M. Brescia

January 20, 2026

Rubin-LSST@Italy
in-kind program status
& ICT perspectives

August 2018...

...just 7.5 years ago

Rubin is a real telescope and LSST is approaching!

2025 VERA C. RUBIN OBSERVATORY
LEGACY SURVEY OF SPACE AND TIME
FIRST LOOK EVENT
PALERMO

June 23: first images!

On June 23rd, the Vera C. Rubin Observatory unveiled its first glimpse of the universe.
To celebrate this milestone, INAF organized a national watch Party and press conference in Palermo, broadcasted live from Palazzo dei Normanni.
It was a unique opportunity to experience the excitement of the Vera Rubin Observatory's first images.

everybody loves it
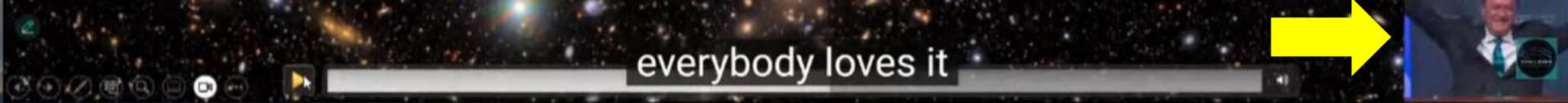
Rubin is a real telescope and LSST is approaching!

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In September and October 2025, the team put a pause on observing the sky to take care of some important tasks, including a few final "big lift" construction activities (the last of three screen panels into the opening of the dome).

With the upper panels successfully placed, Rubin had reached substantial completion of its construction phase and moved into its operations phase.

Members of the NSF–DOE Vera C. Rubin Observatory team gathered on October 25th, 2025, to celebrate the formal handover of the observatory from the Construction to the Operations team.

This major milestone marks the beginning of a new era as Rubin begins final preparations for the start of the decade-long Legacy Survey of Space and Time (LSST), due to begin in early 2026.

The event recognized effort and collaboration by thousands of people (including Italian in-kind teams) over the past 20+ years that brought Rubin to reality, beginning a new era of scientific discoveries.

Italian participation to Rubin-LSST – in-kind program

The Italian scientific and technological community is heavily involved since 2016 in Rubin-LSST project, covering leadership roles in various WPs of the Science Collaborations (SC): R&D in scientific pipelines, scientific roadmaps and observational strategies, commissioning on-site...
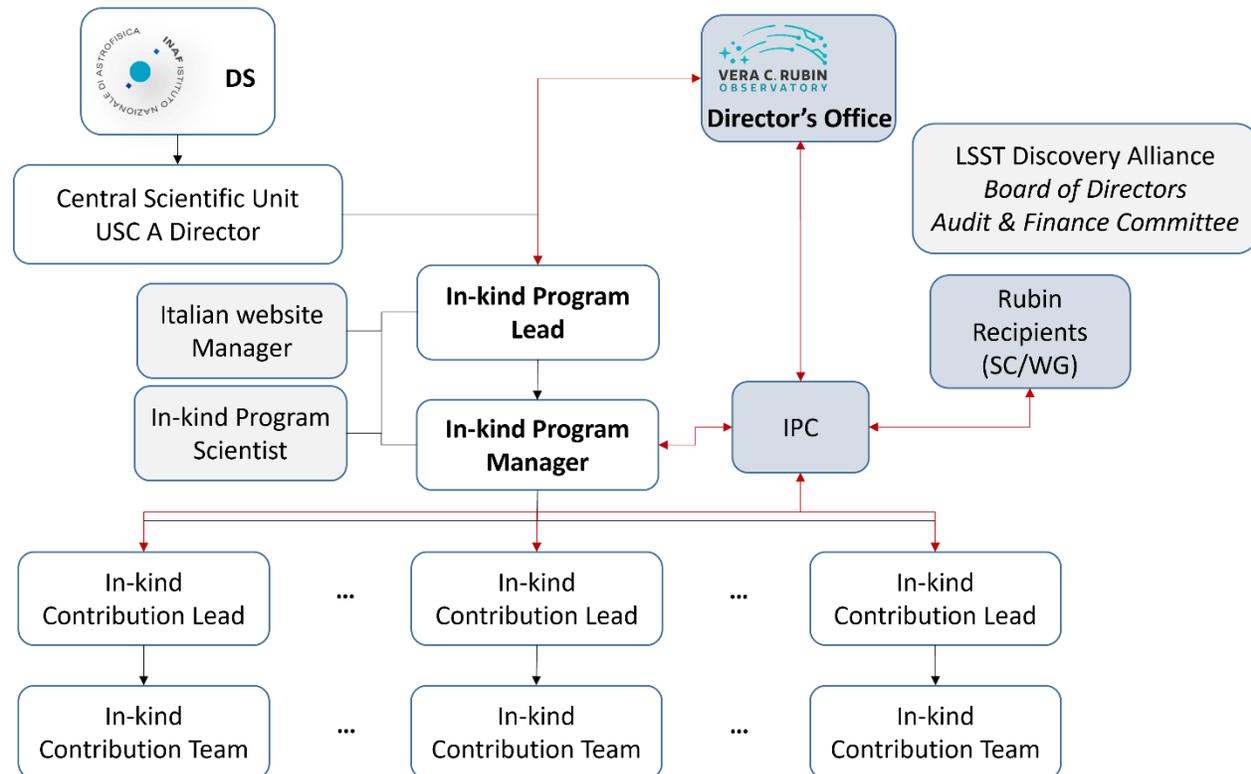
The Italian participation in the Rubin-LSST project is focused on the <u>in-kind contributions program</u>, for which the LSST Corporation undertakes to provide shares of data access rights, proportional and commensurate with the value of the In-kind contributions

in-kind contribution categories:

- **Directable SW**: science SW for SCs for LSST pipeline
- **Commissioning**: on-site support & SW solutions
- **Observing Facilities**: guaranteed observing time & science products from observing programs with national instruments
- **External data**: photometric and/or spectroscopic data provided in exclusive preview
- **Non directable SW**: SW solutions already supplied and scientifically validated for SCs
- **DAC**: Data Access Centers, i.e. computing resources or science data production services

More information on the official site:

https://sites.google.com/inaf.it/rubin-lsst-italy

Rubin-LSST Italia – in-kind program status

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Data rights value: ~ 28%

In-kind contributions already started (2021 – 2023):

Commissioning

S22 **Contribution Lead**: Giuliana Fiorentino (start date: October 2021 – closing in 2026)
Staff effort in support of Rubin commissioning: Image quality analysis

Non directable

S25 **Contribution Lead**: Leo Girardi (start date: October 2022 - closed)
Population models of the LSST stellar content

Directable

S2 **Contribution Lead**: Angela Bongiorno (start date: October 2022 - closed)
Simulations of high-z AGNs and galaxies in the LSST survey

Commissioning

S21 **Contribution Lead**: Gabriele Rodeghiero (start date: October 2022 – closing in 2026)
Staff effort in support of commissioning: Engineering support at Telescope commissioning

Commissioning

S23 **Contribution Lead**: Giuseppe Riccio (start date: October 2022 – closing in 2026)
Support of Rubin commissioning: ML tools for instrumental monitoring and analysis

Rubin-LSST Italia – in-kind program status

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Data rights value: ~ 17%

In-kind contributions started in 2024/25:

Directable → S6 **Contribution Lead**: Michele Cantiello
Tools for the measurement of surface brightness fluctuations on LSST data

Directable → S9 **Contribution Lead**: Crescenzo Tortora
Structural parameters with Machine learning

Directable → S10 **Contribution Lead**: Massimo Dall'Ora
Software Tools for Stellar Populations in Crowded Fields

Directable → S11 **Contribution Lead**: Laura Inno
Advanced active objects' detection & characterization

Directable → S15 **Contribution Lead**: Gisella Clementini
Tools for classification, full characterization and validation of variable sources

Rubin-LSST Italia – in-kind program status

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Data rights value: ~ 29%

VST/LBT In-kind contributions started in 2025:

Obs. Facilities → S27 **Contribution Lead**: Maria Teresa Botticella
A VST survey to support the Legacy Survey of Space and Time

Obs. Facilities → S28 **Contribution Lead**: Claudio Grillo
Exploiting the synergy between LSST and VST to investigate the cosmos: the expansion rate and the geometry of the Universe measured through the time delays of strongly lensed variable sources

Obs. Facilities → S29 **Contribution Lead**: Maurizio Paolillo
Toward next-generation time-domain surveys (TIMEDOMES): VST monitoring of the LSST Deep Drilling Fields

Obs. Facilities → S18 **Contribution Lead**: F. Cusano
Access to Telescope Time for the US/Chilean communities

Rubin-LSST Italia – in-kind program status

In-kind contributions starting/approaching:

Data rights value: ~ 26%

Directable

S3 **Contribution Lead**: Rosaria Bonito
Development of a SW to classify variable stars

Directable

S5 **Contribution Lead**: Innocenza Busà
Software for the measure of the optical fluxes from galactic diffuse medium

Directable

S8 **Contribution Lead**: Ilaria Musella
Tools for the simulation of Pulsating Stars

Directable

S12 **Contribution Lead**: Sara Lucatello
Machine Learning tools for the characterization of stellar populations

Directable

S13 **Contribution Lead**: Emiliano Merlin
Advanced tools for extragalactic photometry

Directable

S14 **Contribution Lead**: Alex Saro
Tools for the simulations, detection, and characterization of galaxy clusters

Non directable

S16 **Contribution Lead**: Sergio Campana
The Son of X-Shooter contribution to Rubin: a set of 2,000 spectra for ML light curve classification

Non directable

S17 **Contribution Lead**: Piero Rosati
A Cluster Spectroscopy Hub for galaxy cluster science with LSST

Non directable

S26 **Contribution Lead**: Angelo Antonelli
A Bridge from Gamma to Optical

Rubin-LSST Italia in-kind program numbers

Data Rights provide same real-time data access as US/Chilean community

in-kind program duration: **15** years (*LSST survey duration: 10 years*)

involved national Researchers: 188 from INAF + 41 from other Institutes/Universities = **229**

in-kind contributions in 15 years: **23**
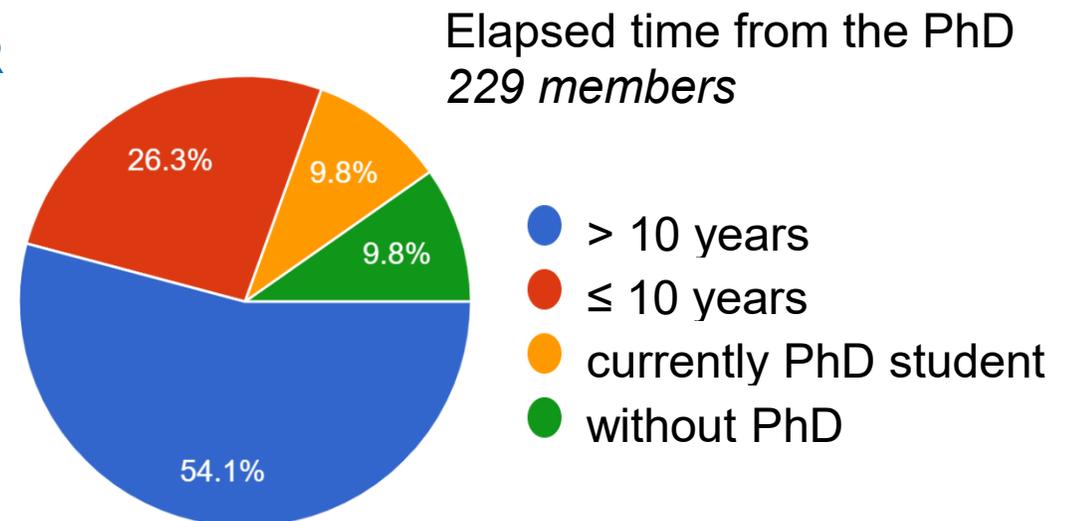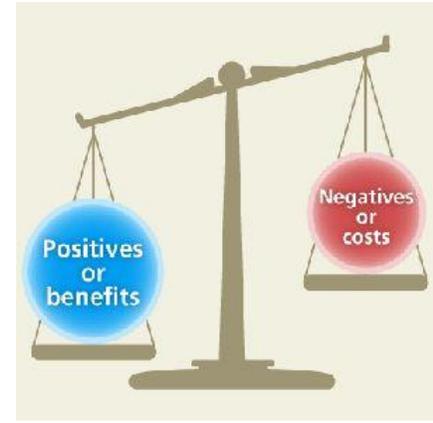
FTEs from Staff in 15 years: **53.5**

FTEs from contracts in 15 years: **49.8**

Total contributed FTEs in 15 years: **103.3**

Total Data Rights (DR) for 10 years: **96 PIs** + **384 JAs** = **480** DR

PI: senior (postdoc for > 10 years)

JA: junior (postdoc for ≤ 10 years)

Elapsed time from the PhD
229 members

26.3%   9.8%   9.8%   54.1%

- > 10 years
- ≤ 10 years
- currently PhD student
- without PhD

Rubin-LSST Italia Fundings

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INAF global investment in 15 years	
Missions/Meetings	988.000,00 €
AdR contracts	705.000,00 €
TD contracts	2.208.160,00 €
Contractor's HW	48.000,00 €
TOTAL	**3.949.160,00 €**

In-kind Funding distribution
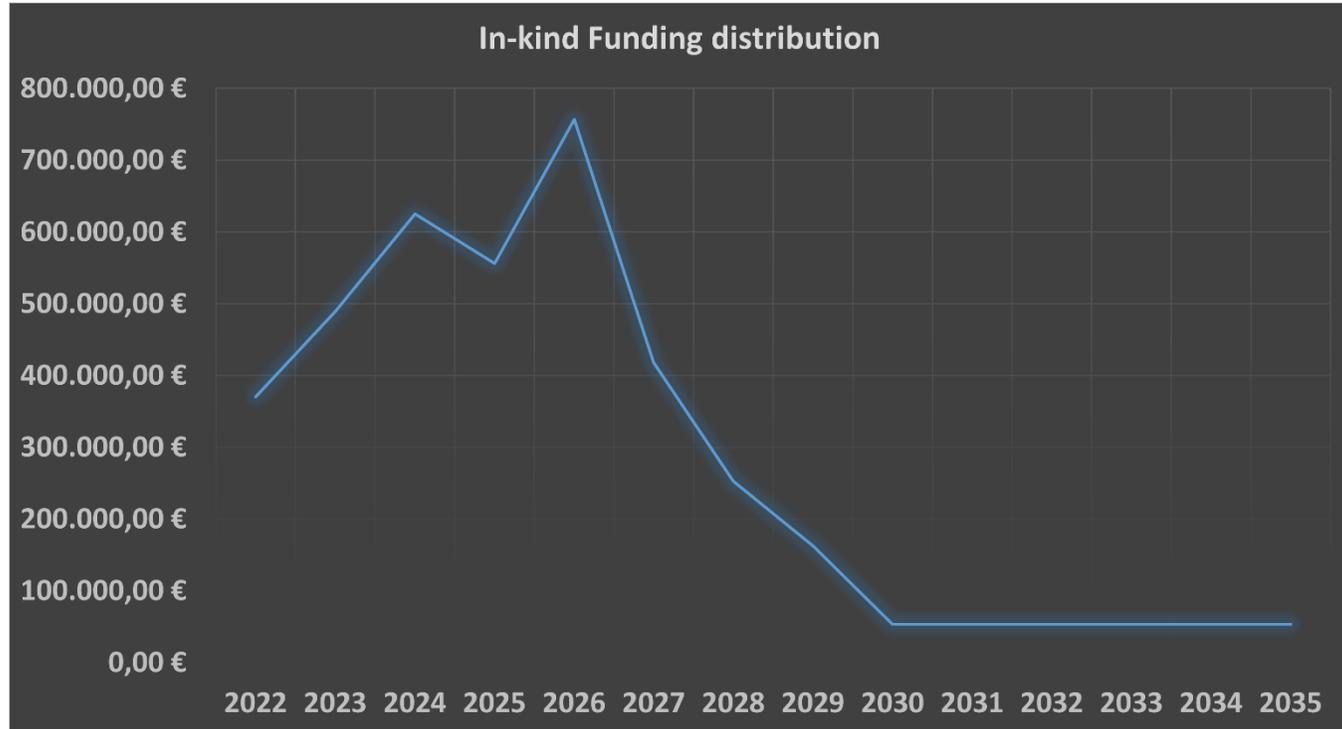
Total Data Rights (DR) for 10 years: **96 PIs** + **384 JAs** = **480** DR

~823 € / (DR per year) *past policy (15 quintuplets) cost before 2021: **4.000** € / (DR per year) for a total of **75 DR** and a total cost of 3.000.000 €, excluding the supplementary required budget for missions/meetings;*
Thus, the same cost but with a net benefit of +85% for DR amount

~38.000 € / FTE *less than the standard cost for 1 FTE of an annual research contract*
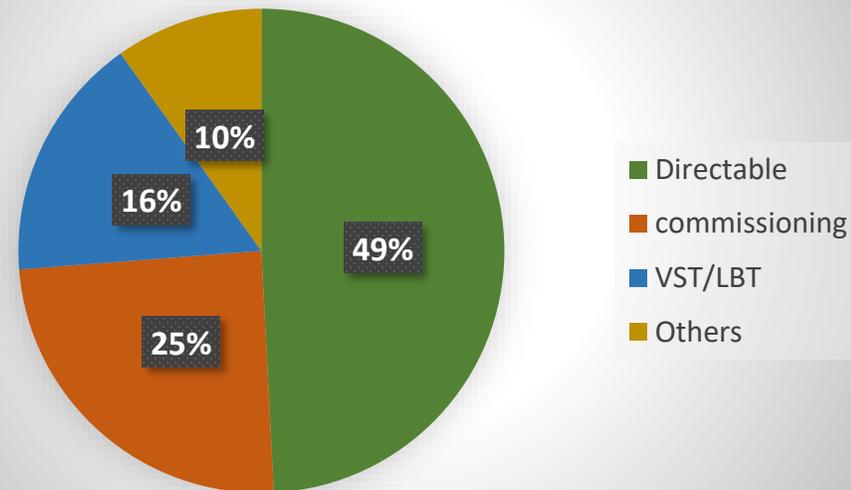
~5 DR / FTE *Each FTE invested will produce 1 PI + 4 JA DR positions (1 quintuplet)*
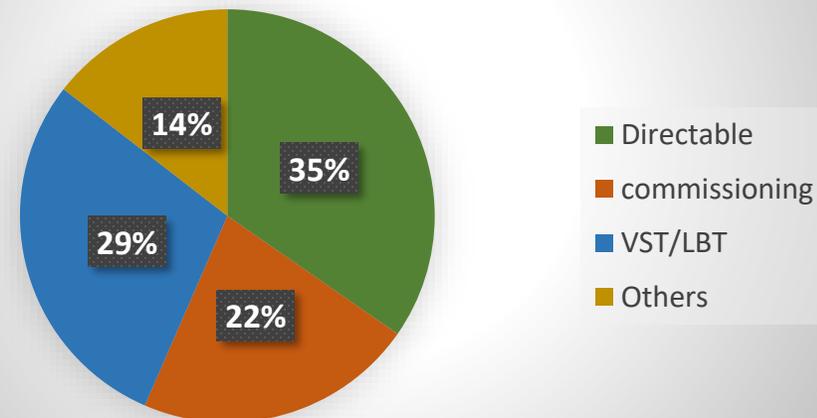
Rubin-LSST Italia in-kind program numbers

% **types** of in-kind contributions [23]
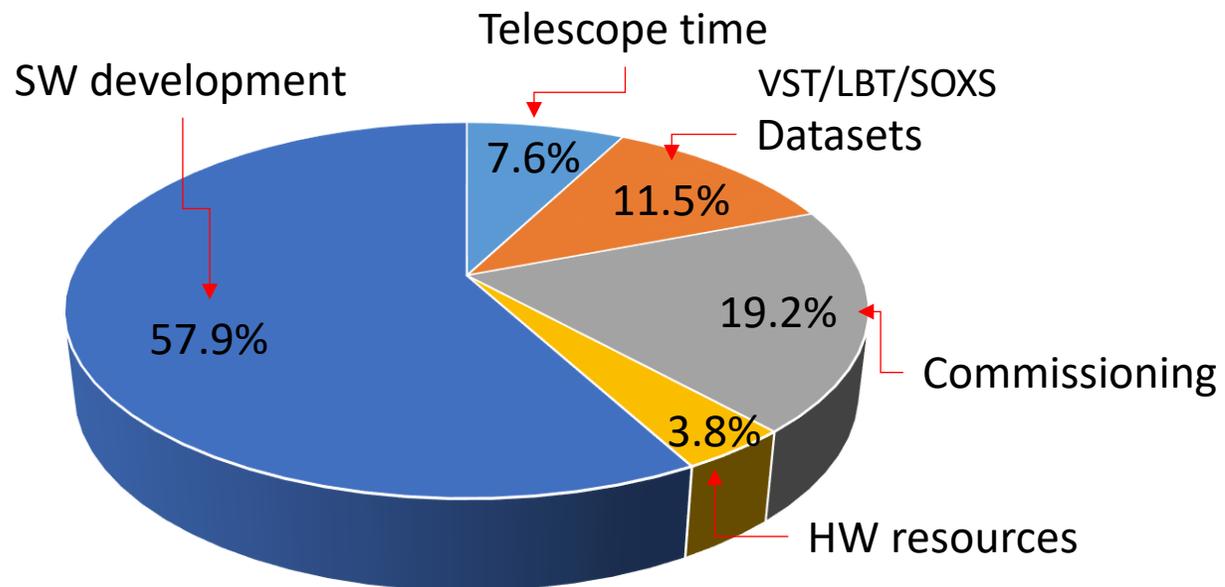
Contract distribution per topics

- Directable — 49%
- commissioning — 25%
- VST/LBT — 16%
- Others — 10%

Return distribution from 480 data rights for 10 years

- Directable — 35%
- commissioning — 22%
- VST/LBT — 29%
- Others — 14%

% types of in-kind contributions:
- SW development — 57.9%
- Telescope time — 7.6%
- VST/LBT/SOXS Datasets — 11.5%
- Commissioning — 19.2%
- HW resources — 3.8%

Rubin-LSST Italia – Data rights & publication policy

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INDEX	REASON
	Level 0 – Highest priority (in-kind team CL, JA or LSST program membership)
0.1	Contribution Lead (CL) of an in-kind team
0.2	DP0 delegate or Catalyst/LSST-related fellowship
	Level 1-2 High priority (in-kind team membership or ex-quintuplet PI-ship)
1	member of an in-kind team with exposed FTEs
2	PI of an ex-quintuplet still active in LSST data exploitation
	Level 4-5 Medium priority (active in-kind team externals or ex-quintuplet members)
4	Active external member of an in-kind team (not exposing FTEs) suggested by the related CL with motivations:
4.1	*Urgent/needed task to be carried out, which requires a direct data access (including LSST SC/WG membership imposed by its internal policy)*
4.2	*In-kind contribution started and under scheduled working time (active contribution)*
4.3	*Recognized concrete effort within the in-kind team*
5	Active member of an ex-quintuplet suggested by the related PI with motivations:
5.1	*urgent/needed task to be carried out, which requires a direct data access (including LSST SC/WG membership imposed by its internal policy)*
5.2	*recognized concrete effort within the in-kind team*
	Level 6 – Low priority (active in LSST science but externals to in-kind or ex-quintuplet teams)
6	Researcher interested to any LSST-related scientific task (external to any in-kind/quintuplet team):
6.1	*with active membership to any Rubin SC/WG*
6.2	*working to a scientific use case outside in-kind or ex-quintuplet topics and requiring a direct data access*
6.3	*supervisor of any PhD student involved in LSST data exploitation requiring a direct data access*
	Level 7 – Lowest priority (general research/academy people interested in LSST Science)
7	people interested at any level in the Italian participation to Rubin-LSST not satisfying any of the above priorities

[Rubin-LSST @ Italy - Italian Data Right Policy](#)

Italian Rubin-LSST in-kind program – Data right policy

VERA C. RUBIN OBSERVATORY

Data Right Policy

The international Rubin-LSST in-kind program foresees that data rights are assigned by the Rubin IPC (In-kind Program Committee) as return of accepted in-kind contributions. This is one of the subjects of an official MoA (Memorandum of Agreement) between INAF and Rubin Foundations Board, still under negotiation. As well known, participation in the in-kind contribution program is on a voluntary basis. This implies that some groups of Italian researchers agree to expose their resources and efforts to provide a scientific/technological contribution to the Rubin-LSST community, obtaining in exchange a certain amount of data rights, partly donated to the Italian community interested in having access to the LSST data before the public releases, equalizing their right of access to the US and Chilean communities.

Although without an official signed MoA, the Italian in-kind program started in the last quarter of 2021, by following a contribution activation schedule, regulated by a temporary INAF-Rubin agreement. The Italian participation to the in-kind program is lead and financed by INAF. The financial support was regulated by an initial resolution of the INAF CdA in 2016, which allocated 3 million euros for a 10-years participation in the program based on quintuplets, predecessor of the current in-kind program, subsequently updated in 2023 to 3.5 million euros through an agreement between the INAF Scientific Director and the Director of UTG-I.

An updated data rights holder list is foreseen to be published every year
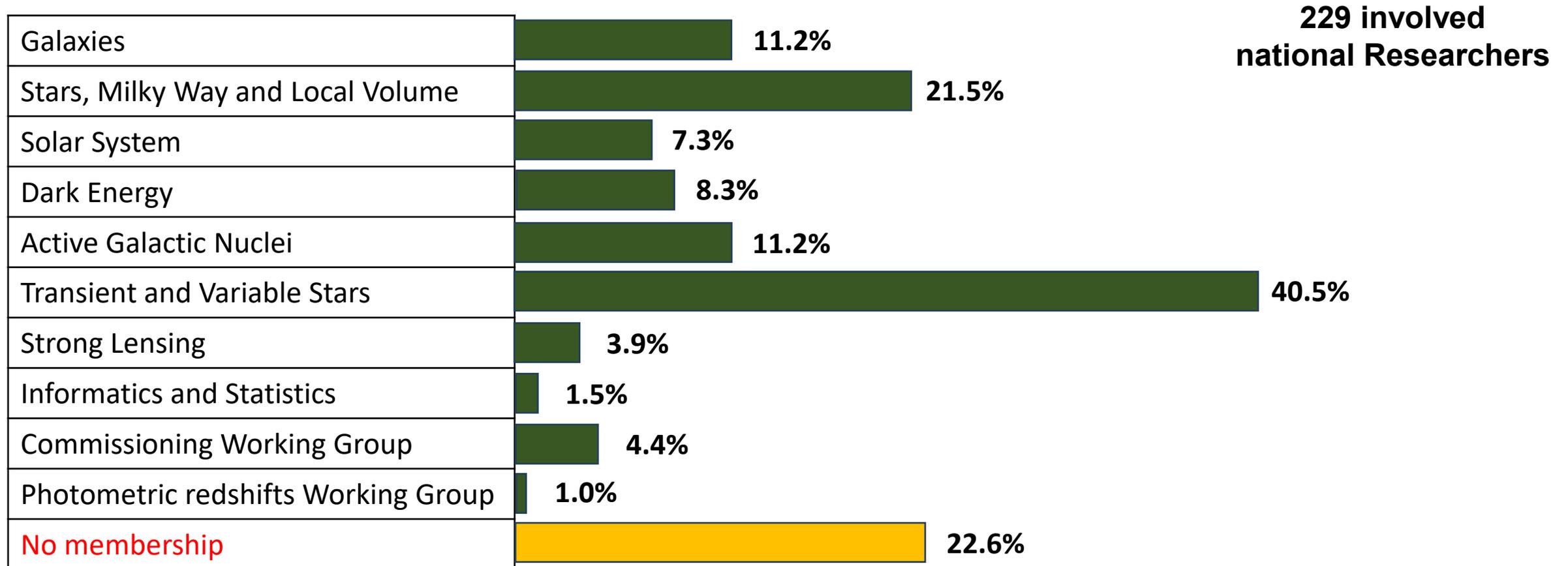
From the last census, with the recent negotiation of VST/LBT in-kind contributions we are fully covering the current community needs

PI data rights coverage - availability: ~13%
JA data rights coverage - availability: ~75%

[International Data Rights Holder List | Rubin Observatory](#)

[Scientific Production Policy](#)

Rubin-LSST Italia
Science Collaborations membership

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229 involved national Researchers

Science Collaboration	Percentage
Galaxies	11.2%
Stars, Milky Way and Local Volume	21.5%
Solar System	7.3%
Dark Energy	8.3%
Active Galactic Nuclei	11.2%
Transient and Variable Stars	40.5%
Strong Lensing	3.9%
Informatics and Statistics	1.5%
Commissioning Working Group	4.4%
Photometric redshifts Working Group	1.0%
No membership	22.6%

Different membership policy among SCs – But, data rights recommend membership

Computing support: minimal benchmarks

We intend to provide ICT support to in-kind teams and to the entire Italian community involved in LSST

A rough estimate of required dedicated storage is an incremental scenario, starting from ~3 PB

- Crowding source fields photometry, such as the analysis of the galactic plane (for sure the galactic bulge);

BENCHMARK   **~100 GB of RAM for a single CCD image processing (for each core)**
~20 TFlops for each single mosaic image processing

- Classification and characterization of sources from images and catalogues (both in the time domain and at different scales, from solar system to large scale structures), including specialized methods (such as Machine/Deep Learning);

BENCHMARK   **Multi-GPU (many-core) parallel computing strategy with ~80 GB of dedicated RAM, for training on ~100K image cutouts with deep learning models**

- Synergies with other surveys for the combined exploitation of merged data, cross correlation with legacy multi-wavelength data, coordination of follow-up groups. Here the most demanding operation is the cross-matching, depending on the amount of entries and column size of the matched tables.

BENCHMARK   **Multi-core strategy, 0.3 PFlops required for cross-matching between 2PB sized (150-columns) catalogues**

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Progetti PNRR
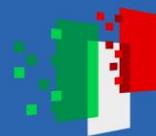
Nr. of CPU's cores requested

- from 1 to 4
- from 5 to 8
- from 9 to 16
- from 17 to 32
- from 33 to 64
- from 65 to 96
- more than 96

Primary projects involved

- ELT
- Euclid
- Rubin-LSST
- SKA
- VST
- Others

Nr. of GPUs requested

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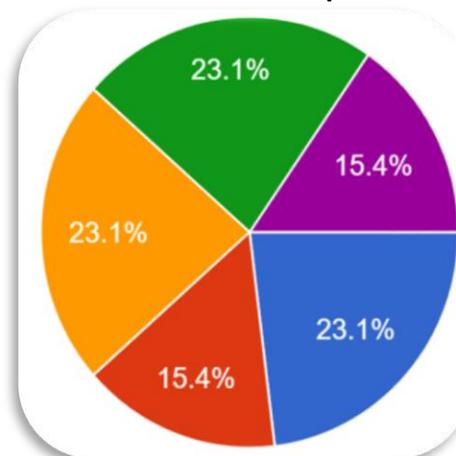
- no GPU required
- up to 1 GPU
- up to 2 GPUs
- up to 4 GPUs
- up to 6 GPUs

RAM requested

- up to 32 GB
- up to 64 GB
- up to 128 GB
- up to 256 GB
- up to 512 GB
- up to 1 TB
- up to 1.5 TB
- more than 1.5 TB

Storage requested

- up to 10 TB
- up to 20 TB
- up to 50 TB
- up to 100 TB
- up to 500 TB
- up to 1 PB
- up to 2 PB
- up to 4 PB
- more than 4 PB

GPU's RAM requested
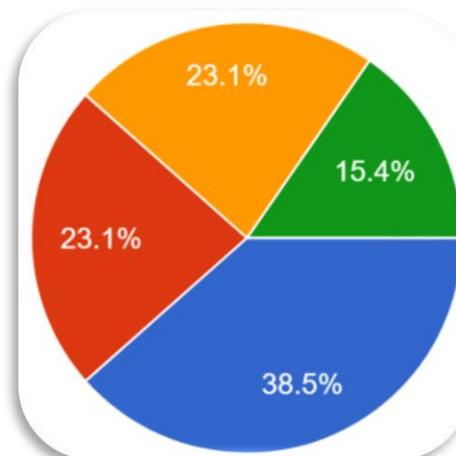
- up to 16 GB
- up to 32 GB
- up to 48 GB
- up to 80 GB

**User Survey
(15 research
groups)**

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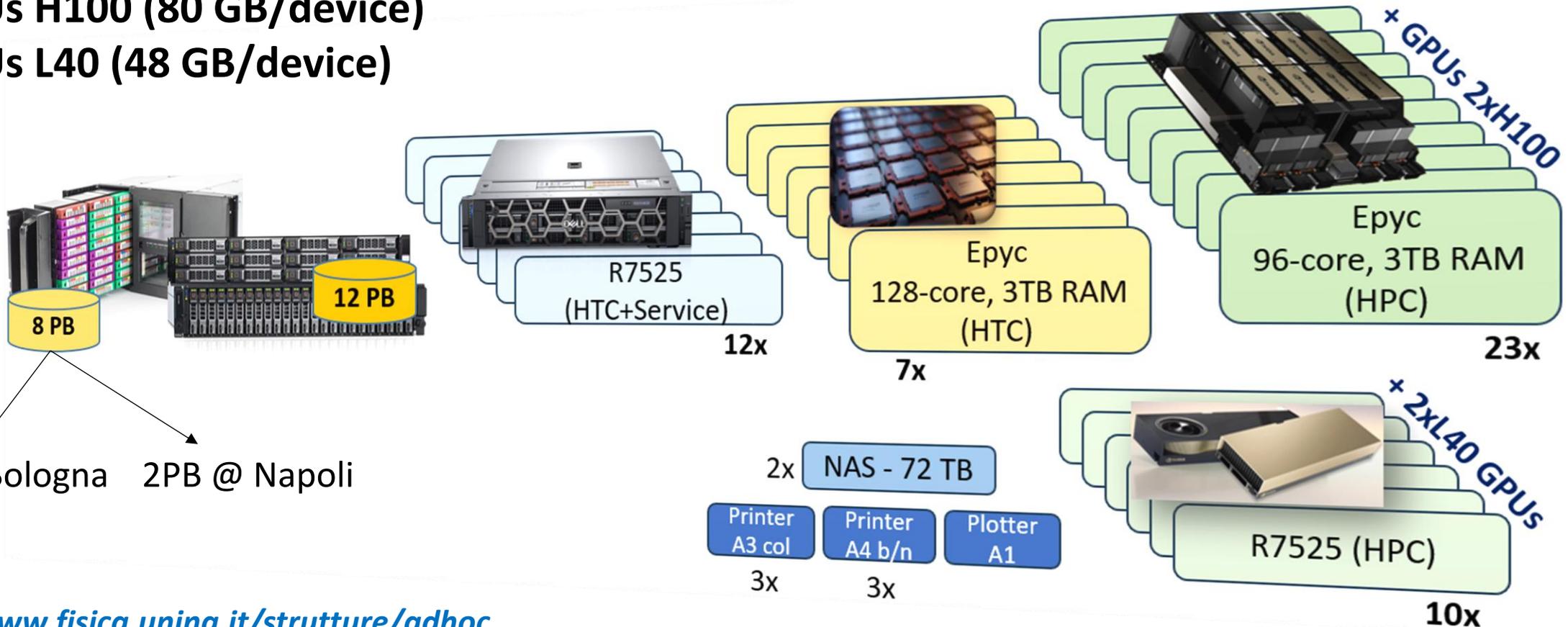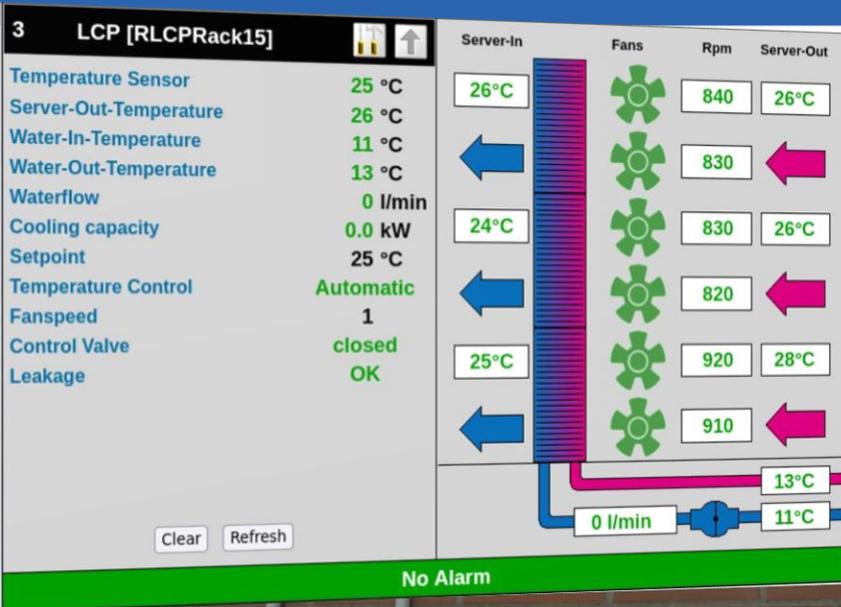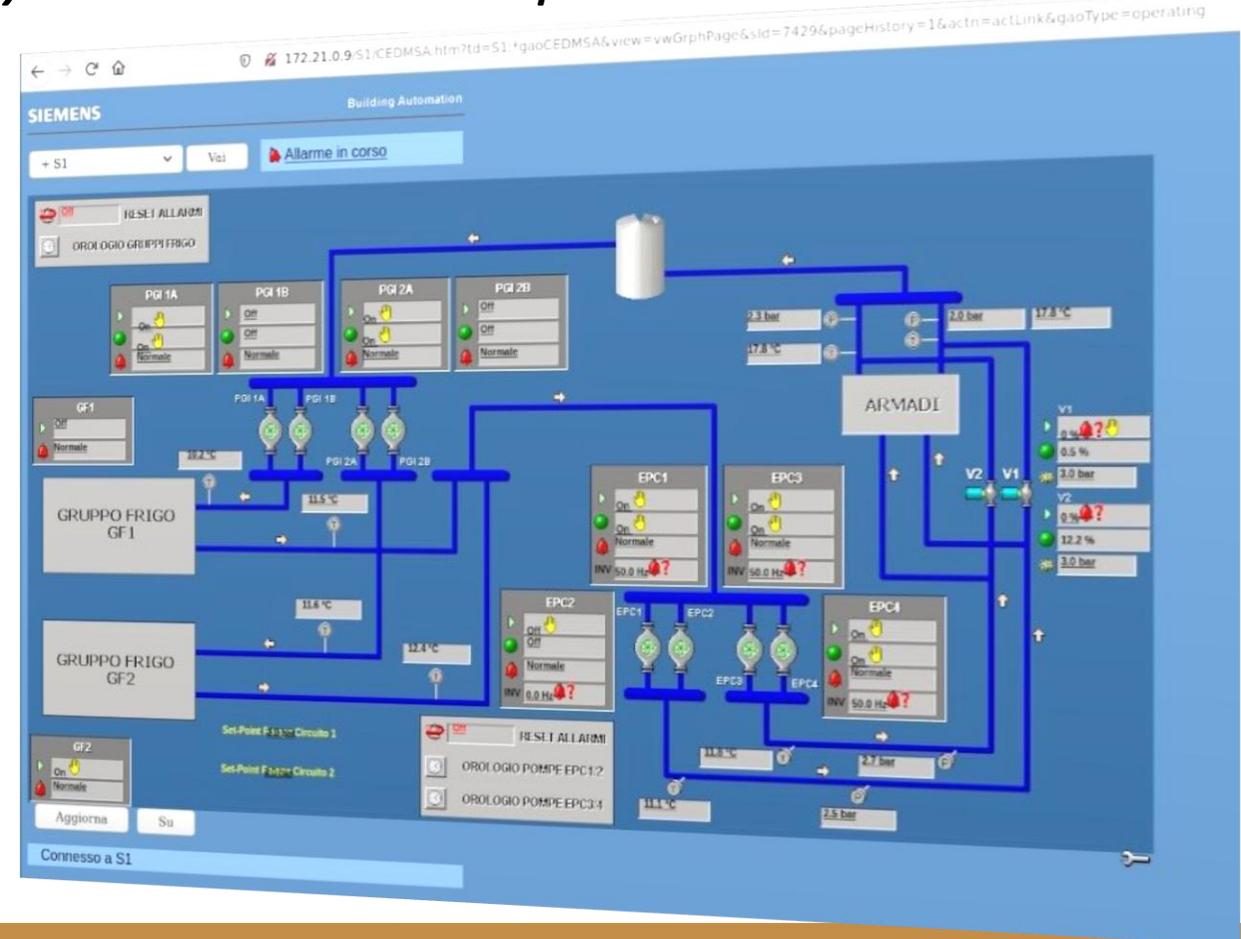PIANO NAZIONALE
DI RIPRESA E RESILIENZA

Progetti PNRR

AD HOC
Astrophysical Data HPC Operation Center

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Network system model architecture

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PNRR STILES – IR0000034, CUP C33C22000640006
Missione 4 – Componente 2 – Investimento 3.1

Missione 4 • Istruzione e Ricerca

Power/Cooling system architecture

AD HOC
Astrophysical Data HPC Operation Center

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Power Usage real-time monitoring

2 420KW UPS

37 LCP columns

30°C in-Rack full load conditions

2 Chillers of 400 thermal KW

AD HOC
Astrophysical Data HPC Operation Center

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Monitoring system

AD HOC
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Astrophysical Data HPC Operation Center

INFINIBAND 200 Gb/s

25Gb/s

100 Gb/s

2xFront-end

Disk controller

JBOD disks, NVMe

JBOD disks, SATA

JBOD disks, SATA

JBOD disks, SATA

Disk Storage system (12 PB)

- 500 SATA disks, 22 TB each (11 PB)

- 135 NVMe disks, 7.5 TB each (1 PB)

- 12 enclosures, 3x single FC-AL controller

- Two server every 3 PBytes as a front-end

- multiple networking options:
  - 2x25 GbE, 2x100 GbE, 2x200 Infiniband

8 (6+2) PB Tape long-term Storage system

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Missione 4 • **Istruzione e Ricerca**

AD HOC
Astrophysical **D**ata **HPC** **O**peration **C**enter

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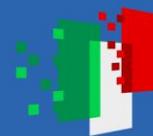
Boss war fort

Control Room

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Progetti PNRR

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Total Users	Academia	Students
59	45	15

Total available storage: 3PB

Avarage Computational time per project per job

Storage Volume per project

Storage Volume Used
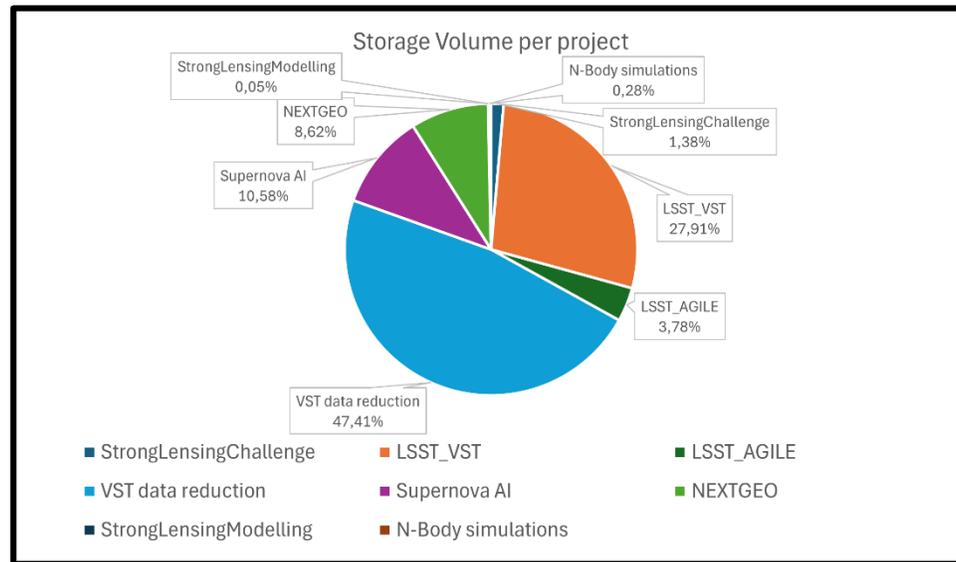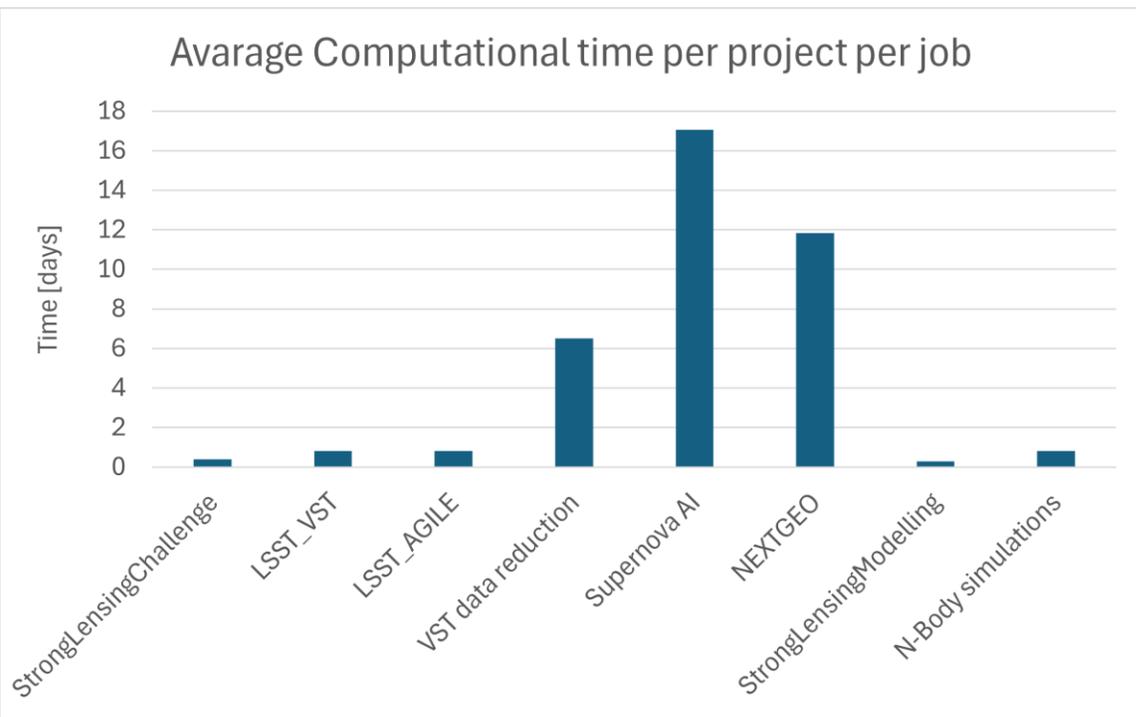
User statistics for the first cluster, active since June 2025

*Courtesy by
Fabio Ragosta & Antonio Ferragamo
ADHOC System Administrators*

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*PNRR STILES – IR0000034, CUP C33C22000640006
Missione 4 – Componente 2 – Investimento 3.1*

Missione 4 • **Istruzione e Ricerca**
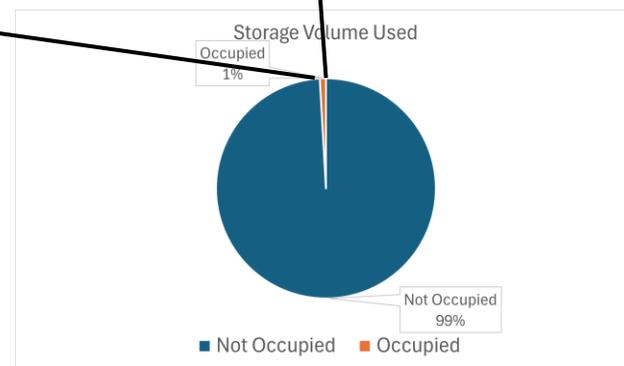
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Quantity	Node [code, functionality]	CPU [threads]	GPU [RAM GB]	RAM [TB]
1	HTC [44, master]	AMD Epyc 7413 [96]	-	0.735
2	HPC [13, 14, processing]	AMD Epyc 9634 [336]	2xH100 [80]	3
2	HPC [40, 41, processing]	AMD Epyc 9536 [256]	2xL40 [45]	1.5
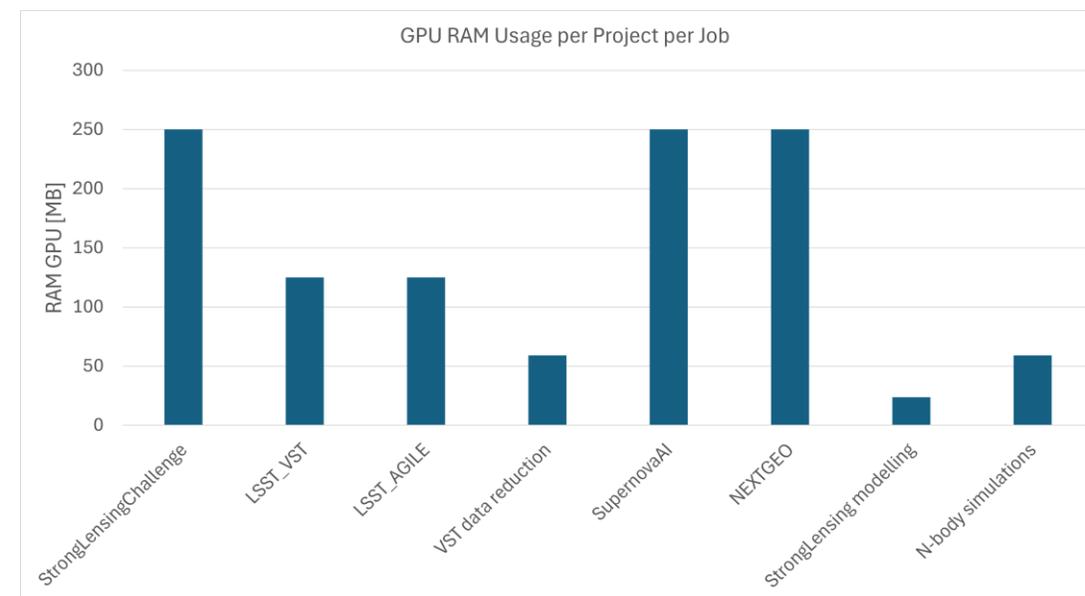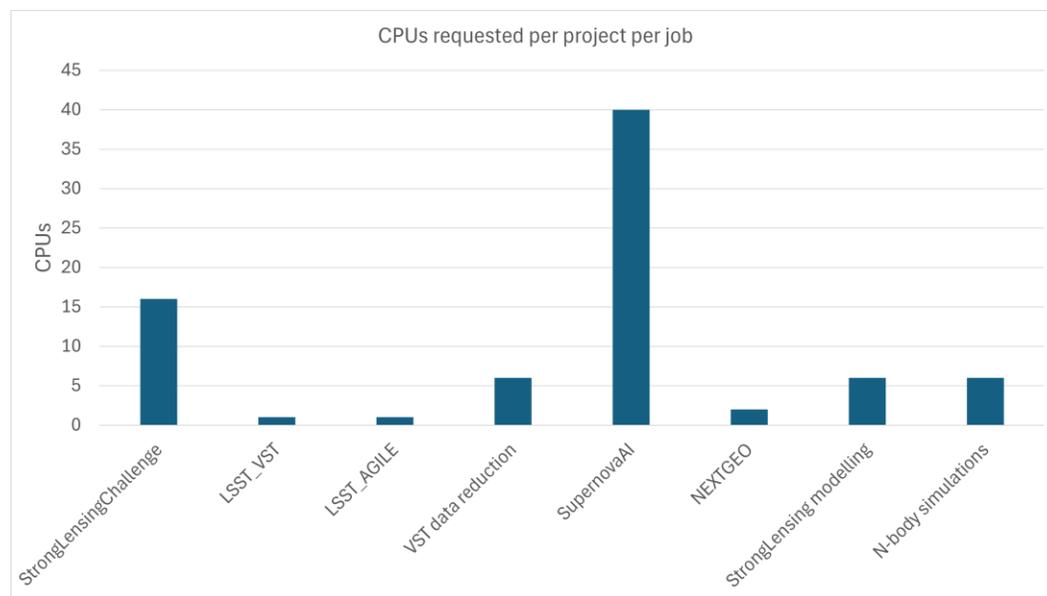
take home message

The Rubin-LSST@Italy in-kind Program is a long-term effort of INAF with evident benefits for the entire national community, in terms of scientific and technological exploitation of LSST data (same rights of US/Chilean community).

We are completing an IDAC resource based on two concepts:

Data Access Center (partial mirroring of LSST data, mainly tabular data, but not only…)

Data Processing Center (hosting HPC/HTC scientific pipelines, exposing data products)

Able to fulfil a heterogeneous science case ecosystem:
- Observation data reduction and calibration;
- High resolution and wide field image analysis;
- Intensive and data-demanding machine/deep learning applications;
- Hybrid execution of multi-thread and many-core computing processes;
- Massive data cross-matching;
- On-demand data/applications Interoperability among user groups;
- Application developing/optimizing/testing;
- Hosting services for external communities (ELT, SKA, ALMA, VST, Euclid, LSST…);

The *ADHOC* infrastructure is a reality, and it represents a feasible and concrete pillar to support the ICT needs of the program…

MESSAGES

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A giant thanks to All contributors to the Italian in-kind program!

These slides were

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