



LIDAL

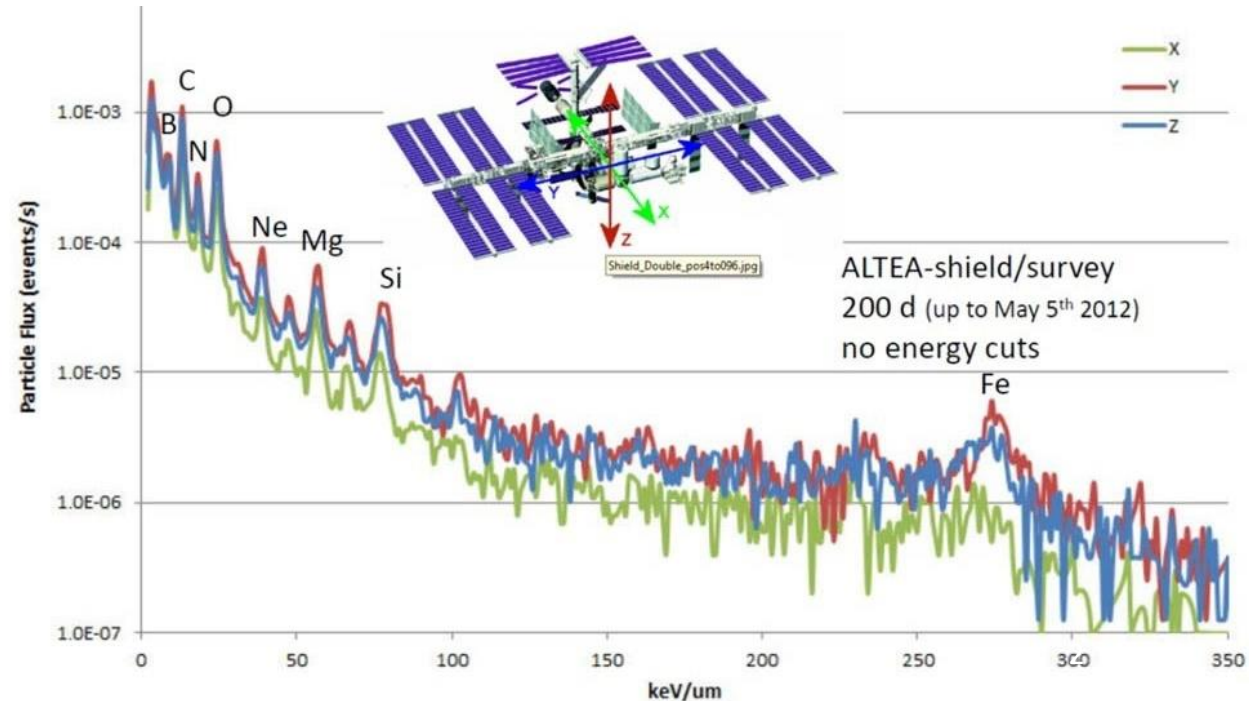
Light Ions Detector for ALtea

Luca Di Fino for LIDAL collaboration



Background

- LIDAL is a project aimed to upgrade the ALTEA detector system.
- ALTEA detector system includes six Silicon Detector Units (SDU) that can track and measure $\Delta E/\Delta x$ of cosmic ray particles, and it took data onboard the International Space Station (ISS) from 2006 to 2012.
- LIDAL adds a TOF system to extend sensitivity to low Z particles and to better discriminate different ions adding an independent measure on kinetic energy.



Detector geometry

3 ALTEA SDUs

2 Lidal Detector Units (LDUs)

SDU

6 stripped silicon planes
(80x80 cm, 380 μ m thick)

2.9 KeV/um threshold

LDU

TOF system

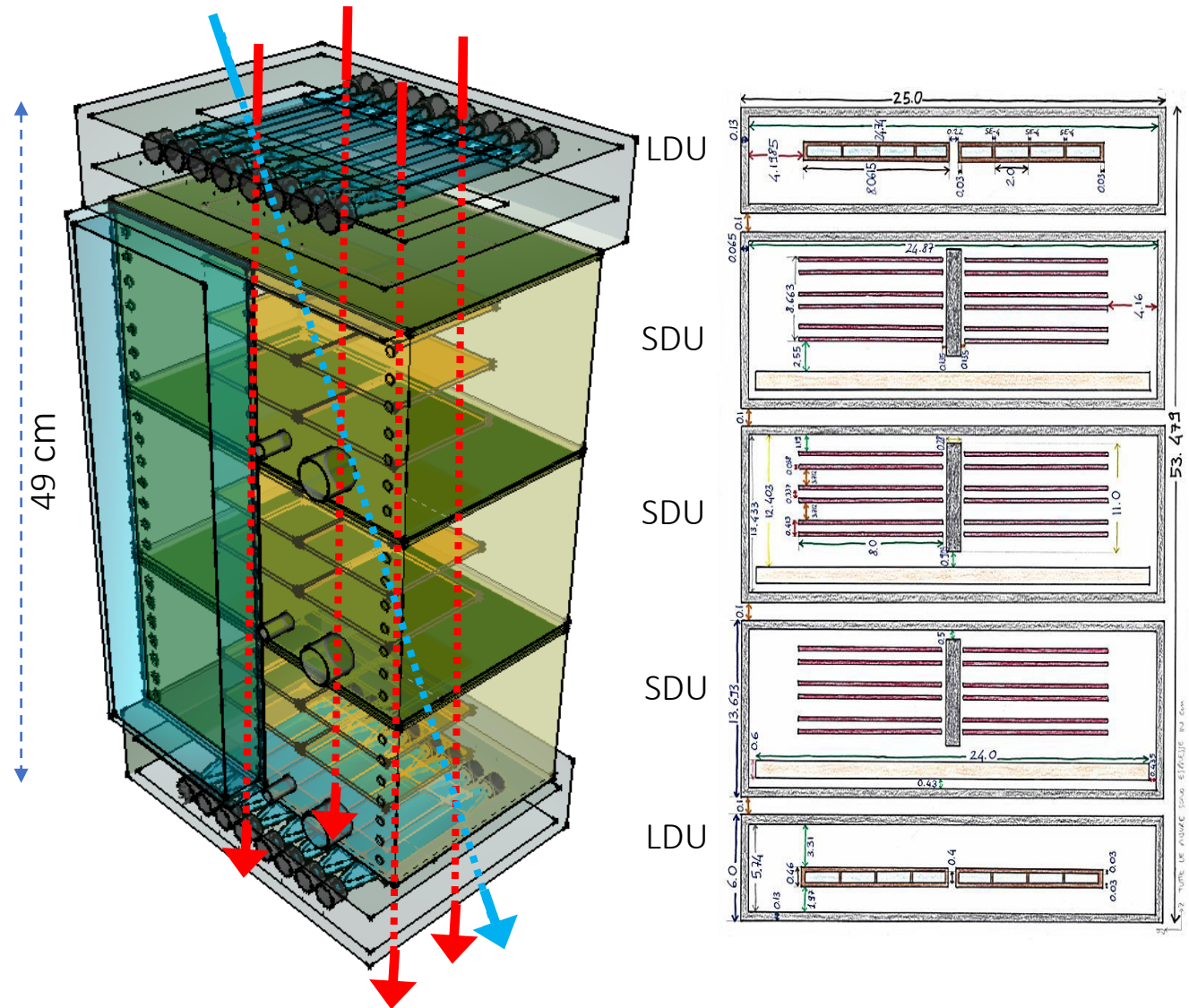
8 plastic scintillators
(80x20x4 mm)

2 PMTs per scintillator

Geometrical factors

$$GF_{1SDU} = 217 \text{ cm}^2\text{sr}$$

$$GF_{LID} = 13.5 \text{ cm}^2\text{sr}$$



On the ISS

Light Ions Detector for **ALTEA** (LIDAL) is a project financed by the Italian Space Agency (ASI)

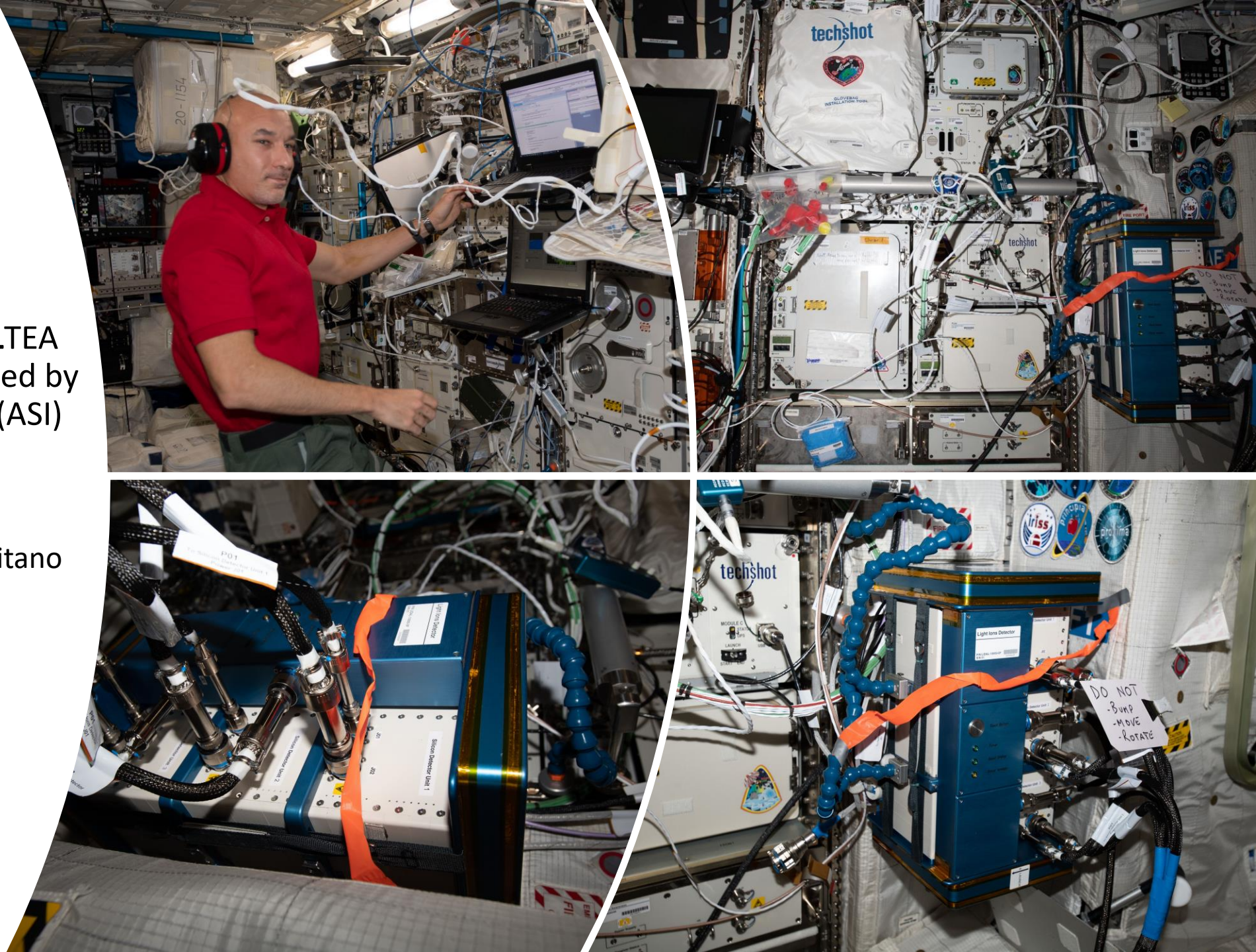
Activated on Jan, 19th 2020
by ESA astronaut Luca Parmitano

822+ days

1.3 TB raw binary data

453'320'318 triggers (TOF)

212'652'592 triggers (Silicon detectors)





EMERGENCY USE
FIRE PORT
COL1A0-1

Light Ions Detector

P/N LIDAL-10000-0F
S/N 01

Silicon Detector Unit 1

J01

J02

DO NOT
- BUMP
- MOVE
- ROTATE

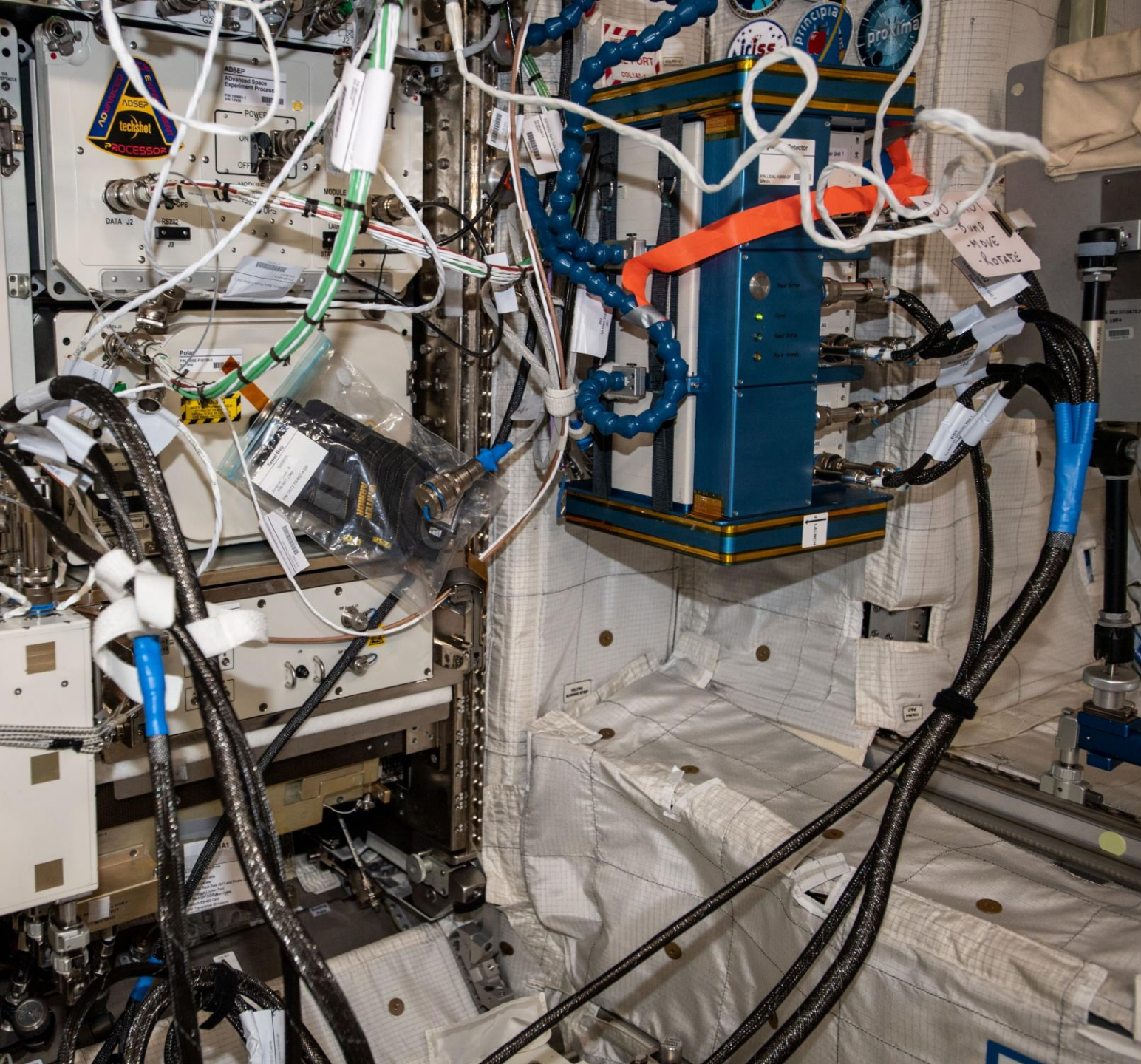
Reset Button

Power

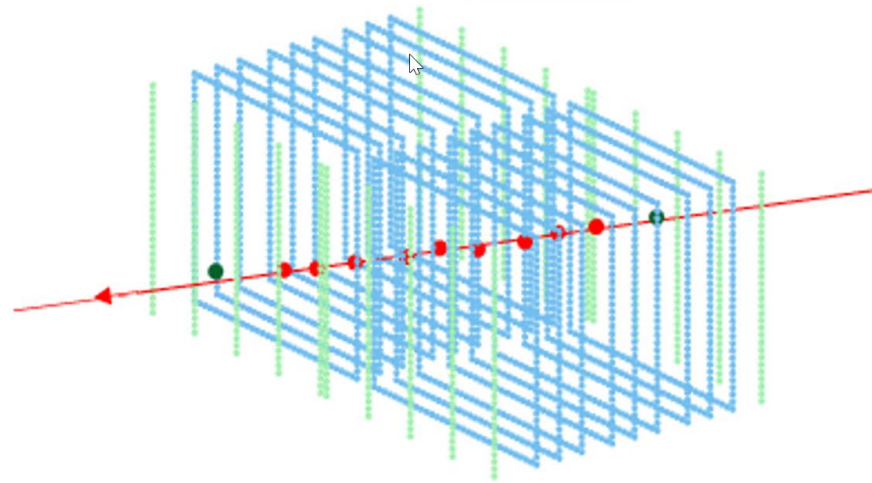
Reset Status

Power Anomaly

CAUTION
FLOATING DEBRIS HAZARD
VACUUM CLEANER REQUIRED FOR
BLANKET REMOVAL



TOF [ns] 1,78 ± 0,13



PARTICLE TRAJECTORY

THE PARTICLE IS ALIGNED AND TRAVERSES 18 PLANES OF THE ALTEA DETECTOR

$$\begin{cases} x = t \\ y = p_1 t + p_2 \\ z = p_3 t + p_4 \end{cases}$$

p_1	$-0,156 \pm 0,002$
p_2	$1,13 \pm 0,03$
p_3	$0,042 \pm 0,002$
p_4	$-0,71 \pm 0,03$

HIT POINTS ON PLASTIC SCINTILLATORS

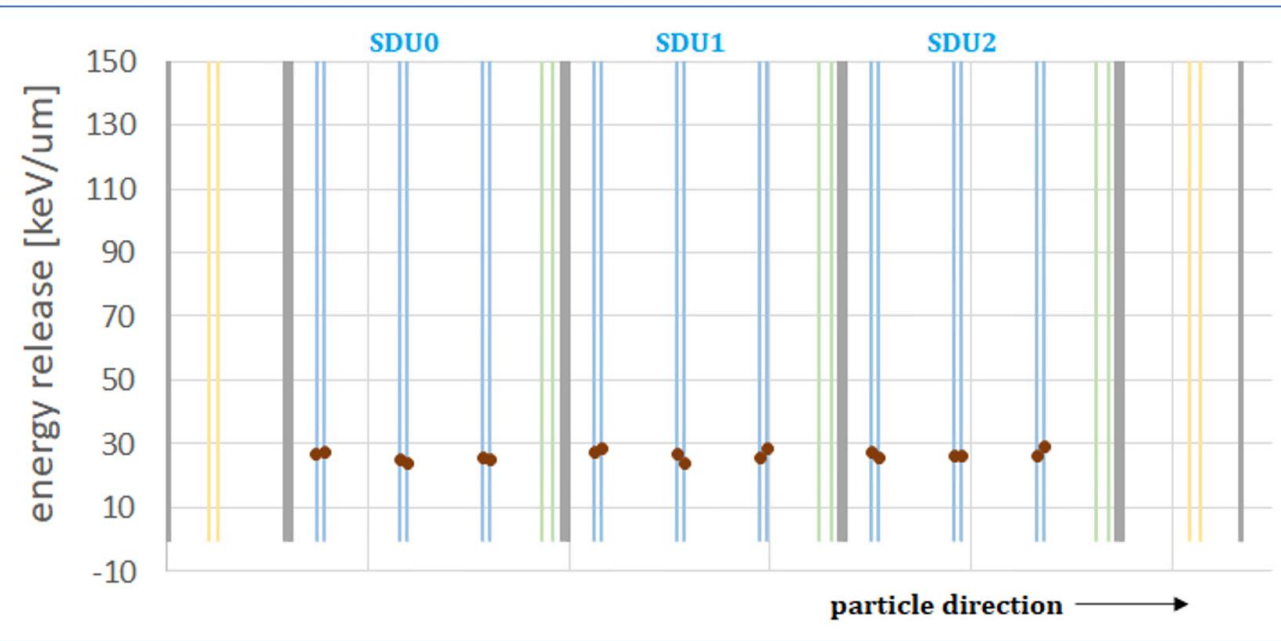
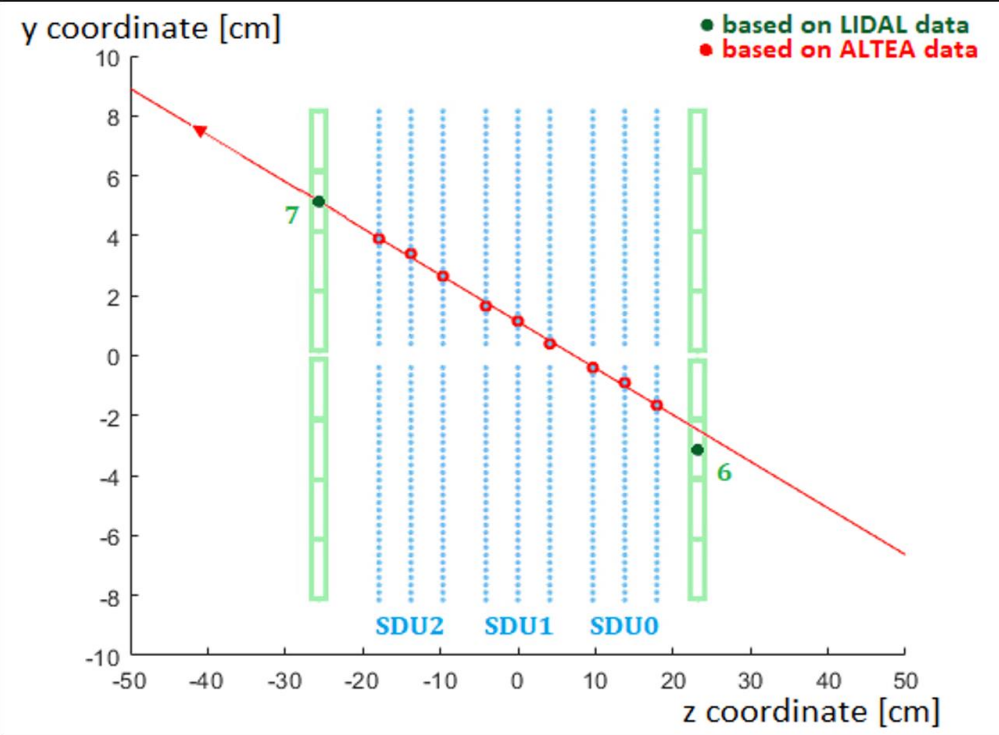
THE ALTEA TRACE PASSES THROUGH THE PLASTIC SCINTILLATORS WHERE THE LIDAL SIGNAL IS RECORDED

plastic scintillators are [-4;4] cm long in the x direction

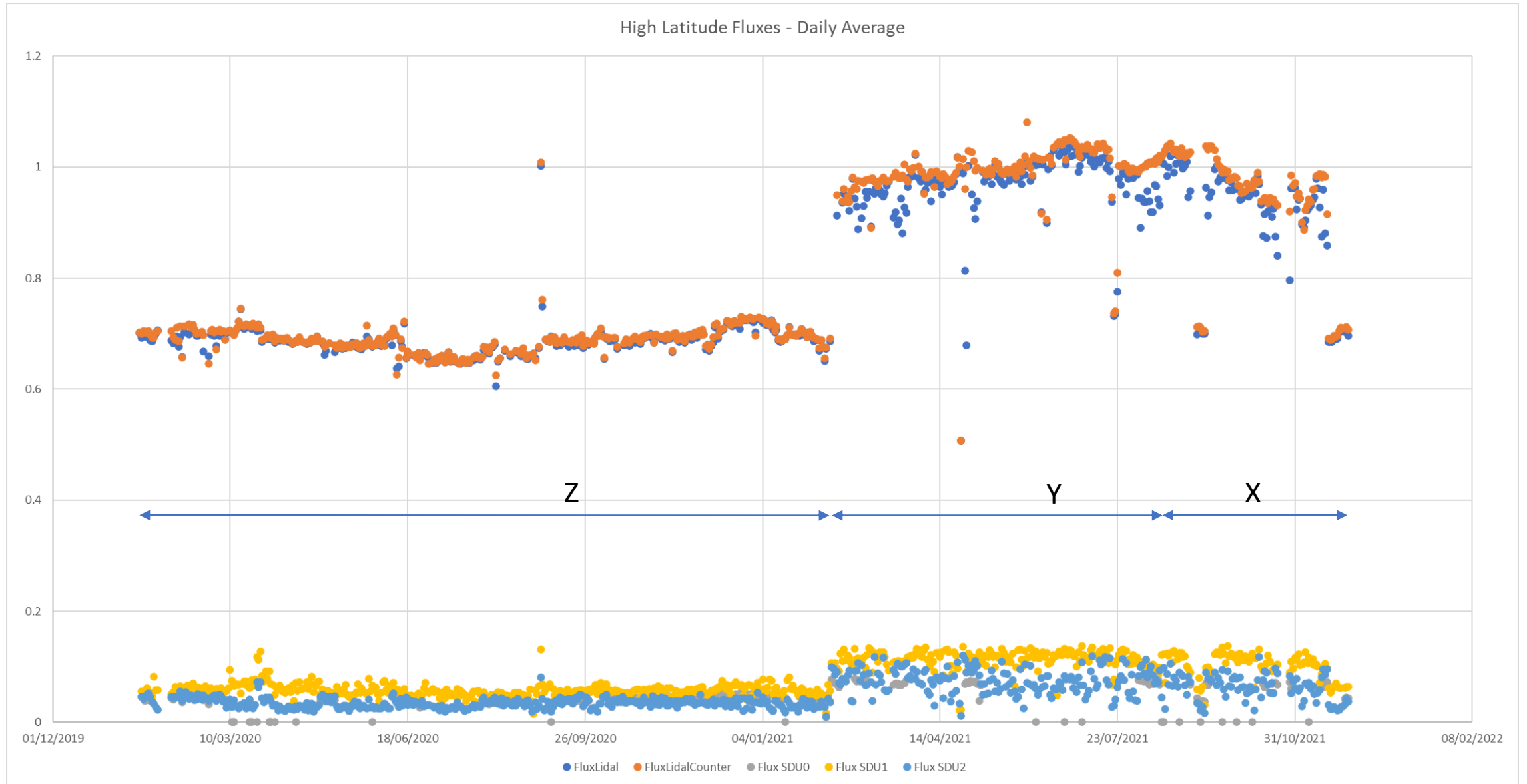
x coordinate (front) [cm]	ALTEA	LIDAL
	$0,27 \pm 0,09$	$0,7 \pm 0,7$
x coordinate (rear) [cm]	ALTEA	LIDAL
	$-1,79 \pm 0,01$	$-1,4 \pm 0,7$

FRONT SCINT	6	REAR SCINT	7
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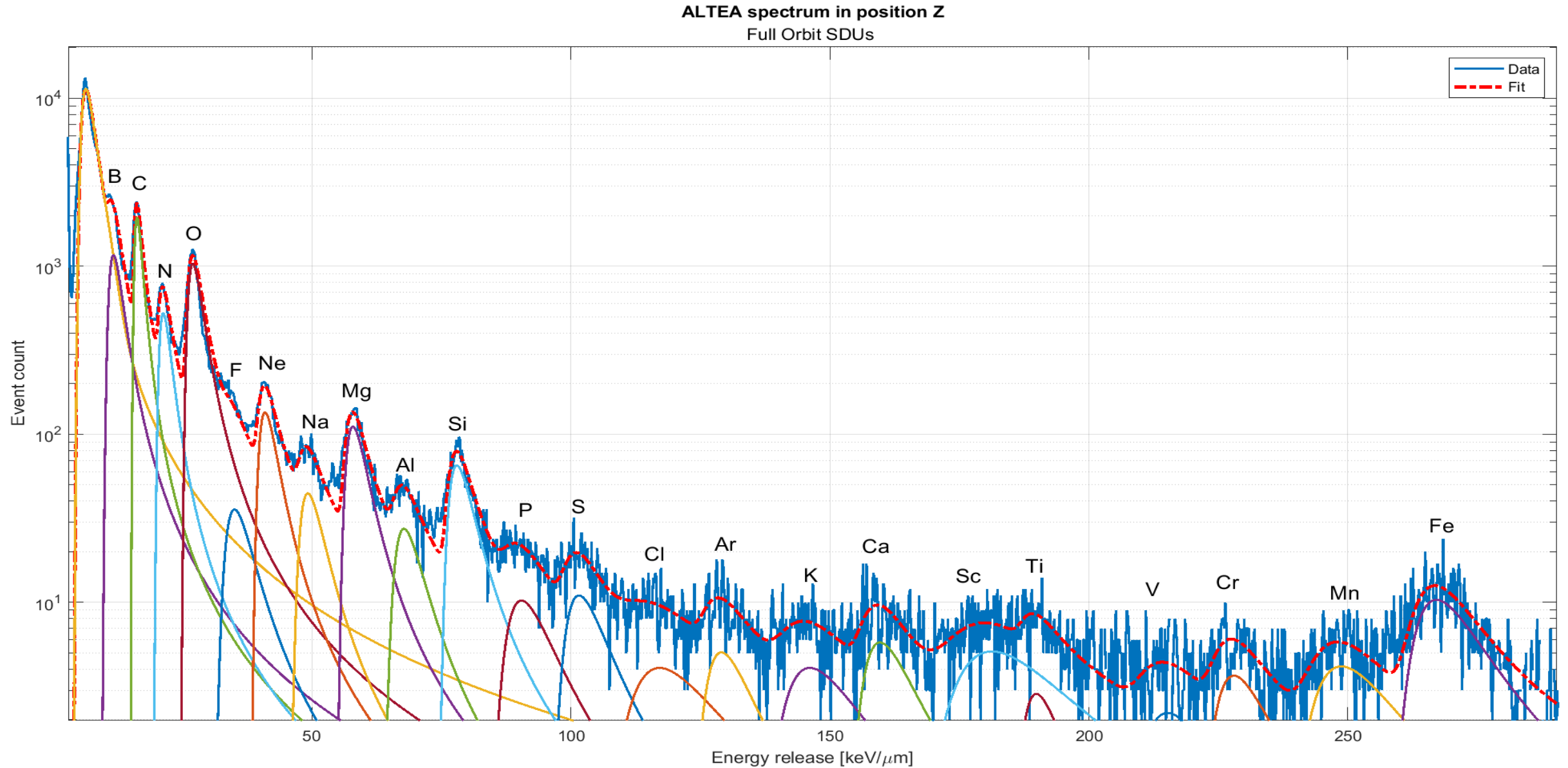
MEAN ENERGY RELEASE IN Si [keV/μm] 26,4 ± 1,5



Daily fluxes for high latitude regions



Nuclear discrimination



Cross calibration with NASA REM and DLR DOSTEL

Comparison 2021 DOY 261 - Lidal X Direction

