Sloan Digital Sky Survey II

2005 THIRD QUARTER REPORT

July 1, 2005 – September 30, 2005

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Q3 PERFORMANCE HIGHLIGHTS

- July 1, 2005 marked the official start of the SDSS-II Survey. SDSS-II observing operations began on July 1 and are scheduled to end on June 30, 2008. The SDSS-II Survey is fully-funded.
- In Q3, we obtained 30 square degrees of imaging data for the SEGUE Survey and 844 square degrees of imaging data for the Supernova Survey.
- We completed 11 Legacy Survey plates and 13 SEGUE plates (8 bright and 5 faint). The combination of SEGUE bright and faint plates allowed us to declare 6 SEGUE tiles complete.
- Weather was marginal as expected, given the summer monsoon season at APO.
- Summer shutdown work at APO, which included extensive preventive maintenance activities, and the implementation of the SN compute cluster and DA upgrade, was completed as planned.
- Data Release 5 was loaded in preparation for a fall Collaboration release. Our goal was to release DR5 to the collaboration by September 30. Problems with the loading operation, due in large part to the growing size of the database, prevented us from meeting the goal. We anticipate releasing DR5 to the collaboration in late October, approximately three weeks later than planned. The DR5 public release is scheduled for June 30, 2006.
- Q3 cash operating expenses were $1,076K against a baseline budget of $1,395K, excluding management reserve. In-kind contributions were $246K against anticipated contributions of $235K. No management reserve funds were expended in Q3.

1. SURVEY PROGESS

Due to the summer shutdown, there were only two complete observing runs in 2005 Q3. The first occurred prior to the shutdown; it started on July 1 and ended on July 14. The second occurred after the summer shutdown; it started on August 22 and ended on September 14. The time from September 15 through 30 will be accounted for in the next report, as it is more practical and convenient to report progress and performance metrics in terms of complete observing runs as opposed to partial runs. This is what we have traditionally done and is consistent with our reporting methods for SDSS-I.

Data obtained prior to the summer shutdown are for the Legacy and SEGUE Surveys. Data obtained after the summer shutdown are for the SEGUE and Supernova Surveys. The following sections describe progress made in each of the three Surveys.

1.1. Legacy Survey

Observing operations associated with the Legacy Survey occurred during the July run. Weather conditions were not suitable for imaging; therefore we did not obtain any Legacy imaging data. The baseline goal for Q3 was 41 square degrees. Since we acquire imaging area at the rate of 18.75 square degrees per hour, we are roughly two hours behind the baseline plan for imaging.

We fared much better on spectroscopy. Through mostly cloudy conditions, we completed 11 Legacy spectroscopic plates against the baseline goal of 6 plates.

Given the small increment in the baseline projections for Q3 and the small amount of new data obtained, we have chosen not to include the standard progress graphs for the Legacy Survey in this quarter's report, as they would convey little new information. The progress graphs will be included in the Q4 report, when the Northern Galactic Cap again becomes visible and we anticipate more substantial progress in both Legacy imaging and spectroscopy.

1.2. SEGUE Survey

Table 1.1 summarizes progress made on the SEGUE Survey through Q3. As with Legacy, weather prevented SEGUE imaging in July. Carryover effects from the summer monsoon season, along with problems associated with commissioning the new data acquisition system, limited SEGUE observing (imaging and spectroscopy) in August. As a result, we obtained 30 square degrees of new SEGUE imaging data against the baseline goal of 201 square degrees. It is worth noting that the baseline goal assumes imaging through the end of September, whereas the accounting for this report stops at September 14, the end of the last full dark run of the quarter. We did obtain additional SEGUE imaging data in the latter half of September, which will be included in the accounting for the Q4 report. We also obtained the imaging data necessary to design new SEGUE plates that will be observed later in the fall season.

In addition to imaging, a total of 13 SEGUE plates (8 bright and 5 faint) were observed, which allowed us to complete 6 SEGUE tiles. A SEGUE tile is considered complete when the faint and bright plate combination for a field is observed. Since the baseline plan defines progress in terms of tiles, not plates, Table 1.1 compares the number of tiles completed to the baseline goal.

Table 1.1. SEGUE Survey Progress in 2005-Q3

	2005-Q3		Cumulative through Q3	
	Baseline	Actual	Baseline	Actual
SEGUE Imaging (sq. deg)	201	30	201	1334
SEGUE Spectroscopy (tiles)	11	6	11	39

Although progress in Q3 was less than anticipated, cumulative progress on the SEGUE Survey is ahead of the baseline due to the acquisition of SEGUE data in previous quarters, when commissioning and proof-of-concept observations were made. To date, SEGUE has obtained approximately 1334/3320 square degrees of imaging and approximately 39/206 tiles towards its baseline goal. Progress graphs for the SEGUE Survey are not included in this report for the same reasons noted above for the Legacy Survey. They will be included in the Q4 report.

SEGUE work in Q3 included data acquisition and processing activities. In addition, SEGUE target selection algorithms were changed in a limited fashion following meetings of the SDSS-II Collaboration's SEGUE participants. The modified algorithms will be used to design plates for this fall and next spring.

The survey footprint was also slightly modified, to incorporate changes discussed by the collaboration. We anticipate no further changes at high Galactic latitude, $|b| > 20$, to either the footprint or the target selection algorithm. See http://home.fnal.gov/~yanny/fut/layout.html for the current SEGUE layout and progress map (current as of Sep 1, 2005).

The SEGUE calibration effort, which plans to obtain photometric and spectroscopic observations of stars with a variety of atmospheric parameters is underway, including observations of known clusters with the APO Photometric Telescope (PT) and the USNO 1-m telescope. These observations are being conducted by the 2.5m observers at APO, by J. A. Smith and P. McGehee of LANL at the USNO, with processing overseen by D. Tucker of Fermilab. Further proposals to obtain spectroscopy of known metallicity standards on a variety of large telescopes are also underway.

1.3. Supernova Survey

Observing for the Supernova Survey is scheduled to occur during 90-day observing periods in the fall of each year. The 2005 observing campaign began on September 1 and is scheduled to end on December 1. The supernova observing program started out slowly, due to weather and DA commissioning problems, but by quarter's end, we managed to collect quite a bit of data. The Q3 report includes progress through September 14, the last day of the last complete observing run in the quarter. The baseline plan anticipated that we would acquire approximately 700 square degrees of Stripe 82 imaging data during this fourteen day period (Sep 1-14). In fact, we obtained 844 square degrees of new imaging data.

The Q4 report will summarize progress through December 31, which includes the full 2005 Supernova observing season. At that time, we will be better positioned to report progress against the stated metric for the Supernova Survey, namely, the discovery per observing season of 50 good Type Ia light curves found sufficiently early that follow-up spectroscopy can be undertaken. The criterion for "good" requires that the peak brightness is better than 15% per supernova.

2.0 OBSERVING EFFICIENCY

Observing efficiency is summarized according to the categories used to prepare the baseline projection.

2.1. Weather

The weather category reports the fraction of scheduled observing time that weather conditions are suitable for observing. Table 2.1 summarizes the amount of time lost to weather and Figure 2.1 plots the fraction of suitable observing time against the baseline forecast. The graph shows a single data point after the summer shutdown, reflecting the fact that there was only one run after the shutdown included in the accounting period for this report.

Table 2.1. Potential Observing Hours Lost to Weather in Q3

Observing Condition	Total hours potentially available for observing	Total hours lost to weather	Fraction of time suitable for observing	Baseline Forecast
Dark Time	213	103	52%	50%
Dark & Gray Time	307	130	58%	50%

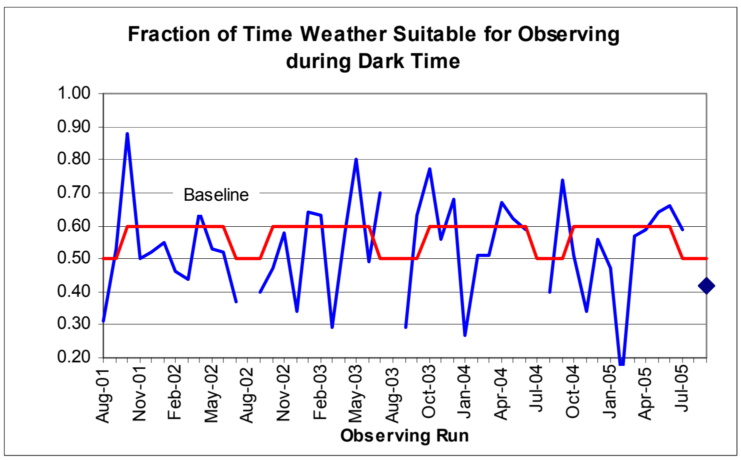

Figure 2.1. Percentage of Time Weather Suitable for Observing

Weather conditions in Q3 are typically poor due to the annual monsoon season and the baseline plan takes this into account. As seen in Figure 2.1, this year was no exception. Weather in July was significantly better than anticipated; weather during the August/September observing run was significantly worse than anticipated. Averaged over the quarter, the fraction of available observing time was slightly more than predicted in the baseline plan.

2.2. System Uptime

System uptime measures the availability of equipment when conditions are suitable for observing. We averaged 95% uptime against a baseline goal of 90%. Table 2.2 summarizes the total amount of time lost to equipment or system problems and Figure 2.2 plots uptime against the baseline goal.

Table 2.2. Potential Observing Hours Lost to Problems in Q3

Observing Condition	Total hours potentially available for observing	Total hours lost to problems	System Uptime	Baseline Forecast
Dark Time	213	10	95%	90%
Dark & Gray Time	307	11	96%	90%

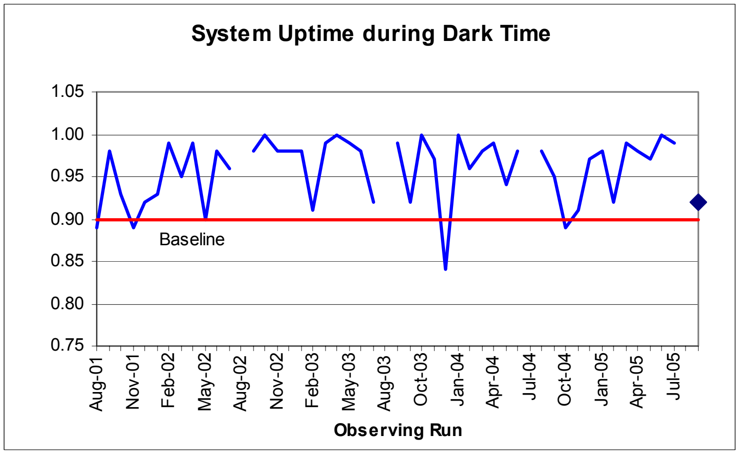

Figure 2.2. System Uptime

2.3. Imaging Efficiency

Imaging efficiency averaged 72% against a baseline goal of 86%. Imaging efficiency was extremely low in July (60%) because there was a single imaging run of very short duration (~1.1 hours). Although imaging efficiency was better during the August/September run, it was still slightly lower than normal because two of the eight imaging runs were of shorter than average duration. One was 1.6 hours in duration and one was 2.9 hours in duration. As imaging overhead time is the same regardless of run length, short runs impact efficiency.

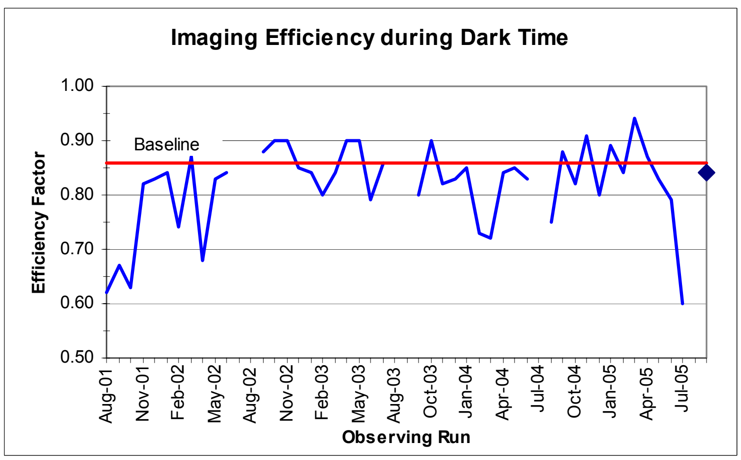

Figure 2.3. Imaging Efficiency

2.4. Spectroscopic Efficiency

Spectroscopic efficiency is derived by assessing the time spent performing various activities associated with spectroscopic operations. Table 2.3 provides the median time, by dark run, for various overhead activities associated with spectroscopic operations. Units for all categories are minutes except for efficiency, which is given as the ratio of baseline science exposure time (45 minutes) to total time required per plate. Using these measures, spectroscopic efficiency averaged 68% against the baseline goal of 64%.

Table 2.3. Median Time for Spectroscopic Observing Activities

Category	*Baseline*	*Run starting Jul 1*	*Run starting Aug 23*
Instrument change	10	4	5
Setup	10	11	5
Calibration	5	6	5
CCD readout	0	3	3
Total overhead	25	24	18
Science exposure (assumed)	45	45	45
Total time per plate	70	69	63
Efficiency	0.64	0.65	0.71

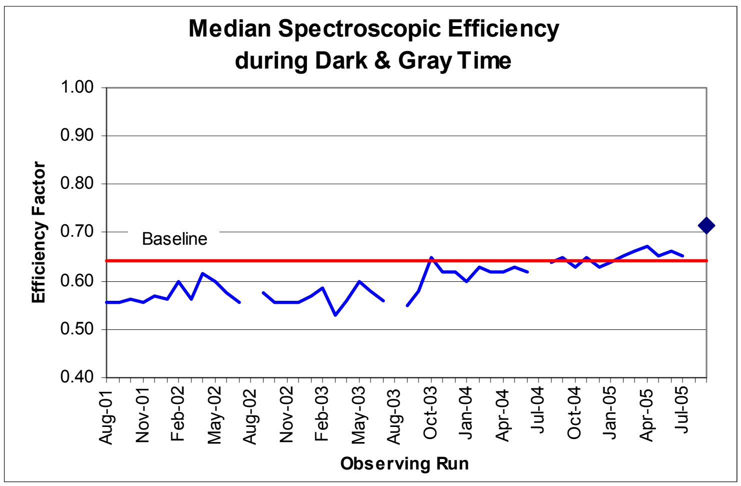

Figure 2.4. Spectroscopic Efficiency

3. OBSERVING SYSTEMS

Observing systems includes the instruments, telescopes, computers and various sub-systems that support observing operations at APO. In addition to observing operations, Q3 includes the annual summer shutdown for scheduled maintenance, details of which are discussed in the following sections.

3.1. The Instruments

The imaging camera was moved into the clean room in July and scheduled repairs and preventive maintenance work were performed. Work during the shutdown included the following:

1. Normal annual preventive tasks such as checking plumbing inside camera; leak-testing the nitrogen pressurization system, etc,; and cleaning and re-purging with dry N2.

2. Replaced the ion pump and cable and built a new high-voltage connector. There have been no “incidents” since we did this; a post-mortem would be interesting, but we have not had time to perform one.

3. Replaced a faulty full sensor on dewar 8, and prepared for a new system to be installed next summer to allow better external monitoring of the full sensor health and performance for all the dewars.

4. All the preparation is in place to replace the u filters should that be necessary. The fact that we chose (because of lack of understanding of the nature of the problem) not to do it this summer made the summer tasks relatively light compared to past years, though if we have to dig into i5 this fall it will more than make up for it.

The imaging camera was re-assembled, tested and was working well through mid-September, when an intermittent problem with the i5 chip appeared. The problem initially showed up as streaking in images obtained from the chip. Zooming in on saturated stars showed negative ghosting to the right of the stars. We had seen similar behavior years ago on this chip, but never as bad as we had on the u2 chip. The problem in i5 was intermittent at first but became increasingly worse until the chip stopped functioning altogether. However, by quarter's end, the chip had mysteriously fixed itself and has been working properly since. We will continue to monitor performance through the end of the fall 2005 Supernova program. Should the problem recur, we will take the camera into the clean room during the December bright time (Dec 11-19) to troubleshoot the chip and associated circuitry and components.

The spectrographs worked well during the quarter, with the exception of a minor vacuum leak and possible contamination introduced during the repair. Prior to the summer shutdown, a vacuum leak appeared in the blue camera dewar on Spectrograph 2 (SP2). During the summer shutdown, the leaky dewar was removed from SP2 and replaced with a spare unit. The leaky unit was sent to Princeton, where it was inspected and repaired, and its vacuum integrity verified. The repaired unit was returned to the observatory and re-installed during the September bright time.

After the spare dewar was installed, a check of the data from SP2 indicated the possible presence of dirt or other contamination on the surface of the blue camera CCD. Initial speculation was that the contamination was introduced into the system during the dewar swap. Plans were quickly made to warm up the spectrograph, open the dewar, and remove the contamination in early October, which was the earliest that off-site technical staff could travel to APO to effect the repair. However, a subsequent and closer inspection of the data, as well as a comparison with data taken prior to the dewar swap, indicated that the contamination was present prior to the dewar swap and may have been caused by deliquescent material on the chip that did not get fully dehydrated during an earlier CCD pump-down. It is possible that the CCD was cooled before an adequate pump-down time had elapsed. Since we are now in Supernova observing season, the spectrographs are not being used. Therefore, the plan is to warm the blue camera CCD, pump down the dewar for an extended period of time, re-cool the dewar, and take test data to verify whether the contamination has been removed, or at least reduced to an acceptable level.

Scheduled summer shutdown work included completing the mapping of thermometers installed inside of the spectrograph bodies during initial construction. As a result, observing software such as SOP and specMech now correctly know the location of all of the thermometers in the spectrographs. We also inspected and photographed the extent of separation in the optical couplant between the lenses on the spectrograph cameras. Noticed several years ago, the separations in the couplant do not appear to be growing, nor are they impacting the quality of the spectroscopic data. Therefore, we have no plans to take corrective action at this time, but we will continue our monitoring program.

3.2. The 2.5m Telescope

The majority of work on the telescopes and related subsystems was associated with planned summer shutdown activities, summarized as follows:

1) Annual preventive maintenance tasks were completed:
   a) The azimuth drive bearing on the 2.5-m telescope was cleaned out, inspected and re-lubricated. Inspection revealed good clean contact surfaces with no visible surface degradation. Torque measurements were made and recorded after the bearing was re-lubricated; torque values remain within nominal limits.
   b) The wind baffle altitude drive chain was visually inspected and its length measured for excessive stretch. The chain is in good working order and its length remains within spec.
   c) The primary mirror of the Photometric Telescope was re-aluminized in the coating chamber at the National Solar Observatory in Sunspot.
   d) The primary mirror of the 2.5m telescope was re-aluminized in the coating chamber at Kitt Peak National Observatory. Upon the mirror's return to Apache Point, a number of whitish spots had appeared on the coating surface; the spots were not present when the mirror was crated for shipment at Kitt Peak. The spots do not appear to be growing in number or size and do not appear to negatively affect the data; therefore we decided to operate this observing season with the mirror as is. The engineers at Kitt Peak have been informed of the spots.
   e) The telescope enclosure roll-up doors were inspected and re-lubricated.
   f) The drive bearing on the instrument rotator was cleaned, inspected and re-lubricated. Bearing rollers and race appear to be in good working condition. Torque values were measured and recorded.
   g) The enclosure dome for the Photometric Telescope was inspected and moving parts re-lubricated.
   h) The fiber cartridge plugging station was inspected and re-lubricated.
   i) Various other minor maintenance activities were completed.

2) A new set of Wind Baffle wheels had been fabricated during the last quarter and we had the opportunity to use them this quarter; they worked well. The upgrade was implemented to prevent the Wind Baffle from being pushed over a gravel surface when it was being moved to its asphalt storage apron. The new wheels greatly increase the safety of this procedure.

4) Two new carts for transporting the spectrographs were fabricated and used during the summer shutdown. The new carts allow us to more safely move the spectrographs from the telescope enclosure to the plug lab.

5) The imager calibrator manual stage lead screw mechanism was redesigned, fabricated, and installed. The old system kept getting loose and required frequent maintenance. In addition, the rotary encoder that was used on the end of the lead screw mechanism failed on average once per two-month interval. We replaced the rotary encoder with a string encoder attached to the stage body.

6) A new enclosure control pendant reel was installed on the east end of the enclosure. The retractable reel helps to prevent the control cord from being trapped under the enclosure walls and damaged during operation. We plan to install a similar reel on the enclosure west end sometime this fall.

7) A fixture was fabricated that allows the engineers to remove and install the rotator from the 2.5-m telescope primary mirror support structure (PSS) without having to remove any components from the top end of the telescope. The fixture was used during the rotator bearing maintenance and it worked well. It shortens the time required to perform rotator bearing work by 8 hours, or approximately 30%.

8) We experimented with methods of connecting multiple 180-liter LN2 dewars to the autofill system for the imager. After testing various manifold combinations, we came up with a system that connects enough LN2 dewars to provide sufficient LN2 for an entire weekend. The new system precludes

daily dewar changes by the technical staff. It also provides a margin of safety during winter storms, when it is often difficult for technical staff to get safely to the observatory.

9) New stainless steel connectors were installed on the rotator wrap coolant lines. The new connectors will eliminate potential contamination problems caused by rust generated by the old steel connectors.

10) A hand-crank mechanism was installed on the DIMM for opening and closing the dome. The new system works well and has met with observer approval; therefore, we will remove the air drive motor sometime this fall.

11) A new pump for the site ground loop cooling system was installed in the lower level of the telescope enclosure. The new pump has a 208 VAC motor, which reduces its heat load from 1KW to about 500 watts. Since the new pump has a different form factor, we also fabricated and installed a new heat shield for the pump, to further reduce the heat load into the enclosure.

3.3. The Photometric Telescope

The Photometric Telescope (PT) worked reasonably well throughout the quarter. We are experiencing growing reliability problems with the PT Telescope Control System (TCS), which is the commercially-purchased computer system that controls telescope operation. The existing system is built on obsolete computer hardware and software and is showing signs of aging. We postponed upgrading the system pending funding for the SDSS-II extension. Now that SDSS-II is funded, we are moving forward with the procurement of a system upgrade. The upgrade should be complete in the coming months.

During the summer shutdown, the new Cryotiger closed cycle refrigerator was installed and put into service. With an expected useful life of four years before recommended factory servicing, we do not anticipate troubles with the compressor like we've had over the past two years. Notwithstanding, we are keeping the two older units on site as spares. Other work during the summer included annual preventive maintenance work, such as inspecting and re-lubricating moving parts on the PT enclosure dome.

3.4. Operations Software and the Data Acquisition System

The new data acquisition system (DA) was installed at APO during the summer shutdown. The obsolete and expensive-to-maintain central computer, *sdsshost*, was replaced with a new Linux computer, *sdsshost2*. Obsolete Motorola MVME167 single-board computers were replaced with MVME5500 PowerPC single-board computers. DLT tape drives were replaced with a new Linux fileserver, *sdssfiles1*. A second fileserver, *sdssfiles2*, was brought online as a hot backup. With the implementation of these file servers, data are no longer being written to tape at APO. Instead, data are written to a file server where it is immediately available for spooling to the Supernova compute cluster at APO, for near-real-time SN data processing. The data on the file server is also transferred via the internet to Fermilab and Princeton for data processing. Prior to data processing at Fermilab, a copy of the data are packaged and written to tape in the Fermilab Enstore tape robot. In the coming quarter, removable disk drives will be implemented on the file servers at APO, which will allow us to write a second backup copy of the data to removable disks that will be temporarily stored at APO and shipped annually to Fermilab for long-term archiving.

Transferring data via the internet eliminates the need for daily Federal Express tape shipments. However, given the volume of data associated with imaging, it was necessary to increase the bandwidth of the microwave link between APO and Alamogordo in order to keep up with the rate of data collection. The bandwidth was increased from 10 to 15 megabits per second, which provides data transfer rates such that it currently takes approximately two hours to transfer one hour of imaging data. Spectro and PT data transfers occur much more quickly. Increasing the microwave bandwidth was simply a matter of modifying the contract with the service provider and paying a slightly higher monthly access fee.

In addition to implementing new hardware, the DA upgrade required modifications to a large number of the software programs used at APO to control the telescopes and acquire data from the instruments. Extensive modifications were required to the DA software packages, *astroline* and *astroda*. The Archiver, which used to write data to tape, was modified to write data to file servers. A new cron job script, *frameCatcher*, was developed and implemented to create links that convert the data written to the file server into a format expected by the various data processing operations: the Archiver writes data referenced to frames from the camera, whereas the DP pipelines expect the data to be referenced to fields on the sky. In addition, *frameCatcher* verifies the integrity of the Archiver data transfer by comparing checksums calculated before and after the transfer, compresses the data on the file server for faster data transfers via the internet, and computes checksums on the compressed files. The xOP programs (IOP, SOP, and MOP), which provide the interface between the observers and the DA, telescope systems, and instruments, were extensively modified to accommodate the various elements of the new DA. The Watcher, which monitors the health and status of the instruments and other key systems, and alerts the observers of problems, was modified to accommodate the new DA. In addition, software that used to operate on *sdsshost* was ported to operate on the new Linux-based *sdsshost2*. Software in this category included *murmur* and the Telescope Performance Monitor (TPM).

At the receiving end of the data transfer pipeline at Fermilab, a great deal of effort went into developing automated scripts to look for new data on the APO file server, and when found, to transfer the data to Fermilab. Once at Fermilab, the data are packaged and copied to the Enstore tape robot for long-term storage and archiving. Once safely archived, messages are sent back to APO verifying that data can be safely removed from the APO file server, to free up space for subsequent data acquisition.

Similar handshaking occurs between Princeton, Fermilab, and APO; and with the SN compute cluster at APO. Spectro and PT data are transferred via the internet to Princeton in parallel with data transfers to Fermilab. Given bandwidth limitations, imaging data are transferred to Fermilab and placed on a file server, where they are subsequently transferred to Princeton. The SN compute cluster is connected to the APO file servers via a GB ethernet connection, so data transfers between these systems do not compete with off-site data transfers. In all cases, verification is made that data was transferred successfully, and that a copy exists in the Enstore tape robot, before the data are deleted from disk at APO. The data transfer process is evolving through experience and we anticipate that we will have in place a formal and documented procedure for the data transfer process early in Q4.

Installation of the new DA hardware and associated software took place at APO in early August. Preliminary tests were made by taking engineering data with the instruments and comparing the results to data taken with the old DA. The tests indicated that data collected with the new DA were of the same quality as those taken prior to the upgrade.

Additional system tests involved moving the telescopes about to verify proper operation of the mechanical systems. End-to-end testing and debugging continued into the early part of the August dark run, as it was felt that the most effective way to test and commission the new system was with the telescopes on the sky, collecting real imaging, spectroscopic, and PT data. Although there were numerous communication and configuration bugs to work out, overall commissioning went reasonably well. We collected our first science spectra with the new DA on August 29 when we finished three SEGUE plates. We collected our first science imaging data on September 2, when we obtained 6.8 hours, or approximately 315 square degrees of imaging data on Stripe 82N.

Ongoing work associated with the DA upgrade includes fixing bugs as they occur to improve system performance, reliability, and robustness. Unless they are critical-high in nature and impede our ability to collect data, bug fixes are only being implemented during "shake" periods, following standard observing software change control procedures. We are also working to implement the process of writing a backup copy of all data to removable disks at APO, and refining and formalizing the data transfer process between APO and production data processing operations. Finally, there are a few programs remaining on *sdsshost* that need to be ported to *sdsshost2*. Once the port is complete, we plan to de-commission *sdsshost* and eliminate the high maintenance contract costs.

4. DATA PROCESSING AND DISTRIBUTION

4.1. Data Processing

4.1.1. Pipeline Development and Testing

No changes were made to the Legacy photometric or spectroscopic pipelines in Q3.

Significant development work was completed at Princeton on the SEGUE spectroscopic pipeline, and in particular idlspec2d, v5. Significant development work was also completed by the JINA-MSU team on the development of the stellar atmosphere pipeline that will be used for SEGUE observations in order to estimate atmospheric parameters (Teff, log g, [Fe/H]) based on R = 2000 spectroscopy and ugriz photometry.

The stellar atmosphere pipeline in use is presently based on a number of independent methods (obtained from different calibrations) for each parameter, which are then suitably averaged in the final estimation process. Estimates of the internal scatter in the determination of a given parameter are also kept track of. The pieces of this pipeline are (for now) run as separate procedures. Steps are being taken in order to put all of these pieces into an IDL procedure so that they can be run in standalone mode. Several of the calibrations rely on input B-V colors, which have to be derived from observed g-r colors via an approximate transformation. This step will be eliminated soon, as new calibrations tied directly to ugriz colors are obtained.

Highlights of Q3 progress in this area are as follows:

- Generation of grids of synthetic spectra for both Kurucz and MARCS models, covering a wide range of parameter space in Teff, log g, and [Fe/H].
- Generation of a sub-grid of synthetic spectra for carbon-enhanced versions of the MARCS models, covering a wide range of [C/Fe].
- Development of a preliminary set of line index definitions for features to be measured during the course of the pipeline execution. These indices were sent to other SEGUE calibration participants for comments/suggestions. It is anticipated that further refinement of these line indices will take place as SEGUE evolves.
- Development of an "optimal" continuum fitting procedure (in IDL), which has been demonstrated to be superior to previously available methods we were using.
- Testing of methodologies (based on Artificial Neural Networks and Support Vector Machines) for the estimation of stellar atmospheric parameters based on ugriz photometry alone. It is expected that these techniques might prove useful for refinement of SEGUE target selection algorithms, or as standalone methods for further analysis of stars without available spectroscopy.

- Began obtaining high-resolution spectroscopy of SDSS stars with predicted parameters from the present pipeline, so that calibration and refinement of these estimates can be carried out.
- Processed existing SDSS/SEGUE spectroscopy and distributed estimated atmospheric parameters to the SDSS collaboration obtained from the current pipeline.

Looking ahead, the primary goal of the JINA-MSU team is to have a working (IDL based) stellar atmosphere pipeline up and running by the end of November or early December. This will represent v1_0 of the pipeline. Once this goal is accomplished, we will seek to refine and improve the pipeline based on empirical comparison of the estimated atmospheric parameters with those obtained from high-resolution spectroscopic observations that we either have already, or are presently obtaining. This effort will also provide an external measure of the expected errors in the parameter determinations.

We plan to run v1_0 of the stellar atmosphere pipeline through all available SEGUE data as of early December, in order to verify that it is working properly (i.e., that it reproduces what we obtain from the "individual components" of the pipeline mentioned above). A catalog of the derived parameters will be circulated to the SDSS-II/SEGUE collaboration.

4.1.2. Data Processing Operations at APO

Our goal is to process data for the Supernova Survey at APO within 24 hours of acquisition in order to quickly identify Type Ia supernova candidates for spectroscopic follow-up. Q3 work included the installation and commissioning of the production SN compute cluster at APO, and the processing of supernova data. In particular, from July through the end of August, the final DA upgrades were put in place and the 10-server SN computer cluster was installed. From September 1-14, SDSS imaging collected about 5000 frames of data. About 90% if the data was dedicated to the supernova search and the remainder was for SEGUE and oblique scans.

Processing the first few runs encountered problems requiring a few hours of debugging, but these were fixed soon enough to avoid a negative impact on the SN search. As an example, the first problem was that file-names and variable-names had the string "Tape" replaced with "Disk"; needless to say a new version of photo was needed.

The first two weeks of September also saw some DA development resulting in SN-processing delays of up to several hours for things like missing or corrupted log-files. Fortunately all problems were recoverable and had minimal impact on the SN search.

Overall data quality looked good; there are no apparent problems compared to our experience from last year. At quarter's end, the compute cluster is operating in a production manner. Future work will include minor modifications as necessary to fix bugs, fine-tune performance and increase operational efficiency and system robustness.

4.1.3. Data Processing Operations at Fermilab

Data for the Legacy, SEGUE and Supernova Surveys are processed at Fermilab. In Q3, we processed spectroscopic data from 11 Legacy plates and 13 SEGUE plates. All spectro data were processed in the standard production environment using existing Legacy versions of the spectroscopic pipelines (idlspec2d VV4_10_4 and spectro 1D v5_9_4) and flat fields from last observing season. The recent discovery of surface contamination on the CCD in the blue camera of spectrograph 2 suggests that we may need to reprocess the data obtained after the summer shutdown, using flat fields generated after the shutdown.

In addition to spectro processing, 30 square degrees of SEGUE imaging data and 844 square degrees of imaging data collected on Stripe 82 for the Supernova Survey were processed in the Fermilab data processing factory. All imaging data were processed in the standard production environment with the Legacy version of the photometric pipeline (photo v5_4_28). Because some of the Supernova data were obtained under less-than-ideal conditions (i.e., non-photometric, moony, and/or cloudy), we are unable to calibrate these data using standard pipelines. As time permits, we will attempt to calibrate those data taken under photometric conditions.

4.1.4. Data Processing Operations at Princeton

SEGUE data processing at Princeton currently uses the standard (Legacy) version of the spectroscopic pipelines. The Princeton data processing system is currently undergoing development and refinement. Existing hardware is being used to finish the development and testing of the SEGUE spectroscopic pipeline, and to process SEGUE data as it is acquired. Orders will be placed shortly for the additional computing hardware needed to meet ongoing and future SEGUE data processing demands. Looking forward, our goal is to have the new hardware and improved pipelines in place, tested and in production use by the end of Q4.

4.2. Data Distribution

4.2.1. Data Usage Statistics

To date, the general public and astronomy community have access to the EDR, DR1, DR2, DR3, and DR4 through the DAS and SkyServer interfaces. Figure 4.1 shows the volume of data transferred monthly from the DAS through the rsync server. A total of 4.41 TB were transferred in Q3, compared to 5.39 TB in Q2.

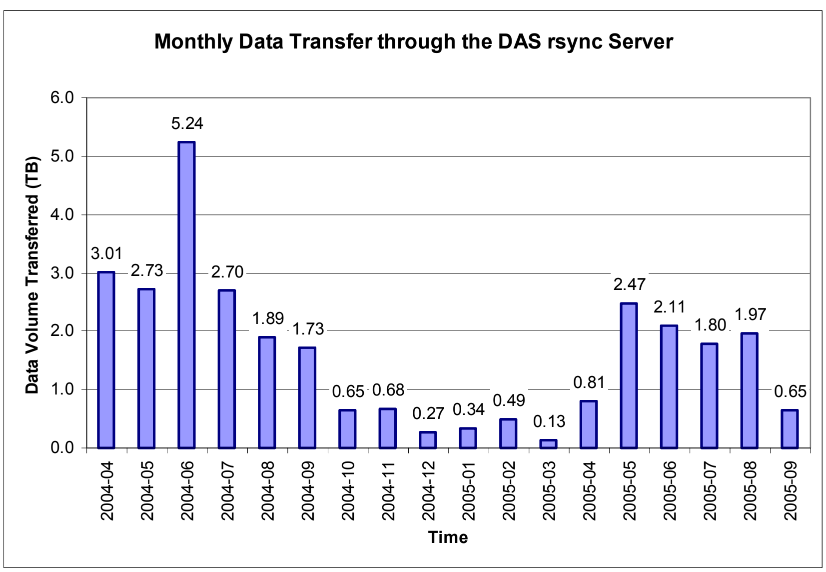

Figure 4.1. Monthly data transfer through the DAS rsync Server

Figure 4.2 shows the volume of data transferred monthly through the DAS web interface. A total of 2.88 GB were transferred in Q3, compared to 4.85 GB in Q2 and 2.69 GB in Q1. There continues to be quite a bit of variance in the volume of data transferred per month.

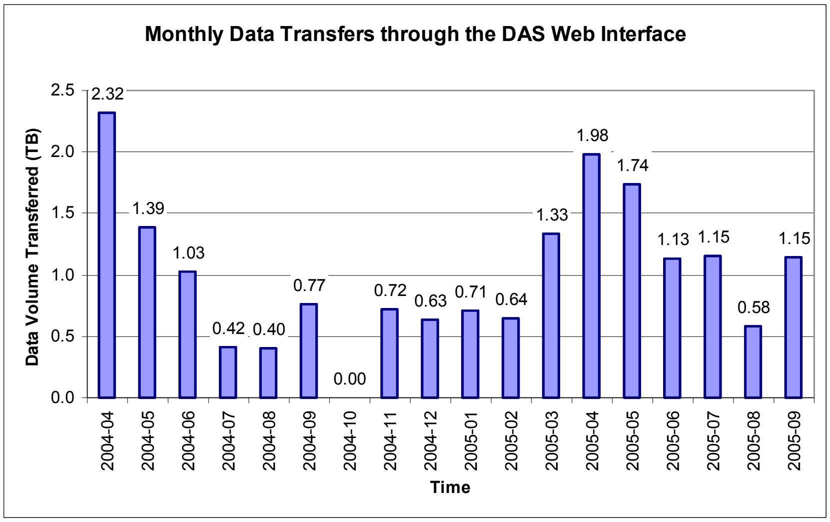

Figure 4.2. Monthly data transfer through the DAS web interface

Figure 4.3 plots the number of web hits we receive per month through the various SkyServer interfaces. In Q3 we recorded 15.6 million web hits, compared to 12.7 million web hits in Q2 and 14.6 million hits in Q1. Through September 30, 2005, the SkyServer interfaces have received a total of 114 million web hits and processed over 16.8 million SQL queries. As the graph shows, the rate at which the user community is accessing SDSS data continues to grow.

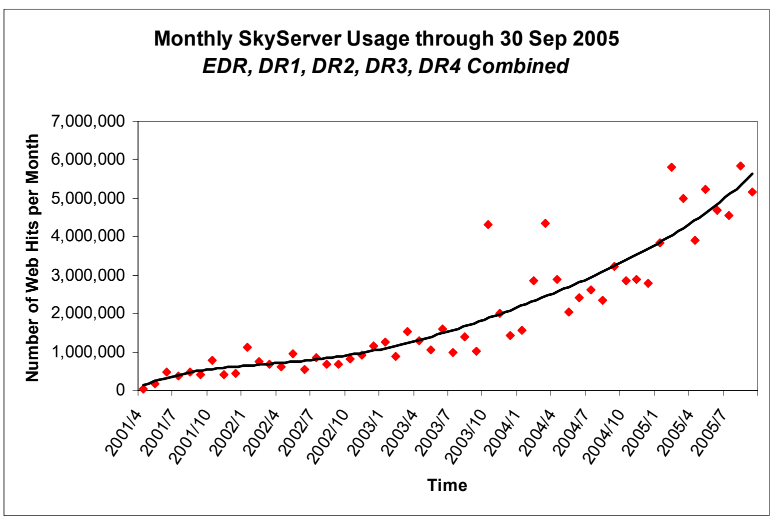

Figure 4.3. SkyServer usage per month, for all public releases combined.

Figure 4.4 shows the total number of SQL queries executed per month. We executed 0.7 million queries in Q3, compared to 1.6 million queries in Q2 and 4.3 million queries in Q1. As previously reported, the spike in February was due to machine-generated queries. Usage over the past quarter was slightly below that of recent quarters.

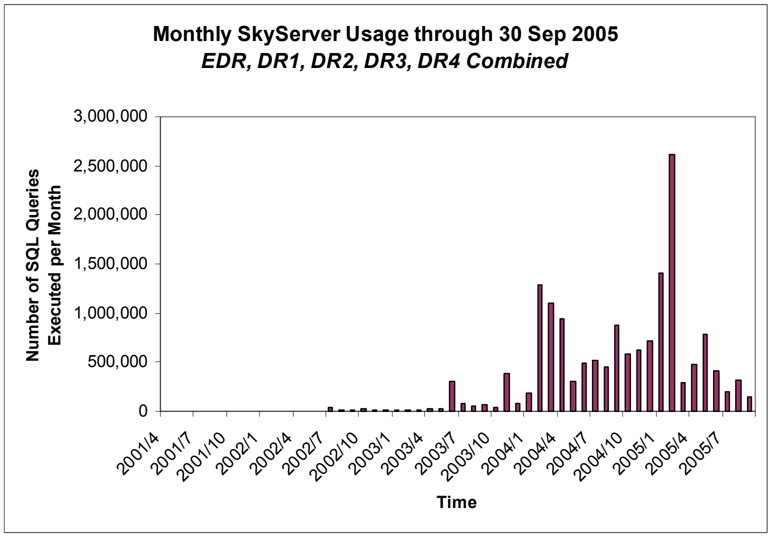

Figure 4.4. SkyServer usage, measured by the number of SQL queries submitted per month.

4.2.2. Data Release 5

In addition to supporting prior data releases, data distribution efforts in Q3 focused on preparing Data Release 5 (DR5) for use by the collaboration. DR5 contains all survey quality imaging data collected through June 30, 2005, and the corresponding spectra. Thus, DR5 comprises the final Science Archive of the SDSS-I. Table 4.1 summarizes the contents of DR5 and provides a comparison with the DR4 release. Note that DR5 contains more than one million spectra.

Table 4.1. DR5 Contents

	DR4	*DR5*	*Increment*
Imaging			
Footprint Area	6,670 sq. deg.	8,000 sq. deg	1,330 sq. deg.
Imaging Catalog	180 million objects	215 million objects	39 million
Data volume			
Images	7.5 TB	9.0 TB	1.5 TB
Catalogs (DAS, fits format)	1.5 TB	1.8 TB	0.3 TB
Catalogs (CAS, SQL database)	3.0 TB	3.6 TB	0.6 TB
Spectroscopy			
Spectroscopic Area	5,320 sq. deg	5,740 sq. deg.	420 sq. deg.
Total Number of Spectra	849,920	1,048,960	199,040
Galaxies	565,715	674,749	109,034
Quasars (redshift < 2.3)	67,382	79,934	12,552
Quasars (redshift > 2.3)	9,101	11,217	2,116
Stars	102,714	154,925	52,211
M Stars and later	50,373	60,808	10,435
Sky Spectra	44,363	55,555	11,192
Unknown	10,272	12,312	2,040

In addition to standard survey data, DR5 contains spectroscopic data from 361 “extra” and “special” plates (compared to 276 for DR4; Δ = 85 plates). The bonus data come from the following plate observations:

- 62 "extra" plate/MJD combinations which are repeat observations of 52 distinct main survey plates (*increment of one plate above that released with DR4*).
- 289 distinct "special" plates, which are observations of spectroscopic targets, mostly in the southern galactic cap, which were selected by the collaboration for a series of specialized science programs. Some of these plates are outside of the DR5 imaging area (*increment of 83 plates above that released with DR4*).
- 10 "extra-special" plates, which were repeat observations of "special" plates (*increment of 1 plate above that released with DR4*).

Additional preparations for the collaboration release included updating web pages to describe the DR5 data set, updating documentation, and testing and where necessary fixing the various links and interfaces associated with DR5.

4.2.3. Data Archive Server

The Data Archive Server (DAS) and its associated interfaces continue to be stable. The DAS is currently serving up all survey quality data collected through June 2004 to the general public, and all data collected through June 2005 to the collaboration.

Work in the latter part of Q3 included preparing the links for the DR5-DAS. This work was still in progress as the quarter ended, and should be complete in time for the late-October DR5 release to the collaboration.

4.2.4. Catalog Archive Server

Work on the Catalog Archive Server (CAS) focused largely on bug fixes and code modifications associated with loading the DR5 data set and preparing it for collaboration use. As we have seen in the past, the incremental growth in data volume associated with each release taxes new areas of the database loading software, or the manner in which the database itself handles billion-row data tables. As a point of reference, the BestDR5 and TargDR5 databases are 1.9 and 2.0 terabytes (TB) in size, respectively.

Additional CAS work involved testing and debugging a new version of the Finish step of the loading process. The refined Finish step includes the region, wedge, and sectors code that will, when fully implemented, allow collaboration members and other users to generate large scale structure galaxy sample catalogs, including mask and selection function information, directly from the database. At quarter’s end, the JHU development team had successfully run the Finish step on the DR4 data set. Efforts are underway to run the Finish on a copy of the newly-loaded DR5 data set. If successful, the new code will be checked into CVS and turned over to the production team, for validation testing and implementation into the production operation.

Along with work on standard data releases, a modest level of effort went into testing and debugging a modified version of the loading software for a Runs DB. Initially, the Runs DB will host and serve to the collaboration all imaging runs collected since the start of SDSS-I operations. As time and resources permit, we plan to incrementally load imaging runs obtained during the commissioning period, but this will be done on a best-effort basis. At quarter’s end, a version of the loading software for the Runs DB was being installed and tested in the production environment at Fermilab. We anticipate that testing will be finished and the software verified in Q4, at which time we will begin the process of loading the repeat imaging runs from Stripe 82 into the database. Once these runs are loaded, we will continue loading additional runs on a best-effort basis. It is important to note that loading and serving the Runs DB will take second priority to preparing for and hosting the major data releases.

5. SURVEY PLANNING

5.1. Observing Aids

Several programs are used to aid in planning and carrying out observations. No software changes were made. A second set of patches for the SEGUE program were loaded into the patch database to account for some refinements in the SEGUE coverage. No further refinements are anticipated at this time.

5.2. Target Selection

For this quarter, 39 plates were designed and drilled in one drilling run. Of these, 35 were for the Northern survey area, 2 were for the normal exposure (bright) SEGUE plates, and 2 were for double-length exposure (faint) SEGUE plates.

5.3. Survey planning

The software used to track survey progress and generate some of the metrics data contained in this report is also used to prepare monthly observing plans. The software has had several upgrades for SDSS-II. The monthly report now gives a detailed comparison of the data collected for the legacy and SEGUE surveys against the 3 year baseline plan, providing information on both the incremental and cumulative data collection metrics. Observing instructions for the supernova program are now provided in the observing plans. The program that is used to project future plate needs has been modified to account for the sparse sampling of imaging runs in the SEGUE program.

6. COST REPORT

The operating budget that the Advisory Council approved for SDSS-II activities during the period July 1 through December 31, 2005 consists of $325K of anticipated in-kind contributions from Fermilab, the US Naval Observatory (USNO), the University of Chicago (UC), the University of Washington (UW), and the Joint Institute for Nuclear Astrophysics (JINA); and $2,334K for ARC-funded cash expenses.

Table 6.1 shows actual cost performance for ARC-funded cash expenses in Q3. A more complete table comparing actual to baseline performance is included in the appendices of this report. Appendix 1 compares Q3 cash expenses to the budget and presents the revised cash forecast for 2005. Appendix 2 compares actual in-kind contributions to the budget and presents the revised in-kind forecast for 2005.

Table 6.1. Q3 Cash Expenses and Forecast for 2005 ($K)

Category	2005 – 3rd Quarter Baseline Budget	2005 – 3rd Quarter Actual Expenses	2005 Operations Budget Total *(for the period Jan-Jun 2005)* Baseline Budget	2005 Operations Budget Total *(for the period Jan-Jun 2005)* Actual Expenses
1. Survey Management	148	112	208	174
2. Survey Operations				
2.1. Observing Systems	189	166	376	358
2.2. Observatory Support	394	367	787	764
2.3. Data Processing	118	83	236	192
2.4. Data Distribution	39	0	77	39
2.5. ARC Support for Survey Ops	6	0	11	11
3. New Development				
3.1. SEGUE Development	106	41	138	108
3.2. Supernova Development	162	74	162	122
3.3. DA Upgrade	211	218	241	248
3.4. Photometric Calibration	5	5	10	10
4. ARC Corporate Support	19	11	32	32
Sub-total	1,395	1,076	2,279	2,059
5. Management Reserve	28	0	55	30
Total	1,423	1,076	2,334	2,089

6.1. Q3 Performance - In-kind Contributions

The sum of in-kind contributions was $246K against the baseline forecast of $235K and was provided by Fermilab, USNO, UC, UW, and Michigan State University (MSU) for JINA, as follows:

- Fermilab provided support for survey management and data processing activities. Fermilab also provided effort to support oversight, planning and development work for the SEGUE and Supernova projects. Fermilab support for data distribution activities was associated with the final data load for SDSS-I; costs associated with this effort were captured in the final report for SDSS-I.
- USNO provided support as required for the astrometric pipeline and other software systems they maintain.
- UC provided support for the development, installation and commissioning of the SN compute cluster at APO, and support for SN data processing.
- UW contributed the overhead associated with the plate drilling operation.
- MSU provided support for the development of the spectroscopic pipelines that will be used for SEGUE observations in order to estimate atmospheric parameters.

In all areas, the level of support provided was in close agreement to that anticipated.

6.2. Q3 Performance – ARC Funded Cash Expenses

ARC-funded expenses in Q3 were $1,076K, or $319K (23%) below the third quarter budget of $1,395K, excluding management reserve.

Survey management costs were $112K against a budget of $148K. Actual support costs for the Director, Project Scientist, Public Information Officer, and project management support staff were less than anticipated. No charges were incurred against the budget for Public Affairs or Collaboration Affairs. For the year, the revised forecast for Survey Management is $174K, or $34K (16%) below the baseline budget.

Observing Systems costs were $166K against a budget of $189K. UW costs were less than budgeted, as the amount of UW engineering and technical effort required to support on-going operations was less than anticipated. Actual Fermilab and Princeton expenses exceeded the budget. The baseline Princeton budget did not include salary support for technical staff who participated in the summer maintenance work on the imaging camera. Fermilab expenses included the procurements necessary to support the long list of summer maintenance activities. Direct expenditures from the ARC Observing Systems Support account were less than anticipated. It is worth noting that the ARC account holds funds for additional engineering support and unanticipated hardware expenses. If necessary at year's end, these funds could be re-allocated to the Princeton and Fermilab accounts to offset the Q3 overruns. For the year, the revised forecast for Observing Systems is $358K, or $18K (5%) below the baseline budget.

Observatory Support costs were $367K against a budget of $394K. Salary expenses were below budget, due largely to the flux in filling open personnel positions. Remaining budget categories were also slightly below budget. It is worth noting that the baseline budget was prepared using assumptions for overhead and annual merit raise rates; actual rates turned out to be lower than assumed. For the year, the revised forecast for Observatory Support expenses is $764K, or $23K (3%) below the baseline budget.

Data Processing costs were $83K against a budget of $118K. Fermilab expenses were less than budgeted in part because the baseline budget included funds for DLT tapes for data transfers from APO. Given the success of the DA upgrade, we did not need to purchase tapes. We will purchase a batch of hard drives in Q4 for APO data backup, but the cost of drives is significantly less than tapes. Princeton expenses were less than budgeted because the level of effort provided in Q3 was less than anticipated. The budget included funding for a post-doc, but the position has not been filled and so the funds went unspent. UC expenses were in close agreement with that budgeted. For the year, the revised cost forecast for Data Processing is $192K, or $44K (19%) below the baseline budget.

No data distribution costs were incurred against SDSS-II in Q3. All costs associated with data distribution were charged against SDSS-I, as all activities and expenses were related to loading the final year of SDSS-I data in preparation for DR5. For the year, the cost forecast for Data Distribution is $39K, or $38K (50%) less than the baseline budget.

No expenses were incurred in Q3 against the ARC accounts holding funds for additional Survey Operations support (specifically, the accounts for Additional Scientific Support and Observers' Research Support). Unspent funds have been carried forward into the Q4 budget. For the year, the revised forecast has been set equal to the baseline budget.

Expenses associated with development work for the SEGUE Survey were $41K against a budget of $106K. Fermilab expenses were in agreement with the budget. Princeton expenses were significantly less than budgeted because the level of available resources in Q3 was less than anticipated. The development budget also included funds for work associated with the distribution of SEGUE data. As all data distribution resources in Q3 were consumed by DR5 work, no effort was expended towards SEGUE data distribution and so no expenses were incurred. For the year, the revised forecast for SEGUE development work is $108K, or $20K (22%) below than the baseline budget.

Expenses associated with development work for the Supernova Survey were $74K against a budget of $162K. The UC budget included funds for data processing hardware at APO. This equipment was provided as an in-kind contribution by UC; consequently, the budgeted cash funds were not spent. The Fermilab budget included funds for database servers to support the Supernova data distribution effort. The servers were not purchased in Q3 and so these funds have been carried forward into Q4. For the year, the revised forecast for Supernova development work is $122K, or $40K (24%) less than the baseline budget.

Expenses associated with the DA upgrade were $218K against a baseline budget of $211K. Expenses included the procurement of new hardware for the DA system and the effort of personnel at Fermilab involved in the upgrade project. For the year, the revised forecast for the final cost of the upgrade project is $248K, or $7K (3%) greater than the baseline budget of $241K.

A modest amount of effort went into the calibration effort in Q3. Expenses were approximately $5K, against a budget of $5K. The forecast for the year remains unchanged at $10K. The calibration effort is expected to ramp up over the course of the survey; consequently, the budget is larger in future years when efforts from available resources shift from development to calibration work.

Miscellaneous ARC corporate expenses (i.e., audit fees, bank fees, petty cash, and APO trailer rentals) were less than expected. Unspent funds have been carried forward into Q4. For the year, the revised forecast has been set equal to the baseline budget.

6.3. Management Reserve

No management reserve funds were expended in Q3. The management reserve for Q4 is set at $30K, or approximately 3% of the revised forecast for Q4 cash expenses. Remaining unspent management reserve will be carried forward into the operating budget for future years.

7. PUBLICATIONS

In Q3, there were 17 papers based on SDSS data that were published by members of the SDSS collaboration. There were also 11 papers published by individuals outside of the collaboration, using publicly available data. Exhibit 3 lists papers published by members of the SDSS Collaboration; Exhibit 4 lists papers published by individuals outside of the SDSS collaboration.

At the time of this writing, there are 880 published refereed papers that include 'SDSS' or 'Sloan' in their title and/or abstract. These papers have been cited a total of 24,030 times, including 42 papers cited more than 100 times and 118 papers with 50 or more citations. In addition, there are 1202 un-refereed papers with "SDSS" or "Sloan" in the title and/or abstract.

Exhibit 1. CY2005 Cash Budget Forecast

SDSS-II CY2005 Budget Forecast as of October 31, 2005 *(in $000s)*

			Qtr 3 Jul-Sep			Qtr 4 Oct-Dec			CY2005 Total		
		Inst	Baseline Budget	Actual Expenses	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)
OPERATIONS BUDGET - CASH EXPENSES											
1.0 Survey Management											
SSP-221	ARC Secretary/Treasurer	ARC	3	2	-23%	3	3	0%	6	5	-11%
SSP-234	ARC Business Manager	ARC	16	14	-15%	16	19	20%	32	33	2%
SSP-246	PU Office of the Project Scientist	PU	62	57	-7%	5	5	0%	66	62	-7%
SSP-248	FNAL Support for Survey Management	FNAL	14	8	-44%	14	15	0%	29	23	-22%
SSP-267	UC Support for Survey Management	UC	45	29	-34%	14	14	0%	59	44	-26%
SSP-291a	ARC Support for Public Affairs	ARC	0	0	---	0	0	---	0	0	---
SSP-291b	ARC Support for Spokesperson	ARC	0	0	---	0	0	---	0	0	---
SSP-291c	ARC Support for Collaboration Affairs	ARC	2	0	-100%	2	0	-100%	3	0	-100%
SSP-291i	ARC Support for Public Information Officer	ARC	7	1	-80%	7	7	0%	13	8	-40%
	Survey Management Sub-total		**148**	**112**	**-24%**	**61**	**62**	**3%**	**208**	**174**	**-16%**
2.0 Survey Operations											
2.1 Observing Systems											
SSP-231	UW Observing Systems Support	UW	68	54	-20%	68	70	3%	136	124	-9%
SSP-232	PU Observing Systems Support	PU	2	13	471%	1	13	900%	4	25	624%
SSP-242	FNAL Observing Systems Support	FNAL	71	87	24%	70	60	-14%	141	147	5%
SSP-261	FNAL Observing Programs and DA Support	FNAL	5	0	-100%	3	5	33%	8	5	-43%
SSP-291d	ARC Observing Systems Support	ARC	44	11	-74%	44	46	5%	88	57	-35%
	Observing Systems Sub-total		189	166	-12%	187	193	3%	376	358	-5%
2.2 Observatory Support											
SSP-235	NMSU Site Support	NMSU	394	367	-7%	394	397	1%	787	764	-3%
2.3 Data Processing											
SSP-240	FNAL Software and Data Processing Support	FNAL	76	56	-27%	76	76	0%	152	132	-13%
SSP-238	PU Software and Data Processing Support	PU	30	16	-46%	30	30	0%	59	46	-23%
SSP-239	UC Software and Data Processing Support	UC	13	11	-9%	13	3	-74%	25	15	-42%
	Data Processing Sub-total		118	83	-30%	118	109	-8%	236	192	-19%
2.4 Data Distribution											
SSP-240	FNAL Software and Data Processing Support	FNAL	16	0	-100%	16	16	0%	31	16	-100%
SSP-268	FNAL Data Distribution Support	FNAL	8	0	-100%	8	8	0%	16	8	-100%
SSP-237	JHU Data Archive Development and Support	JHU	15	0	-100%	15	15	0%	30	15	-50%
	Data Distribution Sub-total		39	0	-100%	39	39	0%	77	39	-50%
2.5 ARC Support for Survey Operations											
SSP91f	ARC Additional Scientific Support	ARC	3	0	-100%	3	5	100%	5	5	0%
SSP91h	ARC Observers' Research Support	ARC	3	0	-100%	3	6	100%	6	6	0%
	ARC Support Sub-total		6	0	-100%	6	11	100%	11	11	0%
	Survey Operations Sub-total		**745**	**616**	**-17%**	**742**	**748**	**1%**	**1,487**	**1,364**	**-8%**

Exhibit 1. CY2005 Cash Budget Forecast (continued)

SDSS-II CY2005 Budget Forecast as of October 31, 2005 *(in $000s)*

			Qtr 3 Jul-Sep			Qtr 4 Oct-Dec			CY2005 Total		
		Inst	Baseline Budget	Actual Expenses	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)
OPERATIONS BUDGET - CASH EXPENSES											
3.0 New Development											
3.1 SEGUE Survey Development											
SSP-138	PU Software and Data Processing Support	PU	61	26	-57%	0	35	---	61	61	1%
SSP-137	JHU Data Archive Development	JHU	5	0	-100%	5	5	0%	10	5	-50%
SSP-140	FNAL SDSS-II Development	FNAL	12	14	18%	0	0	---	12	14	18%
SSP-168	FNAL Data Distribution Support	FNAL	28	0	-100%	28	28	0%	55	28	-50%
	SEGUE Development Sub-total		106	41	-62%	33	68	108%	138	108	-22%
3.2 Supernova Survey Development											
SSP-131	UW Supernova Survey Development	UW	15	8	-47%	0	8	---	15	16	7%
SSP-139	UC Supernova Survey Development	UC	41	5	-88%	0	0	---	41	5	-88%
	APO Computer Room Upgrade	ARC	34	47	39%	0	0	---	34	47	39%
SSP-140	FNAL Supernova Survey Development	FNAL	72	14	-80%	0	40	---	72	54	-25%
	Supernova Development Sub-total		162	74	-54%	0	48	---	162	122	-24%
3.3 Data Acquisition System Upgrade											
SSP-161	FNAL Data Acquisition Upgrade	FNAL	211	218	3%	30	30	0%	241	248	3%
	DA Upgrade Sub-total		211	218	3%	30	30	0%	241	248	3%
3.4. Photometric Calibration Development											
SSP-138	PU Software and Data Processing Support		5	5	0%	5	5	0%	10	10	0%
	Photometric Calibration Sub-total		5	5	0%	5	5	0%	10	10	0%
	New Development Sub-total		**484**	**338**	**-30%**	**68**	**151**	**123%**	**551**	**488**	**-11%**
4.0 ARC Corporate Support											
SSP91e	ARC Corporate Support	ARC	19	11	-43%	13	21	60%	32	32	0%
	ARC Corporate Support Sub-total		**19**	**11**	**-43%**	**13**	**21**	**60%**	**32**	**32**	**0%**
Cash Budget Sub-total			**1,395**	**1,076**	**-23%**	**884**	**982**	**11%**	**2,279**	**2,059**	**-10%**
5.0 Management Reserve		ARC	28	0	-100%	28	30	9%	55	30	-45%
TOTAL CASH BUDGET			**1,423**	**1,076**	**-24%**	**911**	**1,012**	**11%**	**2,334**	**2,089**	**-11%**

Exhibit 2. CY2005 In-Kind Contribution Forecast

SDSS-II CY2005 Budget Forecast as of October 31, 2005 *(in $000s)*

			Qtr 3 Jul-Sep			Qtr 4 Oct-Dec			CY2005 Total		
		Inst	Baseline Budget	Actual Expenses	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)	Baseline Budget	Forecast (18-Oct-05)	Variance (%)
OPERATIONS BUDGET: IN-KIND											
1.0 Survey Management											
SSP-248	FNAL Support for Survey Management	FNAL	33	44	32%	33	33	0%	66	77	16%
	Survey Management Sub-total		**33**	**44**	**32%**	**33**	**33**	**0%**	**66**	**77**	**16%**
2.0 Survey Operations											
2.1 Observing Systems											
SSP-231	UW Observing Systems Support	UW	16	16	3%	16	16	3%	31	32	3%
SSP-257	USNO Support for Survey Operations	USNO	4	4	0%	4	4	0%	8	8	0%
	Observing Systems Sub-total		20	20	3%	20	20	3%	39	40	3%
2.3 Data Processing											
SSP-239	UC Software and Data Processing Support	UC	0	0	---	0	0	---	0	0	---
SSP-240	FNAL Software and Data Processing Support	FNAL	3	53	2001%	3	51	1956%	5	104	1979%
SSP-257	USNO Support for Survey Operations	USNO	10	10	0%	10	10		19	19	
	Data Processing Sub-total		12	62	417%	12	61	408%	24	123	412%
2.4 Data Distribution											
SSP-237	JHU Data Archive Development and Support	JHU	0	0	---	0	0	---	0	0	---
SSP-240	FNAL Software and Data Processing Support	FNAL	1	0	-100%	1	0	-100%	2	0	-100%
SSP-268	FNAL Data Distribution Support	FNAL	9	0	-100%	9	0	-100%	18	0	-100%
	Data Distribution Sub-total		10	0	-100%	10	0	-100%	20	0	-100%
	Survey Operations Sub-total		**42**	**82**	**98%**	**42**	**81**	**95%**	**83**	**163**	**96%**
3.0 New Development											
3.1 SEGUE Survey Development											
SSP-269	MSU SEGUE Software Development and Support		16	16	1%	16	16	1%	31	31	1%
	SEGUE Development Sub-total		16	16	1%	16	16	1%	31	31	1%
3.2 Supernova Survey Development											
SSP-139	UC Supernova Development and Support		49	49	0%	0	0	---	49	49	0%
SSP-140	FNAL SDSS-II Development and Support		96	56	-42%	0	0	---	96	56	-42%
	Supernova Development Sub-total		145	105	-28%	0	0	---	145	105	-28%
	New Development Sub-total		**161**	**120**	**-25%**	**16**	**16**	**1%**	**176**	**136**	**-23%**
TOTAL IN-KIND CONTRIBUTIONS			**235**	**246**	**5%**	**90**	**130**	**44%**	**325**	**376**	**16%**
TOTAL OPERATING BUDGET (Cash and In-kind)			**1,658**	**1,323**	**-20%**	**1,002**	**1,142**	**14%**	**2,659**	**2,465**	**-7%**

Exhibit 3. Papers from within the SDSS Collaboration

1. The Fourth Data Release of the Sloan Digital Sky Survey
   ApJS submitted – J. Adelman-McCarthy, et al

2. Detection of large scale intrinsic ellipticity-density correlation from the Sloan Digital Sky Survey and implications for weak lensing surveys. MNRAS submitted - Rachel Mandelbaum, et al

3. Candidate Isolated Neutron Stars and Other Optically Blank X-ray Fields Identified from the ROSAT All-Sky and Sloan Digital Sky Surveys. AJ submitted - Marcel Agueros, et al

4. XMM-Newton and optical follow-up observations of SDSS 093249.57+472523.0 and SDSS J102347.67+003841.2. AJ accepted - Lee Homer, et al

5. Current Star Formation in Early-type Galaxies and the E+A Phenomenon. II. The Progenitors of E+A Galaxies. MNRAS submitted -Joe Helmboldt, et al

6. Current Star Formation in Early-type Galaxies and the E+A Phenomenon. I. The Sample. MNRAS submitted - Joe Helmboldt, et el

7. Quantitative Morphology of Galaxies from the SDSS I: Luminosity in Bulges and Disks. MNRAS submitted - Lidia Tasca, et al

8. A Snapshot Survey for Gravitational Lenses Among z>=4.0 Quasars: II. The 4.0 < z < 5.4 Sample. AJ accepted - Gordon Richards, et al

9. Ellipticity of dark matter halos with galaxy-galaxy weak lensing. MNRAS submitted - Rachel Mandelbaum, et al

10. Chandra and XMM-Newton Observations of Type II Quasars from the SDSS, ApJ accepted - Andrew Ptak, et al

11. Broadband Optical Properties of Massive Galaxies: the Scatter Around the Field Galaxy Color-Magnitude Relation Out to z ~ 0.4. AJ submitted - Richard Cool, et al

12. Spectral Decomposition of Broad-Line AGNs and Host Galaxies. AJ submitted - Daniel Vanden Berk, et al

13. Bivariate Galaxy Luminosity Functions in the Sloan Digital Sky Survey. MNRAS submitted - Nick Ball, et al

14. SDSSJ103913.70+533029.5: A Super Star Cluster in the Outskirts of a Galaxy Merger. AJ submitted - G.R. Knapp, et al

15. Photometric Covariance in Multi-Band Surveys: Measuring the Photometric Error in the SDSS. AJ submitted -Ryan Scranton, et al

16. Evolution and environment of early-type galaxies. AJ accepted - M. Bernardi, et al

17. Morphological Classification of Galaxies with Photometric Parameters: the concentration index versus the texture parameter. AJ 130:145 (2005)- Chisato Yamauchi, et al

Exhibit 4. Publications Based on Public Data

1. Systems of Galaxies in the SDSS: the fundamental plane. MNRAS accepted – E. Diaz, et al

2. A Spectroscopic Study of the Ancient Milky Way: F- and G-Type Stars in the Third Data Release of the Sloan Digital Sky Survey. ApJ accepted - C. Allende Prieto, et al

3. Discovery of a Magnetic White Dwarf/Probable Brown Dwarf Short-Period Binary. ApJL submitted - G. Schmidt, et al

4. Constraining the photometric properties of MgII absorbing galaxies with the SDSS. ApJL accepted - Stefano Zibetti, et al

5. The blueshift of the [O III] emission line in NLS1s. MNRAS accepted – w. Bien, et al

6. The 2dF-SDSS LRG and QSO Survey: The z<2.1 Quasar Luminosity Function from 5645 Quasars to g=21.85. MNRAS submitted -Gordon Richards, et al

7. The RASS-SDSS Galaxy Cluster Survey. VI. The dependence of the cluster SFR on the cluster global properties. A&A accepted - Paola Popesso, et al

8. Acoustic oscillations in the SDSS Luminous Red Galaxy sample power spectrum. A&A submitted – Gert Huetsi (0507678)

9. The Axis-Ratio Distribution of Galaxy Clusters in the SDSS-C4 Catalog as a New Cosmological Probe. ApJ submitted - Jounghun Lee

10. Two Degree Field Galaxy Redshift Survey and Sloan Digital Sky Survey Galaxy Group Density Profiles. ApJ 629:158 (2005) – E. Diaz, et al.

11. Updated Colors for Cool Stars in the SDSS. PASP 117:706 (2005) - A. West, et al