



HKED™

Hybrid K-Edge Densitometry Software

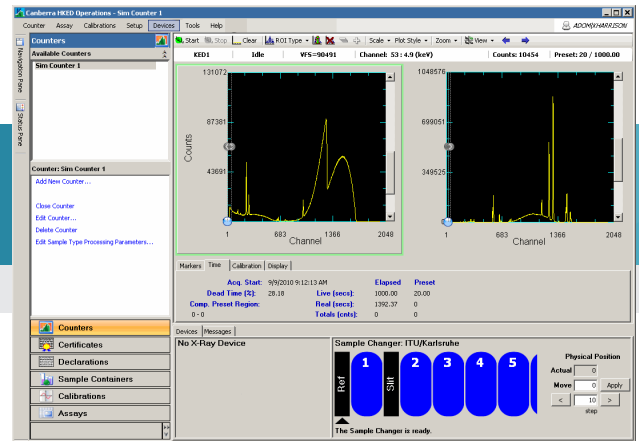


Figure 1. HKED Software main user interface.

KEY FEATURES

- Intuitive User Interface for simplified operations and status display
- Multiple measurement protocols are supported and facilitated using the 'Count Type' and 'Sample Type' paradigm
- Calibration options, performance, and review are fully integrated
- Preexisting (VMS) calibrations can be imported; new calibrations can be exported
- Data export (xml format) is possible to a facility LIMS system
- Data Review is enhanced with flexibility to review and reanalyze data files
- Security features integrated with Windows-defined account properties
- Archiving and restore capability for data files
- PC platform eliminates all software and hardware issues faced by VMS™ obsolescence

KEY CUSTOMER BENEFITS

- Fully integrated operation, measurement, calibration, and analysis capability for HKED systems
- Ease of use for setup and operations reduces facility burden on training and reduces risk of operator error

APPLICATIONS

- Nuclear Safeguards; On-Site Laboratories
- Process monitoring; fuel recycling and fuel fabrication facilities
- Research, Development, and Training Laboratories

INTRODUCTION

Hybrid K-Edge Densitometry (HKED software) is a highly accurate non-destructive analysis technique used to determine the uranium and plutonium concentrations in dissolver and product solutions as an alternative to chemical (destructive) analysis. The HKED technique is utilized in the fuel recycling process, typically in production, on-site laboratory, and research environments. The technique uses results from two measurements performed simultaneously providing both a K-Edge transmission (KED) measurement and an X-Ray Fluorescence (XRF) measurement of the sample. The HKED software automates the process of measuring and analyzing samples by controlling the HPGe gamma detectors, and ancillary equipment when needed. The analysis is integrated into the software and conforms to the currently accepted algorithms referenced in the international standard ISO 13464¹. Mirion's experience with the application and the software dates back to the original development of the technique through close collaboration with the originators. The original HKED software is VMS-based, but with increasing concerns for the obsolescence of this platform, a new PC-platform based software has been developed.

The new software has an easy-to-use graphical user interface for all functions, including setup, calibration, sample measurement, and system maintenance. Although not directly visible to the user, the algorithms used in the analysis remained unchanged in order to ensure traceability of results. Also not directly visible is the underlying architecture of the software which allows for the future addition of new analysis algorithms when needed.

The following section highlights some of the software function and performance.

1. INTERNATIONAL STANDARD® ISO 13464 Simultaneous determination of uranium and plutonium in dissolver solutions from reprocessing plants – Combined method using K-absorption edge and X-ray fluorescence spectrometry.

DESCRIPTION

The HKED software is based on a client-server architecture where the *client* is a relatively small application that contains the user interface that communicates with a server that contains the main control and analysis parts of the software. The client may be on the same computer as the server or it may be on a different computer. Figure 1 shows the main user interface of the HKED software. The interface offers functionality and displays information in an intuitive fashion through a Title and a Menu bar, and through panels for Navigation, Spectral view and control, and Message and Device display. The spectral view panel is known as MVC for MCA (Multi-Channel Analyzer) View and Control and is the main display during measurements for viewing the sample spectra from both the KED and XRF detectors. The software is designed to promote an easy flow of the logical progression of operations including Setup, Measurement (or Assay) and Analysis, Calibration, and Data Review. By allowing different user types based on the Windows login, the software can control access to these various functions by assigning privileges based on whether the user is an Operator, an Analyst (data review), a Manager, or Administrator.

SETUP

Used to create a new HKED counter (or list previously created counters), create certificates, declarations, and sample containers. Parameters that are inherent to various sample types can also be defined in Setup using the Sample Type Processing Parameters. Finally, the setup of devices such as the sample changer is also supported through Setup.

ASSAY

Contains the commands to measure and analyze samples; various measurement types including Routine, Reference, Calibration, and Quality Control (QC) check are supported. A Batch operation allows creating batches of samples to be measured.

CALIBRATIONS

This is a fully integrated calibration protocol to create a new KED or XRF calibration either using measurements or by parameter entry. There are also two import features available:

(i) One is to import *files* from the Mirion VMS-based HKED software to be used to create calibrations in the current software; (ii) the other is to import files or calibration constants from a different Mirion Windows-based HKED system to be used to reproduce the calibration constants in the current system. The software provides an easy interface to support carrying multiple calibrations, by separating a default calibration from any others. Calibrations can also be approved or disapproved in order to control which calibrations may be used on the system. Finally, the software supports the possibility of multiple calibrations for a given sample type.

ANALYSIS

In order to ensure the historical traceability of results, the analysis algorithms used in the VMS version of the software were directly ported to the new version of the software. These analysis 'engines' include: U KED, Pu KED, U XRF, Pu XRF, and the hybrid analysis for U:Pu where uranium (U) is the major element and plutonium (Pu) is the minor element, with americium (Am) as the interfering element. For each analysis method, results were compared between the previous and new versions of the software and confirmed to be consistent. In addition, a new analysis routine was added to the new software to analyze MOX solutions (where U:Pu is 1:1) using the generalized KED analysis. The analysis 'engine' architecture of the software also allows for the future addition of new analysis algorithms that can be implemented without impacting the existing algorithms.

DATA REVIEW

Used to inspect and re-analyze previously acquired data. The Data Review portion of the HKED software runs as an independent application from Operations so that existing data may be viewed and re-analyzed even while the software continues to acquire new data. Data Review provides a convenient easy-to-use application to search for data using various filters, show the spectrum results for the analysis, load and use new calibrations, and re-analyze files. Batch re-analysis is available to apply changes to multiple files if needed.

QUALITY ASSURANCE

When the 'QC Check' measurement is performed on a known sample to track system performance, certain results are transferred automatically to a Quality Assurance (QA) file. The variations of the parameters over time can be viewed graphically and printed reports can be obtained as well. The QA view is accessed through Data Review.

SPECIFICATIONS

REQUIREMENTS

- The Windows Operating Systems supported by Mirion HKED v1.0 are: Windows XP (SP3 or higher), Windows 7 (32-bit), Windows Server 2008 (32-bit).
- Genie™ 2000 software v3.2.1 or higher must be installed.
- Genie 2000 Quality Assurance software must be installed.
- Mirion HKED v1.0 is an English only release; it is recommended that Genie 2000 software is installed in English to view all portions of the UI in the same language.

ORDERING INFORMATION

- Model # S733C – Mirion Hybrid K-Edge Densitometry Software (Windows OS); HKED v1.0.
- S500C Genie 2000 software v3.2.1 or higher.
- S505C Genie 2000 Quality Assurance v1.3 or higher.

SUPPORTED HARDWARE

- GE Titan X-ray controller.
- Pantak X-ray controller.
- ISEL sample changer and Mirion Remote Parallel Interface (RPI).
- The system was tested with Lynx® Digital Signal Analyzers and AIM signal processing NIM components.
- Support for alternate or additional hardware can be considered depending on the application.



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