



SPACECRAFT ENVIRONMENT INTERACTION

R7004R

SPENVIS Report

ANALYSIS OF THE CLUSTER-II FM-8 (TANGO) MISSION

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Abstract

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1 Introduction

Since space applications become more and more important for our everyday life, be it direct-broadcast services, environmental monitoring or even space travel, the understanding of the environment those applications operate in is crucial to ensure proper and smooth functioning.

To improve the understanding of the space environment and to examine different effects of the space environment on a spacecraft, this report will give an in-depth analysis of the Cluster-II Mission, a mission carried out by the European Space Agency (ESA) to study the interaction between the solar wind and the earth's magnetosphere and provide an unprecedented 3D-model of those interactions [1].

This report is focused especially on the space radiation environment of the Cluster-II FM8 (Tango) satellite, one of the four satellites of the Cluster-II mission, and on the radiation effects on solar arrays and different electronic devices. For analysing the space environment a tool called SPENVIS (Space Environment Information System) developed by ESA is used. SPENVIS is a Web-interface with a powerful backend that provides access to numerical calculations and evaluations of a user-defined orbit or mission. It also provides data on different effects as "[...] cosmic rays, natural radiation belts, solar energetic particles, plasmas, gases, and "micro-particles" [...]" [2].

To provide an overview over the FM8 Tango Mission, the next chapter will introduce the mission objectives as well as the basic space environment this specific satellite faces. After, different radiation effects are examined and numerical calculations for solar arrays and memory devices are performed, followed by an analysis of their results. [2].

2 Mission Definition

The Mission

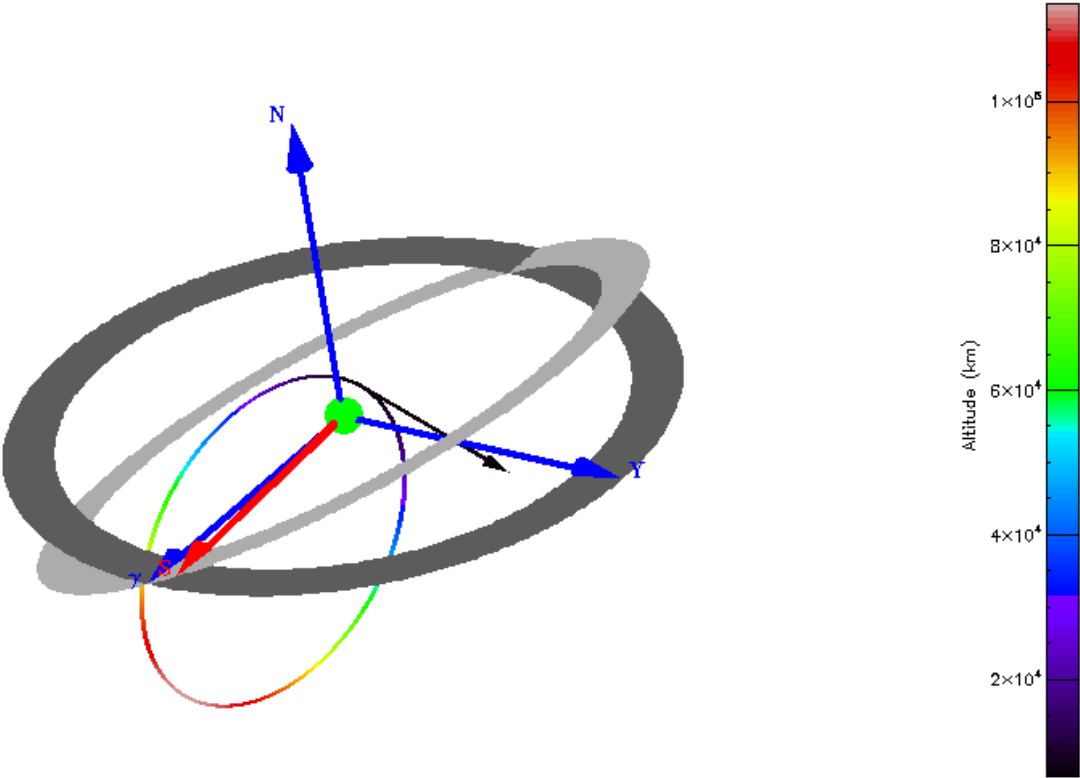


Figure 1: One Orbit of the Tango Satellite, color bar shows the altitude

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References

- [1] ESA science cluster mission, 2016. URL: <http://sci.esa.int/cluster/> [cited 2016-03-26].
- [2] SPENVIS space environment information system, 2016. URL: <https://www.spenvis.oma.be/intro.php> [cited 2016-03-26].

Appendix

Orbital Parameters of Cluster-II FM8 Tango

CLUSTER II-FM8 (TANGO)

```
1 26464U 00045B 16087.81656212 .00000382 00000-0 00000+0 0 9996
2 26464 131.5572 328.3783 5181518 141.3516 0.4910 0.44219885 51441
```

Table 1 shows the parameters extracted from the TLE data in a more readable format.

Table 1: Cluster-II Tango Parameters extracted of TLE set

Parameter	Value
Satellite Common Name	CLUSTER II-FM8 TANGO
Satellite Number	26464
Elset Classification	U
International Designator	00
Launch Number of the Year	045
Epoch Year	16
Epoch	87.81656212
BSTAR Drag Term	0.00000382
Inclination (deg)	131.5572
RAAN (deg)	328.3782
Eccentricity	0.5181518
Argument of Perigee (deg)	141.3516
Mean Anomaly (deg)	0.4910
Mean Motion (rev/day)	0.44219885
Rev number at epoch	5144