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Action to be taken		*Voting Procedure*
For information	**SCIENTIFIC POLICY COMMITTEE** 330th Meeting **26-27 September 2022**	-
For information	**RESTRICTED COUNCIL** 209th Session **29 September 2022**	-

EUROPEAN STRATEGY FOR PARTICLE PHYSICS
DETECTOR R&D ROADMAP

In the context of the implementation of the 2020 update of the European Strategy for Particle Physics, the European Committee for Future Accelerators (ECFA) was mandated by the CERN Council in 2020 to develop a detector R&D roadmap. The 2021 ECFA Detector Research and Development Roadmap was presented to the Council at its meeting in December 2021 and the Council invited ECFA to elaborate a detailed implementation plan.

ECFA hereby invites the Council to take note of the implementation plan that has been developed, as set out in annex 1 of this document.

European Strategy for Particle Physics
Implementation of the
Detector Research and Development Roadmap

Introduction

The European Committee for Future Accelerators (ECFA) was mandated by the CERN Council to develop a detector R&D roadmap in parallel with the accelerator R&D roadmap being developed under the auspices of the Large Particle Physics Laboratory Directors Group (LDG).

The two roadmaps were presented to the Council in December 2021. At that session, the Council agreed to invite ECFA and the LDG to elaborate, in close collaboration with the Scientific Policy Committee (SPC), funding agencies and relevant research organisations in Europe and beyond, detailed implementation plans setting out milestones, priorities and funding sources.

Drawing on the expertise of the Detector Roadmap Coordination Group, ECFA has worked out an implementation plan, which is presented in annex 1 of this document. In order to address long-term R&D efforts in a coherent way, the proposal is to set up new detector R&D collaborations anchored at CERN. Such an approach would ensure that both the organisational structure and the resources required to carry out the anticipated research programme successfully are available.

We would like to stress that, as mentioned in the European Strategy for Particle Physics, the achievements of particle physics experiments rely heavily on innovative instrumentation, and the highly relevant detector R&D issues identified in the Roadmap need to be addressed. However, the successful completion of the high-luminosity upgrades of the LHC (machine and detectors) must remain a key focus. Large-scale involvement of many of the institutes involved in the Phase 2 upgrades of ATLAS and CMS may therefore only become possible once the present construction work has been completed. However, the urgent needs of other experiments call for the timely realisation of the structure described, which also offers longer-term prospects for those engaged in instrumentation work, enhancing the attractiveness of this vital area. We therefore aim to establish the DRD collaborations, which should start work in January 2024, with a ramp-up of resources through 2024/2025, reaching a steady state by 2026.

In line with the mandate, this plan was presented to and discussed with the SPC at several meetings. At the end of April, a presentation to funding agency representatives followed by a discussion session was held (https://indico.cern.ch/event/1133070/timetable/). The purpose was to establish whether funding agencies would be able to support the proposed structure. In general, the plan of setting up a long-term structured R&D programme involving detector R&D collaborations was supported. However, it was also pointed out that funding mechanisms would have to be put in place or adapted. The need for funding opportunities for “blue-sky” R&D and experiment-specific R&D in addition to the new structure covering strategic R&D (via DRD collaborations) was also supported. Furthermore, it was pointed out that synergies with neighbouring fields should be exploited wherever reasonably possible. Given the importance of successfully integrating existing R&D activities, dedicated meetings were also held with the management of the RD50 and RD51 collaborations, and their feedback has been taken into account. In addition, the plan was discussed within Restricted ECFA, shared with the national contact physicists for detector R&D and presented to the full community during the open part of the Plenary ECFA meeting in July 2022.

Proposal:

In the context of the implementation of the 2020 update of the European Strategy for Particle Physics, ECFA was mandated by the CERN Council to work out a detailed implementation plan for the Detector R&D Roadmap presented in December 2021.

ECFA hereby invites the Council to take note of the implementation plan that has been developed, as set out in annex 1 of this document.

Annex 1

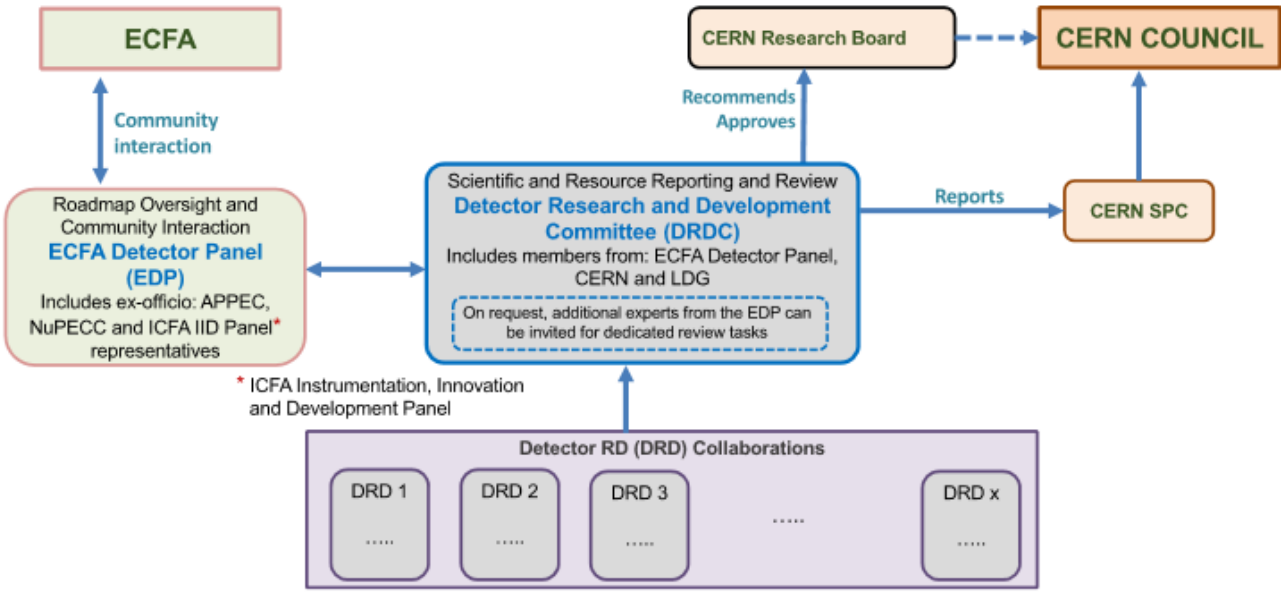
Proposed Implementation Plan for the 2021 ECFA Detector Research and Development Roadmap

For each of the technology areas considered, the 2021 ECFA Detector Research and Development Roadmap[1] (hereinafter referred to as the Roadmap) has identified major detector R&D themes (DRDTs) where longer-term research must be carried out, in most cases directed towards experiments at large future facilities with earlier experiments as important "stepping stones". A major guideline was to define the requirements and milestones such that detector R&D would not be the limiting factor in establishing the next large research projects envisaged on timescales extending well beyond the High-Luminosity LHC programme.

In addition, community themes have been developed, some of which are reflected in the general strategic recommendations (GSRs) that must also be addressed in the coming years.

1. Establishment of DRD Collaborations at CERN

It is proposed that the long-term R&D efforts be organised into newly established Detector R&D (**DRD**) collaborations, as illustrated below, following the model of the well-known and very successful RD collaborations established in the early 1990s to address the huge challenges posed by the construction of the LHC detectors.



Proposed organisational structure for implementation of the Roadmap (the arrows indicate the reporting lines)

- In the detector area, larger DRD collaborations should be considered. The proposal is that such collaborations be established to address each of the six detector technology areas identified in the Roadmap. This would guarantee a critical mass of institutes, expertise and effort, thereby avoiding too much fragmentation. It would also keep the administrative support and reviewing requirements to a manageable level. For the cross-cutting areas of electronics and integration, one or two further DRD collaborations should be anticipated; they should pick up on specific themes, but not necessarily be mapped directly onto the TF topic areas.

- In addition, the community themes identified in the area of training must be addressed. However, for these, alternative implementation steps are needed, as discussed later in this document.

[1] http://cds.cern.ch/record/2784893/files/

- All DRD collaborations should be anchored at CERN, be recognised by CERN and obtain a CERN DRD label. It would be very welcome if other institutes in Europe, such as major (national) laboratories or universities, were to take the lead in certain collaborations and help provide the necessary administrative support.

- As with existing collaborations, resources are expected to be awarded to and held at the participating institutes, which would determine the appropriate organisational structure and take ultimate responsibility for meeting the commitments to identified deliverables.

2. Reviewing and Oversight of DRD Collaborations

It is proposed that two bodies with the roles listed below be responsible for the review and oversight of the DRD collaborations. The Detector Research and Development Committee (DRDC) would be a new committee at CERN, taking over the roles currently performed by the LHCC with respect to the existing RD collaborations. The ECFA Detector Panel (EDP) already exists and is currently hosted at DESY but its membership and mandate would need to be updated.

Detector Research and Development Committee
The DRDC would be a new CERN body embedded, as shown above, in the existing CERN committee structures and would ensure rigorous oversight through CERN's well-known and internationally respected peer reviewing processes. CERN would play a central role here by giving the DRD collaborations credibility in their dealings with funding agencies, companies and other external organisations.

The DRDC would:

- provide financial and strategic oversight, as well as scientific oversight in conjunction with the ECFA Detector Panel (see below);

- evaluate the initial request for DRD resources with a focus on the required effort and how it matches the pledges by participating institutes (paying particular attention to justification and to existing staff, infrastructures and funding streams);

- decide whether to recommend approval;

- conduct reviews of the progress of the DRD collaborations and produce a concise annual scientific summary encompassing the full detector R&D programme;

- be the single body that interacts with the existing CERN committee structure for the purposes of approvals, reporting, etc.

ECFA Detector Panel
The EDP is a subcommittee of ECFA that provides a broad representation of the scientific community in Europe through the country representatives, observers and the ex-officio members of Restricted ECFA (RECFA) who make up its composition. Both within RECFA and the EDP, the neighbouring fields of nuclear and astroparticle physics are also represented, through the presence of observers from APPEC and NuPECC. The EDP also invites the chair of the ICFA Instrumentation, Innovation and Development Panel to its meetings in order to provide a global detector R&D perspective.

In its expanded role the EDP would:

- provide direct input on DRD proposals, through the appointment of members to the DRDC, in terms of the Roadmap's R&D priorities (as encapsulated in the DRDTs);

- assist, particularly via topic-specific expert members, in the conduct of annual DRDC reviews of the scientific progress of DRD collaborations;

- monitor the overall implementation of the ECFA detector roadmap and the specific DRDTs;

- follow up targets and achievements in the light of evolving specifications from experiment concept groups, as well as proto-collaborations for future facilities;

- help plan for future updates to the Detector R&D Roadmap.

The committee structure proposed here is primarily focussed on the new resources anticipated for *Strategic R&D*, as opposed to those generally awarded for *Blue-Sky R&D* (usually through more short-term schemes that are not specifically targeted towards the needs of the European Particle Physics Strategy) or for highly e*xperiment-specific R&D* that should already be covered within the funding envelope of approved projects. However, the DRD collaborations are likely to include collaborating institutes that are also involved in these latter activities, and cross-fertilisation of ideas should be encouraged.

As indicated in the diagram above, the CERN Research Board is the body to which the recommendations of the DRDC are submitted and would be the one that grants approval to the DRD collaborations. The CERN Council is kept informed of the Research Board's deliberations by the CERN DG. Once established and approved, the intention is to have a light reviewing process consisting of annual follow-up by the DRDC and high-level reports by the DRDC to the SPC on the progress of the detector R&D programme; the SPC chair would then report progress to the Council.

The funding agencies would be involved through a dedicated Resources Review Board (RRB). This board should initially endorse the sharing of responsibilities among the participating institutes and funding agencies, as laid down in memoranda of understanding (MoUs) to be prepared by the DRD collaborations. As described in Section 3 below, 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.

It is suggested that the dedicated RRB meetings should take place every two years. As projects develop, some aspects are expected to transition into approved experiment-specific R&D (outside the DRD programme). In addition, flexibility must be maintained to allow possible changes in research directions, depending on progress and R&D results. In addition, promising achievements from blue-sky R&D may become mature enough to be considered for further long-term strategic R&D. Therefore, regular RRB meetings every two years would be used to (i) review progress and (ii) adapt the research lines and sharing of responsibilities if appropriate.

3. Timeline for Establishing DRD Collaborations

The proposed timeline takes into account the fact that current R&D collaborations at CERN would need to seek an extension for continuation beyond the end of 2023 and that the most labour-intensive aspects of the general-purpose detectors for the HL-LHC deliverables should be completed by the end of 2025, allowing a significant number of experts to become available for new initiatives. This suggests that DRD collaborations need to come into existence in 2023, and requests for new resources would typically anticipate a ramp-up of requirements through 2024/25 before a reasonably steady state is reached in 2026.

It is proposed that this could be achieved according to the following timeline:

Q4 2022:

- Through the ECFA roadmap, task forces identify key players and stakeholders from the wider international community who are interested in pursuing the DRDT topics identified in the ECFA roadmap. Where current relevant detector R&D collaborations exist, their managements need to be fully involved from the beginning of this process.

- The stakeholders to be contacted in each area covered by one of the task forces should also include:
  - representatives of those involved in nearer-term facilities where these are clear "stepping stones" towards the longer-term ambitions;
  - those engaged in establishing detector concepts for the longer-term experimental programmes identified as "high-priority future initiatives" in the European Strategy for Particle Physics;
  - proponents of activities beyond the immediate horizon that are advocated as "other essential scientific activities for particle physics" in the European Strategy;
  - where relevant, the primary contact persons for other existing funded international detector R&D programmes (including activities supported by the EU and CERN).

- With the help of this wider group, one or more community workshops should be organised to gather input on how the relevant communities consider that a strategic R&D programme should be organised and to discuss the proposed structure with the ECFA R&D roadmap coordinators.

- **DRD proposal teams,** to lead the preparation of the more detailed DRD proposals in each area, should be identified as a result of this process.

Q1 2023:

- Outcomes of community workshops are collated and each **DRD proposal team** calls for expressions of interest from institutes (or groups of institutes) wishing to bid for strategic R&D in the corresponding areas identified in the DRDTs. These institutes would also need to organise themselves nationally to initiate discussions with their corresponding funding agencies.

- *DRDC mandate formally defined and agreed with the CERN Management; DRDC membership appointments begin; EDP mandate plus membership updated to reflect additional roles.*

Q2 2023:

- Through the **DRD proposal teams**, and based on the input from the community consultation, coordinate community-led bids for bottom-up roughly costed "strategic R&D" proposals (materials and **total** FTE), from consortia around technologies that can address one or more of the DRDTs, identifying the required materials costs and effort going forward. For the latter, it would be necessary to further separate existing staff or possible in-kind contributions from posts requiring additional resources. Funded activities in the context of supported experiments should be reported where potentially relevant (as stepping stones), but the resources included as in-kind contributions should focus on R&D that is not specific to individual approved experiments. As explained above, the primary aim is to create a dedicated funding line for *Strategic R&D*. The general case and motivation for such long-term strategic R&D can be found in the GSRs of the published Roadmap document.

- Proposals specific to the sub-areas should be evaluated for their relevance to DRDTs and possible overlaps or gaps with respect to them, and resources should then be matched to the stated goals. Each **DRD proposal team** should formulate a lightweight DRD organisational structure to accommodate the ambitions of the community, with appropriate sub-structures where they consider this necessary.

- *Mechanisms agreed with funding agencies for structuring country-specific DRD collaboration funding requests*.

Q3 2023:

- The **DRD proposal teams** submit full DRD proposals at the start of Q3 (July 2023), indicating estimates of the resources needed (including both those requested and those that are already available, as well as details of who covers what, i.e. pledges by institutes/ funding agencies).

- *The DRDC reviews proposals in terms of their scientific scope, milestones and technical feasibility, with the help of topic-specific experts from the EDP, and critically examines all financial aspects of the strategic R&D part of the DRD programme.*

Q4 2023:

- Where part of the new DRDs already has resources allocated for particular R&D deliverables (for example, through a pre-existing R&D collaboration covering a significant fraction of the DRD topic areas), mechanisms to carry funding and activities forward into the new DRD context need to be established.

- *Following the review and revision (if required) of proposals, the DRDC recommends the formal establishment of the DRD collaborations.*

- *Formal approval is given by the CERN Research Board.*

2024:

- Collection of MoU signatures. The areas of interest per institute and the expected support for the long-term commitments involved should be specified in the MoUs.

4. Implementation of the General Strategic Recommendations

Furthermore, the Roadmap makes ten important general strategic recommendations (GSRs). They are reproduced below, together with an outline of the steps towards their implementation.

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.

It is recommended that the approved DRD sub-projects clearly define their needs in terms of test beams, irradiation facilities and large-scale prototyping infrastructures.

A working group made up of members of the EDP, DRDC and LDG should consider to what extent these needs can be fulfilled by existing facilities, what facilities can be consolidated and where new investment is needed. Costs should be covered by the major European laboratories (or associated university institutes, where existing and if possible) and CERN. This working group should be mandated to develop a coherent plan over the next one to two years. EU funding programmes for infrastructures, such as AIDAinnova and EURO-LABS[2], should be exploited as much as possible and non-European options should be explored where appropriate.

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.

Increasing engineering support in the above-mentioned state-of-the art activities is vital in order to keep abreast of the rapidly developing technologies. A working group composed of LDG and DRDC members could be mandated to establish: how needs can best be covered; what can be taken on by CERN, other major European laboratories and universities; how appropriate access can be managed for smaller groups (such as by forming national or European clusters); and, therefore, what level of support should be asked of the respective funding agencies. For

[2] EURO-LABS is an EU-supported network of leading laboratories across Europe, where the users can conduct state-of-the-art research and develop technologies in nuclear physics, high-energy physics and associated fields.

engineers to engage, appropriate permanent positions need to be provided.

In general, the level of engineering support varies significantly from country to country. In particular, countries with a low level of such support should be strongly encouraged to improve. They could achieve this, for example, by requesting appropriate positions in the long-term R&D support programmes discussed above. Restricted ECFA (RECFA) should assess the present situation expeditiously through a survey of the national representatives and should point out strengths and weaknesses, for example during country visits or in dedicated meetings with funding agencies.

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.

This important topic of software maintenance, updates and further developments could be included in the suggested R&D activities mentioned above. The EDP should identify – together with the respective task force leaders of the present Roadmap Panel – which software packages can be embedded in the respective R&D activities. Supported positions are needed for such tasks to be carried out, and it would be appropriate to explore to what extent this could be jointly accommodated within the major laboratories.

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.

This point is addressed in the earlier sections of this document via the implementation of a coordinated and coherent R&D structure. Although the DRD collaborations are formally anchored at CERN, other national laboratories can take a leading role in nurturing these through their global contacts and can assist as a major catalyser. Coordination with non-European R&D programmes is expected through close engagement with the ICFA Instrumentation, Innovation and Development Panel.

Collaboration with neighbouring fields can be fostered through ECFA/RECFA, where they are already represented (as discussed above), as well as via the already established Joint ECFA–NuPECC–APECC Seminars (JENAS), where, in future, for example, a session dedicated to detector R&D could be established.

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.

Setting up such a structure is vital and may, for some topics, be integrated into the DRD programmes discussed above. However, for several important areas and cross-cutting activities, such as electronics (ASICs or others), a dedicated backbone structure is needed. This should be defined through discussions between the DRDC and the LDG, with the involvement of the EDP, to ensure that the relevant DRDTs identified in the roadmap are appropriately addressed. The major concern to be taken into account is that, for several R&D areas (particularly those linked to solid-state devices, microelectronics and on-detector data handling), the costs involved in exploiting, adapting and further developing cutting-edge technologies are rising rapidly while the field remains – by commercial standards – a low-volume, niche market. Increasingly, costs can be met only through a significant pooling of resources, particularly given the growing complexity and degree of specialisation required of those involved in device design and the need to negotiate with vendors as larger-scale organisations. The proposed new structures would need to have the necessary critical mass to meet these challenges while ensuring that creativity is

maintained at smaller institutes. Such strategic funding should supplement current schemes aimed more at sustaining a diverse R&D ecosystem.

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.

Long-term funding structures should be established and linked to DRD lines, as suggested in the earlier sections of this document.

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 (as 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.

As stated, blue-sky R&D is essential and should be funded as part of "generic" or short-term funding lines. The investment in more sustained strategic R&D, as discussed above, should supplement the continued more agile but limited-timescale support of exploratory proposals through the existing peer-reviewed funding streams that are available in most countries. The challenge of facilitating game-changing new ideas, while ensuring that coherent long-term programmes have appropriate resources, is acknowledged, but both aspects are absolutely vital for a healthy research ecosystem. In the longer term, RECFA could help to assess the prospects for more generic and short-term R&D funding streams across Europe through surveys via the national representatives and to encourage funders to reserve an appropriate fraction of their spending for this area.

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.

As suggested, ECFA should address this. However, solutions will not be straightforward to implement. A mindset change – whereby physics faculties hire people for more technical positions and funding agencies finance them – is needed. The ECFA Early-Career Researchers Panel should clearly be involved in these deliberations, as well as in the task of strengthening recognition of the importance of detector R&D and improving the career paths of those engaged in this vital activity.

Another important issue raised in this context is the need to improve coordination of the instrumentation training that already exists. The EDP had started to play a limited role here by providing a centralised resource for listing upcoming instrumentation schools (along with relevant workshops and conferences), but the next step would be to bring the organisers of all these excellent initiatives together to explore routes to greater coordination and thus ensure even greater impact. Innovative approaches to online learning and participation should be further explored, even though there can be no complete substitute for direct hands-on training. It would be particularly useful to strengthen coordination between the EDP and the ICFA-IID in order to improve access and inclusivity internationally and to encourage the widest possible diversity of participation.

It is further suggested that a new panel should be established by ECFA, involving representatives of universities, learned bodies and major laboratories. This body should explore synergies between the current training available

in detector and accelerator R&D along with that available in neighbouring disciplines and, based on the findings, propose the contents of a core Master's level curriculum in instrumentation. The aim should be to see how the distributed resources and expertise in Europe could be better pooled to provide a common framework, leading to a widely recognised, accredited Master's degree programme that participating institutes could adopt either in its entirety or in part.

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.

This task should also be followed up by the EDP, with the involvement of the management of the new DRDs. It could also foster links between existing knowledge transfer units, such as those of CERN, CNRS, Helmholtz Germany, INFN, STFC, etc. Methods of establishing meaningful longer-term relationships with industrial partners should be explored, and barriers due to IP issues, confidentiality and competition rules should be investigated with help from these bodies, the LDG and national funding agencies.

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.

ECFA should get in touch with SCOAP^3 and explore possibilities for addressing the issues around instrumentation journals. The possibility to involve the knowledge transfer units mentioned above (CERN, CNRS, Helmholtz Germany, INFN, STFC, etc.) in facilitating this should also be investigated by ECFA.