

# *ASPERA activities*

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# From ApPEC to ASPERA, ASPERA-2 and beyond

- ✓ ApPEC 10 years (MoU 29 March 2011)
- ✓ ASPERA (FP6) (July 2006-July 2009)
  - ✓ Census of Resources, Linking actions
  - ✓ Roadmap for Infrastructures → Definition of the field
  - ✓ 1<sup>st</sup> common call (CTA, Dark Matter)
  - ✓ Common portal, outreach, newsletter , ...
- ✓ ASPERA-2 (FP7) (July 2009-July 2012)
  - ✓ See next slides and ASPERA-2 talks in this workshop
- ✓ Beyond ? One of the deliverables
  - ✓ see last slides and talk by M. Bourquin



# ASPERA-2 – work programme

**Overall Management of ASPERA (WP1)**

**Update of status of Astroparticle Physics (WP2)**

**Knowledge and technology transfer (WP3)**

**Positioning Europe worldwide (WP4)**

**European-wide procedures (WP5)**

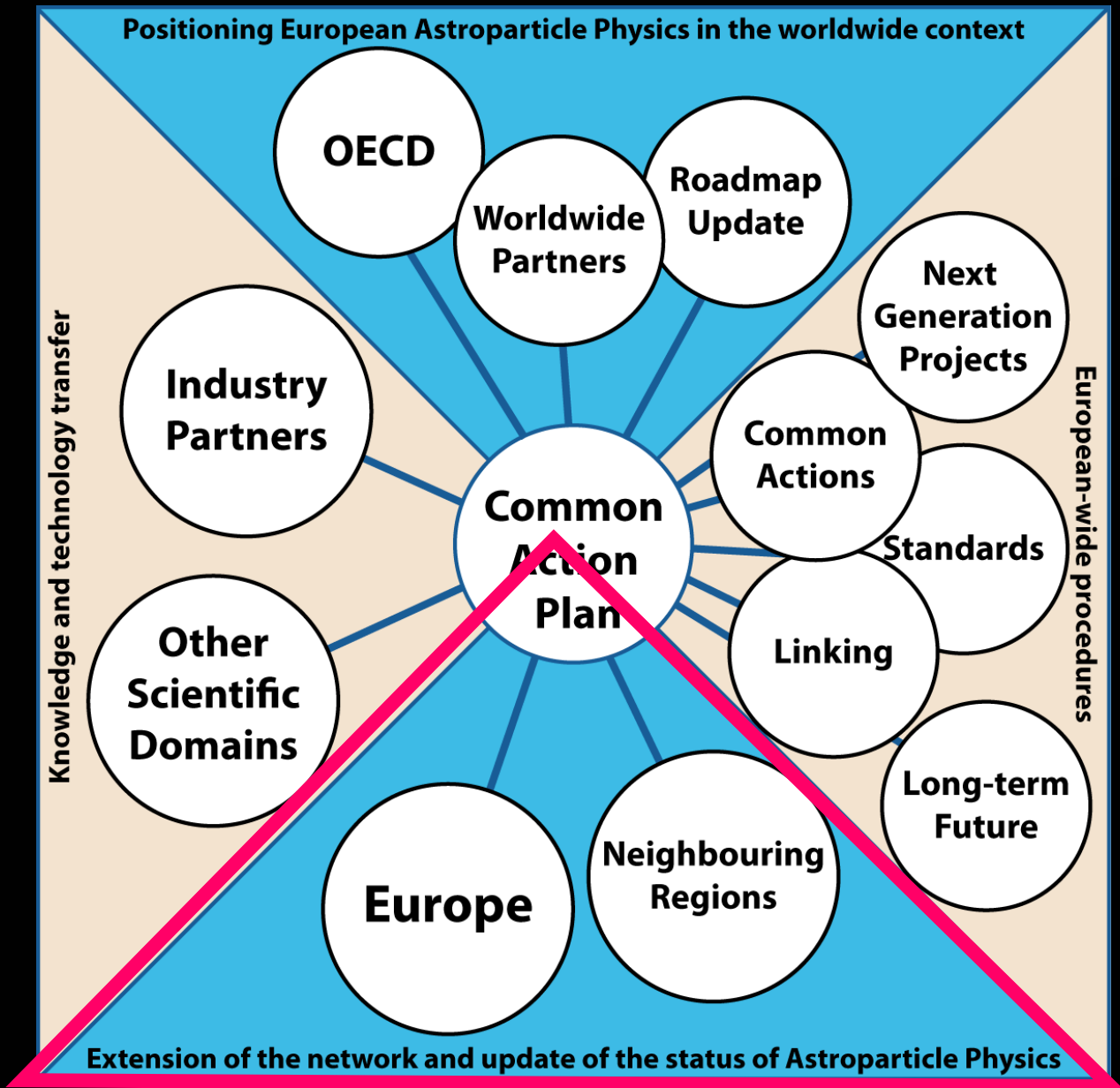
**Network  
extension**

**Electronic  
Infrastructure**

**Outreach**

**(WP2/6)**

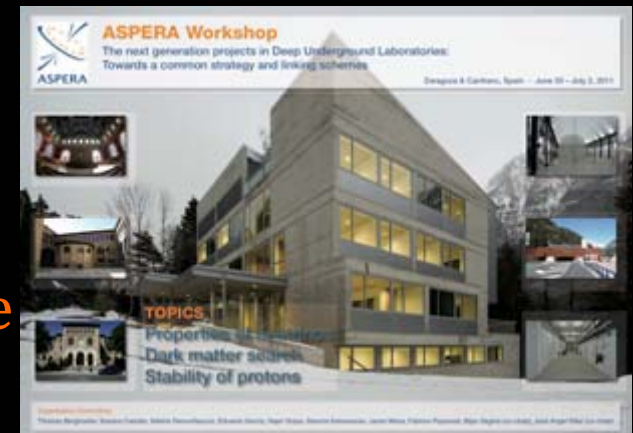
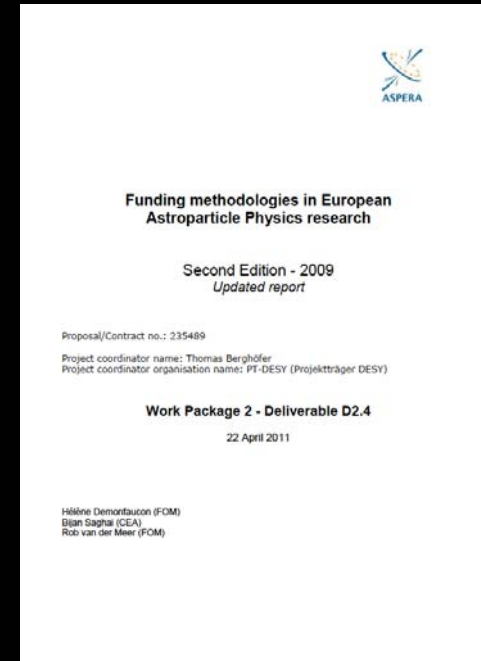
# WP2



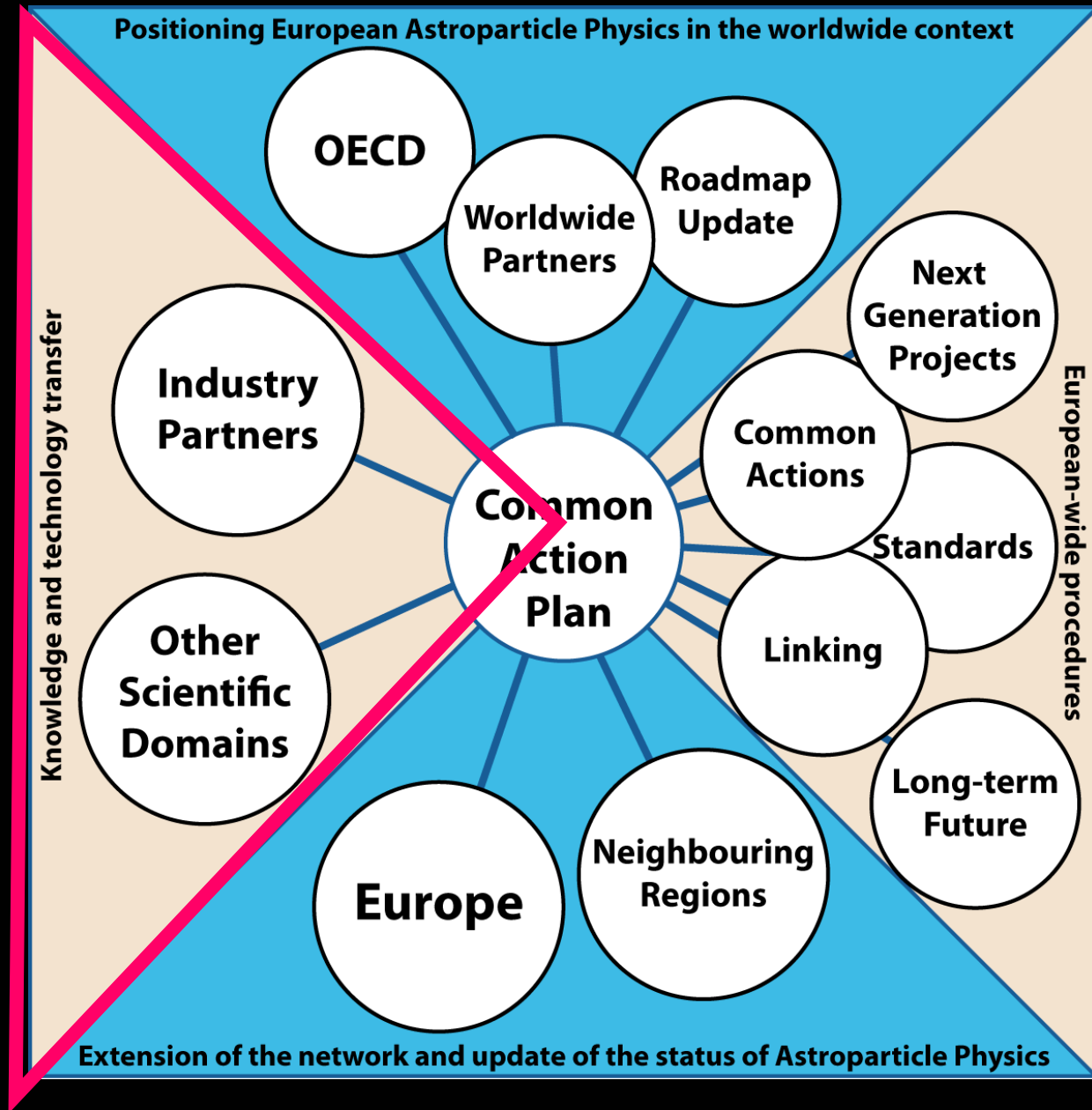


# WP2 Update Status of Astroparticle Physics

1. Extend the network in Europe
  - See talk by T. Berghoefer
2. Census of funding and personnel
  - See talk of B. Saghai and report →
3. Linking of infrastructures
  - MoU between Underground laboratories
  - Workshop on Underground science June 30-July 2 2011 in Zaragossa



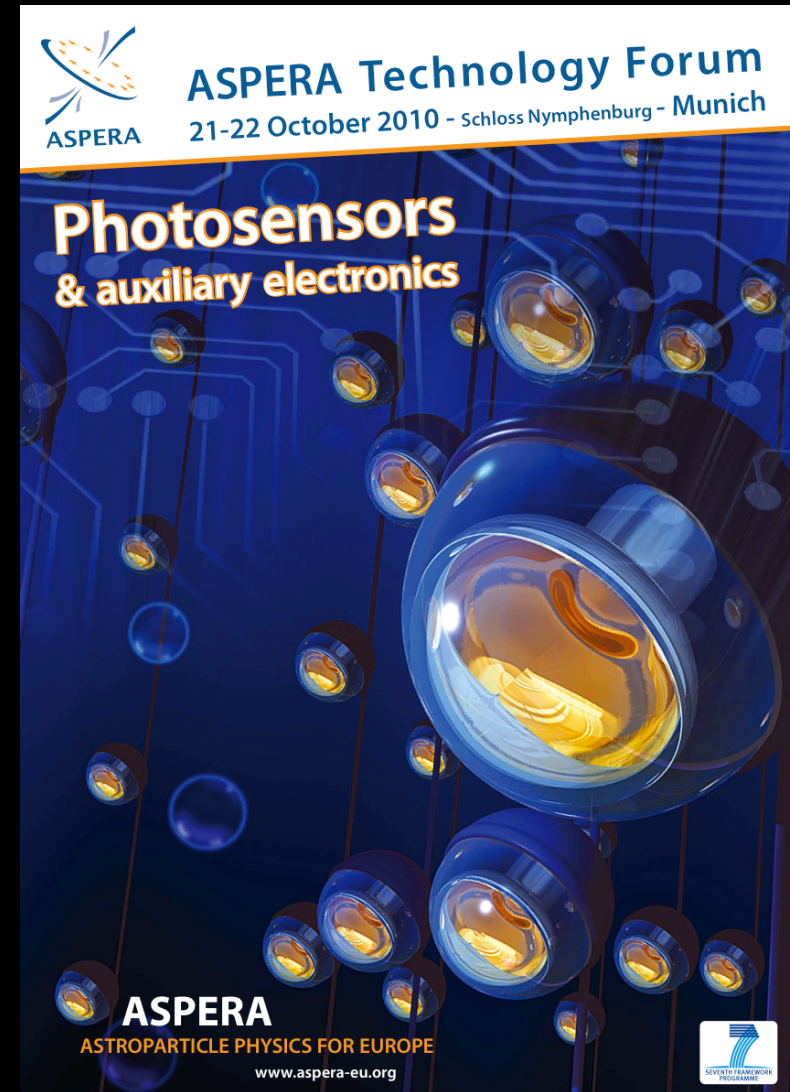
# WP3





# WP3: Industrial contacts and innovation

- Photosensor workshop
  - Munich 21-22 October 2010
- Mirros and Lasers
  - Pisa 20-21 October 2011
- → Cryogenics + vacuum
  - Darmstadt March 2012  
Work in progress
- Cartography of industrial landscape and needs
- Organisation of procurement, encourage developments of existing products in industries to match ApP project needs
- Organise access to ApP Research Infrastructure services
  - Inform industrials on the services that ApP RI can offer
  - Standardise rules of access, fees, Intellectual Property rights etc.
- Encourage Innovation



Very popular with industry



# WP3: Synergies with other fields

- From the Geosphere to the Cosmos
  - Paris 1-2 December 2010
- → Underwater Science
  - Amsterdam 24-25 May 2012

A new frontier:

- ApP RI provide continuous time series data to other sciences by deploying large networks in hostile environments (sea, desert, underground)
- ApP RI provide noise-free platforms (e.g. in underground laboratories) for dating and other high sensitivity searches for environment and applications
- ApP collaborations could provide the experience of large data manipulation and worldwide networking
- In some cases ApP scientists elaborate and try to test *ambitious* theories on meteorological/geological events/hazards (cloud formation, lightning, earthquakes,...).

FROM THE GEOSPHERE

TO THE COSMOS

SYNERGIES WITH  
ASTROPARTICLE PHYSICS



ASPERA

DRAFT No2

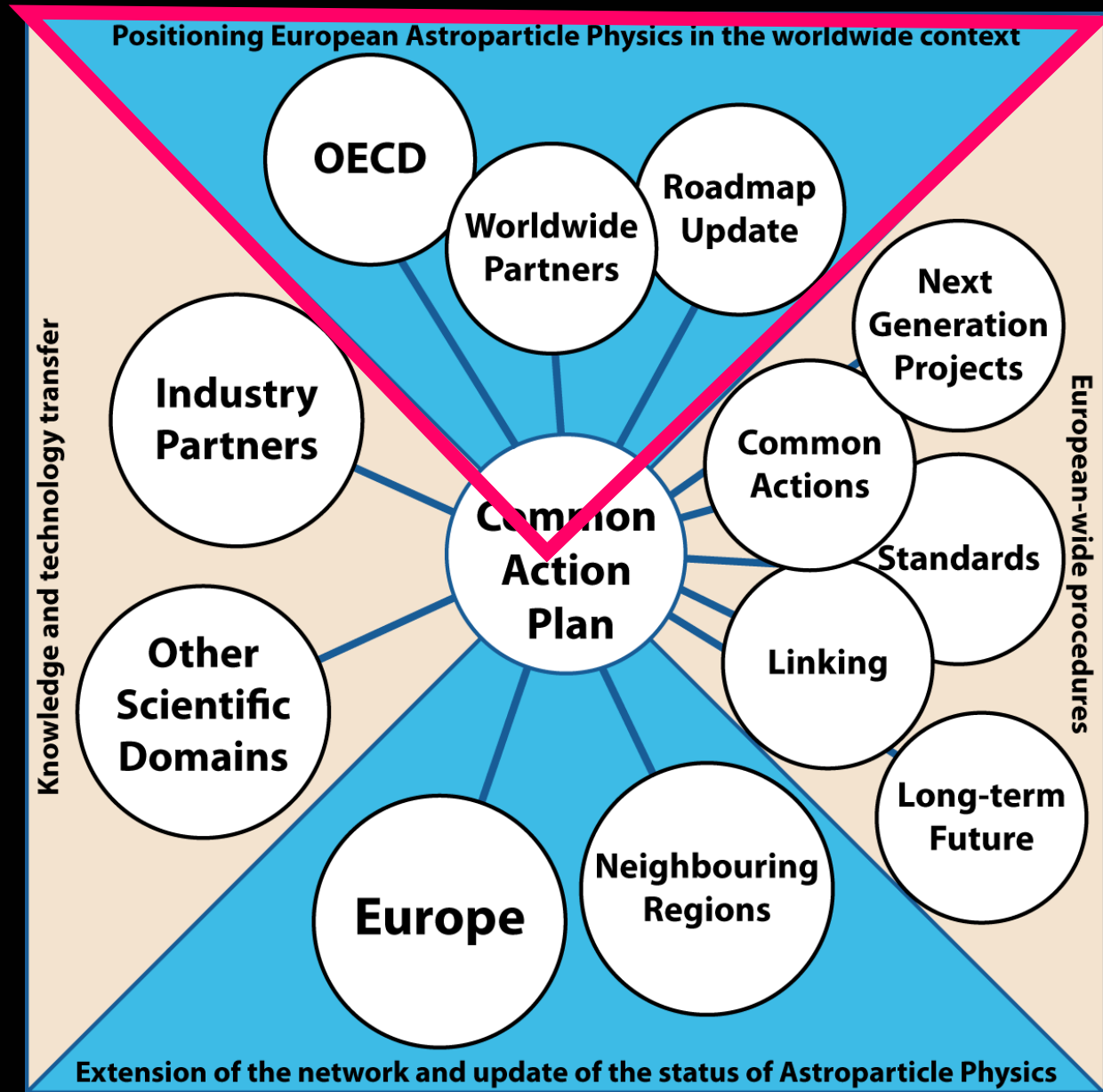
07/11/2011

See talk by I. Agrafioti

Forthcoming  
brochure



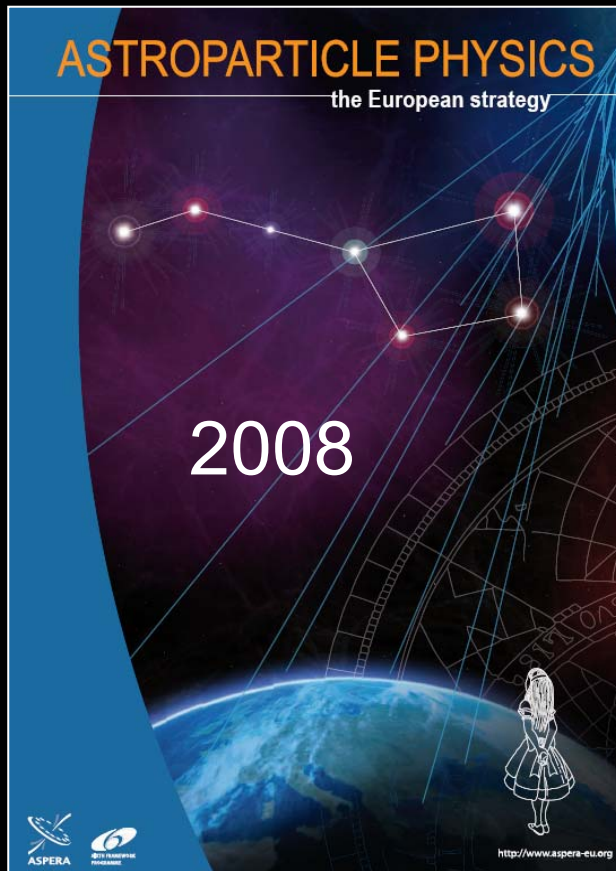
# WP4





# WP4 The Roadmap update

„The Magnificent Seven“  
a definition of the field



See talk  
C. Spiering

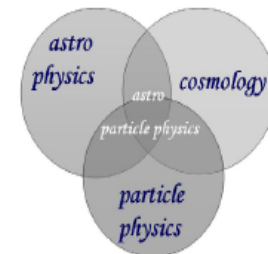
## *The Roadmap Update*

### European Roadmap for Astroparticle Physics

2011 Edition

Draft 15.6.2011

Version submitted to ApPEC SC and ASPERA GB



## 2011

Ad M. van den Berg, Roberto Battiston, Laura Baudis, Jose Bernabeu, Daniel Bertrand, Pierre Binetruy, John Carr, Enrique Fernandez, Francesco Fidecaro, Gilles Gerbier, Andrea Giuliani, Andreas Haungs, Werner Hofmann, Steven Kahn, Uli Katz, Paul Kooijman, Hans Kraus, Antoine Letessier-Selvon, Manel Martinez, Benoit Mours, Lothar Oberauer, Rene Ong, Michal Ostrowski, Sheila Rowan, Subir Sarkar, Stefan Schoenert, Guenter Sigl, Ion Siotis, Christian Spiering, Robert Svoboda, Francesco Vissani, Lucia Votano, Roland Walter



## WP4: Extending coordination to global scale

ASPERA

- ( OECD) Creation of APIF (Astroparticle International Forum) a subsidiary body of the OECD Global Science Forum composed of funding agency officials chaired by M. Turner
- APIF goals:
  - Exchange information between agencies
  - Prepare joint actions
  - Propose solutions for governance structures
  - Propose solutions to science policy issues, (facility access, operation costs etc)
  - Engage collective dialogue with governmental and non-governmental entities
  - Develop strategies for transfer of technology and other benefits to industry and to society in general.
  - Develop educational and outreach materials.

See talk by M. Turner and round table

*A Worldwide Vision  
Creation of APIF*

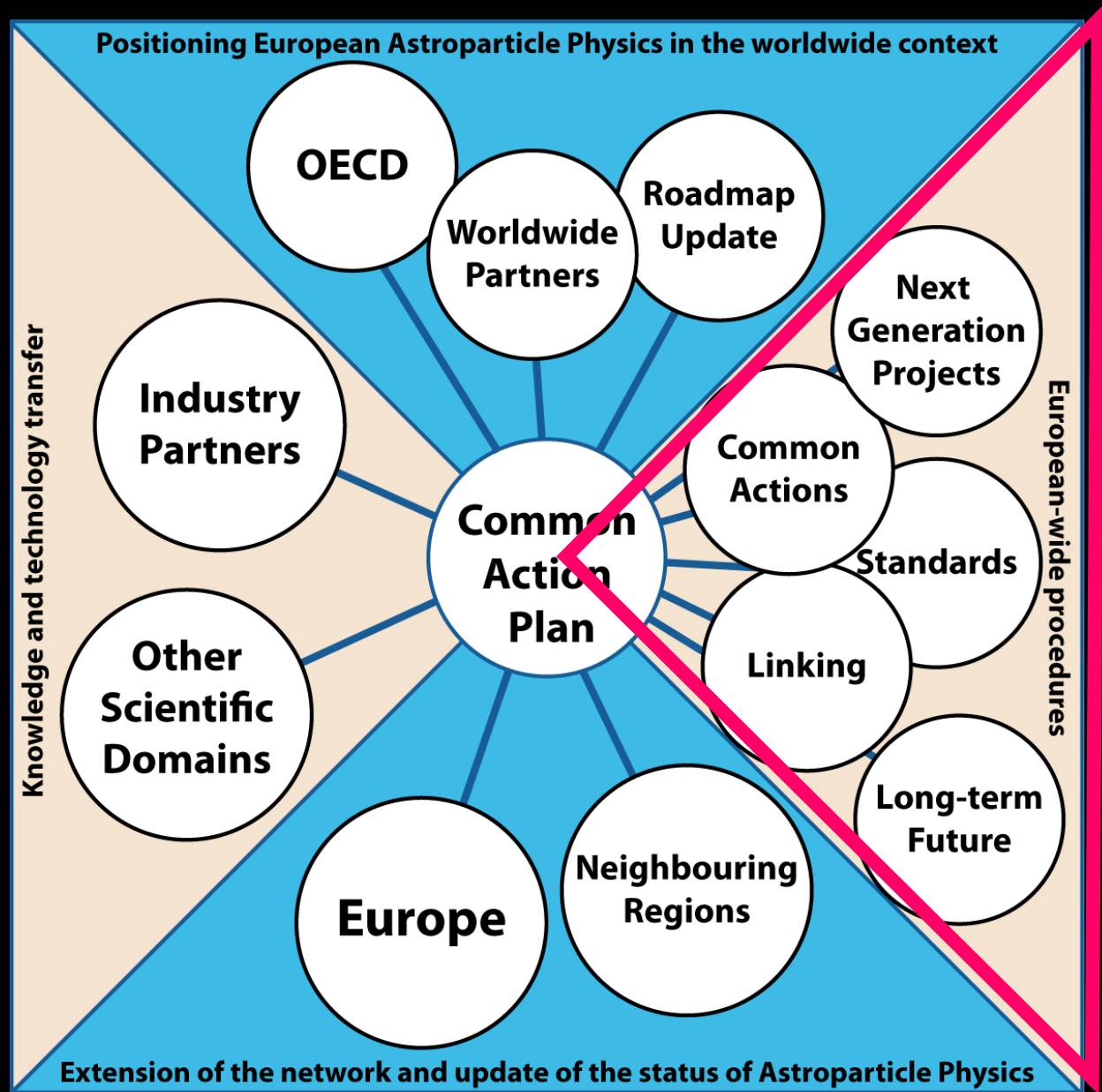
OECD Global Science Forum

Report of the Working Group  
on Astroparticle Physics

MARCH 2011



# WP5





# WP5 Common Actions

## 1. Common calls

- 2<sup>nd</sup> common call completed (UHECR and neutrino mass R&D)
- 3<sup>rd</sup> common call in definition

## 2. Guide, evaluate and consult forthcoming Astroparticle infrastructures

- Ressource Boards/Scientific Committees formed or in formation for CTA, KM3
- Discussions for optimal formal structure
  - light « à la Auger » vs ERIC etc.
- Discussions on uniformisation of phase definition
  - Phase A,B,C etc as in ESA, or similar ones in NSF/DoE
- ASPERA works here as an « environment » and not as a collective decision body, and probably this is best given the fact that these projects are formed with a variable geometry of agencies
- A report in preparation (synergy with APIF equivalent work )



# WP5 Common Actions

## 3. Actions of coordination of national programs

- Tetstbed → coordination in e-infrastructures/computing
- Define the Astroparticle computing model
- 2 workshops (Lyon, Barcelona) and one forthcoming in Hannover
- See talk by Manuel Delfino

## 4. Create standards for project management accounting and controlling

- A report delivered

## 5. Long term sustainability of Astroparticle Physics in Europe

- Work in synergy with ApPEC (see talk by M. Bourquin)
- An LOI to be signed by ministries and agencies
- A continuation of ASPERA through 3-4 distributed centres with agency resources, a common fund
- FP8 support (starting 2014) probably necessary for smaller country participation






# WP6 Outreach

1. ASPERA Website (30000/year)
2. ASPERA Newsletter (1500 recipients)
3. ASPERA Twitter (10000 followers)
4. Factsheets on 7 magnificent
5. Common press releases
  - AMS, ET, LAGUNA
6. Events
  - 2009: Astroparticle week in Astronomy year
  - 2012: 100 years of Cosmic Rays




## EURECA

The future European dark matter search with cryogenic detectors




### Solving the Dark Matter Enigma

Determining the precise composition of our Universe is at present one of the high-priority outstanding scientific questions. In a context of intense international competition, recent measurements indicate that ordinary nuclear matter in our Universe only represents about 4 percent of the Universe content. The remaining 96 percent are attributed to Dark Matter and Dark Energy. Two mysterious components that have not been escaped direct detection.



Particle physics provides a natural debate for Dark Matter, in the form of elusive particles called WIMPs, (Weakly Interacting Massive Particles) which are predicted by unified theories of interactions, such as Supersymmetry.



The segments for dark matter have been discovered by the Wilkinson Microwave Anisotropy Probe (WMAP) after a mission of 9 months in orbit in 2001. In the meantime, the measured curvature of galaxies suggested that 80% of mass gravitationally made from dark matter.


### What is EURECA?

EURECA is a European project testing cryogenic detectors at a temperature of a few millikelvin. It is designed to detect WIMP interactions for a large fraction of theoretical models.

Its very sensitive detectors will be able to identify and reject with high efficiency the radioactive background, which would otherwise hide that by signal of WIMP Dark Matter particles. With EURECA, direct detection tests of WIMP will be observed in the controlled environment of a deep underground laboratory, shielded from cosmic rays and natural radioactive background.

EURECA is based on the expertise of two cutting edge running experiments: CRESST and Edelweiss. CRESST is using cryogenic detectors that are able to detect directly in real time the heat and light produced by WIMP interactions. Edelweiss is utilizing germanium detectors, with an active rejection of the background based on the simultaneous measurement of the heat and charge signals created by WIMP interactions.

EURECA also brings together leading European teams




### About EURECA's Design Study (DS)

EURECA is presently in its Design Study phase (2008-2012), supported financially by several of the ASPERA funding institutions. The Design Study will define the layout options of the project, in terms of deep underground site, active shielding against cosmic rays, ultra-low radioactivity materials, cryogenic line, ultra-low noise electronics, etc.

In 2013, EURECA will start its test phase involving about 150 kg of detectors. A second phase of the EURECA experiment, beginning in 2016, will involve up to one ton of cryogenic detector, with enhanced measurements over at least 10 years.

The baseline site for EURECA is the deepest site in Europe, the Modane Underground Laboratory (LSM) at the French-Italian border under the Alps, with its reduction of the cosmic-ray flux by a factor two million. Other deep underground sites could also be considered, such as the Gran Sasso National Laboratory in Italy.



Cryogenic detector developed by the EDWARDS collaboration for the EURECA experiment.

### Techniques and challenges

WIMPs, trapped in the gravitational field of our galaxy have velocities of the order of one thousandth of the speed of light. The recoil energy delivered by a WIMP collision is then very small, only a few tens of eV. The detection of such small energies for massive detectors - several hundred grams per detector - only possible at very low temperatures, of the order of few millikelvin above absolute zero. In addition to the heat signal, charge or light generated by the WIMP interaction are also detected, a crucial factor to identify and reject the radioactive background.

WIMP interactions are also very rare, typically a few interactions per 100 kg and per year. With a target of about one ton, EURECA will be able to identify a WIMP signal and characterize its properties. This also means that EURECA must be shielded from cosmic rays in a deep underground laboratory, and that all materials used in the EURECA setup must be selected for their ultra-low radioactivity.

Even in a deep underground laboratory, it is necessary to be shielded against alpha radioactivity, and the identification is achieved by measuring very low specific activities. EURECA therefore plans to further shield its two cryostats with a pool of ultrapure water equipped with photomultiplier tubes to detect particle showers.

### Partners:

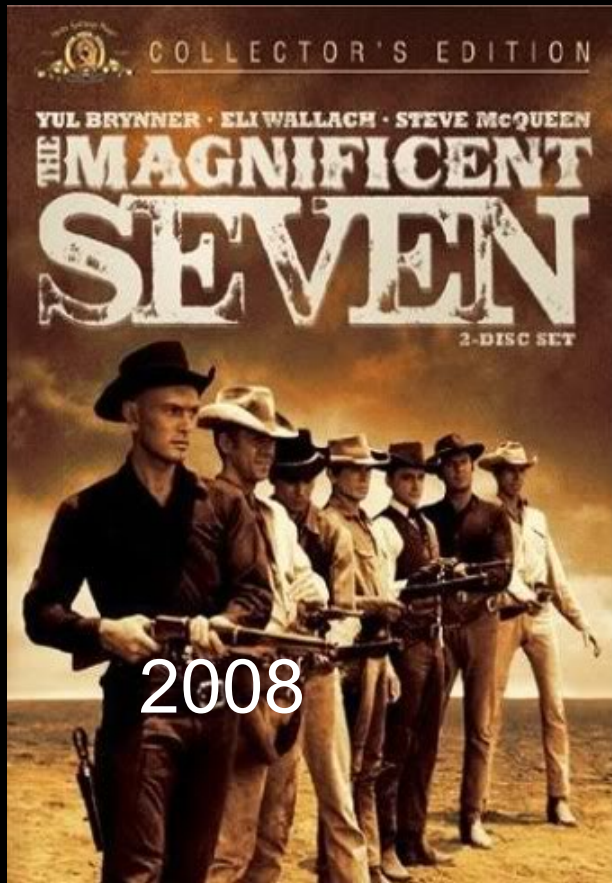
CEA - Saclay (DSM) & ILLMED & CNRS (D2FS & INF) & Universities of Paris Sud Orsay, Claude Bernard - Villeurbanne, Grenoble, Bordeaux, Poitiers / Max-Planck-Institut für Physik, München, Technische Universität München, Garching, Universität Tübingen, Cardiff, University of Technology (BRIP) ASTP - Germany / JINR Dubna - Russia / University of Zaragoza - Spain / University of Oxford, University of Sheffield - United Kingdom / NIKHEF - Ukraine

Contacts, web: [www.eureca.eu.ac.uk](http://www.eureca.eu.ac.uk)

# In conclusion and as a tentative definition of the new task at hand

*FROM*

*TO*







# Main themes of Astroparticle Physics (OECD GSF definition)

What is the role of high energy phenomena in the Universe ?

- High Energy messengers ( $\gamma$ ,  $\nu$ ,  $p/N$ )
- Gravitational waves

What is the Universe made of ?

- Dark Matter
- Dark Energy

What is the nature of matter and interaction at the highest energies ?

- Neutrino Mass
- Proton decay and neutrino Properties

