Soyuz 38S Docking
Qualify

sams2, 121f03 at LAB1O1, ER2, Lower Z Panel:[191.54 −40.54 135.25]
500.0000 sa/sec (200.00 Hz)
Δf = 0.122 Hz, Nfft = 4096
Temp. Res. = 2.192 sec, No = 3000

SAMS2, 121f03, LAB1O1, ER2, Lower Z Panel, 200.0 Hz (500.0 s/sec)

Start GMT 27−March−2014, 086/23:00:00.002

Sum
Hanning, k = 3281
Span = 119.83 minutes

Σ PSD Magnitude [log $_{10}$(g^2/Hz)]

GMT 27−March−2014, 086/hh:mm

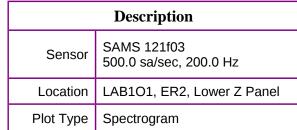| Description	
Sensor	SAMS 121f03 500.0 sa/sec, 200.0 Hz
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	Spectrogram

Notes:

- This color spectrogram shows the acceleration spectrum as it varies over 2 hours approximately centered on the Soyuz 38S docking to the ISS.
- The nominal sequence for a Soyuz docking went as follows...
- GMT 27-Mar-2014, 21:43 was time of **handover** from US Momentum Management to **RS attitude control**
- GMT 27-Mar-2014, 21:48 to 22:03 was **maneuver** to docking attitude
- GMT 27-Mar-2014, 23:53 to 28-Mar-2014, 00:01 was **free drift for the docking event**
- GMT 28-Mar-2014, 00:01 to 00:16 was **maneuver** to post-dock attitude
- GMT 28-Mar-2014, 00:55 was time of **handover** from RS back to **US Momentum Management attitude control**

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

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NASA

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sams2, 121f03 at LAB1O1, ER2, Lower Z Panel:[191.54 −40.54 135.25]
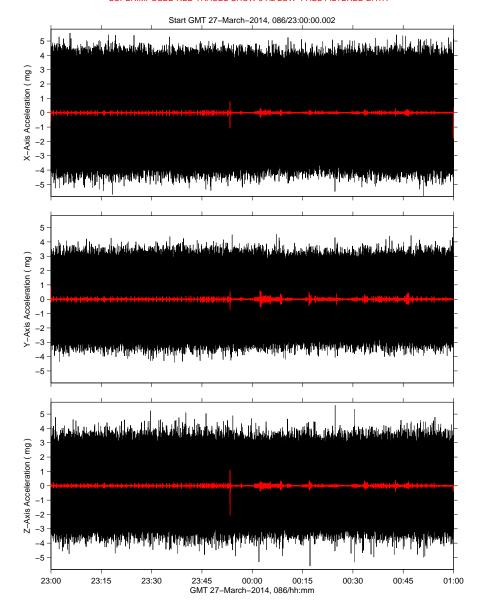500.0000 sa/sec (200.00 Hz)

SAMS2, 121f03, LAB1O1, ER2, Lower Z Panel, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW−PASS FILTERED DATA

Start GMT 27−March−2014, 086/23:00:00.002

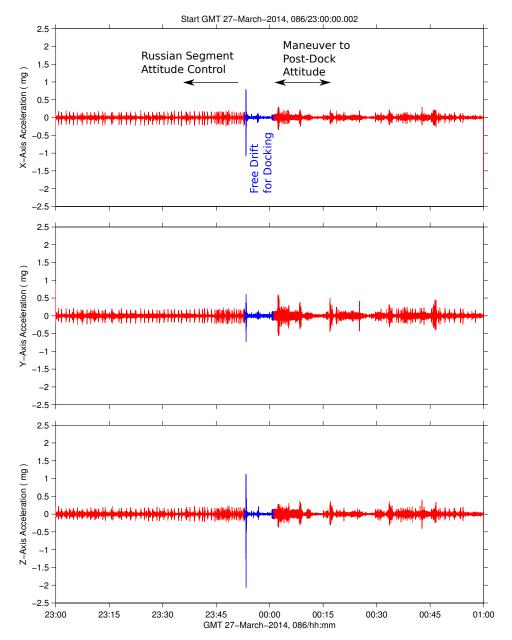| Description	
Sensor	SAMS 121f03 500.0 sa/sec, 200.0 Hz
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	Acceleration vs. Time

Notes:
- This 3-panel plot of acceleration vs. time is the same span as the previous spectrogram.
- The black trace shows the as-measured data up to the sensor cut-off frequency of 200 Hz.
- Interesting details associated with the Soyuz docking are overwhelmed by higher-frequency vibrations seen in black traces.
- The superimposed red traces are the same data, just low-pass filtered at 6 Hz.
- The low-pass filtered data shows us some interesting details as seen on subsequent page plots.

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

SAMS2, 121f03, LAB1O1, ER2, Lower Z Panel, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW–PASS FILTERED DATA

Start GMT 27–March–2014, 086/23:00:00.002

Russian Segment
Attitude Control

Maneuver to
Post-Dock
Attitude

Free Drift
for Docking

GMT 27–March–2014, 086/hh:mm

Soyuz 38S Docking
Quantify

Description	
Sensor	SAMS 121f03 500.0 sa/sec, 200.0 Hz
Location	LAB1O1, ER2, Lower Z Panel
Plot Type	Acceleration vs. Time

Notes:

- This 3-panel plot of acceleration vs. time is the same span as the previous page, but with the as-measured (unfiltered) data removed and annotations added.
- The low-pass filtered data here shows us some interesting details...
  - starting with Russian Segment (RS) attitude control,
  - followed by free drift period to allow for mating of the 2 vehicles,
  - followed by a maneuver to post-docking attitude.

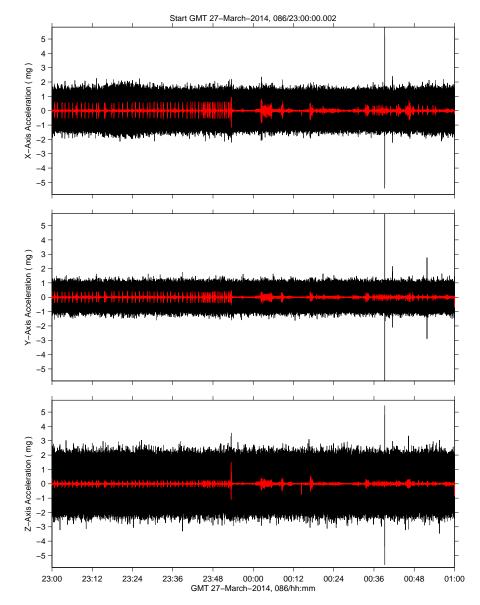|	
Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

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sams2, 121f05 at JPM1F5, ER4, Drawer 2:[466.80 −292.06 214.58]
500.0000 sa/sec (200.00 Hz)

SAMS2, 121f05, JPM1F5, ER4, Drawer 2, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW−PASS FILTERED DATA

Start GMT 27−March−2014, 086/23:00:00.002

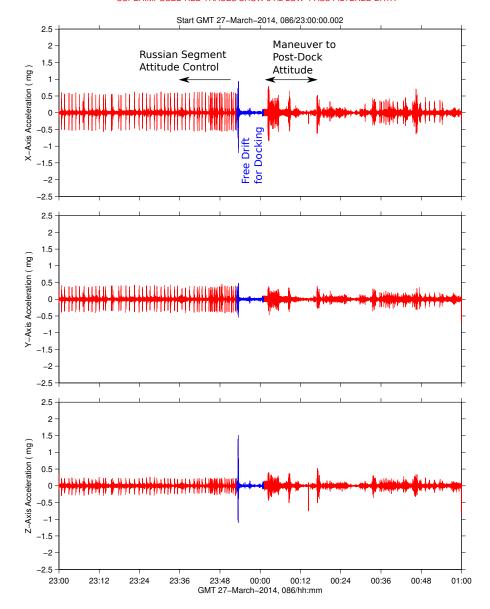|	Description	
Sensor	SAMS 121f05 500.0 sa/sec, 200.0 Hz	
Location	JPM1F5, ER4, Drawer 2	
Plot Type	Acceleration vs. Time	

Notes:
- This 3-panel plot of acceleration vs. time is the same span as the previous pages, but now shows SAMS data measured in the JEM.
- The black trace again shows the as-measured data up to the sensor cut-off frequency of 200 Hz.
- The superimposed red traces are the same data, just low-pass filtered at 6 Hz.
- The low-pass filtered data shows us some interesting details as seen on the next page.

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

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Soyuz 38S Docking
Quantify

sams2, 121f05 at JPM1F5, ER4, Drawer 2:[466.80 −292.06 214.58]
500.0000 sa/sec (200.00 Hz)

SAMS2, 121f05, JPM1F5, ER4, Drawer 2, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW−PASS FILTERED DATA

Start GMT 27−March−2014, 086/23:00:00.002

	Description	
Sensor	SAMS 121f05 500.0 sa/sec, 200.0 Hz	
Location	JPM1F5, ER4, Drawer 2	
Plot Type	Acceleration vs. Time	

Notes:
- This 3-panel plot of acceleration vs. time is the same span as the previous page, but with the as-measured (unfiltered) data removed and annotations added.
- The low-pass filtered data here shows us some interesting details from the JEM...
  - starting with Russian Segment (RS) attitude control,
  - followed by free drift period to allow for mating of the 2 vehicles,
  - followed by a maneuver to post-docking attitude.

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

sams2, 121f02 at COL1D3, Seat Track near A3:[378.11 246.46 234.96]
500.0000 sa/sec (200.00 Hz)

SAMS2, 121f02, COL1D3, Seat Track near A3, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW–PASS FILTERED DATA

Start GMT 27–March–2014, 086/23:00:00.001

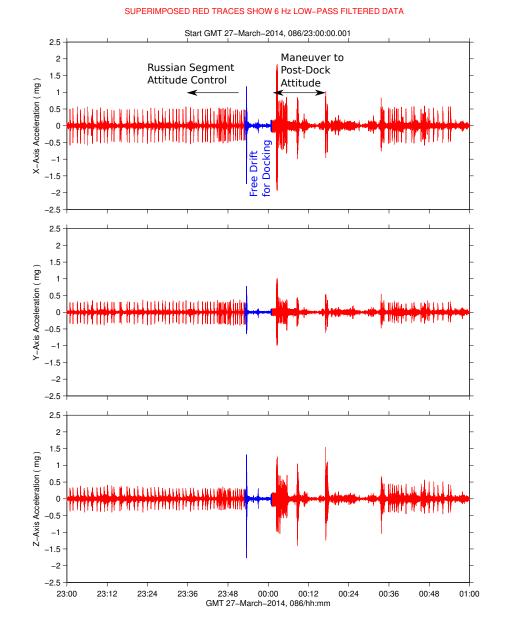|	Description	
Sensor	SAMS 121f02 500.0 sa/sec, 200.0 Hz	
Location	COL1D3, Seat Track near A3	
Plot Type	Acceleration vs. Time	

Notes:
- This 3-panel plot of acceleration vs. time is the same span as the previous pages, but now shows SAMS data measured in the Columbus module.
- The black trace again shows the as-measured data up to the sensor cut-off frequency of 200 Hz.
- The superimposed red traces are the same data, just low-pass filtered at 6 Hz.
- The low-pass filtered data shows us some interesting details as seen on the next page.

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

sams2, 121f02 at COL1D3, Seat Track near A3:[378.11 246.46 234.96]
500.0000 sa/sec (200.00 Hz)

SAMS2, 121f02, COL1D3, Seat Track near A3, 200.0 Hz (500.0 s/sec)

SSAnalysis[0.0 0.0 0.0]

SUPERIMPOSED RED TRACES SHOW 6 Hz LOW–PASS FILTERED DATA

Start GMT 27–March–2014, 086/23:00:00.001

Russian Segment
Attitude Control

Maneuver to
Post-Dock
Attitude

Free Drift
for Docking

GMT 27–March–2014, 086/hh:mm

Soyuz 38S Docking
Quantify

Description	
Sensor	SAMS 121f02 500.0 sa/sec, 200.0 Hz
Location	COL1D3, Seat Track near A3
Plot Type	Acceleration vs. Time

Notes:
- This 3-panel plot of acceleration vs. time is the same span as the previous page, but with the as-measured (unfiltered) data removed and annotations added.
- The low-pass filtered data here shows us some interesting details from the Columbus module...
    - o starting with Russian Segment (RS) attitude control,
    - o followed by free drift period to allow for mating of the 2 vehicles,
    - o followed by a maneuver to post-docking attitude.

Regime:	Vibratory
Category:	Vehicle
Source:	Soyuz 38S Docking

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The Soyuz 38S launch took place as scheduled, but a failed engine burn meant that the crew could not execute the planned 6-hour rendezvous and docking with the ISS. The crew had to use the traditional 2-day rendezvous profile instead.

Three International Space Station (ISS) crews members were transported from the Baikonur Cosmodrome in Kazakhstan to dock at the MRM-2 (shown in the image to the right below). The three are Russian cosmonauts Alexander Skvortsov and Oleg Artemyev, and NASA astronaut Steve Swanson.   NASA refers to this as Soyuz 38 because it is the 38th Soyuz mission to ISS.   These 3 crew mates joined three ISS crew members who were already aboard: Japanese astronaut and ISS commander Koichi Wakata, NASA astronaut Rick Mastracchio, and Russian cosmonaut Mikhail Tyurin.

Data from SAMS sensors in all 3 orbiting laboratories of the ISS were analyzed and show that at about GMT 27-Mar-2014, 23:53:27 (during the free drift period to allow for docking) the maximum acceleration vector magnitudes were at about 2 mg as seen here:

<div style="text-align:center">

SAMS SE-F03 in the USL: 2.09 mg
SAMS SE-F05 in the JEM: 1.95 mg
SAMS SE-F02 in the COL: 2.07 mg

</div>

Recall from details shown with the plots on the previous pages that the data used for analysis were the low-pass filtered data; otherwise, the docking event would not be discernible against the louder, higher-frequency vibrations of the ambient environment at these sensor locations.