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CPU processing and data storage needs for AIM system developments

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Introduction

With this document we want to clarify the simulations and storage needs for AIM.
As written in the *SRS* [1] and *SDD* [2] we need to simulate several no-nominal optical configurations making a performance analysis over the Gaia optical configuration elements.
The work is divided in three steps: identification of the most significative degree of freedom, running montecarlo simulation with the optical Code like ZEMAX and CODEV, then producing one PSFs Library (optical, effective and polychromatic) for each no-nominal configuration identified by the previous analysis (see [3]).
The generation of PSFs for each AF ccd for the identified no-nominal configurations and at different wavelengths with CODEV or ZEMAX is too much time consuming, so that we choose to produce with CODEV only the WFE maps at λ=600 nm and then to simulate the images using the AIM simulator written in Java and C.

1. Simulation and storage needs

WFE maps storage size:
- about 1Mb for each map (one field for CCD for two telescopes)
- about 115 Mb for 63 CCD and two telescopes

811 optical monochromatic PSFs, time consuming and storage size for one CCD:
- about 20 min of calculation including the storage in .fits format x 2 (telescopes)
- about 3,16 Gb of disk space x 2 (telescopes)

11 optical quasi-monochromatic PSFs, time consuming and storage size for one CCD:
- about 15 min of calculation including the storage in .fits format x 2 (telescopes)
- about 44 Mb of disk space x 2 (telescopes)

11 effective quasi-monochromatic PSFs, time consuming and storage size for one CCD:
- about 30 min of calculation including the storage in .fits format x 2 (telescopes)
- about 44 Mb of disk space x 2 (telescopes)

The total amount for 63 CCD and 2 telescopes (only one configuration and one field per CCD taking into account) is:
- optical monochromatic PSFs about 400 Gb
- optical quasi-monochromatic PSFs about 5,5 Gb
- effective quasi-monochromatic PSFs about 5,5 Gb
- the polychromatic PSFs (the star images) where we can introduce the CCD transit and the CTI degradation and radiation damage are not taken into account for this first estimate; we have to foreseen the storage size and CPU allocation also for such simulation but not before two months. A raw estimate of the simulation time for one polychromatic PSF is of about few minutes without including the radiation damage effect and 4 Mb as storage size. We need 63 image, one for each CCD, and several polychromatic PSFs (for each spectral type, 3 at least, and star magnitude we decide to investigate, 8 at least), for an amount of 5,9 Gb.

Without considering the polychromatic PSFs simulation, the total amount is about 410 Gb of required storage disk for one single configuration during the processing.

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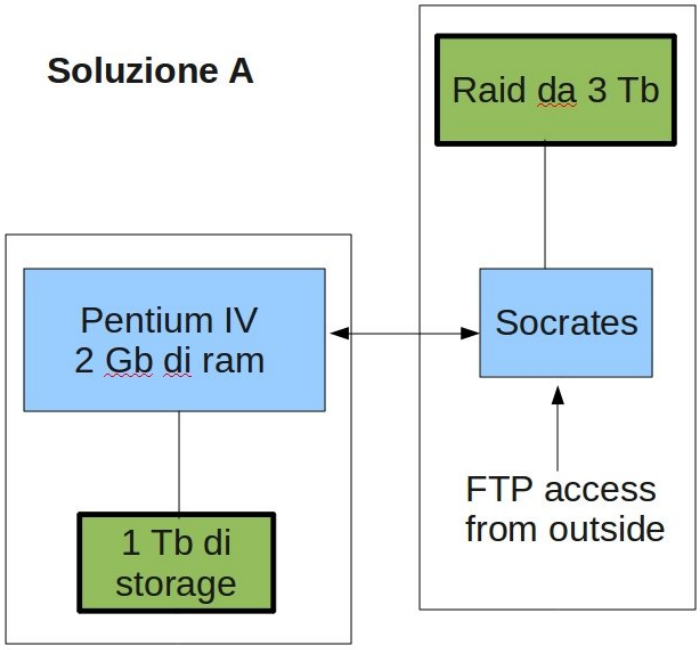
We need to keep in mind that the nominal configuration have to be permanently stored since it will be the reference one, so that about 410 Gb will be permanently filled until the end of the work.
We propose to realize about a thousand of no-nominal configuration for performing the study and the analysis helpful for AIM goals. That implies a data storage need of about 11 Tb. This would be a very huge amount of data collection.
We plan for ourself to choose the more meaningful and representative configurations sample keeping the essential. At the moment we can not estimate the right number. A reasonable number should be around 200 for an amount of 2,2 Tb.
Summary:
410 Gb space disk for processing
2,2 Tb space disk for storage, at least
Total processing time for one configuration (63 ccds, two FOV, effective PSFs): about 4 days

The calculation of the processing time has been done considering the following hardware configuration:
RAM 3 Gb
CPU Intel Core(TM)2 Duo P9500 @ 2.53GHz
It is quite obviously that a more humble hardware configuration extends the processing time.
As example, a Pentium 4 CPU 2.4 GHz with 770 Mb RAM takes 32 days.

2. Possible solutions: ALTEC or Oato?

The Operations Manager spoke about two possible solutions: the solution **A** available in Oato which could be more efficient in time and the solution **B** in ALTEC which could be better from the point of view of the Operations but to be investigated.
In the figure 1 we summarize the possible solution available in Oato, being shared with the BAM performance analysis and simulation needs.

Figure1: Possible solution available in Oato



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Remark: The proposed solution seems reasonable and useful for the urgent needs but it is necessary that a similar facility shall be provided by ALTEC since it is part of the scientific validation chain needed for the AIM software system and for processing of AIM during the Operations.

References

[1] D. Busonero, M. Lattanzi, M. Gai, "**AVU-Astrometric Instrument Model Software Requirements Specifications**", Gaia Livelink Publication, Ref. Code: GAIA-C3-SP-INAF-DB-003-04, 2009

[2] D. Busonero, M. Lattanzi, F. russo, "**AVU/AIM Software Design Description**", Gaia Livelink Publication, Ref. Code: GAIA-C3-SP-INAF-DB-008-01, 2009

[3] D. Busonero, D. Loreggia, A. Riva, "**Gaia optical configuration performance analysis work-planning for AIM needs**", Oato Technical Report n. 137.

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