Comments from the Hyper-K group

T. Nakaya for Hyper-K WG

1

Messages from the Hyper-K working group

The 5th Open Hyper-K meeting is now on-going from July 19 to 22 in UBC/TRIUMF.

- 100 participants (46 from America[US, Canada, Brazil], 23 from Europe and 29 from Asia).
- For global discussion on neutrino projects, we consider that participation of the neutrino summit is VERY important.
- In the Hyper-K meeting, we discuss how we can contribute to the neutrino summit.

Message to the FNAL summit from Hyper-K - Irving K Barber Learning Centre Room 182 (10:50-12:30)

- Conveners: Prof. SHIOZAWA, Masato

time	[id] title	presenter
10:50	[14] Physics potential of Hyper-K and complementarity (accelerator nu)	Prof. YOKOYAMA, Masashi
11:00	[21] Opportunities for a WC detector at the second Oscillation maximum at LBNF/Homestake	Dr. KONAKA, Akira
11:15	[15] Physics Potential of Hyper-K and complementarity (atmospheric nu and Proton decays)	WENDELL, Roger
11:25	[16] Physics Potential of Hyper-K and complementarity (astrophysics)	Prof. WALTER, Chris Dr. O'SULLIVAN, Erin
11:35	[17] Discussions and Summary	Prof. NAKAYA, Tsuyoshi
	- [3] Hyper-K physics potentials and complementality	
	- [4] Water detector in LBNF	
	- [0] collaborative work on accelerator/beamline upgrade	
	- [2] collaborative work on Argon detector?	
	- [1] collaborative work on water detector development (liner, water system, photo-sensors, DAQ, other materials)	
	- [5] more?	

Sensitivity Comparison and Complementarity

- In order to understand the physics potential of LBNE (-> LBNF) and Hyper-K, we perform the study of physics sensitivity with detailed comparison.
  1. Beam physics at 1st Osc. Max
  2. Beam physics at the 2nd Osc. Max
  3. Atmospheric neutrino
  4. Proton Decay
  5. Astrophysics (mainly Supernova neutrinos)
- We find complementarity of physics and two large neutrino detectors makes the global neutrino program more fruitful.

Discussed subjects in addition to Physics Potential

- Water detector in LBNF
  - An ideal detector at the 2nd Osc. Max
- Collaborative works on accelerator/beamline power-up
  - Necessary in both projects. Discussions are welcome to proceed.
- Collaborative work on (Gas) Argon detector
  - good for a near detector
  - detailed study of neutrino interactions.
- Collaborative work on water detector developments (liner, water system, photo-sensors, electronics, DAQ, etc..)
  - Since the LBNE collaboration had many expertise of the water detector, sharing expertise is valuable for us (Hyper-K group).

- We expect more discussions on
  - physics potential
  - area of cooperations
- during the summit.

- Thank you very much for the invitation.

2

Hyper-K Status in Japan

Strategy toward the approval of the Hyper-K projects in Japan

1. Make a proposal with the realistic design, reliable budget plan, solid organization and visible international contributions.
2. Negotiation with MEXT. It will be accelerating with the proposal.
3. Discussions with KEK and ICRR managements.
4. Have a campaign of Hyper-K physics seminars in the major Japanese universities and institutes for more outreach.
    1. In each country, the similar campaign is desired.
5. Continuous endorsements of Hyper-K in the Japanese communities (HEP and CRC) with moderate supports from Nuclear Physics, Astronomy, J-PARC community, etc..
6. Endorsements of Hyper-K in the world-wide neutrino community.
7. Submit the budget request in 201X (X=6,7?)

Japan HEP community Future Plan

- http://www.jahep.org/office/doc/201202_hecsubc_report.pdf

Recommendations

The committee makes the following recommendations concerning large-scale projects, which comprise the core of future high energy physics research in Japan.

- **Should a new particle such as a Higgs boson with a mass below approximately 1 TeV be confirmed at LHC, Japan should take the leadership role in an early realization of an e^+e^- linear collider.** In particular, if the particle is light, experiments at low collision energy should be started at the earliest possible time. In parallel, continuous studies on new physics should be pursued for both LHC and the upgraded LHC version. Should the energy scale of new particles/physics be higher, accelerator R&D should be strengthened in order to realize the necessary collision energy.

- **Should the neutrino mixing angle θ_{13} be confirmed as large, Japan should aim to realize a large-scale neutrino detector through international cooperation, accompanied by the necessary reinforcement of accelerator intensity, so allowing studies on CP symmetry through neutrino oscillations.** This new large-scale neutrino detector should have sufficient sensitivity to allow the search for proton decays, which would be direct evidence of Grand Unified Theories.

Science Council of Japan (SCJ)

- SCJ selects Hyper-K as a top priority project in the "Japanese Master Plan of Large Research Projects" (27 chosen out of 192 in all science area).
  - http://www.scj.go.jp/ja/info/kohyo/pdf/kohyo-22-t188-1.pdf
  - English translation of Hyper-K part

No.	Scien-tific Field No.	Project Name	Project Summary	Scientific Significance	Social Value	Project Duration	Financial Requirement (1billion yen)	Implementing Institution, or Affiliation of Proposer
85	23-2	Nucleon decay and neutrino oscillation experiment with an advanced large detector	The project aims to construct a one million ton-scale water Cherenkov detector, Hyper-Kamiokande, to succeed Super-Kamiokande and to perform world-leading neutrino and nucleon decay research in conjunction with the J-PARC accelerator facility.	The project will explore CP violation (matter-antimatter asymmetry) in neutrinos in order to help understand the evolution of the universe. Additionally, with the world's best nucleon decay searches it also aims to establish the unification of elementary particles and their forces.	Addressing profound questions concerning the elementary structure and evolution of the universe appeals directly to the inherent intellectual curiosity mankind harbors for comprehension of its origins and future. Additionally, dramatic advances in neutrino research with a world-leading project in Japan represent society's dreams for a rich program in basic science.	2015 to 2038	Total:1,880 Construction of Hyper-Kamiokande 800, Operating cost of Hyper-Kamiokande 450, Operating cost of J-PARC 600, Neutrino monitor 30	Lead by the Institute for Cosmic Ray Research, University of Tokyo and the High Energy Accelerator Research Organization. Participation from domestic and foreign universities and research institutions is anticipated.

MEXT Roadmap 2014 draft is released

- The recent MEXT roadmap recommends funding 10 of the 27 immediately.
- Hyper-K not among those ten recommended for urgent funding.
- Hyper-K is also being asked to improve
  - International participation
  - Organization
  - Cost estimate
- Next revision of roadmap in 2017. Time to address above items.
- Does not delay HK operations. Budget request was planned for 2017 anyway.

Comments about Hyper-K

- **Advantages**
  - Expect world-leading scientific results by using upgraded J-PARC facility.
  - Expect steady progresses based on the past achievements in the neutrino field. Support by Japanese society is foreseen.
- **Issues**
  - Although the plan of Super-K's successor should be made, appropriate organizations and international cooperation, cost-sharing should be well defined for such a large project.
  - Because the required budget is large, necessity and scientific merit of the project should be fully explained and recognized.