Scientific Computing

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1 Introduction

Over the years, the role of this computing center in the Laboratories has evolved beyond farm in Grid for ATLAS, becoming a facility for other experiments and scientific activities of the LNF, following the INFN distributed computing policies and projects at the same time.
Since 2017 also PADME experiment carries out part of the off-line computing in Tier2 in close collaboration with the experiment for: MC simulations and data reconstruction activities and data analysis, evaluation of referee requests, choice and purchase of hardware by optimizing operations common to several experiments (with pledged resources only at Frascati and at INFN- CNAF). In addition, the grid computing of other experiments is supported, (Belle II, LHCb) as well as some local computing needs, like, for examples: Muon Collider, ATLAS Micromegas chamber validation system and some user interfaces, for LNF and non LNF users, of various experiments; taking part, at the same time, to many different INFN computing activities, above all the ICSC data center thanks to the PNRR founds.
All these computing activities are carried out in collaboration with many LNF services like: technical service, safety service, computing service, the administration service and the responsible for the experiments. The size of the Tier2 Data Center (DC) is about 6PB of disk storage net, 45000HS06 computing power (distributed in about 5000 core), the network infrastructure

is 100/25/10Gbps and a big part of these resources are dedicated to the ATLAS computing activities.
The recent developments of computing activities, and the significant increase in personnel involved in scientific computing at the Laboratories, has led to the definition of a service dedicated to *Computing High Technologies*. This service is divided into three departments: *"Supporto agli Esperimenti e Infrastrutture dei Laboratori"*, *"Gestione Risorse di Calcolo"* and *"Gestione Dati Scientifici"*.

2 Most recent activities

The most recent activities of the LNF scientific computing take place in a more general context of the INFN computing and international collaborations. They are: PON Ibisco (in collaboration with INAF/OAR), CIR Ibisco, CTA Data Center (in collaboration with INAF/OAR and CTAO) and the national PNRR for the realization of part of the INFN-Cloud in the Tier2 and the new Space Economy Data Center.

2.1 PON Ibisco, CIR Ibisco

The participation in the I.Bi.S.Co. Project for the PON-DHTCS (National Operational Program Infrastructure for Big Data and Scientific Computing), to implement an *"Upgrading systems for the Frascati site"* (period 2018-24), in collaboration with INAF/OAR, has financed the upgrade of the Tier2 network infrastructure and led the host of INAF resources for common projects. The CIR01 00011 IBISCO project, *"Infrastructure for BIg data and Scientific COmputing - Strengthening of human capital"* (period 2021-2025), allocated funds for personnel: 4 three-year technological research grants also in synergy with the Open Access Repository activity.

2.2 Italian Cherenkov Telescope Array Data Center

In 2014 a collaboration with INAF-OAR started for the development and implementation of the computing of the Astri and Cherenkov Telescope Array (CTA) experiments in Tier2 of Frascati.

This collaboration, enforced in 2018 thanks to the I.Bi.S.Co. PON, led LNF as headquarters of the INAF computing resources to be dedicated to CTA. During 2024 the Tier2 data center continued to host the Italian CTA data center, one out of a total of four, in collaboration with the CTA INFN group, and the INAF/OAR group. The others DCs are PIC (Spain), Desy (Germany)

and CSCS (Swiss Supercomputing Center).

2.3 PNRR ICSC-Spoke 0

Frascati Laboratories participates to the Italian PNRR (*Piano Nazionale di Ripresa e Resilienza*) with different projects. About computing, Frascati will host two data centers part of the National Center foreseen in the Spoke 0 of ICSC: *National Centre for Research in High Performance Computing, Big Data and Quantum Computing*.
One of the two data centers involved in ICSC is the Tier2 DC: the infrastructure of the computing room presently dedicated to scientific computing in the Laboratories will be consolidated so that it could host a node of the new INFN-Cloud distributed computing infrastructure, developed with Openstack middleware.
The second, and most significant, contribution of Frascati to ICSC will consist in the construction of a new data center with an HPC room. This new DC, called Space Economy Center, will be dedicated to the INFN scientific computing, with the installation of another INFN-Cloud node, the opportunity to host new experiments DCs (as CTA DC), the EuPRAXIA HPC DC and potentially a DC for future collaborations. In fact, in a new acquired building, a 400 sqm Data Center will be realized, designed to accommodate approximately 50 racks for both low and high (HPC) density systems. The installable IT load will be about 1.2 MW: 800 kW via Direct Liquid Cooling (DLC) and 400 kW via air cooling. It will be provided of redundant UPS and cooling systems, and a heat recovery system will provide heating for building during winter. This infrastructure will be scalable, expandable in terms of both floor area and IT load, and will cost about 4M€.
Further PNRR ICSC funds of about 2M€ have been spent for both hardware purchases and other infrastructural works. Finally, PNRR has allowed the recruitment of personnel with specific skills and dedicated to scientific computing: three technologists and one technician.