Thermal Gravimetric Analysis using Mass Spectrometry.
(TGA-MS)

Aspec. Application Note

Principles and application:

The Aspec Mass Spectrometer system is ideal for interfacing with most Thermal Gravimetric Analysers.

By connecting the specially designed, heated Mass Spectrometer sample Inlet probe, evolved gases from a heated sample within the TGA reactor can be measured and recorded with respect to time.

In addition, both the temperature ramp (profile) and weight loss signals from the TGA can be integrated directly into the Mass Spectrometer software.

It is also important to start the data acquisition of both instruments (TGA and MS) at the same time. There is a built in digital "trigger input signal" that allows this. In this way Time t=0 can be synchronised to both instruments.

Instrument interconnections.

Compact. Aspec Mass Spectrometer Instrument

TGA Instrument

Data PC-MS

Data PC-TGA

**Heated sample line from TGA exhaust or reactor to Mass Spectrometer.
Continuous, evolved sample + carrier gas.
Sample transfer time <80ms**

**Weight loss, Temperature and data trigger signals**

**The Aspec, bench top, Mass Spectrometer is connected directly to the TGA instrument via a 3m signal cable and heated sample line as shown above.
The sample line may be connected directly to the exhaust port of the TGA and both sample and carrier gas is transferred to the Mass Spectrometer within 80ms for mass analysis and data logging.**

Typical Live data profiles.
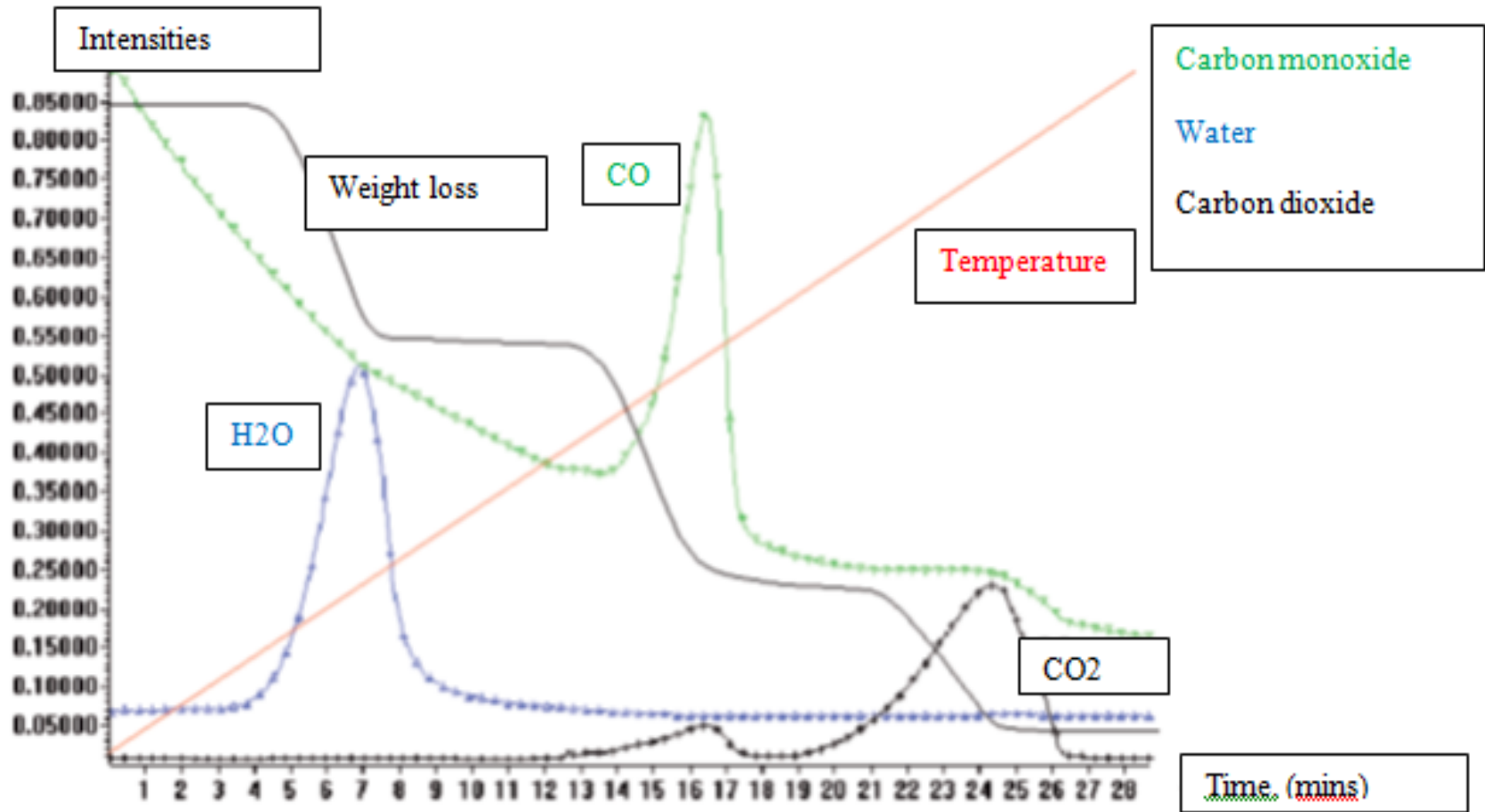
Data analysis
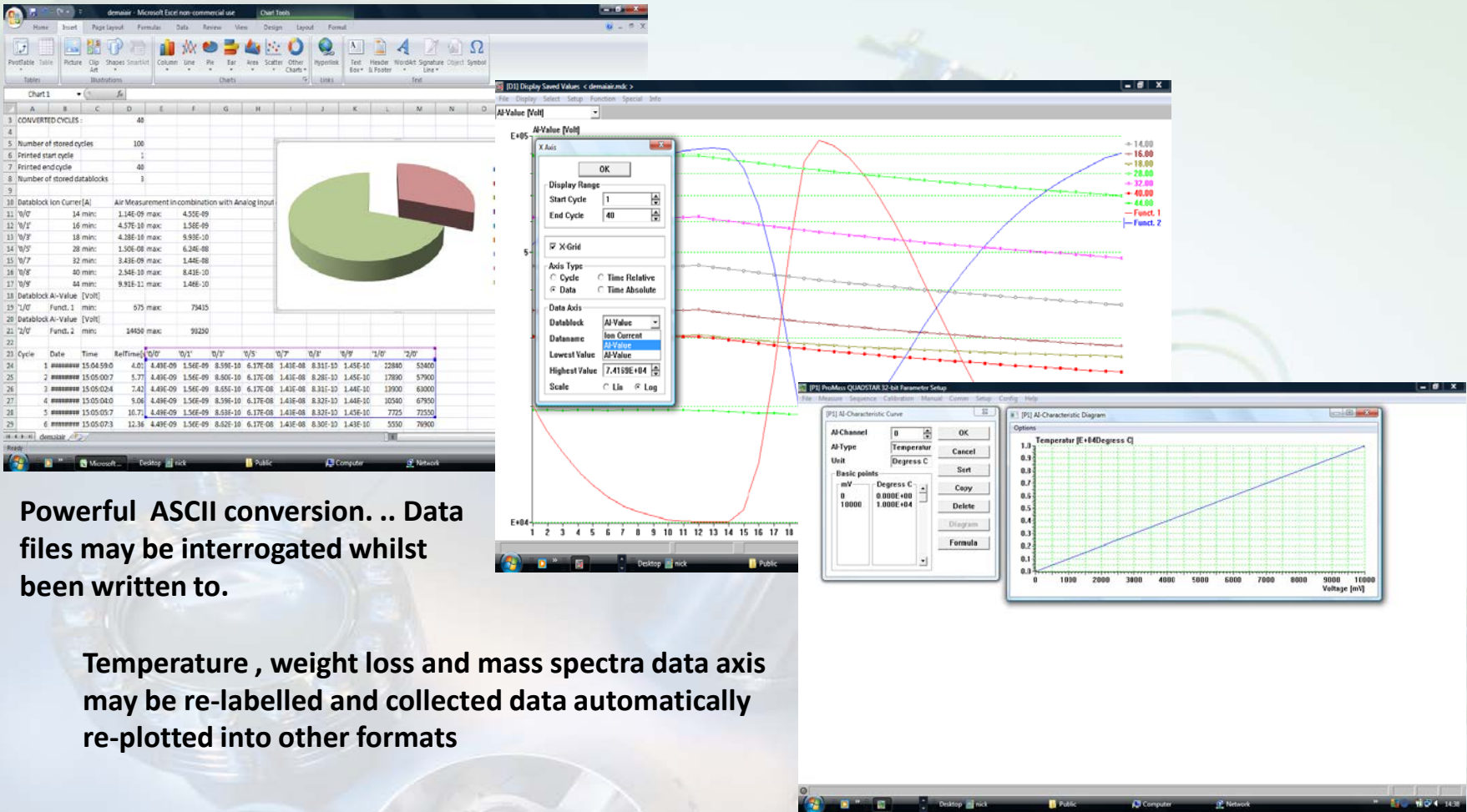
Powerful ASCII conversion. .. Data files may be interrogated whilst been written to.

Temperature , weight loss and mass spectra data axis may be re-labelled and collected data automatically re-plotted into other formats

Software control over peripheral instrument signal inputs (temperature and weight loss) allows interfacing/scaling of signals.

# Mass Spectrometer data Analysis modes

The Mass Spectrometer instrument is an extremely fast and flexible instrument and has the capability to measure up to 64 gas species at any one time.

The choice of gas species may be selected by the operator at any time or a standard matrix of gas species may be stored under a single analysis file and launched when required.

Here are 3 analysis mode examples that demonstrate the capability and power of the Mass Spectrometer instrument

- Raw data **scan** mode.
- **Background** process **subtraction** (for looking at unknowns)
- Full **Calibration data** collection mode and data logging WRT time

Raw Gas/Mass scan Mode
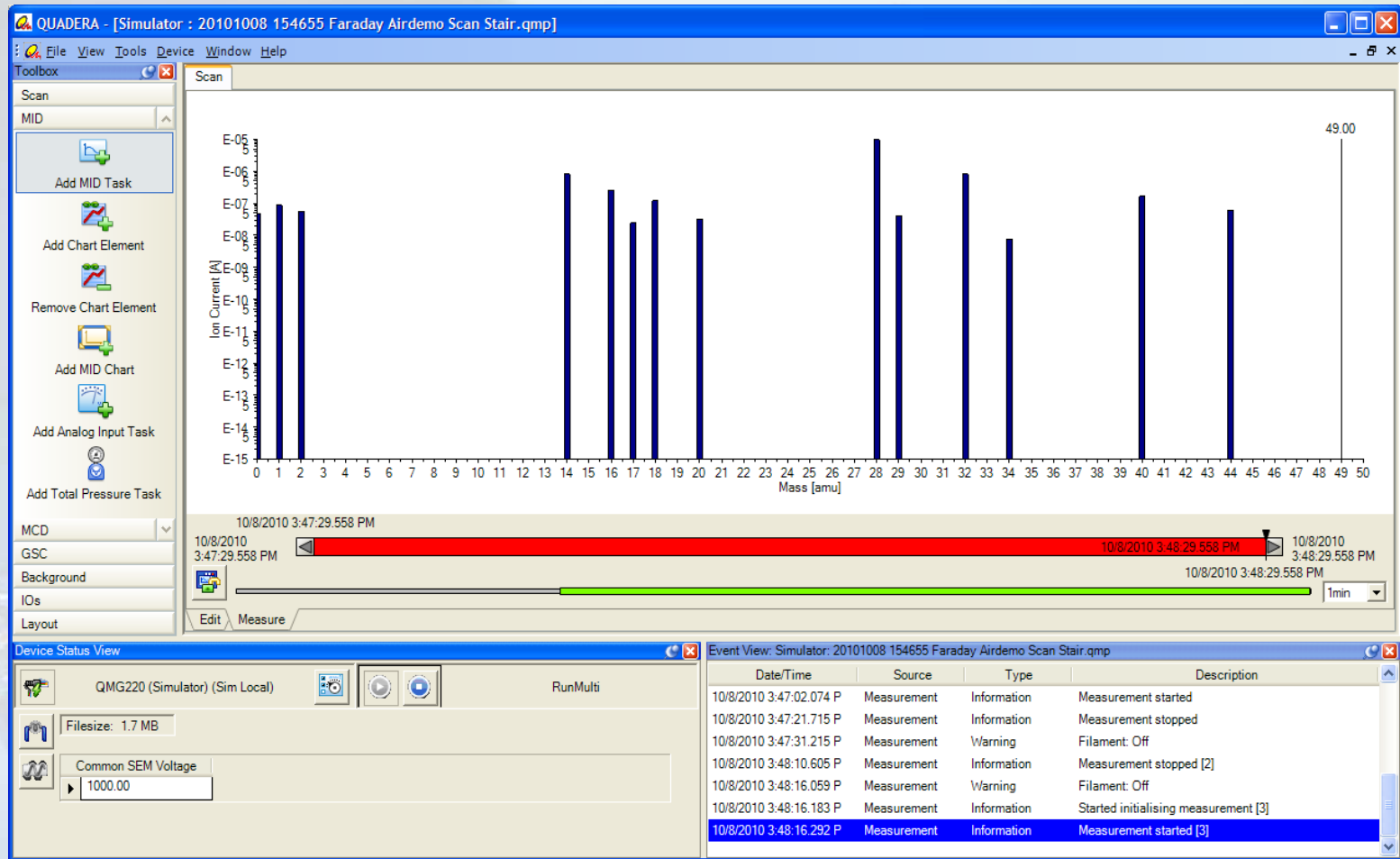
In this mode, you can "scan" the entire mass range of the instrument in less than 2 seconds and produce a complete spectra of any gas composition. The spectra will automatically show very low as well as very high concentrations all on one single spectra. Each bar of the graph above represents a different gas or isotope of a gas. The higher the signal, the more gas there is.

This mode enables the user to quickly see if the gas composition is accurate and correct.

Background subtraction
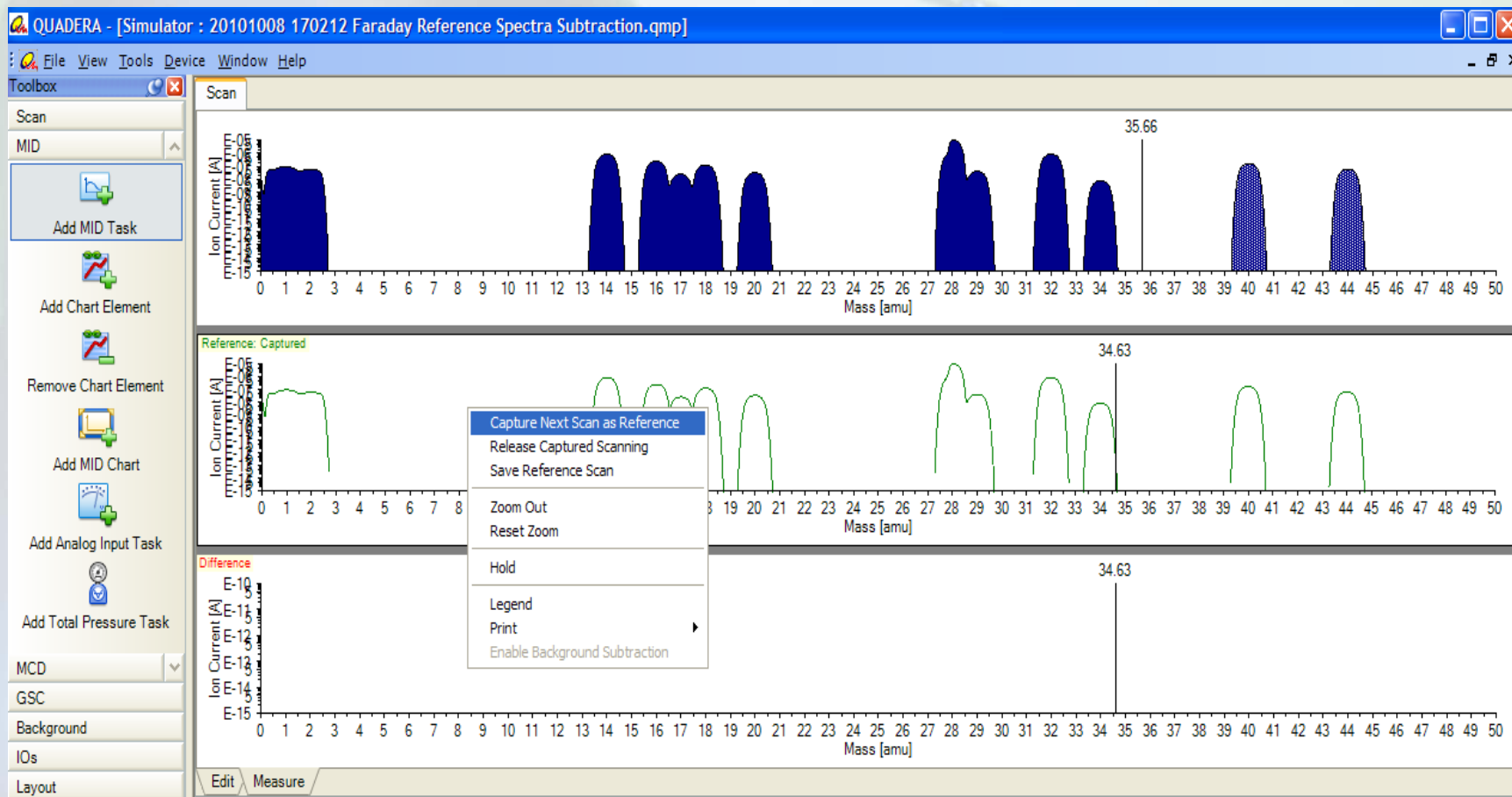
This mode enables the operator to monitor a process for any changes that may occur. Any difference in gas composition can easily be logged and displayed on the bottom "Difference" axis.

The acquired spectra may be interrogated and compared with a spectra library for identification of new, evolved gas species at any time.

Gas Identification
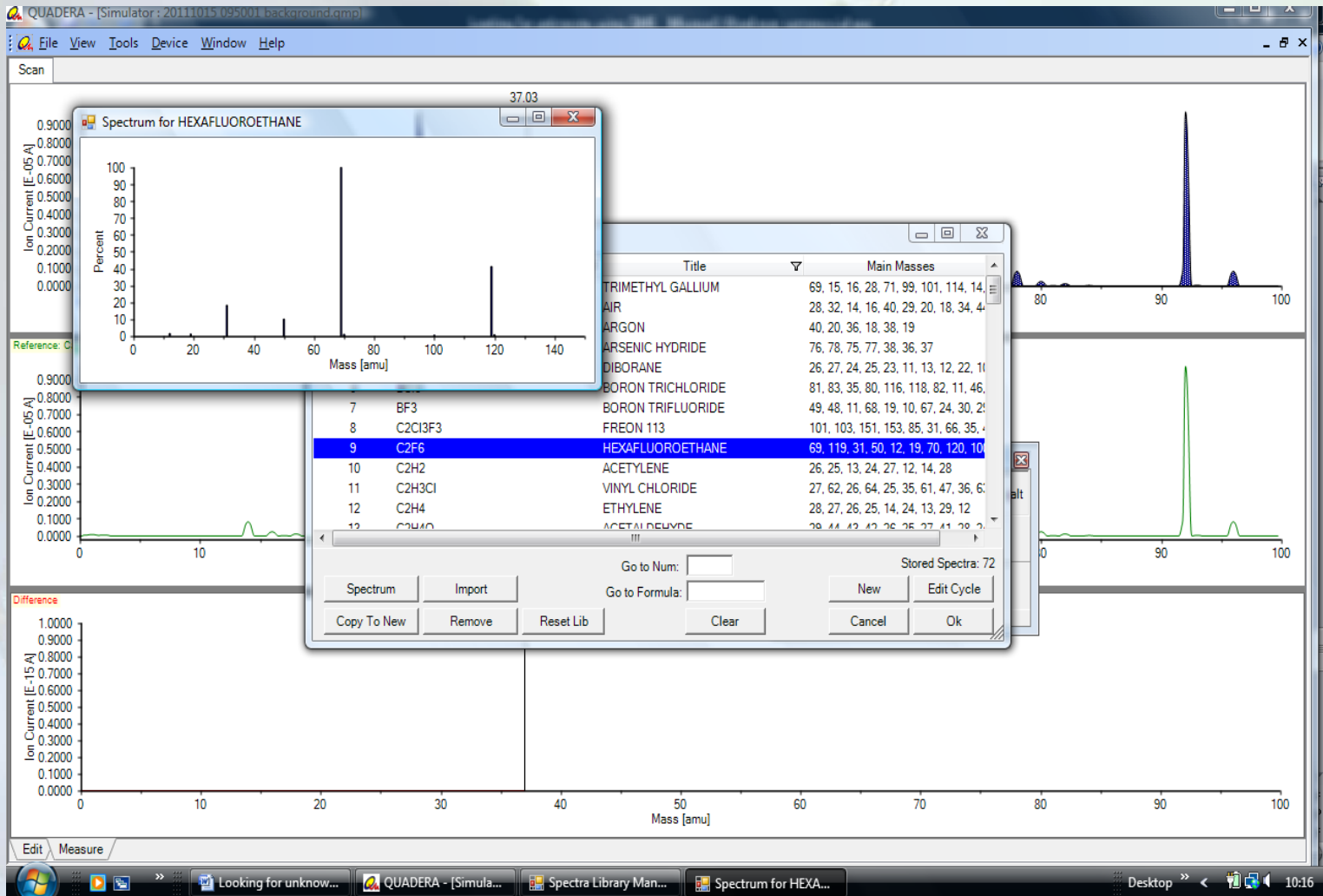
Continuously stored data may be interrogated at any time and correlated with known spectra either from the built in spectra library data base or from a remote spectra source such as NIST.

Full calibration Data Mode
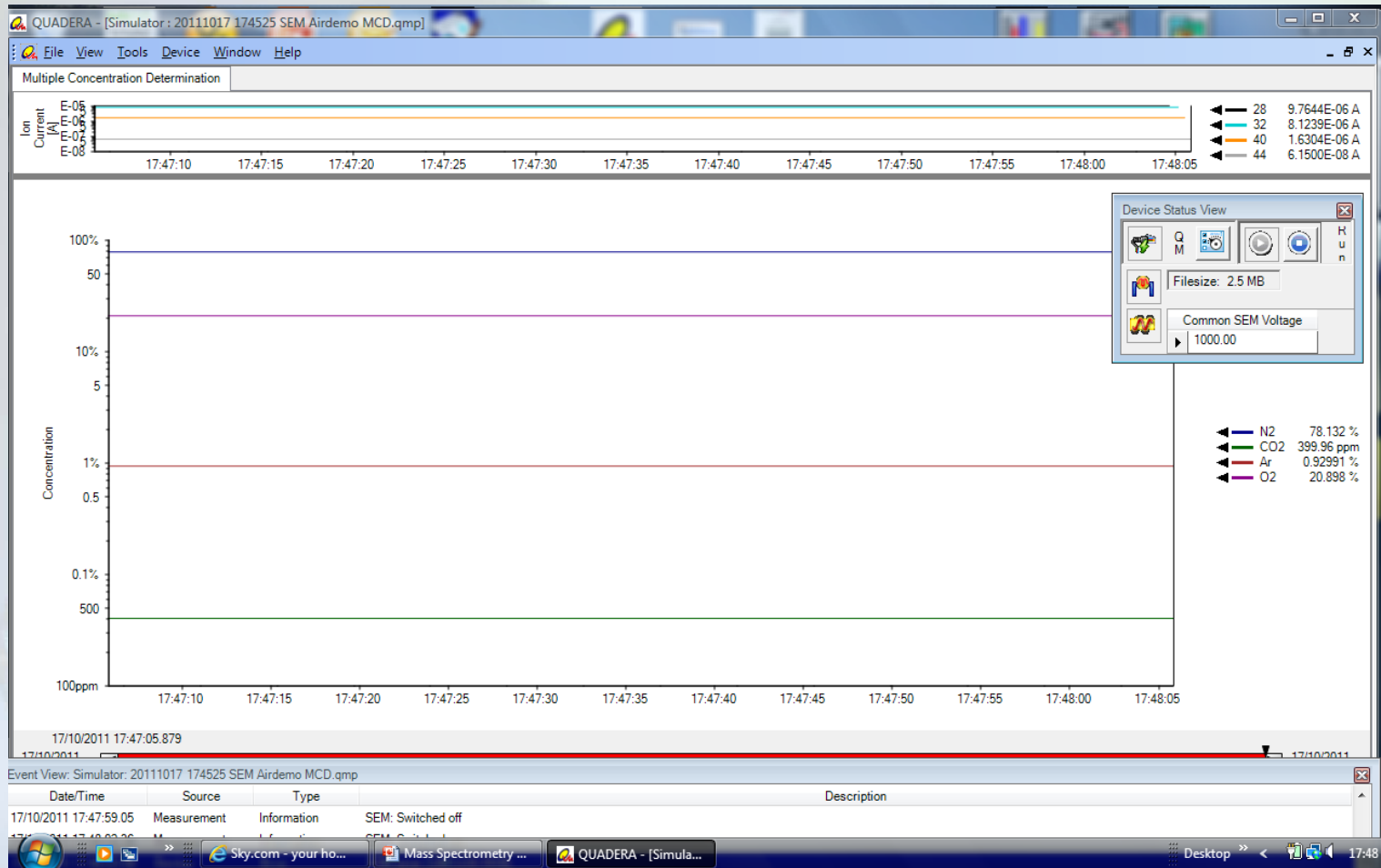
This mode the is the most commonly used mode. It enables the user to calibrate and display up to 64 gas species and measure in direct concentration. Each gas component is calibrated by a set up routine and once calibrated the instrument will measure, data log and display the data in real time.

The above example shows a simple calibration and data logging of 4 common components that appear in air. All axis can be modified depending on the process and reaction you are wanting to measure.