BOOM SUITE, IDPU INTEGRATION AND TEST

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Verification

- **Verification Includes:**
  - **The Instrument Performance Requirements**
    - **Requirements Documented in IMPACTPerformanceSpec**
    - **Verification Plan: IMPACTRequirementsVerification Plan**
  - **The Environmental Requirements**
    - **Environmental Requirements: 7381-9003**
    - **EMC Requirements: 7381-9030**
    - **Contamination Control Requirements: 7381-9006**
    - **Verification Plan: IMPACT Environmental Test Plan and Matrix**
  - **Interface and Functional Requirements**
    - **Spacecraft Interface ICD: 7381-9012**
    - **Various Internal ICDs and Software Requirements Documents**
    - **Verified in Electrical Functional and Software Acceptance Tests**
    - **Often included as part of Performance or Environmental test plans**

ETU Testing

- **ETU Testing shall be functional, not Environmental**
  - **In some cases ETUs are not mechanically representative**
  - **Thermal testing of electronics to verify performance**
  - **Conducted Emissions testing of power converters**
  - **Protoflight levels to be used on Flight units**
  - **Exception is the boom**
- **All Electrical interfaces have been or will soon be tested**
  - **PLASTIC will have a dedicated ETU IDPU for testing**
  - **IDPU/SEP, IDPU/SWEA-STE, IDPU/MAG**
  - **Boom/Instrument Mechanical & Electrical (harness properties)**
  - **IDPU/SWAVES/Spacecraft test**
  - **MOC/POC test**

Flight Unit Testing

- Instrument-level calibrations and functional tests
- Protoflight Testing to levels indicated in 7381-9003
- Thermal Vac at instrument level
  - IDPU, SWEA, STE, MAG, Boom
- Vibration of assembled Boom
  - IDPU separately
- EMC at Suite level
  - Verifies intra-instrument harnessing

Typical Performance Verification Matrix (SWEA)

Description	Goal	Requirement	Verification
FOV	360 x 130 degree	360 x 60 degrees	Calibration with electron gun at CESR
Resolution	22.5 degree	45 degrees	Calibration with electron gun at CESR
Energy	1 to 5000eV	20 to 1000eV	Calibration with electron gun at UCB for high energy end, with extrapolation to lower energies by analysis
Energy Resolution (Telemetry)	65%	100%	Calibration with electron gun at UCB for high energy end, with extrapolation to lower energies by analysis
Geometric Factor	0.01 cm^2 ster E(eV)	0.001 cm^2 ster E(eV)	Calibration with electron gun at CESR
Max Count Rate (per 22.5 degree sector)	1E6 counts/sec	1E5 counts/sec	Calibration with electron gun at CESR
Time Resolution	1 minute (3D) to 2 seconds (moments, burst)	1 minute	Analysis of telemetry allocation together with suite end-to-end verification test of data throughput

Suite Environmental Test Matrix

System	EMC	Bakeout	Thermal Vac Cycling (Op/NonOp)	Thermal Balance	Sine Vib	Random Vib	Mass props	Failure Free Hours
SEP								
- SEPT-NS	Mag Screening	√	-25 - +35C -30 - +50C	√	√	√	√	24
- SEPT-E	Mag Screening	√	-25 - +35C -30 - +50C	√	√	√	√	24
- SIT	Mag Screening	√	-20 - +30C -35 - +35C	√	√	√	√	24
- HET, LET, Common Elec.	Mag Screening	√	-20 - +35C -40 - +50C	√	√	√	√	24
Boom Assy		√			√	√	√	
- Boom	Mag Screening		-10 - +20C -70 - +40C	√			Mass	N/A
- SWEA	Mag Screening		-25 - +30C -30 - +50C	√			Mass	24
- STE	Mag Screening		-50 - -30C -50 - +40C	√			Mass	24
- Mag Sensor			-20 - +45C -20 - +45C	√			Mass	24
IDPU	Mag Screening	√	-23 - +55C -30 - +60C		√	√	√	24
Flight Harness		√						
IMPACT Suite	RS,RE,CS,CE per EMC Requiurements							100

SWEA Verification Matrix

HARDWARE DESCRIPTION	TEST	ETU 1	ETU2	FM	SPARE
1/ Component Level					
MCP	Gain			X(CESR)	x (CESR)
Preamplifier	Threshold			x (CESR)	x (CESR)
	Dead Time			x (CESR)	x (CESR)
Optocouplers	Current transfert ratio	X (CESR)	X (CESR)	x (CESR)	x (CESR)
2/ Subsystem Level					
Preampli – board	Electrical tests (gain, threshold)	X (CESR)	X (CESR)	x (CESR)	x (CESR)
HVPS board	Electrical tests	X(CESR)	X(CESR)	x (CESR)	x (CESR)
	Thermal tests & calib.	X(CESR)	X(CESR)	x (CESR)	x (CESR)
All boards (3)	Bake-out			x (CESR)	x (CESR)
3/ Instrument	Vibrations		X(CESR)	X(UCB)	
	Electrical tests	X(CESR)	X(CESR)	x (CESR)	x (CESR)
Environmental tests on complete unit at UCB	Gain and noise tests (in vacuum)	X(UCB)		x (CESR)	x (CESR)
	Beam calibration	X(UCB)	X(CESR)	x (CESR)	
	Interface verification	X(UCB)		x (UCB)	
	Thermal balance	X(UCB)		X(UCB)	
	Thermal test in vacuum	X(UCB)		X(UCB)	X(CESR)

STE Verification Matrix

		Verification Matrix for STEREO/IMPACT/STE																		Revision Date: 11/7/2002
																				Revision Number: 2
Hardware Description		Test																		
Level of Assembly	Item	Elect. test, rm. Temp	Bench Calibration	Elect. Test, hot	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Self Shock	Acoustics	Thermal Vacuum	Voltage margins	Thermal cycle	Thermal balance	Life Test	EMC/EMI	Magnetics	Beam Calibration	Bakeout	Contamination	Comments
C	Detector, EM	X																		
C	Detector, F	X																	X	
C	Preamp, BB	X	X																	
I	Instrument, ETU	X	X	X	X			X	A		X						X			
I	Instrument, PF (FM1)	X	X	X	X	H	H	X		X	X		X	X	H	X	X	X	X	
I	Instrument, F (FM2)	X	X	X	X	H	H	X		X	X			X	H	X	X	X	X	

Legend:

Level of Assembly	Unit Type		X =	Test required	
			A =	Analysis	
C = Component	BB	Breadboard	H =	Test at higher level of assembly	
I = Instrument	EM	Engineering Model			
	PF	Protoflight			
	F =	Flight			

MAG Verification Matrix

Verification Matrix for STEREO/IMPACT/MAG

Revision Date: 9/7/01

Revision Number: 1

Hardware Description		Test																	
Level of Assembly	Item	Elect. test, rm. Temp	Bench Calibration	Elect. Test, hot	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Shock	Acoustics	Thermal Vacuum	Voltage margins	Thermal cycle	Thermal balance	>100 hours Operation	EMC/EMI	Magnetics	Bakeout	Contamination	Comments
C	Sensor, EM	X	X																
C	Sensor, F	X	X	X	X	H	H	H		X		X	H	H	H		H	X	
C	Electronics, EM	X	X	H	H									H					
C	Electronics,F	X	X	X	X	H	H	H		H	X	H	H	H	H		H	X	

Legend:

Level of Assembly	Unit Type		X =	Test required	
			A =	Analysis	
C = Component	BB	Breadboard	H =	Test at higher level of assembly	
I = Instrument	EM	Engineering Model		(Boom for sensor, IDPU for electronics)	
	PT	Prototype			
	PF	Protoflight			
	F =	Flight			

IMPACT Boom Verification Matrix

Verification Matrix for STEREO/IMPACT/Boom — Revision Date: 11/05/02 — Revision Number: 2

Hardware Description		Test																
Level of Assembly	Item	Deploy Test, Room Temperature	Deploy test, Thermal Vac	First Motion, Thermal Vac	Stiffness, Proof Load	Vibration, Sinusoidal	Vibration, Random	Shock	Acoustics	Thermal Vacuum	Thermal cycle	Thermal balance	EMC/EMI	Magnetics	Bakeout	Deployment contamination	Contamination Inspection	Comments
C	Proto	X			X													
C	EM	X		X	X	X	X	X		X	X			X		X		Qual levels
C	FS	X	X		X	X	X	X		X	X			X				Protoflight levels
C	FM1	X		X	X	X	X	H		X	X	X	X	X	H		X	Acceptanec levels
C	FM2	X		X	X	X	X	H		X	X			X	H		X	Acceptance levels

Legend:

Level of Assembly	Unit Type			X = Test required	
				A = Analysis	
C = Component	BB =	Breadboard		H = Test at higher level of assembly (with instruments)	
I = Instrument	EM =	Engineering Model			
	PT =	Prototype			
	PF =	Protoflight			
	F =	Flight			

IDPU Verification Matrix

Revision Date: 11/06/02
Revision Number: 2

Hardware Description		Test																
Level of Assembly	Item	Elect. test, rm. Temp	Elect. Test, hot	Elect. Test, cold	Vibration, Sinusoidal	Vibration, Random	Shock	Acoustics	Pressure change	Voltage margins	Thermal Vacuum	Thermal balance	>100 hours Operation	EMC/EMI	Magnetics	Leak	Bakeout	Contamination	Comments
C	PWB, EM	X								X									
I	IDPU EM	X	X	X						X			X	X					EMC CE test on EM
C	PWB, F	X								X							X		
I	IDPU, F	X	X	X	X	X			A	X	X		X	H	X		X	X	EMC at Suite level

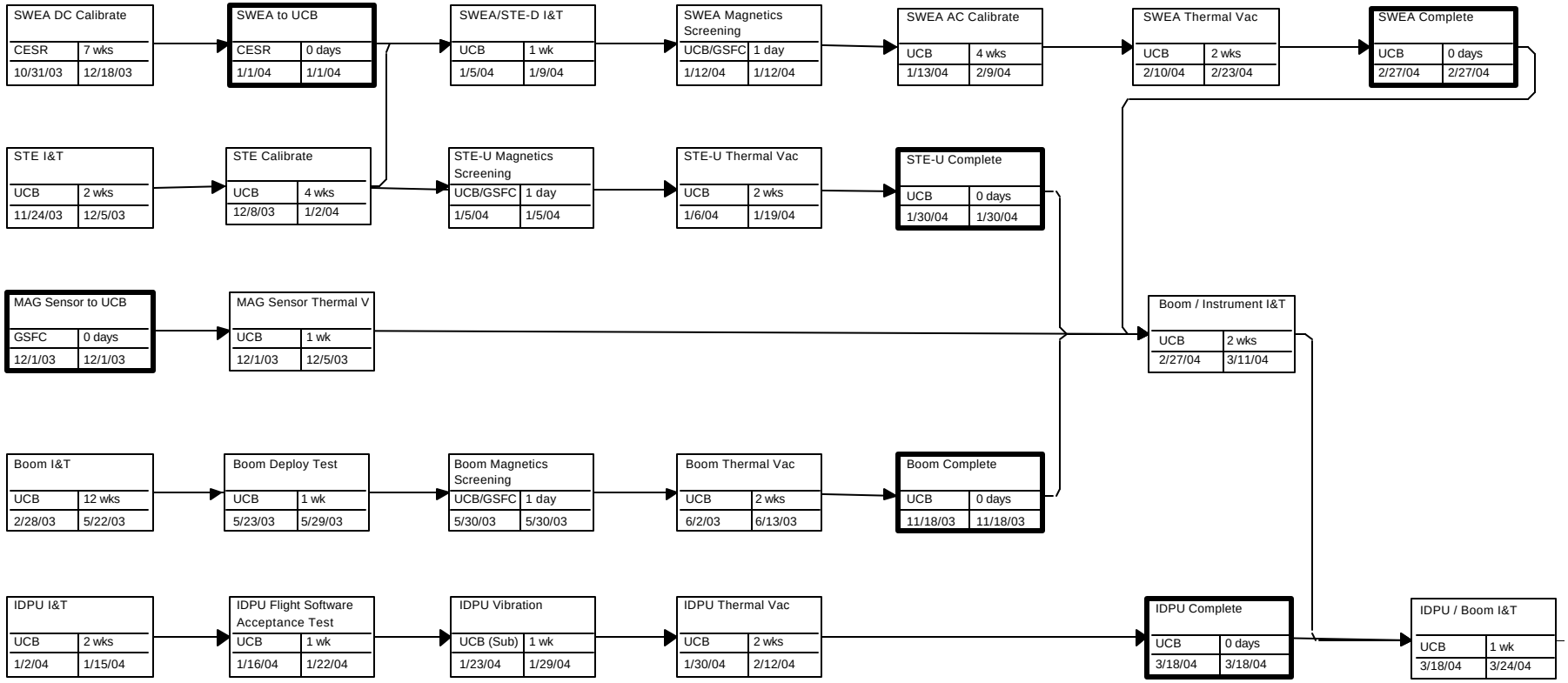
Legend:

Level of Assembly	Unit Type			X = Test required	
				A = Analysis	
C = Component	BB =	Breadboard		H = at higher level of assembly	
I = Instrument	EM =	Engineering Model			
	PT =	Prototype			
	PF =	Protoflight			

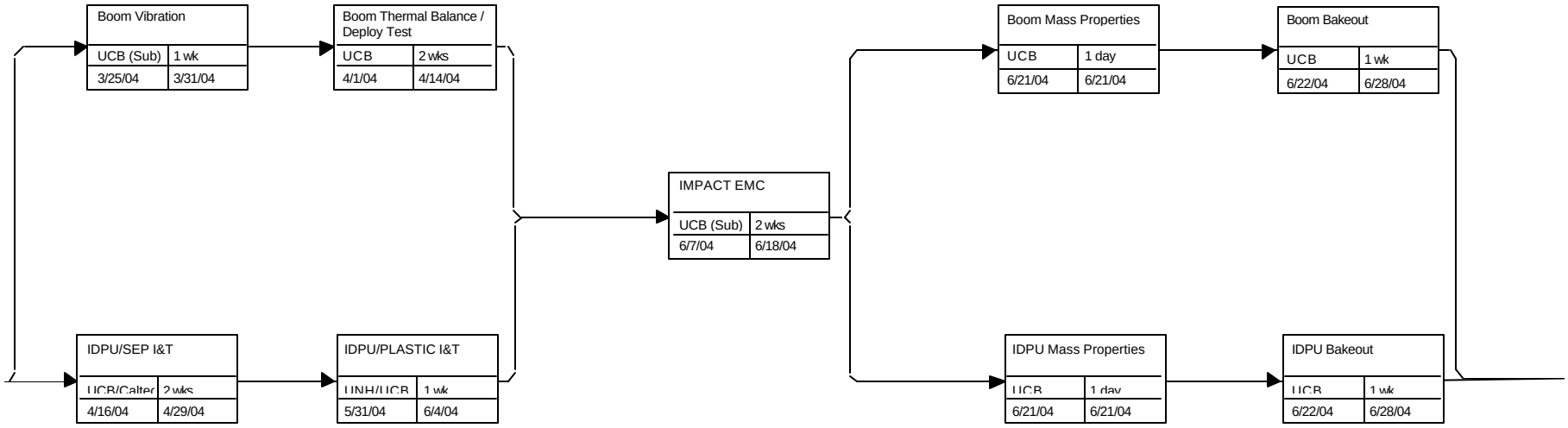
Boom Suite I&T Flow

- **Boom Suite:**
  - SWEA fabricated & calibrated at CESR, delivered to UCB
  - SWEA integrated with STED, interface electronics, tested, calibrated, Thermal Vac tested at UCB
  - STE fabricated, calibrated, thermal-vac tested at UCB
    - STE-D integrated with SWEA
    - STE-U tested separately with its preamp
  - MAG sensor fabricated, calibrated at GSFC
    - Thermal-vac tested at UCB
  - Boom fabricated, tested, thermal vacuum tested, vibrated at UCB
  - Boom/MAG/SWEA/STE integrated at UCB
  - Boom vibrated, mass props, baked out as a suite
- **IDPU**
  - MAG analog fabricated, tested, calibrated at GSFC
  - LVPS, DCB, STE-U Interface, box fabricated and tested at UCB
  - IDPU Integrated, tested, thermal vac tested, mass props, vibrated at UCB
- **IMPACT Suite:**
  - Full IMPACT Suite integrated (together with PLASTIC) for Functional and EMC test only prior to delivery
  - An earlier interface test between the IDPU and SEP

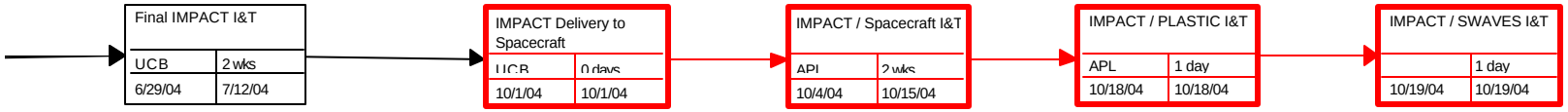
Integration & Test Flow



Integration & Test Flow (Continued)

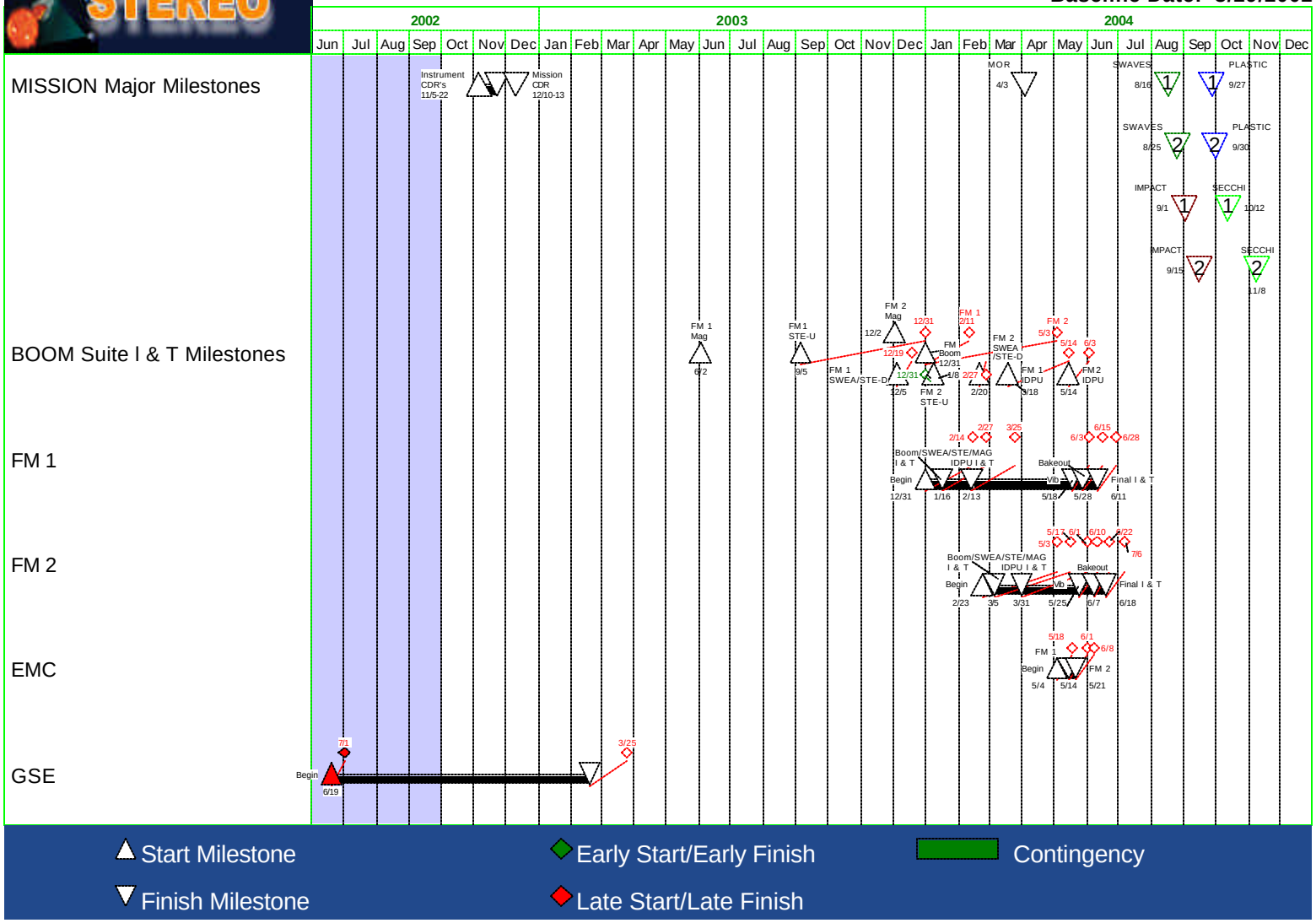


Integration & Test Flow (Continued)



BOOM I & T - BOOM Suite I & T

Status Date: 9/30/02
Baseline Date: 3/29/2002



Start Milestone
Finish Milestone
Early Start/Early Finish
Late Start/Late Finish
Contingency

Schedule Analysis

- **Some instruments are coming in later than originally planned**
  - **Instrument schedule re-baselining will recover some of that slip**
  - **It is important to keep EMC as soon as possible; this requires coordination of all the instrument test plans.**
- **We still show 47 days contingency to delivery to APL**