VLVnT11 - Very Large Volume Neutrino Telescope Workshop (2011)

Report of Contributions

Contribution ID: **4** Type: **not specified**

IceCube results

Wednesday 12 October 2011 10:30 (50 minutes)

The construction of IceCube neutrino telescope and IceTop surface array was successfully completed at the South Pole during December, 2010. IceCube is the most sensitive telescope to date for observing high energy neutrino sources.
The performance of the IceCube detector and a selection of results will be reported from earlier years as the detector increased in size from 40, 59 and 79 strings. New analysis methods developed for the study of the Southern Hemisphere as well as for extended regions in the sky will be emphasized. The long term experience with AMANDA and IceCube has proven that the South Pole ice is an ideal
site for astroparticle physics. New ideas and possible future projects beyond IceCube will also be presented.

Presenter: RESCONI, Elisa

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **5** Type: **not specified**

Northern Hemisphere Neutrino Telescopes

Wednesday 12 October 2011 11:20 (35 minutes)

The main features and performances of the Antares and Baikal neutrino telescopes are reviewed. The results obtained by these detectors in several studies, such as the search for neutrino point sources and diffuse fluxes, the search for neutrinos in coincidence with optical, high-energy gamma and gravitational wave signals, as well as the indirect search for dark matter and a short summary of other analyses will be presented.

Presenter: HERNANDEZ-REY, Juan (Universidad de Valencia (ES))

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **6** Type: **not specified**

UHE Neutrino Searches

Wednesday 12 October 2011 11:55 (35 minutes)

We expect an observable flux of neutrinos in the ultra-high energy (UHE) regime (above 10ˆ18 eV) from the interactions of the highest energy cosmic rays with cosmic microwave background photons. I will review the latest constraints set by neutrino telescopes which are closing in on this UHE neutrino flux. The next generation of UHE neutrino experiments are aiming for detection volumes of order 100˜kmˆ3 in order to exploit a sample of these unique cosmic messengers. I will give an overview of what we can expect to come online in the field in the coming years.

Presenter: CONNOLLY, Amy (University College London)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **7** Type: **not specified**

KM3NeT - where are we and where do we go

Friday 14 October 2011 10:00 (1 hour)

The talk will show the present technical status of the KM3NeT telescope.
The optimisation studies for detection of Galactic super nova remnant sources will be presented and the present sensitivity to such sources will be reviewed. Implications of the design on other science subjects will be shown. Possible scenarios for the realisation of the telescope in the near future will be given.

Presenter: KOOIJMAN, Paul Martin (NIKHEF)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **8** Type: **not specified**

Toward precision neutrino physics with DeepCore and beyond

Friday 14 October 2011 11:00 (30 minutes)

DeepCore, the fully contained low energy extension to IceCube, extends IceCube's sensitivity for indirect dark matter searches and atmospheric neutrino oscillations. With the first year of DeepCore data we observe a significant sample of atmospheric neutrino-induced cascades, confirming the scientific potential of this approach. We will discuss ideas for PINGU, a further IceCube infill array which aims for an energy threshold of around 1 GeV to support a precision IceCube neutrino physics program. In the longer term, we are exploring the feasibility of a precision neutrino physics program with a multi-megaton, sub-GeV detector in the Antarctic ice cap.

Primary author: DEYOUNG, Tyce

Presenter: DEYOUNG, Tyce

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **10** Type: **not specified**

Neutrinos with JEM-EUSO

Friday 14 October 2011 12:00 (30 minutes)

In this contribution we will present the Extreme Universe Space Observatory onboard the Japanese Experiment Module of the ISS. After briefing summarize the scientific case of the mission, we will discuss the technological aspects and the expected performance of the mission. We will then focus on the capability of JEM-EUSO in detecting neutrinos at Ultra High Energy and on the potential science outcome of the mission in neutrino astrophysics.

Presenter: SANTANGELO, Andrea

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **12** Type: **not specified**

Roadmaps for neutrino APP

Friday 14 October 2011 15:00 (30 minutes)

This talk will summarize the recommendations of the ASPERA roadmap, with a focus to high energy neutrinos. It will also relate the ASPERA strategy on neutrino projects to strategy discussions in other parts of the world.

Presenter: SPIERING, Christian (DESY)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **13** Type: **not specified**

Funding aspects

Friday 14 October 2011 15:30 (30 minutes)

ASPERA is the network of European funding agencies in the field of astroparticle physics. In my presentation I will report on the status of the implementation of the European roadmap for astroparticle physics and the network's supporting activities in view of the realization of coming large projects including a large underwater neutrino telescope in the Mediterranean.

Presenter: Dr BERGHOEFER, Thomas (PT-DESY)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **14** Type: **not specified**

Welcome by the Vice-President of the University of Erlangen

Wednesday 12 October 2011 10:15 (15 minutes)

Presenter: Prof. HORNEGGER, Joachim (Friedrich-Alexander-Universität Erlangen-Nürnberg)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **27** Type: **not specified**

Plenary Session: Conference Summary

Friday 14 October 2011 16:30 (45 minutes)

Primary author: DE JONG, Maarten (NIKHEF)

Presenter: DE JONG, Maarten (NIKHEF)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **29** Type: **not specified**

The neutrino sky at very high energies

Thursday 13 October 2011 14:00 (50 minutes)

Neutrino astronomy opens a new window for the observation and study of high-energy phenomena in our Universe. The emission of high energy neutrinos is intimately related to that of gamma rays and cosmic rays (CRs) via hadronic interactions in extragalactic sources or the cosmic environment. I will discuss our present expectations for the cosmogenic neutrino flux associated with the propagation of ultra-high energy (UHE) CRs in the cosmic radiation background. This flux is a "guaranteed" contribution to the diffuse EeV neutrino background but shows a strong model dependence on the UHE CR scenario. Specific models of extragalactic TeV to PeV neutrino sources are already testable by large volume neutrino observatories like IceCube. I will show how present limits on diffuse and point-source neutrino fluxes can be used to constrain candidate sources of UHE CRs like gamma ray bursts.

Primary author: AHLERS, Markus

Presenter: AHLERS, Markus

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **30** Type: **not specified**

Acceleration processes, galactic sources, the gamma connection

Thursday 13 October 2011 14:50 (50 minutes)

Presenter: DRURY, Luke

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **32** Type: **not specified**

Welcome and Information by the Workshop Organisers

Wednesday 12 October 2011 10:00 (15 minutes)

Presenter: KATZ, Uli (Physikalisches Institut)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **34** Type: **not specified**

Terrestrial Magnetic Field Effects on Large Photomultipliers

Wednesday 12 October 2011 16:50 (20 minutes)

The influence of the Earth's magnetic field on candidate large PMTs for a cubic-kilometer-scale neutrino telescope was studied within the framework of the KM3NeT design study. In particular, this study was aimed at deciding whether the use of a magnetic shield could be avoided, thereby reducing cost and simplifying optical sensor module assembly. Measurements were performed for three Hamamatsu PMTs: two 8-inch, R5912 types; one with standard and the other with super-bialkali photocathode, and a 10-inch R7081 type with a standard bialkali photocathode. The various characteristics of the PMTs, such as transit time, transit time spread, gain, peak-to-valley ratio and charge resolution, were measured while varying the PMT orientations with respect to the Earth's magnetic field, both with and without mu-metal cage magnetic shielding. Detection efficiency and the rates of spurious pulses were also investigated. In the 8-inch PMTs the impact of the magnetic field was found to be smaller than on the 10-inch PMT. With a mu-metal cage, the 10-inch PMT had a similar response as the 8-inch PMTs without a cage. The increased quantum efficiency in the 8 super-bialkali PMT almost compensates its smaller detection surface compared to the 10"PMT. No significant effects of the Earth's magnetic field were measured upon transit time and the rates of spurious pulses.

Summary

The influence of the Earth's magnetic field on candidate large PMTs for a cubic-kilometer-scale neutrino telescope was studied within the framework of the KM3NeT design study. Measurements were performed for three Hamamatsu PMTs: two 8-inch, R5912 types; one with standard and the other with super-bialkali photocathode, and a 10-inch R7081 type with a standard bialkali photocathode. The various characteristics of the PMTs were measured while varying the PMT orientations with respect to the Earth's magnetic field, both with and without mu-metal cage magnetic shielding. In the 8-inch PMTs the impact of the magnetic field was found to be smaller than on the 10-inch PMT. With a mu-metal cage, the 10-inch PMT had a similar response as the 8-inch PMTs without a cage. The increased quantum efficiency in the 8 super-bialkali PMT almost compensates its smaller detection surface compared to the 10"PMT.

Primary author: Dr LEONORA, Emanuele (INFN, section of Catania)

Presenter: Dr LEONORA, Emanuele (INFN, section of Catania)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **35** Type: **not specified**

Assembly and Design of the Optical Modules for the NEMO Phase-2

Wednesday 12 October 2011 15:40 (20 minutes)

The NEMO collaboration has undertaken a Phase-2 project, which aims at the realization and installation of a new infrastructure at the deep-sea site of Capo Passero at 3500 m depth. To this aim, a fully equipped 8-storey tower hosting two Optical Modules (OMs) at each end (four OMs per storey) is under construction. Following a well established procedure, the assembly of the 32 OMs is under completion. The designed OM consists of a large area photomultiplier tube (PMT) enclosed in a 13 in. pressure resistant glass sphere. The PMT is a R7081 sel , produced by Hamamatsu, with a 10 in. photocathode and 10 dynodes. Measurements carried out from a batch of 72 PMTs have shown high gain, low dark count rate, good resolution for timing and charge.
Mechanical and optical contact between PMT and the glass surface is ensured by an optical bi-component silicone gel. Tests were done to choose the best composition considering optical and mechanical properties. A mu-metal cage is used to shield the PMT against the Earth's magnetic field. The influence of the Earth's magnetic field on the PMT performances, and the effects of the magnetic shield were measured accurately. The PMT base card circuit is produced by ISEG, based on the NEMO specifications. Inside the OM there are also a front-end board and an optical pulser for timing calibration.

Summary

The NEMO collaboration has undertaken a Phase-2 project, which aims at the realization and installation of a new infrastructure at the deep-sea site of Capo Passero at 3500 m depth. Following a well established procedure, the assembly of the 32 OMs is under completion. The designed OM consists of a large area photomultiplier tube (PMT) enclosed in a 13 in. pressure resistant glass sphere. The PMT is a 10 in. 10 stages R7081 sel , produced by Hamamatsu. Tests were done on a batch of 72 PMTs. Mechanical and optical contact between PMT and the glass surface is ensured by an optical bi-component silicone gel. Tests were done to choose the best composition of the gel. A mu-metal cage is used to shield the PMT against the Earth's magnetic field. The influence of the Earth's magnetic field on the PMT performances was measured accurately. The PMT base card circuit is produced by ISEG. Inside the OM there are also a front-end board and an optical pulser for timing calibration.

Primary author: Dr LEONORA, Emanuele (INFN, section of Catania)

Co-author: Dr AIELLO, Sebastiano (INFN, section of Catania)

Presenter: Dr LEONORA, Emanuele (INFN, section of Catania)

Session Classification: Parallel Session 5

Track Classification: Deep-sea and deep-ice technologies

Contribution ID: **36** Type: **not specified**

Ageing Characterization on Large Area Photomultipliers

Wednesday 12 October 2011 17:10 (20 minutes)

An accurate study and measurement on the ageing effects on two large area photomultipliers has been performed for over three years. The photomultipliers were 10", 10 stages Hamamatsu R7081one with standard bialkali and the other one with super-bialkali photocathode. Gain, dark count rate, charge and timing properties have been measured, as well as the fraction of the spurious pulses.
During the ageing cycles, the anode current of the two photomultipliers has been monitored and recorded in order to measure the total output anode charge and determining the ageing grade. The ageing conditions have been set by the use of a 400nm led regulated to about 3 photo-electrons at 1 MHz. The ageing process was stopped when the total charge arrived up toabout 2200-2550 C for both the PMTs. Measurements of the parameters of the two PMTs have been performed using a 410 nm pulsed LASER in single photoelectron condition . Considering the main results, only the gain showed a variation while all the other parameters remain quite stable. A first phase of up-drift shows an increase of the gain of about 10% and is followed by a final phase of down drift which shows a faster diminution of the gain of about 30%. The mechanism of the gain drift has been modelled and compared with the results.

Primary author: Dr LO PRESTI, Domenico (University of Catania - INFN Catania (Italy))

Co-authors: Dr LEONORA, Emanuele (INFN Catania (Italy)); Prof. RUSSO, Giovanni Valerio (University of Catania - INFN Catania (Italy)); Dr LEANZA, Renata (University of Catania); Dr AIELLO, Sebastiano (INFN Catania (Italy))

Presenter: Dr LEONORA, Emanuele (INFN Catania (Italy))

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **37** Type: **not specified**

Indirect Search for Dark Matter with the ANTARES Neutrino Telescope

Wednesday 12 October 2011 15:20 (20 minutes)

The ANTARES Collaboration is now operating the largest water Cherenkov neutrino telescope in the Nothern hemisphere. The apparatus, completed in 2008, comprises 12 detection lines and a multidisciplinary instrumentation line installed at a depth of about 2500 m in the Mediterranean Sea offshore from France.

The goals of ANTARES are among others the search for astrophysical neutrino point sources and for neutrinos produced in self-annihilation of dark matter particles. Likely sources of the latter type of neutrino emission would be the Sun and the Galactic Centre, where dark matter particles from the galactic halo are expected to accumulate.

Prior to its completion, ANTARES has been taking data for more than a year in an intermediate setup with a five and a ten line detector configuration. Results on the search for dark matter annihilation in the Sun with the data recorded in 2007 and 2008 are presented, as well as sensitivity studies on dark matter searches with the full ANTARES detector.

Primary author: ZORNOZA GOMEZ, Juan De Dios

Co-author: Mr GAY, Pascal (LPC Clermont-Ferrand)

Presenter: ZORNOZA GOMEZ, Juan De Dios

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **38** Type: **not specified**

Data readout system utilizing photonic integrated circuit

Thursday 13 October 2011 11:40 (20 minutes)

We describe a novel optical solution for data readout systems, developed within the framework of the FP7 NMP project EuroPIC (europic.jeppix.eu). In this project photonic ICs in the Indium-Phosphide-based material system are designed and fabricated. This enables the monolithic integration of active (amplifiers, photodetectors) with modulators and passive components (waveguides, splitters, filters). With these components, circuits containing laser light sources , receivers, switches and routers can be fabricated. In comparison to bulk fiber-optic or electrical equivalents, photonic integrated circuits offer advantageous performance in terms of size and weight, energy consumption, operational speed and bit-rate.
Although the specifications of the system presented here have been taken from the KM3NeT project, the proposed solution is sufficiently general to make it suitable for use in other experiments. The core of the system is a photonic integrated circuit acting as a front-end readout unit. It is an optical serializer in which the serialization of an input signal is provided by means of on-chip optical delay lines. The circuit employs electro-optic phase shifters to build amplitude modulators, power splitters for signal distribution, semiconductor optical amplifiers for signal amplification as well as on-chip reflectors. We present the concept, design and first characterization results of the fabricated devices.

Primary author: Mr STOPINSKI, Stanislaw (1. Technische Universiteit Eindhoven 2. Institute of Microelectronics and Optoelectronics of Warsaw University of Technology)

Co-authors: Prof. SMIT, Meint K. (Technische Universiteit Eindhoven); Prof. MALINOWSKI, Michal (Institute of Microelectronics and Optoelectronics of Warsaw University of Technology); Dr PIRAMIDOWICZ, Ryszard (Institute of Microelectronics and Optoelectronics of Warsaw University of Technology); Dr LEIJTENS, Xaveer (Technische Universiteit Eindhoven)

Presenter: Mr STOPINSKI, Stanislaw (1. Technische Universiteit Eindhoven 2. Institute of Microelectronics and Optoelectronics of Warsaw University of Technology)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **39** Type: **not specified**

White Rabbit: Sub-Nanosecond Timing over Ethernet

Thursday 13 October 2011 12:00 (20 minutes)

On behalf of the White Rabbit consortium
The White Rabbit (WR) project is a multi-laboratory, multi-company effort to bring the best of the data transfer and the timing world together in a completely open design. White Rabbit is a fully deterministic Ethernet-based network for general purpose data transfer and synchronization. The aim is to be able to synchronize a large number of nodes with sub-nanosecond accuracy and picosecond jitter over long lengths of fiber. The key technologies used are physical layer syntonization (clock recovery) and the Precision Time Protocol (IEEE 1588). It generates sub-nanosecond synchronous precision timing in all nodes by continuous tracking and compensating the fiber transmission delays.
This presentation/paper gives an overview of WR and describes the design goals and specification used for the project. It describes the WR switch and the (user) node which are the central components of the WR system. Finally, it presents real timing measurements of prototypes of WR hardware.

Primary authors: PEEK, Henk (NIKHEF (NL)); JANSWEIJER, Peter (Nikhef)

Presenter: PEEK, Henk (NIKHEF (NL))

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **40** Type: **not specified**

Search for Ultra-High-Energy neutrinos at the Pierre Auger Observatory

Wednesday 12 October 2011 15:20 (20 minutes)

The Pierre Auger Observatory is sensitive to extended air-showers induced by ultra-high-energy neutrinos of all flavors as they interact with the atmosphere and inside the earth. These air-showers display characteristic features that allow their identification. We report on recent searches for ultra-high-energy neutrinos at the Pierre Auger Observatory. We present the different identification criteria used, discuss the sources of background and systematic uncertainties, and place the corresponding limits on the neutrino fluxes.

Primary author: GONZALEZ, Javier (KIT)

Presenter: GONZALEZ, Javier (KIT)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **41** Type: **not specified**

Development of a compact acoustic calibrator for ultra-high energy neutrino detection

Wednesday 12 October 2011 15:45 (15 minutes)

With the aim to optimize and test the acoustic detection of ultra-high energy neutrinos in underwater telescopes, we have developed a compact acoustic transmitter array able to reproduce the acoustic signature of UHE neutrino based on the parametric acoustic sources effect. We present different R&D studies to show the viability of the parametric sources technique to deal with the difficulties of generating the acoustic signal (a very directive transient bipolar signal with 'pancake' directivity). The design, building and characterization of the prototype is described, including theoretical simulations of several waveforms propagation at km range the experimental measures in a pool. Following these studies, next steps will be to test the device in situ, in underwater neutrino telescopes or from a vessel in Sea Campaigns.

Primary author: Ms ADRIÁN, Silvia (Antares-UPV)

Co-authors: LLORENS ALVAREZ, Carlos (Universidad Politécnica de Valencia); LAROSA, Giuseppina (University of Valencia-Gandía); MARTÍNEZ-MORA, Juan Antonio (Antares-UPV); BOU-CABO, Manuel (Antares-UPV); ARDID, Miguel (UPV)

Presenter: Ms ADRIÁN, Silvia (Antares-UPV)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **42** Type: **not specified**

Characterization of optical properties of the site of the ANTARES neutrino telescope

Wednesday 12 October 2011 14:25 (20 minutes)

ANTARES is a neutrino detector based on a three dimensional grid of photomultipliers tubes (PMTs) arranged in several detection lines anchored to the seabed at 2.5 km of deep into the Mediterranean Sea (40 km o of the Toulon coast in France), being its main goal the reconstruction and identication of high energy neutrinos from extra-terrestrial origin. The PMTs collect the Cherenkov light induced by relativistic charged leptons produced by the interaction of neutrinos with the detector surroundings. Light propagation strongly depends on the optical properties of the sea water, being crucial their understanding in order to get the expected detector performance. To reach the ANTARES physics goals, a good time and positioning calibration systems are required. In this sense, several devices have been implemented being possible to achieve their expected time and space resolution.

The ANTARES Optical Beacon system consists of a set of pulsed light sources strategically located throughout the detector mainly used for time calibration but which can also be used as a tool to study the water optical properties and their stability. In this contribution we will present the current status of our measurements of light velocity and transmission length of light carried out between 2008 and 2011. A water model proposal at different wavelengths will be discussed, supported by some preliminary results on its impact on track reconstruction.

Primary author: YEPES RAMIREZ, Harold (IFIC-ANTARES)

Presenter: YEPES RAMIREZ, Harold (IFIC-ANTARES)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **43** Type: **not specified**

VSiPMT for underwater neutrino telescopes

Wednesday 12 October 2011 18:50 (20 minutes)

Underwater neutrino telescopes are nowadays considered as one of the most important aims in the astroparticle physics field. Their structure consists of a cubic-kilometer three dimensional array of photosensitive devices aimed at the detection of the Cherenkov light emitted by charged particles produced by high energy neutrino interactions with Earth. To date, a crucial role in this kind of experiments has been played by PhotoMultiplier Tubes (PMTs), however they suffer of many drawbacks such as linearity-to-gain relationship and difficulty in single photon counting. The next generation of experiments will require further improvements in photon detectors performances, therefore alternatives to PMTs are under study. In particular the most promising development in this field is represented by the rapidly emerging CMOS p-n Geiger-mode avalanche photodiode technology (G-APD or SiPM), that will allow the detection of high speed single photons response with high gain and linearity. In order to overcome to the limits of its small sensitive surface we propose an innovative design for a modern hybrid, high gain, silicon based Vacuum Silicon Photomultiplier Tube (VSiPMT) based on the combination of a SiPM with a hemispherical vacuum glass PMT standard envelope.
In this work we describe the full SiPM characterization realized by our group and present the results of our Geant4-based simulations of backscattering of electrons over SiPM surface.

Primary authors: MOLLO, Carlos Maximiliano (INFN); Dr VIVOLO, Daniele (Università degli Studi di Napoli "Federico II" e INFN); Prof. BARBARINO, Giancarlo (Università degli Studi di Napoli - Federico II); DE ROSA, Gianfranca (INFN); DE ASMUNDIS, Riccardo (Sezione di Napoli (INFN)-Universita e INFN); Dr RUSSO, Stefano (Università degli Studi di Napoli - Federico II)

Presenter: Dr VIVOLO, Daniele (Università degli Studi di Napoli "Federico II" e INFN)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **44** Type: **not specified**

A Kalman Filter approach for track reconstruction in a neutrino telescope

Thursday 13 October 2011 11:30 (20 minutes)

In high energy neutrino telescopes, the detection principle relies on the detection of Cherenkov light emitted from an up-going muon induced by νμ that have penetrated the Earth.
At the muon energy range of interest in astrophysical search (namely from about 100 GeV to about 1 PeV), the electromagnetic showers accompanying the muon track generate Cherenkov light emitted within a few degrees of the same cone as the light from the primary particle. Furthermore, since photon scattering in the water, the measurement is affected by non-Gaussian noise. As a consequence, the reconstruction of tracks in underwater Cherenkov neutrino telescopes is strongly complicated.
Moreover, environmental background originates large noise counting rate. In an undersea neutrino detector, in fact, the decay of radioactive elements in the water, mainly the β-decay of potassium isotope 40K, generates electrons that produce Cherenkov light leading an isotropic background of photons. These photons may compromise the hit pattern of a neutrino induced event, and consequently the event reconstruction, even when coincidence methods significatively reduce the contamination.
As result, track reconstruction deal with a non-linear problem with a non-Gaussian measurement noise. A method for track reconstruction in a km3 underwater neutrino telescope, based on Gaussian Sum Filter algorithm to take into account non-Gaussian process noise, is presented.

Primary author: Dr DE ROSA, Gianfranca (Università di Napoli Federico II)

Co-author: Dr PETUKHOV, Yuri (Joint Institute for Nuclear Research, Dubna)

Presenter: Dr DE ROSA, Gianfranca (Università di Napoli Federico II)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **45** Type: **not specified**

Search for magnetic monopoles and nuclearites with the ANTARES experiment

Wednesday 12 October 2011 15:40 (20 minutes)

The ANTARES neutrino telescope was installed in the Mediterranean Sea in several stages, and was completed in 2008. It comprises a three-dimensional array of 885 Optical Modules distributed on 12 vertical lines, anchored at a depth of 2475 m. While designed to observe upgoing neutrinos, ANTARES could also be sensitive to the bright signal of relativistic magnetic monopoles and slow nuclearites.

Magnetic monopoles are stable particles first predicted by Dirac in 1931, and decades later in various Grand Unified Theories (GUT). Relativistic magnetic monopoles would produce a large amount of Cherenkov light in the detector, surpassing by 8500 times the intensity of light emitted by a muon.
A dedicated analysis and a new upper limit on the magnetic monopole flux, extracted from ANTARES data taken in 2008, is presented.

Nuclearites are massive particles of strange quark matter that may be present in the cosmic radiation. Their origin could be in the early Universe or in energetic astrophysical phenomena, like supernovae or strange stars collisions. Nuclearites are supposed to be neutral particles and to interact with the surrounding media via elastic and quasi elastic collisions.
The search strategy and the preliminary upper limit for a nuclearite flux will be presented, using data collected during 2007 and 2008.

Primary author: Ms PAVALAS, Gabriela Emilia (Institute for Space Sciences, Bucharest, Romania)

Presenter: Ms PAVALAS, Gabriela Emilia (Institute for Space Sciences, Bucharest, Romania)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **46** Type: **not specified**

A large surface Photomultiplier based on SiPMs

Wednesday 12 October 2011 19:10 (20 minutes)

Photosensitive devices represent a key solution for several current and future categories of experiments in which light detection can be considered the main observation channel for physical phenomena.
Astro-particle experiments for instance, one of the most promising observation channels for passive High Energy Physics, typically study energetic phenomena in which charged particles originating from the interactions or decays of primary particles radiate Cherenkov or fluorescence light, which is then detected by photosensitive devices.
In these fields of applications, the relatively new Silicon Photomultipliers (SiPM) based on the limited Geiger-mode avalanche (generally G-APD, Geiger Avalanche Photons Detectors), are starting to be extensively studied in view of their future utilization.
Actually, however, their use is highly limited by their small sensitive surfaces. In order to overcome to the limits of the small dimensions of the sensitive hart of SiPM devices, different solutions to increase their field of view are reported. In particular it is discussed the use of Optical Concentrators with the correct refraction index, characteristic and geometry for the improvement of the aperture angle of view of a SiPM device and the development of a FPGA based digital circuit that allows the combination of many Optical Concentrator +MPPC systems in order to reduce dark counts and to obtain a larger total sensitive surface.

Primary authors: MOLLO, Carlos Maximiliano (INFN); VIVOLO, Daniele; Prof. BARBARINO, Giancarlo (Università degli Studi di Napoli Federico II); DE ROSA, Gianfranca (INFN); DE ASMUNDIS, Riccardo (Sezione di Napoli (INFN)-Universita e INFN)

Presenter: MOLLO, Carlos Maximiliano (INFN)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **47** Type: **not specified**

A mechanical design for a detection unit for a deep-sea neutrino telescope

Thursday 13 October 2011 10:45 (15 minutes)

The future KM3NeT neutrino telescope will be built on the seabed of the Mediterranean Sea at a depth between three and five kilometers. The high ambient pressure, but also the fact that the detector is hardly accessible, put severe constraints on the mechanical design of the detection units of the telescope. A detection unit is a vertical structure which supports the optical sensors of the telescope.
It has a height of almost one kilometer; two data cables run along the full length of the structure. Simple and therefore reliable rope and cable handling during installation of the unit at the seabed is important. During installation the stability of the unit depends mostly on the hydrodynamic behavior in the vertical direction, while when in operation, the horizontal behavior is of more importance. In order to reduce the estimated total transport volume of about 10000 mˆ3 as, a compact design is essential.
We will present a mechanical design that has been developed during the KM3NeT Preparatory Phase following an analysis of the designs for Antares, NEMO and Nestor and that at the same time complies with the requirements for use in the KM3Net detector. The experience with this design has been used as input to the design of the KM3Net detection unit.

Primary author: BERBEE, Edward (Nikhef (for the KM3NeT consortium))

Presenter: BERBEE, Edward (Nikhef (for the KM3NeT consortium))

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **48** Type: **not specified**

A vertical electro-optical data cable for KM3NeT

Wednesday 12 October 2011 15:15 (25 minutes)

KM3NeT is a research facility which will be built at the bottom of the Mediterranean Sea. The facility will host a neutrino telescope with several hundreds of detection units - vertical mechanical structures to which the optical sensors modules of the telescope are attached. A data cable will run the full length of the structure, which is almost one kilometre. In order to allow a novel compact deployment of the detection unit, the cable must be flexible and at the same time protect the two copper conductors and eleven optical fibres inside. In order to comply to these requirements a pressure balanced oil-filled cable has been designed, for which a prototype is being built for in-situ tests at the anticipated telescope depths of 3 to 5 km. At the level of each optical sensor module a short horizontal cable breaks out which is connected to the readout components inside the glass sphere of the module via a novel tapered glass transit. We will present the design and assembly method of the cable, the design of the glass transit and the results of laboratory tests.

Primary author: MUL, Gertjan (Nikhef (for the KM3NeT consortium))

Presenter: MUL, Gertjan (Nikhef (for the KM3NeT consortium))

Session Classification: Parallel Session 5

Track Classification: Deep-sea and deep-ice technologies

Contribution ID: **49** Type: **not specified**

A launching vehicle for optical modules of a deep-sea neutrino telescope

Thursday 13 October 2011 11:05 (15 minutes)

KM3NeT is a future deep-sea research facility that will be built at depths between three and five kilometres in the Mediterranean Sea. The facility will host a neutrino telescope consisting of several hundreds of detection units - vertical mechanical structures that suspend the optical sensor modules of the telescope. During the design phase of the KM3NeT telescope, two mechanical designs for the detection unit have been worked out, one of which is a mooring consisting of two parallel ropes with 20 optical sensor modules attached at regular intervals; a data cable runs along the full length of the structure. For this design, which usually is referred to as a string, a novel deployment method using a recyclable launching vehicle has been successfully tested during two cruises in the Ionian Sea. We will present the design and the results of the deployment tests.

Primary author: HILLEBRAND, Theo (NIOZ)

Co-authors: SMIT, Andre (NIOZ); DE WOLF, Els (Nikhef/University of Amsterdam); VAN HAREN, Hans (NIOZ); BOER ROOKZHUIZEN, Herman (Nikhef); VAN HEERWAARDEN, Johan (NIOZ); LAAN, Martin (NIOZ); BAKKER, Roek (NIOZ); GREOENEWEGEN, Ruud (NIOZ)

Presenter: DE WOLF, Els (Nikhef/University of Amsterdam)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **51** Type: **not specified**

Photonics-oriented data transmission network for the KM3NeT prototype detection unit

Thursday 13 October 2011 11:20 (20 minutes)

The design of the readout and data acquisition system of the future KM3NeT neutrino telescope employs 10Gbps photonic technologies for data transmission to shore. The photonic architecture can handle standard transmission protocols. The generic scheme is based on DWDM technology using lasers on shore and optical modulators in each of the 15.000 Digital Optical Modules (DOMs) arranged on vertical detection units anchored to the seabed. Each DOM will house 31 small-size PMTs together with auxiliary transducers. A 100 km electrical/optical fibre cable will connect the DOMs to the store. The readout system will guarantee a unique optical connection between each DOM and the shore. A small-scale prototype of a detection unit with four DOMs is now in a realization phase for a.o. in-situ testing of the data transmission network. We will present results of laboratory tests of the photonics-oriented transmission layer of the network being realised for the prototype detection unit.

Primary author: HOGENBIRK, Jelle (Nikhef (for the KM3NeT consortium))

Co-authors: SCHMELLING, Jan-Willem (Nikhef); VAN DER HOEK, Mar (Nikhef); MOS, Sander (Nikhef)

Presenter: HOGENBIRK, Jelle (Nikhef (for the KM3NeT consortium))

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **52** Type: **not specified**

A TDC for characterization of KM3NeT PMTs

Wednesday 12 October 2011 18:30 (20 minutes)

The optical modules of the future KM3NeT neutrino telescope will contain many photomultiplier tubes with a diameter of about three inch.
In order to characterize these photomultiplier tubes, a 16 channel Time-Over-Threshold TDC with a GigaBit Ethernet communication channel has been built in an Altera StratixIV evaluation board. The TDC data are packed in UDP packages and sent to the host PC. Control is implemented using I2C command packages send to the TDC by the host PC. After execution of I2C commands a result package is send back to the host. We will present the TDC setup and first results.

Primary author: ZWART, Albert (Nikhef)

Co-author: KIEFT, Gerard (Nikhef)

Presenter: KIEFT, Gerard (Nikhef)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **53** Type: **not specified**

GPUs for Parallel Trigger Implementation For Muon Detection

Wednesday 12 October 2011 18:30 (15 minutes)

Bachir BOUHADEF, INFN Pisa & Physics department of Pisa, On behalf of NEMO Collaboration.

Graphics Processing Units are high performance co-processors originally intended to improve the use and quality of computer graphics applications. Because of their potential, researchers have extended their use beyond the computer graphics scope. The main goal of this work is to evaluate the time benefit of using GPUs rather than CPUs for muon trigger implementation into the NEMO Trigger and Data Acquisition System (TriDAS). A simulation on a 16 plane Nemo Tower shows a possibility of reduced time requirements, in addition to power consumption and hardware space benefits.

Primary author: Dr BOUHADEF, Bachir (INFN Pisa.)

Co-authors: Dr MARINELLI, Antonio (INFN Pisa); Prof. MORGANTI, Mauro (INFN Pisa)

Presenter: Dr BOUHADEF, Bachir (INFN Pisa.)

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **56** Type: **not specified**

Simulation Chain for Acoustic UHE Neutrino Detectors

Thursday 13 October 2011 10:30 (20 minutes)

Acoustic neutrino detection is a promising approach for large-scale ultra high energy neutrino detectors in water. The presented simulation chain is designed within the SeaTray/IceTray software framework. Its modular architecture is highly flexible and makes it easy to adapt to different detector geometries, environmental conditions or hardware used. The simulation chain covers the generation of the acoustic pulse produced by a neutrino interaction and the propagation to the sensors within the detector. In this phase of the development, ambient and transient noise models for the Mediterranean Sea and data acquisition hardware, which is similar to the one used in ANTARES/AMADEUS, are implemented. A pre-selection scheme for neutrino-like signals based on matched filtering is employed, as it can be used for on-line filtering. To simulate the whole processing chain for experimental data, signal classification and acoustic source reconstruction algorithms are integrated.
In the presentation an overview of the design and capabilities of the simulation chain will be given, as well as some applications and preliminary studies.

Primary author: NEFF, Max (ECAP)

Presenter: NEFF, Max (ECAP)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **57** Type: **not specified**

The KM3NeT high energy neutrino telescope and Fermi bubbles: some predicitions

Wednesday 12 October 2011 18:10 (20 minutes)

A recent analysis of the Fermi data [1] provides evidence of the emission of high energy gamma rays (up to 100 GeV) with a high intensity E-2 spectrum. This emission was detected as originating from two large areas around the Galactic center, spanning 50° above and below the Galactic center and 40° in longitude, with no spacial evidence of variation both in the spectrum shape and in the intensity. Currently, all the observed features of the Fermi bubbles are not fully explained by a leptonic mechanism and an hadronic mechanism has been proposed [2]. The possible origin of high energy gammas from an hadronic mechanism makes these bubbles promising sources for high energy neutrino emission.
KM3NeT [3] is a consortium with the aim to develop a deep-sea research infrastructure hosting a multi-cubic-kilometer scale high energy neutrino detector in the Mediterranean sea. The location of the detector makes possible the survey of the Galactic center and of a large area surrounding the center and makes this future detector the ideal instrument for the observation of neutrino from Fermi bubbles.
In this work some predictions, based on Monte Carlo simulations and on the high energy gamma observations, regarding the possible detection of high energy neutrino from Fermi bubbles will be presented.
[1] Meng Su et al., Astroph. Journal 724 :1044-1082, 2010
[2] R.M. Crocker and F. Aharonian Phys. Rev. Lett. 106 (2011)101102
[3] KM3NeT web page http://www.km3net.org/home.php

Primary author: Dr CONIGLIONE, Rosa (INFN- Laboratori Nazionali del Sud)

Presenter: Dr CONIGLIONE, Rosa (INFN- Laboratori Nazionali del Sud)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **58** Type: **not specified**

KM3NeT sensitivity and discovery potential for galactic point-like sources

Wednesday 12 October 2011 17:30 (20 minutes)

The KM3NeT consortium http://www.km3net.org aims at the construction of a cubic-kilometre-scale neutrino telescope for the Northern hemisphere with an integrated platform for earth and deep sea sciences.
The telescope location in the Mediterranean Sea will allow for surveying a large part of the Galactic Plane (87%), including the Galactic Centre, thus complementing the sky coverage of IceCube at the South Pole. Due to its good angular resolution, 70% of selected events lie within 0.2° of the neutrino direction, and large size, about 5 km3 of instrumented volume, this project will provide the scientific community with a very powerful instrument to study many astrophysical objects, including supernova remnants, active galactic nuclei, gamma-ray bursts and possibly also dark matter.
One of the main physics objective of KM3NeT is the search of neutrinos from galactic sources.
In this contribution first results on sensitivity and discovery potential for point-like galactic sources and in particular for the Supernova Remnant RXJ1713 are presented. Further improvements on the reconstruction algorithm and detector optimisation are in progress.

Primary author: Dr SAPIENZA, piera (lns)

Co-authors: Dr TROVATO, agata (lns); Dr CONIGLIONE, rosa (lns)

Presenter: Dr SAPIENZA, piera (lns)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **59** Type: **not specified**

Specification of Underwater Fiber Optic Connectors for Neutrino Telescope systems

Wednesday 12 October 2011 14:50 (25 minutes)

Connectors for underwater use are an important component of many subsea systems, they make it easier to conduct onshore or offshore testing, easier to manage cabled assemblies and facilitate ease of installation during deployment. Underwater connectors come in a variety of types and configurations, a majority of the underwater connectors are either dry-mate or wet-mate having electrical or optical contacts or a combination of both, typically called hybrid connectors. These underwater connectors are being used for Subsea Neutrino Telescope systems, demonstrating their value to Neutrino detection projects. Currently, Neutrino Telescope systems are typically making use of the commercially available underwater connectors. These commercial connectors have been developed over the past decades for naval acoustic arrays, ocean science observatories and connection of umbilical's and control equipment for offshore oil and gas facilities. As the offshore industry evolves, testing and demonstrating newer Subsea Neutrino Telescope systems, brings more focus on critical technologies required for the system to perform reliably. While, certain underwater connectors are well proven with a good field history and track record, more advanced optically based Neutrino Telescope systems utilizing fiber optic dry-mate and wet-mate underwater connectors become an increased focus on reliability to ensure that these technologies are ready for the market.

Summary

To ensure that these underwater connection technologies are ready for the market much focus is placed on their development. Typical underwater connector development programs include; design and feasibility studies, prototyping, concept reviews, critical design reviews (CDR's), failure mode, effects, and criticality analysis (FMECA's), final design reviews (FDR's), test readiness reviews (TRR's), detailed qualification programs, and pilot project deployments. This paper reviews the processes and considerations in the specification of reliable subsea connectors for use in a Neutrino Telescope type system.

Primary author: THUMBECK, Steven (Seacon Advanced Products, LLC)

Presenter: THUMBECK, Steven (Seacon Advanced Products, LLC)

Session Classification: Parallel Session 5

Track Classification: Deep-sea and deep-ice technologies

Contribution ID: **60** Type: **not specified**

NEMO-SMO acoustic array: a deep-sea test of a novel acoustic positioning system for a km3-scale underwater neutrino telescope

Wednesday 12 October 2011 14:45 (20 minutes)

Within the activities of the NEMO project, the installation of a demonstrator 8-floors tower (NEMO-Phase II) at a depth of 3500m is foreseen in the next months. On board the NEMO tower, an array of 18 acoustic sensors will be installed permitting acoustic positioning of the tower (detecting acoustic signals emitted by a long baseline of five acoustic beacons anchored on the sea-floor), acoustic detection of biological sources and studies for acoustic neutrino detection.
Fourteen high sensitivity and broadband (10 Hz –70 kHz) hydrophones, provided by INFN, will be managed by the SMO (Submarine Multidisciplinary Observatory) project; two free flooded rings hydrophones -suggested for possible use in the KM3NeT long-baseline- are provided by UPV in collaboration with CPPM-CNRS; two acoustic sensors will be installed on special Opto-Acoustic Modules, equipped with piezo-sensors developed by ECAP. The sensors' data acquisition system - fully integrated with the detector data transport system- is based on "all data to shore"philosophy. Signals coming from hydrophones are continuously sampled underwater at 192kHz/24 bit and transmitted to shore through an electro-optical cable for real-time analysis. A novel technology for underwater GPS time-stamp of data offshore has been implemented and tested.
The operation of the acoustic array will permit long term test of sensor and electronics technologies that are proposed for the acoustic positioning system of KM3NeT.

Primary author: VIOLA, Salvatore (INFN)

Presenter: VIOLA, Salvatore (INFN)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **62** Type: **not specified**

Coincident searches for high energy neutrinos and gravitational waves with the ANTARES and LIGO/VIRGO detectors

Wednesday 12 October 2011 14:40 (20 minutes)

A multimessenger approach with gravitational waves (GW) and high-energy neutrinos (HEN) is expected to open new perspectives in the study of the most violent astrophysical processes in the Universe. Several experiments (e.g. ANTARES, IceCube, LIGO and VIRGO) are currently recording data and searching for astrophysical sources. A working group gathering physicists from those experiments has been formed, which the aim is to search for any connection between GW and HEN signals. The joint searches focus mainly on the gamma-ray bursts as plausible sources of both GW and HEN. In this talk we present a joint analysis effort, and some recent progresses using data from ANTARES 5Line configuration, and S5/VSR1 data from LIGO and Virgo.

Primary author: BOUHOU, boutayeb (APC)

Presenter: BOUHOU, boutayeb (APC)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **63** Type: **not specified**

The MEUST submarine infrastructure for neutrino astronomy

Wednesday 12 October 2011 14:25 (25 minutes)

Located next to the existing ANTARES neutrino telescope site, operational since 2008 offshore of Toulon at a depth of 2500m, MEUST (Mediterranean Eurocentre for Underwater Sciences and Technologies) will be a second generation submarine cabled infrastructure developed within the European projects KM3NeT and EMSO.
This new cabled facility will share its high-capacity with neutrino astronomers and marine environmental sciences.
We will present the foreseen layout and functionalities of the deep sea permanent infrastructure of the MEUST project and its technical features. The general topology of the sea bed network corresponds to the "ring option"presented in the KM3NeT TDR. The technological solutions take into account the evolution of available commercial components and the specificities of the MEUST site. Made of standard components designed to be deployed gradually, the foreseen submarine infrastructure consists in a scalable ring network with 6 nodes uniformly distributed at the periphery of a circular area of about 2km diameter. At each node a bunch of 16 neutrinos detection units can be connected and arranged on the bed in a similar way as ANTARES. The full network therefore accommodates up to one hundred detection units.

Primary author: Dr VALLEE, Claude (CPPM)

Presenter: Dr VALLEE, Claude (CPPM)

Session Classification: Parallel Session 5

Track Classification: Deep-sea and deep-ice technologies

Contribution ID: **64** Type: **not specified**

Current status of the BAIKAL-GVD project

Friday 14 October 2011 11:30 (30 minutes)

Since 2006, the development of a km3-scale neutrino telescope - the Gigaton Volume Detector (GVD) in Lake Baikal - is the central goal of the Baikal collaboration. A prototype cluster of GVD was installed in Lake Baikal in April 2011. The cluster consists of 24 optical modules located on three strings. We present selected results obtained in the course of developing and testing key elements and systems of GVD. We furthermore describe configuration and technical design of GVD.

Summary

The objective of the Baikal Project is the creation of a kilometer-scale high-energy neutrino observatory: the Gigaton Volume Detector (GVD) in Lake Baikal. Basic elements of the GVD (new optical modules with PMTs of various types, FADC readout units, underwater communication systems) were investigated and tested in-situ with prototype strings in 2008–2010. Measurements with a LED flasher, a calibration laser, and muons allow estimating the time accuracy of the GVD measuring system at the level of about 2 ns. On the basis of the studies of the prototype strings and optical module parameters the optimization of the GVD configuration was performed. A technical design report for the GVD Baikal neutrino telescope has been prepared. A prototype cluster which comprises all key elements of the measuring and communication systems of GVD cluster was put in operation in Lake Baikal during the 2011 winter expedition.

Primary author: Dr AYNUTDINOV, Vladimir (INR RAS)

Presenter: Dr AYNUTDINOV, Vladimir (INR RAS)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **65** Type: **not specified**

Quality control considerations for the KM3NeT very large volume neutrino telescope

Thursday 13 October 2011 11:25 (15 minutes)

Within the KM3NeT project a quality management system was proposed that included a qualification process and a data base to store information on the design.
This paper highlights quality control procedures applicable to KM3NeT and describes the data base.

Primary author: SOLLIMA, Calogero (INFN-Pisa)

Presenter: SOLLIMA, Calogero (INFN-Pisa)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **66** Type: **not specified**

Status of the PMT development for KM3NeT

Wednesday 12 October 2011 17:30 (20 minutes)

Three companies are developing new types of 3 inch photomultiplier tubes (PMTs) for the KM3NeT project. The first PMT samples have been delivered from Hamamatsu (R6233mod type) and ET Enterprises (D783KFLA type) and tested. The results of these tests are presented. PMTs of these two types have been ordered to build the the first KM3NeT developmental optical modules. MELZ have produced new 82mm-diameter PMTs, which are under internal tests in the company. First delivery from MELZ is expected in October 2011. Hamamatsu have started the development of new versions of PMTs, with better timing parameters and a larger photocathode. The delivery of the first samples of this new Hamamatsu type is expected in the Fall of 2011.

Primary authors: Mr CLASSEN, Lew (ECAP, University of Erlangen); Dr KALEKIN, Oleg (ECAP, University of Erlangen)

Presenter: Mr CLASSEN, Lew (ECAP, University of Erlangen)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **67** Type: **not specified**

PMT measurements in Antares

Wednesday 12 October 2011 16:30 (20 minutes)

The comparison of the simulated to the real data in the Antares experiment is very important to understand the detector behavior. The observed differences in the charge distribution of the background hits, in the K40 coincidence rate in two adjacent optical modules and in the hit residual time distribution have been investigated both by a more detailed description of the PMT and by a dedicated series of measurements. The understanding of these effects has reduced the discrepancies and improved the analysis quality. The effect of late pulses, after pulses and angular acceptance have been taken into account or corrected. Measurements of these parameters have been carried out using Antares PMTs and optical modules while a more detailed simulation of the angular acceptance of the Antares optical module has been performed. The results of these studies are presented.

Primary author: Dr KALEKIN, Oleg (ECAP, University of Erlangen)

Presenter: Dr KALEKIN, Oleg (ECAP, University of Erlangen)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **68** Type: **not specified**

Influence of Cosmic Ray Composition

Wednesday 12 October 2011 14:20 (20 minutes)

The composition of cosmic rays in the range relevant for large-volume neutrino detectors constitutes a significant systematic uncertainty. An overview of available data from other experiments will be given, and the potential for independent measurements with a cubic-kilometer scale detector outlined.

Primary author: BERGHAUS, Patrick (University of Delaware)

Presenter: BERGHAUS, Patrick (University of Delaware)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **69** Type: **not specified**

Data Acquisition, Triggering, and Filtering at the Auger Engineering Radio Array

Wednesday 12 October 2011 17:10 (15 minutes)

The Auger Engineering Radio Array (AERA) is currently detecting cosmic rays
of energies at and above 10ˆ17 eV at the Pierre Auger Observatory, by triggering on the radio emission produced in the associated air showers. Unlike other air shower detection methods, the radio-detection technique must cope with a significant background of man-made radio-frequency interference, but can provide information on shower development with a high duty cycle. We discuss our techniques to handle the challenges of self-triggered radio detection in a low-power autonomous array, including triggering and filtering algorithms, data acquisition design, and communication systems.

Primary author: Dr KELLEY, John (Radboud University Nijmegen)

Presenter: Dr KELLEY, John (Radboud University Nijmegen)

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **70** Type: **not specified**

The Askaryan Radio Array

Friday 14 October 2011 14:00 (30 minutes)

The ARA collaboration is developing an array of radiofrequency antennas covering approx. 150 sq-km surface which will be installed in boreholes extending 200 m below the ice surface at the geographic South Pole. The antennas are senstitive to the weak, transient impulses given off by exteremely high energy neutrino-induced cascades. The array geometry has been chosen to ensure the detection of the flux of neutrinos guaranteed by observations of the GZK cutoff by HiRes and the Pierre Auger Observatory. The first components of ARA have been installed during the austral summer of 2010-2011 and have proven that the South Pole site is an optimal environment for such a detector. After three years of operation, the full array sensitivity will exceed that of any other instrument in the 0.1-10 EeV energy range by an order of magnitude. The primary goal of the ARA experiment is to establish the absolute cosmogenic neutrino flux through a modest number of events. This talk will describe the array, its science goals, and give the current status of the project.

Primary author: HANSON, Kael (Université Libre de Bruxelles)

Presenter: HANSON, Kael (Université Libre de Bruxelles)

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **71** Type: **not specified**

Neutrino-induced showers in the ANTARES Deep-Sea Telescope

Thursday 13 October 2011 10:50 (20 minutes)

The ANTARES neutrino telescope operating in the Mediterranean Sea aims to measure the cosmic neutrino flux and locate point sources in the multi-TeV energy range. Primarily this is achieved by detecting up-going muon tracks caused by charged-current interactions of neutrinos having passed through the Earth. Neutrino-induced showers, initiated by neutral-current interactions, extend the sensitivity of the detector to all neutrino flavors. A major challenge in reconstructing showers is their identification within an overwhelming background of down-going atmospheric muons. We have developed a strategy to select up-going showers with high efficiency and purity. Atmospheric muons are suppressed largely by estimating the shower direction from the direction of light emission and rejecting down-going events. In addition, events are selected with a large amount of collected charge. We estimate the mean space-time position of the shower vertex, assuming that the shower light is emitted from a bright point, and refine the estimate by an M-estimator fit. By combining the quality cuts on observables describing the shower structure, we are able to reconstruct showers with high purity and a selection efficiency of about 22%. The parameters of the selection strategy are tuned on Monte-Carlo simulations producing the proper amount of background and atmospheric neutrino-induced showers. The method has been applied to ANTARES experimental data and the performance results will be discussed.

Summary

Neutrino-induced showers, initiated by neutral-current interactions, extend the sensitivity of the ANTARES neutrino detector to all neutrino flavors. We have developed a method to largely suppress the huge background and reconstruct showers with high purity and decent selection efficiency by combining quality cuts on observables describing the shower structure. Performance results, tuned on Monte Carlo events and applied to ANTARES experimental data will be presented.

Primary authors: LOEHNER, Herbert (University Groningen); DOROSTI, Qader (KVI Groningen)

Presenter: DOROSTI, Qader (KVI Groningen)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **72** Type: **not specified**

Performance of Photo-Sensors for KM3NeT

Wednesday 12 October 2011 17:50 (20 minutes)

KM3NeT, the future deep-sea neutrino telescope of multi-cubic km size, is being designed to search for high energy neutrinos originating from galactic and extragalactic sources. The neutrinos can be detected by collecting Cherenkov light emitted from relativistic charged secondary particles caused by the interaction of neutrinos with the medium surrounding the detector. To collect the Cherenkov light, an optical module (OM) containing an array of 31 3-inch diameter photomultiplier tubes (PMTs) has been designed as a promising alternative to an OM containing one 10-inch diameter PMT. The main advantage is to reduce the environmental background by requiring local coincidences between neighbouring photo sensors and to provide a homogeneous photon acceptance. Optimum performance requires high collection efficiency at low dark noise, homogeneous photocathode response and excellent timing properties.
We studied the response to single photo-electrons of a newly developed 3-inch diameter PMT from Electron Tube Enterprises Ltd.. To study the timing and homogeneity of the PMT, we employed a 2D scanning system with a picosecond-laser (timing precision < 70 ps) that illuminates various positions on the photocathode surface.
Results of these investigations indicate good photocathode homogeneity, low dark noise on the sub-kHz level, and an average transit-time spread below 2ns. The expected performance in the Multi-PMT optical module of the future KM3NeT detector will be discussed.

Summary

For the Multi-PMT optical module of KM3NeT a newly developed 3-inch diameter PMT has been evaluated with strong requirements on collection efficiency, dark noise, photocathode homogeneity and timing properties. Results on measurements of performance parameters will be presented.

Primary authors: LOEHNER, Herbert (University Groningen); DOROSTI, Qader (KVI Groningen)

Co-authors: PEEK, Henk (Nikhef Amsterdam); STEIJGER, Jos (Nikhef Amsterdam); KAVATSYUK, Oksana (KVI Groningen)

Presenter: DOROSTI, Qader (KVI Groningen)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **73** Type: **not specified**

Reconstruction efficiency and discovery potential of a Mediterranean neutrino telescope: A simulation study using the Hellenic Open University Simulation & Reconstruction (HOURS) package

Wednesday 12 October 2011 17:50 (20 minutes)

We report on the evaluation of the performance of a Mediterranean very large volume neutrino telescope. We present results of our studies concerning the capability of the telescope in detecting/discovering galactic (steady point sources) and extragalactic, transient (Gamma Ray Bursts) high energy neutrino sources as well as measuring ultra high energy diffuse neutrino fluxes. The neutrino effective area and angular resolution are presented as a function of the neutrino energy, and the background event rate (atmospheric neutrinos and muons) is estimated. The discovery potential of the neutrino telescope is evaluated and the experimental time required for a significant discovery of potential neutrino emitters (known from their gamma ray emission, assumedly produced by hadronic interactions) is estimated. For the simulation we use the HOU Reconstruction & Simulation (HOURS) software package.

Primary author: Dr TSIRIGOTIS, Apostolos (HOU)

Co-authors: Dr LEISOS, Anthony (Hellenic Open University School of Science & Technology); Prof. TZAMARIAS, Spyros (Hellenic Open University)

Presenter: Dr TSIRIGOTIS, Apostolos (HOU)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **74** Type: **not specified**

A reconstruction method for neutrino induced muon tracks taking into account the apriori knowledge of the neutrino source

Thursday 13 October 2011 11:50 (20 minutes)

Gamma ray earthbound & satellite experiments have observed over the last years many Galactic and extragalactic gamma ray sources. The detection of astrophysical neutrinos emitted by the same sources would imply that these astrophysical objects are charged cosmic ray accelerators and help to resolve the enigma of the origin of cosmic rays. A very large volume neutrino telescope will be able to detect these potential neutrino emitters. The apriori known direction of the neutrino source can be used effectively to suppress the ^{40}K optical background through causality filters. We report on advanced filtering and prefit techniques using the known neutrino source direction and first results are presented.

Primary authors: LEISOS, Antonios (Aristotle Univ. of Thessaloniki (GR)); Dr TSIRIGOTIS, Apostolos (Physics Laboratory, School of Science & Technology, Hellenic Open University)

Co-authors: Dr LEISOS, Anthony (Hellenic Open University School of Science & Technology); Prof. TZAMARIAS, Spyros (Hellenic Open University)

Presenter: Dr TSIRIGOTIS, Apostolos (Physics Laboratory, School of Science & Technology, Hellenic Open University)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **75** Type: **not specified**

A feasibility study for the detection of Super Nova explosions with an Underwater Neutrino Telescope

Wednesday 12 October 2011 15:00 (20 minutes)

We investigate the potential of a Very Large Volume Underwater Neutrino Telescope to observe Super Nova explosions within our Galaxy. The intense neutrino burst emitted in a SN explosion results in a large number of MeV neutrinos in the vicinity of the Neutrino Telescope which can be detected (mainly) via the reaction $\bar{\nu}_e + p \rightarrow e^+ + n$. For the simulation study we have used the HOURS package assuming the anti electron neutrino flux of the Garching model for SN explosions and an underwater Neutrino Telescope with 6000 direction sensitive Optical Modules each containing 31 small PMTs. Multiple Coincidences between the photomultiplier tubes of the same Optical Module are used to suppress the noise produced by K^{40} decays and to establish a statistical significant measurement of the neutrino flux.

Primary author: Dr LEISOS, Anthony (Hellenic Open University School of Science & Technology)

Co-authors: Dr TSIRIGOTIS, Apostolos (Physics Laboratory, School of Science & Technology, Hellenic Open University); Prof. TZAMARIAS, Spyros (Hellenic Open University)

Presenter: Dr LEISOS, Anthony (Hellenic Open University School of Science & Technology)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **76** Type: **not specified**

Evaluation of the discovery potential of an underwater Mediterranean neutrino telescope taking into account the estimated directional resolution and energy of the reconstructed track

Thursday 13 October 2011 12:10 (20 minutes)

We report on the development of search methods for point like and extended neutrino sources taking into account the resolution of an underwater Mediterranean neutrino telescope to reconstruct the direction as well as the energy of the detected muon tracks, on a track by track basis. We present results on the potential of a very large volume neutrino telescope to discover neutrino sources. The developed techniques offer an improvement on the telescope's discovery flux sensitivity up to a factor of 2. We also report comparisons between different telescope configurations containing the same number of Optical Modules.

Primary author: Prof. TZAMARIAS, Spyros (Hellenic Open University)

Co-authors: Dr LEISOS, Anthony (Hellenic Open University School of Science & Technology); Dr TSIRIGOTIS, Apostolos (Hellenic Open University (HOU))

Presenter: Prof. TZAMARIAS, Spyros (Hellenic Open University)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **77** Type: **not specified**

KM3NeT deep-sea cabled network: the star-like layout

Wednesday 12 October 2011 14:00 (25 minutes)

KM3NeT is a future deep-sea research infrastructure hosting a neutrino telescope with a volume of more than one cubic kilometre to be constructed in the Mediterranean Sea. In the context of the Preparatory Phase of KM3NeT, funded by the EU FP7 framework, the engineering design of the deep-sea telescope has been carried out and optimized to prepare rapid and efficient construction. This paper presents the technical solutions that have been developed for the construction of the deep sea floor network. Special focus will be on the star-like subsea network with emphasis on the electrical power system, the deep-sea electro-optical cables, the connection systems and the junction boxes.

Primary author: COCIMANO, Rosanna (INFN-LNS)

Presenter: COCIMANO, Rosanna (INFN-LNS)

Session Classification: Parallel Session 5

Track Classification: Deep-sea and deep-ice technologies

Contribution ID: **78** Type: **not specified**

Neutrino Detection, Position Calibration and Marine Science with Acoustic Arrays in the Deep Sea

Friday 14 October 2011 14:30 (30 minutes)

Arrays of acoustic receivers are an integral part of present and potential future Cherenkov neutrino telescopes in the deep sea. They are required to monitor the positions of the optical detection modules whose positions vary with time as an effect of undersea currents. At the same time, the acoustic receivers can be employed for marine science purposes, in particular for monitoring the ambient noise environment and the signals emitted by the fauna of the sea. And last not least, they can be used for studies towards acoustic detection of ultra-high energy neutrinos. Measuring acoustic pressure pulses in huge underwater acoustic arrays, exceeding an instrumented volume of 10 kmˆ3, is a promising approach for the detection of cosmic neutrinos with energies exceeding 1 EeV. The pressure signals are produced by the particle cascades that evolve when neutrinos interact with nuclei in water and can be detected over large distances in the kilometre range. In this talk, the status of acoustic detection will be
reviewed and plans for the future —most notably in the context of KM3NeT —will be discussed. The connection between neutrino detection, position calibration and marine science will be illustrated.

Primary author: LAHMANN, Robert (Friedrich-Alexander-Univ. Erlangen (DE))

Presenter: LAHMANN, Robert (Friedrich-Alexander-Univ. Erlangen (DE))

Session Classification: Plenary Session

Track Classification: Plenary Session

Contribution ID: **79** Type: **not specified**

FPGA shore station demonstrator for KM3NeT

Thursday 13 October 2011 11:00 (20 minutes)

The KM3NeT readout concept is based on a point-to-point optical network connecting the ten thousand optical modules in the deep-sea neutrino telescope with the shore station. The numerous fibre optic channels arriving at the shore station will be concentrated on the shore electronics systems, which will receive, merge and time order the data, and send them to the DAQ system. Although the network functionality is bi-directional, the physical channel allocation is asymmetric; most channels are assigned to the data reception and only a few channels are used for control with data transport from shore to the telescope.
We will discuss the FPGA based platform systems for the shore station and the appropriate firmware implementation for the data gathering and broadcast demands of a neutrino telescope. We will present our experiences based on FPGA evaluation platforms suitable to build a demonstrator of the KM3NeT shore station.

Primary authors: Dr MANOLOPOULOS, Kostas (NESTOR Institute for Astroparticle Physics for the KM3NeT consortium); BELIAS, Tass (Institute for Astroparticle Physics (GR)); Mr KOUTSOUMPOS, Vasileios (NESTOR Institute for Astroparticle Physics for the KM3NeT consortium)

Presenter: Dr MANOLOPOULOS, Kostas (NESTOR Institute for Astroparticle Physics for the KM3NeT consortium)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **80** Type: **not specified**

A DAQ processing system for the KM3NeT shore station

Wednesday 12 October 2011 17:50 (15 minutes)

The framework for the KM3NeT shore system is based on the Internet Communications Engine, ICE. The task of the system includes control, data acquisition and processing, pre-selection of events for storage and further processing and on-line monitoring of the KM3NeT neutrino telescope. We describe the overall shore DAQ system and discuss in particular the processing, storing and monitoring tasks. We present our experience with implementations for the DAQ systems which have been build to support the foreseen demonstrator of the KM3NeT shore station.

Primary authors: Dr PAPAIKONOMOU, Antonis (University of Athens for the KM3NeT consortium); BELIAS, Tass (Institute for Astroparticle Physics (GR))

Presenter: Dr PAPAIKONOMOU, Antonis (University of Athens for the KM3NeT consortium)

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **81** Type: **not specified**

Time integrated search for point sources of cosmic neutrinos with the ANTARES telescope

Wednesday 12 October 2011 16:30 (20 minutes)

Results of a time-integrated search for astrophysical high energy neutrinos are presented using data collected from January 2007 to December 2010 with the ANTARES neutrino telescope. ANTARES is currently the largest neutrino detector on the Northern Hemisphere consisting of a tri-dimensional array of 885 photomultipliers arranged on 12 vertical lines, placed at a depth of 2475 meters in the Mediterranean Sea near Toulon, France.

An unbinned likelihood ratio method is used to search for signal events. The final sample consists of 3058 events. From the simulations 84\% of them are estimated to be neutrinos, while the rest are mis-reconstructed atmospheric muons. A full sky survey as well as a search on a pre-defined list of candidate objects were performed. No evidence for a signal is found so neutrino upper limits are obtained. The neutrino flux sensitivity is 2.6×10^{-8} (E/GeV)$^{-2}$ GeV^{-1} s^{-1} cm^{-2} for the part of the sky that is always visible (declination $\leq$-48 degrees) which corresponds to almost a factor 3 better than the previous search.

Primary author: Mr BOGAZZI, Claudio (NIKHEF)

Presenter: Mr BOGAZZI, Claudio (NIKHEF)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **82** Type: **not specified**

Reconfigurable hardware applications on NetFPGA for network monitoring in large area sensor networks

Thursday 13 October 2011 10:00 (20 minutes)

A valuable functionality in many distributed, very large volume sensor network applications is the requirement to characterize and analyze the data traffic at wire speed. We discuss the benefits of a reconfigurable hardware router for real-time data processing and monitoring from sensors before the transmission to the network, based on the NetFPGA platform. We report on our study of a hardware implementation to monitor web-based network applications and compare our results with a software based network analyzer. Finally, we highlight the possible cases of reconfigurable hardware routers, to augment the real-time data routing, processing and monitoring tasks for large distributed sensors network such as of a neutrino telescope.

Primary authors: Dr KACHRIS, Christoforos (Networks and Optical Com. Lab, Athens Information Technology, Athens, Greece); BELIAS, Tass (Institute for Astroparticle Physics (GR)); Mr KOUTSOUMPOS, Vasileios (Nestor Institute for Astroparticle Physics)

Presenter: Mr KOUTSOUMPOS, Vasileios (Nestor Institute for Astroparticle Physics)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **83** Type: **not specified**

Cosmogenic neutrinos in KM3NeT

Wednesday 12 October 2011 15:40 (20 minutes)

Cosmogenic neutrinos are produced during the propagation of ultra high energy cosmic rays (UHECR) through the cosmological microwave background radiation. Extragalactic origin of UHECR guarantees generation of the high energy cosmogenic neutrinos, however the flux depends on the currently unknown properties of UHECR, for example the chemical composition and distribution of the sources. Estimations of cosmogenic neutrino flux, which are constrained by UHECR observations, includes a range of models in which a detectable signal could be produced in a very large volume high energy neutrino telescope. In particular the favorable scenarios are based on the models with a pure proton composition of UHECR.
The possible event rates of cosmogenic neutrinos in KM3NeT telescope and a current status of simulations of ultra high energy neutrino events are discussed in this talk.

Primary author: SHANIDZE, Rezo (Unuversity of Erlangen)

Presenter: SHANIDZE, Rezo (Unuversity of Erlangen)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **84** Type: **not specified**

Muon Energy Reconstruction in the ANTARES Detector

Wednesday 12 October 2011 14:00 (20 minutes)

The energy reconstruction of both neutrino induced muons from neutrino interactions in the vicinity of the detector and of muons from cosmic ray air showers contributes indispensable information for a broad range of physics analyses, e.g. by increasing the sensitivity in neutrino point source searches or by offering access to observables such as the atmospheric neutrino spectrum. Currently four energy reconstruction methods are implemented in the ANTARES data analysis framework, ranging from estimates based on photon counting and the total charge deposited in the detector to pdf-based methods and artificial neural networks. These four methods, their performance and systematic studies of the energy resolution capabilities of the ANTARES detector are presented.

Primary author: SCHNABEL, Jutta (Universität Erlangen-Nürnberg/ECAP)

Presenter: SCHNABEL, Jutta (Universität Erlangen-Nürnberg/ECAP)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **85** Type: **not specified**

Acoustic Calibration for the KM3NeT Pre-Production Module

Wednesday 12 October 2011 15:05 (20 minutes)

The design of the KM3NeT neutrino telescope is based on flexible structures - the detection units. The highly dynamic environment in the deep sea necessitates a continuous monitoring of their exact position.
A common way to perform this is the use of acoustic emitters and receivers based on the piezoelectric effect. The receivers are attached to detection units whereas the emitters are located at fixed positions on the sea floor. Either commercial or custom-built devices are able to withstand the high ambient pressure in the deep sea while still sensitive to small pressure variations, e.g. caused by acoustic signals. With this system it is possible to determine the position of the detection unit with respect to the emitter on a centimetre scale, corresponding to a nanosecond precision for an optical device.
The KM3NeT Pre-Production Module (PPM) is a test system to verify the correct operation and interoperability of the major involved hardware and software components. The proposed solution presented here is the use of a small piezoelectric element equipped with preamplifiers inside the optical module in the same housing as the optical sensors. This custom-built solution also holds the possibility to extend the application area from only positioning to additional tasks like acoustic particle detection or monitoring of the barely known deep-sea acoustic environment.

Primary author: ENZENHÖFER, Alexander (ANTARES)

Presenter: ENZENHÖFER, Alexander (ANTARES)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **86** Type: **not specified**

Evaluation of triggering schemes for KM3NeT

Wednesday 12 October 2011 17:10 (20 minutes)

The future neutrino telescope KM3NeT, to be built in the Mediterranean Sea, will be the largest Cherenkov detector and will include several hundred thousands photomultiplier tubes (PMT). In the deep sea the dominant source of PMT signals are decays of K40 and marine fauna bioluminescence. Selection of neutrino and muon events from this continuous optical background signals requires the implementation of fast and efficient data filtering algorithms. Various schemes for the filtering of background data and the selection of neutrino and muon events were evaluated for the KM3NeT telescope using Monte Carlo simulations. The results obtained in this study will be presented in the talk.

Primary author: Mr SEITZ, Thomas (ECAP - University of Erlangen (for the KM3NeT consortium))

Co-authors: Mr HEROLD, Björn (ECAP - University of Erlangen); Dr SHANIDZE, Rezo (ECAP - University of Erlangen)

Presenter: Mr SEITZ, Thomas (ECAP - University of Erlangen (for the KM3NeT consortium))

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **87** Type: **not specified**

Search for neutrino emission in gamma-ray flaring blazars with the ANTARES telescope

Wednesday 12 October 2011 14:40 (20 minutes)

The ANTARES telescope observes a full hemisphere of the sky all the time with a duty cycle close to 100%. This makes it well suited for an extensive observation of the neutrinos that can be produced in astrophysical transient sources.
In the surrounding medium of the blazars, i.e. active galactic nuclei with their jets pointing almost directly through the observer, neutrinos may be produced together with gamma-rays by hadronic interactions, so it is expected a strong correlation between neutrinos and gamma-rays emissions. This information can be provided by the gamma-ray light curves measured by the LAT instrument on-board the Fermi satellite, which reveals the time variability information of the studied sources. If the expected neutrino flux observation is reduced to a narrow window around the assumed neutrino production period, the background and point-source sensitivity can be drastically reduced.
The ANTARES data collected in 2008 has been analysed looking for the neutrinos detected in the high state period of nine bright and variable Fermi sources and assuming the gamma-ray light curves as the neutrino emision time distributions. First results show a sensitivity improved by a factor 2-3 with respect to a standard time-integrated point source search. The analysis has to be done with an unbinned method based on the minimization of a likelihood ratio, applied to a subsample data of ˜60 days of live time, with typical widths for the flare ranging between 1 and 20 days.

Primary authors: SÁNCHEZ LOSA, Agustín (IFIC (Spain)); DORNIC, Damein (IFIC (Spain))

Presenter: SÁNCHEZ LOSA, Agustín (IFIC (Spain))

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **88** Type: **not specified**

SCOTT: A time and amplitude digitizer ASIC for PMT signal processing using multi time over threshold technique.

Thursday 13 October 2011 10:20 (20 minutes)

The observation of high energy neutrinos produced in astrophysical phenomena would open a new window on the Universe. The very low neutrino cross section requires instrumented volumes at the cubic-kilometre scale. The European KM3NeT consortium is now in a preparatory phase towards the construction of such a large neutrino telescope in the Mediterranean Sea. Physics studies have shown that the Cherenkov light produced by the neutrino induced muon must be measured with a timing precision of less than 2ns RMS, and a charge estimate in a dynamic range of 1 to 100 photoelectrons. To comply with the high timing demand, a dedicated ASIC, named SCOTT, has been developed in an AMS BiCmos 0.35 µm process technology. It uses up to 16 adjustable thresholds to digitise the signals from large photomultipliers using the time-over-threshold technique. Each threshold channel is divided into three sub-circuits: fast comparators which thresholds are set by an internal 10-bit resistor string, a circular sampling memory and a "first in first out"(FIFO) digital memory. The sampling frequency is equivalent to a conventional ADC with an 800 MHz sampling clock. A detailed study was performed to process and analyse the data output of the ASIC. In particular, the choice of the number and level of the thresholds was optimised for pulses generated by a 10" photomultiplier tube. The methodology used for characterisation and the performance obtained in a broad charge dynamic range will be presented.

Primary authors: GUILLOUX, Fabrice (CEA); FERRY, Sophie Catherine (CEA - Centre d'Etudes de Saclay (FR)); FERRY, Sophie

Co-authors: VALLAGE, Bertrand (CEA - Centre d'Etudes de Saclay (FR)); Mr DELAGNES, Eric (CEA/DAPNIA); SCHULLER, Jean-Pierre (CEA); LOUIS, frederic (CEA)

Presenters: FERRY, Sophie Catherine (CEA - Centre d'Etudes de Saclay (FR)); FERRY, Sophie

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **89** Type: **not specified**

Anisotropy of TeV cosmic rays in IceCube and IceTop

Wednesday 12 October 2011 14:00 (20 minutes)

The main background to the search for astrophysical neutrino sources with large volume telescopes is due to the muon component of extensive air showers produced in the interaction of high-energy cosmic rays with the Earth's atmosphere. This background, however a nuisance for neutrino-event searches, can be used to explore certain aspects of cosmic ray physics. The high rate of muon events in large neutrino detectors provides a high-statistics data sample that can be used to look for an anisotropy in the arrival directions of the parent cosmic ray particles at the per-mille level.
I will report on the observation of anisotropy in the cosmic ray data collected with the IceCube neutrino telescope in the 20-400 TeV energy range at multiple angular scales. New data from the IceTop air shower array, located on the ice surface above IceCube, shows an anisotropy that is consistent with the high-energy IceCube results. The sensitivity of IceTop to all the components of the extensive air shower will allow us to explore in more detail the characteristics of the primary cosmic rays associated with the observed anisotropy.

Primary author: SANTANDER, Marcos (UW-Madison)

Presenter: SANTANDER, Marcos (UW-Madison)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **90** Type: **not specified**

Calibration systems of the ANTARES neutrino telescope

Wednesday 12 October 2011 14:00 (25 minutes)

The ANTARES neutrino telescope is a photo-detector array consisting of 12 flexible strings holding 885 photomultiplier tubes which collect the Cherenkov light emitted by the charged leptons produced in the interaction of high energy neutrinos with the matter in or surrounding the detector. The trajectories of the resulting muons can be reconstructed using the time, position and charge information of the hits arriving to the PMTS. An accurate calibration of each acquisition elements is demanded to ensure the best event reconstruction attainable and to make astronomy. This contribution reviews the different calibration systems and methods developed in ANTARES, including some measurements that validate the expected performance.

Primary author: GÓMEZ GONZÁLEZ, Juan Pablo (ANTARES)

Presenter: GÓMEZ GONZÁLEZ, Juan Pablo (ANTARES)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **91** Type: **not specified**

Development of an acoustic transceiver for the KM3NeT positioning system

Wednesday 12 October 2011 15:25 (20 minutes)

In this paper we describe the acoustic transceiver developed for the KM3NeT positioning system. The acoustic transceiver is composed of a commercial free flooded transducer, which works mainly on the 20-40 kHz region and withstands high pressures (up to 500 bars). A developed sound emission board, which has been designed to be adapted to the specific transducer and fulfill all the requirements: low power consumption, high intensity for emission, low intrinsic noise, arbitrary signals for emission and the capacity of acquiring the receiving signals with very good timing precision. Moreover, a simplified version of the transceiver might be used for the receivers of the KM3NeT positioning system as well for the large number of units needed.
The results of the different tests made to the transceiver in the laboratory are described, as well as, the activities for its integration in the Instrumentation Line of ANTARES and in the NEMO tower for the in situ tests.

Primary author: Ms LAROSA, Giuseppina (IGIC-Universitat Politècnica de València)

Co-authors: LLORENS ALVAREZ, Carlos (Universidad Politécnica de Valencia); Mr MARTÍNEZ-MORA, Juan Antonio (IGIC-Universitat Politècnica de València); BOU CABO, Manuel (IGIC-Universitat Politècnica de València); ARDID, Miguel (IGIC-Universitat Politècnica de València); Ms ADRIÁN MARTÍNEZ, Silvia (IGIC-Universitat Poiltècnica de València)

Presenter: Ms LAROSA, Giuseppina (IGIC-Universitat Politècnica de València)

Session Classification: Parallel Session 3

Track Classification: Calibration

Contribution ID: **92** Type: **not specified**

The NEMO Trigger and Data Acquisition System

Wednesday 12 October 2011 16:50 (15 minutes)

The phase 2 of the NEMO project represents a unique occasion to test a new Trigger and Data Acquisition System (TriDAS), designed to scale up to the km3.
Because of the deep sea optical background, the NEMO "all data to shore" approach requires to handle a large continuous data-stream from off-shore to on-shore, up to the last on-line computing element.
The computing layers of TriDAS start after the Ethernet Floor Control Module (eFCM) electronic boards on-shore, which gate the data-stream arriving from the off-shore detector. It is arranged into 4 elements: hit managing into time-coherent aggregates, data selection according to possible concurrent trigger algorithms, composition of the selected events into a post-trigger files and finally a persistent data storage.
The finalized design of TriDAS adapted for NEMO -Phase 2 is presented together with its on-line data monitoring environment and the dedicated networking architecture.

Primary authors: CHIARUSI, Tommaso (INFN - Sezione di Bologna); CHIARUSI, Tommaso (Universita e INFN, Roma I (IT))

Presenter: CHIARUSI, Tommaso (INFN - Sezione di Bologna)

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **93** Type: **not specified**

Measurement of Neutrino Oscillations with the ANTARES detector

Wednesday 12 October 2011 15:00 (20 minutes)

The data taken with ANTARES from 2007 to 2010 with a total lifetime of 830 days have been analysed in view of a possible neutrino oscillation signal. The flux of vertical upward going muon neutrinos should be completely suppressed at energies of 24 GeV due to neutrino oscillations.
A dedicated algorithm is used, which allows the reliable reconstruction of muon tracks with energies as low as 20 GeV. The oscillation signal is extracted by comparing two event samples: a low energy sample of vertical upward going tracks seen on a single detector line and a higher energetic set of more isotropic events seen on several detector lines. The presentation will detail the analysis method, the estimation of systematic effects and the result of the measurement of the oscillation parameters.

Primary author: BRUNNER, Juergen (Universite d'Aix - Marseille II (FR))

Presenter: BRUNNER, Juergen (Universite d'Aix - Marseille II (FR))

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **94** Type: **not specified**

Reconstruction and identification of neutrino-induced particle showers in IceCube

Thursday 13 October 2011 11:10 (20 minutes)

An instrument like IceCube searches for neutrinos by recording and interpreting the Cherenkov light of charged particles that traverse the instrumented volume. From the photon intensity and arrival times at different locations in the detector one has to discern the nature of the event, separate neutrino candidates from the atmospheric muon background, and derive relevant properties like the deposited energy or the direction of the incident primary. This talk presents methods currently used to reconstruct events containing electromagnetic and hadronic particle showers. This class of events is important because particle showers emerge from the interactions of neutrinos of all flavors and allow for a better reconstruction of the neutrino energy compared to muon tracks.

Primary author: MIDDELL, Eike (DESY)

Presenter: MIDDELL, Eike (DESY)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **95** Type: **not specified**

Embedded electronics and data acquisition of a detection node for the European KM3NeT telescope.

Thursday 13 October 2011 12:20 (20 minutes)

A KM3Net detection node consists of a multi-PMT Digital Optical Module(DOM) containing 31 photomultipliers (PMTs) and the associated electronic for power, readout and control.
The components of the DOM electronic will be reviewed, namely a System-on-chip in charge of the data acquisition and slow control, a power board converter, various instrumentation devices and a Gigabit Ethernet link over an optical network to shore
The PMT front end signals are sampled with TDCs integrated in the SoC. An embedded processor is used for real time data processing and transmission to shore. The off shore electronics receives a bit stream from the optical network which carries both data and a synchronous clock signal used as a timing reference for the SoC. The overall architecture of the SoC and its inner functionalities will be presented in detail.

Primary author: LOUIS, frederic (CEA)

Presenter: LOUIS, frederic (CEA)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **96** Type: **not specified**

The Antares Computing Model

Wednesday 12 October 2011 16:30 (15 minutes)

Completed in 2008, ANTARES is now the largest water Cherenkov neutrino telescope in the Northern Hemisphere. Its main goal is to detect neutrinos from galactic and extra-galactic sources. Due to the high background rate of atmospheric muons and the high level of bioluminescence, several online and offline filtering algorithms have to be applied to the raw data taken by the instrument. To be able to handle this data stream, a dedicated computing infrastructure has been set up.

The talk will cover the main aspects of the current official Antares computing model.
This includes an overview of online and offline data handling and storage. In addition, the "IceTray" software framework, which is used to link together the various data analysis modules, will be presented and its current usage in Antares data processing will be highlighted. Finally, an overview of the final data storage format used for high-level analysis will be given.

Primary author: Dr KOPPER, Claudio (NIKHEF (for the ANTARES collaboration))

Presenter: Dr KOPPER, Claudio (NIKHEF (for the ANTARES collaboration))

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **97** Type: **not specified**

Online Control and Configuration in KM3NeT

Wednesday 12 October 2011 17:30 (15 minutes)

The data acquisition infrastructure of the KM3NeT deep-sea neutrino telescope in the Mediterranean will be a massively distributed system. The control and configuration application will be distributed over some 2000 offshore embedded nodes and hundreds of onshore processes. The full run conditions and detector state will have to be reliably set up and traced for a valid scientific analysis of the data. The actual implementation of the online software system must also take into account the complexity of development processes involving multiple actors and laboratories. Following the development principles established during the KM3NeT Design Study, an implementation of the online control and configuration software framework has been developed for the KM3NeT pre-production model detection unit (PPM-DU) of the FP7 Preparatory Phase. It features a highly modular client-server architecture based on specialized components communicating over the ZeroC Ice distributed application middleware. The full detector configuration is implemented using a framework developed for KM3NeT which provides for a coherent development process among multiple teams through features such as automatic database mapping or default parameter value broadcasting. Key features of the different frameworks, their integration for the PPM-DU and the client-server architecture of the data acquisition system and its control and configuration architecture are presented.

Summary

This paper presents the key features of the client-server architecture for the KM3NeT neutrino telescope data acquisition and its implementation for the pre-production model detection unit (PPM-DU). The implementation of both offshore embedded software and onshore software modules is based on a configuration framework designed for KM3NeT (CompoundConfig) and an open-source middleware for distributed applications (ZeroC Ice). The highly modular, distributed and component-oriented architecture is described and justified according to the demands a very large volume detector calling for thousands of nodes over the acquisition network.

Primary authors: Mr CHATEAU, Frédéric (CEA Irfu); Mr LOUIS, Frédéric (CEA); Mr LE PROVOST, Hervé (CEA Irfu); Dr ANVAR, Shebli (CEA - Centre d'Etudes de Saclay (FR))

Co-authors: Dr VALLAGE, Bertrand (CEA - Centre d'Etudes de Saclay (FR)); Dr SIZUN, Patrick (CEA Irfu); Dr MOUDDEN, Yassir (CEA Irfu)

Presenter: Dr ANVAR, Shebli (CEA - Centre d'Etudes de Saclay (FR))

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **98** Type: **not specified**

Photomultiplier Design and Manufacture at ET Enterprises

Wednesday 12 October 2011 18:10 (20 minutes)

ET Enterprises Limited started in May 2007 and took over the photomultiplier tubes and accessories business of Electron Tubes Limited and will continue to manufacture, supply and develop the Electron Tubes brand product range. ET Enterprises is located in Uxbridge, which is about 30km west of London.

A subsidiary of Ludlum Measurements Inc., ET Enterprises Limited benefits from the additional production facilities of ADIT, a US based producer of photomultipliers. Similarly, ADIT, which specialises in photomultipliers for scintillation applications, has access to ET Enterprises' development resources and experience in many different photomultiplier applications worldwide.

We present information on the company, or manufacturing facilities, and our products, with a focus on work on photomultipliers for HEP experiments with requirements for 3 inch, 9 inch, and 11 inch diameter pmts.

Primary author: CORMACK, Andy (ET Enterprises Ltd)

Presenter: CORMACK, Andy (ET Enterprises Ltd)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **100** Type: **not specified**

Photon tracking with GPUs in IceCube

Wednesday 12 October 2011 18:10 (15 minutes)

GPUs (graphics processing units) have become increasingly popular in the recent years for scientific calculations involving large numbers of similar steps. Photon propagation is a necessary part of simulating detector response to passing charged particles in IceCube that is an ideal application for use with GPUs. We discuss the principle ideas and practical issues of running such an application within the simulation chain used within our collaboration.

Primary author: CHIRKIN, Dmitry (UW, Madison, U.S.A.)

Presenter: CHIRKIN, Dmitry (UW, Madison, U.S.A.)

Session Classification: Parallel Session 7

Track Classification: Computing and data

Contribution ID: **102** Type: **not specified**

Methods for muon energy loss reconstruction in IceCube

Wednesday 12 October 2011 14:20 (20 minutes)

The energy of muon neutrinos and muons detected by IceCube is not directly measured. For low energy contained events the length of the track inside can be used to derive an energy estimate. For higher energy through-going events the main energy-related observable is the energy *loss* of muons. The stochastic nature of this energy loss makes the reconstruction non-trivial. Several approaches have been developed to reconstruct the muon energy loss in IceCube events and to derive the muon energy from that. These approaches vary both in the level of detail of the result and in the techniques they use to take the ice properties into account. I will present an overview of these approaches and the preliminary estimates of their performance.

Presenter: BOERSMA, David (RWTH Aachen University)

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **103** Type: **not specified**

Point Source Searches by IceCube: Recent Results and Progress

Wednesday 12 October 2011 16:50 (20 minutes)

A wide range of analyses are pursued by IceCube in the search for astrophysical sources of neutrinos. These include time-integrated searches for steady sources, time-dependent searches correlated with AGN and other flares, and searches dedicated to GRBs as well as generic all-sky burst searches. In addition, an online system is now in place that sends neutrino-triggered alerts to optical, x-ray, and gamma-ray telescopes for follow-up observations. In this talk I will present recent results of point source searches by IceCube, and describe progress toward maximizing the potential of the completed detector to discover astrophysical neutrino sources.

Primary authors: FINLEY, Chad; FINLEY, Chad

Presenters: FINLEY, Chad; FINLEY, Chad

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **104** Type: **not specified**

Common Simulation Tools for Large Volume Neutrino Detectors

Thursday 13 October 2011 10:00 (30 minutes)

A short overview of the MC simulation tools used in the ANTARES and IceCube experiments is given. The differences in the general approaches used by the 2 groups due to the characteristic features of the medium where the detectors collect data are stressed and discussed. Limitations of the present tools are reviewed and on-going developments of new software and techniques are presented.

Primary author: MARGIOTTA, Annarita (Universita e INFN (IT))

Presenter: MARGIOTTA, Annarita (Universita e INFN (IT))

Session Classification: Parallel Session 1

Track Classification: Physics, reconstruction and software

Contribution ID: **105** Type: **not specified**

Mechanical design of the Pre-Production Detector Unit Model of KM3NeT

Thursday 13 October 2011 11:45 (15 minutes)

The KM3NeT Consortium, aiming to design and prepare the deployment of a deep sea detector for high energy neutrino astronomy, is developing a Pre-Production Model of the Detection Unit (PPM-DU) of the future telescope.
A description of the mechanical structure of the PPM-DU, of the R&D activity that have brought to it and of the ongoing qualification process will be presented.

Primary author: MUSUMECI, Mario (INFN)

Presenter: MUSUMECI, Mario (INFN)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **106** Type: **not specified**

Maintenance of the deep-sea ANTARES neutrino telescope

Thursday 13 October 2011 10:05 (15 minutes)

ANTARES is the first neutrino telescope ever built in deep sea. The apparatus is equipped with 885 Optical Modules arranged on 12 detection lines. The construction of the apparatus was completed in 2008. The Collaboration then launched a two-year maintenance campaign, during which three lines were recovered and reinstalled, after curing some initial functionality problems. This activity has been quite successful so that the apparatus is back in the full 12 detection line configuration since November 2010. Furthermore, valuable experience toward the construction of a km3-scale apparatus has been gained during the process. The main points of these activities will be illustrated in this talk.

Primary author: CIRCELLA, Marco (INFN Bari, Italy)

Presenter: CIRCELLA, Marco (INFN Bari, Italy)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **107** Type: **not specified**

Mechanical design of NEMO Phase 2

Thursday 13 October 2011 10:25 (15 minutes)

The NEMO Collaboration, which is part of the KM3NeT consortium, is pursuing a wide prototyping campaign (NEMO Phase 2)
off the coast of Sicily. A summary of the mechanical developments performed in this project will be presented.

Primary author: CACOPARDO, Giorgio (INFN- LNS)

Presenter: CACOPARDO, Giorgio (INFN- LNS)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **108** Type: **not specified**

Parallel Session 2 - Mechanics, Deployment and Vessels

Thursday 13 October 2011 10:00 (5 minutes)

Presenters: Prof. ANASSONTZIS, Efstratios (University of Athens (GR)); CIRCELLA, Marco (INFN Bari, Italy)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **109** Type: **not specified**

Nautilus Marine Service GmbH - Industrial Presentation

Thursday 13 October 2011 12:05 (15 minutes)

Presenter: Dr EGLOFF, Frank (Nautilus Marine Services GmbH)

Session Classification: Parallel Session 2

Track Classification: Mechanics, deployment and vessels

Contribution ID: **110** Type: **not specified**

Development of new 3-inch PMTs

Primary author: HOTTA, Yuji (Hamamatsu Photonics K.K.)

Presenter: HOTTA, Yuji (Hamamatsu Photonics K.K.)

Contribution ID: **111** Type: **not specified**

Latest progress in PMT development

Thursday 13 October 2011 10:40 (20 minutes)

Primary author: HOTTA, Yuji (Hamamatsu Photonics K.K.)

Presenter: HOTTA, Yuji (Hamamatsu Photonics K.K.)

Session Classification: Parallel Session 4

Track Classification: Photodetection and readout

Contribution ID: **112** Type: **not specified**

Introduction

Thursday 13 October 2011 16:10 (10 minutes)

Presenter: KATZ, Uli (Friedrich-Alexander-Univ. Erlangen (DE))

Session Classification: Plenary Session

Contribution ID: **113** Type: **not specified**

Astrophysical Multi-messenger Observatory Network (AMON)

Thursday 13 October 2011 16:20 (25 minutes)

Presenter: Dr DEYOUNG, Tyce (UNIVERSITY OF MARYLAND)

Session Classification: Plenary Session

Contribution ID: **114** Type: **not specified**

HEAPNet and its ideas

Thursday 13 October 2011 16:45 (15 minutes)

Presenter: PIATTELLI, Paolo (INFN-LNS, Catania)

Session Classification: Plenary Session

Contribution ID: **115** Type: **not specified**

Global Neutrino Observatory

Thursday 13 October 2011 17:00 (15 minutes)

Presenter: KATZ, Uli (Friedrich-Alexander-Univ. Erlangen (DE))

Session Classification: Plenary Session

Contribution ID: **116** Type: **not specified**

Panel Discussion

Thursday 13 October 2011 17:15 (1h 15m)

Session Classification: Plenary Session