

AIRDOS

an open source dosimeter for measurement on board of aircraft

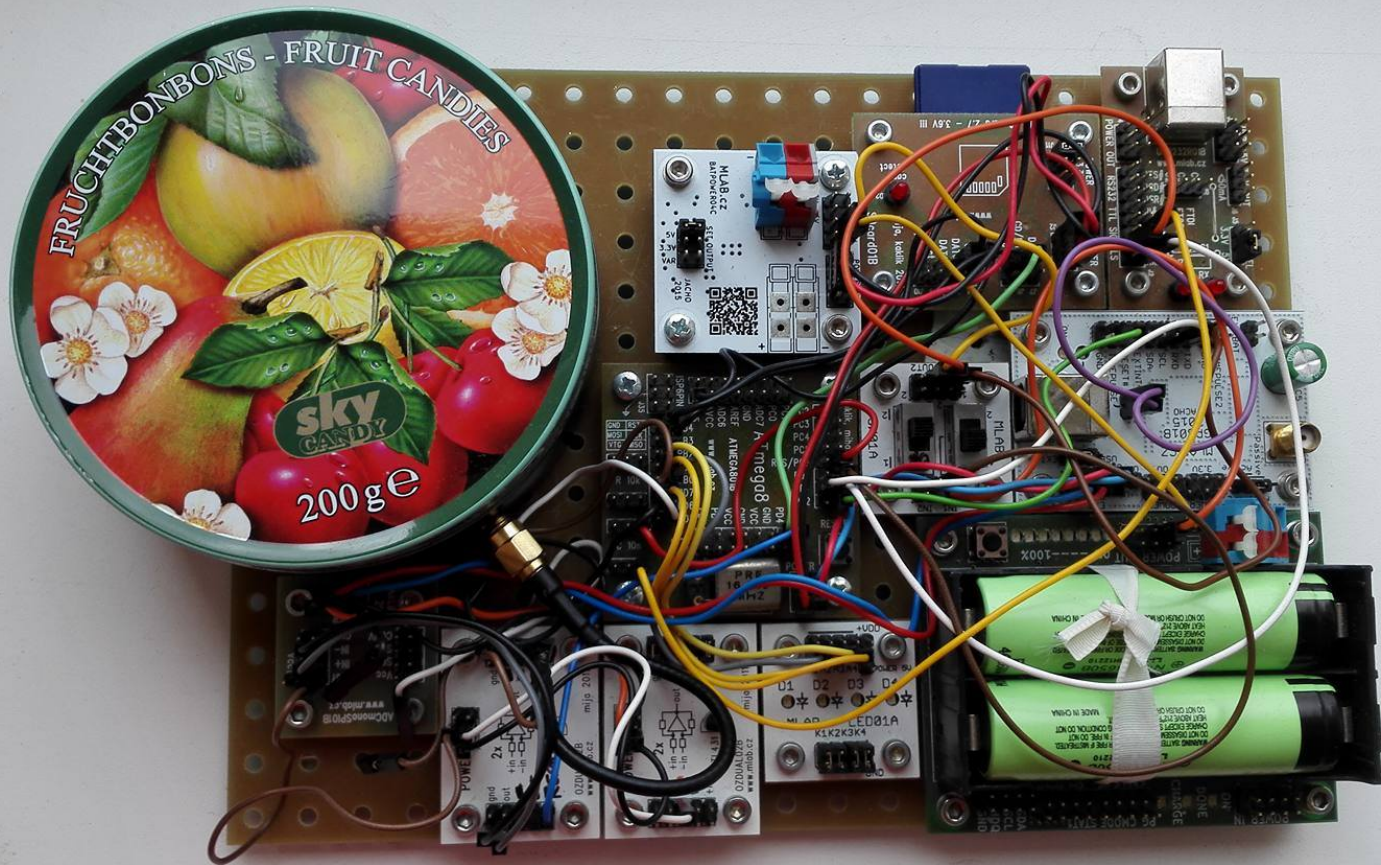
M. Kákona^{1,2}, P. Krist¹, V. Štěpán¹, D. Peksová^{1,2}, I. Ambrožová¹, J. Šlegl^{1,2}, J. Záhora², M. Lužová², M. Sommer^{1,2},
J. Kákona^{2,3}, J. Chroust³, O. Ploc¹

1 Nuclear Physics Institute of the Czech Academy of Sciences, Prague, Czech Republic

2 Czech Technical University in Prague, Czech Republic

3 Universal Scientific Technologies s. r. o., Soběslav, Czech Republic

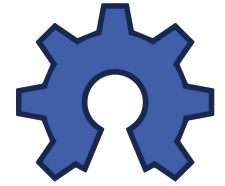
CANDY



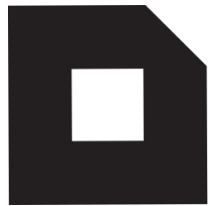
AIRDOS



Technology



open hardware



modular laboratory

<http://mlab.cz/>

<https://processing.org/>



Open Source Project

<https://github.com/ODZ-UJF-AV-CR/AIRDOS.git>



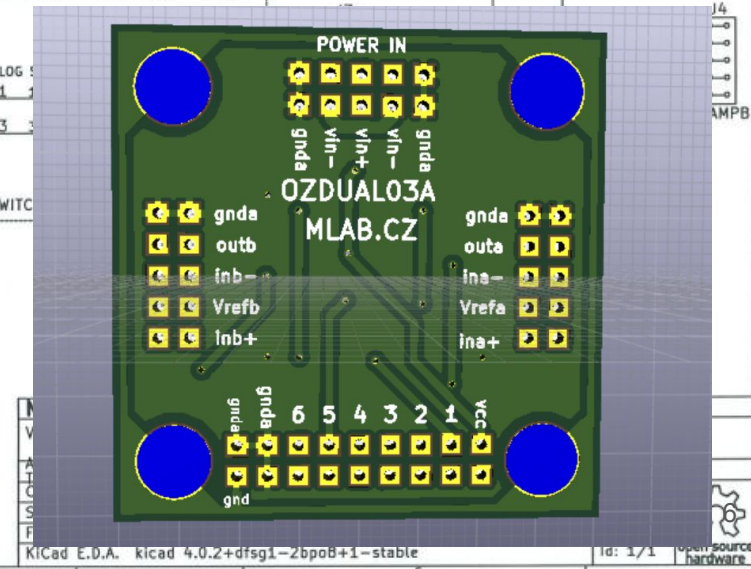
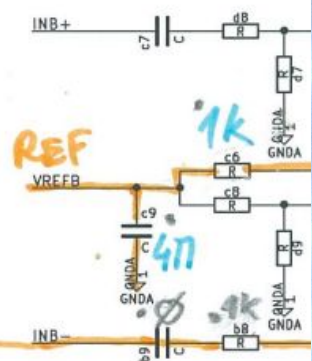
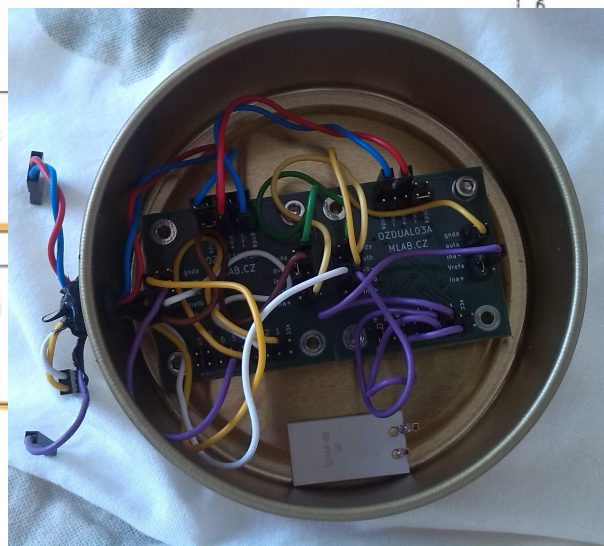
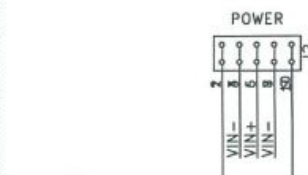
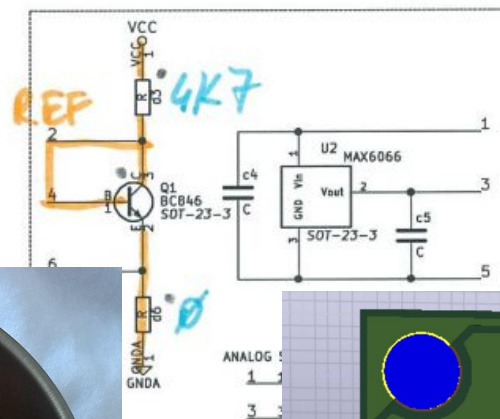
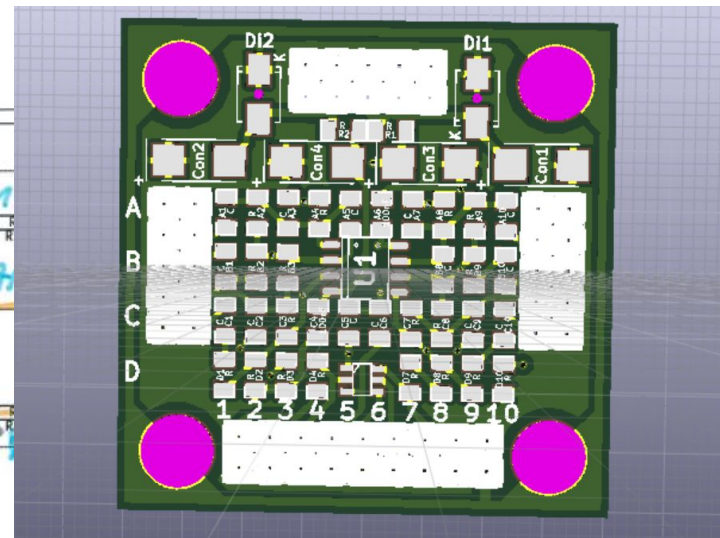
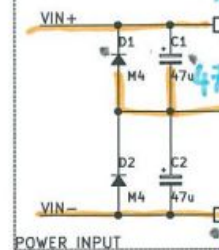
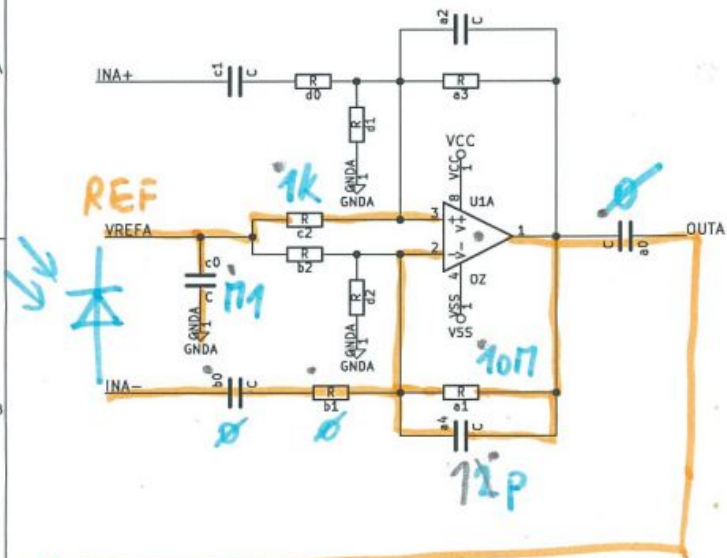
MLAB, Open HW, Open SW, Open Science,...

https://github.com/MLAB-project/Modules/tree/master/op_amps/OZDUAL03B

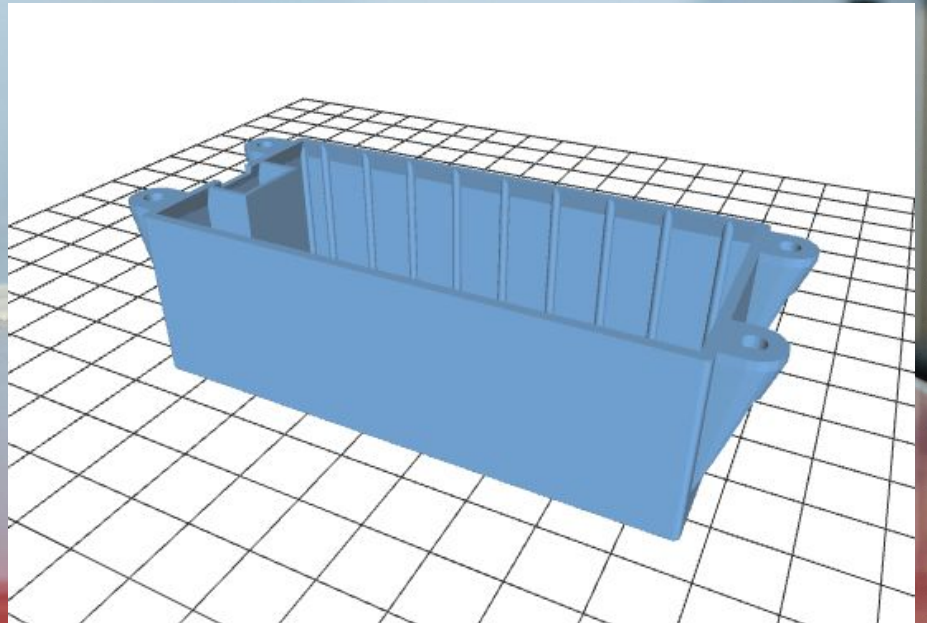
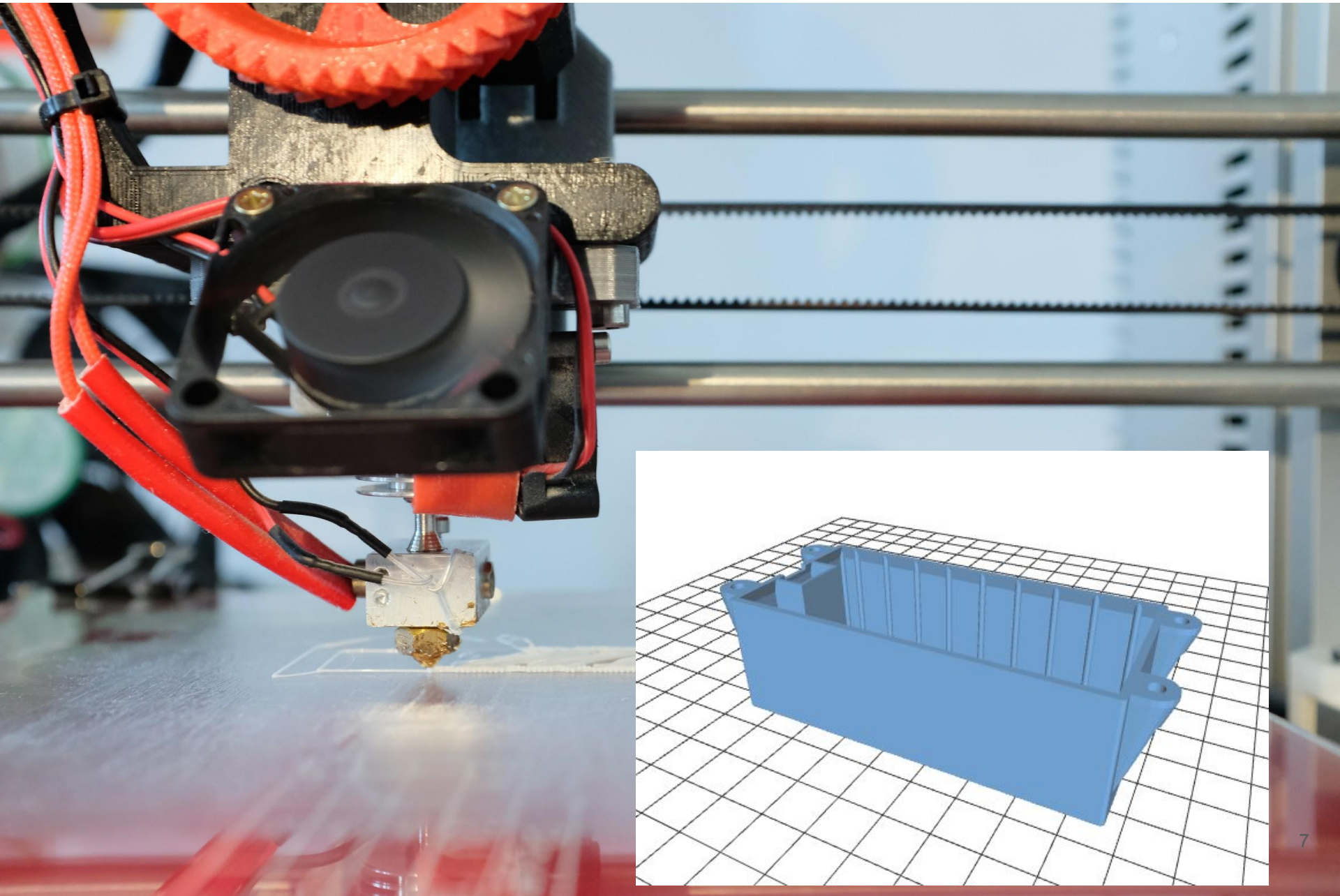
https://github.com/MLAB-project/Modules/tree/master/MCU_CPU/AVR/ATmegaTQ4401A

...

Universal and modular PCBs



3D print



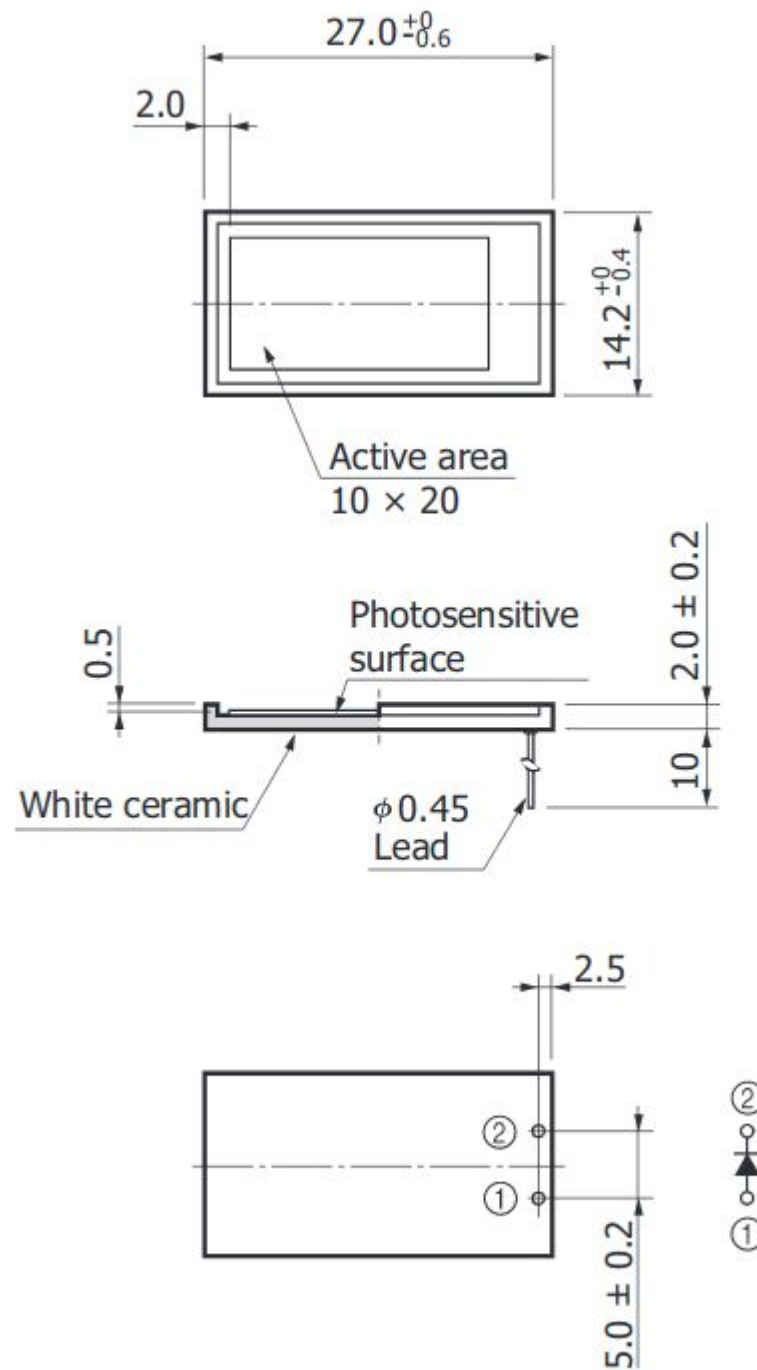
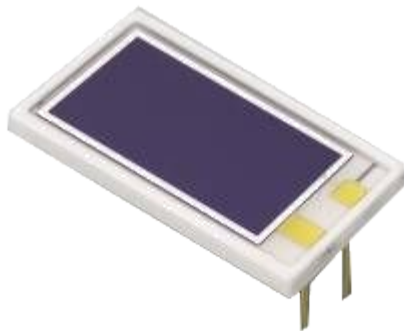
Parameters

	Liulin 6C
Dimensions [mm]	110 x 100 x 45
Weight [g]	570
Energy range [MeV]	0.04 - 20.8
Number of channels	256
Channel width [keV]	81.4
Exposition time [s]	10, 20, 30, 60, 120, 240, 300
Continuous measurement [months]	3 (300 s)
PIN diode type	HAMAMATSU S2744-08
Battery	2x LS 33600
Flash memory [MB]	0.513

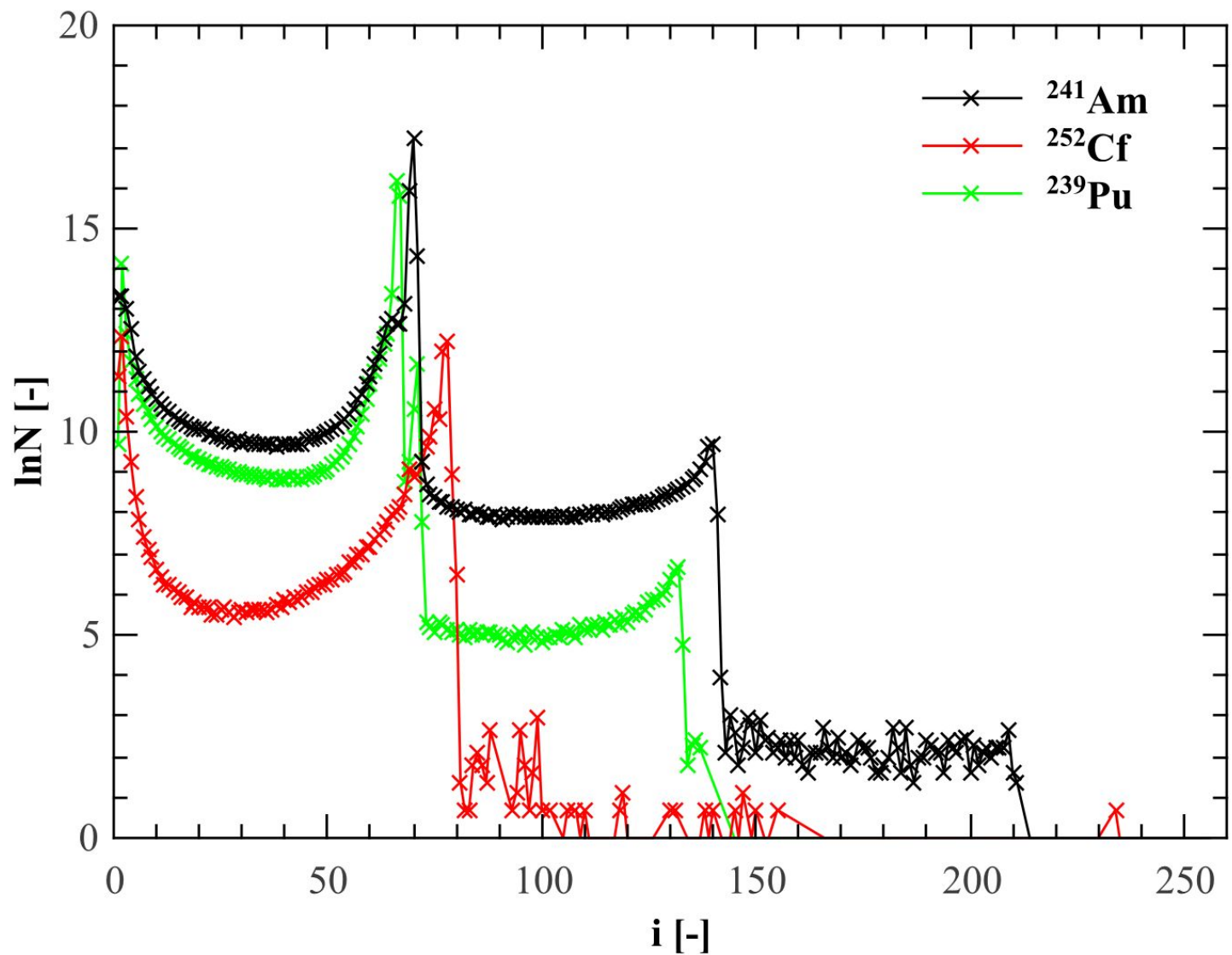
T. Dachev, P. Dimitrov, B. Tomov, Y. Matviichuk. **Technical Description of the Spectrometer-Dosimeter Liulin-6C MDU-6**
Solar–Terrestrial Influences Laboratory, Bulgarian Academy of Science, Sofia, Bulgaria (2009)

Sensor

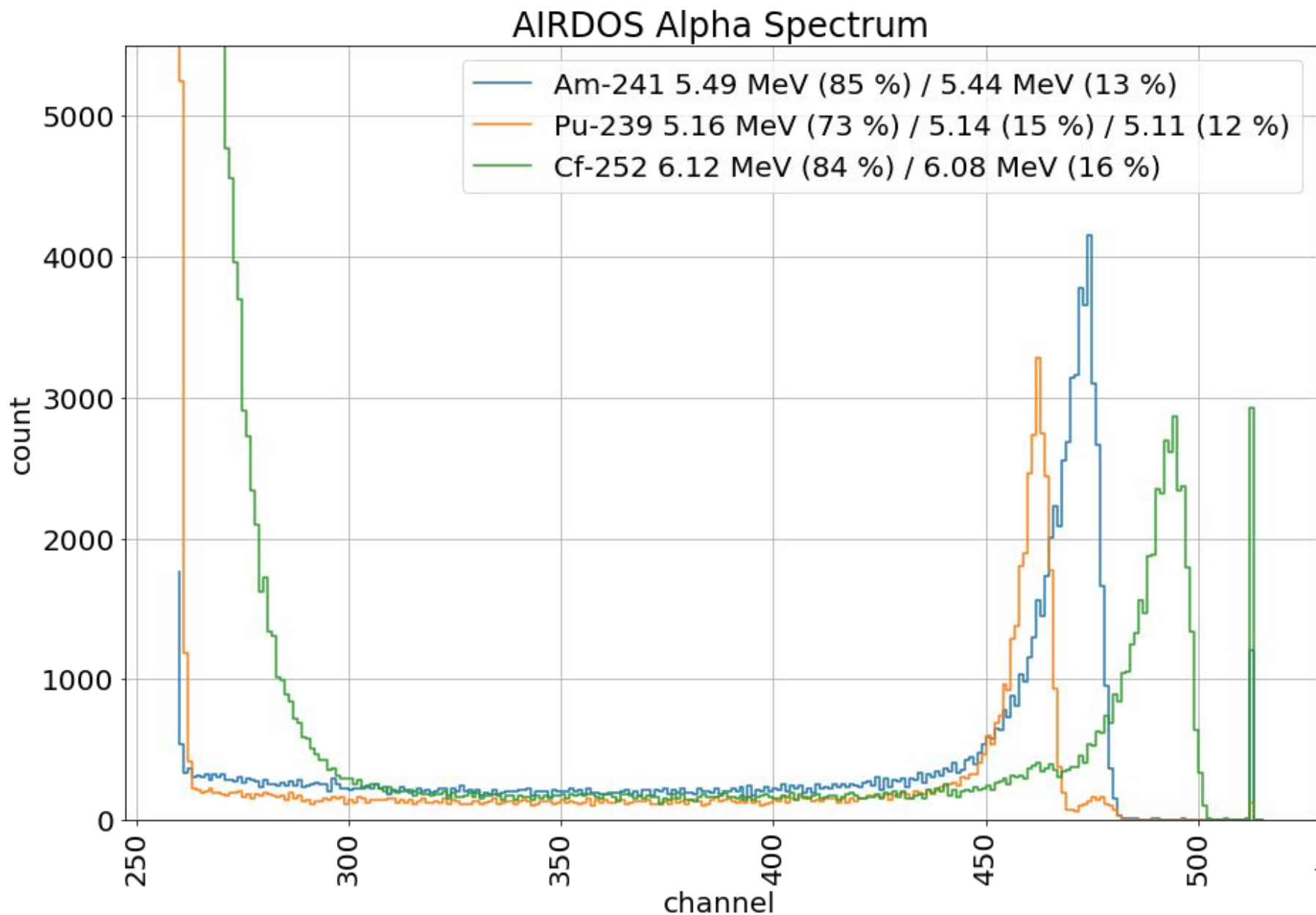
P-I-N



Energy calibration of Liulin



Energy calibration of AIRDOS



Energy calibration of AIRDOS

Energies of transmitted alphas after passing an air layer of thickness 0.5 mm calculated with TRIM

Radionuclide	Nominal alpha energy [MeV]	Transmitted alpha energy [MeV]	Energy loss [MeV]
Pu-239	5.11 (12%)	5.064(5)	0.0458
	5.14 (15%)	5.094(4)	0.0455
	5.16 (73%)	5.115(4)	0.0454
Am-241	5.44 (13%)	5.396(4)	0.0437
	5.49 (85%)	5.447(4)	0.0435
Cf-252	6.08 (16%)	6.040(4)	0.0405
	6.12 (84%)	6.080(4)	0.0402

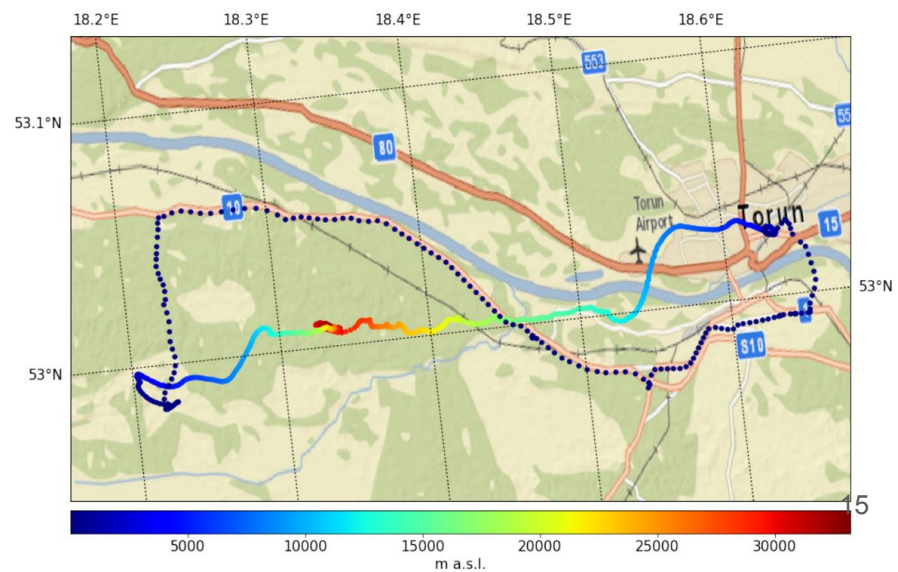
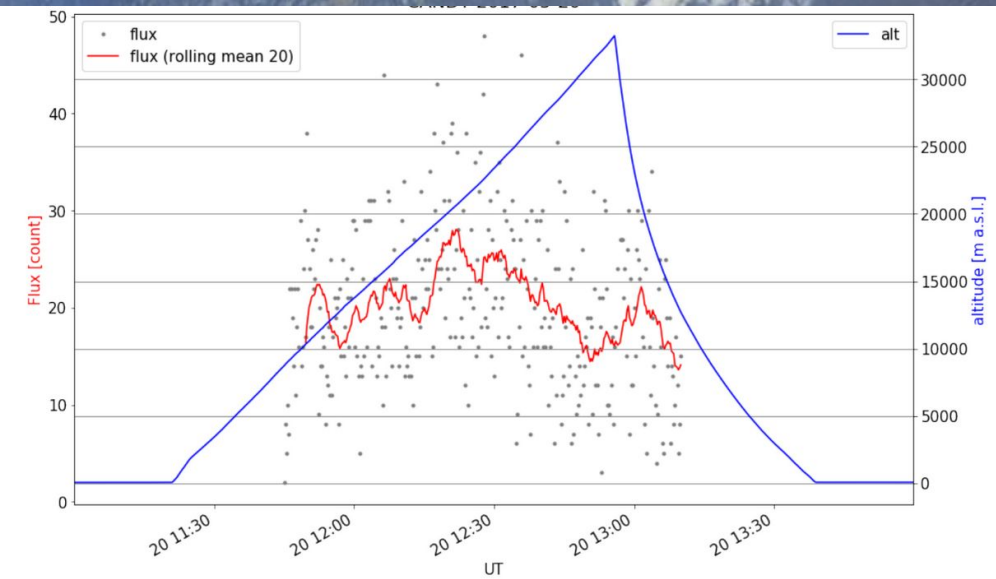
Parameters

	Liulin 6C	Airdos
Dimensions [mm]	110 x 100 x 45	170 x 55 x 250
Weight [g]	570	1455
Energy range [MeV]	0.04 - 20.8	0.06 - 6.4
Number of channels	256	252 (>500)
Channel width [keV]	81.4	25
Exposition time [s]	10, 20, 30, 60, 120, 240, 300	11
Continuous measurement [months]	3 (300 s)	1
PIN diode type	HAMAMATSU S2744-08	HAMAMATSU S2744-09
Battery	2x LS 33600	3x LS 33600
Flash memory [MB]	0.513	> 2 000

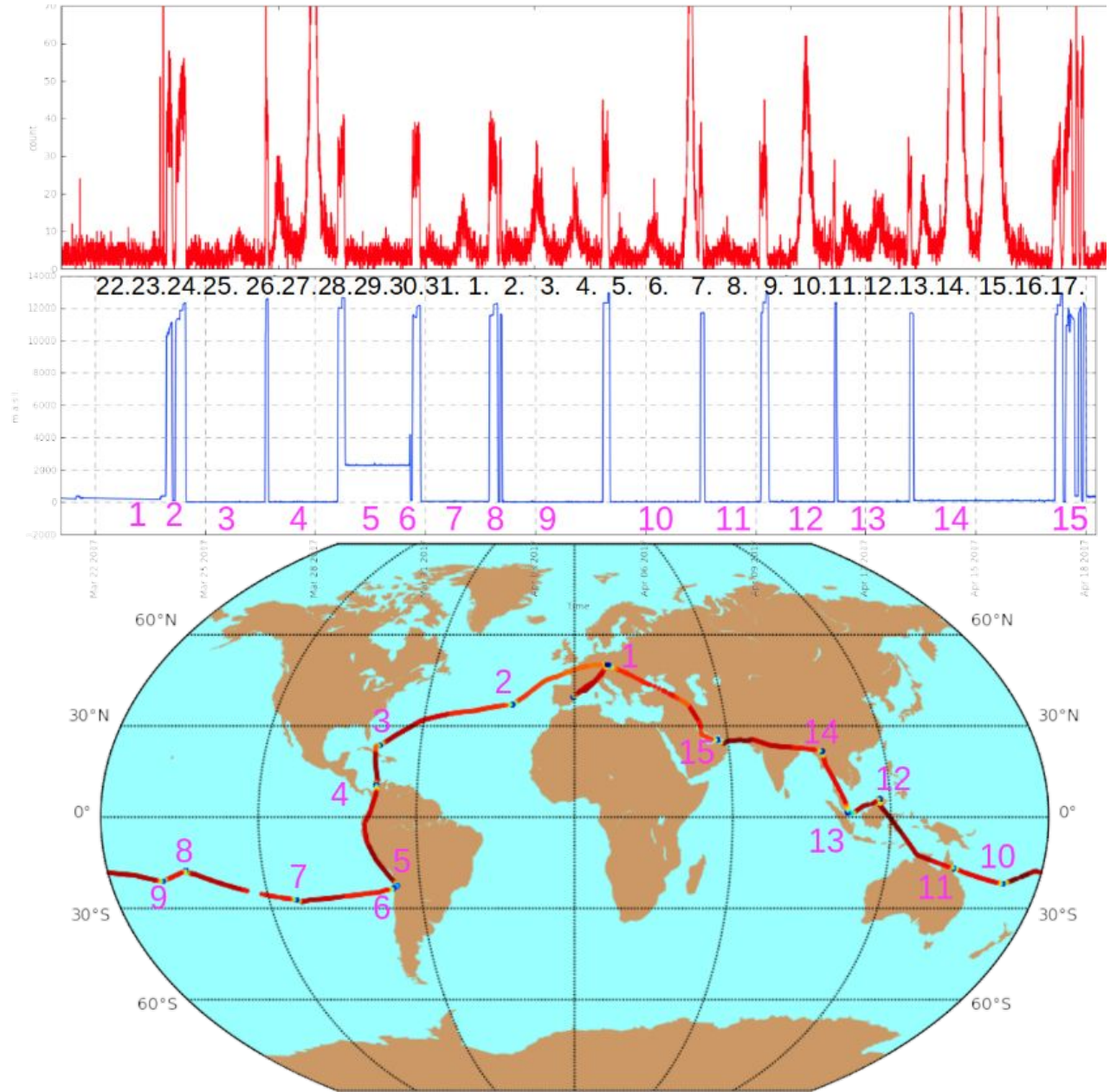
Experiments



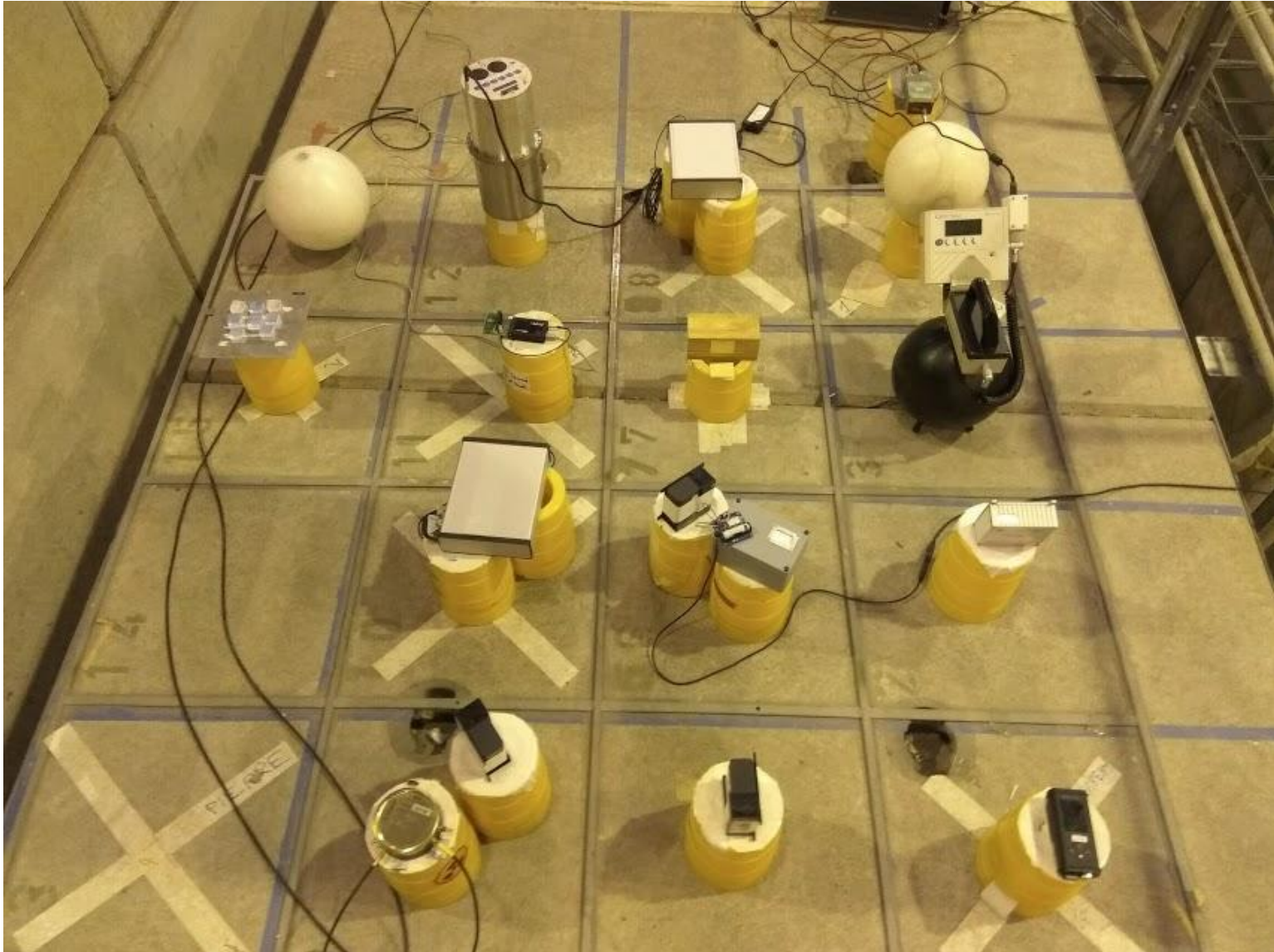
Stratospheric balloon



Trip around the World



CERF



Sample of evaluation

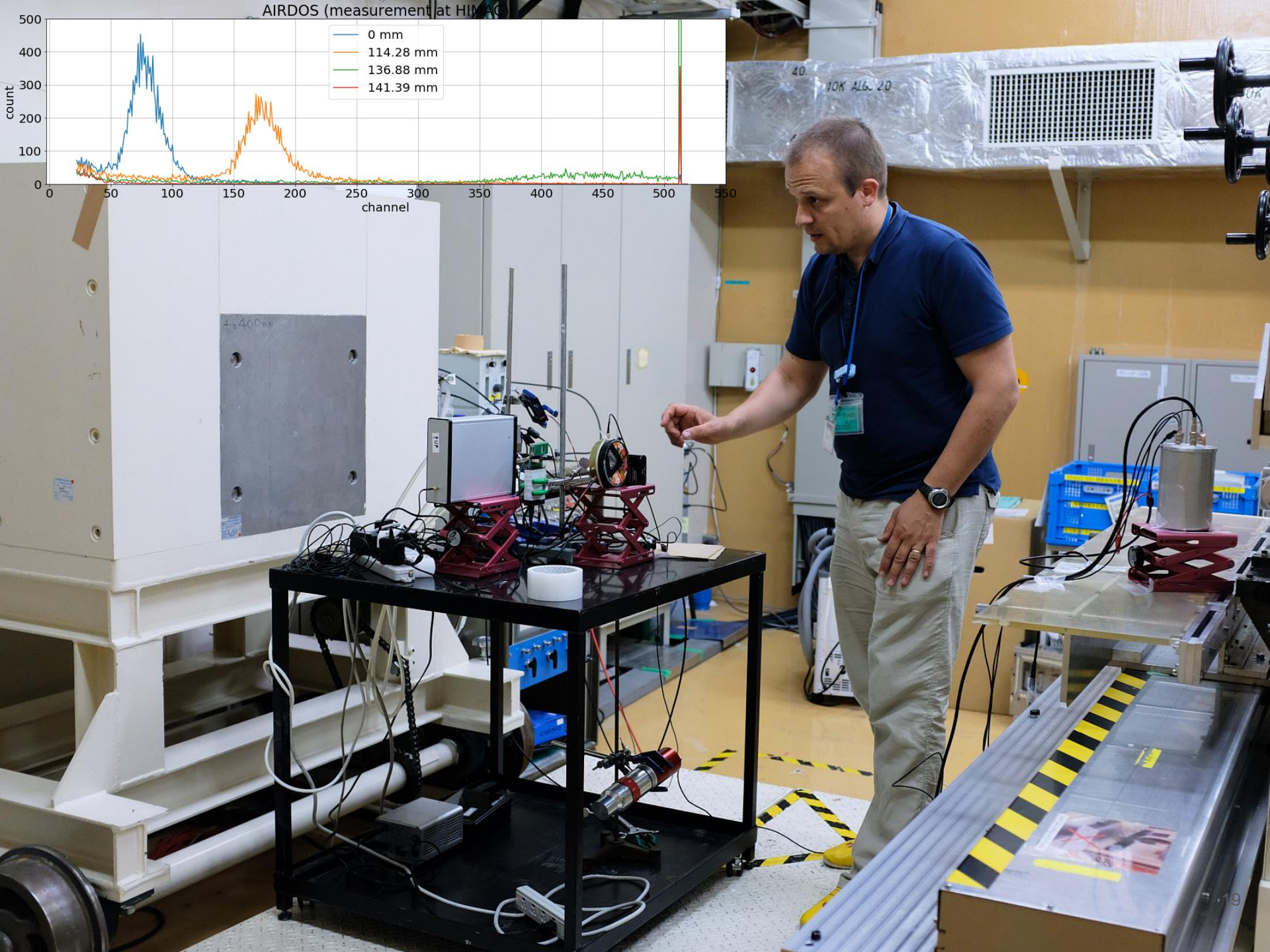
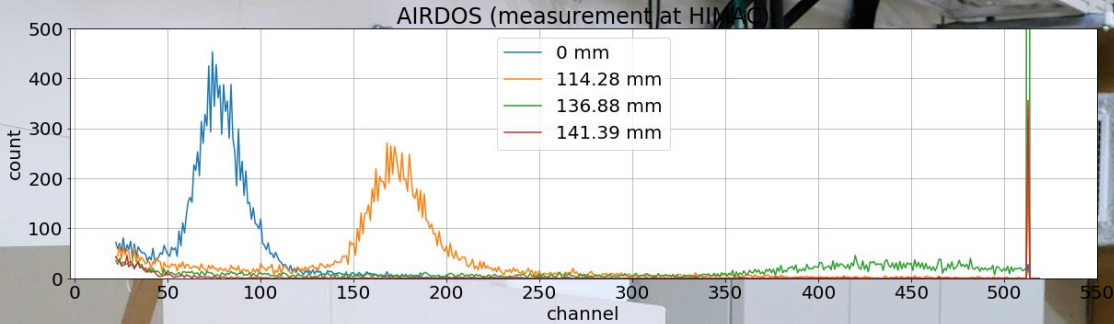
PRELIMINARY

Flight	Liulin		AIRDOS		CARI		
	D _{Si} [uGy]	H*(10) [uSv]	D _{Si} [uGy]	H*(10) [uSv]	E [uSv] ICRP60	E [uSv] ICRP103	H*(10) [uSv]
15:18 - 17:26 26. 3. 2017	3.58	10.00	2.59	23.62	8.51	6.88	7.03
14:46 - 19:42 28. 3. 2017	7.15	19.69	6.65	58.22	16.22	13.39	13.37
0:54 - 2:18 2. 4. 2017	1.49	4.04	1.83	15.92	3.51	2.94	2.95
11:54 - 14:42 7. 4. 2017	3.63	10.03	2.88	25.36	8.67	7.18	7.24

$$D_{low} = \frac{1}{m} \sum_{\varepsilon < 1MeV} \varepsilon_i N_i$$

$$D_{neut} = \frac{1}{m} \sum_{\varepsilon \geq 1MeV} \varepsilon_i N_i$$

$$H^*(10) = k_{low} D_{low} + k_{neut} D_{neut}$$



CERF





open hardware



open science



RESEARCH CENTRE OF COSMIC RAYS
AND RADIATION EVENTS IN THE ATMOSPHERE



EVROPSKÁ UNIE
Evropské strukturální a investiční fondy
Operační program Výzkum, vývoj a vzdělávání



MINISTERSTVO ŠKOLSTVÍ,
MLÁDEŽE A TĚLOVÝCHOVY