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

**Scope of Work**

**University of Delaware**

**Tom Gaisser**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **9** (6 3 2)

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **Tasks** | **Funds Source** | 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 | GAISSER, TOM | Administration | Institutional lead | Inst. In-Kind | 0.20 |  |  |  |  |  | 0.20 |
|  | **GAISSER, TOM Total** | |  |  | **0.20** |  |  |  |  |  | **0.20** |
|  | SECKEL, DAVID | Online Filter (Pnf) | TFT Board | Inst. In-Kind |  | 0.10 |  |  |  |  | 0.10 |
|  |  | Administration | Pubcom member | Inst. In-Kind | 0.05 |  |  |  |  |  | 0.05 |
|  |  | Data Acquisition | DAQ Monitoring | Inst. In-Kind |  | 0.05 |  |  |  |  | 0.05 |
|  | **SECKEL, DAVID Total** | |  |  | **0.05** | **0.15** |  |  |  |  | **0.20** |
|  | SCHROEDER, FRANK | Surface Detectors | Surface detector enhancements | Inst. In-Kind |  | 0.20 |  |  |  |  | 0.20 |
|  | **SCHROEDER, FRANK Total** | |  |  |  | **0.20** |  |  |  |  | **0.20** |
|  | EVENSON, PAUL | Administration | Managing solar and heliospheric  aspects of IceTop | Inst. In-Kind | 0.05 |  |  |  |  |  | 0.05 |
|  | **EVENSON, PAUL Total** | |  |  | **0.05** |  |  |  |  |  | **0.05** |
| SC | TILAV, SERAP | Surface Detectors | Coordinate IceTop Operations | NSF M&O Core |  | 0.70 |  |  |  |  | 0.70 |
|  |  | Detector Monitoring | Data monitoring | Inst. In-Kind |  | 0.15 |  |  |  |  | 0.15 |
|  | **TILAV, SERAP Total** | |  |  |  | **0.85** |  |  |  |  | **0.85** |
| PO | SOLDIN, DENNIS | Simulation Production | IceCube/IceTop  simulation production | NSF M&O |  |  |  | 0.5 |  |  | 0.50 |
|  |  | Reconstruction | Software maintenance: Event reco and corsika reader | Inst. In-Kind |  |  |  |  | 0.20 |  | 0.20 |
|  |  | Administration | ICC member | Inst. In-Kind | 0.05 |  |  |  |  |  | 0.05 |
|  |  | Online Filter (Pnf) | IceTop Filter | Inst. In-Kind |  | 0.10 |  |  |  |  | 0.10 |
|  | **SOLDIN, DENNIS Total** | |  |  | **0.05** | **0.10** |  | **0.50** | **0.20** |  | **0.85** |
|  | GONZALEZ, JAVIER | Reconstruction | Event reconstruction and simulations | NSF M&O |  |  | 0.20 |  |  |  | 0.20 |
|  | **GONZALEZ, JAVIER Total** | |  |  |  |  | **0.20** |  |  |  | **0.20** |
| GR | PANDYA, HERSHAL | Simulation Software | sim-services | Inst. In-Kind |  |  |  |  | 0.10 |  | 0.10 |
|  | KOIRALA, RAMESH | Online Filter (Pnf) | Two station trigger | Inst. In-Kind |  | 0.10 |  |  |  |  | 0.10 |
|  | **UD GR Total** | |  |  |  | **0.10** |  |  | **0.10** |  | **0.20** |
| **UD Total** | |  |  |  | **0.35** | **1.40** | **0.20** | **0.50** | **0.30** |  | **2.75** |

**Faculty:**

Tom Gaisser – Institutional Lead; atmospheric neutrinos

Paul Evenson – Managing Solar and heliospheric aspects of IceTop

David Seckel – TFT board / DAQ monitoring, Scintillators, Gen2 R&D

Frank Schroeder – Cosmic-ray physics; radio/scintillator detection of cosmic rays

Todor Stanev – Atmospheric muons/neutrinos, cosmogenic neutrinos

Jamie Holder – Multi-messenger and coordination with VERITAS

**Scientist:**

Serap Tilav - IceTop data quality; IceTop operations; scintillators

Analysis: Primary spectrum and composition

**Post-docs:**

Dennis Soldin – Air shower reconstruction and simulation code. 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: Spectrum and composition at high energy using coincident events over a large angular range; muon bundles, surface hits and laterally separated muons

Javier Gonzalez – Event reconstruction and simulations

Analysis topics: Cosmic-ray physics with surface muons

**Ph.D. Students:**

Ramesh Koirala – Data monitoring shift, IceTop two-station trigger and filter verification.

Analysis: Spectrum in the knee region with small showers in IceTop

Hershal Pandya – Data monitoring shift; CORSIKA reader maintenance, simulation verification.

Analysis: Gamma ray and cosmic-ray composition with IceCube; muon production depth

**Computing cluster:**

UD is part of the IceCube system of distributed computing. The IceCube cluster at UD is used primarily for simulation (CORSIKA) production of air showers and development of simulations of 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 has been upgraded from time-to-time since then. After the current upgrade, the IceCube portion of the Bartol-UD cluster now consists of 272 computing cores (28 nodes), 200 with 2GB/core, 40 with 3GB/core and 32 with 4GB/core. There is a total of 90TB of disk space divided across 3 disk servers. The UD share of the cost if upgrades amounted to about $40,000 in total.