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From Start to Finish: Python for Space Missions

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Abstract. The software development process for many space observatories is often disjoint and inefficient due to the use of multiple languages during the different phases of mission development. Code and algorithms that are often developed using an interactive, array language during the pathfinding efforts of Phase A are often rewritten in a non-interactive, compiled language for use in the production code for Phase C. This approach leads to inefficiency in both development time and cost and can introduce errors during the rewriting process. Python is one programming language that can be used as a high-level, array language and as an efficient, production language. This paper shows how Python will be used during the different phases of development of the Joint Milli-Arcsecond Pathfinder Survey (JMAPS) space mission with an emphasis on code and algorithm reuse from one phase to the next.

1. Introduction

The Joint Milli-Arcsecond Pathfinder Survey (JMAPS) is a micro-satellite mission intended to update Hipparcos astrometry. With its single aperture 19 cm telescope, JMAPS will access not only the brightest stars observed by Hipparcos, but also extend Hipparcos level milli-arcsecond astrometry to 14th magnitude stars. Combining JMAPS and Hipparcos data will provide proper motion information at the level of a few tens of micro-arcseconds per year for stars brighter than 11 magnitude in the V band. Using a step-and-stare mode concept, JMAPS can integrate longer for specific fields on the sky, which allows the JMAPS star catalog to tie directly to version 2 of the International Celestial Reference Frame (ICRF2) by observing the brightest quasars in the optical. The JMAPS program is in the design and development stage, with an expected launch in mid-2013.

2. Motivation

JMAPS is unusual for a space mission in that the timely processing of the data has a significant effect on the overall success of the mission. This is because all images are directly related during the global block adjustment (see Global Solution Simulator). In order to minimize global systematic errors, the results of the ground processing, specifically the global solution, are incorporated into the planning and scheduling system on a periodic basis. This creates a feedback

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