



OMERE space radiation environment and effects tool: new developments and new interface

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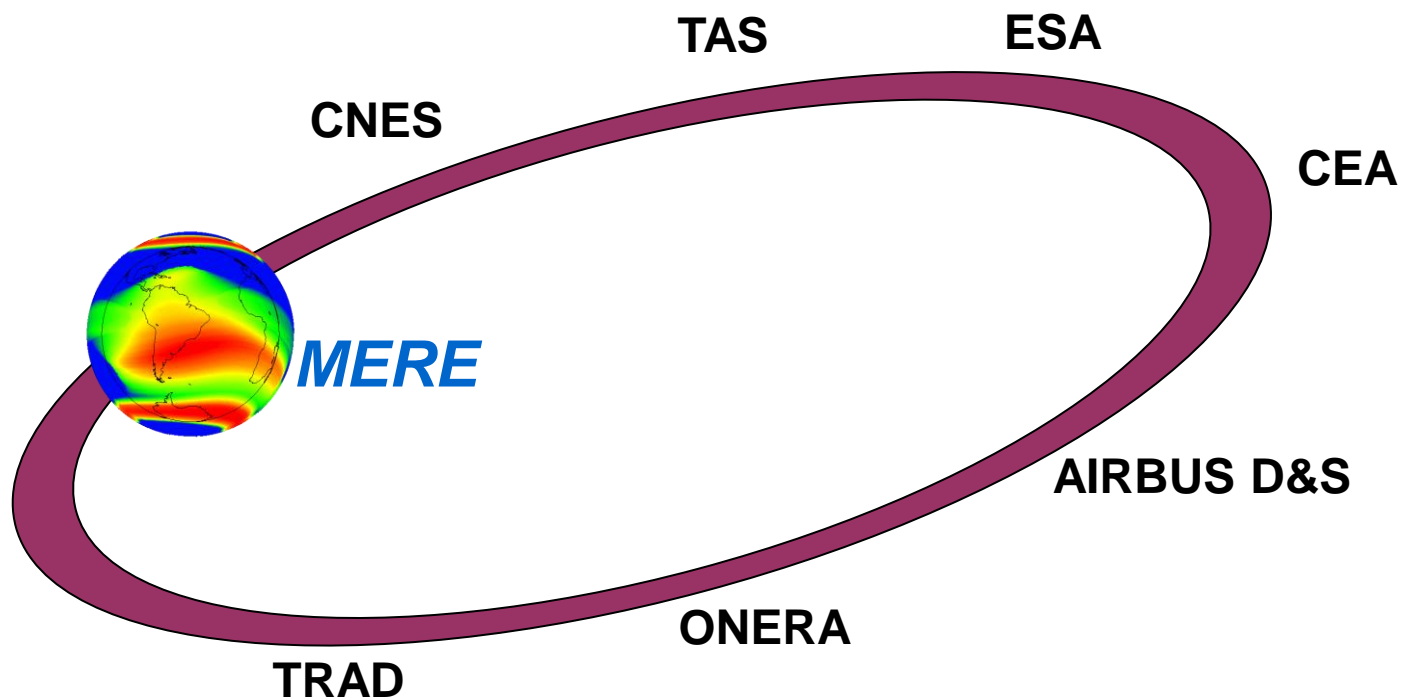
R. Ecoffet, G. Rolland and D. Standarovski, CNES

OMERE = Outil de Modélisation de l'Environnement
Radiatif Externe

■ The project

- ▶ Since 1999.
- ▶ TRAD development with CNES support.
- ▶ Freeware for space radiation environment and effects on electronic components.
- ▶ Stand alone software (no internet connection needed).
- ▶ Conceived to meet industrial requirements.
- ▶ Integrates ONERA models.
- ▶ Integrates outcomes of Research and Technology projects financed by the CNES.
- ▶ Coupling with FASTRAD®.

- The partnership



■ Existing modules

- ▶ Orbit and mission definition
 - Orbit parameters or trajectory file
- ▶ Radiation environment definition
 - Radiation belt models
 - Solar proton and solar ion models
 - Cosmic Ray models
- ▶ Ionising dose
 - Dose depth curve behind Al equivalent shielding
 - Dose rate calculation along the orbit
- ▶ Non-Ionising dose
 - Using NIEL curves from the ONERA NEMO (NIEL Evaluation Model of ONERA) code.
 - Electron, proton and neutron equivalent fluence.

■ Existing modules

- ▶ LET spectrum
 - Behind fixed aluminium equivalent shielding or using a sector file.
- ▶ Particle Transport
 - Electron, proton, ion behind fixed aluminium equivalent shielding or using a sector file.
- ▶ Single Event Effects
 - Component database
 - Weibull fit of ion and proton cross-section curves
 - PROFIT and SIMPA methods for predicting proton cross-section curve from the ion one
 - Mission average and along the orbit single event rate behind fixed aluminium equivalent shielding or using a sector file.

- Existing modules

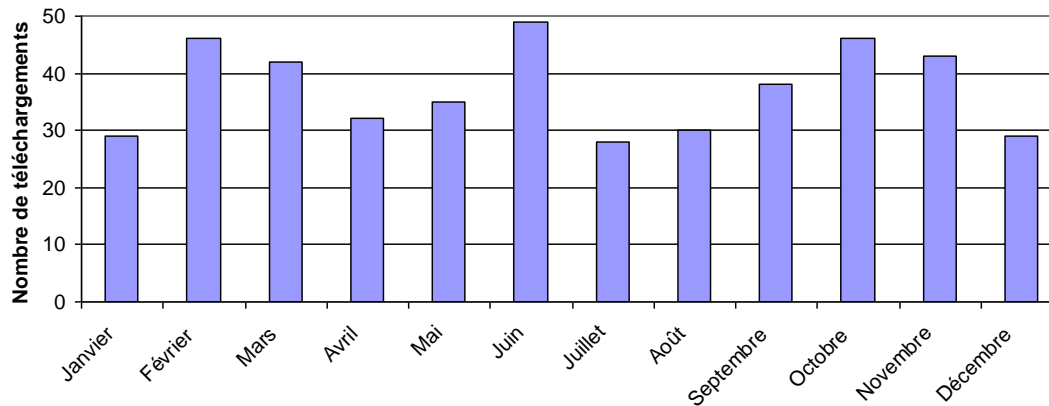
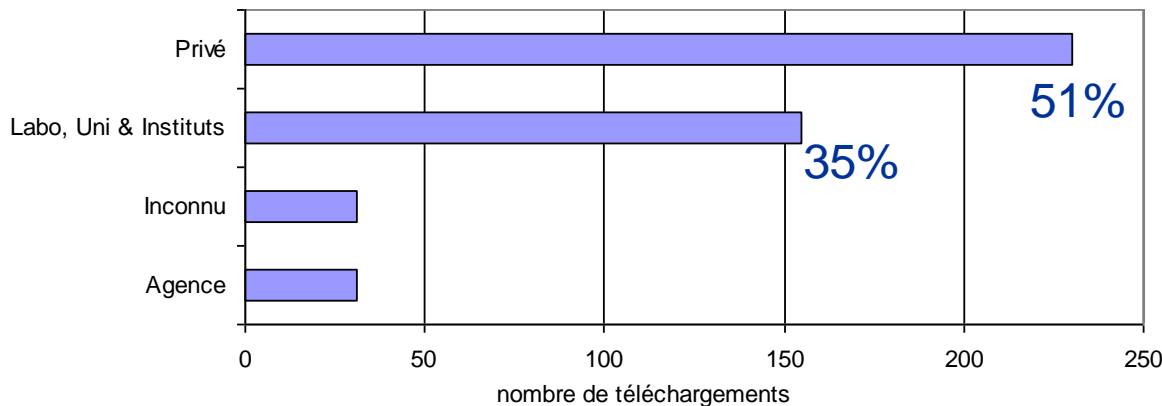
- ▶ Equivalent LET
 - LET variation inside the sensitive volume for an ion of energy E .
- ▶ Solar Cells
- ▶ Multi-mission calculations
 - Batch calculations of environment and effects for multiple missions.
 - Post processing tools.

■ The users

- ▶ System engineering (can be a client requirement)
- ▶ Electronic component engineering
- ▶ Equipment and scientific instrument conception
- ▶ Research and development
- ▶ Education

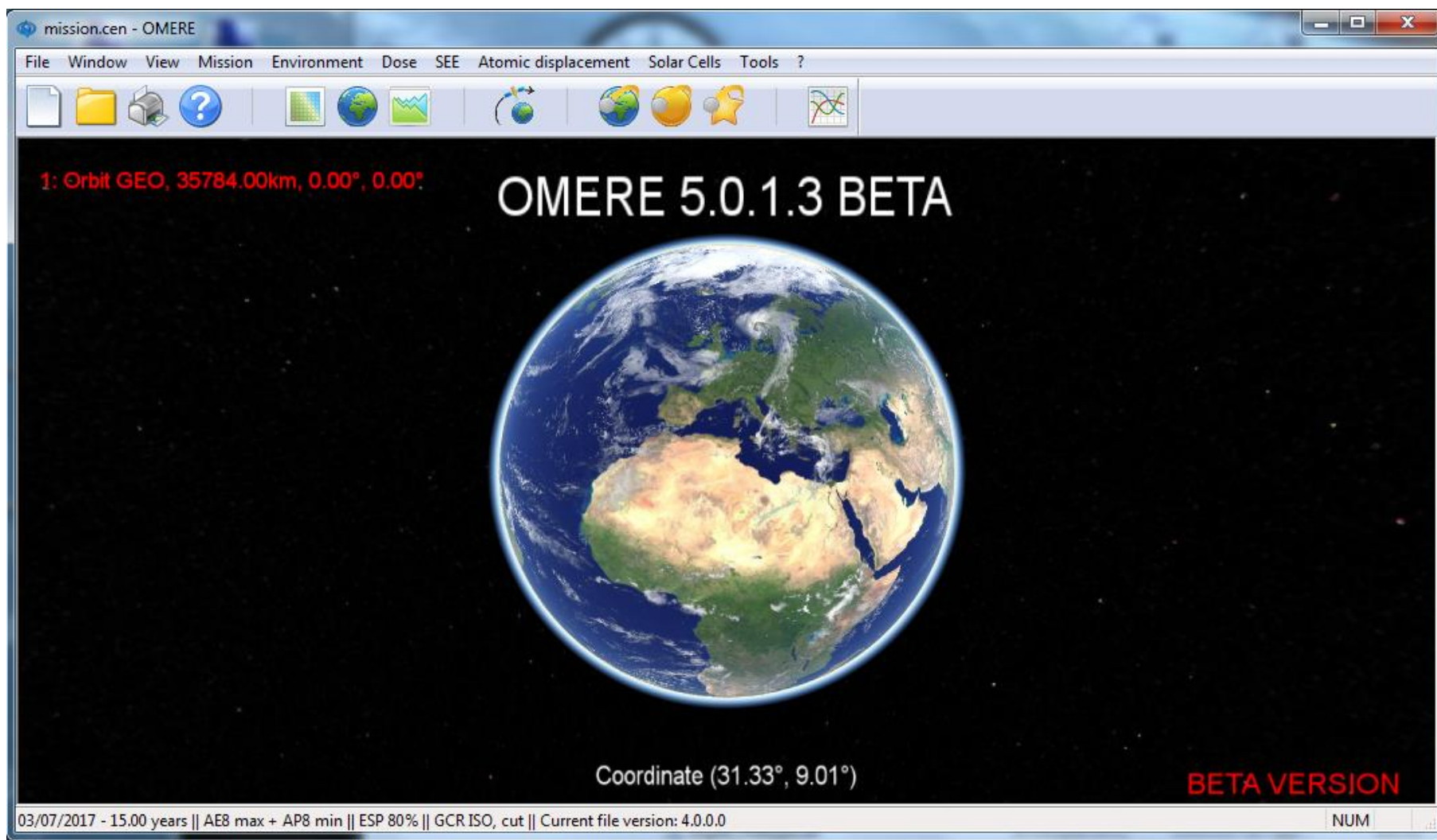
User statistics

- ▶ 450 downloads in 2016
- ▶ From 40 different countries



On average 1 new download/day

- Since 2015, important efforts to improve interface and optimize code
- Calculations are faster – approximate factor of x2 less
- The first version reflecting this work is v5.0, soon to be released on the TRAD web page (<http://www.trad.fr/OMERE-Software.html>)



mission.cen - OMERE

File Window View Mission Environment Dose SEE Atomic displacement

1: Orbit GEO, 35784.00km, 0.00°, 0.00°

OMERE

03/07/2017 - 15.00 years || AEB max + AP8 min || ESP 80% || GCR ISO, cut || Current file ver

Mission definition

Mission launch date

Date of launch : 03/07/2017

Time of launch : 02:01:25

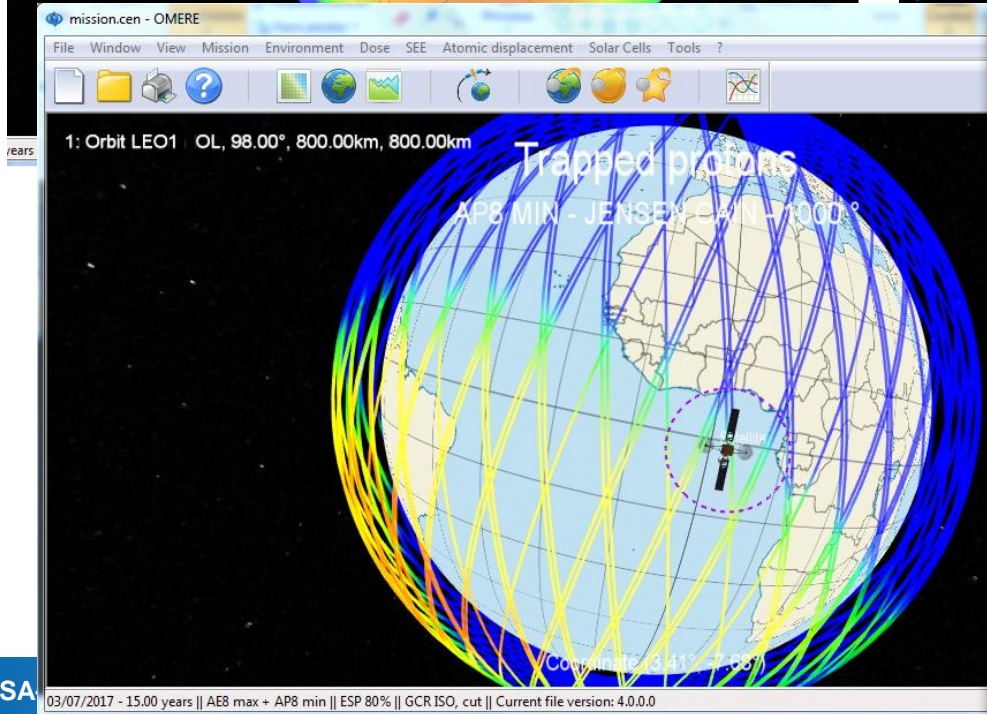
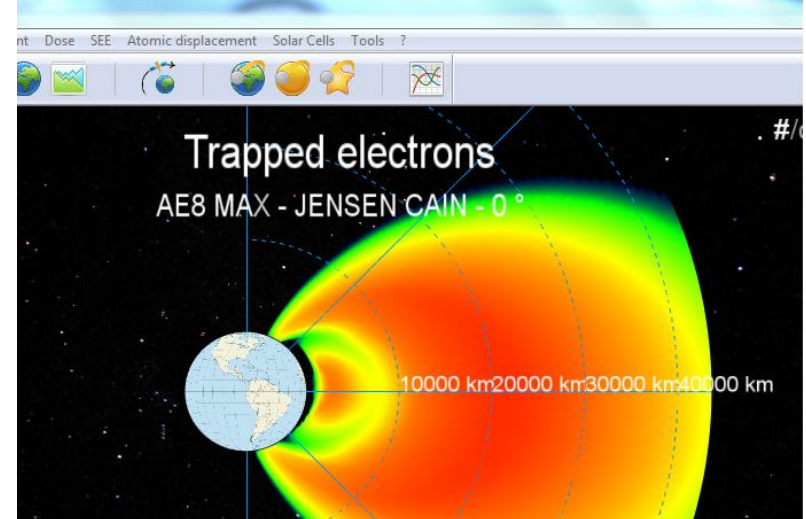
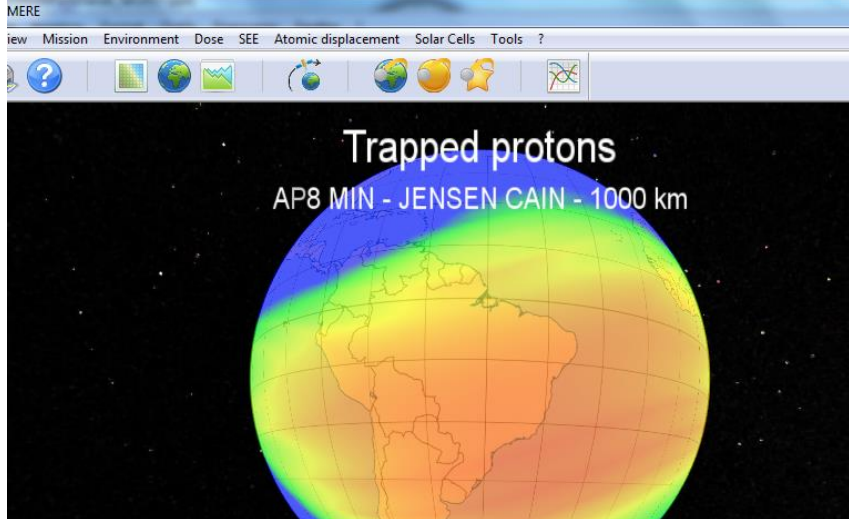
Solar Cycle

Orbit(s)

Orbit name	Inclination	Apogee	Perigee
Orbit GEO	0.0°	35784.0km	35784.0km

Output File: C:\OMERE\orbit.dat

Ok Cancel



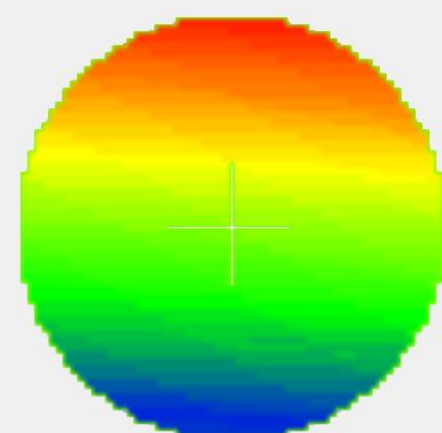
Satellite position

Parameters

07/03/2017 -- 02:01:25

Size: km

Resolution: ² points



mission.cen - OMERE

File Window View Mission Environment Dose SEE Atomic displacement Solar Cells Tools ?

1: Orbit GEO, 35784.00km, 0.00°, 0.00°

SINGLE EVENT UPSET DATA

Part Type : HM0000000B Function : 256 M-bit SDRAM
 Manufacturer : HITACHI Capacity (cells) : 450000
 Technology : CMOS

HEAVY IONS TEST DATA		PROTONS TEST DATA	
Reference Report : SEE/001	LET threshold = 4.0 MeV.cm ² /mg	Reference Report : SEE/002	E threshold = 23.0 MeV
Device Cross Section = 9.91e-002 cm ² /device	W = 19.84	Device Cross Section = 2.55e-008 cm ² /device	W = 0.26
S = 1.53		S = 0.23	

SEU RATES - Galactic Cosmic Rays @ 1.0 g.cm-2		SEU RATES - Trapped Protons @ 1.0 g.cm-2	
Mean Rate = 2.3e-002 seu/device.day	Max Rate @ 90° = 6.3e-002 seu/device.day	Mean Rate = 1.8e-001 seu/device.day	Max Rate @ SAA = 9.8e+000 seu/device.day

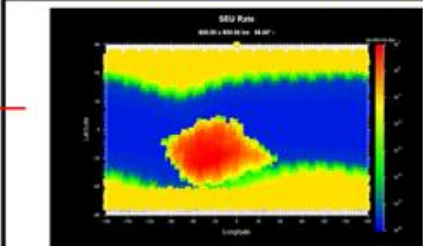
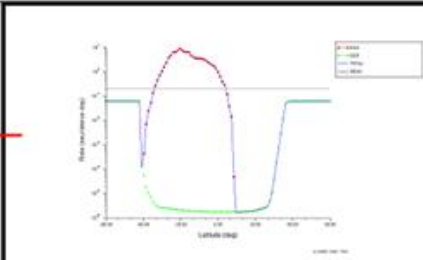
GEOGRAPHICAL DISTRIBUTION OF INSTANTANEOUS SEU RATES > MEAN SEU RATE

Mean SEU Rates	SEU device.day
Cosmic Rays : 2.3e-002	
Trapped Protons : 1.8e-001	
Total : 2.1e-001	

# SEU /	device,12.5 years
Galactic Cosmic Rays : 1.1e+002	11.29%
SAA Trapped Protons : 8.3e+002	89.71%
Total : 9.4e+002	

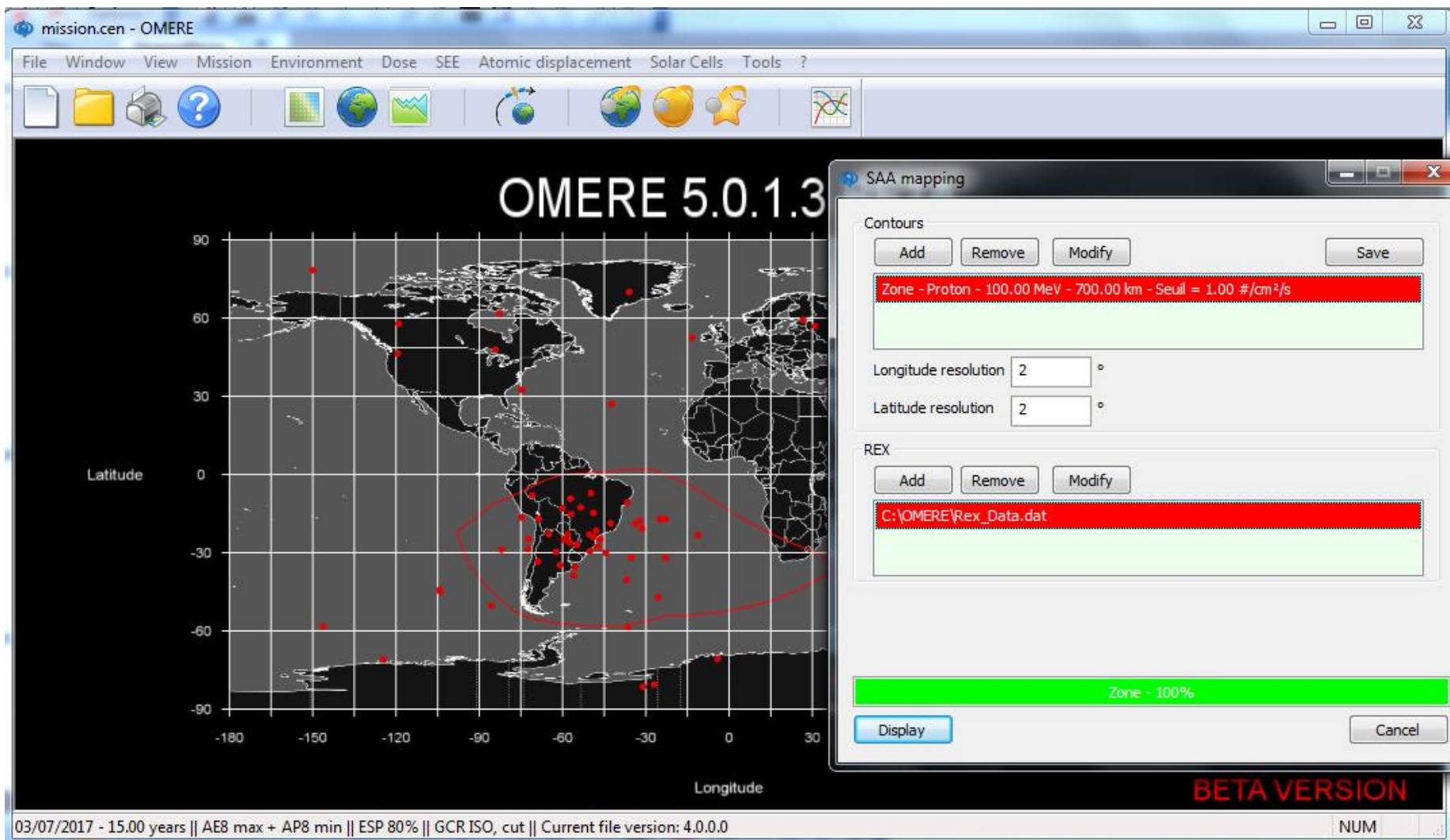
Orbit Characteristics

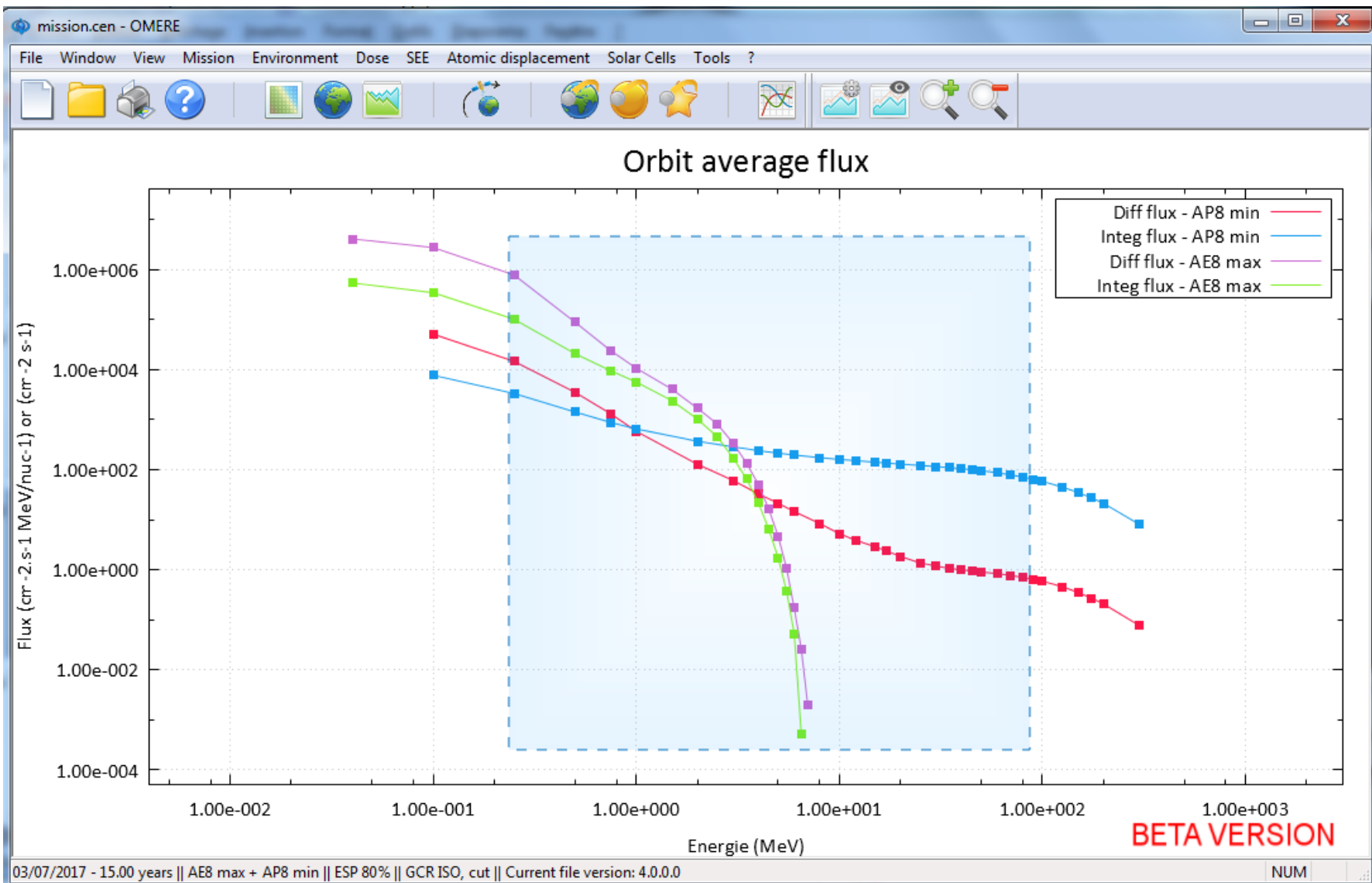
- Altitude : 800.0 (km)
- Inclination : 98.0 (degree)
- Cosmic Rays : GCR ISO (SOL MIN)
- Trapped Protons : AP8 MIN (SOL MIN)
- Orbit Period : 100.87 (min)
- Mission Duration : 12.5 (years)
- SAA max location : -30° latitude/ -31° longitude

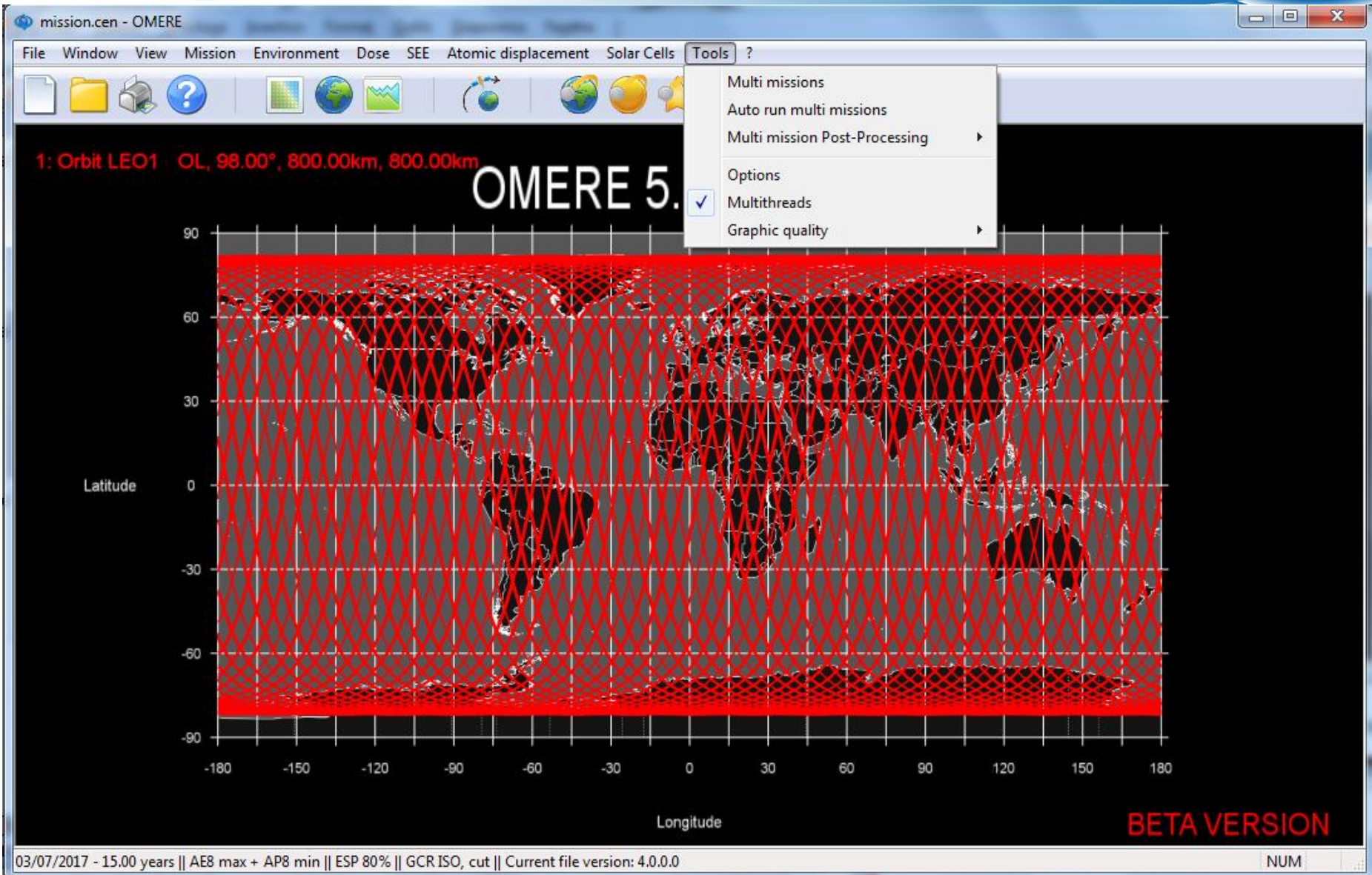



03/07/2017 - 15.00 years || AEB max + AP8 min || ESP 80% || GC

OMERE







The screenshot shows the CCT website interface. At the top, there is a navigation bar with 'Home', 'CCT List', 'Events list', 'FAQs', and 'Scoop.it!'. A search bar is also present. The main content area is titled 'CCT ENV - Workshop OMERE' and features a large image of a globe with a colorful atmospheric overlay. Below the image, the text reads: 'Workshop OMERE May 15 & 16, 2017 (CLS, Toulouse)'. A paragraph follows: 'The Atmospheric & Space Environment CCT is pleased to announce the "Workshop OMERE" to be held at CLS (Toulouse) on 15 & 16 May 2017. OMERE is a freeware dedicated to space environment and radiation effects on electronic'. At the bottom of the page, there is a red URL: <http://cct.cnes.fr/content/cct-env-workshop-omere>. On the left side of the page, there are several sidebar sections: 'Events & Inscription' with a calendar for March, 'Pages de la CCT' with a list of links including 'Workshop OMERE', 'Environnement atmosphérique et spatial' with a search group box, and a section about solar activity prerequisites.