ECFA Detector R&D Roadmap Status

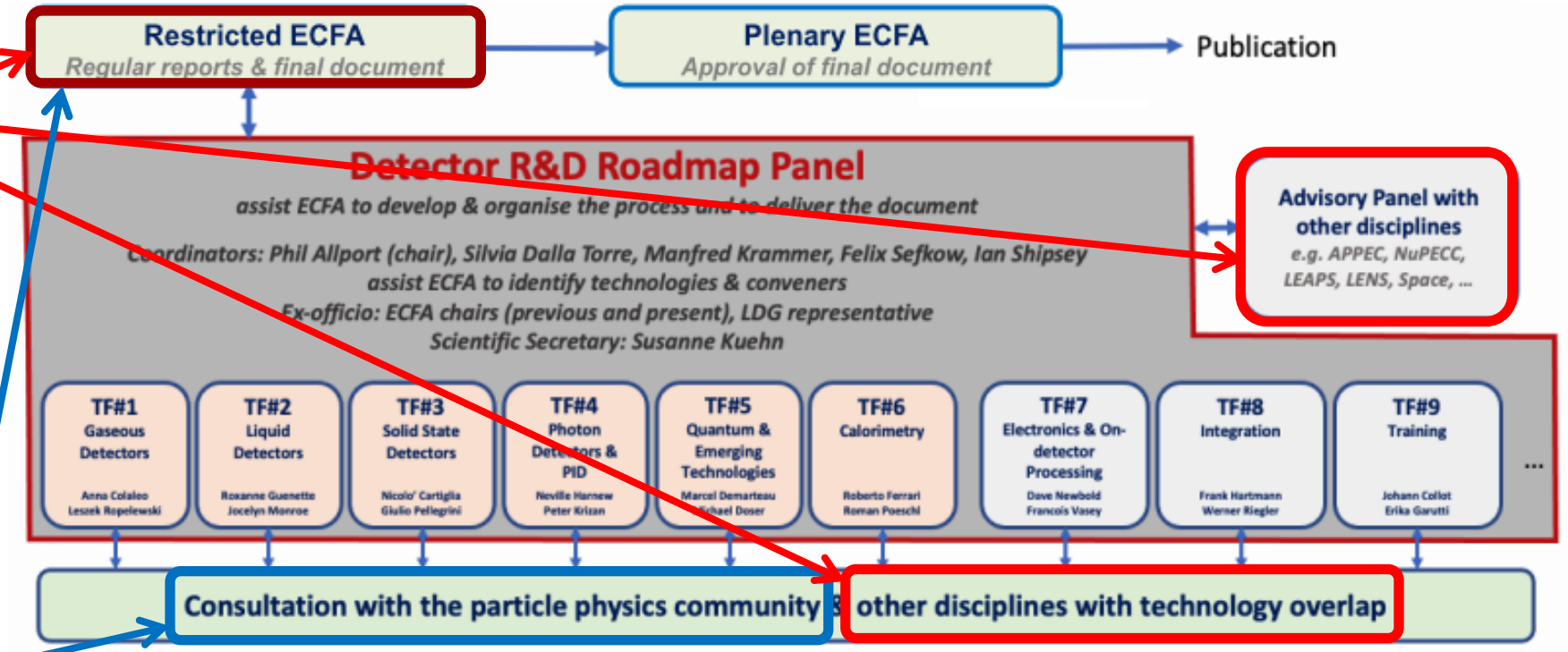
Phil Allport

On behalf of all those who contributed as members of the
ECFA Detector R&D Roadmap Process Group

Roadmap Organisation

***"Organised by ECFA, a roadmap should be developed by the community to balance the detector R&D efforts in Europe, taking into account progress with emerging technologies in adjacent fields"* ***

***"The community should define a global detector R&D roadmap that should be used to support proposals at the European and national levels"* ***



ECFA Detector R&D Roadmap Panel web pages at:
https://indico.cern.ch/e/ECFADetectorRDRoadmap

*** 2020 European Particle Physics Strategy Update**
https://europeanstrategyupdate.web.cern.ch/

ECFA
European Committee for Future Accelerators

Process and Timeline

Organisation

May 2020
EPPSU mandate to ECFA to develop a roadmap for detector R&D efforts in Europe

Sep 2020
Structure in place with **Detector R&D Roadmap Panel**

Dec 2020
Task Forces active

Website:
https://indico.cern.ch/e/ECFADetectorRDRoadmap

Expert & Community Consultation

Feb 2021
Collection of requirements of future facilities & projects

Feb/March 2021
Questionnaires of Task Forces to national contacts

Task Forces liaise with experts in
- ECFA countries
- adjacent disciplines
- industry

March-May 2021
Open Symposia

Drafting Roadmap & Feedback

May 2021
Task Forces collate input from symposia

25-28 May 2021 **Drafting sessions**
- opening session with all experts involved
- plenary & parallel sessions with Task Force members
- final session of Roadmap Panel

July 2021
Near final draft shared with RECFA*

30 July 2021
Presentation at Joint ECFA-EPS session

August 2021
Collect final community feedback*

October 2021
Detector R&D Roadmap Document approval by ECFA in Nov 2021 and presentation to Council in Dec 2021

*community feedback via Restricted ECFA delegates and National Contacts
(See https://ecfa.web.cern.ch/restricted-ecfa-composition in back-up)

Detector R&D Roadmap Process Group

Task Force convenors, Task Force expert members and Panel members of the ECFA Detector R&D Roadmap Process

Task Force 1 Gaseous Detectors: Anna Colaleo[1], Leszek Ropelewski[2] *(Conveners)*
Klaus Dehmelt[3], Barbara Liberti[4], Maxim Titov[5], Joao Veloso[6] *(Expert Members)*

Task Force 2 Liquid Detectors: Roxanne Guenette[7], Jocelyn Monroe[8] *(Conveners)*
Auke-Pieter Colijn[9], Antonio Ereditato[10,11], Ines Gil Botella[12],
Manfred Lindner[13] *(Expert Members)*

Task Force 3 Solid State Detectors: Nicolo Cartiglia[14], Giulio Pellegrini[15] *(Conveners)*
Daniela Bortoletto[16], Didier Contardo[17], Ingrid Gregor[18,19] Gregor Kramberger[20],
Heinz Pernegger[2] *(Expert Members)*

Task Force 4 Particle Identification and Photon Detectors: Neville Harnew[16],
Peter Krizan[20] *(Conveners)*
Ichiro Adachi[21], Eugenio Nappi[1] Christian Joram[2],
Christian Schultz-Coulon[22] *(Expert Members)*

Task Force 5 Quantum and Emerging Technologies: Marcel Demarteau[23],
Michael Doser[2] *(Conveners)*
Caterina Braggio[24], Andy Geraci[25], Peter Graham[26], Anna Grasselino[27],
John March Russell[16], Stafford Withington[28] *(Expert Members)*

Task Force 6 Calorimetry: Roberto Ferrari[29], Roman Poeschl[30] *(Conveners)*
Martin Aleksa[2], Dave Barney[2], Frank Simon[31],
Tommaso Tabarelli de Fatis[32] *(Expert Members)*

Task Force 7 Electronics: Dave Newbold[33], Francois Vasey[2] *(Conveners)*
Niko Neufeld[2], Valerio Re[29] Christophe de la Taille[34], Marc Weber[35] *(Expert Members)*

Task Force 8 Integration: Frank Hartmann[35], Werner Riegler[2] *(Conveners)*
Corrado Gargiulo[2], Filippo Resnati[2], Herman Ten Kate[36], Bart Verlaat[2],
Marcel Vos[37] *(Expert Members)*

Task Force 9 Training: Johann Collot[38], Erika Garutti[18,39] *(Conveners)*
Richard Brenner[40], Niels van Bakel[9] Claire Gwenlan[16], Jeff Wiener[2],
ex-officio Robert Appleby[41] *(Expert Members)*

The Task Force Convenors join those listed below to compose the Detector R&D Roadmap Panel.

Panel coordinators: Phil Allport[42] *(Chair)*, Silvia Dalla Torre[43], Manfred Krammer[2],
Felix Sefkow[18], Ian Shipsey[16]

Ex-officio Panel members: Karl Jakobs[44] *(Current ECFA Chair)*,
Jorgen D'Hondt[45] *(Previous ECFA Chair)*, Lenny Rivkin[46] *(LDG Representative)*

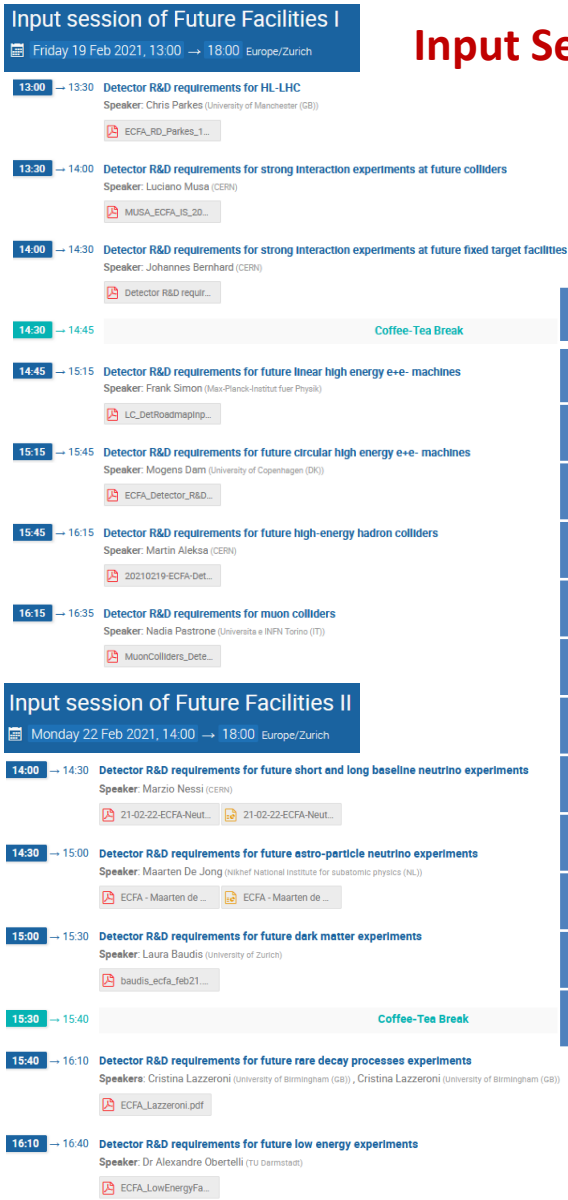
Scientific Secretary: Susanne Kuehn[2]

[1] INFN Bari, Bari, Italy
[2] CERN, Geneva, Switzerland
[3] Stony Brook University, New York, US
[4] INFN Roma, Rome, Italy
[5] IRFU/DPhP CEA Saclay, Saclay, France
[6] Universidade de Aveiro, Aveiro, Portugal
[7] Harvard University, Cambridge, US
[8] Royal Holloway University of London, London, UK
[9] NIKHEF and University of Amsterdam, Netherlands
[10] Yale University, New Heaven, US
[11] University of Bern, Berne, Switzerland
[12] CIEMAT, Madrid, Spain
[13] MPI Heidelberg, Heidelberg, Germany
[14] INFN Sezione di Turino, Turino, Italy
[15] IMB-CNM-CSIC, Barcelona, Spain
[16] University of Oxford, Oxford, UK
[17] IN2P3-IP2I, Lyon, France
[18] DESY, Hamburg, Germany
[19] University of Bonn, Bonn, Germany
[20] University of Ljubljana and J. Stefan Institute, Ljubljana, Slovenia
[21] KEK, Tsukuba, Japan
[22] University of Heidelberg, Germany
[23] ORNL, Oak Ridge, US
[24] INFN Sezione di Padova, Padova, Italy
[25] Northwestern University, Evanston, US
[26] Stanford University, Stanford, US
[27] FNAL, Batavia, US
[28] University of Cambridge, UK
[29] INFN Sezione di Pavia, Pavia, Italy
[30] IN2P3-IJClab, Paris, France
[31] MPP Munich, Munich, Germany
[32] INFN Milano-Bicocca, Milano, Italy
[33] RAL, Didcot, UK
[34] IN2P3-OMEGA, Palaiseau, France
[35] KIT, Institut für Kernphysik, Karlsruhe, Germany
[36] University of Twente, Twente, Netherlands
[37] IFIC Valencia, Valencia, Spain
[38] IN2P3-LPSC, Grenoble, France
[39] University of Hamburg, Hamburg, Germany
[40] University of Uppsala, Uppsala, Sweden
[41] University of Manchester, Manchester, UK
[42] University of Birmingham, Birmingham, UK
[43] INFN Sezione di Trieste, Trieste, Italy
[44] Albert-Ludwigs-Universität Freiburg, Freiburg, Germany
[45] IIHE, Vrije Universiteit Brussel, Brussels, Belgium
[46] ETH Lausanne and PSI, Villigen, Switzerland

Process and Timeline

Input Session speakers provided detailed specifications and continued giving support for the process

… particularly for checking if there were any unmet detector R&D needs for the ESPP identified programme which may have been overlooked in the symposia programmes.



	Speaker	Presentation Topic
1	Chris Parkes	Detector R&D requirements for HL-LHC
2	Luciano Musa	Detector R&D requirements for strong interaction experiments at future colliders
3	Johannes Bernhard	Detector R&D requirements for strong interaction experiments at future colliders
4	Frank Simon	Detector R&D requirements for future linear high energy e+e- machines
5	Mogens Dam	Detector R&D requirements for future circular high energy e+e- machines
6	Martin Aleksa	Detector R&D requirements for future high-energy hadron colliders
7	Nadia Pastrone	Detector R&D requirements for muon colliders
8	Marzio Nessi	Detector R&D requirements for future short and long baseline neutrino experiments
9	Maarten De Jong	Detector R&D requirements for future astro-particle neutrino experiments
10	Laura Baudis	Detector R&D requirements for future dark matter experiments
11	Cristina Lazzeroni	Detector R&D requirements for future rare decay processes experiments
12	Alexandre Obertelli	Detector R&D requirements for future low energy experiments

ECFA
European Committee for Future Accelerators

Process and Timeline

Two days of Input Sessions covered all the future facilities and topic areas identified in the EPPSU (see back-up).
Following these were nine technology focussed full-day public symposia as the main fora to collect community input.

Task Force	TF7	TF8	TF2	TF5	TF3	TF1	TF9	TF4	TF6
Dates	25/3/21	31/3/21	9/4/21	12/4/21	23/4/21	29/4/21	30/4/21	6/5/21	7/5/21
Unique users	369 + 123 (webcast)	154 + 17 (webcast)	197 + 5 (webcast)	220	504	339	105	207	201
Max. number of concurrent viewers	230 + 123 (webcast)	76 + 17 (webcast)	130 + 5 (webcast)	100	275	191	59	110	115

Common registration for the symposia had logged 1359 participants by the end of the last one.

Received extensive feedback during symposia and after by email.

Surveys were also employed to receive direct inputs from individuals and via RECFA delegates or their National Contacts.

APOD appointed experts consulted where needed by Task Force convenors for advice on developments in their disciplines.

May 2021

- 07 May ECFA Detector R&D Roadmap Symposium of Task Force 6 Calorimetry
- 06 May ECFA Detector R&D Roadmap Symposium of Task Force 4 Photon Detectors and Particle Identification Detectors

April 2021

- 30 Apr ECFA Detector R&D Roadmap Symposium of Task Force 9 Training
- 29 Apr ECFA Detector R&D Roadmap Symposium of Task Force 1 Gaseous Detectors
- 23 Apr ECFA Detector R&D Roadmap Symposium of Task Force 3 Solid State Detectors
- 12 Apr ECFA Detector R&D Roadmap Symposium of Task Force 5 Quantum and Emerging Technologies
- 09 Apr ECFA Detector R&D Roadmap Symposium of Task Force 2 Liquid Detectors

March 2021

- 31 Mar ECFA Detector R&D Roadmap Symposium of Task Force 8 Integration
- 25 Mar ECFA Detector R&D Roadmap Symposium of Task Force 7 Electronics and On-detector Processing

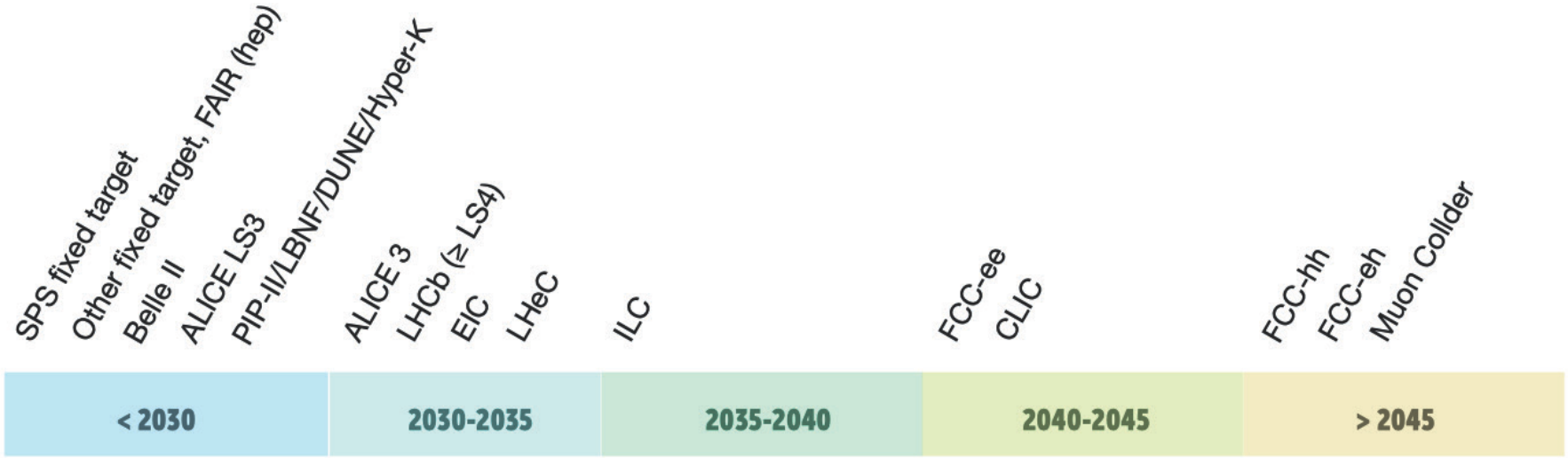
Materials from past Symposia, Input Sessions and other components of the ECFA Detector R&D Roadmap Process can be found at https://indico.cern.ch/e/ECFADetectorRDRoadmap

Detector R&D Roadmap

- **The sections start from the principle that for the earliest feasible start dates of a proposed facility (including those which are still considered in the EPPSU, but would be mutually exclusive):**
  - **the basic detector R&D phase is not the time limiting step, i.e. that R&D is started sufficiently early and prioritised correctly to meet the needs of the long-term European particle physics programme in its global context;**
  - **the outcomes of the R&D programme are able to provide the necessary information on the feasibility and cost of future deliverables to allow such decisions to be made.**
- **The relevant Task Forces have then identified a set of detector R&D areas which are required if the physics programmes of experiments at these facilities are not to be compromised.**
- **It is also noted that in many cases, the programme for a nearer-term facility helps enable the technologies needed for more demanding specifications later, providing stepping stones towards these.**
- **In the text there are developed and defined "Detector R&D Themes" (DRDTs) to highlight the most important drivers for research in each technology area.**
- **We also defined Detector Community Themes in the context of the training area (TF9).**
- **These are represented graphically in the figures later in this presentation and are identified by arrows lasting up to the last currently identified facility for which they are relevant.**

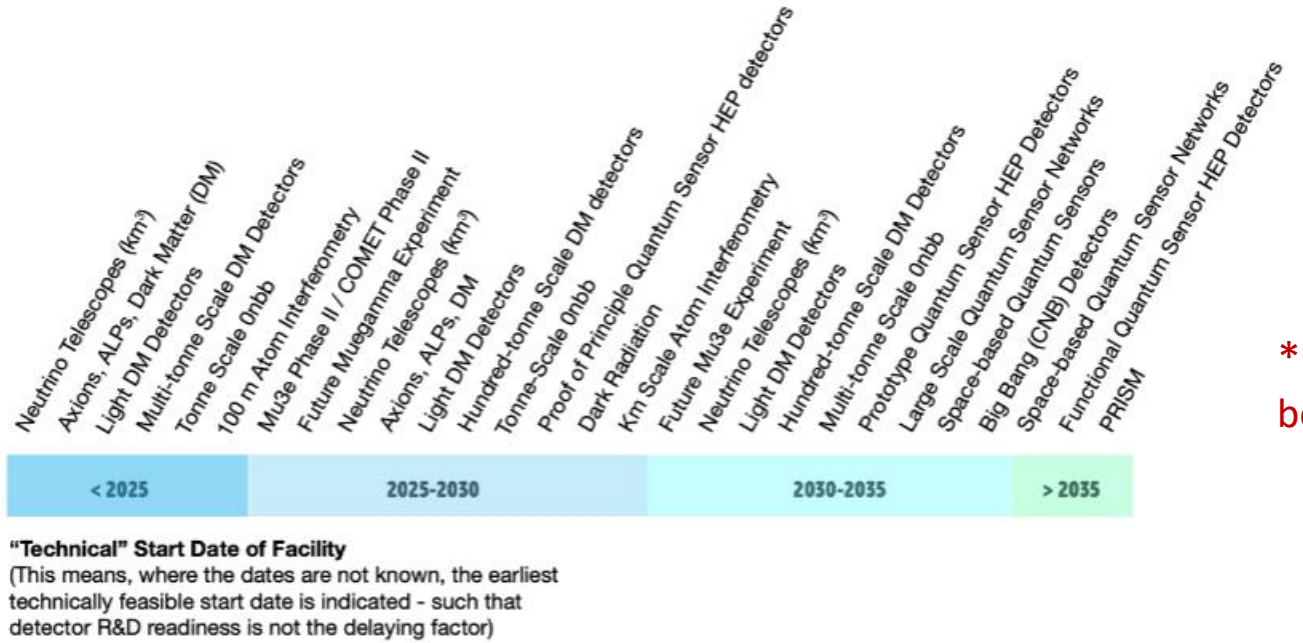
The dates used for the above are shown in this diagram have deliberate low precision, and are intended to represent the earliest 'feasible start date' (where a schedule is not already defined), taking into account the necessary steps of approval, development and construction for machine and civil engineering. They do not constitute any form of plan or recommendation, and indeed several options presented are mutually exclusive. Fine-tuning of time-ordering iterating with the Laboratories Directors Group responsible for the Accelerator R&D Roadmap preparation. Furthermore, the projects mentioned here are limited to those mentioned in the EPPSU, although it should be noted that detector R&D for other possible future facilities is usually aligned with that for programmes already listed.

Figure 3. Large Accelerator Based Facility/Experiment Earliest Feasible Start Dates



The dates shown in the diagram have low precision, and are intended to represent the earliest "feasible start date" (where a schedule is not already defined), taking into account the necessary steps of approval, development and construction for machine and civil engineering.

Figure 4. (Representative*) Smaller Accelerator and Non-Accelerator Based Experiments Start Dates



"Technical" Start Date of Facility
(This means, where the dates are not known, the earliest technically feasible start date is indicated - such that detector R&D readiness is not the delaying factor)

*Not intended at all to be an exhaustive list

In the ECFA Detector R&D Roadmap the focus has been on facilities targeting the properties and interactions of fundamental particles (including those that are undiscovered but theoretically motivated). It is noted that a number of particles increasingly play the role of cosmic messengers for phenomena happening far beyond our own galaxy which provides some of the exciting science opportunities in the neighbouring field of astroparticle physics, but the demanding detector requirements specific to this area are not generally within the scope of this document.

Throughout the document these figures inform the development of the Detector R&D Roadmap with a view to set concrete target timelines for the readiness of the recommended R&D thematic programmes emerging in each Task Force and summarized in the conclusion chapter.

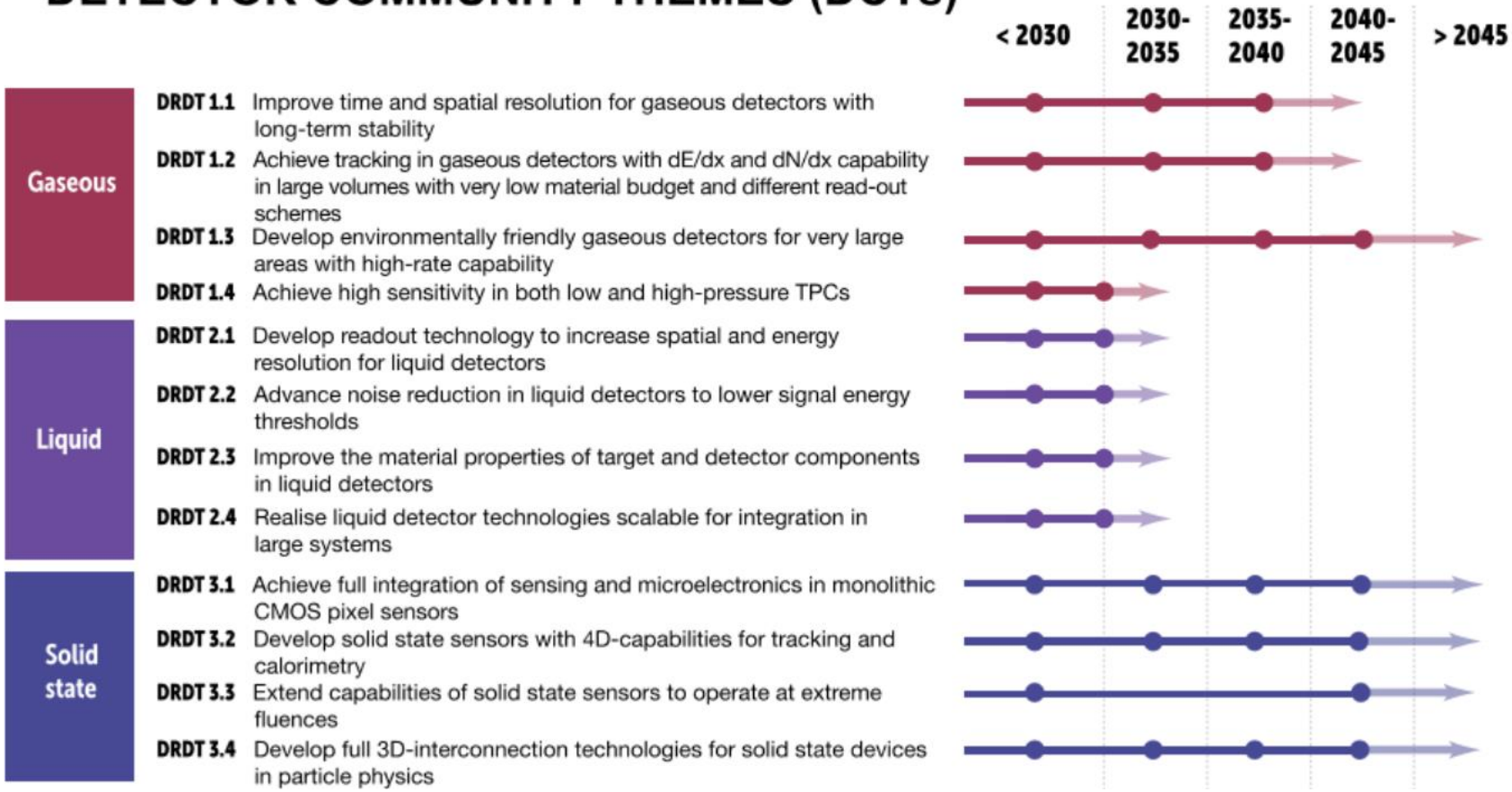
Detector R&D Roadmap

- **It should be emphasised that the future beyond the end of the arrows is simply not yet defined, not that there is an expectation that R&D for the further future beyond that point will not be needed.**

- **Stepping stones are shown to represent the R&D needs of facilities intermediate in time.**

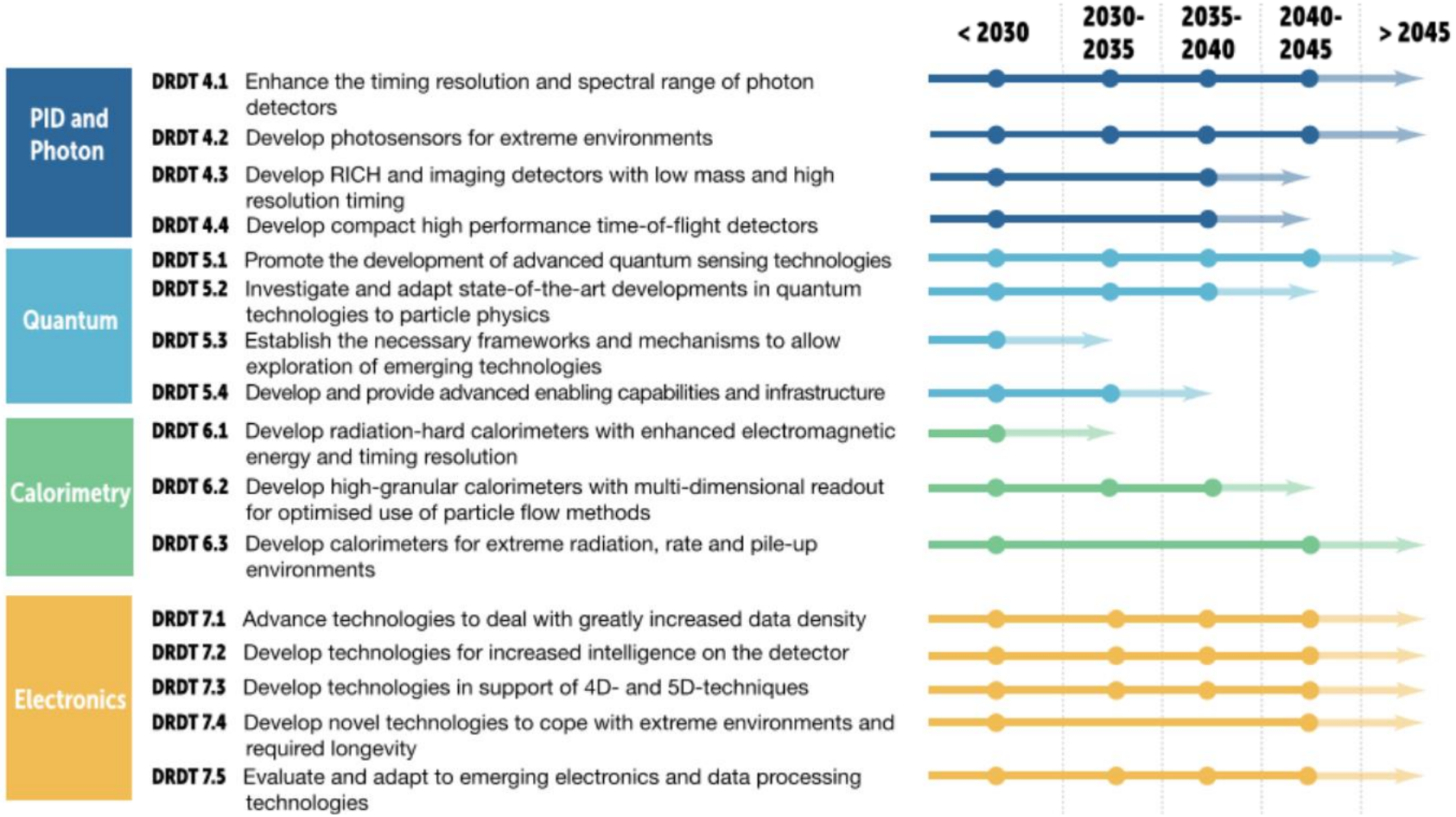
- **The faded region acknowledges the typical time needed between the completion of the R&D phase and the readiness of an experiment at a given facility.**

DETECTOR RESEARCH AND DEVELOPMENT THEMES (DRDTs) & DETECTOR COMMUNITY THEMES (DCTs)



Detector R&D Roadmap

- **It should be emphasised that the future beyond the end of the arrows is simply not yet defined, not that there is an expectation that R&D for the further future beyond that point will not be needed.**
- **Stepping stones are shown to represent the R&D needs of facilities intermediate in time.**
- **The faded region acknowledges the typical time needed between the completion of the R&D phase and the readiness of an experiment at a given facility.**



Detector R&D Roadmap

- It should be emphasised that the future beyond the end of the arrows is simply not yet defined, not that there is an expectation that R&D for the further future beyond that point will not be needed.

- Stepping stones are shown to represent the R&D needs of facilities intermediate in time.

- The faded region acknowledges the typical time needed between the completion of the R&D phase and the readiness of an experiment at a given facility.

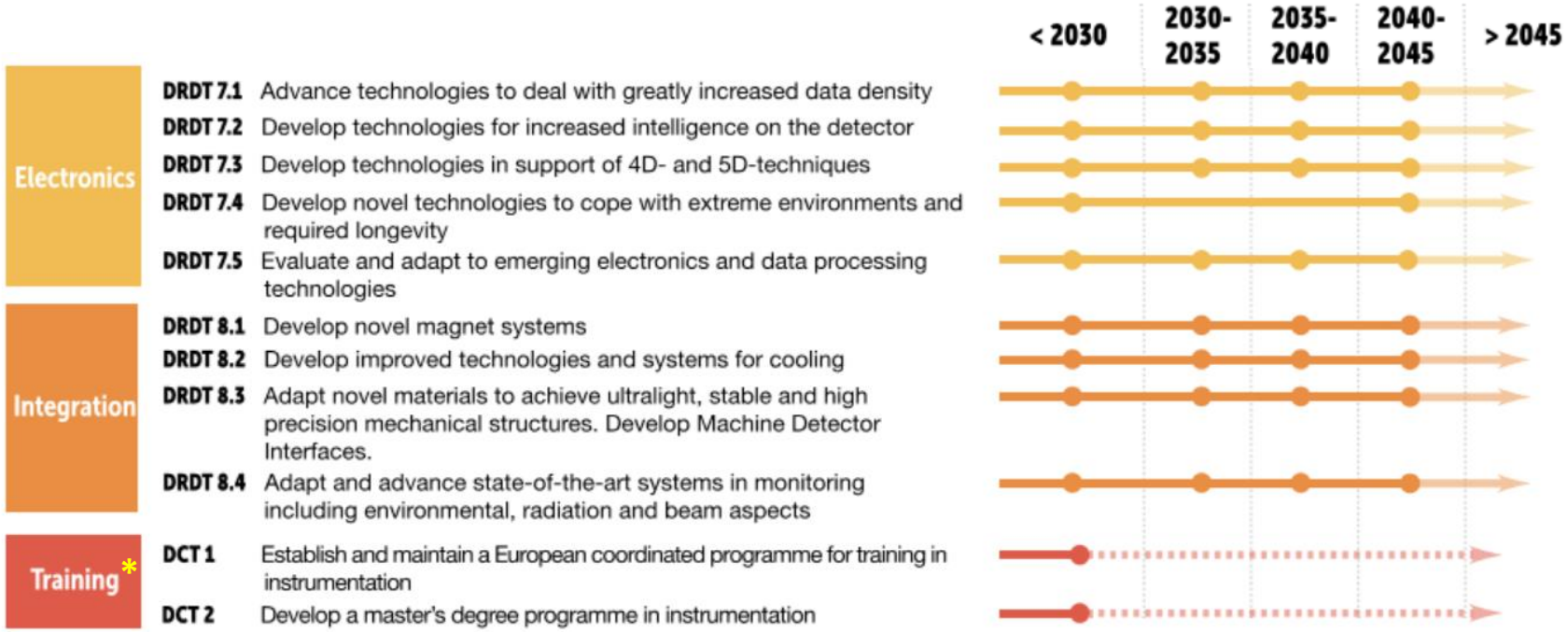


Figure 11.1: Detector R&D Themes (DRDTs) and Detector Community Themes (DCTs). Here, except in the DCT case, the final dot position represents the target date for completion of the R&D required by the latest known future facility/experiment for which an R&D programme would still be needed in that area. The time from that dot to the end of the arrow represents the further time to be anticipated for experiment-specific prototyping, procurement, construction, installation and commissioning. Earlier dots represent the time-frame of intermediate "stepping stone" projects where dates for the corresponding facilities/experiments are known. (Note that R&D for Liquid Detectors will be needed far into the future, however the DRDT lines for these end in the period 2030-35 because developments in that field are rapid and it is not possible today to reasonably estimate the dates for projects requiring longer-term R&D. Similarly, dotted lines for the DCT case indicate that beyond the initial programmes, the activities will need to be sustained going forward in support of the instrumentation R&D activities).

* See "Results of the 2021 ECFA Early-Career Researcher Survey on Training in Instrumentation" ECFA ECR Panel *arXiv:2107.05739*

In addition to the Detector R&D Themes described above and discussed in each chapter the following General Strategic Recommendations are made under the following headings.

GSR 1 - Supporting R&D facilities

GSR 2 - Engineering support for detector R&D

GSR 3 - Specific software for instrumentation

GSR 4 - International coordination and organisation of R&D activities

GSR 5 - Distributed R&D activities with centralised facilities

GSR 6 - Establish long-term strategic funding programmes

GSR 7 - Blue-sky R&D

GSR 8 - Attract, nurture, recognise and sustain the careers of R&D experts

GSR 9 - Industrial partnerships

GSR 10 - Open Science

GSR 1 - Supporting R&D facilities

It is recommended that the structures to provide Europe-wide coordinated infrastructure in the areas of: test beams, large scale generic prototyping and irradiation be consolidated and enhanced to meet the needs of next generation experiments with adequate centralised investment to avoid less cost-effective, more widely distributed, solutions, and to maintain a network structure for existing distributed facilities, e.g. for irradiation

GSR 2 - Engineering support for detector R&D

In response to ever more integrated detector concepts, requiring holistic design approaches and large component counts, the R&D should be supported with adequate mechanical and electronics engineering resources, to bring in expertise in state-of-the-art microelectronics as well as advanced materials and manufacturing techniques, to tackle generic integration challenges, and to maintain scalability of production and quality control from the earliest stages.

GSR 3 - Specific software for instrumentation

Across DRDTs and through adequate capital investments, the availability to the community of state-of-the-art R&D-specific software packages must be maintained and continuously updated. The expert development of these packages - for core software frameworks, but also for commonly used simulation and reconstruction tools - should continue to be highly recognised and valued and the community effort to support these needs to be organised at a European level.

GSR 4 - International coordination and organisation of R&D activities

With a view to creating a vibrant ecosystem for R&D, connecting and involving all partners, there is a need to refresh the CERN RD programme structure and encourage new programmes for next generation detectors, where CERN and the other national laboratories can assist as major catalysers for these. It is also recommended to revisit and streamline the process of creating and reviewing these programmes, with an extended framework to help share the associated load and increase involvement, while enhancing the visibility of the detector R&D community and easing communication with neighbouring disciplines, for example in cooperation with the ICFA Instrumentation Panel.

GSR 5 - Distributed R&D activities with centralised facilities

Establish in the relevant R&D areas a distributed yet connected and supportive tier-ed system for R&D efforts across Europe. Keeping in mind the growing complexity, the specialisation required, the learning curve and the increased cost, consider more focused investment for those themes where leverage can be reached through centralisation at large institutions, while addressing the challenge that distributed resources remain accessible to researchers across Europe and through them also be available to help provide enhanced training opportunities.

GSR 6 - Establish long-term strategic funding programmes

Establish, additional to short-term funding programmes for the early proof of principle phase of R&D, also long-term strategic funding programmes to sustain both research and development of the multi-decade DRDTs in order for the technology to mature and to be able to deliver the experimental requirements. Beyond capital investments of single funding agencies, international collaboration and support at the EU level should be established. In general, the cost for R&D has increased, which further strengthens the vital need to make concerted investments.

GSR 7 – "Blue-sky" R&D

It is essential that adequate resources be provided to support more speculative R&D which can be riskier in terms of immediate benefits but can bring significant and potentially transformational returns if successful both to particle physics: unlocking new physics may only be possible by unlocking novel technologies in instrumentation, and to society. Innovative instrumentation research is one of the defining characteristics of the field of particle physics. "Blue-sky" developments in particle physics have often been of broader application and had immense societal benefit. Examples include: the development of the World Wide Web, Magnetic Resonance Imaging, Positron Emission Tomography and X-ray imaging for photon science.

GSR 8 - Attract, nurture, recognise and sustain the careers of R&D experts

Innovation in instrumentation is essential to make progress in particle physics, and R&D experts are essential for innovation. It is recommended that ECFA, with the involvement and support of its Detector R&D Panel, continues the study of recognition with a view to consolidate the route to an adequate number of positions with a sustained career in instrumentation R&D to realise the strategic aspirations expressed in the EPPSU. It is suggested that ECFA should explore mechanisms to develop concrete proposals in this area and to find mechanisms to follow up on these in terms of their implementation. Consideration needs to be given to creating sufficiently attractive remuneration packages to retain those with key skills which typically command much higher salaries outside academic research. It should be emphasised that, in parallel, society benefits from the training particle physics provides because the knowledge and skills acquired are in high demand by industries in high-technology economies.

GSR 9 - Industrial partnerships

It is recommended to identify promising areas for close collaboration between academic and industrial partners, to create international frameworks for exchange on academic and industrial trends, drivers and needs, and to establish strategic and resources-loaded cooperation schemes on a European scale to intensify the collaboration with industry, in particular for developments in solid state sensors and micro-electronics.

GSR 10 – Open Science

It is recommended that the concept of Open Science be explicitly supported in the context of instrumentation, taking account of the constraints of commercial confidentiality where these apply due to partnerships with industry. Specifically, for publicly-funded research the default, wherever possible, should be open access publication of results and it is proposed that the Sponsoring Consortium for Open Access Publishing in Particle Physics (SCOAP^3) should explore ensuring similar access is available to instrumentation journals (including for conference proceedings) as to other particle physics publications.

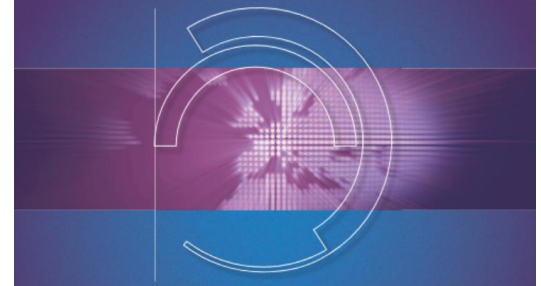
Conclusions

- The ECFA Detector R&D Roadmap has been prepared by a large team of internationally recognised leaders in this area with access to a much wider pool of other instrumentation experts.
- It has been the product of wide community consultation with very broad participation.
- The draft document was iterated with the RECFA delegates and National Contacts with numerous helpful comments received from committees looking at this in a number of countries.
- We also have benefited from very valuable feedback from neighbouring disciplines where there are strong synergies between instrumentation needs.
- The main messages contained here were presented to the particle physics community at the ECFA Plenary Session of the EPS-HEP2021 Conference and remain unchanged.
- The results of all the feedback have been implemented in a final 248 page version which was further iterated with RECFA and will be formally presented to ECFA for approval, while being sent for printing to allow paper copies (along with an additional non-expert 8 page synopsis) to be presented to CERN Council in December, after which these will become publicly available.

Contents

We ought, in every instance, to submit our reasoning to the test of experiment, and never to search for truth but by the natural road of experiment and observation.

Antoine Lavoisier
Traité élémentaire de chimie, 1789



More information:

https://europeanstrategy.cern
https://indico.cern.ch/e/ECFADetectorRDRoadmap
https://ecfa.web.cern.ch/

ISBN 978-92-9083-614-8 (online)
ISBN 978-92-9083-615-5 (paperback)

European Strategy Update

ECFA
European Committee
for Future Accelerators

2021

Back-up

Detailed ECFA Timeline

- Draft circulated to RECFA, National Contacts and ECR on 2nd July with deadline for comments on 16th July
- Comments received from many of the RECFA members, observers and appointed National Contacts for the ECFA Detector R&D Roadmap process.
- Overwhelmingly positive and a number of countries had also organised a careful reading of the full draft with many detailed comments to each section - which were very helpful and have been implemented.
- A number of more general comments were discussed in greater detail on 21st July with a special sub-panel composed of RECFA members with reports back to RECFA and also to Plenary ECFA on 22nd July.
- The main messages contained here were presented to the particle physics community on 30th July at the ECFA Plenary Session of the EPS-HEP2021 Conference.
- **The document will need formal approval from ECFA on 19th November and will be presented as printed copies to CERN Council on 10th December.**
- **In parallel we have prepared an 8 page "synopsis" to accompany this, summarising the main conclusions which has been prepared with CERN IR-ECO in a more accessible language and style.**
- **Currently the 8 page document is printed and will be made available with the main document as both paper copies and pdf versions.**
- **The main document has been sent for printing on 25th October and final formatting of the pdf is being completed with a view to all materials being public once they have first been presented to CERN Council.**

European Particle Physics Strategy Update

"**Main report**: ***"Recent initiatives with a view towards strategic R&D on detectors are being taken by CERN's EP department and by the ECFA detector R&D panel, supported by EU-funded programmes such as AIDA and ATTRACT. Coordination of R&D activities is critical to maximise the scientific outcomes of these activities and to make the most efficient use of resources; as such, there is a clear need to strengthen existing R&D collaborative structures, and to create new ones, to address future experimental challenges of the field beyond the HL-LHC. Organised by ECFA, a roadmap should be developed by the community to balance the detector R&D efforts in Europe, taking into account progress with emerging technologies in adjacent fields."***

Deliberation document: ***"Detector R&D programmes and associated infrastructures should be supported at CERN, national institutes, laboratories and universities. Synergies between the needs of different scientific fields and industry should be identified and exploited to boost efficiency in the development process and increase opportunities for more technology transfer benefiting society at large. Collaborative platforms and consortia must be adequately supported to provide coherence in these R&D activities. The community should define a global detector R&D roadmap that should be used to support proposals at the European and national levels."***

Extracted from the documents of 2020 EPPSU, https://europeanstrategyupdate.web.cern.ch/

For previous presentations see Plenary ECFA: Jorgen D'Hondt (https://indico.cern.ch/event/933318/), Susanne Kuehn (https://indico.cern.ch/event/966397/) and Phil Allport (https://indico.desy.de/event/28202/)

More roadmap process details at: https://indico.cern.ch/e/ECFADetectorRDRoadmap

Restricted ECFA Composition

https://ecfa.web.cern.ch/restricted-ecfa

Chair	Prof. Dr Karl Jakobs	Appointed Jan. 2021
Secretary	Prof. Patricia Conde Muino	Appointed July 2021

Members		
Austria	Dr Manfred Jeitler	Appointed Jan. 2018
Belgium	Prof. Nick van Remortel	Appointed July 2018
Bulgaria	Prof. Plamen Iaydjiev	Appointed Jan. 2016
Croatia	Prof. Mirko Planinic	Appointed July 2020
Cyprus	Prof. Panos Razis	Appointed Oct. 2017
Czech Republic	Dr Marek Tasevsky	Appointed Jan. 2019
Denmark	Prof. Mogens Dam	Appointed Jan. 2018
Finland	Dr Kati Lassila-Perini	Appointed Jan. 2018
France	Dr Jean-Claude Brient	Appointed Jan. 2020
Germany	Prof. Heiko Lacker	Appointed July 2021
Greece	Prof. Paris Sphicas	Appointed July 2018
Hungary	Dr Ferenc Siklér	Appointed Jan. 2021
Italy	Prof. Chiara Meroni	Appointed July 2020
Israel	Prof. Eilam Gross	Appointed Jan. 2018
Netherlands	Prof. Stan Bentvelsen	Appointed Jan. 2015
Norway	Prof. Alexander Read	Appointed Jan. 2018
Poland	Prof. Justyna Łagoda	Appointed Jan. 2021
Portugal	Prof. Patricia Condes Muino	Appointed July 2020
Romania	Dr Alexandru-Mario Bragadireanu	Appointed Jan. 2019
Serbia	Prof. Peter Adžic	Appointed July 2012
Slovakia	Dr Pavol Stríženec	Appointed May 2016
Slovenia	Prof. Marko Mikuž	Appointed July 2018
Spain	Prof. Celso Martinez	Appointed Jan. 2021
Sweden	Prof. David Milstead	Appointed Jan. 2018
Switzerland	Dr Mike Seidel	Appointed Jan. 2019
Turkey	Prof. Mehmet Zeyrek	Appointed July 2018
United-Kingdom	Prof. Max Klein	Appointed Jan. 2021
Ukraine	Prof. Mykola Shul'ga	Appointed July 2018
CERN	Dr Roger Forty	Appointed Sept. 2015

Ex-Officio Members		
CERN	Dr Fabiola Gianotti Prof. Joachim Mnich	Appointed Jan. 2016 Appointed Jan. 2021
LDG	Prof. Dave Newbold	Appointed Jan. 2021

Observers		
EPS-HEPP Board Chair	Prof. Thomas Gehrmann	Appointed Sept. 2019
ApPEC Chair	Dr Andreas Haungs	Appointed Jan. 2021
NuPECC Chair	Prof. Marek Lewitowicz	Appointed March 2018
Russian Federation	Prof. Victor Matveev	Appointed Jan. 2007
Early Career Researchers (ECR)	Lydia Brenner	Appointed Feb. 2021

Links for Roadmap Process

(**https://indico.cern.ch/e/ECFADetectorRDRoadmap**)

https://indico.cern.ch/event/957057/page/21633-mandate (Panel Mandate document)

https://indico.cern.ch/event/957057/page/21653-relevant-documents

https://home.cern/resources/brochure/cern/european-strategy-particle-physics

https://arxiv.org/abs/1910.11775 (Briefing Book)

https://science.osti.gov/-/media/hep/pdf/Reports/2020/DOE_Basic_Research_Needs_Study_on_High_Energy_Physics.pdf

https://ep-dep.web.cern.ch/rd-experimental-technologies (CERN EP R&D)

https://aidainnova.web.cern.ch (linking research infrastructures in detector development and testing)

https://attract-eu.com/ (ATTRACT: linking to industry on detection and imaging technologies)

https://ecfa-dp.desy.de/public_documents/ (Some useful documents from the ECFA Detector Panel)

Advisory Panel with Other Disciplines

Organisation name	Contact name
APPEC	Andreas Haungs (Chair)
NuPECC	Marek Lewitowicz (Chair)
LEAPS	Caterina Biscari (Chair)
LENS	Helmut Schober (Chair)
ESA	Guenther Hasinger (Director of Science) Franco Ongaro (Director of Technology, Engineering and Quality)

APPEC: Astro-Particle Physics European Consortium
ESA: European Space Agency
LEAPS: League of European Accelerator-based Photon Sources
LENS: League of advanced European Neutron Sources
NuPECC: Nuclear Physics European Collaboration Committee

Named expert contacts		
APPEC	TF1	Jennifer L Raaf (Fermilab)
	TF2	Manfred Lindner (MPI Heidelberg)
	TF3	Fabrice Retiere (TRIUMF)
	TF4	Tina Pollmann (Nikhef)
	TF5	Harald Lück (Hannover)
	TF6	Federica Petricca (MPI Munich)
	TF7	Marc Weber (KIT)
	TF8	Aldo Ianni (LNGS)
	TF9	Katrin Link (APPEC)
NuPECC	TF1	Laura Fabbietti (TUM Munich)
		Bernhard Ketzer
	TF2	
	TF3	Luciano Musa (CERN)
		Michael Deveaux
	TF4	Eugenio Nappi (INFN Bari)
		Jochen Schwiening
	TF5	: Christian Enss (Heidelberg),
	TF6	Thomas Peitzmann (Utrecht)
		Ulrike Thoma (Bonn)
	TF7	David Silvermyr (Lund)
		Christian J. Schmidt
	TF8	Werner Riegler (CERN)
		Lars Schmitt
	TF9	Michael Deveaux,
LEAPS	Bernd Schmitt (PSI)	
	Fabienne Orsini	
	Steve Aplin (European	
	Heinz Graafsma (DESY)	

Named contacts for each TF where appropriate

Many thanks to these experts for their advice and availability

LENS	TF1	Bruno Guerard (ILL)
	TF2	Manfred Lindner (MPI Heidelberg)
	TF3	
	TF4	
	TF5	Helmut Schober (ILL)
	TF6	
	TF7	Bruno Guerard (ILL)
	TF8	
	TF9	
ESA	TF1	Nick Nelms
	TF2	
	TF3	Brian Shortt
		Nick Nelms
		Giovanni Santin
		Alessandra Constantino Mucio
	TF4	Brian Shortt
		Peter Verhoeve
		Sarah Wittig
		Nick Nelms
		Giovanni Santin
	TF5	Peter Verhoeve
		Sarah Wittig
		Nick Nelms
	TF6	Nick Nelms
	TF7	Joerg Ter Haar
		Christophe Honvault
		Nick Nelms
		Alessandra Constantino Mucio
	TF8	Massimo Braghin
	TF9	Christophe Honvault

ECFA
European Committee for Future Accelerators

Process and Timeline

Organisation

May 2020
EPPSU mandate to ECFA to develop a roadmap for detector R&D efforts in Europe

Sep 2020
Structure in place with **Detector R&D Roadmap Panel**

Dec 2020
Task Forces active

Website:
https://indico.cern.ch/e/ECFADetectorRDRoadmap

Expert & Community Consultation

Feb 2021
Collection of requirements of future facilities & projects

Feb/March 2021
Questionnaires of Task ces to national contacts

with ex
- ECFA cou
- adjacent discipl
- industry

March-May 2021
Open Symposia

Feedback very positive but many detailed comments received and now being implemented in final version by end September

Drafting Roadmap & Feedback

May 2021
Task Forces collate input from symposia

25-28 May 2021 **Drafting sessions**
- opening session with all experts involved
- plenary & parallel sessions with Task Force members
- final session of Roadmap Panel

July 2021
Near final draft shared with RECFA*

30 July 2021
Presentation at Joint ECFA-EPS session

August 2021
Collect final community feedback*

October 2021
Detector R&D Roadmap Document approval by ECFA in Nov 2021 and presentation to Council in Dec 2021

*community feedback via Restricted ECFA delegates and National Contacts
(See https://ecfa.web.cern.ch/restricted-ecfa-composition in back-up)

ECFA
European Committee for Future Accelerators

Process and Timeline

Organisation

May 2020
EPPSU mandate to ECFA to develop a roadmap for detector R&D efforts in Europe

Sep 2020
Structure in place with **Detector R&D Roadmap Panel**

Dec 2020
Task Forces active

Website:
https://indico.cern.ch/e/ECFADetectorRDRoadmap

Expert & Community Consultation

Feb 2021
Collection of requirements of future facilities & projects

Feb/March 2021
Questionnaires of Task Forces to national contacts

Task Forces liaise with experts in
- ECFA countries
- adjacent disciplines
- industry

March-May 2021
Open Symposia

Drafting Roadmap & Feedback

May 2021
Task Forces collate input from symposia

25-28 May 2021 **Drafting sessions**
- opening session with all experts involved
- plenary & parallel sessions with Task Force members
- final session of Roadmap Panel

July 2021
Near final draft shared with RECFA*

30 July 2021
Presentation at Joint ECFA-EPS session

August 2021
Collect final community feedback*

October 2021
Detector R&D Roadmap Document approval by ECFA in Nov 2021 and presentation to Council in Dec 2021

*community feedback via Restricted ECFA delegates and National Contacts
(See https://ecfa.web.cern.ch/restricted-ecfa-composition in back-up)