Scientific Advisory Committee (SAC)

Report following Meeting of the SAC: 20 & 21 May 2005

Chair and Apologies for Absence

The meeting commenced with the nomination of JBD as chair.

Present were Roger Cashmore, Thomas Hebbeker, Klaus Pretzel and Michel Spiro. Apologies for absence were received from Siggi Bethke and Georgio Goggi.

Agenda

Presentations were made to the meeting by the NIKHEF groups following the agenda:

Friday 20 May 2005
NIKHEF, Room N328

13.45 – 14.45	**ATLAS**: S. Bentvelsen
14.45 – 15.30	**LHC*b***: J. van den Brand, M. Merk
15.30 – 16.00	Break + tour LHC*b* & ATLAS construction facilities
16.00 – 16.45	**GRID**: J. Templon
16.45 – 17.30	**Heavy Ion Physics**: Th. Peitzmann

Saturday 21 May 2005
NH Amsterdam Centre Conference, Stadhouderskade 7, 1054 ES Amsterdam

08.30 – 09.30	**Other matters**: Frank Linde
09.30 – 10.00	**ANTARES**: M. de Jong
10.00 – 10.30	**Astroparticle Physics**: G. van der Steenhoven
10.30 – 11.00	**Industrial Out-reach and Involvement**: J. Visschers
10.30 – 12.30	Closed session: SAC deliberations

Preliminary Remarks

This report includes below comments and remarks by the SAC. They follow the order of items in the above agenda. As such therefore, the report of this meeting does not include consideration by the SAC of on-going progress in the NIKHEF data-talking experiments, *BABAR*, *D*0, ZEUS, STAR and HERMES.

Overall, the committee considers that, in all areas of activity, **NIKHEF is one** of the **leading centres for High Energy Physics in the world**. This desirable state of affairs is based on a modus operandi which secures rather effectively the close collaboration of front-line university groups in the Netherlands with the impressive, and well organised, technical infrastructure of NIKHEF to enable "cutting edge" research internationally. This in turn makes it possible for Dutch physicists and engineers to play leading roles in their projects. The excellence of NIKHEF's technical infrastructure is further exemplified by the demand for it by experiments (most recently AMS) in which, through lack of physicist staff, NIKHEF is unable to take on a scientific role.

The success of NIKHEF as Particle Physics moves into the "LHC era" depends on the physics return from the successful completion of its present data-taking experiments at DESY and Fermilab and from the successful operation of its LHC experiments ATLAS, ALICE and LHC*b* from 2007. NIKHEF is thus positioned optimally for discovery in its accelerator-based work.

However, developments in new detector technologies, many of which have been, and continue to be, developed at NIKHEF, now make possible new experiments using cosmic sources. In these circumstances, and alongside its peer laboratories worldwide, it is natural that the NIKHEF physics programme should develop in these non-accelerator experiments. In this way opportunities for discovery will be further enhanced, and a new and powerful symbiosis between accelerator-based and non accelerator-based physics established in the Netherlands. It was therefore timely, and highly appropriate, that, at this meeting, the SAC received first details of a major new proposal for a substantial extension of the programme in Particle Astrophysics at NIKHEF in close collaboration with a number of other Dutch institutes and universities with research in Astronomy and Space Science.

ATLAS

The SAC is very impressed by the progress of the NIKHEF ATLAS group. Work is focused on a number of central aspects of the ATLAS detector, primarily the end-cap silicon detectors and muon drift tubes, all of which are progressing well to completion of construction. The development of a technique based on coordinate determination, which is orthogonal to drift, is innovative, and should, if possible, be implemented throughout the ATLAS Muon Drift Tube system.

The plan for the installation, commissioning and operation of all components in ATLAS is established, and the necessary resources from NIKHEF for these purposes are in place. The SAC considers that **every effort must be made to maintain the schedule for completion and installation of ATLAS**, given the importance of the NIKHEF components for first physics at the LHC.

Preparation by the NIKHEF ATLAS group for first physics at the LHC is now developing rapidly. It builds partly on the expertise of those members of the group working on antiproton-proton physics at the Tevatron with *D*0. The SAC is particularly pleased to note that this commitment to *D*0 by NIKHEF some years ago is thus now seen to be of substantial and growing value in the transition to ATLAS physics. Also the leadership now of important ATLAS physics analysis by NIKHEF staff reflects the group's central role and good reputation in the ATLAS experiment through its responsibilities for major detector components. Thus the SAC considers that **the continuation of adequate and comprehensive support for the NIKHEF ATLAS group for the foreseeable future is clearly of the greatest importance for the NIKHEF physics programme**.

The SAC consider it also important to record that the full Dutch contribution to the "cost to completion"of ATLAS is now assured. That there has not been any delay in, or any reduction of, this important commitment is both sensible and appropriate, in view of the success of the NIKHEF ATLAS programme hitherto, and given the high priority for a timely beginning to first LHC physics from 2007.

LHC*b*

The SAC is also **very impressed with the progress of the NIKHEF LHC*b* programme**. NIKHEF is one of the leading groups in LHC*b* with staff involved in central management, direction and leadership

The OTR straw detector has demonstrably made impressive progress, following a late start to production. The production rate is now such that, barring any further unforeseen problems, all lost time will be recovered. A number of technical issues related to the particular challenges of straw tubes in the LHC*b* geometry have been solved in an innovative manner.

The VELO detector is one of the major detector challenges at the LHC. The assembly is proceeding to schedule, and the SAC was particularly interested to see the VELO support structure, which has to sit as an integral part of the LHC beam pipe in the LHC*b* interaction region, now at NIKHEF.

The SAC is pleased to see the developments towards the implementation of the BEETLE1.5 chip in 0.13 μm technology for the VELO hybrids.

Though well aware of the scheduling pressure on the VELO for first LHC*b* physics, the SAC is **concerned that enough attention is being paid to the successful operation of the VELO throughout the foreseeable life of LHC*b*, given the anticipated lifetime of the silicon sensors in their operating environment**. It encourages strongly the NIKHEF group to take advantage of its central role in the VELO project and to set about establishing a plan for replacement, and performance upgrade, of the VELO for the foreseeable LHC*b* future.

Grid

As is to be expected given the excellent reputation over a number of years of Dutch physicists and engineers in software and IT for experiments in High Energy Physics, the development of **Grid work at NIKHEF is particularly impressive**. This is even more the case, given that very little, if any, NIKHEF resource has so far been committed from its core budget to Grid work.

In close collaboration with Dutch computing centres, and in the main using resources from these centres, the NIKHEF team has positioned Dutch High Energy Physics as a lead-player in the development of the LHC Computing Grid (LCG), and thereby has also enabled these computing centres to develop optimal Grid technologies to meet their broader remit. This has been achieved as part of the first successful deployment of LCG technology throughout Europe in the world's first operational Grid of 14000 cpu's.

The SAC finds this progress particularly noteworthy. It also wishes to point out the importance of **providing essential resources to the NIKHEF Grid team to enable them now to focus on the establishment of a "Tier 1" centre for Dutch High Energy Physics as part of the LCG**. The absence of such a facility in the Netherlands would severely hinder the speed and efficiency with which Dutch physicists could participate in, and lead, LHC physics analysis. Furthermore, the SAC is strongly of the opinion that such investment would also bring huge benefit to the LCG, as well as to the development of *e*Science and Grid technology in the Netherlands, by enabling more of the recognised expertise of NIKHEF physicists and engineers to define, refine, and influence the operation of Tier 1 centres worldwide.

In making the above points, the SAC also urges the NIKHEF Grid team to **consider carefully the nature and deployment of "Tier 2" resources throughout Dutch centres**, and the optimisation of their connection to Tier 1. It was not clear to the SAC precisely how resources, when available, would be distributed optimally between Tier 1 and Tier 2, in particular with respect to the demands of personnel to sustain 24/7 operation. In view of the importance, and therefore likelihood, of new Grid resources being made available to NIKHEF, it urges those involved to prepare a clear plan for the use of them with the above in mind.

Heavy Ion Physics

The heavy ion physics programme in NIKHEF continues with STAR and ALICE. The SAC considers it to be appropriate that a heavy ion programme is maintained on ALICE as part of the Dutch research programme at CERN. The NIKHEF group is responsible for the delivery and operation of the silicon detectors in the ITS in ALICE.

The **production programme for the silicon detectors is now becoming critical** to the overall schedule for the construction and operation of ALICE and its physics programme. The SAC is pleased to see, and considers it very important, that a review of the schedule for delivery is now carried out, and that the necessary NIKHEF resources to meet this schedule are thereby identified and committed as soon as possible.

Other Matters

The SAC considers that the consequence for the science programme of the proposed reduction in the NIKHEF budget could be extremely damaging, primarily because it would impact most severely on opportunities for young staff at the post-graduate and post-doctoral levels. The consequences of such reductions would be severe, jeopardising all physics programmes at NIKHEF, including physics exploitation at the LHC. Further, the growth of new spin-out/in to/from other sciences, and to/from industrial exploitation, would be inhibited.

Already, it has been found necessary in the face of budgetary limitations to **truncate severely Dutch involvement in the data-taking programmes at DESY with the ZEUS and HERMES experiments**. The SAC regards this as **particularly unfortunate** in view of

- the strong recommendations to the contrary in the FOM DESY mid-term review at the end of 2003,
- the now excellent performance of HERA2,
- the major new theoretical developments in NNLO pQCD pioneered by Dutch theory groups, and
- substantial investment already made in manpower and equipment focused on the upgrades of both experiments in the forms of the MVD and the recoil spectrometer.

If the decision is taken to reduce overall the NIKHEF budget, then the SAC recommends strongly that NIKHEF management recognise

1. the need to **maintain technological expertise for the full exploitation of LHC, and for new projects**, such as ILC/CLIC (if and when appropriate) and astroparticle physics;
2. the need to **maintain and enhance post-doctoral opportunities for young people**, particularly from the perspective of the need for continual investment nationally in the maintenance of a highly skilled work-force for the future, and more specifically for the exploitation of the LHC physics programme in the Netherlands;
3. that **provision must be made for continuation of a vibrant theoretical physics group**.

The SAC considers that the sustenance and enhancement of the technological excellence of the NIKHEF infrastructure in the LHC-era will occur naturally with demands from LHC upgrades, with LHC maintenance, and with a major new thrust of activity in Particle Astrophysics.

The SAC cannot overestimate the importance of the provision of adequate opportunities for young physicists, *both* postgraduate and postdoctoral, to work for a number of years on the physics programmes at NIKHEF during the LHC-era. To rely for the provision of such postdoctoral opportunities on European Framework initiatives and/or on CERN Fellowships is both short-sighted and inappropriate. To do so would jeopardise the chain - PhD student onto postdoctoral physicist and thence to academia or to industry - which underpins both the existence

of a major research activity in its national home base and its continuing impact on national wealth creation.

Dutch theoretical particle physics has always manifestly been of the highest quality and of great significance. Recent success in developing a NNLO pQCD approach to hadron structure is crucial to the future of the LHC physics programme, and presently such work can only be tested with further precision measurements of deep-inelastic lepton-proton scattering at HERA. This is only one of many examples of effective and important theoretical work which is essential for the LHC physics era. The SAC therefore looks forward to a plan for new investment to strengthen the theoretical physics base in the Netherlands.

The SAC strongly encourages NIKHEF to continue its impressive programme concerned with the public understanding of its science and other related outreach activities.

ANTARES

Since NIKHEF joined the ANTARES experiment and commenced a programme of neutrino astrophysics, a number of pivotal contributions have been made to the deployment and operation of "strings" of photo-detectors.

Most notable is the adoption of the **"all data to shore"** concept in which ANTARES is operated as a fully exposed telescope, and data are filtered and analysed after collection. The technology necessary to operate in such a mode continues to be developed successfully at NIKHEF. The **SAC finds this** development **impressive**, and that the **work in NIKHEF to realise it should continue to be supported well**.

The SAC notes the importance of the work which has demonstrated through timing resolution of 1 ns that ANTARES will without doubt achieve its 0.2^{o} angular resolution for muon reconstruction.

Both of the above developments underline the importance of making available the **resources wherever possible to ensure that the ANTARES experiment moves towards a deployment appropriate for data-taking as soon as possible**. The SAC encourages NIKHEF to ensure that its ANTARES group is resourced appropriately in view of this and thereby to ensure that the central contributions which it now makes to the experiment can be continued to completion and fully implemented.

The SAC is strongly of the opinion that the ANTARES experiment is very important, and that it will undoubtedly lead to an experiment of larger scale. It was therefore very pleased to hear of the success of the EUFr6 bid for Km^3Net in which NIKHEF is centrally involved and which will fund the first design study for such a km^3 volume detector.

Astroparticle Physics

The SAC received for the first time a proposal detailing an extended programme of Astroparticle Physics in the Netherlands. The programme builds on the multi-disciplinary, technical, expertise of Particle Physics, Space Physics, and Astronomy centres in the Netherlands. NIKHEF's present leading role in neutrino astronomy with ANTARES, and contributions which it can make concerning the operation, development and exploitation of the Pierre Auger Observatory aimed at the measurement of very high energy cosmic rays, secure for the Institute a major role in this programme from the beginning. The intention also to include in the proposal collaboration in the space-based, interferometric, programme for Gravitational Wave Detection and Astronomy (LISA) is also highly relevant to the on-going scientific programme of NIKHEF.

The SAC finds the proposed Astroparticle Physics programme to be attractive and matched well to the scientific and technical base in NIKHEF. NIKHEF will bring to the programme experience and technical infrastructure central to success, and the programme will secure a major new experimental approach to the fundamental questions which also drive NIKHEFs present accelerator-based programme.

The SAC finds the **strong support from FOM, Kvl, SRON, ASTRON and universities both encouraging and essential if the proposed programme is to develop to its maximum impact**. At face value, the opportunities for Astronomers and Physicists, which this proposal, with its symbioses, enable, seem to be immense. The SAC therefore considers this proposal an opportunity not to be missed by all the relevant funding agencies in the Netherlands, and it looks forward to hearing further details concerning the evaluation and organisation of necessary resources to realise the programme.

Industrial Outreach and Involvement

The **Medipix detector has clearly been a major success** from the perspectives both of a successful development as a detector in many areas of science and engineering, and of a major industrial exploitation to market. The SAC welcomes this outcome, and notes that it required non-negligible commitment of NIKHEF resource even at the stage of industrial exploitation. The SAC encourages funding agencies such as FOM to realise that other such developments of NIKHEF technologies may be possible, provided that the additional resources are made available for such purposes right through to completion of industrial exploitation.

The SAC considers that NIKHEF is one of the most important European laboratories capable of seeding such industrial exploitation from spin-off. In view of its success so far, the SAC considers that NIKHEF be encouraged by the provision of new FOM resources to continue and expand such activities. The SAC also points out that close industrial collaboration by NIKHEF's staff engaged in technological development can often be beneficial not only to future commercial exploitation, but also to achieving NIKHEF's primary goal of fundamental research (e g already Grid-based "spin-out" is substantial and has led also to major "spin-in").

Roger Cashmore
John Dainton (Chair)
Thomas Hebbeker
Klaus Pretzl
Michel Spiro
NIKHEF SAC
May 30th 2005