Project Activities

Activities report submitted 2001

Following the successful deployment of the final stage of the AMANDA-II detector in January 2000, the collaboration focus has shifted to the completion of the analysis of all the detector data. Concurrent with the completion of the 1997 data analysis publications, analysis of the 1998/99 (AMANDA-B13) and 2000/2001 (AMANDA-II) data sets are in progress.

1998/99 data The filtering of the 1998/99 data sets is in progress. The analysis methods developed in the B10 analysis will be used to reduce these data, which will triple the statistics of the original B10 analyses.

2000 data The 2000 data were returned from the South Pole in late 2000. The completion of the level 1 filtering of these data is imminent, a level 2 filtering scheme is ready, and determination of final neutrino cuts is well advanced. Throughout this process, the experience and techniques developed throughout the B10 analysis have allowed for a rapid, and simple, processing scheme for these data. The simplification of the data reduction techniques and cuts has been helped greatly by the larger size of the 19-string AMANDA-II detector. First indications are that the rate of observed atmospheric neutrinos will be of the order 4-5 events per day, and that sensitivity to extra-terrestrial source will be significantly improved. Once the data have been reduced, the first results from dedicated searches for excesses from point sources and gamma-ray bursts will follow quickly. The supernova system will achieve 97% coverage of the galaxy.

2001 data During the austral summer of 2000, sophisticated web-based detector monitoring and an on-line filtering system were introduced into the data flow chain at the south pole. The continuous monitoring and subsequent correction of detector problems means that the on-line filtered level 1 data, transferred via satellite on a regular basis, are of high quality. Some of these data have been processed through the higher level of the analysis chain. This work will eventually pave the way for real-time, automated data reduction to high analysis levels, from where, for instance, sky plots of the neutrino arrival directions can be produced in real time.

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Data analysis

1997 data Much work was done in completing or bringing closer to completion the analyses of the 1997 data set. Results of the completed analyses have been submitted to refereed journals, with several already accepted for publication. The last of the analyses will be submitted in the near future.

1998/99 data Filtering of the 1999 data has been completed, and a re-filtering of 1998 data, using updated calibration information will follow. The analysis methods developed in the B10 analysis will be used to reduce these data, which will triple the statistics of the original B10 analyses.

2000 data The year 2000 data set has been filtered to a level where searches for atmospheric, diffuse and point sources of neutrinos can be made. The first results from these searches are reported.

2001 data The 2001 data tapes from the South Pole arrived in Madison in early 2002. All initial preparations for high level filtering have been completed. The entire year's data, 1.7TB, is on disk awaiting final filtering, which will start in August 2002 when the new computer cluster is commissioned.

2002 data The on-line filtering system at the south pole has been developed to the stage where neutrino candidates are being extracted on a daily basis.

analysis of SPASE/AMANDA coincidence events The existence of the surface SPASE air shower array allows for the study of the composition of the cosmic ray events that enter the earth's atmosphere. Events that pass through both SPASE and AMANDA are studied by two complementary techiniques, leading to detailed knowledge of the makeup of the primary cosmic ray. Coincident data from 1997 has been analysed using new techniques and this analysis tells us about the cosmic ray composition.

Data handling and computer resources

Data Movement In May 2002 data transfers from the South Pole, via the TDRS Ku-Band service, were moved from LBNL to Madison, WI. This was to provide a more comprehensive range of data services to the AMANDA collaboration. All data is kept on disk and is easily accessible to all collaboration members, and large resources are immediately available for work on the data. A comprehensive web interface makes locating relevant data, and monitoring of data flow and communications easy. http://amanda.physics.wisc.edu/data/

UW - Madison Computing Resources In 2001 a 28 CPU computer cluster was commissioned (in August 2002 it will be extended a further 128 CPUs) in Madison to facilitate efficient and timely analysis of South Pole experimental data, and for simulation work crucial to the data analysis. To maximize the reliability of the system and safety of the data, a number of high reliability servers and storage systems have also been installed, providing around 5TB of high reliability, fast access storage, along with taping systems to guard against disaster situations.

The UW AMANDA group has been working in conjunction with the Computing Science department on implementation of the simulation chain under the CONDOR distributed computing system. This system has been a major development of the Computing Science department, and allows the distribution of computing jobs to CPUs located all over the world. During the first testing phase, the group accessed about 60000 CPU hours of computer resources.

South Pole Computing Resources The upgrading of the AMANDA computing resources at the South Pole, which was started in 2000, has continued. Almost all hardware has been upgraded to high quality Compaq systems. This is in line with the NSF support contractor, RPSC, who also use Compaq systems. Through consultation with RPSC personnel, AMANDA and RPSC have coordinated and agreed on the type of resources to be used at the South Pole, which has minimized the number of spare resources that are needed, and maximizes expertise which can be shared.

South Pole Communications AMANDA continues to be the major user of the TDRS Ku-Band forward store system. In early 2001 the average daily transfer of data was above 3GB. By the same time in 2002, by using more extensive and complex analysis techniques at the South Pole, made possible by the improved computing resources, this had dropped to 2.5GB per day. This will make it possible to increase data collection rates, which is expected through future improvements in the DAQ system, while not impeding other science groups using this service. The data being transfered to Madison on a daily basis is now of the highest quality. http://amanda.physics.wisc.edu/data/satellite.shtml

AMANDA continues to work closely with RPSC to help the support contractor understand the specific needs of science communications, and support requirements at the South Pole.

Data Collection and Filtering The 2001 data tapes from the South Pole arrived in Madison in early 2002. All initial preparations for high level filtering have been completed. The entire year's data, 1.7TB, is on disk awaiting final filtering, which will start in August 2002 when the new computer cluster is commissioned.

The 2002 high level filtering is being done on-line at the South Pole, with results being transfered to Madison daily.

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Data analysis

A summary of the status of the data analyses are shown in table 1, with more specific details on some analyses given here.

AMANDA-B10 data analysis The diffuse muon neutrino search with the 1997 data set has been completed and the limits set on extraterrestrial fluxes have been published in Physical Review Letters. An analysis of 1997 data is also near completion where ultra-high energy neutrino events, the muons from which are of such high energy that they can be separated from the downgoing atmospheric muon background, are searched for.

The 1998/1999 data have been filtered after finalisation of the detector calibration for those years, and analyses are underway.

AMANDA-II data analysis The analysis of the AMANDA-II data from the year 2000 is well advanced, with initial results reported for the diffuse neutrino searches (both muon and cascade detection channels), for the point source search, the Gamma-ray burst search and for the ultra high energy muon-neutrino search. The data from 2001 have been filtered and high level analyses have begun for the point source and diffuse searches. Data from 2002, filtered on-line at the south pole, are being analysed in various ways. Realtime filtered data from the current year, 2003, are flowing from the south pole to the collaboration via satellite uplink.

SPASE-AMANDA coincidence analysis The analysis of the coincident SPASE-AMANDA data set from 1998 has been completed, yielding results on the mass composition of cosmic rays near the knee region. Data from 2002 are now being analysed.

Table 1

Summary of the AMANDA analysis activities by data collection year. Key to symbols : P - published results, S - paper submitted , D - draft for publication, PR - preliminary results, IP - analysis in progress. For data archiving and filtering, Off - Data filtered offline, On - Data filtered online at the south pole

	1997	1998	1999	2000	2001	2002	2003
Data archiving and filtering	Off	Off	Off	Off	On/Off	On	On
Downgoing muons	PR	D		IP		IP	
Atmospheric neutrinos	P			PR	IP		
Diffuse upgoing neutrinos	P			PR	IP		
Diffuse cascade neutrinos	P		PR	PR			
Diffuse UHE neutrinos	D			PR			
Point source neutrinos	P		IP	D	IP	IP	
Gamma-ray burst neutrinos	PR	PR	PR	PR	IP		
WIMPs (earth)	P	IP	IP	IP			
WIMPs (sun)				IP	IP		
Monopoles	PR	IP	IP	IP			
Supernovae neutrinos	P	P	IP	IP	IP	IP	
SPASE-AMANDA calibration	S					IP	
SPASE-AMANDA composition		D				IP	