LDG-ECFA DETECTOR R&D INFRASTRUCTURE

Panel for the LDG and ECFA infrastructure

Co-chairs

- Marko Mikuz (ECFA, Slovenia)
- Stan Bentvelsen (LDG, ECFA, the Netherlands)

LDG Members:

- J. Mnich (CERN)
- One other representative

ECFA members:

- Rep. from BMBF/Universities Germany
- Rep. from IN2P3/Universities France
- Rep. from Italy INFN
- Rep. from UK universities
- Rep. from smaller countries

Ex officio

- Dave Newbold, LDG
- Karl Jakobs, ECFA
- Phil Allport, Detector roadmap

ECFA-LDG-Infra-Panel@cern.ch

Marko Mikuz	Co-chair Ljubljana
Stan Bentvelsen	Co-chair Nikhef
Karl Jakobs	Ex-officio - ECFA
Dave Newbold	Ex-officio - LDG
Phil Allport	Ex-officio - DRD
Joachim Mnich	LDG - CERN
Achille Stocchi	LDG - IJCLab - Paris
Ingrid Gregor	Germany
Mogens Dam	Denmark
Carlos Lacasta	Spain
Nadia Pastrone	Italy
Laurent Serin	France
Iacopo Vivarelli	UK
Jiri Kroll	Czech Republic
Rosemarie Aben	Nikhef



DETECTOR RESEARCH AND DEVELOPMENT THEMES

Detector R&D themes (DRDT)

- 1. Gaseous
- 2. Liquid
- 3. Solid state
- 4. PID and photon
- 5. Quantum
- 6. Calorimetry
- 7. Electronics
- 8. Integration

The DRDs are taking shape See the presentation of Phil

Each DRDT has a target date assigned for completion of the R&D. This date is set as required by the latest known future facility/experiment for which an R&D programme would still be needed in that area.

Plus two training DCT's

- programme for training in instrumentation
- DCT2: Develop a master's degree programme in instrumentation

2030-2035-2040-< 2030 > 2045 2040 2045 2035

This includes anticipation for experiment-specific prototyping, procurement, construction, installation and commissioning. Earlier milestones represent the time-frame of intermediate "stepping stone" projects where dates for the corresponding facilities/experiments are known.

DCT1: Establish and maintain a European coordinated





LDG-ECFA DETECTOR R&D INFRASTRUCTURE

expertise that DR&D activities need

- R&D infrastructure that are needed by the DRD themes Involvement of the Large National Labs as indicated by (some of the) GSRs

- In our view this "nexus process" requires several stages 1. Create an inventory of available resources & expertises at labs 2. Monitor requests of DRD themes, match-making with labs 3. Develop (federated) organisation between labs (incl. CERN) with the aim
 - to optimise R&D resources needs

Set-up further European cooperation between CERN and the Large National Labs, with universities and smaller labs, to list and coordinate facilities and



PRELIMINARY RESULTS SURVEY

Survey to the coordinators of the DRD themes have been send-out

- Responses received so far
 - DRD1 Gaseous
 - DRD3 Solid State
 - DRD4 PID and photon
 - DRD5 Quantum
 - DRD7 Electronics

Survey to the (national) labs is pending

- Survey is ready to send around
- - Propose to take care after summer



Yorgos	Tsipo	litis

Michael Moll

Christian Joram

Michael Doser

Francois VASEY

• Still missing DRD2 (Liquid), DRD6 (Calorimetry) and DRD8 (Integration)

Need proper introduction to the labs - we need more commitment from CERN



SOME RESULTS OF THE SURVEY

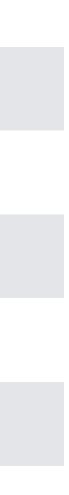
Which testbeams do you plan to use?

		Other
DRD1	SPS, PS, DESY,PSI	DESY II, GSI, Fermilab, Frascati, Bonn Critical pe
DRD3	SPS, PS, DESY,PSI	Further facilities mentioned in the DRD3 meeting (IPHC), Micro
DRD4	SPS, PS, DESY,PSI	BTF, DAFNE
DRD5	SPS, PS	Infrastructures of most of the participating coun
DRD7	None	No

period is expected during CERN LS3, DESY (2026-27), Fermilab (2026-28) shutdown.

ng, but do not represent a complete list. MAMI (Mainz), ELSA (Bonn), Frascati, COSY, CYRCE

intries (Europe, US, India, Japan, ...) will most likely be used for at least one WP.



INFRASTRUCTURE

What of the following infrastructure is needed ?

	Trigger system	Tracking telescope	Calorimeter	Fast timing reference detector	Reconstruction software	Particle ID
DRD1	Yes	Yes	No	Yes	Yes	Yes
DRD3	Yes	Yes	No	Yes	Yes	Yes
DRD4	Yes	Yes	No	Yes	No	Yes
DRD5	Yes	Yes	No	Yes	No	Νο
DRD7	No	No	No	No	No	No

Is any other infrastructure needed?

Support for test beams and infrastructure plays a crucial role in the success of DRD1. Currently, within RD51, support and shared infrastructures have been established and maintained by the collaboration, albeit with limited resources. If, in the context of the ECFA Detector Roadmap implementation, these resources can be integrated with external resources or initiatives, it would have a significant impact on the strategic research activities of the DRD1 groups.

(Large) remotely controlled position stages allowing for precise positioning and rotation an xyz movements Patch panels between beam zone and control rooms (BNC, SHV, RJ45, optical fiber); low jitter clock distribution systems.

not foreseeable

many different types of novel materials to be tested: impossible to provide a list now

I entered "no" test beam infrastructure need, since I expect this need to be specified by the detector-related DRDs, not by the more generic DRD7 group.

IRRADIATION FACILITIES Which irradiation facilities are you needing?

	CERN IRRAD	CERN GIF++	JSI TRIGA Reactor	IFJ PAN AIC-144	UV Louvain CRC	UoB MC40 Cyclotron
DRD1	Yes	Yes	Yes	Yes	Yes	Yes
DRD3	Yes	Yes	Yes	Yes	Yes	Yes
DRD4	Yes	Νο	Yes	No	No	No
DRD5	Yes	Yes	No	No	No	No
DRD7	Yes	Yes	Yes	No	Yes	Yes

What else is missing or would be nice to have ?

Access to detector laboratories, clean rooms, and mechanical workshops nearby the test facilities when possible (this applies to test beams as well).

A variety of heavy ions with different LET for SEE testing; storage in a cold refrigerator and material shipping service; stages allowing to perform uniform irradiation (with small beam) or allowing to move equipment out of the beam for testing; Irradiation facilities have to be operated, maintained by an expert team with expertise in dosimetry

standardised readout system

presumably, some active detectors will be involved in the characterization of devices (producing light, electronic signals). Some of these will require a cryogenic environment, room for mu-metal shielding, device-specific electronics.

Co60 irradiation facilities with large dose-rate to reach GRads in reasonable time.

Other...

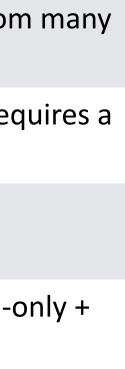
CERN CHARM, SFTC/RAL ISIS/NILE, ERIC, Demokritos, LNL ... Different requirements from many users for long irradiation to a few users for limited time

Radiation testing for the complex radiation fields in high energy physics experiments requires a wide range of facilities to test for individual parti

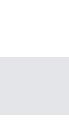
No

as for test beam, worldwide infrastructure might be useful, although most likely, CERN-only + neutron irradiation could suffise

PSI, CERN-CC60







CENTRALISED INFRASTRUCTURES

Is there any need for centrally accessible infrastructures such as Detector Characterisation Laboratory?

DRD1	DRD1 is organizing a detector laboratories network (see Draft Extended DRD1 limited ones of the collaboration, would allow increasing the impact in the correcovering infrastructures released by closed projects. Support from LDG-ECFA
DRD3	Some centralized community laboratories, best in connection with test beam a minimum cold IV/CV bench test should be available. It might be interesting to and TID lab testing facilities. Material characterization facilities are also of high
DRD4	no, infrastructure available in DRD4
DRD5	would be helpful for comparative studies of new materials, but those will prob
DRD7	High end facilities for testing state of the art electronics are available in a few lequipment will only be affordable if the entire community sets up a shared certain the equipment concerned is high end probe stations for 30cm wafers, sub-um timing instrumentation with ps resolution etc.

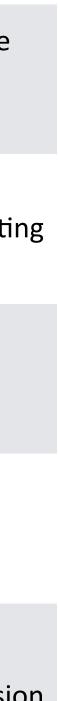
1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.7.1). Resources, in addition to the ommunity of such a network. The collaboration will moreover investigate the possibility of ⁻A in this could have a positive impact.

and/or irradiation facilities are needed, this holds especially for CERN. In these facilities at b have a centrally accessible TPA laser and a TDR (Time Domain Reflectometer), but also EMC testing gh demand (SIMS, FIB,...) and would be very useful to have accessible w

bably require too device-specific infrastructure for a generic lab to be able to cover all needs

/ labs today. However, as technology will become more sophisticated, it is likely that future test entral laboratory.

m precision die placement tools, high speed scopes for 25GHz bandwidths and above, high precision



CENTRALISED FACILITIES

Manufacturing and Production Workshop?

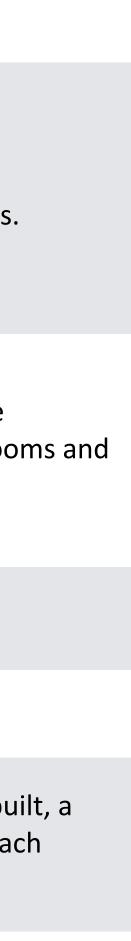
Assembly facilities?

DRD1 is organizing common production facilities for the various covered technologies (see Draft Extended DRD1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.6.1) following the experience in RD51 with the CERN EP-DT Micro Pattern Technology (MPT) Workshop. Centralised resources in addition to the limited one of the collaboration, would allow to secure their support to strategic R&D activities.	DRD1 is organizing ass technologies. Resource collaboration, would a community.
not really clear what is meant by this ; common mechanics should be provided at institute level; access to mechanics facilities at test beam/irradiation facilities for repair/ modification is needed.	access to wirebonding facilities for repair/mo facilities with expert w common in-house inte gluing; visual inspect be establish within the
infrastructure available in DRD4	infrastructure available
possibly, although probably not	no



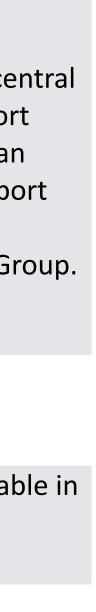
Clean Rooms: Which clean room classes ?

sembly facilities for the various covered tes in addition to the limited one of the allow increasing the impact in the	ISO 6 is the preferred solution in most of cases and in particular for MPGD, ISO 7 is acceptable in some cases.
g/interconnect facilities at test beam odification ; access to wire bonding vire bonders is generally of interest; erconnect techniques; bump-bonding, tion infrastructure; These facilities should e collaborative network of institutes	most probably no centralized clean room needed; the collaboration will have several institutes with clean room could internally try to organize access, if needed.
e in DRD4	infrastructure available in DRD4
	if a central electronics characterization laboratory is bui clean room should host the wafer probing and die attac stations



WORKSHOPS

	Mechanical workshops beyond normal standards?	Electronics Workshop beyond normal standards?	Analysis Laboratory?	Metrology Laboratory?
DRD1	Very important and essential, in particular for what concerns precision mechanics (um) on large areas (m2).	Very important and essential, in particular for PCB design, assembly and fast prototype production (covering high performances FE, protection circuits, HV powering and high- resolution monitoring units - see Draft Extended DRD1 Proposal https:// cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.5).	Despite being covered by the DRD1 proposal (see Draft Extended DRD1 Proposal https:// cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.3.3 and 4.3 more generally), a common and centralized strategy to support access to a diversified set of Analysis laboratories will be very beneficial for DRD1, in particular for ageing studies and detector long-term operation.	It will benefit if a general and cent strategy will be set up to support these laboratories at a European level. As RD51, important support from CERN EN Mechanical and Materials Engineering (MME) Gro
DRD3	Some vibration testing might be needed for more complex objects (within collaboration)	No	No, but see comments above for material characterization	No
DRD4	infrastructure available in DRD4 (incl. CERN)	infrastructure available in DRD4, count on support by DRD7	equipment and expertise available in DRD4 and at CERN is normally sufficient	equipment and expertise available DRD4 and at CERN is normally sufficient
DRD5		cryogenic electronics are expected to be one a	area of study (at 4K)	
DRD7				



SOFTWARE

support the work?

Matrix of multiple choices , answers 5 x, unanswered 0 x

Answer

Maintained software:

New software packages:

41 Simulation software & support? (Monte Carlo)

Matrix of multiple choices, answers 5 x, unanswered 0 x

Answer

Maintained software:

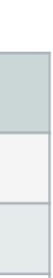
New software packages:

11

40 Is your DRD community needing any specific software/licences/license sharing to

• yes	• no	e do not know	probably
4 (80.0%)	0	0	1 (20.0%)
3 (60.0%)	0	1 (20.0%)	1 (20.0%)

🔍 yes	• no	e do not know	probably
3 (60.0%)	0	1 (20.0%)	1 (20.0%)
2 (40.0%)	0	2 (40.0%)	1 (20.0%)





REMARKS

- Not only at CERN but in many places
- Coordination seems very much appreciated

We plan to complete and analyse the surveys

- Involve all DRDs
- Submit the survey to the labs

This provides valuable input for the DRD collaborations & committee

Responses of DRD's clearly show the need for facilities and infrastructures

