

DESY PRC 70 Recommendations

Theory:

In this review of the DESY theory group the PRC specifically concentrated on the activities in mathematical physics/string theory. The PRC is impressed by the presentation of the development of mathematical physics in Hamburg, which continues and strengthens a long tradition. The cooperation between mathematical physicists at DESY, mathematical and particle physicists at Hamburg University, and mathematicians from Hamburg University represents a unique feature and strength of the laboratory. The present and mid-term future research focus is seen to be on non-perturbative aspects of gauge theories, with connections both to particle physics phenomenology (scattering amplitudes, anomalous dimensions) and string theory as a theory of quantum gravity. The PRC supports and encourages this development.

OLYMPUS:

The PRC congratulates the collaboration for the progress since the last meeting. The BLAST spectrometer system has been successfully shipped to DESY. Infrastructure preparations in the DORIS hall are being finalized. The wire chambers and the TOF system have been/are being overhauled.

There are concerns about the number of readout options for the GEM detectors; the PRC recommends the collaboration to make a definitive choice during the next collaboration meeting.

The target chamber is to be completed by the end of November at MIT-Bates to meet the narrow time window for installation in mid January. The vacuum connections have to be completed subsequently.

The delays on the forward luminosity GEM-tracker should be carefully monitored. Switching lepton-charge and high rate running has to be tested carefully during the trial in February 2011. A report on the results should be given at the next PRC meeting.

The collaboration has started to work on the offline analysis. This development should be vigorously continued with the goal of assuring immediate feedback on data quality during the limited time windows of data taking.

The PRC recommends continued support from the lab. This will be critical for the success of the experiment.

LHC experiments:

CMS:

The CMS detector has been working impressively well with high data-taking efficiency. The CMS collaboration has already produced many physics results in the form of publications as well as conference results. The DESY-CMS group is now one of the

largest groups in CMS. Despite having joined CMS relatively late, the group has many responsibilities and prominent roles in the collaboration. This includes leadership in tracking alignment, in technical coordination, in management (CB deputy chair), in integrated DQM, beam conditions monitor and responsibilities in the CASTOR detector. There is strong participation in the upgrade projects; both the tracking and SiPM projects proceed on track.

In physics analysis, the group has made prominent contributions in the recent publications on cosmic muon charge asymmetry as well as on tracking performance from the first data taking period. They also contributed to the study of forward energy flow. There are now groups of healthy size working on top physics and SUSY searches as well as Higgs searches and QCD. Due to the choice of topics, there are still relatively few public results from the CMS group at this stage of LHC. The PRC looks forward to the visible expansion of the DESY group's contributions to CMS physics publications and conference output.

The PRC congratulates the DESY-CMS group on their achievements.

ATLAS:

The DESY ATLAS group is making major contributions to Standard Model studies like charged-particle production (Minimum Bias), W/Z (+jets, tau channel) production, multijets, and top pair production; several measurements have been published already or are close to publication. These studies provide input and experience for searches for new physics. The latter analyses are in preparation, but first results await more data, which are coming in more and more rapidly. The PRC congratulates the group (and ATLAS) on the performance of the detector and the impressive first analysis results.

The ALFA luminosity detector is ready to be installed in the LHC tunnel. The DESY group is furthermore involved in two upgrade projects: a smaller activity is the participation in the pixel IBL (Insertable B-Layer) for which sensor tests are continuing at test beams. A major activity is the construction of a prototype endcap detector module by 2014 (PETAL 2014). The project is approved, and a budget of 1.3 MEur was granted. The PRC notes that work has started both in Zeuthen and Hamburg and that person power is adequate.

In view of the departure of the person leading the MC simulation activities for the L1 trigger upgrade, the PRC urges the group to evaluate the options for continuing this effort.

DESY Tier2 and NAF:

DESY has set up a very performant and well-accepted Grid infrastructure for High Energy Physics (Tier2), supporting the experiments ATLAS, CMS and LHCb within the LHC World-Wide computing Grid; the DESY Tier2 also provides grid infrastructure for the HERA experiments and the ILC. DESY has also established a National Analysis Facility (NAF) for end-user analyses which is well-accepted by the German user community. These important services located at DESY result in a high visibility of DESY

IT but also imply a major responsibility towards the community; these services need continuing support by the DESY management.

The PRC welcomes the installation of a task force to evaluate the efficiency of the installed resources and to propose an upgrade-plan for the coming years. The PRC awaits the detailed report from the task force.

HERA:

ZEUS:

The ZEUS experiment is following its physics program as presented previously to the PRC. The new management has now taken up its work, and the PRC wishes them success for the finalization of the ZEUS physics program.

A very complete plan on data preservation had already been presented to the previous PRC, requiring all longer-term analyses to switch to the new data format. It has become clear now that this goal cannot be achieved for all of the relevant analyses, and computing support for the ZEUS collaboration is needed beyond December 2011, the originally foreseen end-date. The PRC requests from ZEUS to converge rapidly on a concrete plan and specify additional resource requests. The PRC expects a solution to be found in close collaboration between the ZEUS and DESY managements and the participating ZEUS institutes.

The PRC also recommends strong support of the HERA data preservation project and encourages ZEUS to closely collaborate with the other experiments to ensure efficient common procedures in spite of slightly different data preservation philosophies adopted by the HERA experiments.

The PRC thanks the laboratory for its high level of support, and recommends continuous support in the coming years to ensure a successful completion of the ZEUS physics program.

H1:

The H1 collaboration has remained dedicated to its physics analyses, as documented by the large number of publications, preliminary results and invitations for talks on conferences. The publications proceed mostly according to plan with the exception of only few problematic cases. H1 is collaborating very successfully with ZEUS in combining results, in particular in producing HERA parton distribution functions.

The size of the H1 collaboration is decreasing as expected from surveys in the past years. The management is preparing for a transformation to a new structure which is more appropriate for a small collaboration with many groups outside DESY.

H1 has taken leadership in the efforts for data preservation of the HERA experiments and has become highly visible in international data preservation workshops.

The PRC congratulates the H1 collaboration for their achievements. Since 2008, 40 papers have been published; about 35 papers remain to be published by 2013, with a significantly smaller collaboration. Rapid convergence of existing analyses is therefore vital. The PRC asks the DESY management to continue the very good support for H1, notably financial support for eastern collaborators and technical support from IT, and to closely monitor progress and problems in the coming critical years.

HERMES:

The HERMES collaboration has shown an impressive list of publications and conference contributions. The PRC commends the collaboration for sustaining their high activity in data analysis and congratulates the collaboration for their success in delivering high quality results in a timely manner. The number of talks at DIS-2010, SPIN-2010 shows that HERMES is still the experiment with the biggest impact in the field of spin physics of the nucleon.

The progress on the analysis of the data with the recoil detector is significant and physics results can be expected soon. The PRC feels that this sector should still receive higher priority over other analyses with less impact on the field. The PRC would like to see the results on the beam spin asymmetry to be finalized at the level of paper drafting. It also hopes to see a NIM paper on the Recoil Detector in the near future.

The collaboration should develop a strategy to streamline the analysis topics, to ensure that the most important remaining analyses will definitively lead to publication.

The collaboration maintains a healthy state in terms of person power in the data analysis. The PRC recommends that the lab should support the collaboration by finding ways to extend the terms of postdocs and PhD students who are needed for completing ongoing analyses.

Polarization:

The polarization group presented the results of a detailed reanalysis of the LPOL data, mostly confirming the systematic errors found earlier. For the TPOL data, a new analysis method was commissioned in which critical parameters like the distance to the interaction point and the beam spot size at the calorimeter surface were determined from data. This was made possible by extensive Monte Carlo studies as presented in previous PRC meetings. Systematic errors were fully quantified for this analysis. However, a significant systematic shift of the resulting absolute polarization level with respect to the polarization rise time method remains unexplained. This is likely due to an observed systematic energy dependence of the analyzing power and indicates influence of further critical parameters which remained hidden up to now.

The PRC acknowledges the significant effort of the small but dedicated group which led to a complete and careful reanalysis of the polarimeter data.

Since the final combination of electroweak results from H1 and ZEUS are expected next year and resources are shrinking, the PRC urges the polarization group to terminate further studies on the TPOL systematics as soon as possible and then to concentrate on summarizing the acquired knowledge and on producing realistic numbers for polarization errors, even if unfavorable.

Data preservation:

Detailed plans for data preservation were presented to the PRC in the meeting in April 2010. Since then the data preservation group has made significant progress in further developing their strategies. Presentations in international workshops on data preservation have been well received.

On request of the PRC, a document has been submitted, specifying the resources for data preservation at DESY. The PRC recommends that DESY supports the project such that first steps can be taken immediately. Most importantly, the software validation framework should be fully developed and implemented. For highest efficiency, the participating experiments are urged to join forces from the beginning, even though the development of final data formats may still have to be completed. In parallel the developments on an archival system for long term storage should be continued.

The PRC notes that the preservation project is only useful for those experiments which install structures for supporting and authorizing publications from preserved data after the end of the active collaborations.

Additional projects like the use of HERA data in education and outreach and the archiving of documentation material are useful but will depend on availability of person power. Discussions should continue within the collaborations and between the collaborations and the DESY management to evaluate the financial boundary conditions.

Finally, the PRC asks the DESY management to support the data preservation group to keep and, if possible, strengthen its leadership on the international level.

Astroparticle Physics:

IceCube:

The IceCube detector is close to completion, the last strings being deployed in the season 2010/11. The drilling equipment will stay available at the pole for possible additions to the IceCube detector. As a first test, NaI crystals will be deployed to evaluate the possibility of a direct Dark Matter search experiment in which the crystals would act as Dark Matter sensors while the surrounding IceCube detector would provide a cosmic ray veto. Other ideas are being discussed. A setup for in situ measurement of the absolute noise levels of acoustic detectors is under preparation as requested by the PRC.

The DESY IceCube group has been strengthened by one tenured position, one postdoc and several new PhD students. In addition, a visiting DESY professorship (A. Kappes) for Neutrino Astrophysics has been created together with the Humboldt University Berlin.

The PRC congratulates the IceCube group for the rich physics output and notes with satisfaction that the DESY group is being ramped up for the upcoming observations with a fully operational IceCube detector. The PRC also acknowledges the excellent technical support of the IceCube group, in particular in computing, by the lab.

CTA:

The CTA collaboration has entered a Preparatory Phase Project funded by the EU. DESY is playing a leading role in mechanics and prototyping for the medium size telescopes, in array control, trigger developments and in simulation. CTA is evolving into a world-wide project with international groups joining, in particular from the US.

Through two Young Investigator Groups and the DESY professorship for astroparticle theory at Potsdam University, the DESY CTA group holds membership in the existing gamma ray experiments MAGIC, VERITAS and Fermi LAT, adding physics analysis and interpretation of data from existing instruments to the activities of the group. Together with the close cooperation of the H.E.S.S. group at Humboldt University, this represents an important component of building knowledge inside the group.

The CTA group has been further strengthened by several postdoc positions and PhD positions, partially through funds of the federal state of Brandenburg.

The PRC congratulates the CTA group for establishing their leading role in the EU Preparatory Phase Project and recommends to vigorously pursuing the current activities in this project. The PRC notes that the increasing person power (especially PhD students) should also be exploited to further strengthen the physics analysis efforts in existing gamma ray experiments. Finally, the PRC acknowledges the excellent financial and technical support of the CTA group by the lab.

ILC:

TPC:

The LCTPC collaboration was organized by an MoU in 2008. Today, it consists of over 30 institutes from 12 countries. The collaboration is working well together, centered around the EUDET infrastructure at DESY, which consists of the 1T PCMAG magnet, on loan from KEK, and the DESY electron test beam. Over the past two years the main detector choices have been identified. Both GEM based and Micromegas based detectors have been shown to be capable of achieving the required $<100\mu\text{m}$ point resolution in a 3.5 T field over the full length of the TPC. There is also the promising development of GEM/Micromegas-pixel hybrid detectors which offer the possibility of ultimate resolution. First promising results on these detectors have been obtained and need to be

followed up. Moreover, there is good progress in software development, the readout system based on the ALICE design, and the low-mass endplate design.

There is still much to be investigated before the baseline design is determined in 2012. This includes more realistic powering and readout, pulsed power, integration of the endplate and cooling with minimum material, further investigation into space charge effects, development of a large outer field cage, etc. The next main steps are construction of GEM-based and Micromegas-based integrated systems which can demonstrate the performance for macro-requirements such as track resolution and separation.

The PRC congratulates the LCTPC collaboration on the impressive progress since 2008. The collaboration is now in a position to achieve an excellent baseline design in 2012. However, the continued availability of the EUDET infrastructure at DESY is vital to the success of the collaboration. Also important is the availability of the COMAG high field facility at DESY. The latter should be brought into operation as soon as possible.

SiLC:

SiLC continues to be a very useful collaboration for drawing together R&D interests for Si-tracking at the Linear Collider and now with extension to CLIC and other experiments. Significant progress has been made in many areas since the last report to PRC65 in 2008. The R&D results being obtained provided essential information during the initial LOI phase and are expected to continue to do so for the DBD's/CDR currently being addressed by the various detector concept groups for ILC and CLIC.

The PRC congratulates SiLC on the successful production and testing of a variety of new sensors from HPK and other sources, including edgeless and alignment friendly (IR transparent) sensors. The use of the alignment friendly sensors should be investigated in the context of the overall requirements for an alignment scheme for a specific detector concept.

The PRC is also encouraged by the progress being made towards a high degree of front-end electronics integration/chip-sensor mounting.

The PRC congratulates SiLC on the development of new fast and detailed simulation software, with the latter being an essential tool for contributions to the ILD DBD and the CLIC CDR.

The PRC encourages SiLC to produce and publish timely analysis results from all beam tests.

Finally, while the PRC notes the developing synergies with other experiments, such as BELLE II and g-2, the main focus of SiLC should continue to be towards silicon tracking for linear colliders.