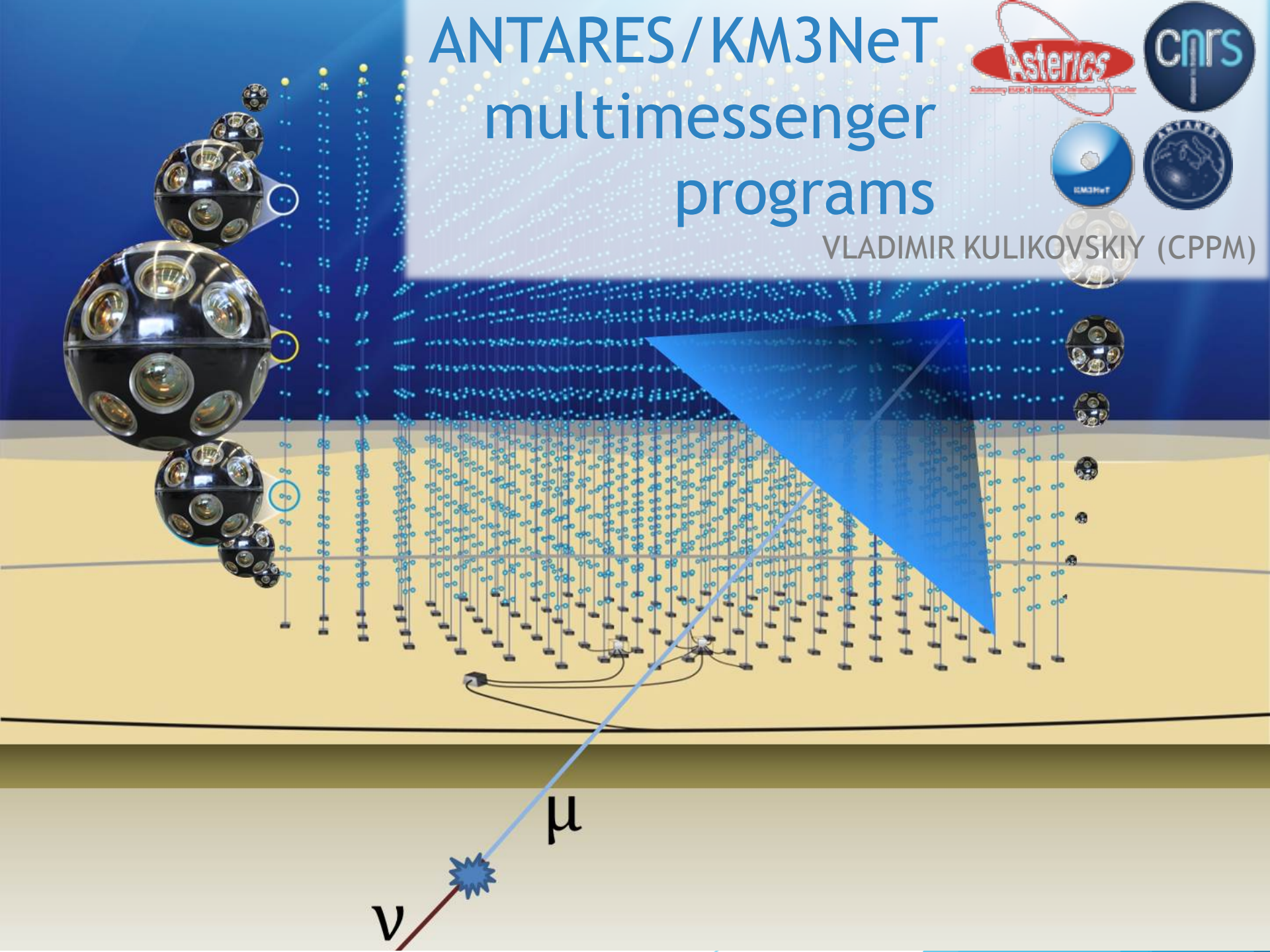
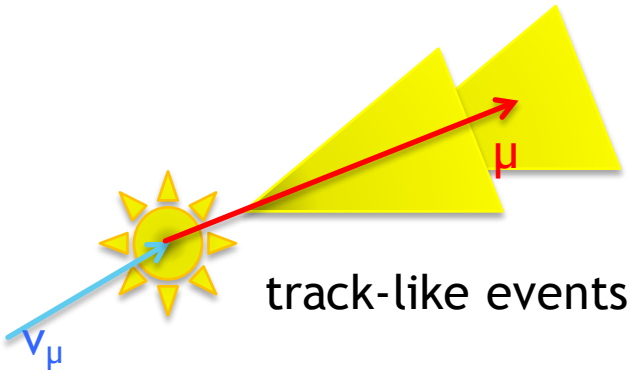
ANTARES/KM3NeT multimessenger programs

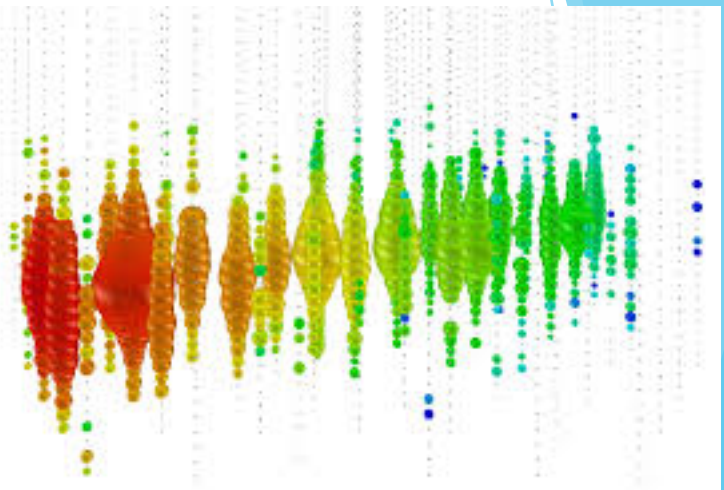
VLADIMIR KULIKOVSKIY (CPPM)

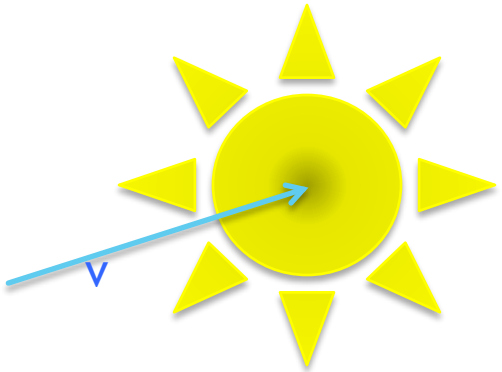


Neutrino detection

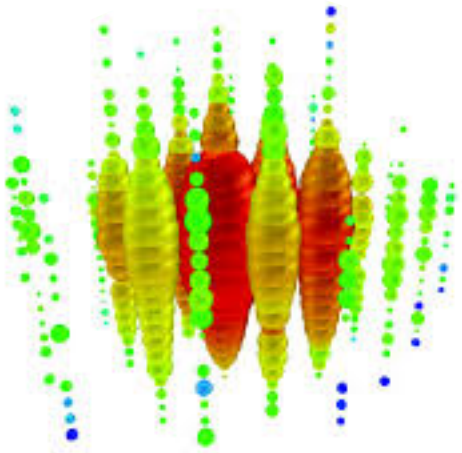


track-like events ν_μ(CC)



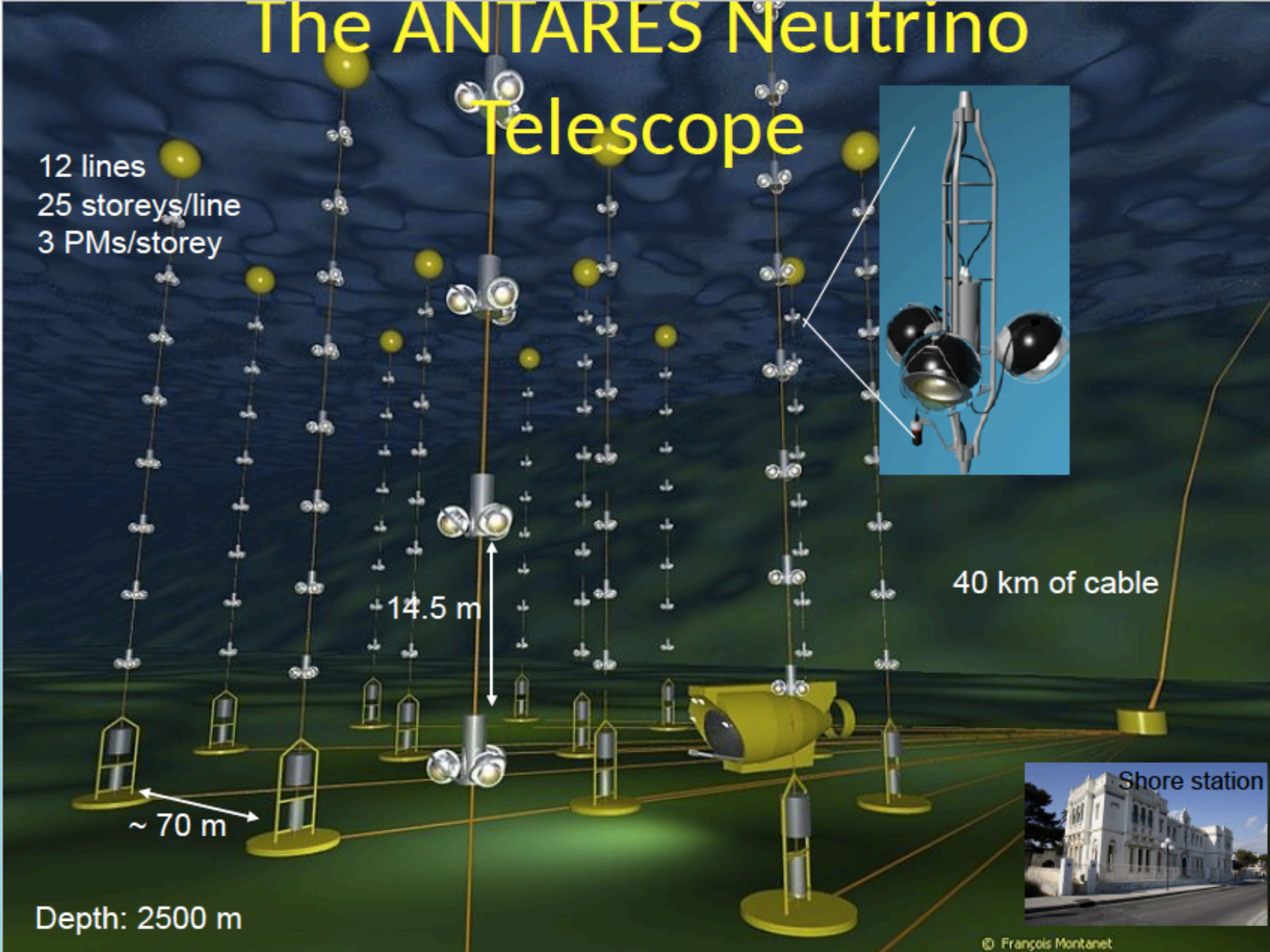


shower-like events
ν_μ(NC), ν_e, ν_τ



This is how events look like in the detector ©IceCube

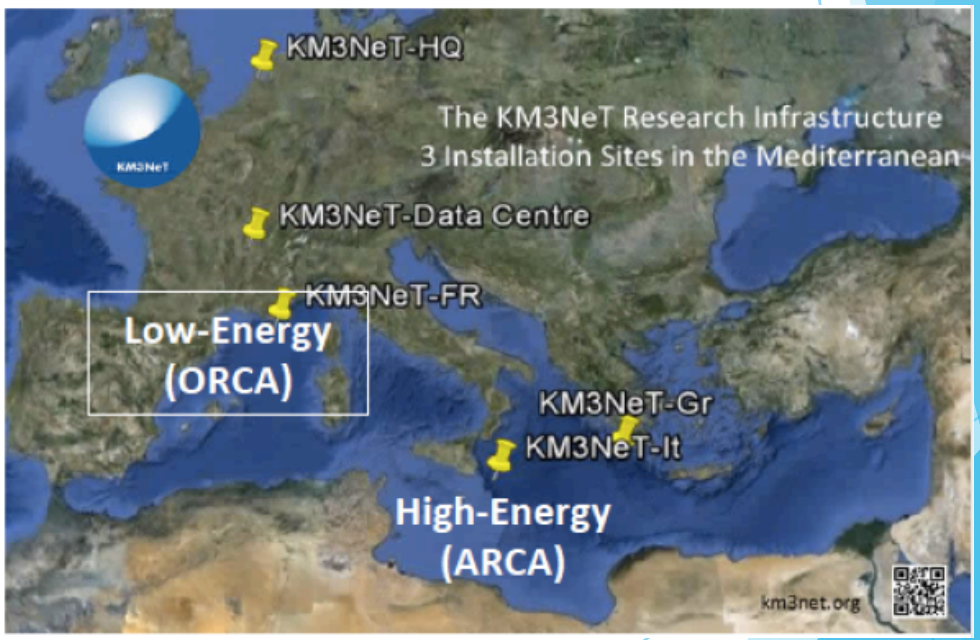
The ANTARES Neutrino Telescope



KM3NeT

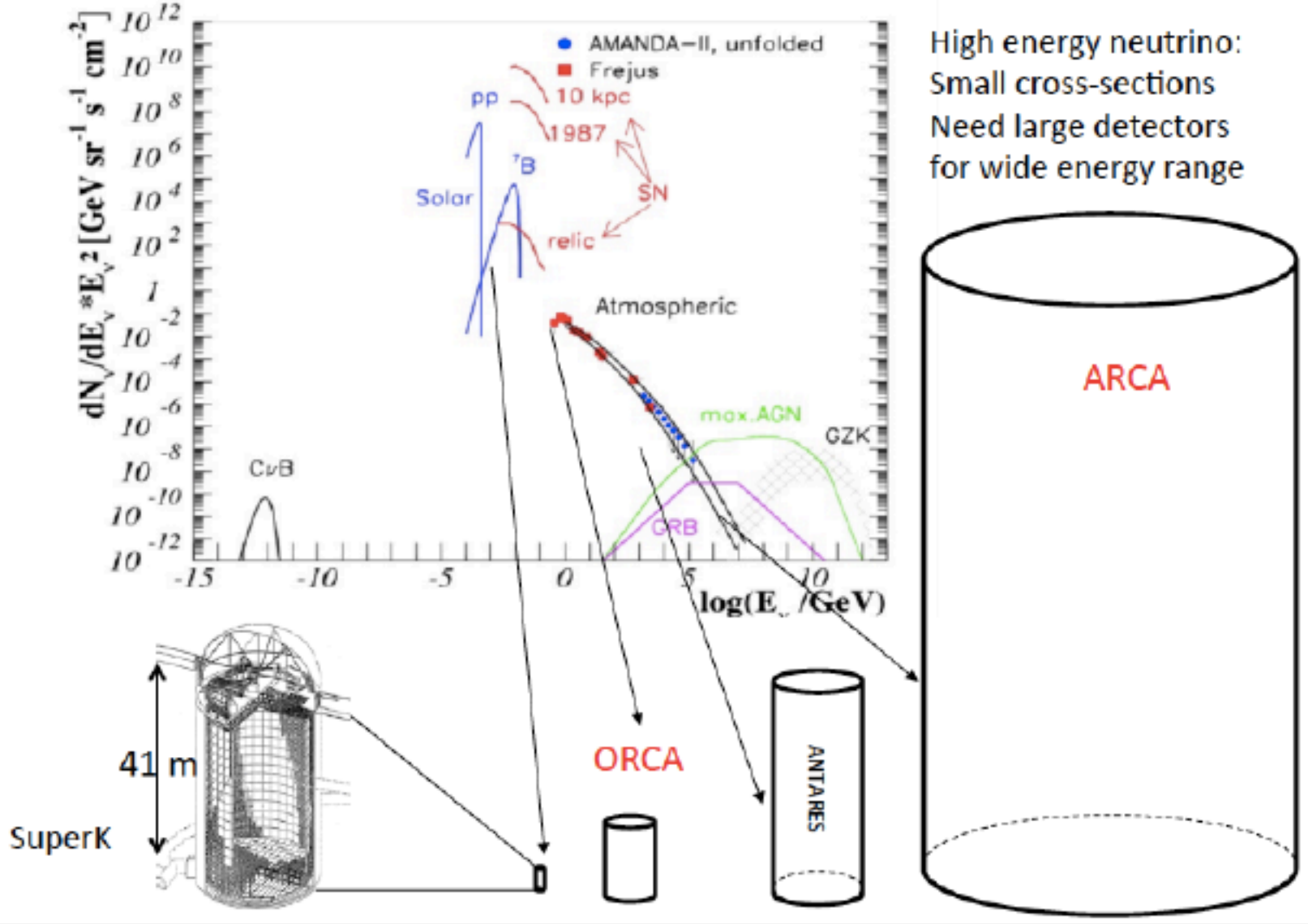
- KM3NeT is a distributed research infrastructure with 3 main science topics:
  - The origing of cosmic neutrinos (high energy)
  - Measurement of fundamental neutrino properties (low energy)
  - Deep Sea Observatory – Oceanography, bioacustics, bioluminescence, seismology.

Single Collaboration
Single Technology
Single Management

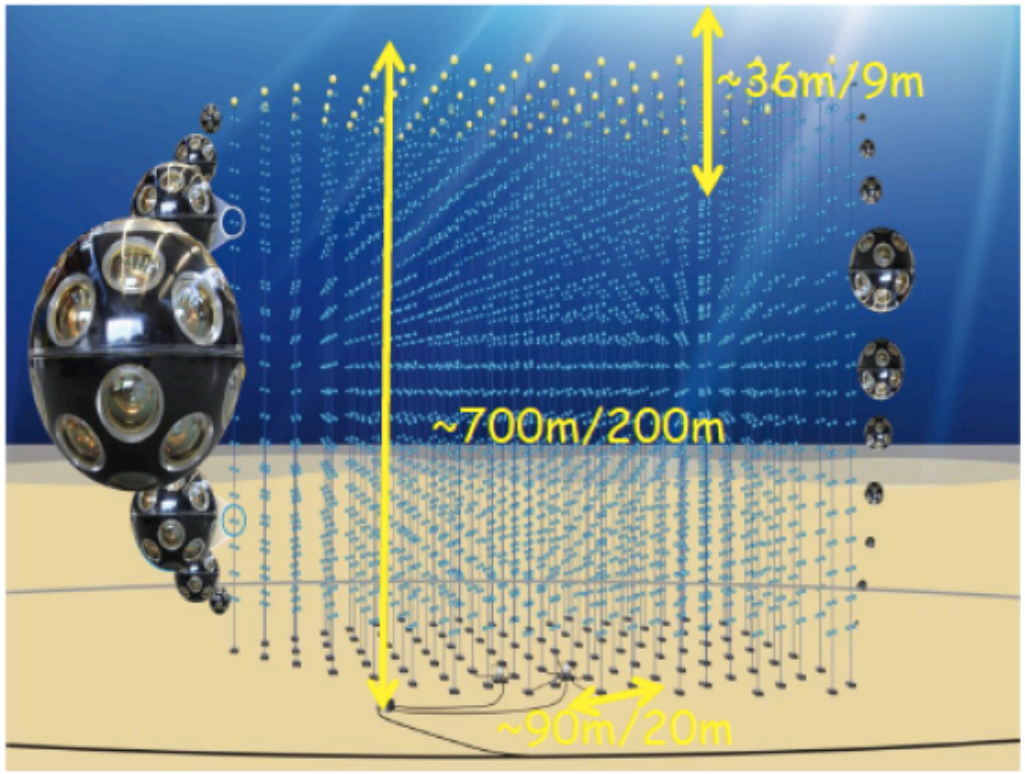


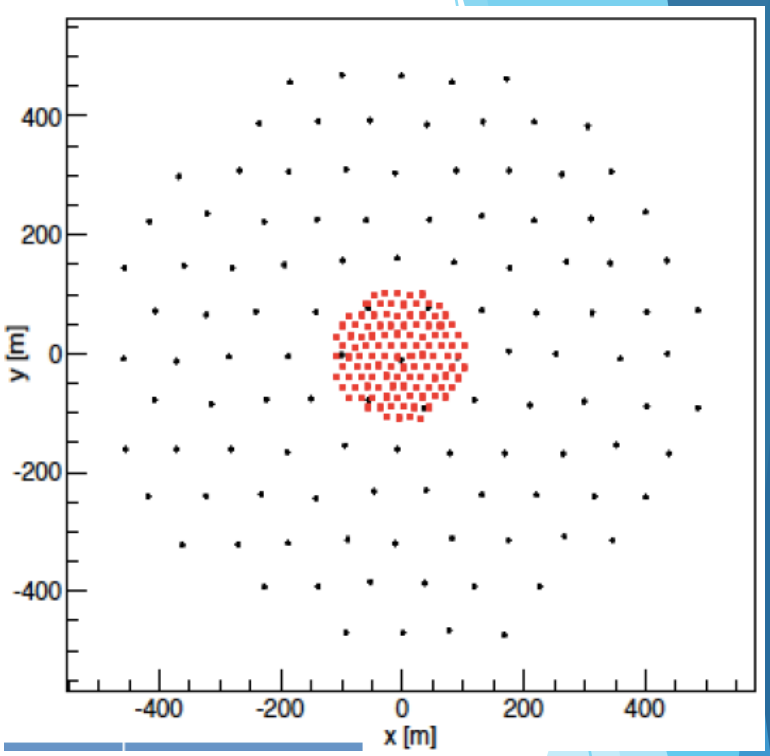
ARCA – Astroparticle Research with Cosmics in the Abyss
ORCA – Oscillation Research with Cosmics in the Abyss

Neutrinos from MeV to PeV



KM3NeT building block (115 strings)





	ARCA	ORCA
Location	Italy	France
String distance (m)	90	20
DOM spacing (m)	36	9
Volume (MTon)	500	3.8

KM3NeT Timeline

KM3NeT Technical Design Report¶

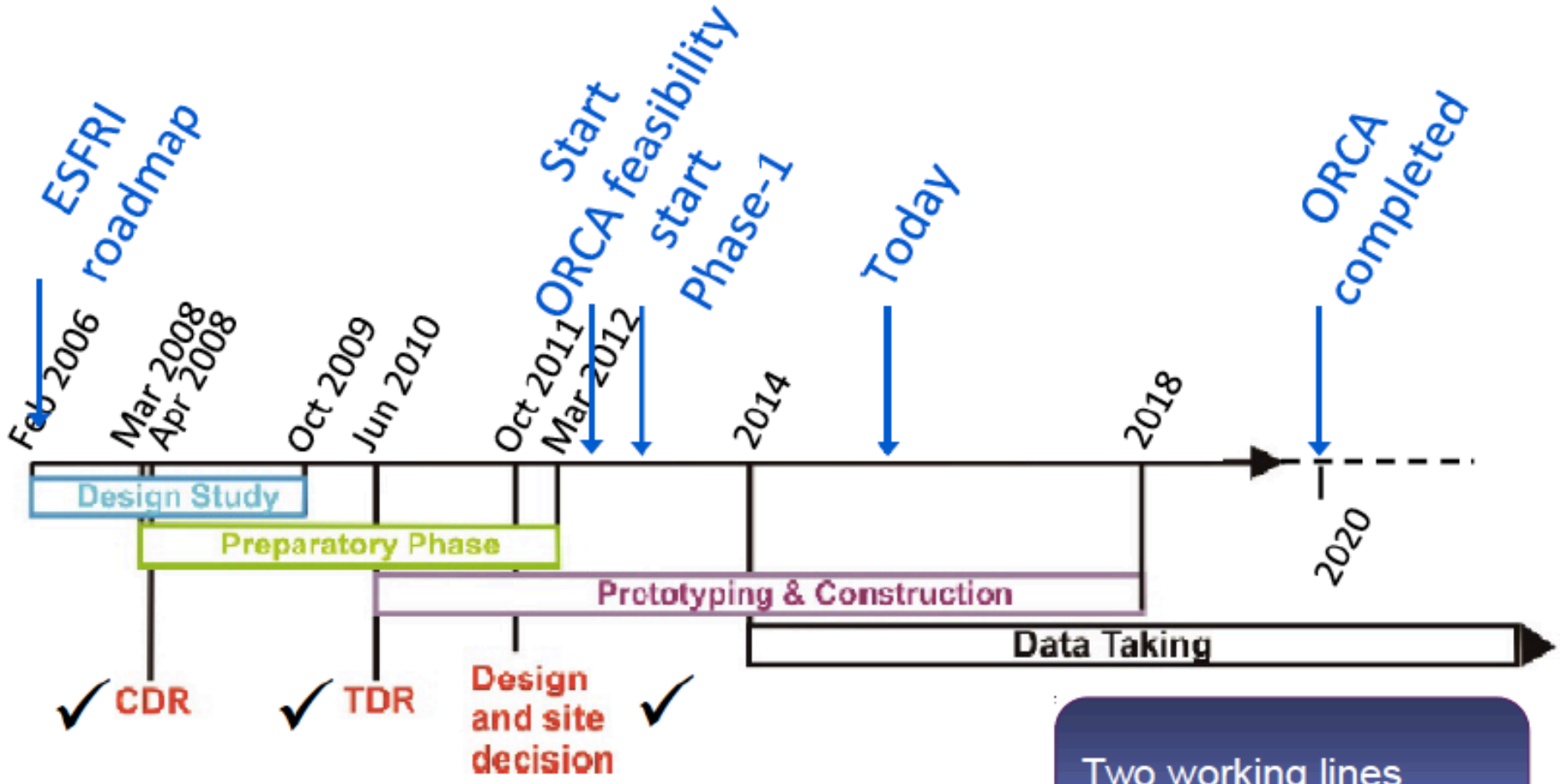
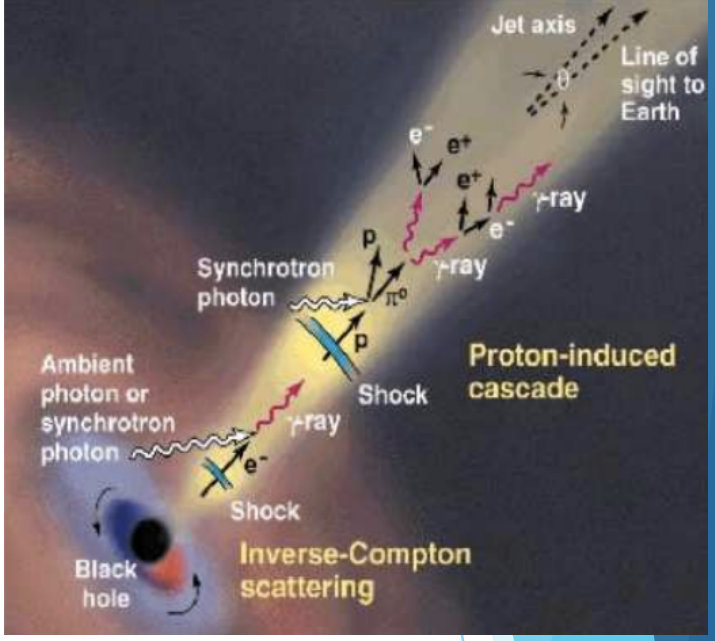


Figure 10-1: Overall time schedule of the KM3NeT project.

Two working lines since May 2016

¶ Deliverable of EU-funded Design Study.

Why neutrinos?

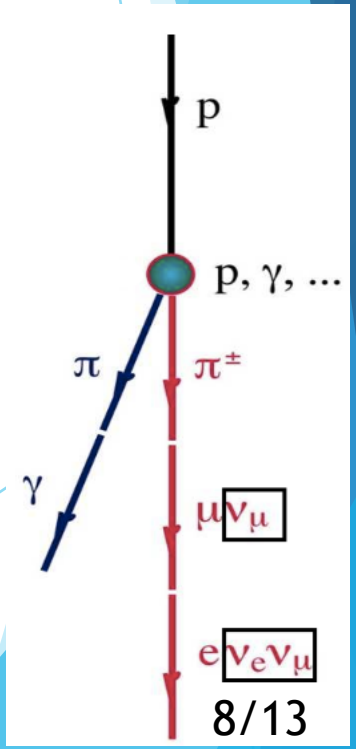


- Link between CR / γ / ν:
  - CRs and UHECRs origin?
  - Hadronic , leptonic or leptohadronic models?
  - Jet composition?

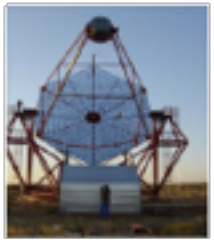
Cosmic neutrinos:

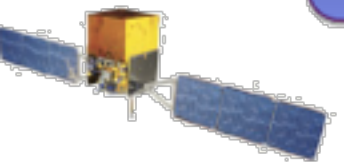
- Neutrinos possibly produced in the interaction of high energy nucleons with matter or radiation
- If hadronic mechanisms:

  Simultaneous emitters of neutrinos and photons
- Detection from a cosmic source would be a direct evidence of hadronic scenario



Multi-messenger programs online and offline





GeV-TeVγ-rays
Fermi / HESS…

UHECR
Auger

HE neutrinos

Optic / X-ray
TAROT,MASTER,
ROTSE / Swift,
ZADKO

HE neutrinos
Icecube

Gravitational
Waves
Virgo / Ligo

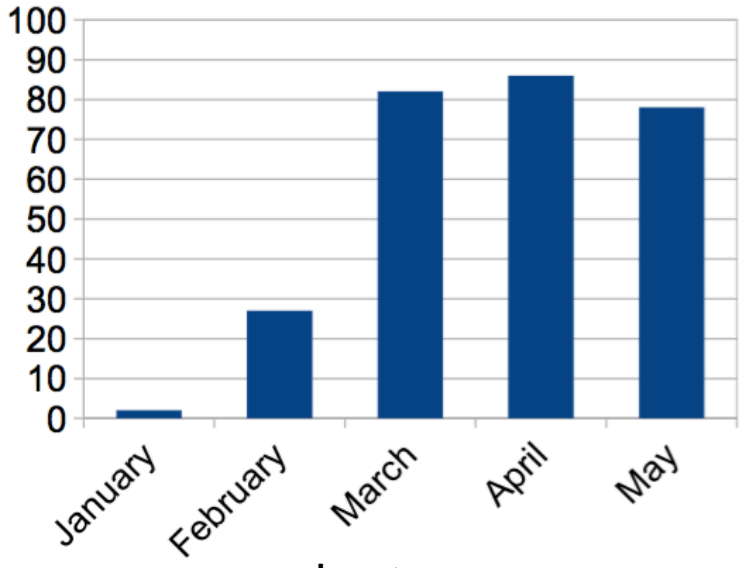
* partecipation to

AMON
Astrophysical Multimessenger Observatory Network

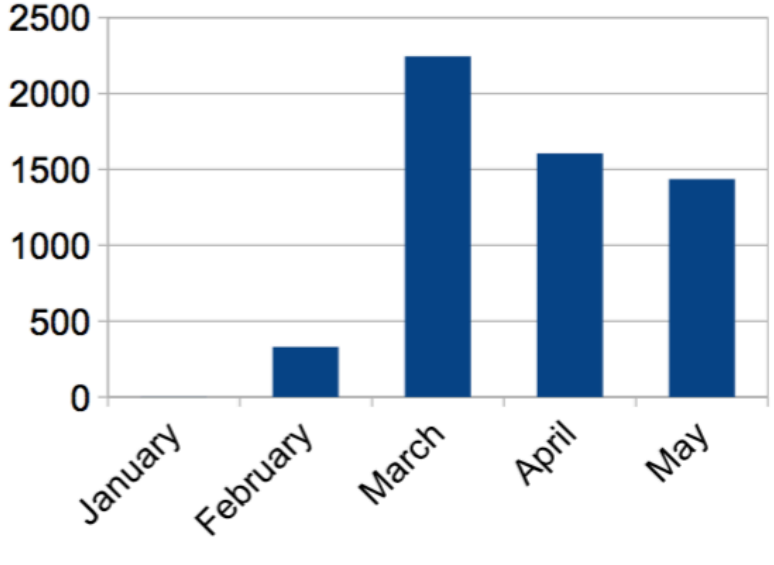
Released ANTARES data in VO

- GAVO -"2007-2010 ANTARES search for cosmic neutrino point sources"
  - 3058 neutrino-like events obtained during the effective livetime of 813 days
  - Coordinates, simple energy estimator (number of photons detected)
- Data access (GAVO):

Approx. numbers
-30% due to bot counting(?)

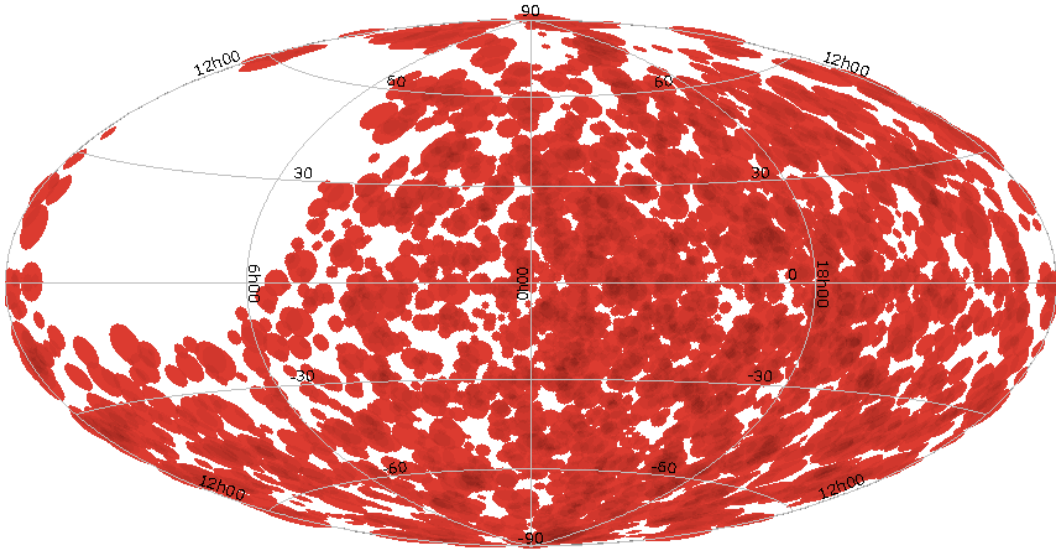


hosts

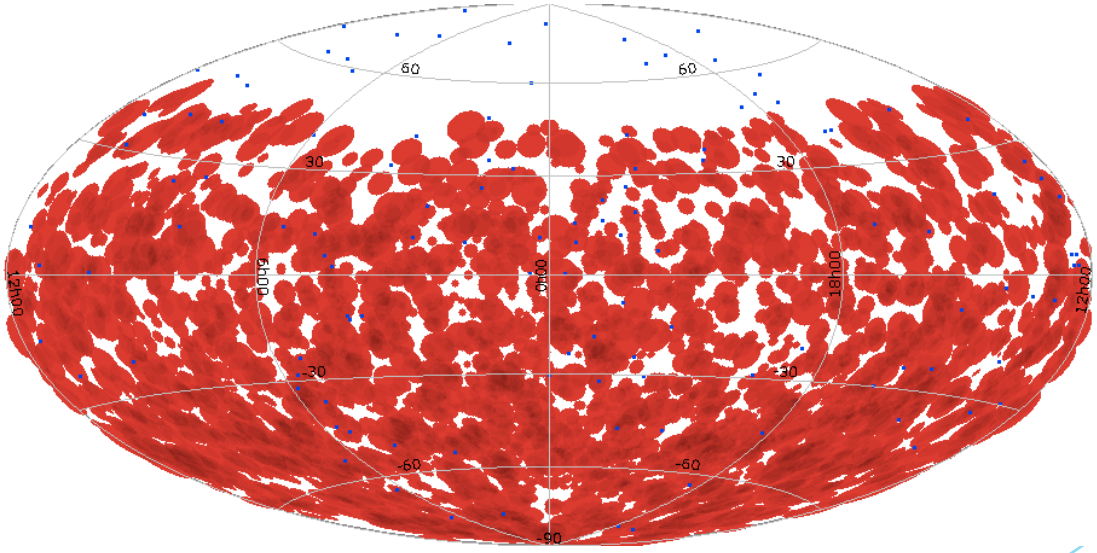


accesses

TopCAT usage examples

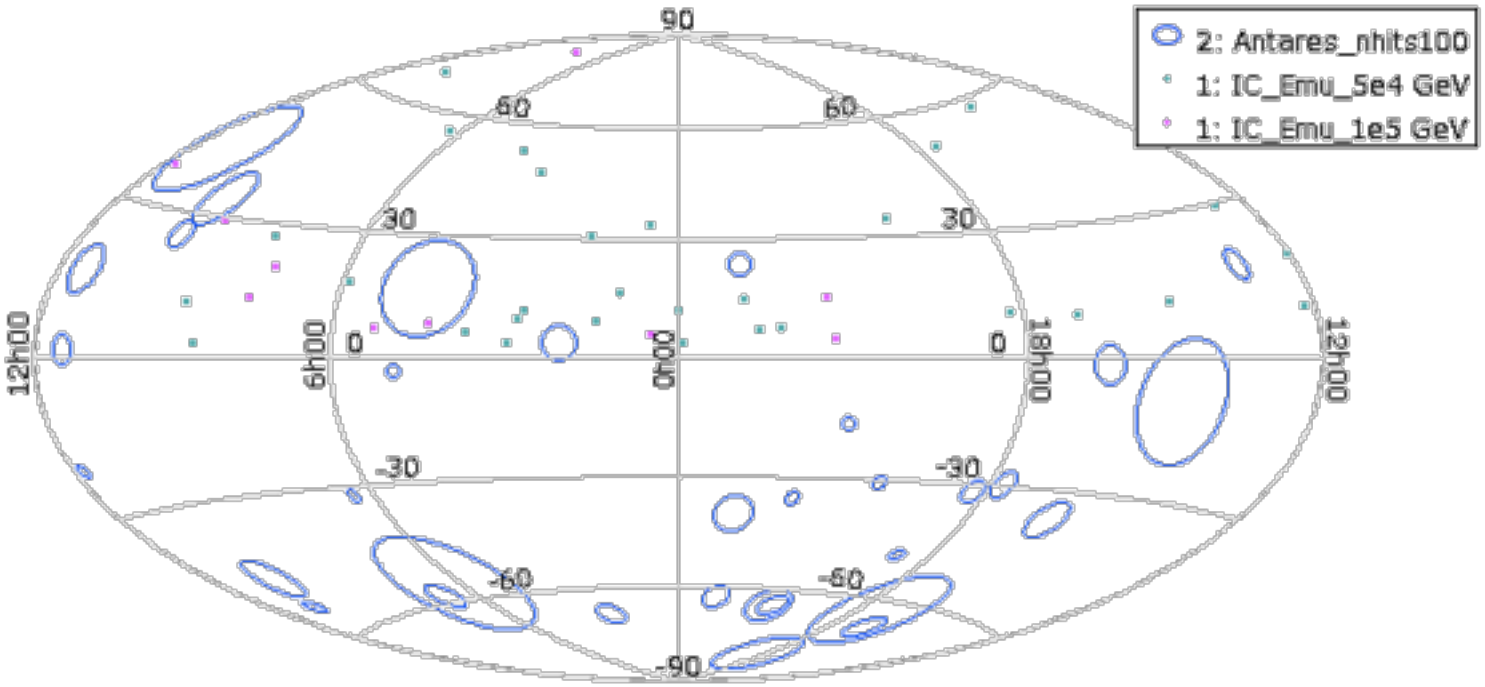


Galactic coordinates
(circle radius
corresponds
to the angular error)



Equatorial coordinates
Blue points – 121 blazars
discovered with 3 sigma
with Swift (BAT telescope)
A&A 520, A47 (2010)

TopCAT usage examples



Correlation between high energy IC40 events (Emu> 100TeV) and Antares high energy events (nhits>100)

Future ANTARES data releases

- Plans to release more data (until 2012)
  - The new set will also have time stamps included and should therefore allow to make time correlation studies with other catalogues.
- Possibility to include shower events data
- Possibility to include KM3NeT simulated data for a fake point source

- Stay tuned!