REX Data Summary
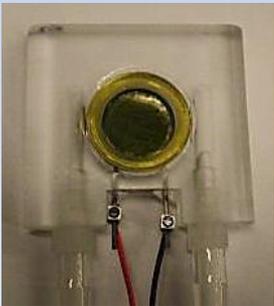
Based on **X-ray fluorescence** (XRF) --

A standard analytical technique routinely used for detection of elements at concentrations of >1ppm
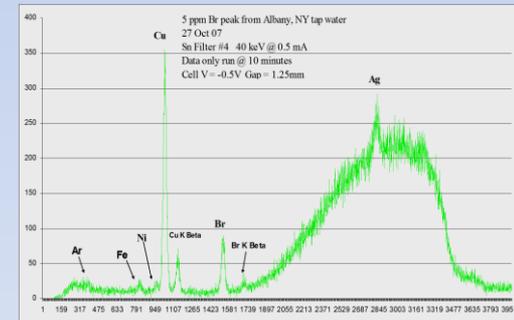
Sensitivity enhancement provided by a **preconcentration** step using patented nanocellular carbon aerogel foam

Signal enhancement in minutes
ppb metals detection in less than an hour

Unattended quantitative results

Simple reporting

Simplicity of a pH meter, quantification capability approaching that of an ICP-MS

REX – Exemplar Data

The following slides are standard calibration curves for various dissolved metals in well water or distilled water (as indicated.) These slides represent a range of different elements with different properties, all clearly showing the capability of detection and quantitation in the part per billion (ppb) range.

The error bars represent three standard deviations (3σ) about the mean, calculated through replicate experimentation. Typical analyses are shown with error bars representing one standard deviation (1σ), however 3σ is used in this case in order to demonstrate reproducibility with a >99% confidence level as compared to the typical 68% achieved with 1σ.

Each replicate experiment is done with a maximum two-hour total experiment time, including ion collection and spectrum acquisition. Lower detection levels can be attained with a longer collection time, and a shorter collection time can be used if such a low detection level is not required.

REX – Exemplar Data

The instrument calibration coefficients are established using a standard solution made from a known amount of a soluble salt of the element of interest dissolved in distilled (or sample) water. The solution is measured for a fixed time, flow rate, and collection voltage. The raw XRF data are collected using fixed tube voltage, current, and filter. The analysis uses a regression fitting to extract the peak counts above continuum (background) from a blank-subtracted spectrum taken immediately before the sample spectrum.

In those cases where the blank already contains an indication of an element, whether due to the background or other matrix effects, the statistics will be characteristic of the differences between two similar large numbers and measurements of the minimum levels will be compromised.

Se Standard Calibration Curve

Se

y = 59.435x + 2889.1
R² = 0.9972

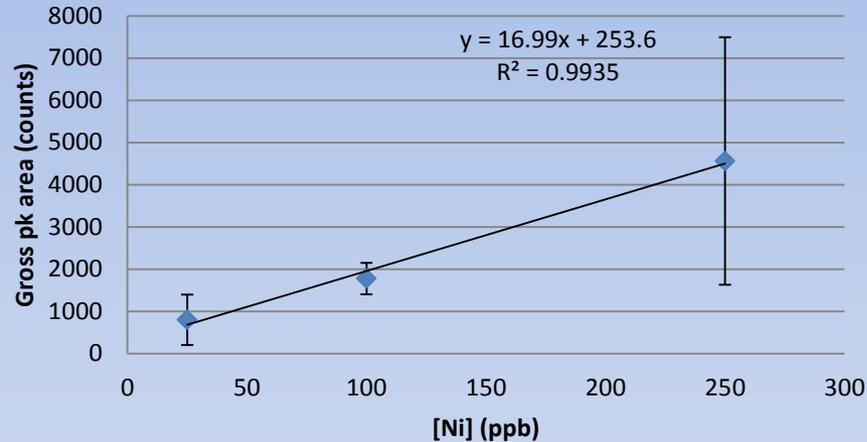Gross pk area (counts)

[Se] (ppb)
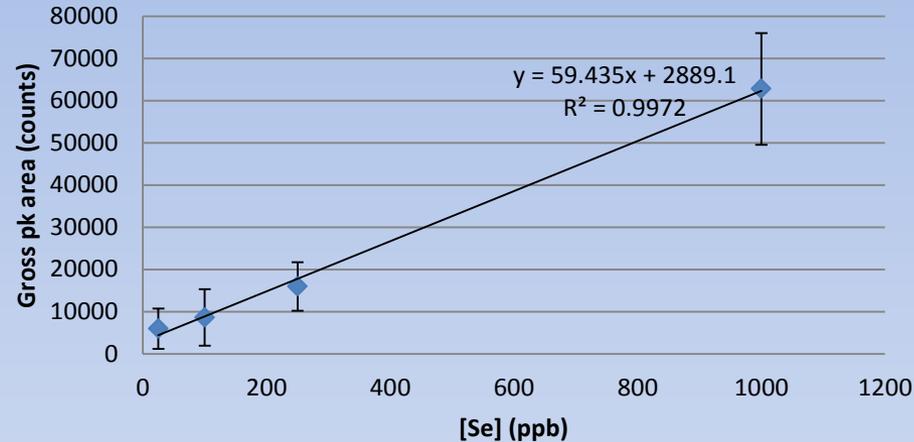
The above chart indicates the performance of the system using a series of selenium standard solutions in DI water. Precision-based LOD is calculated to be approximately 20 ppb.

Error bars above are at 3 x sigma.

Image credit: Wikimedia Commons

Ni Standard Calibration Curve

Ni

$y = 16.99x + 253.6$
$R^2 = 0.9935$

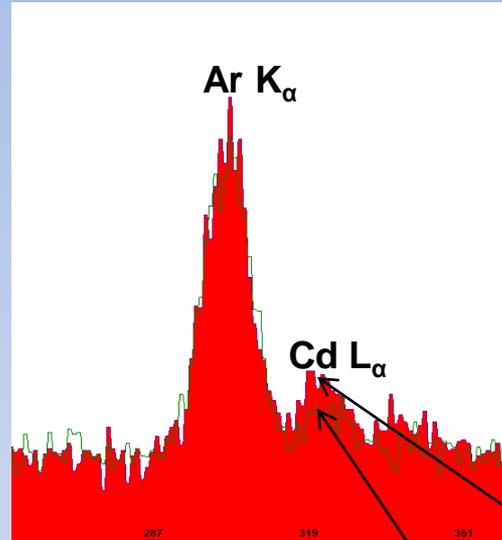Gross pk area (counts) vs [Ni] (ppb)

The above chart indicates the performance of the system using a series of nickel standard solutions in DI water. As with Se, precision-based LOD for Ni is calculated to be approximately 20 ppb.

Error bars above are at 3 x sigma.

Image credit: Wikimedia Commons

Cd Sample Data

The unprocessed data above represent 10 minute blank and analytical spectra for a solution of cadmium at 10 mg/L, with zero ion collection time between spectra.

This confirms that cadmium can be detected in a very short time frame at this concentration, and replicate studies indicate good reproducibility even with this collapsed time frame (~10% signal RSD).

REX – Summary
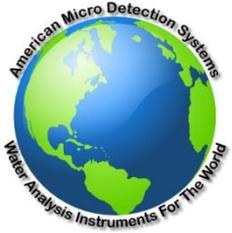
- A wide range of elements can be detected using the REX instrument, with a few examples shown in the previous slides

- Low ppb levels for detection and quantitation of various dissolved metals are typically achievable with a run-time of two hours (or less)

- This instrument does not require the operator to be a trained spectroscopist, as the data are processed and analyzed automatically, and in real-time