MATROSHKA – Overview of 2004 - 2005

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- ESA Project
- Project Manager Dr. Reitz, DLR
- International Contribution:
  15 Institutes

MATROSHKA

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J. Palfalvi	Atomic Energy Research Institute, AERI, Budapest, Hungary
D. O´Sullivan	DIAS, Dublin, Ireland
D. Bartlett	National Radiological Protection Board, NRPB, Chilton, UK
N. Vana	Atominstitute of the Austrian Universities, ATI, Vienna, Austria
Y. Uchihori	NIRS, Chiba, Japan
S. Yoshitomi, A. Nagamatsu	JAXA, Japan
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B. Atwell	Space Systems Division, Boeing, Houston, USA
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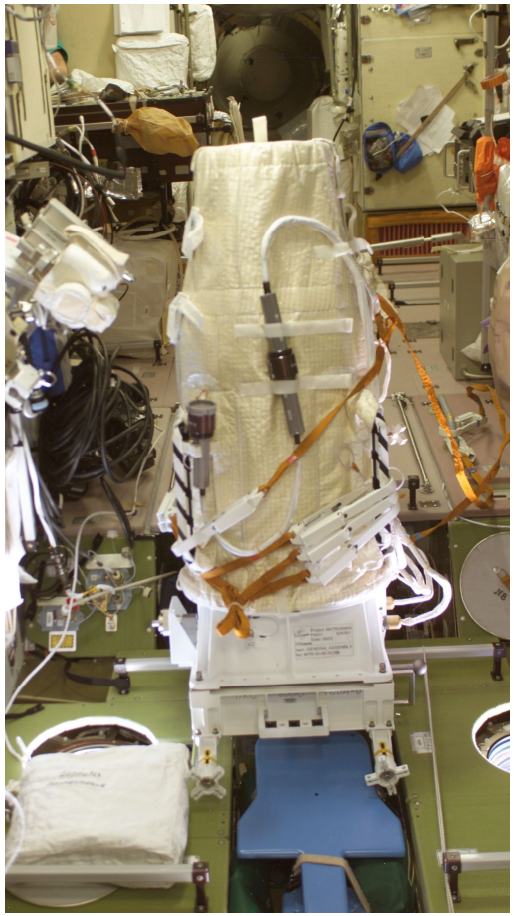
S. McKeever	Oklahoma State University, Stillwater, USA
J. Miller and C. Zeitlin	Lawrence Berkeley Laboratory, Berkeley, CA, USA

MATROSHKA

- MATROSHKA (MTR) Facility is designed to determine the radiation exposure of an astronaut / cosmonaut during an extravehicular activity (EVA)
- Radiation exposure is measured in a Phantom simulating an Human Upper Torso shielded with a Carbon Fibre structure simulating the EVA suit
- Active and Passive Radiation Detectors are distributed over the whole body to determine skin and organ doses



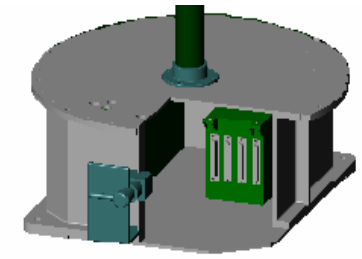
MATROSHKA

- MATROSHKA is the first long duration phantom experiment positioned outside a Space Station

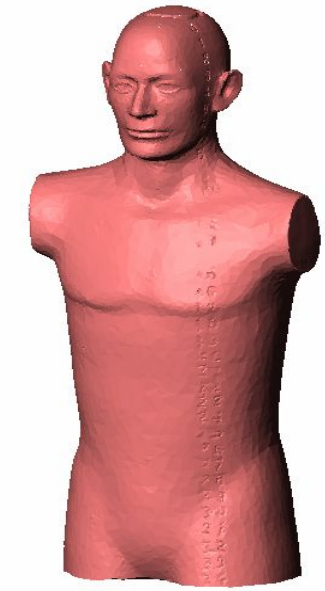
- Results shall give the dose distribution inside a Human Phantom for a better correlation between skin and organ dose and for better risk assessment in future long duration space flight

MATROSHKA

- **MATROSHKA** simulates an astronaut during an Extra Vehicular Activity. A human phantom is exposed in a pressurized container which meets the mean shielding thickness of a space suit (0.5 – 1 g/cm2).



Base structure



Phantom

Container

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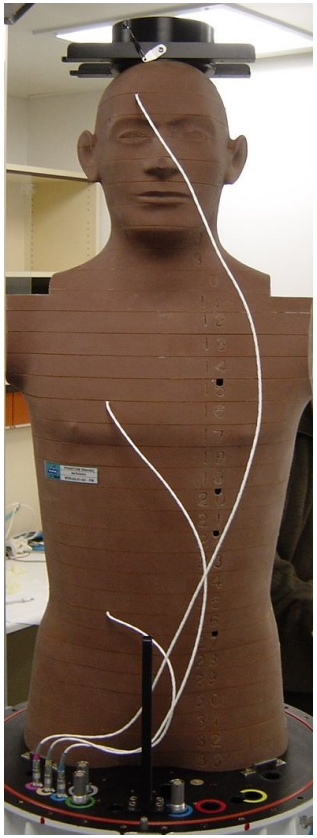
MATROSHKA

Phantom Torso + Poncho + Container + MLI



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DOSTEL

TEPC

SSD
- Eye
- Lung
- Stomach
- Kidney
- Intestine

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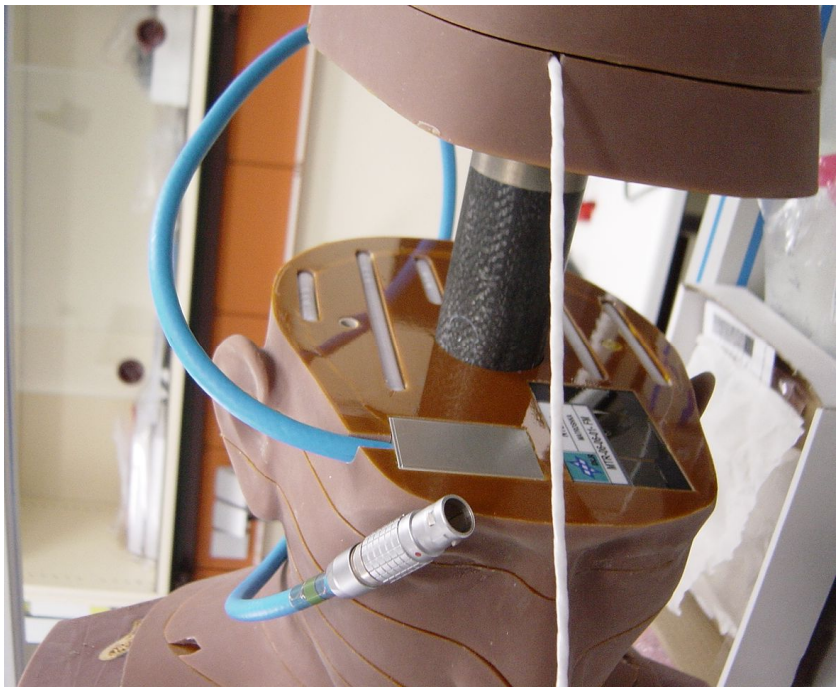
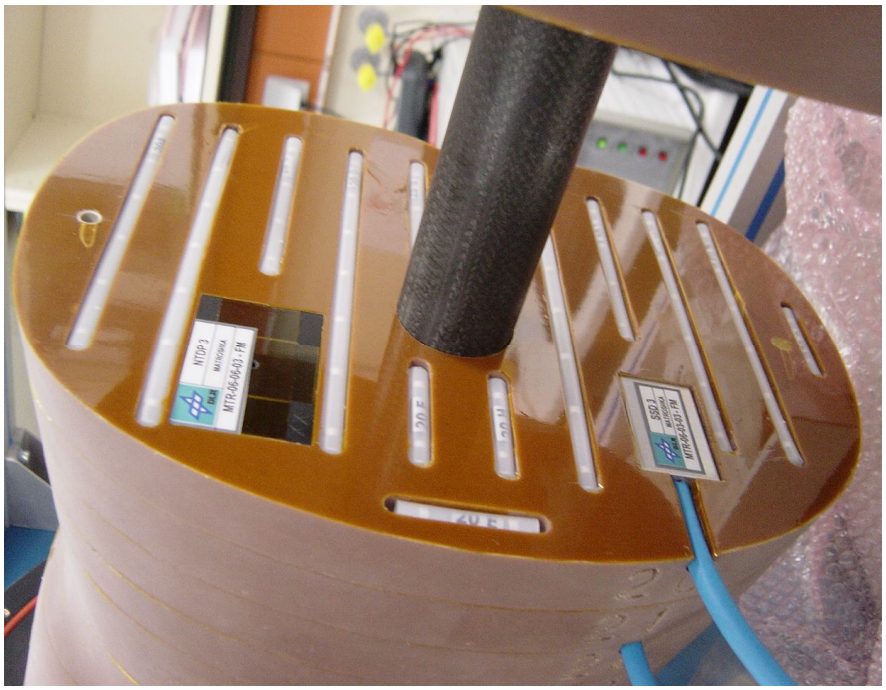
- Radiation detectors inside the MATROSHKA facility

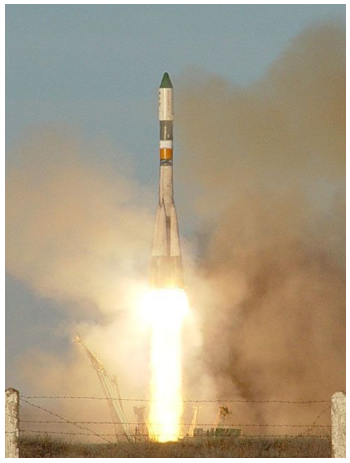


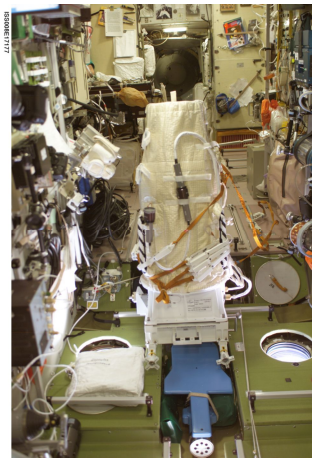


- MATROSHKA 2004 - 2005

MATROSHKA

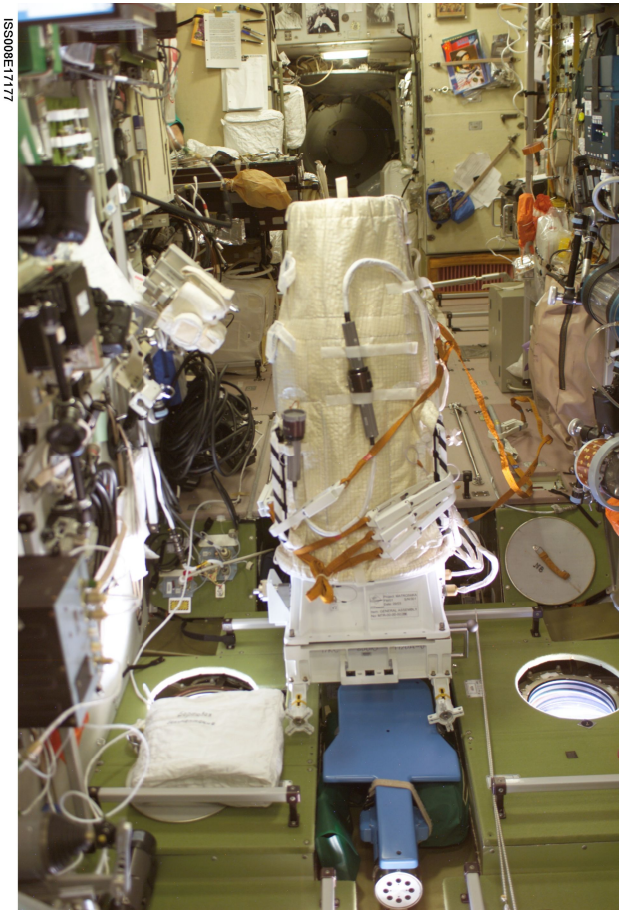
- Launch: 29. January 2004
- Docking: 31. January 2004
- EVA: 26. February 2004
- Active instruments: April 2004
- Exposure Time: 1 ½ years
- Back inside ISS: 18. August 2005





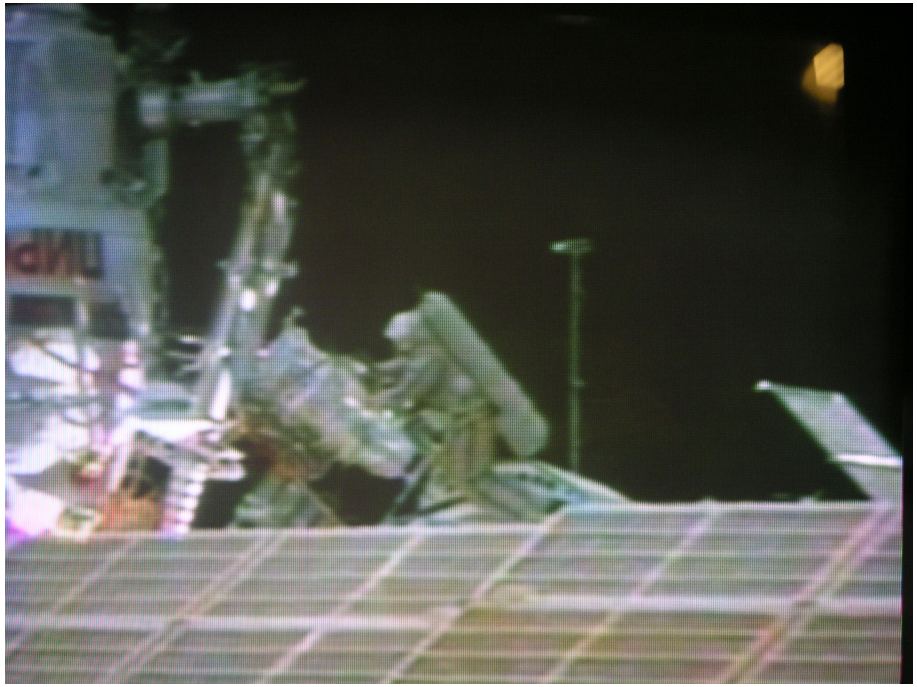
MATROSHKA

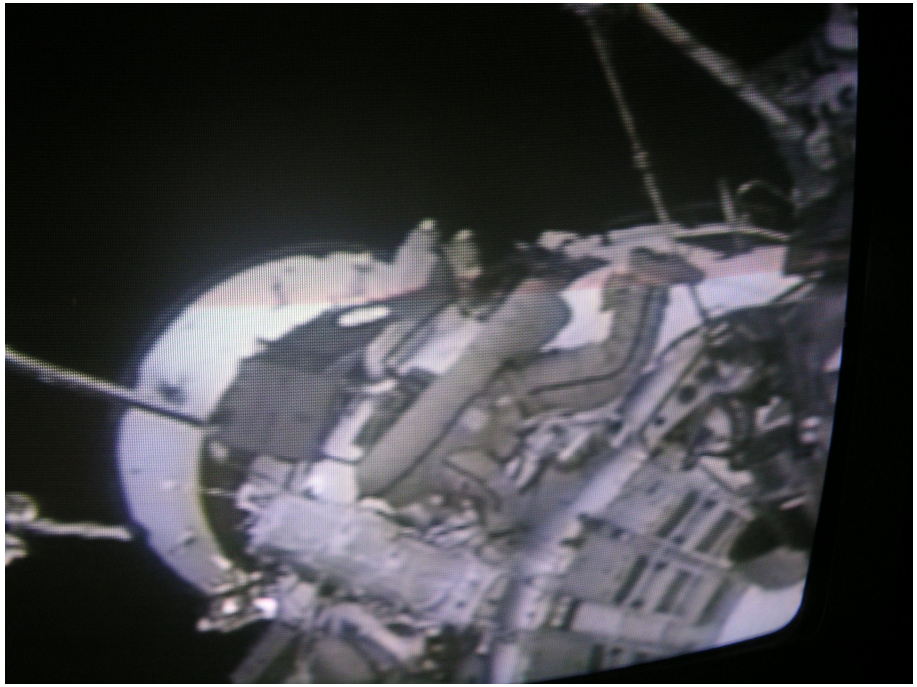
- MTR inside ISS: 31. January 2004 – 26. February 2004



MATROSHKA

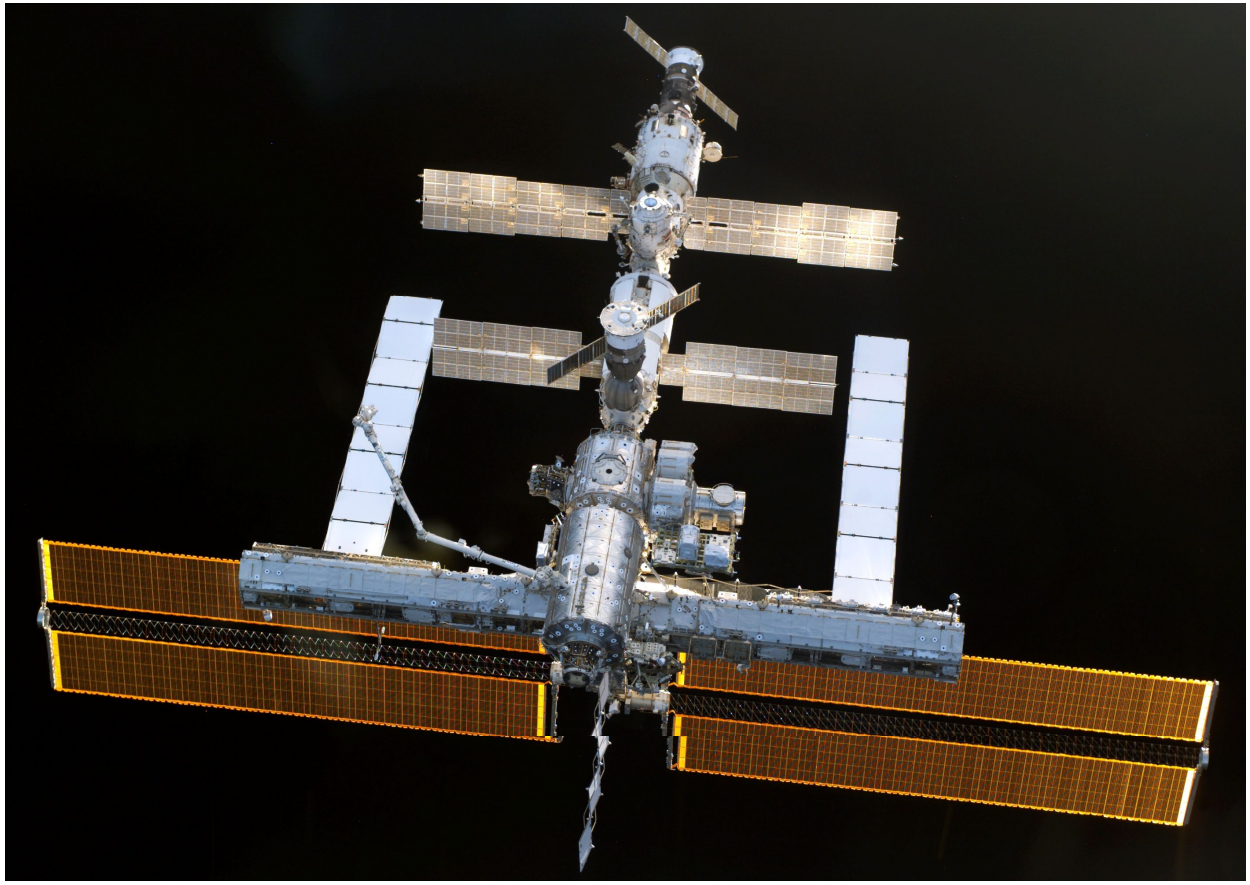
- MTR EVA: 26. February 2004





MATROSHKA

- MTR Outside ISS: 26. February 2004 - 18. August 2005



MATROSHKA

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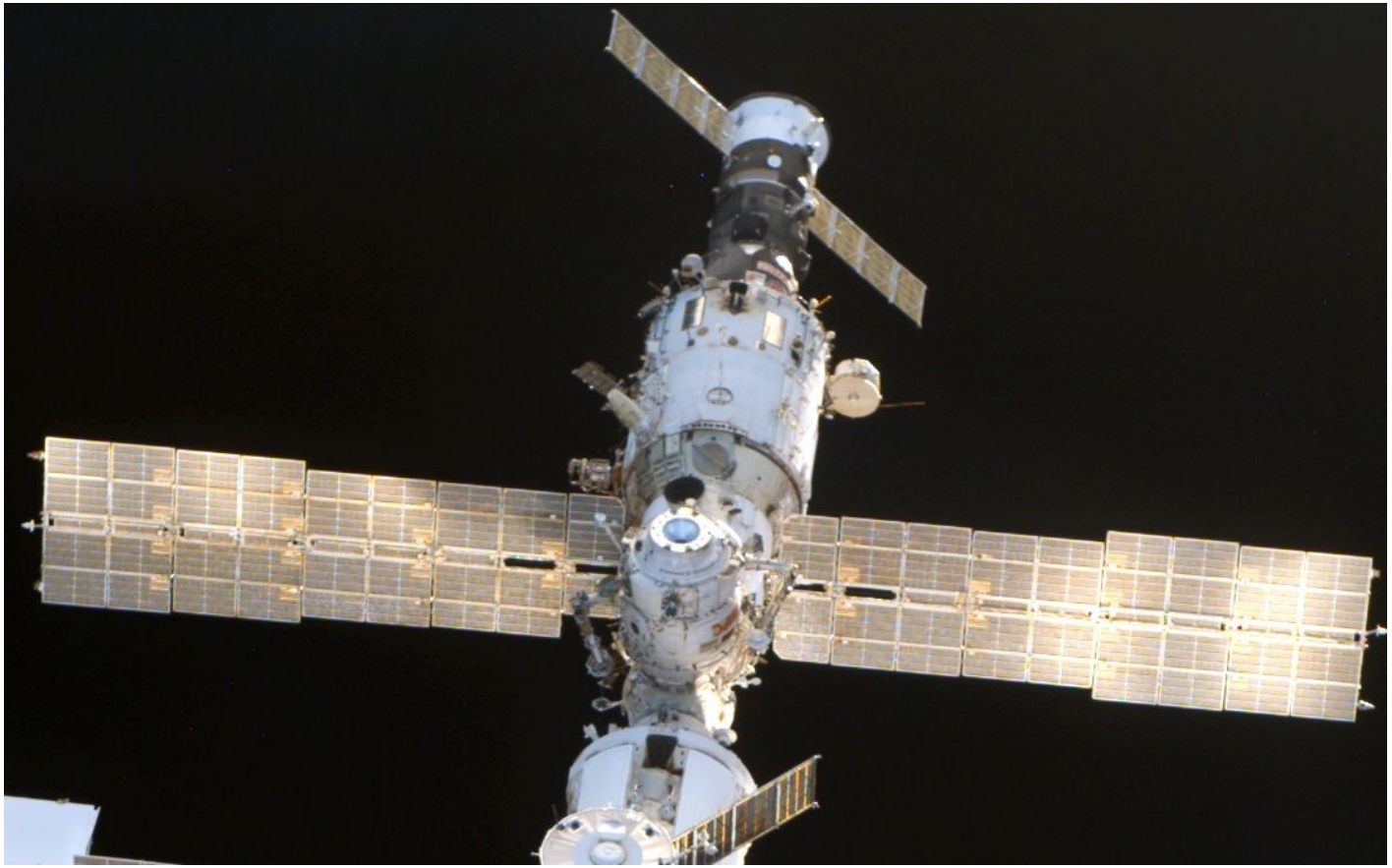

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- MTR Outside ISS: 26. February 2004 - 18. August 2005

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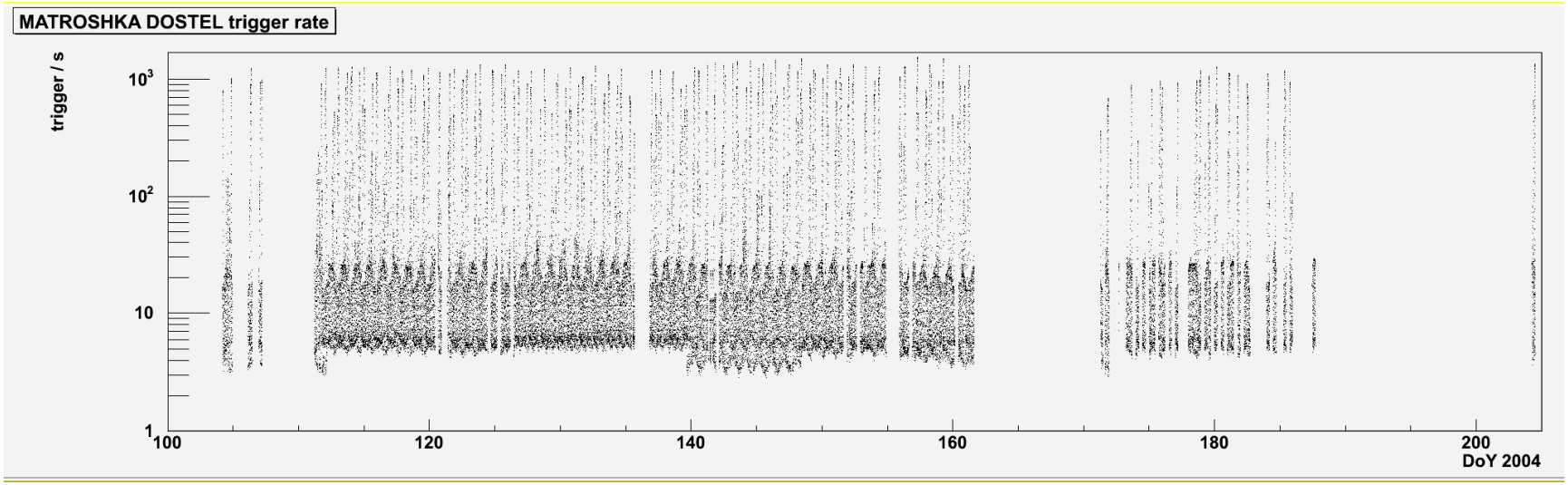
- MTR Activation of active instruments: April 2004



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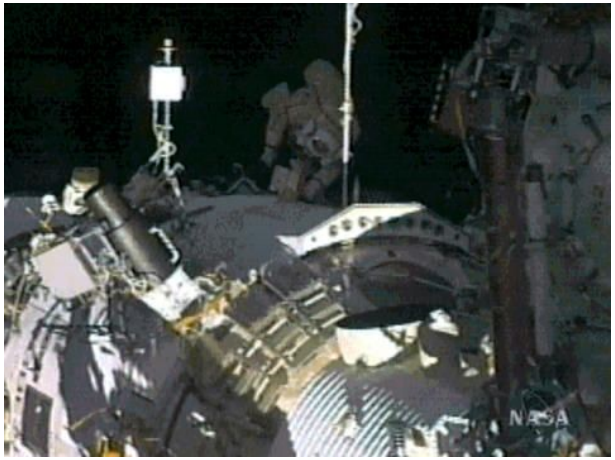
- MTR Recovery EVA: 18. August 2005



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  Science and Housekeeping Data

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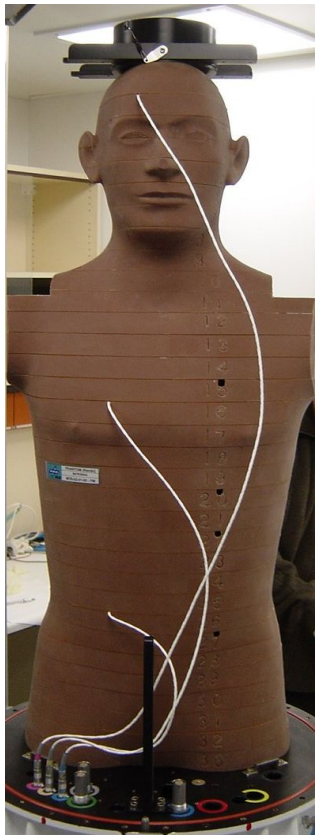

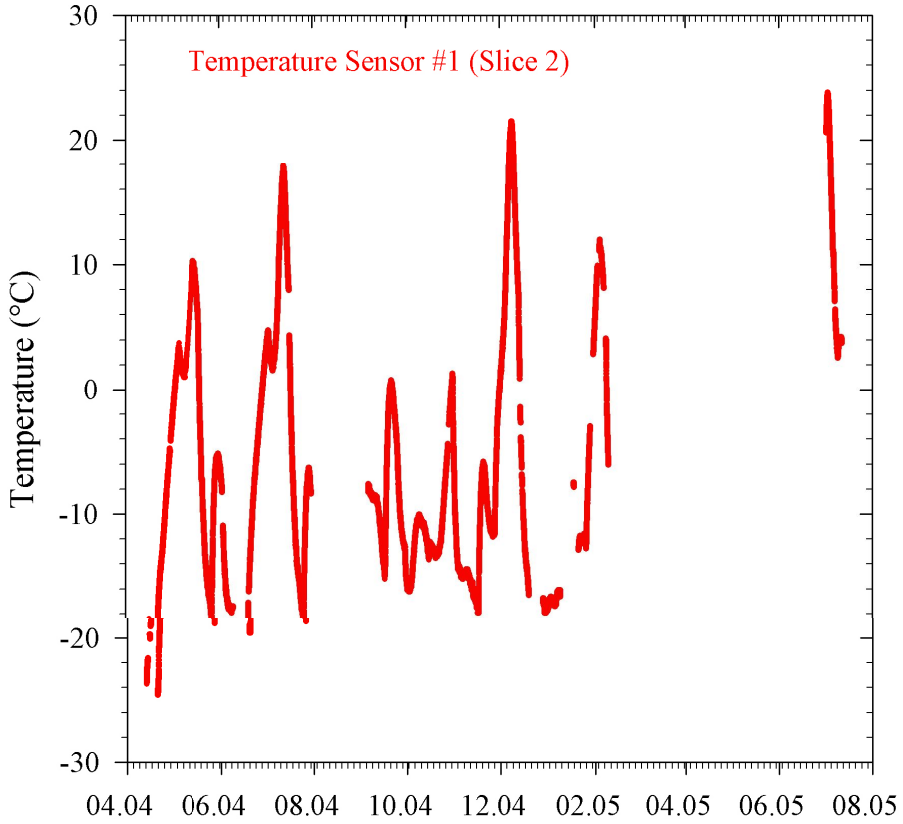
Temperature Sensor #1 (Slice 2)
Temperature (°C)
30
20
10
0
-10
-20
-30
04.04
06.04
08.04
10.04
12.04
02.05
04.05
06.05
08.05

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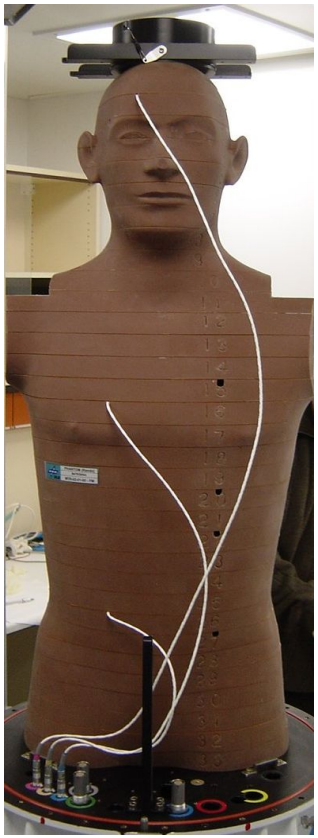

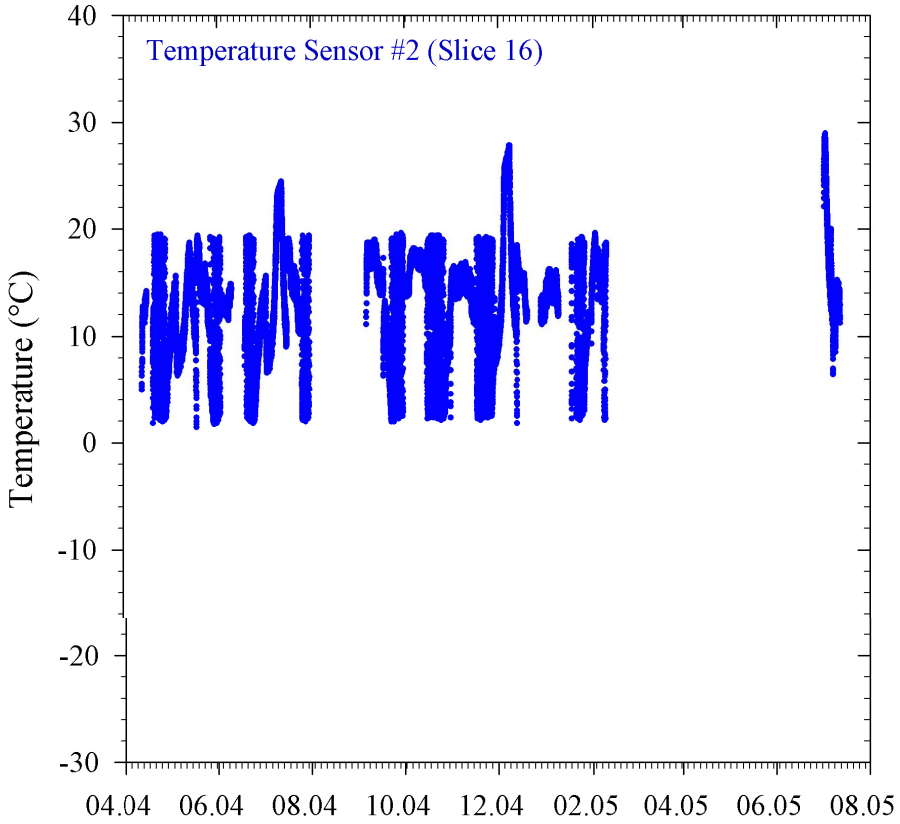
Temperature Sensor #2 (Slice 16)
Temperature (°C)
40
30
20
10
0
-10
-20
-30
04.04
06.04
08.04
10.04
12.04
02.05
04.05
06.05
08.05

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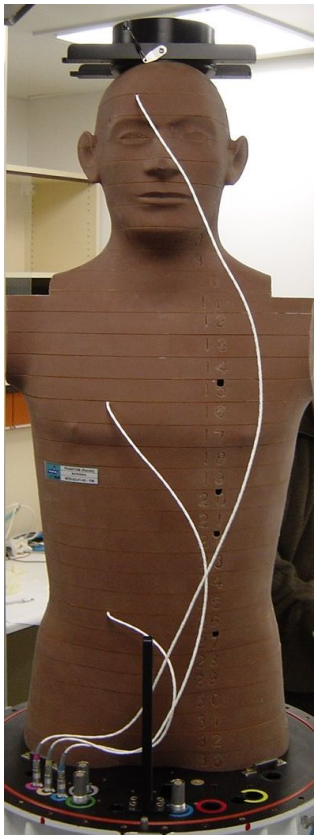

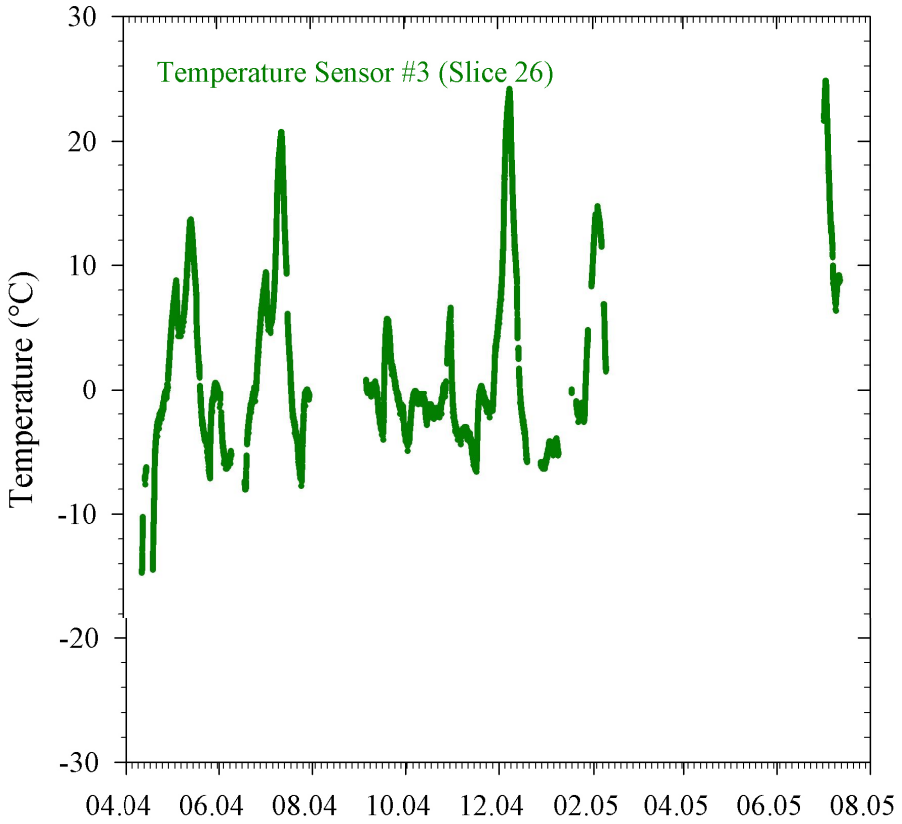
Temperature Sensor #3 (Slice 26)
Temperature (°C)
30
20
10
0
-10
-20
-30
04.04
06.04
08.04
10.04
12.04
02.05
04.05
06.05
08.05

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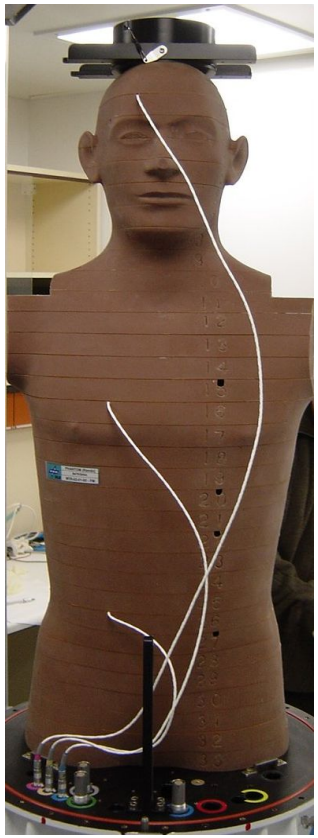

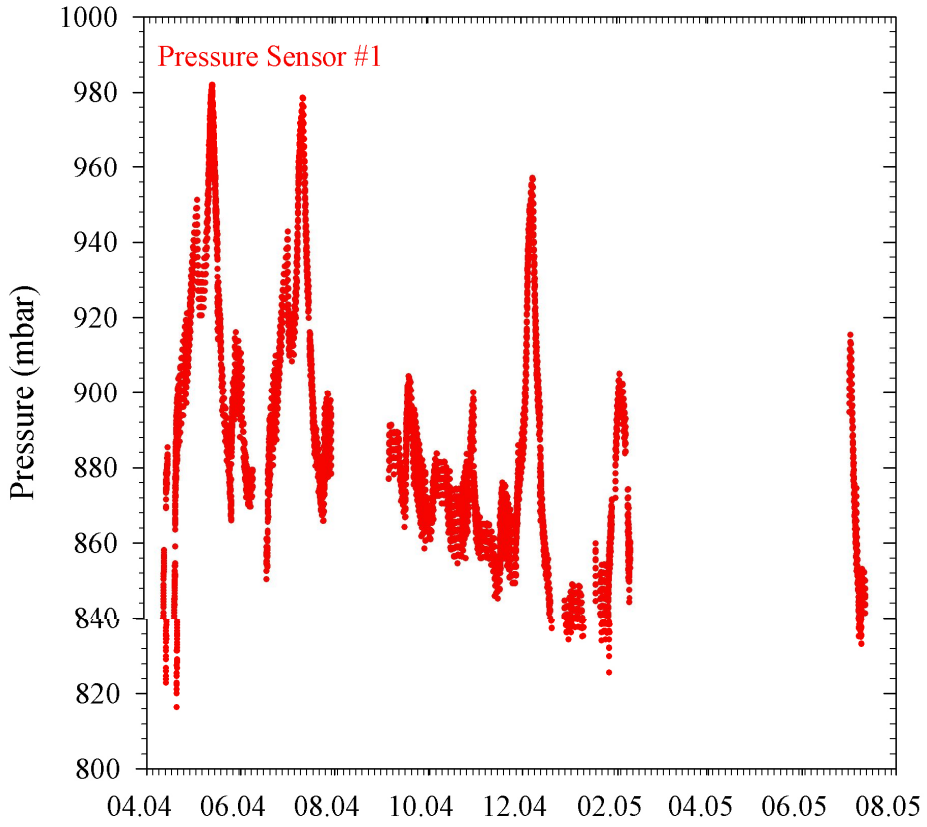
Pressure Sensor #1
Pressure (mbar)
1000
980
960
940
920
900
880
860
840
820
800
04.04
06.04
08.04
10.04
12.04
02.05
04.05
06.05
08.05

MATROSHKA

	DOSTEL / April 04	JSC / April 04
GCR – Dose :	296 µGy/day	277µGy/day
Qualityfactor :	3.1 ± 0.3	3.7
SAA – Dose :	256 µGy/day	219µGy/day
Qualityfactor :	1.5 ± 0.4	1.4
Dose :	**552** µGy/day	
Dose equivalent:	**1.36** mSv/day	

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Outside ISS measurements (April 2004)

- DOSTEL: ~ 1.3 mSv/day
  ~ 550 µGy/day
- EV-CPDS: ~ 400 µGy/day

Inside ISS measurements (April 2004)

- NASA TEPC: ~ 450 – 550 µSv/day
- TLD´s: ~ 150 – 250 µGy/day
- IV-CPDS: ~ 220 – 270 µGy/day

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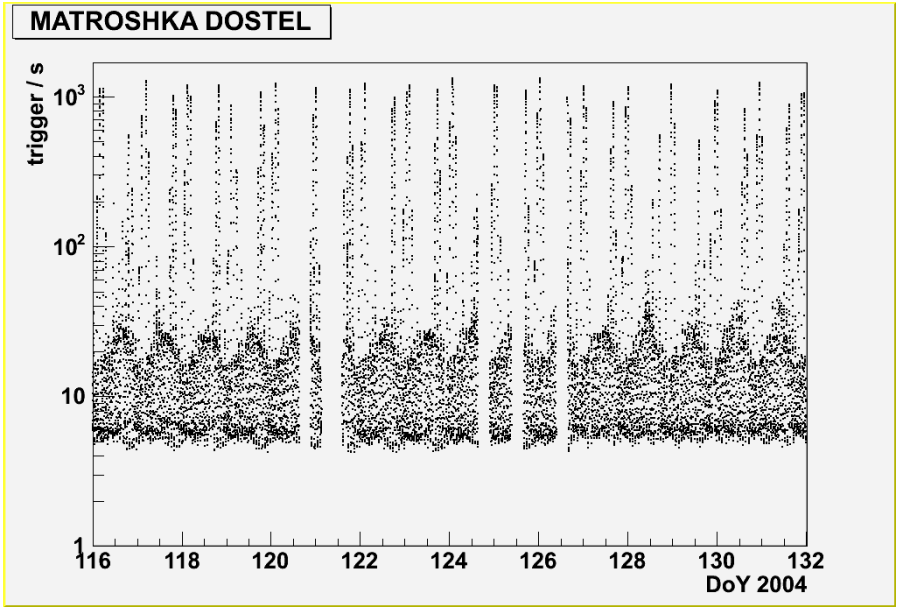
- Radiation exposure during an EVA: ~ 1.3 mSv/day
- Radiation exposure inside the ISS: ~ 0.4 mSv/day



Countrate of the active radiation detector „DOSTEL“ over a period of 16 days

- MATROSHKA
  OUTLOOK 2005 - 2006

MATROSHKA I

- MATROSHKA Recovery EVA on the 18. August 2005
- MATROSHKA passive detectors to be returned with Soyuz in October 2005
- Passive detectors distributed to investigators ~ November 2005

MATROSHKA II

- Preparation for MATROSHKA II already started
- Passive detector packages to be uploaded with Progress in December 2005
- Passive detector packages to be ready by the end of October 2005

Thanks very much for your attention !!