WP3 OBELICS
First 9-months report

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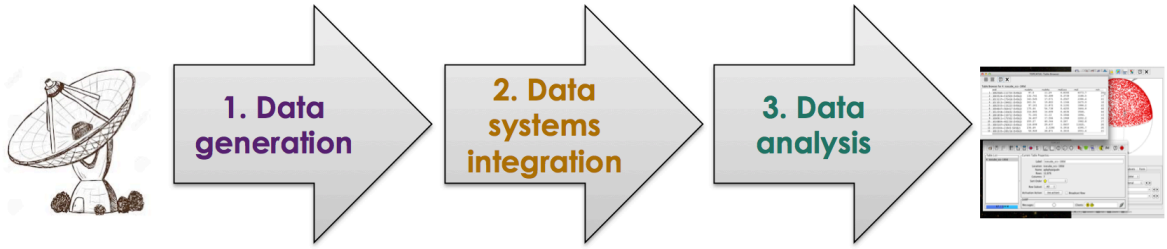
1. OBELICS

Major scopes of the WP3-OBELICS are:

- to enable interoperability and software reuse for the data generation, integration and analysis of the ASTERICS ESFRI and pathfinder facilities.
- to create an open innovation environment for establishing open standards and software libraries for multi-wavelength/multi-messenger data.
- to develop common solutions, share prototypes, exchange experience for: streaming data processing, extremely large databases, advanced analysis algorithms, software and middleware frameworks for data management, data processing and data access.

The challenging work programme of OBELICS is to support the ESFRI projects in Astronomy and Astroparticle Physics by building up a collaborative framework among scientists and ICT technical experts and along the data flow from observations to scientific data products.



OBELICS activities are structured through a matrix between ESFRIs and common data challenges. Main aims are: cross-fertilisation avoiding repetitions; common works and open dissemination; contribution to the construction and operation of ESFRIs.

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2. STATUS REPORT

According to its original proposal, OBELICS partners were expected to dedicate most of the first year (6 to 8 months) in hiring and building up the teams, which will execute the project work plan. Most of the first period activities report concerns the starting-up of the activities concentrated between November 2015 (M6) and February 2016 (M9).

2.1 Achievements

Task 3.1 MAUD (MAnagement, User engagement and data Dissemination)

The first OBELICS deliverable (D3.1) at M4 consists of its Project Plan (PP) providing a guide to all partners to the execution and the control of the expected work, detailing: i) scopes; ii) roles of partners and stakeholders; iii) schedule and resources; iv) work breakdown structure (WBS) and deliverables; v) management plan; vi) risk analysis and management.

Task achievements:

- Project Plan Document (D3.1).
- Preliminary work plan and matrix (ESFRI vs data challenges) work breakdown structure.
- Task and sub-task assignments.
- Electronic tools set-up for cooperative project management.
- Contribution to the definition of the ASTERICS data dissemination plan edited by WP1.
- ASTERICS-OBELICS talks on invitation given at international conferences (4th LSDMA Symposium; ESA-ESO SciOps 2015).
- Preliminary contacts established with computing and data centres, e-infrastructures, policy forums (e.g. ASTRONET, APPEC) and ESO.
- Participation on invitation (and on behalf of ASTERICS) to the High Level Expert Group of the European Science Cloud EC initiative.
- First actions in preparation of the first OBELICS public event, where technical engagement of data centres and ESFRI projects will be considered.
- First in person OBELICS meeting held in Rome on 26-27 January 2016.
- Follow-up of partners' hiring-plan, sub-teams definition and works assignment.
- Endorsing and/or establishing links and bridges with other EC projects, e.g. ARC, HNSciCloud, and consortia, e.g. EU-T0, HEPSF.

Task 3.2 D-GEX (Data GEneration and information eXtraction)

The kick-off event of Task 3.2 took place at the OBELICS meeting in Rome.

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UCM and INAF leaderships were confirmed.
Jose Luis Contreras and Marcos Lopes (UCM) lead Sub-Tasks 3.2.1 to 3, while Angelo Antonelli (INAF-RM) leads Sub-Tasks 3.2.4.
For Sub-Tasks 3.2.1-.3 a first work plan is defined with the following main milestones:

a) Data Format Survey:
- Survey of standards used in ESFRI projects and others widely used.
- Comparison of functionalities and performances of those formats in regards to ESFRI projects needs.
- Selection of the formats to be analysed.

b) Prototype Development:
- Development of prototypes of Data Access Libraries for those formats selected.
- Testing formats and libraries on CTA.
- Evaluation of results with prototype.

c) Deliverables:
- Data Format Survey Report.
- Data Access Library (DAL) Prototypes for selected formats.
- Test Results on CTA implementation.

First achievements:
A survey of data formats used in ESFRI projects and related pathfinders is started by looking for public information and initiating a round of contacts with projects. A table and a report showing data formats and relevant information of these projects were presented at the kick-off meeting and are under construction and soon will be available on the ASTERICS wiki pages.
We have nearly completed a list of contacts for all the institutes involved in the task and are completing a full list of contacts for all ESFRIs and observatories included in ASTERICS.
A test-bed was launched for evaluation of currently proposed formats for CTA low-level data and more news are expected soon.

Sub-Tasks 3.2.4 concerns the benchmarking of low-power computer platforms (including Multicore, MIC, Microservers, GPU, FPGA, ARM) and software technologies/methods for data-driven scalable parallel programming.

Links and cooperative works with Task 3.4, and Task 3.3 are identified and task leaders are in charge of the interfaces.

The roadmap of the Sub-Tasks 3.2.4 is still to be designed, however the leader institute (INAF-RM) relies on some quite advanced R&D activities related to CTA and the ASTRI projects. They concern the application of new generation devices (such as of GPUs NVIDIA

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Jetson TK1 integrating CPU & GPU in a single mini-board) for front-end and/or on-line processing data. The activities are also conducted in cooperation with the NVIDIA research centre and University of Padova (Italy). A development board equipped with an heterogeneous NVIDIA Tegra System-on-Chip in the framework of ASTRI has demonstrated that, leveraging its efficient Kepler GPU and the four ARM cores, the data streaming processed has a factor 2 gain in rapidity (more than 2k events/s) with a power consumption lower than 10 W. This makes Jetson TK1 a promising embedded processing module for the on-line data analysis of gamma-ray astronomy with Imaging Atmospheric Cherenkov Telescopes. Starting from such an experience it is envisaged to enlarge such an approach also to other ESFRI projects and related pathfinders that are covered by ASTERICS.

Similar expertise and/or first actions are polled from other projects (e.g. LOFAR, KM3Net, GW, ..) aiming to make similar developments and take advantage of the expected Sub-Tasks 3.2.4 benchmarking. A list of contacts among OBELICS partners is defined and a group has been recently put in place.

Task 3.3 D-INT (Data systems INTegration)

This is a key Task for the research projects since technical solutions are expected to help ESFRIs in defining or improving their own computing model and archive strategies.
ASTRON and LAPP lead this task. Key representatives of all ESFRI projects are going to participate since a continuous updating on their requirements is critical.
The major common challenge addressed in this task is scaling-up existing databases and storage architectures beyond the Peta-scale level, while allowing for more complex queries addressing both primary sensor data and secondary data-streams.

Four sub-tasks are listed in the OBELICS proposal:

1) Coordination with e-infrastructures providers to address specifications of ESFRI projects.
2) New DB technologies benchmarking and prototyping activities.
3) A repository of services for data workload management.
4) Extension of software framework into the archive system optimizing the queries for multiparameters metadata IRF.

Tammo Jan Dijkema (ASTRON) is one of the coordinators.
LAPP coordinator has been recruited and will start in April 2016. Jean Jacquemeir (LAPP) co-leads interim.
The computing models of CTA, LOFAR, SKA and EUCLID are the first use-cases on which a preliminary survey was accomplished and are going to be studied. Many challenges are on the main infrastructures such as: Network connections; Security on high bandwidth Storage/Retrieval parallelization; Multi node service scaling; Inter-institute coordination. A

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coherent link is set-up with Sub-Task 3.4.2.
Engagement of experts from data centres is needed and will be subject of a dedicated workshop.

Sub-Task 3.3.1 is addressed first, also in view of the first deliverables, by the coordinators and the MAUD working group together. Sub-Task 3.3.2 is not yet assigned while Sub-Task 3.3.3 is starting by considering the different workload management system software in use or under consideration by different ESFRI projects.
Tarek Hassan from IFAE coordinates sub-Task 3.3.4. In particular the CTA development to produce through Monte Carlo simulation the Instrument Response Functions of the array of Cherenkov telescopes is the starting use-case. The method, the multi-dimension metadata sets and the data format will be conceived flexible enough to comply with dependencies on detector, environment, observation conditions and therefore usable for other (event-based) similar projects.
It extends FITS standard to allow:

- Any IRF parameterization.
- Any axis binning (e. g. irregular or overlapping bins).
- Any number of dimensions.

The proposed development has clear connections with analysis pipeline software tools (Task 3.4) and IRF database developments (Sub-Task 3.3.2).

Task 3.4 D-ANA (Data ANAlysis/interpretation)

Task 3.4 is divided in two subtasks. Sub-Task 3.4.1 is led by Bojan Nikolic (UCAM) while Sub-Task 3.4.2 by Fabio Pasian (INAF-TS).

Sub-Task 3.4.1 is focused on software for robust and efficient statistical analysis of very large scientific datasets. Three themes identified in the proposal are:

1. Statistically robust Bayesian analysis software
2. Feature detection and classification in imaging data
3. Likelihood reconstruction optimised for new computer technologies

Emphasis is on multi-instrument/resolution/dimensional data such as may be obtained when combining the data from several ESFRI facilities as well as other leading scientific experiments and observatories.

The first milestone for this task (D3.4) is at T0+12M. This deliverable will be the collection of existing libraries that currently address the themes of this task, packaged together with descriptions and improvements by the individual contributing partners. The milestone planning is well advanced and the deliverable is on track.

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This first milestone will be followed by a systematic analysis of the existing codes, as well as the requirements of the partners to identify where the relevant overlap is and where it will be most efficient to do joint development within the scope of this task. This will enable the creation of the next version of the work plan where the synergies (as well as the divergences) between the ESFRI projects are identified.

The overall work plan is expected to follow that outlined in the proposal.

Summary of organisational achievements:

- The task (together with its sister Task 3.4.2) has established a regular sequence of telecons during which planning and staffing updates have been discussed
- A draft work plan for the remainder of the project has been created in the wiki system
- Planning for the first deliverable (M12) is well advanced

Summary of technical achievements:

- Most of the partners have identified the scientific areas and potential technical solutions where they see their contributions to this work package. This was presented to the other partners at the OBELICS F2F meeting in Rome in January 2016.
- A provisional list of software libraries from each partner that will form the first milestone has been established

Sub-Task 3.4.2 has undertaken the following activities:

1. Actions aimed at producing a global authorisation and authentication infrastructure, which could be used by the science infrastructure projects involved in ASTERICS.
2. Establishing a common set of workflow architectures for the orchestration of compute intensive analysis of Petascale datasets on distributed computing infrastructures.
3. Liaising and being complementary with WP4 (DADI), interfacing the respective activities.

The first achievements obtained since the beginning of the projects are listed below for each of the three above points, respectively. In the activity described below, staff from a single institution (INAF) was involved for an estimated total of 3.5 person-months.

1. Analysis of existing authorisation, authentication and accounting protocols being used or foreseen by the partners' communities has started. The initial step of this activity has been a networking activity, also through dedicated working meetings, with the reference projects (SKA, CTA, Euclid, and the VO) to gather information on the approaches required. A cooperation with a project supported by the European Commission through the call EINFRA-7-2014 ("Provision of core services across e-infrastructures"), i.e. AARC, has started to foster harmonisation by proposing and implementing, as required, a global authorisation and authentication infrastructure using agreed-upon standards (e.g.

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eduGAIN services). The first results of such activity have underlined that having an authentication mechanism common to the various projects is actually feasible: each custom authentication system would accept user information from other authentication authorities through a unifying layer. The systems implementing authentication are going to be available in the Software Repository planned as Task 3.4 deliverable (D3.4) at M12.

2. The initial step of the activity is the collection of a whole set of workflow architectures used by various projects and/or popular in the field of astrophysics and astroparticles. The systems implementing the above architectures are going to be available in the Software Repository planned as T3.4 deliverable (D3.4) at month 12. This will be done coherently with Sub-Tasks 3.3.2 and 3.3.3.
3. Liaison and coordination with WP4 (DADI) has started. This has been achieved by defining at the beginning of the project personnel (contributed by INAF) working across ASTERICS WPs 3 and 4, and particularly on the interface aspects. Such personnel attended a working meeting (the first "ESFRI Forum and Training event" organised by WP4 in Trieste, 3-4 Dec 2016). During the meeting (see deliverable D4.3 of WP4), authentication and authorisation aspects relevant to the data access and VO-related requirements from the projects belonging to ASTERICS were discussed.

2.2 Challenges, difficulties and risks

Task 3.2 D-GEX (Data GEneration and information eXtraction)

SUB-TASK 3.2.1

In the first place we are experiencing some problems to complete the list of contacts. In fact we have already realized that data management information of projects is not always publicly available and might be difficult to access.

In addition synergies between projects concerning data formats and related software are limited, because of large differences between event-based, image-based and signal-based projects. Therefore, the scope of the data format survey and the comparison of functionalities should be made in different categories.

Risks:

As described above projects may not be willing to make available the information needed for the task or the information may not be enough.

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It is possible that data products of projects do not share enough common points so that data formats are reusable in different projects. This effect is expected to affect more low-level data.
Projects may prefer to use customized formats and software for low level data not intended to be shown publicly. In addition, they may want not to adopt proposed standards even for higher level data or to make their data formats publicly available

SUB-TASK 3.2.2
Most partners have had (and some still have) to recruit staff for this task and therefore the staffing level has been ramping up relatively slowly. This is being addressed by carefully tracking the progress of recruitment at each partner institution.

Risks:
Involvement of experts in computing hardware and professional software programming are critical to make any benchmarking effective. OBELCIS-MAUD should act to open the participation to external experts.
Experiments and projects already running or finalizing their computing model may be not interested in adopting Low Power Computing (LPC) solutions as main stream for their data handling activities.

Task 3.3 D-INT (Data systems INTegration)

Staffing level ramping up slowly. A full engagement is expected not before M12.

Risks:
The major risk could be represented by the limited capacity of partners to share the ESFRI developments.
Limited implications of technical expertes form e-infrastructures. The way we do minimize this risk is to bring on board those data centres that are supported to the purpose of implementing the computing model of any ESFRI project.

Task 3.4 D-ANA (Data ANAlysis/interpretation)

SUB-TASK 3.4.1
Challenges/issues:

- Most partners have had (and some still have) to recruit staff for this task and therefore the staffing level has been ramping up relatively slowly. This is being

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addressed by carefully tracking the progress of recruitment at each partner institution

- The requirements of the ESFRI projects are not documented and identifying areas where joint development will be efficient is difficult. This will be addressed by analysis of deliverable D3.4 which will bring together the software libraries from all of the ESFRI projects
- One of the project partners has not yet participated in the task contact meetings and therefore their contributions and interests are not yet known.

Risks:
Identifying where there is a large overlap in requirements of the ESFRI projects will require careful analysis and mutual understanding of the problems that each has to solve. Sufficient focus from everybody will be needed to ensure this is done.

SUB-TASK 3.4.2.
While a common solution to authentication aspects seems to be viable, authorisation aspects are likely to be left to the individual projects. Accounting still needs to be analysed but it could possibly be as specific as authorisation. These difficulties may result in a deviation from the plan included in the original proposal.

Risks:
While initial contacts across projects have indicated that common mechanisms for authentication, or at least for interoperability of authentication certificates between authorities may be achieved, interfacing with custom authorisation and accounting mechanisms need to be investigated within the different projects constraints.

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3. PERSPECTIVES AND DELIVERABLES

Task 3.1 MAUD (MAnagement, User engagement and data Dissemination)

The OBELICS project plan delivered at M4 will be revisited and a new version will be published on M16. It will include detailed work plans of each Task provided by the appointed Tasks leaders.

One valuable approach for the next months is to organize a workshop based on computing model and archive requirements convening scientists, ESFRIs and e-infrastructure providers to learn more about:
i) services for workflow management and AAA;
ii) cloud computing and data-cloud (for open science?);
iii) computing architectures (combining HTC, HPC and LPC) and distributed archive systems;
iv) defining training or briefing sessions for workload management services.

Task 3.2 D-GEX (Data GEneration and information eXtraction)

SUB-TASK 3.2.1
The proposed work plan is in line with the proposal of OBELICS, aiming to promote cross-fertilisation between ESFRI projects via a three-step process: a) share studies and seek synergies, b) foster evaluation and adoption of innovative solutions, c) sharing common prototype frameworks and standards.

The work plan for future months is already defined, including two extra tasks:

- Extension to other ESFRI Projects:
    - Proposal for a Standard DAL (SDAL) library to support other ESFRI projects.
    - Training sessions with ESFRI projects.
    - SDAL documentation.

- Final Evaluation:
    - Development of the SDAL library.
    - Implementation on other ESFRI projects.
    - Final evaluation and lessons learnt.

SUB-TASK 3.2.2
First survey on ideas for the industrial contracts as well as for a training event on new data architectures is expected. The activities in the next 9 months will be mainly focused on the

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testing and benchmarking of low-power computing platforms and the development of the related open software, libraries and optimal data format.
A dedicated Workshop on these technologies with the goal of having together contribution from both industrial and research partners is considered.

Task 3.3 D-INT (Data systems INTegration)

Main prospective is to get more hired partners. First survey on ideas for the industrial contracts as well as for a training event on specialized Big-Data archive use and architecture.

Task 3.4 D-ANA (Data ANAlysis/interpretation)

SUB-TASK 3.4.1

1. Preparation of the first deliverable (D3.4) and publication (expected 1st May 2016)
2. Analysis of existing software libraries to identify common components, interaction with other ASTERICS tasks and areas where common development will be most beneficial
3. Commencement of the detailed development work on these software libraries

SUB-TASK 3.4.2

1. Systems implementing authentication are going to be available in the Software Repository (D3.4). As a second phase, a development plan aimed at producing a global authentication infrastructure will be drawn shortly, including the definition of interfaces to authorisation and accounting mechanisms.
2. Systems implementing workflow architectures are going to be available in the Software Repository (D3.4). After making available workflow architectures for the orchestration of compute-intensive data analysis on distributed computing infrastructures, a networking activity with the reference projects (SKA, CTA, LOFAR, Euclid, and others) will start, to gather information on the approaches required, also through dedicated working meetings. The result of this activity will be a development plan.
3. Coordination between WP3 and WP4 will continue as required. In spring 2016 INAF will hire a senior position with a 3-year grant, shared between WP3 and WP4.

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3.1 Next deliverables

1) D3.3
Analysis Report on Standards and Libraries
Task 3.2
M12: 1/5/2016.
Leader Institutes: UCM, INAF.

2) D3.4
Release of Software Libraries
Task 3.4
M12: 1/5/2016 (next on M48).
Leader Institutes: UCAM, INAF

3) D3.2, 3.6
Annual user engagement forum, workshops and training events
Task 3.1
M12, M24.
Leader Institutes: LAPP

4) D3.5
Analysis Report on Resource Requirements
Task 3.3
M18: 1/11/2016
Leader Institutes: ASTRON, LAPP

4. SUMMARY

The OBELICS project has started. Working groups around Tasks and Sub-Tasks are in place and leaderships are assigned. Periodical meetings, forum discussions and document edition are well progressing.
OBELICS is well achieving proportionally to the very few months of activities. We are following the proposed direction, which is still shared to be the preferred one, although OBELICS will follow-up the evolution of ESFRI-projects' plans.
For the next 9 months the project is under control, the expected deliverables will be produced in time and the participation (including the new hiring) will be more effective.
In the following tables the list of contacts of OBELICS partners and the current participation per institute are detailed.

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Project	Institute	Name	Family Name	role
CTA	LAPP-CNRS	Giovanni	Lamanna	OBELICS coorrdinator and CNRS contact
CTA	LAPP-CNRS	Gilles	Maurin	LAPP contact and HESS contact
CTA	INAF-RM	L. Angelo	Antonelli	INAF contact and CTA contact
CTA	CEA	Thierry	Stolarczyk	CEA contact
CTA	IFAE	Javier	Rico	IFAE contact and MAGIC contact
CTA	UCM	Jose Luis	Contreras	UCM contact
LSST	LAPP-CNRS	Dominique	Boutigny	LSST contact
SKA	ASTRON	Tammo	Jan Dijkema	ASTRON contact and LOFAR contact
SKA	UCAM	Paul	Alexander	SKA contact
SKA	UCAM	Bojan	Nikolic	UCAM contact
SKA	JIVE	Arpad	Szomoru	JIVE contact
EUCLID	INAF-TS	Marco	Molinaro	WP4 interface
EUCLID	IAP-CNRS	Yannick	Mellier	IAP contact and EUCLID contact
KM3NeT	FAU	Kay	Graf	FAU contact
KM3NetT	INFN	Cristiano	Bozza	INFN contact and KM3NeT contact
KM3NeT	CPPM-CNRS	Paschal	Coyle	CPPM contact and ANTARES contact
EGO	APC-CNRS	Eric	Chassande-Mottin	APC contact and EGO contact
ESO	E-ELT	Michael	Sterzik	ESO contact and E-ELT contact

TABLE 1: Contact persons for the ESFRI/precursor/other projects and OBELICS partners.

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Project	Institute	Name	Family Name	% FTE	EC funded	Task	start Month	end Month	effort planned (PM)
CTA	LAPP-CNRS	Giovanni	Lamanna	0,2	0	3.1	1	48	9,4
CTA	LAPP-CNRS	Gilles	Maurin	0,1	0	3.2	6	48	4,2
CTA	LAPP-CNRS	Pierre	Aubert	1	1.0	3.2, 3.4	6	42	36
CTA	LAPP-CNRS	Jean	Jacquemier	0,5	0	3.3	6	48	21
CTA	LAPP-CNRS	Thomas	Vuilaume	1	1.0	3.3, 3.4	10	46	36
CTA	LAPP-CNRS	Dominique	Boutigny	0.1	0	3.1. 3.3	9	48	39
LSST	LAPP-CNRS	X	Y	1	TBR	3.3	12	48	36
CTA	INAF-RM	L. Angelo	Antonelli	0,2	0	3.2	1	48	9,4
CTA	INAF-RM	Denis	Bastieri	0,1	0	3.2	4	48	4,4
CTA	INAF-RM	Matteo	Perri	0,3	0	3.2	4	48	13,2
CTA	INAF-RM	Stefano	Gallozzi	0,1	0	3.2	4	48	4,4
CTA	INAF-RM	Saverio	Lombardi	0,1	0	3.2	4	48	4,4
CTA	INAF-RM	X	Y	1	TBR	3.3, 3.2	12	48	36
CTA	INAF-RM	X	Y	1	TBR	3.3	12	48	36
CTA	INAF-RM	X	Y	1	TBR	3.3	12	48	36
CTA	CEA	Karl	Kosack	0,1	0	3.4	1	48	4,7
CTA	CEA	Thierry	Stolarczyk	0,1	0	3.4	1	48	4,7
CTA	CEA	Fabio	Acero	0,1	0	3.4	1	48	4,7
CTA	CEA	Jeremie	Decock	1	1.0	3.4	9	45	36
CTA	IFAE	Javier	Rico	0,1	0	3.2, 3.3	1	48	4,7
CTA	IFAE	Tharek	Hassan	0,8	0,8	3.3	6	36	24
CTA	UCM	Jose Luis	Contreras	0,1	0	3.2, 3.3	1	48	4,7
CTA	UCM	Marcos	Lopez	0,1	0	3.2, 3.3	1	48	4,7
CTA	UCM	Jaime	Rosado Vélez	1	1.0	3.2	8	32	24
CTA	UCM	Fran. Javier	Franco Peláez	0.2	0	3.2	1	48	9.4
SKA	ASTRON	Marco	de Vos	0,1	0		1	48	4,7
SKA	ASTRON	Tammo	Jan Dijkema	1	1.0	3.2, 3.3	6	42	36
SKA	ASTRON	Bas	van der Tol	1	1.0	3.4, 3.3	6	42	36
SKA	ASTRON	X	Y	1	TBR	3.3	6	42	36
SKA	UCAM	Paul	Alexander	0,1	0	3.4	1	48	4,7
SKA	UCAM	Bojan	Nikolic	0,5	0	3.4, 3.3	1	48	23,5
SKA	UCAM	Gerry	Gilmore	0,1	0	3.4	6	48	4,2
SKA	UCAM	Richard	McMahon	0,1	0	3.4	6	48	4,2
SKA	UCAM	X	Y	1	TBR	3.2, 3.3	10	42	32
SKA	UCAM	X	Y	1	TBR	3.3	6	42	36
SKA	UCAM	X	Y	1	TBR	3.4	8	40	32
LSST	UCAM	X	Y	1	TBR	3.4	8	40	32
SKA	JIVE	Arpad	Szomoru	0,1	0	3.4	4	48	4,4
SKA	JIVE	Des	Small	0,5	0,5	3.4	4	24	10
SKA	JIVE	Mark	Kettenis	0,5	0	3.4	8	48	20
EUCLID	INAF-TS	Fabio	Pasian	0,3	0		1	48	14,1
EUCLID	INAF-TS	Giuliano	Taffoni	0,3	0	3.4.2	4	48	13,2
EUCLID	INAF-TS	X	Y	1	TBR	3.4.2	6	42	36

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EUCLID	INAF-TS	Marco	Molinaro	0,2	0	3.3.3 (VO)	4	48	8,8
SKA	INAF-TS	Cristina	Knapic	0,2	0	3.4.2 (A&A)	4	48	8,8
EUCLID	IAP-CNRS	Yannick	Mellier	0,2	0	3.4	1	48	9,4
EUCLID	IAP-CNRS	Henry Joy	McCracken	0,1	0	3.4	4	48	4,4
EUCLID	IAP-CNRS	Karim	Benabed	0,1	0	3.4	4	48	4,4
EUCLID	IAP-CNRS	Patrick	Hudelot	0,2	0	3.4	4	48	8,8
EUCLID	IAP-CNRS	X	Y	1	TBR	3.4	6	42	36
KM3NeT	FAU	Tamas	Gal	0,3	0	3.3	4	48	13,2
KM3NeT	FAU	Kay	Graf	0,1	0	3.3	4	48	4,4
KM3NeT	FAU	Thomas	Heid	0,1	0	3.3	4	48	4,4
KM3NeT	FAU	Clancy	James	0,2	0	3.3	4	48	8,8
KM3NeT	FAU	X	Y	1	TBR	3.3	6	42	36
KM3NeT	INFN	Cristiano	Bozza	0,2	0	3.2, 3.4	4	48	8,8
KM3NeT	INFN	Agnese	Martini	0,2	0	3.2, 3.4	4	48	8,8
KM3NeT	INFN	Rosa	Coniglione	0,2	0	3.2, 3.4	4	48	8,8
KM3NeT	INFN	Bernardino	Spisso	1	1	3.4	9	33	24
KM3NeT	INFN	Carmelo	Pellegrino	0.5	1	3.4	9	33	12
KM3NeT	INFN	Giulia	De Bonis	0.5	1	3.2, 3.4	9	33	12
KM3NeT	CPPM-CNRS	Paschal	Coyle	0,1	0	3.4	4	48	4,4
KM3NeT	CPPM-CNRS	Jurgen	Brunner	0,1	0	3.4	4	24	2
KM3NeT	CPPM-CNRS	Liam	Quinn	0,665	1	3.2, 3.4	6	42	23,94
EGO	APC-CNRS	Eric	ChassandeMottin	0,1	0	3.4	4	48	4,4
EGO	APC-CNRS	X	Y	1	TBR	3.4	6	30	24
ESO	E-ELT	Michael	Sterzik	0,1	0	3.2, 3.3, 3.4	0	0	0

TABLE 4: Complete list of WP3 participants per partner, per project and task.

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