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

**Scope of Work**

 **Massachusetts Institute of Technology**

**Janet M. Conrad**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads): **3** (1 2 4)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS Level 3** | **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 | Janet M. Conrad | Engineering and R&D support  | Test beam development | 0.05 |   |   |   |   |  | 0.05 |
|  | Engineering and R&D support | mTOM development | 0.05 |   |   |   |   |  | 0.05 |
|   | **Janet M. Conrad Total** |  | **0.10** |  |  |  |  |  | **0.10** |
| PO | Carlos Arguelles Delgado | Simulation Software | NuSQuIDS, NuSFGen, and MC reweighting development |   |  |   |   | 0.30 |  | 0.30 |
|   | **Carlos Arguelles Total** |  |  |  |  |  | **0.30** |  | **0.30** |
|  | Ben Safdi | Reconstruction  | NonPoisson Template Fitting Code |   |  |   |   | 0.30 |  | 0.30 |
|   | **Ben Safdi Total** |  |  |  |  |  | **0.30** |  | **0.30** |
| GR | Gabriel H. Collin | Detector Calibration | Flasher code development |   |  |    |  |   | 0.10 | 0.10 |
|   |   | Simulation Software | NuSQUIDs model update |   |   |   |  | 0.50  |  | 0.50 |
|   | **Gabriel H. Collin Total**  |  |  |  |  |  |  **0.50** | **0.10** | **0.60** |
|  | Spencer Axani | Simulation Software | Earth & Atmos simulations for systematic error studies |    |  |  |  |  0.10 |  | 0.10 |
|  |  | Engineering and R&D Support  | mTOM development and expertise in CAD | 0.20 |  |  |  |  |  | 0.20 |
|  | **Spencer Axani Total**  |  | **0.20** |  |  |  | **0.10** |  | **0.30** |
|  | Marjon Moulai | Simulation Software | Development of code describing nu decay |  |  |  |  | 0.15 |  | 0.15 |
|  |  | Engineering and R&D support | Test beam development | 0.10 |  |  |  |  |  | 0.10 |
|  | **Marjon Moulai Total**  |  | **0.10** |  |  |  | **0.15** |  | **0.25** |
|  | Nick Rodd | Reconstruction  | NonPoissonian Template Fitting code |    |  |  |  | 0.25 |  | 0.25 |
|   | **Nick Rodd Total**  |  |  |  |  |  | **0.25** |  | **0.25** |
| **MIT Total** | **0.40** | **0.0** | **0.0** | **0.0** | **1.60** | **0.10** | **2.10** |

**Note: Gen-2 contributions not relevant for IceCube M&O are highlighted in blue (Total: 0.30 FTE)**

 **Faculty:**

Janet M. Conrad – Institution lead, M&O responsibilities in R&D (2.1.2) including proposing a FNAL testbeam run at to constrain particle simulations for IceCube and PINGU (this project is being organized by Teppei Katori) and studying isolated optical modules (mTOMs) for PINGU.

**Scientists and Post Docs:**

Carlos Arguelles -- M&O responsibility is in maintaining and improving his simulation code for use in the 5 year IC86 analysis. Specific projects are 1) speeding up NuSQUiDS, 2) updating NuFSGen to represent the 5 year data set and 3) speeding up the analysis by improving the reweighting algorithm for MC events.

Analysis Topics: Bring the 1-year IC86 sterile neutrino analysis to publication, and start organizing the 5-year IC86 analysis. Develop the neutrino decay analysis. Begin outlining the NSI-using-TeV-neutrinos analysis.

Ben Safdi – M&O responsibility is in introducing his code for NonPoissonian Template Fitting to find below-threshold point sources. The technique was developed for Fermi-LAT and then made publicly available through github.

Analysis Topics: Apply the NPTF algorithm to the IC86 sterile neutrino, having initially developed the code using the IC59 public release data set.

**Grad Students:**

Spencer Axani – (2nd year) M&O responsibility is in Data Quality, Reconstruction and Simulation (2.5.1), presently concentrating on taking over the sterile neutrino oscillation error code from Ben Jones who has graduated, as well as starting the event selection for the 1 to 100 TeV range of data in the 5 year data set. M&O responsibilities in R&D (2.1.2) consist of developing the mTOM prototypes.

Analysis Topic: IC86 sterile neutrino analysis using 5-year data set.

Gabriel Collin – (4th year) M&O responsibility in detector maintenance and operations (2.2.8) is single PE DOM studies in coordination with Dawn Williams. This began June 1, 2015 and will continue through next summer. M&O responsibility in Data Quality, Reconstruction and Simulation (2.5.1.) is on 1) expanding the flux model of A. Fedynitch to include more atmospheric density data sets and 2) determining atmospheric systematics using errors on these data sets for the NonPoissionian Template Fit Input. Focus is in the 1-100 TeV range.

Analysis Topics: NPFT analysis, IC86 sterile analysis using 5-year data set and neutrino decay analysis.

Marjon Moulai – (2nd year) Still completing coursework, starts full time in summer. M&O responsibility in R&D (2.1.2) is on 1) studying the advantages of more pixelization in HEA for reconstructing PeV events and 2) working on the testbeam concept, which is being led by Teppei Katori.

Analysis Topics: TBD. Will begin in the Osc-Low En group.

Nick Rodd – (3rd year) M&O responsibility in Data Quality, Reconstruction and Simulation (2.5.1.) is on introducing the the NonPoissionian Template Fit Input. Focus is in the 1-100 TeV range.

Analysis Topics: NPFT analysis.