Z106a The JASMINE iterative solver: using JAX to achieve a fast yet flexible framework for astrometric missions

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The JASMINE satellite will be observing the stars in the innermost parts of the Milky Way thousands of times during its three years of nominal mission. In order to convert the individual locations of the stars in the detector into positions, proper motions and parallaxes, we need to simultaneously solve for the attitude and calibration of the instrument, as well as for the astrometric parameters. Taking inspiration in the Gaia mission, we overcome this problem with a self-calibrating block iterative approach, which requires setting up and solving tens of millions of Least-Square problems, each one requiring the calculation of a Jacobian matrix. Instead of painstakingly re-deriving all the analytical derivatives every time we update any aspect of our model, which will inevitably evolve throughout the mission as our understanding of the instrument improves, we use JAX to build a flexible framework that allows us to quickly explore different models while remaining computationally performant. In this presentation, we will describe in detail the JASMINE solver, how we introduced JAX, the main hurdles that we had to overcome, and the benefits that it brought us. In summary, we present here a robust, fast and easy-to-adapt software that future astrometric point-and-stare missions could readily adopt, thus allowing their teams to focus on what truly matters: the accurate modelling of their instrument.