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

**Pennsylvania State University**

**Doug Cowen**

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

**Scope of Work**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **Funds Source** | **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 |
| KE | COWEN, DOUG  | Education & Outreach | Education & Outreach | Inst. In-Kind | 0.05 |  |  |  |  | **0.05** |
|   | Engineering and R&D | PINGU Co-Lead | Inst. In-Kind | 0.35 |  |  |  |  | **0.35** |
|   | **COWEN, DOUG Total** |  |  | **0.40** |  |  |  |  | **0.40** |
|   | DEYOUNG, TYCE | Education & Outreach | Education & Outreach | Inst. In-Kind | 0.05 |  |  |  |  | **0.05** |
|   | Physics Filters | Oscillations WG - Co Chair | Inst. In-Kind |  |  |  | 0.15 |  | **0.15** |
|  |  | Administration | Deputy Spokesperson | Inst. In-Kind | 0.20 |  |  |  |  | **0.20** |
|   | **DEYOUNG, TYCE Total** |  |  | **0.25** |  |  | **0.15** |  | **040** |
| PO | ARLEN, TIM | Simulation Production | Simulation Production | Base Grants |  |  | 0.08 |  |  | **0.08** |  |
|  |  | Reconstruction/ Analysis tools | Develop analysis tools for systematics study | Base Grants |  |  |  |  | 0.10 | **0.10** |
|  |  | Detector Monitoring | Monitoring Shifts | Base Grants |  | 0.03 |  |  |  | **0.03** |
|   | **ARLEN, TIM Total** |  |  |  | **0.03** | **0.08** |  | **0.10** | **0.21** |
|  | JOAO PEDRO DE ANDRES | Computing Resources | Coordination and Support Grid distributed computing | NSF M&O Core |  |  | 0.25 |  |  | **0.25** |
|  |  | Simulation Production | Simulation Production, IceSim vetting for LowEn  | Base Grants |  |  | 0.08 |  |  | **0.08** |
|  |  | Reconstruction/ Analysis tools | Low energy reconstruction techniques for DeepCore | Base Grants |  |  |  |  | 0.10 | **0.10** |
|  | **DE ANDRES, JOAO PEDRO Total**  |  |  | **0.33** |  | **0.10** | **0.43** |
|  | TESIC, GORDANA | Reconstruction/ Analysis tools | Integrate IceCube into AMON | Inst. In-Kind |  |  |  |  | 0.50 | **0.50** |
|  | **TESIC, GORDANA Total** |  |  |  |  |  | 0.50 | **0.50** |
| GR | DUNKMAN, MATT | Reconstruction/ Analysis tools | develop starting track reconstruction - hybrid reco | Base Grants |  |  |  |  | 0.47 | **0.47** |
|  |  | Detector Monitoring | Monitoring Shifts | Base Grants |  | 0.03 |  |  |  | **0.03** |
|   | **DUNKMAN, MATT Total** |  |  |  | **0.03** |  |  | **0.47** | **0.50** |
| **PSU Total** |  |  |  | **0.65** | **0.06** | **0.42** | **0.15** | **1.17** | **2.45** |

**Summary:**

Penn State contributions to the maintenance and operations of IceCube include:

**Faculty:**

Doug Cowen (L,+) - PINGU co-lead, outreach, 100% IceCube

Tyce DeYoung – Deputy Spokesperson, Oscillations WG Co-Chair, outreach, 50% IceCube

**Scientists and Post Docs:**

Tim Arlen – simprod, PINGU systematics studies, monitoring, 100% IceCube

 Analysis topics: Tau neutrino appearance

João Pedro de Andres–

 simprod, distributed computing, Low-En triggering and filtering, Low-En reconstruction methods, 100% IceCube

 *Reconstruction modules: MultiNest*

 Analysis topics: Neutrino mass hierarchy

Gordana Tesic – Integrating IceCube into AMON, 50% IceCube (on internal PSU funds, not PSU base grant)

 Analysis topics: n/a

**Ph.D. Students:**

Matt Dunkman – Starting track reconstruction development, 100% IceCube

 *Reconstruction modules: HybridReco*

 Thesis/Analysis topics: Oscillations

Feifei Huang - (still taking classes)

 Thesis/Analysis topics: n/a

**Computing Resources:**

The Penn State IceCube group has access to several large computing clusters maintained and administered by the Penn State High Performance Computing group, comprising a total of approximately 8,000 computing cores, including several GPUs. Since September 2012, the Penn State group has had priority access to 260 cores. Our historical average utilization has been around 120% of the cores to which we have priority access, with peak usage levels around 600%.

With these clusters Penn State has contributed substantially to simulation production, including the entire collaboration-wide simulation of low energy neutrinos with GENIE, all PINGU simulations, and around 10% of all simprod jobs run collaboration-wide. Substantial amounts of reconstruction development work have also been conducted using these resources.

**Note:** The activities and staffing levels in this MoU are appropriate for the period beginning October 1, 2013.