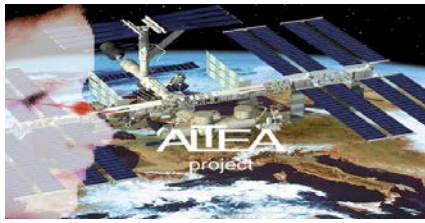


Iron flux inside the International Space Station is measured to be lower than predicted

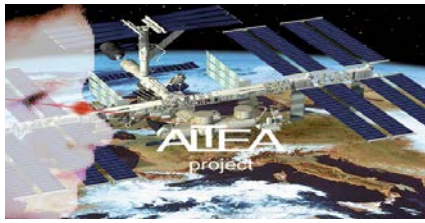
L. Narici^{1,2}, M. Casolino², L. Di Fino^{1,2}, M. Larosa^{1,2}, O. Larsson³, V. Zaconté^{1,2}

1 Department of Physics University of Rome Tor Vergata, Rome Italy; 2 INFN sect. Roma2, Rome, Italy; 3 KTH Royal Institute of technology, Stockholm, Sweden

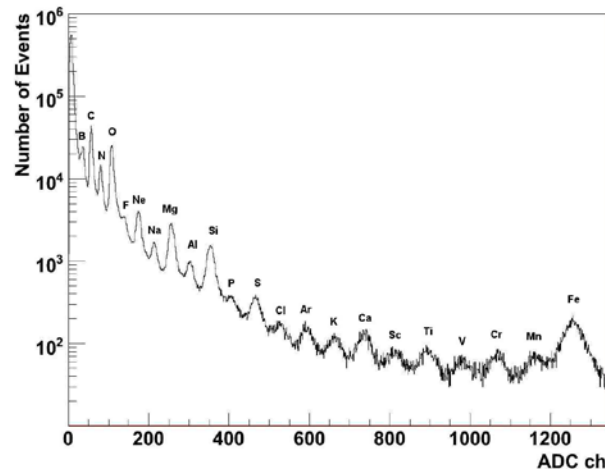


summary

- ALTEA:
- surveying the USLab
 - real time on the web
 - the question of the Fe abundance



The ALTEA *detector system*



Measure of the ion trajectory

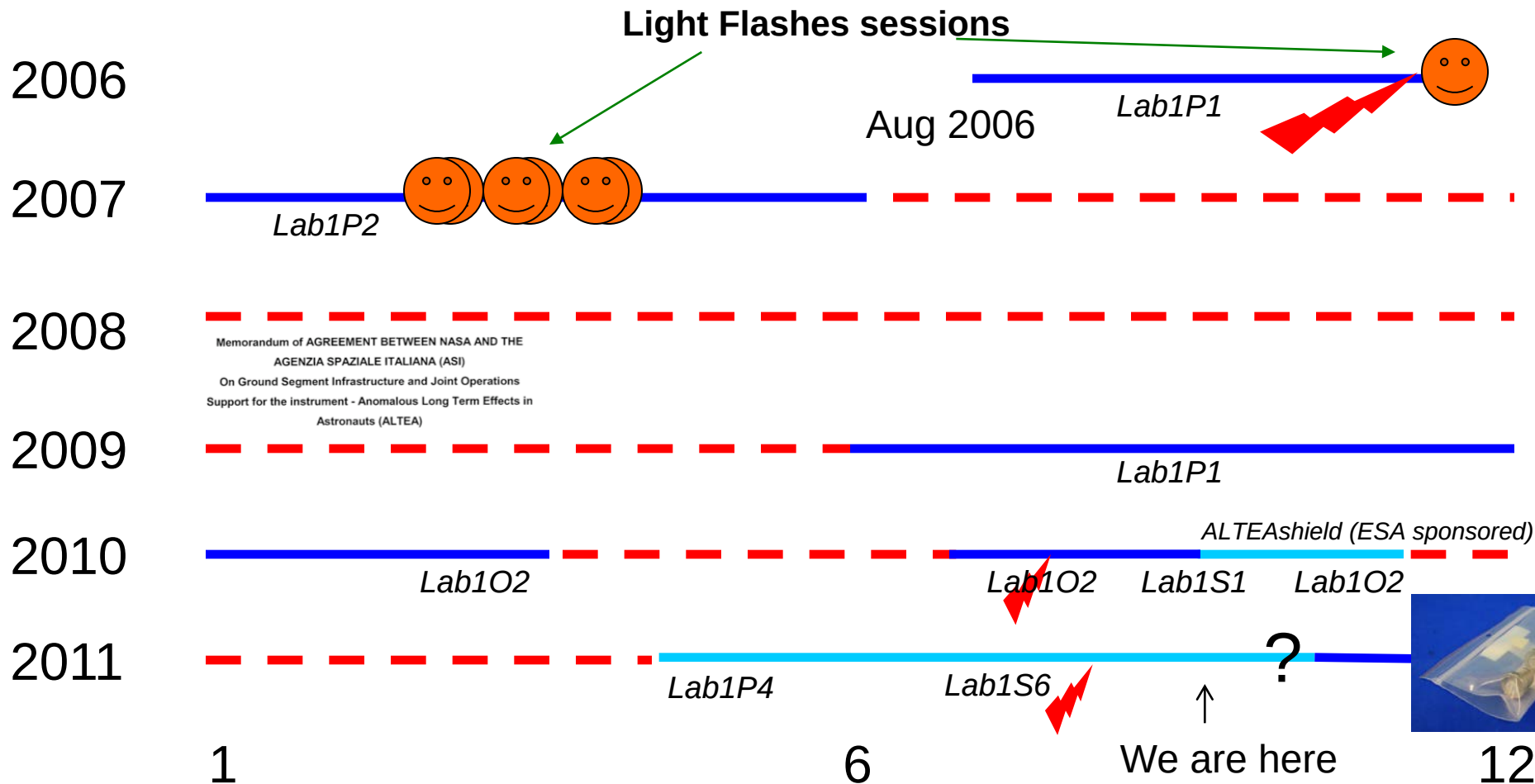
$3 \text{ keV}/\mu\text{m} < \text{LET} < 800 \text{ keV}/\mu\text{m}$

Sponsored by ASI, URTV, INFN, ESA
built by TAS Italy



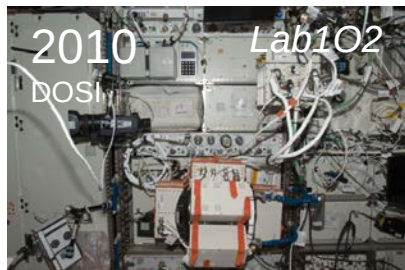
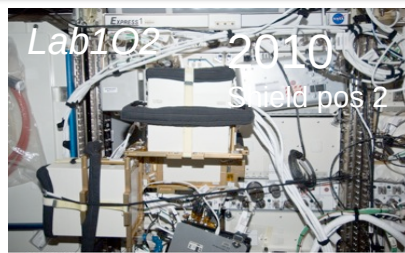


ALTEA "up" periods in the USLab

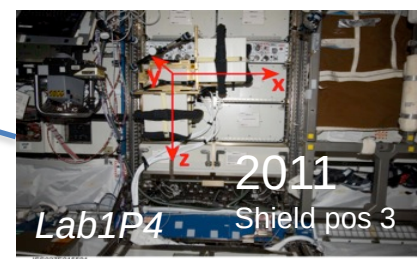
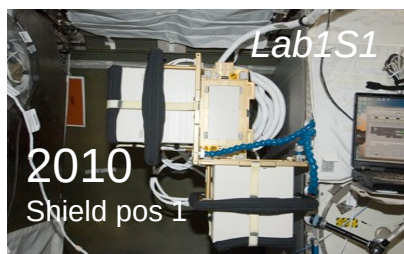
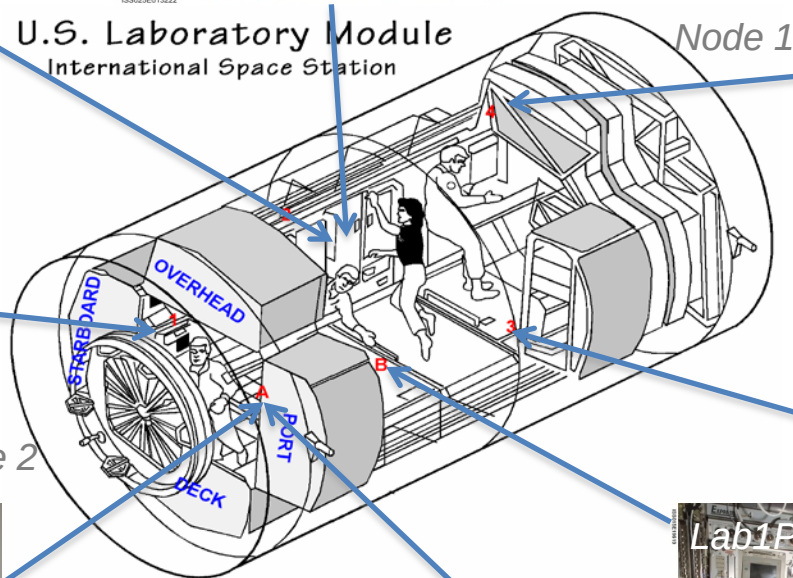


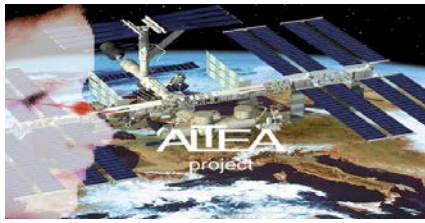


ALTEA positions in the USLab



U.S. Laboratory Module
International Space Station

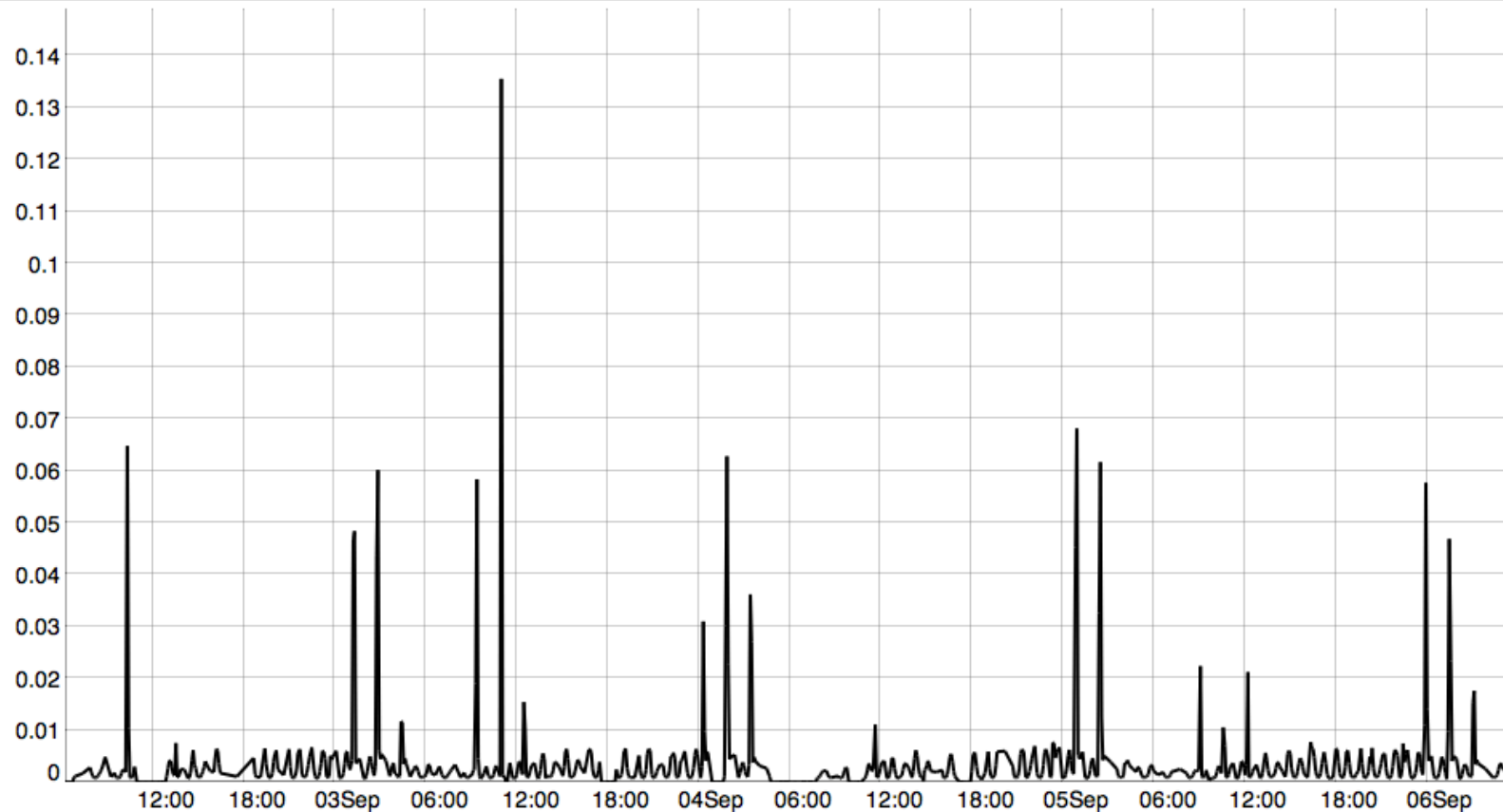




Real time ALTEA data available in the web (iSWA)

iswa.gsfc.nasa.gov/

ISWA Custom Timeline Cygnet

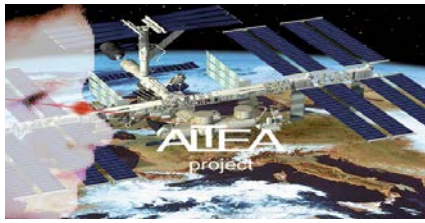


— ALTEA-Shield-Experiment:
Particle Flux(part/s cm² sr)

http://iswa.ccmc.gsfc.nasa.gov:8080/IswaSystemWebApp/index.jsp?i_1=388&l_1=4&t_1=27&w_1=1239&h_1=614&s_1=0

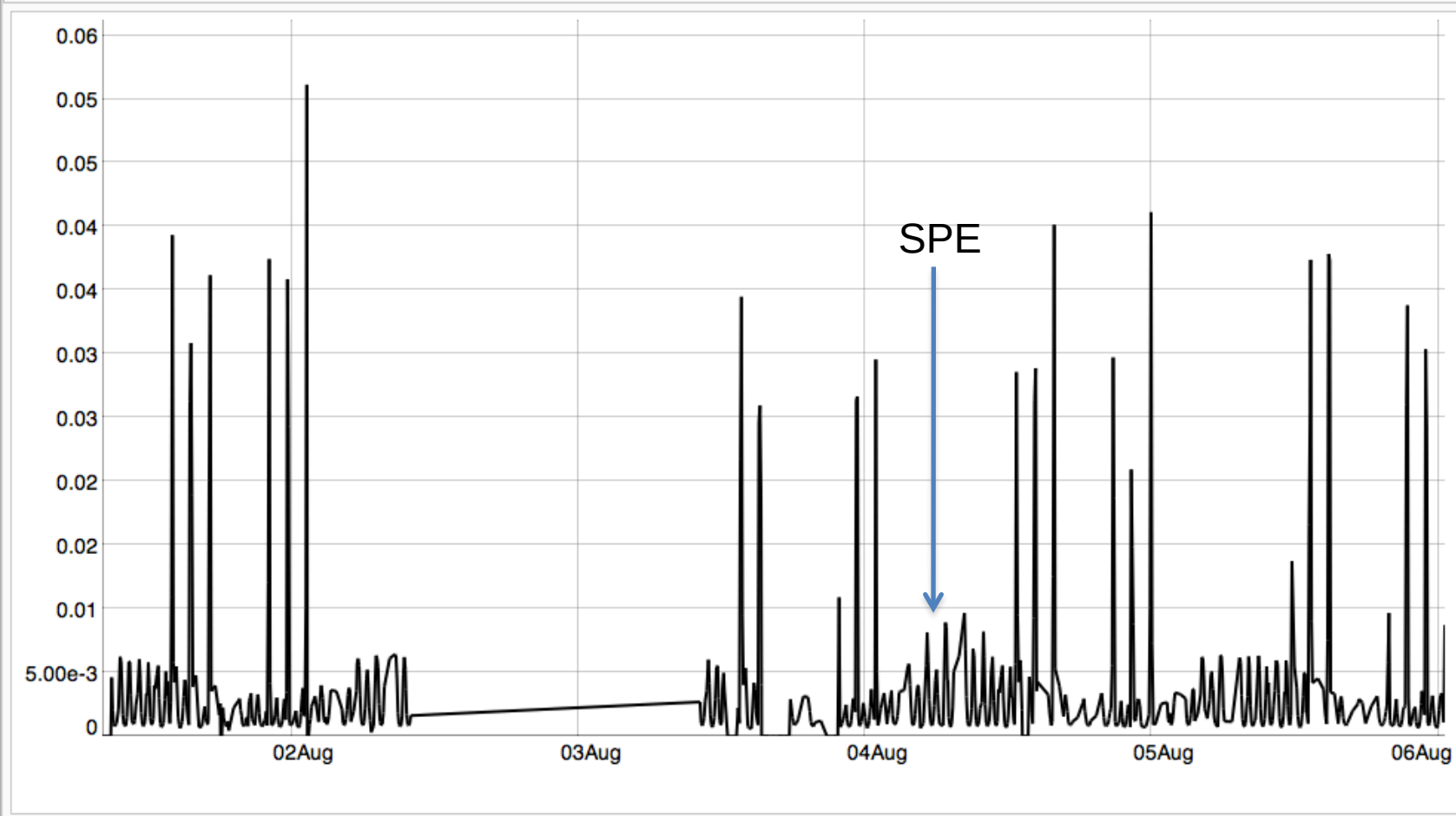
2011-09-06 05:51:01.0 Settings Select Data





Real time ALTEA data available in the web (iSWA)

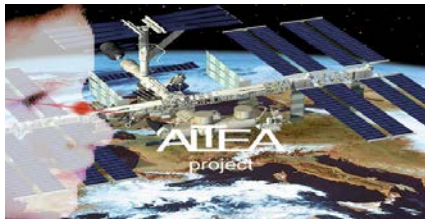
iSWA Custom Timeline Cygnet



—ALTEA-Shield-Experiment:
Particle Flux(part/s cm² sr)

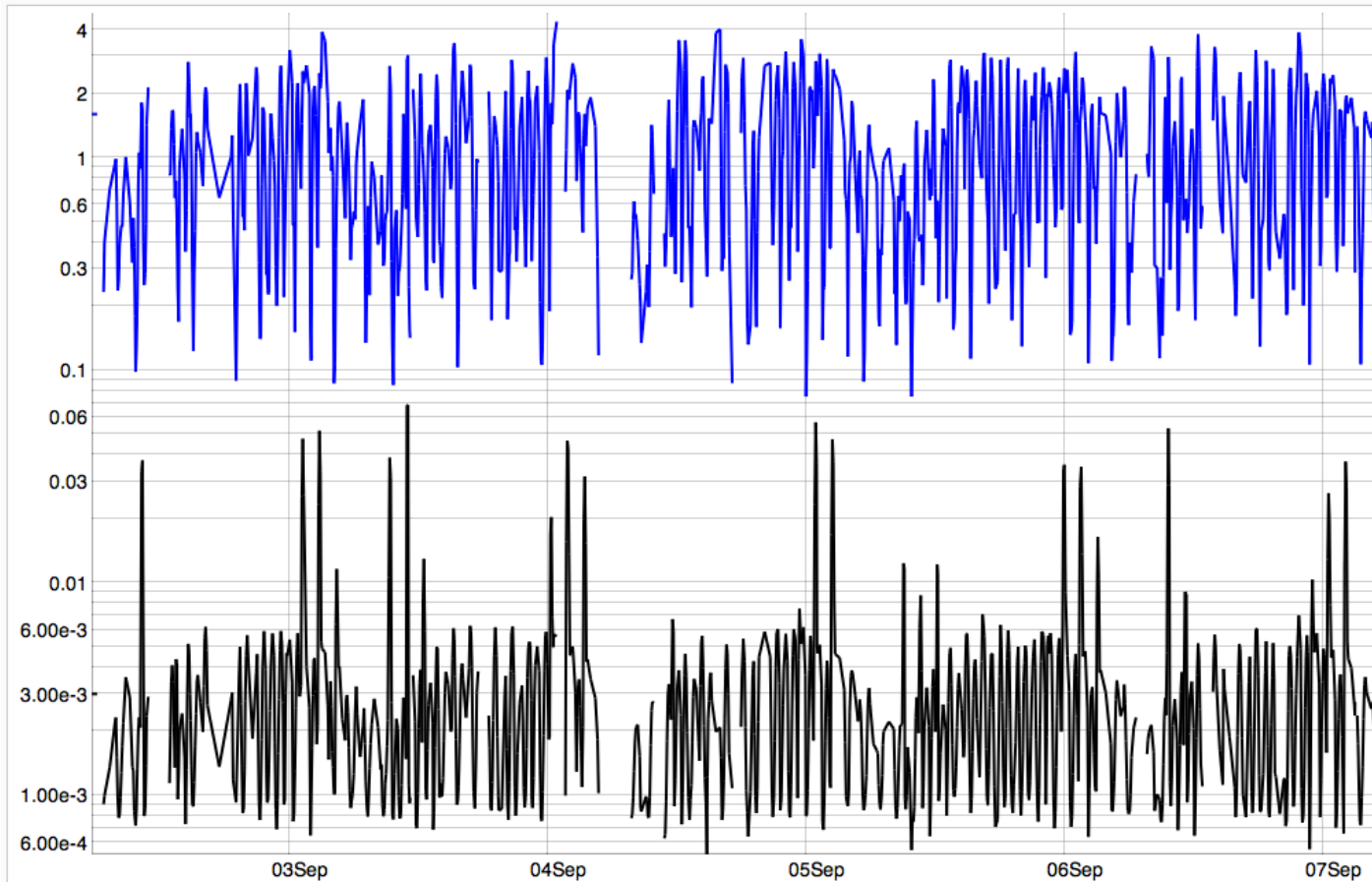
◀ 2011-08-06 00:40:39.0 ▶ ⌂ Settings Select Data ▼





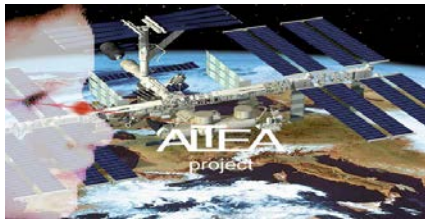
Real time ALTEA data available in the web (iSWA)

iSWA Custom Timeline Cygnet



—ALTEA-Shield-Experiment:
Particle Flux(part/s $\text{cm}^2 \text{sr}$)
—ALTEA-Shield-Experiment:
Equivalent Dose
(in water)(nSv/s)

◀ 2011-09-07 05:46:20.0 ▶ ⌂ Settings Select Data ▼



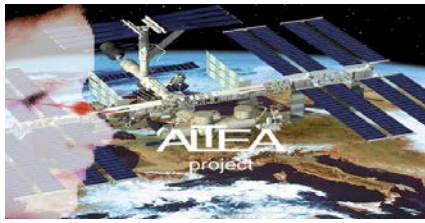
Fe measurements

No Fe measurements inside the ISS (neither outside in LEO)

Fe is quite important in the assessment of the radiation risks

and we need to rely on models for the extrapolation of the radiation risk in outer space

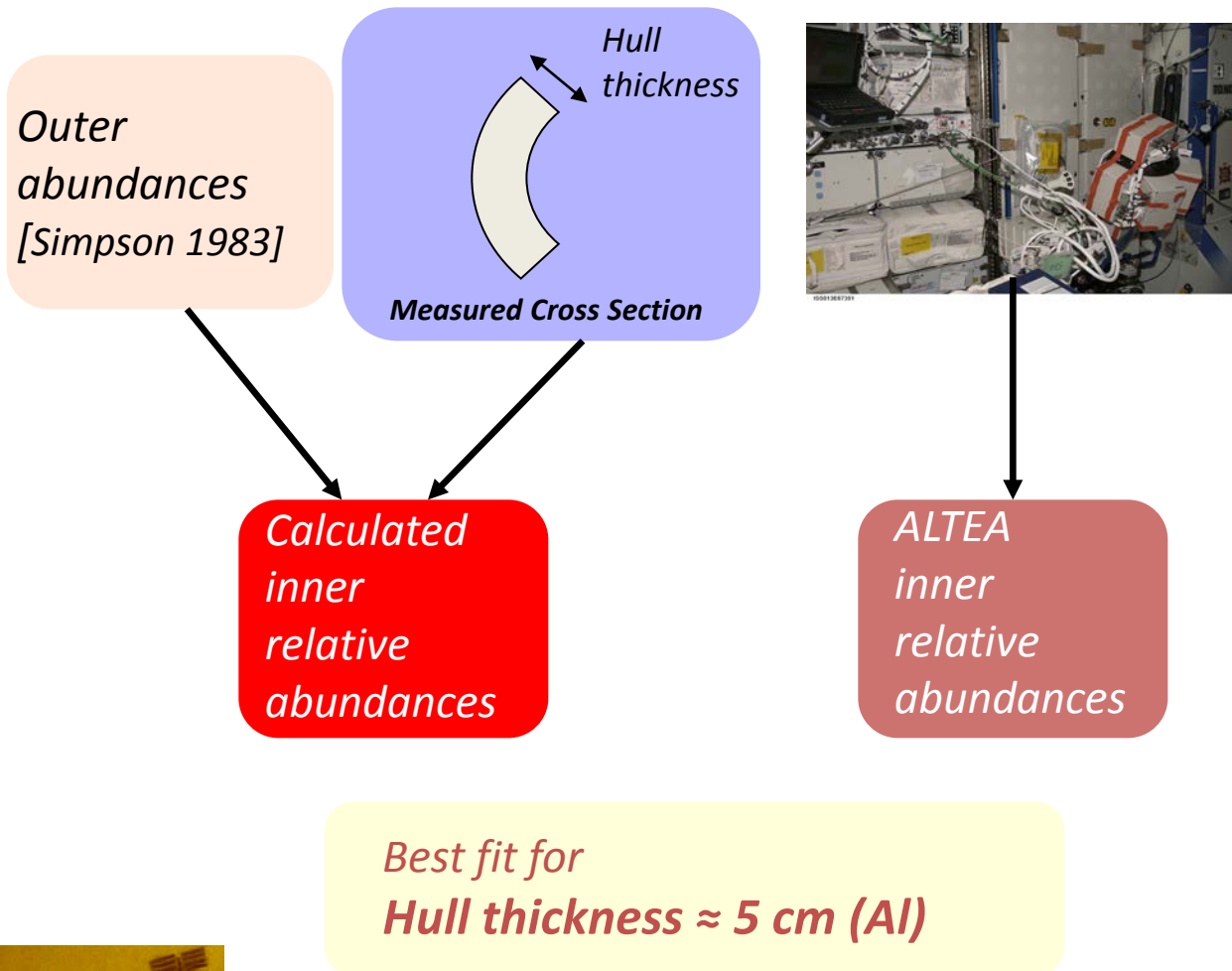
Models for Fe and Fe measurements in the ISS must agree

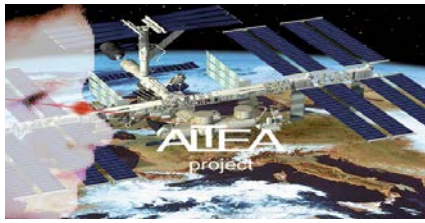


Estimate of USLab equivalent (Al) thickness

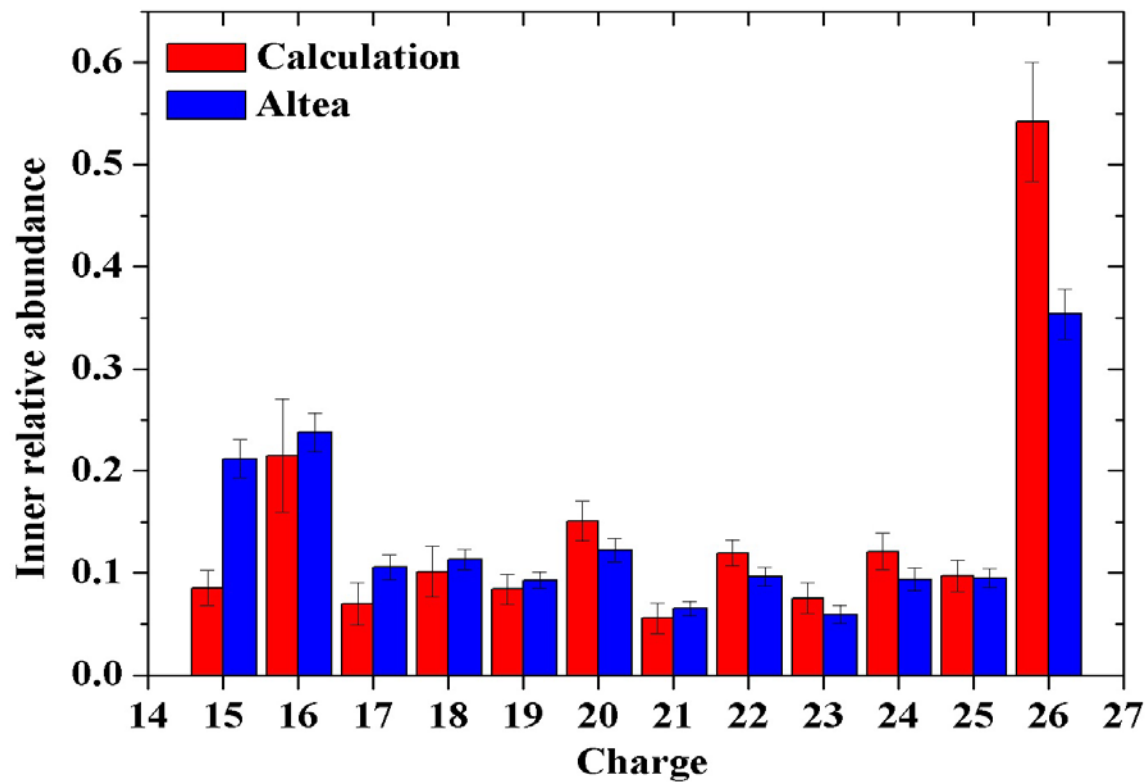
Calculation

ALTEA measurements



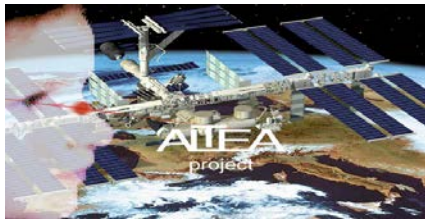


Overestimation of Fe



Fe contribution:

Calculation > ALTEA
By > +50% ($p < 0.009$)

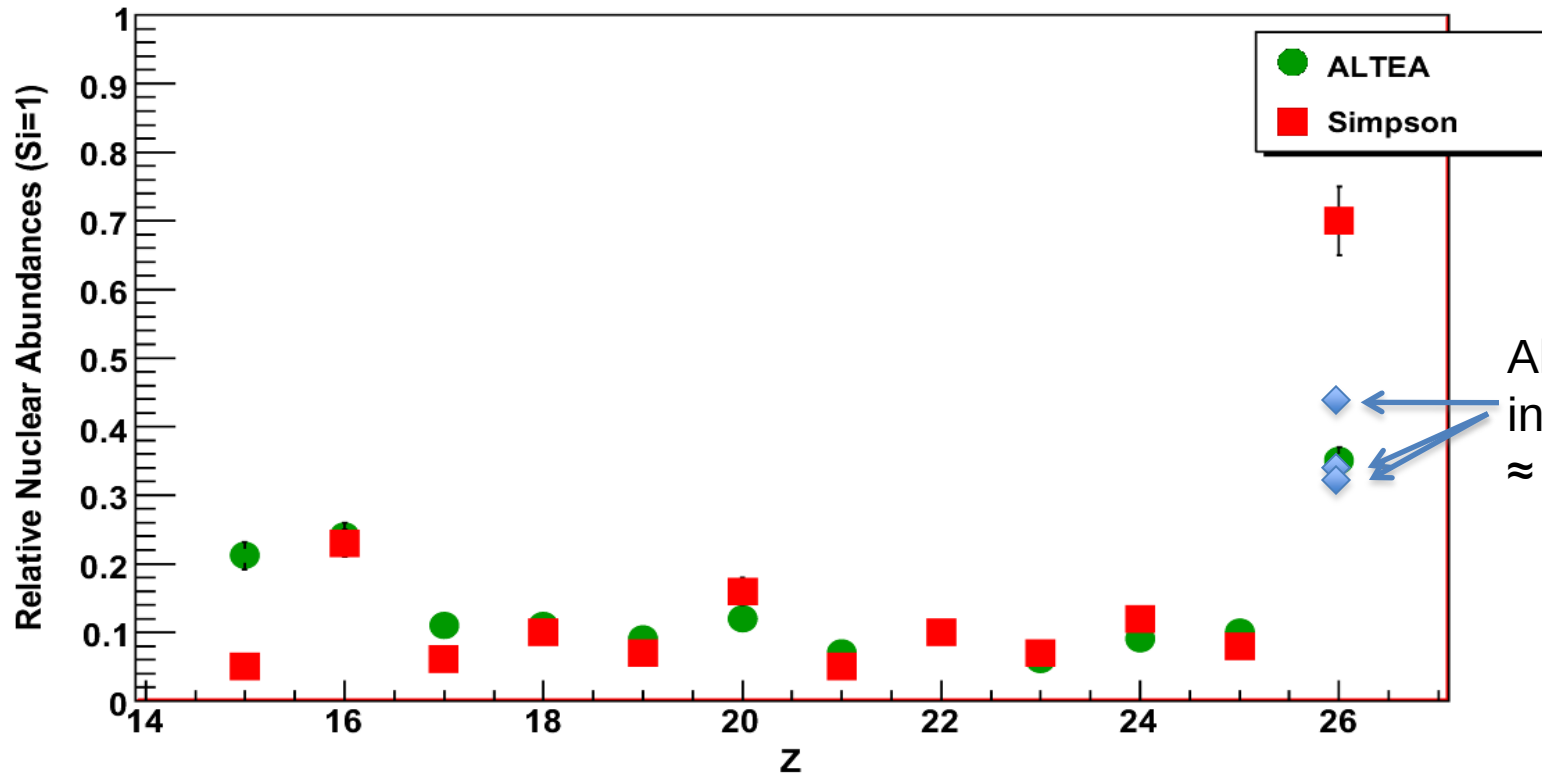


Relative abundances: overestimation of Fe - 2

Fe contribution

Simpson > ALTEA

By > x 2 or (transported inside) By > 75%

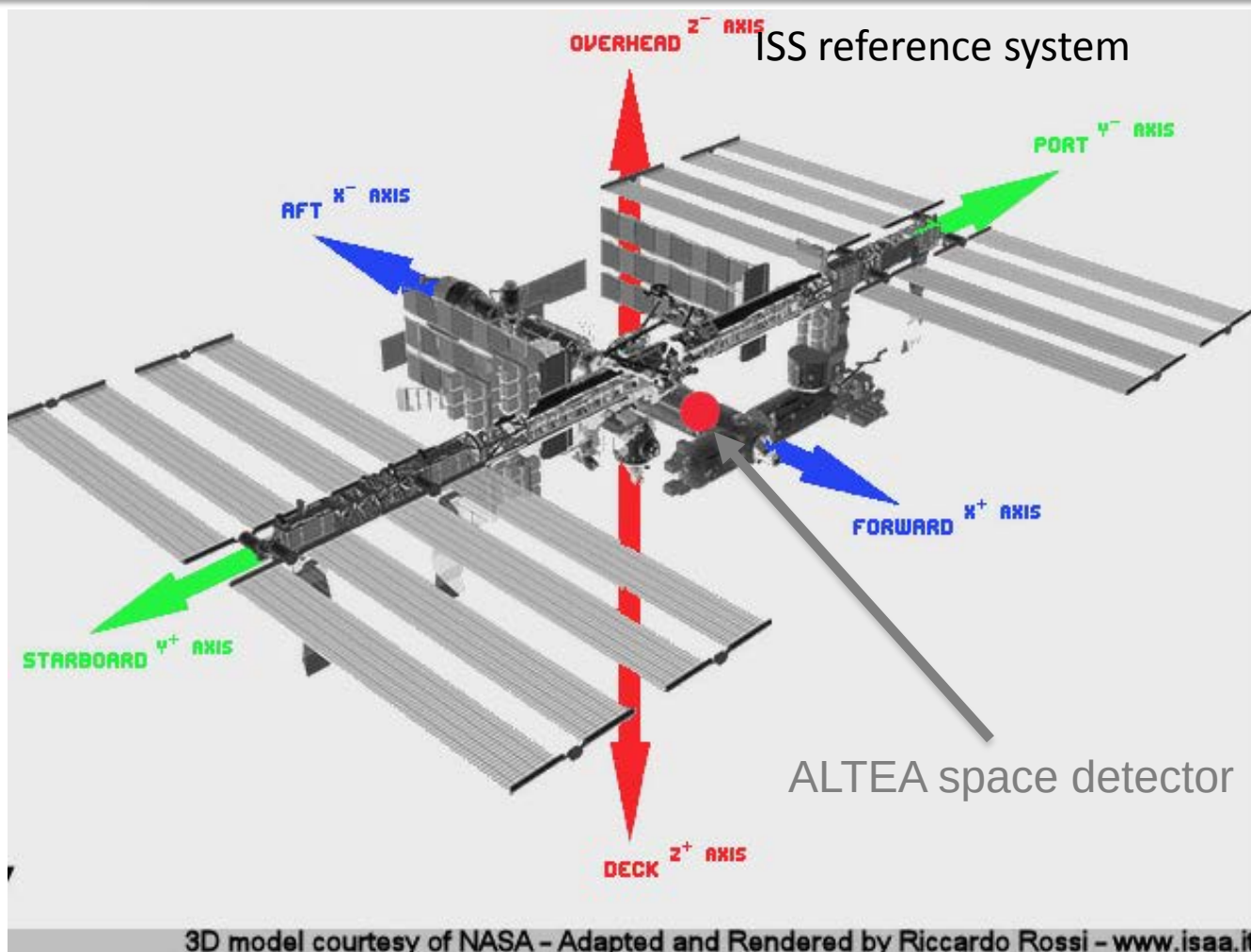


Alteino measurements
in the Pirs modulus
≈ Jan-March 2007



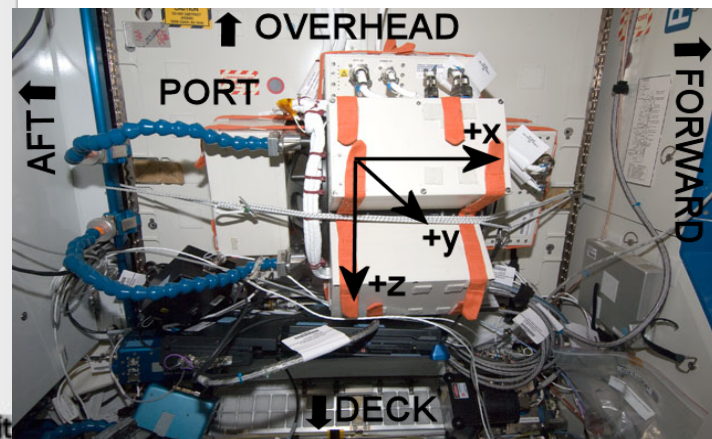


ISS coordinates and ALTEA position



Observation period:
 ~ 74 effective days:
 01/06/2009 – 28/09/2009

About
 6×10^6 s 5×10^7 triggers





The high LET anisotropy in the USLab

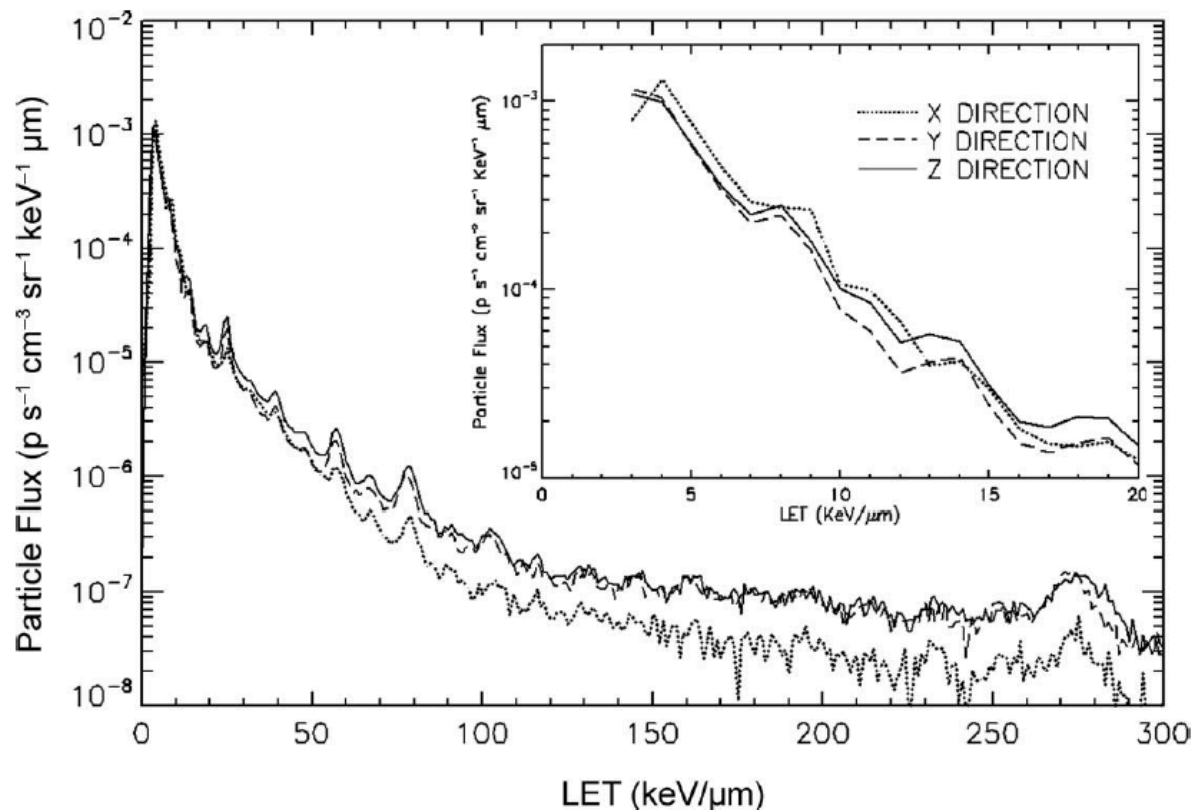
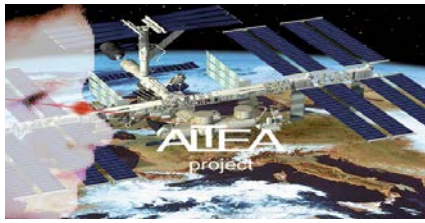
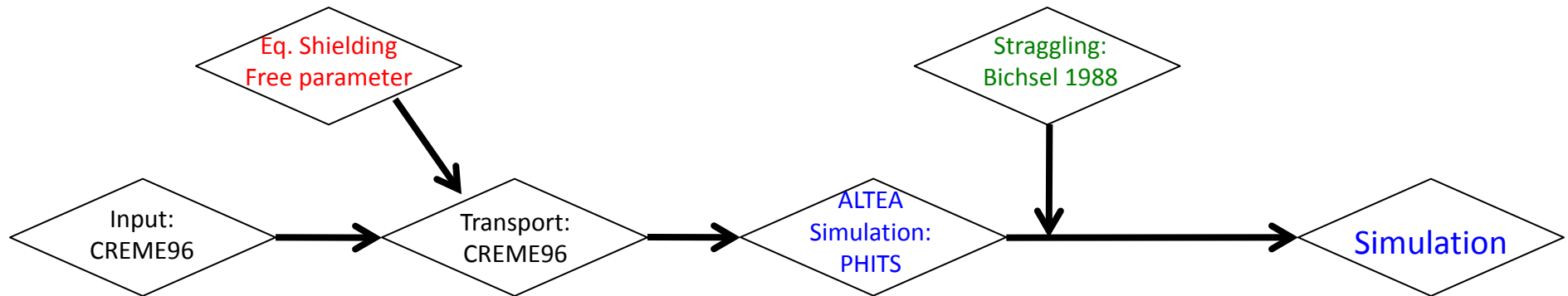


FIG. 4. LET spectra in three orthogonal directions. The Y and Z directions correspond to transverse sections of ISS while X is along the ISS longitudinal axis. The X spectrum is lower than those for Y and Z for high-LET particles and higher at low LET (see inset).

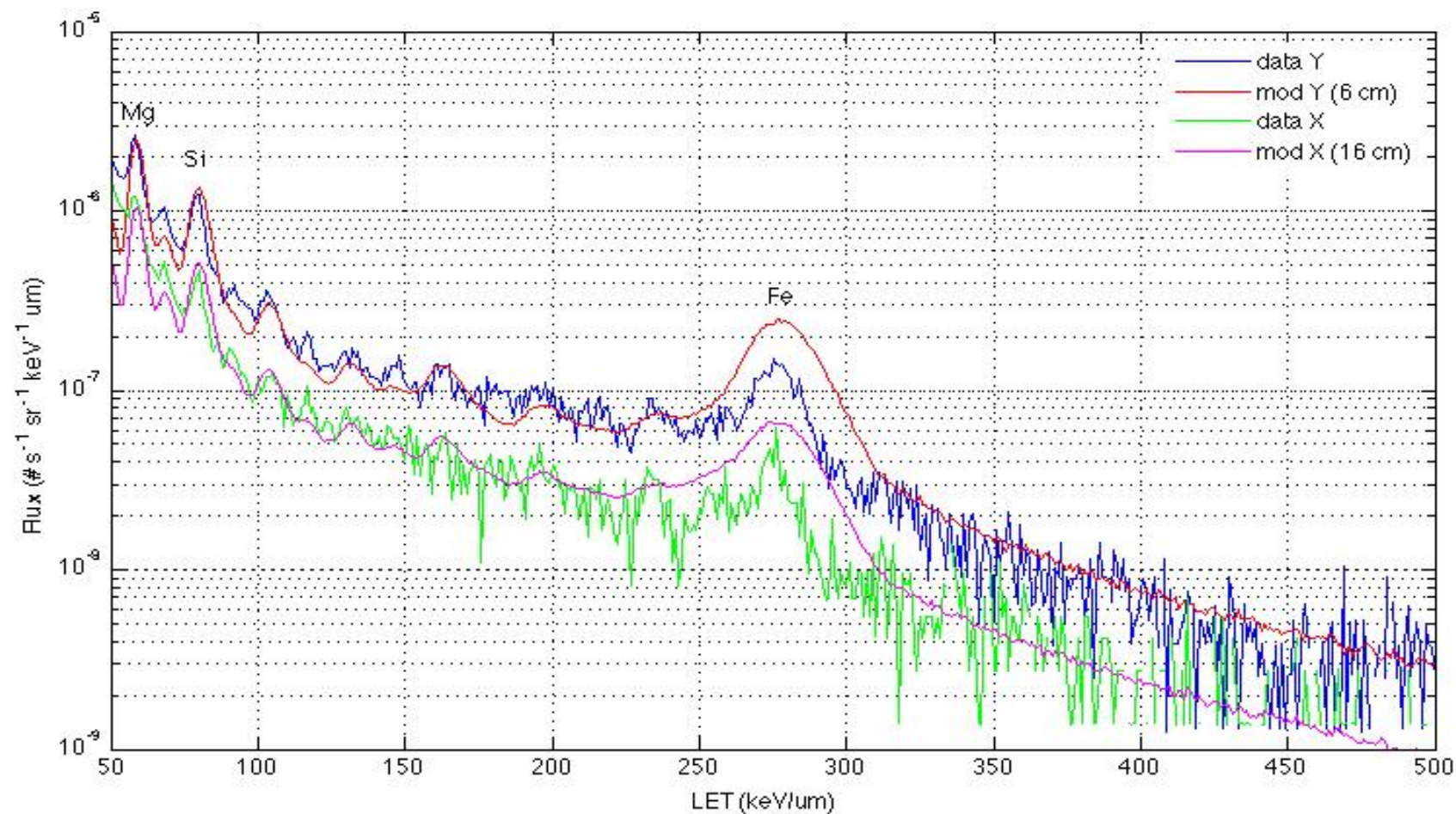


Simple simulation





The anisotropy measured and simulated



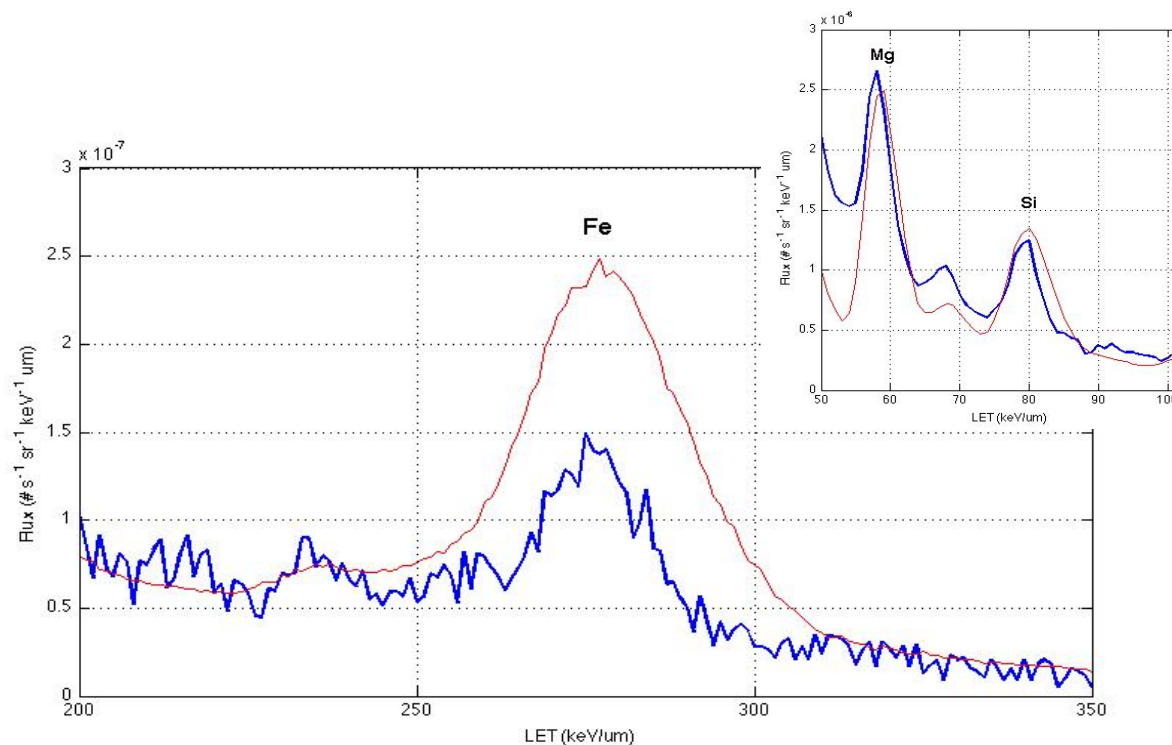


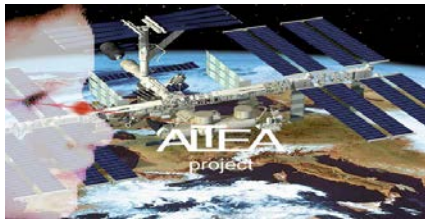
Overestimation of Fe - 3

Fe contribution
(Integrating above 260 keV/μm)

Simulation > ALTEA

+74 % (X direction)
+78 % (Y direction)
+76 % (Z direction)





Summary and conclusion

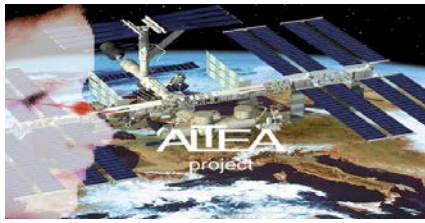
The overestimation of Fe appears to be consistent across different measurements and with different amount of shielding and using different analysis techniques

Alteino measurements performed in 2007 in Pirs modulus appear to confirm the overestimation (detailed analysis is in progress)

New ALTEA measurements appear consistent with the previous, regardless the position

A possible reason for this discrepancy could be the Fe source knowledge in LEO

In order to understand the problem and therefore to perform correct risk estimation for Fe we need to perform new concurrent measurements inside – outside (now possible: collaboration with AMS is under way)



Thank you for your attention