2**	**1**	**1**

Acoustics Levels

Table 7-2. Acoustic Flight Levels

1/3 Oct Center Freq (Hz)	MEFL (dB)	1/3 Oct Center Freq (Hz)	MEFL (dB)
32	123.0	630	120.5
40	124.8	800	119.1
50	126.2	1000	117.8
63	127.5	1250	116.4
80	128.3	1600	115.0
100	128.8	2000	113.6
125	129.0	2500	112.3
160	128.7	3150	110.9
200	127.5	4000	109.5
250	126.0	5000	108.1
315	124.3	6300	106.8
400	123.3	8000	105.4
500	121.9	10000	104.0
		OASPL	138.1

Thermal Vacuum Test Cycles



Instrument Subsystem	Design / Test Operating Temperture Range (C)	Non-op Survival Temperature Range (C)	Survival Heater Equivalent Resistance (Ohms)	Operational Heater Equivalent Resistance (Ohms)	Set Point Temperature Range (C)
EPI-Hi	-25 / +30	-40 / +50	87	1056	-35 to -32
EPI-Lo	-30 / +35	-45 / +50	121	---	-40 to -37

Observatory Environmental Testing

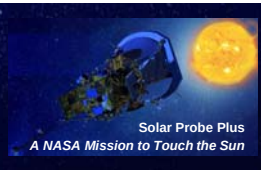
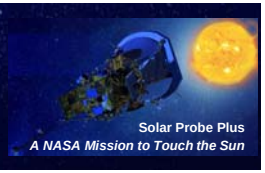


Table 2-3. Typical Test Flow for Observatory

Typical Test Flow for Observatory Test	Observatory Requirement
Magnetics (each box before integration on S/C)	X
Baseline Comprehensive Performance Test	X
EMI/EMC[1]	X
Initial Mass Properties	X
Initial Optical Alignment	X
Pre & Post Vibration Survey	X
Sinusoidal Vibration	X
Acoustic	X
Modal Survey	X
Strength	X
Deployments (N/A for ISIS)	X
Comprehensive Performance Test	X
End-to-End Test[2]	X
Spacecraft Magnetic Swing Test	X
Thermal Vacuum Balance	X
Thermal Vacuum Cycle	X
Comprehensive (functional) Performance Test (hot during TV)	X
Comprehensive (functional) Performance Test (cold during TV)	X
Mission Simulation (during TV)[2]	X
Comprehensive Performance Test[3]	X
Final Optical Alignment	X
Final Mass Properties	X

X Test is required

Summary



- EM is used as a pathfinder for FM integration and test
- Selected EM environmental testing provide risk reduction
- FM unit undergoes instrument level environmental testing to EDTRD levels
- EM is used for command and procedure testing after FM delivery to spacecraft and to support commanding activities after launch