



ESCAPE

European Science Cluster of Astronomy &
Particle physics ESFRI research Infrastructures

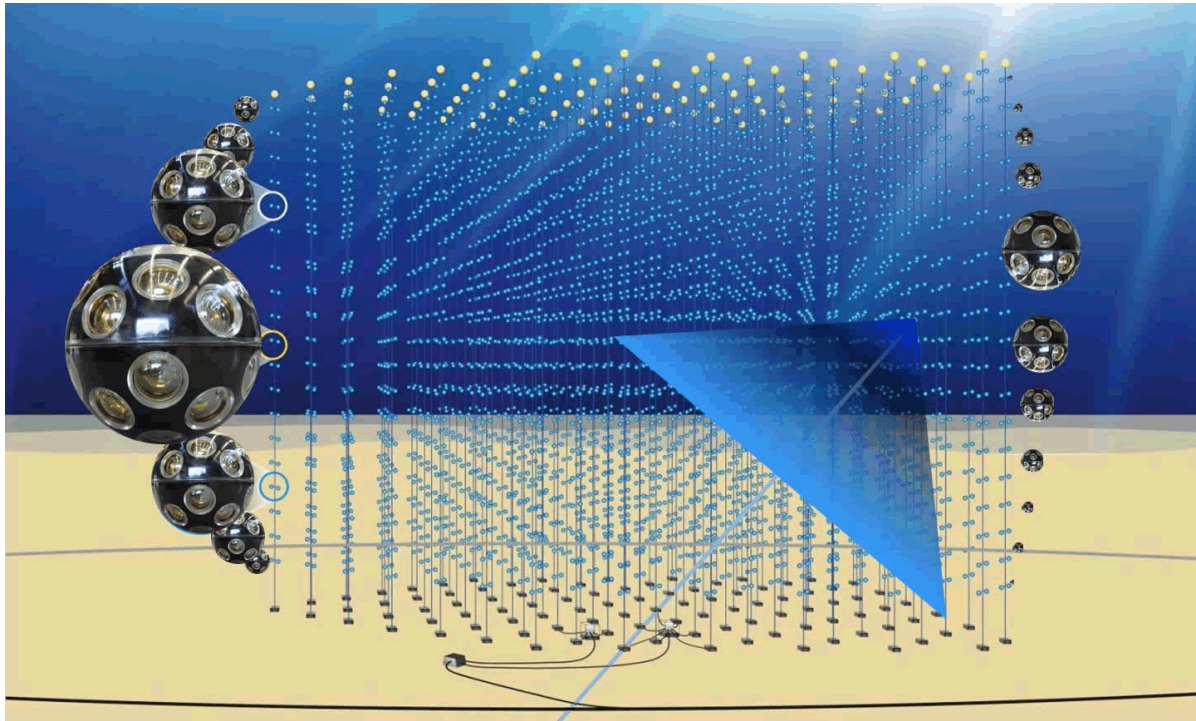
Use Case of KM3NeT for WP2+WP5 integration

WP2+WP5 workshop, 6th April 2021

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The KM3NeT experiment



Water Cherenkov detector for high-energy neutrinos

- Multi-PMT sensor modules
- Building blocks (BBs) of 115 DUs (lines)

Science goals

- astrophysics (ARCA)
- neutrino oscillations (ORCA)

Under construction

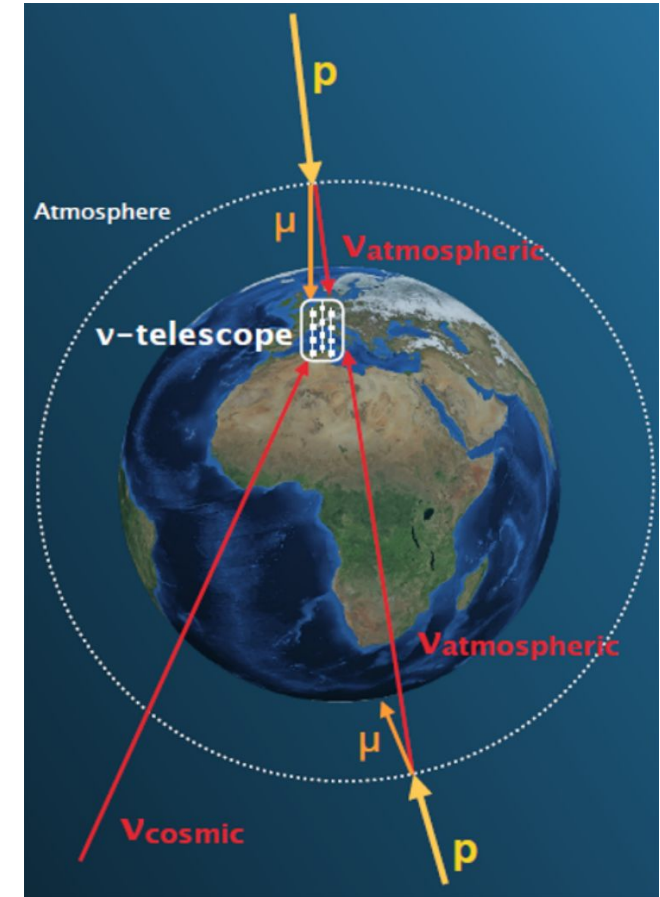
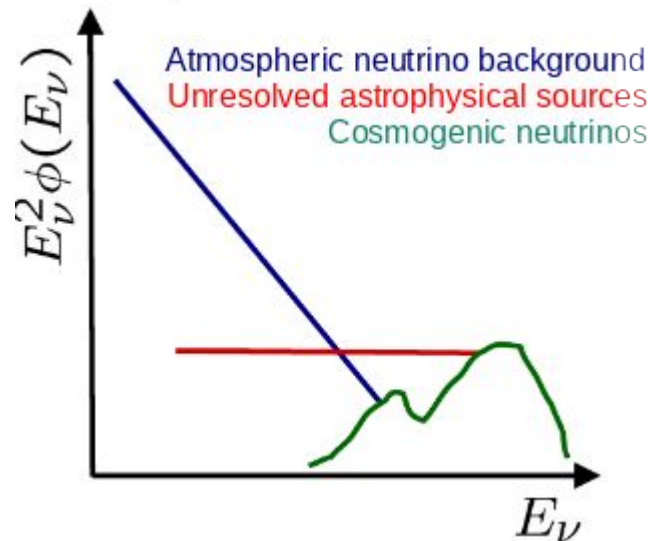
- 1 DU installed in ARCA
- 6 DUs installed in ORCA
- more to come this year



Data: Particle events

Measuring neutrinos $E_\nu > \text{MeV}$

- Galactic and extragalactic neutrino sources
- Neutrinos from dark matter annihilations
- Transient sources
- Neutrino properties, e.g.
- oscillation parameters



Data formats

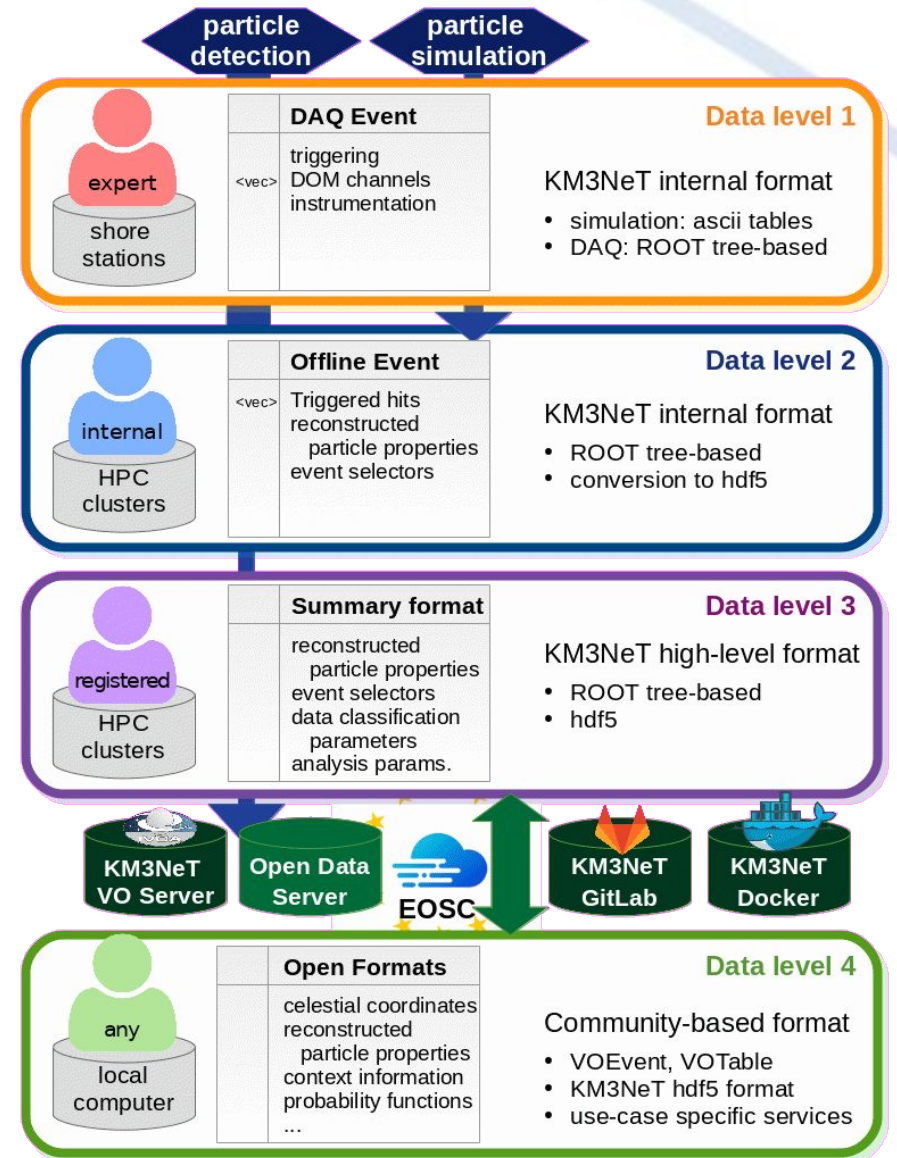
Particle event data

- High-level data: particle “events”
- can include full “hit”, i.e. photon detection information (special ROOT format)
- Reduced high-level format: event tables (direction, energy, particle type) - hdf5 or other

Event simulation

- Signal and background events
- Analogous processing to measurements

→ need of distributed PB-sized storage and 10k+ CPU resources (internal)

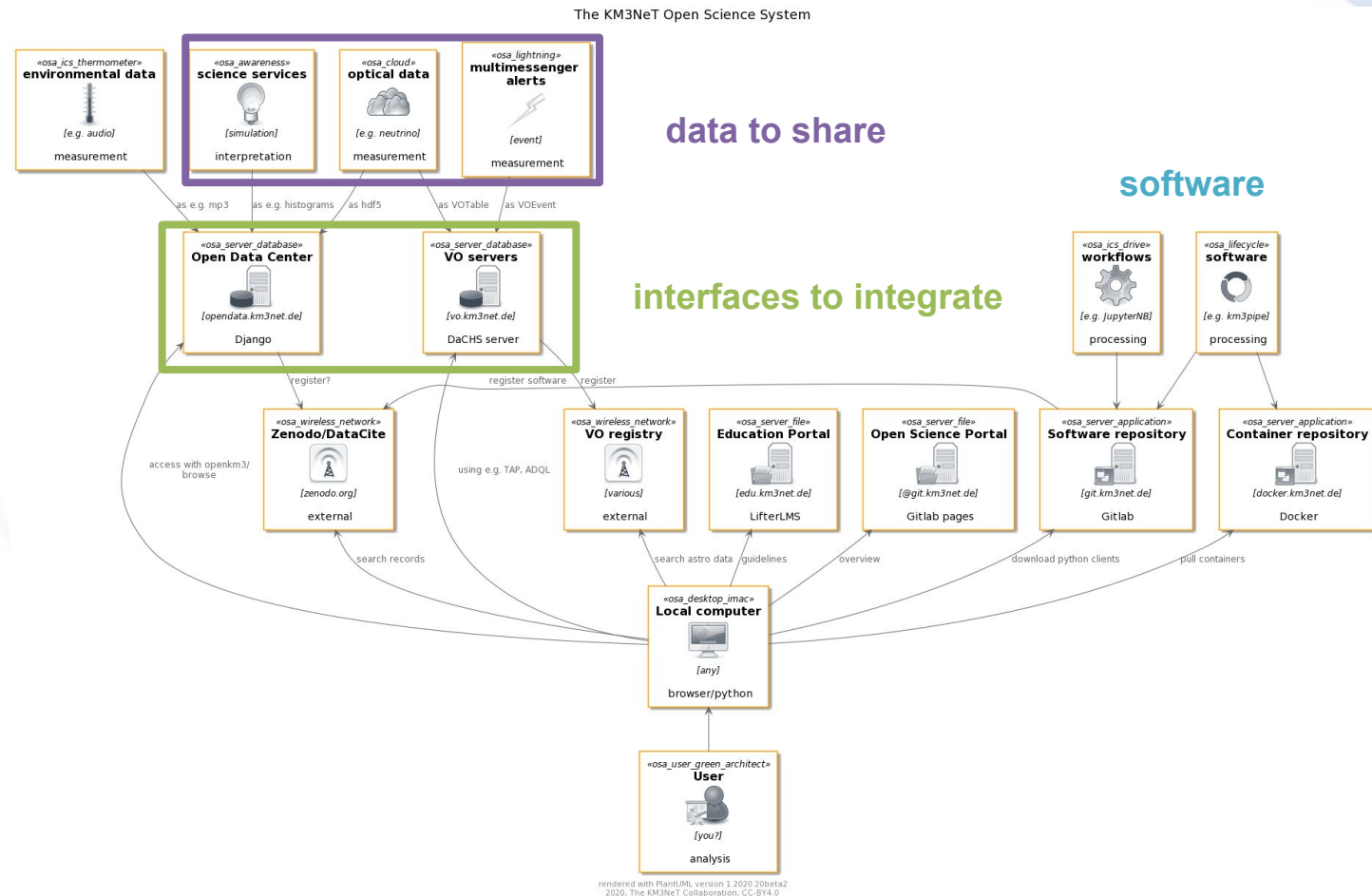


Test open science products by KM3NeT

Integrate Use Cases from former **Infradev** project

(openscience.km3net.de, [ADASS presentation](#))

- ANTARES data for point-source search (VO)
- share **KM3NeT data releases** (WP2)
- MM alerts & analyses
- share software (WP3)



Use case: KM3NeT data releases

Use Case description

The scientist can find and read KM3NeT event data through ESAP and perform analyses on public data sets.

Goal

- Develop interfaces for reading of KM3NeT event data
- explore the use of the Data lake and develop KM3NeT's multisite computing environment

Data & Software

- One week ORCA4 data ([KM3NeT data center](#), full sample to be provided)
 - simple event table (h5)
 - fully reconstructed event files (root)
- Example notebooks
- km3py package for access from KM3NeT data center

WPs: WP2 (bring data to data lake), WP3 (onboard software), WP5 (access)

Contributions: FAU, Nikhef



Use case backup: Event lists in VO

Use Case description

The scientist can calculate the probability of neutrino observation for a given point source, using a neutrino event list (measurement) and additional services for instrument responses (simulation).

Goal

Integrate full neutrino analysis

- Neutrino data shared through the VO
- provide services to interpret the neutrino data
 - move from “homemade” solution to interoperable solution with VO?

Data & Software

- ANTARES 2007-2017 point source set ([KM3NeT VO server](#))
- Background and sensitivity estimates ([KM3NeT data center](#))
- Jupyter notebook with example analysis

WPs: WP4 (VO discussions) / WP3 (common data formats, just starting)

Contributions: FAU, Nikhef

