User Solution: Alphachron™ He Extraction/Measurement Instrument

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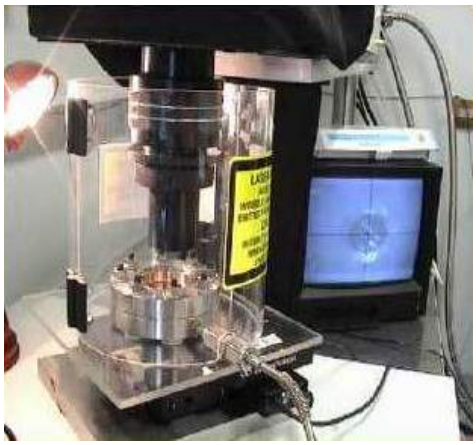
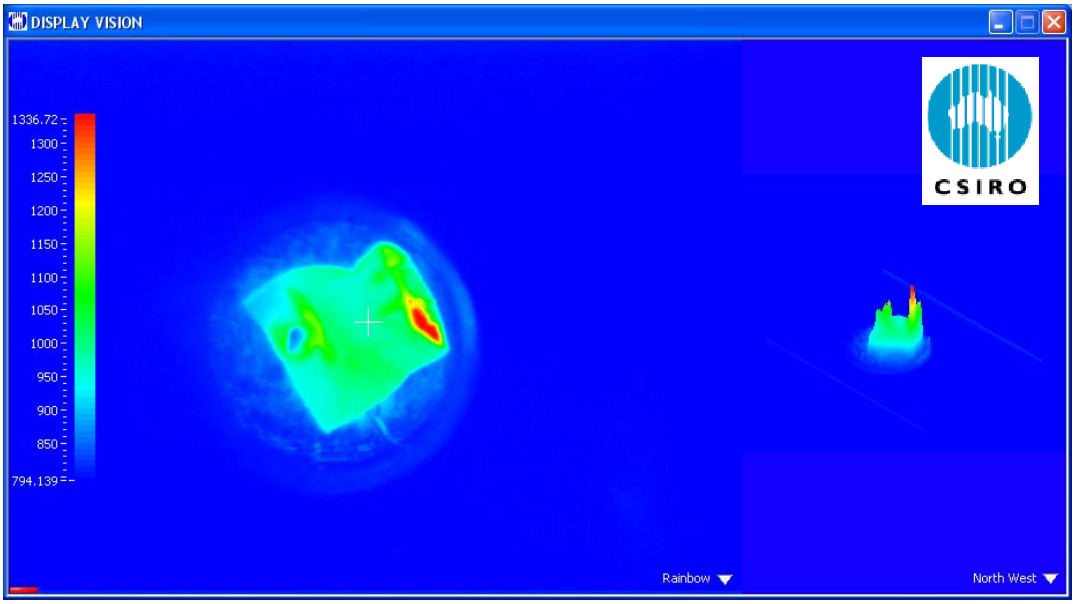
Uranium-helium geochronology is a highly sensitive and cost-effective method of radiometric age dating that can be used to determine the thermal history of the Earth's crust. Helium (^{4}He), in addition to the radiogenic isotopes of lead (atomic symbol: Pb), is a natural fission product of the uranium (U) and thorium (Th) decay series. Similar to the more commonly used U-Pb geochronology system, age relationships can be determined by measuring the concentrations of both the parent (U and Th) and daughter (^{4}He) elements in minerals. Australia's CSIRO (Commonwealth Scientific & Industrial Research Organization) is developing applications based on the U-Pb and (U+Th)-He decay schemes to quantitatively determine the thermal histories of mineral belts and petroleum basins, data that is fundamental in the exploration for deposits of minerals, oil and gas.

The Solution

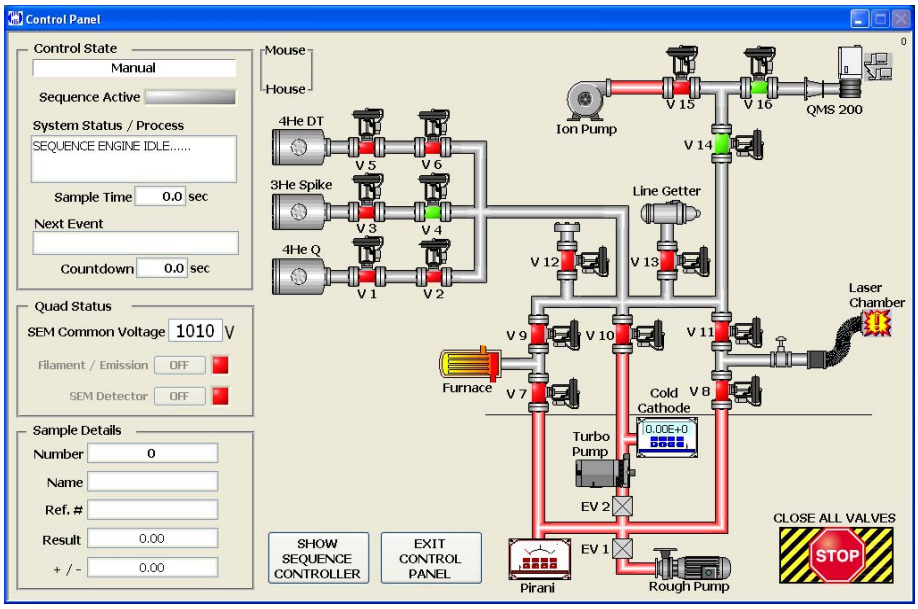
Neo Vista System Integrators Pty Ltd (NVSI) was approached by CSIRO to create a software solution. The task of the software was to tie several hardware technologies together in order to help develop R&D laboratory experimentation into a commercially robust prototype. The result is a professional, industry-focused solution called the *Alphachron™ He Extraction/Measurement Instrument*. Alphachron™ is an automated, integrated and compact turnkey system, designed for the extraction and measurement of gases from mineral samples. CSIRO and its collaborator, Patterson Instruments Pty Ltd, deliver and commission Alphachron™ instruments worldwide. The technologies tied together by the NVSI solution include a Balzers Prisma QMS200 vacuum pump (RS-232), Pfeiffer vacuum heads (TCP/IP), a Eurotherm temperature controller (RS-232), a Coherent laser system controller (GPIB), a Newport motion controller (RS-232), a

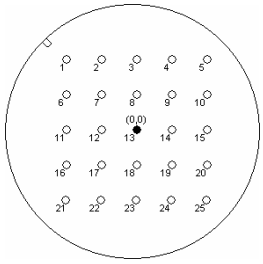


SONY camera (through a National Instruments PCI-1408) and numerous vacuum valves (National Instruments PCI- 6503). Two PCs are used to control the system – one in the light-tight room directly controlling the system, and a second in the technician's room for process definition and control, and system monitoring.

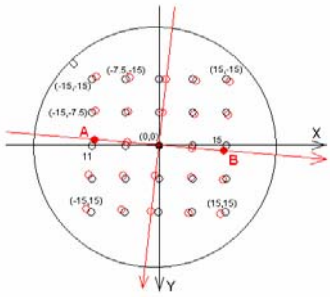


When controlling and monitoring sample irradiation, the software solution can automatically detect and correct for inconsistent sample orientations, by determining two reference points, and calculating the relative coordinates of the 25 specimens. Once irradiated with a compact, novel and inexpensive CSIRO-developed diode laser module, the samples begin to glow as they outgas.





Assumed Sample Locations



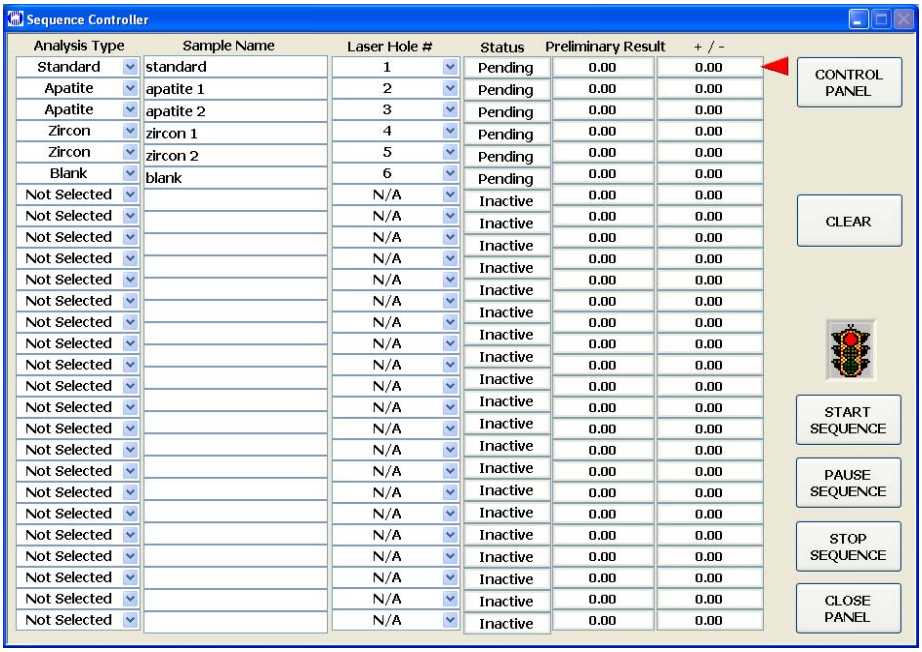
System Realigned

If a physical surface feature of the sample causes the laser beam to flare, the vision-based software is able to detect the issue, and automatically adjust the motion controller to select a more appropriate position. A standard SONY camera with a neutral density and IR filter fitted was calibrated across the thermal range of the glowing samples by the Australian National Measurement Laboratory, currently based in West Lindfield (Sydney).

Users can create and adjust the operational sequence of the system experiments without any previous programming knowledge. An intuitive interface has been included to help users manage experiments using scripts – simple textual files – that are able to tightly control all aspects of the system's automated operation. Users can define separate scripts for each of the samples present on the sample disk, allowing multiple tests on varying samples during one automated run, without the need for user intervention, or loading/reloading of samples between tests. To satisfy tight quality assurance guidelines, the solution (with the use of ActiveX control calls to Microsoft® Excel™) is able to analyze the results and generate a summary spreadsheet for further offline processing or sample and/or test report generation.

The overall design of the system software leverages the modular architecture available in the National Instruments LabVIEW development environment. Most components of the software are dynamically initiated, increasing the upgradeability of the system to allow for improvements. Rather than requiring major rewrites and excessive revalidation, modules can be simply replaced with qualified updated versions as future directions of this technology may require.

CSIRO is delighted with the result and, together with and Patterson Instruments, full commercialization of the Alphachron™ He Extraction/Measurement Instrument is now planned.



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