IceCube Institutional Memorandum Of Understanding (MOU)

Scope Of Work

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| Niels Bohr Institute – Københavns UniversitetD. Jason KoskinenPh.D Scientists (Faculty Scientist/Post Doc Grads) : 4 (2 2 3) |

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| 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 | KOSKINEN, D. JASON | Administration | Member of ICC | 0.10 |  |  |  |  |  | 0.10 |
|  |  | Education & Outreach  | Speaking engagements (high school classes, open houses) | 0.05 |  |  |  |  |  | 0.05 |
|  | **KOSKINEN, D. JASON Total** |  | **0.15** |  |  |  |  |  | **0.15** |
| PO | RAMEEZ, MOHAMED | Real-Time Alerts | Real Time Shifts |  | 0.10 |  |  |  |  | 0.10 |
|  | STUTTARD, TOM | Core Software | Software Strike Team |  |  |  |  | 0.25 |  | 0.25 |
|  | STUTTARD, TOM | Offline Data Processing | Pass2 verification |  |  |  | 0.10 |  |  | 0.10 |
|  | **NBI PO Total** |  |  |  | **0.10** |  | **0.10** | **0.25** |  | **0.45** |
| GR  | LARSON, MICHAEL | Simulation Production | LE simprod scripting |  |  |  | 0.05 |  |  | 0.05 |
| Simulation Production | GENIE/CORSIKA specialization |  |  |  | 0.10 |  |  | 0.10 |
| Simulation Production | IC86 MuonGun |  |  |  | 0.10 |  |  | 0.10 |
| Detector Monitoring | Monitoring Shifts |  | 0.03 |  |  |  |  | 0.03 |
| MEDICI, MORTEN | Detector Monitoring | Monitoring Shifts |  | 0.03 |  |  |  |  | 0.03 |
|  |  | Education & Outreach | Danish interviews, blog posting, media requests, and speaking engagements | 0.10 |  |  |  |  |  | 0.10 |
|  | BOURBEAU, ETIENNE | Detector Calibration | Dedicated measurements of coincident noise |  |  |  |  |  | 0.10 | **0.10** |
|  |  | Detector Calibration | Individual DOM efficiency |  |  |  |  |  | 0.15 | **0.15** |
|  | **NBI GR Total** | **0.10** | **0.06** |  | **0.25** |  | **0.15** | **0.41** |
| NBI Total |  |  | **0.25** | **0.16** |  | **0.35** | **0.25** | **0.25** | **1.26** |

Contribution from Master Students

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Labor Cat. | Names | WBS L3 | Tasks | WBS 2.1 | WBS 2.2 | WBS 2.3 | WBS 2.4 | WBS 2.5 | Grand Total |
|  | Program Management | Detector Maintenance & Operations | Computing & Data Management | Triggering & Filtering | Data Quality, Reconstruction & Simulation Tools |
| Master Students |  |  |  |  |  |  |  |  |  |
|  | **NBI Master Student Total** |  |  |  |  |  |  |

Faculty:

D. Jason Koskinen: PINGU and low-energy simulation, tau neutrino appearance, 100% IceCube

Markus Ahlers: Cosmic Ray anisotropy analysis, neutrino sources

[Subir Sarkar, representing Oxford U. on ICB, is also Niels Bohr Professor, spending 50% time at NBI]

Scientists and Post Docs:

Tom Stuttard, Mohammed Rameez

Ph.D. Students:

Michael Larson: Maintainer and developer of the Vuvuzela noise model, generating MuonGun muon background, 100% IceCube

Thesis/Analysis topics: Tau neutrino appearance in DeepCore

Morten Medici: Mr. Medici has finished the IC86 multi-year galactic center dark matter analysis, 100% IceCube

Thesis/Analysis topics: Dark matter search in DeepCore

Etienne Bourbeau: New maintainer of Vuvuzela noise model (replacing Michael Larson), working on clustering point-source analysis right now

Thesis/Analysis topics: Extended Tau Neutrino Appearance Measurement in DeepCore

Diploma/Master Students:

Mikkel Jensen: Searches for non-relativistic stable long-lived exotic particles.

Description of Service work

We generated DeepCore/PINGU MuonGun files and with our 10 card GPU farm. NBI is responsible for refining and maintaining the correlated noise simulation, which is a major factor in improving sensitivity to the lowest energy regions. Morten and Jason have conducted numerous interviews (national in Denmark and international as well) on the radio, news, and internet, as well as local MasterClasses on offer to regional High School classes. At some point, Tom Stuttard will look at doing the glide-in so that the NBI GPUs can be fully integrated into the distributed simprod setup.

For IceCube-Gen2 Rameez is working on the mDOM reconstruction in order to provide accurate reco estimates and a comparison to a phase-I deployment with pDOMs.

**Computing Resources**

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| --- | --- | --- |
|  | **2016** | **2017** |
|  | **CPU Cores**  | **GPU Cards** | **CPU Cores** | **GPU Cards** |
| **IceCube**  | 0 |  | 0 |  |
| **PINGU** | 0 | 10 | 0 | 10 |
| **Gen2**  |  |  |  |  |

Due to offsite and remote access issues there is additional work in order to get the necessary glide-ins necessary for automated simprod production.

We have 10 K20 cards with the following setup.

- 2x E5-2650v2 (8 core, @2.6 GHz, 10% faster than E5-2670)

- 64GB memory

- Max 4x Nvidia K10 GPUs, full bandwidth (16x PCIe 3) simultaneously to all GPUs.