

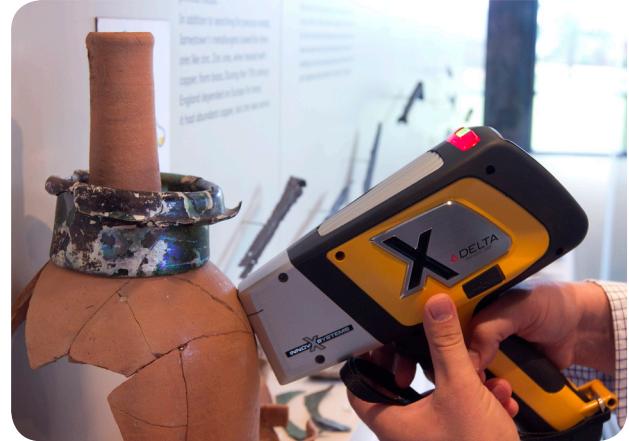
## DELTA Handheld XRF for Research & Discovery

Industrial applications for Handheld XRF are fairly straightforward as the analyst typically has a single goal such as alloy QC, scrap sorting, soil analysis, consumer goods screening, RoHS/WEEE compliance, precious metal authentication, or mining exploration. A DELTA can be specifically configured for each of these applications to give the best possible qualitative and quantitative results in the units that are most useful.

Research applications don't usually have a single analytical goal. For example archaeology, conservation and forensic scientists have varied and changing analytical goals. Their ideal handheld XRF configuration would be optimized and precalibrated to do all or most of the mentioned industrial specific applications with the flexibility to create new calibrations, and with results in selectable units.

No single handheld XRF can be the best at all applications; however, a DELTA can be configured for multiple analytical goals. To configure the optimum DELTA for research, the primary analytical objectives must first be clarified. For example, the mentioned scientists primarily analyze samples for elements at PPM to high % levels in light or complex matrices, such as soil, mortar, rocks, bone, wood, ceramics, or fabrics. They may also investigate some samples with heavier matrices, such as metal objects.

## DELTA R&D Configuration Guide



Start with a DELTA Standard 4000 with Soil Mode (3-beam) which utilizes Compton Normalization for low concentrations (PPM to 3%) of elements in light matrices. Add Mining Plus Mode (2-beam) which utilizes Fundamental Parameters for samples with high concentrations (>3%) of elements in light or complex matrices. If paints and pigments are analyzed, the Soil Mode is ideal. If metal objects are analyzed, add Alloy Mode. You probably should add Precious Metals Addition to Alloy Mode because no matter what, everyone usually wants to check for gold and silver. Pay attention: if user generated calibration curves are required, add Empirical Mode. Once the modes have been selected, review the elements provided in case additions or exchanges are needed.



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# DELTA R&D Configuration Guide

## Optimized Beam Configurations

The optimum tube target material depends on the primary applications, the elements of interest, and the desired limits of detection. For example, the 40kV DP- and DS-4000 with a Ta/Au tube offer the best LODs for the most elements.

The 40kV DS-6000 with a Ag tube offers excellent LODs for most of the elements.

If Mg needs to be analyzed at <1% and/or Al and Si at <0.5%, the 40kV DP-6000 Rh tube with Mining Plus Mode is needed. Be aware though that the 40kV DP-6000 Rh tube LODs are not as good as the Ta/Au tube does for P, S, Cl, K, Ca, Mn, Fe, Ag, Cd, Sn, and Sb. The DELTA Soil-Mining Modes LOD Chart should be consulted for optimum tube target selection for the primary applications.

If the optimum target material has been determined to be Ta/Au, the voltage is selectable: 40kV or 50kV. The Ta/Au tube with 50 kV power, the DP-4050, provides the best possible LODs for Cd, Ag, Sb, Ba and the rare earth elements. All other LODs for the DP-4050 are equivalent to the 40kV DP-4000 Au/Ta tube. Use of the DELTA Probe Shield is recommended when operating at 50kV.

The DELTA can be configured with up to 8 different filters (4 if the camera/collimator is installed). The DELTA filters change automatically; consequently, there is no need to open up the DELTA to physically remove the filters, change them, and realign the analyzer.

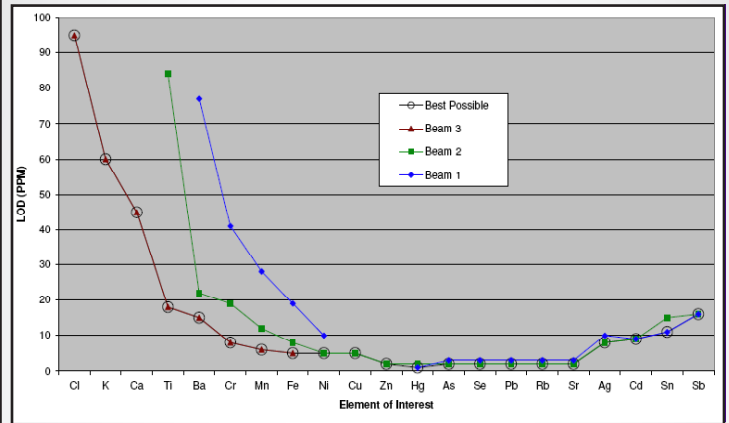
Beam modes incorporate kV-µA-filter settings that are pre-set for optimal analysis conditions. Use of a single-beam mode is ideal for quick qualitative inspections, but if particular elements are of interest or very precise and accurate results are required, use of 2 or 3 beams is better. Consult the DP-4000 3-B Soil Mode LODs Graph to see how this works. Soil Mode comes with 3 beams and Mining Plus Mode comes with 2 Beams. A single beam can be used at any time.

## Detector Optimization

DELTA Handheld XRFs can be configured with SiPin or SDD detectors. The DELTA Classic has the SiPin Detector; the DELTA Standard and DELTA Premium have SDD detectors. Consult the DELTA LOD Chart for a comparison in detection limits for typical elements of interest.

## Targets, Power & Filters

DELTA Premium 4000 3-Beam Soil Mode LODs



DELTA Soil-Mining Modes LOD Chart

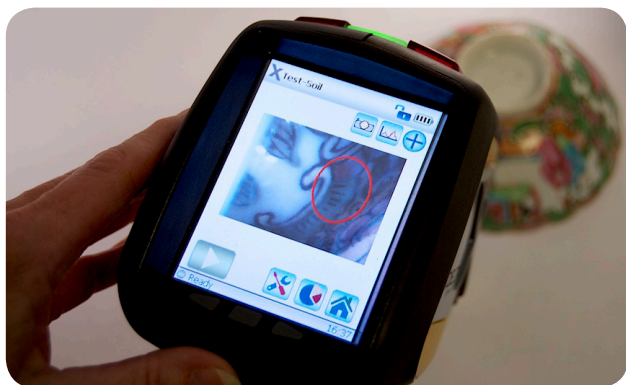
Element of Interest	DELTA Std/Prem 3-B Soil & 2-B Mining Ta/Au Tube, SDD	DELTA Std 3-B Soil & 2-B Mining Ag Tube, SDD	DELTA Premium 3-B Soil & 2-B Mining Rh Tube, SDD	DELTA Classic 3-Beam Soil Au Tube, SiPIN
Mg	Not Available	5%	< 1%	Not Available
Al	< 4.0% (DP only)	< 1.5%	< 0.5%	Not Available
Si	< 0.75%	< 0.6%	< 0.5%	Not Available
P	500 - 700	500-700	800 - 1500	1 - 5%
S	100 - 250	200-300	150 - 300	0.1 - 0.5%
Cl	60 - 100	75-150	100 - 200	500 - 1000
K	30 - 50	50-200	40 - 60	150 - 250
Ca	20 - 30	35-50	25 - 40	150 - 250
Ti	7 - 15	7-15	7 - 15	20 - 50
Cr	5 - 10	5-10	5 - 10	10 - 30
V	7 - 15	7-15	7 - 15	10 - 30
Mn	3 - 5	5-10	10	10 - 30
Fe	5	10-20	10	10 - 30
Co	10 - 20	10-20	10 - 20	20 - 40
Ni	10 - 20	10-20	10 - 20	20 - 40
Cu	5 - 7	5-7	5 - 7	15 - 30
Zn	3 - 5	3-5	3 - 5	10 - 15
Ga	3 - 5	3-5	3 - 5	10 - 15
As	1 - 3	1-3	1 - 3	4 - 8
Se	1 - 3	1-3	1 - 3	4 - 8
Br	1 - 3	1-3	1 - 3	4 - 8
Rb	1	1-3	1 - 3	3 - 5
Sr	1	1-3	1 - 3	3 - 5
Zr	1	1-3	1 - 3	3 - 5
Mo	1	1-3	1 - 3	3 - 5
Ag	6 - 8	30-50	40 - 50	20 - 30
Cd	6 - 8	20-40	12 - 15	20 - 30
Sn	11 - 15	15-25	20 - 25	30 - 40
Sb	12 - 15	15-20	15 - 20	30 - 40
Ba	10 - 20	10-20	15 - 30	40 - 60
Hg	2 - 4	2-4	2 - 4	10 - 15
Tl	2 - 4	2-4	2 - 4	10 - 15
Pb	2 - 4	2-4	2 - 4	5 - 10

LODs, reported in PPM unless otherwise noted, are optimal. Measurements were taken in air for 120 seconds per beam. Standards used were in a clean, homogenous SiO2 matrix without interfering elements.

# DELTA R&D Configuration Guide

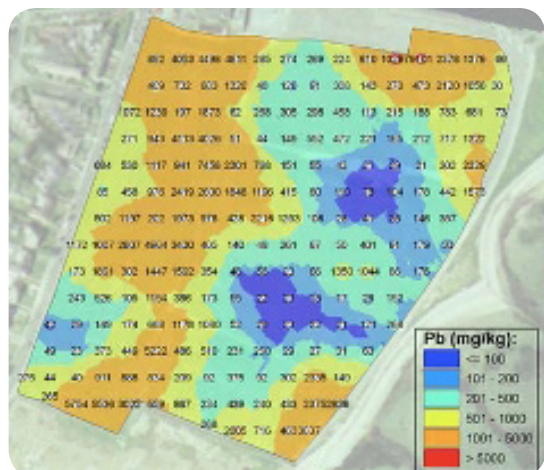
## Recommended Hardware Options

The DELTA Camera/Collimator is an ideal option for archaeologists, conservationists, and forensic scientists. The DELTA can focus in on a specific area of an object, take a measurement and save the spectra, composition, and digital image of the analysis area all at once. The DELTA Sample Cup is a great convenience for small object analysis.



Get Close Up: DELTA Camera/Collimator

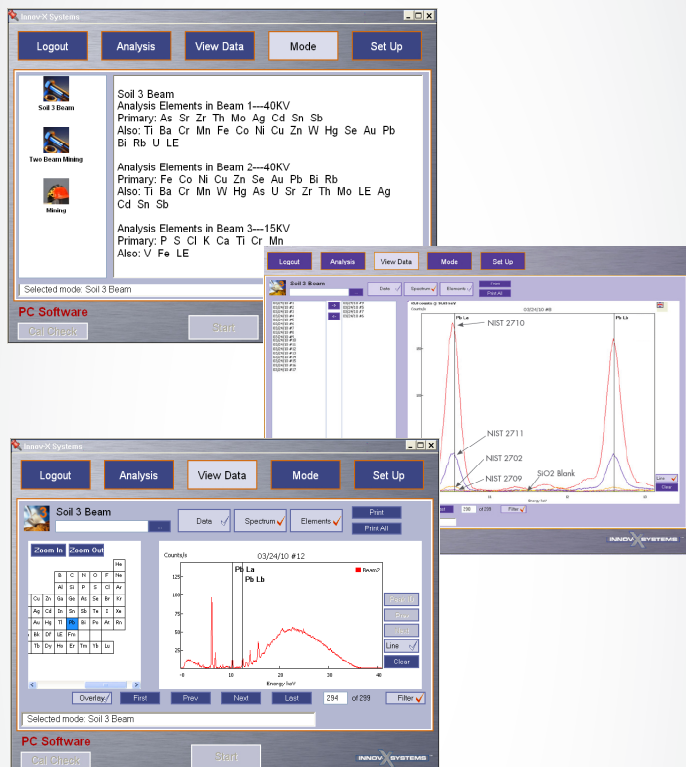
The DELTA Xplorer XRF-GPS-GIS option is ideal for scientists who investigate large areas such as archaeological dig sites, sport turfs, public parks, farms, orchards, or burial grounds. The DELTA Xplorer can simultaneously measure and record XRF-GPS-GIS information for instant metal mapping. The Holster, Soil Foot, and Soil Stick are great convenience accessories for analyzing large sites.



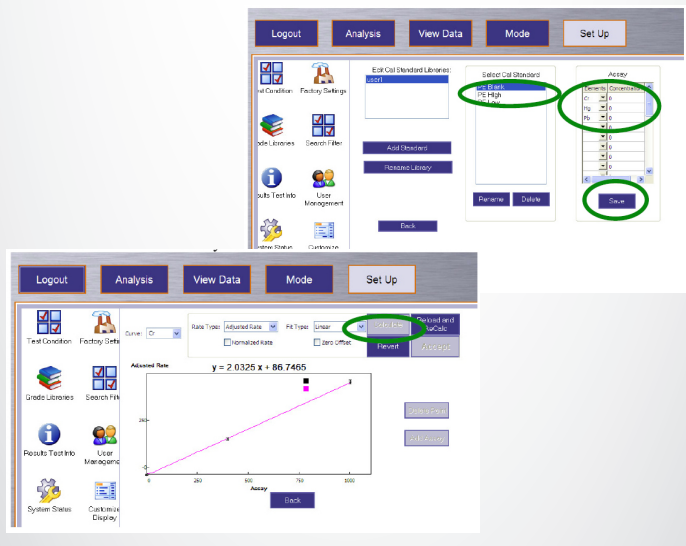
Get the Big Picture: DELTA Xplorer

## Recommended Software Options

Advanced PC Software is highly recommended for R&D as it provides the means to easily view and overlay spectra and to fine-tune or set up calibrations to transfer to the DELTA. It's also very convenient for creating reports and for publication. Remember, user generated calibration curves require the Empirical Mode.



## Fine-tune or Set-up Calibrations



# DELTA R&D Configuration Guide

## Recommended Research Accessories

The shielded, portable DELTA Workstation is convenient for bagged, prepped, and liquid samples or for multiple small objects; a PC is connected for remote control of this closed-beam DELTA set-up. A DELTA Sample Cup is ideal for analyzing small, loose objects. The DELTA Holster, Soil Foot, and Soil Stick are perfect for analyzing large sites.



Workstation



Sample Cup



Holster



Soil Foot

Soil Stick



## DELTA Research & Discovery Configuration Guide

**Start With:** DELTA Standard 4000 with Au/Ta tube (DS-4000)  
 Configure with Modes: Soil (3-beam) & Mining Plus (2-beam)  
 Note: (Check element listings for exchanges/add-ons)

**Specific Applications:**

Paintings, fabrics, paper, etc.	Use Soil Mode
Metal objects or components	Add Alloy Mode
Gold, silver, platinum, etc	Add Precious Metals Addition to Alloy Mode
Public health studies	Add ROHS/WEEE or Consumer Mode
User Generated Calibration Curves	Add Empirical Mode

**Options:**

Camera	Digital image
Camera/Collimator <sup>1</sup>	Small area focus <sup>1</sup> and digital image
Xplorer XRF-GPS-GIS	Metal Mapping
Advanced PC Software	EZ spectral viewing; fine-tune/set-up calibrations

**Cautions:** Need Mg <1%, Al/Si <0.5% analysis? DP-6000 Rh tube and Mining Plus Mode required<sup>2</sup>  
 Need BEST Cd, Ag, Sb, Ba & REEs? DP-4050 Au/Ta tube 50 kV recommended<sup>3</sup>

**NOTE:**

<b>1. Collimator:</b>	Collimation is not available for the following modes: Lead Paint, Hal Free, Filter, and Dust Wipe
<b>2. DP-6000 Rh tube:</b>	Collimation is not available for DP or DS with Rh or Ag target tubes with 3-B Soil Mode
<b>3. DP-4050 kV tube:</b>	LODs for P, S, Cl, K, Ca, Mn, Fe, Ag, Cd, Sn and Sb are not as good as with Au/Ta tube A radiation shield is recommended to operate at 50kV

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