

## **74. PRC Recommendations**

**03 December 2012**

### **ALPS**

Following the suggestions from the PRC at its last session, the ALPS Collaboration has submitted on 31 August 2012 a TDR towards the realization of the ALPS II experiment. The PRC has conducted a dedicated technical design review of this proposal on 7 November 2012. The review was held by PRC members and external experts from various fields which work in similar experimental settings or have significant experience on technical components that are planned for implementation for the ALPS-II upgrade. The purpose of this review was to assess in depth the technical design, performance and feasibility of the ALPS II upgrade as documented in the TDR.

The PRC congratulates the ALPS II collaboration for their achievements in producing a very sound technical design for the ALPS II experiment. The committee is very positive on the scientific case and on the technical feasibility and expected performance as documented in the TDR. The PRC expresses strong encouragement to continue with the preparations for ALPS II. Several milestones have to be defined at various stages of the experiment:

- 2013: Results of ALPS IIa – proof of principle of regeneration cavity should be demonstrated.
- 2014: Full performance of optics/detection system with the full length (2 x 100m) system should be demonstrated in order for a positive decision to be taken to proceed with the installation of the 2x100m HERA magnet strings for ALPS IIc.
- 2015/2016: results from ALPS IIb, i.e. attaining the full improvement factor w/o magnets to reach sensitivity in hidden photon sector should be demonstrated.

These milestones will be subject to review by the PRC in the usual manner.

### **Theory**

The PRC has been asked to comment on the activities of the String theory/formal thrust of the DESY theory group. The PRC values the close connection between the DESY and the University of Hamburg String Theory groups, sharing weekly seminars and research activities for the benefit of the postdoctoral fellows and students in both groups. The group does an excellent job nurturing young scientists, as well as organizing workshops and schools for the benefit of the whole German String/Quantum Field Theory/Mathematical Physics communities.

The PRC observes that the organization of Schools and Workshops as well as regular courses at HU, FU Berlin, TU Dortmund, U. Hamburg, U. Potsdam are activities performed by members of all the four thrusts of the DESY theory group: Cosmology, Lattice Gauge Theories, String Theory and Particle Physics Phenomenology. These activities enrich the intellectual life of the laboratory and uniquely contribute to the academic level of the local universities.

The present and mid-term future research focus of the string group is on topics of great interest for the international String community. Their studies on AdS-CFT-duality and electric-magnetic duality are of relevance to allow the understanding of non-perturbative phenomena. Among recent highlights are works that investigate n-gluon scattering amplitudes in the multi-Regge region of N=4 supersymmetric Yang-Mills theory at strong coupling and electric-magnetic duality from resummation of instanton corrections. They also work and develop mathematical methods and tools connecting QCD calculations and String theory. The work of the String group at DESY is internationally recognized and the PRC congratulates them for their research activities.

The PRC observes that the building facilities of the DESY theory group may be not optimal for the needs of such a large and active group: better discussion rooms and open spaces would benefit the group as a whole.

## **OLYMPUS**

The PRC congratulates the collaboration to the enormous progress since the last meeting and the readiness review in September.

The collaboration has understood the luminosity mismatched of a factor of  $\sim 8$  between the luminosity calculated from the target slow-control information and the measurements from the luminosity detectors seen in the February Run. The effect was caused by a hole in the target cell, which was fixed in summer.

A 2nd level trigger was implemented, which allows to run at a higher beam current and target flow than in February at significant less dead time ( $\sim 35\%$ ).

The final data-taking period has started 24th of October, with all detector components running well after several components have been improved in stability and performance since the February running. The GEM tracker has not been finished due to manpower and time constrains. DORIS is operated in top-up mode, which increases the data taking efficiency.

The offline track reconstruction as well as the Monte-Carlo simulation of the experiment has been improved. The collaboration presented a first attempt to estimate the different contributions to the total systematic uncertainties of the measurement.

The PRC suggests to work on track reconstruction software, which allows for a fast turn-around. This would help understanding the remaining background problems (the B-field setting dependent low energy noise) in the wire chambers and their potential impact on the final result. It is also suggested to ensure the problem of the missing tracks in forward direction seen in the February run is truly resolved, by changing the operating point of the wire chambers.

The PRC commends DESY for the good support and the DORIS machine crew is especially thanked for their offer to operate DORIS over the Christmas and New Year vacations.

The PRC is looking forward to hear during the next meeting how the beam time went and hopes to see very first results from the data taking.

## **BELLE II**

The PRC is pleased with the impressive progress and successful “expansion” of DESY participation in the BELLE collaboration in relatively short time in the areas of VXD, CO<sub>2</sub> cooling, alignment. The PRC acknowledges the constructive role that DESY is playing in providing expertise and resources to the consortium of German university groups engaged in BELLE II.

DESY has taken on a substantial part of the very challenging project to produce and install the new pixel vertex detector. The most challenging aspect of this work is the installation of the new component into the heart of the BELLE II detector on the end of the massive QCS system, with a possible blind/remote vacuum connection. DESY expertise will play a critical role in this regard. DESY has also taken a leadership role in the alignment of the tracker system.

The PRC is pleased to see the quick startup of computing environment and Belle 1 physics analysis, with DESY serving as a repository of a copy of the BELLE I dataset. DESY will clearly benefit from the experience of the prior participation of the German groups in BELLE I.

## **ILC**

The PRC congratulates the DESY ILC group for making major contributions to the design of the ILD Detector Concept and looks forward to receiving the Detector Baseline Design (DBD) document that will be completed by January 2013.

The PRC recognizes the effort that has been made in the areas of overall detector integration for ILD and interfacing to the ILC accelerator systems. The PRC congratulates the DESY ILC group for making successful contributions to the development of the VTX, TPC, Hadron Calorimeter, and FCal systems. The VTX studies benefit from DESY expertise and resources in sensor testing and materials. For the TPC, DESY has contributed GEM-based endplate modules and supports the testing requirements of the LC-TPC collaboration. Hadron calorimetry has substantially benefitted from the DESY leadership and participation in the CALICE collaboration. Finally the DESY-Zeuthen ILC group has made major contributions to the development of the forward calorimetry (BeamCal and LumiCal) through participation and leadership of the FCal collaboration.

DESY has provided critical support for the development and maintenance of software tools for simulation studies. In particular, the PRC congratulates the DESY group for the successful rewriting of the complex tracking software for ILD. The PRC further notes that DESY contributed a large part of the event generation for ILC physics benchmarks that will be included in the DBD.

The PRC notes that the DESY ILC group is playing an important role in physics studies for future linear colliders and fully supports this effort while the global HEP community determines which collider option to pursue.

## **H1**

We congratulate H1 to its efficient and successful publication output despite of further decreasing person power. We welcome the increasing effort of combined publications with the ZEUS collaboration and encourage H1 and ZEUS to continue and intensify this path. The new long term organization structure has started successfully. It ensures a critical analysis monitoring by physics board experts assigned to each analysis and constitutes a very promising setup for sustainable physics outcome over several years. Rewarding analysis contributions are made possible by continuous support for scientists visiting DESY. We encourage H1 to already now pursue options to supplement the DESY support for visiting scientists by other funding sources.

The H1 Data preservation effort is a highly visible role model for other experiments and labs and well embedded in the international DPHEP effort.

The availability of long-term technical expertise ensuring the accessibility of the preserved data and support for the planned analyses presently is a worry; the H1 and DESY managements should very actively seek a solution. The PRC recommends that DESY continues supporting the H1 collaboration wherever possible in the coming years to enable the collaboration to fully exploit the physics potential of the H1 data.

## **ZEUS**

The ZEUS collaboration is well progressing on the finalization of their important analyses and showed an impressive number of new results in 2012 in the areas of structure functions, diffraction, heavy flavour physics, QCD and searches for exotica and rare phenomena. Furthermore, the PRC appreciates that there is a rich programme of planned analysis for the coming years, well beyond the year 2014. The restructured collaboration and analyses based on the data format foreseen for the data preservation effort were shown to work very well. Harvesting the full potential of the HERA data will also rely on the ability to attract, fund and supervise PhD students. The PRC is pleased to see first attempts to open new sources of funding and combined theses with running experiments and encourages ZEUS to progress in this direction. The availability of long-term technical expertise ensuring the accessibility of the preserved data and support for the planned analyses presently is a worry; the ZEUS and DESY managements should very actively seek a solution.

The PRC recommends that DESY continues supporting the ZEUS collaboration wherever possible in the coming years to enable the collaboration to fully exploit the physics potential of the ZEUS data.

## **HERMES**

The HERMES collaboration is congratulated for its continuous progress producing high impact results and papers. It is very nice to see that the first HERMES paper using the recoil detector has been published, that further results have been made preliminary and that the technical recoil paper is in the 2<sup>nd</sup> circulation.

The PRC is happy to see that the collaboration has identified the remaining high impact papers, which should be finished till the end of 2013, which is also when most of the remaining PhD students will finish.

The collaboration has decided on a final collaboration structure, but should find a more efficient way to communicate any type of decision/information.

The PRC congratulates HERMES for the enormous progress since the last PRC to preserve the data.

We thank DESY for the continued support for the east guest as well as for Postdocs and PhD students.

The collaboration needs to find quickly a cost-effective solution to replace EVO, a close collaboration with DESY IT is suggested.

## **Data Preservation project**

The PRC is very pleased to see the progress made in the common data preservation efforts of the HERA experiments and DESY-IT. The Data preservation effort is a role model for other experiments and labs, highly visible and well embedded in the international DPHEP effort. As data preservation aims at long-term access to the data for physics analysis, corresponding technical knowledge and support of the experimental software must be preserved as well. To share personnel with one of the running DESY activities beyond 2014 is considered as a road to pursue. The requested effort of ½ FTE per experiment seems well justified initially, while the actual work load will decrease with time.

The PRC most strongly recommends that the DESY management and the partners concerned find ways to secure the long-term availability of knowledge in this area to the H1, Hermes and ZEUS collaborations.

## **PROSA**

We congratulate the initiators of PROSA for their letter of intent for an impressive collaboration between theorists, co-authors and developers of several pdf-related software tools, and experimentalists from all pdf-relevant experiments. It not only promises to strengthen the interpretations of published data in terms of QCD-related physics parameters, but also to catalyze the effort of obtaining experimental measurement output formats and developing theoretical tools best suited to perform combined interpretations of the data. We emphasize especially the synergy with the already well-established HERAFitter package, which is increasingly used beyond HERA in publications by LHC experiments.

We recommend to DESY to support the PROSA effort whenever appropriate and encourage the DESY-affiliated PROSA collaborators to try and form a supportable structure as a pillar in the DESY Analysis Centre established by the Terascale Alliance.

## **CMS**

DESY CMS group continues to make strong contributions to the physics output of the CMS collaboration. They contribute to conference proceedings and papers in all areas of involvement. The contributions are at the level that are comparable to other laboratory groups in CMS such as Fermilab and CERN with appropriate normalization.

The number of PhD students in the group is healthy and stable. There are recent departures from the postdoc pool that should be replaced in a timely manner. The PRC is pleased to hear that the negotiation for the new leading scientist to join the group is in its final stages. The DESY CMS group continues to make strong contributions to detector operations and computing. The group is also making good progress in upgrade projects up to phase 1, but there is a concern that R&D funding for phase 2 may not be adequate.

The members of the group hold important positions in management, operations as well as in physics analyses. The communication and joint planning with IT and NAF appears to be working well.

PRC notes that it is important to keep this communication strong. The PRC congratulates the DESY CMS group for their many accomplishments and their continued success.

## **ATLAS**

The DESY ATLAS group continues to make strong contributions to the collaboration and is highly visible in physics analyses, in detector operations and in the upgrade project. They hold important leadership positions in the management of the experiment, including in physics coordination since recently.

We congratulate the group for becoming a key player in SCT operations only one year after starting this activity. We note with pleasure that a “computing-oriented” position for ATLAS has been opened.

To ensure that the NAF continues to be optimally used, we recommend that the ATLAS resources be concentrated at a single site.

The DESY group continues to play a key role in the tracker upgrade. The PETAL2014 project is well on track and funding is secured for this prototyping phase - what happens beyond is subject to the concerns detailed below.

The PRC congratulates the DESY ATLAS group for their many accomplishments and their continued success.

## **ATLAS and CMS**

The PRC notes with concern, the funding situation of the CMS and ATLAS experiments concerning their participation in the phase 2 upgrade of the LHC. We understand that the current situation is such that, if nothing changes, the ability of the DESY LHC groups to contribute to the CMS and ATLAS experimental apparatus in the upgrades will be severely hampered. Indeed we see a danger that DESY will be unable to make a contribution that is commensurate with their relative size and importance within the CMS and ATLAS collaborations. This is true particularly in that DESY, having joined CMS and ATLAS relatively late, have not yet had an opportunity to make major contributions to the detector construction they could make.

## **Astroparticle Physics**

Representatives from the experimental neutrino and gamma-ray astroparticle physics groups attended the closed session. The referee report was given by Lutz Köpke and Rene Ong on behalf of the PRC:

The PRC acknowledges the thorough and informative presentations given in the open and closed sessions, demonstrating the impressive overall range of involvement and impact. It is clear that DESY is a world leader in astroparticle physics.

### *Neutrino Astronomy with IceCube*

The PRC appreciates the high quality results obtained in recent analyses covering many areas. While no point sources have been found so far in the data analyzed with a partial detector, there are weak hints for excess diffuse events, both in the muon and cascade channels. Additional data are being analyzed with better selection criteria. The PRC encourages the DESY group to combine cascade (and eventually) all data sets in suitable and timely manner.

DESY acts as a Tier2 center for IceCube, storing 50% of the simulations and data from the low level-2 reconstruction. The PRC suggest the group to investigate whether higher level reconstruction data sets should be stored in addition to serve the German University groups.

Various upgrades are being considered for IceCube. The main goal of the proposed denser sub-array PINGU is the determination of the neutrino hierarchy. An essential part for such a project is the analysis effort to reduce the systematic uncertainties and improve reconstruction algorithms at low energy. The PRC supports the investigation of the PINGU approach which is potentially less costly than accelerator based experiments. We appreciate that the collaboration is well aware that resolutions and selection criteria need to be very carefully studied before claiming that a convincing measurement is possible with PINGU.

The PRC concludes, that either the possibility to determine the neutrino hierarchy with PINGU or observing a signal for an extraterrestrial neutrino flux will be important input for decisions on the future development of the neutrino astroparticle groups at DESY. The PRC appreciates that DESY is aware that some attention may be placed in this area due to upcoming retirements.

*Gamma-Ray Astronomy with HESS, MAGIC, VERITAS, Fermi, and CTA*

Each experiment is operating and producing excellent science results, which is demonstrated by the large number of DESY contributions to the Gamma 2012 conference. There have been recent upgrades in each experiment: a new MAGIC-1 camera, new high quantum-efficiency PMTs for the four VERITAS telescopes, and the completion and operation of the 28m HESS-II telescope. The quality of the science results and the recent upgrades demonstrate a life cycle for HESS, MAGIC and VERITAS of at least five additional years.

While there are numerous unique areas for each experiment, there is also overlap in science among the DESY groups. A convincing case was made that the unique wide range of experiments at DESY and close ties to the theory group is fostering the discussion culture at DESY and advancing CTA, which will be a marriage of techniques, technology, and philosophies of running experiments. A publication on a joint HESS-VERITAS multi-year campaign is in preparation, giving proof of the synergies achieved at DESY. It is not an exaggeration to say that DESY now has the strongest and most diverse effort in high-energy gamma-ray astrophysics in the world.

DESY is playing a central part in CTA and is leading the important work packages on the mid-size telescope (MST) and array controls. The MST prototype is close to completion and considerable work is being done on the array control and many other aspects of the project.

The PRC encourages DESY to keep up the steam for the CTA development and further cost optimizations, even if other collaboration partners suffer from delays.