# Solar wind parameters near Mars and Venus obtained by Mars Express and Venus Express missions. Comparison with simulations and MAVEN data

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Abstract

We present ion moments data set obtained from the IMA mass-spectrometer that is a part of ASPERA plasma package. ASPERA experiments have been mounted onboard of ESA Mars Express and Venus express missions. Mars Express is still active and we have an excellent solar wind and planetary ions data set from 2007 up to now. Venus Express mission has been completed in 2014 and the ions moment data set covers 2006 - 2014 time interval. For space weather purposes we have selected a special data set corresponding to undisturbed solar wind observed in the vicinity of Mars and Venus. The resulting data are available in AMDA database (**http://amda.cdpp.eu/**) online. The present work shows the comparison of our data with the solar wind simulations, and with available MAVEN (NASA) data. We discuss also the pitfalls that user can meet during the data analysis.
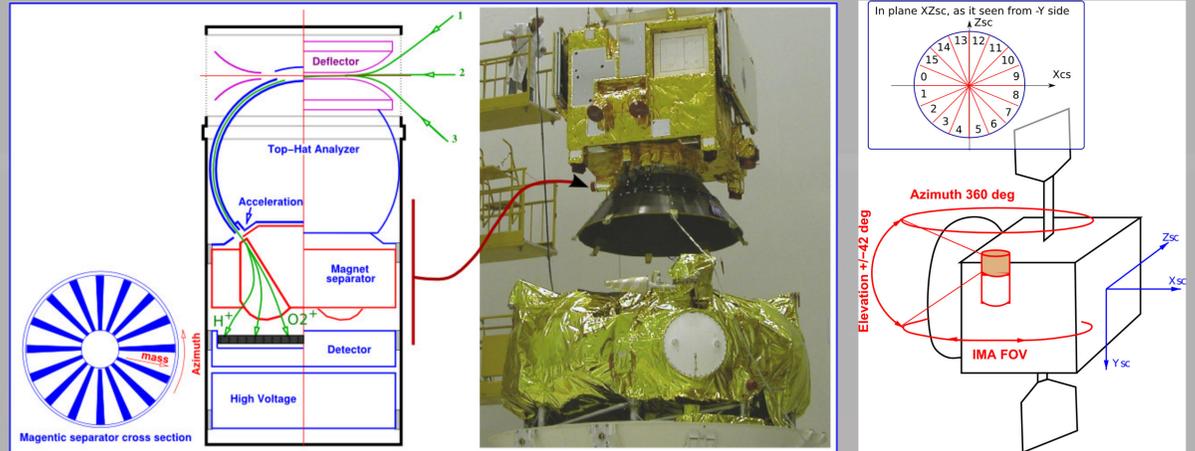
IMA is a mass-spectrometer, that allows to detect both the solar wind flow and the planetary origin ions in the induced martian magnetosphere. The location of IMA on the spacecraft is shown above and on the right. The instrument FOV is partially obscured by the spacecraft body.
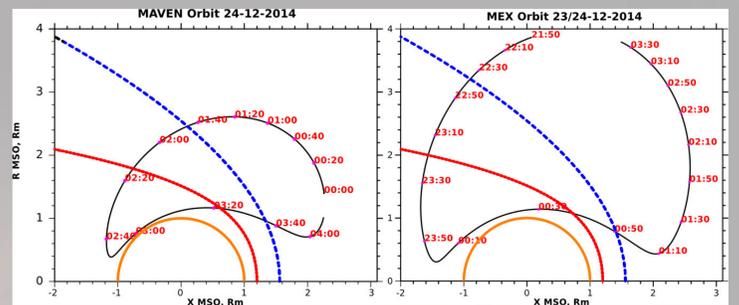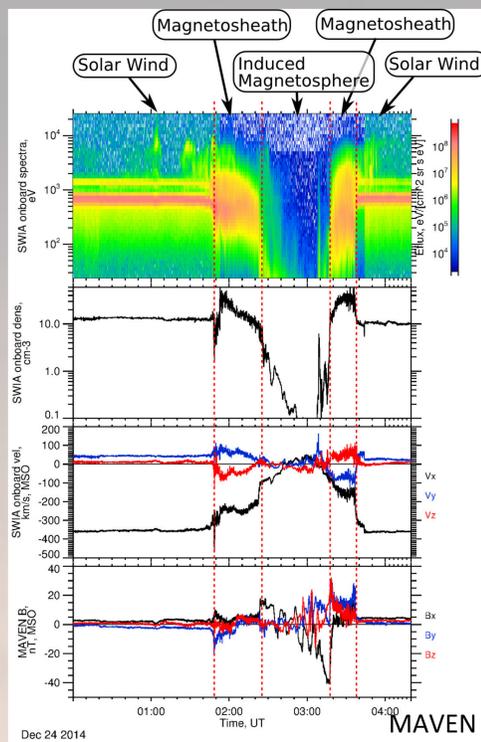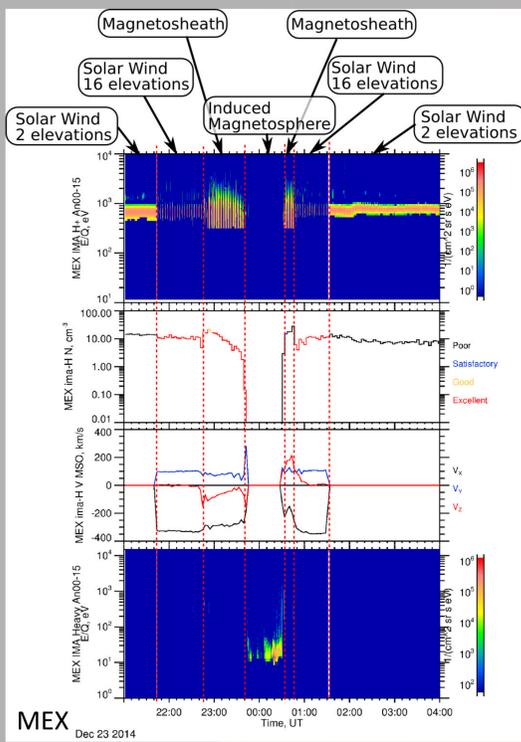
MEX and MAVEN have similar orbits (above) but the ion instruments IMA (MEX, left) and SWIA (MAVEN, center) have rather different properties:
1. IMA has a very small geometrical factor for protons less then 1.5keV and cannot see protons below 300eV of energy
2. Depending on the spacecraft attitude, the ion flow can be obscured
3. Proton flow moment calculation is very complicated task

Nevertheless one can see very similar E-T spectrograms and moments profiles from both instruments. Two figures on the left show similar data taken at the same day.

To prove the MEX IMA solar wind moments we have selected 62 orbits segments in 2014 – 2015 time interval and compare these data with solar wind moments obtained by MAVEN SWIA at the same time when the maximal distance between MAVEN and MEX has been less than 2Rm. The results of such comparison are show on the right. We can see that the solar wind number density is well correlated but IMA underestimates the value with factor 0.7. The velocity magnitude show the excellent consistence. The YZ velocity distributions are different because of the occasional obscuration of the solar wind flow by MEX.
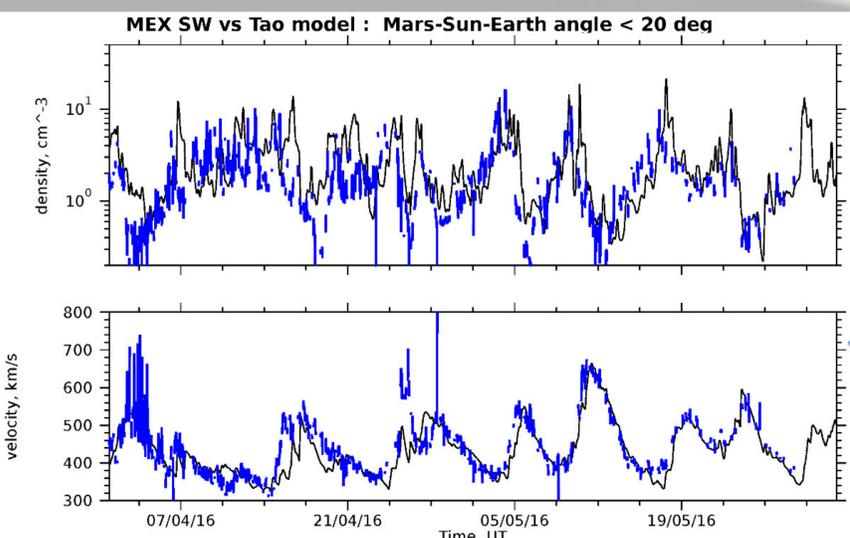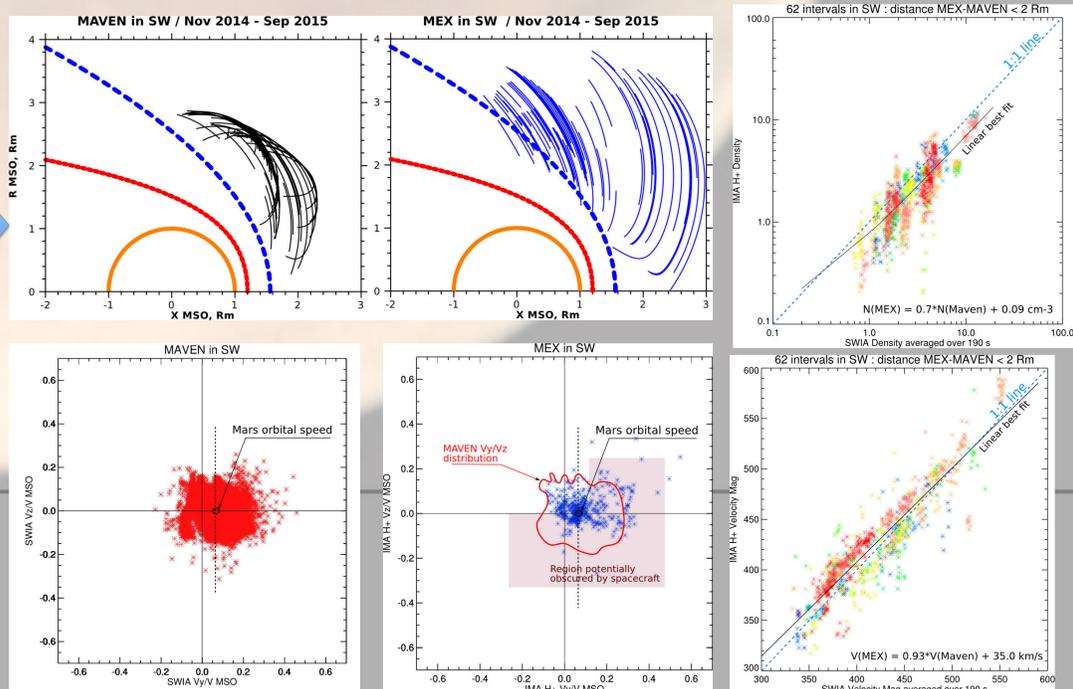
The comparison of the IMA solar wind moments (blue) with Tao 1D MHD solar wind propagation model. We see a nice agreement between two profiles. See Tao et al. 2005, J. Geophys. Res., 110, A11208 for details.

Poster # EPSC2017-948 , Riga, Sep 2017