

Linking ILD to the DRD organization

ILD group meeting at CERN, 15-17 January 2023

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Outline

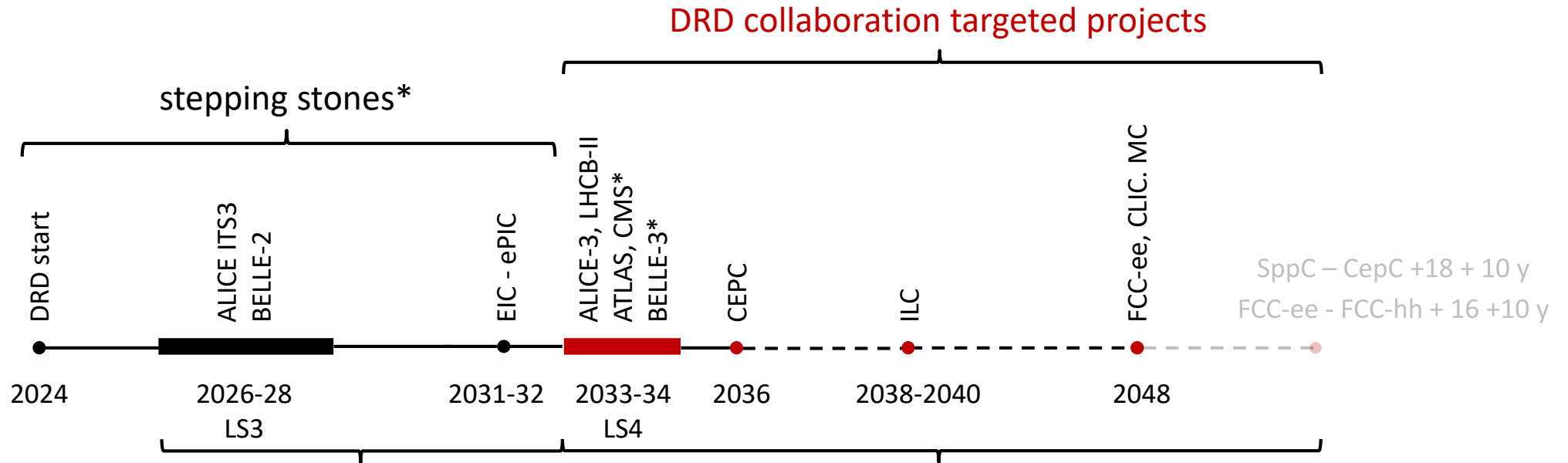
General considerations on links of strategic projects to DRD programs

Highlights of DRD Work Packages related to ILD concept

Linking ILD to the DRD collaboration organization

Outlook

Reminder of current assumptions on collider project timelines*



experiment entering engineering phase
SoA 1st implementation in experiments

not yet approved, technical planning constraints:

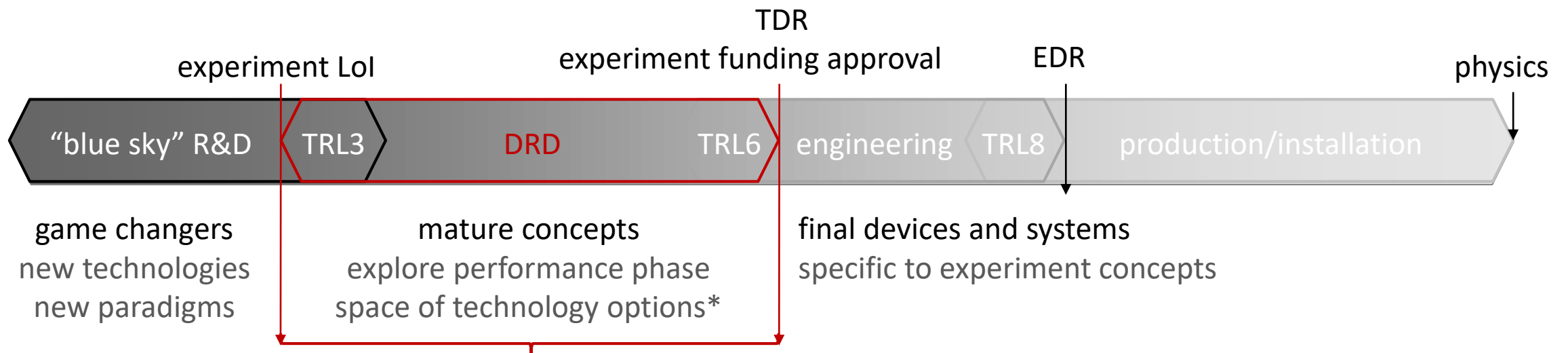
- ALICE-3, LHCb-II, FCC-ee - CLIC : HL-LHC planning
- CEPC, ILC : approval decision
- MC : accelerator muon cooling R&D
- SppC, FCC-hh : accelerator magnet R&D

* projects identified in [ECFA detector roadmap](#) with timelines for physics start (from [ICFA/Desy seminar](#) December 2023)

some other short term programs also enter stepping stones ex. FAIR, fixed target at SPS...

ATLAS/CMS could be replacement for radiation tolerance of the inner pixel and LGAD ToF layers in the forward region, Belle-3 could be a further pixel upgrade for higher luminosity, these projects were not part of the ECFA detector roadmap

Typical project technical and approval steps and DRD collaboration objective

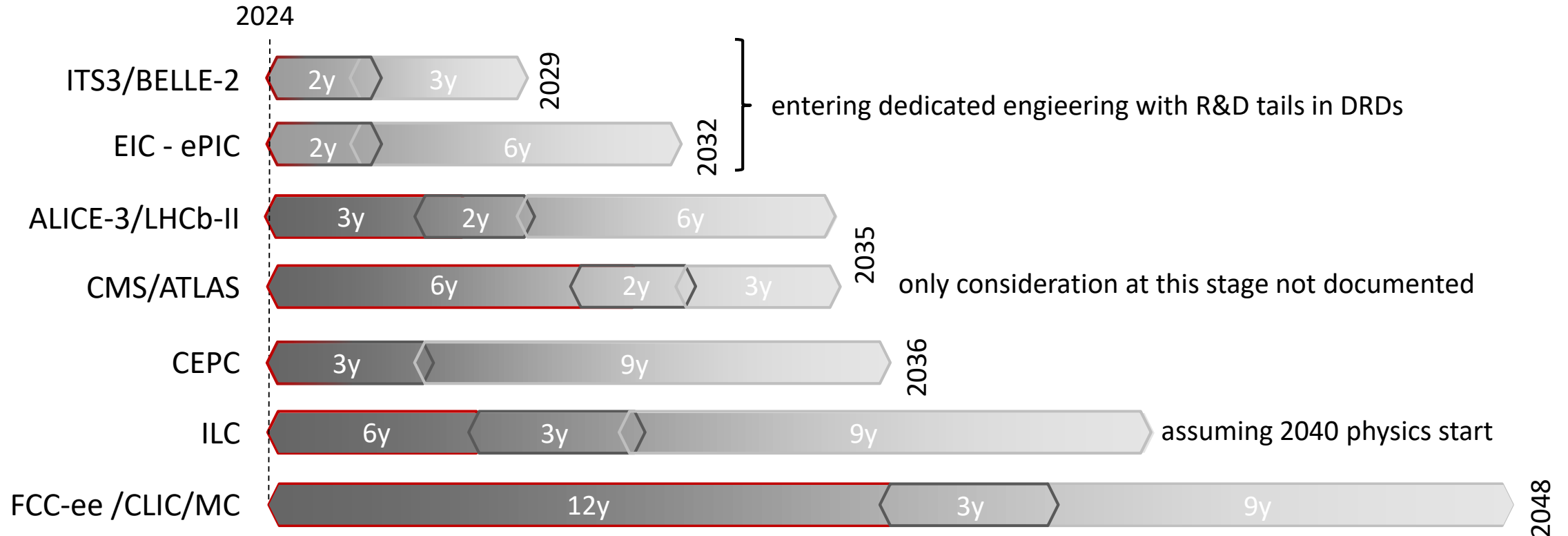


DRD collaborations aim to ensure that R&D readiness is not a primary project schedule driver
they allow proper coverage of common technical options with sustained resources
they can also provide a forum for some common “blue sky” activities

* generic systems and engineering aspects are also considered in DRDs

Broad brush timelines for (generic) DRD collider projects*

needs carefully project planning to anticipate transition to the experiment specific stage



DRD collaborations should consider parallelism of activities with project teams in transition periods

different project timelines can allow to envisage technology changes

for lepton colliders DRD cover several experiment concepts and beam conditions (physics requirements)

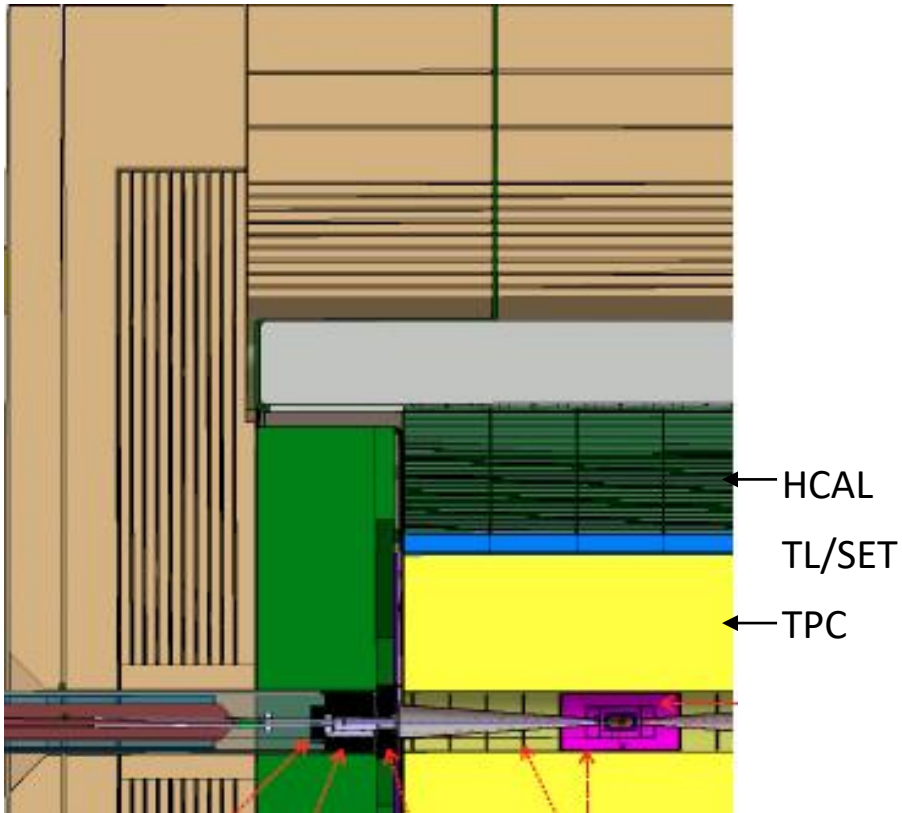
full simulations are needed for specific project rates and beam backgrounds (with technical impact)

* assuming similar typical time scales for specific experiment planning of same small/medium/large scale projects

DRD1 “Gaseous Detectors” - WPs related to ILD concept

<https://drd1.web.cern.ch/>

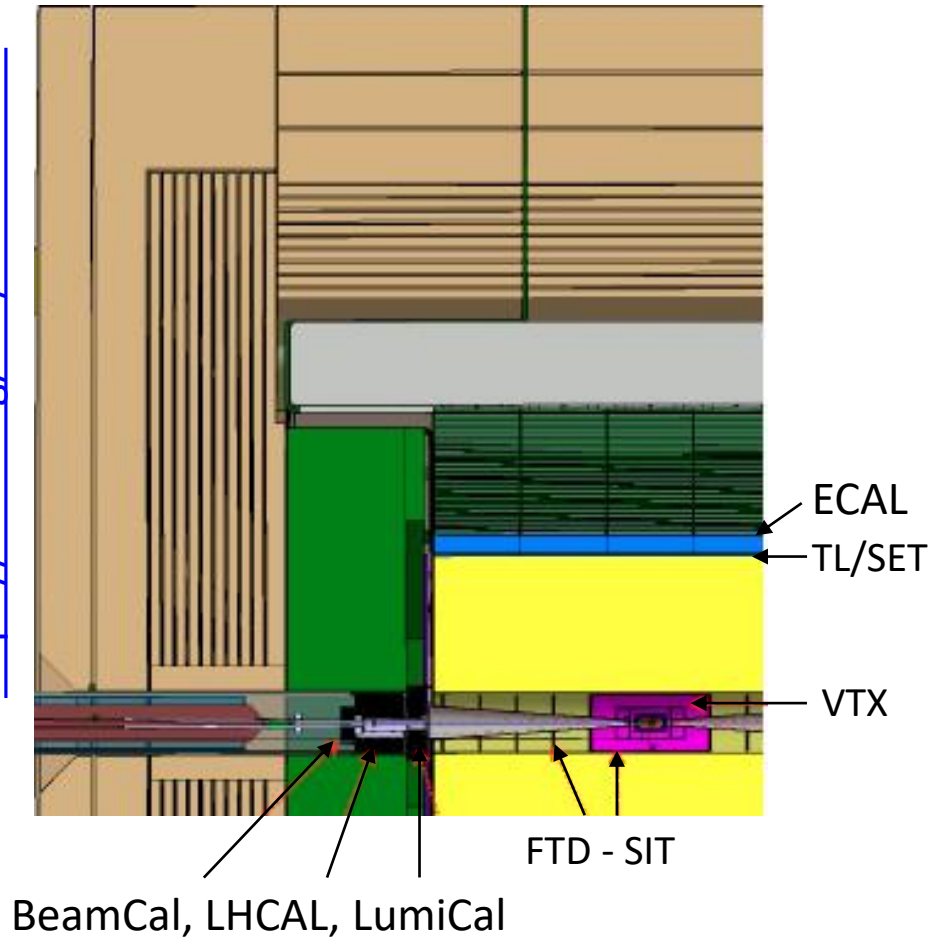
ILD : <https://arxiv.org/abs/2003.01116>



- WP4 : Tracking TPC
 - distortion/ion backflow challenge at FCC-ee & CepC
 - MPGD readout for PID possibly with dN/dx
- WP5 : Calorimetry
 - MPGD and RPCs for HCAL
 - possibly with ToF precision
- WP7 : MPGD for TL/SET

DRD3 “Solid State Detectors” - WPs* related to ILD concept

ILD : <https://arxiv.org/abs/2003.01116>



- WP1: Monolithic CMOS sensors
 - SET/TL** - FTD/SIT - VTX
 - strip layers p_T precision - possibly as TL
 - pixel layers IP precision, hit position & low X/X_0
 - ECAL – FCAL (BeamCal, LHCAL, LumiCal)
 - compactness - pads or pixels for digital calorimetry
- WP2 : Hybrid sensors
 - SET/TL
 - LGAD (pads) position and/or time precision
 - ECAL – FCAL (LumiCAL, LHCAL, BeamCal)
 - possibly layers with ToF capability
- WP4 : non-Silicon based materials
 - BeamCal (GaAs...)
- WP5 : Interconnexion and device fabrication
 - enabling high channel density in light & compact devices at low power consumption

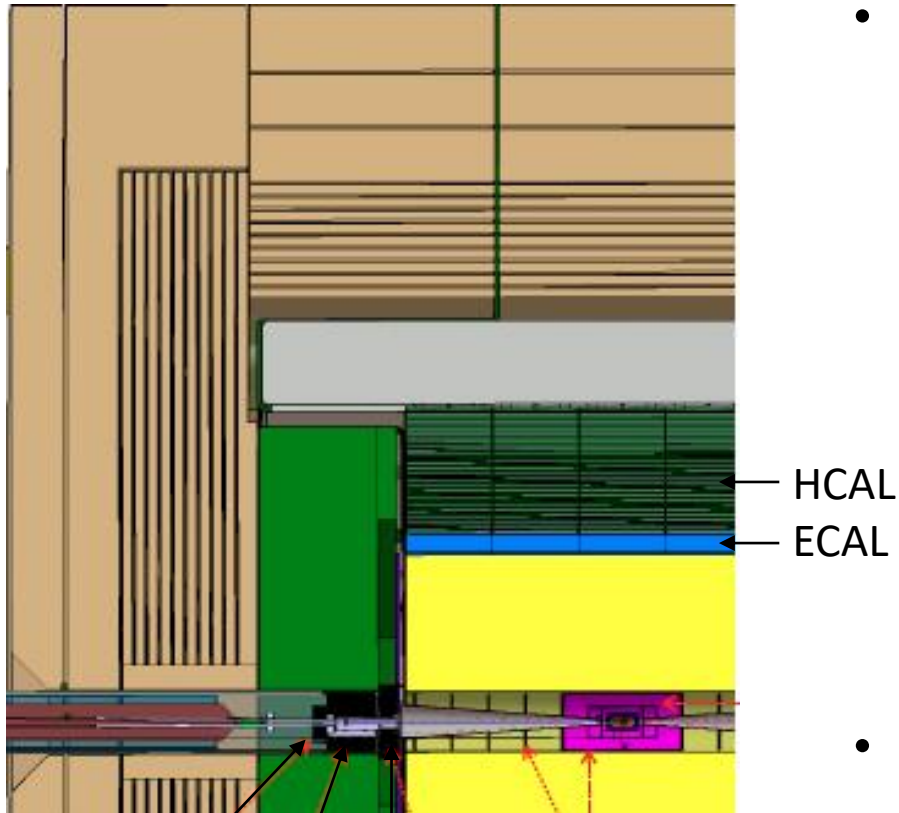
* DRD3 WP and WG organization is still being finalized

** TL = ToF Layer for PID to cover low momentum blind region of TPC - a light device as developed in DRD4 could be considered

DRD6 “Calorimetry” - WPs related to ILD concept

<http://cds.cern.ch/record/2886494>

ILD : <https://arxiv.org/abs/2003.01116>



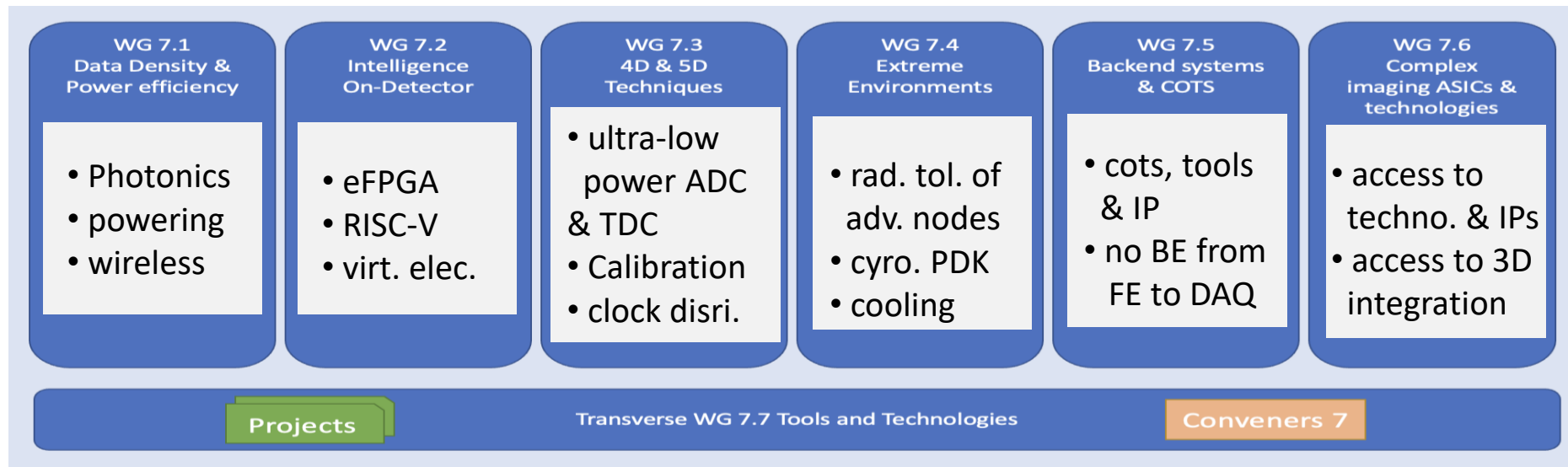
BeamCal, LHCAL, LumiCal

- WP1: sandwich calorimeter with fully embedded electronics several configurations and sensitive materials in relation with DRD1, DRD3 and DRD6 WP3 for scintillating & photodetectors*
 - ECAL
 - Si/W CALICE like design system and readout aspects
 - FCAL highly compact calorimeter
 - DECAL digital with MCMOs
 - Sc-ECAL analog with scintillating strips
 - HCAL
 - AHCAL analog with organic or glass scintillating tiles
 - TSDHCAL RPCs with precision timing
 - MPGD HCAL
- WP4: electronics and DAQ (transverse)
 - low power electronics with continuous readout for CC

* Photodectors can have also relations to DRD2 and DRD4 in areas of common specifications

ILD concept relation to other DRDs

- DRD4 Photon and PID
 - Photodetectors - SiPM readout for scintillators in calorimetry and ToF light device options
- DRD5 quantum and emerging technologies - proposal in preparation targeting approval at June RB
 - relation to collider experiment systems possibly in new (low-D, heterogenous) materials
- DRD7 electronics systems - proposal in preparation targeting approval at June RB
 - relation to ILD in WG1/2/3/5/6/7 projects are being developed (16 proposals received so far)



- DRD8 mechanics and integration
 - being investigated under impulse of tracker integration forum

Linking ILD project to the present DRD framework

- DRD contributions are through institutes
 - it is assumed that several institutes of the ILD proto-collaboration are members of the DRDs
 - with their scientific interests well included in the present DRD programs
 - each institute has a representative in the Collaboration Boards
 - The CBs are currently establishing collaboration rules and management structures & teams
- DRDs next step is the preparation of MoU to plan deliverable contributions & funding
 - ILD as a proto-collaboration can foster internally contributions around WPs of interest
 - DRD organizations are building on existing communities & topical R&D programs, ex. CALICE, FCAL, LCTPC... (that can serve several projects in this framework)
- MoUs will be updated every 3 years
 - based on R&D success reviewed by the DRDC and with the ECFA Detector Panel (EDP) providing input on the evolution of specifications and timelines given by the project concept groups
 - with this purpose concept group liaisons can be formally identified*
 - a first light iteration of inputs could happen on the timescale of initial MoUs
 - with a second deeper update by the following DRD programme cycle and the next ESPP update
 - simulation in project concept groups are essential to identify most critical R&D parameters
 - the ECFA WG3 on detector R&D could provide the forum to discuss these inputs in the community

* at this stage concept groups can be collider project proto-collaborations (FCC-ee/CepC) or experiment proto-collaborations (ILD/SiD)

Outlook

The scheme to link projects (or other R&D programs) to the DRD organization is still an open topic where feedback is welcome

EDP is setting a forum with DRD leaders (for cross-activities) where this can be discussed