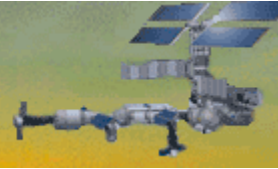




WRMISS



# Preliminary results of the SPD Box experiments onboard ISS

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**16<sup>th</sup> Workshop on Radiation Monitoring for the International Space Station**  
**6-8 September 2011**

**Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University  
Prague, Czech Republic**

# SPD boxes

**SPD-7** experiments from 28/04/2010 till 26/11/2010

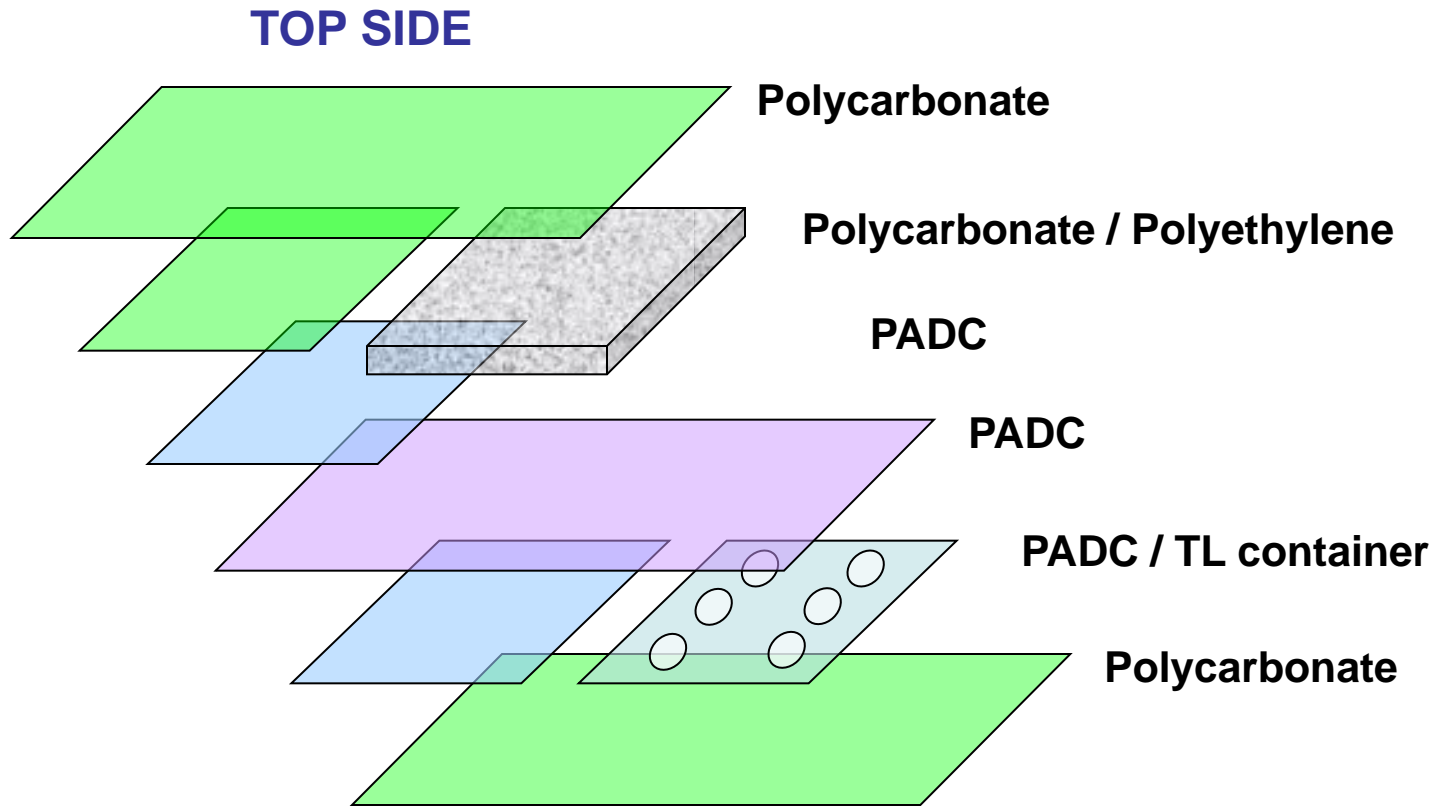
**Duration: 211.48 days**

<b>Box №</b>	<b>Panel № / Location</b>
<b>1</b>	<b>102 / Pirs Neck near Russian node</b>
<b>2</b>	<b>401 / Pirs Neck near Russian node</b>
<b>3</b>	<b>325 / SM CC left, overhead</b>
<b>4</b>	<b>461 / SM near Docking Bay left, starboard</b>
<b>5</b>	<b>323 / SM CC right, overhead</b>
<b>6</b>	<b>305 / SM near Pirs Docking Bay right, overhead</b>

SM : Service Module

CC: Crew Cabin

# Detector stack composition



Dimensions: 36 x 54 x 5 mm<sup>3</sup>

# Solid State Nuclear Track Detectors (SSNTDs)

**Detector material:** polyallyl-diglycol-carbonate (PADC, TASTRAK, Bristol, UK)

**Etching** in 6 N NaOH at  $70 \pm 0.1$  °C

**1<sup>st</sup> step:** 6 h, ~8 µm removal, short range, high LET particles

**2<sup>nd</sup> step:** 15 h, ~20 µm removal, lower LET & GCR particles

**Controlled by standardized Po alpha source**

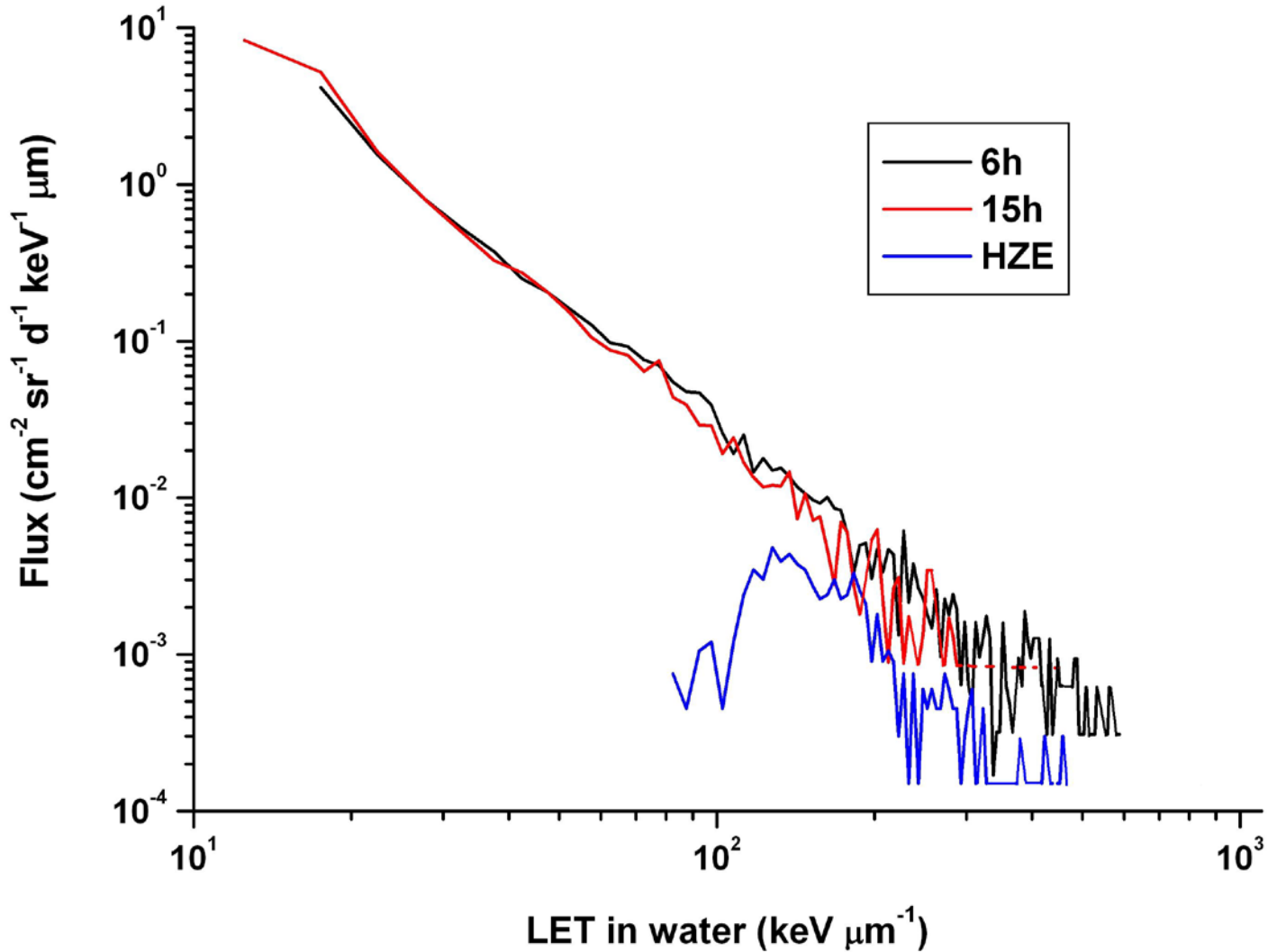
**Semi-automated track analysis**

**Long range particles' parameters measured manually**

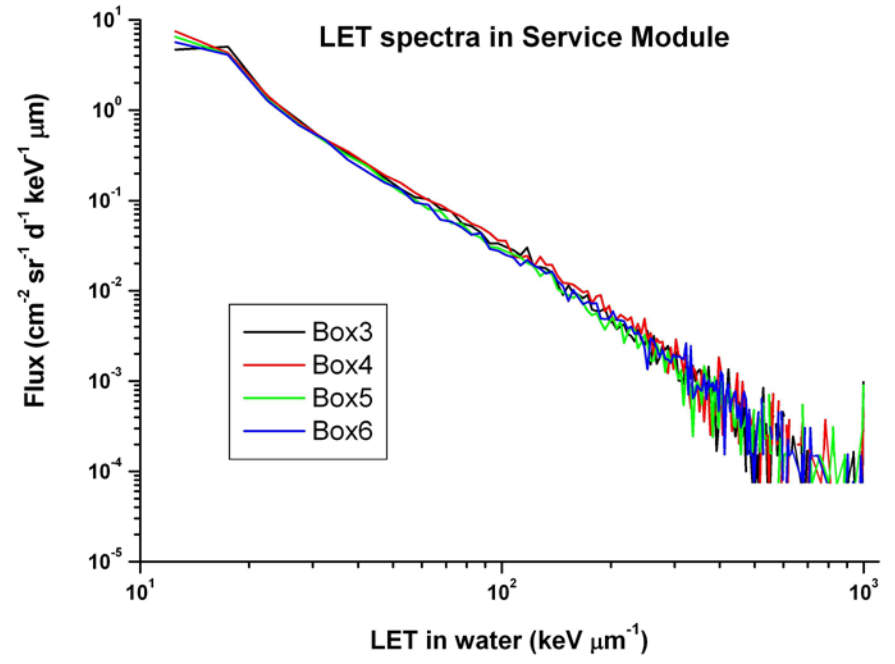
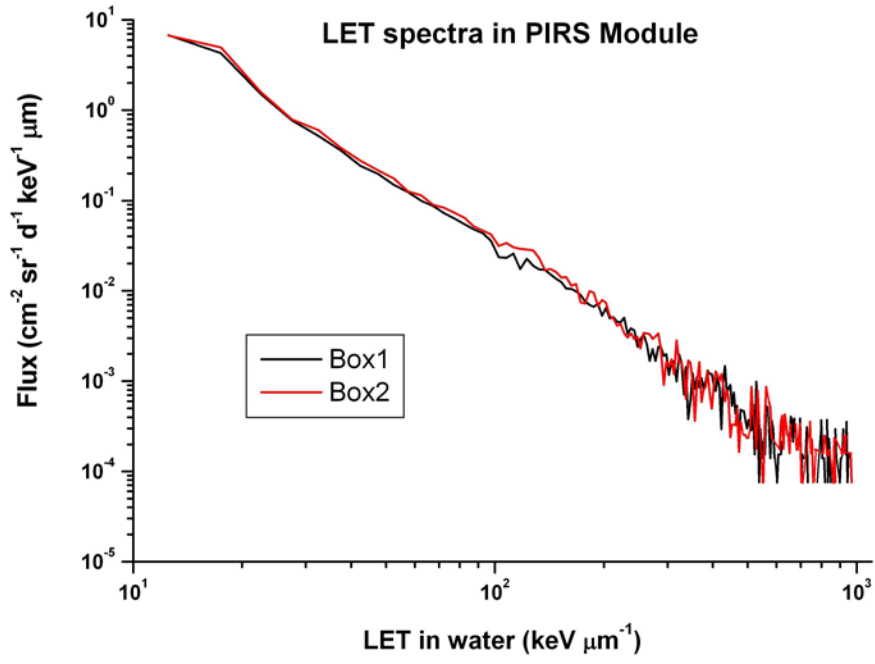
**LET spectra corrected for critical angle and background**

**Short & Long etch LET spectra were combined**

# LET spectra - an example in Box1



# LET spectra



# SSNTD Dose rates above 10 keV/ $\mu\text{m}$

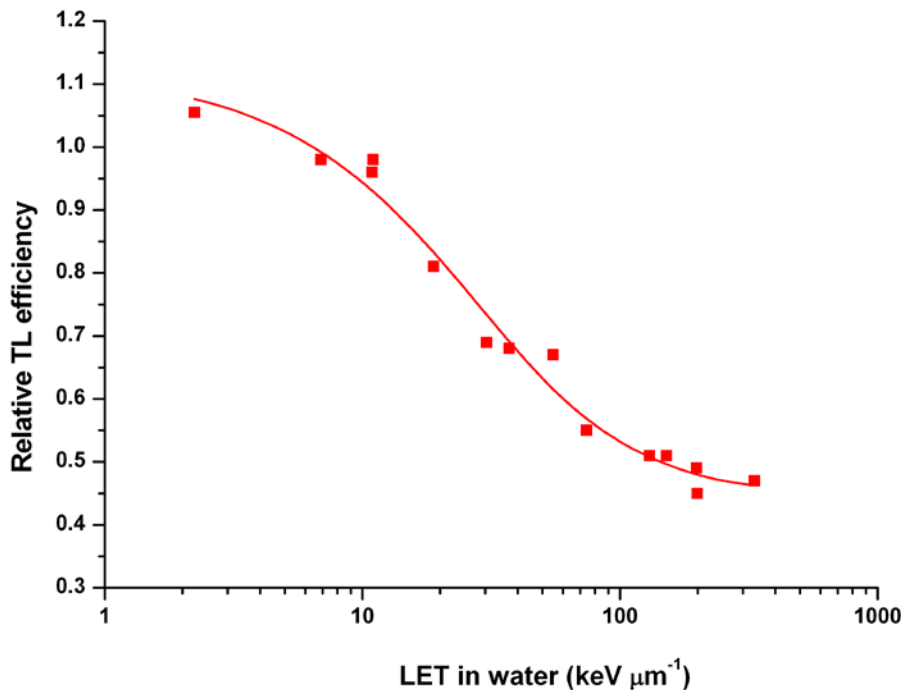
Box №	<b>D <math>\pm 1\sigma</math></b> $\mu\text{Gy/day}$	<b>H <math>\pm 1\sigma</math></b> $\mu\text{Sv/day}$	<b>Q <math>\pm 1\sigma</math></b>
1	40.09 $\pm 6.97$	398.93 $\pm 44.04$	9.95 $\pm 0.59$
2	43.69 $\pm 1.44$	449.20 $\pm 23.15$	10.28 $\pm 0.21$
3	36.73 $\pm 1.03$	371.06 $\pm 10.07$	10.10 $\pm 0.57$
4	40.63 $\pm 1.48$	404.84 $\pm 22.70$	9.96 $\pm 0.94$
5	35.50 $\pm 3.95$	336.46 $\pm 20.02$	9.48 $\pm 0.47$
6	34.48 $\pm 3.02$	339.67 $\pm 29.56$	9.85 $\pm 0.04$

# Thermoluminescence detectors

**Detector material:**  ${}^7\text{LiF:Mg,Ti}$  discs (MTS-7, Krakow, Poland)

The sensitivity curve for high LET radiation was established by the help of high energy particle accelerators to facilitate corrections

The detection sensitivity to 662 keV gamma radiation ( ${}^{137}\text{Cs}$ ) and the intrinsic background of each disc were individually determined



TL efficiency data from:

BILSKI, P., BERGER, T., HAJEK, M. and REITZ, G., 2011.  
**COMPARISON OF THE RESPONSE OF VARIOUS TLDs TO COSMIC RADIATION AND ION BEAMS: CURRENT RESULTS OF THE HAMLET PROJECT.** *Rad.Meas.*  
doi:10.1016/j.radmeas.2011.03.023

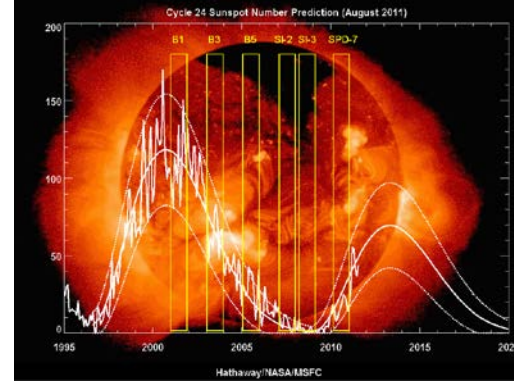


# Total Dose rates

<b>Box No</b>	<b>TLD Dose rate</b> μGy/day	<b>TLD Dose rate corrected</b> μGy/day	<b>Total Dose rate</b> μGy/day	<b>Dose Equivalent rate</b> μSv/day	<b>Q</b>
1	298.97	273.40	313.49	672.33	2.14
2	287.56	259.85	303.54	709.05	2.34
3	225.03	201.63	238.36	572.69	2.40
4	249.28	223.16	263.79	628.00	2.38
5	209.52	186.44	221.94	522.90	2.36
6	189.91	167.79	202.27	507.46	2.51

# D, H and Q on the ISS

## LET $\geq 10$ keV/ $\mu$ m



Experiment	Mission date	Location	D rate $\pm 1\sigma$ $\mu$ Gy/day	H rate $\pm 1\sigma$ $\mu$ Sv/day	Q $\pm 1\sigma$
BRADOS-1	02.24. – 31.10.2001	SM, P443	$38.8 \pm 8.2$	$324.8 \pm 3.6$	$8.4 \pm 1.8$
BRADOS-3	02.02. – 28.10.2003	SM, P443	34.8	310.2	8.9
BRADOS-5	28.02. – 11.10.2005	SM, P443	$27.0 \pm 1.6$	$211.4 \pm 14.4$	$7.9 \pm 0.1$
SI2	12.05. – 21.10.2007	SM at Matroshka-R	$27.7 \pm 0.9$	$336.1 \pm 3.9$	$12.1 \pm 0.3$
SI3	14.05. – 24.10.2008	SM	$38.3 \pm 3.2$	$380.2 \pm 14.5$	$9.9 \pm 0.4$
SPD-7	28.05. – 26.11.2010	Box4, SM, P461	$40.6 \pm 1.4$	$404.84 \pm 22.7$	$9.9 \pm 0.9$

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Thanks for your attention!