**IceCube Institutional Memorandum Of Understanding (MOU)**

**Scope of Work**

**Chiba University**

**Shigeru Yoshida**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **5** (2 3 0)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | WBS 2.1 | WBS 2.2 | WBS 2.3 | WBS 2.4 | WBS 2.5 | WBS 2.6 | **Grand Total** |
| Program Coordination | Detector Maintenance & Operations | Computing & Data Management  | Data Processing & Simulation  | Software | Calibration |
| KE  | YOSHIDA, SHIGERU | Reconstruction | Maintain Romeo, EHE Simulations, Calibration using Standard Candles |   |   |   |   | 0.20 |  | 0.20 |
|  |  | Reconstruction  | EHE online pipeline for follow-up observations |  |  |  |  | 0.15 |  | 0.15 |
|  | **YOSHIDA,SHIGERU Total** |  |  |  |  |  | **0.35** |  | **0.35** |
|  | ISHIHARA, AYA | Online Filter (Pnf) | EHE filter  |  | 0.15 |  |  |  |  | 0.15 |
|  |  | Reconstruction  | Maintain Portia and the SC data filtering  |  |  |  |  | 0.15 |  | 0.15 |
|  |  |  | **IceCube Upgrade Optical Sensor L3** |  |  |  |  |  |  |  |
|  |  | Administration | Member of Speaker Comm | 0.10 |  |  |  |  |  |  |
|   | **ISHIHARA, AYA Total** |  | **0.10** | **0.15** |  |  | **0.15** |  | **0.40** |
|   | **KE Total** |  | **0.10** | **0.15** |  |  | **0.50** |  | **0.75** |
| PO | Lu, Lu | Real-Time Alerts | Maintenance of IceCube realtime analysis system |  |  |  0.20 |  |  |  | 0.20 |
|  |  | Realtime Oversight Comm |  | 0.10 |  |  |  |  |  | 0.10 |
|  |  | Distributed Computing Resources | Grid Operations Team  |  |  | 0.20 |  |  |  | 0.20 |
|  |  | Simulation Production  | Special background simulation production (Corsika) |  |  | 0.20 |  |  |  | 0.20 |
|   | **LU, LU Total** |  | **0.1** |  | **0.60** |  |  |  | **0.70** |
|  | Maximilian Meier | Simulation Production  | High energy Corsika simulation production with Sibyll 3.2 and EPOS |  |  | 0.20 |  |  |  | 0.20 |
|   | **Meier, Maximilian Total** |  |  |  | **0.20** |  |  |  | **0.20** |
|   | **PO Total** |  | **0.1** |  | **0.80** |  |  |  | **0.90** |
|  GR |  |  |  |  |  |  |  |  |  |  |
|   | **CHIBA GR Total** |  |  |  |  |  |  |  |  |
| **CHIBA Total** |  |  | **0.20** | **0.15** | **0.80** | **0.0** | **0.50** | **0.00** | **1.65** |

Chiba was responsible for the PMT and EHE simulation programs and many of our service tasks are related to these business. The detector simulation project, Romeo, which is also responsible for the DOM’s acceptance calculation to be implemented in the Photonics and CLsim, is maintained by our group (**S. Yoshida, M.Meier, L.Lu**) who includes one of the original authors of Romeo (**S. Yoshida**).

The detector calibration using the standard candle has also been on our priority to provide the collaboration with some key knowledge of our detector response., **S.Yoshida**, **L Lu** maintain this activity to have better understanding of the DOM response and the ice propaties.

 Our other service activities include Portia, (**A. Ishihara**), which is alternative to WaveReform for processing large pulses in DOM. This module has been frequently used in EHE and monopole analysis that must handle extremely luminous events. The EHE simulation framework/meta-project is maintained by **S. Yoshida** and **M.Meier**

Chiba also works on EHE filters that contain most energetic population of IceCube events. The filtered data are compared with simulation (**A. Ishihara/S,Yoshida/L.Lu** ) for confirming our detector response and its stability to high energy data.

Because the present EHE signal search procedures are not CPU-intensive, **S.Yoshida** is serving as a contact person and maintainer on the online signal selection pipeline for sending alerts to other astronomical instruments. The online search for extremely-high energy neutrinos allows IceCube to trigger follow-up observation by optical/gamma-ray telescopes. He also serves as a member of Realtime Oversight Group to ensure functions of the online processing for sending alerts. **A.Ishihara** provided the initial baseline algorithm for this program. **Lu Lu** is now in charge of maintaining the online EHE selection program.

**Faculty:**

 Shigeru Yoshida – maintain Romeo and EHE simulations, detector calibration, D-Egg production and supervising the D-Egg quality control.

Aya Ishihara –maintain EHE simulation. MC/Data comparison for EHE-filtered events, maintain the reconstruction projects (Portia), and develop the suitable algorism for the online search of EHE neutrino signals.

 **Scientists and Post Docs:**

 Lu Lu – detector development and simulation study for IceCube gen2. The contact point for the grid computing. The **coordination task lead for the diffuse working group.**

 Analysis topics: Multi-flavor PeV spectrum analysis.

 Colton Hill – calibration and characterization of D-Egg and design of the D-Egg FAT. He is making the long range photonics table production as a service task for IceCube and IceCube-Gen2.

Maximilian Meier – Developing the DAQ/analysis pipeline for D-Egg calibrations and FAT. Maintenance of the EHE simulation framework and expansion for IceCube-Gen2/Radio simulaton study.

Ryo Nagai – Development of the D-Egg front-end electronics and its production control.

Kein’ichi Kin – Oversighting the D-Egg mass production and its quality control.

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  **Ph.D. Students:**

 Thesis/Analysis topics: Not at the moment

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**Remarks on the IceCube Upgrade related activity**

Chiba is working on the new optical detectors, D-Egg, for IceCub Upgrade. **Aya Ishihara** leads the development of the D-Egg and currently served as L3 for the optical sensors (D-Egg), spending a significant fraction of her time for this project. **Colton Hill** and **Maximilian Meier** is responsible for testing and calibrating all the devices as well as FAT for IceCube Upgrade. **Ken’ichi Kin** is managing the mass production of D-Egg and responsible for quality control of the production procedures. **Ryo Nakai** is responsible for developing the front-end electronics and partly help PMT characterization. **Lu Lu** is working on the Gen2-related simulation study. Thus a major fraction of available resources from Chiba has now been channeled into the IceCube-gen2 and IceCube upgrade.

**Computing Resources**

Chiba has 16 computational nodes and 196 cores in total. They are all intel Xenon machines and the latest one’s specification is Xeon E5-2667 v2 with the frequency of 3.3 GHz.

There are also two GPU nodes and one has two nvidia Tesla K40 and another has two Tesla K80, so 6 cores in total.

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