*Speaker

Estimation of the exposure of the TUS space based cosmic ray observatory

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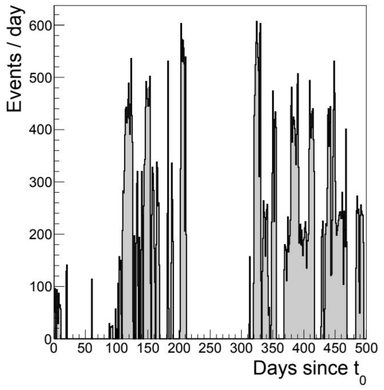
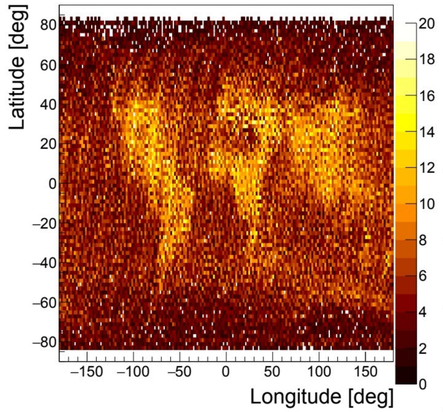
The TUS mission





- TUS: fluorescence detector placed on the Lomonosov satellite (test of the JEM-EUSO technique)
- Flight: 2016-2017
- 485 km altitude
- 95 min. sun-synchronous orbit
- 800 ns frame
- 80X80 km² field of view

Analysis based on ~78000 triggers in EAS mode collected from May 2016 to December 2017

The active time fraction

At the occurrence of a trigger ~52-60 s dead time

In quiet areas higher active time

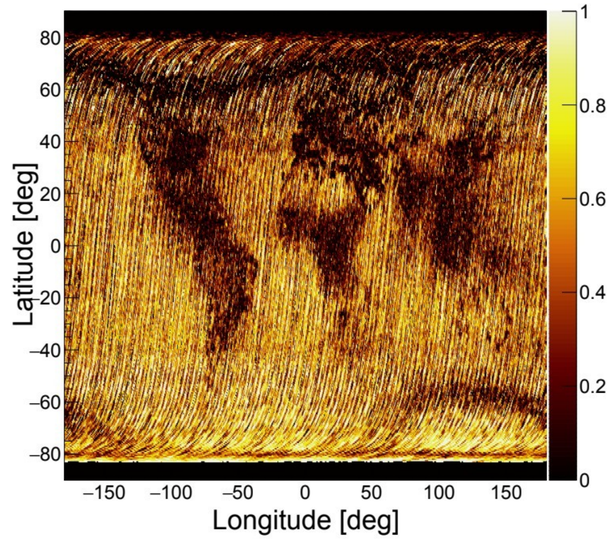
Over populated areas, Aurora ovals, stormy regions low active time

3118 acquisition orbits identified

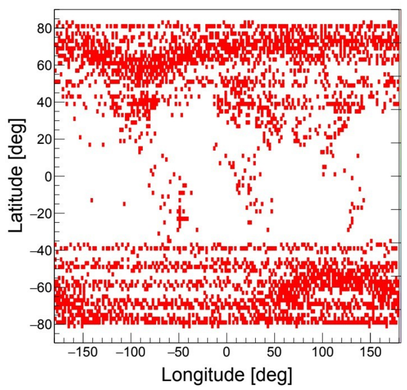
0-40 triggers per orbit

31 days of active time

Geometrical exposure: 1550 km² sr yr



The Earth emission rate calculation



Very variable rate

1-10³ photoelectrons per frame

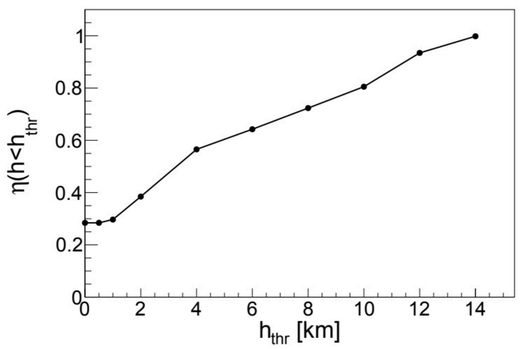
Higher luminosity:
- Aurora ovals
- Populated areas
- Near terminator

Measured rates used in simulations

Dependence of exposure on Earth emission rate

Airglow rate [ph / frame]	5	18	30	50	100
$N_{Trigg.} / N_{Trigg.,5}$	100%	60%	56%	18%	0%

Impact of clouds on the exposure



Cloud top height estimated for each trigger

Trigger performance estimated with simulations for each cloud condition

After the inclusion of clouds the exposure is **57%** of what estimated in clear sky

Dependence of the exposure from cloud condition

	Clear sky	1 km	2 km	4 km	6 km	8 km	10 km	12 km	14 km
$\eta(h < h_{thr})$	28%	29%	38%	56%	64%	72%	80%	93%	99.8%
$\epsilon_{cloud} / \epsilon_{CS}$	100%	100%	83%	53%	40%	16%	6%	6%	0%