Neutrino telescope with an instrumented volume of $5 \text{ km}^3$ at the bottom of the Mediterranean Sea at a depth of 2.5 – 5 km.

Detection of high-energy neutrinos from distant astrophysical sources or from annihilation of dark matter particles: a new window on the Universe.

Detection principle: Cherenkov light emitted by charged particles resulting from neutrino interactions in the matter surrounding the telescope.

**KM3NeT technical design**

Detection unit of the telescope – flexible tower with horizontal bars, each holding two multi-PMT OMs.

**KM3NeT specification for 3-inch PMTs**

- Quantum efficiency (QE) at 470 nm: $>20\%$
- Inhomogeneity of cathode response: $<10\%$
- Supply voltage: $<1400\text{V}$
- Gain: $>2\times10^6$
- Dark count rate at 15°C: $<3\text{ kHz}$
- Transit time spread (TTS): $<2\text{ns (r)}$
- Peak to valley ratio: $>3$
- Length: $<12\text{cm}$

**New Hamamatsu PMTs: R6233mod and R12199**

R6233mod PMT is a modification of existing R6233 PMT with a new concave-convex lens-like input window and with an increase of number of dynode stages from 8 to 10. In 2011, 53 PMTs of this type were delivered for tests in January 2012. TTS of new PMTs is below 2ns (sigma, or $\sigma$), to improve TTS, an additional layer on side will be glued to increase effective photocathode area $\sim$ increased sensitivity.

**New ETEL PMTs D783KFLA**

100 new ETEL PMTs were delivered by a few batches starting in May 2011. Most part of delivered samples meet the KM3NeT specifications. Test results on quantum and detection efficiency measurements are presented below. New ETEL PMTs are used now to build first fully operational prototypes of multi-PMT optical modules.

**New MELZ PMT**

MELZ (Moscow, Russia) is developing a new 82mm diameter PMT. An effective photocathode diameter of 76mm is expected, corresponds to a $\sim$30% increase of the effective photocathode area in comparison with a standard 3-inch PMT. The new PMT is under internal tests at the company. Expected delivery of first samples – Summer 2012.

**Increased photon collection efficiency through use of reflector**

Use of reflector increases photon detection efficiency by $\sim$30%. Aluminum expansion cone serves as a reflector for PMTs with lens-like input windows (picture left). Glass lens with a reflective layer on side will be glued to 3-inch (76+ mm diameter) hemispherical PMTs (picture right). Outer radius of 198mm of this lens fits radius of the pressure sphere.

**Detection efficiency (DE) of PMTs is a product of photocathode quantum efficiency (QE) and photoelectron collection efficiency (CE). The important parameter is usually not specified by manufacturers exactly. Measurements of CE performed for new Hamamatsu and ETEL PMTs are resulting in CE of 97% for D783KFLA PMT and of 91% for R12199 PMT.