Kepler closes quarter nine, moves onto quarter 10

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Summer has been quite busy with the Kepler project team. The mission operations team successfully completed the summer quarterly roll of the spacecraft over June 26-27. The spacecraft is rolled 90 degrees every three months to keep the solar panels pointed at the sun. Power for the spacecraft is provided by four non-coplanar panels with a total area of 10.2 square meters (109.8 square feet). Combined, the 2,860 individual solar cells can produce over 1,100 watts. That's equivalent to the wattage of the typical household coffee maker.

The team also completed two monthly science data downloads. One download activity was completed in 21.6 hours during the summer quarterly roll completing data collection for the quarter. Quarter nine, which is April through June 2011, had no unplanned breaks in collecting science data in the 95-day period resulting in an observing efficiency greater than 97 percent (compared to the 91 percent requirement).

The second data download on July 27 was for the first month in quarter 10 and activities were successfully completed in 20 hours. Quarter 10, month two science data collection, is now underway. The next monthly science data download is on Aug. 28. Quarter 10 is off to a strong start.

Located at NASA Ames Research Center, the Kepler Science Operations Center (SOC) also was busy. The SOC, the nerve center that processes the raw data from the spacecraft, upgrade the science data processing pipeline in early May 2011. Called SOC 7.0, the science pipeline can now stitch multiple quarters of data together and search for

planets with orbital periods longer than 93 days. In addition, the SOC can now perform a suite of data validation diagnostic tests across quarterly boundaries, providing the science team with important information for prioritizing and ranking the candidates identified by the pipeline.

The SOC is currently working on the next upgrade to the processing pipeline. Coined SOC 8.0, the upgrade features a significant improvement in the ability to identify and remove instrumental effects from the data by the application of a Bayesian approach. The Bayesian inference refers to an iterative process in which collection of fresh evidence repeatedly modifies an initial confidence in the truth of a hypothesis.

SOC 8.0 will be far more capable than the previous code in terms of preserving signatures of intrinsic stellar variability, which is of great interest to the astrophysics community. The release also will improve on cleaning systematic errors from light curves in general, and in identifying and correcting Sudden Pixel Sensitivity Dropouts (SPSD). SPSD is caused by radiation damage to the CCDs and results in permanent and near instantaneous drop in the sensitivity of the affected pixels. These code updates greatly improve the sensitivity of our search for small, Earth-size planets. Other features in SOC 8.0 include improved pixel level calibrations at the front end of the pipeline and significantly improved diagnostic information for planetary candidates identified at the back end of the pipeline. The transit search has been made more robust against instrumental effects.

Finally, the multi-quarter transit search and data validation tests now run on the NASA Advanced Supercomputer (NAS) Pleiades system at NASA Ames Research Center for vastly improved throughput. The team recently completed the first eight-quarter (q1-q8) run on Pleiades: 190,923 targets were searched using 193,591 CPU-hours on 15,690

processors.

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