



RD50 online Workshop – 21-23.06.2021



Welcome to the 38th RD50 Workshop

**Radiation hard semiconductor devices
for very high luminosity colliders**

CERN (online) 21-23.06.2021

The RD50 Collaboration

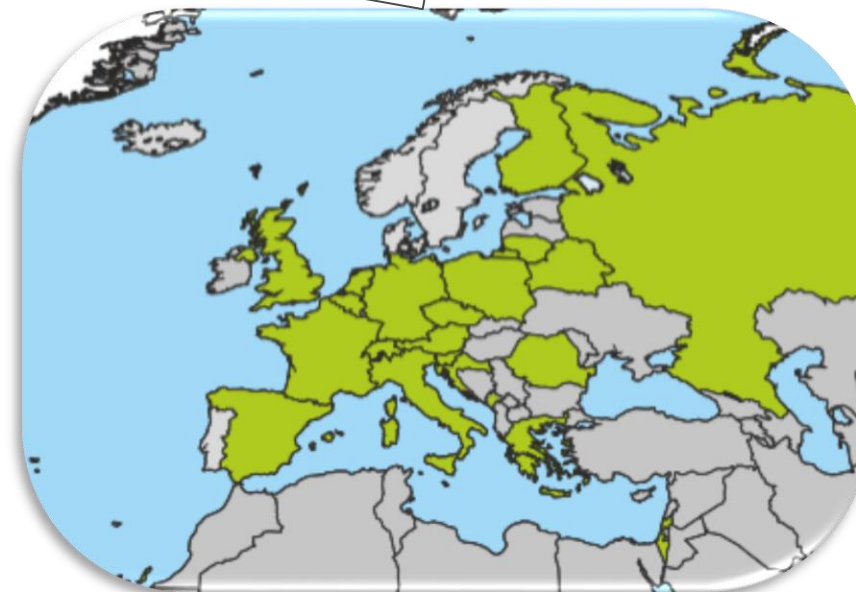
last changes in June 2020;
Jilin joining



• RD50: 64 institutes and 410 members

51 European institutes

Austria (HEPHY), **Belarus** (Minsk), **Czech Republic** (Prague (3x)), **Finland** (Helsinki, Lappeenranta), **France** (Marseille, Paris, Orsay), **Germany** (Bonn, Dortmund, Freiburg, Göttingen, Hamburg (Uni & DESY), Karlsruhe, Munich (MPI & MPG HLL)), **Greece** (Demokritos), **Italy** (Bari, Perugia, Pisa, Trento, Torino), **Croatia** (Zagreb), **Lithuania** (Vilnius), **Montenegro** (Montenegro), **Netherlands** (NIKHEF), **Poland** (Krakow), **Romania** (Bucharest), **Russia** (Moscow, St.Petersburg), **Slovenia** (Ljubljana), **Spain** (Barcelona(3x), Santander, Sevilla (2x), Valencia), **Switzerland** (CERN, PSI, Zurich), **United Kingdom** (Birmingham, Glasgow, Lancaster, Liverpool, Oxford, Manchester, RAL)



8 North-American institutes

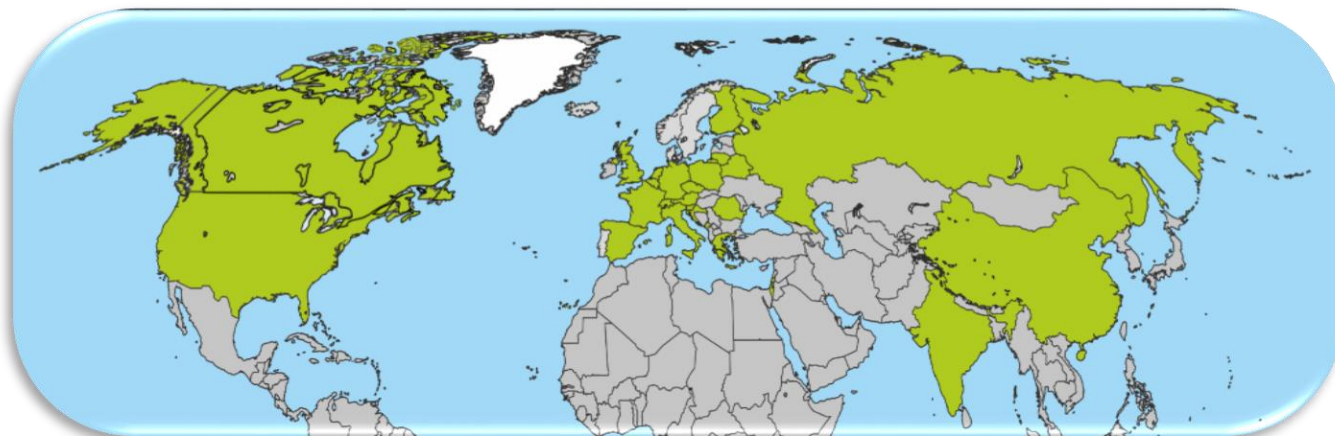
Canada (Ottawa), **USA** (BNL, Brown Uni, Fermilab, LBNL, New Mexico, Santa Cruz, Syracuse)

1 Middle East institute

Israel (Tel Aviv)

4 Asian institutes

China (Beijing-IHEP, Hefei, Jilin), **India** (Delhi)



Full member list: www.cern.ch/rd50

Organizational Structure / Work Program



Covering all fields of semiconductor detectors exposed to radiation

Co-Spokespersons
Gianluigi Casse and *Michael Moll*
 (Liverpool University, UK & FBK-CMM, Trento, Italy) (CERN EP-DT)

Targeting new detector technologies including high precision 4D detectors

Defect / Material Characterization
Ioana Pintilie
 (NIMP Bucharest)

- Characterization of microscopic properties of standard-, defect engineered and new materials; pre- and post- irradiation
- DLTS, TSC,
- SIMS, SR, ...
- NIEL (calculations)
- Cluster and point defects
- Boron related defects
- SiC/GaN based detectors

Detector Characterization
Eckhart Fretwurst
 (Hamburg University)

- Characterization of test structures (IV, CV, CCE, TCT,..)
- Development and testing of defect engineered devices
- EPI, MCZ and other materials
- NIEL (experimental)
- Device modeling
- Operational conditions
- Common irradiations
- Very high radiation fluences
- Wafer procurement (M.Moll)
- Acceptor removal (Kramberger)
- TCAD modeling (J.Schwandt)

New Structures
Giulio Pellegrini
 (CNM Barcelona)

- 3D detectors
- Thin detectors
- Cost effective solutions
- Other new structures
- Detectors with internal gain
- LGAD:Low Gain Avalanche Det.
- Deep Depleted Avalanche Det.
- Slim Edges
- HVCMOS
- LGAD (S.Hidalgo)
- HVCMOS (E. Vilella)

Full Detector Systems
Gregor Kramberger
 (Ljubljana University)

- LHC-like tests
- Links to HEP (LHC P2, FCC)
- Links electronics R&D
- Low rho strips
- Sensor readout (Caribou,Alibava)
- Comparison:
 - pad-mini-full detectors
 - different producers
- Radiation Damage in HEP detectors
- Timing detectors
- Test beams (M.Bomben & G.Casse)

RD50 work program and key achievements documented in a 5yrs work plan 2018-23 (70 milestones)

[LHCC-SR-007]

Collaboration Board Chair & Deputy: G.Kramberger (Ljubljana) & J.Vaitkus (Vilnius), Conference committee: U.Parzefall (Freiburg)
 CERN contact: M.Moll (EP-DT), Secretary: V.Wedlake (EP-DT), Budget holder: M.Moll & M.Glaser (EP-DT) , EXSO: R.Costanzi (EP-DT)

RD50 – 5 Year Work Plan



- **5 year work program submitted in May 2018**
 - Approved by CERN Research Board in June 2018
- **Workplan [70 milestones]**
 - **Defect and Material Characterization [16 MS]**
 - p-type silicon [7 MS]
 - Cluster defects [4 MS]
 - Theory of defects [5 MS]
 - **Device Characterization & Device Simulation [21MS]**
 - Silicon materials [5 MS]
 - Extreme fluences [5 MS]
 - Experimental techniques [3 MS]
 - Surface damage [1 MS]
 - TCAD simulations [7 MS]
 - **New structures [21 MS]**
 - 3D sensors [6 MS] ; LGAD [4 MS]
 - CMOS [6 MS] ; New Materials [5 MS]
 - **Full Detector Systems [12 MS]**
 - LHC [7 MS]; HL-LHC [3 MS]
 - FCC [2 MS]



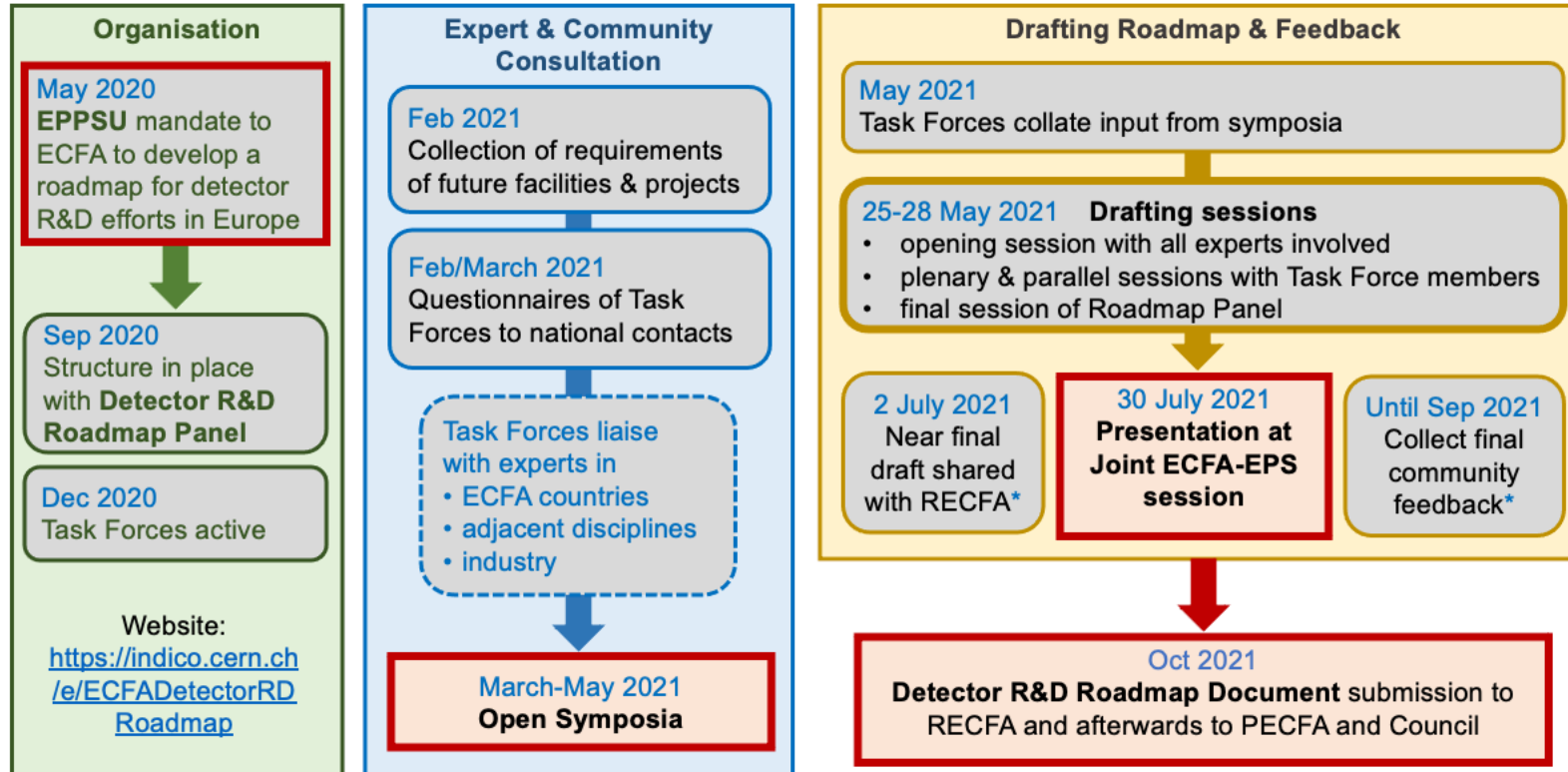
<https://cds.cern.ch/record/2320882/files/LHCC-SR-007.pdf>

...starting to think about an update in-line with European Strategy update..

European Strategy on Particle Physics



ECFA Detector R&D Roadmap Process



*community feedback via RECFA delegates and National Contacts

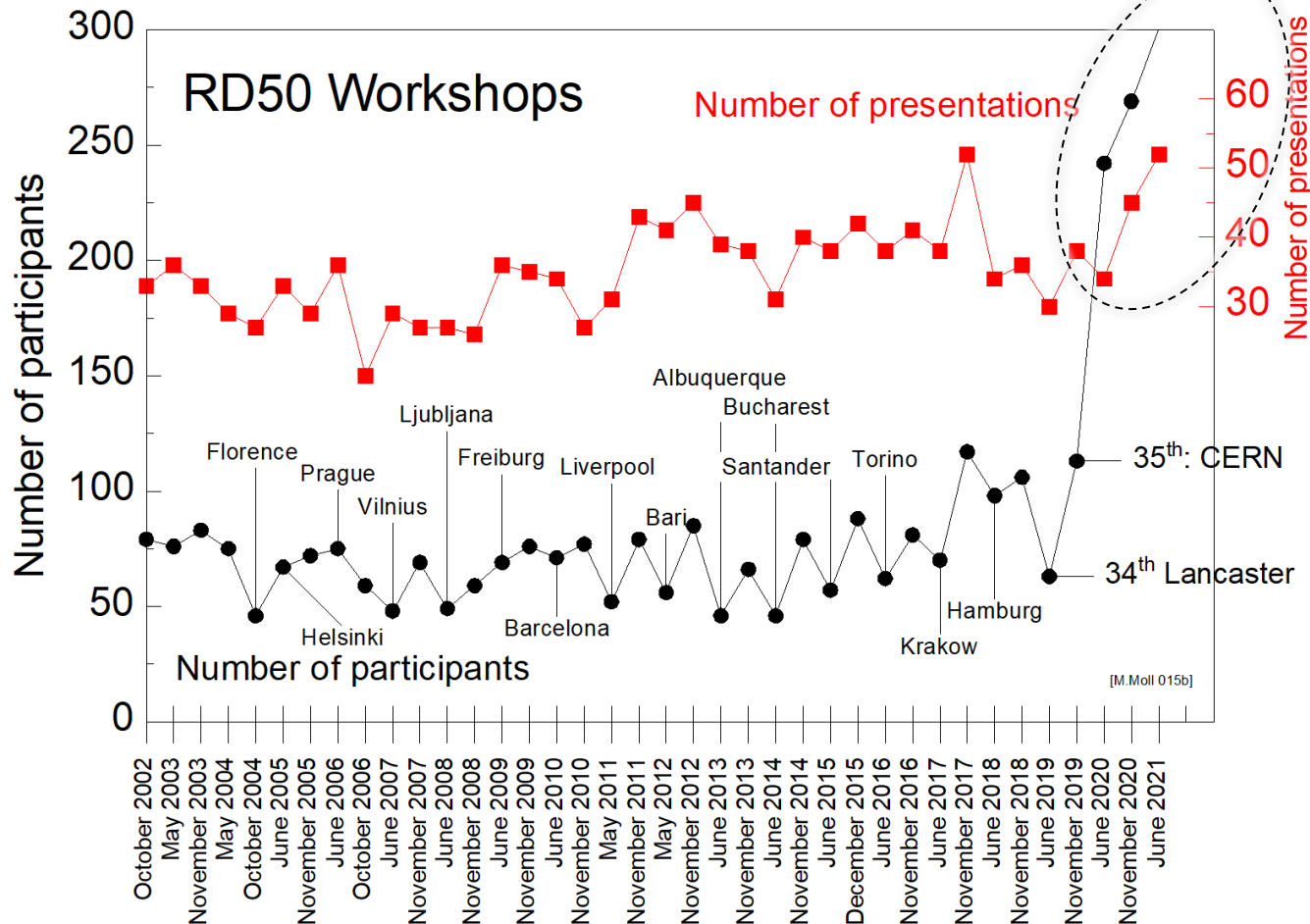
- ECFA Detector R&D Roadmap Symposium of Task Force 3 Solid State Detectors
 - 23.4.2021 - <https://indico.cern.ch/event/999816/>

RD50 Workshop statistics



- RD50 holds every year two RD50 workshops
 - Average numbers for RD50 Workshops: <35 talks> <85 participants>

Online workshops



- June 2021:
 - 38th RD50 Workshop
 - “third online workshop”
- Online Workshop:
 - Very high number of participants (> 216 participants → >50% of collaboration); 51 talks + 6 discussions
- Online workshops since June 2020:
 - higher number of participants
 - fruitful discussions in discussion sessions are possible
 - However, we miss the social contact & ‘coffee meetings’
 - We learned for the future:
- Future workshops to be tailored as well for online participation, online discussions and online presentations.
- November 2021
 - Workshop in Valencia (week 15-19 November)

Program: 38th Workshop



• Monday 21.06.2021

- Defect, Material and Sensor Characterization (9 talks + discussion)
- SiC, Ultrahigh fluences, Detector Characterization, Passive CMOS (7 talks + discussion)
- **18:00 Collaboration Board (closed session)**

• Tuesday 22.06.2021

- LGAD – Low Gain Avalanche Detectors (17 talks + discussion)

• Wednesday 23.06.2021

- 3D sensors (3 talks)
- Sensor characterization with TCT and IBIC (5 talks + discussion)
- Studies on LGAD mortality (3 talks + discussion)
- CMOS sensors and readout electronics (7 talks + discussion)

51 talks
&
6 discussion
sessions



...many thanks to

- the session chairs and discussion session leaders,*
- ... all speakers*

- the local organization team*

... Esteban, Anja

- ... and on behalf of all RD50*

.. to Veronique Wedlake for doing such a great job as RD50 secretary!

.. to Maurice Glaser for helping to handle the RD50 finances

while enjoying his retirement in Brazil!

**Next RD50 Workshop
in person in Valencia.
3 days in week 15-19 November 21
Stay healthy and in good mood!**

Enjoy the Workshop!

