Sloan Digital Sky Survey

Quarterly Progress Report

First Quarter 2004

May 4, 2004

<u>Table of Contents</u>

Q1 PERFORMANCE HIGHLIGHTS

- We obtained 412 square degrees of new imaging data on the Northern Galactic Cap (NGC) against a baseline goal of 727 square degrees (57%).
- We completed 83 spectroscopic plates on the NGC against a baseline goal of 156 plates (53%).
- We obtained 15 square degrees of imaging data and 10 plate-equivalents on the Southern Equatorial Stripe. The baseline plan did not forecast observing on the Southern Equatorial Stripe in Q1.
- Weather was the largest impediment to observing progress. There were 56 potential observing nights in Q1; we were completely closed on 24 of these due to weather.
- Observatory operations ran smoothly during the quarter. There were no personnel injuries or major system problems.
- All data acquired during the quarter was promptly processed and calibrated. The DP factory continues to operate smoothly.
- We fulfilled our commitment for the second major data release. Data Release 2 occurred on March 15, 2004. We released 3,324 square degrees of imaging data (88 million objects) and 367,360 spectra (including 260,490 galaxies) to the general public.
- Q1 cash expenses were $734K against a baseline budget of $793K (-8%). In-kind contributions were $465K against anticipated contributions of $473K (-2%). No management reserve funds were expended.

1. SURVEY PROGESS

1.1 Summary

We observed primarily on the Northern Galactic Cap, with a small amount of data collected on the Southern Equatorial Stripe. On the Northern Galactic Cap, we obtained 412 square degrees of new “unique” imaging data against a baseline goal of 727 square degrees. On the Southern Equatorial Stripe, we obtained 15 square degrees of new imaging data against a baseline goal of zero square degrees. We also completed 83 plates on the Northern Galactic Cap against a baseline goal of 156 plates, and 10 plate-equivalents on the Southern Equatorial Stripe against a baseline goal of zero plates. Plate-equivalents are reported to account for the longer exposure times required on special southern program plates. Finally, we spent 6 hours of observing time acquiring Apache Wheel data and 1 hour on an oblique scan.

Progress in Q1 was hampered by weather and several minor equipment problems. Overall, we lost 341 potential observing hours to poor weather. We also lost 10 potential observing hours to equipment problems; these are discussed in Section 2.2.

1.2 Q1 Imaging

Table 1.1 compares the imaging data obtained against the baseline projection.

Table 1.1. Imaging Survey Progress in Q1-2004

	Imaging Area Obtained (in Square Degrees)			
	Q1-2004		Cumulative through Q1	
	Baseline	Actual	Baseline	Actual
Northern Survey[1]	727	412	7221	6526
Southern Survey[1]	0	0	745	738
Southern Equatorial Stripe[2]	0	15	3430	2853

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

As previously noted, we allocated approximately 6 hours to Apache Wheel scans. The area imaged for Apache Wheel scans is not included in Table 1.1. These data are taken in binned scan mode; therefore, they are not standard survey data.

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.

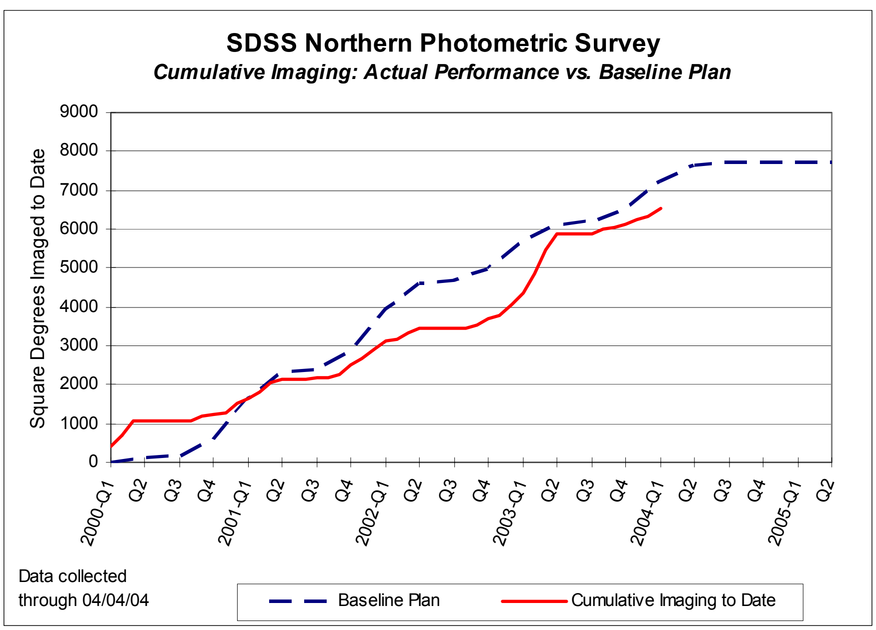


Figure 1.1. Imaging Progress against the Baseline Plan – Northern Survey

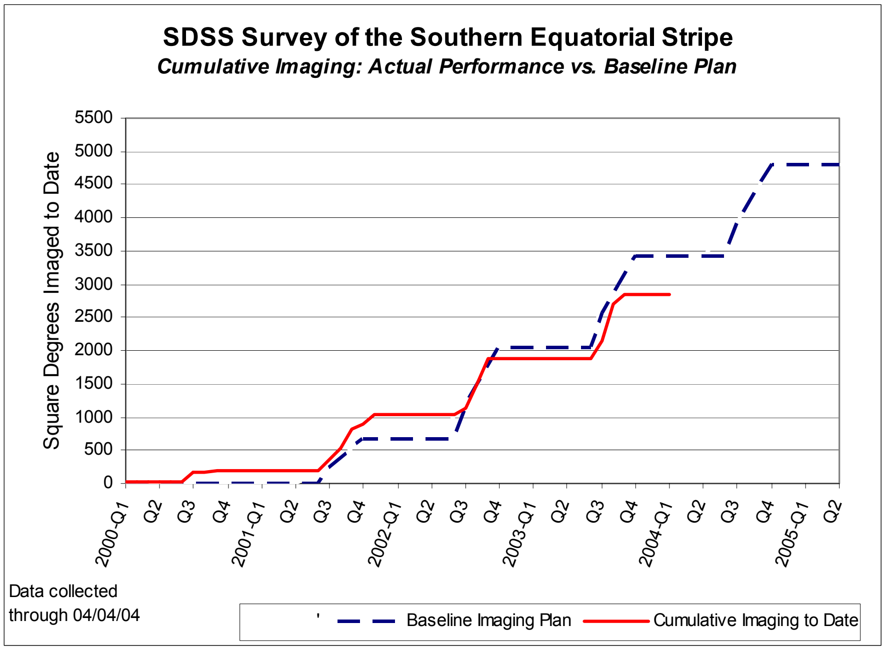


Figure 1.2. Imaging Progress against the Baseline Plan – Southern Equatorial Survey

1.3 Q1 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 Q1, we completed a total of 90 physical plates, of which 7 were special plates associated with the Southern Equatorial Stripe program. Some of the special plates require longer exposure times than standard survey plates. In order to compare progress against the baseline, we apply a scale factor to these plates to determine the number of standard survey plates that would have been observed in the same amount of time. Through this accounting, we would have completed 10 standard-survey plates in the amount of time it took us to complete the seven special plates. Combining these 10 "plate-equivalents" with the 83 standard-survey plates observed, we completed a total of 93 plate-equivalents against the baseline goal of 156 plates.

We had several high yield nights during the March observing run. We had our first perfect 9-plate night, in which we completed nine plates, none of which had any previous exposures. We also had two 8-plate nights and one 7-plate night. In these four nights alone, the observers obtained spectra on over 20,000 unique objects.

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.

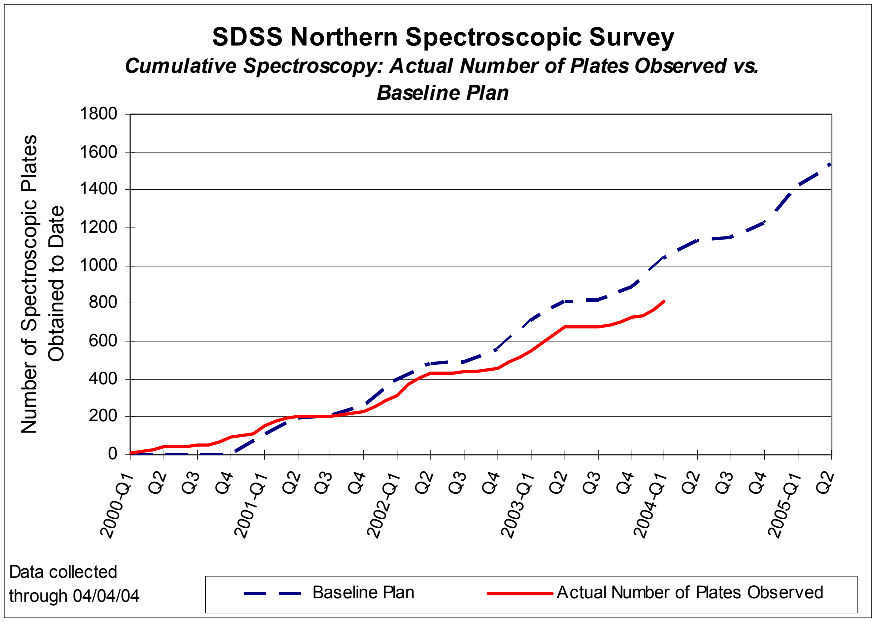


Figure 1.3. Spectroscopic Progress against the Baseline Plan – Northern Survey

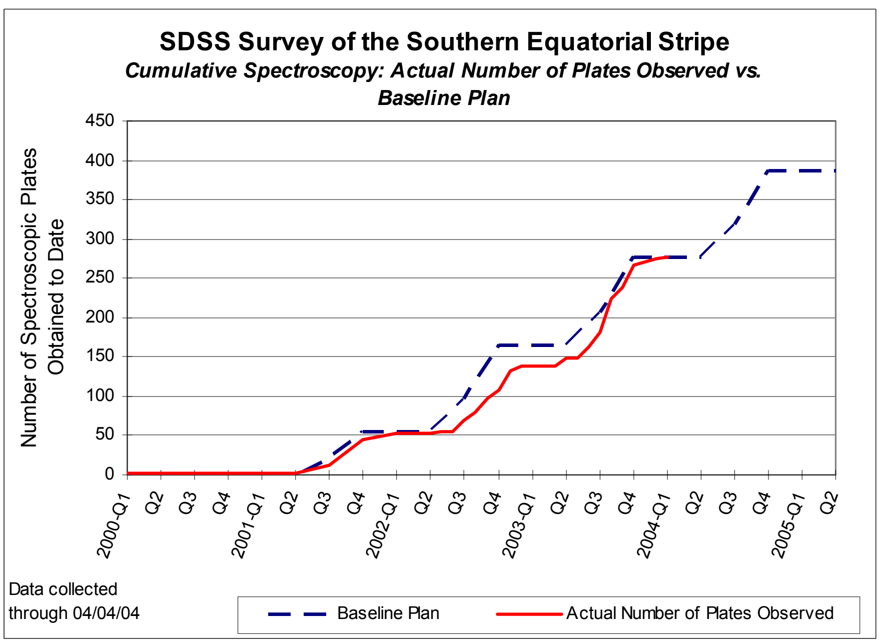


Figure 1.4. Spectroscopic Progress against the Baseline Plan – Southern Equatorial Survey

2.0 OBSERVING EFFICIENCY

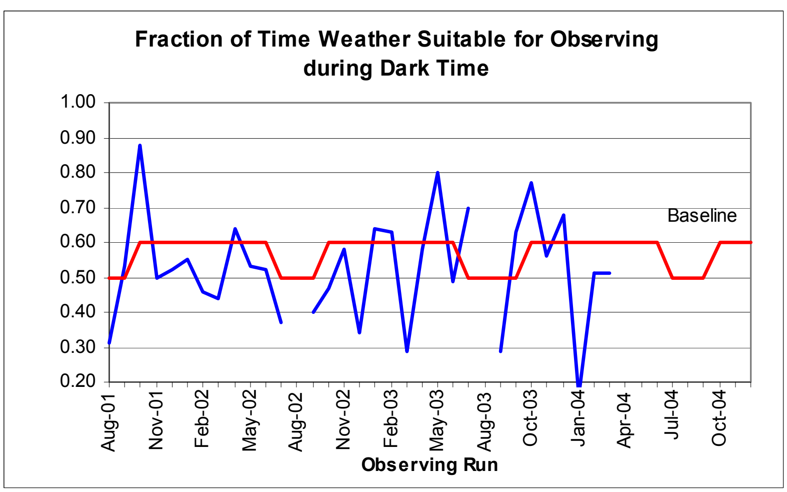
Table 2.1 summarizes the breakdown of observing time in 2004-Q1 according to the categories used to prepare the baseline projection.

Table 2.1. Comparison of Efficiency Measures to the Baseline

Category	Baseline	January Dark	January Dark + gray	February Dark	February Dark + gray	March Dark	March Dark + gray
Total time (hrs)	January:	147:06	215:41				
	February:			140:37	201:46		
	March:					127:55	174:12
Imaging fraction	0.27	0.48	0.28	0.11	0.10	0.21	0.20
Spectro fraction	0.63	0.46	0.69	0.68	0.68	0.69	0.65
Weather	0.60	0.16	0.21	0.51	0.49	0.51	0.46
Uptime	0.90	0.99	0.99	0.96	0.97	0.98	0.99
Imaging efficiency	0.86	0.87	0.87	0.88	0.88	0.86	0.86
Spectro efficiency	0.65	0.61	0.63	0.69	0.66	0.66	0.64
Operations	0.90	0.96	0.96	0.96	0.96	0.96	0.96
Hours lost to problems		1:21	2:03	5:17	6:08	2:23	2:23
Hours lost to weather		123:10	169:32	68:50	103:27	62:33	94:24

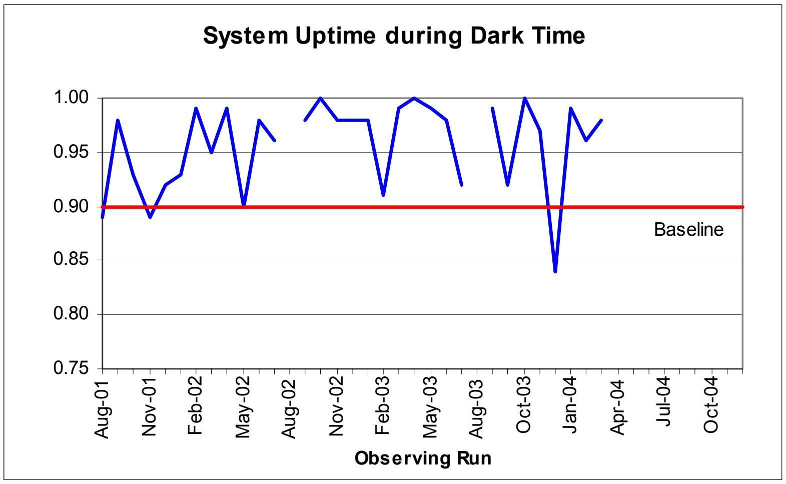
2.1. Weather

The weather category reports the fraction of scheduled observing time that weather conditions were suitable for observing. In Q1, weather was substantially below baseline expectations. January in particular was bad. Weather kept us closed on 12 of the 19 scheduled observing nights. We were also closed during parts of the remaining nights. The overall fraction of time suitable for observing in January was 16%, substantially below our baseline expectation of 60%.



2.2. System Uptime

System uptime measures the availability of equipment when conditions are suitable for observing. We averaged 98% uptime in Q1 against a baseline goal of 90%. Uptime performance over time is shown in the following graph.

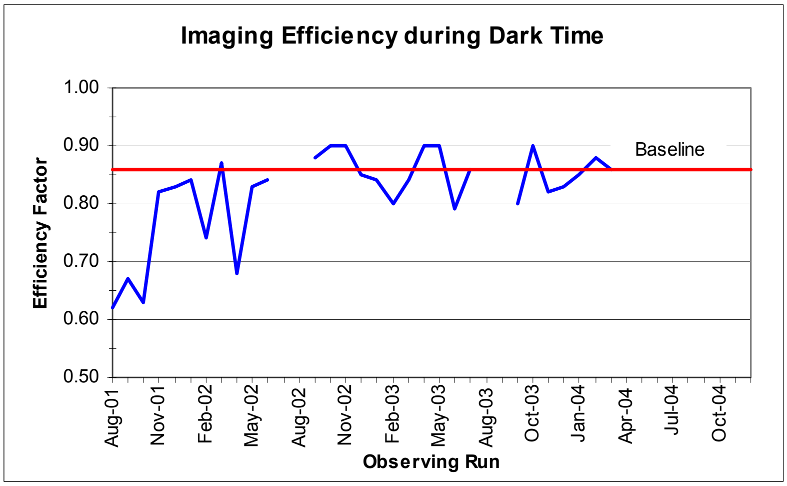


Although we exceeded our baseline uptime goal, we did lose approximately 10 hours of observing time to system problems. The following bullets highlight a few of the more notable problems encountered.

- In Q4 we had replaced a failed collimator mirror actuator in spectrograph #1. In Q1, the actuator coupling became loose, which caused spectrograph focus problems. Tightening the actuator screws fixed the problem; periodic inspections to monitor these screws have been added to our preventive maintenance program.
- Guide fiber bundle #4 came loose from the slithead on spectroscopic cartridge #5. After several years in operation, the glue joint holding the bundle to the slithead failed. It appears that there may have been an insufficient amount of adhesive applied initially. The old adhesive was removed, bonding surfaces were cleaned and the bundle re-bonded to the slithead. Adjacent bundles were inspected and found to be in good shape.
- We experienced an onslaught of azimuth axis aborts in March. A follow-up inspection discovered that the gauge on an air hose had lodged between the rotating floor and the telescope. Removing the gauge solved the problem.
- A computer problem associated with one of the observers' laptop computers affected all computer systems at APO and took approximately 1.5 hours to resolve. The exact cause of the problem is still not clear. Fortunately, no damage was done and the problem has not reoccurred.

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; average imaging efficiency in Q1 was 0.86.



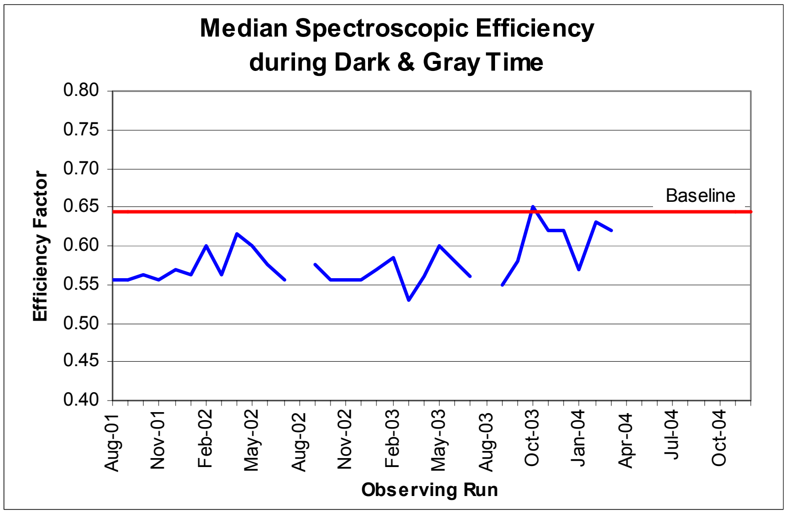
2.4. Spectroscopic Efficiency

Spectroscopic efficiency is derived by assessing the time spent performing various activities associated with spectroscopic operations. Table 2.2 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 61% in Q1 against the baseline goal of 64%.

Table 2.2. Median Time for Spectroscopic Observing Activities

Category	*Baseline*	*Run starting Jan 12*	*Run starting Feb 10*	*Run starting Mar 10*
Instrument change	10	8	4	4
Setup	10	17	13	14
Calibration	5	6	6	6
CCD readout	0	3	3	3
Total overhead	25	34	26	27
Science exposure (assumed)	45	45	45	45
Total time per plate	70	79	71	72
Efficiency	0.64	0.57	0.63	0.62

Spectroscopic efficiency fell short of the baseline goal as a result of January's poor weather. When the weather is bad, the observers often take a little longer to change cartridges or complete setup operations while waiting for the weather to clear. This has a negative effect on the efficiency numbers but no real operational effect, since the weather is keeping us closed. The February and March efficiency numbers are more representative of typical performance. The following graph shows spectroscopic efficiency over time.



3. OBSERVING SYSTEMS

In addition to addressing the problems described in Section 2.2, we addressed a number of additional issues and completed a number of planned engineering tasks and preventive maintenance activities.

3.1. The Instruments

Spectrograph problems were previously discussed in Section 2.2. In addition, we began seeing an increase in scattered light warnings in spectrograph #2. Follow-up troubleshooting discovered that a section of foam insulation around the spectrograph slithead door had fallen off; the foam serves as a light seal between the cartridge slithead assemblies and the spectrograph. Replacing the foam took care of the problem.

The imaging camera worked well throughout the quarter, with the exception of problems with the U3 chip during a particularly cold night in January. U3 became increasingly noisier during imaging scans on January 27, to the point that median bias value for the bias run at the end of the night exceeded acceptable limits. Fortunately, median bias levels were within tolerance during the actual data runs. We were able to establish that the chip experiences real saturation under extremely cold conditions and that the charge generation is immediately adjacent to the chip's amplifier. We instituted a test to identify the onset of the phenomenon and ran it for a period of time; however, we have not seen the problem recur since the January 27 incident. Because the problem is cold-temperature related, it is unlikely that we will see the problem again until next winter. As a result of the January incident, however, we now have software code that should provide the information we need to catch the chip in the process of misbehaving so we can better study what exactly is happening and perhaps how to fix the problem.

3.2. The 2.5m Telescope

We completed a number of engineering projects, minor repairs and planned maintenance tasks in Q1. Examples of work performed include the following:

- While we did not lose observing time, we experienced problems with the secondary mirror control system piezo actuators and controllers that could potentially impact imaging data quality. The piezo actuators are currently disabled as we continue to diagnose and troubleshoot the problem. The actuators increase the positional stability of the secondary mirror, so we run risk of slightly degraded data quality until the actuators are restored to full operation. A significant amount of effort went into resolving this issue in Q1, but we have yet to successfully solve the problem.

- A temporary thermal radiation shield was installed on the back side of the secondary mirror to limit excessive cooling to the night sky. The shield demonstrated that the conceptual design worked effectively; a permanent shield will be fabricated and installed during the 2004 summer shutdown.
- We designed and tested a new hub design for the spectrograph collimator mirror actuators to eliminate the problem that resulted in downtime in the last two quarters. System tests were successful, so new hubs have been fabricated and shipped to a commercial vendor to have stainless steel bellows attached to the hubs. We anticipate installing the new assemblies in Q2.
- The instrument change system was put into full operation. Instrument change operations are still performed under manual control, but the interlock system now monitors instrument change activities (e.g., lift height, speed, etc.) and prevents operations that could potentially result in instrument or equipment damage.
- We plan to replace the drive motor bearings on the azimuth axis during the 2004 summer shutdown. In preparation for this, tooling and fixturing was designed and is currently being fabricated.
- The design and fabrication of a lower light baffle removal rigging system was finished. This will reduce risk to the primary mirror during telescope disassembly and re-assembly.
- Fabrication and assembly of the new plug plate drilling fixture. When finished, the new fixture will increase production efficiency and reduce production cost.
- To improve system reliability, we are upgrading the altitude fiducial read-head mount to eliminate missed fiducials during operations. Design work was completed; we are now soliciting fabrication quotes.

3.3. The Photometric Telescope

There were no problems with the Photometric Telescope (PT) during the quarter. We observed patches for the standard program and began experimenting with using the PT for follow-up observations of new supernova discoveries to better understand capabilities for a possible supernovae program in the period beyond mid-2005.

3.4. Operations Software and the Data Acquisition System

There were no problems with the data acquisition system in Q1 that prevented us from acquiring data. We continue to have the occasional problems with the PTVME link, but existing workarounds keep these problems from affecting our ability to collect data. We have scheduled a DA upgrade workshop in June to evaluate the current state of the DA system and consider areas of concern and upgrade possibilities to ensure the reliability and robustness of the DA in the period beyond mid-2005. The original system was assembled and delivered in 1996, so we are becoming increasingly concerned about system aging and component obsolescence. The DA workshop will address these concerns.

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 Q1:

- The Telescope Control Computer (TCC) was updated to improve guide camera error reporting;
- Several minor changes were made to IOP and SOP. A new scrolling display provides an option for viewing 2x2 decimated images of the camera chips; this allows the observers to see the whole chip on the display monitors. New guider code recognizes dead guide fibers and automatically disables those fibers.
- The Telescope Performance Monitor (TPM) ChannelArchiver was relocated from the computer “sdsshost” to “sdsscommish.” Reducing the load on sdsshost has been an ongoing effort, as sdsshost is the primary computer used for observing operations.
- Several minor bug fixes were made on various pieces of observing software as required.

3.5. APO Operations and Facility Improvements

Observatory operations ran smoothly throughout the quarter. There were no personnel injuries related to SDSS operations. Site infrastructure support (e.g., cryogens, facilities maintenance, visitor housing) was provided as needed.

We augmented the observing staff by adding a half-time observer in Q1. John Barentine, who previously served as a full-time observer on the 3.5m telescope, will now split his time evenly between SDSS and 3.5m operations. John's addition adds depth to the existing observer pool and frees up time for Dan Long, Deputy Lead Observer, to focus half of his time on SDSS mountaintop QA activities. Effective April 1, Dan will spend 50% of his time observing and 50% of his time on QA activities. In his role as Mountaintop QA Coordinator, Dan will be responsible for seeing that timely data quality checks are being performed at APO on all data gathered with the SDSS telescopes. In addition, Dan will help develop and/or specify necessary QA tools for mountaintop operations, examine data from monthly instrument checks, and follow up on all specific QA issues as needed.

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 Q1. The spectroscopic pipeline, idlspec2d, was revised to apply a reddening correction to the spectra. The revised version also provides sky-subtracted spectra and improved spectrophotometry. However, final testing of the revised code was not finished in time to incorporate the new code into the data processing (DP) factory, re-process existing spectroscopic data, and load the data for the DR2 public release. In addition, incorporating the new code requires a data model change, as well as revisions to the spectroscopic pipeline, Spectro1D, and revisions to the Catalog Archive Server (CAS). Since we are releasing DR3 with the same data model as DR2, these code changes will be incorporated in DR4 at the earliest.

The astrometric pipeline is mature and stable; no major upgrades or changes are foreseen. It is anticipated that observing for the all-sky UCAC catalog will be completed in Q2. When the reductions have been made and the catalog is available, the UCAC Known Objects SDSS product will be updated. At that point, UCAC reference stars will be available for all of the SDSS survey area, and areas previously reduced with the astrom pipeline against the Tycho-2 catalog will be re-reduced against UCAC.

4.1.2. Data Processing Operations

In Q1 we processed all newly acquired imaging data, as well as data from 90 spectroscopic plates and 31 unique PT patches. The median turnaround time to process data was 13 days (including calibrations) for imaging data, 1-2 day for spectroscopic data, and 5 days for PT data. Overall, the factory data processing operation is working very smoothly.

A current snapshot of data volume obtained and processed can be found on-line. Imaging history is summarized at http://das.sdss.org/skent/runHistory.html; spectroscopy history is summarized at http://das.sdss.org/skent/specHistory.html; and target and tile runs are summarized at http://das.sdss.org/targetlink/target.html .

We brought a number of new computers online in Q1 as part of the on-going DP factory upgrade project. However, we encountered hardware problems during the installation of the new machines. Specifically, the new machines came with a suspect version of hard-drive controller cards. The vendor has subsequently provided us with new controller cards and we are in the process of installing and testing the machines with the new cards. Preliminary tests suggest that the replacement cards are working properly and that the new machines will be ready for production use shortly.

As part of our ongoing QA improvement effort, we have initiated weekly QA meetings between the DP factory, mountaintop operations, and project management. The goal is to regularly discuss data quality issues to ensure that any new problems are quickly identified and mitigated, that the signature of a given problem is understood, and that new tests are designed and implemented to quickly catch problems should they reoccur in the future. We are also working on improving the error warnings thrown by software used by the observers to operate the telescopes and instruments. More meaningful error messages will help identify and resolve problems more quickly.

To ensure data reliability, we implemented a system that automatically compares checksums against all of the data in the DR1 and DR2 datasets weekly. In Q1, we discovered and replaced one corrupt file. We also had one instance in which a checksum was computed incorrectly, but follow-up inspection showed the file to be fine. Both of these occurrences were in the DR1 data set. There have been no incidents in the DR2 data set since its public release.

A new version of the imaging QA tool, runQA, was delivered by Princeton to the DP factory late in the quarter. The new code incorporates a field quality algorithm that assigns a quality rating to each processed field. Other improvements include ignoring fields known to be bad (using opdb field quality information) when reporting problems, and more detailed reports. In particular, html tables now report maximum deviations of median principal color, the locus width, and also measure the behavior of the distribution tails. All the problems can be traced on a field-by-field basis. In addition, there is also new code to post-process runQA outputs for a large set of runs and present summary statistics in tabular and histogram format (e.g. the distribution of photometric zero-point errors for all runs, their column-to-column scatter in a given run, etc.). As of this writing, the new tools are currently undergoing checkout tests by the factory. We anticipate the new version will be put into regular use early in Q2.

4.2. Data Distribution

4.2.1. Data Release 2

Data distribution activities focused on Data Release 2. We made the DR2-Data Archive Server (DR2-DAS) and the DR2-Catalog Archive Server (DR2-CAS) available to the SDSS collaboration on December 18, 2003. The collaboration release started the three-month clock for the public release. On March 15, 2004, we announced the availability of DR2 to the general public, thereby fulfilling our commitment for Data Release 2. Access to DR2 is provided through the SDSS web site.

In addition to loading and testing the databases, we created new DR2 web pages. We also updated on-line documentation and created a caveats page relevant to DR2. Finally, a paper describing and documenting DR2 was written and submitted to The Astronomical Journal for publication.

Table 4.1 summarizes the sky coverage and data volumes associated with DR2. As with all releases, DR2 contains two versions of the imaging data: *Target* and *Best*. The *Best* version contains images and photometric catalogs with the highest quality data at the time of the data release. For DR2, the *Best* imaging data was processed with photo v5_4_18 or greater, with the majority of data processed with photo v5_4_25. The *Target* version contains those imaging data at the time the target selection algorithm was run for that part of the sky. *Target* data was processed with the version of photo current at the time the target selection algorithm was run.

Table 4.1. Data Release 2 Highlights

Imaging	
Footprint area	3324 square degrees
Imaging catalog	88 million unique objects
Data volume	
Images	5.0 TB
Catalogs (DAS, FITS format)	0.7 TB
Catalogs (CAS, SQL database)	1.4 TB
Spectroscopy	
Spectroscopic area	2627 square degrees
Spectroscopic catalog	
Total spectra	367,360
Galaxies	260,490
Quasars (redshift < 2.3)	32,241
Quasars (redshift > 2.3)	3,791
Stars	34,998
M stars and later	13,379
Sky spectra	18,767
Unknown	3,694
Data volume	
Calibrated spectra	27 GB
Spectra, redshifts, line measurements	73 GB

The DR2-CAS is being served from Fermilab. We are currently working on setting up a DR2 mirror site at Johns Hopkins. Data usage for DR2 has been quite strong. Figure 4.1 shows the number of site hits since DR2 went public on March 15. Figure 4.2 shows the number of rows returned by SQL queries generated on the CAS. Figure 4.3 shows the volume of data transferred through these queries. There were two days with exceptionally heavy use. 1.9 billion rows of data were returned on April 4; 419 million rows were returned on April 15.

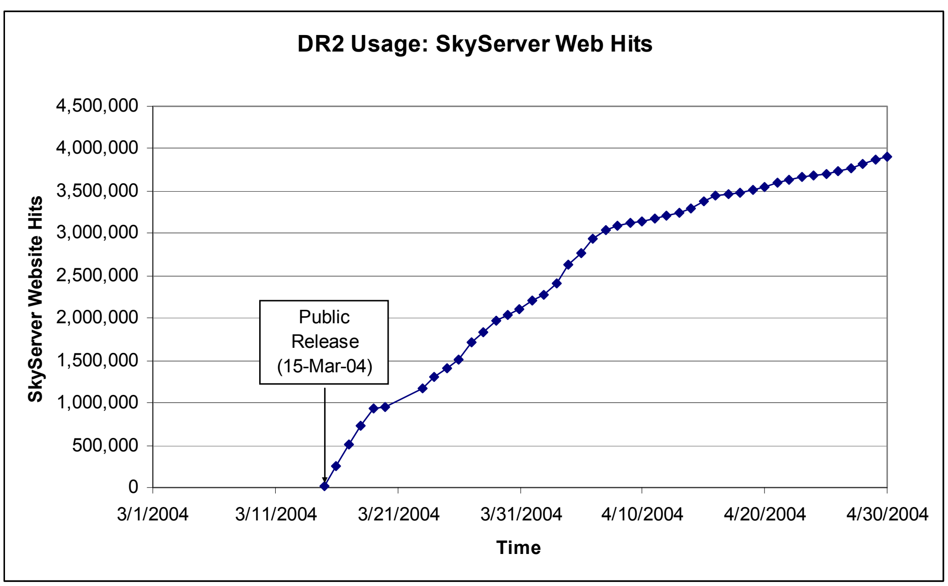


Figure 4.1. Number of SkyServer website hits since the DR2 public release.

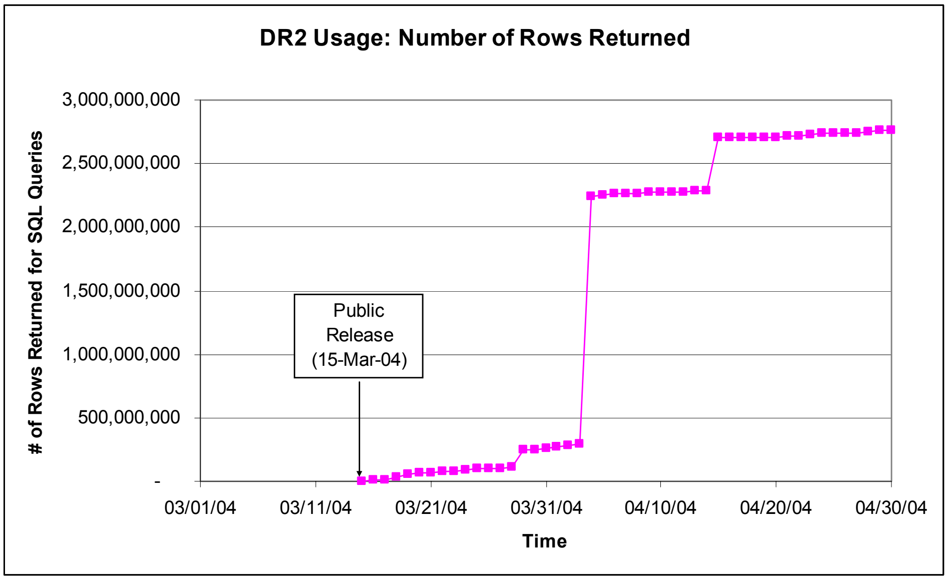


Figure 4.2. The number of rows of data returned from queries executed through the collaboration and public SkyServer interfaces.

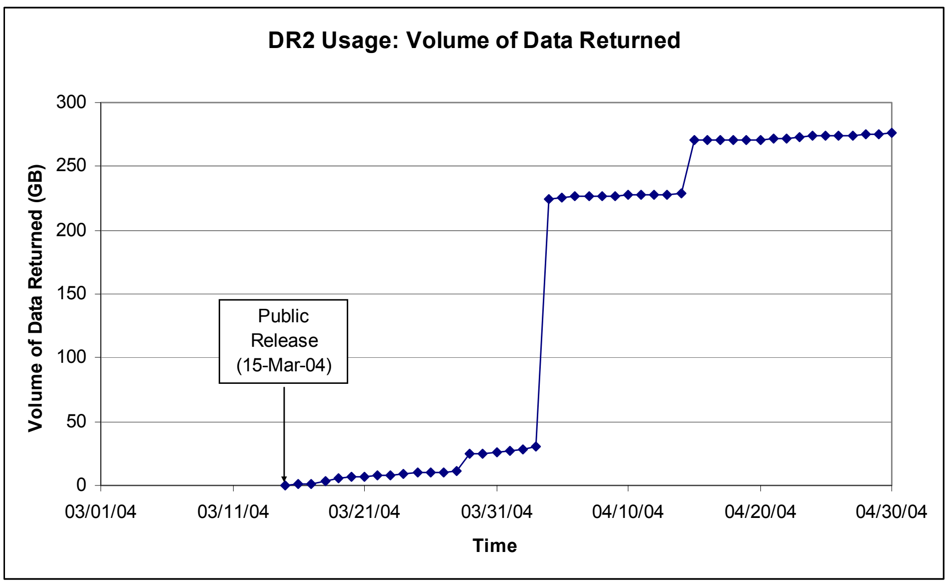


Figure 4.3. The volume of data returned from queries executed through the collaboration and public SkyServer interfaces.

4.2.2. Data Archive Server

The DR1-DAS remained available to the SDSS collaboration and general astronomy community through March 15, at which time it was replaced with the DR2-DAS. The DAS continues to serve data reliability. An internal data integrity checking system found and fixed one corrupt file in Q1. Helpdesk support continues to be provided by Fermilab; the helpdesk has been receiving and responding to an average of 10 help requests per week since the DR2 release.

To further improve reliability and system performance, a new web farm is being implemented that will relocate CPU-intensive operations off of the DAS data servers. This work began in earnest in Q1 and will finish in Q2. Additional DAS activities in Q2 will focus on preparations for DR3. Specific activities will include updating data links, verifying data integrity, updating documentation, and testing the DR3-DAS prior to collaboration release.

4.2.3. Catalog Archive Server

CAS work focused on final preparations for the DR2 public release, integrating the CAS loading operation at Fermilab, procuring and installing new hardware to support DR2 and DR3, and loading the DR3-CAS.

Subsequent to the collaboration data release on December 18, we focused on fixing a number of CAS items in preparation for public DR2 release. These fixes include the following:

- Fix to spectro CSV maker which lost track of fibers following an untiled fiber. This previously resulted in significantly fewer 'science primary' spectra than there should have been.
- Fix to the 'quality' entry in the Target and Best Field table, to correct fields which were incorrectly marked as holes or bad, or not correctly marked as holes.
- Fix to the USNO, FIRST and ROSAT 'external catalog' match tables, to include matches for objects in the southern stripes with 0 < RA < ~60 degrees.
- Fixes to the target tables and target tiling info.
- Fixes to various sub-sections of the "FINISH" step to include items like setting TARGET-BEST matchup ids and changing the match radius between spectra and imaging to 1" (was 6").
- Added Stetson photometry.

We also made several changes to the SkyServer web interface:

- The look and feel (i.e., stylesheets) applied to the public DR1 released in October 2003 were propagated to the DR2 site. The DR1 and DR2 web interfaces were also integrated with each other.
- Documentation updates, mainly in the Help pages.
    - A much expanded Archive Intro page to describe data organization (including table/view descriptions and indices) in addition to data access.
    - New separate Data Organization and Data Access pages
    - API page that lists direct access URLs etc.
    - Expanded FAQ, How To (tutorial) and supported Web Browsers pages

CAS work in Q2 will focus on completing the integration of the CAS into the production environment at Fermilab, loading DR3 into the CAS for collaboration use, completing the CAS system documentation, and finalizing the CAS production hardware system design.

In addition to working on the CAS, we held an internal review of the CAS to assess the state of CAS development and our implementation of the CAS into the production operation at Fermilab. The review was held at Fermilab on March 1-2. The review committee consisted of non-SDSS individuals from Fermilab, the Space Telescope Science Institute, and the Canadian Astronomy Data Center who have experience operating and managing large data management systems. The committee also included two members of the SDSS collaboration, to ensure that collaboration needs were represented and considered in the assessment. Significant recommendations included freezing the CAS data model until the loading operation is successfully implemented in the production environment at Fermilab; hiring additional staff to support data distribution operations at Fermilab; developing a long-term implementation plan and schedule for database implementation, and finalizing the computer hardware plan for collaboration and public database systems. The full committee report is posted on the SDSS website.

4.2.4. Data Distribution Goals for 2004-Q2

The following high-level goals have been established for data distribution during 2004-Q2:

- Fully document the CAS loading operation;
- Prepare the DR3-DAS for collaboration release;
- Make the DR3-DAS available to the collaboration for evaluation, testing and use;
- Finish loading the DR3-CAS with the full set of DR3 imaging, spectro, and tiling data;
- Make the DR3-CAS available to the collaboration for evaluation, testing and use;
- Begin developing the DR3 web site and preparing documentation to support the DR3 release. An initial version of the website and documentation will be available for use and evaluation by the collaboration in preparation for the public release of the DR3 data set in October 2004.
- Finalize the hardware system for the production CAS at Fermilab.

5. SURVEY PLANNING

5.1 Observing Aids

Several programs are used to aid in planning and carrying out observations. No changes were made in Q1.

5.2 Target Selection

For this quarter, 95 plates were designed and drilled in three drilling runs. All were for the Northern survey area. Of these, 80 were located in the area of the "gap" that is the highest priority for observing, while 15 were in the northern part of the survey area that is outside the "gap". These northern areas are observed only when the gap itself is not visible.

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 is also used to prepare monthly observing plans. This code will need additional upgrades in the future in order to track the progress of data collection and processing of the Segue scans. At present this work is all done by hand.

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 Q1. A more complete table comparing actual to baseline performance is included as an attachment to this report.

Table 6.1. ARC-Funded 1st Quarter and Forecast for 2004 ($K)

Category	2004 – 1st Quarter Baseline Budget	2004 – 1st Quarter Actual Expenses	2004 – Total Baseline Budget (Nov 2003)	2004 – Total Current Forecast
1.1. Survey Management	63	36	294	309
1.2. Collaboration Affairs	4	2	16	16
1.3. Survey Operations				
1.3.1. Observing Systems	157	117	648	546
1.3.2. Data Processing & Dist.	152	169	593	661
1.3.3. Survey Coordination	0	0	0	0
1.3.4. Observatory Support	380	401	1,522	1,569
1.4. ARC Corporate Support	37	9	176	95
Sub-total	793	734	3,248	3,196
1.5. Management Reserve	40	0	152	152
1.6. Capital Improvements	0	0	0	40
Total	833	734	3,400	3,388

6.1. Q1 Performance - In-kind Contributions

The sum of in-kind contributions for the first quarter was $465K against the baseline forecast of $473K 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 Q1 in-kind contributions are as follows:

- 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%. We have reviewed engineering needs at APO and our available resources and conclude that we can properly complete engineering projects and maintain telescope systems with the reduced level of support. Accordingly, we have revised downward the in-kind forecast for the remainder of 2004.
- The level of in-kind support for Software and Data Processing is higher than the baseline and reflects an increase in the amount of effort going into QA and data distribution operations at Fermilab. In particular, implementation of the quality assurance program; and preparations for the public release of DR2 and the collaboration release of DR3.

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 support provided in Q1 was in reasonable agreement with the baseline forecast.

USNO provided support as required for the astrometric pipeline and other software systems they maintain. Q1 activities focused on quality assurance testing and support in preparation of DR2. 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 total anticipated level of support that the USNO will provide in 2004 is 0.5 FTE. The forecast for the remainder of the year has been revised downward accordingly.

No in-kind support was provided by the JPG in Q1 because no support was required for the imaging camera filters or calibration system. We anticipate a modest amount of in-kind support in Q2 to measure the filter response curves for the imaging camera as part of our ongoing QA and instrument monitoring program.

6.2. Q1 Performance – ARC Funded Expenses

The sum of ARC-funded expenses for the first quarter was $734K, or $59K (8%) below the first quarter budget of $793K, excluding management reserve.

Survey management costs were $27K (43%) below the Q1 budget. Travel and office support expenses related to the Office of the Project Scientist were significantly lower than anticipated. Expenses related to ARC Support for Public Affairs were also significantly lower than anticipated. With regard to Public Affairs costs, AAS meeting expenses were lower than budgeted and we incurred no expenses for invited speaker travel. Unspent funds have been moved forward. ARC Business Manager charges were lower than budgeted. Salary costs were accrued but not expensed in Q1; we will see these charges in Q2. For Q2, we have also revised upward the budget for Project Scientist support. The baseline budget allocated a portion of summer salary support to SSP46 and held a portion of salary support in ARC Corporate Account SSP91f. We have since re-allocated all of the support from SSP91f to SSP46. This adjustment, in combination with the carry-forward of unspent Q1 funds, increases the Q2-4 forecast for Project Scientist Support (SSP46). For the year, the revised forecast for Survey Management is $309K, or $15K (5%) above 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. Q1 expenses covered travel costs for two working group chairs to attend the SDSS collaboration meeting hosted by New Mexico State University. Unspent Q1 funds have been moved forward into subsequent quarters. As a result, the forecast for the year for Collaboration Affairs remains unchanged from the baseline budget.

Observing Systems costs were $40K (25%) below the Q1 budget. Funds had been allocated to the ARC Observing Systems Support account to cover the cost of repairs or other unanticipated engineering needs that might arise over the course of the year. Since these funds were not required in Q1, the ARC budget appears under spent. Rather than carry the unspent funds forward, we re-allocated the funds to support the purchase of computer hardware for data distribution activities associated with DR3. The UW Observing Systems Support budget is under spent. The level of available engineering support was lower than anticipated; therefore salary expenses were lower than budgeted. The Princeton observing systems budget was slightly under spent; salary, shop and materials expenses were less than anticipated. For the year, the revised forecast for Observing Systems is $546K, or $102K (16%) below the baseline budget of $648K.

Data Processing and Distribution expenses were $17K (11%) above the Q1 budget. We reviewed data distribution hardware needs for DR2 and DR3 and re-allocated funds from ARC account SSP91d to Fermilab account SSP40 to support the purchase of four new database servers. As a result, SSP40 expenses exceeded the SSP40 baseline budget allocation. Princeton Q1 expenses also appear overspent. The baseline budget allocated 50% salary support for one the Princeton staff members; the remaining 50% of salary support was held in an ARC corporate account for additional scientific support. A review of support needs in Q1 determined that the level of salary support at Princeton needed to be increased by 25%; we re-allocated funds from SSP91f to SSP38 to cover the required increase. JHU expenses for data distribution support were lower than anticipated. Salary costs were accrued but not invoiced in Q1; we will see these charges in Q2 and have carried forward the unspent funds to cover the expense in Q2. For the year, the forecast for Data Processing and Distribution is $661K, or $68K (11%) above the baseline budget of $593K.

Observatory Support expenses were $21K (5%) 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. Since there is little vacation time taken in Q1, salary expenses are artificially higher than budgeted. In past years, this imbalance has always corrected itself later in the year as observatory staff take vacation time. For the year, the forecast for Observatory Support is within 3% of the baseline budget of $1,522K.

Miscellaneous ARC corporate expenses (petty cash, insurance) were as expected. Expenses associated with the CAS Director's Review were covered under the ARC corporate account; funds for such reviews are included in the baseline budget. No charges were made against the observers' development fund in Q1; unspent funds have been carried forward into Q2-4.

Finally, as previously noted, we re-allocated $78K of the funds held in the ARC account for Additional Scientific Support, SSP91f, to SSP38 and SSP46; $24K of unallocated funds remains in the account. We also re-allocated $66K of the funds held in the ARC account for Observing Systems Support, SSP91d, to SSP35, SSP40, and SSP91i. Re-allocation of funds from the ARC holding accounts allows us to meet changing project needs without tapping into the management reserve.

6.3. Management Reserve

No management reserve funds were expended during Q1. Unspent management reserve funds have been carried forward into Q2-4.

7. PUBLICATIONS IN 2004-Q1

Andromeda IX: A New Dwarf Spheroidal Satellite of M31
ApJL submitted – D. B. Zucker, et al

Galaxy-galaxy weak lensing in SDSS: intrinsic alignments and shear calibration errors
MNRAS submitted – Christopher M. Hirata, et al

Microlensing of the Broad Emission Line Region in the Quadruple Lens SDSS J1004+4112
ApJ submitted – Gordon Richards, et al

Variable Faint Optical Sources Discovered by Comparing POSS and SDSS Catalogs
AJ submitted – Branimir Sesar, et al

Spectroscopic Properties of Cool Stars in the SDSS: An Analysis of Magnetic Activity and a Search for Subdwarfs
AJ accepted – Andrew A. West, et al

Three-point Correlation Functions of SDSS Galaxies in Redshift Space: Morphology, Color and Luminosity Dependence
PASJ accepted – Issha Kayo, et al

The Environmental Dependence of the Relations between Stellar Mass, Structure, Star Formation and Nuclear Activity in Galaxies
MNRAS submitted – G. Kauffmann, et al

A New Giant Stellar Structure Near the Outer Halo of M31: Satellite or Stream?
APJL submitted – D. B. Zucker, et al

The Galaxy-mass Correlation Function Measured from Weak Lensing in the SDSS
AJ accepted – Erin Sheldon, et al

SDSS Spectroscopic Lens Search: I. Discovery of Intermediate-Redshift Star-Forming Galaxies Behind Foreground Luminous Red Galaxies
AJ 127:1860 (2004) Adam S. Bolton, et al

Public Data

Candidate Type II Quasars from the Sloan Digital Sky Survey: II. From Radio to X-Rays
AJ submitted – Nadia L. Zakamska, et al

Present-day Growth of Black Holes and Bulges: the SDSS perspective
ApJ submitted – Tim Heckman, et al

Baryonic Conversion Tree: The Global Assembly of Stars and Dark Matter in Galaxies from the SDSS
MNRAS submitted – Alan Heavens, et al

The Star-Formation History of the universe from the Stellar Populations of Nearby Galaxies
Nature accepted – Alan Heavens, et al

The Bimodal Galaxy Color Distribution: Dependence on Luminosity and Environment
ApJL submitted – Michael Balogh, et al

Robust Cosmological Constraints from Gravitational Lens Statistics
ApJ submitted – J.L. Mitchell, et al

The SDSS Damped Lya Survey: Data Release One
PASP submitted – J. Prochaska, et al

Color-Induced Displacement Double Stars in SDSS
A&A submitted – Dimitri Pourbaix, et al

Detection of X-ray clusters of Galaxies by Matching RASS Photons and SDSS Galxies within GAVO
A& A accepted – Peter Schuecker, et al

Comments on the Redshift Distribution of 44,200 SDSS Quasars: Evidence for Predicted Preferred Redshifts?
APJL submitted – M.B. Bell, et al

A Second Stellar Color Locus: a Bridge from White Dwarfs to M stars
ApJ submitted – Vernesa Smolcic, et al

Actively Star Forming Elliptical Galaxies at Low Redshifts in the Sloan Digital Sky Survey
ApJL 603:65 (2004) – Masataka Fukugita, et al