

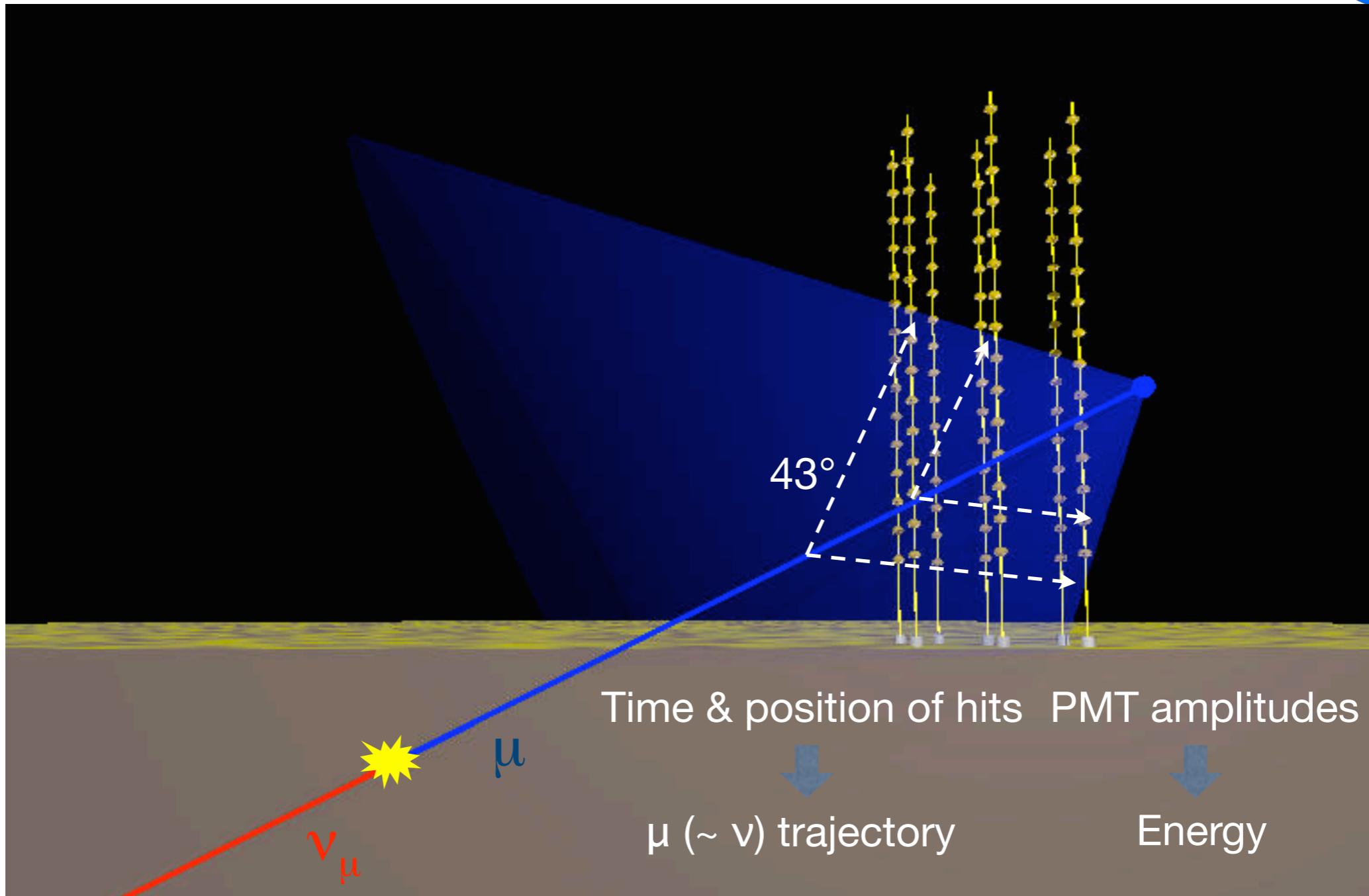
The KM3NeT project: Towards a km³-scale neutrino telescope in the Mediterranean Sea



Alexander Kappes
ECAP, Universität Erlangen-Nürnberg
for the KM3NeT Consortium
2009 EPS HEP, Krakow, 16. July 2009



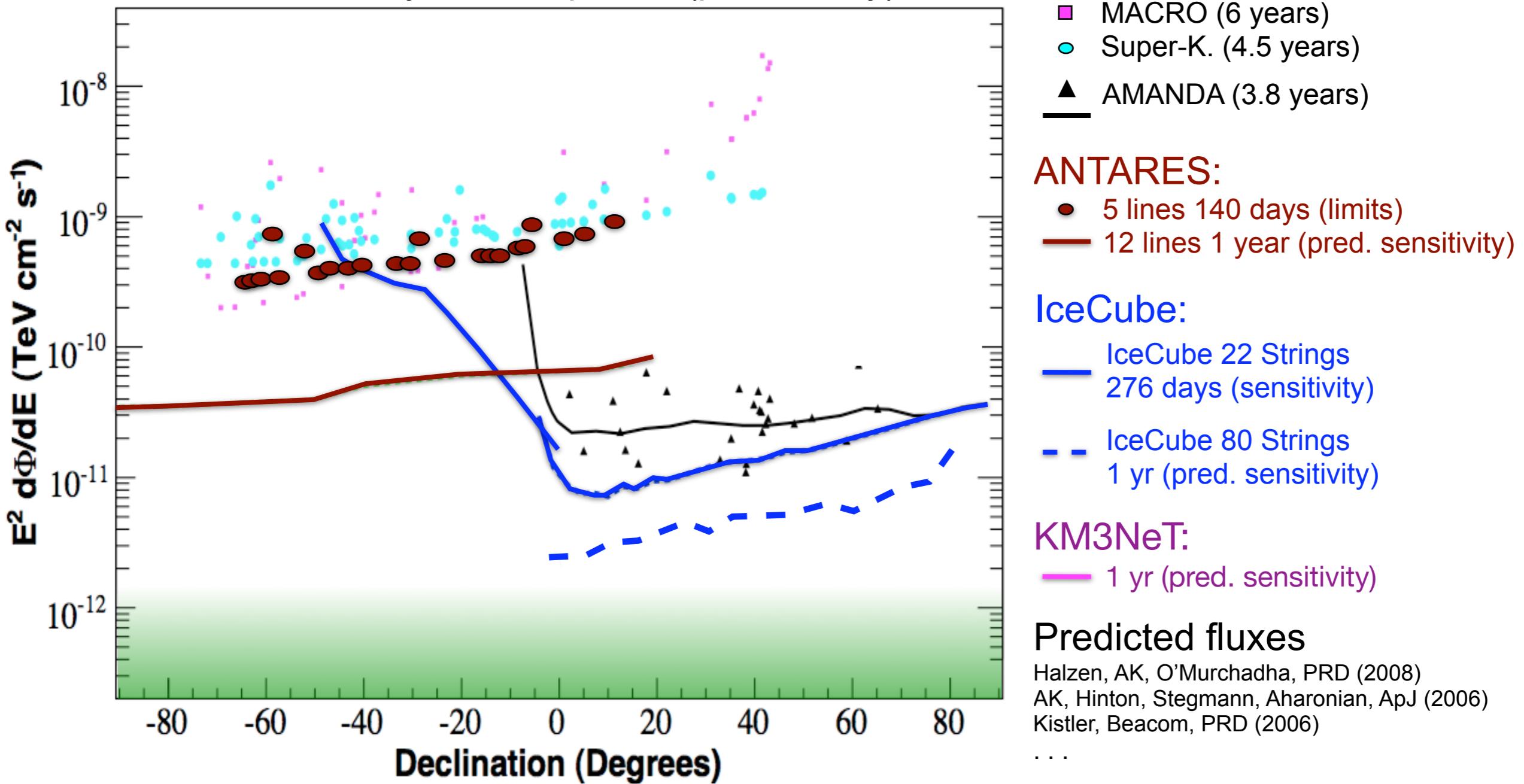
Principle of neutrino detection



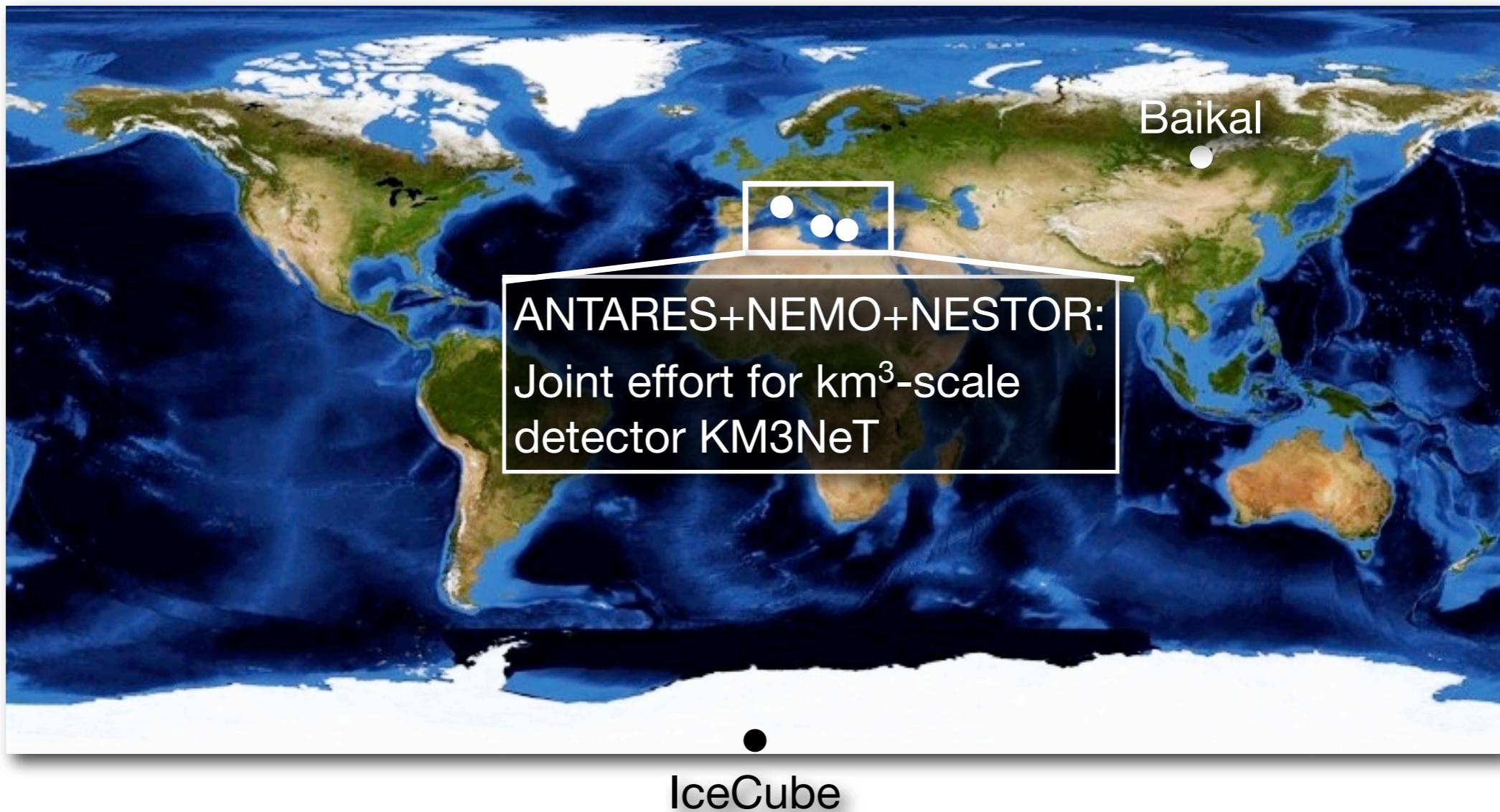


Point source sensitivities

90% CL sensitivity for E^{-2} spectra (preliminary)



Neutrino telescope projects





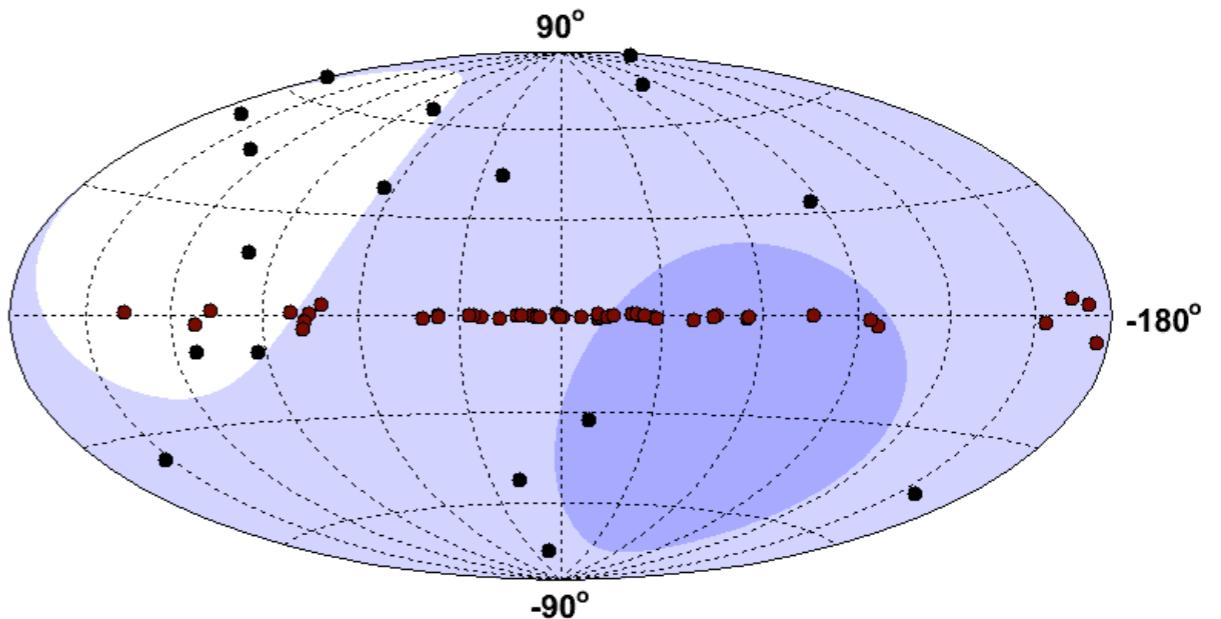
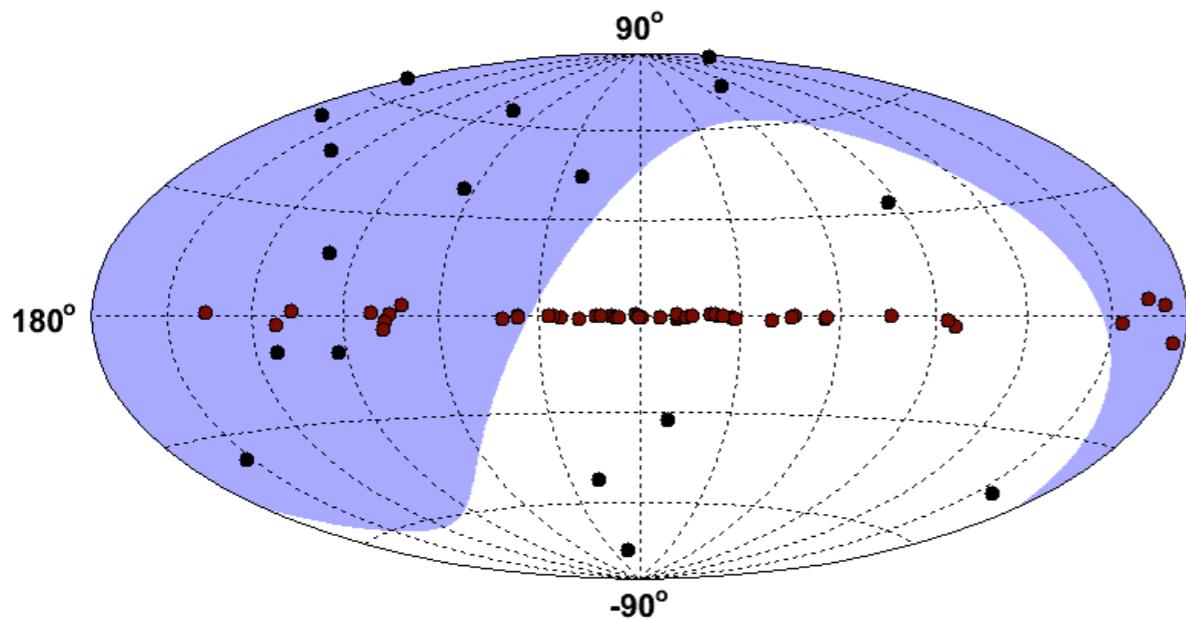
Sky coverage

Visibility IceCube (South Pole)

- 100%
- 0%

Visibility KM3NeT (Mediterranean)

- > 75%
- 25% – 75%
- < 25%



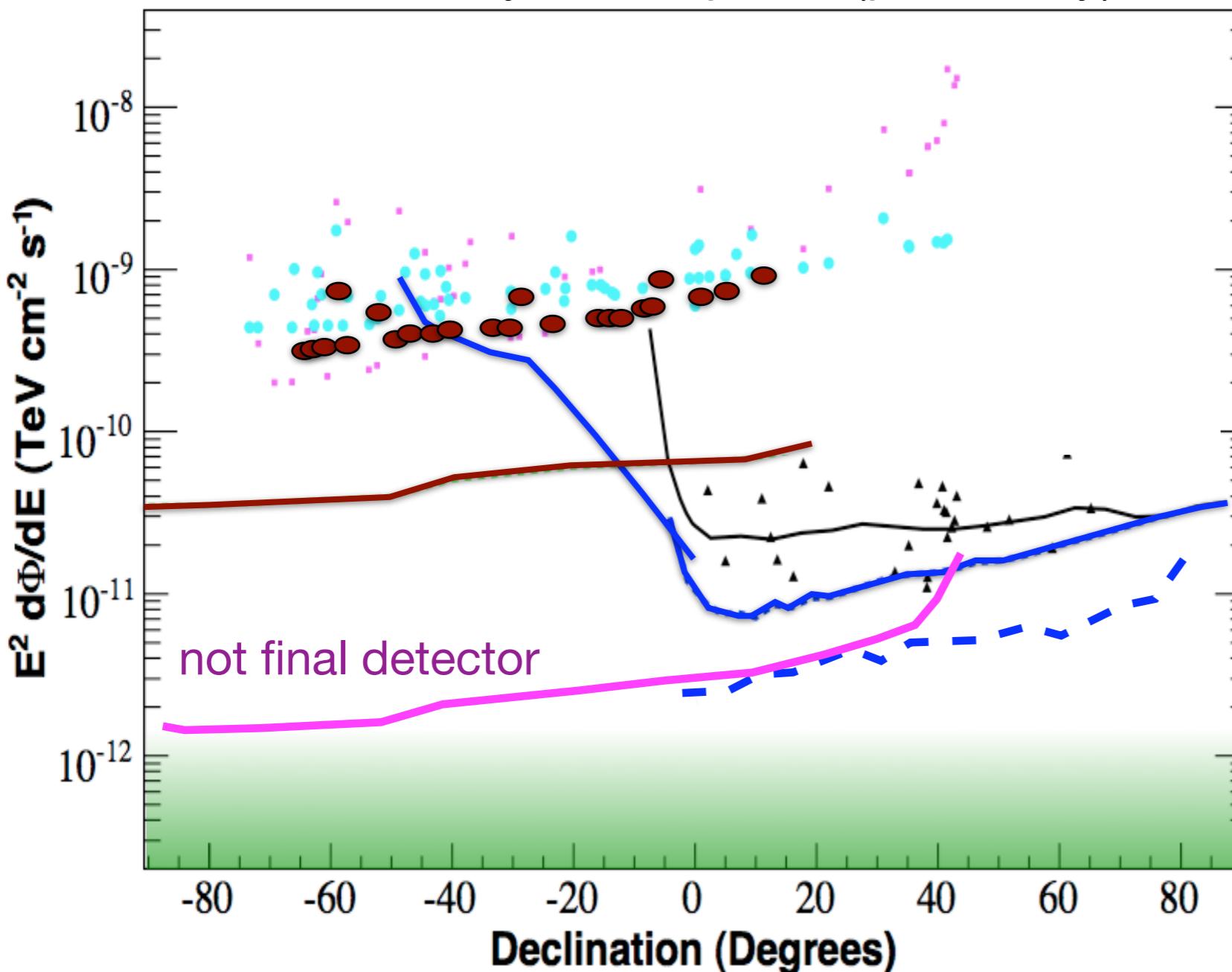
TeV γ -ray sources

- Galactic
- extra-Galactic

KM3NeT point source sensitivity



90% CL sensitivity for E^{-2} spectra (preliminary)



- MACRO (6 years)
- Super-K. (4.5 years)
- ▲ AMANDA (3.8 years)

ANTARES:

- 5 lines 140 days (limits)
- 12 lines 1 year (pred. sensitivity)

IceCube:

- IceCube 22 Strings
276 days (sensitivity)
- - - IceCube 80 Strings
1 yr (pred. sensitivity)

KM3NeT:

- 1 yr (pred. sensitivity)

Predicted fluxes

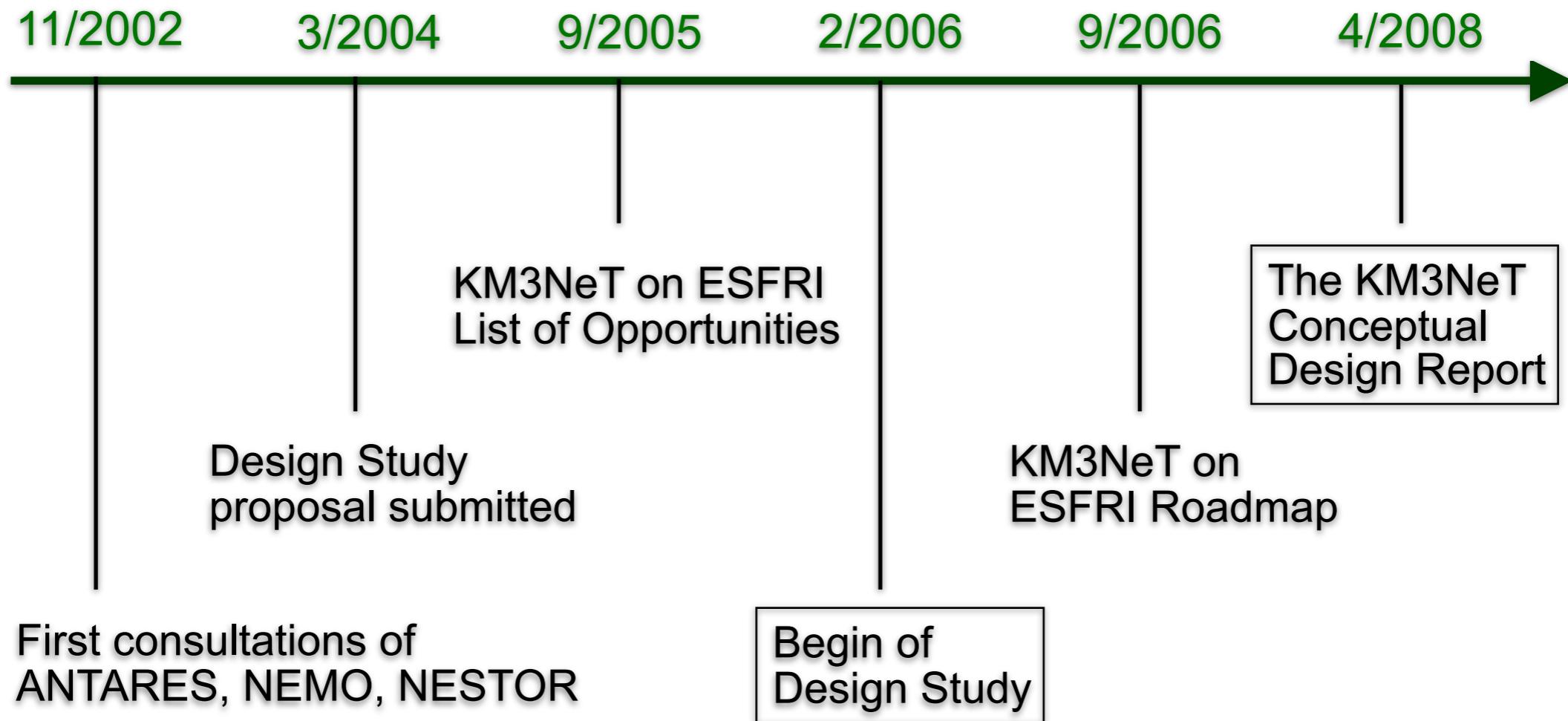
- Halzen, AK, O'Murchadha, PRD (2008)
- AK, Hinton, Stegmann, Aharonian, ApJ (2006)
- Kistler, Beacom, PRD (2006)

KM3NeT science case



- Astroparticle physics with neutrinos
 - “Point sources”: Galactic and extra-Galactic sources of high-energy neutrinos
 - Diffuse neutrino flux
 - Neutrinos from Dark Matter annihilation (WIMPs)
 - Cosmogenic neutrinos ($E \gtrsim 10^{17}$ eV)
- Search for exotics
 - Magnetic monopoles, nuclearites ...
 - Lorentz violation
- Earth and marine sciences
 - Long-term, continuous measurements in deep-sea
 - Marine biology, oceanography, geology/geophysics, ...

KM3NeT: from the idea to a concept





Design study topics

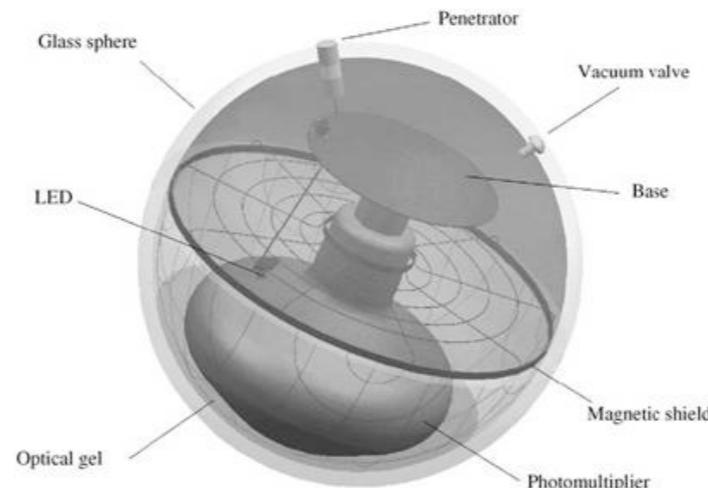
- • Photo-sensors and optical modules
- Data acquisition
- • Detector configuration
- Calibration
- Deep-sea infrastructure
- • Deployment
- Associated science infrastructure



Photo sensors and optical modules

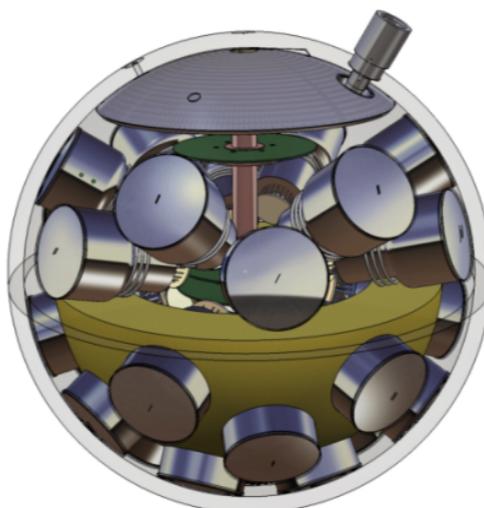
1× 10" PMT:

- 17" glass container
- improved ANTARES OM with electronics inside



31× 3" PMTs:

- 17" glass container
- directional information
- almost uniform directional sensitivity

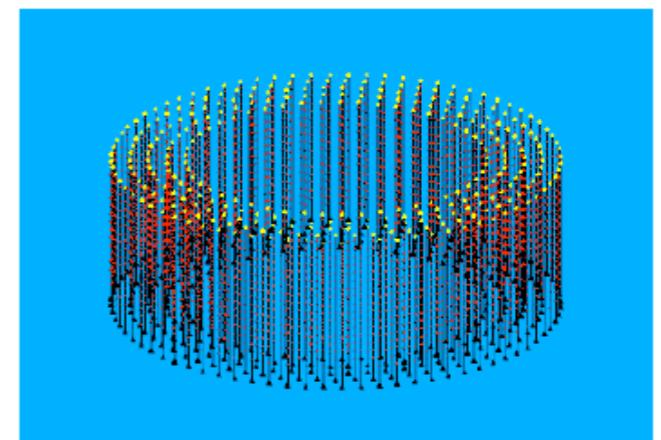
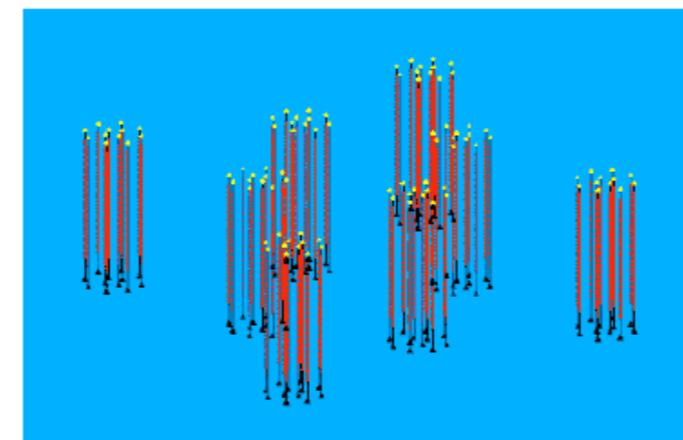
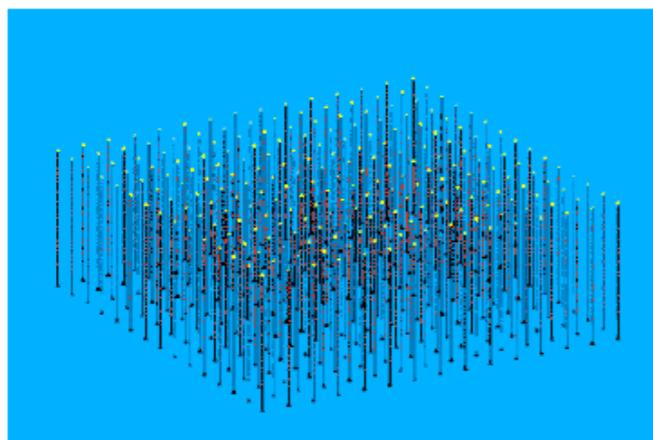
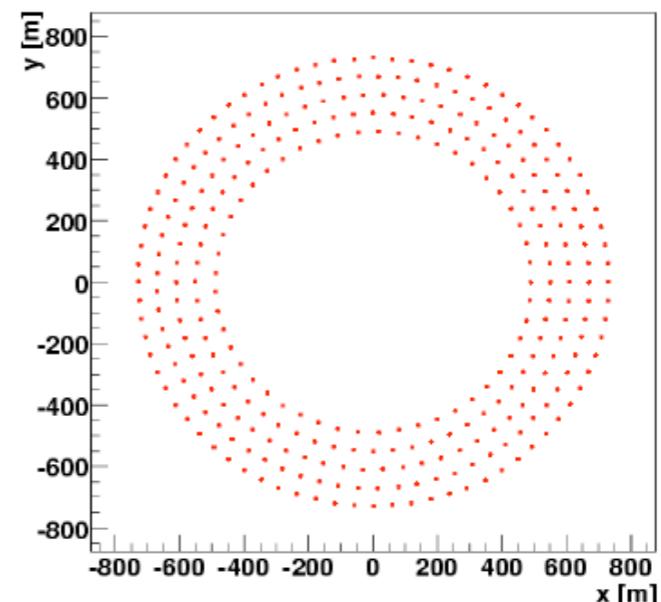
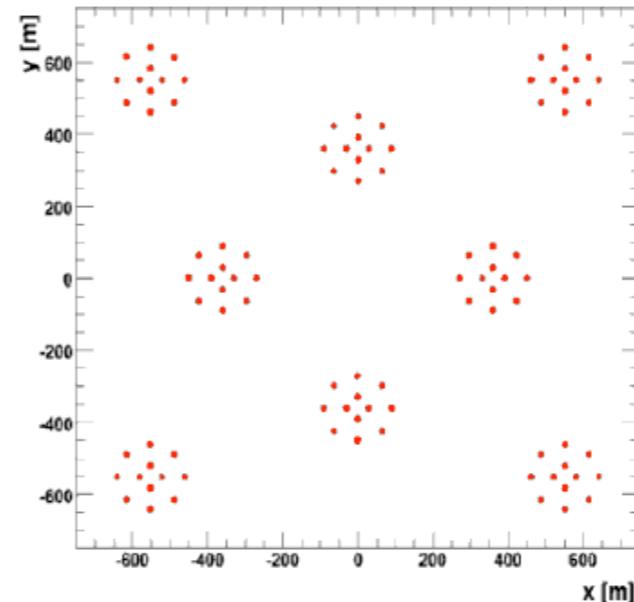
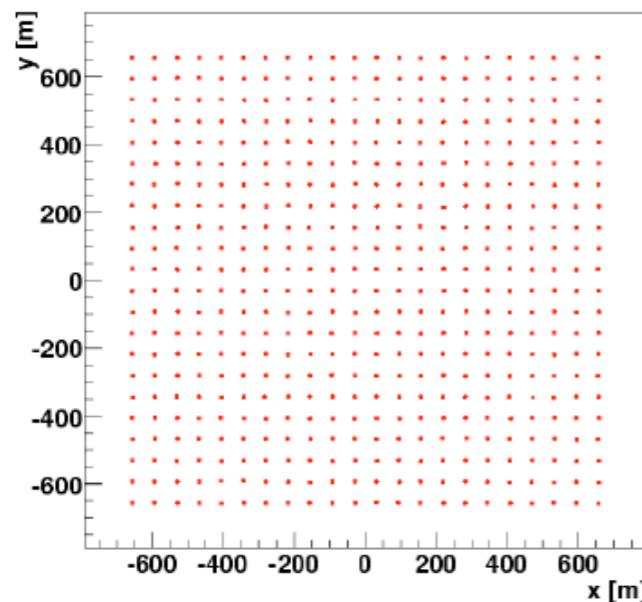


Further simulations required
Costs and reliability studied

Detector configuration



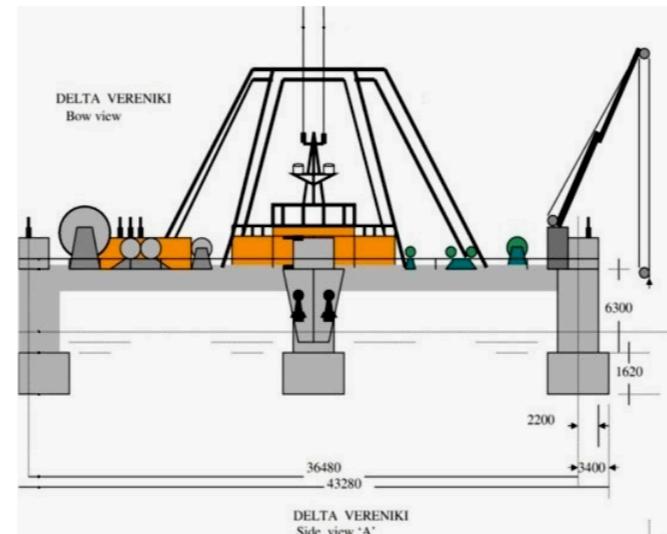
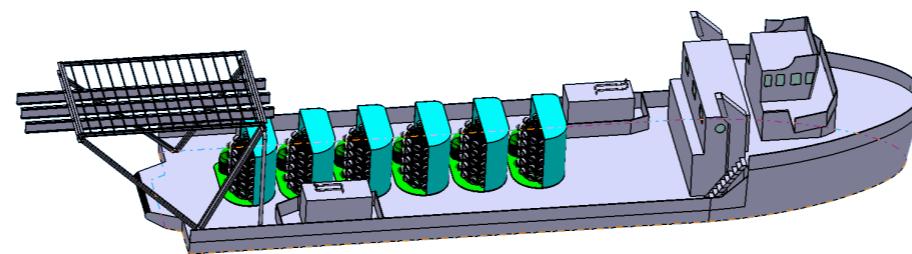
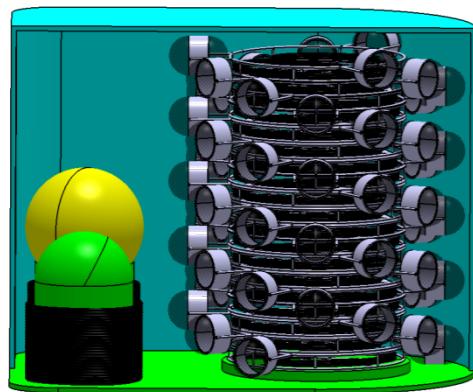
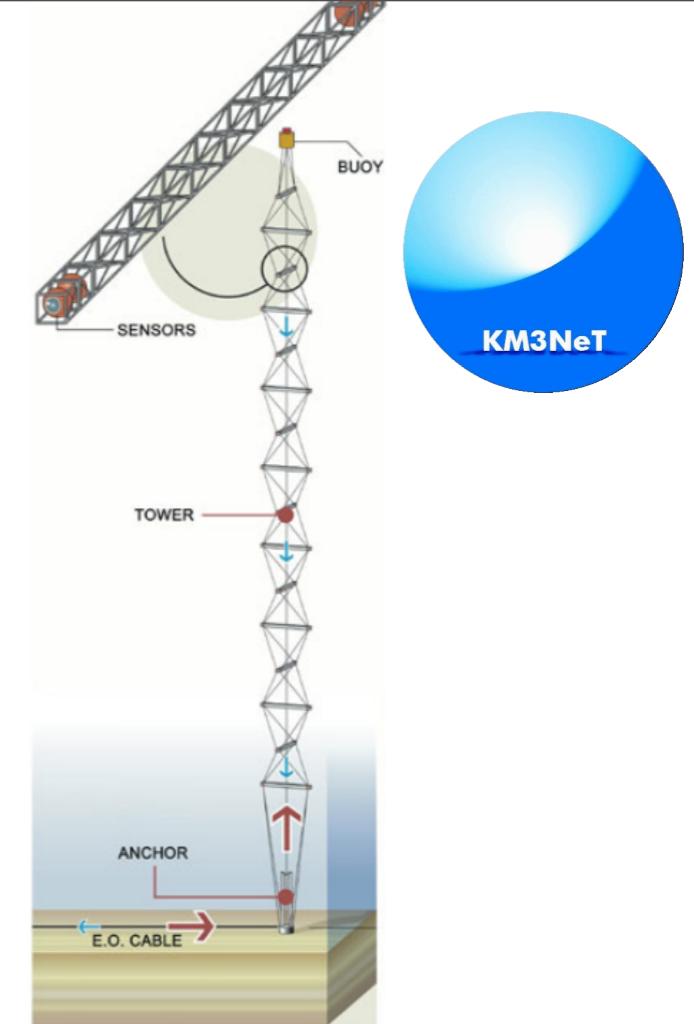
- Various configuration studied
- Constraints on OM pattern due to optical background rejection



Deployment

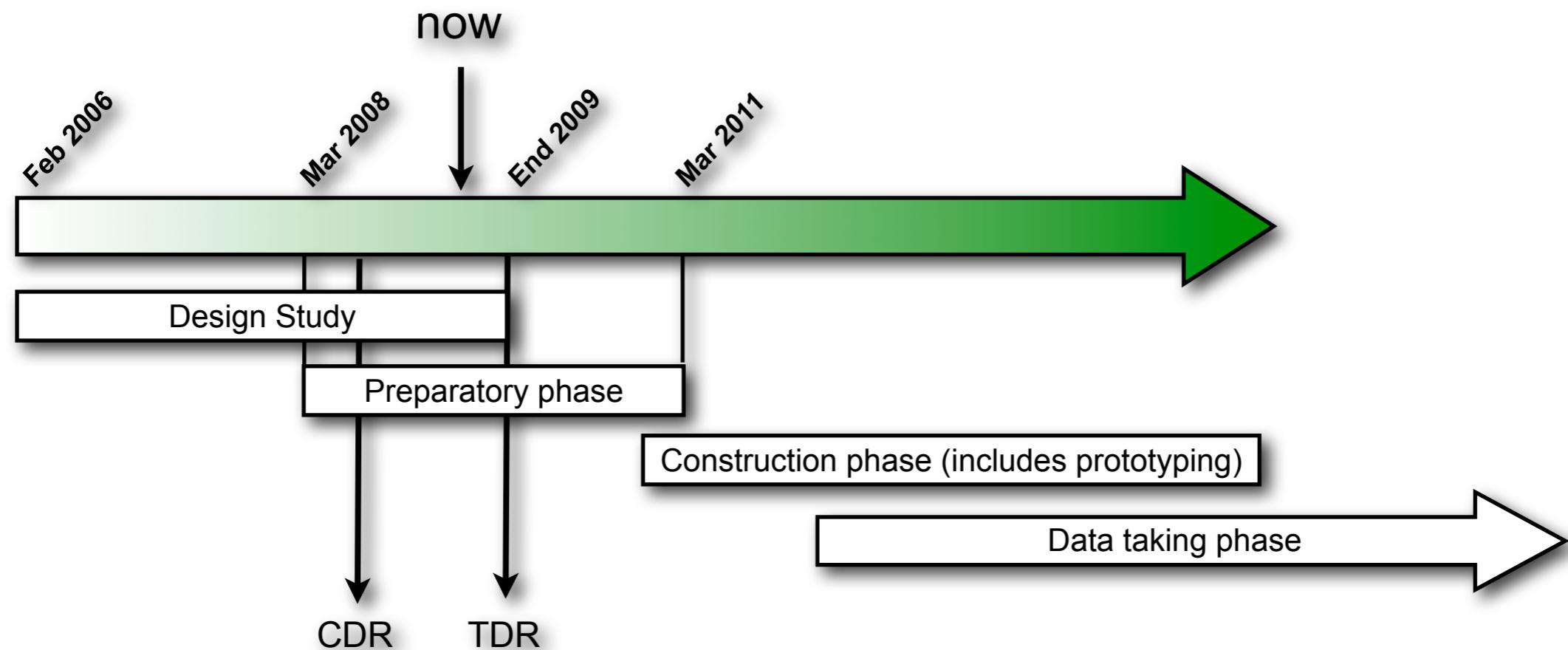
Compact structures
(example)

Lease/buy ship . . .



. . . or use platform
(Delta Berenike)

KM3NeT: Timeline



Summary



- Compelling science case for neutrino telescopes
- We need km³-scale neutrino telescope (KM3NeT) in Northern hemisphere to complement IceCube's field of view
- KM3NeT currently in planning phase
 - Conceptual Design Report available
 - Technical Design Report end of 2009
- Working towards start of construction in 2011
→ first data in 2012 possible