Advanced European Infrastructures for Detectors at Accelerators

Felix Sefkow

AIDA2020

Detector Workshop of the Helmholtz Alliance
Berlin, March 5, 2015

Outline:

- History
- Proposal
  - Context, objectives, consortium
- Implementation
  - Work plan, management, resources

Previous infrastructure initiatives

- FP6: EUDET: 2006-2010
  - Total budget 21M, EU contribution 7M
  - 31 partners + associates
  - detector development for a linear collider
  - pixel telescope, TPC magnet and field cage, calorimeter absorber and electronics, software, transnational access to test beams

- FP7: AIDA: 2011-2014
  - Total budget 26M, EU contribution 8M
  - 80+ institutes, 40 (direct) beneficiaries
  - detector development for LHC upgrades, ILC, CLIC, neutrino physics and Super-B
  - TA to test beam and irradiation facilities, DD4HEP, more telescopes, 3D integration, etc pp

AIDA Advanced European Infrastructures for Detectors at Accelerators

Towards AIDA-2020

- FP8 - Horizon2020: targeted call, published 11/12/2013
  - following a successful evaluation of pre-proposal
- Deadline 2.9.2014
  - budget 140M, success rate 50%
  - competing with nuclear and astro-physics
- End of 2013: Call for expressions of interest
  - >50 EoIs received, strong interest from LHC
- Open meeting 17.2.14 @ CERN
  - coordination office, WP contact persons
- March 2014: AIDA annual meeting
  - follow-up end April: work package structure, content
- Summer: proposal writing, budget
  - EC request 10M, overall budget 28.9M
- 2.9.2014: submission
  - coordinator CERN, L.Serin, LAL
- Decision delayed due to budget uncertainties

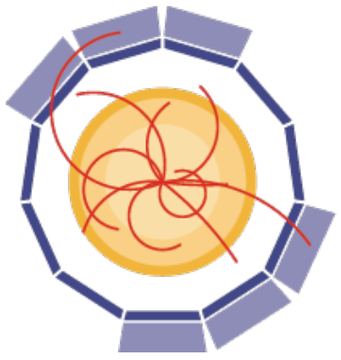
Proposal coordination

- Coordination office:
  - Laurent Serin, LAL-CNRS/IN2P3 Orsay, AIDA scientific coordinator (chair)
  - FS replacing Ties Behnke (DESY), AIDA deputy coordinator
  - Paul Soler (University of Glasgow), AIDA deputy coordinator
  - Ivan Vila, CSIC Santander, AIDA Governing board chairman
  - Svet Stavrev (DG-EU, CERN), AIDA administrative coordinator
  - Chiara Meroni, ATLAS, for LHC community
  - P.Giacomelli, CMS, for LHC community
  - Juan Fuster Verdú, IFIC – Valencia, for ILC community
  - Konrad Elsener, CERN, representing CERN and CLIC community
  - Etam Noah Messomo, UNIGE, for Neutrino community

- Work package contact persons

Success!

- 16.1.2015: AIDA-2020 selected by the EC, funding 10M
  - fast grant agreement procedure, no negotiation phase
  - no budget reduction and re-distribution
- Now: grant agreement with EC being prepared
- Consortium agreement
  - matching contributions
- Expected starting date: 1.5.2015
- Kick-off meeting 3.-5.6.2015 @ CERN
- First instalment in summer

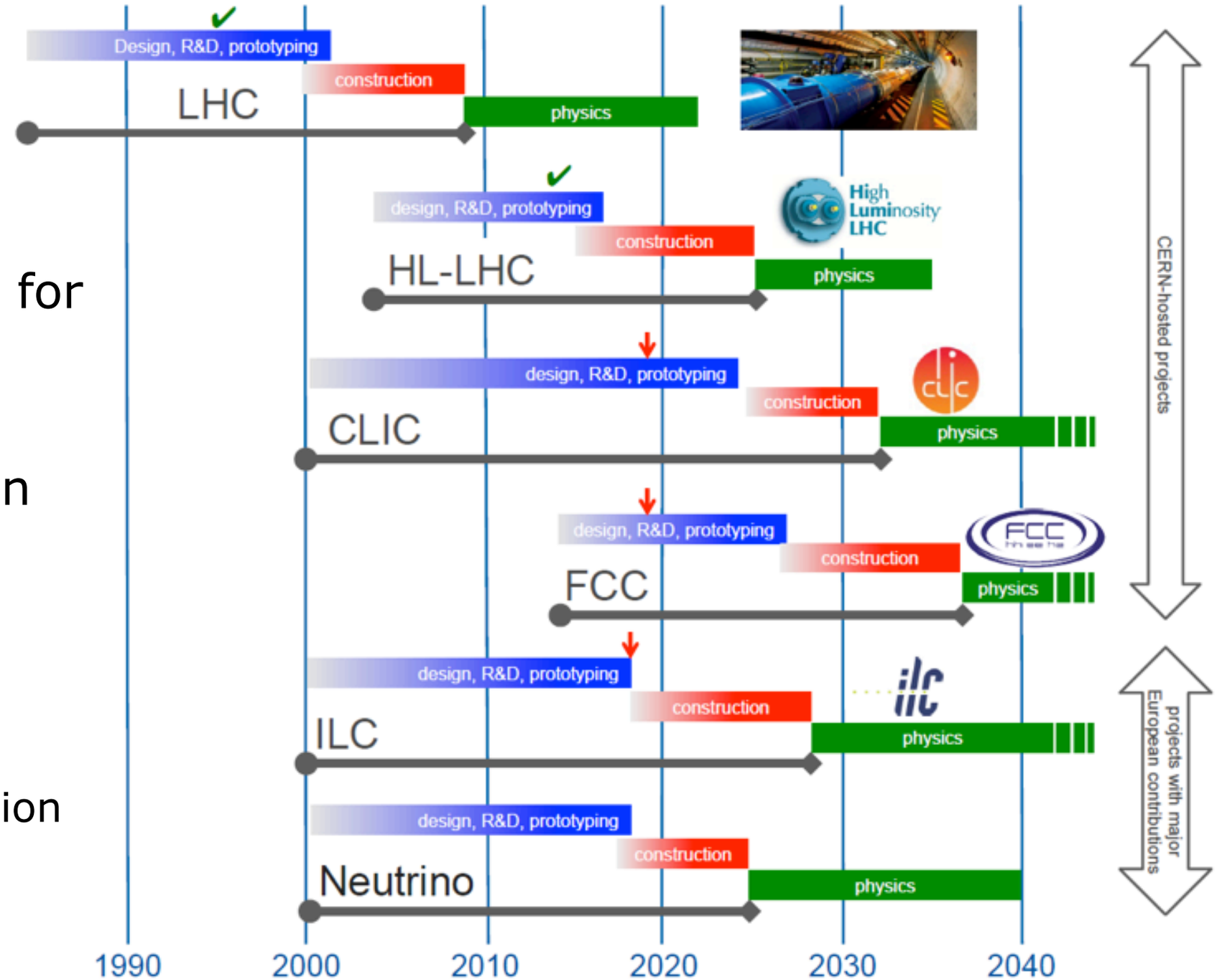


AIDA2020

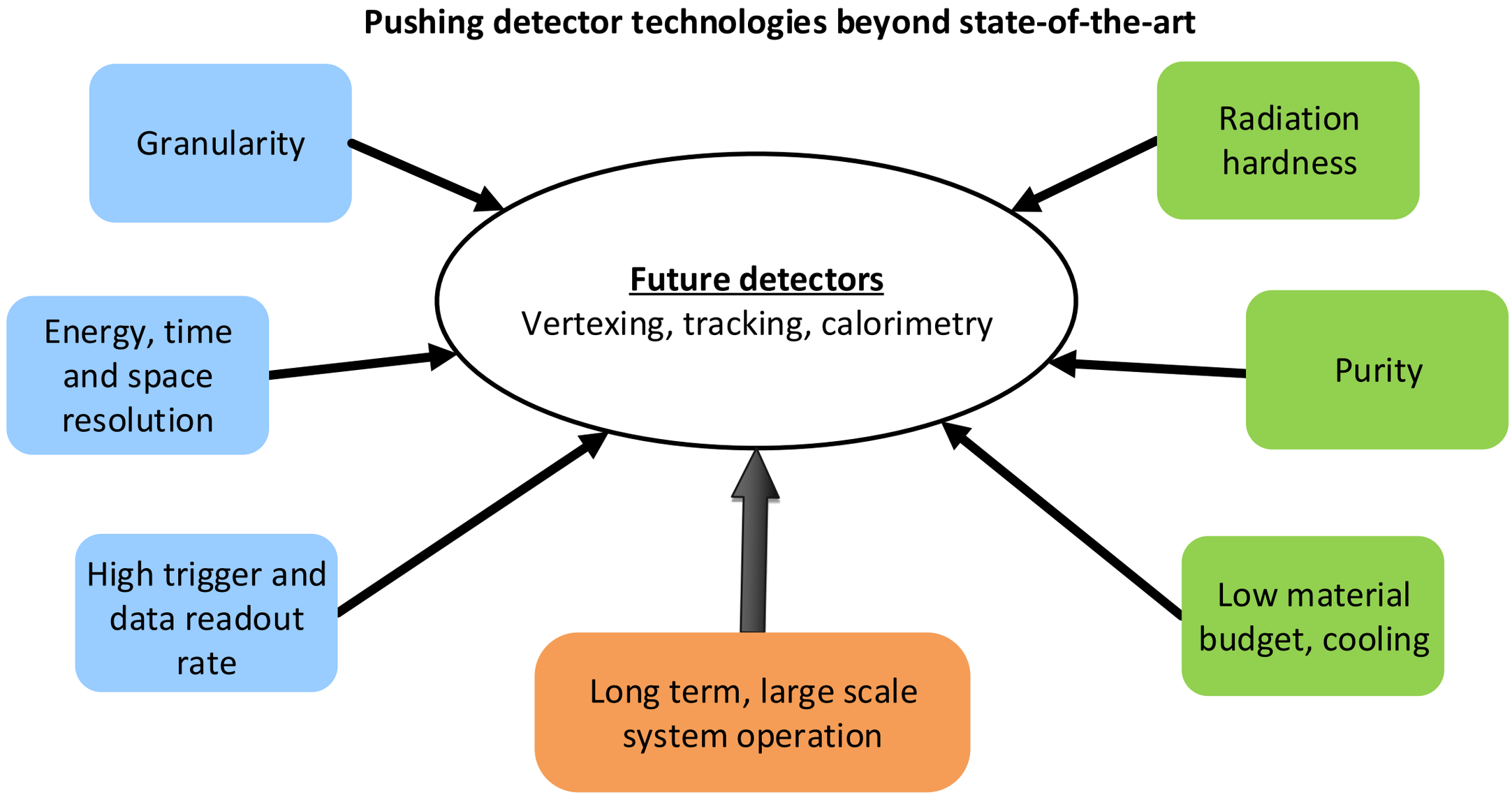
Proposal

Context

- Follow closely the European strategy for particle physics
- Many R&D issues in common
- Build on AIDA achievements
  - test beam, irradiation
  - software
  - micro-electronics



Objectives



- and offer highly equipped infrastructures for tests

Beyond AIDA

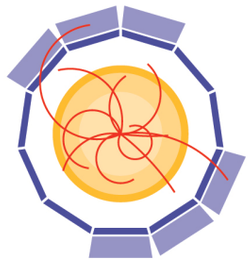
- More transnational access
  - 3x users, 4 new facilities
- Latest technologies for micro-electronics and software
  - parallelisation and vectorisation
- Novel technologies, not covered by AIDA
  - HV CMOS, 3D, micro-channel cooling
- Enhance infrastructures to advance to construction phase
  - calorimetry and gaseous detectors
- Cooperation with industry and technology transfer
  - proof-of-concept fund

- **Ambition:**
- Serve as a European forum for detector development
- Maintain European leadership in particle physics

HL-LHC

- 13 TeV this year
- HL-LHC: 5x higher luminosity
  - pile-up, irradiation and trigger challenges

- **R&D for detector upgrades:**
- Silicon trackers
  - hybrid pixels, interconnects, LGAD, HV-CMOS, …
- Forward calorimeters
  - high granularity
- MPGD, RPC
  - muon detection with fast timing, industrialisation
- Advanced software
  - 100x more data: parallelisation and vectorisation



Linear Collider

- Main challenge: precision
  - tracking: very limited material budgets, 1/10 LHC
  - calorimetry:very high granularity: 100x LHC
- CLIC: fast read-out, time stamping

- **R&D towards realistic detector designs:**
- Hybrid pixels for CLIC
  - planar and 3D, ultra-thin: 1% for 5 layers
- MPGD for TPC and DHCAL
- Test facilities for calorimeter elements
  - Silicon and optical readout
- DAQ for combined test beams
  - alignment and inter calibration
- Test beam upgrades
  - Si tracker as reference for TPC, slow control
- Software

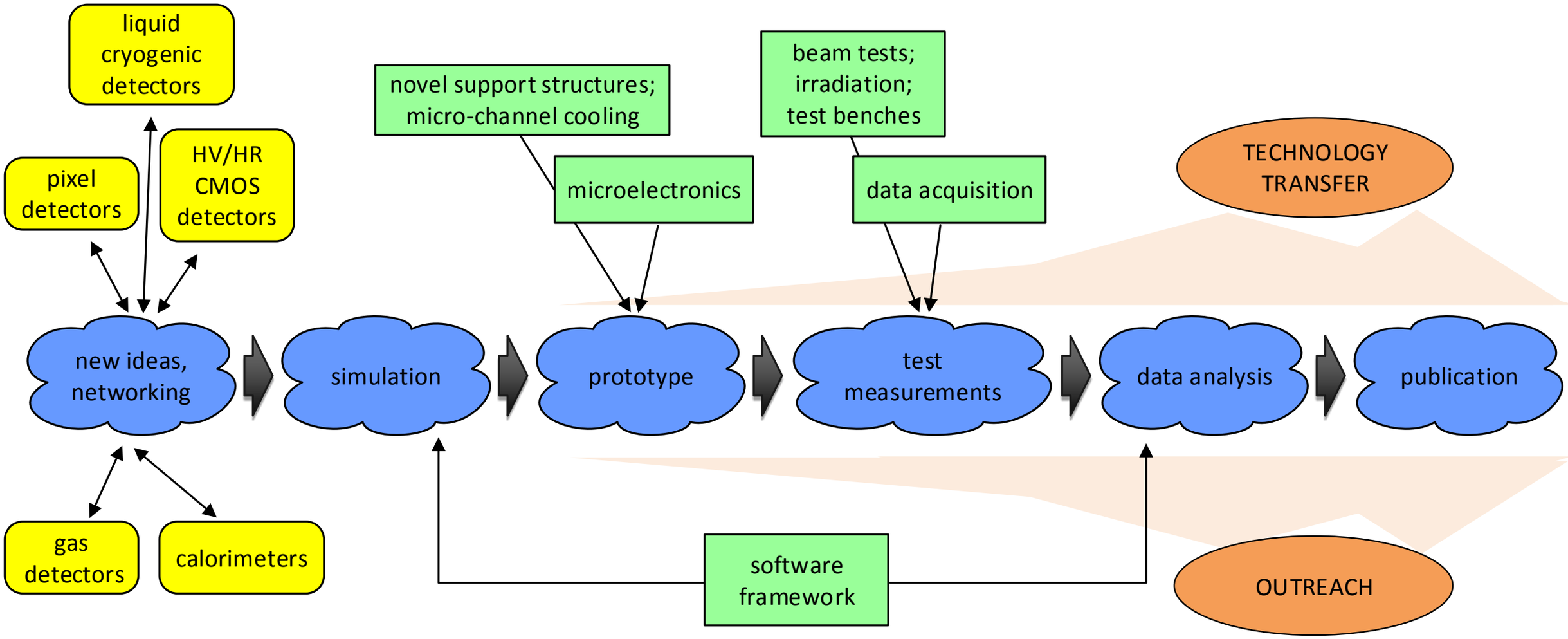
Neutrino facilities

- Towards direct discovery of CP violation
- Accelerator-based experiments
  - large mass detectors

- **European network for detector R&D:**
  - around CERN-based LAr infrastructure

- Large scale LAr systems
- Purification and monitoring
- HV and SC magnetisation schemes

Detector life cycle

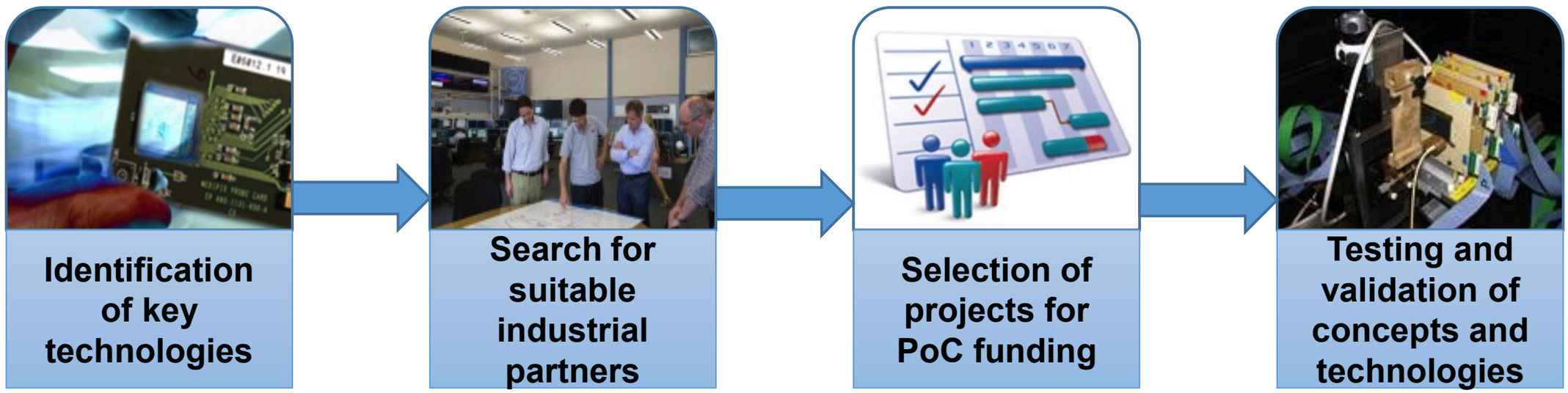


- Guides the work-package structure of AIDA

Innovation and outreach

- Emphasised by EU
- Increased effort on communication
  - CERN and DESY
- Continue “Academia meets Industry” events
- Explore feasibility of large area Silicon production
  - trackers and calorimeters

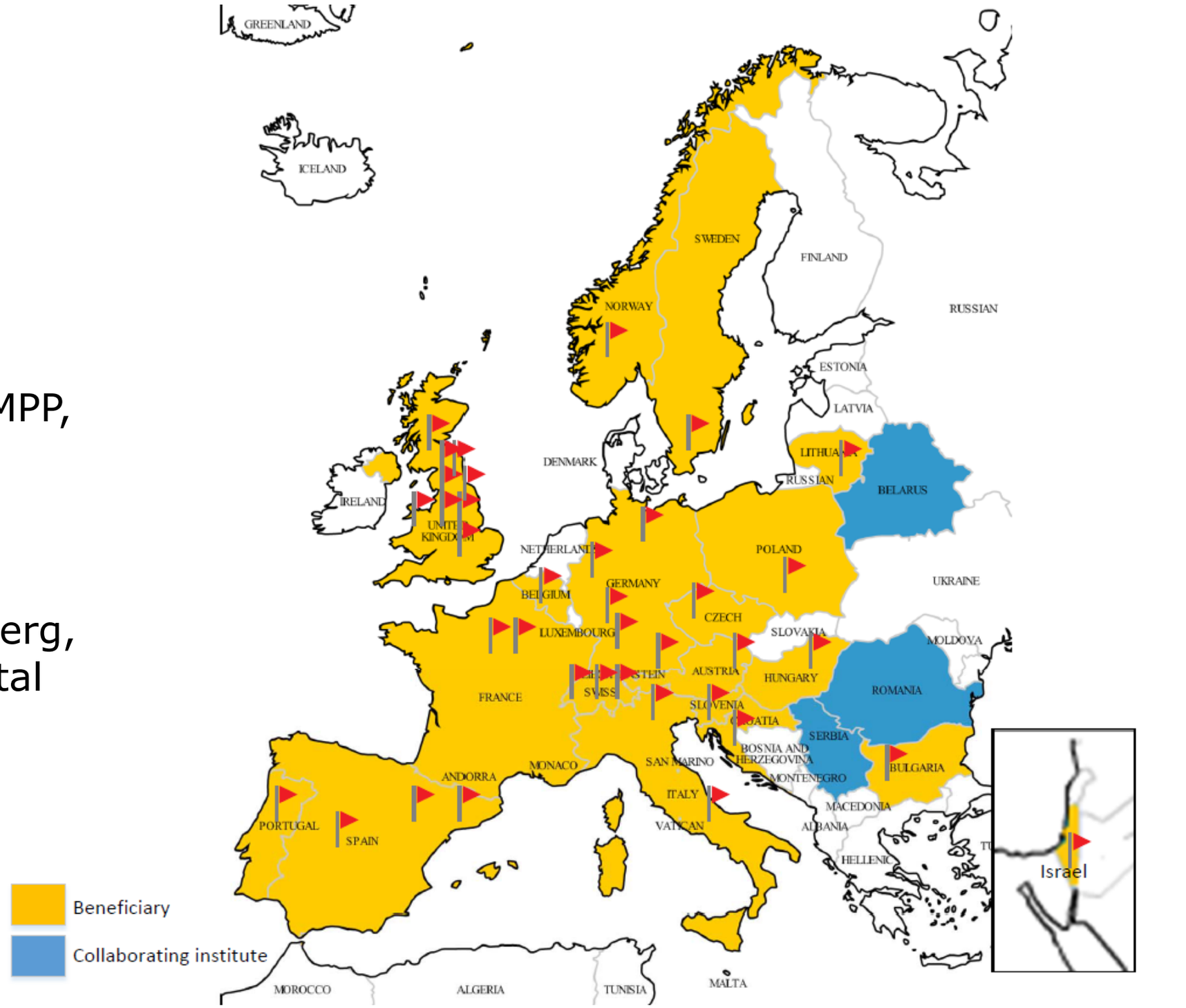
- Proof-of-Concept Fund
  - test and validate technologies with high potential for non-HEP exploitation



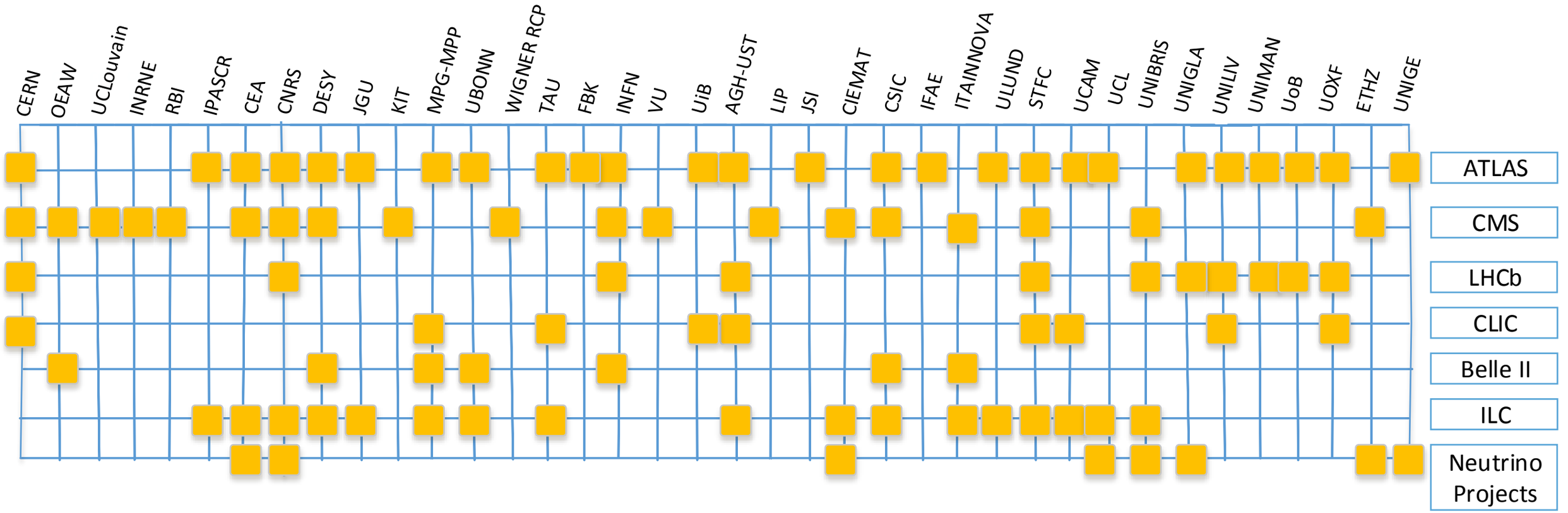
Consortium

Participants

- 19 countries
- 38 beneficiaries
  - D: DESY, KIT, MPG-MPP, UBONN, JGU
- 17 collaborating institutes
  - D: Freiburg, Heidelberg, Rossendorf, Wuppertal

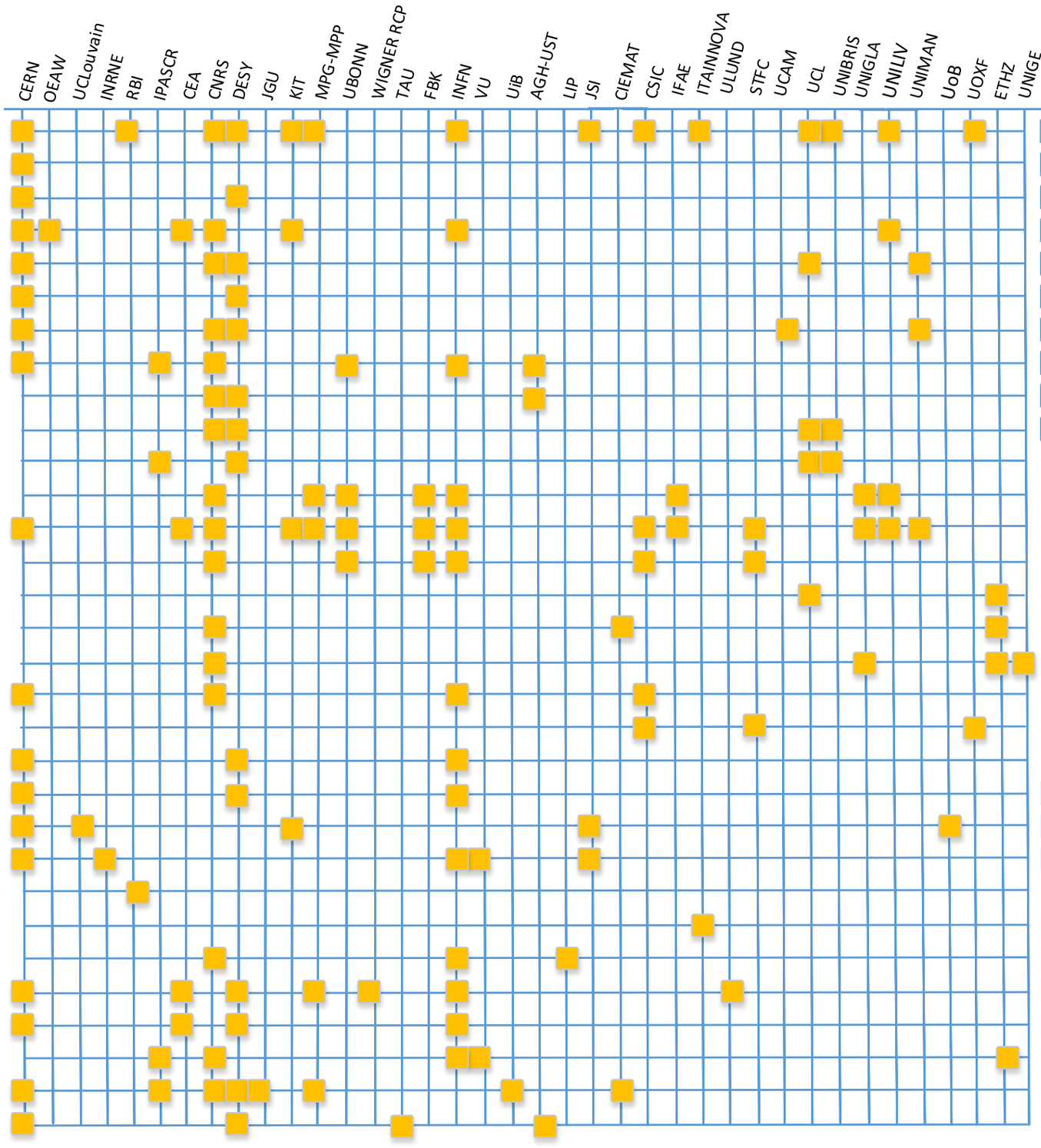


Involvement



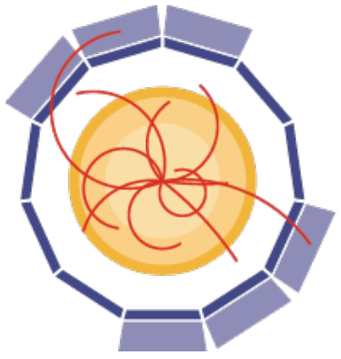
- Balance

Competences



- Complementarity

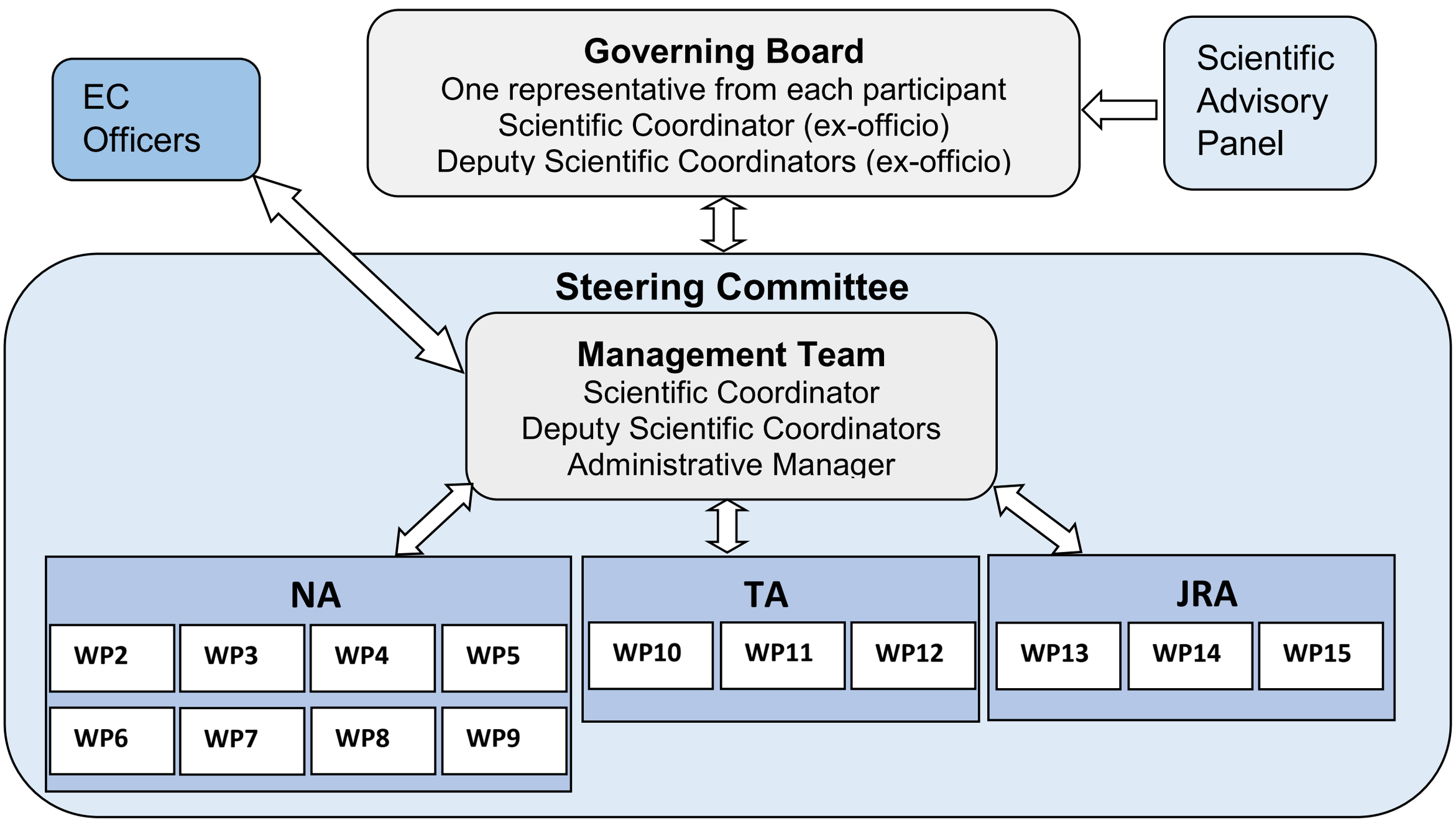
Management and coordination	All WP
Technology transfer	WP2
Communication and outreach	WP2
Detector industrialisation (silicon, gas detectors)	WP2,13
Data description, event data model software	WP3,5
Simulation software	WP3
Reconstruction software	WP3
ASICs for tracker	WP4,6,7
ASICs for gas detector and calorimeters	WP4,13,14
Data acquisition	WP5,14
Slow control, monitoring	WP5
Interconnection and hybridisation	WP4,6,7
Sensor (CMOS, 3D, planar, LGAD) development	WP6,7
Sensor simulation	WP6,7
Purification and monitoring of noble liquids	WP8
Charge and light signals in noble liquids	WP4,8
Very high voltage and magnetisation	WP8
Micro-channel cooling	WP6,7,9
Low mass mechanical structures and design	WP6,7,9
Operation of test beam facilities	WP10
Upgrade of test beam facilities	WP15
Operation of irradiation facilities	WP11
Upgrade of irradiation facilities	WP15
Testing of solid state materials with MeV ions	WP12
Testing of electromagnetic compatibility	WP12
RPC developments	WP3,4,13
MGPD developments	WP3,4,13
Gas detector infrastructure	WP13
Electromagnetic calorimeters	WP3,4,5,14
Hadronic calorimeters	WP3,4,5,14
Forward calorimeters	WP4,5,14



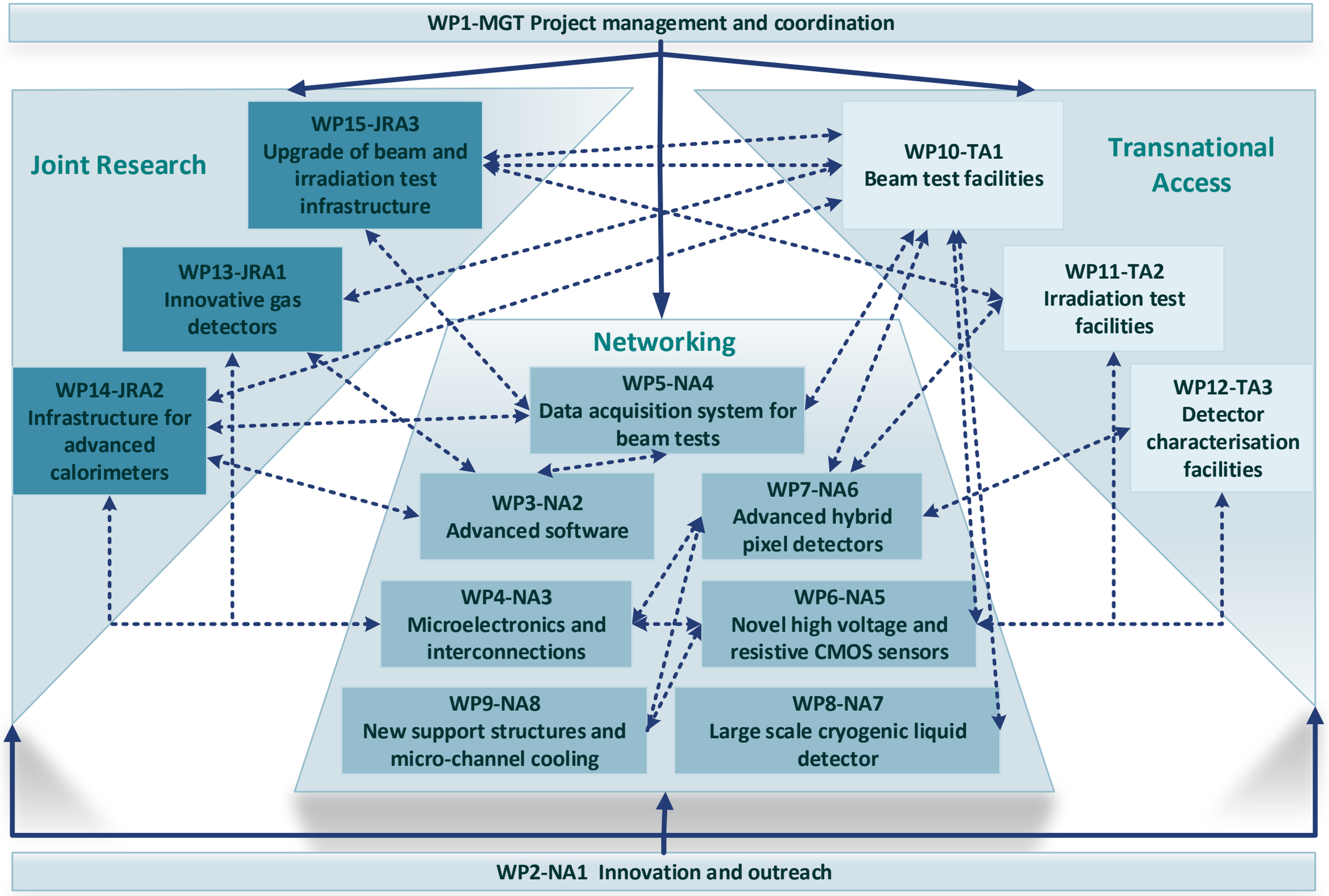
AIDA 2020

Implementation

Management


Governing Board
One representative from each participant
Scientific Coordinator (ex-officio)
Deputy Scientific Coordinators (ex-officio)
Scientific Advisory Panel
EC Officers
Steering Committee
Management Team
Scientific Coordinator
Deputy Scientific Coordinators
Administrative Manager
NA
WP2
WP3
WP4
WP5
WP6
WP7
WP8
WP9
TA
WP10
WP11
WP12
JRA
WP13
WP14
WP15

Work packages



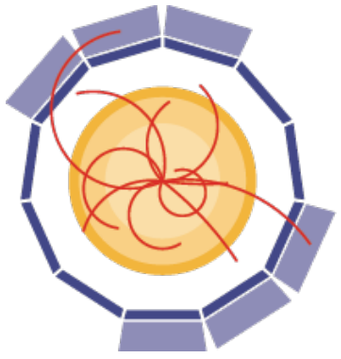
Co-ordinators

No	Type	WP	WP coordinators	Institute
WP1	MGT	Project management and coordination	Svet Stavrev	CERN
WP2	NA1	Innovation and outreach	Marcello Lossasso	CERN
WP3	NA2	Advanced software	Witold Pokorski Frank Gaede	CERN DESY
WP4	NA3	Micro-electronics and interconnections	Christophe De La Taille Valerio Re	CNRS INFN
WP5	NA4	Data acquisition system for beam tests	Matthew Wing David Cussans	UCL UNIBRIS
WP6	NA5	Novel high voltage and resistive CMOS sensors	Ivan Peric Gianluigi Casse	KIT UNILIV
WP7	NA6	Advanced hybrid pixel detectors	Anna Macchiolo Ivan Vila	MPG-MPP CSIC
WP8	NA7	Large scale cryogenic liquid detectors	Dario Autiero	CNRS
WP9	NA8	New support structures and micro-channel cooling	Paolo Petagna Georg Viehhauser	CERN UOXF
WP10	TA1	Beam test facilities	Henric Wilkens Natalia Potylitsina	CERN DESY
WP11	TA2	Irradiation facilities	Marko Mikuz	JSI
WP12	TA3	Detector characterisation facilities	Stjepko Fazinic Fernando Arteche	RBI ITAINNOVA
WP13	JRA1	Innovative gas detectors	Silvia Dalla Torre Imad Laktineh	CNRS INFN
WP14	JRA2	Infrastructure for advanced calorimeters	Roman Poeschl Frank Simon	CNRS MPG-MPP
WP15	JRA3	Upgrade of beam and irradiation test infrastructure	Federico Ravotti Marcel Stanitzki	CERN DESY

Deliverables

- Around 5 per WP
- Lead participant for each
- German responsibilities
  - WP3: software
    - event data model toolkit (DESY)
    - advanced tracking tools (DESY)
  - WP5: test beam DAQ
    - online event data model (DESY)
  - WP6: HV CMOS
    - sensor design guidelines (UBONN)
    - final report on devices (KIT)
  - WP7: pixel
    - final pixel characterisation (MPG-MPP)
  - WP10: test beam
    - trans-national access (DESY)
  - WP11: irradiation
    - trans-national access (KIT)

- German responsibilities (cont)
  - WP14 calorimeters
    - test infrastructure optical r/o (MPG-MPP)
    - common running of calorimeters; DAQ (DESY)
    - leak-less cooling system (DESY)
  - WP15: test beam upgrades
    - pixel telescope for CERN (DESY)
    - Si strip tracker for TPC tests (DESY)
    - Environmental control system (DESY)



AIDA 2020

Resources

Overall

- Total EC request: 10M
  - Indirect cost fixed to -20%
- Total budget: 28.9M
  - including matching funds 66%
  - 2670 ppm
- Project duration: 4 years

- Management 3.5%
- Transnational access 13.4%
  - to users, no fees

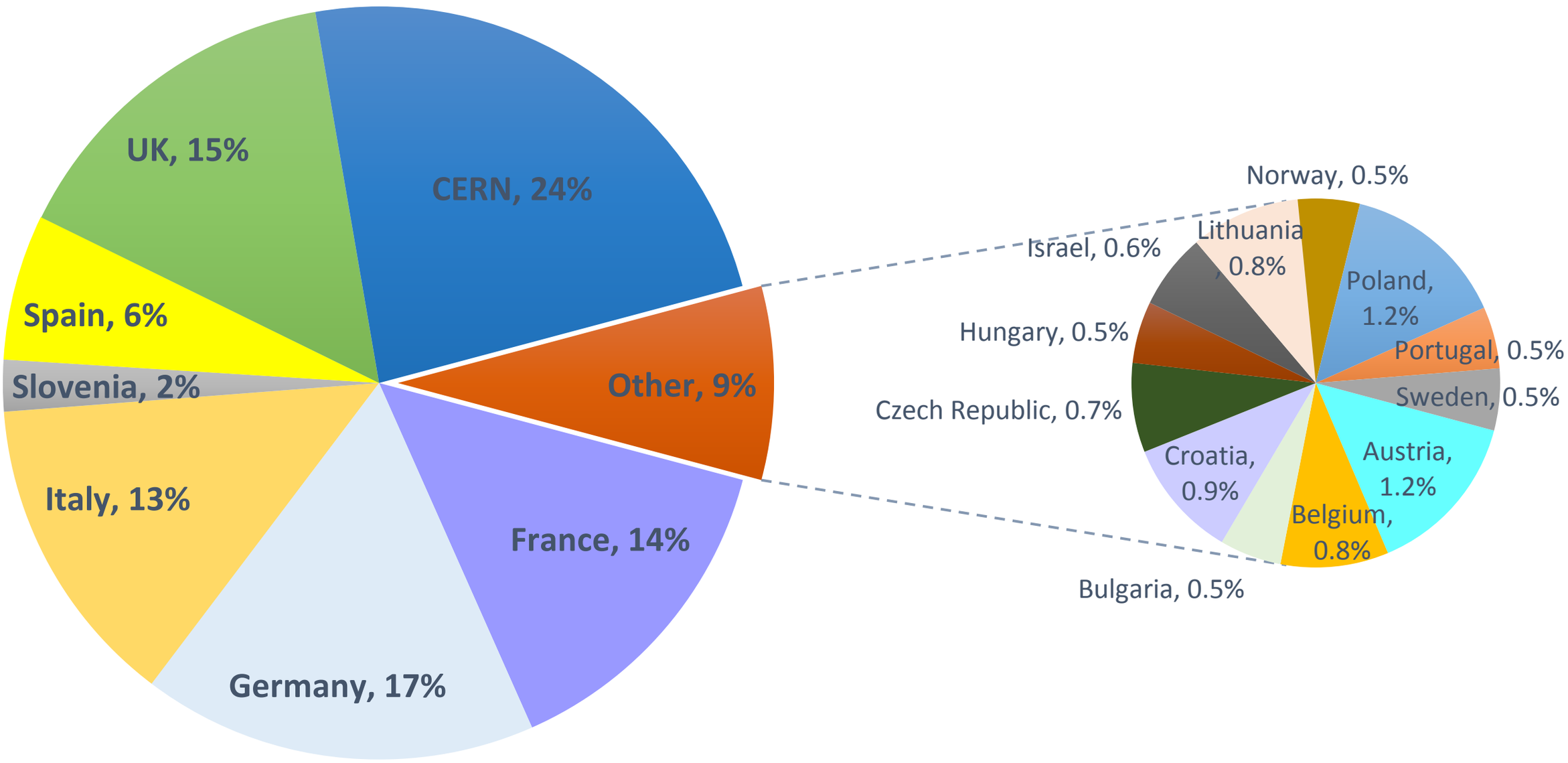
- ~ 50% LHC, 25% LC, 25% general

By work package

Work package	Type	PM	Total costs (€)	Requested EC contribution (€)
WP1	MGT	60	892,569	349,331
WP2	NA1	71	809,556	538,000
WP3	NA2	339	2,628,040	920,000
WP4	NA3	202	2,388,724	987,000
WP5	NA4	147	1,085,875	475,000
WP6	NA5	213	1,790,332	719,000
WP7	NA6	217	1,820,516	766,000
WP8	NA7	214	1,718,944	500,000
WP9	NA8	118	1,175,147	517,000
WP10	TA1	164	5,281,386	453,000
WP11	TA2	72	1,835,740	688,029
WP12	TA3	14	204,140	199,640
WP13	JRA1	197	1,897,949	806,000
WP14	JRA2	281	2,446,983	966,000
WP15	JRA3	361	2,947,650	1,116,000
TOTAL		**2,670**	**28,923,550**	**10,000,000**

Coord
Inno&Out
Soft
Microele
DAQ
HV CMOS
Pixels
Cryo
Mech&Cool
TA Testbeam
TA Irradiation
TA DetTest
GasDet
Calo
TBupgrade

By country


UK, 15%
CERN, 24%
Spain, 6%
Slovenia, 2%
Other, 9%
Italy, 13%
France, 14%
Germany, 17%
Norway, 0.5%
Israel, 0.6%
Lithuania 0.8%
Poland, 1.2%
Hungary, 0.5%
Portugal, 0.5%
Czech Republic, 0.7%
Sweden, 0.5%
Croatia, 0.9%
Austria, 1.2%
Belgium, 0.8%
Bulgaria, 0.5%

Conclusion

- Approval of AIDA-2020: evidence for competitiveness of particle physics
- 10M for detector R&D for our future
- Build on AIDA, but merge communities even more within common work packages
- Kick-off Meeting at CERN, June 3-5
- Scientific content: hopefully next time!