Summary of the 1st OBELICS in-person meeting held in Rome (26-27/1/16) and Action Points.

Giovanni Lamanna, LAPP-IN2P3-CNRS

Participants

L. Angelo Antonelli (INAF-RM); Pierre Aubert (LAPP); Denis Bastieri (Uni. PD/INFN); Cristiano Bozza (Uni. SA/INFN); Eric Chassande-Mottin (APC); Giuseppe Cimo (ASTRON); Giulia De Bonis (INFN); Jeremie Decock (CEA); Tammo Jan Dijkema (ASTRON); Stefano Gallozzi (INAF); Tarek Hassan (IFAE); Jean Jacquemier (LAPP); Rico Javier (IFAE); Mark Kettenis (JIVE); Cristina Knapic (INAF-TS); Karl Kosack (CEA); Giovanni Lamanna (LAPP); Saverio Lombardi (INAF-RM); Marcos López (UCM); Marco Molinaro (INAF-TS); Bojan Nikolic (UCAM); Fabio Pasian (INAF-TS); Matteo Perri (INAF-RM); Vincent Poireau (LAPP); Bernardino Spisso (INFN); Giuliano Taffoni (INAF-TS); Vincenzo Testa (INAF-RM); Sebastiaan van der Tol (ASTRON).

Agenda

I. Welcome and meeting objectives
II. Task 3.4 Work Plan (Partners vs ESFRIs)
III. Introduction to Task 3.3, short presentation about LOFAR integration challenges and others
IV. Introduction to Task 3.2 and discuss plans per partner.
V. Project plan, management and next deliverables.

Summary

Giovanni Lamanna (OBELICS coordinator) recalls the main goals of the OBELICS WP and the way the proposal was structured. A matrix between ESFRIs and common data challenges is the way through which OBELICS activities must be structured. Main aims are: cross-fertilisation avoiding repetitions; common works and open dissemination; contribution to the construction and operation of ESFRIs. During the meeting discussions are organized around four issues:

- A first face-to-face Task 3.4 working-group meeting, introducing one each other.
- Setting up the first work-plans for Task 3.2 and Task 3.3.
- Planning commitments for first (12-18 Months) expected deliverables.
- Discussing OBELICS organization, results dissemination and project-plan revision.

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Giuseppe Cimo` (ASTERICS project scientist) reminds the ambitious plan of the OBELICS WP. The ASTERICS web page is available at www.asterics2020.eu and provides also Forums and Wiki pages.

Task 3.4 D-ANA

Bojan Nikolic (UCAM) and **Fabio Pasian (INAF)** are the task leaders.
Bojan Nikolic chairs the session.

The task 3.4 meeting session was organized according to the following format:
1. Each participating organisation in Task 3.4 gives a 15-minute presentation on its aims and plans.
2. Together we go through everybody's plans and identify overlaps and commonalities.
3. A planning for the 1 May 2016 deliverable is discussed.

Contributions from partners:

UCAM

Bojan Nikolic introduces the SKA project and reminds that OBELICS is aimed at contributing to a contained, but significant and neglected, part of the ICT challenge: joint analysis of data from multiple telescopes.

The planned outputs are:

1. MW-Inference: Multi- wavelength/messanger/observatory Bayesian Analysis and Machine Learning Library
2. StatPlanner: Tool for planning statistical analysis of large surveys and statistical re-analysis of archival data
3. “Recipe” – practical handling of large-data set data reduction (in cooperation with JIVE)

Within sub-Task 3.4.2: *« designing and testing of workflow engines on distributed compute-intensive systems »:*

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- Practical tool for explorative data analysis with minimal re-computation
- Building on RadioNET/HILADO work
- Initial milestone can be a baseline based on this work
- More from JIVE

First steps :

- How to plan an archival statistical study?
- Create a baseline on current telescope tools (LSST, Gemini, SDSS)

JIVE

Mark Kettenis talks about the JIVE contribution to Task 3.4: Interactive Remote Data reduction Framework.

Radio Astronomy community uses CASA. New developments use CASA/casacore.

- Conversion of polarisation basis
- Wide field imaging
- Beam shape correction

Building a framework for minimal re-computation which turns CASA scripts into execution graphs. The idea is to deep explore the JUPYTER approach: a Python-scripts Web-based framework, enabling remote computation.

Goals :

- Integrate CASA with Jupyter
- Integrate the HILADO minimal recomputation framework with Jupyter
- Deliver Python and Haskell modules necessary to achieve this
- Deliver a description on how to set up a complete environment

ASTRON

Tammo Jan Dijkema (EC-funded member of ASTRON team)**:** LOFAR (as a SKA precursor) use-case.
In terms of processing overview: GPUs correlator is applied for Real-time analysis while 4 main grid sites are applied for offline processing and archive.
Software – Offline data reduction challenges:

- Calibrate the instrument (using model sky)
  - Efficient parameter fitting

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- Algorithms SAGECAL, STEFCAL
- Program DPPP, streaming framework

- Recover an image of the sky:
  - Efficient gridding of UV data on GPUs
  - Fourier Transform
  - Deconvolution algorithm CLEAN
  - Program AWIMAGER, using CASA

CEA

Karl Kosack presents the CEA activities and the CTA pipeline.

The expected contributions from CTA pipeline in Task 3.4 delivering first software library (tools from CTA that could be used by others): e.g. signal processing, sparsity, machine learning, Higher level science tools.
The CTA approach of building up a pipeline framework is top-down gluing between various components. CTA could provide and benefit from the OBELICS collaboration in setting up a set of common APIs (in Phyton) and user interfaces packaging, etc.

LAPP

Pierre Aubert (EC-funded member of LAPP team) presents his current work in ASTERICS exploring the different HPC computing architectures and benchmarking performance after coding optimization.
Gamma-ray events reconstruction with Cherenkov telescopes through Hillas method is considered as a first use-case and the goal is to optimize the computing time of the CTA pipeline. A first OBELICS result is a memory reduction in the CTA pipeline of 34% thanks to optimization of data format in memory and memory usage in the computation.
SSE4, AVX and AVX 512 architecture were explored.

The interests of this study in OBELICS is in the efficient use of computers (CPU, GPU, ...) :

- Save Computing time
- Save development time
- Save electricity and money
- Green HPC

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INAF

Cristina Knapic presents the INAF-TS involvement in sub-Task 3.4.2 which started mainly on the Authorisation, Authentication and Accounting issue through: i) analysis of existing requirements and protocols (SKA, CTA and EUCLID ESFRI use-case are considered first) ; ii) proposal and implement, as required, a global infrastructure using agreed-upon standards.
Other contributions will be on:

- Workflow architectures for the orchestration of compute-intensive data analysis on distributed computing infrastructures.

Workflows tools to structure complex scientific experiments in order to enable and accelerate scientific discoveries by « Users » which are:

- researchers
- projects (orchestrate high level pipelines and infrastructures)
- science gateways

Identify, suggest and prototype solutions for ESFRI projects is proposed.

- Liaison and coordination with WP4 (DADI) aims at
  Avoiding effort duplication.
  Assuring interoperability among the solutions/developments arising from the two ASTERICS packages.
  Providing a means for WP3 requirements to be taken into account in WP4 activities.
  Providing a means for WP4 comments/constraints to feed back WP3 activities.

INFN

Cristiano Bozza represents the INFN-KM3Net team in OBELICS.

Some first contributions to be included in the first 12 M deliverables of Task 3.4 are:

- CORSIKA benchmark data.
- ROOT extension with astrophysical datasets/packages
- ROOT-based machine learning and multivariate analysis tools: Neural Networks, (Forests of) Boosted Decision Trees; ROOT libraries in CUDA.

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APC

Eric Chassande-Mottin on behalf of EGO leads the APC contribution in Task 3.4 aiming at producing « Statistical methods for multi-messenger astrophysics with gravitational wave ».

Ideas for GW-EM association statistical assessment:

- Analyse data jointly – Define joint GW-EM likelihood

1. Different observables (cannot form images with GW)
2. Function of the characteristics of the GW and EM transients (luminosity, duration)
3. Measures the overlap in direction between GW and EM transients

- Estimate joint background from archival data
  From random associations of simulated GW triggers and spurious EM transients (e.g., cosmic rays, ...)

- Deduce p-value for an observed association
  How likely is this coincidence to be fortuitous?

A preliminary work plan:

Implementation of a joint GW-EM analysis scheme
  Perform custom selection cuts to extract marginal sub 5-s GW and EM events.

Test using real observations
  Recent aLIGO data & INTEGRAL (ACS)
  Benchmark for GW/High-energy observation

Questions to be answered
  Provide quantitative assessment of a joint observation
  Can two ~3-s events be combined into one 5-s ?

FAU not attending the meeting provided information:

« The contribution of FAU to Task 3.4. could be an interface between ROOT and Jupyter first for KM3NeT data and later on for common data formats evolved within OBELICS. The contribution of FAU to Task 3.2 would be exactly along the lines of the computing challenges Tammo presented for LOFAR (FAU coordinates the KM3NeT computing and software group and the challenges of KM3NeT are exactly the same) - and more specifically in sub-tasks 3.1 and 3.3 »

IAP missing

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Task 3.3 D-INT

A kick-off of Task 3.3 takes place. ASTRON and LAPP lead this task.
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**) leads and chairs the session.
LAPP coordinator has been recruited and will start in April 2016. **Jean Jacquemeir** co-leads interim.

Tammo Jan Dijkema gives a short presentation about LOFAR integration challenges.

The LOFAR long-term archive model purpose and its computing model are shown.

Main Archive challenges are:

- Design Complexity
- Data Model, provenance
- Procedures Databases, queries
- Network Authentication, ownership
- User interfaces, documentation

Main Infrastructures challenges are :

- Network connections
- Security on high bandwidth
- Storage/Retrieval parallelization, previews
- Robustness, redundancy
- Multi node service scaling
- Inter-institute coordination
- Monitoring, alarms
- VM's, cluster file systems, RAID

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A list of problems to be solved and based on current experience within LOFAR is shown.

Engagement of experts from data centres is recommended.

Giovanni Lamanna mentions the involvement of LAPP on aspects responding to the CTA and LSST requirements and addressed in all four sub-Tasks of 3.3.
Jean Jacquemeir is the interim LAPP-CTA contact for Task 3.3. Two more colleagues (one CTA and one LSST) will join respectively starting on April-June 2016 and on October-November 2016.

IFAE

Tarek Hassan reminds the CTA development to produce through Mote Carlo simulation the Instrument Response Functions of the array of Cherenkov telescopes. 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 dev. (Task 3.3).

Tammo Jan Dijkema takes note of contact persons per institute and invites to discuss in the WIKI forum.

Task 3.3 participants:

Partner	LAPP	ASTRON	INAF	UCAM	UCM	IFAE	FAU	INFN
Effort (PM)	72	48	48	48	8	14	36	6
Contact point	Jean Jacquemier*	Tammo Jan Dijkema	Marco Molinaro, Stefano Gallozzi	Bojan Nikolic*	José Luis Contreras	Tarek Hassan	Kay Graf	Cristiano Bozza

(*: contact point until new hire arrives)

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Task 3.2 D-GEX

A kick-off of Task 3.2 takes place. UCM and INAF lead this task.
The major common challenge addressed in this task is to create more robust hardware and software solutions for the handling of ever increasing data streams. A three-step process is promoted within Task 3.2: a) share studies and seek synergies, b) foster evaluation and adoption of innovative solutions, c) sharing common prototype frameworks and standards.

Four sub-tasks are listed in the OBELICS proposal; the first three ones are under UCM coordination while the fourth is led by INAF.

1) Study real-time streaming data architectures and common software frameworks/modules.

2) Developing new and common data models and high performance formats for data streaming, compatible with interoperability standards.

3) Developing prototype libraries that allow robust and optimised handling of secondary data streams and meta-data.

4) Benchmarking low-power computer platforms (including Multicore, MIC, Microservers, GPU, FPGA, ARM) and software technologies/methods for data-driven scalable parallel programming.

Marco Lopez (UCM) chairs the session and presents a work plan for Task 3.2, sub-tasks 1-to-3.

- Data Format Survey: Survey and comparison of standards used in ESFRI projects and related pathfinders.
- Prototype Development: Prototypes of Data Access Libraries (DAL) for selected formats, tests of libraries on CTA and evaluation of results.
- Extension to other ESFRI Projects: Proposal for Standard DAL (SDAL) to support ESFRI projects, training sessions and documentation.
- Final Evaluation: Development of SDAL library, implementation on ESFRI projects and final evaluation and lessons learnt reports.

Data Format Survey has started and inputs are provided by a series of partners. Prototype developments are in progress based first on CTA data prototypes.

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Angelo Antonelli (INAF) leads the sub-task 3.2.4.

Angelo Antonelli shows the activities related to CTA and the ASTRI project concerning the application of new generation devices (such as of GPUs NVIDIA Jetson TK1 integrating CPU & GPU in a single mini-board) for front-end and/or on-line processing data.

Other projects (e.g. LOFAR, KM3Net, GW, ..) are aiming to make similar developments and take advantage of the INAF benchmarking. A list of contacts will be defined and a group will be put in place.

Established contact points are:

Bojan Nikolic – UCAM – SKA
Tamo Jan Dijkema – ASTRON – Lofar
Pierre Aubert – LAPP – CTA
Marcos Lopez – UCM – MAGIC and CTA
Tarek Hassan - IFAE – CTA
Cristiano Bozza – INFN – KM3Net

OBELICS management, plan and deliverables

Giovanni Lamanna presents the main deliverables for the first year/year and half and proposes milestones to achieve them to tasks coordinator.

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, 3.10
Annual user engagement forum, workshops and training events
Task 3.1
M12, M24, M36.
Leader Institutes: LAPP

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

The OBELICS project plan delivered at M4 will be revisited and a new version will be published on M16.

Giovanni Lamanna discusses one valuable approach towards the completion of D3.3 : organize a workshop based on computing model and archive requirements convening scientists, ESFRIs and e-infra. providers to learn more about:
i) services for workflow management;
ii) cloud computing and data-cloud (for open science?);
iii) computing architectures (combining HTC, HPC and LPC);
iv) defining training or briefing sessions for workload management services.

This and all actions discussed are listed in the new table of Action points n.3.
The table of Action points n.2 is updated (and also reported in this document).

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Action points OBELICS 2 (updated on 27/1/2016)

Action Number	Responsible	Description	Status
2.1	Tammo	Provide inputs about ASTRON participation in OBELICS and the ASTRON-OBELICS hiring plan.	CLOSED
2.2	Lucio Angelo Antonelli	CTA summary data challenges description	CLOSED
2.3	Giovanni Lamanna	LAPP complete hiring plan for task 3.1 and 3.3	3.3 CLOSED
2.4	Eric Chassande-Mottin	Inputs from APC about hiring plan.	OPEN
2.5	Jose Luis Contreras and Lucio Angelo Antonelli	UCM and INAF-RM meet and discuss task 3.2 leaders appointing	CLOSED
2.7	Marco de Vos and Giovanni Lamanna	ASTRON and LAPP meet and discuss task 3.3 leaders appointing	CLOSED
2.8	Bojan Nikolic and Fabio Pasian	Report about Task 3.4 meeting and disseminate information and meeting call to a full OBELICS mailing list.	CLOSED
2.9	Bojan Nikolic and Fabio Pasian	Prepare the planning of the task 3.4 activities and propose a tentative agenda for a face-to-face meeting to be held during the OBELICS meeting (see action point 2.16).	CLOSED
2.10	Cristina Knapic	Report about A&A investigation with AARC project, EUCLID and CTA.	CLOSED
2.11.*i* (for each *i* task)	Task leaders (TBD)	Deliverables production plan; responsibility assignment; start organizing the first face-to-face meeting in January 2016.	CLOSED
2.12.i	Each Partner	Update information on hiring plan	In progress
2.13	Rosie Bolton	Provide SKA summary description of major Data Management challenges (in particular those addressed by OBELICS)	OPEN
2.14	Rob van der	Based on the table of OBELICS participants	OPEN

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	Meer	update the ASTERICS 'who is who' database and provide mailing lists.	
2.15	All	Feedback on first test of REDMINE tools for OBELICS/ WIKI/ repository on WEB…	In progress
2.16	Giovanni Lamanna & Mike Garret.	Communicate the place of the 26-27 January 2016 OBELICS meeting co-located with the ASTERICS General Assembly meeting.	DONE
2.18	Giovanni Lamanna	Send minutes of meeting plus action points	DONE

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Action points OBELICS 3

Action Number	Responsible	Description	Status
3.1	Giovanni Lamanna	Send minutes of meeting plus new table of action points	CLOSED
3.2	All partners	Updating Hiring Plans	OPEN
3.3	All partners	Updating list of OBELICS participants	OPEN
3.4	Bojan Nikolic and Fabio Pasian	Task 3.4 work and project plan; Deliverables D3.4 production plan; responsibilities assignment.	OPEN
3.5	Jose Luis Contreras/ Marcos Lopez and Lucio Angelo Antonelli	Task 3.2 work and project plan; Deliverables D3.3 production plan; responsibilities assignment.	OPEN
3.6	Tammo Jan Dijkema and Jean Jacquemeier/Giovanni Lamanna	Task 3.3 work and project plan Deliverables D3.5 production plan; responsibilities assignment.	OPEN
3.7	Giovanni Lamanna	Next OBELICS meeting on Deliverables and Task plans (in March).	OPEN
3.8	Giovanni Lamanna and Tammo Jan Dijkema	Collecting ESFRI computing model and major data management challenges in support of first 12 M workshop and deliverable D3.5.	OPEN
3.9	Rosie Bolton/Bojan Kikolic	Provide SKA summary description of major Data Management challenges (in particular those addressed by OBELICS)	OPEN
3.10	Rob van der Meer	Based on the table of OBELICS participants update the ASTERICS 'who is who' database and provide mailing lists.	OPEN
3.11	Task and sub-task leaders	Define choice and suggestions for using REDMINE tools, OBELICS WIKI/ forum, repository on WEB both for internal use and external dissemination.	In progress
3.12	Giovanni Lamanna	Deliver a WP3 report to Rob and Giuseppe for the next AGA meeting (11 February 2016)	OPEN
3.13	Giovanni Lamanna and Task leaders	Collecting ideas about first OBELICS Training event.	OPEN

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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	Karl	Kosack	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	Marco	de Vos	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 3: 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	10	46	36
CTA	INAF-RM	X	Y	1	TBR	3.3	10	46	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	Bar	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

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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
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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