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

**Scope of Work**

**University of Maryland**

**Greg Sullivan**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **7** (3 4 4)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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 | SULIVAN, GREG | Administration | M&O/Upgrade planning | Inst. In-Kind | 0.30 |  |  |  |  | 0.30 |
|  | Administration | ExecCom member | Inst. In-Kind | 0.20 |  |  |  |  | 0.20 |
|  | **SULIVAN, GREG Total** | |  |  | **0.50** |  |  |  |  | **0.50** |
|  | HOFFMAN, KARA | Engineering and R&D Support | Detector R&D | Inst. In-Kind | 0.20 |  |  |  |  | 0.20 |
|  | **HOFFMAN, KARA Total** | |  |  | **0.20** |  |  |  |  | **0.20** |
|  | UMD KE | Education & Outreach | E&O | Inst. In-Kind | 0.10 |  |  |  |  | 0.10 |
|  | **UMD KE Total** | |  |  | **0.10** |  |  |  |  | **0.10** |
| SC | BLAUFUSS, ERIK | Online Filter (PnF) | Maintain PnF Software and Online Filters | NSF M&O Core |  | 0.20 |  |  |  | 0.20 |
|  | Administration | Analysis Coordinator | Base Grants | 0.40 |  |  |  |  | 0.40 |
|  | TFT Coordination | filter requests, bandwidth, TFT Board Member | Inst. In-Kind |  |  |  | 0.30 |  | 0.30 |
|  | **BLAUFUSS, ERIK Total** | |  |  | **0.40** | **0.20** |  | **0.30** |  | **0.90** |
| PO | OLIVAS, ALEX | Simulation Programs | Simulation Software Programs coordinator | Inst. In-Kind |  |  |  |  | 0.40 | 0.40 |
|  |  | Administration | IceCube Weekly call coordination | Inst. In-Kind | 0.20 |  |  |  |  | 0.20 |
|  |  | Detector M&O | Support Detector M&O | Inst. In-Kind |  | 0.40 |  |  |  | 0.40 |
|  | **OLIVAS, ALEX Total** | |  |  | **0.20** | **0.40** |  |  | **0.40** | **1.00** |
|  | FELDE, JOHN | Data Production Processing | Implement near real time GRB analysis | Base Grants |  |  | 0.40 |  |  | 0.40 |
|  | **FELDE, JOHN Total** | |  |  |  |  | **0.40** |  |  | **0.40** |
|  | WISSING, HENRIKE | Administration | PubComm member | Base Grants | 0.10 |  |  |  |  | 0.10 |
|  | Physics Filters | EHE & Brights-WG co-chair | Base Grants |  |  |  | 0.25 |  | 0.25 |
|  | Reconstruction/ Analysis tools | develop & test reconstruction | Base Grants |  |  |  |  | 0.125 | 0.13 |
|  | Simulation Programs | Maintain Detector Simulation (IceSim) | Base Grants |  |  |  |  | 0.125 | 0.13 |
|  | **WISSING, HENRIKE Total** | |  |  | **0.10** |  |  | **0.25** | **0.25** | **0.60** |
| GR | CHEUNG,  ELIM | Simulation Production | Simulation Production coordination | Base Grants |  |  | 0.25 |  |  | 0.25 |
|  | **CHRISTY, BRIAN Total** | |  |  |  |  | **0.25** |  |  | **0.25** |
|  | MAUNU,  RYAN | Core Software | Detector R&D | Base Grants |  |  | 0.25 |  |  | 0.25 |
|  | **MEAGHER, KEVIN Total** | |  |  |  |  | **0.25** |  |  | **0.25** |
|  | RICHMAN,  MIKE | Online Filter (PnF) | Online Filter Testing | Base Grants |  | 0.125 |  |  |  | 0.125 |
|  | Reco/Analysis tools | Reco./ Analysis tools | Base Grants |  |  |  |  | 0.125 | 0.125 |
|  | Simulation Programs | Maintain Detector Simulation (IceSim) | Base Grants |  |  |  |  | 0.125 | 0.125 |
|  | **REDL, PETER Total** | |  |  |  | **0.125** |  |  | **0.25** | **0.375** |
|  | HELLAUER, ROBERT | Core Software | Core Software | Base Grants |  |  | 0.125 |  |  | 0.125 |
|  | TFT Coordination | Datasets for filter testing & common MC datasets | Base Grants |  |  |  | 0.10 |  | 0.10 |
|  | **HELLAUER, ROBERT Total** | |  |  |  |  | **0.125** | **0.10** |  | **0.225** |
|  | UMD GR | Detector Monitoring | Monitoring shifts | Base Grants |  | 0.06 |  |  |  | 0.06 |
|  | **UMD GR Total** | |  |  |  | **0.06** |  |  |  | **0.06** |
| **UMD Total** | |  |  |  | **1.50** | **0.79** | **1.03** | **0.65** | **0.90** | **4.87** |

**Faculty:**

Greg Sullivan (L,+) – Former Spokesperson, Data Systems, ExecCom, ICB, Institution lead, Outreach

Kara Hoffman – filter development, Radio R&D, Outreach

Jordan Goodman – Coordination with Milagro/HAWC, Outreach

**Scientists and Post Docs:**

Erik Blaufuss – Analysis Coordinator, TFT board Member, PnF, IceTray, SVN repository, Operations Group

Analysis topics: GRB

John Felde – Online – near realtime GRB analysis

Analysis topics: GRB, Neutrino Oscillations

Alex Olivas – Tuesday Call co-convener, Software management, Simulation program coordinator

Analysis topics:

Henrike Wissing –EHE and Brights WG co-chair, PubComm member, atmospheric monitoring, reconstruction, simulation

Analysis topics: EHE

**Ph.D. Students:**

Mike Richman – filter verification, filter development

Thesis/Analysis topics: GRB search with muons

Elim Cheung – Offline Processing development & testing, Simulation

Thesis/Analysis topics: Neutrino Oscillations

Ryan Maunu – Filter development, Simulation production coordination

Thesis/Analysis topics: GZK Neutrinos

Robert Hellauer – Core Software, Datasets for filter testing & common MC datasets

Thesis/Analysis topics: GRB search with all flavors

**UMD General M&O (non-science) IceCube Responsibilities and Contributions:**

The Maryland Group’s major responsibilities and contributions towards maintenance and operations of the IceCube experiment include:

* Primary institutional responsibility for the maintenance of the online PnF filter system.
* Primary institutional responsibility for the maintenance of the IceTray analysis framework, SVN code repository and software package building.
* Major responsibility for the maintenance of the IceCube simulation package (IceSim).
* The Maryland group maintains a computing cluster of approximately several hundred cpu cores and online disk storage of more then 100TB dedicated to IceCube activities. A minimum of 140 cpu cores (50%) are reserved for dedicated simulation production under the coordination of the IceCube simulation production manager. ***The university just recently provided funding of $80k to enhance the cluster with a large number of GPU equipped units with a capability of approximately 25-30% of real time IceCube simulation.***

**Institutional (UMD) resource contribution to Computing:**

The maintenance and operation of the computing cluster includes:

1. High quality Computing Space, cooling and power (provided by UMD)
2. Networking and high speed connectivity to the Internet (provided UMD)
3. System administration (.5 FTE sys-admin) (partial support by UMD)
4. Hardware maintenance on a 5-year replacement cycle of $40k/year (partial support by UMD).

*1. & 2. Computing Space, cooling and power & Networking and high speed connectivity to the Internet*

***The University of Maryland provides high quality space, cooling and power.*** The IceCube group is provided essentially unlimited space in a modern HPC computing facility for research computing on campus. The facility is monitored 24/7 by provided technicians and we have 24/7 secure access. The current system occupies 10 rack spaces with additional space set aside for possible expansion. Maryland is a major hub for the Internet-2 backbone in the northeast US. *The University provides a 10 Gb/s fiber connection directly from the interenet-2 backbone into our cluster in the research computing facility.* In addition, the university provides a dedicated fiber between the research computing facility and our research group in the physics building.

*3. & 4. System administration & Hardware maintenance on a 5-year replacement cycle*

***The University of Maryland provides $45k per year in funding to be used towards the total.*** The system administration is approximately .5 FTE and includes administration for the computing cluster as well as about 1 dozen workstations used by the PA group. The hardware maintenance for the compute cluster is $40k per year.