Preliminary TLD results from the DOSMAP experiment on ISS

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- **DOSMAP (Dosimetric Mapping) experiment:**
  - **one of the very first scientific experiments on ISS**
  - **international, leaded by dr. Günther Reitz (PI), DLR**
  - **operated by Expedition Two within a four month period (May-August 2001)**
  - **attempted to record and map radiation inside Space Station**
  - **uses different types of active and passive dosimeters, f.i.**
    - **the Passive Dosimeter System (PDS), containing**
      - **12 pcs of TLD-PNTD kits,**
      - **an onboard TLD Reader**

- **TLD (ThermoLuminescent Dosimeter) System**
  - **containing**
    - **unlimited number of bulb type TL Dosimeters**
      - **applying $CaSO_4$:Dy TL material,**
      - **encapsulated in a key,**
    - **an onboard TLD Reader**
      - **small in size, mass and power consumption**
      - **easy-to-handle,**
      - **suitable for automatic readout with short time periods.**
  - **developed, manufactured and maintained by KFKI AEKI, Hungary**
  - **launched on Space Shuttle “Discovery” on March 8, 2001**
  - **activated on May 3, 2001**

The Main Specifications of “Pille” (TLD-System)

Dosemeters

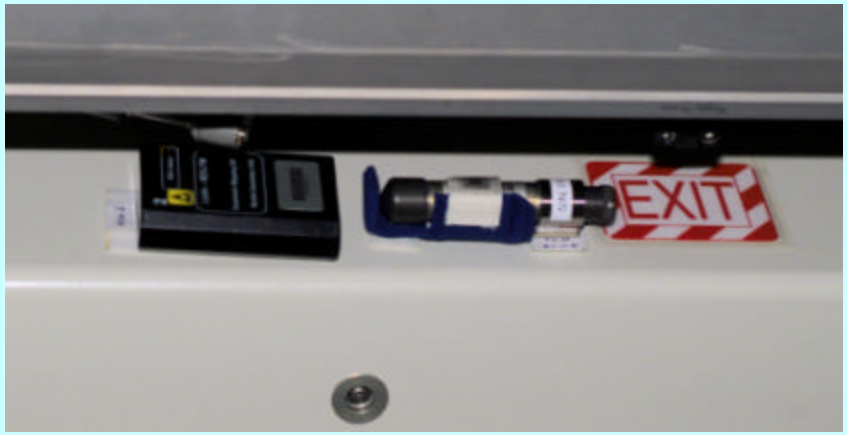
Type: bulb
Material: $CaSO_4$:Dy
Dimensions: f 20 mm * 60 mm
Mass: 70 g (with carrying case)

Reader

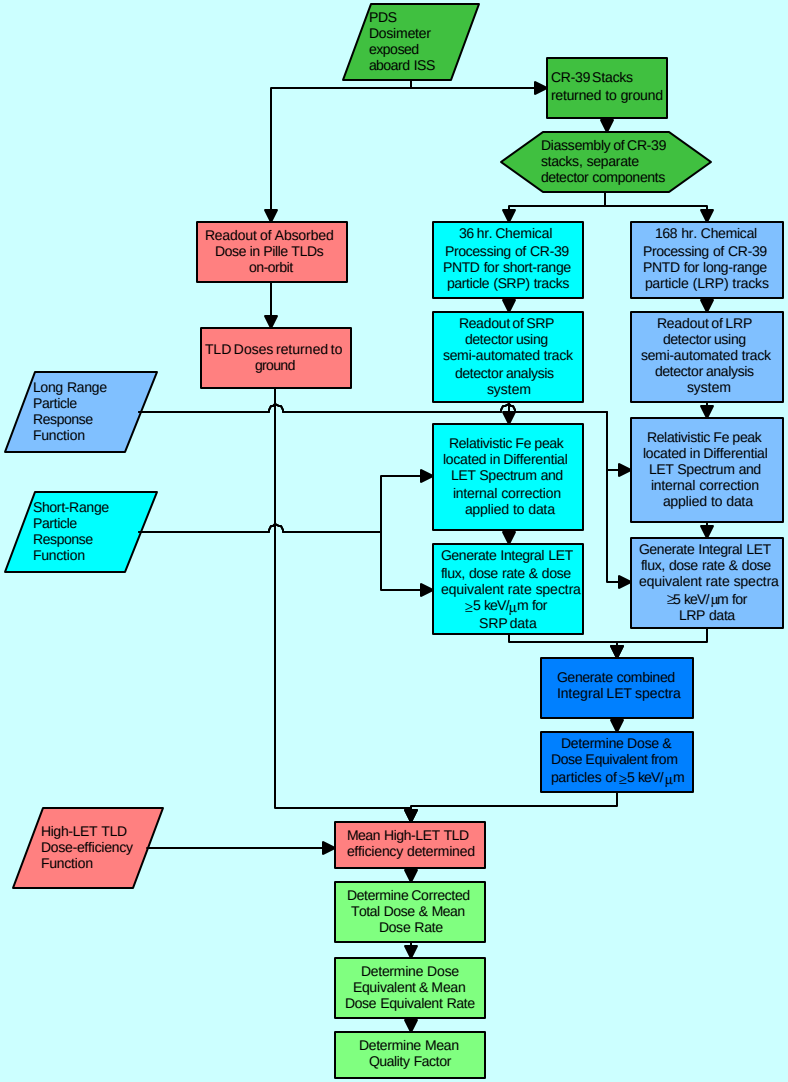
Measuring range (s<10%):	**3 mGy ¸ 10 Gy ($CaSO_4$:Dy)**
TLD Efficiency e=1±10%	**LET¥H_2O < 10 keV/mm**
Read-out precision:	**3 digits + exp.**
Accuracy (above 10 mGy):	**d < 5%**
Measuring modes:	**manual / automatic read-out**
Display:	**8-digit alphanum. LED**
Displayed information:	**- dose in mGy** **- date and time of measurement** **- identification numbers** **- dose rate** **- error codes**
Storage of information:	**PCMCIA mem. card (> 4000 data sets)**
Computer connection:	**RS-232**
Dimensions:	**70 mm * 190 mm * 120 mm**
Mass:	**1,400 g**
Power consumption:	**0.1 / 1 / 7 W (standby/ready/readout)**


Pille • TLD Reader

- **PNTD (Plastic Nuclear Track Detector)**
  - **CR39 covered by Lexan, attached to the TLDs**
  - **to measure the dose of high-LET particles,**
  - **for correcting the LET dependence of the TLD efficiency,**
  - **developed, manufactured and maintained by Eril Research Inc., USA**



Processing and Analysis of ISS Passive Dosimetry System



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- **Preliminary results of TLD measurements from DOSMAP**
  - **11 pieces of TLD-PNTD kits**
    - **located at several places of ISS,**
    - **TLDs of the kits read out every 8th ... 12th day,**
    - **PNTDs of the kits brought back to Earth at the end of the experiment.**
  - **One TLD kept permanently in the Reader and read out every 1.5 hour automatically**
  - **1438 measurements fulfilled until 07.24.2001,**
  - **data downloaded to Earth.**

Location of TLD-PNTD kits

Dosimeter	Location	Orientation
A0102	Node 1 (combined with MDU1 and NTDP4.F	Zenith area of aft hatch, opposite of US Lab
A0103	US Lab	Any axis on BBND
A0104	Node 1	Zenith area of forward hatch
A0105	Node 1	Zenith area of starboard hatch
A0106	Node 1	Port side close to US Lab
A0107	US Lab (combined with NTDP5.F and MDU 4)	Opposite end of lab from Ku Band on Zenith area of aft hatch
A0108	Node 1	Nadir area on forward hatch
A0109	US Lab	Seat track on starboard side of US Lab close to forward hatch
A0110	US Lab	Seat track on starboard side of US Lab close to aft hatch
A0111	US Lab	Seat track on port side of US Lab close to forward hatch
A0112	US Lab	Seat track on port side of US Lab close to aft hatch

Measured dose values

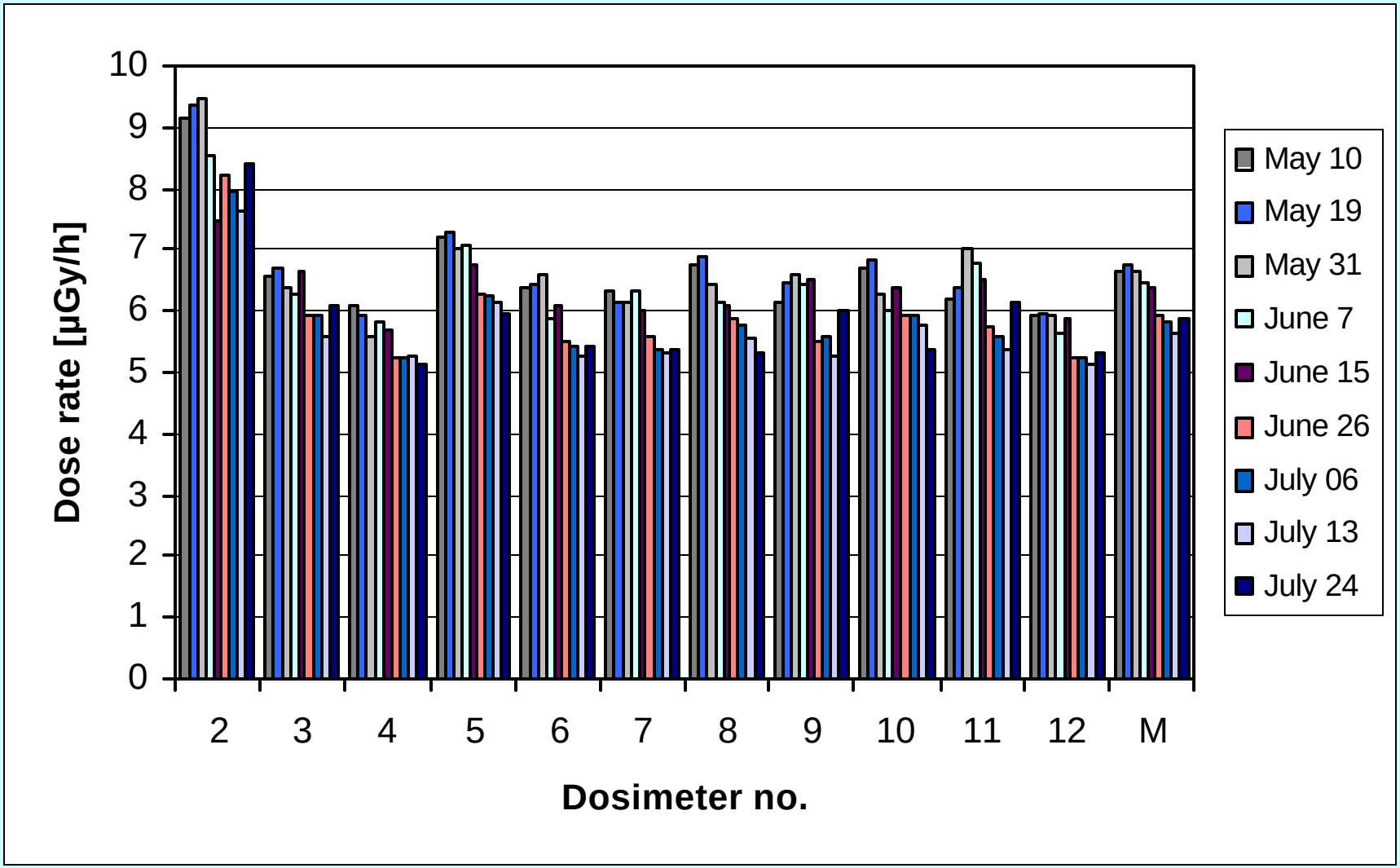
Dos no.	dose [µGy]									
	05.03	05.10	05.19	05.31	06.07	06.15	06.26	07.06	07.13	07.24
A0101	9.82E3	autom.	autom.	autom.	autom.	autom.	autom.	autom.	autom.	autom.
A0102	8.94E3	1.53E3	2.01E3	2.68E3	1.43E3	1.42E3	2.16E3	2.16E3	1.39E3	2.16E3
A0103	8.53E3	1.10E3	1.44E3	1.81E3	1.05E3	1.26E3	1.56E3	1.56E3	1.02E3	1.57E3
A0104	7.95E3	1.02E3	1.27E3	1.59E3	9.79E2	1.08E3	1.38E3	1.38E3	9.58E2	1.33E3
A0105	8.71E3	1.21E3	1.57E3	1.99E3	1.18E3	1.28E3	1.66E3	1.66E3	1.12E3	1.54E3
A0106	8.29E3	1.07E3	1.38E3	1.87E3	9.82E2	1.16E3	1.45E3	1.45E3	9.64E2	1.39E3
A0107	8.60E3	1.06E3	1.32E3	1.74E3	1.06E3	1.14E3	1.48E3	1.48E3	9.71E2	1.38E3
A0108	7.99E3	1.13E3	1.48E3	1.83E3	1.03E3	1.16E3	1.55E3	1.55E3	1.01E3	1.37E3
A0109	8.23E3	1.03E3	1.39E3	2.22E3[1]	7.35E2	1.24E3	1.45E3	1.45E3	9.58E2	1.55E3
A0110	8.26E3	1.12E3	1.47E3	1.79E3	1.01E3	1.21E3	1.56E3	1.56E3	1.05E3	1.38E3
A0111	8.38E3	1.04E3	1.37E3	1.99E3	1.14E3	1.24E3	1.51E3	1.51E3	9.76E2	1.59E3
A0112	8.32E3	9.92E2	1.28E3	1.68E3	9.42E2	1.11E3	1.38E3	1.38E3	9.34E2	1.37E3

Measured dose rate values

Dos No.	dose rate [µGy/h]								
	05.10 168 h	05.19 215 h	05.31 284 h	06.07 168 h	06.15 190 h	06.26 264 h	07.06 240 h	07.13 182 h	07.24 258 h
A0102	9.13	9.34	9.436	8.537	7.486	8.189	7.917	7.622	8.378
A0103	6.56	6.70	6.372	6.268	6.643	5.914	5.917	5.594	6.089
A0104	6.09	5.90	5.598	5.844	5.694	5.232	5.250	5.254	5.158
A0105	7.22	7.30	7.006	7.043	6.748	6.293	6.250	6.142	5.973
A0106	6.38	6.42	6.583	5.862	6.115	5.497	5.417	5.287	5.391
A0107	6.33	6.14	6.126	6.327	6.008	5.612	5.376	5.325	5.353
A0108	6.74	6.88	6.442	6.147	6.115	5.878	5.792	5.539	5.314
A0109	6.15	6.46	6.584[1]	6.425[2]	6.535	5.498	5.584	5.254	6.012
A0110	6.68	6.84	6.302	6.029	6.376	5.915	5.918	5.759	5.352
A0111	6.21	6.37	7.006	6.803	6.535	5.725	5.586	5.353	6.167
A0112	5.92	5.95	5.914	5.622	5.850	5.233	5.210	5.123	5.314
Mean	6.67	6.75	6.67	6.45	6.37	5.91	5.84	5.66	5.86
Mean, norm.	1.00	1.01	1.00	0.97	0.88	0.78	0.78	0.77	0.80

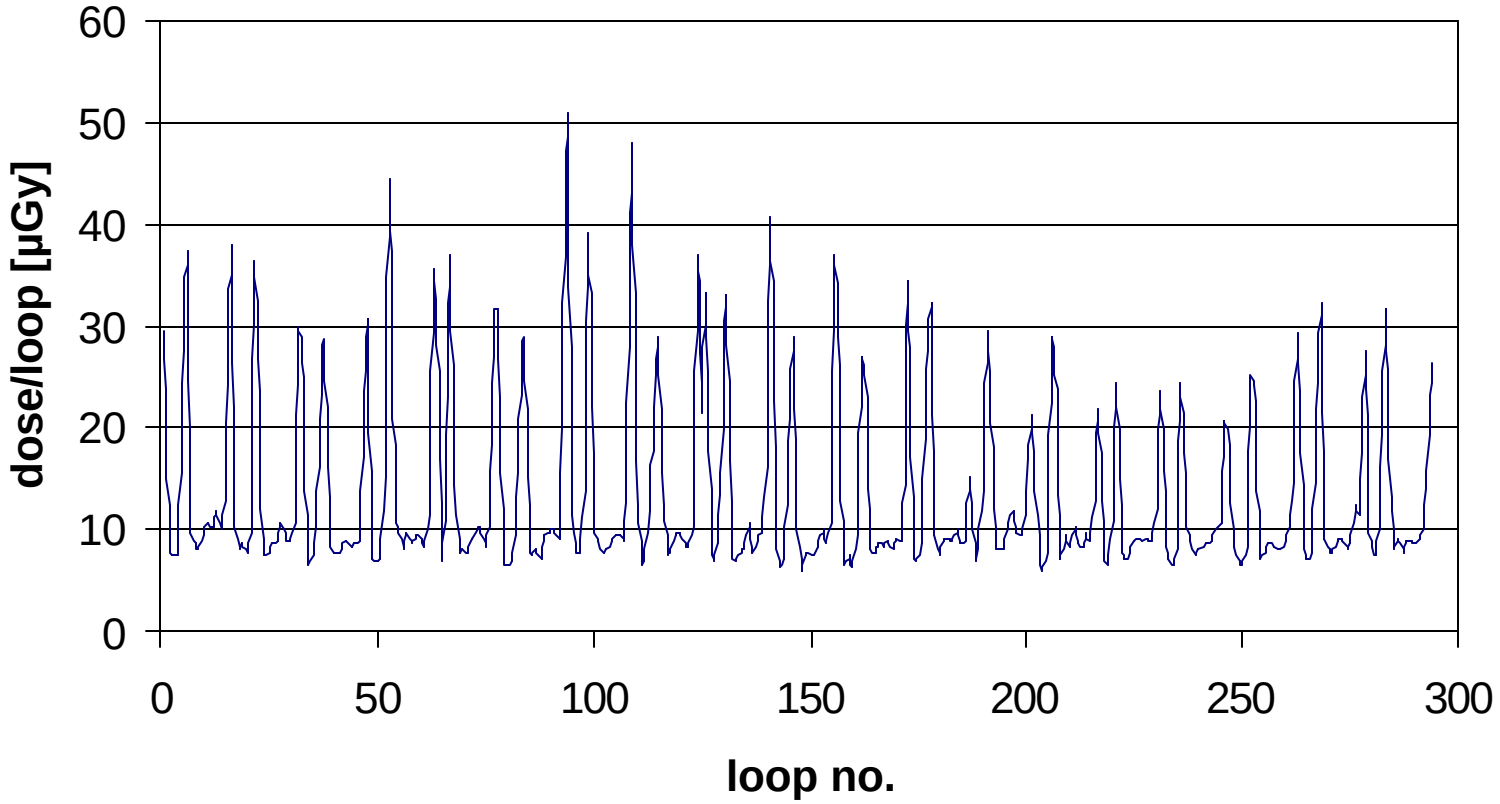
No.2: Zenith area of aft hatch, opposite of US Lab **No.12: Seat track on port side of US Lab close to aft hatch**

Measured dose rate values



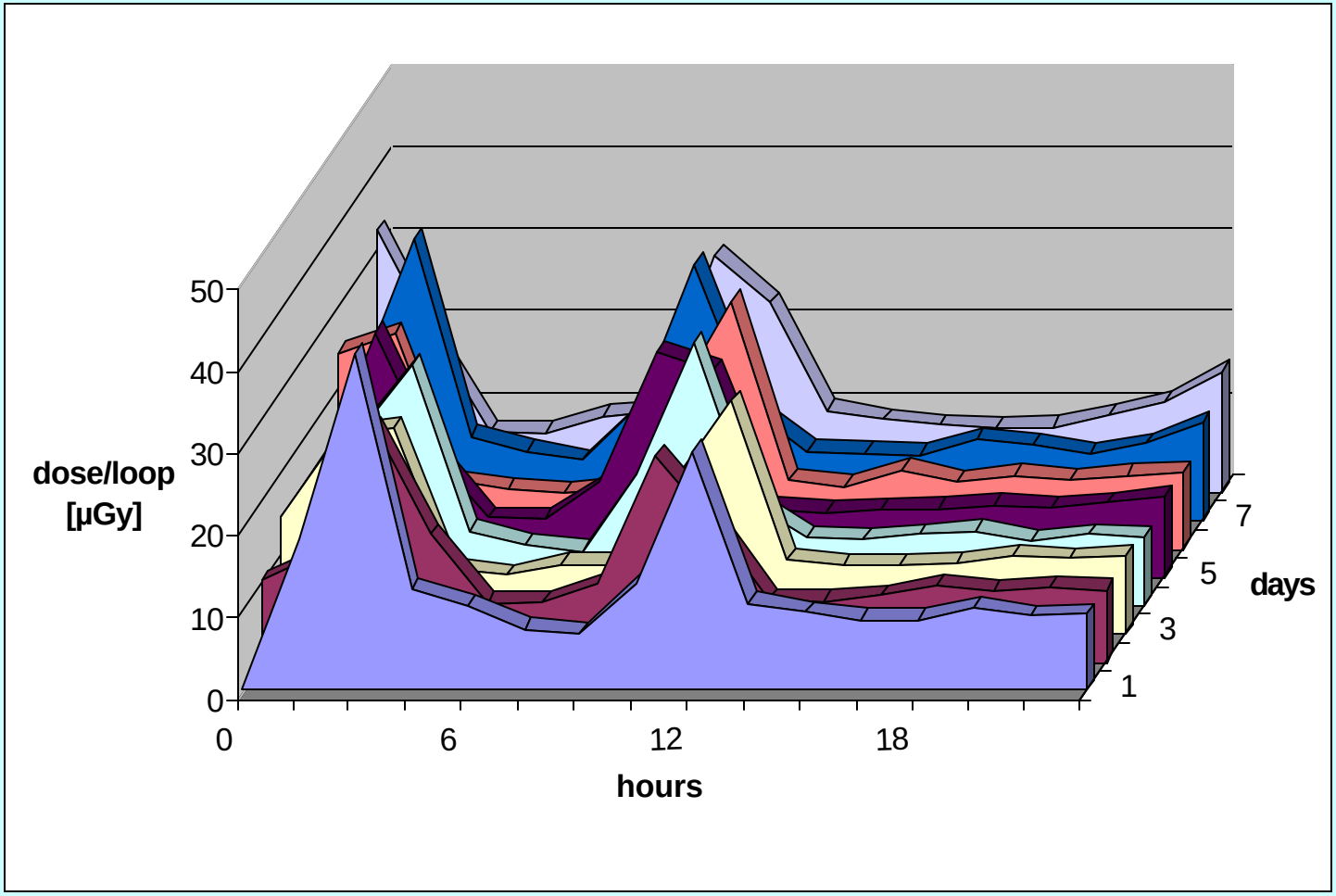
Results of automatic measurements

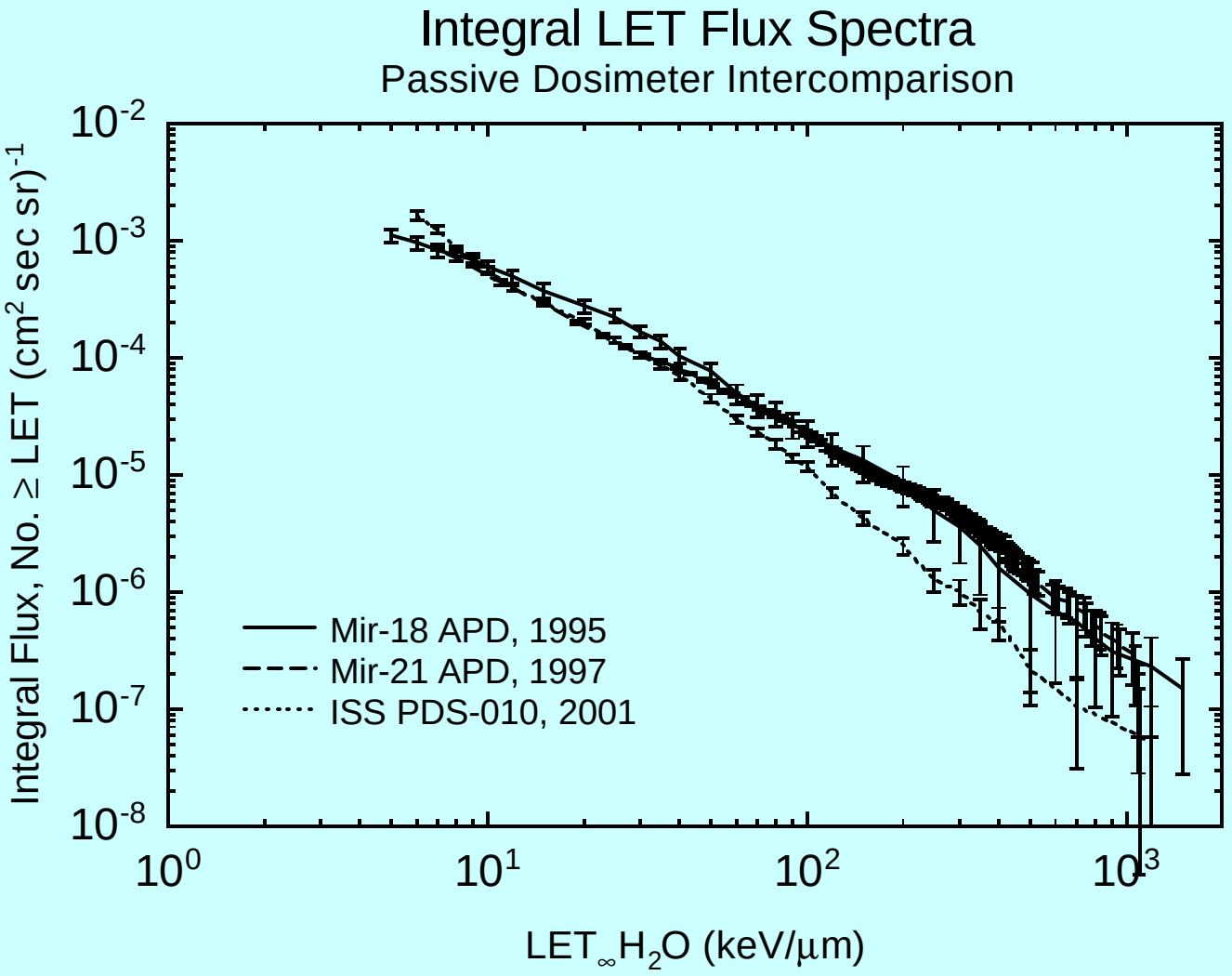
(Time period 05.19.2001 - 06.07.2001)



Results of automatic measurements

(Time period 05.11.2001 - 05.19.2001)




Integral LET Flux Spectra
Passive Dosimeter Intercomparison
Integral Flux, No. ≥ LET (cm^2 sec sr)$^{-1}$
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
10^0
10^1
10^2
10^3
LET$_\infty$H$_2$O (keV/μm)
Mir-18 APD, 1995
Mir-21 APD, 1997
ISS PDS-010, 2001

- **Preliminary results - no conclusions**

  - **TLD: dose rate inside *ISS* considerably less than in *Mir* (average)**
    - **ISS average: ~ 6.2 μGy/h**
    - **Mir average: ~12.5 - 13 μGy/h**
  - **PNTD: more shielding at Mir than at ISS**
    - **(at the location of the detectors)**