Benvenuti a Bari

Emilio Radicioni & Nadia Pastrone

Agenda e formato del workshop

- Una introduzione panoramica sulle sfide future nei principali campi di interesse dell'Ente
  - Rivelatori a stato solido
  - Rivelatori in fase liquida
  - Photodetectors & Particle ID
  - Gas Detectors
  - Calorimetri
- Due sessioni speciali
  - Quantum "primer", come argomento di grande interesse che necessita di introduzione
  - Tecnology Transfer & Training
- Una discussione finale per fare il punto: base per la stesura di un documento
- Molte attività si ritrovano in AIDAinnova, tempo riservato per continuare a discutere

Gli esperti .....

- ... che ci hanno dato il loro aiuto indispensabile
- Quantum: Caterina Braggio, Mirko Lobino
- Stato Solido: Giovanni Ambrosi, Nicolò Cartiglia, Adriano Lai
- Liquidi: Gioacchino Ranucci, Filippo Resnati, Marco Selvi, Francesco Terranova
- TT & Training: Mariangela Cestelli Guidi
- Photodetection / PID: Fabio Gargano, Fulvio Tessarotto
- Gas Detectors: Davide Boscherini, Paolo Iengo, Davide Pinci
- Calorimetri: Francesca Cavallari, Ivano Sarra, Monica Sisti, Gabriella Gaudio
- Discussione finale: tutti noi ...

Il perché delle sessioni (e di questo Workshop)

- La Detector R&D Roadmap di ECFA, ora in fase di attuazione, ci pone di fronte a opportunità e sfide inedite
- Viene naturale ricalcare, nel limite del ragionevole, la struttura della Roadmap
- “nel limite del ragionevole” perché la Roadmap non copre tutti gli ambiti di interesse dell’INFN, né la sua ricchezza di sviluppo e costruzione dei rivelatori

  → La discussione va allargata a tutte le attività di R&D INFN
- I rivelatori sono una componente essenziale (esistenziale?) per l’Ente, e sicuramente una delle basi del suo successo e della sua visibilità, anche in campo internazionale
- È quindi normale che la nostra comunità si interroghi sulle proprie capacità ed interessi in un momento di cambiamento
- Si è quindi consapevolmente scelto di non farne una conferenza standard, ma una vera e propria sessione di lavoro con spazio prioritario lasciato alla discussione

ECFA Detector R&D Roadmap – processo 2021

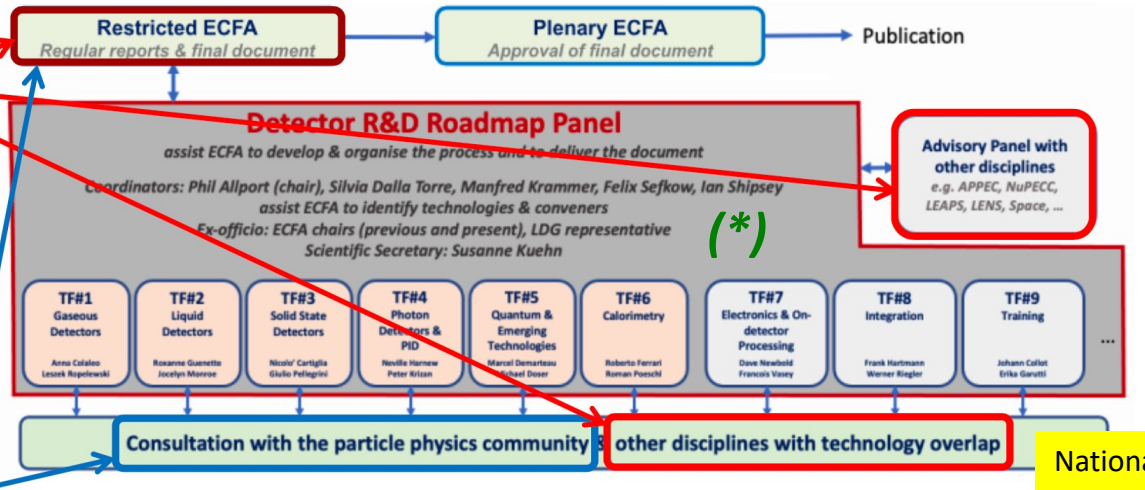
Document released in December 2021 after presentation to CERN Council: https://cds.cern.ch/record/2784893

ECFA
European Committee for Future Accelerators

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/

(*) Phil Allport, Silvia Dalla Torre, Jorgen D'Hondt, Karl Jakobs, Manfred Krammer, Susanne Kuehn, Felix Sefkow, Ian Shipsey

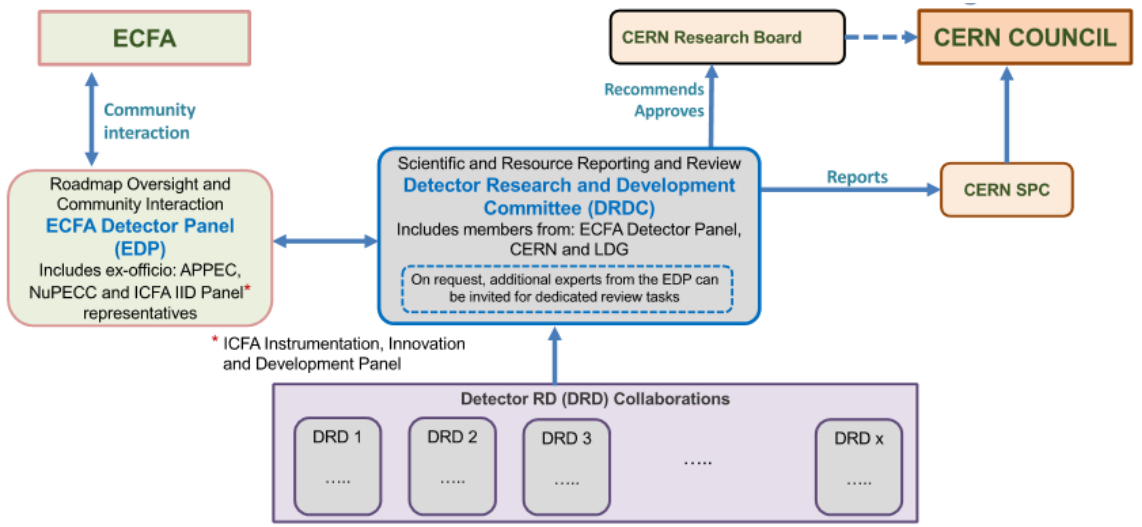
ECFA Detector R&D Roadmap – piani

- CERN Council has mandated ECFA to work out a detailed implementation plan
  (in close collaboration with the SPC, the funding agencies and the relevant research organisations in Europe and beyond)
- ECFA **Roadmap Coordination Group*** worked out a proposal to organise long-term R&D efforts into:
  newly established Detector R&D (DRD) Collaborations anchored at CERN

Three areas of Detector R&D:

1. Strategic R&D via DRD Collaborations (long-term strategic R&D lines)
(address the high-priority items defined in the Roadmap via the DRDTs)
2. Experiment-specific R&D (with very well defined detector specifications)
(funded outside of DRD programme, via experiments)
3. ”Blue-sky” R&D
(competitive, short-term responsive grants, nationally organised)

The aim is to start projects by the beginning of 2024 with a gradual ramp-up of resources in 2024/2025 to reach a steady state in 2026



Preparazione di un documento

- Prendiamo l'occasione per un documento che copra in modo più completo le attività INFN
- Non includendo esplicitamente elettronica e infrastruttura perché li consideriamo inclusi del resto
- Siamo nella fase in cui si discute l'implementazine della roadmap
- → e quindi è importante in questo momento discuterne tra di noi, in un modo che permetta a tutti di dare il loro contributo
- Ci sarà un prossimo plenary ECFA a Novembre e dobbiamo arrivarci preparati
- P-ECFA 17-18 Nov +varie CSN sempre a Novembre → scadenza per il documento (Bozza fine ottobre)

Comitato Scientifico e Locale

SCIENTIFIC Organizing Committee

Emilio Radicioni (INFN-Bari) Chair
Nadia Pastrone (INFN-Torino) Chair
Massimo Casarsa (INFN-Trieste)
Oliviero Cremonesi (INFN-MIB)
Corrado Gargiulo (CERN)
Claudia Gemme (INFN-Genova)
Aldo Ianni (INFN-LNGS)
Stefano Levorato (INFN-Trieste)
Rosario Nania (INFN-Bologna)
Giovanni Paternoster (FBK-Trento)
Alberto Quaranta (UniTN-INFN-Trento)
Filippo Resnati (CERN)
Roberto Tenchini (INFN-Pisa)
Cristina Vaccarezza (INFN-LNF)

LOCAL Organising Committee

Emilio Radicioni (INFN-Bari) (Chair)
Nadia Pastrone (INFN-Torino)
Roberto Bellotti (Universita' degli studi di Bari)
Vincenzo Berardi (Politecnico di Bari)
Maria Gabriella Catanesi (INFN-Bari)
Fabio Gargano (INFN-Bari)
Flavio Loddo (INFN-Bari)
Lorenzo Magaletti (Politecnico di Bari)
Vito Manzari (INFN-Bari)
Salvatore My (Universita' degli studi di Bari)
Cosimo Pastore (INFN-Bari)
Vincenzo Spinoso (INFN-Bari)
Sonia Tangaro (Universita' degli studi di Bari)
Giacomo Volpe (Universita' degli studi di Bari)

Technical and Administrative Support

Francesca Assisi (INFN-Bari)
Alessandro Casale (INFN-Bari)
Enza D'Alba (INFN-Bari)
Antonio Silvestri (INFN-Bari)


VILLA ★★★★
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BAR - RISTORANTE CARDUCCI
GIULIA CONFERENCE CENTRE
A-A1-B-B1-C-C1-D-D1
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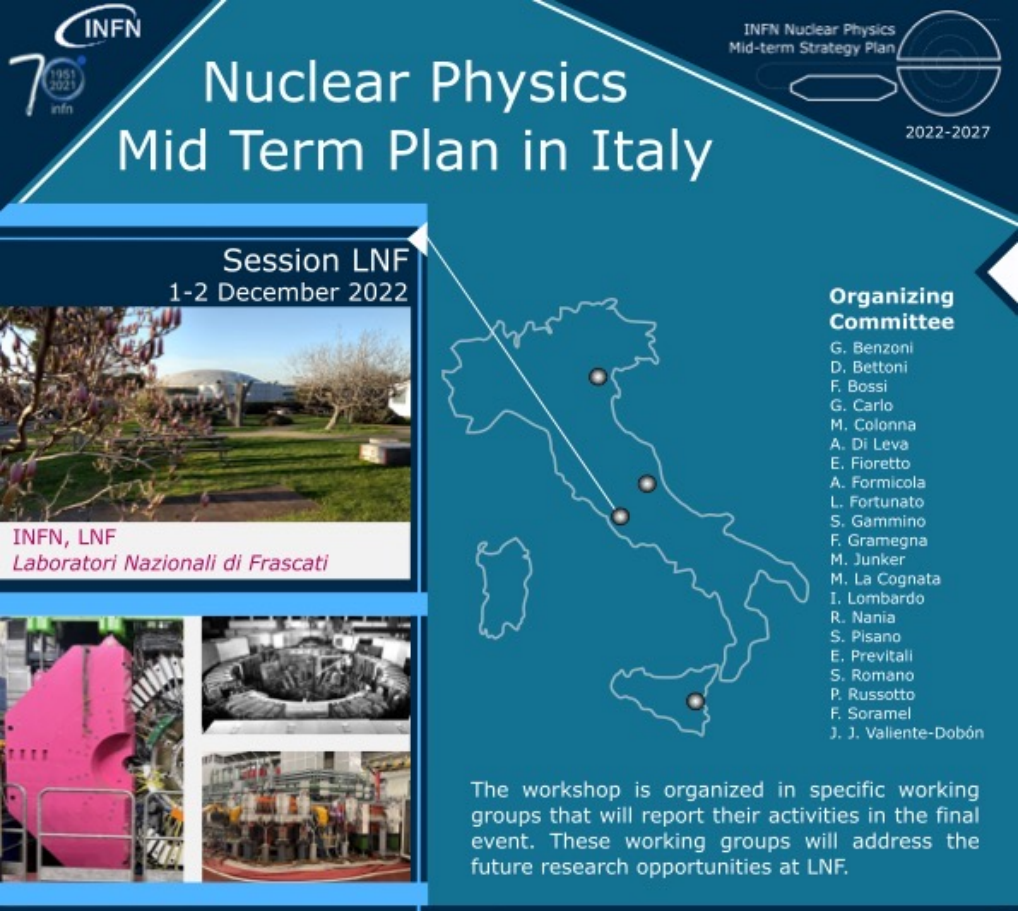
VIA DI TULLIO, 82
segreteria
VILLA RACHELE
TAVERNA
FEDERICO II
NOBEL
LIBERTY
MODIGLIANI
MARCONI
DUSE
CHANEL
D'ANNUNZIO
CARDUCCI
SALA
EUROPA
Tutte le sessioni
Lunches e
coffee breaks
SALA
SCUDERIA

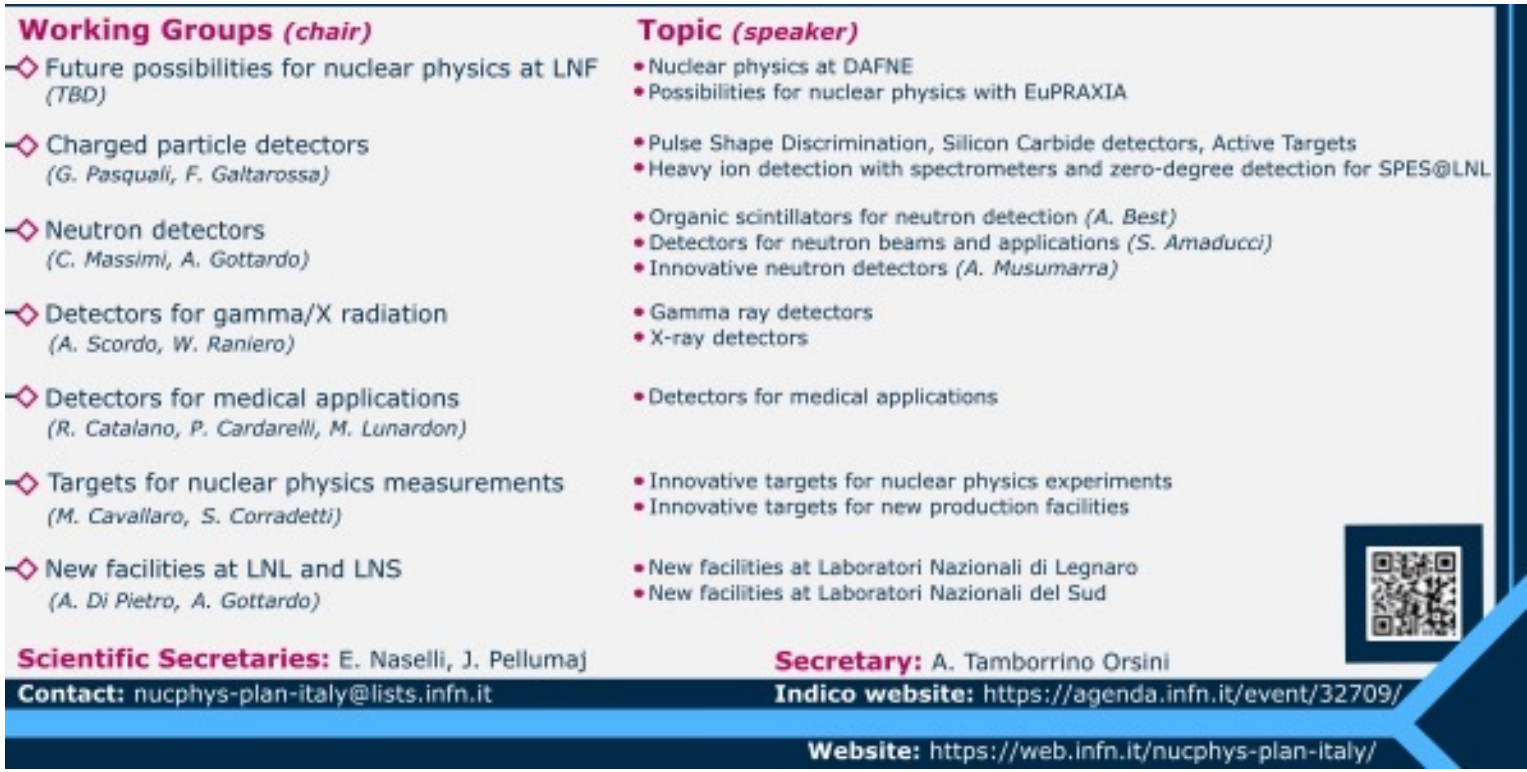
Informazioni pratiche

- Il formato di questo workshop è un esperimento:
  - Non vuole essere una conferenza, ma una vera sessione di lavoro
  - Brevi introduzioni da parte dei conveners
  - Niente posters, ma input diretto tramite presentazioni sintetiche tipo “rapid-fire”
  - Vogliamo lasciare ampio spazio alla discussione
  - → aiutateci a tenere i tempi, in modo che l’esperimento riesca !!!
- Talks
  - Tutti in formato PDF
  - Per i rapid-fire, max 5 slides, da caricare il giorno prima.
  - Verrà preparato un file unico per ridurre il tempo morto di passaggio da una presentazione all’altra

- Wi-Fi: Villa Romanazzi MICE, pwd +VRCEventi2020+
- Conference Photo
  - Martedì 18 ottobre, @coffee break, nel giardino dell'albergo
- Mascherina non obbligatoria, ma cerchiamo di non farci chiudere in casa la prossima settimana ... Quindi usatela in sala quando non dovete parlare
  - Una è già nel set di registrazione, ne potete trovare altre al banco di registrazione
- Un consiglio: data la coincidenza con la Fiera del Levante, se volete cenare al ristorante in più di 2 o 3 persone ... **Prenotate!**

Rivelatori per la fisica nucleare





Nuclear Physics Mid Term Plan in Italy:
https://web.infn.it/nucphys-plan-italy/

Buon lavoro a tutti !

extras

ECFA Detector R&D Roadmap – processo 2021

ECFA

European Committee for Future Accelerators

Roadmap Process

Process involved: 67 authors; 12 expert Input Session speakers; ECFA National Contacts; respondents to the Task Force surveys; 121 Symposia presenters; 1359 Symposia attendees and 44 APOD TF topic specific contacts.

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]

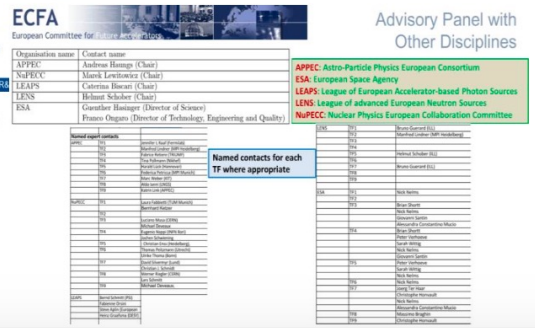
Ex-officio Panel members: Karl Jakobs[44] *(Current ECFA Chair)*, Jorgen D'Hondt[45] *(Previous ECFA Chair)*, Lenny Rivkin[46] *(LDG Representative)*

Scientific Secretary: Susanne Kuehn[2]

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

ECFA National Contacts

Country	Name	Country	Name
Austria	Manfred Jeitler	Finland	Panja Lukka
		France	Didier Contardo
Belgium	Gilles De Lentdecker	Germany	Lutz Feld
		Greece	Dimitris Loukas
Bulgaria	Venelin Koshuharov	Hungary	Dezso Varga
Croatia	Tome Anticic	Italy	Nadia Pastrone
Cyprus	Panos Razis	Israel	Erez Etzion
		Netherlands	Niels van Bakel
Czech Republic	Tomáš Davídek	Norway	Gerald Eigen
Denmark	Mogens Dam	Poland	Marek Idzik
		Portugal	Paulo Fonte
		Romania	Mihai Petrovici
		Serbia	Lidija Zivkovic
		Slovakia	Pavol Strizenec
		Slovenia	Gregor Kramberger
		Spain	Mary-Cruz Fouz
		Sweden	Christian Ohm
		Swtizerland	Ben Kilminster
		Turkey	Kerem Cankocak
		United-Kingdom	Iacopo Vivarelli
		Ukraine	Nikolai Shulga
		CERN	Christian Joram



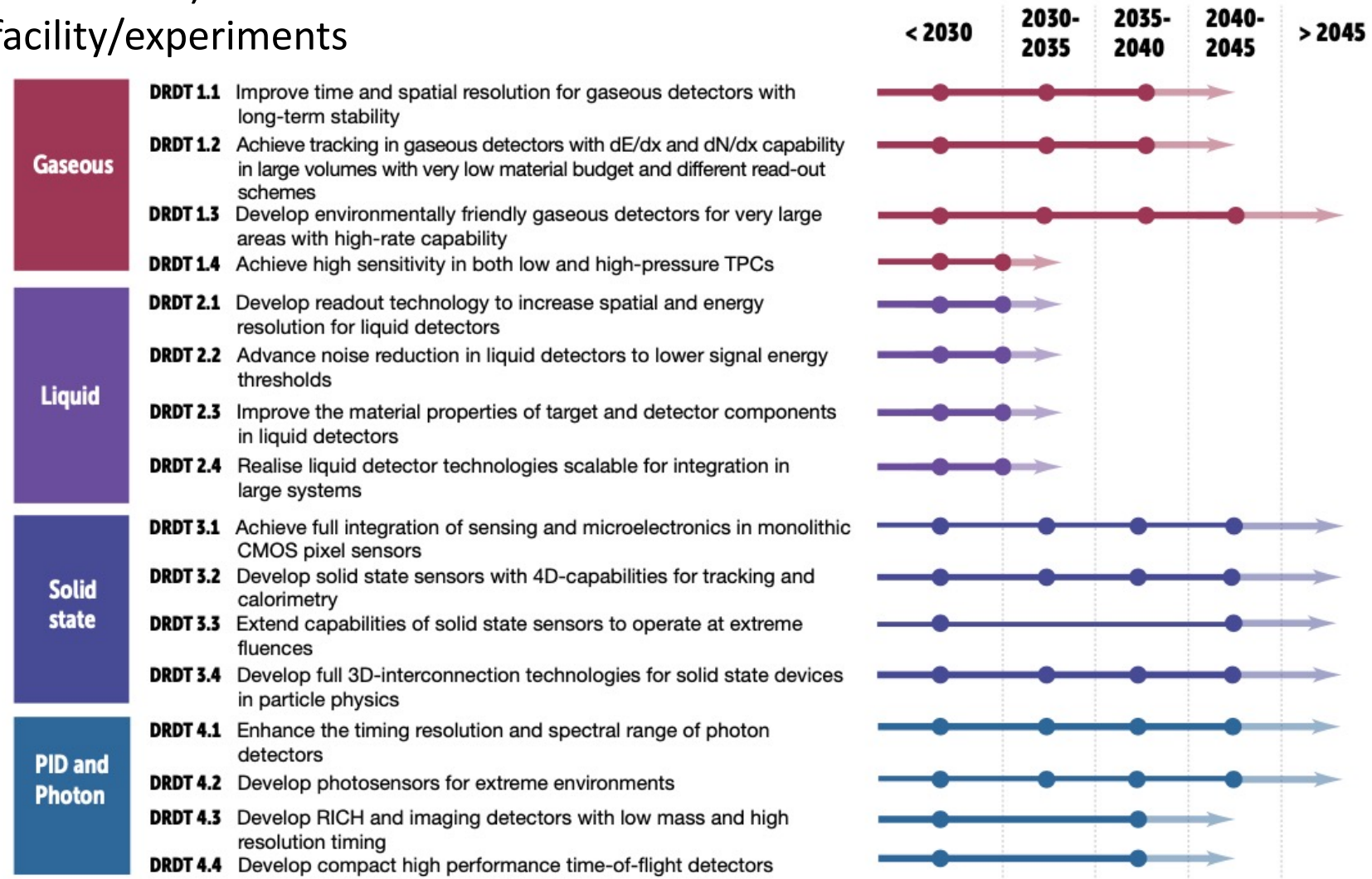
ECFA Detector R&D Roadmap – Targeted facilities

- Full exploitation of the **HL-LHC** (R&D still needed for LS3 upgrades and for experiment upgrades beyond then) including studies of flavour physics and quark-gluon plasma (where the latter topic also interfaces with nuclear physics)
- R&D for **long baseline neutrino physics** detectors (including aspects targeting astro-particle physics measurements) and supporting experiments such as at those at the CERN Neutrino Platform
- Technology developments needed for detectors at **e+e- EW-Higgs-Top factories** in all possible accelerator manifestations including instantaneous luminosities at 91.2 GeV of up to 5×10^{36} $cm^{-2}s^{-1}$.
- The long-term R&D programme for detectors at a **future 100 TeV hadron collider** with integrated luminosities targeted up to 30 ab^{-1} and 1000 pile-up for 25 ns BCO
- Specific long-term detector technology R&D requirements of a **muon collider operating at 10 TeV** and with a luminosity of the order of 10^{35} cm^{-2} s^{-1}
- Accelerator-based studies of **rare processes, DM candidates and high precision measurements** (including strong interaction physics) at both storage rings and fixed target facilities, interfacing also with atomic and nuclear physics.
- R&D for optimal exploitation of **dedicated collider experiments** studying the **partonic structure of the proton and nuclei** as well as interface areas with nuclear physics
- Very broad detector R&D areas for **non-accelerator-based experiments**, including dark matter searches (including axion searches), reactor neutrino experiments, rare decay processes, neutrino observatories and other interface areas with astro-particle physics.

Detector Research and Development Themes (1)

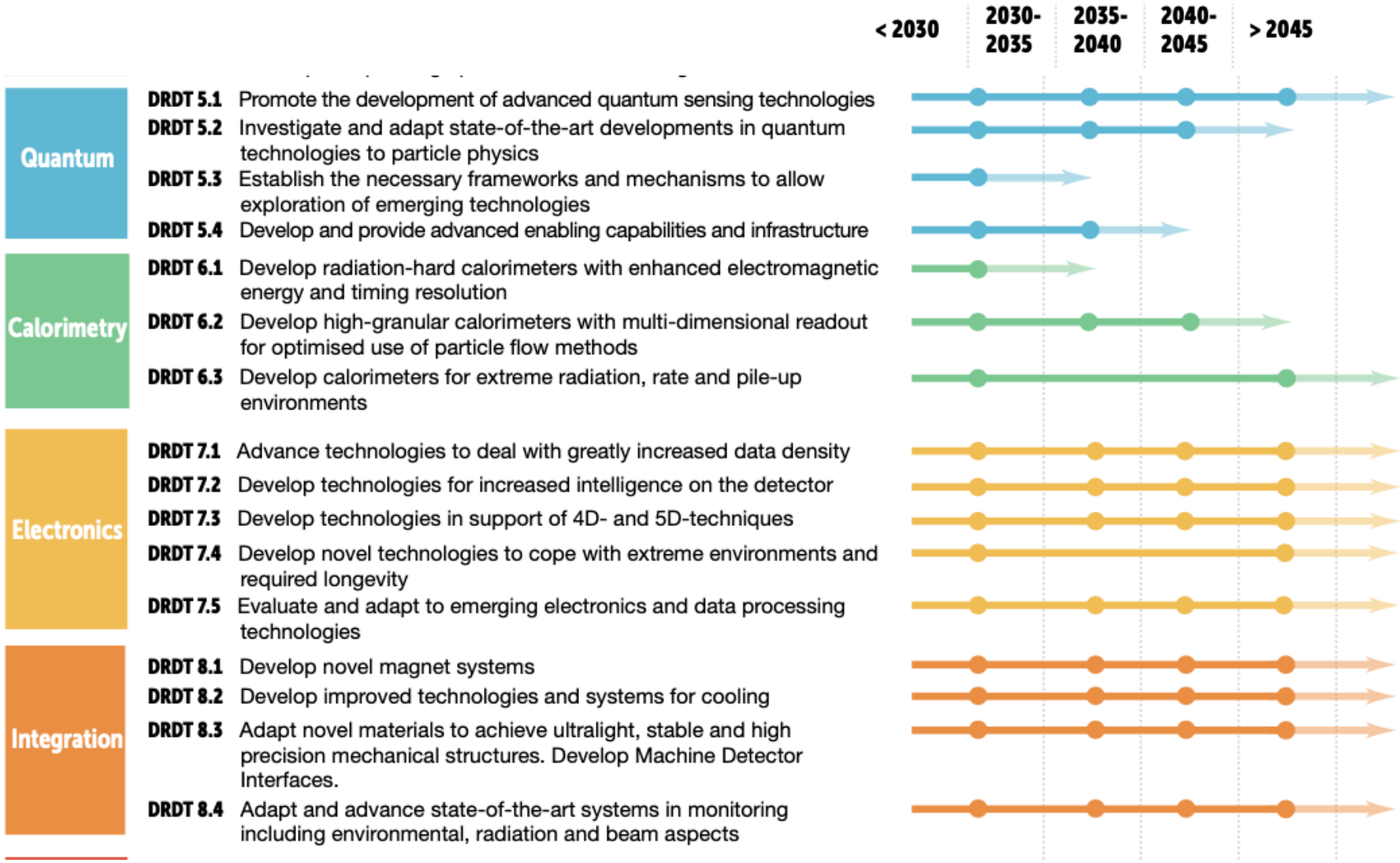
The summarizing timelines (in “Conclusions”) are also based on the needs of the future facility/experiments

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



“short” timelines mainly correspond to science sectors where long-term planning is not needed/not possible

Detector Research and Development Themes (2)



Detector R&D Roadmap: General Strategic Recommendations

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

*Aim: * Propose mechanisms to achieve a greater coherence across Europe to better streamline the local and national activities and make these more effective.*

** Give the area greater visibility and voice at a European level to make the case for the additional resources needed for Europe to maintain a leading role in particle physics with all the associated scientific and societal benefits that will flow from this.*

Detector R&D Roadmap: General Strategic Recommendations

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.

Detector R&D Roadmap: General Strategic Recommendations

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.

Detector R&D Roadmap: General Strategic Recommendations

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.