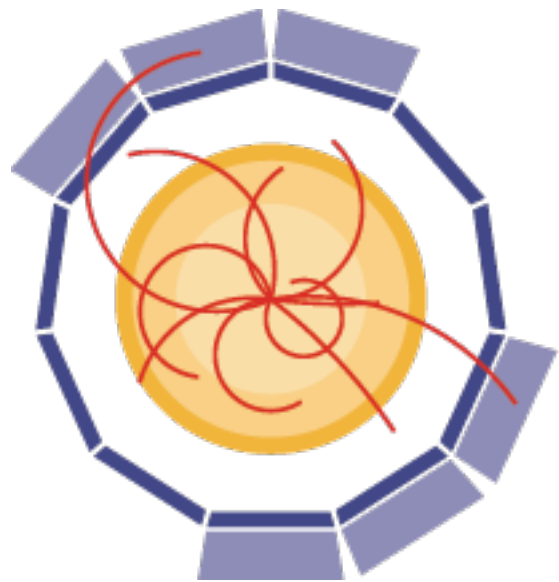


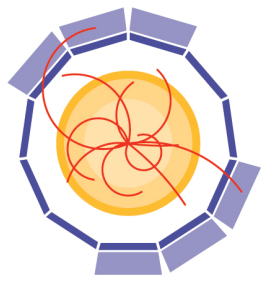
# Advanced European Infrastructures for Detectors at Accelerators

Felix Sefkow



# AIDA 2020

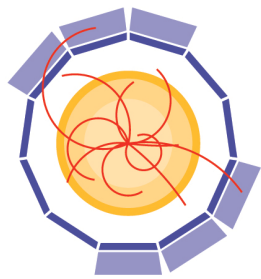
ILD optimisation meeting  
Hamburg, March 18, 2015



# Outline:

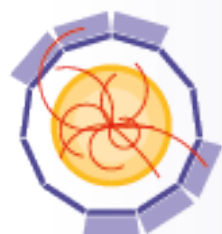
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- History
- Proposal
  - Context, objectives, consortium
- Implementation
  - Work plan, management, resources
  - LC related activities



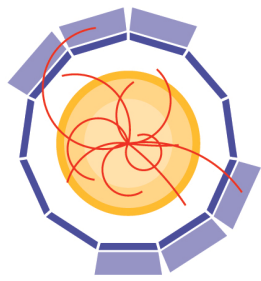
# Previous infrastructure initiatives

- **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

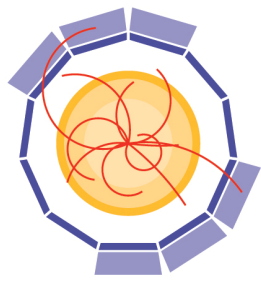
Advanced European Infrastructures  
for Detectors at Accelerators



# Towards AIDA-2020

- FP8 - Horizon2020: targeted call, published 11/12/2013
  - following a successful evaluation of pre-proposal
  - budget 140M, success rate 50%, competing with nuclear and astro-physics
- End of 2013: Call for expressions of interest
  - LC community meeting at LAL
  - LC common (ILD and SiD) plus separate requests
  - >50 EoIs received, strong interest from LHC
- Open meeting 17.2.14 @ CERN
  - establish proposal coordination office
- 2.9.2014: submission
  - **EC request 10M, overall budget 28.9M**
  - coordinator CERN, L.Serin, LAL
- 16.1.2015: AIDA-2020 selected by the EC, funding 10M
  - Fast grant agreement procedure, no negotiation phase
  - no budget reduction and re-distribution
- **Expected starting date: 1.5.2015**
  - First instalment in summer
- **Kick-off meeting: June 3-5, 2015 @ CERN**



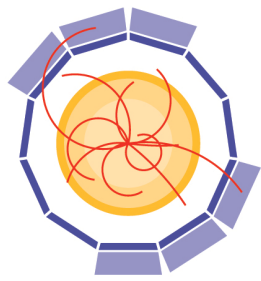


# Proposal coordination

- 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

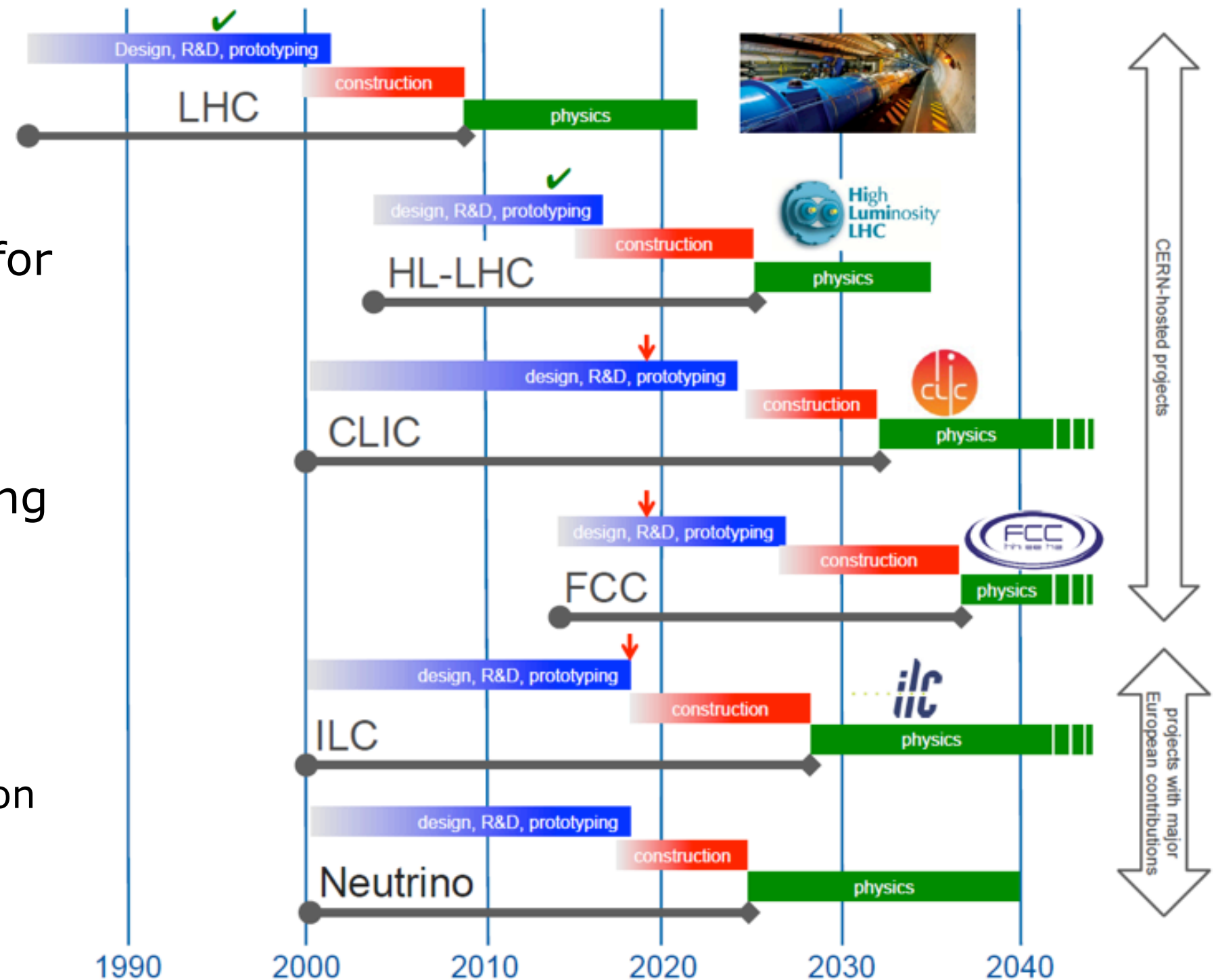


Proposal

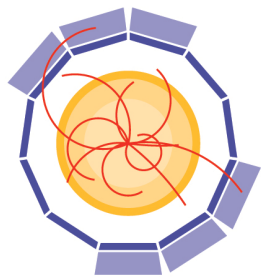


# Context

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

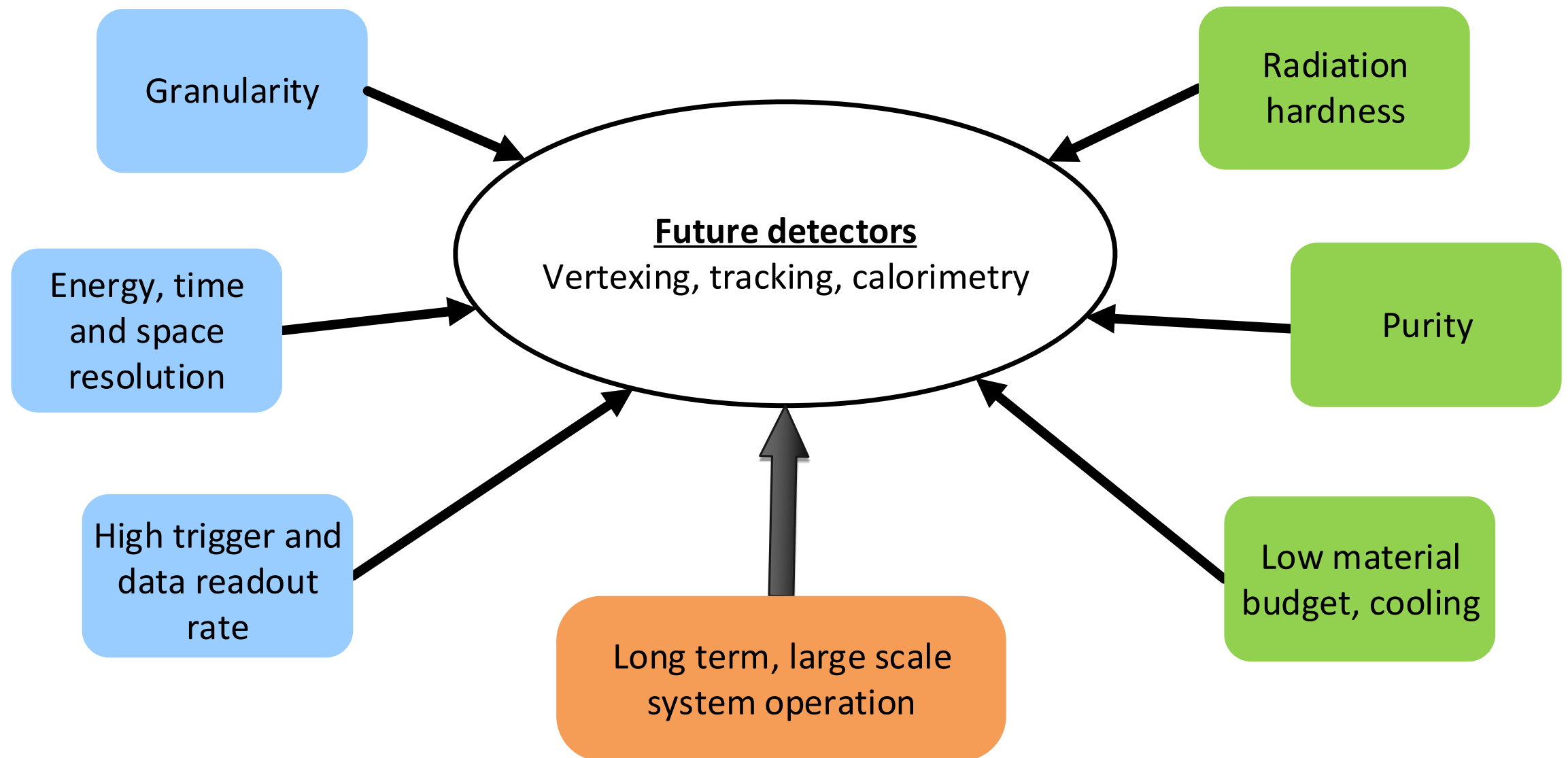






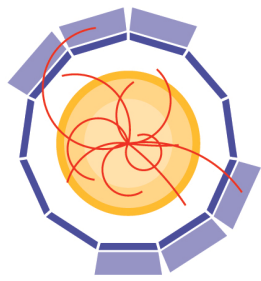
# Objectives

Pushing detector technologies beyond state-of-the-art



- and offer highly equipped infrastructures for tests



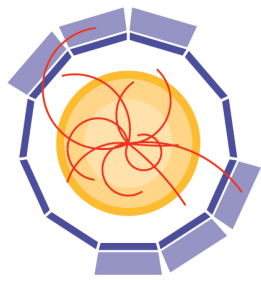


# Beyond AIDA

- 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

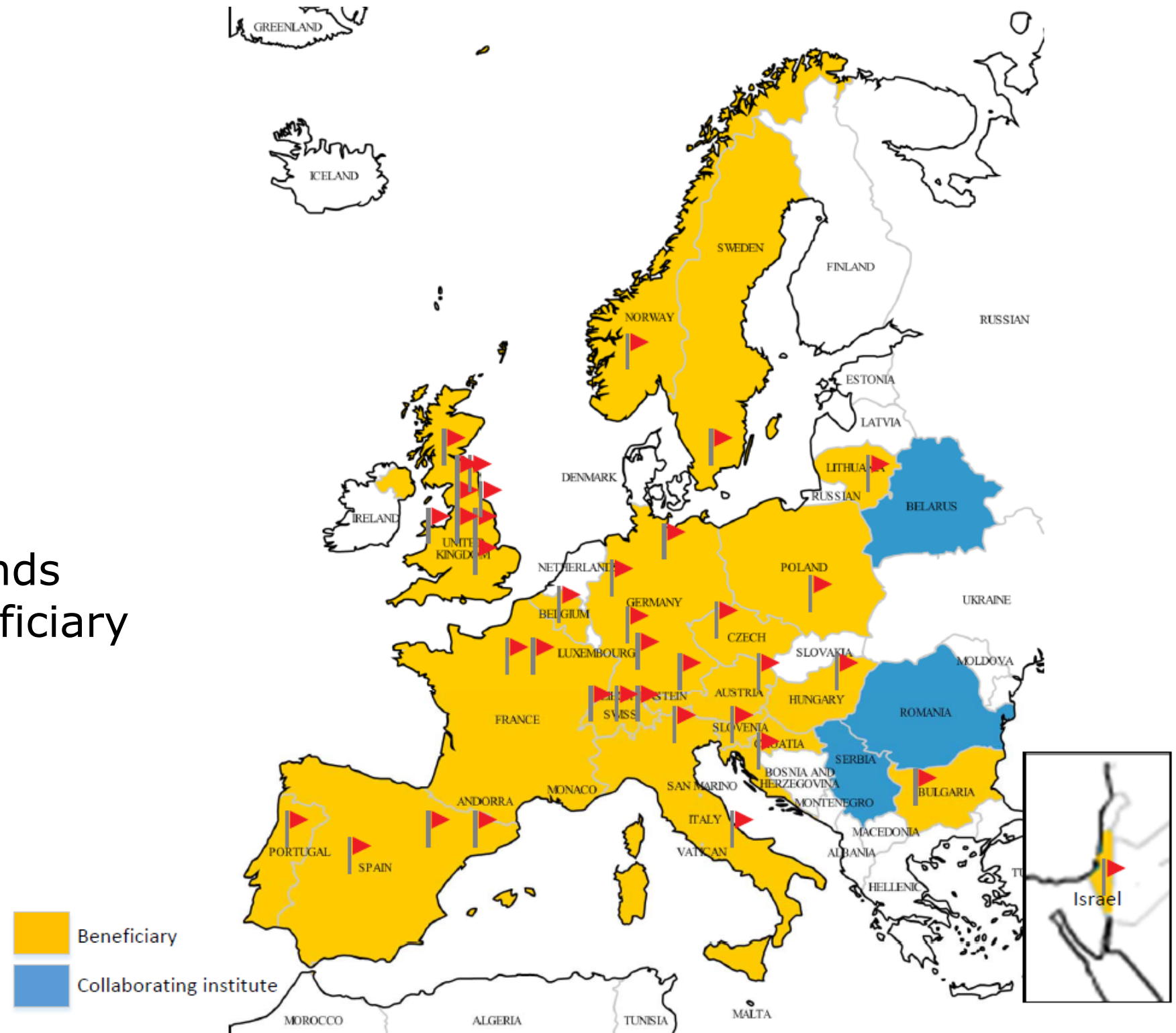


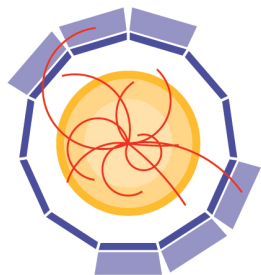
Consortium



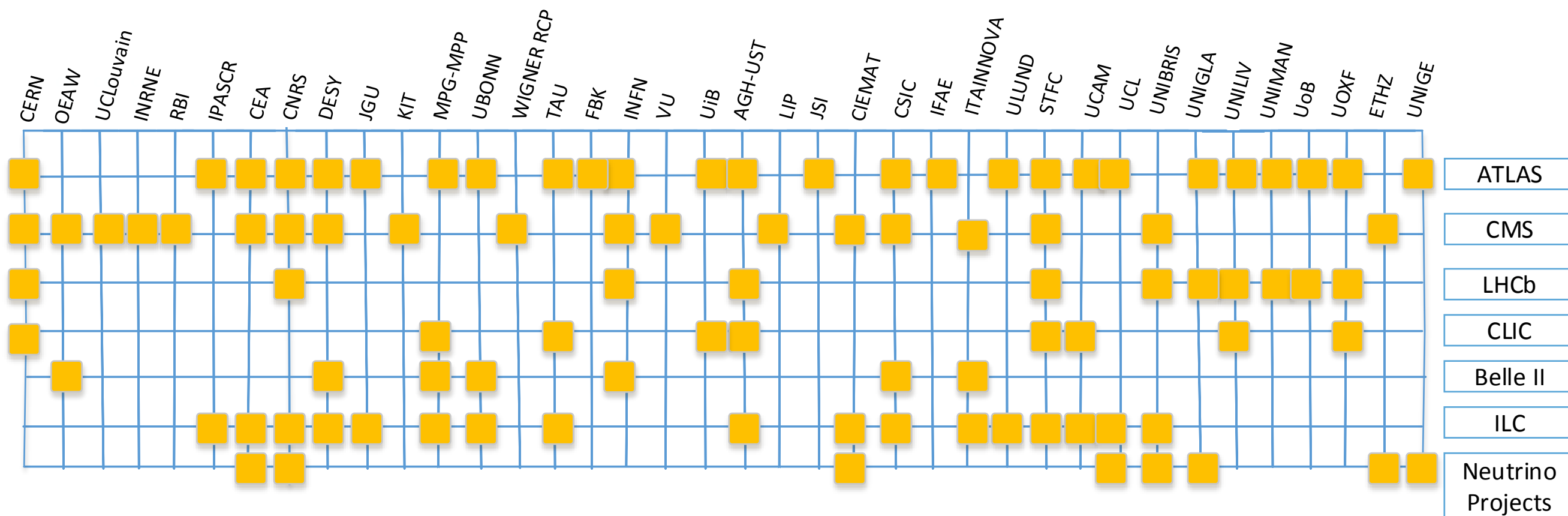
# Participants

- 19 countries
- 38 beneficiaries
- 17 collaborating institutes
  - some receiving funds through host beneficiary

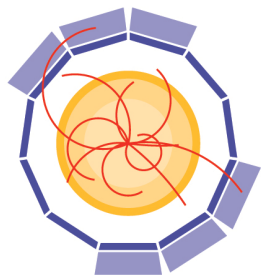




# Involvement

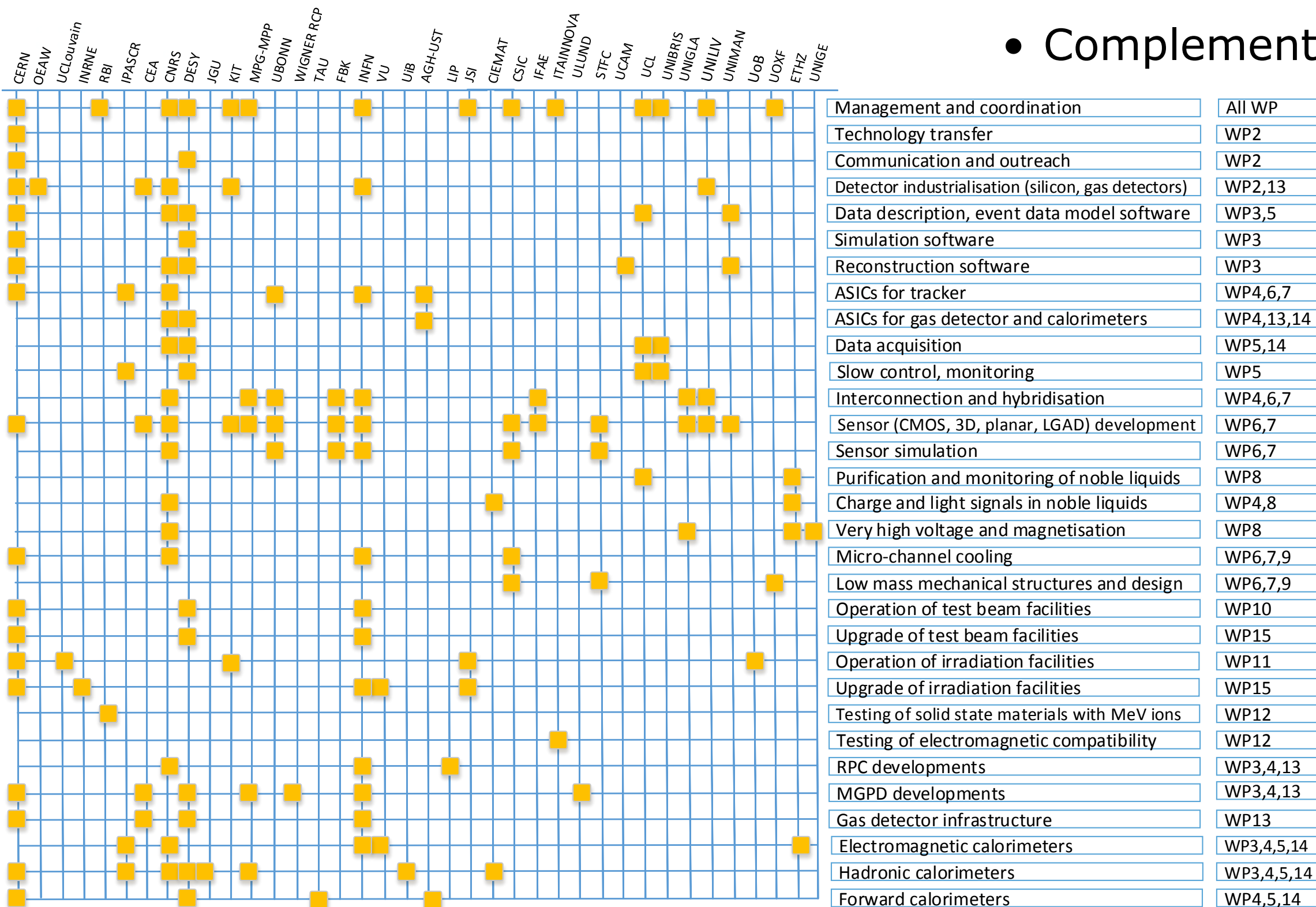


- Balance



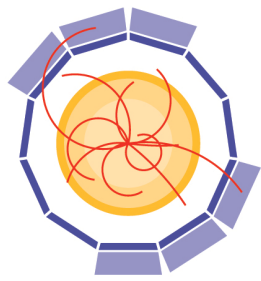
# Competences

## • Complementarity





## Resources

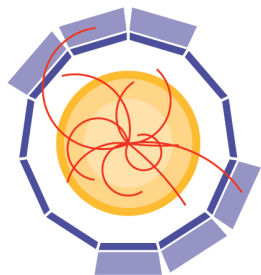


# Overall

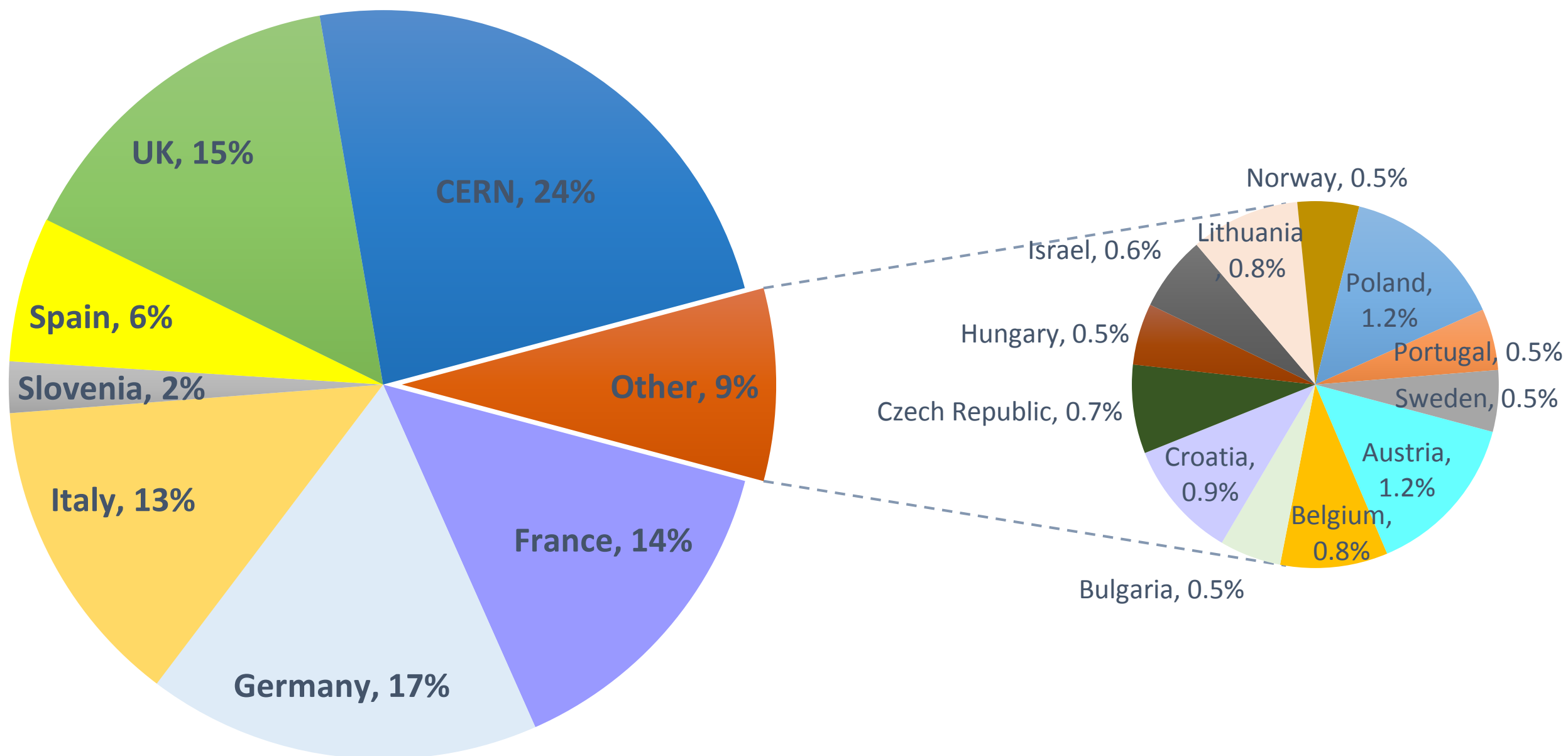
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- Total EC request: 10M
  - Indirect cost fixed to -20%
- Total budget: 28.9M
  - including matching funds 66%
  - 2670 ppm
- Project duration: 4 years
- Management 3.5%
- Transnational access 13.4%
  - to users, no fees
- ~ 50% LHC, 25% LC, 25% other



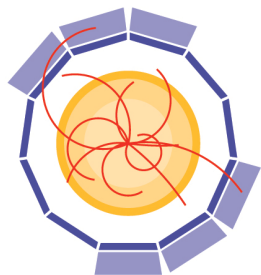


# By country

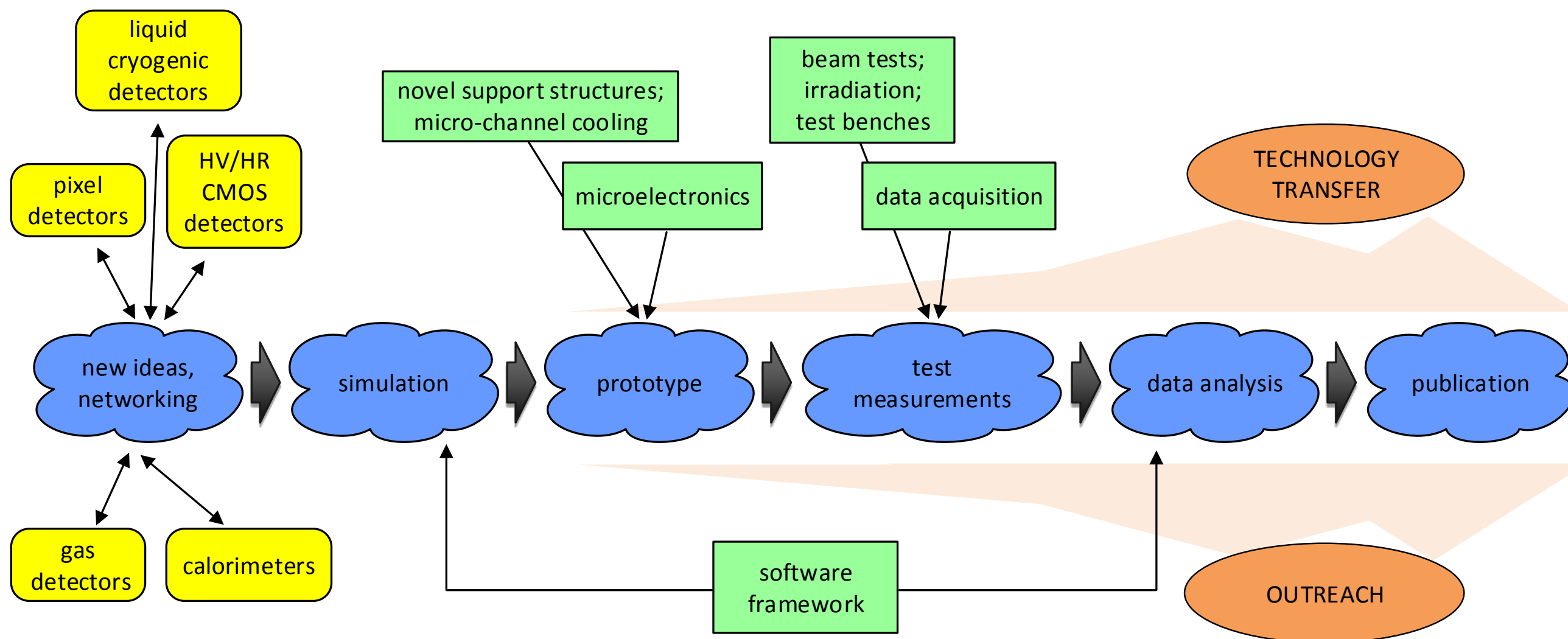




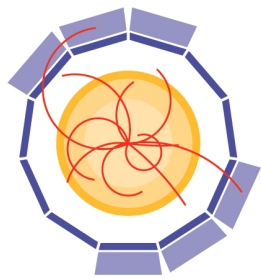
# Implementation



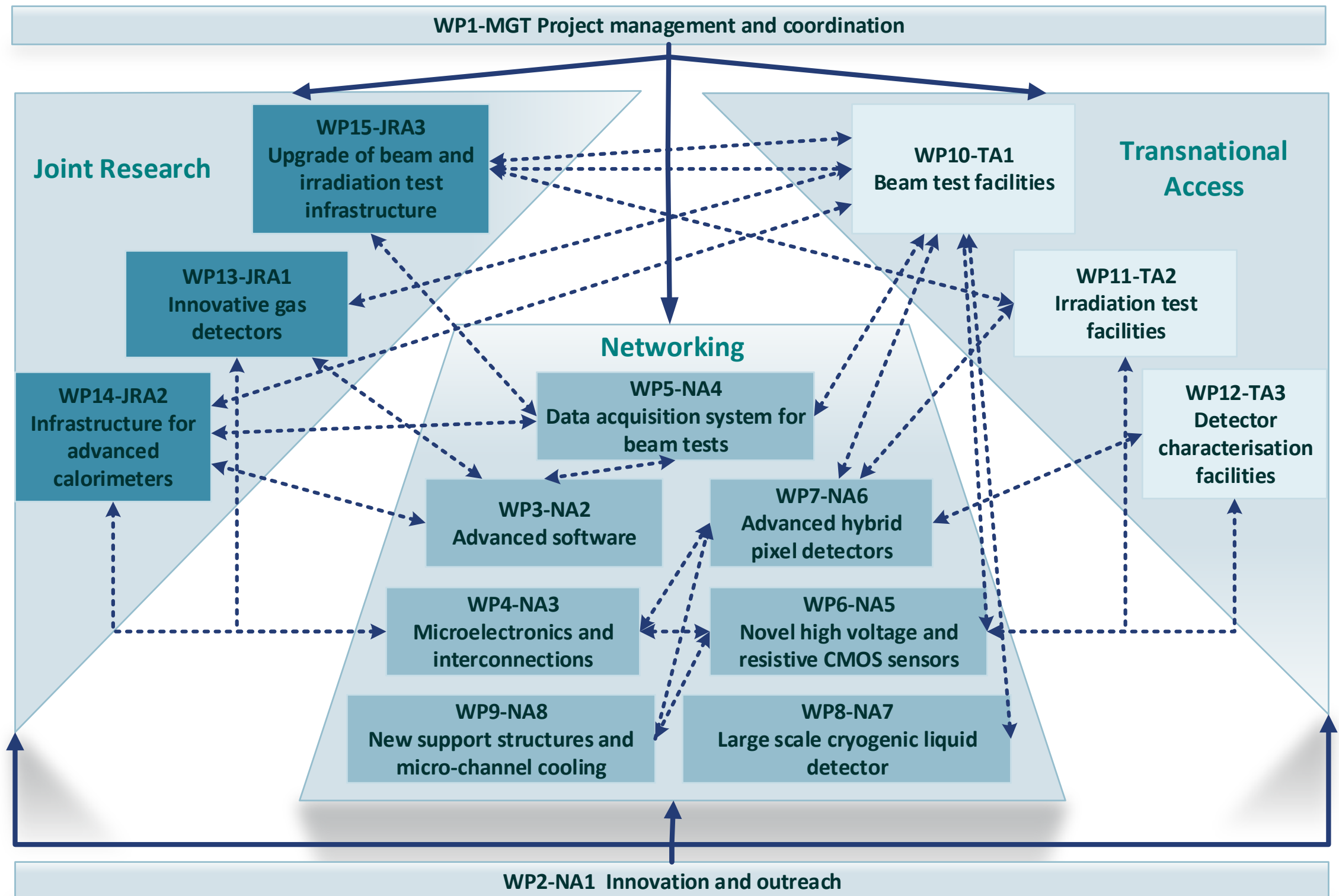
# Detector life cycle

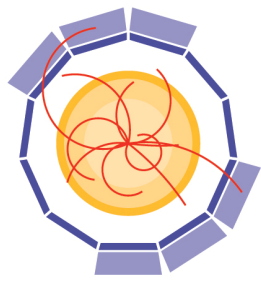


- Guides the work-package structure of AIDA



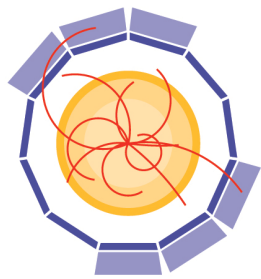
# Work packages



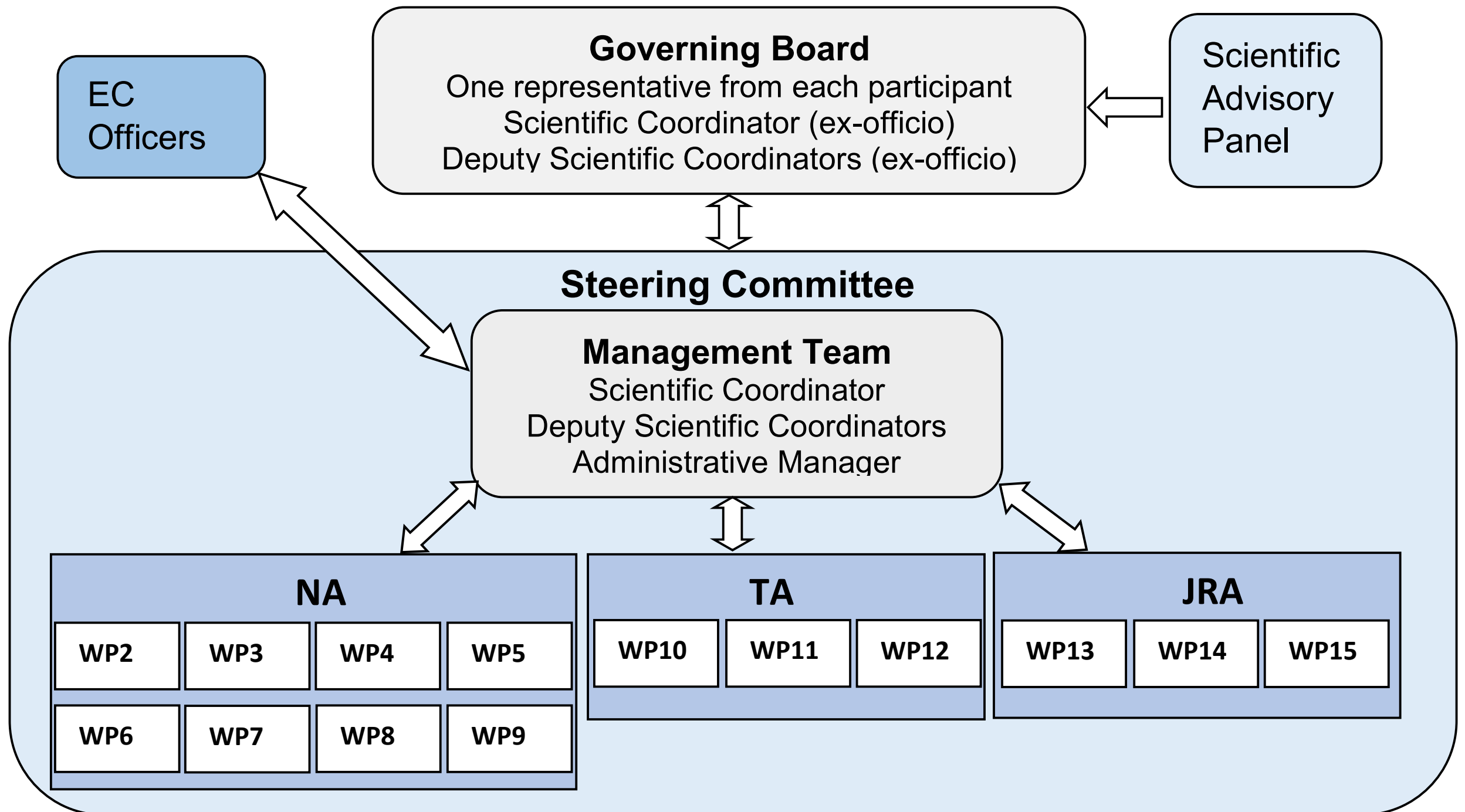


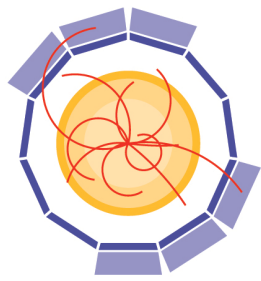
# Co-ordinators

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 <b>Gaede</b>	CERN DESY
WP4	NA3	Micro-electronics and interconnections	Christophe <b>De La Taille</b> Valerio Re	CNRS INFN
WP5	NA4	Data acquisition system for beam tests	Matthew <b>Wing</b> 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 <b>Potylitsina</b>	CERN DESY
WP11	TA2	Irradiation facilities	Marko Mikuz	JSI
WP12	TA3	Detector characterisation facilities	Stjepko Fazinic Fernando Arteché	RBI ITAINNOVA
WP13	JRA1	Innovative gas detectors	Silvia Dalla Torre Imad <b>Laktineh</b>	CNRS INFN
WP14	JRA2	Infrastructure for advanced calorimeters	Roman <b>Poeschl</b> Frank <b>Simon</b>	CNRS MPG-MPP
WP15	JRA3	Upgrade of beam and irradiation test infrastructure	Federico Ravotti Marcel <b>Stanitzki</b>	CERN DESY



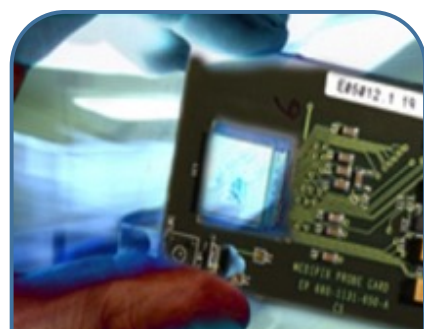
# Management





# 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



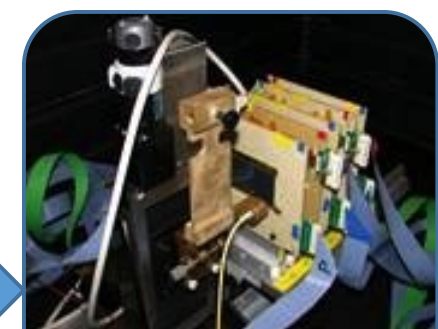
**Identification  
of key  
technologies**



**Search for  
suitable  
industrial  
partners**

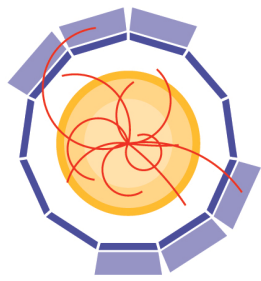


**Selection of  
projects for  
PoC funding**



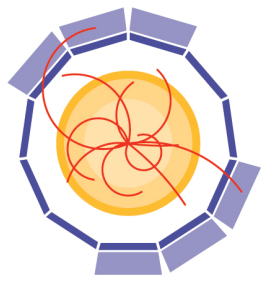
**Testing and  
validation of  
concepts and  
technologies**





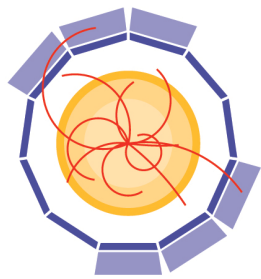
# Transnational access

- WP 10 Access to CERN and DESY test beam facilities
  - travel resources for participating and external groups
  - increased budget w.r.t. AIDA
- WP 11 Irradiation facilities:
  - IRRAD & GIF++ (CERN), JSI (Ljubljana), KIT (Karlsruhe)
- WP 12 - New: detector characterisation facilities
  - ion beams (Zagreb) and EMC test facility (Zaragosa)



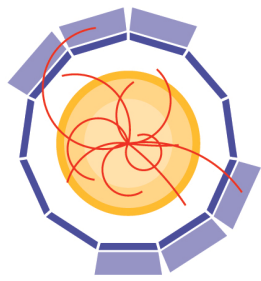
# Joint Research Activities (LC)

- WP 13: Innovative gas detectors
  - development of RPCs, GEMs
  - interfaces to FE chips (e.g. Timepix) and read-out system
  - preparation for large series production
  - CEA, Lyon, Lund
- WP 14: Infrastructure for advanced calorimeters
  - test i/s for calorimeters with optical read-out (LC and LHC)
  - test i/s for calorimeters with silicon read-out (LC and LHC)
  - readout: interfaces to common DAQ, test stands
  - mechanical and thermal tools (welding, cooling)
  - CERN, LAL, LLR, LPNHE Paris, Grenoble, Lyon, CIEMAT, DESY, MPP-M, Mainz, IPASCR Prague, AGH-UST Cracow, Tel Aviv
- WP 15: Upgrade of test beam and irradiation infra-structures
  - pixel telescope for CERN PS beam lines
  - silicon strip telescope for TPC i/s and environmental monitoring at DESY
  - CERN, DESY



# Networking activities (LC)

- WP 3: Advanced software
  - DD4HEP, conditions DB, event data model, DDG4, tracking tools, particle flow
  - CERN, DESY, LAL, LLR, Cambridge
- WP 4: Microelectronics and interconnections
  - 65 nm for CLICpix and others (FCAL, Timepix), SiGe 130/180 for calo and fast RPC, TSVs
  - CERN, OMEGA, Lyon, DESY, AGH-UST
- WP 5: DAQ system for test beam
  - interface, synchronisation, control; DAQ s/w and run control, DQM & SlowC, event data model
  - UC London, Bristol, DESY, IPASCR Prague
- WP 6: HV CMOS
- WP7: Hybrid pixel detectors
- WP 8: Large scale cryogenic detectors
- WP 9: New support structures and micro-channel cooling
  - micro-channel cooling building blocks, low mass mechanical structures
  - CERN, LPNHE, CSIC-IFIC Valencia, Oxford



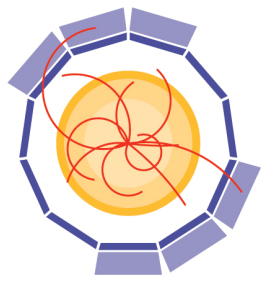
# Conclusion

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- Approval of AIDA-2020: evidence for competitiveness of particle physics
  - and a good sign for the LC
- 10M for detector R&D for our future
  - 25% LC specific: software, common DAQ, ASICs, track and calo infrastructure, test beam access
- 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!

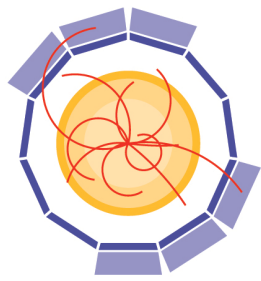


Back-up



# HL-LHC

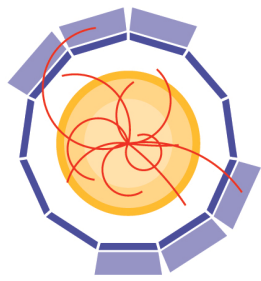
- 13 TeV this year
- HL-LHC: 5x higher luminosity
  - pile-up, irradiation and trigger challenges
- **R&D for detector upgrades:**
- Silicon trackers
  - hybrid pixels, interconnects, LGAD, HV-CMOS, ...
- Forward calorimeters
  - high granularity
- MPGD, RPC
  - muon detection with fast timing, industrialisation
- Advanced software
  - 100x more data: parallelisation and vectorisation



# Neutrino facilities

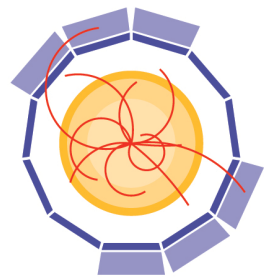
- Towards direct discovery of CP violation
- Accelerator-based experiments
  - large mass detectors
- **European network for detector R&D:**
  - around CERN-based LAr infrastructure
- Large scale LAr systems
- Purification and monitoring
- HV and SC magnetisation schemes





# 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



# Budget by work package

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