Astroparticle Physics for Europe

ASPERA

Large Research Infrastructures for Astroparticle Physics in Europe

Funding Aspects

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ASPERA

is …

- A European Research Area NETwork:
  a tool invented by European Commission to help structuring the ERA
- Network of funding agencies in astroparticle physics
- Working since 2006

ASPERA achievements

- Roadmap update (presentation in Nov. 2011 in Paris)
- Census in 2009 and 2006:
  - funding increased
  - number of researchers increased
- Project Management Handbook (soon)
- New partners

ASPERA 2011

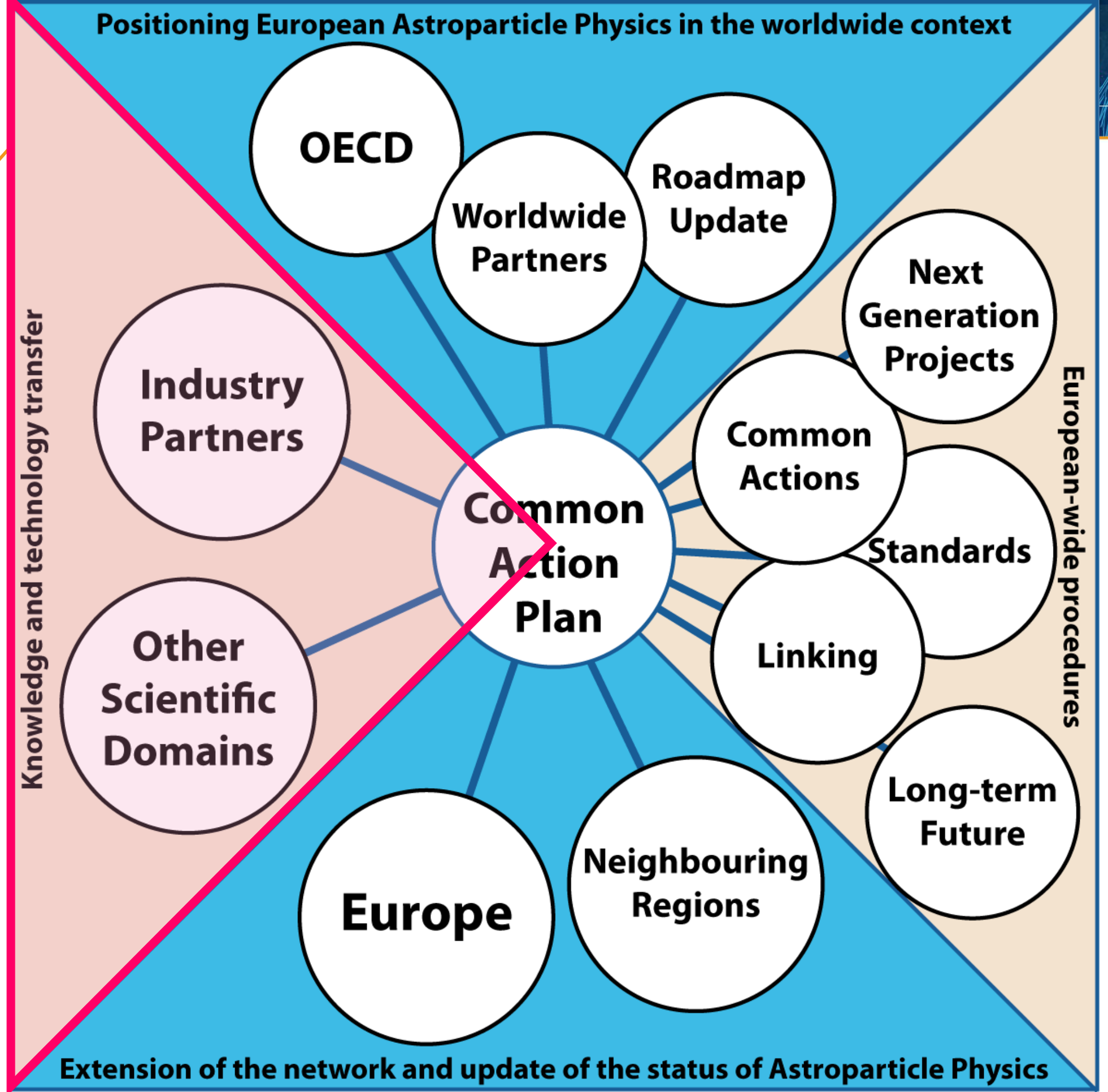
Russian Foundation
of Basic Research

Royal Irish
Academy

A

ASPERA

ASPERA work programme



ASPERA & other scientific domains

- ASPERA interdisciplinary workshop "From the Geosphere to the Cosmos" (Paris, Dec. 2010)
- Interdisciplinary session during the ASPERA Deep Underground Lab. workshop (Zaragoza, June 2011)
- ASPERA interdisciplinary workshop dedicated to **underwater science** (Amsterdam, May 2012)

able 1 Existing Synergies

EART

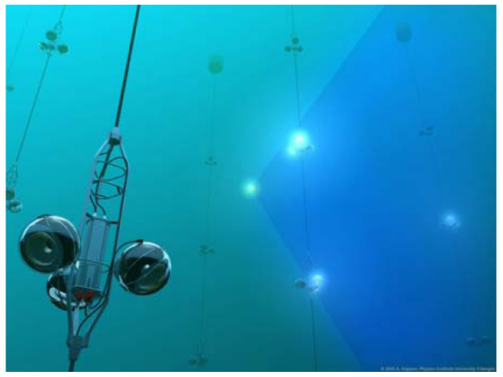
1. SPACE WEATHER
2. ATMOSPHERIC MONIT
3. COSMOCLIMATOLOGY
4. EARTHQUAKE MONITO
5. EROSION RATE CALCU
6. VOLCANO TOMOGRAP
7. THUNDERSTORMS ANI

3.1.3.1. CONTINUOUS OCEANOGRAPHIC DATA

NEW DATA/INSTRUMENTATION

Sensing the Ocean Environment

Progress in ocean model and assessment of system performance depends on rigorous validation against *in situ* data. Currently these are obtained by dropping instruments to the bottom of the sea and recovering them a few months later, whereas real time, long-term and continuous data from the bottom of the sea is a very rare achievement. For example, in the case of measurements of water motions that are fundamental for the understanding of the transfer of energy, heat, and chemical and biological variables in the ocean, oceanographic studies have focused on the upper few 100 meters below the surface, whereas very little is known about the deep-sea, i.e. below 1000 m.



Gathering oceanographic data from deep-sea neutrino telescope installations can greatly benefit the monitoring and forecasting of the ocean. In addition, the Mediterranean sea, where ANTARES, NEMO and NESTOR are placed, is a particularly suitable region both because it can be considered a laboratory basin for fundamental ocean processes and because its outflow influences the Atlantic circulation.

In order to study mesoscale phenomena like eddies, meandering boundary currents and their effects on the distribution of marine life, various oceanographic instruments has been deployed in the ANTARES neutrino detector, which provide a unique opportunity to compare high-resolution acoustic and optical observations near 2475 m. Acoustic Doppler Current Profilers (ADCP) are used to monitor the water current flow along the full height of the detector strings. Conductivity–temperature–depth (CTD) sensors are used to monitor the temperature and salinity of the sea water at various depths in order to determine the sound velocity. Finally, sound velocimetres are used to monitor directly the sound velocity in sea water.

Recently, the NEMO collaboration developed PORFIDO (Physical Oceanography by RFID Outreach). PORFIDO is a system designed to gather oceanographic data (temperature, etc.) from passive RFID tags (WISPs) attached to the outside of the NEMO optical modules, with a minimum of disturbance to the main project and a very limited budget. Ten PORFIDOs will be deployed with the NEMO Phase 2 tower in 2011.

Oxygen, CTD and pressure sensors

REFERENCES

van Haren H *et al.* (2011) "Acoustic and optical variations during rapid downward motion episodes in the deep north-western Mediterranean Sea" *Deep Sea Research Part I: Oceanographic Research Papers* **58**(8): 875-884 .
Cordelli M, Martini A, Habel R, Trasatti L (2011) "PORFIDO: Oceanographic data for neutrino telescopes" *NIMA* **626-627**: S109–S110.

UNDERWATER

1. EARTHQUAKE PREDICTION UNDERWATER
2. EARTH RADIOGRAPHY
3. CONTINUOUS OCEANOGRAPHIC DATA
4. PALEOCLIMATE
5. RADIOACTIVITY
6. SEDIMENT TRANSPORT
7. ATMOSPHERIC TEMPERATURE VARIATION
8. OXYGEN DYNAMICS

1. UNDERWATER SOUND MONITORING
2. BIODIVERSITY UNDER ICE
3. ASTROBIOLOGY
4. BIODEGRADATION
5. MICROBIOLOGY

ocean colour (for biological activity)

1. BIOFOULING

Tidal turbines

ASPERA & industry partners

- ASPERA Technology Forum 1: “Photosensors and auxiliary electronics” (Munich, Oct. 2010)
- ASPERA Technology Forum 2: “Mirrors and Lasers” (Pisa, Oct. 21/22, 2011)
- ASPERA Technology Forum 3: “Cryogenic detectors and Vacuum” (Darmstadt, April 2012)

High Energy Universe

KM3NeT

KM3NeT is a European initiative for a deep-sea research infrastructure hosting an underwater neutrino telescope in the Mediterranean Sea. A volume of several cubic kilometres shall be equipped with light sensors to detect Cherenkov light emitted by charged particles which have been produced in neutrino interactions. To reduce cosmic-ray induced background, in particular atmospheric muons, the light sensors look downward with having the Earth is a shielding and integral part of the telescope.

http://www.km3net.org

Specifications

Photosensors
The options currently being pursued are either ~300 000 PMTs (3 inch, peak QE above 32 %) or 30 000 PMTs (8 inch, peak QE above 30 % or 10 inch, peak QE above 20 %)
Most important specifications: small TTS, small single pe pulse time, short pulse rise time, sufficient peaktovalley ratio, high gain, low dark current.

- Use multi-PMT optical modules with 10″, 8″ or 3″
- Available 3″PMTs don't match the KM3NeT specifications, development urgently needed.
- Improvement is needed in the resolution.

Auxiliary electronics
Low power PMT base developed for the 3 inch option, to be developed for 8 or 10 inch option.
Readout electronics based on custommade ASIC.
Otherwise standard electronic electrooptical and optical components are used.

Requirements

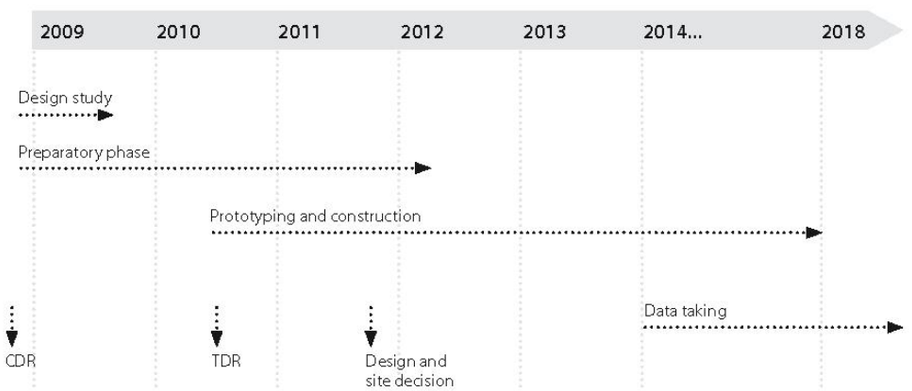
Design phase
Adaptation of existing commercial models to specific needs (form factors, mass production suitability, costeffectiveness)
Interaction with companies established.
Quality control by lab tests of each individual PMT.

Prototyping phase
Sufficiently many closetofinal PMTs to construct, test and deploy prototype optical modules.
Discussions with providers ongoing.
Quality control by lab tests of each individual PMT. Specification of acceptance criteria

Construction phase
Provision of full quantity of PMTs over a period of 45 years.
A continuous contact with provider companies is mandatory. The exact implementation of quality control needs to be discussed.

Critical parameters	Importance high (+++), low (–)	Comments
Quantum efficiency	++	Important: quantum efficiency times photocathode area
Time resolution	+++	Development needed, 2 ns/signal is ok, should be better
Backscattering	++	
After-/Prepulsing	+	
Radioactivity	–	It might be important to use low-radioactivity glass to avoid intrinsic background.
Low temperature	–	Operation at 14–20 °C or so
Pressure		PMTs inside pressure-resistent glass spheres
Lifetime	+++	The figure of merit is probably integrated charge/photocathode area
SiPM an option	no	Price
Other requirements		

Schedule



ASPERA Technology Forum 1: "Photosensors and auxiliary electronics"

- Brochure
  - pdf available from ASPERA website
  - printed version: send email to aspera@desy.de
- Discussion of photosensors tbc during an ASPERA session @ Light2011
- ASPERA 3rd Common Call (in 2012): Photosensor R&D may be a topic

What are other project collaborations doing?

Example: Cherenkov Telescope Array

- PrepPhase started in 2010
- Resource Board met already 2 times
- Clear interest by Germany to lead the consortium
- Funding and siting issues might be solved soon

Funding aspects

- National sources of funding are well known
- European structural funds

„RI and Structural Funds for Regional Cooperation in the Baltic Sea Region" (June 2011 Malmö)

Key Findings of this workshop

- *Study by DG Regio showed clear need for better co-ordination of national strategies*
- *DG Regio reminded the urgent need for joint strategies to reduce the risk of over-dimension and duplication of research infrastructures*
- *Member States should use Structural Funds for investments into infrastructures with clear European dimension*
- *Accessibility for industrial partners to scientific research facilities and the option for customer-oriented services is of utmost importance*
- *Estonian intention to establish an own beamline at the new synchrotron at MAX-IV, supported by European Structural Funds, is a good example of transnational access*
- ***Member States should be encouraged to enable the use of Structural Funds for cross-border activities***

KM3NeT – funding aspects

What are your questions?

Let’s discuss …