ECFA
European Committee for Future Accelerators

ECFA Detector R&D Roadmap

15 June 2023.

DRD4 – Detector R&D Collaboration on

Photodetectors and Particle ID

+ SciFi tracking + Transition Radiation

»Update for the DRD 4 community»

Zoom meeting

Organizers: P. Krizan and C. Joram

Material and Links

- The Roadmap (248 p) https://cds.cern.ch/record/2784893?ln=en

- Implementation of the ECFA Detector R&D Roadmap

https://indico.cern.ch/event/957057/page/27294-implementation-of-the-ecfa-detector-rd-roadmap

DRD 4 Implementation zone. Incl. short chronological overview: https://indico.cern.ch/event/1214407/

Older, but still interesting

- ECFA Detector R&D Roadmap Symposium of Task Force 4 Photon Detectors and Particle Identification Detectors

Thursday 6 May 2021 https://indico.cern.ch/event/999817/

Detector R&D Collaborations in the context of the ECFA Roadmap

- The Roadmap has identified **detector technologies**[1)] that need to be developed for the next generations of particle physics experiments.
- To address those needs in a coordinated and efficient way, **Detector R&D Collaborations** are being formed.
- Some similarity to the CERN R&D collaborations before the construction of LHC (still alive RD50, RD51…)
- Collaborations shall form, define their work programme, define and organise their funding, define their management, report once per year to a DRD Committee at CERN.
- Joint R&D should increase efficiencey (avoid duplication, form partnerships) and lead to synergies (share equipment, samples, know-how).
- The label ***ECFA Roadmap*** should enhance chances for extra funding from Funding Agencies. The participating groups (nationally clustered?) request funds from their FAs.

[1)] IMPORTANT: we are talking about ***technolgical*** (strategic) detector R&D in the fields photodetectors and Particle ID. This is different from **experiment-specific developments and optimisations** (adaptation of geometry, full-size prototype, industrialisation of production process, …). The latter R&D shall remain fully under the responsibility of the experiments.

Scintillating Fibre tracking

- ECFA Roadmap panel decided to include SciFi tracking in DRD 4.
- SciFi uses similar photodetectors than RICH, deals with similar signal levels, FE electronics, ligh structures
- SciFi is also linked to Calorimetry (WP6). Use of organic scintillators
- So far, the following institutes have expressed interest in DRD 4
  - LHCb SciFi institutes Sune Jakobsen, Pascal Perret
  - Mu3e, Geneva, ETH-Z Sandro Bravan, Rainer Wallny
  - CERN SY-BI (Beam instrumentation) Inaki Ortega Ruiz
  - GScan, Estonia (industrial) Madis Kiisk
- We'll soon hold a separate meeting og the SciFi subteam to discuss activites and possible projests

Transition Radiation

- TR is a well established PID method and as such fits in DRD4.
- Classic TR detectors are usually based on gaseous detectors (like straws, MWPC) and should be in DRD 1
- It was agreed to have solid state based TR R&D in DRD 4. So far, there is only 1 group.

Outcome of the community meeting on 16 and 17 May

- Ca. 50 participants at CERN + 30 by zoom
- Agreed on R&D main topics and structure (see next slide)
- Agreed that SciFi tracking and Transition Radiation (based on Solid state detectors) shall be part of DRD 4.
- Agreed on a survey (#3) in which research groups and industrial partners shall define in which Working Group and/or Work Packages (previously joint projects) they want to participate.
- Agreed that the question of the (small) common fund shall be treated ECFA-wide.

Structure and naming scheme of DRD4

ECFA panel. 07 June 2024

- **Coordinator**
- **WP leaders**
- **WG convenors**

Board of Institutes

Themes DRDT 4.1 and DRDT 4.2

Enhance the timing resolution and spectral range of photon detectors

Develop photosensors for extreme environments

Work Packages

Solid state PD
- WP 4.1.1
- WP 4.1.2
- WP 4.1.3
- ...

Vacuum based PD
- WP 4.2.1
- WP 4.2.2
- WP 4.2.3
- ...

Theme DRDT 4.3

Develop RICH and imaging detectors with low mass and high timing resolution

- WP 4.3.1
- WP 4.3.2
- WP 4.3.3
- ...

Theme DRDT 4.4

Develop compact high performance time-of-flight detectors

- WP 4.4.1
- WP 4.4.2
- WP 4.4.3
- ...

Work Packages

Working Groups

WG 4.1
Photodetector R&D
Solid state
Gaseous
Vacuum

WG 4.2
Particle ID
RICH
DIRC
TOP
TORCH
TOF

WG 4.3
Technologies
Radiators
Optical elements
Readout
Cooling
…

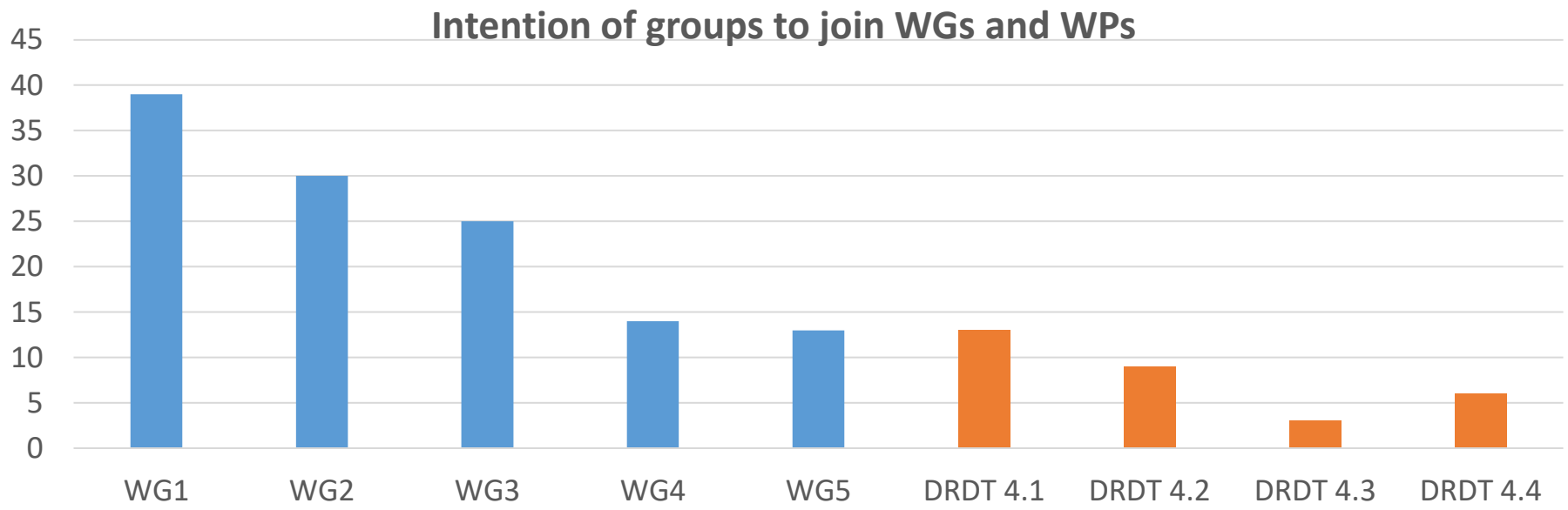
WG 4.4
Software
Simul
Recon
ML
…

WG 4.5
Special
SciFi
TR (Solid state based)
…

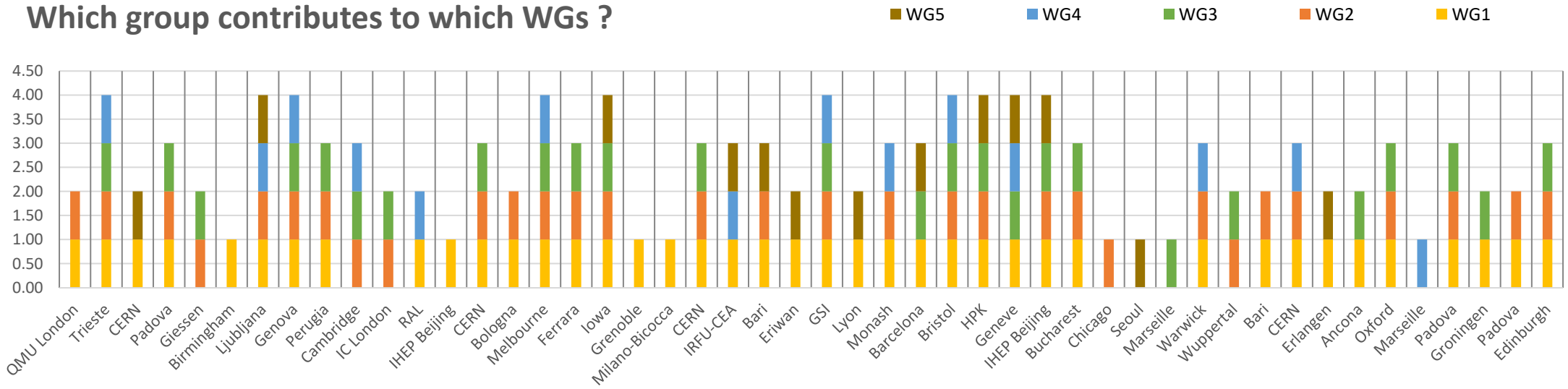
WG 4.6
Future
ideas,
concepts,
blue sky
…

Activities since the community meeting on 16 and 17 May

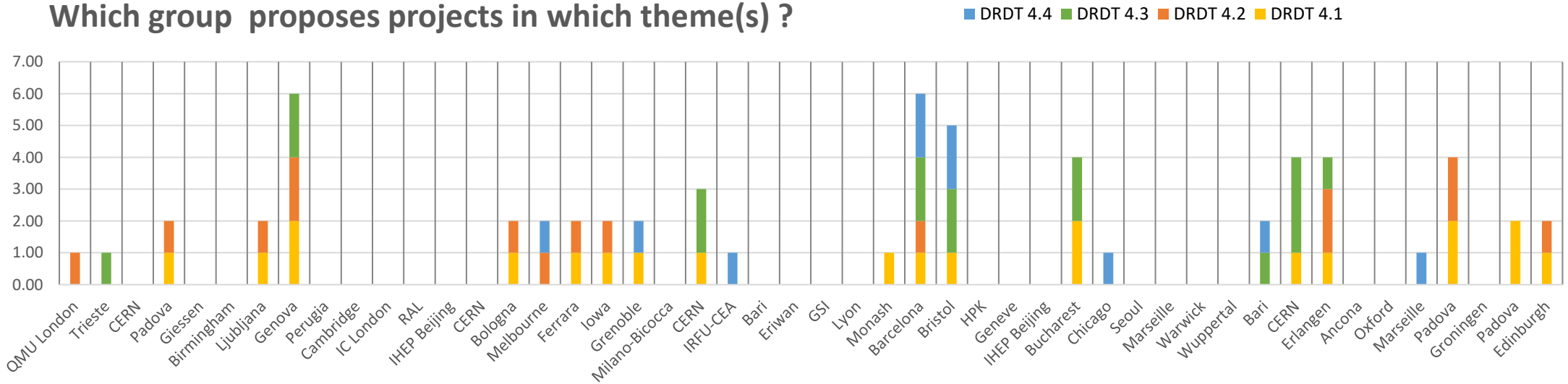
- Survey was sent all participants of community meetings + some more
- 48 replies from research groups and industrial partners. Some later replies were received. Not all are included



Which group contributes to which WGs ?



Which group proposes projects in which theme(s) ?



Activities since the community meeting on 16 and 17 May

- Formed a DRD 4 preparation team based on volunteers

• Sajan Easo, RAL, UK	WG4.4, WG4.2
• Massimiliano Fiorini, Ferrara, IT	WG4.5, WP4.1
• Roger Forty, CERN, CH	- , WP4.4
• Christian Joram, CERN, CH	WG4.2
• Peter Krizan, JSI, Ljubljana, SLO	WP4.2, WP4.4, WG4.1
• Imad Laktineh, IN2P3, Lyon, FR	WP4.1, WG4.5
• Rok Pestotnik, JSI, Ljubljana, SLO	WG4.1, WP4.2
• Alessandro Petrolini, Genova, IT	WP4.3, WG4.3
• Fulvio Tessarotto, Trieste, IT	WG4.3, WP4.3

Teams of two worked on the assembly of WGs and WPs, suggesting activities.

Often still missing: milestones, budget. At least 1 more iteration required for each WG and WP, only with the concerned groups.

	Official Group name (as used in survey)	DRD 4 - internal short name
1	UNIVPM Ancona	Ancona
2	Institute of Cosmos Science of the University of Barcelona, Instrumentation Technology Unit (ICCUB)	Barcelona
3	INFN Bari	Bari
4	INFN Bari	Bari
5	University of Birmingham	Birmingham
6	INFN - sezione di Bologna	Bologna
7	University of Bristol	Bristol
8	IFIN-HH Bucharest Romania	Bucharest
9	Cavendish Laboratory, University of Cambridge, HEP Group	Cambridge
10	CERN	CERN
11	CERN ALICE	CERN
12	CERN-EP	CERN
13	ARC (a compact RICH detector)	CERN
14	University of Illinois at Chicago	Chicago
15	Edinburgh	Edinburgh
16	ARARAT (Advanced RAdio frequency timing appaRATus) AANL	Eriwan
17	Erlangen Centre for Astroparticle Physics (ECAP)	Erlangen
18	FBK	FBK
19	INFN Ferrara	Ferrara
20	DPNC Unige	Geneve

	Official Group name (as used in survey)	DRD 4 - internal short name
21	University and INFN Genova	Genova
22	Justus Liebig-University Giessen	Giessen
23	LPSC Grenoble	Grenoble
24	PARTREC	Groningen
25	GSI	GSI
26	Hamamatsu Photonics Italia	HPK
27	Imperial College London	IC London
28	IHEP-CAS-FPMT	IHEP Beijing
29	IHEP Detector Group 3	IHEP Beijing
30	U.Iowa	Iowa
31	CaLIPSO group, IRFU-CEA	IRFU-CEA
32		Leicester
33	Jožef Stefan Institute	Ljubljana
34	IP2I Lyon	Lyon
35	"CPPM(2)" or "CPPM-mini": (to be decided...) Centre de Physique des Particules de Marseille	Marseille
36	imXgam-CPPM	Marseille
37		Maryland
38	The University of Melbourne	Melbourne
39	INFN/University Milano-Bicocca	Milano-Bicocca
40	Monash	Monash

	Official Group name (as used in survey)	DRD 4 - internal short name
41		Nagoya
42	University of Oxford	Oxford
43	INFN Padova	Padova
44	INFN Padova	Padova
45	Belle II upgrade - INFN Padova	Padova
46	INFN Perugia	Perugia
47	Queen Mary University of London	QMU London
48	STFC - RAL, LHCb	RAL
49	Seoul National University Bundang Hospital	Seoul
50	INFN-Trieste	Trieste
51	University of Warwick	Warwick
52		Weeroc
53	Wuppertal University	Wuppertal

Dedicated status of (semi-)industrial partners

- There shall be a dedicated DRD 4 member status for semi-industrial partners. These are companies or organisation which are producing and/or selling detectors, components, software etc.
- There will be no ECFA-wide definition. Every DRD can define the status as they consider appropriate. DRD 4, as DRD 3 (Solid state detectors) will follow the RD50 definition, possibly with some changes.

Industrial Partners (prel. proposal)

- The CB can grant the status of “Industrial Partners” to collaborating industrial partners.
- Industrial partners are not represented in the Collaboration Board.
- Industrial partners do not contribute to the Common Collaboration Fund.
- Team members of industrial partners are listed as co-authors on common publications (same rules as applicable to all other collaboration members).
- Industrial partners can participate to the activities of one or several Working Groups
- Industrial partners shall not directly participate to a Work Package. Indirect participation via a collaborating institute may be possible.

Industrial Partners (cont.)

Should be discussed

- DRD 4 collaboration differentiates between industrial partners and institutions that have to finance themselves partly by commercial income. The latter can still become full members of the Collaboration (i.e. ”Collaborating Institutions”).
- In cases where conflicts could arise with their commercial interests, e.g. when the collaboration is going to tender products which they are able to sell, the CB shall decide to not allow them to discuss and vote about these issues in the CB.

Common Fund

- Different from what the DRD 4 community requested, ECFA will not request all collaboration to adopt the same common fund modell.
- Every DRD shall chose the model suiting them best.
- For the time being, we assume an annual Common Fund payment of 1 kCHF per participating institute.
- CF will primarily be used to run the meetings at CERN (or elsewhere).

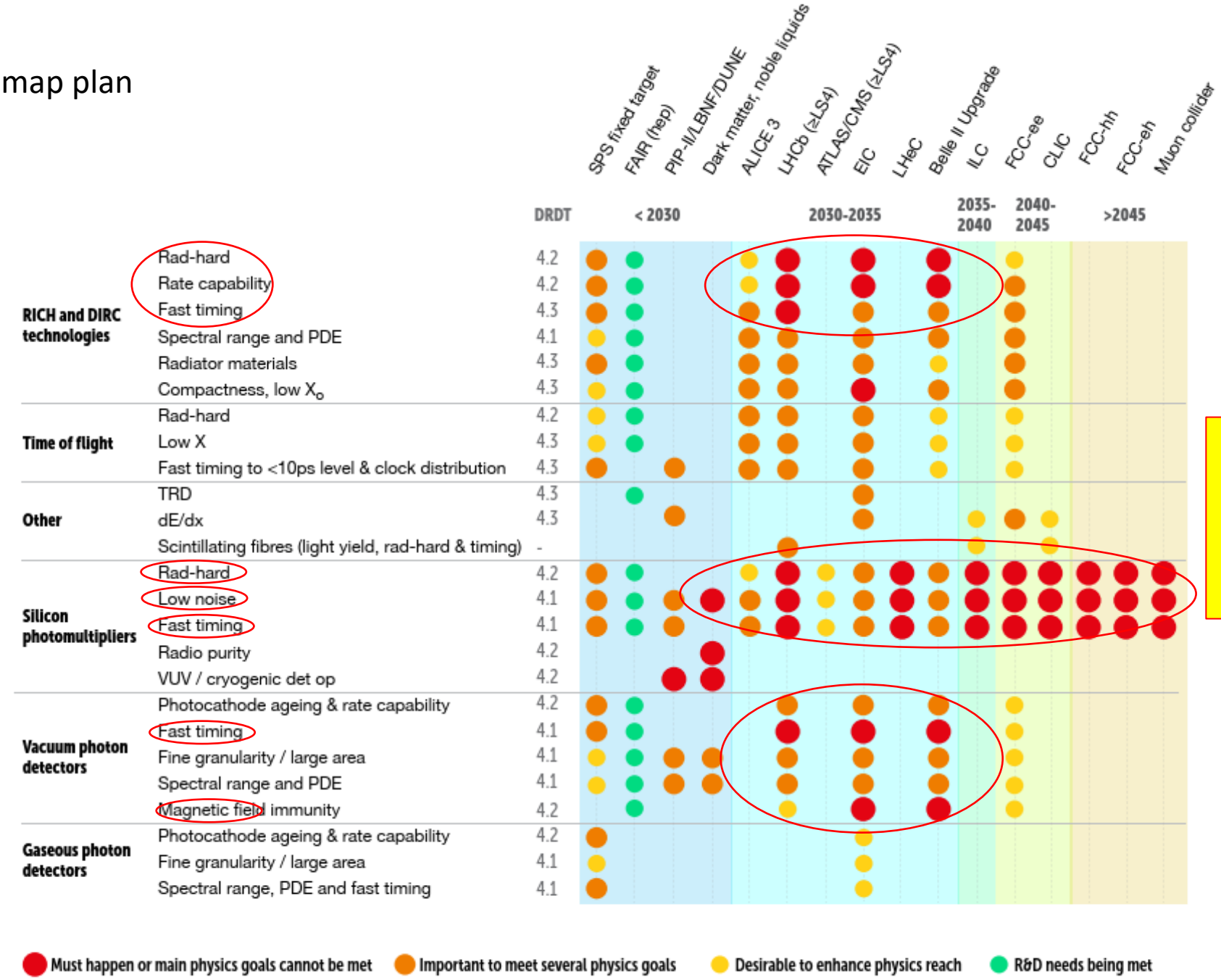
Back-up slides

Current Roadmap plan

ECFA bible p. 89

PID - Technologies

Photodetector Technologies



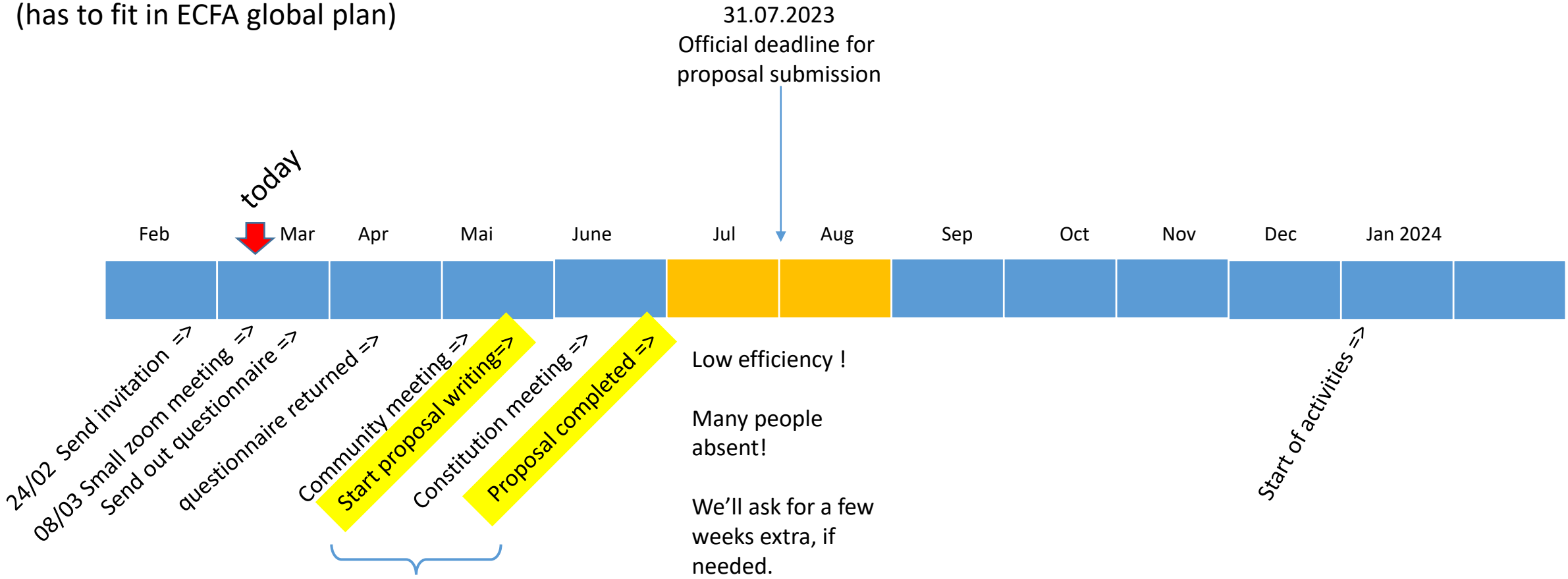
Not covered in this table:

- Specific FE electronics
- Simulation and Analysis-software

… should be discussed!

DRD4 tentative timeline

(has to fit in ECFA global plan)



6 weeks!

20 pages expected.

'Bible' helps, but we have to find groups that commit to do the work.