

CPAD RDC 5: Trigger and DAQ



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Good reasons to be enthusiastic

The particle physics community has identified the need for stronger coordination between the different groups carrying out detector R&D in the US. We strongly support the R&D Collaborations (RDCs) that are being established and will be stewarded by CPAD, the Coordinating Panel for Advanced Detectors, overseen by the APS/DPF. The RDCs are organized along specific technology directions or common challenges, and aim to define and follow roadmaps to achieve specific R&D goals. This coordination will help to achieve a more coherent detector instrumentation program in the US, and will help to avoid duplication while addressing common challenges. International collaboration is also crucial, especially in cases where we want to have technological leadership roles. Involvement in the newly established Detector R&D Groups at CERN is encouraged, as are contributions to the design and planning for the next generation of international or global projects. Targeted future collider detector R&D in particular, such as for Higgs factories or a muon collider, is covered in Section 6.5.

The RDC's are in the P5 report as participation in the DRD's

Area Recommendation 6: Increase the budget for generic Detector R&D by at least \$20 million per year in 2023 dollars. This should be supplemented by additional funds for the collider R&D program.

Area Recommendation 7: The detector R&D program should continue to leverage national initiatives such as QIS, microelectronics, and AI/ML.

Let's also keep in mind:

The office of science will take “months” to turn the P5 report into actionable strategy:

- based on experience from the last P5 report released in 2014: it will take 2+ years to turn this into available budgets
- this could take longer if issues with favorable budgets don't come out the right way

It is also recognized that the current university comparative review is not the ideal vehicle for RDC-type proposals:

- It will take time to develop a new funding mechanism as needed but we should not wait.

How should we prepare?

Creative opportunities

Looking for opportunities in all places for RDC projects such as:

- SCGSR's to fund student
- SBIR's to fund partnerships with businesses
- Looking for funds available from labs to jump start projects (KA25, LDRDs, Lab based fellowships, etc.)

This should be the first year where the CPAD coordinated RDC's bring forward collaborative proposals targeting some set of R&D priorities in the BRN Report

R&D Collaborations

Collaborative proposals:

- These could be new collaborations which formed with coordination by CPAD
- These could be existing collaborations (potentially grown further through the coordination of CPAD)
- These should be “blue-sky” and less project specific R&D
- These should be in line with BRN priorities

CPAD won't be the body determining funding for these proposals:

- These proposals will go into the “regular” comparative review process and be selected through panel review
- These could also be done by working with national labs / DOE to reallocate KA25 funds at the lab to help jump start them

Expectations

We should expect limit ourselves to no more than 5 proposals across 11 RDC's for the first year submission.

- Prioritize work packages which cross many RDC areas and are blue sky proposals would be a good fit for this year's proposals.

We should be aware of the budget expectations:

- Likely minimal budgets in year 1 & 2 and ramp up in 3+ years.

Proposed Timeline for RDC Activities (reverse chronological order)

- **09/04/24:** Deadline for proposals to DOE (before Sept. 5th 2024)
 - [See FOA here](#) page 49
- **08/08/24:** CPAD Executive Committee and RDC coordinators put forward “≤5” (handful) collaborative proposals to be identified as “high priority” RDC proposals
 - These proposals will get letters of collaboration from CPAD and the RDCs identifying that this work has been earmarked as important to the community and will have support from CPAD in helping in the structure and execution of the collaboration
 - Would be helpful if these proposals also had clear synergy with ECFA DRDs
 - **This does not stop any group of PI's from continuing to submit to the DOE FOA.**
 - Hopefully this process enhances the selected proposals and helps them in their formation of new collaborations by identifying synergies, forming collaboration with the CERN based DRDs, identifying common resources, and avoiding duplication of work
 - Hopefully we work to help find other packages opportunities to jump start their work in the coming year (SCGSR, LDRDs, SBIR's, etc...)
- **07/24:** RDC coordinators bring short whitepapers to for each collaborative proposal (Virtual Town Hall) where we try to get a sense of what is being proposed
 - We will need to define what these white papers should have in them
 - This will give the coordinators and the CPAD EC time to
- **06/24:** Virtual check-in with RDCs to see how the formation of collaborations and preparations for the white paper is going.
 - One last opportunity to solicit calls for these proposals and help identify
- **04/24:** RDC Workshop to call to attention and highlight what CPAD is looking for in the RDC proposals
 - Will need time for parallel sessions to have people “workshop” their ideas

Unknown: Will there be a DOE PI meeting in 2024 and when will this be (might drive the schedule a little bit)

Closing discussion from the workshop:

Ideas for Work Packages

- ❖ Excellent joint discussion with RDC4 yesterday. Clearly some work packages involving both RDCs
- ❖ **BRN PRD 21 related**
 - Intelligent data reduction and processing (with RDC4)
 - Real-time / low-latency data reduction and feature extraction
 - Fast artificial intelligence and neuromorphic computing on real-time hardware
 - Link technology (with RDC4)
 - High-bandwidth, rad-hard, low-power optical link (>50Gbps)
 - Wireless readout
- ❖ **BRN PRD 22 related**
 - Intergrading modern computing architecture and emerging technologies
 - Self-running DAQ system
- ❖ **BRN PRD 23 related**
 - Timing distribution with picosecond synchronization (1ps over 1 km) (with RDC4)