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

**Scope of Work**

**University of Delaware**

**Tom Gaisser**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **8** (4 4 2)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | GAISSER, TOM | Administration | Executive Com.; Institutional lead | Inst. In-Kind | 0.20 |   |   |   |   | 0.20 |
|   | **GAISSER, TOM Total** |  |  | **0.20** |  |  |  |  | **0.20** |
|   | SECKEL, DAVID | TFT Coordination | TFT Board member | Inst. In-Kind |   |   |   | 0.10 |   | 0.10 |
|  |  | Data Acquisition | DAQ Monitoring | Inst. In-Kind |  | 0.05 |  |  |  | 0.05 |
|   | **SECKEL, DAVID Total** |  |  |  | **0.05** |  | **0.10** |  | **0.15** |
|   | STANEV, TODOR | Administration | Pubcom member | Inst. In-Kind |  0.10 |  |   |   |   | 0.10 |
|   | **STANEV, TODOR Total** |  |  | **0.10** |  |  |  |  | **0.10** |
| SC | TILAV, SERAP | IceTop Operations | Coordinate IceTop Operations | NSF M&O Core |   | 1.00 |   |   |   | 1.00 |
|   | **TILAV, SERAP Total** |  |  |  | **1.00** |  |  |  | **1.00** |
| PO | GONZALEZ, JAVIER  | Simulation Programs | Simulations | Base Grants |   |   |  |  | 0.10 | 0.10 |
|  |  | Reconstruction / Analysis Tools | event reconstruction | Base Grants |   |   |   |  | 0.25 | 0.25 |
|   | **GONZALEZ, JAVIER Total** |  |  |  |  |  |  | **0.35** | **0.35** |
|  | TAMBURRO, ALESSIO | Simulation Production | IceTop Simulation Production | Base Grant |   |   |  0.35 |  |  | 0.35 |
|  |  | Physics Filters | CR-WG Chair | Base Grant |  |  |  | 0.25 |  | 0.25 |
|   | **TAMBURRO, ALESSIO Total** |  |  |  |  | **0.35** | **0.25** |  | **0.60** |
|   | KUWABARA, TAKAO | Detector Monitoring | Temp. & Pressure atmospheric monitoring | Inst. In-Kind(0.9) M&O(0.1) |   | 0.30 |   |   |   | 0.30 |
|   | **Kuwabara, Takao Total** |  |  |  | **0.30** |  |  |  | **0.30** |
|   | RUZYBAYEV, BAKHTIYAR | Simulation Programs | Environmental corrections in sims | Base Grants |   |   |   |   | 0.30 | 0.30 |
|   | **Ruzybayev , Bakhtiyar Total** |  |  |  |  |  |  | **0.30** | **0.30** |
| GR | PANDYA, HERSHAL | Simulation Programs | sim-services | Base Grants |   |   |   |   | 0.10 | 0.10 |
|  | KOIRALA, RAMESH | Simulation Programs | sim-services | Base Grants |   |   |   |   | 0.10 | 0.10 |
|   | **UD GR Total** |  |  |  |  |  |  | **0.20** | **0.20** |
| **UD Total** |  |  |  | **0.30** | **1.35** | **0.35** | **0.35** | **0.85** | **3.20** |

**Faculty:**

Tom Gaisser – Executive Committee, cosmic rays and neutrinos

Paul Evenson – Heliospheric physics

David Seckel – TFT board / DAQ monitoring, radio R&D

Todor Stanev – Atmospheric muons/neutrinos; Pubcom member

**Scientist:**

Serap Tilav - IceTop data quality; IceTop operations;

 Analysis: Primary spectrum and composition

**Post-docs:**

Javier Gonzalez – Inclined shower reconstruction and simulation code; IceTop event viewer.

 Analysis topics: Cosmic ray physics with IceCube

Alessio Tamburro – Cosmic ray WG chair; ICC Member; in charge of IceTop simulations across the Collaboration and reporting to Simulation Coordination Panel; IceTop simulation code maintenance; online IceTop data filtering code maintenance.

 Analysis topics: ground level enhancements from transient events

Takao Kuwabara – Temperature, pressure & snow; environmental monitoring and monitoring of scalar rates – no longer supported by NSF as of Sept1, 2012; partial support on institutional funds

 Analysis: seasonal variation of atmospheric muon rate

Bakhtiyar Ruzybayev – Multi-year data processing

 Analysis: extending the IceTop cosmic ray spectrum at the highest energies and identifying sources; primary composition

**Ph.D. Students:**

Ramesh Koirala – Periodic data monitoring, IceTop reconstruction tools, data verification.

 Analysis: IceTop cosmic ray spectrum with the constant intensity cut method;

Hershal Pandya – Environmental correction in simulation, simulation verification.

 Analysis: Gamma ray sources with IceCube;

**Computing cluster:**

UD is part of the IceCube system of distributed computing. The IceCube cluster at UD is used primarily for simulation production of air showers and coincident events seen by both the surface and in-ice components of IceCube. In 2008 the Bartol Research Institute of the University of Delaware provided funds for a substantial upgrade of our computer cluster, and the cluster was upgraded again in 2009. After the latest upgrade, and the merging of other IceTop computing resources that were managed separately, the IceTop portion of the Bartol-UD cluster now consists of 232 computing cores (29 nodes), 56 with 2GB/core, 144 with 3GB/core and 32 with 4GB/core. There is a total of 86TB of disk space divided across 4 disk servers. The upgrades amounted to about $40,000 of hardware expenses. In addition, at least 10% of the time of IT specialist Daniel De Marco is attributable to IceCube.