Sloan Digital Sky Survey
Quarterly Progress Report
Third Quarter 2004

November 12, 2004

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Q3 PERFORMANCE HIGHLIGHTS

- We obtained 900 square degrees of new imaging data for the SEGUE and Supernova programs. Of this, 121 square degrees met survey data quality requirements and count towards the survey baseline goal for the Southern Equatorial Stripe.
- We completed seven standard survey plates, seven special program plates, and 29 SEGUE plates. Converting these to plate-equivalents, we completed 46 plate-equivalents against our baseline goal of 52 plates (88%).
- Weather was poor in August (40%) and exceptionally good in September (74%), the latter of which helped substantially with our observing yield.
- Observatory operations ran smoothly during the quarter. There were no major system problems.
- All data acquired during the quarter, including SEGUE and Supernova program data, were promptly processed. The DP factory continues to operate smoothly, with new survey data processed and calibrated within days of collection. Development work continues on SEGUE and Supernova reduction software.
- DR3 was made available to the public on September 27, slightly ahead of the release schedule contained in the approved Data Distribution Plan. DR3 contains 5,282 square degrees of imaging data (141 million objects) and 528,640 spectra (including 374,730 galaxies).
- Data archive use continues to be heavy. Through the end of September, the public SkyServer had received 56.5 million web hits and executed 7.3 million SQL database queries. We averaged 2.7 million web hits per month in Q3, compared to 2.2 million in Q2. We averaged 614,000 SQL queries per month in Q3, compared to 577,000 in Q2. From Jan-Sep, 2004, we achieved 99.5% uptime on our public database cluster.
- Q2 cash operating expenses were $938K against a baseline budget of $887K (6%), excluding management reserve. In-kind contributions were $273K against anticipated contributions of $430K (-37%). No management reserve funds were expended.

1. SURVEY PROGESS

1.1 Q3 Imaging

In Q3, we collected imaging and spectroscopic data primarily for the SEGUE and Supernova programs. Progress reports on the SEGUE and Supernova programs are presented in Section 8.

We collected close to 900 square degrees of imaging data, of which 121 square degrees met survey data quality requirements. Imaging including several SEGUE scans, and two full nights of data on strip 82N (one-half of the Southern Equatorial Stripe) for the Supernova program. The 121 square degrees of survey quality data was collected during the Supernova scans. Table 1.1 compares the imaging data obtained against the baseline projection.

Table 1.1. Imaging Survey Progress in Q3-2004

	Imaging Area Obtained (in Square Degrees)			
	Q3-2004		Cumulative through Q3	
	Baseline	Actual	Baseline	Actual
Northern Survey[1]	52	0	7707	7478
Southern Survey[1]	0	0	745	738
Southern Equatorial Stripe[2]	509	121	3940	2678

1. "Unique" area
2. "Good minus Unique" area.

The following graphs show progress against the imaging goals for the Northern Galactic Cap and the Southern Equatorial Stripe. The full set of graphs is available on the SDSS website.

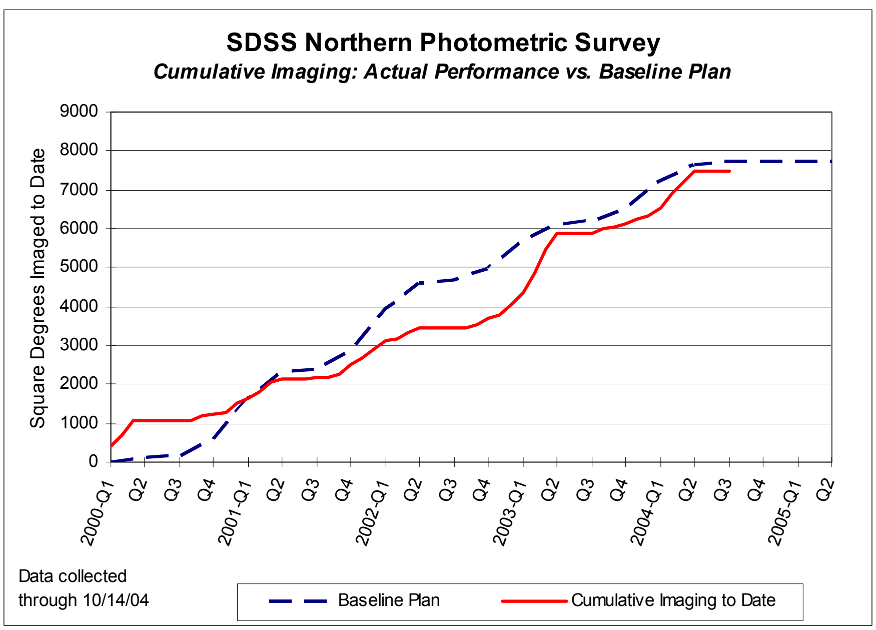

Figure 1.1. Imaging Progress against the Baseline Plan – Northern Survey

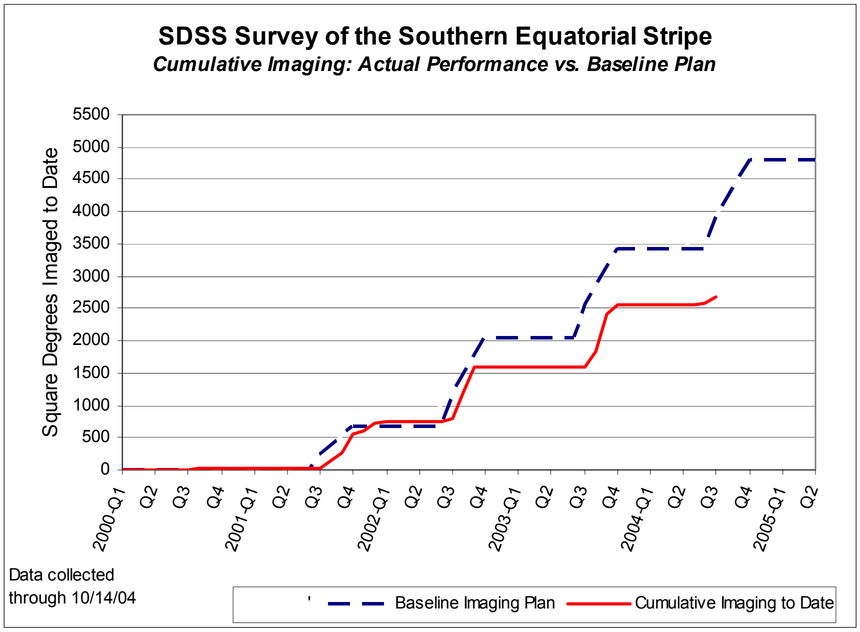

Figure 1.2. Imaging Progress against the Baseline Plan – Southern Equatorial Survey

1.2 Q3 Spectroscopy

Spectroscopic progress is reported in terms of the number of plates observed and declared done during a quarter. Each plate typically yields 640 unique spectra.

In Q3, we completed a total of 43 spectroscopic plates. Of these, seven were standard survey plates, seven were special program plates, and 29 were SEGUE plates. Some of the special plates require longer exposure times than the standard plates, so it is necessary to convert the number of physical plates observed into plate-equivalents to measure progress against the baseline. In these terms, we completed 46 plate-equivalents against the baseline goal of 52 plates (88%).

The following graphs show spectroscopic progress against the baseline goal for each survey region. Progress is reported in plate-equivalents for the special program plates, which allows for a direct comparison with baseline goals. Details on the SEGUE plates are provided in Section 8.

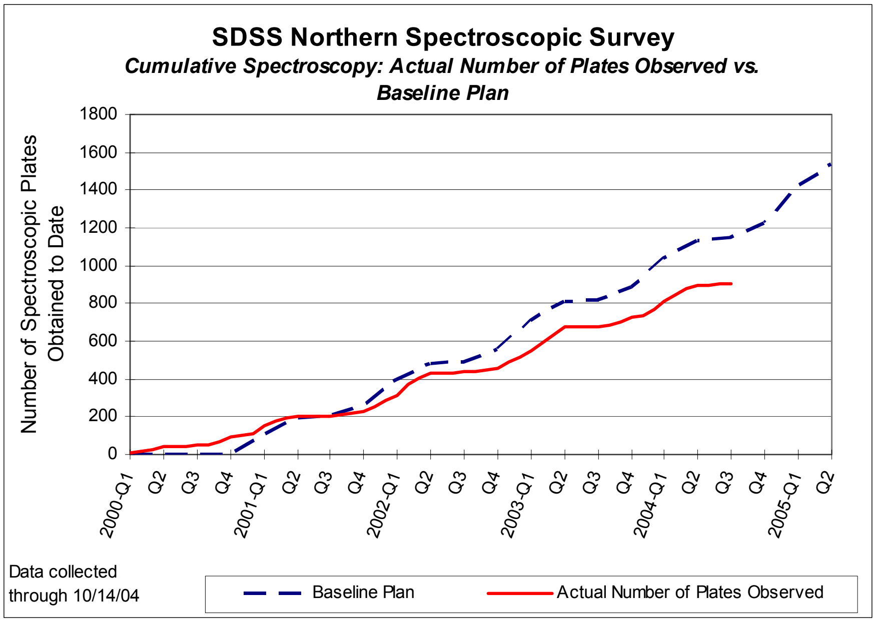

Figure 1.3. Spectroscopic Progress against the Baseline Plan – Northern Survey

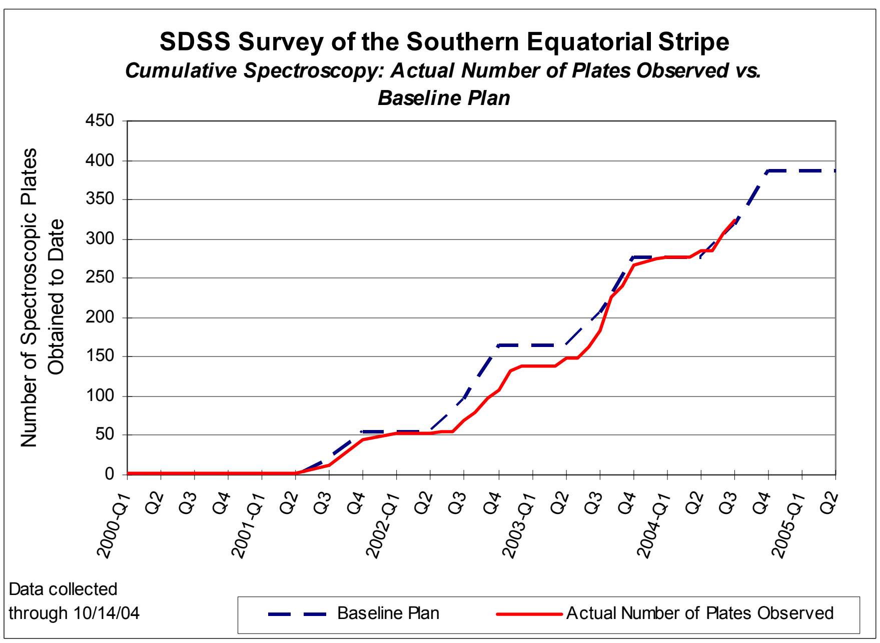

Figure 1.4. Spectroscopic Progress against the Baseline Plan – Southern Equatorial Survey

2.0 OBSERVING EFFICIENCY

The following sections summarize observing efficiency 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 were suitable for observing. August marks the end of the summer monsoon season and weather conditions are always questionable; this year was no exception. Weather in September was significantly better, however, which helped with the strong yield in imaging data. Table 2.2 summarizes the total amount of time lost to poor weather in Q3. Figure 2.2 plots the fraction of suitable observing time against the baseline forecast.

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	226	98	57%	60%
Dark & Gray Time	317	146	54%	---

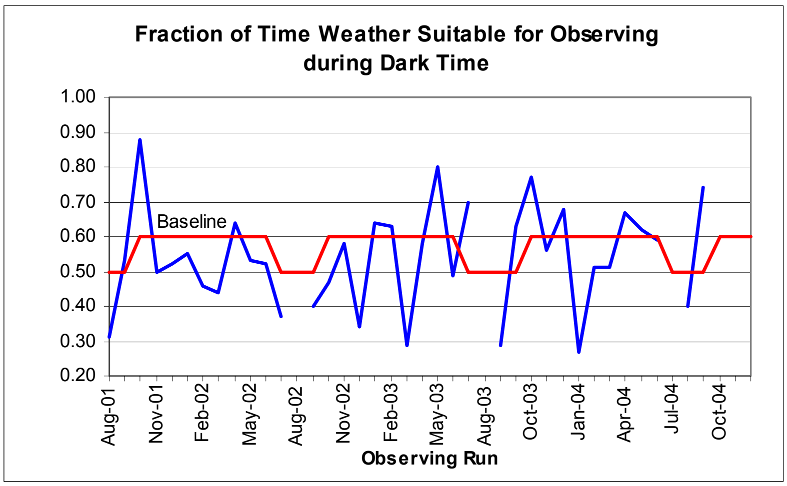

Figure 2.1. Fraction of Time Weather Suitable for Observing

2.2. System Uptime

System uptime measures the availability of equipment when conditions are suitable for observing. We averaged 97% uptime in Q3 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 over time.

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	226	8	96%	90%
Dark & Gray Time	317	9	97%	---

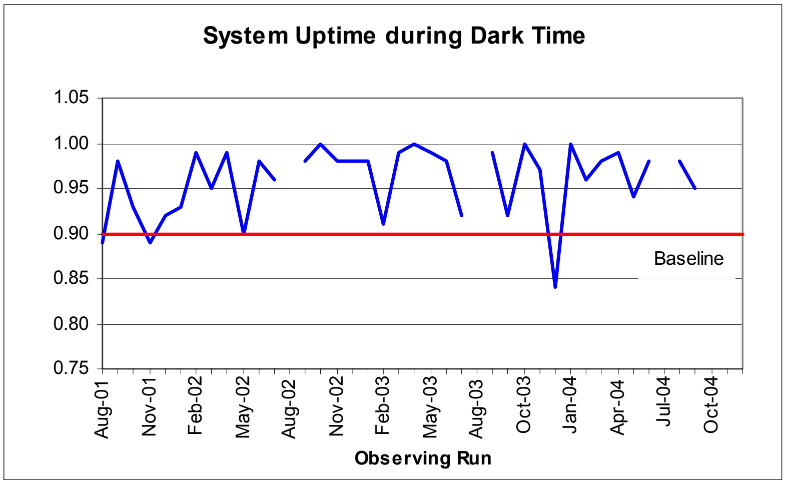

Figure 2.2. System Uptime

We lost observing time to spectrograph camera cross-talk problems, mirror position control problems, a loose electrical junction box on the 2.5m telescope, PTVME link failures, and a computer communication problem that resulted in a hung data acquisition system. In addition, we also experienced a number of smaller problems that caused difficulty during observing operations but did not result in lost observing time.

2.3. Imaging Efficiency

The imaging efficiency ratio provides a measure of observing efficiency and is defined as the ratio of science imaging time to the sum of science imaging time plus imaging setup time. The baseline plan established the imaging efficiency ratio to be 0.86. When the weather is poor, as it was in August, imaging efficiency drops because the observers may take more time than usual to finish setup and calibration; setup and calibration can be performed while waiting for the weather to clear. September provides a more accurate representation of our current level of imaging efficiency. In September, the observers achieved an imaging efficiency of 0.88, which exceeded the baseline target of 0.86.

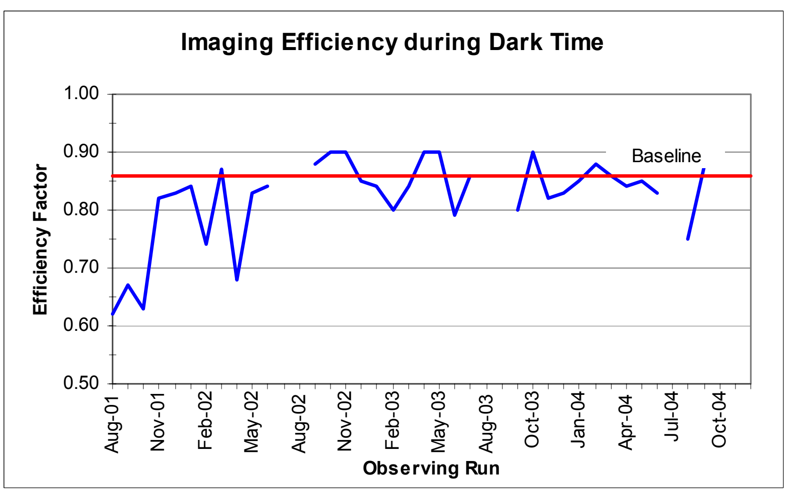

Figure 2.3. Imaging Efficiency

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 64.5% in Q3 against the baseline goal of 64%. September marked another operations milestone for us; September was the first month in which we exceeded the baseline goal for spectroscopic efficiency.

Table 2.3. Median Time for Spectroscopic Observing Activities

Category	*Baseline*	*Run starting Aug 5*	*Run starting Sep 10*
Instrument change	10	4	4
Setup	10	12	11
Calibration	5	6	6
CCD readout	0	3	3
Total overhead	25	25	24
Science exposure (assumed)	45	45	45
Total time per plate	70	70	69
Efficiency	0.64	0.64	0.65

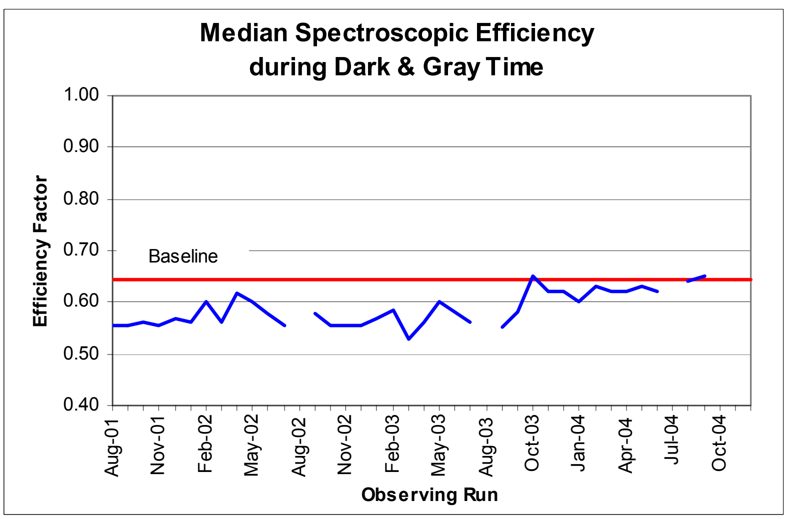

Figure 2.4. Spectroscopic Efficiency

3. OBSERVING SYSTEMS

In addition to addressing the problems described earlier, we addressed a few minor issues and completed a number of planned engineering tasks and preventive maintenance activities during the summer shutdown.

3.1. The Instruments

Scheduled maintenance work was performed on the imaging camera and spectrographs during the summer shutdown.

Work on the spectrographs included the following:

- The blue camera on spectrograph #1 was inspected to understand the cause of focus changes noted when crossing certain instrument rotator angles. Suspect causes were a loose doublet lens related to the camera focus mechanism, a loose CCD dewar, or a loose CCD within the dewar. Investigation and testing did not conclusively identify the source of the problem.
- Some of the SDSS camera lenses were mated with an optical couplant to fill air gaps between them. Over time, some of the lenses have decoupled. During inspection this summer, we found two kinds of voids in the optical couplant: narrow channels similar to rivers and waterways on a map and wider voids and islands similar to island chains. Several unsuccessful attempts were made to disassemble the lenses to replace the couplant. In the end, it was decided that the risk of breaking a lens was not worth recovering the few percent light loss and scattering performance.
- We changed the grease on the focus mechanism threads to make it easier for the observers to adjust focus in cold temperatures. We installed Aeroshell Grease # 33, which is reported to be usable from -100 F to +250 F. To verify this, we conducted a freezer test on four different greases. We found that Aeroshell #33 remained the softest of the greases evaluated.
- In the process of removing and re-greasing the focus ring for the red camera in spectrograph #2, it was found that the inner doublet spring retainer had water corrosion dust on it and the linear bearings and the pins they ride on were rusty and corroded. New bearings were ordered and installed.
- Over the last year, some of the spectrograph collimation mirror actuators began failing due to a design flaw in the flexible couplings between the drive motors and their gear heads. We designed and installed all new couplings over the summer.

During start-up operations after the summer shutdown, we experienced data cross-talk problems in spectrograph #2. The problem was traced to a faulty DB15 connector on the electronics saddle bag associated with the red camera in the spectrograph. The connector, and end cap to which it is attached, was replaced with a spare unit and the problem fixed.

We also began seeing bias variations across dewar 1 in the imaging camera. Amplitude of the variations ranged from about 2 to 10 dn, with bias levels fluctuating on time scales of a few seconds or less. Although the variations occurred infrequently (e.g., once every 20 to 50 frames), they certainly affected data quality. Swapping out power supplies did not fix the problem. What did help was repairing a pinched ion pump power cable that was routed near the camera. The power cable shielding was cut when the cable was pinched and it appears that noise emanating from the high-voltage cable was affecting the camera readout. Bias levels have been stable since the cable was repaired.

3.2. The 2.5m Telescope

We addressed a couple of minor problems associated with telescope systems:

- The central processing unit (CPU) on the inside manipulator failed in Q3, likely caused by a lightning strike near the observatory. We replaced the CPU and returned the manipulator to normal operations. We also ordered an additional CPU to bolster the spares pool.
- During a walk-around inspection late in the quarter, it was discovered that several of the lamps on the emergency stop switches were not lighting properly. Although the interlock system was properly sensing the switches, the PLC module that controlled the lamps was not functioning properly. The module was replaced with a unit from the spares pool and the system returned to normal operation.

Planned engineering work focused on summer shutdowns activities and mirror aluminizing. Summer shutdown work included the following:

- The azimuth drive motors on the 2.5m telescope were removed, their shaft bearings replaced, the shafts themselves ground, the motors replaced, and motor preloads set according to specification. In re-installing the motors, we also removed a vertical tilt that had been present in the telescope azimuth axis. Telescope pointing has vastly improved as a result.
- The imager uninterruptable power supply (UPS) failed and was replaced. Unfortunately, we could not find a replacement UPS with linear power supplies and controllers. We installed a UPS with a switching power supply, for which we had to fabricate and install a filter across the outputs to alleviate electrical noise. In the process of replacing the UPS, we also installed a switching system that allows us to rapidly switch over to a standby UPS, in the event of a main UPS failure.
- Light baffles to block stray light from Holloman Air Force Base were installed and test-fitted. Some fine-tuning is required for the permanent installation.
- The primary mirror for the Photometric Telescope (PT) and the secondary mirror for the 2.5m telescope were aluminized in the coating chamber at Sunspot. The new coatings are of good quality.
- The upgraded M1 Galil control system was installed and tested. The new system will improve system reliability and be significantly easier to maintain.
- New pumps and motors were installed in the cooling system for the instruments (i.e., the thermoelectric chiller and external loop coolant systems). The existing pumps had been in continuous use for approximately two years; the motors had been in continuous use for approximately three years. We changed them as a preventive measure to avoid potential problems during operations.

Additional work in Q3 included the following:

- The 2.5m telescope was disassembled in late August and the primary mirror shipped to Kitt Peak for aluminizing. Upon its return, we discovered that the reflective surface of the mirror was spotted with approximately 7,000 to 10,000 small black spots. We reported the problem to Kitt Peak personnel. Upon investigation, they found that the Messiner trap in the aluminizing chamber had not been properly cleaned after the last firing. Aluminum residue or flakes from the previous firing apparently fell on the surface of our mirror when the bell jar was closed, which caused the spots on the mirror. We estimate that the spots represent at most a few percent of the total reflective area of the mirror. The Project Scientist feels that the spots will not adversely affect performance. We will monitor the spots over time to ensure they do not become worse.
- We inspected the altitude drive bearings while the primary mirror was being aluminized. The bearings are more easily inspected with the mirror out of its support cell. Although visibility was limited, the bearings appear to be suitably lubricated and in good condition.
- An oversized cooling fan was installed on the guider camera, to improve cooling efficiency and hopefully solve the "hot" pixel problem in the camera.
- A new altitude fiducial read head bracket was installed. The bracket design is similar to that installed on the azimuth axis and will improve system reliability.

3.3. The Photometric Telescope

In addition to aluminizing the PT primary mirror and performing normal preventive maintenance activities, we replaced the closed-cycle refrigerator compressor, cold head and lines that cool the PT camera. The system occasionally had trouble keeping the CCD at operating temperature and we suspected that the system had become contaminated. We installed a spare system and sent the original back to the vendor for inspection and refurbishment.

During data processing and analysis, one of our scientists noted the presence of a filament on the surface of the PT CCD. At present, the filament is stationary and is being flat-fielded out of the PT corrected frames. Until the filament becomes problematic, we will leave it in place, as removal requires warming the system and disassembling the camera.

3.4. Operations Software and the Data Acquisition System

All observing software remains under formal version control and all changes are reviewed and approved before work is done. The following work was done on observing software in Q3:

- The Telescope Control Computer (TCC) code was modified to accommodate the 2.5m telescope azimuth tilt correction.
- The Imaging Observers Program (IOP) was modified to help observers avoid wrapping the telescope during imaging scans. IOP was also modified to accommodate SEGUE imaging scans as well as standard survey scans. Initially, IOP modifications to handle SEGUE scans were done on a code branch. During Q3, the branch code was merged with the main line code so that one version of IOP can be used for both the standard and SEGUE observing programs. IOP modifications are documented in PR 6067 and PR 6109.

There were no problems with the data acquisition system that prevented us from acquiring data. We again had several problems with the PTVME link, but existing workarounds keep these problems from affecting our ability to collect data. No significant work was done on the DA upgrade in Q3.

4. DATA PROCESSING AND DISTRIBUTION

4.1. Data Processing

4.1.1. Pipeline Development and Testing

No changes were made to the photometric pipeline in Q3. Work continues on a best-effort basis on the spectroscopic pipeline, idlspec2d, to incorporate the data model changes associated with the public release of DR4. More work is required before the code is ready for final testing and validation.

New Known Object files for the SEGUE stripes were prepared and placed on the SDSS computer cluster at Fermilab. Both Tycho2 koCat files (for use at APO) and UCAC koCat files (for astrom pipeline reductions at Fermilab) were completed and submitted.

Work has begun on preparing UCAC koCat files for the entire SDSS observing area based upon the newly completed preliminary all-sky UCAC catalog. In Q4, we anticipate completing the UCAC catalog in time for the Northern Galactic Cap observing season.

4.1.2. Data Processing Operations

Over the summer shutdown, testing and verification was performed on the new automated imaging QA procedures. The goal was to complete these tests prior to the start of data collection operations in August. The goal was successfully met.

Data processing operations continue to run very smoothly. All newly acquired imaging and spectroscopic data, as well as data from the Photometric Telescope, were promptly processed and inspected.

The data processing group finished preparing all imaging and spectroscopic data associated with the next data release, DR4. This work included updating the Data Archive Server interface.

In addition to processing new data and preparing for data releases, data processing personnel were involved in the development, installation and commissioning of the Supernova data reduction system at APO. Work performed on this system is discussed in Section 8.

The data processing group remains focused on continuously improving system reliability and maintainability. Hardware purchasing plans for 2005 have been prepared and budget requests submitted, and computer professionals in the group are in the process of porting the software infrastructure to the Long Term Support version of Linux.

Data processing goals for the coming quarter (Oct-Dec 2004) include the following:

1. Keep current on all new data collected.
2. Finish port to Long Term Support version of Linux.
3. Reduce the number of PRs to fewer than 30 in categories for which the data processing group is responsible.
4. Submit purchase requisitions for all hardware purchases for the year.

4.2. Data Distribution

On September 27, 2004, we made DR3 available to the general astronomy community and the public. DR3 is an incremental load on top of DR2, which was released to the public on March 15, 2004. In addition to preparing for the DR3 public release, we spent a considerable amount of time preparing DR4 for the collaboration. Details are contained in the following sections.

4.2.1. Data Usage Statistics

Figure 4.1 shows the volume of data transferred per month from the DAS over the past six months. Since the DR3 release occurred very late in the quarter, the graph really indicates the data transfer volume of DR2 data. As might be expected, the rate of data transfer was highest following the public release in March, and is tailing off over time. We anticipate that the data transfer rate will increase as the availability of DR3 becomes more widely known.

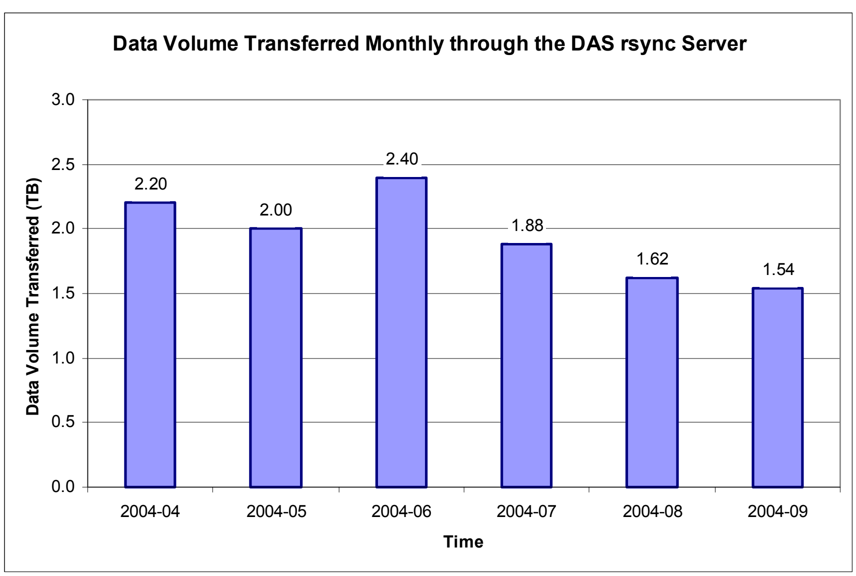

Figure 4.1. Monthly data transfer through the DAS rsync Server

To date, the general public and the astronomy community have access to the EDR, DR1, DR2, and now DR3. Through September 30, 2004, the various SkyServer interfaces have received a total of 56.5 million web hits and have processed over 7.3 million SQL queries. The rate at which the user community is accessing SDSS data continues to grow, as shown in Figure 4.2, which plots the number of web hits we receive per month through the various SkyServer interfaces. We recorded a total of 8.2 million web hits in Q3, compared to 7.4 million hits in Q2.

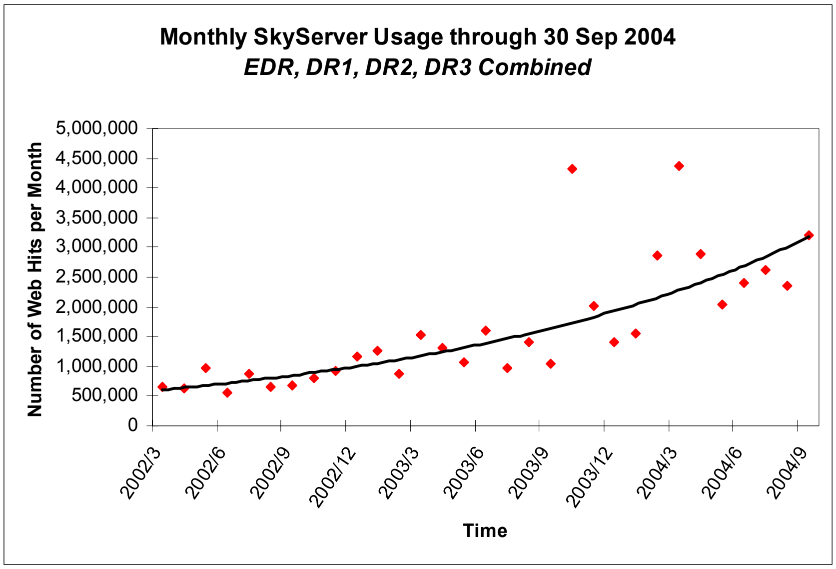

Figure 4.2. SkyServer usage per month, for all public releases combined.

We also measure usage by the number of SQL queries executed. Figure 4.3 shows the total number of SQL queries executed per month. We recorded 1.84 million queries in Q3, compared to 1.73 million in Q2. In addition to an increase in the number of SQL queries submitted, we have noticed that the complexity of queries is increasing, suggesting that users are becoming more familiar with SQL and its capabilities.

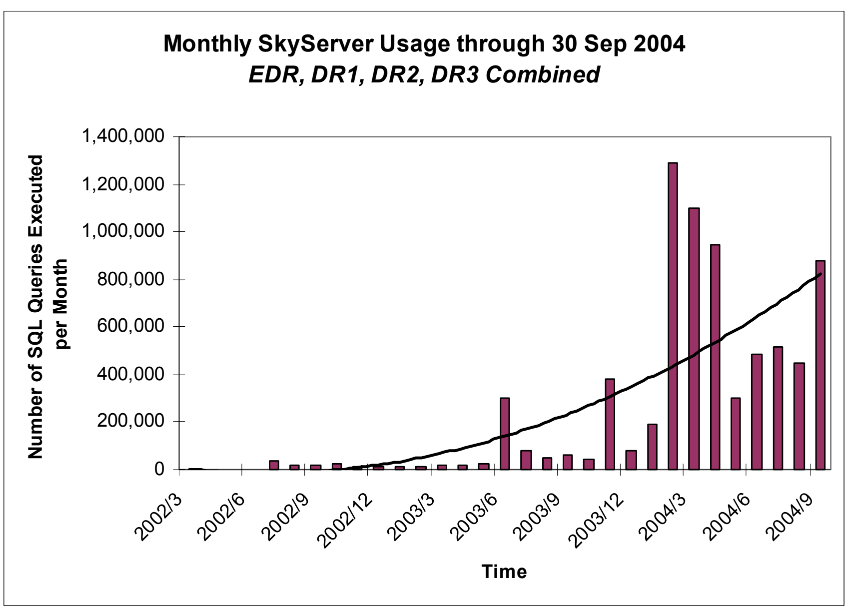

Figure 4.3. SkyServer usage, measured by the number of SQL queries submitted per month.

4.2.2. Data Release 3

Data Release 3 (DR3) was released to the public on September 27, 2004. DR3 contains 5,282 square degrees of imaging data and 528,640 spectra, including approximately 375,000 galaxy spectra. The data release contents are described on the DR3 web site, which is accessible through www.sdss.org. The public release satisfies our commitment to release DR3 as specified in the SDSS Archive Distribution Plan to the Astronomy Community.

Prior to the public release, a few changes were made to the DR3 data set. Testing and evaluation by members of the collaboration resulted in the reclassification of 477 objects in the spectral database. Mostly, these changes were reassignments of objects flagged as "unknown" spectral classes to other spectral classes. In addition, there were some instances in which objects were re-classified as "unknown", plus some non-unknown cases of new spectral classes and redshifts.

A technical paper describing DR3 was prepared and submitted to The Astronomical Journal for publication. The paper, "The Third Data Release of the Sloan Digital Sky Survey", was also posted to astro-ph as paper #0410239.

4.2.3. Data Release 4 Preparations

All survey quality imaging data collected through July 2004, with the exception of repeat scans on the southern equatorial stripe, will be included in DR4. The DR4 public release is scheduled for July 2005.

In order to get the data to the collaboration as quickly as possible, we are loading the DR4 data with the same data model used for DR2 and DR3. Thus, the initial release of DR4 to the collaboration will be an incremental data load on top of DR3, which was an incremental load on top of DR2. Providing DR4 to the collaboration in late 2004 will provide the collaboration with at least six months of proprietary access prior to public release.

In Q3, we generated the DR4 runs and plates list, generated the comma-separated value (CSV) files necessary for CAS loading, and loaded the DR4 imaging and spectroscopic data into the CAS. We ran into a number of problems during the "Finish" step, which computes such things as database indices and "neighbors" tables. Some of the problems appear to be hardware related, some appear data related, and some appear related to the increasing volume of data. As of the end of Q3, we are still in the process of troubleshooting and debugging the loading operation in order to complete the initial data load.

4.2.4. Data Archive Server

The Data Archive Server (DAS) and its associated interfaces continue to be stable and reliable. The DAS is currently serving up the DR1, DR2 and DR3 to the public and collaboration. We continue to monitor the integrity of data spinning on the DAS file server. There were no file corruption problems or unscheduled downtime in Q3. The DAS was taken offline for scheduled maintenance on August 27.

In Q3, the DAS was revised to provide users with the option to create a wget download file: sdss-wget.lis (which is just a list of http URLs, one for each file). This option improves on the "rsync" method of downloading long lists of files, since rsync can potentially take hours to compose the list of files users had already provided to it.

4.2.5. Catalog Archive Server

Work on the CAS was associated with preparing for the public DR3 data release and the DR4 collaboration release. Data release work included:

- Installing the skyServer public interface to DR3.
- Copying backup copies of BESTDR3 and TARGDR3 from FNAL to JHU.
- Setting up web access for DR3 public.
- Updating and adding documentation for the DR3 algorithms and help pages.
- Adding sample queries for DR3.
- Setting up DR3 queues and access control for CasJobs.

In addition to data release preparations, a significant amount of work went into developing a data loading history table, implementing automated dependency checking, and modifying the database loading software to "break up" the Finish step into smaller, more manageable chunks. We had planned to use the modified Finish step for the DR4 load; unfortunately, code modification and debugging was not finished in time. We subsequently rolled back to the same version of the loading software used to load DR3.

At the quarter's end, the "Finish" step was being run on the DR4 data load. We anticipate that the initial DR4 load, using the DR2/DR3 data model, will be ready for collaboration use in December 2004.

Several upgrades were made to CasJobs, including the following:

- Documentation, testing and bug fixes associated with the DR3 release.
- Queue selection is now done behind-the-scenes.
- Short-queue-like synchronous execution is now available in the form of the 'quick' button.
- Prefix syntax has been simplified and made more powerful. Users can now use any context name as a prefix, in any situation that is appropriate in normal SQL. This allows users to reference many different catalogs in a single query.
- The on-line user guide has been extensively updated to reflect enhancements.
- Session time-out has been increased.
- The "Import" form has been updated to accept more data formats and includes file upload as well as cut and paste.
- 'Table' field on submit page will automatically insert results into a table, without users having to write a 'select into' clause.

Planned work for Q4 includes integrating sector computations, "match" tables and data partitioning into BESTDR3 database, and improving the database loading software to provide the capability for backing out and replacing data from the finished database.

5. SURVEY PLANNING

5.1. Observing Aids

Several programs are used to aid in planning and carrying out observations. No changes were made this quarter. However, one program used to check the quality of spectroscopic observations does not work well with plates for the SEGUE program. Work-arounds are being used now, and it is not clear if changes will be necessary in the future.

5.2. Target Selection

For this quarter, 158 plates were designed and drilled in two drilling runs. Of these, 109 were for the Northern survey area, 5 were for the low-redshift galaxy program on the Southern equatorial stripe, and 44 were drilled for the SEGUE program. Of those plates in the Northern survey area, all were located in the area of the "gap" that is the highest priority for observing. For the first time, three stripes were "tiled together", which increases the efficiency with which plates can cover the sky.

Plate storage at APO continues to be tight. We have a sufficiently large backlog of plates that we are now juggling incoming plates with outgoing plates that have already been observed. At present we continue to maintain that balance.

5.3. Survey Planning

The software that is used to track survey progress that is contained in this report is also used to prepared monthly observing plans. Code was written to automatically create an observing plan for the Supernova observing program. Improvements were made to the code used for planning the SEGUE program. Observing plans for the fall are now becoming rather complicated due to the need to juggle three observing programs in combination with needed calibration scans.

6. COST REPORT

The operating budget that the Advisory Council approved for the year 2004 consists of $1,806K of in-kind contributions from Fermilab, US Naval Observatory (USNO), Los Alamos National Laboratory (LANL), and the Japan Participation Group (JPG); and $3,400K for ARC funded expenses.

Table 6.1 shows the actual cost performance by project area for ARC-funded cash expenses in Q3. A more complete table comparing actual to baseline performance is included as an attachment to this report.

Table 6.1. ARC-Funded 3rd Quarter and Forecast for 2004 ($K)

	2004 – 3rd Quarter		2004 – Total	
Category	Baseline Budget	Actual Expenses	Baseline Budget (Nov 2003)	Current Forecast
1.1. Survey Management	103	129	294	273
1.2. Collaboration Affairs	4	2	16	9
1.3. Survey Operations				
1.3.1. Observing Systems	155	204	648	630
1.3.2. Data Processing & Dist.	142	143	593	649
1.3.3. Survey Coordination	0	0	0	0
1.3.4. Observatory Support	380	419	1,522	1,584
1.4. ARC Corporate Support	63	40	176	94
Sub-total	847	938	3,248	3,239
1.5. Management Reserve	40	0	152	50
1.6. Capital Improvements	0	0	0	43
Total	887	938	3,400	3,332

6.1. Q3 Performance - In-kind Contributions

The sum of in-kind contributions for the second quarter was $273K against the baseline forecast of $430K and was provided by Fermilab, Los Alamos, and the U.S. Naval Observatory (USNO).

Fermilab provided telescope engineering and maintenance support, and the data processing systems at Fermilab, as agreed. Details of Q3 in-kind contributions are as follows:

- As reported in previous reports, the level of in-kind engineering support at APO was less than the baseline forecast because the engineer who serves as the SDSS Telescope Engineer became involved in another Fermilab astrophysics project in Q1. As a result, his level of support for the SDSS project has been reduced from 100% to 50%.
- The level of in-kind support for Software and Data Processing appears to be less than the baseline forecast. Salary expenses for two individuals, which should have been provided as an in-kind contribution, were accidentally submitted to ARC for reimbursement. Adjustments will be made in Q4 to correct the error.

Los Alamos provided programming support for the Telescope Performance Monitor, testing support in preparation of DR2, and work on an open star cluster project related to calibration efforts. The level of in-kind infrastructure support provided in Q3 was substantially less than the baseline forecast, but was appropriate to complete the necessary work in the quarter.

USNO provided support as required for the astrometric pipeline and other software systems they maintain. As previously reported, the value of in-kind support was lower than the baseline because the baseline did not properly reflect the lower level of anticipated support in 2004. The forecast for the remainder of the year has been revised downward accordingly.

6.2. Q3 Performance – ARC Funded Expenses

ARC-funded expenses in Q3 were $934K, or $91K (10%) above the third quarter budget of $847K, excluding management reserve.

Survey management costs were $26K (25%) above the Q3 budget. Fermilab Support for Survey Management exceeded the baseline budget; computing hardware purchases associated with DR3 were charged against the survey management account in Q3. We are in the process of establishing a new SSP to properly budget for and track data distribution expenses at Fermilab in the future. Regarding Princeton Support for Survey Management, as reported in previous reports, the baseline budget allocated a portion of summer salary support to SSP46 and held a portion of salary support in ARC Corporate Account SSP91f. The funds were re-allocated to SSP46 after the baseline budget was established. While SSP46 expenses exceeded the baseline in Q3, they were in line with the revised forecast. For the year, the revised forecast for Survey Management is $273K, or $21K (7%) below the baseline budget.

The budget for Collaboration Affairs provides for Working Group travel and technical page charges and is held in an ARC corporate account. Q3 expenses covered expenses for the DA upgrade workshop and page charges for one technical paper. A portion of the unspent funds have been moved forward into subsequent quarters. As a result, the forecast for the year for Collaboration Affairs is $9K, or $7K (44%) below the baseline budget of $16K.

Observing Systems costs were $49K (32%) above the Q3 budget. The Fermilab budget for Observing Systems Support was overspent by $38K. Unanticipated Q3 expenses included tooling to remove and replace the telescope azimuth drive bearings, and the fabrication, grinding, and assembly of replacement azimuth drive rollers. We also received in Q3 a significant number of machine shop invoices for work performed earlier in the year. The UW Observing Systems Support budget was slightly overspent. Princeton expenses were in close agreement with the budget. Funds from the ARC Observing Systems Support account were used to procure a replacement guide fiber bundle and cover the travel costs for two individuals who assisted with the maintenance and repair work on the spectrographs during the summer shutdown. For the year, the forecast for Observing Systems is $630K, or $18K (3%) below the baseline budget of $648K.

Data Processing and Distribution expenses were $1K (< 1%) above the Q3 budget. SSP40 expenses exceeded the baseline budget allocation by $22K. Salary costs for two people were accidentally charged against the ARC account. The error will be corrected in Q4. Princeton and JHU expenses were slightly less than budgeted. UC costs were in close agreement with the budget. For the year, the forecast for Data Processing and Distribution is $649K, or $56K (10%) above the baseline budget of $593K. This reflects adjustments that were discussed in earlier reports.

Observatory Support expenses were $39K (10%) above the baseline forecast. Salary costs for the new part-time observer were not in the baseline budget. In addition, NMSU accrues vacation salary as it is earned and pays it back when vacations are taken, which makes salary expenses appear greater than budgeted. As in past years, we expect this imbalance to correct itself later in Q4 as vacation time is recorded. For the year, the forecast for Observatory Support is within 4% of the baseline budget of $1,522K.

Miscellaneous ARC corporate expenses (i.e., audit fees, bank fees, petty cash, and APO trailer rentals) were as expected. Modest charges were incurred against the observers' development fund in Q3; unspent funds have been carried forward into Q4.

6.3. Management Reserve

No management reserve funds were expended during Q3. A portion of the unspent management reserve funds have been carried forward into Q4. The remainder will be carried forward into the CY2005 budget.

7. PUBLICATIONS

Through November 5, there are 612 published refereed papers that include 'SDSS' or 'Sloan' in their title and/or abstract. These papers have been cited a total of 11,086 times, including 14 papers cited more than 100 times and 50 papers with 50 or more citations. The York et al (2000) paper has been cited over 500 times, which puts it in the category of "renowned" papers.

In addition, there have been 802 un-refereed papers with "SDSS" or "Sloan" in the title and/or abstract.

The following papers were published in Q3:

Discovery of Two Gravitationally Lensed Quasars with Image Separations of 3 Arcseconds from the Sloan Digital Sky Survey
ApJ submitted - Masamune Oguri, et al

{\em XMM-Newton} and optical follow-up observations of three new Polars from the Sloan Digital Sky Survey
ApJ accepted - Lee Homer, et al

Candidate Type II Quasars from the SDSS: III. Spectropolarimetry Reveals Hidden Type I Nuclei
AJ submitted - Nadia Zakamska, et al

The properties and luminosity function of extremely low luminosity field galaxies
ApJ submitted - Michael Blanton, et al

NYU-VAGC: a galaxy catalog based on new public surveys
AJ submitted - Michael Blanton, et al

The RASS-SDSS galaxy cluster survey. III Scaling relations of galaxy clusters
A&A accepted - Paola Popesso, et al

Spectroscopic Properties of Void Galaxies in the Sloan Digital Sky Survey
ApJ submitted - Randall Rojas, et al

Intergalactic stars in z~0.25 galaxy clusters: systematic properties from stacking of Sloan Digital Sky Survey imaging data
MNRAS submitted - Stefano Zibetti, et al

The Nature of Nearby Counterparts to Intermediate Redshift Luminous Compact Blue Galaxies. II CO Observations
ApJ accepted - Catherine Garland, et al

The Intermediate-Scale Clustering of Luminous Red Galaxies
ApJ submitted - Idit Zehavi, et al

The Luminosity and Color Dependence of the Galaxy Correlation Function
ApJ submitted - Idit Zehavi, et al

Cosmology and the Halo Occupation Distribution from Small-Scale Galaxy Clustering in the Sloan Digital Sky Survey
ApJ submitted - Kevork Abazajian, et al.

Cosmological parameter analysis including SDSS Lyalpha and galaxy bias: new constraints on the primordial spectrum of fluctuations, neutrino mass, and dark energy
PRD submitted - Uros Seljak, et al

Colors, magnitudes and velocity dispersions in early-type galaxies: Implications for galaxy ages and metallicities
AJ accepted - M. Bernardi, et al

The Linear Theory Power Spectrum from the Lyman-alpha Forest in the Sloan Digital Sky Survey
ApJ submitted - Patrick McDonald, et al

The IRAS 05436-0007 Protostar and Its Environment
ApJ submitted - Peregrine M. McGehee, et al

RASS-SDSS Galaxy Clusters Survey II. A unified picture of the Cluster Luminosity Function.
A&A accepted - Paola Popesso, et al

An Empirical Calibration of the Completeness of the SDSS Quasar Survey
AJ submitted - Daniel Vanden Berk, et al

The Nature of Nearby Counterparts to Intermediate Redshift Luminous Compact Blue Galaxies: I. Optical/HI Properties and Dynamical Masses
ApJ accepted - Catherine Garland, et al

Active Galactic Nuclei in the Sloan Digital Sky Survey: II. Emission-Line Luminosity Function
AJ submitted - Lei Hao, et al

Active Galactic Nuclei in the Sloan Digital Sky Survey: I. Sample Selection
AJ submitted - Lei Hao, et al

Spectral Classification of Quasars in the Sloan Digital Sky Survey First Data Release: Eigenspectra, Redshift and Luminosity Effects
AJ accepted - Ching-Wa Yip, et al

Publications Based on Public Data

Anomalously low PAH emission from low-luminosity galaxies
ApJ submitted David Hogg, et al

X-ray Insights into Interpreting CIV Blueshifts and Optical/UV Continua
AJ submitted - S. Gallagher, et al

XMM Cluster Survey: Automated X-ray Source Identification using the Sloan Digital Sky Survey
ApJ submitted - Kate R. Land, et al

A Catalog of Very Isolated Galaxies from the SDSS Data Release 1
AJ accepted - Sahar Allam, et al

A Quasar without Broad Lya Emission
AJ 128:534 - P. Hall, et al

The LEDA Galaxy Distribution I. Maps of the Local Universe
A&A 423:27 – H. Courtois, et al

A Catalogue of the Chandra Deep Field South with Multi-colour Classification and Photomotric Redshifts from COMBO-17*
A&A 421:913 – C. Wolf, et al

The Dark Side of the Halo Occupation Distribution
ApJ 609:35 – A. Kravtsov, et al.

On the Environmental Dependence of the Cluster Galaxy Assembly Timescale
ApJL 609:45 – C. Carretero, et al.

The Transverse Proximity Effect: A Probe to the Environment, Anisotropy, and Megayear Variability of QSOs
ApJ 610:105 – M. Schirber, et al

Double-damped Ly Absorption: A Possible Large Neutral Hydrogen Gas Filament Near Redshift z=1
ApJL 609:53 – D. Turnshek, et al,

Redshifted 21 Centimeter Signatures around the Highest Redshift Quasars
ApJ 610: 117 – J.S. Wyithe, et al

Second Order General Slow-roll Power Spectrum
JCAP 7:12 – J. Choe, et al

High-Speed Photometry of SDSS J013701.06 - 091234.9
MNRAS 352:1056 - M. Pretorius, et al

The XMM-Newton/2dF survey - IV. The X-ray spectral properties of the hard sources
MNRAS 352:91 - I. Georgantopoulos, et al

Redshift Distortions in One-dimensional Power Spectra
MNRAS 351:1395 – V. Desjacques, et al

The shallow slope of the z~ 6 quasar luminosity function: limits from the lack of multiple-image gravitational lenses
MNRAS 351:1266 - J.S. Wyithe, et al

High-speed photometry of faint cataclysmic variables - IV. V356 Aql, Aqr1, FIRST J1023+0038, Ha 0242-2802, GI Mon, AO Oct, V972 Oph, SDSS 0155+00, SDSS 0233+00, SDSS 1240-01, SDSS 1556-00, SDSS 2050-05, FH Ser
MNRAS 351:1015 - P. Woudt, et al

The XMM-Newton/2dF Survey - III. Comparison between optical and X-ray cluster detection methods
MNRAS 351:989 - S. Basilakos, et al

Constraints from Gravitational Recoil on the Growth of Supermassive Black Holes at High Redshift
ApJ 613:36 – Z. Haiman, et al

Redefining the Empirical ZZ Ceti Instability Strip
ApJ 612:1052 – A. Mukadam, et al

Linking Gas Fractions to Bimodalities in Galaxy Properties
ApJL 611:89 – S. Kannappan, et al

Evidence of a Cosmological Strömgren Surface and of Significant Neutral Hydrogen Surrounding the Quasar SDSS J1030+0524
ApJL 611:69 - A. Mesinger, et al

The X-Ray Spectrum of the z=6.30 QSO SDSS J1030+0524
ApJL 611:13 – D. Farrah, et al

Chandra Observations of X-Ray-weak Narrow-Line Seyfert 1 Galaxies
ApJ 610:737- R.J. Williams, et al

Active Galactic Nuclei with Candidate Intermediate-Mass Black Holes
ApJ 610:722 – J. E. Greene, et al

Effects of Triaxiality on the Statistics of Large-Separation Gravitational Lenses
ApJ 610:663 – M. Oguri, et al

Ionizing Radiation Fluctuations and Large-Scale Structure in the Lya Forest
ApJ 610:642 – R.A. Croft, et al

Obscured and Unobscured Active Galactic Nuclei in the Spitzer Space Telescope First Look Survey,
ApJS 154:166 – M. Lacy, et al

The Far- and Mid-Infrared/Radio Correlations in the Spitzer Extragalactic First Look Survey
ApJS 154:147 – P. Appleton, et al

Rest-Frame Mid-Infrared Detection of an Extremely Luminous Lyman Break Galaxy with the Spitzer Infrared Spectrograph (IRS)
ApJS 154:103 – H. Teplitz, et al

Radio Continuum Imaging of Far-Infrared-Luminous QSOs at z > 6
AJ 128:997 - C. Carilli, et al

8.0. SDSS-II DEVELOPMENT WORK

8.1. Progress on the SEGUE Project

The SDSS Management Committee and the Advisory Council, with input from the collaboration, approved scheduling and observations of some 'low-Galactic latitude' SEGUE stripes as well as some SEGUE spectroscopy to take place during the Fall 2004 'southern' observing session, specifically during Aug 2004 and Sep 2004 when remaining SDSS-NGC sky was not available.

The SEGUE team held a number of phone cons and smaller meetings of interested collaboration participants and developed v2_0 of the SEGUE target selection code. Twenty plate-pairs (40 plates total) were designed and drilled for Aug-Oct observing based on this code, and 28 plates were observed by SDSS in August and September, resulting in spectra of over 16,000 stars, about 7% of the 240,000 stellar spectra goal for all of the proposed SEGUE project.

In addition, approximately 600 square degrees of photometric SEGUE imaging was obtained during Aug and Sep 2004, including scans on southern stripe 72 which extends the SDSS areal coverage in the south and potentially allows increased Large Scale Structure baselines. The total goal for SEGUE imaging is roughly 3500 square degrees, and so during this two month period SDSS obtained approximately 15% of the total SEGUE project imaging, making an excellent head start on a baseline plan.

Development work was also completed on allowing the SDSS telescope to scan along SEGUE stripes and record the scanning information in a rational fashion, as a natural extension of regular SDSS observing.

Contacts with experts in stellar atmosphere parameter estimation (gravities, metallicities, effective temperatures) were pursued within and beyond the SDSS project, and a draft plan for pipelining the determination of these important parameters was laid out.

A visual of SEGUE progress through Q3 is shown in Figure 8.1. Progress is given by the black stripes and black dots (indicating completed scans and plates). The figure is maintained online at: http://www-sdss.fnal.gov/yanny/ext/lbmapoct2004.gif

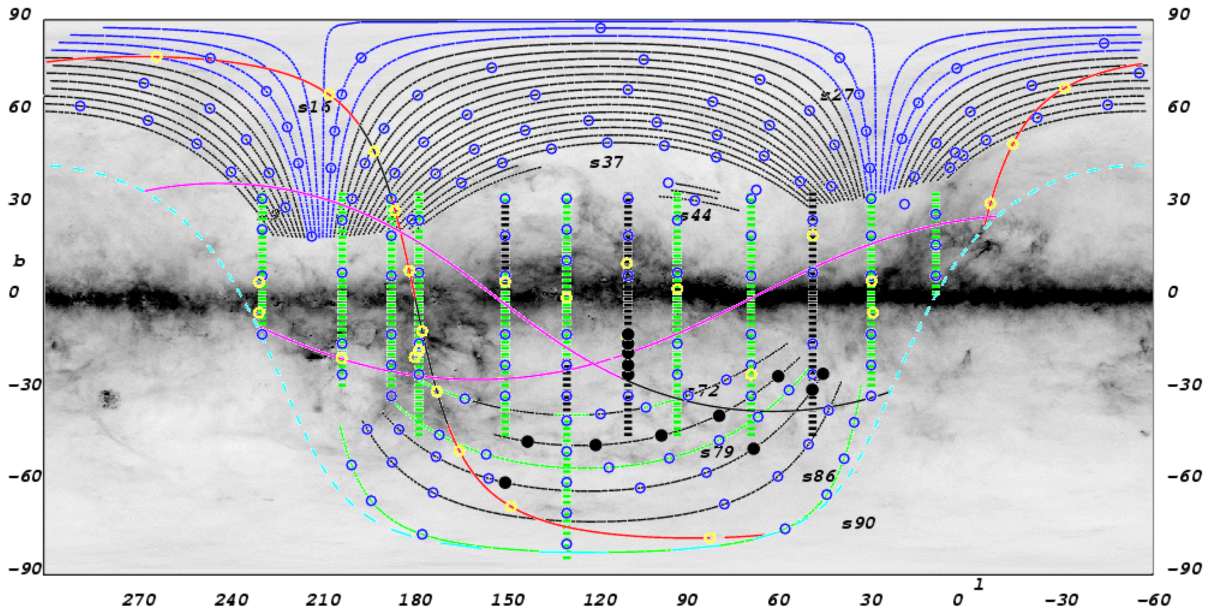

Figure 8.1. SEGUE Observing Scans and Progress through September 30, 2004.

8.2. Progress on the Supernova Project

During this quarter, the bulk of the work needed to be done in preparation for the Oct-Nov. SDSS SN imaging run was carried out and, for the most part, completed. The main focus of the effort during this period was at Fermilab and Chicago, with support from the University of Washington.

Tasks completed include:

- A 7 dual-processor compute cluster with tape mounts was assembled at Fermilab, loaded with necessary pipeline software, tested with historical SDSS stripe 82 data, shipped to APO at the beginning of September, reconfigured there, and exercised.
- End-to-end software was installed on this cluster, tested, and further developed: tape spooling script, PHOTO through corrected frames, frame subtraction, MySQL database for capturing candidates.
- Development of the frame subtraction pipeline inherited from UW so it would process reliably on SDSS data; tweaking of frame-subtraction parameters; work on noise estimates.
- Development of MySQL database for candidates output by the frame subtraction pipeline, including comparison of positions in g and r to weed out asteroids, and computation of SN magnitudes by zero-pointing the search images to template, calibrated SDSS images.
- Compilation of template images for stripe 82 N to be used in the frame-subtraction pipeline.
- Compilation of veto catalogs of variable stars and AGN based on historical stripe 82 data, and incorporation of these into the MySQL database.
- Development of scripts to run the pipelines in automated fashion on the mountain.

- Development of ds9 environment for `hand-scanning' of candidate supernovae to rank them for follow-up observations.

- Development of web interface for capturing hand-scanned candidates, displaying photometric information, cutout images, finding charts, etc.

- Applied for and awarded spectroscopic and photometric follow-up time on the APO 3.5m, and exercised tools for reduction of 3.5m spectra. Coordinated with collaborators to schedule HET spectroscopic follow-up, Liverpool Telescope NIR follow-up, and NMSU 1m imaging follow-up.

- Began SDSS imaging run with 2 nights in late September, with three team members present at APO. Successfully processed this data through the pipelines on the mountain; modulo compute glitches, the processing time for a night's data through g and r is in the ballpark of our 48-hour goal. Identified a number of supernova candidates.

SDSS CY2004 Budget Forecast as of October 1, 2004 (*in $000s*)

		Qtr 1	Qtr 2	Qtr 3			Qtr 4			CY2004		
		Jan-Mar	Apr-Jun	Jul-Sep			Oct-Dec			Budget Forecast		
		Actual Expenses	Actual Expenses	Approved Budget	Actual Expenses	Variance (%)	Approved Budget	Oct 2004 Forecast	Variance (%)	Approved Budget	Oct 2004 Forecast	Variance (%)
ARC-FUNDED BUDGET												
1.1 Survey Management												
SSP21	ARC Secretary/Treasurer	2	2	2	2	-8%	3	3	0%	12	10	-13%
SSP34	ARC Business Manager	10	19	14	14	4%	15	15	3%	58	58	1%
SSP46	PU Office of the Project Scientist	1	.2	36	62	75%	8	8	0%	59	71	21%
SSP48	FNAL Support for Survey Management	12	14	9	18	103%	9	9	0%	36	53	47%
SSP67	UC Support for Survey Management	12	12	36	30	-18%	14	4	-72%	79	58	-26%
SSP91a	ARC Support for Public Affairs	2	.2	0	0	----	0	6	----	24	8	-67%
SSP91i	ARC Support for Public Information Officer	4	2	6	2	-65%	6	7	12%	27	14	-47%
	Sub-total	42	49	103	129	25%	55	52	-5%	294	273	-7%
1.2 Collaboration Affairs												
SSP91c	ARC Support for Collaboration Affairs	2	1	4	2	-43%	4	4	0%	16	9	-44%
	Sub-total	2	1	4	2	-43%	4	4	0%	16	9	-44%
1.3.1 Observing Systems												
SSP42	FNAL Observing Systems Support	62	48	37	75	101%	38	38	0%	149	223	49%
SSP61	FNAL Observing Programs and DA Support	1	3	6	2	-60%	5	5	1%	23	11	-54%
SSP31	UW Observing Systems Support	66	57	72	88	23%	72	68	-6%	288	280	-3%
SSP32	PU Observing Systems Support	10	12	16	18	14%	15	15	0%	59	55	-7%
SSP91d	ARC Observing Systems Support	6	24	24	21	-14%	29	11	-61%	128	62	-52%
	Sub-total	145	145	155	204	32%	158	137	-14%	648	630	-3%
1.3.2 Data Processing and Distribution												
SSP40	FNAL Software and Data Processing Support	48	54	27	49	83%	27	27	0%	128	179	40%
SSP38	PU Software and Data Processing Support	56	47	33	24	-27%	33	42	28%	148	170	15%
SSP39	UC Software and Data Processing Support	9	10	11	10	-2%	11	11	0%	42	40	-6%
SSP37	JHU Data Archive Development and Support	65	51	62	51	-19%	57	67	16%	240	232	-3%
SSP33	UC Operations Support	8	9	9	9	2%	9	3	-66%	35	29	-17%
	Sub-total	186	171	142	143	1%	137	149	9%	593	649	10%
1.3.4 Observatory Support												
SSP35	NMSU Site Support	384	391	380	419	10%	380	389	2%	1,522	1,584	4%
	Sub-total	384	391	380	419	10%	380	389	2%	1,522	1,584	4%
1.4 ARC Corporate Support												
SSP91e	ARC Corporate Support	10	17	13	37	173%	12	10	-15%	62	73	18%
SSP91f	ARC Additional Scientific Support	0	0	47	0	-100%	18	9	-50%	102	9	-91%
SSP91h	ARC Observers' Research Support	0	4	3	4	25%	3	4	42%	12	12	0%
	Sub-total	10	21	63	40	-36%	33	23	-29%	176	94	-46%
SUBTOTAL		769	778	847	938	11%	767	755	-2%	3,248	3,239	0%
SSP91g	Capital Improvements	0	43	0	0	---	0	0	---	0	43	---
SSP91	Management Reserve[1]	0	0	40	0	-100%	32	50	56%	152	50	-67%
TOTAL ARC-FUNDED BUDGET		769	778	887	938	6%	799	805	1%	3,400	3,332	-2%

SDSS CY2004 Budget Forecast as of October 1, 2004 (*in $000s*)

		Qtr 1	Qtr 2	Qtr 3			Qtr 4			CY2004		
		Jan-Mar	Apr-Jun	Jul-Sep			Oct-Dec			Budget Forecast		
		Actual Expenses	Actual Expenses	Approved Budget	Actual Expenses	Variance (%)	Approved Budget	Oct 2004 Forecast	Variance (%)	Approved Budget	Oct 2004 Forecast	Variance (%)
IN -KIND CONTRIBUTION												
1.1 Survey Management												
SSP48	FNAL Support for Survey Management	42	41	47	38	-20%	49	40	-18%	191	161	-15%
	Sub-total	42	41	47	38	-20%	49	40	-18%	191	161	-15%
1.3.1 Observing Systems												
SSP42	FNAL Observing Systems Support	50	52	66	55	-18%	68	55	-19%	267	211	-21%
SSP58	LANL Observing Systems Support	59	40	55	30	-46%	57	29	-49%	222	157	-29%
SSP61	FNAL Observers' Programs and DA Support	5	2	13	7	-46%	13	5	-62%	52	19	-64%
	JPG Observing Systems Support	0	0	0	0	---	0	0	---	0	0	---
	Sub-total	114	93	134	91	-32%	138	89	-35%	541	387	-29%
1.3.2 Data Processing and Distribution												
SSP40	FNAL Software and Data Processing Support	293	167	214	126	-41%	229	214	-7%	941	801	-15%
SSP57	USNO Software and Data Processing Support	16	14	34	17	-50%	34	15	-54%	133	63	-53%
	Sub-total	310	181	248	143	-42%	263	229	-13%	1,074	863	-20%
TOTAL IN-KIND CONTRIBUTION		465	316	430	273	-37%	450	358	-20%	1,806	1,412	-22%
TOTAL BUDGET		1,234	1,093	1,317	1,210	-3%	1,249	1,163	-7%	5,206	4,744	-9%

Notes
1) Management Reserve is controlled by the SDSS Director.