

# White-Rabbit in KM3NeT



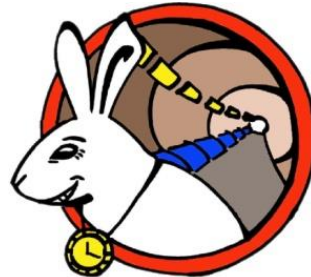
# Outline

- \* Intro:



- \* A multi-km<sup>3</sup> neutrino telescope in the deep-sea

- \* KM3NeT readout &

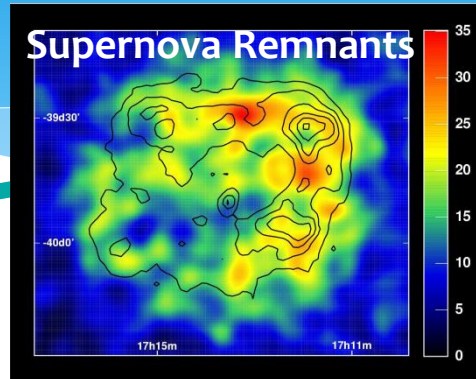


# Potential neutrino sources

Pulsar Wind Nebula



Supernova Remnants



Dark Matter

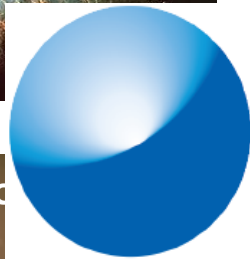


Active Galaxies

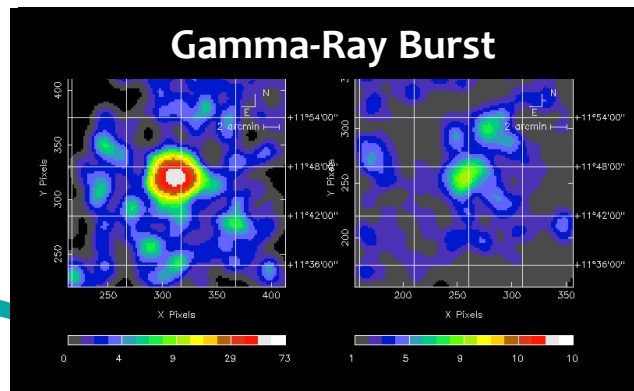


## KM3NeT

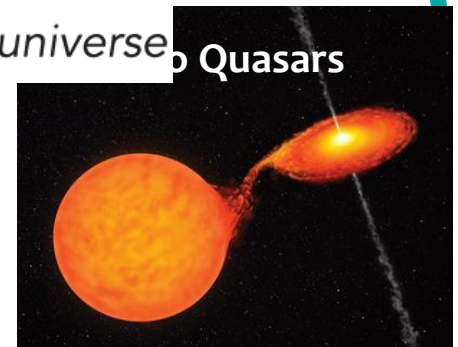
Opens a new window on our universe



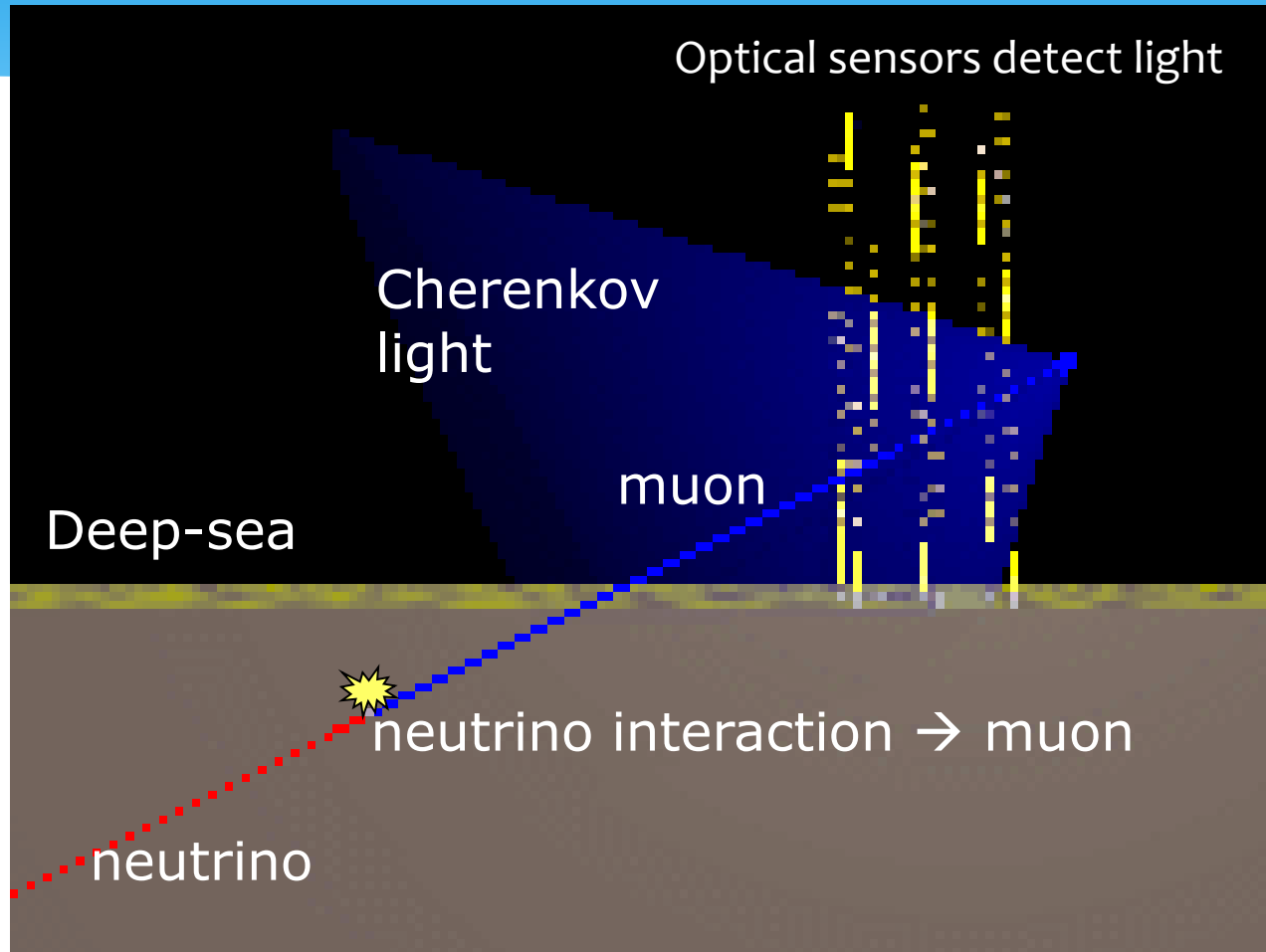
Gamma-Ray Burst



Quasars

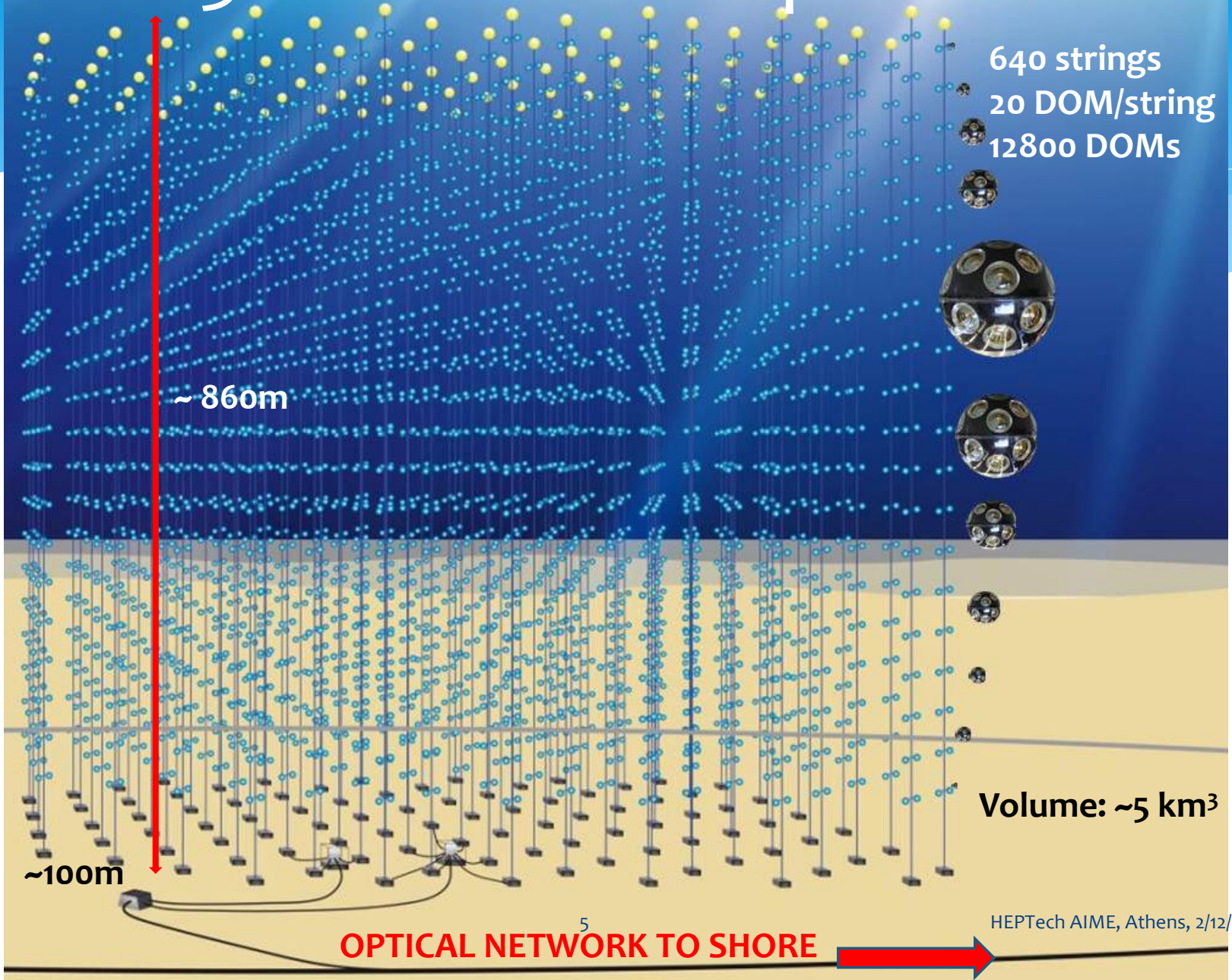


# Detection method



Neutrino-induced muons in the deep sea

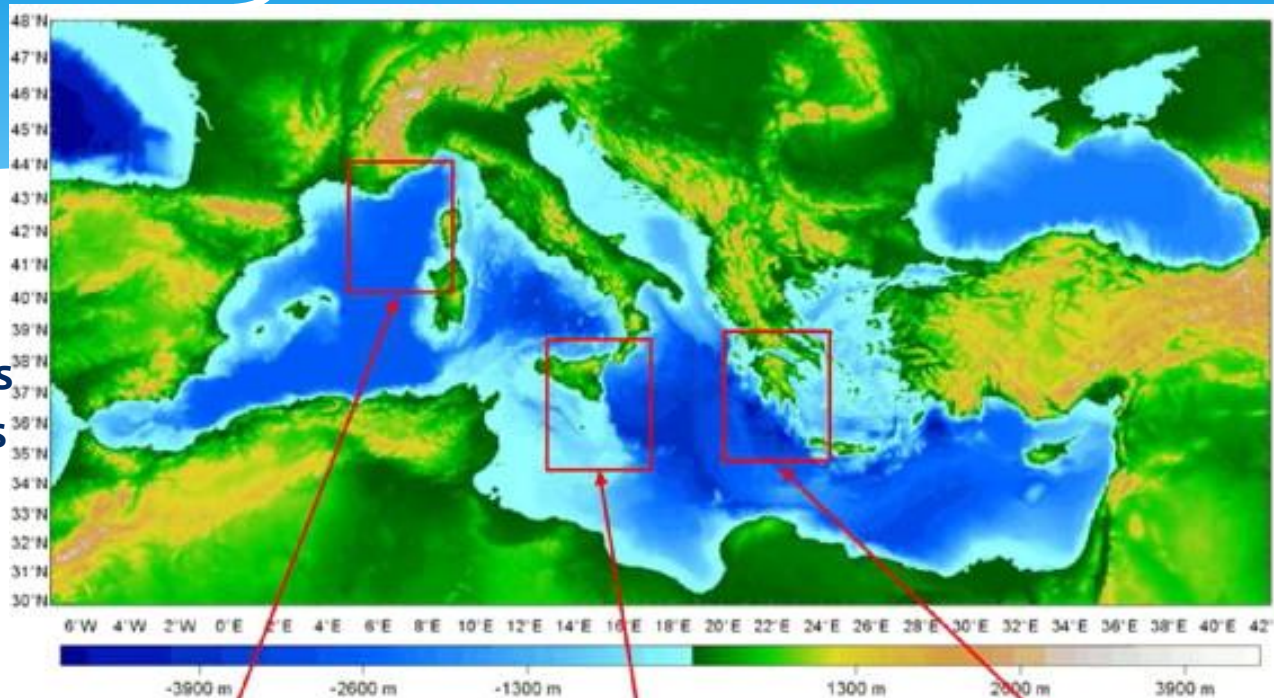
# KM<sup>3</sup>NeT - Artist Impression



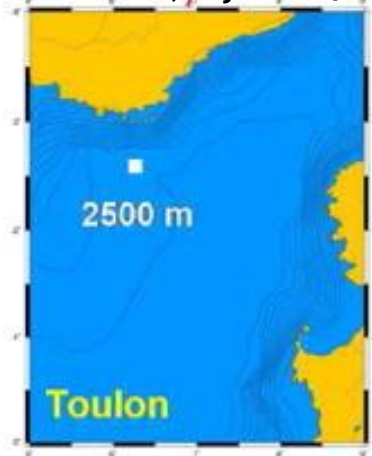


# KM<sub>3</sub>NeT- Where & When

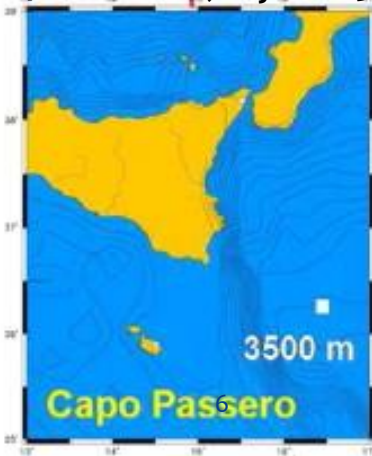
200 People  
40 Institutes  
10 Countries



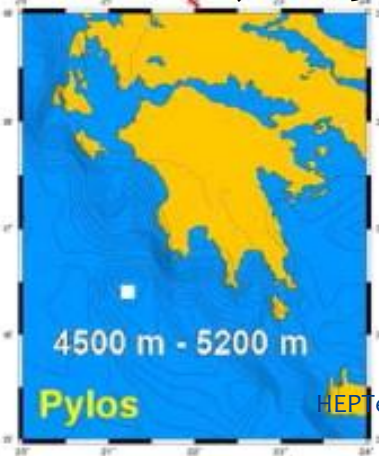
20 DOM, by 2014



480 DOM, by 2015

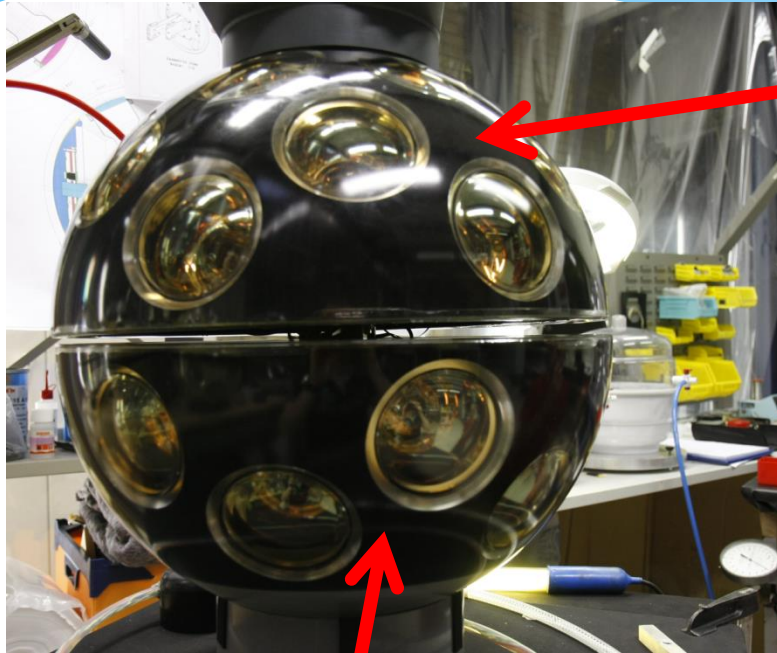


10000 DOM, >2015 (possibly)



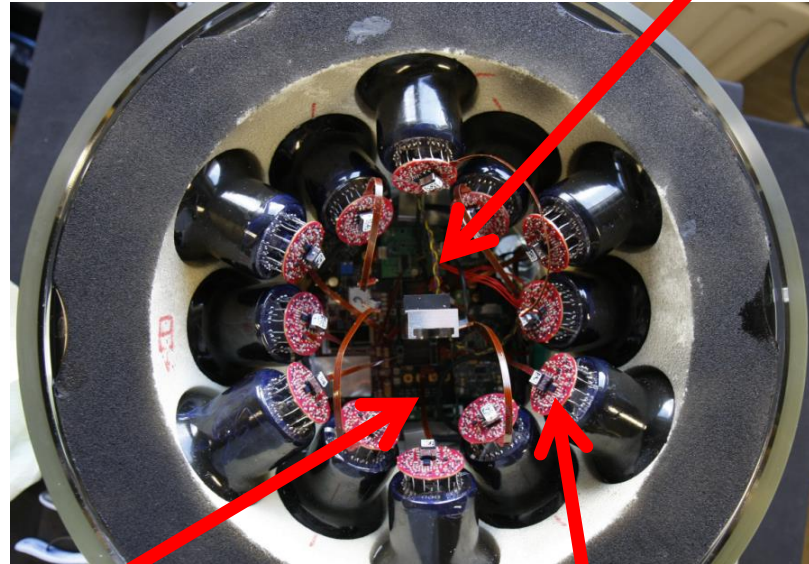
# Digital Optical Module (DOM)

**Power-Board**



**Upper Hemisphere  
12 PMTs**

**Lower Hemisphere  
19 PMTs**



**Central Logic Board  
(CLB)**

**PMT Base:  
High Voltage Supply  
Analog Front-End**

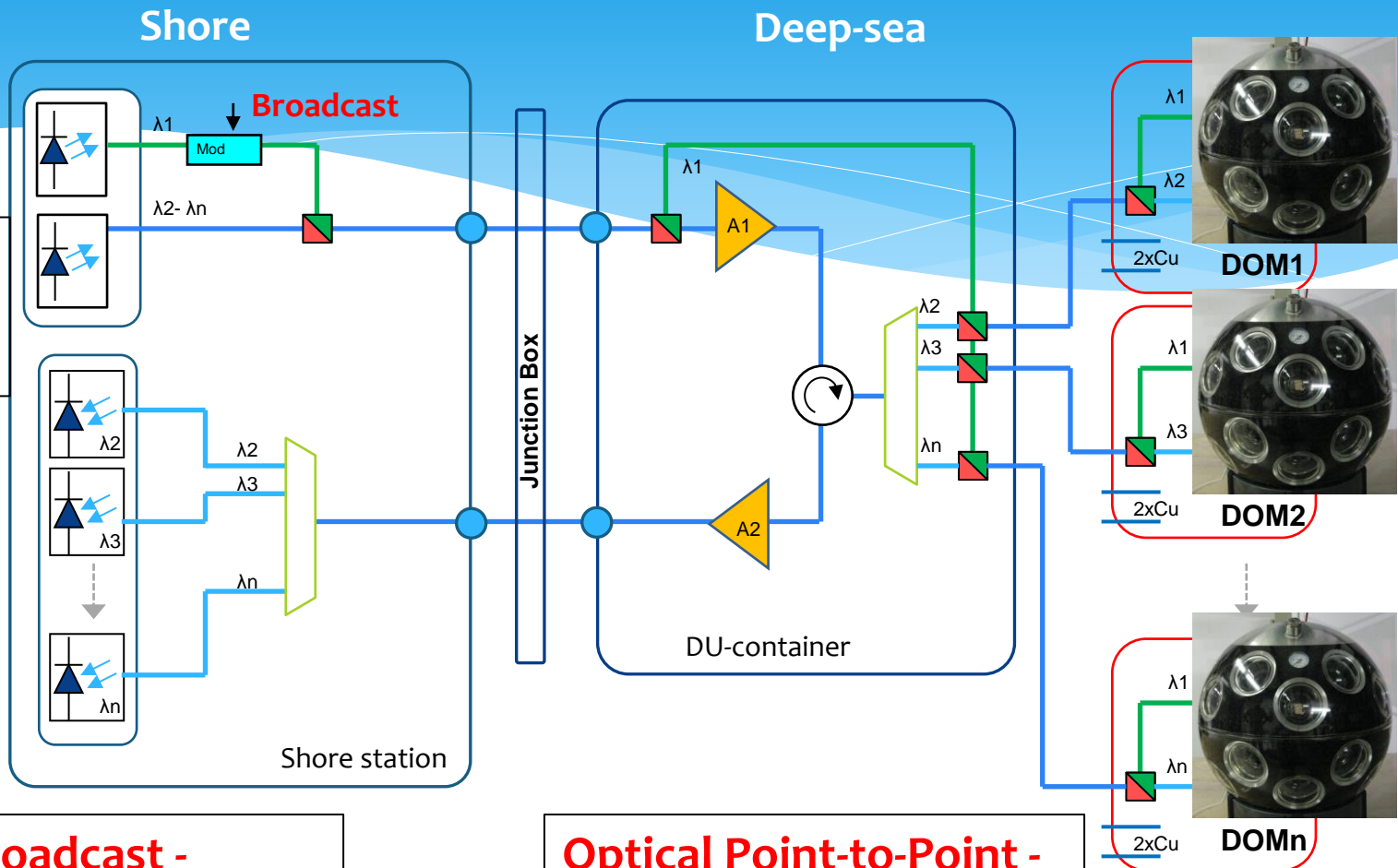


# Power-Board ← Made in Greece





# KM<sub>3</sub>NeT Optical Network - Asymmetry



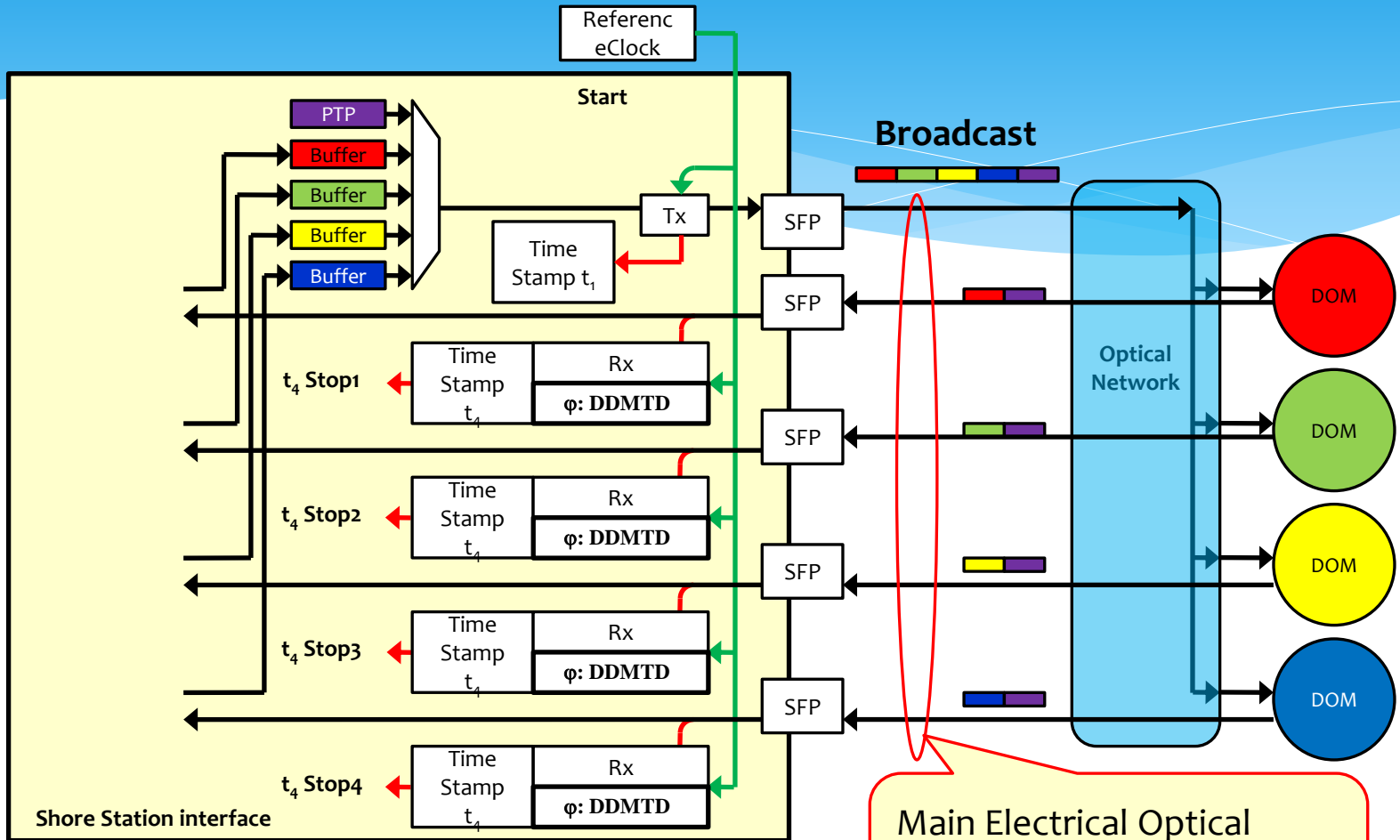
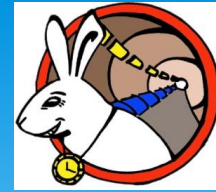
All complex systems on-shore

**Optical Broadcast -**  
Single optical channel from shore control/cmd to each DOM

**Optical Point-to-Point -**  
Specific optical channel from each DOM to shore

Each DOM:  
20-200Mb/s

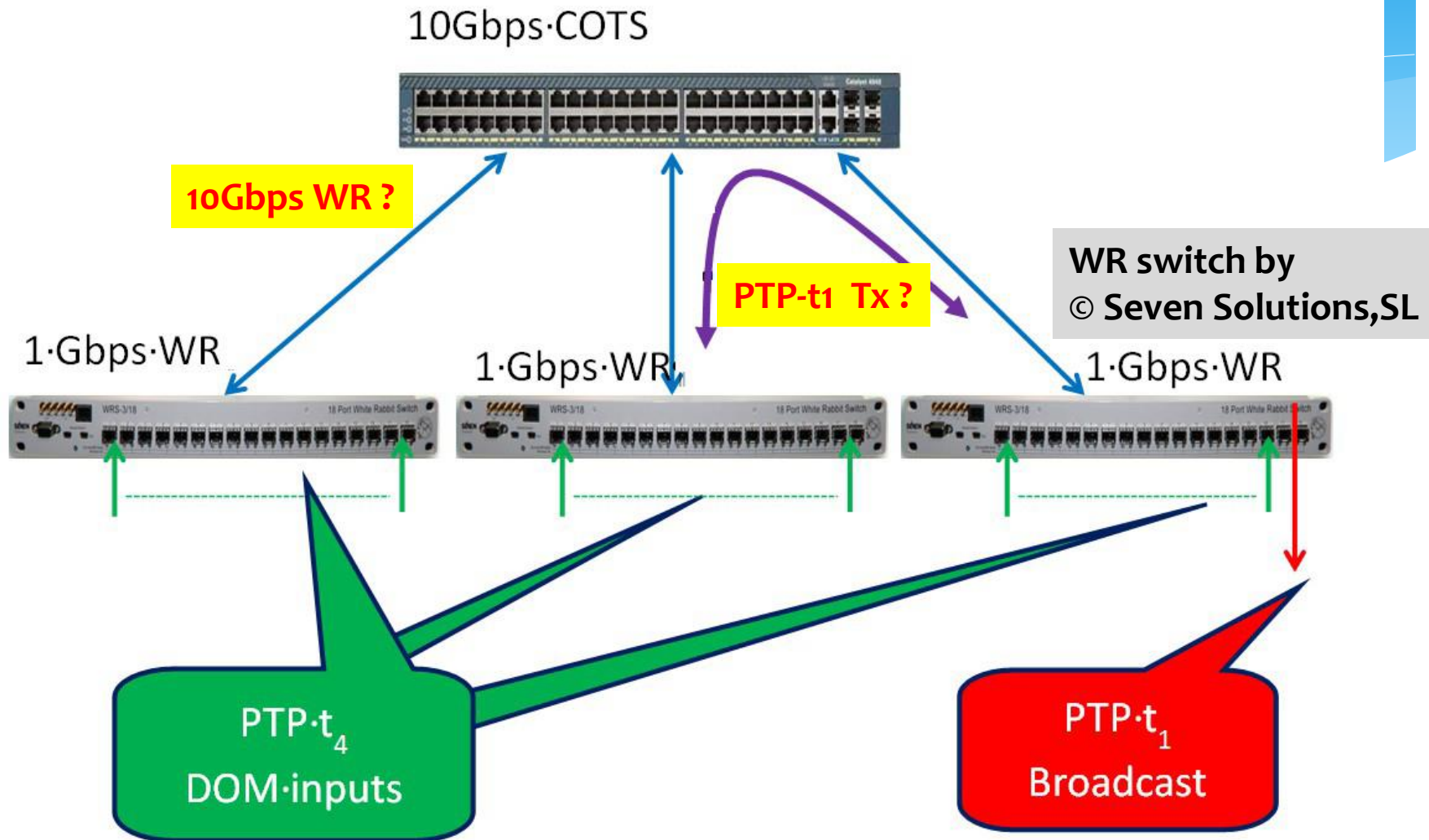
# Optical Broadcast &



**Can this be done with WR switch ?  
Only Firmware/Software changes ?  
Study is in progress !**

Main Electrical Optical  
Cable  
May be 100 km long...

# Distributed network of switches





# White-Rabbit in KM<sub>3</sub>NeT Possibilities & Challenges



- \* Readout every DOM, 31 PMTs, with 1 ns resolution
- \* “Knowledge” of absolute time (1 ns resolution)
- \* Data pushed from DOMs to Shore Station
- \* P2P optical link to shore, each DOM sends data up to 200Mbps
- \* Single optical link from shore to send WR-PTP information to all DOMs ← Challenge
- \* Total number of P2P links ~12000 into WR network, scalability through distributed WR switches ← Challenge
- \* Other I/O: 10Gbps concentrators for WR capable h/w ← Challenge
- \* Challenges under study at INPP NCSR-Demokritos ...

# ... stay in synch



in



# KM<sub>3</sub>NeT- Activities @NCSR-D

- \* (1) the development and manufacture of electronic systems for optical modules (Powerboard, Compass, Inclinator)
- \* (2) development of electro-optical system firmware and software for data collection and processing in real time in the shore-station using White Rabbit
- \* (3) development of software and algorithms for the simulation and reconstruction of neutrino event detection