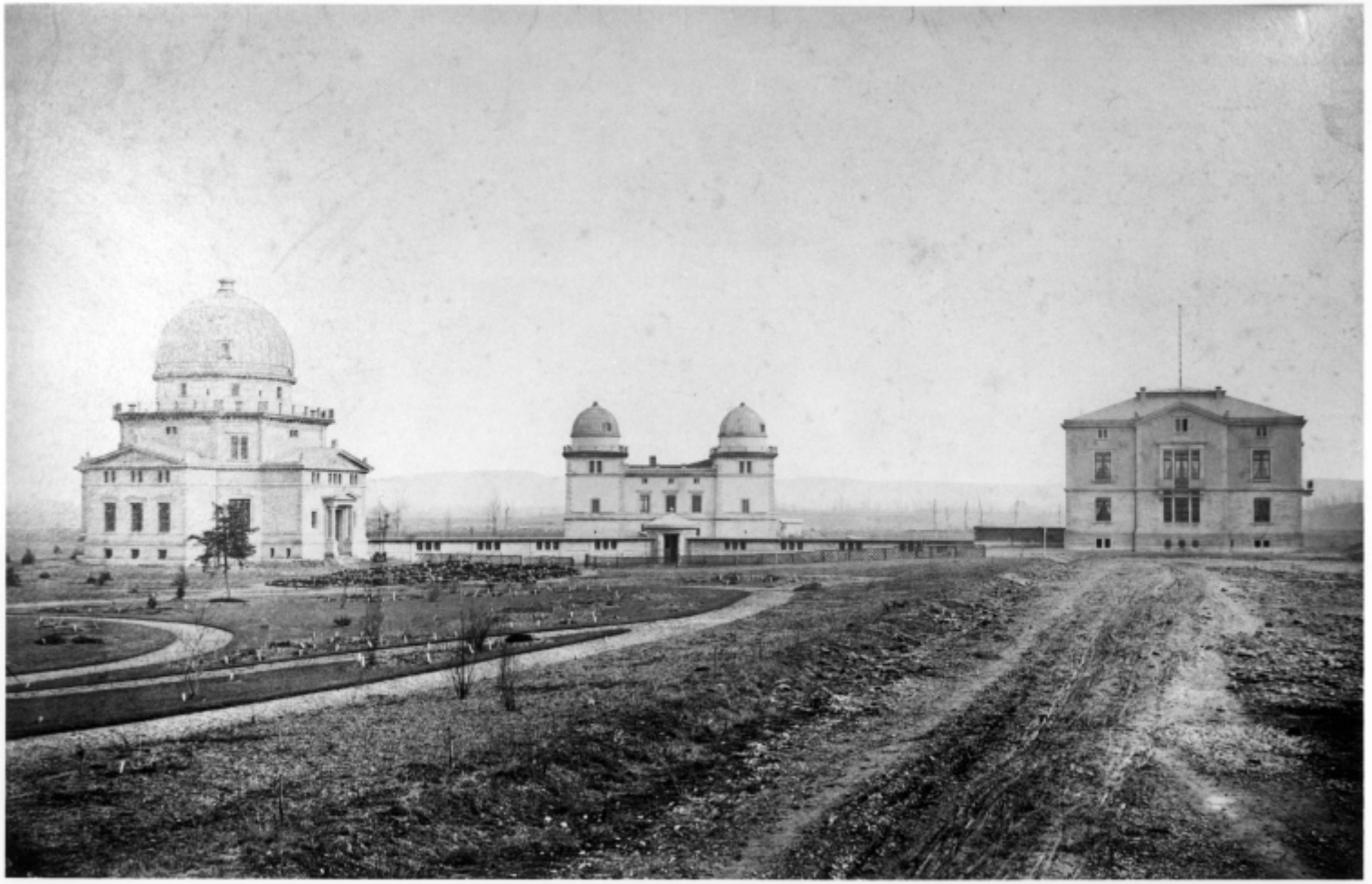
Conclusions of the ASTERICS DADI Technology Forums

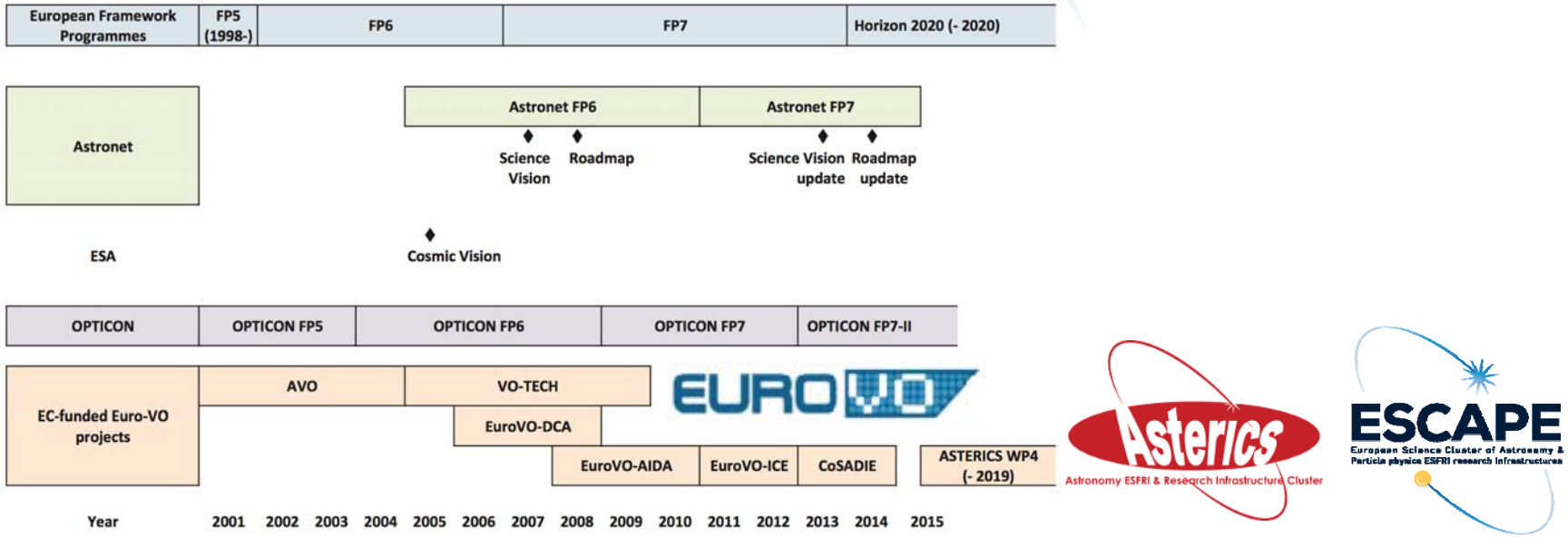
Françoise Genova



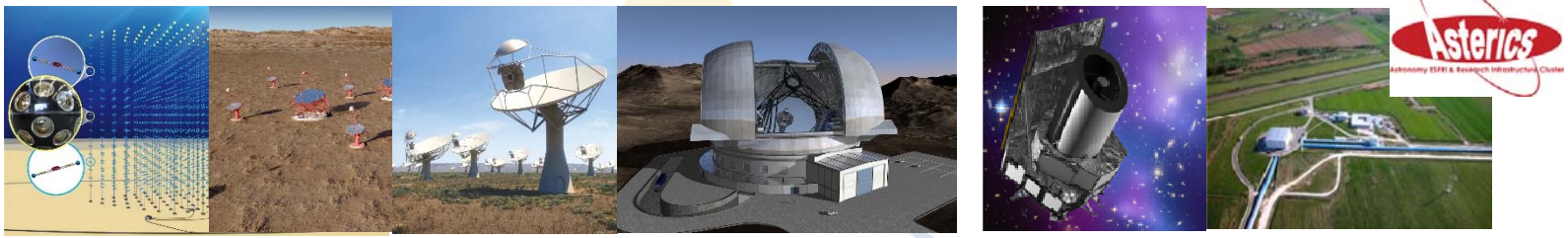
Background…

How we got here, and where we're going

- Virtual Observatory infrastructure for astronomy



Genova et al. 2015



Funded by the European Union's Horizon 2020 - Grant N° 824064

Pre-IVOA Interoperability meeting

Strasbourg, 28-29 January 2002

- Meeting of the OPTICON Interoperability Working Group
- VOTable (finalised in March 2002)
- 2001: AVO, NVO and AstroGRID
- May 2002: IVOA

Euro-VO projects

AVO
ASTROPHYSICAL VIRTUAL OBSERVATORY

2001-2004

EURO VO TECHNOLOGY CENTRE

2005-2009

EURO VO DATA CENTRE ALLIANCE

2006-2008

EURO VO AIDA Astronomical Infrastructure for Data Access

2008-2010

EURO VO ICE International Cooperation Empowerment

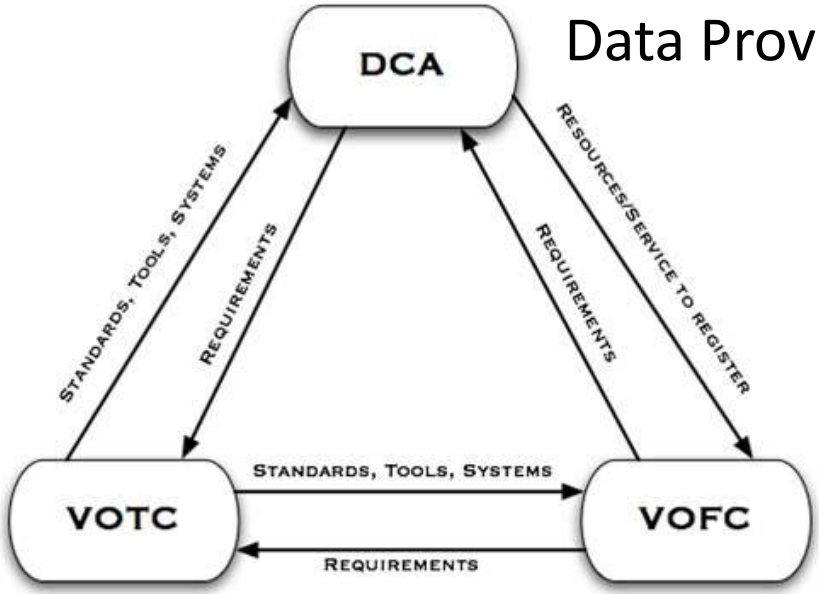
2010-2012

EURO VO CoSADIE Collaborative and Sustainable Astronomical Data Infrastructure for Europe

2012-2014

EURO VO

Data Providers



Technological Developments VO standards and tools

Astronomers

ASTERICS

- Cluster gathering ESFRI and ESFRI-like, large Research Infrastructures
- Astronomy + Astroparticle physics
- WP4 *Data Access, Discovery and Interoperability* DADI

- DADI (WP4) - Francoise Genova (CNRS-OAS):

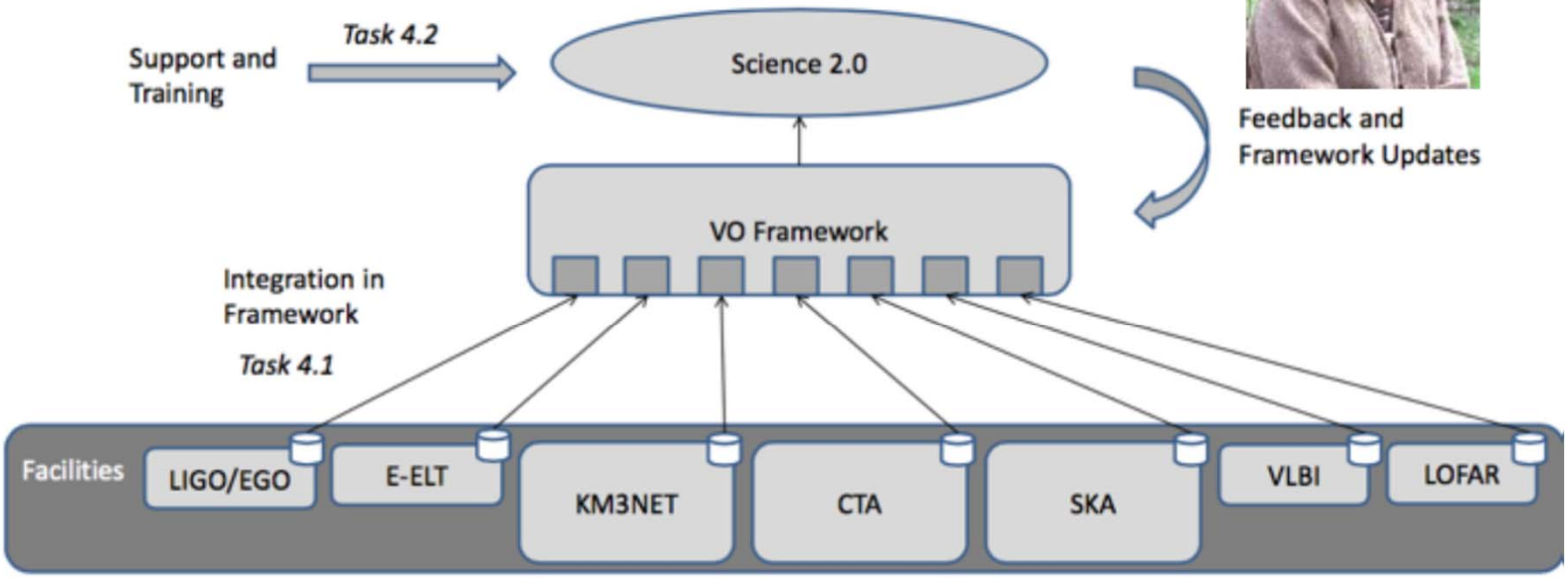


Figure 6: The ESFRI projects integrated in the VO Framework offers users uniform access.

Who's involved

- Euro-VO partners, i.e. VO initiatives from France (CNRS/OAS- CDS+UNISTRA), Germany (UHEI), Italy (INAF), Spain (INTA),UK (UEDIN)
- Representatives of ESFRI and pathfinders
  - CTA (CNRS/LUTH + OBSPAR)
  - EGO/VIRGO and ET (CNRS/APC)
  - KM3Net (CNRS/CPPM)
  - SKA (ASTRON)
- ESO is associated to the project
- ESA (ESAC) is working in close collaboration with Euro-VO
- EST joined in 2018!

Targets

Three Tasks in support to three complementary targets

- Task 4.1: Support to astronomy ESFRI facilities, their pathfinders and other infrastructures of pan-European interest for implementation of their data in the VO framework
- Task 4.2: Support to the astronomical community
- Task 4.3: Updates of the VO framework from feedback and requirements

Technology Forums CNRS-CDS/UEDIN

- Discuss the partners' technological activities
- Requirements and feedback on VO standards and tools
- Prepare contributions to IVOA

- The first was the first meeting of DADI
  - Getting to know each other
  - ESFRI presentations
- Two Tech Forums during the first year, then one/year
  - Strasbourg/Edinburgh

Initial priorities

- IVOA science priorities in 2014
  - Multi-Dimensional data
  - Time Domain
- With the ESFRIs in mind, also DADI's

Priorities

- DADI initial priorities
  - Multi-dimensional data
  - Time Domain

  Plus…
- Provenance – CTA becoming an actor in the VO in collaboration with ‘traditional’ VO participants

Multi-dimensional data

- « Caravan » of VO standards completed (cf F. Bonnarel's talk)
  - Multi-D data discovery
  - Link resources
  - Cutouts
  - HiPS
- They are in action in widely used services and adopted by data providers

Time domain

- Work started again in IVOA under ASTERICS team leadership (Ada & Dave)
- VO Event V2.0 used for alerts – OK with needs
- Ada's summary
  - Search and Find data
    - TIMESYS in VOTable will solve most of the use cases
  - Visualise data
    - T-MOC
  - Analyse data

DADI highlights

- Forum and Training Events > data providers' feedback
- Schools – evolving tutorials > science users' feedback
- In IVOA
  - Multi-D
  - Time Domain
  - Provenance
- AAI, platforms (modules), …

DADI impact

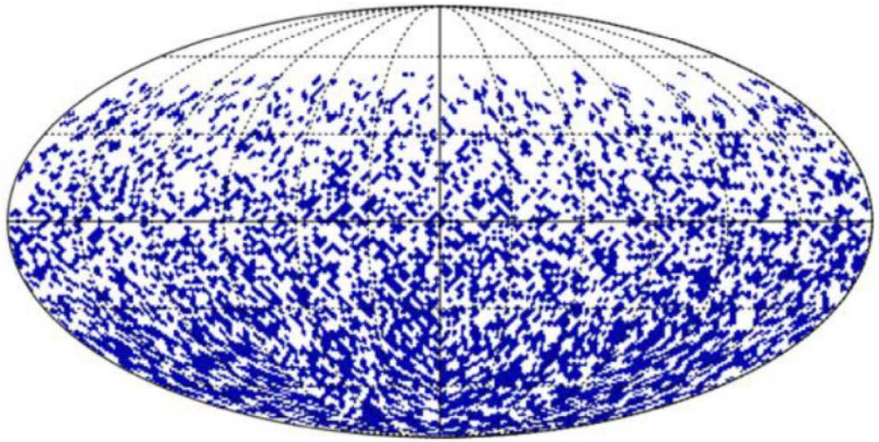
- Continued collaboration between the European VO teams
- Collaborations built with the ESFRI/ESFRI-like projects on VO development and usage
- Support to VO usage by Ris
  - ANTARES – KM3Net
- VO building blocks in the research infrastructure pipelines/services
  - Provenance for CTA
  - GWSky
  - VO in ESO system

Graf, Second DADI Data Provider Forum 2018

ANTARES Data in GAVO Data Centre

- "2007-2012 ANTARES search for cosmic neutrino point sources"
  - Update from 2010 to 2012 in Dec. 2017
- 5921 events obtained during the effective lifetime of 1338 days.
- Coordinates, simple energy estimator (number of photons detected)

⇒ test case for KM3NeT



from: http://dc.zah.uni-heidelberg.de/antares/q/cone/info

ASTERICS EDP Forum, Heidelberg - June 2018 - K. Graf, ECAP 13

Servillat, DADI Second ESFRI Forum, 2017

VO data access prototype

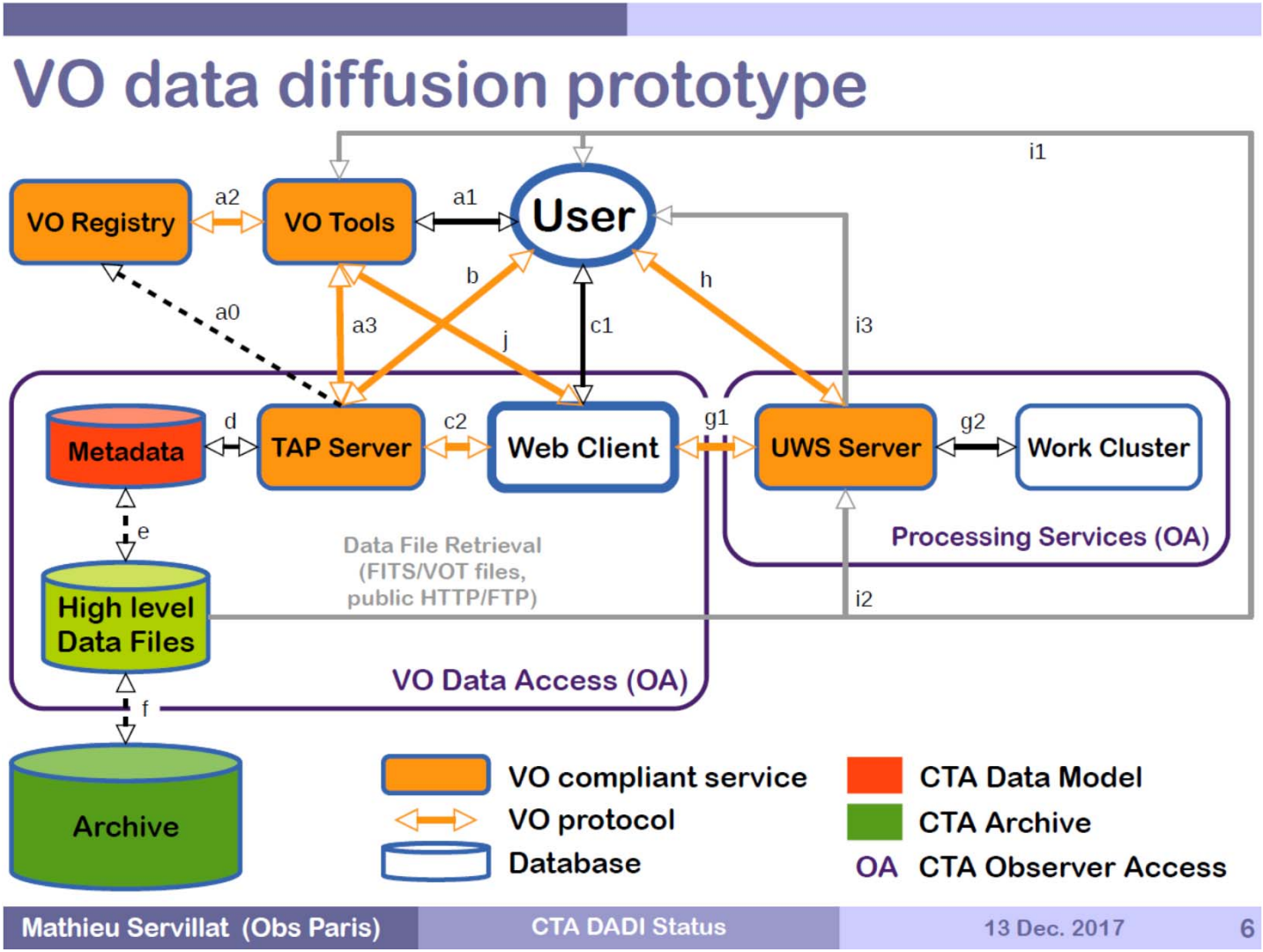
- **CTA Data Model** (not complete, still evolving)
  - https://forge.in2p3.fr/projects/model/wiki/UML_models
  - **Automatic** Conversion UML to SQL
  - Relational database implemented (PostgreSQL)
- **Data Ingestion**: CTA First Data Challenge (1DC)
- **VO Compliant**
  - IVOA ObsCore Data Model
  - GAVO DaCHS server: TAP, ADQL

  } ObsTAP
- **Web Client** (Django, jQuery, BootStrap)
- **Online Analysis**: UWS, SAMP
- **Single Sign On** solutions

► Complete solution based on VO standards/protocols

Mathieu Servillat (Obs Paris) | CTA DADI Status | 13 Dec. 2017 | 5

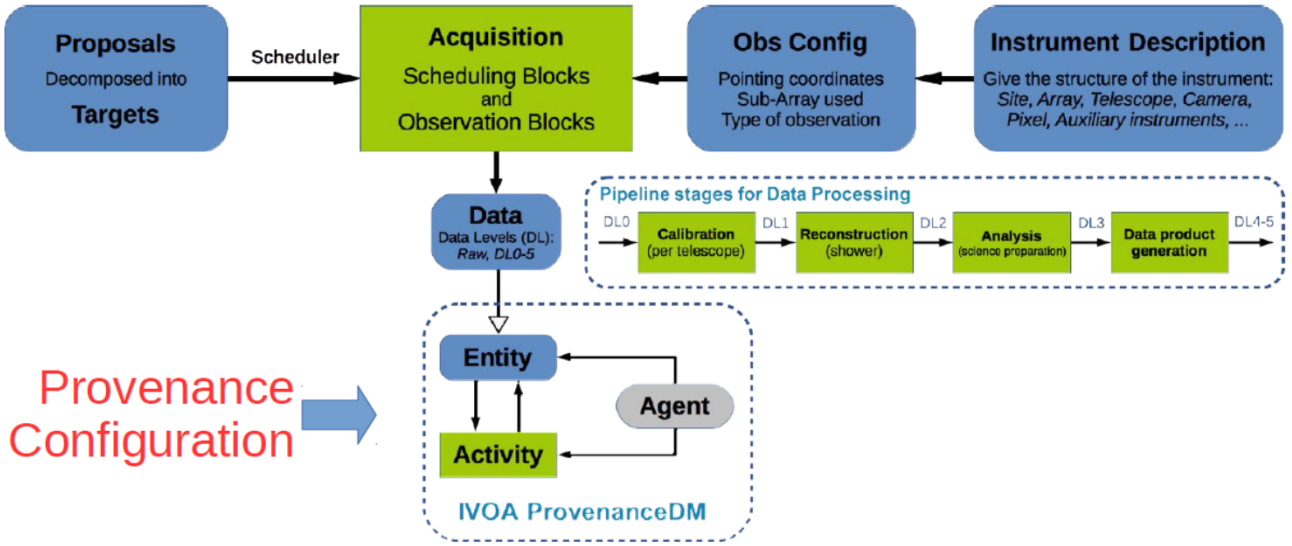
Servillat, DADI Second ESFRI Forum, 2017



Servillat, DADI Second ESFRI Forum, 2017

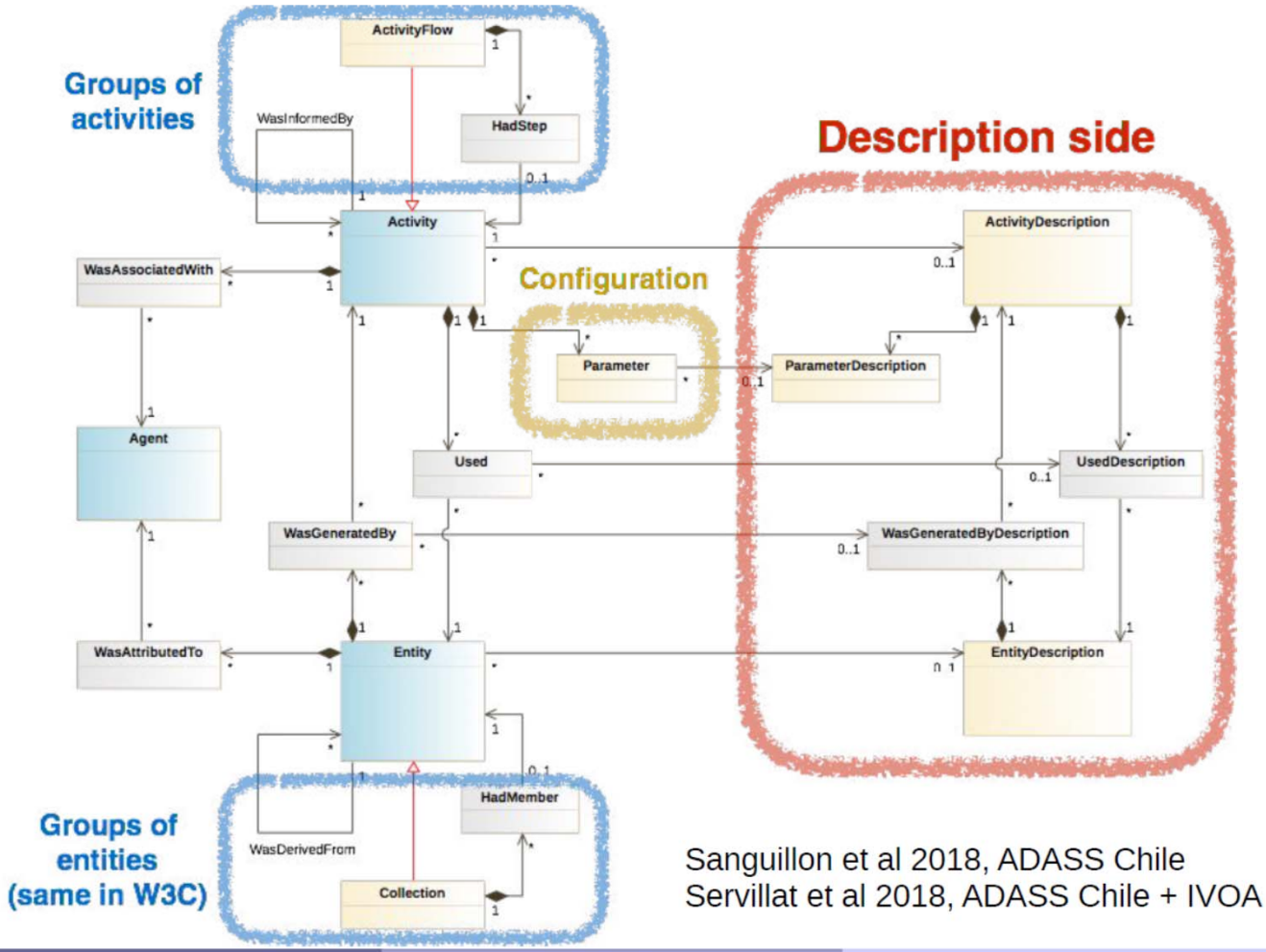
High level metadata model

- Defines **structure** of services, content and context of data
- Can be seen as a **global interface**



Servillat et al. 2017, ADASS Trieste

Servillat, DADI Second ESFRI Forum, 2017

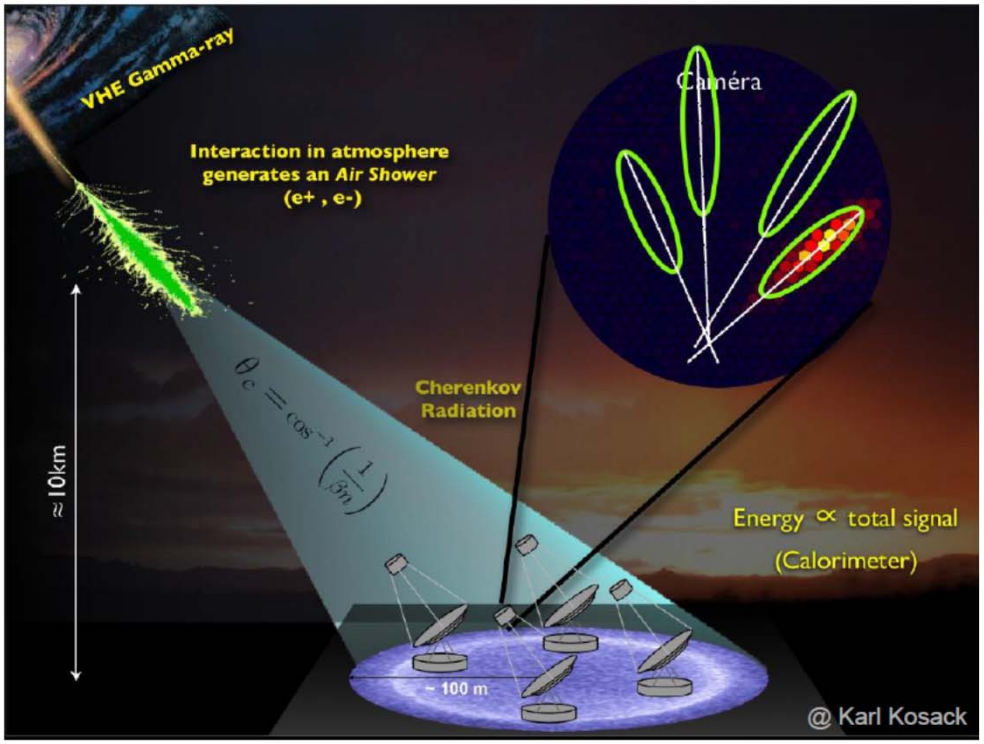


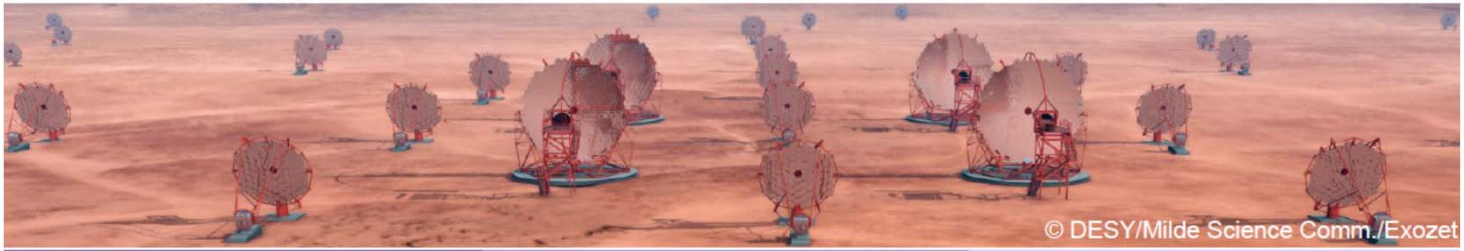
Servillat, DADI Second ESFRI Forum, 2017

Cherenkov Astronomy and CTA

Cherenkov Astronomy Principles

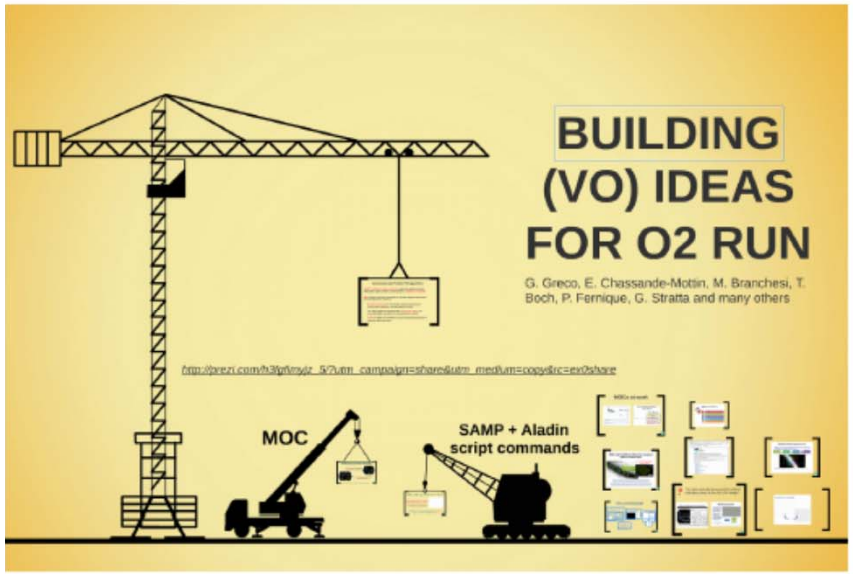
- **Dark nights** (small duty cycle)
- **Event Reconstruction**: photon, particle shower, Cherenkov light (faint, few nanoseconds)
- **Atmosphere** = calorimetre Simulations, assumptions
- **Complex Metadata**, need to be structured





Chassande-Mottin, First DADI Data Provider Forum 2016

GW alerts and skymaps (2)



Credits: Giuseppe Greco (INFN)

- Help to define follow-up strategy
  - **Visualize, tile and combine skymaps with other information** (e.g., galaxy catalog for “mass targetting”)
  - On-going collaboration to demonstrate usage of VO tools (Multi Order Coverage Map)
  - Skymaps will soon include a distance estimate for binary mergers

From Greco et al, DADI ESFRI Forum Trieste 2017

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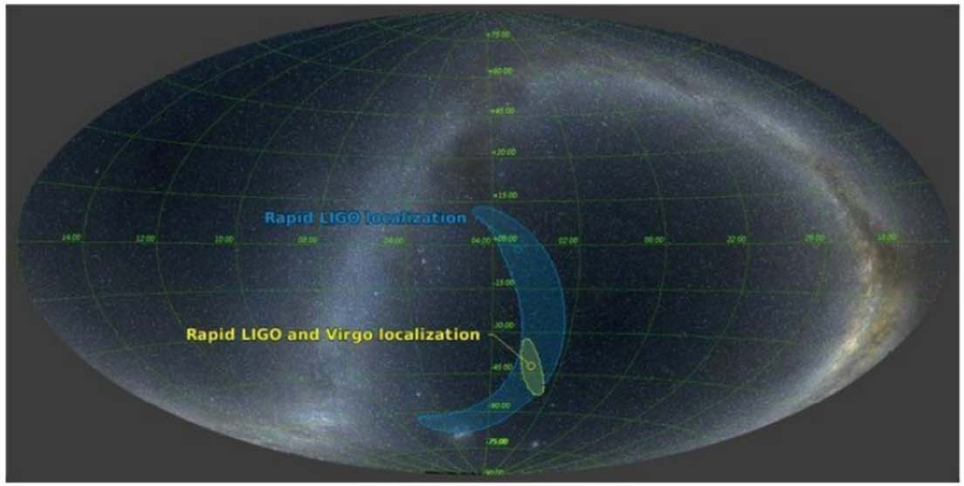
SCIENCE

New Gravitational Wave Detection From Colliding Black Holes

By DENNIS OVERBYE SEPT. 27, 2017



The LIGO and Virgo detectors in the United States and Europe identified gravitational waves emitted by the ... holes 1.8 billion light years away. The location of the black holes in the night skies is ... LIGO/Virgo

4 ARTICLES REMAINING THIS MONTH

RELATED COVERAGE

Third Gravitational Wave Detection, From Black-Hole Merger 3 Billion Light Years Away JUNE 1, 2017

Press Statement from Dr. France A. Córdova at G7 Science Ministerial Meeting

NEW ESO Archive Services: programmatic interface

- deploy VO services and protocols
  - incl. ADQL, TAP, ObsTAP/ObsCore, DataLink, AccessData (Simple Data Access)…
- Convergence to few stable VO protocols for data access
- Authenticated VO access
  - Access statistics are vital to understand our community, hence serve them better
  - Balance with ease of access and removal of access barriers
- VO accessibility of textual release descriptions
  - Vital information on global data quality, limitations and usability beyond mere file-by-file metadata

ASTERICS European Data Provider Forum, Heidelberg, 15/16 June 2016

NEW ESO Archive Services: implementation strategy

- We want to reuse existing components (Aladin Lite, VO libraries, etc.) as much as possible to build archive services tailored to ESO's requirements
- We maintain ownership of the application but not of the building blocks
- ASTERICS collaboration as opportunity to improve/further develop existing components
- Possible new developments @ ESO
  - usage of NoSQL search platform (Apache Solr, Elastic Search) to enable "real-time" exploration of archive contents (multi-dimensional aggregations/histograms)
    - Problem: different back-ends for programmatic/VO access and web/ interactive access (data replication)

ASTERICS European Data Provider Forum, Heidelberg, 15/16 June 2016

Legacy

- ESFRIs consumers/actors of VO
- Astronomy/Astroparticle working hands in hands
  - Inclusion of astroparticle needs in the VO
- First contact with EST, ESFRI 2016
- Leadership in/strong contribution to IVOA activities
- Schools/tutorials
- A set of standards
- Evolution of existing tools/new tools
- Excellent starting point for ESCAPE Task 4.2
    - Interferometric data
    - Event based data
    - VO Scalability for extremely large datasets