Symposium Task Force 2: Liquid Detectors

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Welcome and thanks!

- Your attendance and input are essential
- The symposium is recorded
- You are invited to register to the symposium
- Thanks to our **invited speakers!**
  - 15 min talks
  - They will give their personal input as experts (no reviews on current status but future oriented)
  - No questions at the end of talks but write questions or comments on this google doc
- Thanks to our **breakout room discussion leaders!**
  - 2 discussion sessions after 3 topical talks
  - Join the discussions!
- Thanks to the **colleagues who sent input**!
  - Extremely useful

TF2 + discussion leaders meeting

Laura Zambelli (IN2P3 LAPP)	Vicente Pesudo (CIEMAT)
Teresa Marrodan (MPIK Heidelberg)	Clara Cuesta (CIEMAT)
Sander Breur (Stanford)	Andrzej Szelc (Edinburgh)
Marie-Cécile Piro (Alberta)	Tina Pollmann (Munich)
Marcin Kuzniak (AstroCeNT)	Elena Gramellini (Fermilab)

Organize the development of a Detector R&D Roadmap

"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. The roadmap should identify and describe a* ***diversified detector R&D portfolio that has the largest potential to enhance the performance of the particle physics programme in the near and long term****. This community roadmap could, for example, identify the grand challenges that will guide the R&D process on the medium- and long-term timescales, and define technology nodes broad enough to be used as the basis for creating R&D platforms.* ***This will allow concerted and efficient actions on the international scale addressing the technological challenges of future experiments while fostering an environment that stimulates innovation and collaboration with industry****."*

Extract from the 2020 ESPP update

Scope of the Detector R&D Roadmap

- The ESPPU calls upon ECFA to develop a global detector R&D roadmap that should be **used to support proposals** at the European and national levels.
- That roadmap aims to define the backbone of detector R&D required to **deploy the community's vision for both the near- and longer-term**.
- The mandate is to **focus on the technical aspects** to realize the research facilities in a timely fashion, and to provide **strategic guidance for detector development at large**, in **synergy with neighboring fields and industrial applications**.

ECFA
European Committee for Future Accelerators

Organization to structure the consultation with the community

RECFA
regular reports & final document

Plenary ECFA
final document for community endorsement (aim by Summer 2021)

Publication

Detector R&D Roadmap Panel

assist ECFA to develop & organise the process and to deliver the document

Coordinators: Phil Allport (chair), Silvia Dalla Torre, Manfred Krammer, Felix Sefkow, Ian Shipsey
assist ECFA to identify technologies & conveners
Ex-officio: ECFA chair (outgoing & incoming), LDG chair
Scientific Secretary: Susanne Kuehn

Advisory Panel with other disciplines
APPEC, NuPECC, LEAPS, LENS, ESA

TF#1	TF#2	TF#3	TF#4	TF#5	TF#6	TF#7	TF#8	TF#9	...
Gaseous Detectors	Liquid Detectors	Solid State Detectors	Photon Detectors & PID	Quantum & Emerging Technologies	Calorimetry	Electronics & On-detector Processing	Integration	Training	
Anna Colaleo Leszek Ropelewski	Roxanne Guenette Jocelyn Monroe	Nicolo' Cartiglia Giulio Pellegrini	Neville Harnew Peter Krizan	Marcel Demarteau Michael Doser	Roberto Ferrari Roman Poeschl	Dave Newbold Francois Vasey	Frank Hartmann Werner Riegler	Johann Collot Erika Garutti	

Consultation with the particle physics community & other disciplines with technology overlap

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

Grouped targeted facilities/areas emerging from the EPPSU

1. Detector requirements for 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).
2. R&D for long baseline neutrino physics detectors (including aspects targeting astro-particle physics measurements) and supporting experiments such as those at the CERN Neutrino Platform.
3. Technology developments needed for detectors at e^+e^- EW-Higgs-Top factories in all possible accelerator manifestations including instantaneous luminosities at 91.2GeV of up to $5\times10^{36}cm^{-2}s^{-1}$.
4. The long-term R&D programme for detectors at a future 100 TeV hadron collider with integrated luminosities targeted up to $30ab^{-1}$ and 1000 pile-up for 25ns BCO.
5. Specific long-term detector technology R&D requirements of a muon collider operating at 10 TeV and with a luminosity of the order of $10^{35}\,cm^{-2}\,s^{-1}$.
6. Detector developments for 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.
7. 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.
8. The 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.

Grouped targeted facilities/areas emerging from the EPPSU

In addition, facilities and structures supporting detector development need to be evolved:

9. Facilities needed for detector evaluation, including test-beams and different types of irradiation sources, along with the advanced instrumentation required for these.
10. Infrastructures facilitating detector developments, including technological workshops and laboratories, as well as tools for the development of software and electronics.
11. Networking structures in order to ensure collaborative environments, to help in the education and training, for cross-fertilization between different technologically communities, and in view of relations with industry.

12. Overlaps with neighbouring fields and key specifications required for exploitation in other application areas
13. Opportunities for industrial partnership and technical developments needed for potential commercialisation

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

May-June 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

Until Sep 2021
Collect final community feedback*

Oct 2021
Detector R&D Roadmap Document submission to RECFA and afterwards to PECFA and Council

*community feedback via RECFA delegates and National Contacts

Input from community: TF2

- Google form:
  - 30 replies
  - Inputs posted on the symposium indico webpage
  - Additional feedback welcome until 7 May 2021
- This symposium:
  - First part: Noble liquids (properties, charge collection, purification, cryogenics and infrastructure)
  - Second part: Any liquids (light collection, LSc and WC, readout)
  - Breakout rooms (30 minutes each) for discussion after each part + summary and recap of discussions
  - Highlights of novel ideas + summary and future directions

Breakout room discussions

- 30 minutes discussion + 20 minutes summary (each)
- Rooms divided by topics:

First discussion (12:10-12:40) NOBLE LIQUIDS			Second discussion (14:45-15:15) ALL LIQUIDS		
Liquid properties	Charge collection	Cryogenics, purifications and infrastructure	Light collection	Liquid scintillators and Water detectors	Readout
Summary and recap by leaders (12:40-13:00)			Summary and recap by leaders (15:15-15:35)		

- Room numbers will be given before each session
- Please join and participate!

Many thanks for your participation

(apologies in advance for any technical problem)

and ENJOY the symposium!