# DRD-LDG-ECFA-survey

# General

| | |
|---|---|
| Survey name | DRD-LDG-ECFA-survey |
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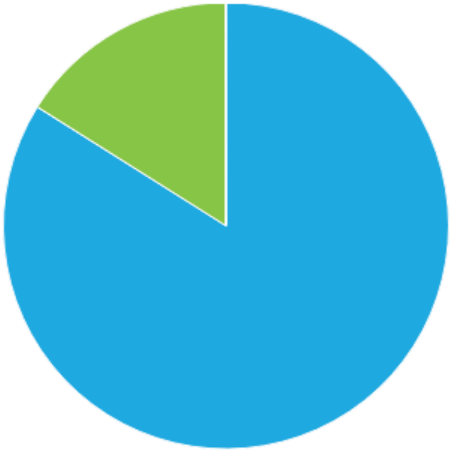
## Total Hits



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- Unfinished (0 %)

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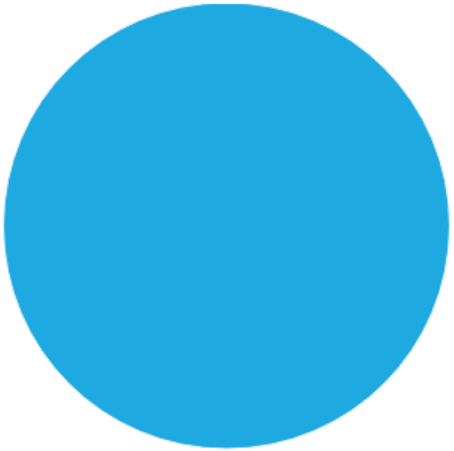
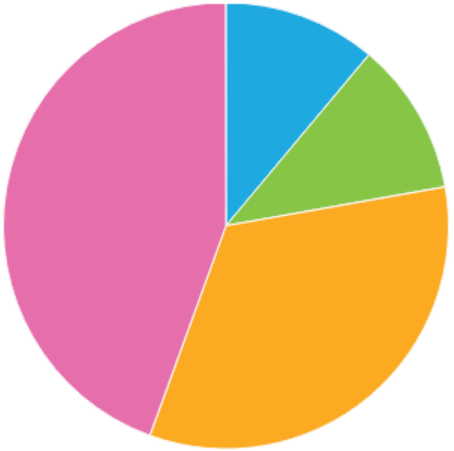


- Direct link (100 %)

## Average Time of Completion



- 5-10 min. (11.1 %)
- 10-30 min. (11.1 %)
- 30-60 min. (33.3 %)
- >60 min. (44.4 %)

## Name of person filling in the questionnaire

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Francois VASEY |
| Gabriella Gaudio, Roberto Ferrari, Roman Pöschl on behalf of DRD Calo Proposal Team |
| Christian Joram, for DRD 4 |
| Michael Doser |
| Michael Moll on behalf of DRD3 proponents (The questionnaire was distributed to all DRD3 institute contacts and a community meeting was held on 5.7.2023 to ask for feedback) |
| Roxanne Guenette |
| Yorgos Tsipolitis |

## Email of person filling in questionnaire

*Text answer, answers 7x, unanswered 2x*

| |
|---|
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| Roxanne.guenette@manchester.ac.uk |
| Yorgos.Tsipolitis@cern.ch |

## Identify the DRD TF

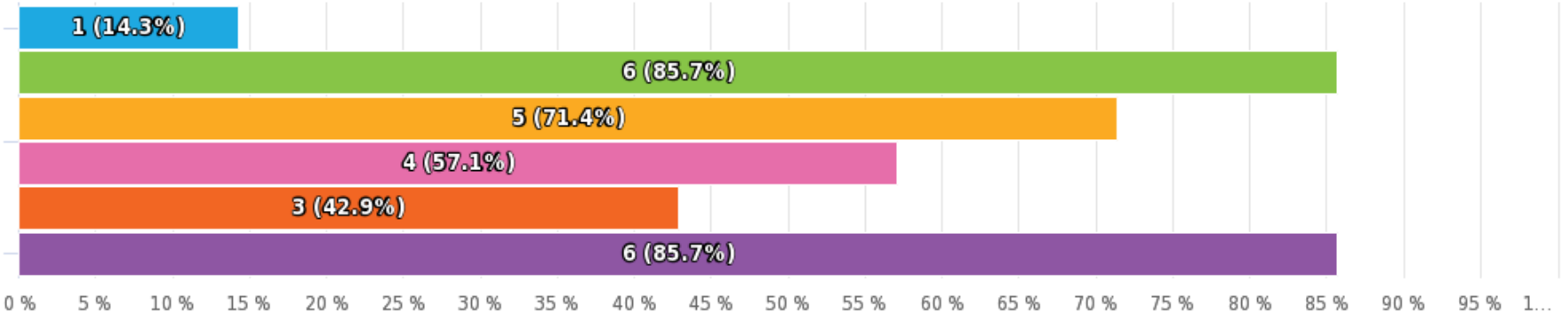
*Text answer, answers 7x, unanswered 2x*

| |
|---|
| DRD Calo |
| DRD1 |
| DRD2 |
| DRD3 - Solid State Detectors |
| DRD7 |
| 4 |
| 5 |

## Which test beam facilities you plan to use?

*Multiple choice, answers 7x, unanswered 2x*

| Answer Choices | Responses | Ratio |
|---|---|---|
| None | 1 | 14.29% |
| CERN SPS | 6 | 85.71% |
| CERN PS | 5 | 71.43% |
| DESY | 4 | 57.14% |
| PSI | 3 | 42.86% |
| Other... | 6 | 85.71% |



## What is the preferred particle type and energy for the test beam studies:

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Electron, pions, kaons, protons, muons 1-400 GeV |
| charged hadrons (pions, protons) of few tens to hundreds of GeV, e.g. pions at high energy (> 60 GeV/C) to minimise multiple scattering, muons 20-120 GeV, electrons 5 GeV |
| Muons, pions, and electrons, ranging from GeV/c up to hundreds of GeV/c.  Mixed hadron beam: pion, proton, (kaon) < 3 GeV/c |
| Neutrinos (low energy: <50MeV), electrons (1keV to 1 GeV), neutrons (1keV to 100MeV) |
| pions, protons |
| Radiation damage, scintillation light yield, electronics signals are all important aspects, so mip's, neutrons or gammas will be most interesting. Some sensors might in addition lead to high resolution tracking, for which SPS energies would be more appropriate. |

## What is the preferred particle rate for the test beam studies

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| few kHz |
| kHz - MHz |
| Radiation damage studies: as high as reasonably possible ;)<br>Other studies: those are proof-of-principle studies with novel materials, so continuous access is more important than high rate. |
| TBD (highly dependent on tests/studies) but usually not high-rate as radiation damage tests. |
| Up to a few MHz/cm2 |
| would be nice to have high rates up to 100 MHz/cm2 in EUROPE as well in an area over a few cm2; a wide range of rates, depending on the experiment requirements, should be available; the usual few kHz/cm2 with typical trigger rate for DAQ of 1 kHz is generally o.k., but it would be very nice to have an infrastructure to cover up to few hundreds of MHz/cm2 for high occupancy/trigger rate tests too. |

## Estimate roughly how much beam-time per year is needed in each of the coming few years and then beyond:

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| As baseline, DRD1 aims to continue with the common RD51 TB setup at CERN/SPS requiring 3 periods of 2 weeks each (H4/PPE134, ex-RD51 semi-permanent).<br>DRD1 groups will in addition access CERN and other facilities independently via running experiments or projects. This will sum up with a larger request of beam time that is hard to quantify in a short time.<br>DRD1 will explore the possibility of having other TB campaigns outside CERN, based on the availability of DRD1 local teams. |
| Continuous access is more relevant; a dedicated test station (e.g. in PS and in SPS) with regular access to beam is probably more helpful than concentrated beam-time |
| Difficult to answer as >105 Institutes are participating in DRD3<br>A cumulated beam time of > 1 year is expected |
| expect a more or less constant need. 6-8 weeks per year. |
| Small runs of 1-2 weeks at the time. Probably 1-2 runs per year across different efforts. |
| 3 months/year |

## Is any special beam structure needed ?

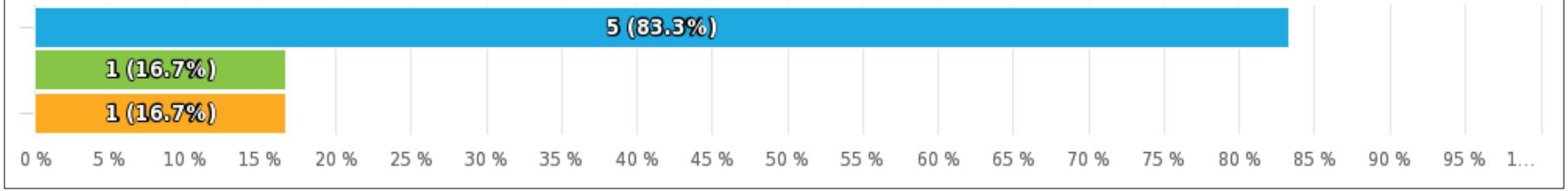
*Text answer, answers 7x, unanswered 2x*

| |
|---|
| An LHC like bunched beam would be nice to have, provided the rate per second is maintained, i.e. with high peak intensity |
| At this moment no, but need may evolve. |
| In general, there are no strong or relevant requests on the beam structure. For some specific test (connected to timing), bunched beams with short bunch length (<ns) instead of continuous beams could be beneficial. |
| no |
| Not know at this point |
| Some runs with LHC structure |

## Do you need a magnet in the test beam?

*Multiple choice, answers 6x, unanswered 3x*

| Answer Choices | Responses | Ratio |
|---|---|---|
| Yes | 5 | 83.33% |
| No | 1 | 16.67% |
| Do not know | 1 | 16.67% |



## What would be the preferred magnetic field ?

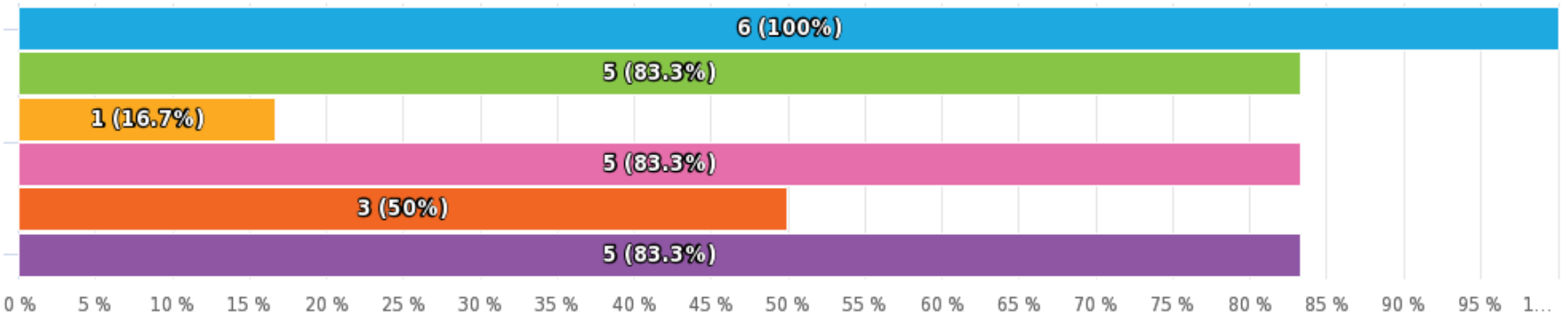
*Text answer, answers 7x, unanswered 2x*

| |
|---|
| n.a. |
| TBD |
| Tesla magnets with a large opening for large area detectors are preferred. The Goliath magnet in the H4 line of the SPS covers the majority of the user needs (1.5T and large opening). In some cases, a beam parallel to the magnetic field would be useful (a configuration that is not possible with Goliath). |
| tests may be of novel magnetic materials, of of the sensitivity of signals to magnetic fields; for detector-relevant applications, testing in field strengths compatible with those of existing or future detectors (several T) would be useful |
| 1.5 T, like available at DESY is a good example |
| 2-3 T |

## What of the following infrastructure is needed ?

*Multiple choice, answers 6x, unanswered 3x*

| Answer Choices | Responses | Ratio |
|---|---|---|
| Trigger system | 6 | 100% |
| Tracking telescope | 5 | 83.33% |
| Calorimeter | 1 | 16.67% |
| Fast timing reference detector | 5 | 83.33% |
| Reconstruction software | 3 | 50% |
| Particle ID | 5 | 83.33% |



## What resources to handle low/ultra-low temperature is needed?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| At a later stage SiPM at low temperature will be tested. Cooling equipment will be provided. |
| Cryogenics for LAr and LXe (~80K) |
| lHe supply at minimum; cryostats would be crucial; dilution refrigerators a dream. additionally, sufficient space for (large) dewars next to the test setups |
| No particular need but we will bring Liquid Noble prototypes to beam and have a minor contribution from cryogenic calorimeters |
| Not relevant as of today |
| No, we need mostly only cooling down to about -40 °C with cold boxes, dry atmosphere and chillers. Power at -40C should be sufficient to remove 10Watt. Temperature must remain stable of the time of experiment. Chiller, dry ice and nitrogen should be available to allow for custom cooling solutions. Cold boxes provided should have a low mass entry window. Slow control should be available for the cooling system and temperature and humidity should be constantly monitored and recorded. |

## Is any other infrastructure needed?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| 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. |
| (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. |
| many different types of novel materials to be tested: impossible to provide a list now |
| Movable tables (including the option to rotate) that can carry up to 10t (a la DESY Table or scissors table in SPS H2), maybe gas systems, |
| not foreseeable |
| 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. |
| TBD |

## Estimate roughly your need for test beams of your DRD per year, for the coming few years and then beyond:

*Text answer, answers 7x, unanswered 2x*

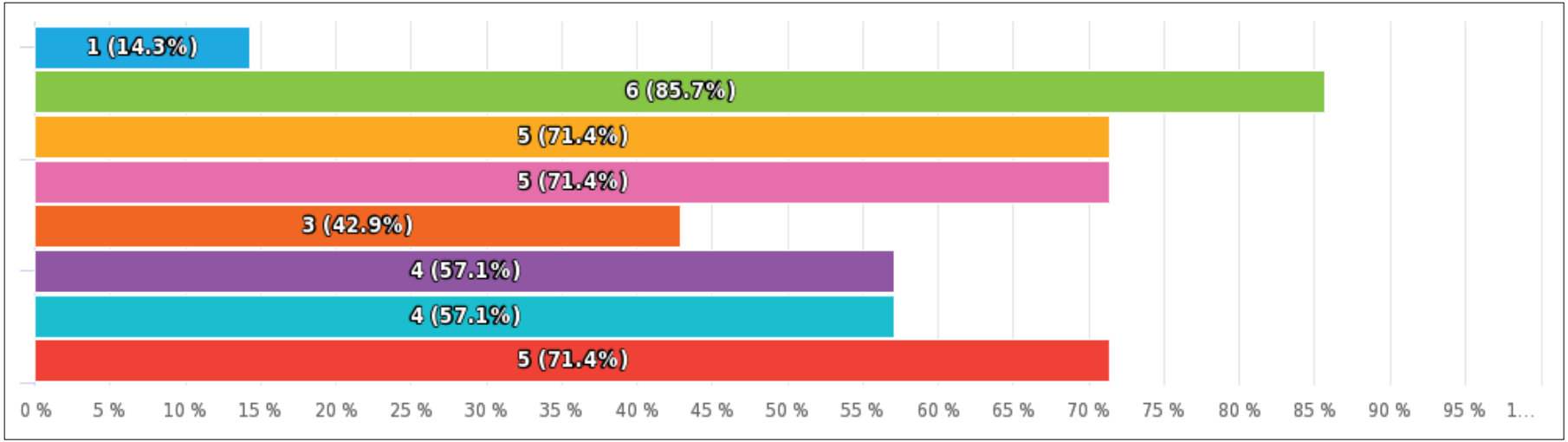
| |
|---|
| Different tests for developing calorimeter concept |
| (..same answer as above) a cumulated beam time of > 1 years per year is expected |
| See the answer to question 7 |
| Small runs of 1-2 weeks at the time. Probably 1-2 runs per year across different efforts. |
| 6 - 8 weeks |

## Which irradiation facilities are you needing? 1/2

*Multiple choice, answers 7x, unanswered 2x*

| Answer Choices | Responses | Ratio |
|---|---|---|
| None | 1 | 14.29% |
| CERN IRRAD | 6 | 85.71% |
| CERN GIF++ | 5 | 71.43% |
| JSI TRIGA Reactor | 5 | 71.43% |
| IFJ PAN AIC-144 | 3 | 42.86% |
| UV Louvain CRC | 4 | 57.14% |
| UoB MC40 Cyclotron | 4 | 57.14% |
| Other... | 5 | 71.43% |

## Which irradiation facilities are you needing? 2/2



## How many irradiations per year do you expect?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| a few |
| DRD1's objective is to establish joint irradiation campaigns at the CERN/ GIF++ (see Draft Extended DRD1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.7.3). Considering that several DRD1 groups access the facility through experiments, our aim is to establish a setup spanning a few square meters that will support measurement needs of DRD1's. The possibility to characterize detectors using SPS beams and gamma sources is significant.The time required will be confirmed every year. |
| N/A |
| We expect in the order of about 100 irradiation experiments per year. |
| 10 - 20 |
| 1-2, number will increase if focus will move again to hadron colliers |
| 6-8 weeks every year |

## What is the range of target flux?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| don't know |
| For most irradiations: no preference, as low as possible to achieve the target fluence (see next question) in a sensible time. However, facilities for dedicated flux (dose rate) testing should be made available. Final numbers are 1 Grad and 10^16 neq/cm2, to be achieved within a usual campaign ( some week time) |
| N/A |
| Up to a few MHz/cm2 |
| 10^12-10^16 neq/cm2 |
| 10^6 - 10^10  cm-2s-1 |

## What is the range of target fluence?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| N/A |
| Needs further evaluation within the DRD |
| Up to a few tens of C/mm2 |
| 1e12 - 1E17  1 MeV neq/cm2  (from defect spectroscopy testing to max FCC-hh damage evaluation); with the possibility to do some limited testing even beyond 1e17 |
| 10^11 - 10^13 neq/cm2 |
| 10^12 - 10^16 cm-2 |

## Is there a need for powering, cooling & read-out during irradiation?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| cooling and temperature monitoring during irradiation is desirable for many irradiation experiments; ideally devices should be operating under close to final conditions during irradiation (if feasible); for in-situ experiments power, controllable cooling and readout infrastructure would be nice to have; this holds especially for chip testing, as they need to be powered during e.g. X-ray irradiations (surface/oxide damage evaluation) |
| N/A |
| no |
| No clear idea at the moment but most likely. |
| probably |
| The setup will require remotely controllable High Voltage (10-15kV, low power), Low Voltage for FE (high power), some NIM/VME crates for signal processing, single and multichannel DAQ readout, monitoring units (environmental parameter). |
| YES, cooling and online monitoring |

## What else is missing or would be nice to have ?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| 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 |
| Co60 irradiation facilities with large dose-rate to reach GRads in reasonable time. |
| Don't know at this point, needs further evaluation also in view of a potential dedicated calorimeter beamline. |
| N/A |
| 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. |
| standardised readout system |

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

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, needs further evaluation also in view of a potential dedicated calorimeter beamline. |
| DRD1 is organizing a detector laboratories network (see Draft Extended DRD1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.7.1). Resources, in addition to the limited ones of the collaboration, would allow increasing the impact in the community of such a network. The collaboration will moreover investigate the possibility of recovering infrastructures released by closed projects. Support from LDG-ECFA in this could have a positive impact. |
| High end facilities for testing state of the art electronics are available in a few labs today. However, as technology will become more sophisticated, it is likely that future test equipment will only be affordable if the entire community sets up a shared central laboratory.<br>The equipment concerned is high end probe stations for 30cm wafers, sub-um precision die placement tools, high speed scopes for 25GHz bandwidths and above, high precision timing instrumentation with ps resolution etc. |
| no, infrastructure available in DRD4 |
| Not really. This will be done at University labs. |
| Some centralized community laboratories, best in connection with test beam and/or irradiation facilities are needed, this holds especially for CERN. In these facilities at minimum cold IV/CV bench test should be available. It might be interesting to have a centrally accessible TPA laser and a TDR (Time Domain Reflectometer), but also EMC testing and TID lab testing facilities. Material characterization facilities are also of high demand (SIMS, FIB,…) and would be very useful to have accessible w |
| would be helpful for comparative studies of new materials, but those will probably require too device-specific infrastructure for a generic lab to be able to cover all needs |

## Manufacturing and Production Workshop?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| |
| Don't know at this point, see before. |
| 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. |
| infrastructure available in DRD4 |
| N/A |
| 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. |
| possibly, although probably not |

## Assembly facilities?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| access to wirebonding/interconnect facilities at test beam facilities for repair/modification ; access to wire bonding facilities with expert wire bonders is generally of interest; common in-house interconnect techniques; bump-bonding, gluing…; visual inspection infrastructure; These facilities should be establish within the collaborative network of institutes |
| DRD1 is organizing assembly facilities for the various covered technologies. Resources in addition to the limited one of the collaboration, would allow increasing the impact in the community. |
| infrastructure available in DRD4 |
| N/A |
| no |
| Rigging and hosting to move objects of up to several tons will have to be available. Might be useful to have more dedicated assembly facilities but assessment will be needed. Easy detector alignment. |

## Clean Rooms: Which clean room classes ?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| if a central electronics characterization laboratory is built, a clean room should host the wafer probing and die attach stations |
| infrastructure available in DRD4 |
| ISO 6 is the preferred solution in most of cases and in particular for MPGD, ISO 7 is acceptable in some cases. |
| most probably no centralized clean room needed; the collaboration will have several institutes with clean rooms and could internally try to organize access, if needed. |
| N/A |
| Not really needed but having an ISO 6 may not hurt |

## Radiation background free laboratory – underground facility?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Cryogenic calorimeters for double beta decay may need this |
| No |
| no, infrastructure available in DRD4 |
| possibly - some quantum devices will be exceedingly sensitive, and having access to such facilities could help develop them further |
| Relevant for the DRD1 groups involved in TPCs  for rare events detections |
| Yes, lab spaces in undergrad facilities will be required |

## Gas system design and production?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Development of gas systems (distribution, control and monitoring, for both (non)-flammable gases) and recirculating systems (non-environmentally-friendly gases) is crucial for the DRD1 (see Draft Extended DRD1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.3 and 4.7.5). Currently, most of the main and common developments in this field are carried out by the CERN EP-DT-FS Gas Systems team. Additional support will bring strong benefits to TB, irradiation and detector R&D labs |
| may need special gas systems for studies of environment friendly radiator gases. Gas system will be made available in DRD4 |
| No |
| yes |
| Yes, for gaseous prototypes |

## Mechanical workshops beyond normal standards?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, needs further evaluation also in view of a potential dedicated calorimeter beamline. |
| infrastructure available in DRD4 (incl. CERN) |
| No |
| Some vibration testing might be needed for more complex objects (within collaboration) |
| Very important and essential, in particular for what concerns precision mechanics (um) on large areas (m2). |

## Electronics Workshop beyond normal standards?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| cryogenic electronics are expected to be one area of study (at 4K) |
| Don't know at this point, needs further evaluation also in view of a potential dedicated calorimeter beamline. |
| infrastructure available in DRD4, count on support by DRD7 |
| No |
| 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 ). |

## Analysis Laboratory?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| 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. |
| Don't know at this point, see before. |
| equipment and expertise available in DRD4 and at CERN is normally sufficient |
| No |
| No, but see comments above for material characterization |

## Metrology Laboratory?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, see before. |
| equipment and expertise available in DRD4 and at CERN is normally sufficient |
| It will benefit if a general and central 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) Group. |
| No |

## Radioactive Sources (active, passive)?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, see before. |
| equipment and expertise available in DRD4 and at CERN is normally sufficient |
| Relevant and of interest to the full community. Any action that will facilitate access/dissemination to DRD1 groups will be important. |
| use of radioactive source is useful and desirable but will mostly be handled on the institute level; central facility for high-rate x-ray fluorescent tests would be nice to have |
| Yes, regular sources (AmBe, Na, Ca,...) |

## Generic data acquisition systems?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| A team at one of the big institutes (request to LDG) working and supporting data acquisition system would be much appreciated; a system like Caribou/EUDAQ (to be further developed/conceived within or with the help/contact of the DRD3 collaboration) are an efficient way to create DAQ systems, but require centralized resources for design, development, production, maintenance of the DAQ system; there is rising need for DAQs that can handle picosecond timing resolution and last but not least an int |
| Covered by the DRD1 program but with limited resources (see Draft Extended DRD1 Proposal https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.5.4). External support will increase the impact and the dissemination in the community. In this context, support for firmware and software (control, DAQ and analysis software) is very crucial and any common initiative will be more than welcome. |
| EUDAQ will be our backbone for DAQ. Support will be needed. DRD Calo will also have to provide expertise. |
| FE and DAQ for photodetector testing, from single channel to a few hundreds of channels would be very useful. Part of DRD4's work programme |
| No |

## Cryo-labs?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| definitely. 4K at minimum, ideally dilution refrigerator test beds to go down to the mK range, with optical and electronic access |
| Don't know at this point, see before. |
| equipment and expertise available in DRD4 and at CERN is normally sufficient |
| No |
| NO |
| Yes, needed for liquid argon and liquid xenon (~80K) |

## Anything else?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Apart from the shared electronics characterization laboratory mentioned in (21) and needed for testing the generic DRD7 developments, I assume that the detector-related DRDs will specify their own needs for assembly facilities. I have not mentioned these here to avoid double counting, but it is obvious that electronics needs to be assembled with sensors to be fully tested. |
| Dissemination and sharing of custom instrumentation, sensors, monitoring units (power supplies, gas, environmental parameters) and logging systems could be beneficial for several groups to improve the quality and completeness of the performed studies |
| Don't know at this point, see before. |
| No |
| Optical lab for study of mirrors, lenses, etc. available at CERN, must be maintained and upgraded |
| • Stress the importance of a low-jitter clock distribution network<br>• Laser SEU testing facility (see lab infrastructure below) |

## What kind of support in mechanical construction are you needing ?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, needs further evaluation also in view of a potential dedicated calorimeter beamline. |
| High Precision Mechanics (µm) over large areas (m2). Rigid and stable but lightweight solutions. |
| Light weight mechanics, composite  materials, vessels |
| mostly very simple support (vacuum vessels, cryovessels) but occasionally additive manufacturing, coating, precision machining (micron-level), ... |
| none |
| None |
| No, we use our own workshops;  for test beam and irradiation facilities (as stated above) short notice access to mechanics workshop/help should be provided; access to high-level 3D printing facilities (metals, polymer..) would be appreciated |

## Is the community needing support in FEA?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Access to copyrighted and commonly used FEA software (e.g. COMSOL, ANSYS,…) |
| can't see that being crucial at this point in time |
| Don't know at this point, see before. |
| no |
| No |
| not a high priority issue. Some expertise available in DRD4 and at CERN |
| Potentially |

## Do you need services in firmware design?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Don't know at this point, see before. |
| no |
| Occasionally for sure. some expertise available in DRD4 |
| only if that includes electronics at the 4K stage |
| Potentially |
| Very important in the context of DAQ development (see the answer of question 32). |
| We do not see how this can be implemented in practice (see also commen on commen DAQ) |

## Is there a need for support in special cooling equipment?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| dilution refrigerators |
| No other than mentioned above |
| Well, cooling (CO2 and water) will play a major role during the R&D phase. Not sure whether this falls under special. |
| Would be nice to have a generic detector cooling system at the test facilities; Beyond a support on conventional chillers or other standard cooling techniques and cooling boxes with the corresponding gas service and environmental monitoring, no special equipment is needed. |
| yes, for cryogenic electronics |
| yes, for low temp and cryo (<80 deg.C) |
| NO |

## Anything else

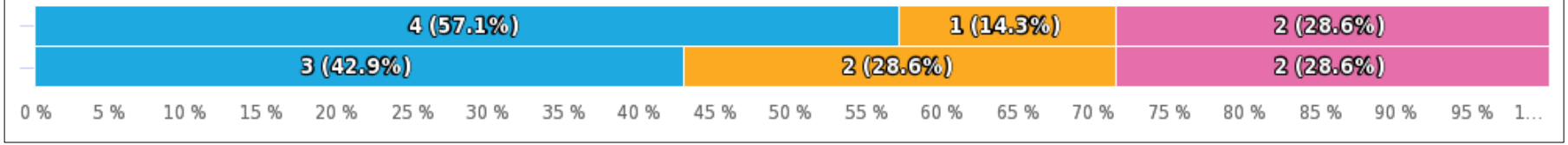
*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Common efforts for modular DAQ systems should be encouraged and resourced |
| generic template designs for test platforms could be useful; what I mean is that given the available infrastructure, novel devices will need to be incorporated into that, and having a library of compatible test platform layouts would be helpful, also wrt interfaces |
| no |
| No |
| No answer at this moment. |
| Workshop and laboratory for photocathode deposition and characterization. |

# Is your DRD community needing any specific software/licences/license sharing to support the work?

*Matrix of multiple choices, answers 7x, unanswered 2x*

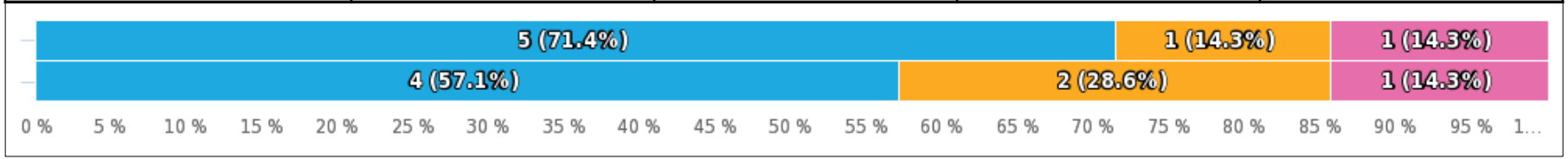
| | yes | no | do not know | probably |
|---|---|---|---|---|
| Maintained software: | 4 | 0 | 1 | 2 |
| New software packages: | 3 | 0 | 2 | 2 |



# Simulation software & support? (Monte Carlo)

*Matrix of multiple choices, answers 7x, unanswered 2x*

| | yes | no | do not know | probably |
|---|---|---|---|---|
| Maintained software: | 5 | 0 | 1 | 1 |
| New software packages: | 4 | 0 | 2 | 1 |



## Any remarks on specific software?

*Text answer, answers 7x, unanswered 2x*

| |
|---|
| Continued developments on GEANT4, NEST, other low-energy and low-background software will be needed. |
| further development of Geant4 towards ultralow energy deposits; COMSOL; agent-based software (for multi-particle interactions) |
| GEANT4 support is of vital interest. |
| Keeping alive the EUROPRACTICE like access to software tools with reasonable license fees is very important (concerning Cadence design suite, Synopsis TCAD, …) The cost outside Europractice is 2-3 order of magnitude higher. Central access to high performance computing for simulation would be helpful (as compatible with the licensing). Support for Corryvreckan for test beam analysis. (request to LDG). |
| Ref. (https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa sec. 4.4). Support for software like Garfield++, MAGBOLTZ, HEED... is important in view of design optimization of new detector concepts. Although initially developed for gaseous detectors, they showed their validity for other technologies (e.g. solid-state devices).Geant4, FLUKA (and their interface to previously mentioned tools) is important. Access to licensed software will be of high importance FEA, CAD,PCB Design/Analysis SW, LabVIEW, WinCC OA |
| To work in a collaborative mode, design files will need to be exchanged across partners. A legal framework may have to be setup to allow seamless sharing of files produced by licensed software. This is typically possible for global multinational companies with multiple labs, but collaborations of independent institutes are not always allowed to share files (see for instance EDA software for ASIC design). |