

SIS Mixer Test System Development -- Clay Sheaff

Working to the specifications and under the guidance of the technical staff at NRAO's Central Development Lab, the student designed, documented, constructed, and tested a circuit to control the vacuum pump in a cryogenically cooled Dewar used to test Superconductor-Insulating-Superconductor (SIS) mixers. The student also learned both stand-alone Visual Basic and the version of Visual Basic, called VBA, that is integrated into Microsoft applications such as the Excel spreadsheet program. The student used VBA to design, code, and test several programs to control test instruments and store the measured data in spreadsheets. Software was designed using object-oriented techniques and, following the principles of the Unified Modeling Language, included sequence diagrams showing how objects interact with each other in time sequence. In addition, the student was required to write the software in a format that followed our group's coding standards. This effort is documented in <http://www.cv.nrao.edu/~jeffland/SumStu/Sheaff/Lakeshore.pdf>

Another task was to document how to control remotely a different vacuum pump. That work is documented in <http://www.cv.nrao.edu/~jeffland/SumStu/Sheaff/RmtTSH071D.pdf>

The student developed a software class that controls a RF power meter. The power meter measurement algorithms included routines to measure repeatedly the power until the calculated standard error was below a specified threshold. His report is at <http://www.cv.nrao.edu/~jeffland/SumStu/Sheaff/Anritsu.pdf>

The student also developed a system to test and optimize the linearity of a square-law detector, which converts radio signal power into voltages. Software was developed to record onto a spreadsheet both power meter readings and voltages from a precision multimeter. The student then graphed the data and a quantitative figure of merit was developed and used to optimize the square law detector response. Clay developed all the tools required to optimize the square law detector response, but his term ended before he could provide the final optimization.

As discussed above, Mr. Sheaff met all of the goals of three of the four major tasks assigned to him during his summer term, and completed about 90% of the final goal. His progress was quite remarkable in light of his having completed just a few elementary electronics courses. Clay's final report can be found at <http://www.cv.nrao.edu/~jeffland/SumStu/Sheaff/FinRpt.pdf>

Software to Test an Automated Local Oscillator -- Tim Thacker

The student designed, documented, and coded software for measuring and recording spurious responses from an automated local oscillator (LO) system. Spurious responses from the LO system, which was designed by another group at the NRAO's Central Development Laboratory, can significantly degrade receiver noise performance. A spectrum analyzer employing external mixers was used to measure the power and frequency of the spurious signals, but its response is also contaminated with internally generated spurious responses. A "signal identify" mode is included with the spectrum analyzer to identify true input signals by displaying a second trace where true signals are identified as peaks near the same frequency as the primary trace. The student wrote software to control the spectrum analyzer and return data from both the primary and "signal identify" traces. Algorithms were developed to determine the true input signals by matching peaks between the primary and "signal identify" traces and the data were automatically recorded onto Excel spreadsheets. This work is documented in the report <http://www.cv.nrao.edu/~jeffland/SumStu/Thacker/LOSwp.pdf>

The student also supported the system tests during the development of the local oscillator by installing and operating the LO system in our SIS mixer cryogenic test system. In addition, the student integrated software routines written by our other summer student along with additional software to collect data and document the performance of two different the millimeter-wave triplers. See <http://www.cv.nrao.edu/~jeffland/SumStu/Thacker/TripComp.pdf>

Mr. Thacker met all of the goals assigned to him during his summer term. His final report is at <http://www.cv.nrao.edu/~jeffland/SumStu/Thacker/FinRpt02.pdf>