ESCAPE EOSC Thematic Cluster: OSSR

Kay GRAF, ECAP, Friedrich-Alexander Universität Erlangen-Nürnberg

DMS-ST2 Meeting: Discussion with ESCAPE WP3

March, 22nd, 2021

ESCAPE - The European Science Cluster of Astronomy & Particle Physics ESFRI Research Infrastructures has received funding from the European Union's Horizon 2020 research and innovation programme under the Grant Agreement n° 824064.

EOSC & ESCAPE

Funded by the European Union's
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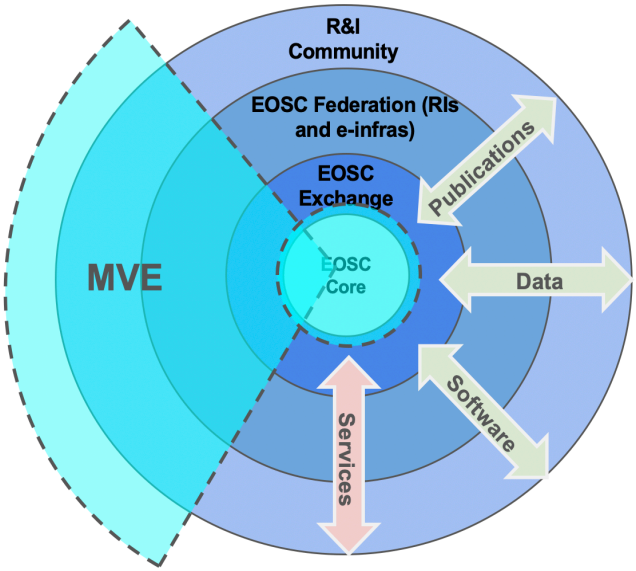
EOSC Embedding

EOSC (M)architecture

- EOSC-Core
  - Minimum architecture elements to enable the Federation
- EOSC-Exchange
  - Evolving Federation to serve the needs of research communities
  - Widening to the general public and the private sector
- Minimal Viable EOSC (aka MVE)
  - Minimum Federation to bring value to users



From: https://www.esfri.eu/sites/default/files/Abramatic_Session-2_ESFRI-EOSC_06.10.20.pdf

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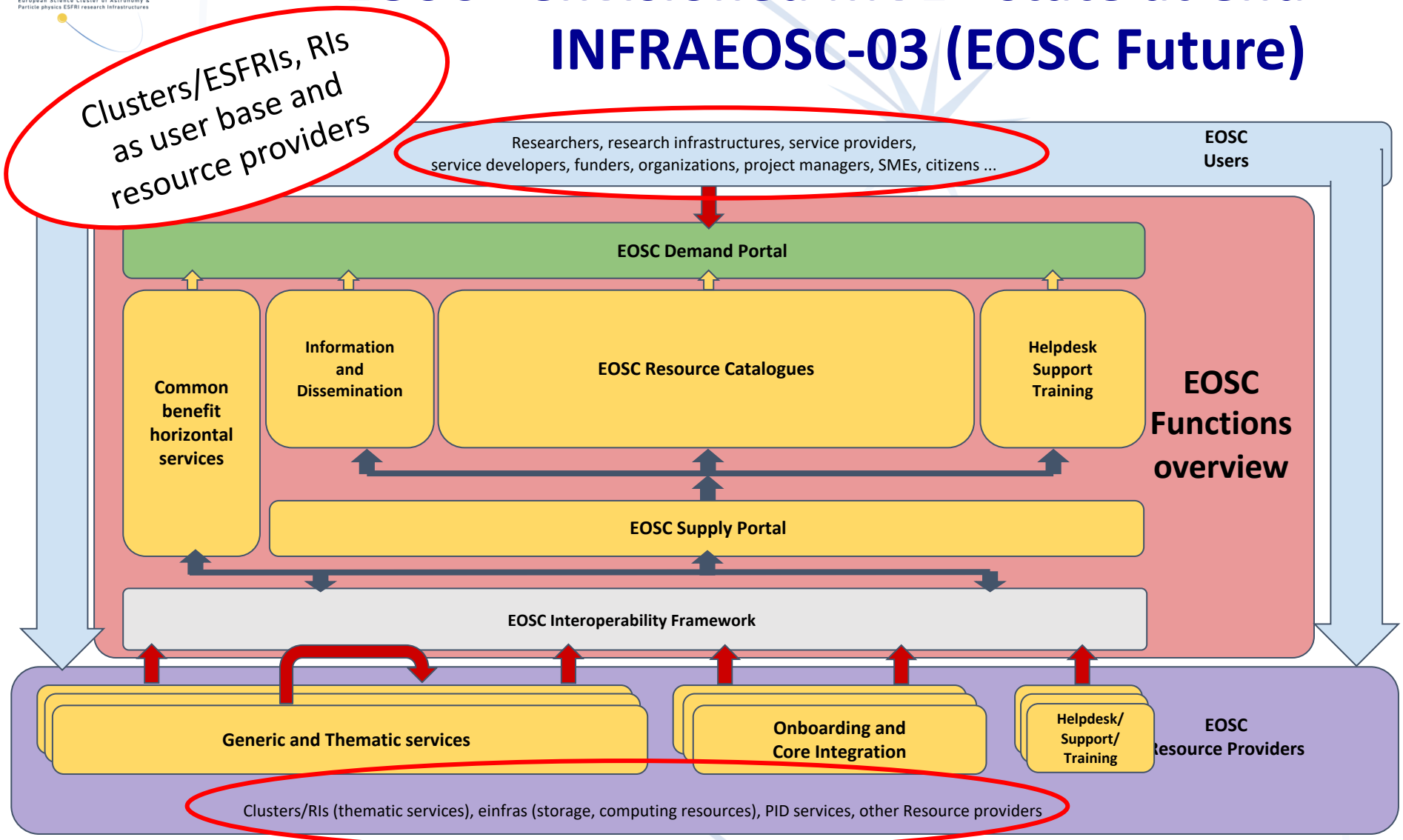
EOSC - envisioned MVE - state at end INFRAEOSC-03 (EOSC Future)



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Five EOSC Clusters

- *The EC funds clustered participation to EOSC; funding based* ***on the number*** *of pan-European research infrastructures (****EUR 1.5 - 2 million for each ESFRI project/landmark)*** *in the clusters*
- **Clusters funded in H2020-INFRAEOSC-04-2018**
  - **EOSC-LIFE:** Life science RIs
  - **ENVRI-FAIR:** Environmental Research Infrastructures
  - **ESCAPE: Astronomy and Particle Physics**
  - **PANOSC:** Photon and Neutron sources RIs
  - **SSHOC:** Social Sciences and Humanities

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ESCAPE in a Nutshell

ESCAPE - *https://escape2020.eu* - convenes a large scientific community

- **31** partners (including 2 SMEs), representing:
  - **7** ESFRI projects & landmarks: CTA, ELT, EST, FAIR, HL-LHC, KM3NeT, SKA
  - **2** pan-European International Organizations: CERN, ESO
    (with their world-class established infrastructures, experiments and observatories).
  - **4** supporting ERA-NET initiatives: HEP (CERN), NuPECC, ASTRONET, APPEC
  - **1** involved initiative/infrastructure: EURO-VO
  - **2** European research infrastructures: EGO and JIV-ERIC
- Budget: **15.98 M€**
- Started: **1/2/2019**
- Duration: **42** months (end date 31/7/2022) – extd. to **48** months (31/01/2023)
- Coordinator: **CNRS**
- *Each RI commits to ESCAPE,* ***teaming up with a sub-set of associated national stakeholders.***

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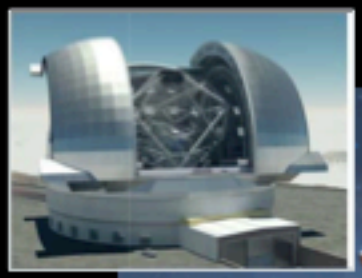
ESCAPE Partner RIs

Radio

SKA

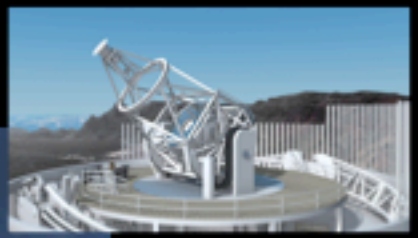
JIVE-VLBI

Visible light



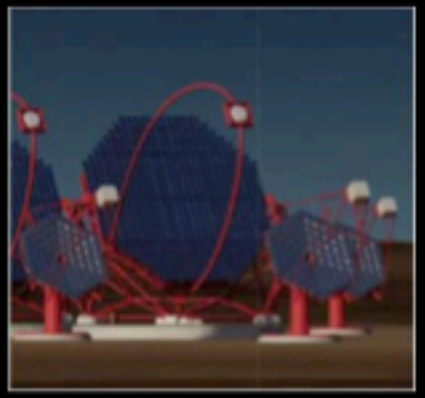
ELT

ESO



EST

Gamma rays



CTA

Accelerator-based Particle Physics

HL-LHC

CERN

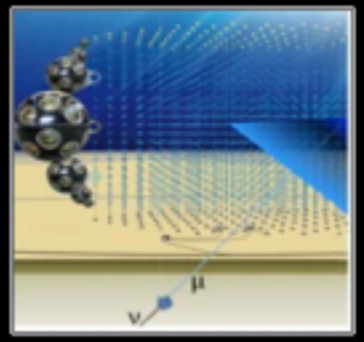
Accelerator-based Nuclear Physics

FAIR

Gravitational Waves

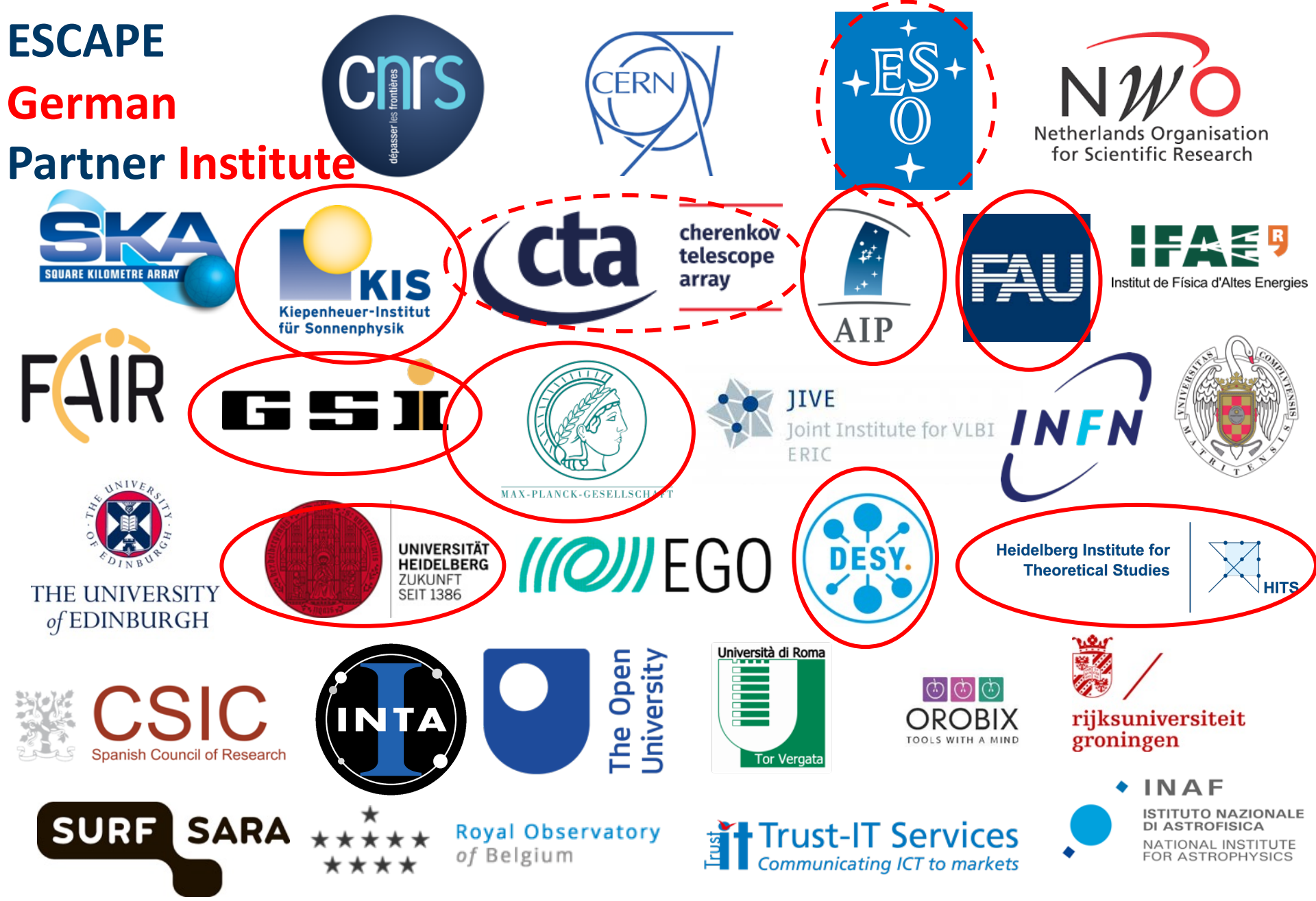
EGO-VIRGO

Cosmic-rays Neutrinos



KM3NeT

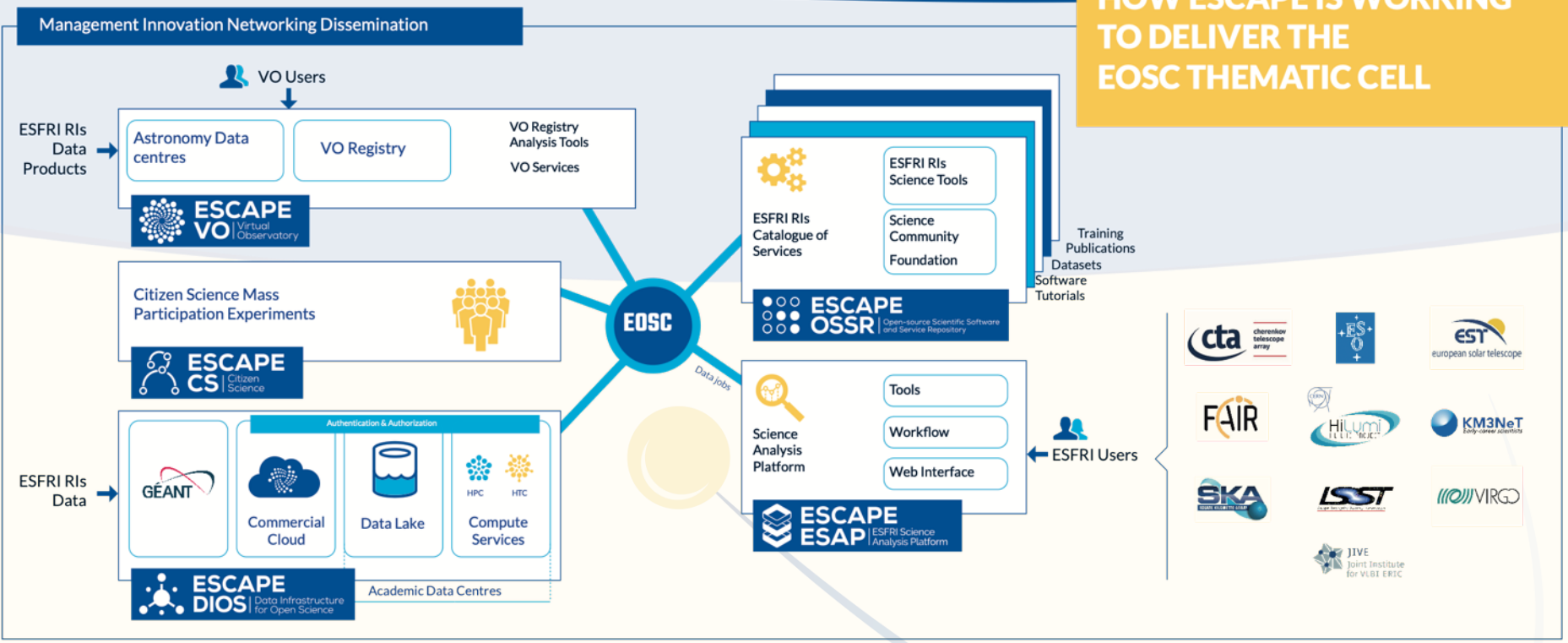
ESCAPE German Partner Institute



European Science Cluster of Astronomy & Particle physics ESFRI research infrastructures

ESCAPE brings together the astronomy, astroparticle and particle physics communities, as well as a cluster with European Strategy Forum on Research Infrastructures (ESFRI) projects. These ESFRI have demonstrated capabilities in addressing various stages of data workflow and concerned with fundamental research through complementary approaches.

HOW ESCAPE IS WORKING TO DELIVER THE EOSC THEMATIC CELL



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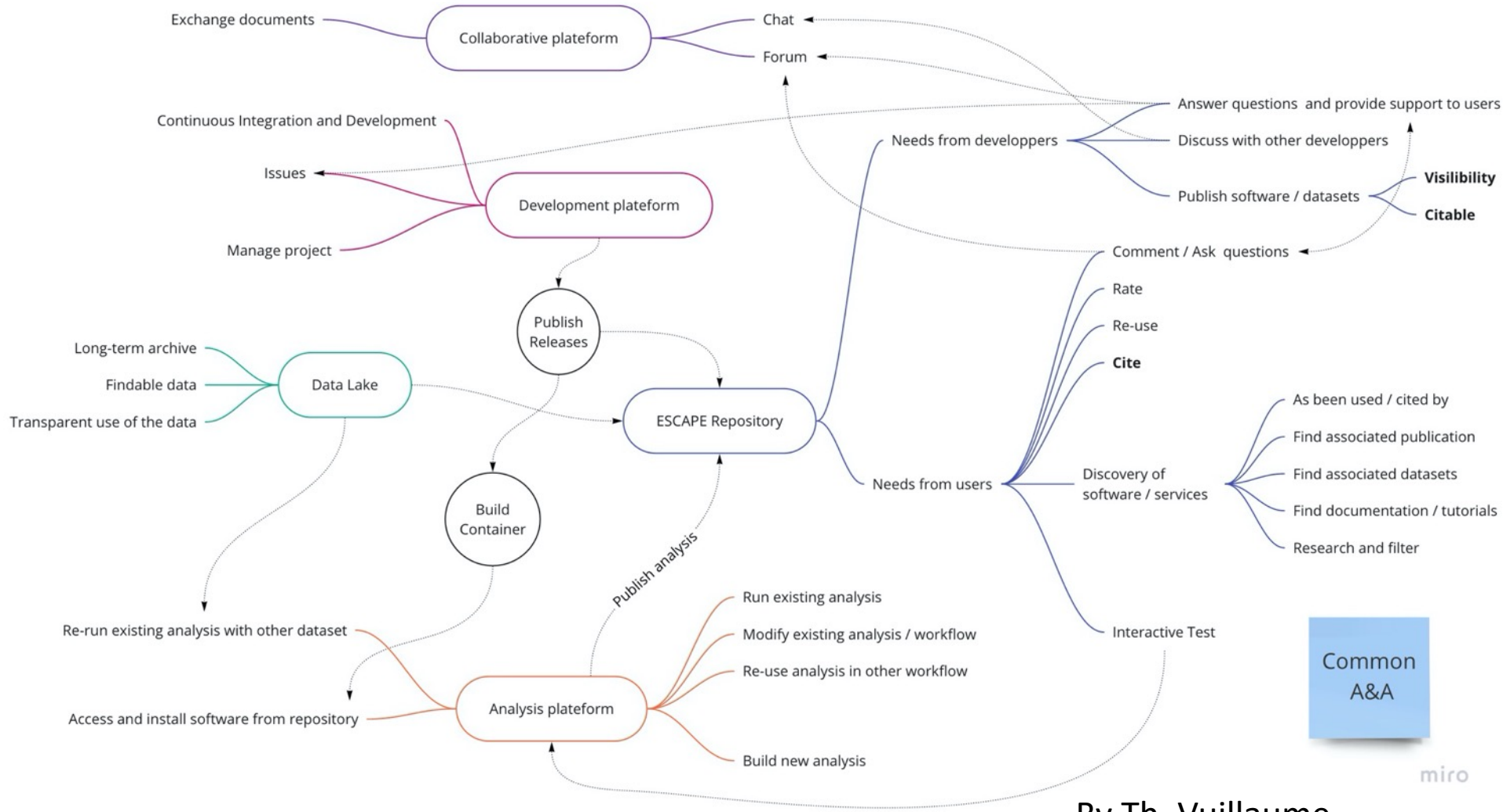
ESCAPE Virtual Research Environment Tested via Science Projects



By Th. Vuillaume

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OSSR

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E-OSSR Aims and Objectives

- **Aim:**
  shared open science software and services based on FAIR principles
- Objectives:
  - Facilitate and support continuous **development, deployment, exposure and preservation** of partners' software/tools/services
  - Foster **interoperability, software re-use and cross-fertilisation** between ESFRIs (e.g. simulation)
  - Offer an **open innovation environment for open standards** (e.g. workflows, data-formats), **common regulations** and **shared (novel) software** for multi-messenger & multi-probe data
- All objectives follow:
  - Paradigm of **enabling open science** – with **software as "first class citizen"**
  - a **community-based, inclusive** approach
  - the **FAIR principles** for open science resources – software and derivatives
  - **Federation** of available resources

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Co-Development and Community Engagement

23 July 2020 to28 July 2020

ESCAPE Workshop on Open-Source Software Life Cycles

Virtual

Software development is an integral part of modern science, gaining knowledge from data. All ESCAPE partners develop and

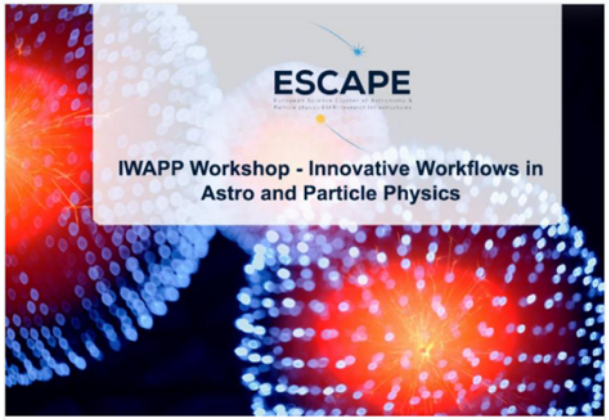
[...]

17 February 2021

Webinar: ESCAPE OSSR | Enhancing science through sharing software - benefits & use cases

Virtual

When: 17th February 3pm CET. In the webinar "ESCAPE OSSR Enhancing science through sharing software - benefits & use cases" we will show the ESCAPE OSSR developments and achievements towards a FAIR multi-messenger data-driven cooperative approach.



08 March 2021 to12 March 2021

IWAPP Workshop - Innovative Workflows in Astro and Particle Physics

Online

The objective of this workshop is to bring together the scientists' communities of Astrophysics, Astroparticle Physics and Particle Physics who are leading the development of Innovative Workflows within their domain.

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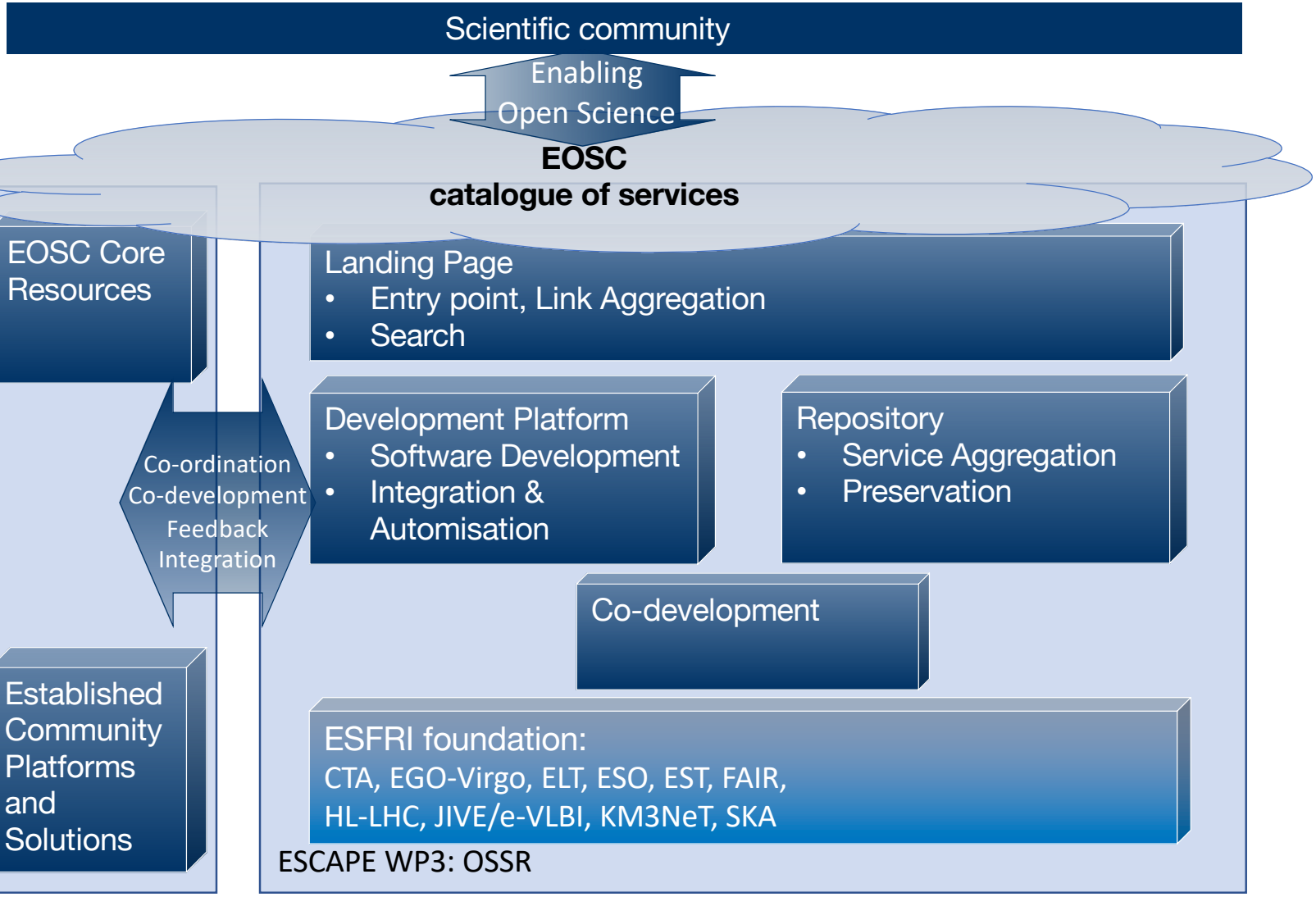
OSSR Prototype



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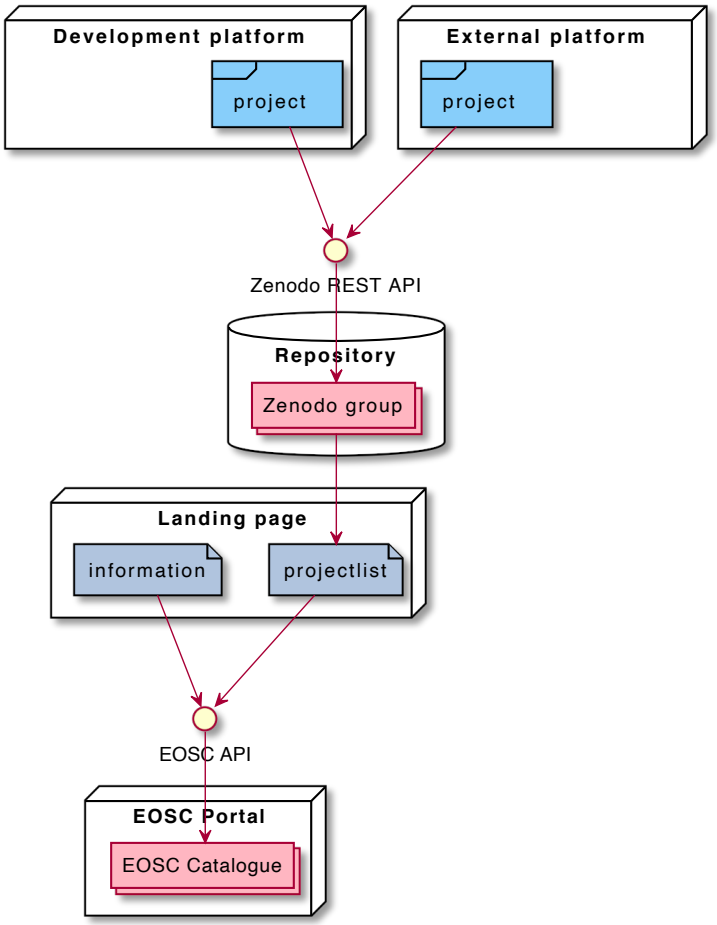
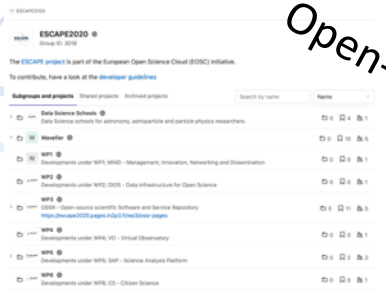
OSSR Prototype - Schematic

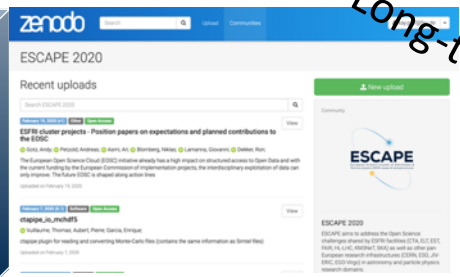


Development Platform
- Software Development
- Integration & Automization



Open-source

Repository
- Service Aggregation
- Preservation



Long-term

Landing Page
- Entry point, Link Aggregation
- Search

Federation

Same structural approach as [CERN Open Data Portal]

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OSSR Use Cases

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An example of open science project: The Crab bundle

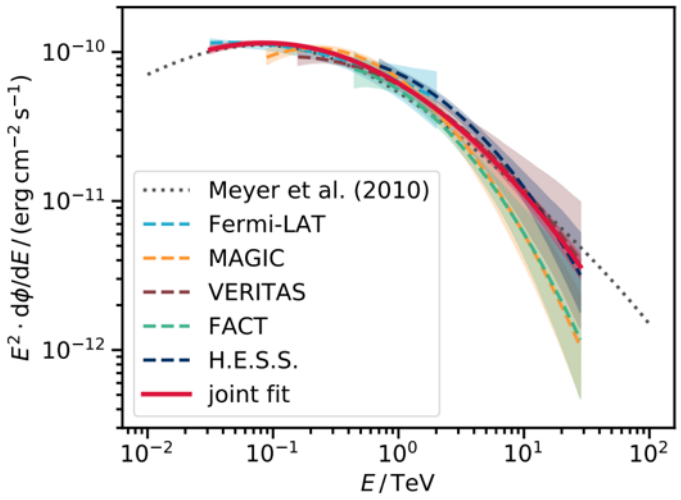

Fig. 2. Crab nebula SED for individual instrument fits and from the joint fit. Single-instrument results are represented with dashed lines, the fit of all the datasets together, labelled as joint, is represented as a thick, solid red line. The shaded areas represent the SED error bands whose calculation is explained in Sect. 3.2. The dotted line shows the model in Meyer et al. (2010).

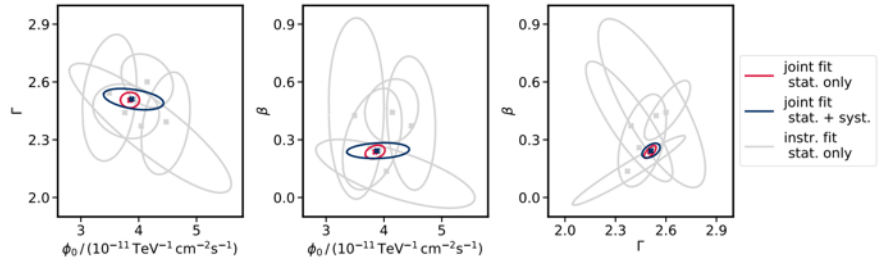

Fig. 5. Likelihood contours corresponding to 68% probability content for the fitted spectral parameters (ϕ_0, Γ, β), for the likelihood in Eq. (1) (red) and the likelihood in Eq. (5) (blue). Results from the individual instruments with the likelihood in Eq. (1) are shown in grey.

Multi-instrument gamma-ray analysis of the Crab Nebulae with Fermi-LAT, MAGIC, VERITAS, FACT and H.E.S.S.

Towards open and reproducible multi-instrument analysis in gamma-ray astronomy, C. Nigro et al, in A&A 625 (2019)

T. Vuillaume ESCAPE progress meeting https://indico.in2p3.fr/event/20203/

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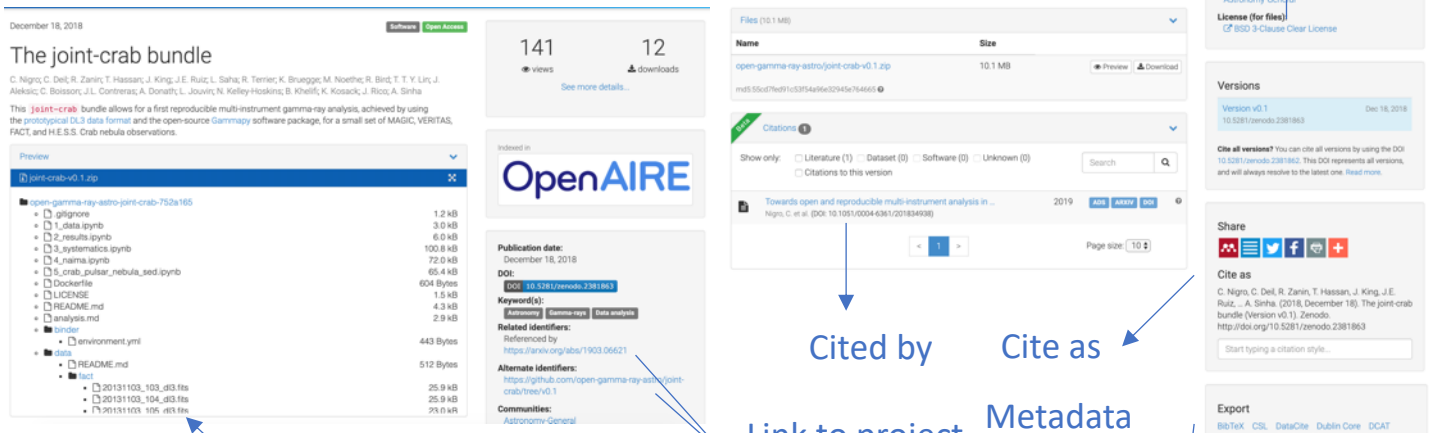
An example of open science project: The Crab bundle

The Crab multi-instrument gamma-ray analysis with MAGIC, VERITAS, FACT and H.E.S.S.
https://github.com/open-gamma-ray-astro/joint-crab/tree/v0.1
https://zenodo.org/record/2381863#.XkxcD5NKhhA



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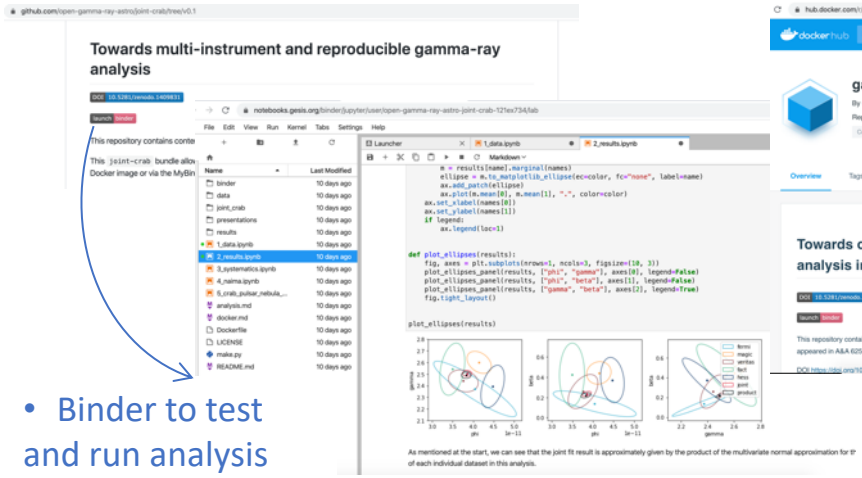

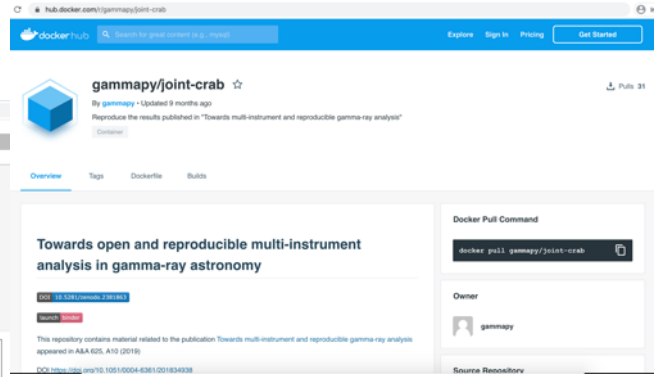

- Binder to test and run analysis interactively online
- Docker to ensure reproducibility

T. Vuillaume ESCAPE progress meeting https://indico.in2p3.fr/event/20203/

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How do we get here?

1. Thanks to the promotion and implementation of

FAIR principles

- **Findable** → Data is described with **rich metadata**, and assigned an **unique** and **persistent** identifier
- **Accessible** → Metadata identifiers follows **standard** (open, free, universal) communication protocols – accessible even when data is no longer available!
- **Interoperable** → Metadata uses a formal, accessible, shared, and broadly applicable language for knowledge representation (**metadata schema** or standard).
- **Reusable** → Data and collections have a **clear** usage **licenses** and provide accurate information on **provenance**.

E. Garcia, OSSR Webinar, 02/2021

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How do we get here ?

2. Providing the **infrastructure** and **services** to host **FAIR contributions**

- GitLab
  - Git repository hosted at cc-in2p3.
  - Fully connected with Zenodo by providing a metadata schema.
    - Various metadata standards are being investigated
  - https://gitlab.in2p3.fr/escape2020/wp3

- Zenodo
  - General general-purpose open access repository.
  - Hosted and operated by CERN (since 2013).
  - FAIR compliant !
  - https://zenodo.org/communities/escape2020

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OSSR environment - FAIR principles

- **Findable** → Data is described with **rich metadata**, and assigned an **unique** and **persistent** identifier

- Scientific project
- **Metadata file** (standard/schema)

zenodo

- **Persistent DOI**
- **Metadata (various exportable schemas)**

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OSSR environment - FAIR principles

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- Scientific project
- Metadata file (standard/schema)

- Persistent DOI
- Metadata (various exportable schemas)
- **Long term archived (CERN)**
- **Entries findable even if restricted/closed data.**
- **OAI-PMH harvest protocol**

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OSSR environment - FAIR principles

- **Interoperable** → Metadata uses a formal, accessible, shared, and broadly applicable language for knowledge representation (OSSR **metadata schema**; CodeMeta schema).

- Scientific project
- Metadata file (standard/schema)

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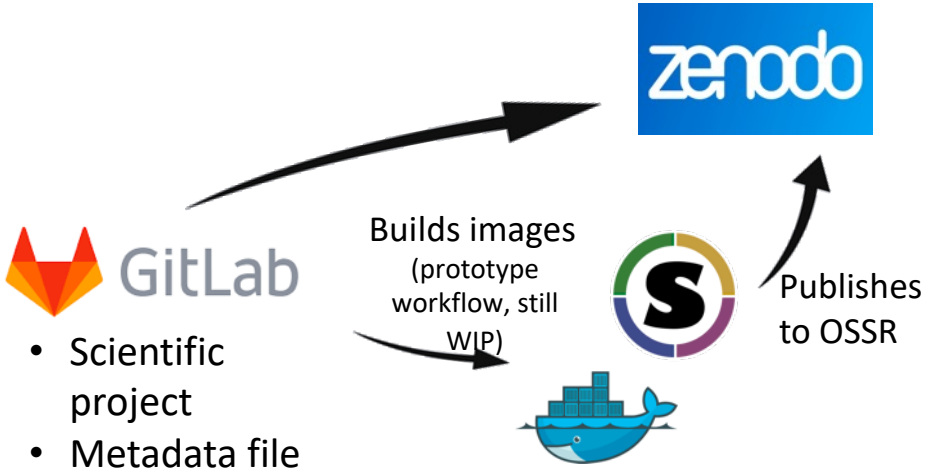
OSSR environment - FAIR principles

- **Reusable** → Data and collections have a **clear** usage **licenses** and provide accurate information on **provenance**.
  - OSSR Environment provides an integration service.



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Next steps – OSSR and EOSC

- Where are we ?
  - Define the **onboarding** procedures and start onboarding
  - **Connect** the ESCAPE services to create an integrated environment
    - ✅ OSSR environment
    - **WIP** ESCAPE services
  - Define **license**, **provenance** and **metadata guidelines** (preliminary version)
    - ✅ OSSR environment
    - **WIP** ESCAPE services
- What we aim for OSSR from the user perspective?
  - Starting a new **Science project** (through validation) sets up a complete linked virtual environment
  - Researchers / Institutes **contribute** to the science project by publishing software / data / workflow - the contributions are validated by science project curators.
  - Users can **search** the repository (OSSR / EOSC) or **explore** it through the science projects
  - **Enhancing** the FAIR principles in every contribution to the OSSR

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Summary

- OSSR implements an **open, inclusive repository** (catalogue) for the Astrophysics, Astroparticle Physics and Particle Physics community
  - embedded in the EOSC environment
- You can benefit from:
  - Onboarding science products into a FAIR, trust-worthy repository
  - Definition of best practices and standards; recognition of software as first-class open science product
  - Cross-fertilization through co-development, re-use and innovation
  - Technical implementations can be adopted to community solution
- Long-term curation under discussion with partners and in EOSC H2020 and Horizon Europe schemes

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Thank you!

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