Joint Recommendations by the Physics Research Committee (PRC) and the Astroparticle Physics Committee (APC)

APC 13 and PRC 99 as an in-person meeting during 8/9 April 2025 at the Zeuthen Campus.

General comments

APC and PRC met on 8/9 April 2025 for a joint meeting and the in-depth discussion of a number of selected topics with promise for synergies between the AP and FH divisions.

The open session began with a welcome and an update on the outcomes of the recent PoF (project-oriented funding) evaluation, presented by the directors Christian Stegmann (AP) and Ties Behnke (FH).

APC and PRC congratulate the AP and FH divisions on the outstanding outcome of the recent PoF evaluation.

The open session then covered three main areas with expert presentations from AP and FH:

- Project overviews: Presentations included hadron collider measurements for IACT background modeling, particle physics collider experiments, and on-site particle physics experiments.
- Detector development: Discussions focused on detector R&D and construction projects within the FH division, instrumentation activities in the AP division, and advancements in monolithic active pixel sensors.
- Software development: Presentations addressed software development at AP, the Key4hep software ecosystem for future HEP experiments, and the role of AI in HEP and AP.

The session provided insights into collaborative efforts and shared challenges between the two divisions. These topics were then pursued in greater detail in a closed session with the experts in the afternoon. From this, specific recommendations were derived.

Detector Development

The APC and PRC heard presentations on detector developments in both divisions, in particular on silicon detectors. The ensuing discussion showed significant potential for synergies as well as overlapping ambitions and aspirations.

Comments and recommendations

- APC and PRC note with satisfaction that there is significant potential for fruitful discussions on joint R&D topics in the field of pixel detectors, concerning technology aspects like materials, readout, simulation, etc. This potential also extends into the field of photon science and can well be pursued in the framework of the Helmholtz DTS (Detector Technologies and Systems) topic.
- In view of the upcoming PoF strategy process for the PoF V period 2028-34, APC and PRC invite the participating scientists from both the AP and the FH division to jointly develop an ambitious detector R&D roadmap for the time horizon of 10 years, with common challenges and far-reaching aspirations that could enable new scientific and technological opportunities.
- APC and PRC strongly suggest to the participating scientists also to prepare on the basis of the existing ideas for a Distributed Detector Laboratory (DDL) - a new proposal for a significant improvement of the detector R&D infrastructure in the Helmholtz DTS world, to be submitted to the Helmholtz FIS roadmap process.

Computing

The APC and PRC heard presentations on research software engineering/development in the two divisions, and on the use of AI in both divisions. In the ensuing discussion, the following topics were identified as the most promising ones for FH+AP collaboration:

- artificial intelligence and related technologies, especially as these are fastly evolving topics
- sustainable computing
- large-scale computing and big data technologies
- software engineering with a good understanding of the underlying hardware situation

It became apparent that all developments need to be fully integrated into the relevant Helmholtz-wide strategies.

Comments and recommendations

- The successful implementation of future scientific computing at DESY relies both on the appropriate strategic setup and SWAT-like on-board expertise. These, in turn, require a core team of permanent DESY staff.
- The complexity in the German academic landscape universities, Helmholtz, states and federal funding - makes constructing a coherent computing programme at DESY a challenge. A high-level strategy is required for PoF V that, within the DMA (Data Management and Analysis) topic, allows the realisation of a stringent research and science-support portfolio. This includes the growing field of AI.
- The committees recommend that the involved experts, over the next six months, identify the long-term (10+ years) purposes of their computing group(s) and then choose the most important technologies needed for their realisation. A special focus is to be placed on the identification of joint topics with promise for significant synergies and economic aspects (e.g. computing energy). During this exercise it might be necessary to engage mediators that help translate existing technologies into concrete application in the research areas relevant to DESY and its community.
- The committees support the idea of establishing a central DESY group of domain specialists and software engineering specialists tasked with advising DESY scientists on the application of modern computing methodologies in their research, especially in the areas of efficient, economic and sustainable computing and software, and of AI / LLMs.

Other business

The next joint meeting of both committees is envisaged for spring 2027.

APC (Terri Brandt, Tomasz Bulik, Stefano Gabici, Hermann Heßling, Jamie Holder, Dorothea Samtleben, Jörn Wilms), 5 May 2025.

PRC (Steinar Stapnes, Dave Charlton, Petra Merkel, Jeff Templon, Arthur Hebecker, Christoph Rembser, Belen Gavela, Tatsuya Nakada, Lindley Winslow), 5 May 2025.