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

**Scope of Work**

**RWTH Aachen**

**Christopher Wiebusch**

**Ph.D Scientists** (Faculty Scientist/Post Doc Grads Master): **2** (1 1 10 6)

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **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 | WIEBUSCH, CHRISTOPHER | Administration | ExecCom member | 0.20 |  |  |  |  |  | 0.20 |
|  | Administration | PubCom member | 0.10 |  |  |  |  |  | 0.10 |
|   | **WIEBUSCH, CHRISTOPHER Total** |  | **0.30** |  |  |  |  |  | **0.30** |
| PD | AUFFENBERG, JAN | Surface Detectors  | IceAct coordination | 0.20 |  |  |  |  |  | 0.20 |
| Surface Detectors | IceAct/Skycam Datataking Maintenance |  | 0.30 |  |  |  |  | 0.30 |
|   | **AUFFENBERG, JAN Total** | **0.20** | **0.30** |  |  |  |  | **0.50** |
| GR | HAACK, CHRISTIAN | Simulation Software | Seasonal Weights for NeutrinoFlux module Flux (provided as described in internal report) |  |  |  |  | 0.05 |  | 0.05 |
|  | Simulation Production | Simulation production for consistent MC spanning IC-59-IC-86-5 (relevant after pass 2 is completed) |  |  |  | 0.05 |  |  | 0.05 |
|  | Reconstruction | Energy reco with machine learning (regression forrest). To be used in diffuse final level  |  |  |  |  | 0.10 |  | 0.10 |
|  |  | Reconstruction  | NuMuFitStandard tool for diffuse profile likelihood fits of the up-going muon sample similar to Skylab for ps and oscfit for osc. analyses (currently in S.Schoenen sandbox) |  |  |  |  | 0.20 |  | 0.20 |
|  |  | Offline Data Production | Pass2 verification Muon L3 and diffuse WG |  |  |  | 0.20 |  |  | 0.20 |
|  | REIMAN, RENE | Distributed Computing Resources | Grid Operations Team |  |  | 0.20 |  |  |  | 0.20 |
|  |  | Offline Data Production | Comparison of diffuse and ps samples for muon L3 and ps-wg-group |  |  |  | 0.10 |  |  | 0.10 |
|  | RONGEN, MARTIN | Ice Properties | Hole Ice & bulk ice calibration |  |  |  |  |  | 0.30 | 0.30 |
|  | Detector Calibration | DOM Calibration and R&D |  |  |  |  |  | 0.10 | 0.10 |
|  | Surface Detectors | IceAct calibration/maintenance |  |  |  |  |  | 0.20 | 0.20 |
|  | Detector Monitoring | Detector monitoring shifts contact from Aachen  | 0.05 |  |  |  |  |  | 0.05 |
|  | LEUERMANN, MARTIN | Reconstruction  | Development and Maintenance of PegLeg (to be part of millipede) |  |  |  |  | 0.30 |  | 0.30 |
|  |  | Reconstruction | Co maintenance of OscFit and implementation of extensions (e.g. KDE, systematic fits, baseline correction)  |  |  |  |  | 0.20 |  | 0.20 |
|  |  | Reconstruction | KDE Tools to produce adaptive weighted KDEs, used in OscFit and NuMuFit (currently in Seb Schoenen sandbox) |  |  |  |  | 0.10 |  | 0.10 |
|  | Schumacher, Lisa | Offline Data Production | Muon Level 3 (future) |  |  |  | 0.05 |  |  | 0.00 |
|  | Offline Data Production | Providing HE muon events from diffuse analysis for the IC/Auger/TA coincident analyses |  |  |  | 0.05 |  |  |  |
|  |  | Reconstruction | Noboloid TBD  |  |  |  |  |  |  |  |
|  | Jöran Stettner | tbd | TBD: NuMuFit tool, GPU computing? |  |  |  |  |  |  |  |
|  | GR | Detector Monitoring | Detector monitoring shifts |  | 0.12 |  |  |  |  | 0.12 |
|  | **GR Total** |  |  | **0.05** | **0.12** | **0.20** | **0.45** | **0.95** | **0.60** | **2.37** |
|  | **RWTH Total:** |  |  | **0.55** | **0.42** | **0.20** | **0.45** | **0.95** | **0.60** | **3.17** |

**Diplom/Master Students M&O Contribution:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Labor Cat.** | **Names** | **WBS L3** | **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 |
| Master | Aatif Waza | Surface Detectors | IceAct Simulation |  | 0.05 |  |  |  |  | 0.05 |
|  Martin Brenzke | Reconstruction |  New energy reco with deep neural network |  |  |  |  | 0.2 |  | 0.2 |
| Jan Paul Koschinski | R&D Support |  IceAct R&D and construction of 61 pixel camera |  | 0.2 |  |  |  |  | 0.2 |
|  | Erik Vogel | Reconstruction | Noboloid : Calculation of resolution estimators for PS analysis |  |  |  | 0.3 |  |  | 0.3 |
|  | Tobias Sälzer | Calibration |  IceAct IceCube coincidences |  |  |  |  |  | 0.3 | 0.3 |
|  | **Diploma/Master Students Total** |  |  | **0.25** |  | **0.3** | **0.2** | **0.3** | **1.05** |

**Faculty:**

Christopher Wiebusch

**Scientists and Post Docs:**

Jan Auffenberg - High energy surface extension, (IceVeto, IceAct).

**Ph.D. Students:**

Marius Wallraff Thesis topic: Sterile neutrinos

Larissa Paul Thesis topic RASTA

Leif Rädel Thesis topic: Multi year diffuse muon neutrino analysis

Sebastian Schoenen Thesis topic: Multi year muon neutrino diffuse analysis

Rene Reimann Thesis topic : Cosmic neutrino sources

Martin Leuermann Thesis topic: Neutrino mass hierarchy analysis with DeepCore

Martin Rongen IceCube Gen2 R&D Calibration, Thesis Topic: Gen 2 DOMs, Calibration

Christian Haack Thesis Topic: Cosmic neutrino sources, Galactic Plane

Lisa Schumacher Auger,TA,IceCube Correlation and angular correlation analysis

Jöran Stettner Multi year diffuse analysis and dark matter decay

**Diploma/Master Students**

Eric Vogel Point source fits (finished-> industry)

Theo Glauch Angular correlation analysis (finished-> Munich)

Aatif Waza IceAct Simulation of Xmax measurement

Martin Brenzke Energy reco with deep Learning

Jan-Paul Koschinski IceAct 61 pixel camera

Tobias Sälzer IceAct, IceCube Coincidence analysis

Piotr Kalacinsky Cross correlation of angular skymap

**Computing Resources**

|  |  |  |
| --- | --- | --- |
|  | **2016** | **2017** |
|  | **CPU Cores**  | **GPU Cards** | **CPU Cores** | **GPU Cards** |
| **IceCube**  | ~27700 (shared resources, guaranteed 0.3% usage) | 58 (shared resources, 50% usage) | ~27700 (shared resources) | 58 (shared resources) |
| **PINGU** | --- | --- | --- | --- |
| **Gen2**  | Same as for IceCube | Same as for IceCube | Same as for IceCube | Same as for IceCube |

GPU Cards: Bullx R425-E2, 2 x NVIDIA Quadro 6000, CPU: X5650 @ 2.67 GHz

CPU Cores: X5675 @ 3.0GHz and X7550 @ 2.0GHz

New GPU cluster under construction, t.b.d.