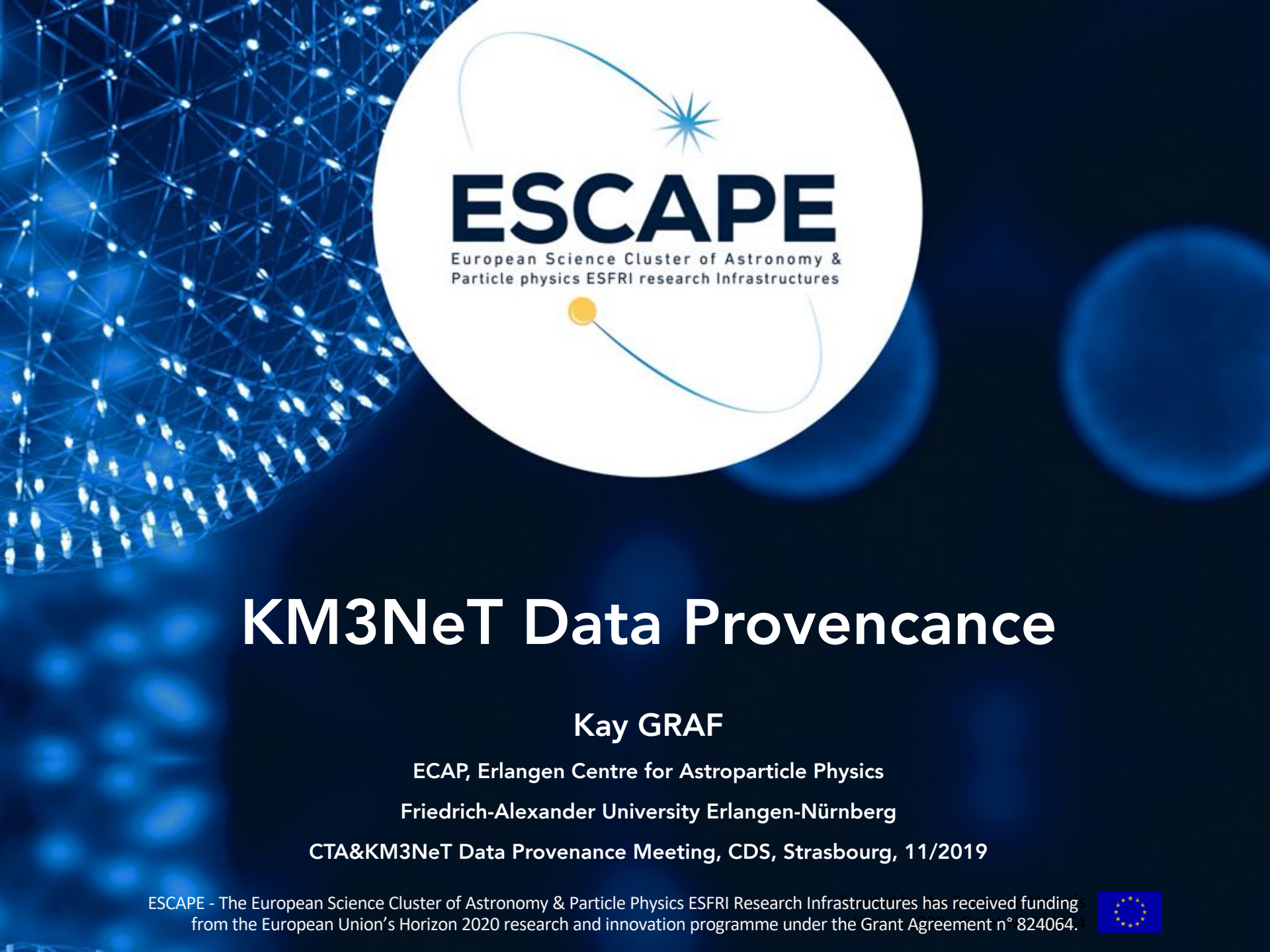


KM3NeT Data Provencance

Kay GRAF

ECAP, Erlangen Centre for Astroparticle Physics

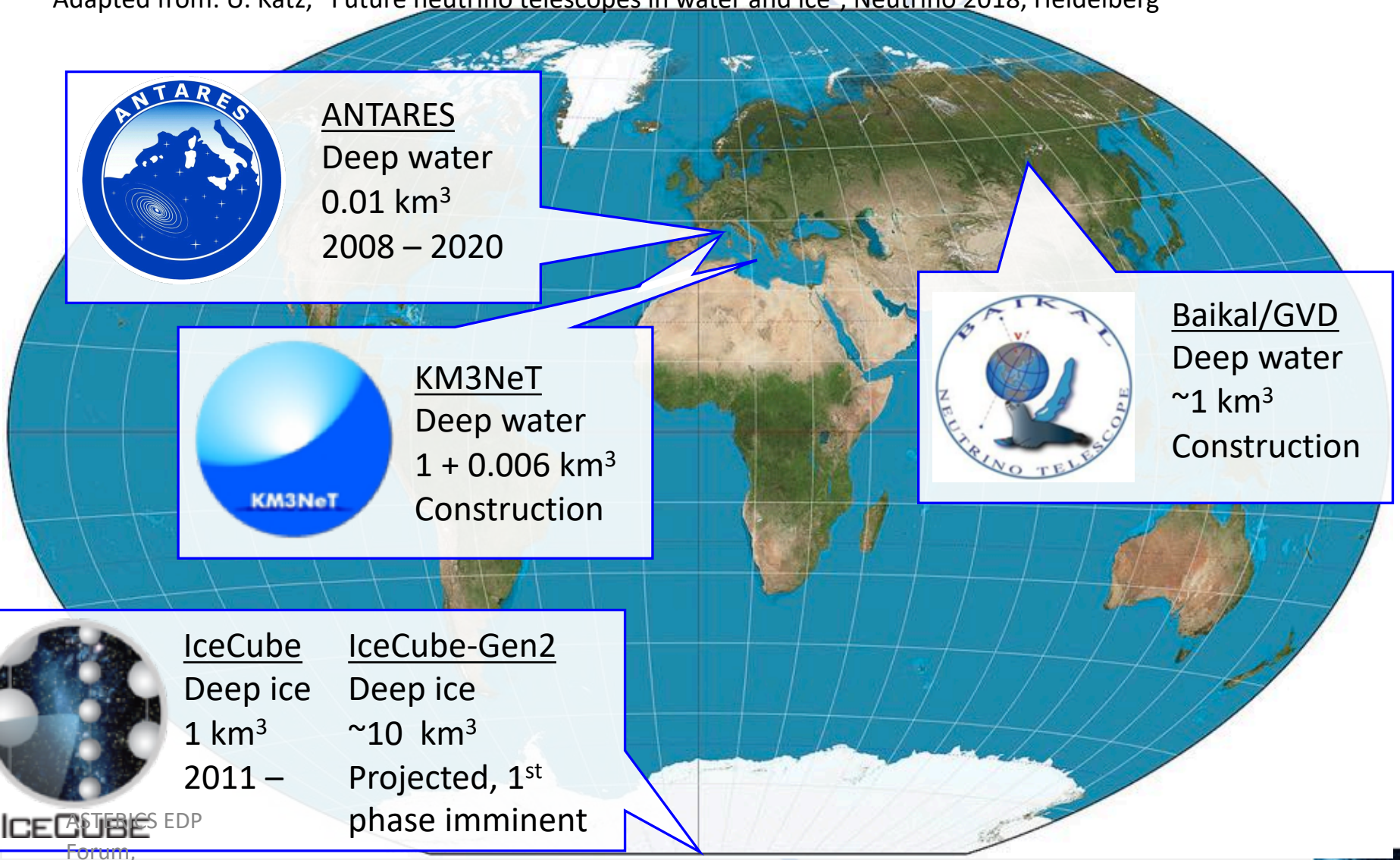
Friedrich-Alexander University Erlangen-Nürnberg

CTA&KM3NeT Data Provenance Meeting, CDS, Strasbourg, 11/2019

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.

The Neutrino Telescope World Map 2019

Adapted from: U. Katz, "Future neutrino telescopes in water and ice", Neutrino 2018, Heidelberg



ANTARES
Deep water
0.01 km^3
2008 – 2020

KM3NeT
Deep water
1 + 0.006 km^3
Construction

Baikal/GVD
Deep water
~1 km^3
Construction

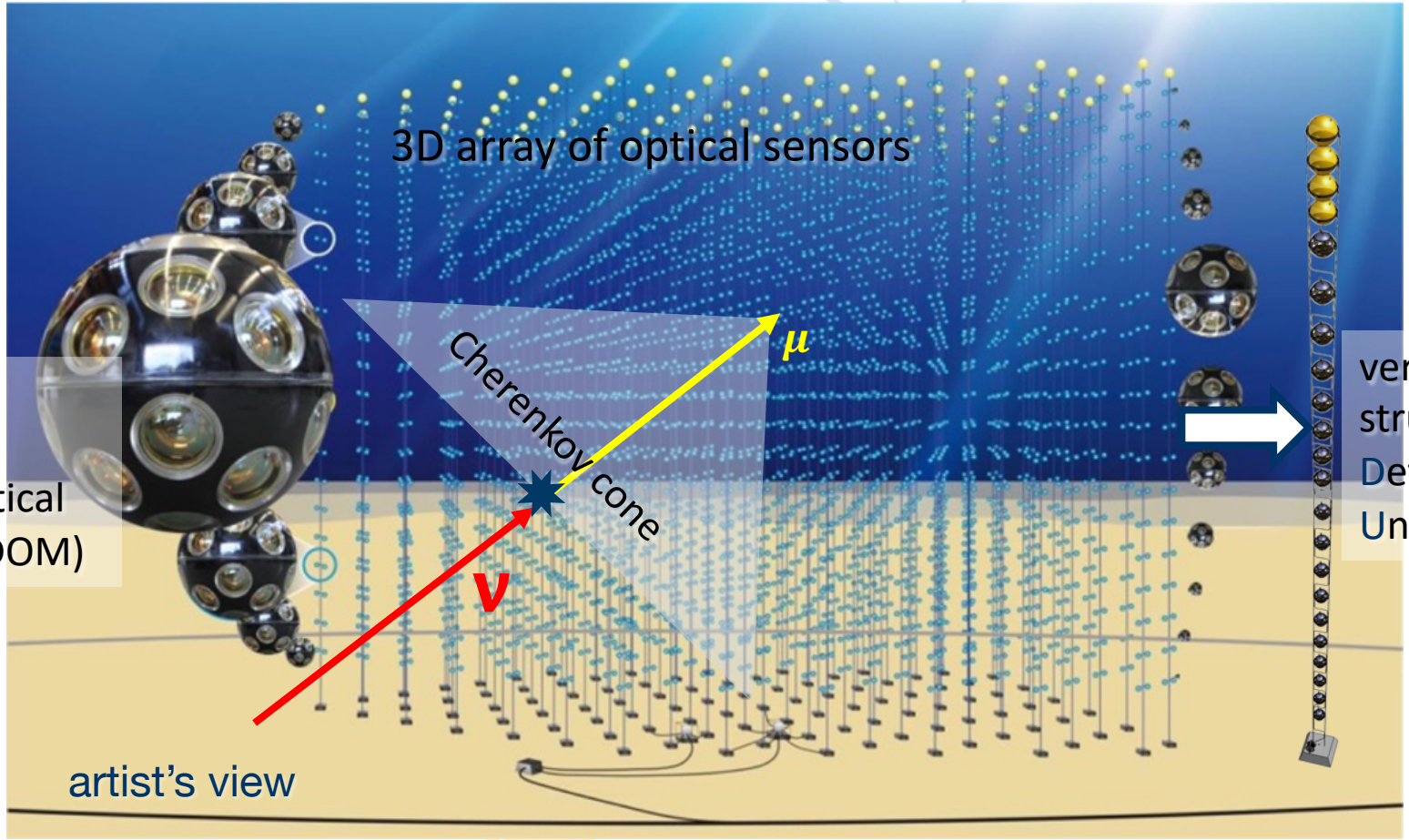
IceCube
Deep ice
1 km^3
2011 –

IceCube-Gen2
Deep ice
~10 km^3
Projected, 1st phase imminent

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

The KM3NeT-ORCA/ARCA Design

sensitive element: Digital Optical Module (DOM)



vertical structure: Detection Unit (DU)

- DU: vertical slender string equipped with 18 DOMS, 9/36 m vertical spacing
- power and data distributed by a single backbone cable from shore; seafloor network of cables and junction boxes connected
- all data sent to shore and processed there in a dedicated computing farm

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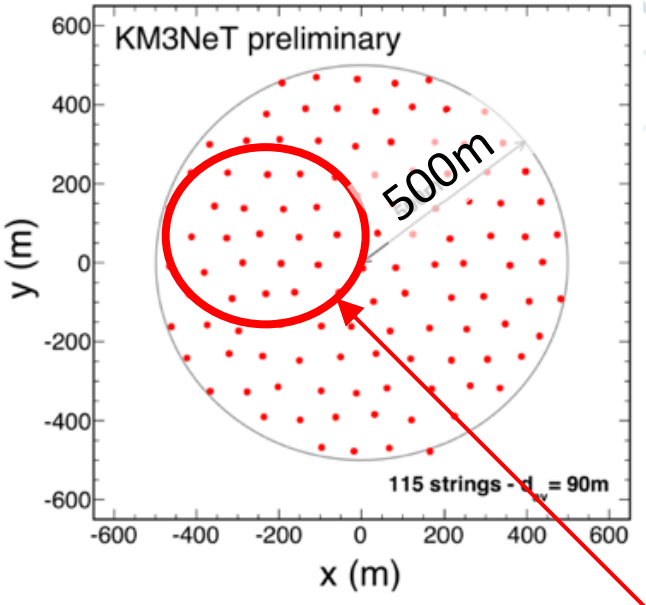
KM3NeT 2.0 = ARCA and ORCA

From: U. Katz, “Future neutrino telescopes in water and ice”, Neutrino 2018, Heidelberg

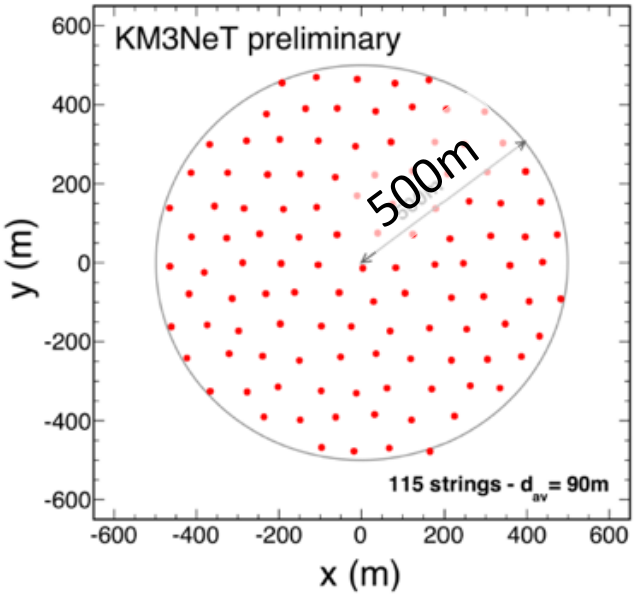
ARCA =

Astroparticle Research with Cosmics in the Abyss

Vertical DOM distance = 36 m



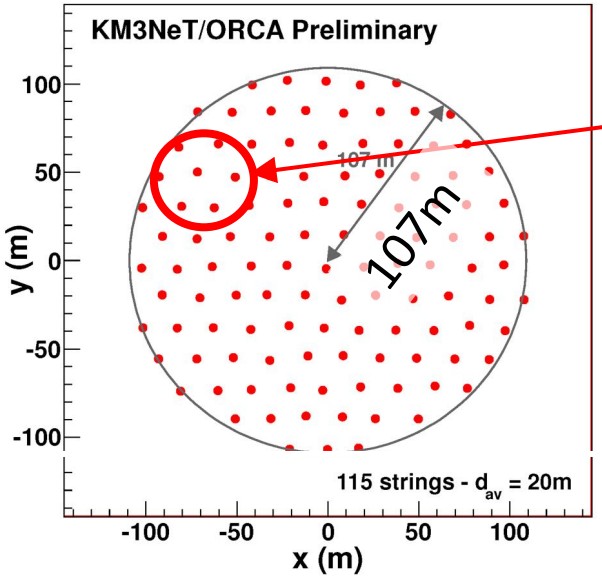
+



ORCA =

Oscillation Research with Cosmics in the Abyss

Vertical DOM distance = 9 m



Phase 1 (fully funded)

Phase 2 partially funded

KM3NeT 2.0 Letter of Intent: arXiv:1601.07459 and J.Phys. G43 (2016) 084001

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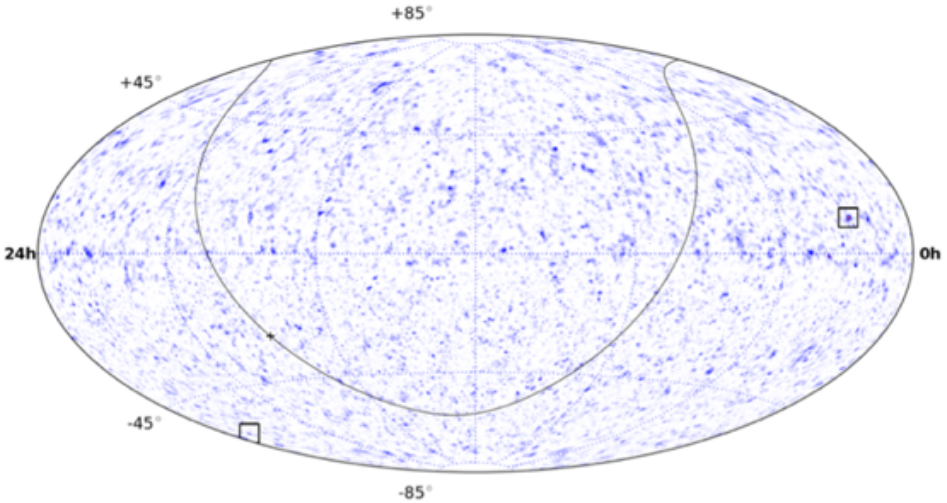
What to Expect from Neutrino Experiments?

from: IceCube Coll. “Searches for Extended and Point-like Neutrino Sources with Four Years of IceCube Data” arXiv:1406.6757 [astro-ph.HE]

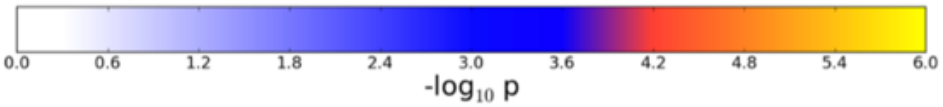
No. of strings	Live-time [days]	No. of up-going events	No. of down-going events
40	376	14,121	22,779
59	348	43,339	64,230
79	316	50,857	59,009
86	333	69,227	69,096

dominated by:
atm. ν’s atm μ’s

⇒ similar numbers for KM3NeT
⇒ ANTARES data available on GAVO (will add latest public data to KM3NeT VO Server)
⇒ note: 95%+ uptime



Pre-trial significance sky map from ~215k events



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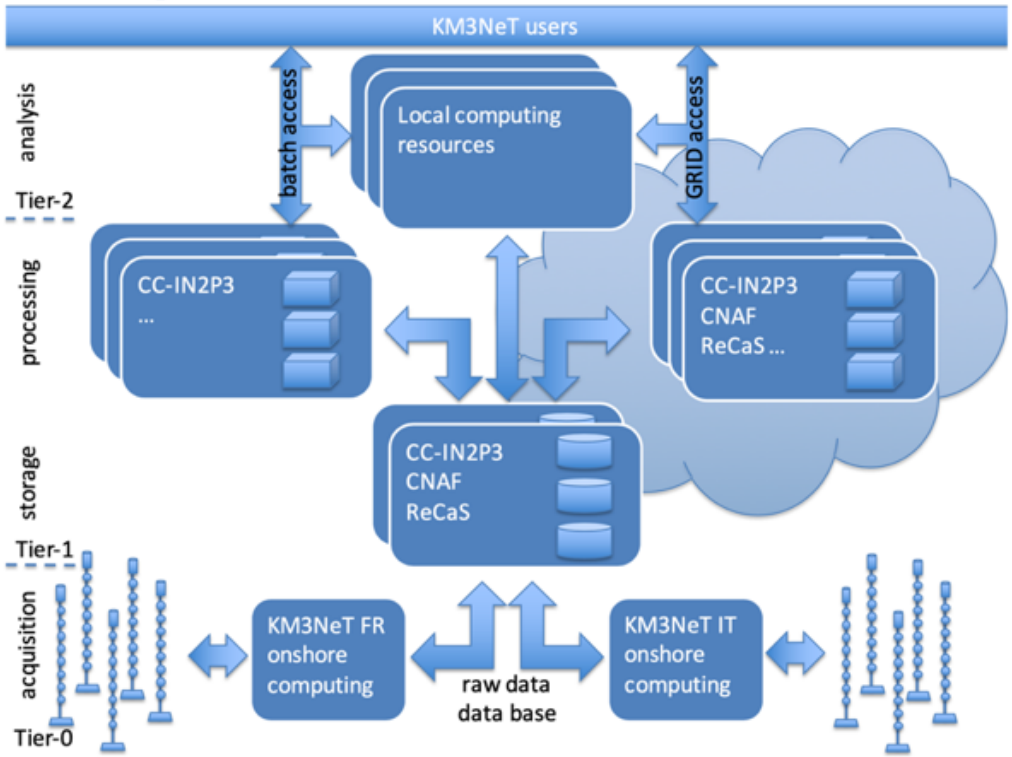
KM3NeT Computing Modell/ Data Management Plan



Data Management Plan is KM3NeT-INFRADEV Deliverable D4.1

Tier	Computing Facility	Processing steps	Access
Tier-0	at detector site	triggering, online-calibration, quasi-online reconstruction	direct access, direct processing
Tier-1	computing centres	calibration and reconstruction, simulation	direct access, batch/grid processing
Tier-2	local computing clusters	simulation and analysis	varying

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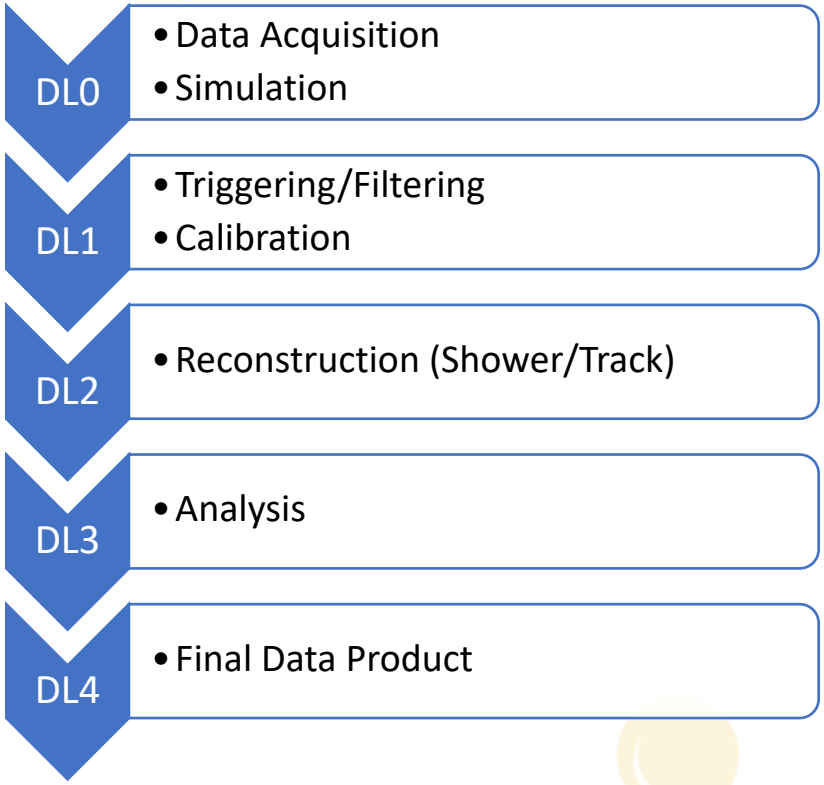
Data Processing Chain



- meta data included in all steps

→ key for preservation, reproducibility and provenance
(meta data server to be established also in ESCAPE WP3)

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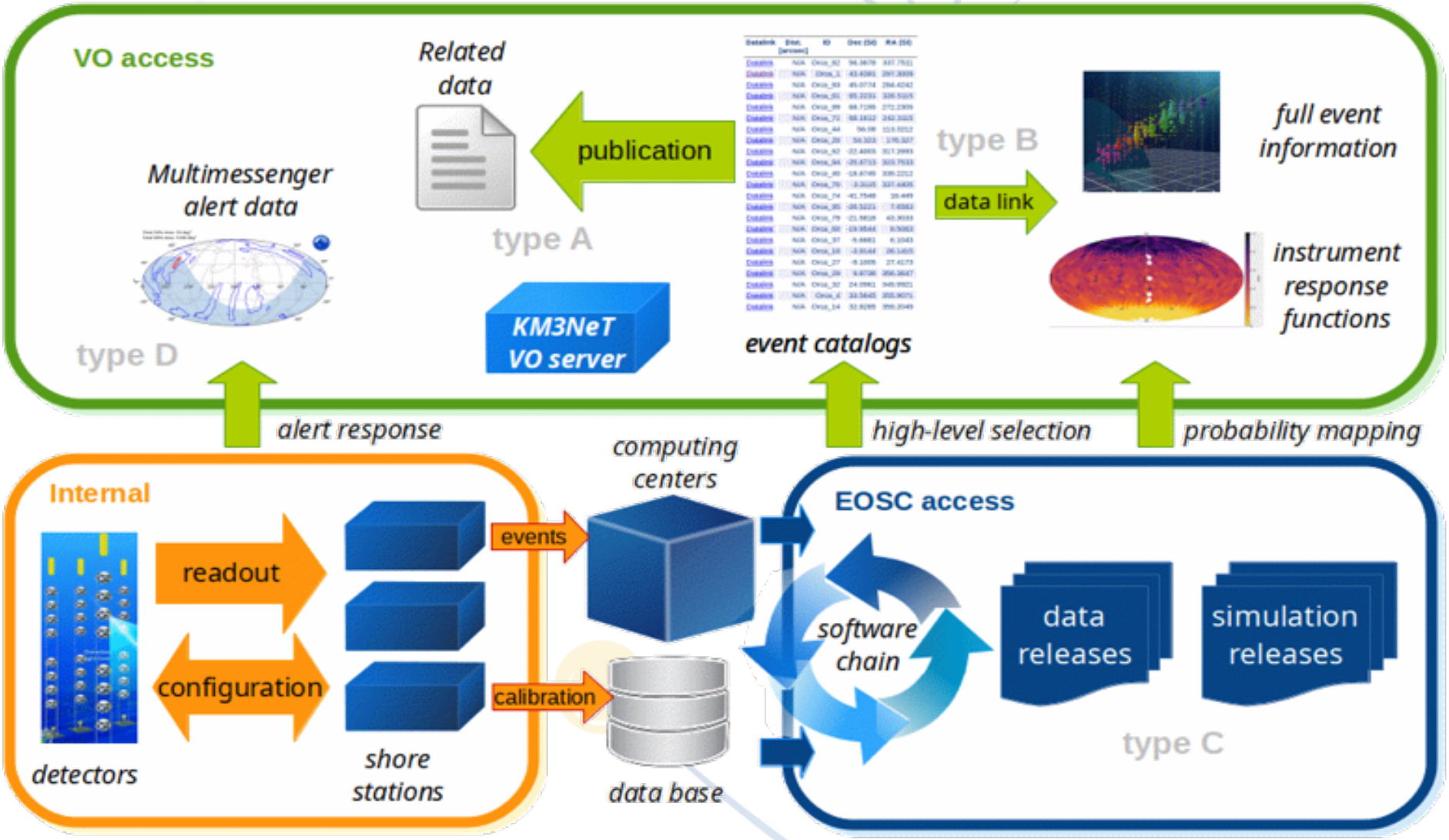
Type of Open Access Data



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Provenance in open access data (use cases)

- Online:
  - Alerts (in and out)
  - Provenance:
    - ”trivial” all steps operated by the collaboration
    - Special cases (co-observations) hold (ToO)
- Offline:
  - Publication-related data, full-event information + IRFs
    - Provenance: ”trivial” all steps operated by the collaboration
  - Special filter algorithms or processing chains of external users on request
    - Provenance: not trivial anymore
- all cases: IVOA standards will be adopted (started a pre-version of a VO server)
  - IVOA provenance model seems a good solution for the provenance part
- Provenance only controllable for the “in collaboration processing”, how to deal with further steps (by user)?

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

Funded by EU H2020

- Grant # 824064 (ESCAPE)

- Grant # 739560 (KM3NeT-INFRADEV)

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