



Riselas

Riselas Technology Co., Ltd.

Add.: Building A5, COFCO (Fuan) Robot Intelligent Manufacturing Industrial Park, No. 90 Dayang Road, Fuhai Street, Bao'an District, Shenzhen, China 518103

www.riselas.com

RAY6000T Spectrometer

Servicing Maintenance Manual

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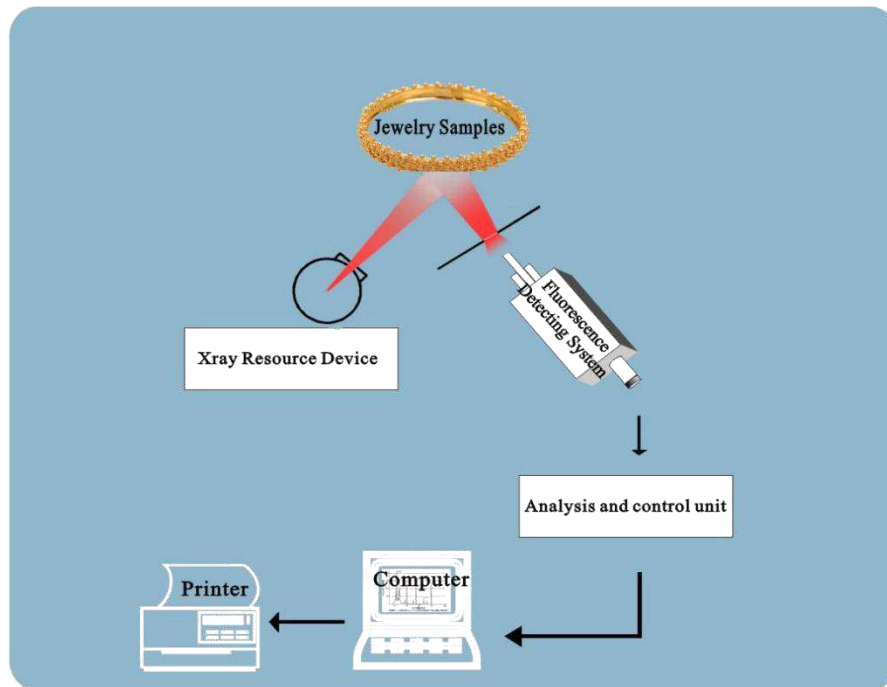
Testing

Maintenance

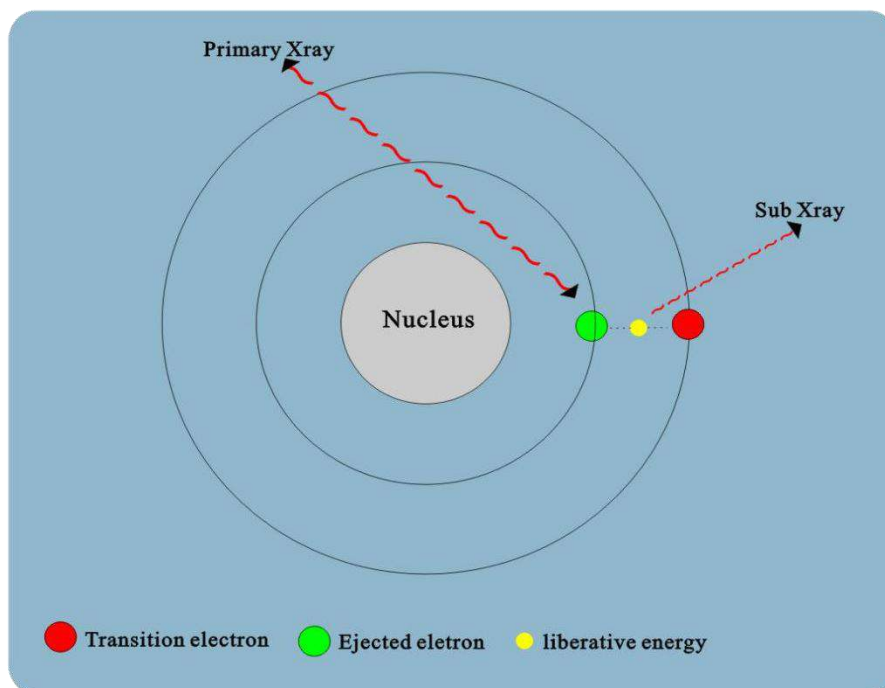
Basic Maintenance

Remark

Working Principle



XRF Spectrometer Working Principle (picture 1)



Xray Principle (Picture 2)

A、Factors affecting measurement results of spectroscopic instruments

1、Effects of quantum number of light

X ray is a quantum of light. According to the principle of quantum mechanics, even if the X ray light source used is very stable, the number emitted per second is not a constant value, but a certain fluctuation. This fluctuation leads to an error in the measured gold content. This fluctuation becomes smaller with the accumulation of time and the increase of count, and the relative error is inversely proportional to the square root of time, that is:

$$\Delta \phi \propto 1/\sqrt{T}$$

(where Δ represents error, T represents time)

In other words, since the count is proportional to time, the relative error is inversely proportional to the square root of the count.

Therefore, the longer the measurement time, the smaller the error; the larger the count, the smaller the error. In principle, measurement errors can be small, but at the expense of long measurement times. For general samples, there are 2000 gold fluorescence counts per second, so it takes about 100 seconds.

2、The influence of the content of elements of interest

The content of the elements of interest has a great influence on the test results. The content is proportional to the accuracy, that is, the higher the content of the element of interest, the smaller the detection error and the higher the measurement accuracy. On the contrary, the lower the content, the greater the detection error and the lower the measurement accuracy.

3、Effect of Sample Shape

X ray fluorescence spectrometry requires that the surface of the sample is smooth and smooth, it is difficult to make every sample smooth and smooth in the actual analysis process. Therefore, the operator should try to select a relatively smooth and smooth position of the sample for analysis. It can be concluded that the more smooth and smooth the sample is, the smaller the error of instrument analysis; conversely, the rougher, uneven and even dirt the sample is detected, the greater.

4、Effect of surface coating or chemical treatment

The surface of the tested sample is coated or treated by other chemical methods. Please remove these coatings or chemical residues as much as possible in order to accurately analyze the purity of the sample.

5、Effect of Sample Uniformity

Expensive metal ornaments are generally difficult to achieve 100% homogeneity, and fluorescence spectrum analyzer is a test method for local analysis of samples. Therefore, it is suggested that the operators of the instrument operate according to the guidance in the National Standard of Non-destructive Analysis of Precious Metals — Fluorescent Spectral Analysis, that is, at least three different points of jewelry samples are selected to detect and analyze.

B Operation steps of the instrument

Introduction to Instrument Structure

▲ Instrument warning light

Color: Blue



When the machine is working, the light is on, the rest of the time is not on

▲ Instrument Back Interface Panel

Instrument power supply port: three-phase 220 V/110V power outlet to supply the instrument

USB control port: control high voltage power supply, data output control board, camera collimating transmission port



▲ Switch on the back side of the instrument, The power switch of the instrument.

Measuring system parameters

● High voltage source

Voltage :0-50 kV Current :0-1 mA

● X light tube

Tube voltage :0-50 kV current :0-1 mA

filament voltage :0-2.5 V filament current :0-1.7 A

● Detector

Si-PIN detector

Size: 58mm x 25mm x 26mm

Operating voltage :1100 V-1200V

● Computer requirements

4G memory , 2 USB2.0 interfaces

OS: Microsoft Windows 10 , 64-bit

Instrument installation

1) Connect the power cord to the power interface on the back of the instrument. (range of input voltage for power supply is AC110V/220V)

2) If necessary, connect the mouse to the USB port on the back of the instrument.



Back Interface Panel

3) Boot and shutdown of instruments

Make sure the instrument hardware connection is finished, press the instrument power switch, the instrument opens, press again, the instrument closes.

After the instrument is turned on, three indicator lights on the back of the instrument are long, and the other two indicator lights are on or not, indicating that the power supply system is normal and the hardware of the instrument is installed.

When the software is calibrated or measured, the three indicator lights on the back of the instrument are long, and the other two indicator lights flicker, indicating that the instrument drive and software are also installed, and the are running normally.

▲The instrument should not be placed in high temperature, direct sunlight, wet environment, avoid the use of this instrument in dusty or dirty places, otherwise it will cause damage to the instrument.

▲ **Instruments should be kept away from volatile, corrosive, flammable and explosive dangerous goods.**

▲Do not have strong magnetic field, high noise near the location of the instrument installation, otherwise it will affect the measurement accuracy.

▲**The instrument should be placed on a horizontal, solid table.**

▲During the installation of the instrument, the back vent reserves at least 10 cm of space from the wall. Do not block the ventilation and heat dissipation hole. The failure of the exhaust air will cause the instrument to overheat in time.

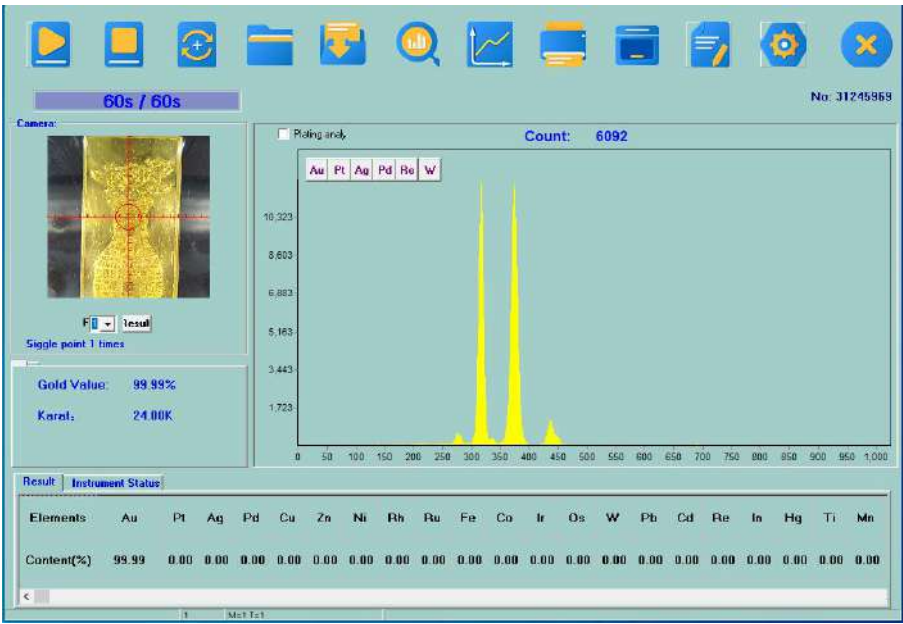
▲ Do not put any liquid containers such as vases, water cups, etc on the instrument. spilled liquid may reduce electrical insulation performance and cause short circuit.

▲Before moving the instrument, must first power off, then unplug the USB interface line and power line. (Live plug-in may cause damage to an instrument or computer chip)

▲If your instrument smoke, overheat, make abnormal sound, smell or liquid immersed in the instrument, please stop the operation immediately, turn off the power supply and remove the external power cord, contact our company.

Opening Software

Double-click on the desktop icon opens measurement software。



Camera

The camera collimates to the left in the middle of the software, as shown in figure 4.4.1. The camera collimating equipment with the instrument is drive-free. Windows system will automatically identify, if unable to identify please check the Windows system or contact your computer administrator. After the software is turned on, the software will try to automatically connect the camera collimation device.

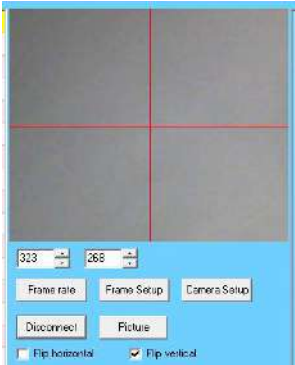
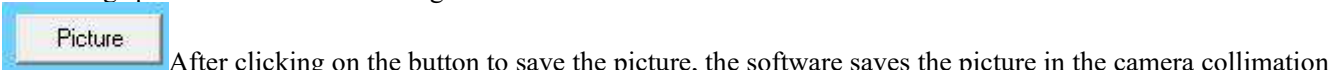


Figure 4.4.1 Camera alignment

After the correct connection, the first button in the second row on figure 4.4.1 will appear as **Disconnect**, otherwise, as **Connect**. If the image display area is not normal after the correct connection **Frame Setup**, click to set the dialog box settings parameters to the following content.



Picture After clicking on the button to save the picture, the software saves the picture in the camera collimation system as a BMP file.

Other settings or buttons in figure 4.4.1 are provided by the vendor engineer for debugging, please do not change them.

Instrument calibration



Select the button in the main interface for instrument calibration, generally, self-check about 3 minutes.

Calibrate once a day, do not shut down the machine, do not shut down the software, and do not need to calibrate a second time.

Instrument Test

After the instrument is successfully calibrated, the test of the instrument can be started.



Please click this button to start the test.

Software Introduction

The software is divided into five parts software is divided into five parts: camera collimation area, button area, content display area, spectral display area and instrument state area.

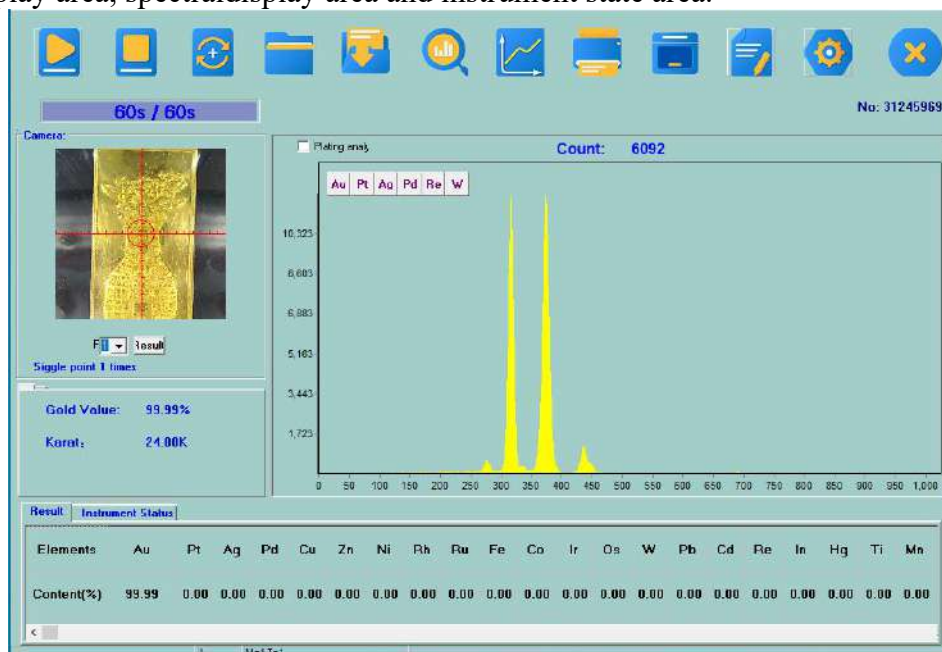


Diagram of the operating interface

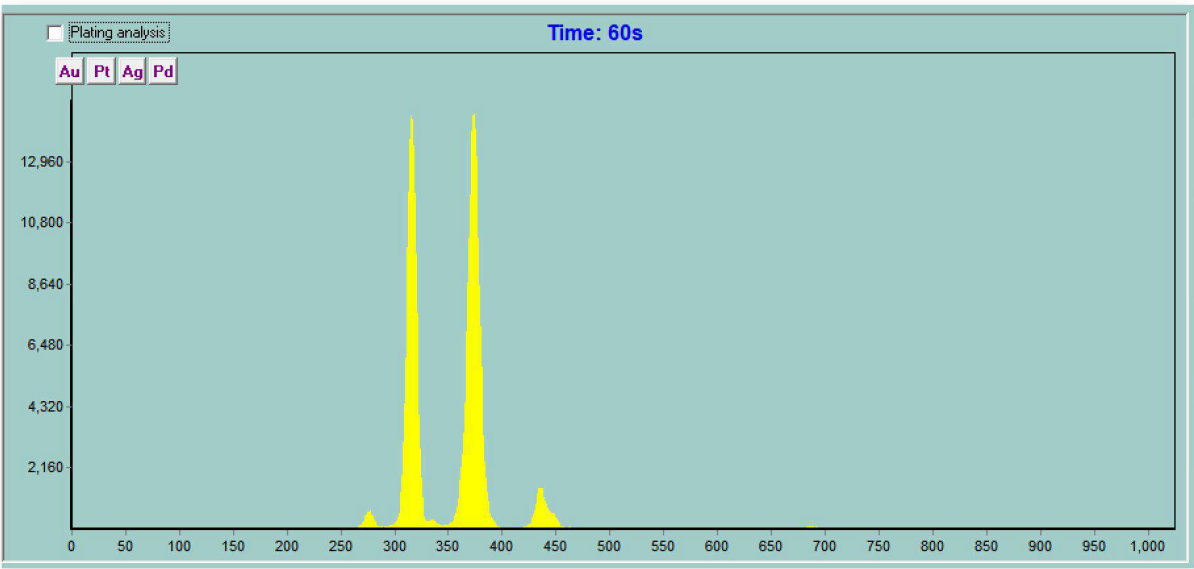
1 Camera collimation.

2 Instrument status area, display instrument and software connection information, feedback instrument equipment working status.

3 Content display area, showing the analysis results after sample testing

Result	Instrument Status																			
Elements	Au	Pt	Ag	Pd	Cu	Zn	Ni	Rh	Ru	Fe	Co	Ir	Os	W	Pb	Cd	Re	In	Hg	Ti
Content(%)	99.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

4 Spectral display region, showing the X fluorescence spectra obtained after sample testing.



5 Button area where users can operate software and instruments by clicking the button. The Button section contains twelve function buttons. Figure



The Setup button, can set the software parameters.



For instrument calibration, Calibrate once a day, do not shut down the machine, do not shut down the software, and do not need to calibrate a second time.



After placing the sample, click the button to start measuring. The progress bar starts rolling and displays the remaining time, count rate, and totals. After 5 seconds of prediction, display the preliminary scan map and start measuring by setting time. After the measurement is completed, the measurement results are automatically displayed, and the results are saved to the Record", which can be queried and printed.

Click the Stop" button to stop measuring.



If the measurement or calibration is stopped, the measurement or calibration process will end immediately after clicking stop, the measurement data will be invalid, the high voltage power supply will stop the power supply, and the X ray will stop issuing.



Click Load Data" button

Select the path and the map file to open in the pop-up dialog box, extract the stored map file, and display the analysis results.

Click Save Data" button

Enter the file name in the pop-up dialog box and select the save path. Save the current spectral map or just measured spectral map to the designated position of the computer.

Click Analyse" button

Analyze the spectral data currently displayed in the spectral display area, and display the



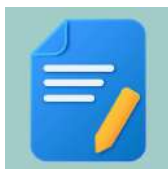
Click on the "Spectrum" button to display the details of the spectral data, can zoom in and out of the and other display operations, the general customer does not need to operate.



Click the "Print" button to print out the display results in a printmould.xls" file that can be set in the EXCEL folder of the analysis software folder. this function requires computer installation EXCEL to be used.



Click the "Devices" button, will open the instrument analysis data input equipment and high-voltage equipment settings form, the general customer does not use, in the fault state engineer use or under the guidance of the engineer customer use.



Button to open the data record form, display the measurement results database, view, print and clear previously recorded measurements.

RecordList

Number	Measure_Time	Measure_Date	Au	Ag	Cu	Pt	Pd	Zn	Ni	Cd	Co	Ru	Ir	Rh	In	Sn	Operator
2259	14:12:21	2011-12-18	99.33%	0.00%	0.00%	0.00%	0.00%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2260	14:14:49	2011-12-18															
2261	14:17:04	2011-12-18	99.34%	0.00%	0.00%	0.00%	0.00%	0.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2262	14:19:25	2011-12-18	99.16%	0.08%	0.00%	0.00%	0.00%	0.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2263	14:22:29	2011-12-18	98.95%	0.15%	0.00%	0.00%	0.00%	0.89%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2264	14:25:07	2011-12-18	98.75%	0.23%	0.00%	0.00%	0.00%	0.94%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2265	14:27:40	2011-12-18	98.72%	0.00%	0.00%	0.00%	0.00%	1.28%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2266	14:30:16	2011-12-18	98.84%	0.10%	0.00%	0.00%	0.00%	1.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2267	14:32:43	2011-12-18	98.34%	0.57%	0.00%	0.00%	0.00%	0.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2268	14:35:36	2011-12-18	98.54%	0.00%	0.39%	0.00%	0.00%	1.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2269	14:39:27	2011-12-18	98.40%	0.23%	0.00%	0.00%	0.00%	1.37%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2270	14:46:12	2011-12-18	98.02%	1.21%	0.00%	0.00%	0.00%	0.77%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2271	14:48:45	2011-12-18	97.82%	0.00%	0.71%	0.00%	0.00%	1.47%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2272	14:51:28	2011-12-18	97.33%	0.00%	0.34%	0.00%	0.00%	1.57%	0.75%	0.00%	0.00%	0.00%	0.00%	0.00%			
2273	14:53:44	2011-12-18	98.10%	0.45%	0.00%	0.00%	0.00%	1.44%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2274	14:57:15	2011-12-18	97.50%	1.54%	0.00%	0.00%	0.00%	0.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2275	14:59:33	2011-12-18	97.50%	0.00%	0.93%	0.00%	0.00%	1.58%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2276	15:02:57	2011-12-18	97.72%	0.66%	0.35%	0.00%	0.00%	1.27%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2277	15:05:31	2011-12-18	96.64%	1.28%	0.96%	0.00%	0.00%	1.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2278	15:09:38	2011-12-18	95.42%	1.82%	1.38%	0.00%	0.00%	1.38%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2279	15:13:29	2011-12-18	95.51%	3.03%	0.00%	0.00%	0.00%	0.61%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2280	15:16:35	2011-12-18	94.54%	0.00%	3.16%	0.00%	0.00%	1.47%	0.84%	0.00%	0.00%	0.00%	0.00%	0.00%			
2281	15:23:14	2011-12-18	95.21%	1.99%	1.48%	0.00%	0.00%	1.33%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2282	15:26:40	2011-12-18	92.67%	3.41%	2.70%	0.00%	0.00%	1.22%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			
2283	15:33:13	2011-12-18	92.13%	7.45%	0.00%	0.00%	0.00%	0.43%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%			

Search ListPrint Clear All

Query

KEY: Au condition: (>) Value: 98.95%

ADD

Au (>) 98.95%

ADD OR NOT Clear last

Start Clear Exit

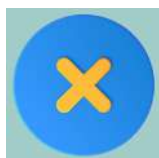
Click the Search button to query the data record

RecodeList																			
Number	Measure_Time	Measure_Date	Au	Ag	Cu	Pt	Pd	Zn	Ni	Cd	Co	Ru	Ir	Rh	In	Sn	Operator	M	
2259	14:12:21	2011-12-18	99.33%	0.00%	0.00%	0.00%	0.00%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					
2261	14:17:04	2011-12-18	99.34%	0.00%	0.00%	0.00%	0.00%	0.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					
2262	14:19:25	2011-12-18	99.16%	0.08%	0.00%	0.00%	0.00%	0.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					
2412	10:54:08	2011-12-20	99.99%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					
2719	16:44:07	2013-5-20	98.99%	0.71%	0.31%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%					

Display Search results

Print Preview																			
Test List Report																			
Measure_Date	Au	Pt	Ag	Pd	Cu	Zn	Ni	Rh	Ru	Os	Co	Ir	Cs	Fe	Pb	In	Other		
2011-12-18	99.33%	0.00%	0.00%	0.00%	0.00%	0.67%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
2011-12-18	99.34%	0.00%	0.00%	0.00%	0.00%	0.65%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
2011-12-18	99.16%	0.00%	0.08%	0.00%	0.00%	0.76%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
2011-12-20	99.99%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
2013-5-20	98.99%	0.00%	0.71%	0.00%	0.31%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%				
Page 1 of 1																			

Click the ListPrint button to print the query results preview, click the printer icon to print



Click the Exit" button to exit the analysis software

Instrument maintenance

一、 Environmental requirements for installation of XRF spectral analysis instruments:

- 1、 Temperature 15° C ~ 30° C
- 2、 humidity 35% ~85%
- 3、 Power requirements AC 220V $\pm$ no high-power electromagnetic and vibration interference sources near 5 V,50/60HZ,

二、 Daily maintenance and maintenance of XRF spectrum analyzer:

- 1 、 The laboratory should maintain constant temperature and humidity, especially in the southern humid weather environment, should pay special attention
- 2、 Equipment laboratories recommend the installation of air-conditioning equipment
- 3、 Acid mist can not exist in the environment of the instrument, that is, XRF instrument should not be in the same room as the chemical laboratory. Because X light tubes and detectors use metal beryllium windows, metal beryllium can easily be corroded by acid
- 4、 It is recommended that the instrument have an independent ground wire for the proper operation of the instrument
- 5、 Keep indoor smoke-free and dust-free, avoid dust entering the chassis
- 6、 Keep the voltage and current of the power supply stable, can choose the precision purifying and stabilizing power supply
- 7、 Moisture-proof, especially when the instrument has not been turned on for the first time, be sure to heat the machine for more than 30 minutes before testing
- 8、 If you want to move the instrument frequently, you can not disassemble the instrument box without authorization. If you have trouble, please call the engineer