EINSTEIN TELESCOPE

ET-PP (WP8)
2nd review meeting (RP2)

15/05/2025

Grant agreement: № 101079696

Horizon Europe: Coordination and Support Actions

WP 8: Introduction and objectives

Objectives

- Definition of the computing and data model of the Einstein Telescope
- Definition of Einstein Telescope workflows
- Estimation of the resources
- Definition of the technical guidelines and principles for implementing the data access policies

ET-PP WP8	**Achim Stahl - RWTH, Nadia Tonello - BSC**
Task 8.1 T0 data center	Patrice Verdier - CNRS
Task 8.2 Computing and Data Model	Paul Laycock - UniGe
Task 8.3 Resources estimation	Silvio Pardi – INFN
Task 8.4 Data Access Implementation	Nadia Tonello, Oscar Reina - BSC
EiB	**Stefano Bagnasco – INFN To, Patrice Verdier - CNRS**
Division 1: Software frameworks and data challenge support	Andres Tanasijczuk – UCLouvain
Division 2: Services and Collaboration Support	Antonella Bozzi –EGO
Division 3: Computing and data model, Resource Estimation	Gonzalo Merino –PIC
Division 4: Multi-messenger alerts infrastructure	Steven Schramm, UniGe
TTG: Technology tracking working group	Sara Vallero, INFN To

Priorities identified in the RP1
Tasks in RP2

- **D8.1** Computing and Data Requirements finalized
- Gathering requirements for computing and data model from **ET Mock Data Challenges**
- **M8.2** WP8 workshop surveying computing resources availability
- **Sustainable computing** and collaboration with **WLCG** (LHC computing) and WP9
- Collaboration with existing experiments to understand **IGWN computing challenges**
- **ET Authentication and Authorization Infrastructure**
- Maintenance of collaborative tool for **file sharing** (EIB-WP8 and WP10)
- Collaboration with European Open Science initiatives **ESCAPE,** and **OSCARS** applications.
- **Goal: ET Computing Model**, from IGWN current models, solutions, limitations considered.

WP 8: Introduction and objectives
Collaboration EiB / ISB / OSB

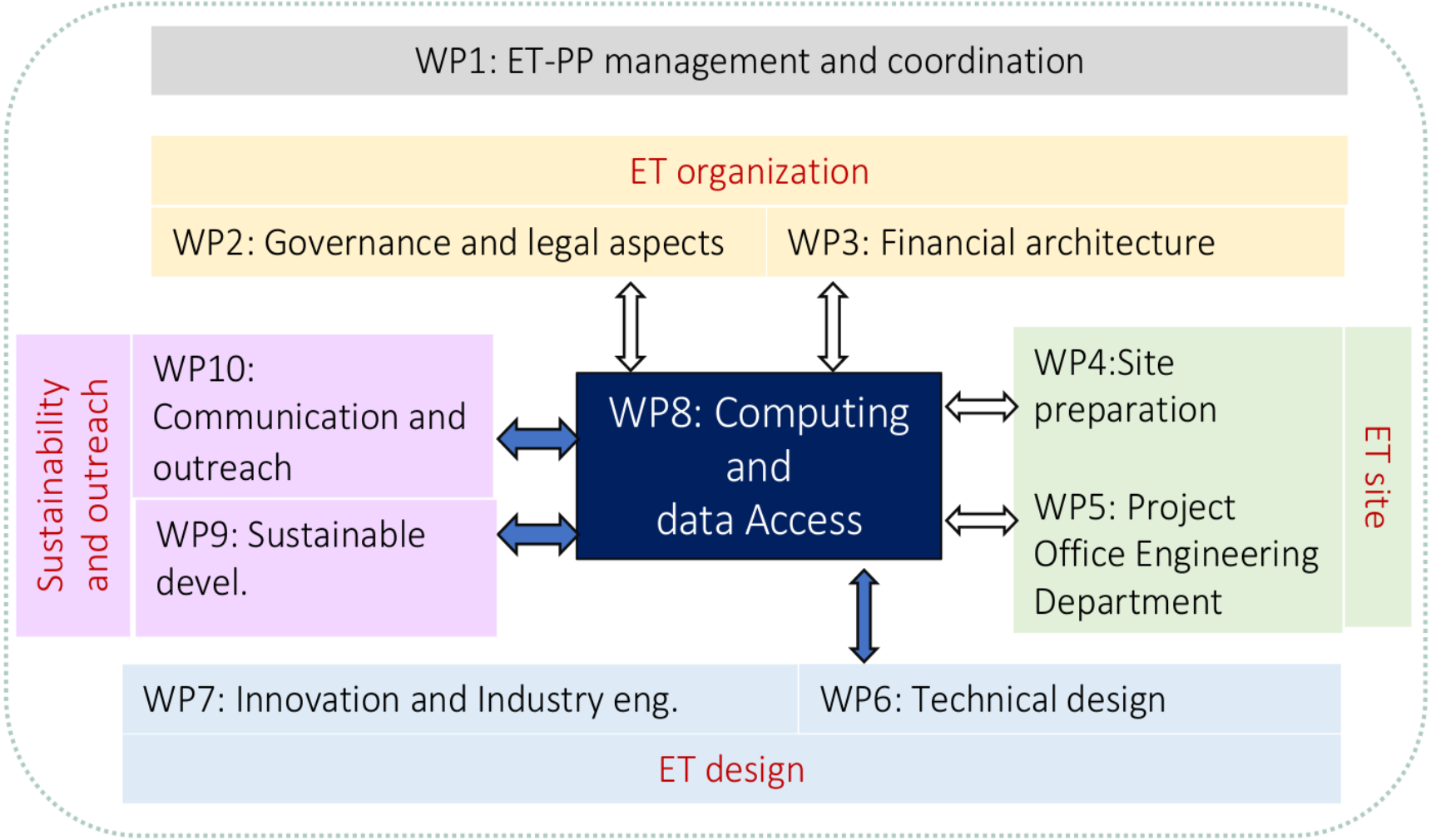
Successful coordination and organization of the activities of WP8 with the ET e-Infrastructure Board (EIB).
Chairs and all-hands online **regular meetings**.

		WP8 Tasks			
		T8.1 T0 data center	**T8.2 Computing and data model**	**T8.3 Resources**	**T8.4 Data access implementation**
ET EiB Divisions	**D1** SW frameworks and Data Challenges		Computing frameworks domains and data formats	Resources for frameworks execution and data storage availability	Data availability Data releases format
	D2 Services and collaboration support				Tools for monitoring, AAI (IAM) data access
	D3 Computing and data models, resources estimation	T0 storage and computing resources estimation	Computing model Data model	Resources estimation	
	D4 Multimessenger alerts infrastructure				Tools for multi-messenger alerts
	Technology tracking working group				

⇔ ET ISB
Workflows and tools

⇔ ET OSB (Div10)
Mock Data Challenges

WP 8: Introduction and objectives
Collaboration with other ET-PP WPs



WP 8: Tasks 8.1

8.1 T0 data center / CNRS - Patrice Verdier
Design the T0 data center and define the on-site services.
• Define Tier-0 storage and computing **requirements** to contribute to D8.1 • **Collaboration with other ET-PP** WPs (ET site related) and ET Boards EIB/ISB/OSB • Close **collaboration with ISB and other Boards** about the conceptual design of the Tier0.

Activities **RP2**	• **ET IAM** discussion, analysis and evaluation of possible solutions. In preparation: Memorandum of Understanding document INFN-CNAF/ET collaboration. Integration with ET Members Database in progress. • ET's representation in **JENA Training working group**. Collaboration with the SPECTRUM and JENA Scientific Computing Survey. • **ET Open-Source Policy** Proposal Introduction and Discussion: Inspired by LIGO and Virgo to address licensing and authorship issues • In preparation: **Workshop On site infrastructure, computing and data model**. CC-IN2P3 Lyon from June 30th-July 1st

WP 8: Tasks 8.2

8.2 Computing and data model / UniGe - Paul Laycock
Develop the computing and data model of ET
• Define the workflow requirements from instrument to publication to contribute to **D8.1** • Collaboration with other **ET-PP WPs**, **ISB** and **OSB**, **IGWN** and **WLCG** to define the scientific data and computing model in **D8.2** • Lead editing of **D8.1 & D8.2**

Activities **RP2**	• Delivery and update of **D8.1** with low latency **computing requirements** based on latest understanding (Science Blue Book) and discussions with IGWN experts • Sustainable Computing**:** edited **WP9** section and established collaboration with **WLCG, HSF** and **IGWN** experts • **EOSC** OSCARS grants to prototype **Open Science** computing tools • **JENA Computing** lead of **Software** WG white paper on **FAIR** software management • Collaboration with **OSB** to gather input from **Mock Data Challenge workshops** • **Organising** a workshop on low latency computing and multi-messenger science

WP 8: Tasks 8.3

8.3 Resources estimation / INFN - Silvio Pardi
Estimation of the computing resources-computing power and storage
• Define operational cost requirements and potential mitigation to contribute to D8.2 • Collaboration with other ET-PP WPs for workshops and sessions regarding ET • Participation of EiB (and other Boards) discussion about computing resources and data needs.

Activities **RP 2**	• Collection of available computing infrastructure for the ET workflows, and collection of their characteristics, and personnel need, costs, etc. • New **TechZoo** cluster in Torino for testing new technologies for ET and IGWN. • Gathering of technical requirements from **EGO services**. Discussion with LVK and CERN community about **tools, standards and computing sustainability solutions** • **JENA Computing** initiative contribution to **HPC** white paper

WP 8: Tasks 8.4

8.4 Data Access Implementation / BSC - Nadia Tonello
Define data access implementation strategy for ET
• Collaboration with other ET-PP WPs for workshops and sessions regarding ET data • Participation of EiB (and other Boards) discussion about data availability and access needs. • Lead editing of D8.3

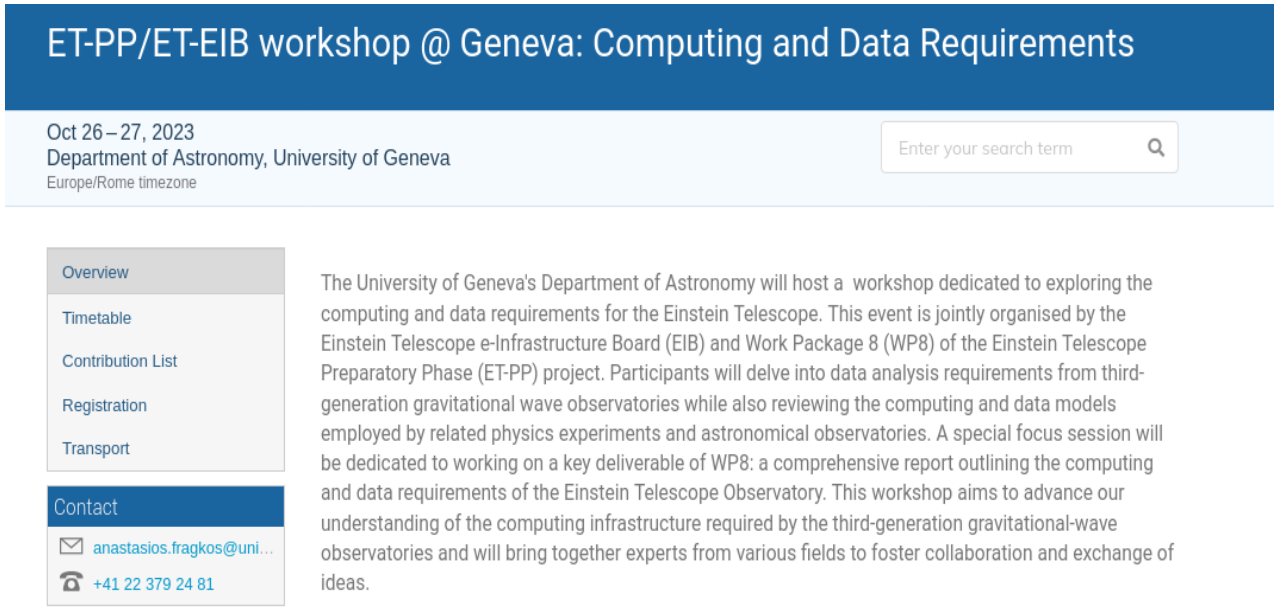
Activities **RP2**	• Contribution to **ET-PP DMP D1.6** • **B2DROP** file sharing tool hosted at BSC adopted by EIB/WP8 in testing phase. Offered for testing to WP10, according to their requirements. Support guaranteed for ET-PP duration and for the migration to a more stable- definitive solution for all ET. • **ET IAM** Memorandum of Understanding document INFN-CNAF and the ET collaboration for the deployment and operation of the ET IAM service (GDPR compliance). • **JENA Computing** contribution to **Data Management** white paper; preliminary draft of **FAIR** data management plan for ET review

WP 8: Deliverables and milestones - RP2

Content	Type	Status	Date
M8.1 Workflows requirements collection and constraints. Workshop Uni Geneva	Milestone	Done - indico	Oct 2023
M8.2 Computing infrastructure availability for ET workflows characteristics. Workshop Napoli	Milestone	Done - indico	July 2024
D8.1 Computing and Data requirements submitted (UniGe). Reviewed and updated	Deliverable	Delivered - TDS	Feb 2024

WP 8: Workshop M8.1

Requirements collection and constraints. Workshop Uni Geneva. Oct 26-27 2023 (indico)



- Setting the scene - the strawman ET computing model Stefano Bagnasco
- Computing and data requirements from the Instrumentation perspective Dr Loic Rollan (LAPP)
- Computing and data requirements from Data Analysis Dr Edward K. Porter (APC / CNRS)
- Computing and data requirements from Data Preparation Dr Loic Rolland (LAPP)
- Algorithm acceleration John Veitch
- Discussion panel on algorithm acceleration Steven Schramm (University of Geneva)
- Vera C. Rubin Observatory - Computing Julien Peloton (IJCLab/CNRS)
- Distributed Computing for Open Science: the ESCAPE collaboration Xavier Espinal (CERN)
- The interface to computing - HSF perspective Graeme Stewart (CERN)
- Supercomputing in Switzerland Joost VandeVondele (ETHZ / CSCS)
- LHC Computing Andrej Filipcic (Jozef Stefan Institute)

WP 8: Review and Update of D8.1

WP8 Deliverables

		Lead	Due date	
D8.1	Computing and Data Requirements	UniGe	Feb 2024	Feb 2024
D8.2	Computing and Data Model	UniGe	Feb 2026	
D8.3	Data Access Implementation Guidelines	IFAE	July 2026	

Available at TDS

Several points addressed in **updated D8.1 v1.2** (as requested)

- New **executive summary & summary tables** in conclusions
- Detailed LIGO/VIRGO **extrapolation factors** for ET (online/offline)
- Estimation on **Low-latency and pre-merger** requirements
- **Summary tables** added to Conclusions

Multi-messenger/low latency

workshop in Geneve, May 21&22 2025

- Rigorous scrutiny of the future LVK low-latency computing model, to ET extrapolation.
- Dedicated session at XV ET Symposium in Bologna (May 26-30, 2025)

WP 8: Workshop M8.2

Computing Infrastructures availability for ET workflows (indico)

The INFN Napoli Unit will host a workshop focuses on the availability and characteristics of computing infrastructures for ET workflows, as part of Work Package 8 (WP8) of the Einstein Telescope Preparatory Phase Project

- [Online now vs ideal](#) Franco Carbognani
- [LL now vs future challenges](#) Steven Schramm
- [Snakemake in LHCb](#) Ben Couturier
- [WLCG](#) Tommaso Boccali
- [EuroHPC](#) Sergi Girona
- [ICSC & TeRABIT](#) Claudio Grandi
- [Experience and perspective from a Virgo Tier 1: CC-IN2P3](#) Eric Fede
- [Experience and perspective from a Virgo Tier 1: CNAF](#) Carmelo Pellegrino (INFN CNAF)
- [SPECTRUM](#) Tommaso Boccali
- [JENA](#) Andreas Haungs
- [Technology tracking](#) Andrea Sciabà (CERN)
- [ESCAPE/EOSC](#) Ignacio Blanquer
- [OSB Div10](#) Elena Cuoco

WP 8: Tasks details

Two proposals prepared and accepted
Virtual Research Environment (VRE) and data management using tools like Rucio and ESCAPE DataLake,

1. ETAP Einstein Telescope Analysis Portal

- PI: P. Laycock (University of Geneva)
- Virtual Research Environment, REANA and Jupyter hub, Metadata management, Monitoring tools; uses **MADDEN** for multi-RI data management

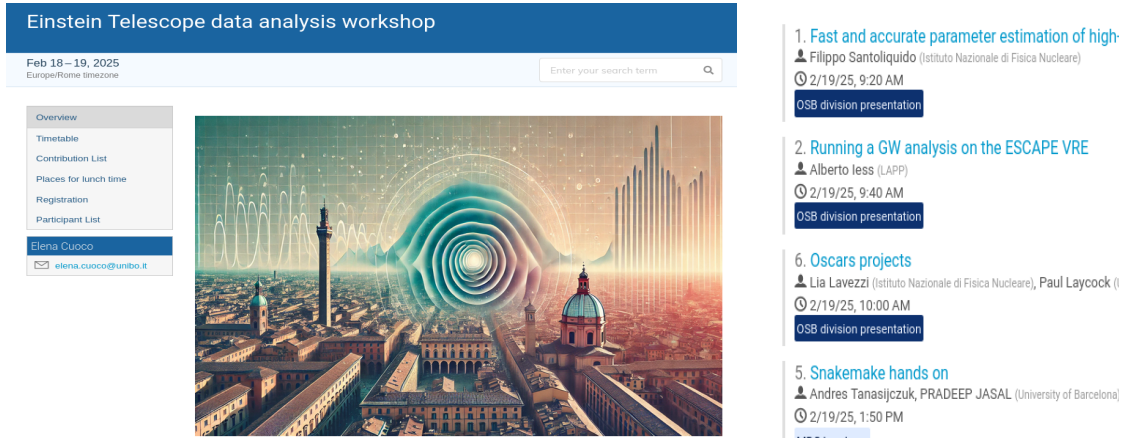
2. MADDEN Multi-RI Access and Discovery of Data for Experiment Networking

- PI: F. Legger (INFN Torino), A. Tanasijczuk (U. Catholique de Louvain)
- Multi-RI Rucio data distribution, Rucio Metadata capability, RucioFS POSIX interface development

WP 8: Tasks details

Mock Data Challenges support and collaboration with OSB

- Data distribution
- Collaboration ongoing for supporting future MDCs (requirements and resource needs)
- Collaboration for refactorizing simulation code.



Baseline

- existing IGWN infrastructure,
- the ESCAPE toolbox (Data Lake and Virtual Research Environment),
- best practices (FAIR) for research software development

- Workshop Bologna ET data analysis - Establishment of actions and strategies to keep track of changes in computing and data requirements using outcomes

WP 8: Other deliverables

ET workshops and meetings

Nov 2023	II ET Annual Meeting	EiB-WP8 and EiB-OSB p.s.
Nov 2024	III ET Annual Meeting	EiB-WP8 parallel session
May 2024	XIV ET Symposium	EiB-WP8 parallel session
Jun 2025	XV ET Symposium	EiB-WP8 parallel session

Conferences

Dec 2023	Computing Challenges for the Einstein Telescope project	Proceedings CHEP 2023
Oct 2024	Towards the Einstein Telescope Computing Model	Contribution to CHEP 2024
Oct 2024	Distributed Data Management with Rucio for ET	Contribution to CHEP 2024
Dec 2024	Sustainability for Einstein Telescope Computing	WLCG Env.Sust. Workshop
May 2025	WLCG/HSF workshop	WLCG/HSF workshop

WP 8: Critical risks, deviations from Annex I

Deviations from Annex 1	Severity of the Impact	Actions Impacted	Corrective Actions
D8.1 not fulfilling the level of detail required	Low	WP8 D 8.1 acceptance	A **review and update of the deliverable D8.1** has been resubmitted, . Strategies to keep track of changes in computing and data requirements are established to take them into account for future versions of the document.
Scientists are not able to provide sufficiently detailed information to elaborate the computing and data model	Medium-Low	WP8 D8.4 Computing and data model	Computing and data model based on most up-to-date scientific information and requirements. **Close follow-up of updates from MDCs and science cases.**
M8.1 (workshop for gathering requirements) scheduled with 1 M of delay with respect to the schedule	Low	WP8 M8.1 accomplished on time	**None**. The 1-month delay on the celebration of the workshop did not affect negatively to the schedule.
Difficulties to find full time personnel adequately in time, with the skills needed for the project.	Medium	WP 1-10	**None**. 2 FTEs hired for WP8 in time, complemented with personnel in-kind contribution.

WP 8: Contribution from each partner

INSTITUTION		PM as per Annex I	PM in period 1	PM in period 2
IFAE	CONTRIBUTIVES			5,4
	REQUESTED EC			0
BSC	CONTRIBUTIVES	9	2,55	8,5
	REQUESTED EC	36	13,11	17,99
CNRS	CONTRIBUTIVES	3	0,24	0,27
EGO	CONTRIBUTIVES			0,06
INFN	CONTRIBUTIVES	3	0	0
UniGe	CONTRIBUTIVES	48	5,4	20.4
Total Person Months	**CONTRIBUTIVES**	63	8,19	34,63
Total Person Months	**REQUESTED EC**	**36**	**13,11**	**17,99**
		99	**21,30**	**52,62**

% PMs used = 53%

WP 8: Outlook and perspectives

- **D8.2 Computing and Data Model**

  M8.3 M8.4 workshops

  Progressive requirements collection from other WPs and MDCs

  Monitoring of needed resources - computing and data resource availability catalog

Preparation of resources and services provision – MoUs

- **D8.3 Data Access Policy implementation**

  M8.5 workshops

  Collaboration to the Policy creation and DMP for ET

Continuous collaboration with IGWN, WLCG, EOSC (ESCAPE) for international alignment.

WP 8: Deliverables and milestones Next period

Content	Type	Status	Date
M8.3 on-site infrastructure, computing and data	Milestone	In preparation	July 2025
M8.4 low-latency and offline workflows, computing and data model	Milestone		Dec 2025
M8.5 data management, data access policy and implementation	Milestone		July 2026
D8.2 Computing and data model for ET	Deliverable		Feb 2026
D8.3 Data access policy implementation	Deliverable		July 2026