

# AMS Italian Monte Carlo Production Facility

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## 1. AMS IMCPF requirements

The AMS Italian Monte Carlo Production Facility (IMCPF) is part of the Italian Ground Segment (IGS) proposal to ASI. The IGS will be the Italian AMS regional centre where all the real data of AMS-02 will be stored as master copy of the Central Production Facility at CERN, allowing users to run analysis and simulation programs. In addition, 20% of the total AMS-02 simulation agreed by the Collaboration will be carried on in the IGS MC production facility.

The requirements for the IMCPF are:

1. to perform 20% of the official AMS-02 simulation;
2. to store the simulation results and to make them available to the whole Collaboration;
3. to allow users for analysing real and simulated data stored in the IGS.

In order to produce 20% of the total AMS-02 simulation, that is 360–400 TB of data, the estimated CPU power is about 60,000 SPECint2000 (equivalent to 100–120 dual-CPU PentiumIII 1 GHz systems) for at least 3 years.

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The simulated data will be archived with the aid of robotic tape libraries and will be available to users through a staging system with 10–20 TB on-disk storage.

Finally, CPU power will be needed in order to allow users to run their analysis and simulation programs.

## 2. IMCPF functional units

In order to fulfil all IMCPF requirements, different tasks will be addressed by three functional units:

- the Monte Carlo Production Farm (MCPF) will be devoted to AMS-02 official simulation runs;
- the Interactive/Analysis Cluster (IAC) will sustain all user processes (interactive and batch jobs);
- the Data Storage & Accessing Facility (DSAF) will serve both as data repository (tape libraries) and as (read-only) data server for analysis (through the staging system).

### 2.1. MC production farm

The processing nodes, running the official AMS-02 simulation jobs, should have enough RAM to avoid as much swapping as possible. They will run only the Operative System (OS), few daemons, the simulation job and the process responsible for moving the produced data to the DSAF.

All the nodes will be multi-CPU Linux boxes with at least 512 MB/CPU ECC RAM, with AMS Athlon or Intel Pentium processors, with the same root directory image and a reserved partition on the local disk where the simulation output files will be written.

A number of nodes will be mounted on a rack system with a disk server node acting as input buffer for the DSAF. As disk server a RAID-5 bunch of disks (+ 1 spare disk for automatic recovery in case of a single disk failure) will be adopted. Possible technologies for

the disks are EIDE (the cheapest one), SCSI and Fibre-Channel (the most expensive).

## 2.2. Interactive/analysis cluster

User processes impose a non constant (neither predictable) load on the system. In addition, multi-user interactive systems have a very variable number of co-existent processes, many of them inactive for a (long) fraction of the time. This means that such systems will make a heavy use of swap space, in contrast to MC nodes.

A further requirement for the IAC is the connection to the DSAF in order to allow users to access (read-only) produced MC files and real data<sup>3</sup>.

For the IAC the use of a Linux cluster seems to be inadequate: very likely, the choice will be among multi-processor Compaq and Sun systems.

## 2.3. Data storage and accessing facility

The required space for the Italian fraction of the official AMS-02 simulation is about 400 TB, the double of the storage needed for the real data coming from the ISS (through the CPF at CERN), for which the Italian Ground Segment Data Storage (IGSDS) has been proposed to ASI for the realization in its Science Data Centre (ASDC) in Frascati.

Presently, commercial systems are available up to 200 TB of total space, hence one could think about buying 1 such a system for the IGSDS and 2 for the MC DSAF. Because the bulk of the hardware will be ordered on 2003 at least, one may expect better storage to price ratio than now (a factor of two seems to be reasonable).

The proposed on-disk staging space for the IGSDS is 20 TB (10% of the whole real data). The staging space for the MC data could be 10–20 TB (to be discussed), hence similar hardware is necessary for real and MC data.

INFN-Milano is presently searching for the best IGSDS configuration. Their solution may be adopted also for the MC DSAF.

## 3. Bologna prototype

Before buying the hardware needed to set up the IMCPF, a well tested and working prototype has to be prepared in Bologna. This prototype will serve as case study for the MCPF and IAC modules only (no prototype is foreseen for the DSAF functional unit).

In its final configuration, the prototype will consist of:

- a master node running the master simulation program (dispatching simulation jobs to the processing nodes);
- multi-CPU processing nodes (about 20 processors in total) as MCPF simulation module;
- a RAID-5 bunch of disks + 1 spare disk as NFS server for MCPF output files and for IAC read-only input files;
- a multi-CPU system as IAC module.

### 3.1. Current status

The current status of the INFN-Bologna prototype (on 14 January 2002) is the following.

- A dedicated room with air conditioning system, UPS ready electrical system and gigabit connection to GARR is available for the prototype.
- A 19"/44U rack was ordered on December 2001 and has to be delivered.
- Two 1U dual Pentium III 1 GHz systems with 1 GB ECC RAM, HD 40.6 GB, Ultra 160 SCSI controller, 2 Ethernet 10/100 cards, Linux OS were ordered on December 2001 and has to be delivered.
- A HP switch 24 × 10/100 + 2 × Gbit ports is available.
- A dual Pentium III 1 GHz PC with 1 GB RAM, HD 240 GB, Ultra 160 SCSI controller, 10/100 Ethernet card will be used to simulate a RAID system before its actual ordering, and will be available starting from the third week of January 2002.

<sup>3</sup>While the storage system for real data (about 200 TB) is functionally different from the MC one, it is conceivable to use at least a uniform interface (if not the same hardware) to access both kinds of data.