

## **Summary of Recommendations**

### **30th LNF Scientific Committee Meeting (May 2005)**

#### **DAFNE**

The committee congratulates the Dafne team for achieving the continuous steady improvement of the machine performance, both in terms of peak luminosity and beam quality, promised at the last review. Most of the anticipated improvements have either been implemented, or are being pursued. We therefore regret that the improved peak luminosity and potential for KLOE integrated luminosity are compromised by an increase in down time, due to failures of aging components and, partly, to the share with other users (TBF and SL). The committee took note of the outcome of the negative momentum compaction test carried out in February. While the tests confirmed the potential of the technique, hardware constraints -- ion-clearing electrodes in the e-beam -- prevent operation with high e- current and make its exploitation unfeasible with the present configuration.

The current performance of Dafne, and the room still left for continuous adiabatic improvements, confirm the anticipated projections for integrated luminosity. As detailed below in the Section dedicated to KLOE, the committee therefore recommends the extension of the current run until the end of 2005.

#### **KLOE**

The committee congratulates KLOE on the extended list of physics results presented during the meeting, and on the excellent performance of the detector systems in the course of the current run. The committee endorses the request of KLOE to collect an additional 800pb<sup>-1</sup> of data at the  $\Phi$  peak, under the current stable conditions. The collaboration described the scientific value of an additional data taking off peak, and required 4 runs of 10pb<sup>-1</sup> (1 above and 3 below the peak) plus a 200pb<sup>-1</sup> run at 1000 MeV. The committee supports this request, proposing that the off-peak run take place immediately after the completion of the operations at the peak, and before Dafne's Winter's maintenance.

Under the current operating conditions we expect the run at the  $\Phi$  to extend at most until end of 2005, and the off-peak data taking to cover the period until end of March 2006. The status of the run will be reviewed at the November SC meeting, when the precise planning for the completion of the run will be defined.

For a prompt analysis of the new data, and for an optimal exploitation of the 2001-02 data which are still being used in several ongoing analyses, the offline infrastructure requires a timely upgrade of the storage and CPU resources. The committee supports this request.

#### **FINUDA**

The committee congratulates the collaboration on the progress reported, in particular the improved understanding of the detector alignment and the detection and first study of deeply-bound  $K^-pp$  clusters. It is suggested that an updated progress report be presented at the next meeting, with focus on the physics highlights and goals of the 2006 data taking. The committee supports a

prompt delivery of beam to FINUDA in Spring 2006, consistently with the recommendations relative to the completion of the KLOE run.

## **SIDDHARTA**

The committee congratulates the collaboration for the progress reported. The committee takes note of the schedule of construction of the apparatus, which supports readiness for data taking by Spring 2007. The committee recommends that this run be scheduled prior to the possible SRF accelerator experiment.

## **SRFF**

The committee welcomes the proposal for a Strong RF Focusing experiment, aimed at proving the feasibility of bunch-length modulation in a storage ring, and encourages the proponents to pursue the necessary preparations in view of a run to be performed after the 2007 SIDDHARTA data taking. In addition, the committee recommends that a stronger international collaboration be developed, in particular with laboratories interested in high luminosity electron storage rings.

## **General issues**

To ensure a minimum down-time between the end of KLOE's run and the start of the FINUDA run, we recommend that a joint task force be put in place to study the optimization of this transition, and present a plan for the installation of FINUDA, the maintenance of DAFNE, and the removal (partial or complete) of KLOE.

The next meeting of the SC will take place on Nov 28-30. Before this date, the SC expects to receive a copy of the Long-Term Future Study Group Report. The committee recommends that the contents of this study be presented during the next meeting. We recommend in particular that all experiments review their long-term plans for data taking after the year 2007.

## KLOE Referee Report (GdA, MLM, FR, AS)

KLOE has already accumulated a large fraction of the data set needed to fulfill its main physics goals and the issue now is to use the remaining data taking period, presumably until end of 2005, to produce the best physics results.

Data have been acquired in stable conditions, therefore allowing to control systematics which are the main limitation for many channels. The peak luminosity has steadily increased although no breakthrough in the average monthly integrated luminosity was achieved or is expected to be achieved soon. Nevertheless the goal of collecting the additional 800pb<sup>-1</sup> necessary to achieve a uniform sample of 2 fb<sup>-1</sup> should be achieved by the end of 2005.

For a prompt analysis of these data, and for an optimal exploitation of the 2001-02 data which are still being used in several ongoing analyses, the current offline facilities require an upgrade in terms of extra storage and CPU. The referees support these requests.

Physics analysis is proceeding very well and we urge KLOE to complete the ongoing studies for presentations at the summer conferences, for inclusion in the next PDG release and for final publication.

We are pleased by KLOE efforts to improve the present experimental determination of  $V_{us}$ , and welcome the recent results on  $K_L \rightarrow 3\pi$  and  $K_L$  semileptonic decays (rates),  $K_L$  lifetime,  $K \rightarrow \mu\nu\gamma$ . In view of the current interest, we urge an improved analysis leading to the determination of the semileptonic slopes (linear and quadratic).

The  $K_S$  rare-decay program is still a primary target for KLOE: nice results on  $K_S \rightarrow 3\pi$  and  $K_S$  semileptonic decays are acknowledged. We look forward to the publication of these results and more rare  $K_S$  decays. The study of  $\eta$  decays is very interesting: results for  $\eta \rightarrow 3\pi$  (Dalitz plot analysis) and  $\eta \rightarrow \pi^0 \gamma\gamma$  rates were shown, and we hope that spectra for this last channel will be extracted.

The hadronic cross section measurements still requires a major effort to provide a decisive input to the g-2 hadronic contribution. An unexplained difference with the  $\tau$  data still remains a puzzle and we think that KLOE has the unique opportunity to finalize the issue and eventually confirm the excess with respect to the SM. We therefore encourage KLOE to invest major efforts in reducing the systematics on the data taken at the peak and very much welcome the proposed running out of peak, in particular at 1000 MeV, which should provide a unique measurement of the pion form factor at very low mass, further reducing the uncertainties on g-2.

To achieve these various ambitious goals, we recommend that after collecting 2 fb<sup>-1</sup> at peak until end of 2005, KLOE is given enough time in 2006 to complete the off-peak program.

## FINUDA Referee Report (GvM, KP and WW)

In response to the previous recommendations by the committee, major progress has been made concerning the alignment of the detector system. An iterative optimization procedure has been applied using cosmic rays. Good results have been achieved and significant improvements of spectral shapes have been demonstrated. Tests of the achieved alignment by detecting the symmetry of  $e^+$  and  $e^-$  (Bhabha) momentum distributions have been performed. Alignment also has positive effects on measurements of  $\mu^+$  and  $\pi^-$  spectra from different targets. A long and important job has been completed successfully.

A new TOFINO detector is being prepared to improve the time resolution and the signal-to-noise ratio.

Control over boost effects has been achieved, indicating in-flight formation of hypernuclei, with additional improvements of the data quality (e.g. vertex reconstruction).

Concerning hypernuclear spectroscopy some well-known hypernuclear levels on several targets have been reproduced. The data quality and resolution is comparable to that achieved at KEK in Japan.

The primary strength of FINUDA is its capability to perform high-quality coincidence measurements. Highest priority should therefore be given to those parts of the physics programme which make optimal use of these capabilities:

1. the investigation of tightly bound  $K^-pp$  clusters produced in a series of nuclear targets;
2. the non-mesonic weak decays of hypernuclei.

Especially the topic 1. (for which a first FINUDA publication is about to appear in Phys. Rev. Lett.) has been developing into a new and exciting physics issue. FINUDA is well positioned to address these questions. Present KEK experiments are aimed at detecting deeply bound  $K^-$  nuclear states in light nuclei, whereas FINUDA has demonstrated the feasibility of detecting  $K^-pp$  clusters systematically over a broad range of nuclear targets. In detailed discussions with members of the collaboration, it was proposed to consider using light and heavy water targets side-by-side in order to have access to  $K^-pn$  systems in direct comparison with  $K^-pp$ .

Both the search for  $K^-pp$  clusters and the measurements of non-mesonic hypernuclear decays require accumulation of the highest possible statistics. Scheduling physics runs for FINUDA in early 2006 is highly recommended. It is suggested that an updated progress report be presented at the next meeting, with focus on the physics highlights of the FINUDA experimental programme. The committee also asks the collaboration to consider its longer term future in the November 2005 presentation.

## SIDDHARTA Referee Report (GvM and WW)

The committee heard the report from SIDDHARTA by A. Longoni and the referees had a detailed discussion with the group. This has led to the following comments:

1. We wish to congratulate the collaboration for the impressive progress made in the development and construction of the SIDDHARTA detector.
2. We were pleased to hear that the SDD production phase is about to finish and that tests of chips are progressing well. There is sufficient contingency in the time schedule to allow for another production run in the unlikely case of failures of SDD's. The preparation, production and tests of the SDD modules are not critical.
3. The most critical (analog-) part of the front-end electronics has been concluded with successful tests. The digital part is well under control.
4. The data acquisition is largely based on "standard components" and, although some choices are still pending, there are no serious problems to be expected. The same is true for slow controls.
5. As to the experimental setup, shielding (mainly by lead) is (as with DEAR) an important issue. The possibility of splitting the setup in two identical parts - one above and one below the beam line - is being considered. This could possibly reduce the background further and would allow, if justified, to run simultaneously with different targets.
6. We are convinced that the collaboration - in view of the proven progress and determination - is able to have the detector ready and installed by March 2007.
7. We wish to reiterate that the H and D high-precision experiments with SIDDHARTA are considered important and timely; see the previous report.
8. The committee would like to see the H/D experiments be performed prior to any changes made to DAFNE, in particular by an accelerator experiment.
9. We wish to suggest that the collaboration documents their fine new detector, e.g. in a NIM paper.
10. The committee asks the collaboration to consider its longer term future - e.g. experiments with a He target - and to report on that in the coming November meeting.