

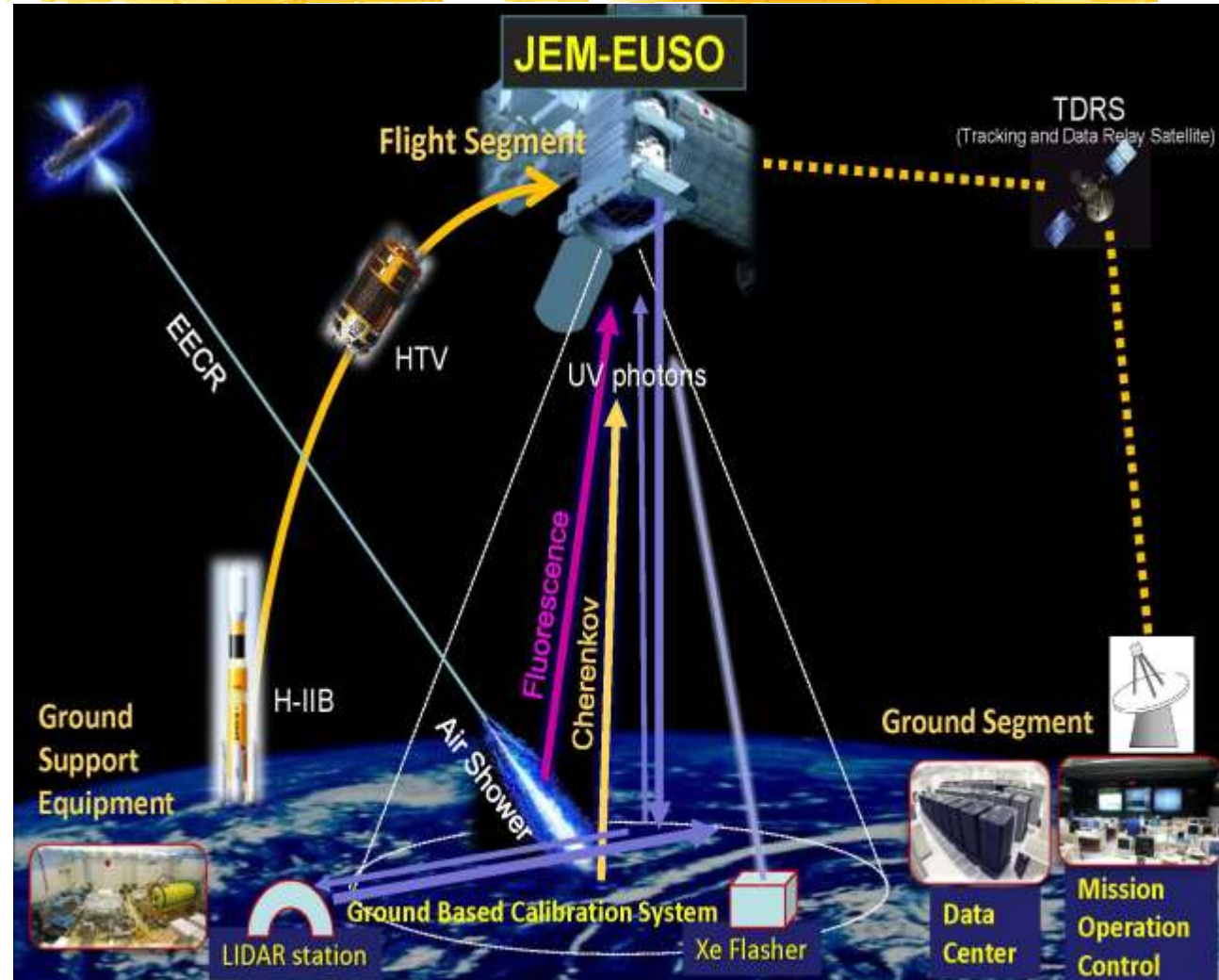
“Doing astronomy by looking downward”

The JEM-EUSO mission to explore ultra high energy cosmic rays from space

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on behalf of the JEM-EUSO collaboration**

Conceptual view of JEM-EUSO

- JEM-EUSO apparatus has been designed to detect the UV photons (330-400nm) emitted in the shower produced by the Extreme Energy Cosmic Ray (EECR) interactions with the atmosphere.
- This will be possible thanks to a super-wide-field of view (60°) telescope of about 2.5m looking downward from the ISS to the night sky.
- JEM-EUSO is designed to detect, in 5 years, more than 1000 events $E < 7 \times 10^{19}$ eV.



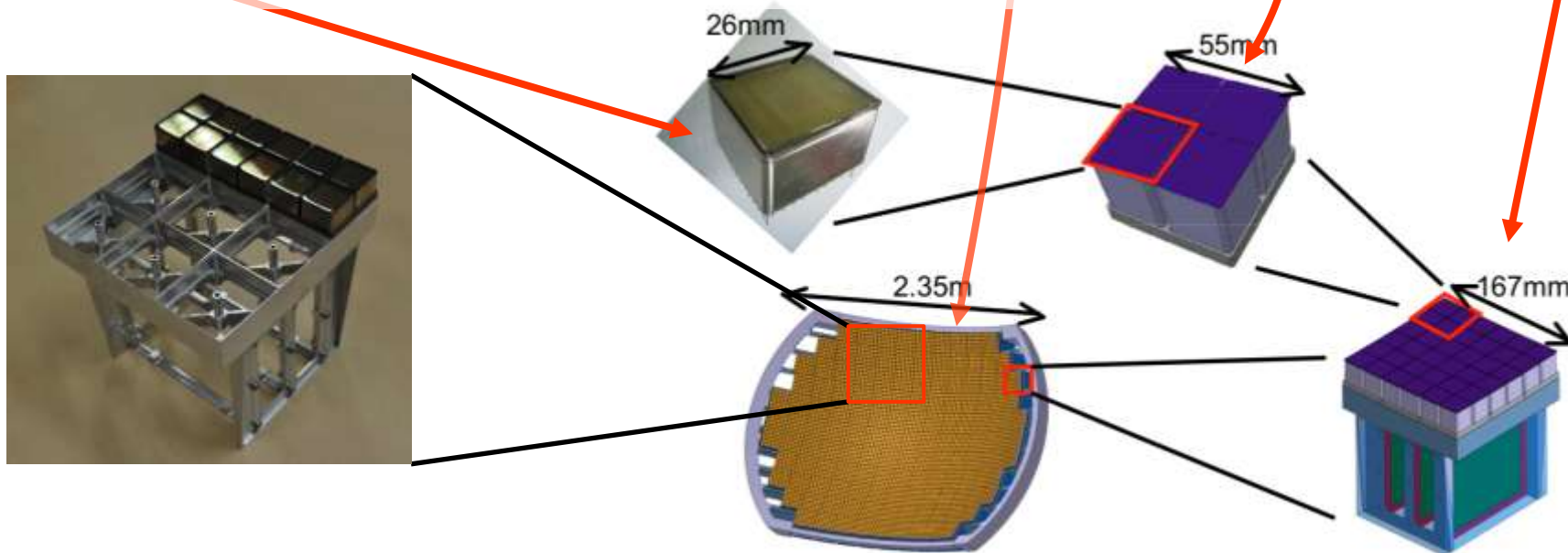
JEM-EUSO facts & figures

JEM-EUSO detector	
Field of View	$\pm 30^\circ$
Monitored Area	$> 1.3 \times 10^5 \text{ km}^2$
Telescope aperture	$\geq 2.5 \text{ m}$
Operational wavelength	300–400 nm
Resolution in angle	0.075°
Focal plane area	4.5 m^2
Pixel size	$< 3 \text{ mm}$
Number of pixels	$\approx 3 \times 10^5$
Pixel size are on ground	$\approx 560 \text{ m}$
Time resolution	$2.5 \mu\text{s}$
Dead Time	$< 3\%$
Detection efficiency	$\geq 20\%$

JEM-EUSO mission	
Launch date	2016
Mission lifetime	3+2 years
Rocket	H2B
Transport Veichle	HTV
Accommodation on JEM	EF#2
Mass	1938 kg
Power	926 W (352 non op.)
Data rate	285 kbps (and on board storage)
Orbit	400 km
Inclination of the orbit	51.6°
Operational Temp.	-10° to 50°

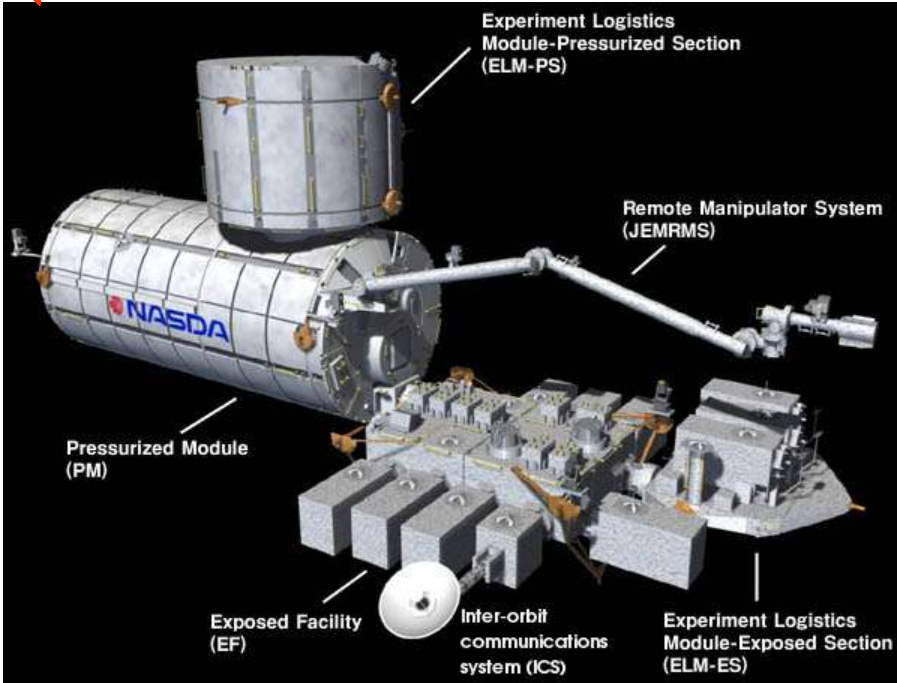
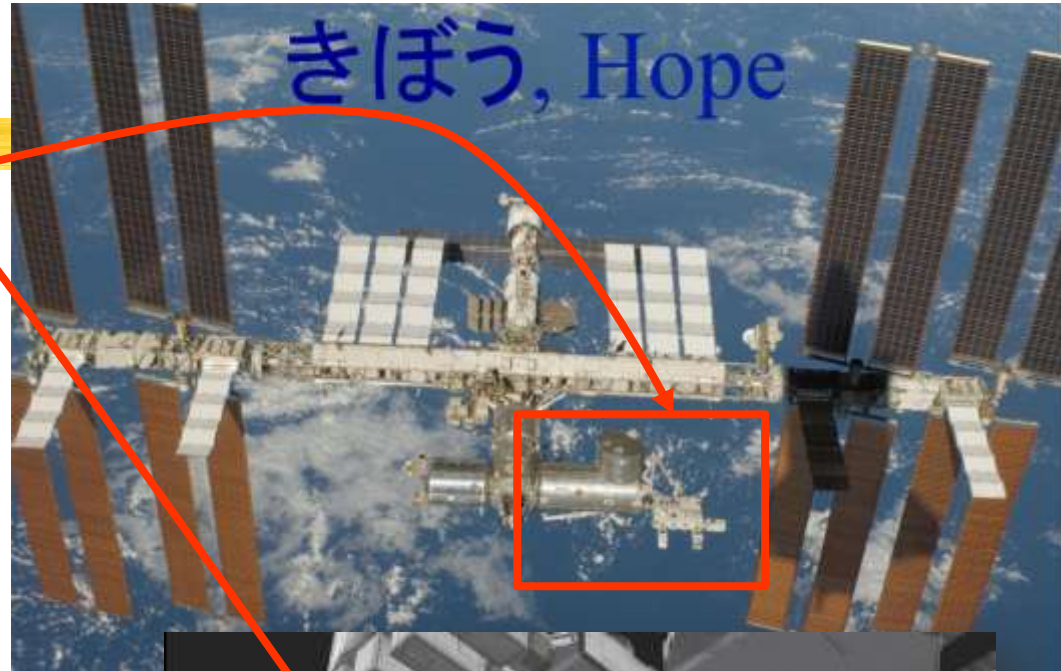
JEM-EUSO detector

- Three Fresnel lenses compose the optics block that focus the UV photons onto a 2.35 m wide focal surface.
- The focal surface, houses 4932 Hamamatsu R11265-03-M64, 64 pixels, MAPMTs.
- MAPMTs are grouped by 4 into elementary cells, that are grouped by 9 into a module (PDM).
- PDM are housed into the focal plane structure.

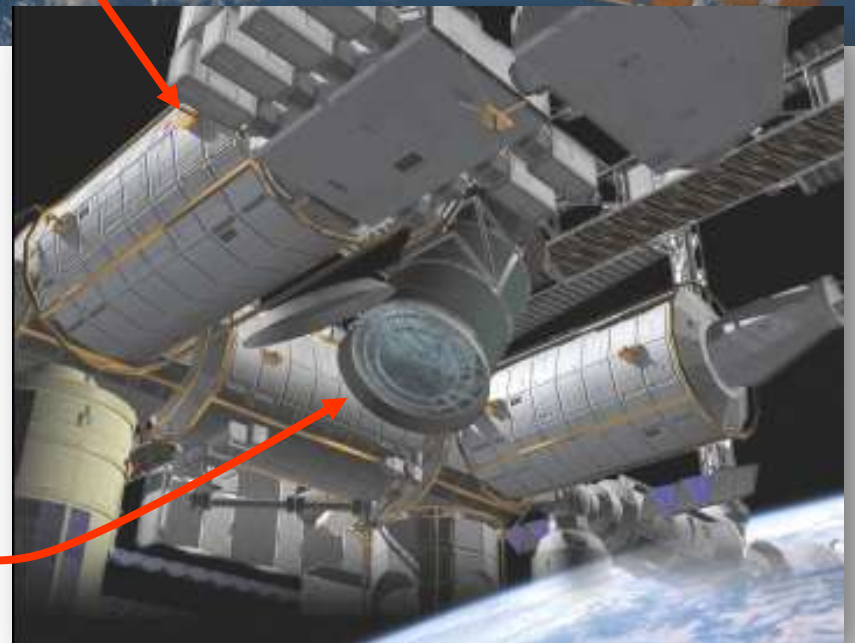


The JEM module

The Japanese Experiment Module (JEM), Kibo, on the ISS

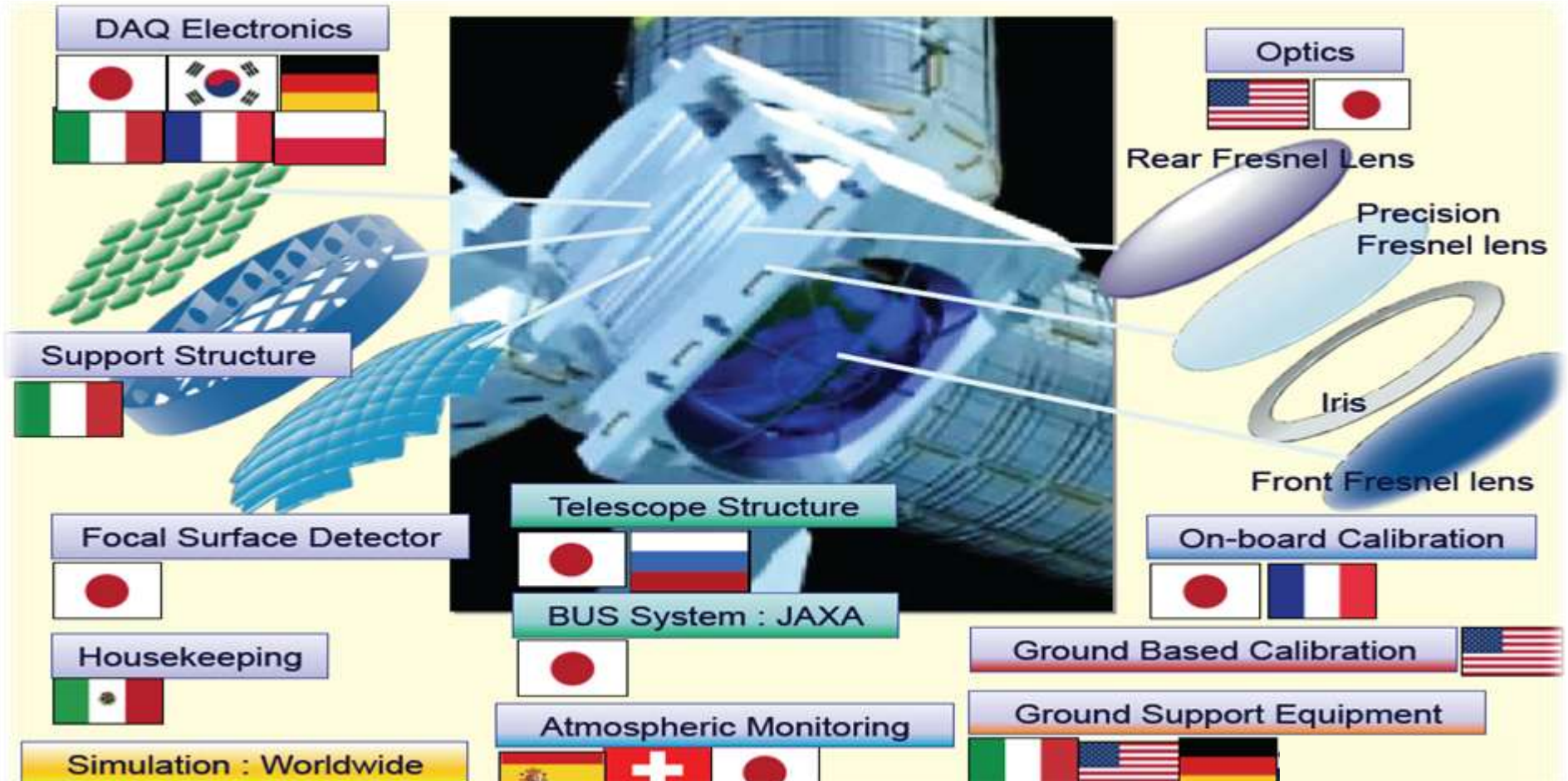


The JEM-EUSO detector on the JEM exposed facility



JEM-EUSO detector and role sharing

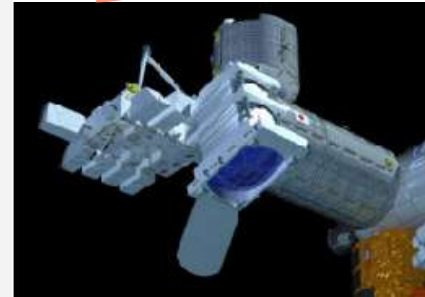
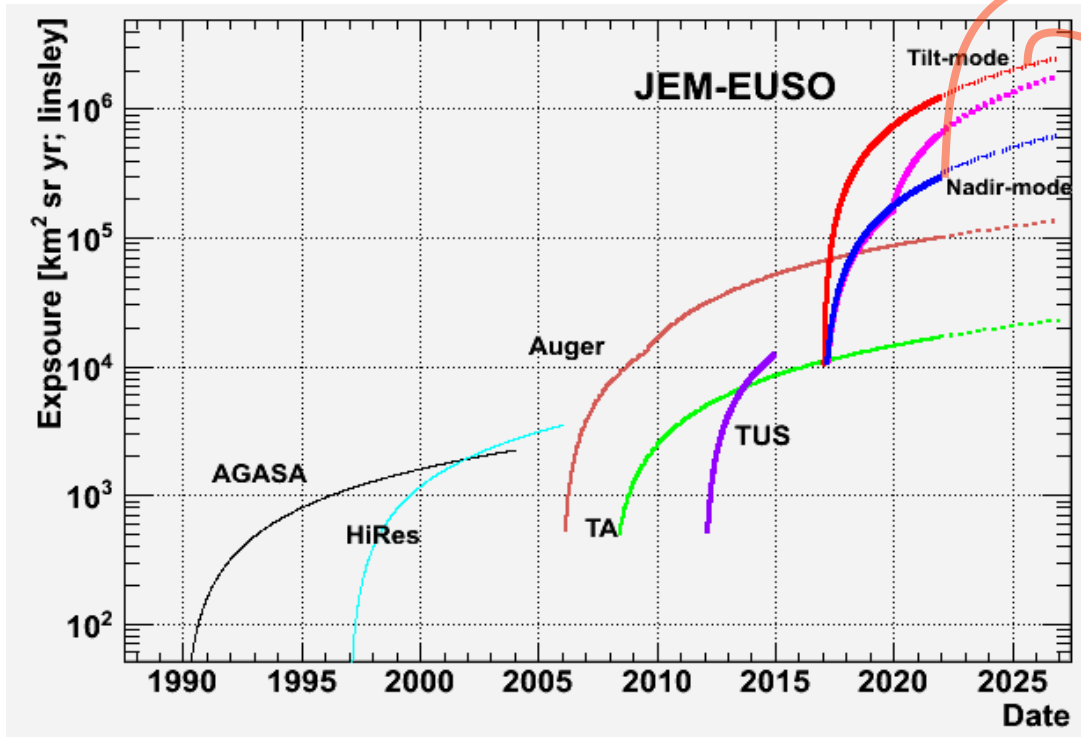
- JEM EUSO Collaboration: 77 Institutions, more than 250 researchers
 - Japan, USA, Korea, Mexico, Russia
 - Europe: Bulgaria, France, Germany, Italy, Poland, Slovakia, Spain, Switzerland
- RIKEN: Leading institution



Scientific objectives

- **Astronomy and Astrophysics through the particle channel:**
 - Identification of sources and study of the acceleration or emission mechanisms by high-statistics arrival direction analysis;
 - Measurement of the energy spectra of individual sources (spectral shape, flux, power);
 - High Statistics measurement of the trans-GZK (Greisen-Zatsepin-Kuzmin) limit spectrum.
- **Physics and Astrophysics at $E > 5. \times 10^{19} \text{eV}$**
- **Exploratory and Secondary Objectives:**
 - **New messengers:**
 - Discovery of UHE neutrinos by neutrino discrimination and identification via X_0 and $X_{\text{max}i}$;
 - Discovery of UHE Gammas by discrimination of X_{max} due to geomagnetic and LPM (Landau–Pomeranchuk–Migdal) effect.
 - **Magnetic field studies:**
 - Constrains on the galactic and local extragalactic fields.
 - **Atmospheric science.**

The JEM-EUSO exposure



- Downward looking from space, is possible to have a **huge exposure area**.
- In JEM-EUSO this area can be enlarged, from $\approx 1.3 \times 10^5 \text{ km}^2$ to $\approx 1 \times 10^6 \text{ km}^2$, thanks to the tilted mode operation (up to 40°).