ISS TEPC Measurement Results
Jun 07 – Sep 08

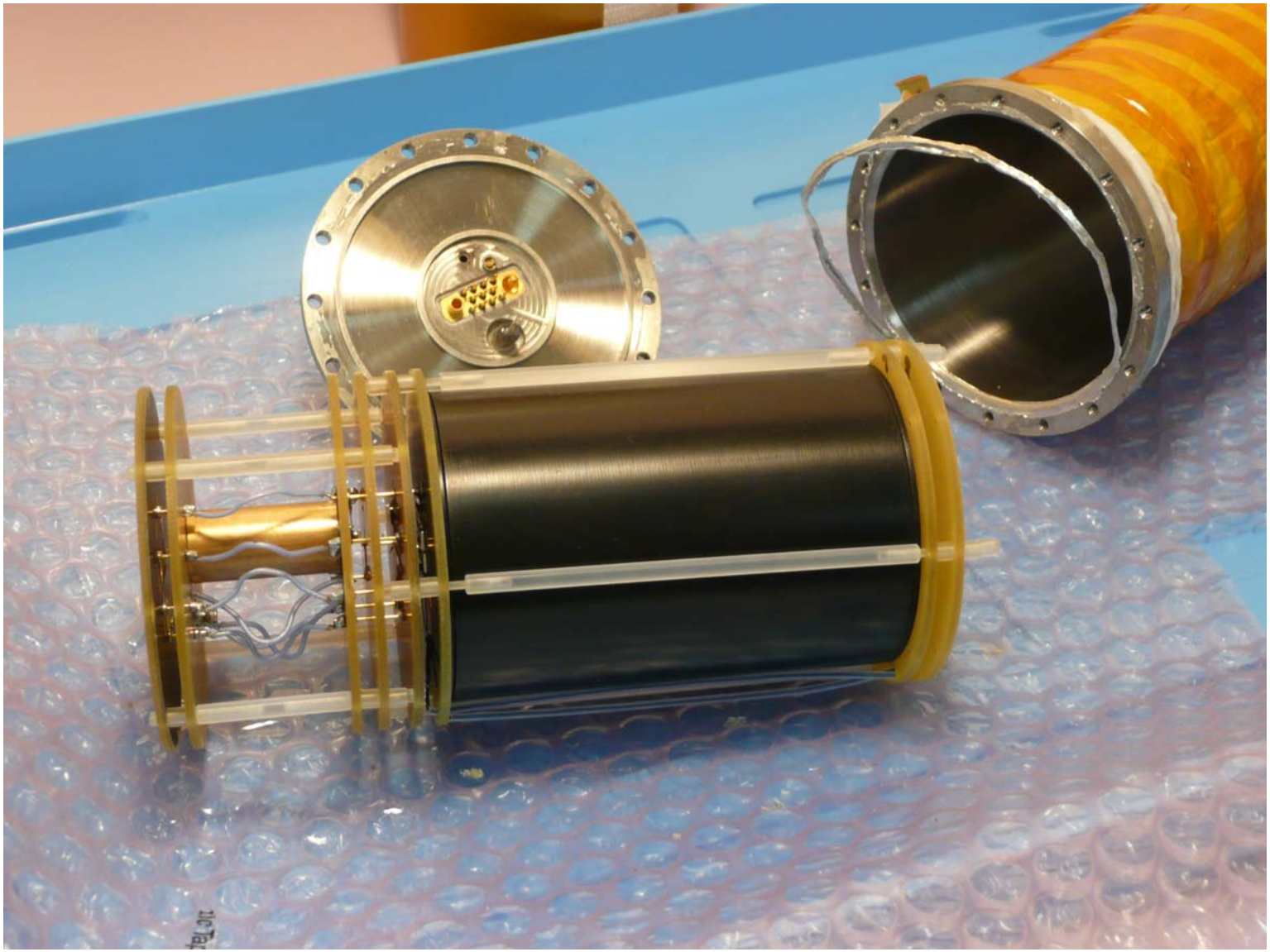
Space Radiation Analysis Group

Johnson Space Center

ISS TEPC Summary

- Right cylinder of A150 plastic – 5 cm x 5 cm
  - Gas is pure propane, simulating 2 μm of tissue
  - the projected area is 30 cm^2 and sensitive volume of the detector is 103 cm^3 for isotropic exposure.
- Current measurement location is JPM
  - New modules recently mapped Node 2, **Columbus**, and JPM
- Measures lineal energy (*y*) in the range 0.4 – 1000 keV/μm
  - y spectra recorded 1 per minute and dose rate/dose equivalent rate calculated every ~4 seconds
- Data sent to the ground every minute and has an alarm threshold of 0.05 mGy/min
- Currently used to officially track Expedition exposures = MRE
- ISS TEPC launched on STS-117 to replace failed unit.
  - Operational since 6/2007

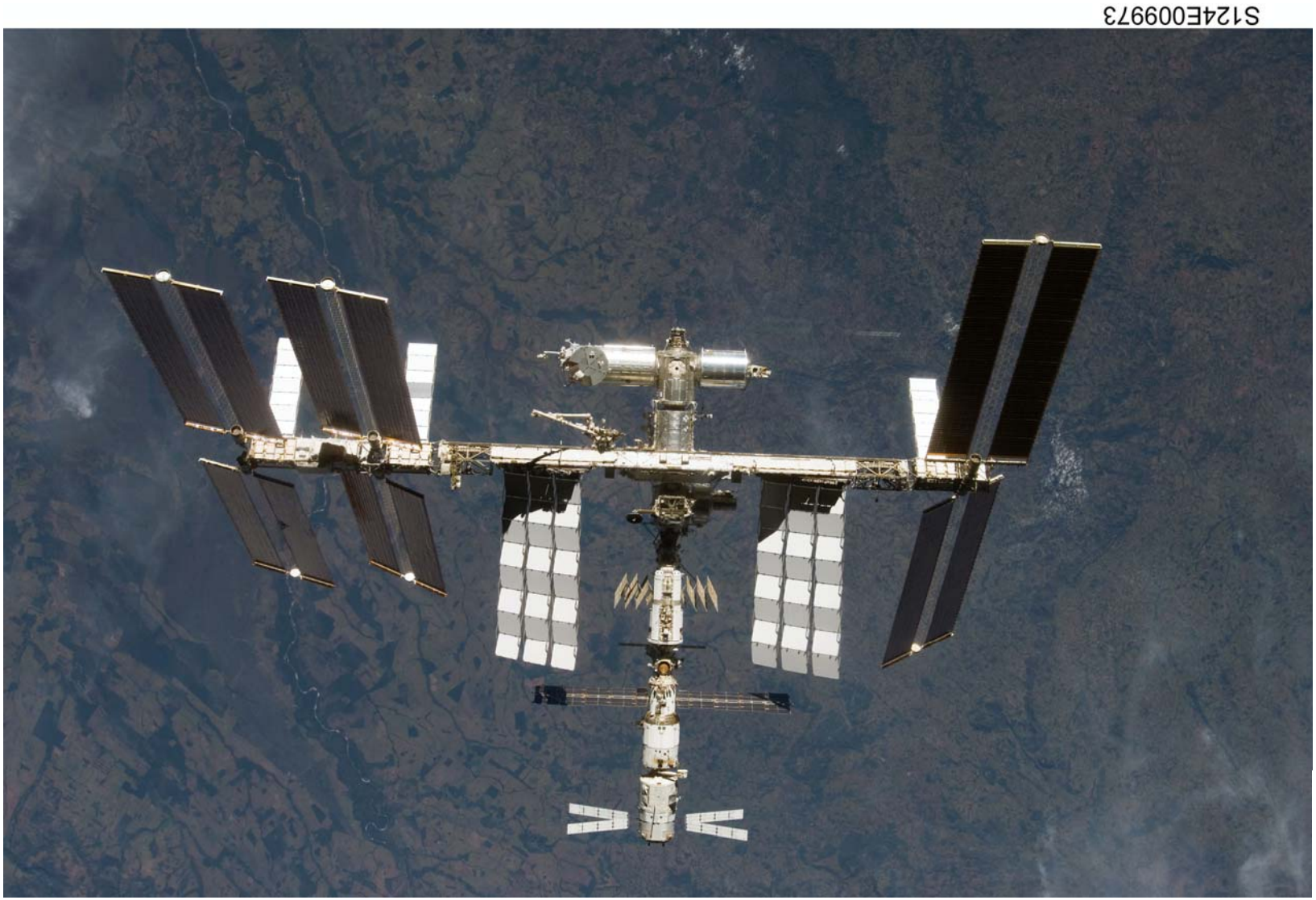
ISS TEPC



Current Location - JPM 1A5

ISS017E014022

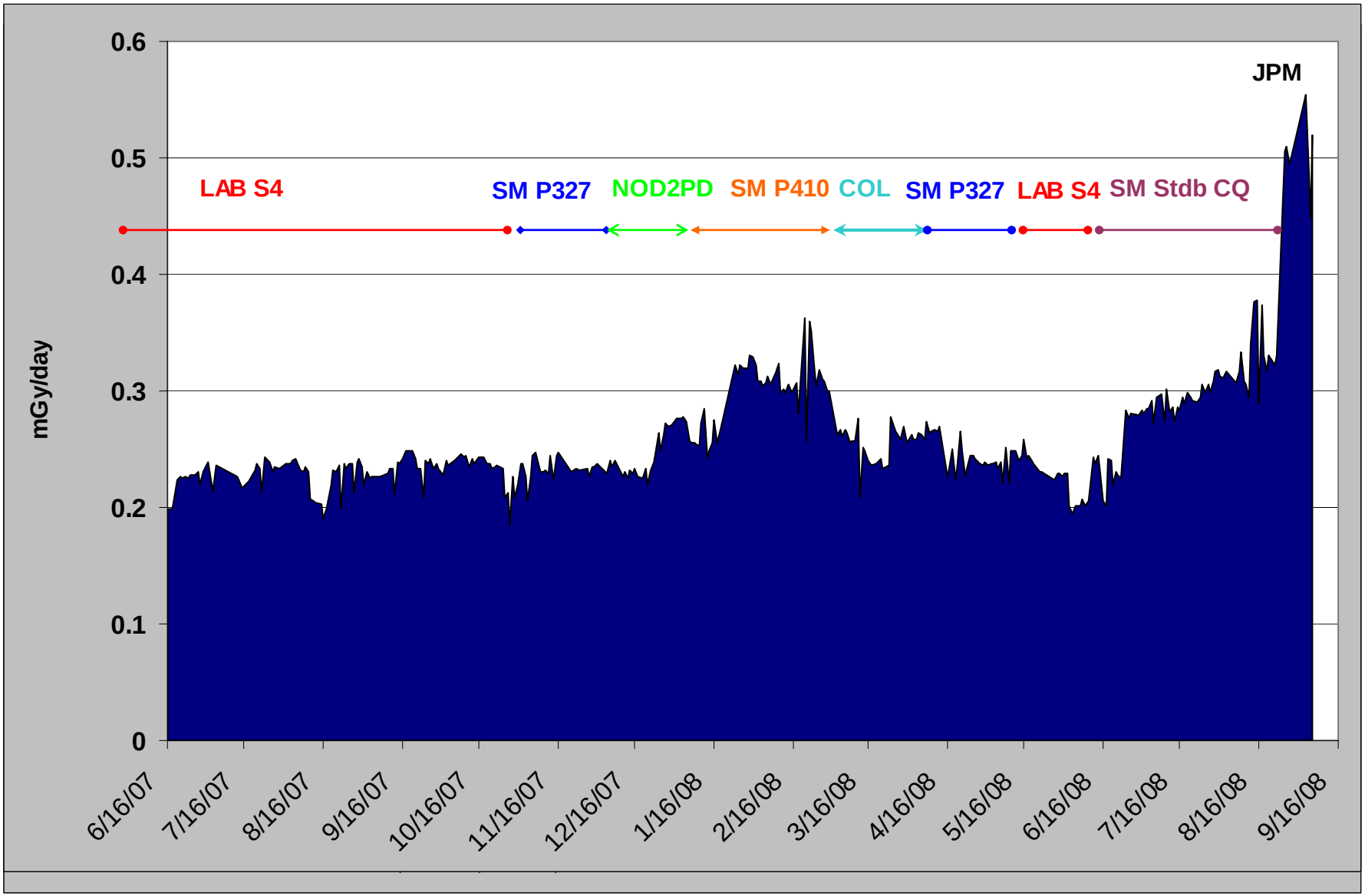
ISS Configuration



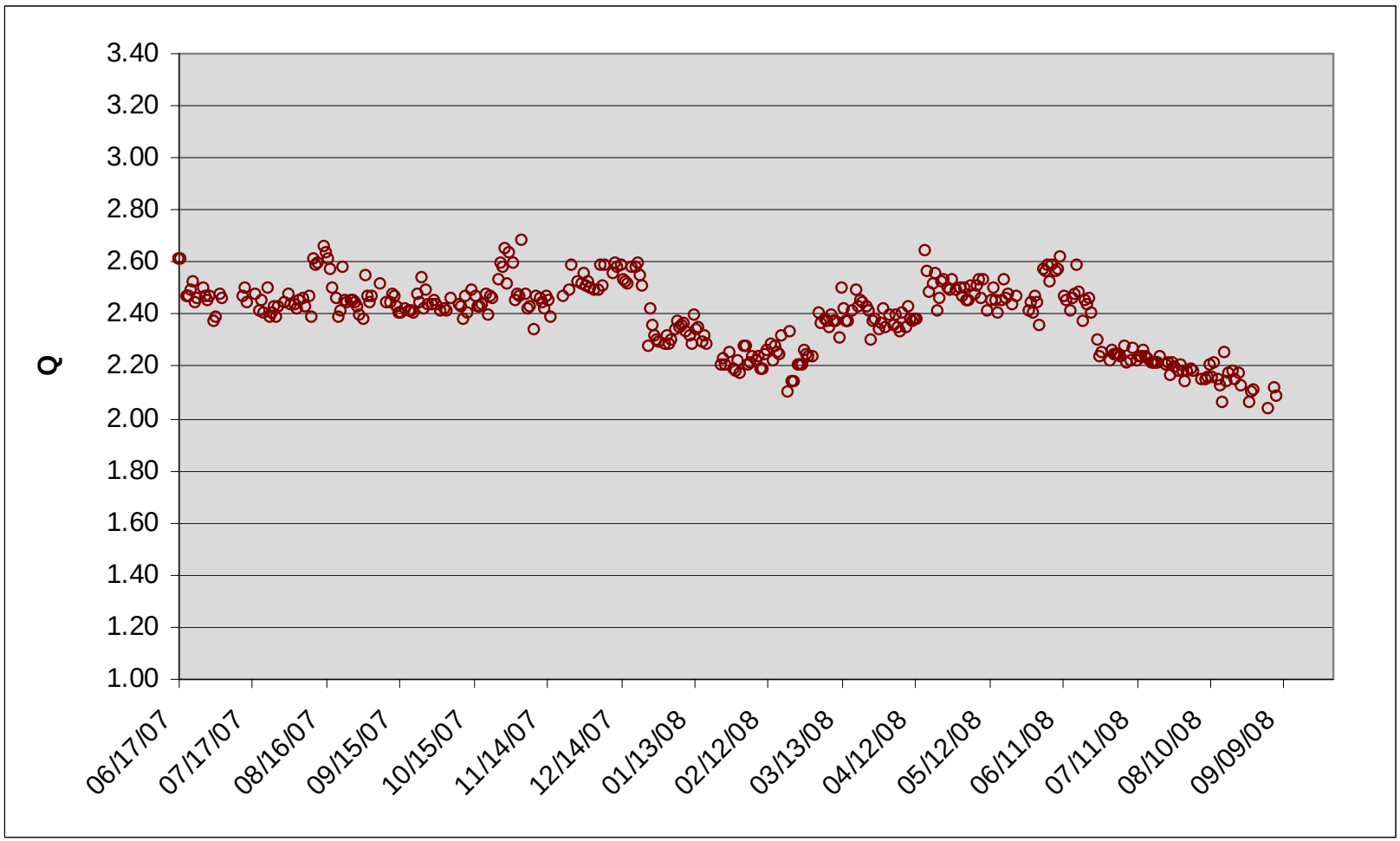
ISS TEPC on ISS

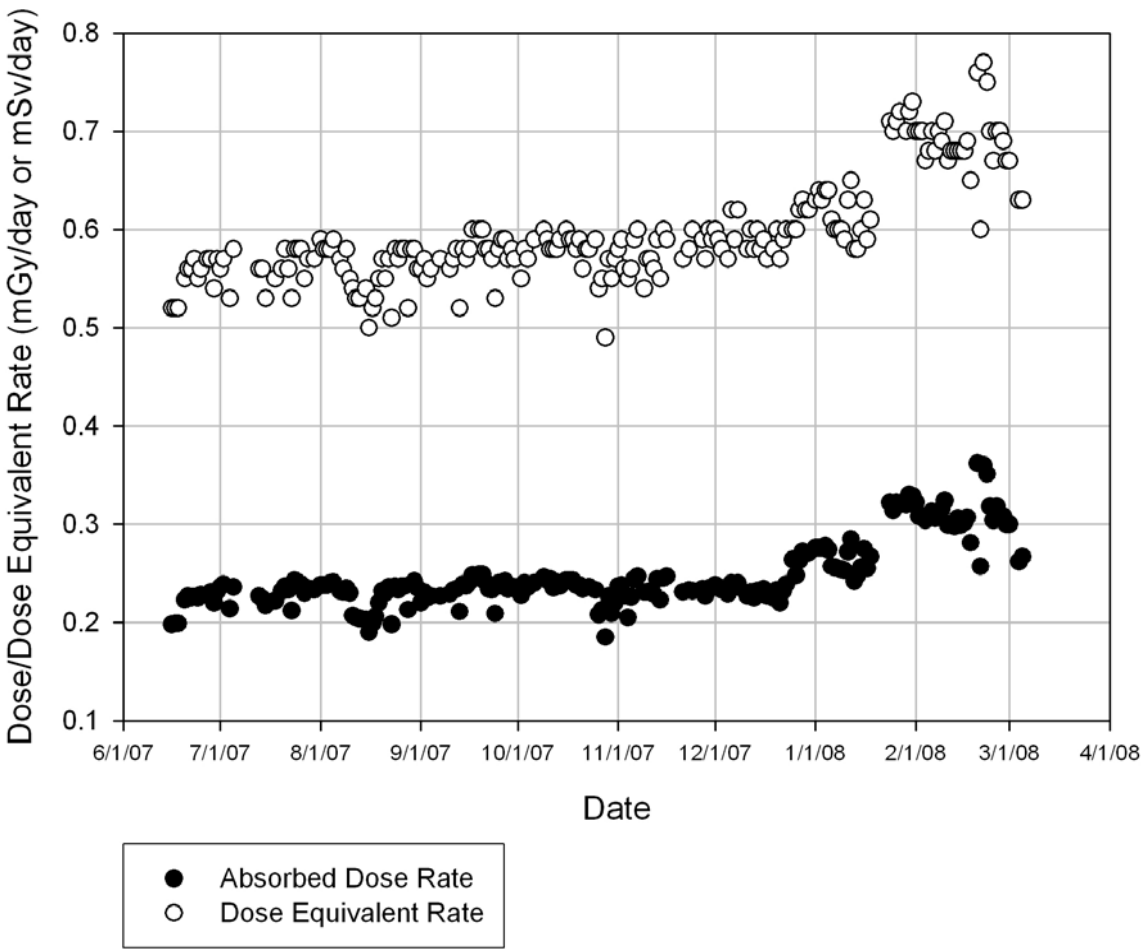
ISS015E22462

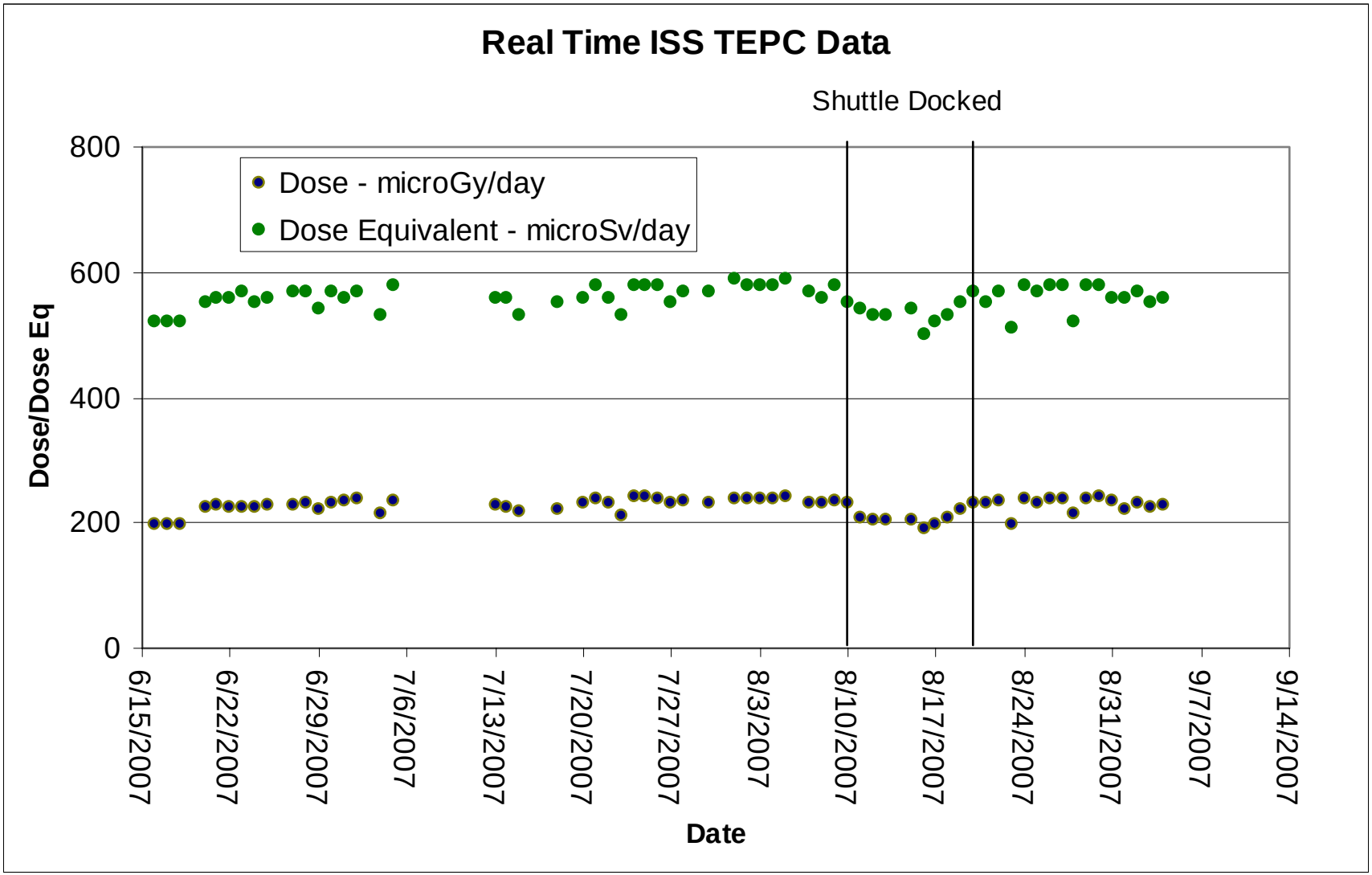
ISS TEPC Long Term Dose Rate



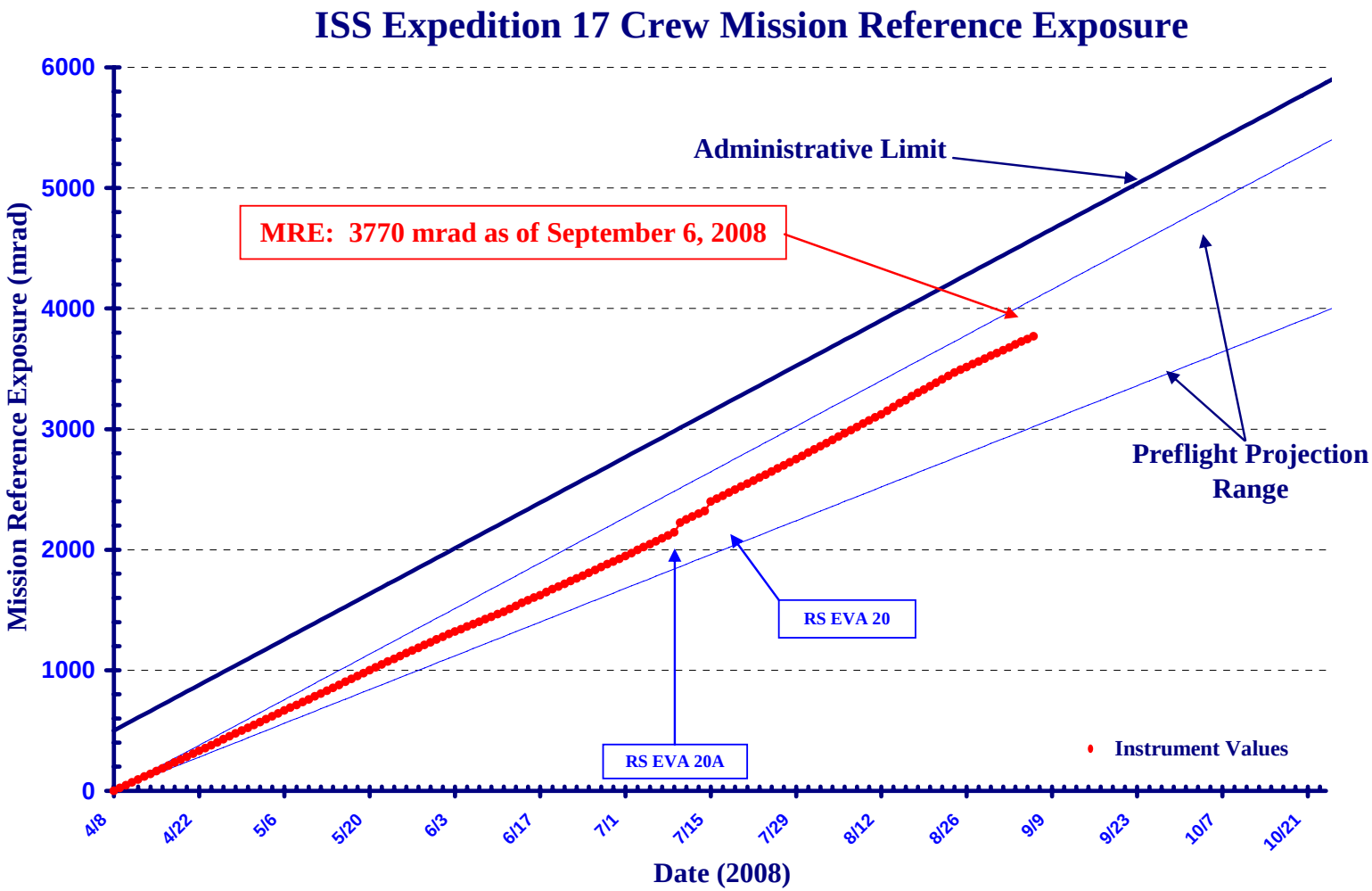
Daily Quality Factor




ISS TEPC Daily Measurements
Dose/Dose Equivalent Rate (mGy/day or mSv/day)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
6/1/07
7/1/07
8/1/07
9/1/07
10/1/07
11/1/07
12/1/07
1/1/08
2/1/08
3/1/08
4/1/08
Date
Absorbed Dose Rate
Dose Equivalent Rate


Real Time ISS TEPC Data
Shuttle Docked
Dose - microGy/day
Dose Equivalent - microSv/day
Dose/Dose Eq
800
600
400
200
0
6/15/2007
6/22/2007
6/29/2007
7/6/2007
7/13/2007
7/20/2007
7/27/2007
8/3/2007
8/10/2007
8/17/2007
8/24/2007
8/31/2007
9/7/2007
9/14/2007
Date

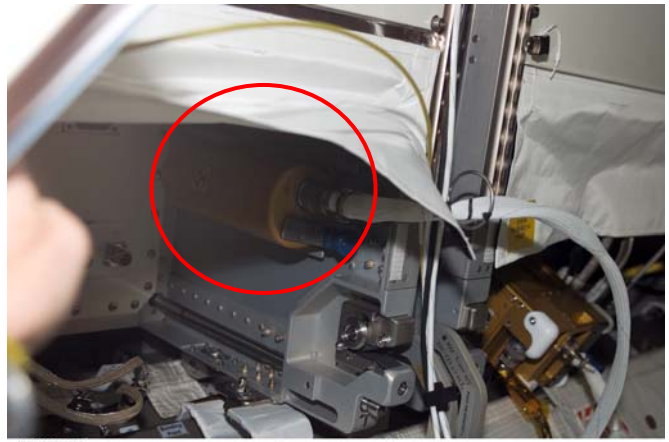
ISS TEPC MRE

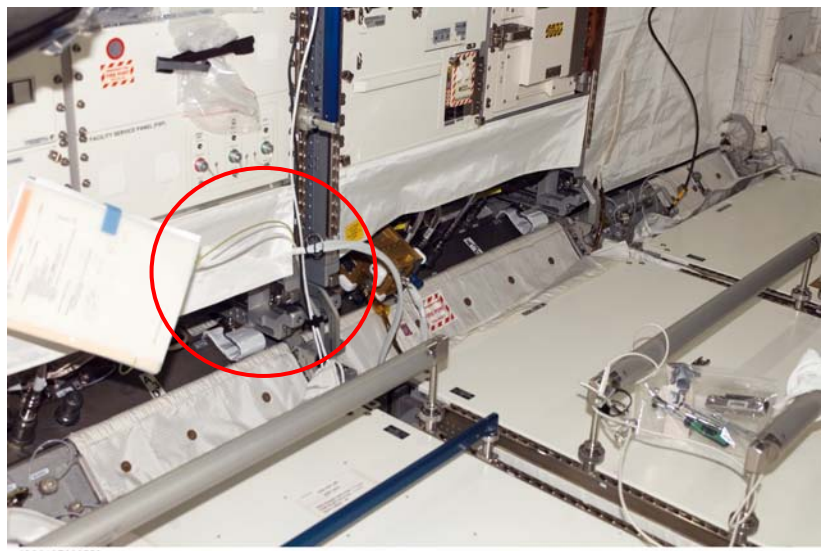

ISS Expedition 17 Crew Mission Reference Exposure
Mission Reference Exposure (mrad)
6000
5000
4000
3000
2000
1000
0
Administrative Limit
MRE: 3770 mrad as of September 6, 2008
Preflight Projection Range
RS EVA 20
RS EVA 20A
Instrument Values
4/8
4/22
5/6
5/20
6/3
6/17
7/1
7/15
7/29
8/12
8/26
9/9
9/23
10/7
10/21
Date (2008)

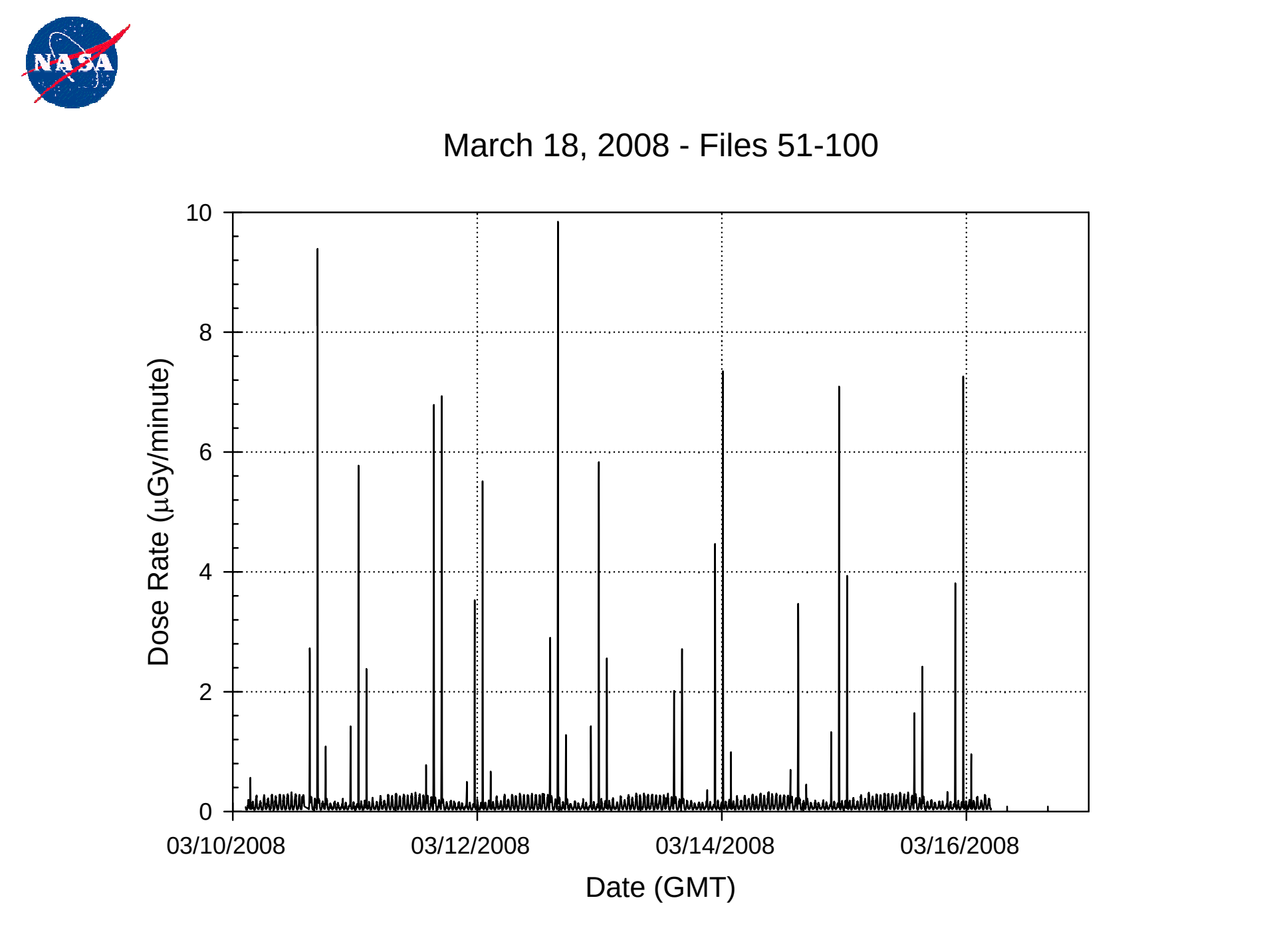
Columbus Module

- The NASA ISS TEPC has completed a measurement campaign in the Columbus Module.
- We moved the detector on March 3, at ~10:43 GMT to the Columbus EPM Rack COL1A3. The measurement period ended on 4/14/08.
  - We have 42 days of monitoring data available.
- We also have overlapping measurement data from the Shuttle-based TEPC during the STS-123 mission (3/11/08- 3/26/08). Docking of the Shuttle to ISS occurred on 3/12 and Kibo was installed
- The average altitude of ISS during the period was 346 km.

TEPC Location in Columbus






March 18, 2008 - Files 51-100
Dose Rate (µGy/minute)
10
8
6
4
2
0
03/10/2008
03/12/2008
03/14/2008
03/16/2008
Date (GMT)

Columbus Results

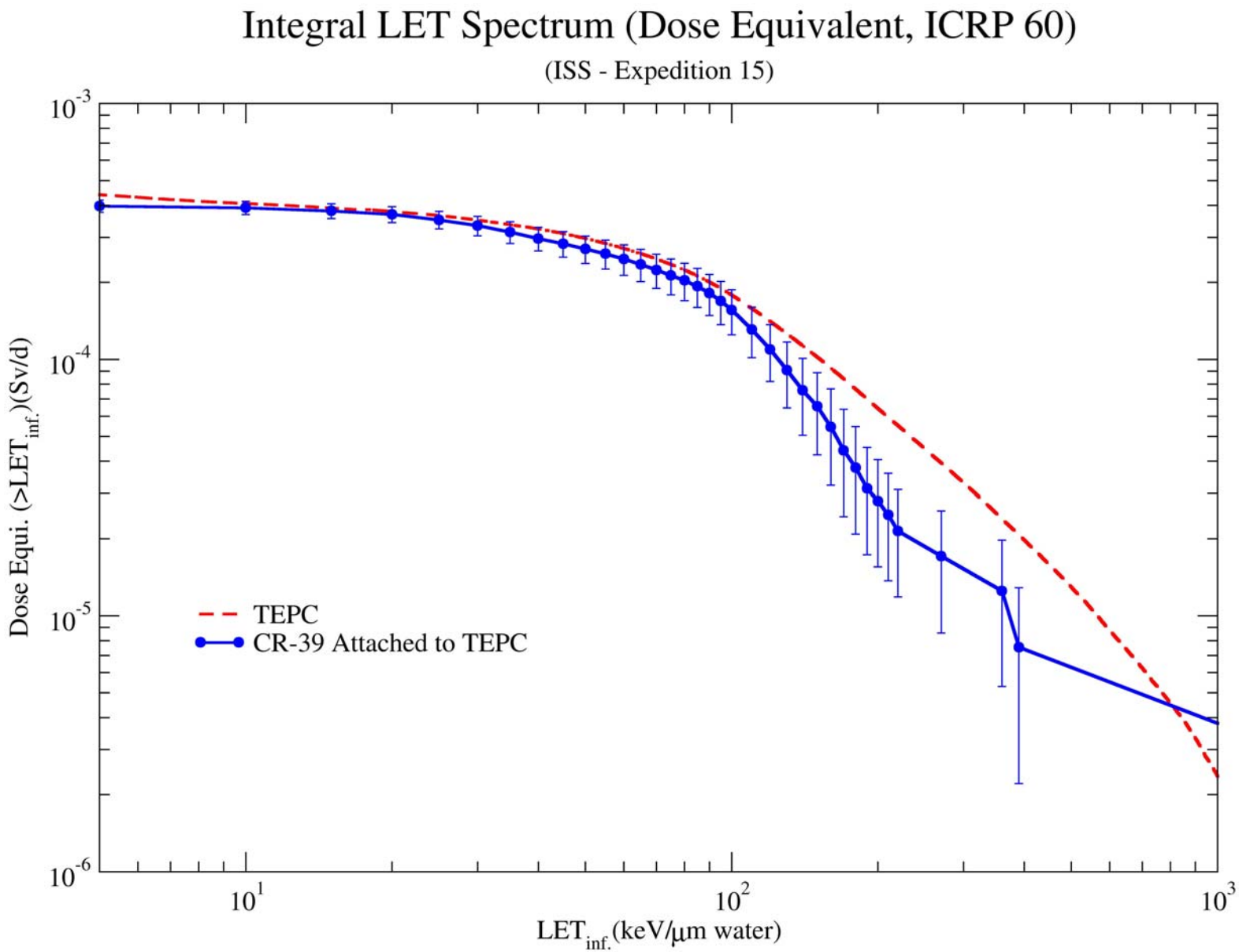
March 4 - 10

	GCR	Trapped	Total
Dose (µGy)	922.506	790.482	1712.988
Dose Eq (µSv)	2768.831	1413.807	4182.638
Particles Count	16883289	12613729	29497018
Time (minutes)	8816	626	9442
µGy/day	140.691	120.556	261.248
µSv/day	422.275	215.62	637.894

March 18 – 24

	GCR	Trapped	Total
Dose (µGy)	872.357	592.419	1464.776
Dose Eq (µSv)	2571.033	1067.608	3638.642
Particles Count	16168033	9620668	25788701
Time (minutes)	8232	502	8734
µGy/day	143.828	97.674	241.502
µSv/day	423.894	176.02	599.913

ISS TEPC and CR-39: 8/07 - 3/08



ISS TEPC RAM Results

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Radiation Area Monitors (RAM) Data (Exposure Time = 231.1 d)

Dosimeter/ Location	Dosimeter Type	Measured Dose (mGy)	[1]Dose Low-LET (<10 keV/ µm water) Q=1 (mGy)	[1]Dose CR-39 High-LET (>10 keV/ µm water) Q>11 (mGy)	[1,2]Total Dose (mGy)	[1,2]Dose Equivalent (mSv)	[1,2]Quality Factor
TEPC	TLD-100	44.32 ± 0.36	39.68	7.93 ± 0.47	47.60 ± 0.59	130.17 ± 5.42	2.73 ± 0.11
	TLD-300	47.25 ± 0.97	40.24		48.16 ± 1.08	130.73 ± 5.50	2.71 ± 0.11
	OSLD-Luxel 300s	45.99 ± 0.67	41.59		49.51 ± 0.82	132.08 ± 5.45	2.67 ± 0.11
	OSLD-Luxel 3s	49.59 ± 1.02	43.29		51.21 ± 1.12	133.78 ± 5.51	2.61 ± 0.11

Comments: [1]Quantities may not be measured/calculated for all of the dosimeter locations
[2]Quantities calculated by combining the CR-39 dose results with the TLDs/OSLDs dose results, as recommended by NCRP 142 (2002), Equation (6.1).

ISS TEPC → 58 mGy 140 mSv 2.4

Conclusions

- Dose & Dose Eq Range
  - **0.18-0.55** mGy day^{-1}
  - **0.50-1.1** mSv day^{-1}
- Q factor range
  - 2.04 – 2.68
- GCR/Trapped ratio
  - 70% Dose Eq is GCR
- ISS TEPC operating well for over 1 year