ECFA

European Committee for Future Accelerators

Detector R&D Roadmap

(apologies from the panel's chair, Phil Allport, who cannot join us today)

Detector R&D Roadmap Panel meeting, December 16th, 2020, *remote*

Topics for today

1. Scope of the Detector R&D Roadmap and its process (*cfr. mandate document*)
2. Structure of the organisation (coordinators, TF convenors and expert members)
3. Adjacent Disciplines Advisory Panel
4. Expert contacts from European countries through ECFA
5. Collect input from Future Facilities (*cfr. document*)

Both draft documents are available on the indico page of this meeting.

Topics for today

mandate document

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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 Roadmap is to layout the detector R&D portfolio required to develop the detector technologies, including the emerging ones, to realise in a timely manner the ambitions expressed in the European Strategy for Particle Physics (ESPP).

- The Roadmap is not resource loaded itself, but will be guidance for the research community and for funding bodies to resource load the identified detector R&D programmes and to strengthen existing or to create new collaborative detector R&D platforms, networks and specific infrastructure.

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Detector R&D Roadmap Panel

- A Detector R&D Roadmap Panel assists ECFA to develop and organize the process and to deliver the final roadmap document.
- With the updated strategy as input, the mandate for the ECFA Detector R&D Roadmap Panel is to focus on the technical aspects to realise future research facilities in a timely fashion. In additional to listing the targeted R&D projects required, the roadmap is to list the transformational R&D relevant to address the updated strategy.
- The above suggests the development of a matrix, where detector technologies are connected to the ESPP identified future science programmes, including an estimate of the lead-time over which the required detector R&D programmes may be expected to extend.
- Consultation with the research community is essential in developing the roadmap, see structure on the next slide (the prime venues will be symposia per Task Force).

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
e.g. APPEC, NuPECC, LEAPS, LENS, F4E, Space, …

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	Michael Doser Anna Grasselino	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

Detector R&D Roadmap Panel

- The Detector R&D Roadmap Panel consists of the coordinators (and ex-officio members) and the Task Force convenors.
- Each Task Force has two Convenors who join the Detector R&D Roadmap Panel, and who are assisted by about four further expert members in their Task Force.
- The scope of each Task Force is described in the mandate document.
- In each Task Force, the objective will be to develop a time-ordered R&D requirements roadmap in terms of key capabilities not currently achievable.
- With a view on R&D requirements, the targeted facilities emerging from the ESPP can be grouped according to the following list.

Grouped targeted facilities emerging from the ESPP

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 emerging from the ESPP

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.

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Develop a matrix of Task Force versus target facilities with topics.

Susanne will collect the initial input from the TF convenors by 11 Jan 2021 with a view to create a first strawman version of the matrix.

Susanne.Kuehn@cern.ch

Draft timeline of the process

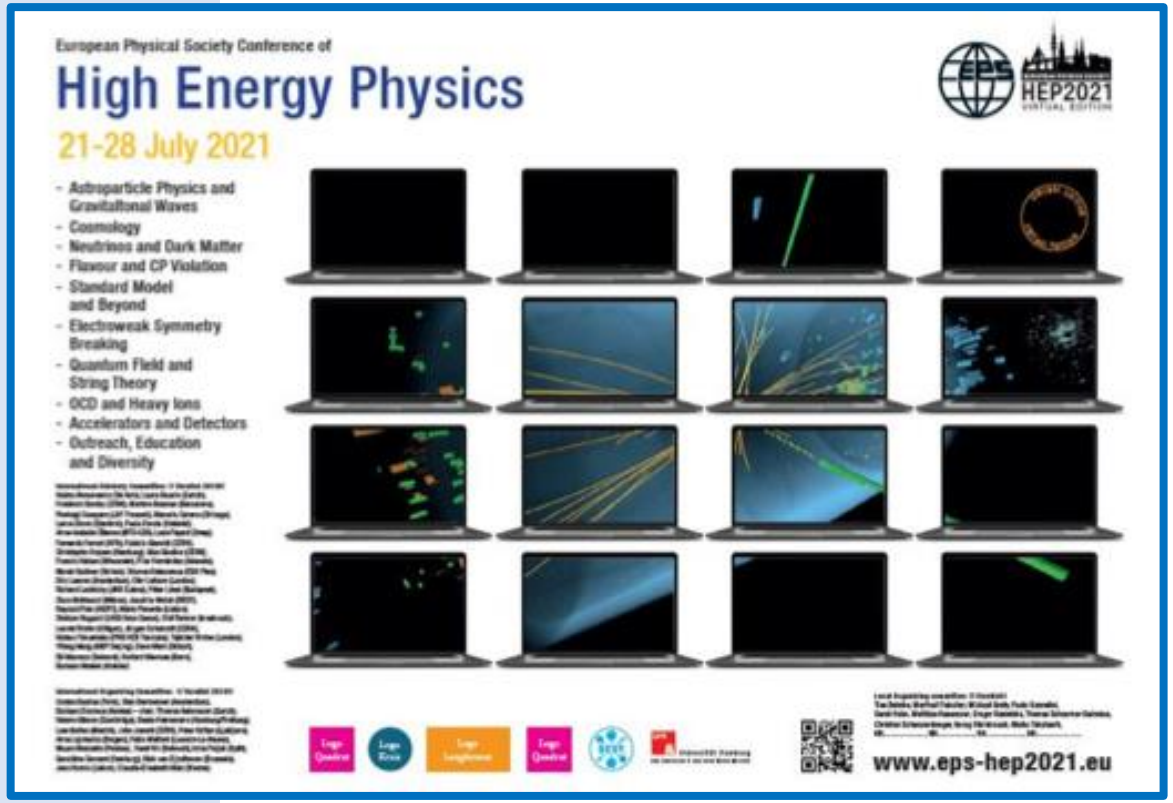
- Several Task Force experts are assigned in consultation with the conveners (cfr. scope document) with a role to preparing the respective Task Force symposia, in general one symposia for each Task Force and scheduled for March-April 2021, and potentially to become speakers at the symposia.
- The role of the Advisory Panel is thought to be helpful to connect, where relevant, Task Force members with experts in adjacent fields to work together towards and during the symposia.
- The presentations and discussions at the open symposia aim to inform the discussion and consultation with the community, and therefore they require dedicated preparation by conveners and experts.
- Task Force members are to connect to the community; national input to conveners and experts can be collected via national contacts which are being assigned through ECFA.
- *A communication line with future projects with a view to collect information → see later in this talk.*
- A multi-day drafting session, in or around May 2021, will bring together the coordinators and conveners to draft the roadmap. Report at the Restricted ECFA meeting, at this stage foreseen on 28 May 2021.
- Consultation with CERN Council in June 2021, and a final community contact prior to the publication at the EPS-HEPP conference .

Joint EPS-HEPP and ECFA session

EPS-HEPP 2021 conference

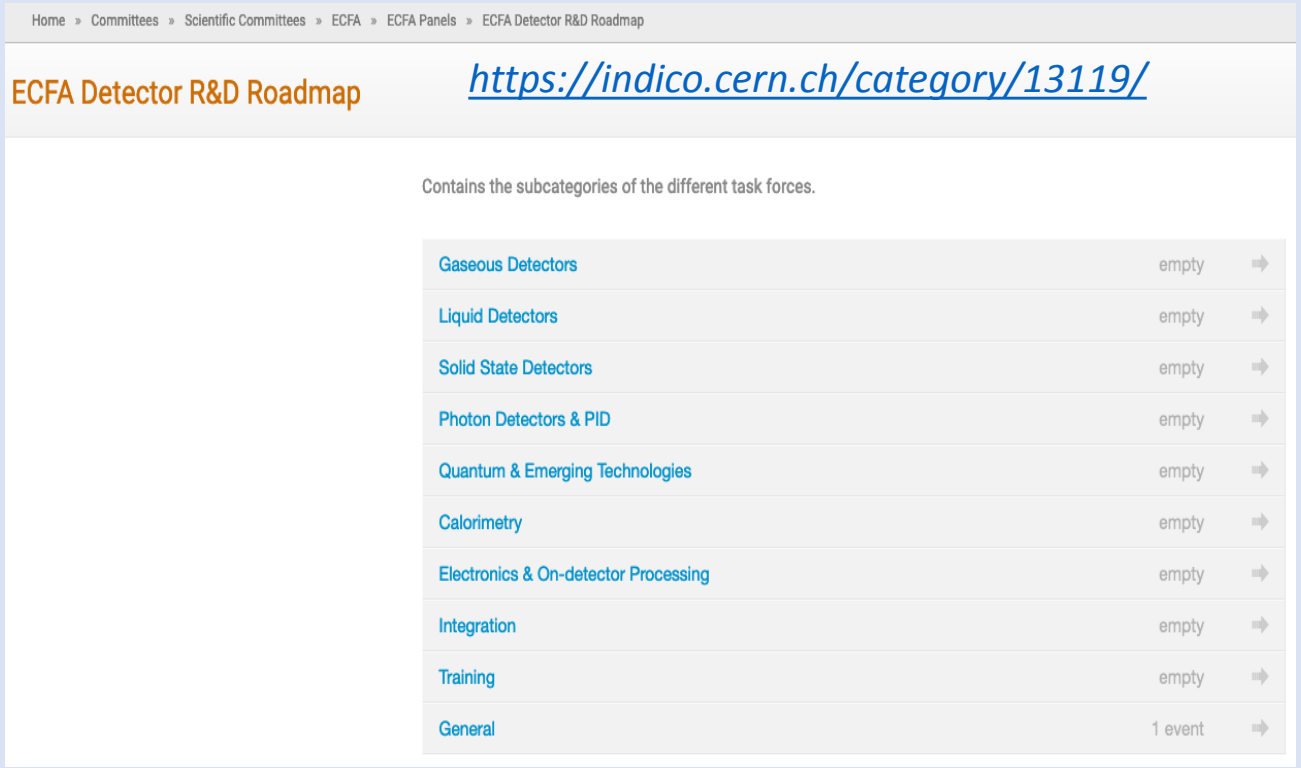
26-30 July 2021
Virtual Edition
Hosted by DESY & University of Hamburg
http://eps-hep2021.eu *(being prepared)*

- The timetable for the conference is being adapted to that for an online meeting.
- A joint ECFA-EPS session of around 2 hours is envisaged on the topic of "Technology Roadmaps" including Computing, Software, Detectors and Accelerators.
- Aim to make public at that occasion the final Detector R&D Roadmap.



Practical aspects

- Indico areas were created for each TF
- Everybody on the e-group “ECFA-DetectorRDRoadmap-Panel” has management rights and you can use it for meetings.
- Protection of meetings to be set as needed
- Public material will be linked and collected on https://indico.cern.ch/event/957057/



Practical aspects

- The following e-groups were created for each TF
- Current e-group members are TF convenors, expert members, contact person from among the Roadmap coordinators, Phil Allport (as Chair), and Susanne Kuehn (as Scient. Secretary)
- Both TF convenors have admin rights on the corresponding e-group
- Please let Susanne know in case of any problems with settings etc.
- The e-group that includes all coordinators, TF convenors and expert members: ECFA-DetectorRDRoadmap-ProcessGroup

	Name
✉	ECFA-DetectorRDRoadmap-Administrators
✉	ECFA-DetectorRDRoadmap-Coordinators
✉	ECFA-DetectorRDRoadmap-Panel
✉	ECFA-DetectorRDRoadmap-ProcessGroup
✉	ECFA-DetectorRDRoadmap-TF1GaseousDetectors
✉	ECFA-DetectorRDRoadmap-TF1GaseousDetectors-Admin
✉	ECFA-DetectorRDRoadmap-TF2-Admin
✉	ECFA-DetectorRDRoadmap-TF2LiquidDetectors
✉	ECFA-DetectorRDRoadmap-TF3-Admin
✉	ECFA-DetectorRDRoadmap-TF3SolidStateDetectors
✉	ECFA-DetectorRDRoadmap-TF4-Admin
✉	ECFA-DetectorRDRoadmap-TF4PhotonPIDDetectors
✉	ECFA-DetectorRDRoadmap-TF5-Admin
✉	ECFA-DetectorRDRoadmap-TF5QuantumDetectors
✉	ECFA-DetectorRDRoadmap-TF6-Admin
✉	ECFA-DetectorRDRoadmap-TF6Calorimetry
✉	ECFA-DetectorRDRoadmap-TF7-Admin
✉	ECFA-DetectorRDRoadmap-TF7Electronics
✉	ECFA-DetectorRDRoadmap-TF8-Admin
✉	ECFA-DetectorRDRoadmap-TF8Integration
✉	ECFA-DetectorRDRoadmap-TF9-Admin
✉	ECFA-DetectorRDRoadmap-TF9Training

Practical aspects

- Finding dates for in total 9 Task Force symposia is not trivial
- Here a list of other major events in the CERN context
- TF convenors to propose a prioritized list of 4 dates to Susanne by 11 Jan
- Coordinators meet on 12 Jan and will take into account this information to find a balanced proposal

2021	Week	Date	Event	
	1	04-Jan		
	2	11-Jan		
	3	18-Jan		
	4	25-Jan		
	5	01-Feb	CMS Week and ATLAS ITk Week	
	6	08-Feb	ATLAS Week	
	7	15-Feb	RD51 meeting	
	8	22-Feb	LHCb Week	
	9	01-Mar	LHCC 3&4 March	
	10	08-Mar		
	11	15-Mar	Moriond	
	12	22-Mar	ALICE Week, Moriond and CERN Council	
	13	29-Mar	Moriond	
	14	05-Apr		4-Apr Easter Sunday
	15	12-Apr	DIS 2021	
	16	19-Apr	CMS Week	
	17	26-Apr	ATLAS Upgrade Week and RRB (26-28)	
	18	03-May		
	19	10-May		May 13, 14 CERN holidays
	20	17-May	CALOR 2021 and CHEP	
	21	24-May	Pisa (PM2021)	
	22	31-May	LHCC 2&3 June	

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Adjacent Disciplines Advisory Panel

- In order to identify synergies and opportunities with adjacent research fields, it is important to remain connected to those fields while developing the Detector R&D Roadmap for particle physics.
- The role of the members of the Advisory Panel with other fields is to help establishing the communication between the conveners and experts in each Task Force and the experts in their fields.
- This can be facilitated by providing a list of expert contacts from within the members research fields for each Task Force, and to stimulate them to participate in the dialogues both towards and during the topical symposia organized to consult with the community.
- Each Task Force will itself connect to industry where relevant within its scope.
- *Work in progress.*

Adjacent Disciplines Advisory Panel

APPEC – astroparticle physics – https://www.appec.org
Chair – Teresa Montaruli, teresa.montaruli@cern.ch

NuPECC – nuclear physics – http://www.nupecc.org
Chair – Marek Lewitowicz, Marek.Lewitowicz@ganil.fr

LEAPS – accelerator-based photon source – https://leaps-initiative.eu
Chair – Caterina Biscari, cbiscari@cells.es

LENS – advanced neutron sources – https://www.lens-initiative.org
Chair – Helmut Schober, schober@ill.fr

F4E – fusion for energy – https://fusionforenergy.europa.eu
Chair – Beatrix Vierkorn Rudolph, Beatrix.Vierkorn-Rudolph@bmbf.bund.de

ESA – space – https://www.esa.int
Director – Johann-Dietrich 'Jan' Wörner, *email address not yet known*

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National contacts – CERN Members States through ECFA

Not all countries have a national contact at this stage, i.e. table might be updated while we move forward

If TF convenors seek specific input from the CERN member state countries, these colleagues can be contacted with specific questions and they will organise such as to provide you with an inclusive answer from their country.

Country	Name	Function	email
Austria	Manfred Jeitler	RECFA member	Manfred.Jeitler@cern.ch
Belgium			
Bulgaria	Venelin Koshuharov	Sofia University "St. Kl. Ohridski"	Venelin.Kozhuharov@cern.ch
Croatia	Tome Anticic	Rudjer Boskovic Institute	anticic@irb.hr
Cyprus	Panos Razis		razis@ucy.ac.cy
Czech Republic	Tomáš Davídek		davidek@ipnp.mff.cuni.cz
Denmark			
Finland			
France	Didier Contardo	CEA/CNRS contact for France	contardo@cern.ch
Germany			
Greece	Dimitris Loukas	Institute of Nuclear Physics, Demokritos	loukas@inp.demokritos.gr
Hungary	Dezso Varga	Wigner RCP	varga.dezso@wigner.hu
Italy	Nadia Pastrone		nadia.pastrone@cern.ch
Israel	Erez Etzion	Tel Aviv University, head of School of Physics and Astronomy	ereze@tauex.tau.ac.il
Netherlands	Niels van Bakel	head of the R&D group at Nikhef	nielsvb@nikhef.nl
Norway	Gerald Eigen		Gerald.Eigen@ift.uib.no
Poland	Marek Idzik	University of Science and Technology AGH	idzik@ftj.agh.edu.pl
Portugal	Paulo Fonte	Polytechnic Institute of Coimbra	fonte@coimbra.lip.pt
Romania	Mihai Petrovici	Senior Researcher in IFIN-HH, Head of Hadronic Physics Department	mpetro@nipne.ro
Serbia	Lidija Zivkovic		Lidija.Zivkovic@cern.ch
Slovakia			
Slovenia	Gregor Kramberger		gregor.kramberger@ijs.si
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Sweden	Christian Ohm		christian.ohm@cern.ch
Swtizerland	Ben Kilminster	Zurich University	ben.kilminster@physik.uzh.ch
Turkey	Kerem Cankocak	İstanbul Technical University	kerem.cankocak@cern.ch
United-Kingdom	Iacopo Vivarelli		I.Vivarelli@sussex.ac.uk
Ukraine			
CERN	Christian Joram		Christian.Joram@cern.ch

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Collect input from Future Facilities (cfr. document)

- Leaders of future facilities will be invited by the Roadmap coordinators to join input discussion sessions. The coordinators will invite speakers to overview at these sessions the main instrumentation opportunities, challenges, and planning to the panel coordinators, TF convenors, and TF members.
- The sessions should focus on the main input and information to be provided to the roadmap process, especially updates on needs not yet covered by existing technologies. The presentations should initially consist of pointers to the latest project descriptions and summarize in slides the unmet needs by TF area.
- Where similar needs exist for different future facilities these are presented in a combined presentation. Accordingly, speakers will collect input from the future facilities to be included in their presentation.
- Leaders of future facilities will be asked to name a contact person for further questions and discussion. Those future facilities and topics not explicitly covered in the two sessions are invited to submit two-page summary slides to Susanne.
- The TF members and convenors are asked to use this information to populate the matrix of technologies vs. future facilities and projects to prepare for the TF symposia (i.e. to update the initial strawman matrix, cfr. slide 12). The matrix is helpful to prepare the symposia, to inform each other across TFs and is also conveyed to symposia speakers.

Input discussion sessions

Session I:

- Talk I: HL-LHC (incl. flavour physics)
- Talk II: FCC-hh
- Talk III: Future linear high energy e^+e^- (ILC, CLIC)
- Talk IV: Future circular high energy e^+e^- (FCC-ee, Belle 2.5, SuperKEKB)
- Talk V: Muon collider
- Talk VI: strong interactions (long list of fixed target FFs, HL-LHC, EIC, FCC-ep, LHeC)

Session II:

- Talk I : neutrino short and long baseline (DUNE, T2K/Hyper-K)
- Talk II: astroparticle neutrinos (KM3Net, IceCube, BAIKAL)
- Talk III: DM-like (underground, Axions/ALPS, 0vBB, astroparticle sources, KATRIN-like… long and diverse list)
- Talk IV: decays (Kaon facilities, LLP facilities, LFV, rare decays… long list of FFs)
- Talk V: low energy (precision, atomic, nuclear, ELENA, ESS, PSI, EDM… long list of FFs)

For discussion

Question: Is the agenda complete? (suggestions to be send to Susanne by 23 Dec)
Coordinators aim to close the loop by early January.

Question: Nominations for speakers? (nominations to be send to Susanne by 23 Dec)
Coordinators aim to close the loop by early January.

Question: With the above settled, how to inform the community?
Coordinators aim to communicate in early January (meeting among coordinators on 12 Jan).

Next steps

- Initiate your Task Force meetings with the expert members (action: convenors)
- Provide initial information for the “matrix” to Susanne, cfr. slide 12 (action: convenors)
- Provide suggestions and nominations to Susanne, cfr. slide 25 (action: convenors)
- Propose dates of the TF symposia, proposals to Susanne by 11 Jan (action: convenors)

- Fix dates, agenda & speakers for input discussion sessions, meeting 12 Jan (action: coordinators)
- With convenor’s input, fix the dates for the symposia, meeting 12 Jan (action: coordinators)
- Inform Task Forces on the above dates (action: coordinators)
- Inform the community on the process & organise the input discussion sessions (action: coordinators)

- Take these dates into account for Task Force meetings towards the symposia (action: convenors)

- National contacts to be completed soon (action: ECFA chair)
- Expert contacts with adjacent disciplines to come soon (action: ECFA chair)