

International Association of Assay Offices - Round Robin 18 - Chemical Testing (Scheme 2008)

Test method: **Chemical** Analyte: **Gold**

Code	Result 1	Result 2	Result 3	Result 4	Mean	s	s ²	Z-Score	Outlier test
ES_4	834.9	834.4	837.6	838.0	836.2	1.837	3.376	-222.0	*2
BH_1	923.9	924.2	924.7	924.4	924.3	0.337	0.113	-1.8	
CN_1	924.5	924.7	924.2	924.1	924.4	0.275	0.076	-1.6	
PT_1	924.4	924.6	924.6	924.4	924.5	0.115	0.013	-1.3	
DK_1	924.7	924.7	924.5	924.4	924.6	0.150	0.023	-1.1	
PT_2	924.8	924.8	924.5	924.3	924.6	0.245	0.060	-1.1	
FI_1	924.7	925.0	924.3	924.5	924.6	0.299	0.089	-1.0	
SG_1	925	925	925	925	924.7	0.082	0.007	-0.8	
AT_1	924.8	924.8	924.8	924.7	924.8	0.050	0.002	-0.6	
CH_4	924.7	924.8	924.8	924.8	924.8	0.050	0.002	-0.6	
UA_2	924.9	924.8	924.7	924.8	924.8	0.082	0.007	-0.6	
SE_1	924.7	924.9	924.8	924.8	924.8	0.082	0.007	-0.6	
UK_2	924.9	924.7	924.8	924.8	924.8	0.082	0.007	-0.6	
FR_1	924.7	924.7	925.1	924.8	924.8	0.189	0.036	-0.5	
NL_1	924.9	924.9	924.8	924.8	924.9	0.058	0.003	-0.4	
UK_4	924.7	924.9	924.8	925.0	924.9	0.129	0.017	-0.4	
PL_1	924.8	924.8	924.9	924.9	924.9	0.058	0.003	-0.4	
CZ_1	924.9	924.7	924.9	924.9	924.9	0.100	0.010	-0.4	
EE_1	925.0	924.8	924.7	924.9	924.9	0.129	0.017	-0.4	
UA_5	924.8	924.9	924.7	925.1	924.9	0.171	0.029	-0.4	
UA_6	924.6	925.1	925.0	924.8	924.9	0.222	0.049	-0.4	
IL_1	924.8	924.7	925.1	925.0	924.9	0.183	0.033	-0.3	
CH_2	924.9	925.0	925.0	924.8	924.9	0.096	0.009	-0.2	
IT_2	924.7	925.1	924.9	925.0	924.9	0.171	0.029	-0.2	
CA_1	924.9	925.0	924.9		924.9	0.058	0.003	-0.2	
CH_7	925.0	925.0	924.9	924.9	925.0	0.058	0.003	-0.2	
CH_5	924.9	924.9	925.0	925.0	925.0	0.058	0.003	-0.2	
UA_7	924.9	925.1	925.0	924.8	925.0	0.129	0.017	-0.2	
CH_1	925.2	924.7	924.7	925.2	925.0	0.289	0.083	-0.2	
CH_6	924.9	925.0	925.0	925.0	925.0	0.050	0.003	-0.1	
UA_1	925.1	924.9	925.0	925.0	925.0	0.082	0.007	0.0	
ES_6	924.9	925.0	924.9	925.2	925.0	0.141	0.020	0.0	
PL_2	925.1	924.9	924.8	925.2	925.0	0.199	0.040	0.0	
UK_1	925.1	925.0	924.9	925.1	925.0	0.096	0.009	0.0	
SK_2	924.9	925.3	925.0	924.9	925.0	0.189	0.036	0.0	
IT_1	925.1	925.3	925.0	924.8	925.1	0.208	0.043	0.1	
CY_1	924.6	925.1	925.1	925.4	925.1	0.332	0.110	0.1	
UA_3	925.1	925.1	925.0	925.1	925.1	0.050	0.003	0.1	
AE_1	925.2	925.1	925.0	925.1	925.1	0.082	0.007	0.2	
UA_4	925.1	925.0	925.2		925.1	0.100	0.010	0.2	
NL_2	925.4	925.0	925.1	924.9	925.1	0.216	0.047	0.2	
UK_3	925.1	924.9	924.8	925.6	925.1	0.356	0.127	0.2	
IE_1	925.1	925.4	925.1	925.0	925.2	0.173	0.030	0.3	
SK_1	925.2	925.2	925.2	925.1	925.2	0.050	0.003	0.4	
SI_1	925.3	925.5	925.0	925.1	925.2	0.222	0.049	0.5	
SK_3	925.4	925.2	925.5	925.0	925.3	0.222	0.049	0.6	
ES_3	925.6	925.2	925.3	925.2	925.3	0.189	0.036	0.8	
LT_1	925.7	925.5	925.2	925.1	925.4	0.275	0.076	0.9	
LV_1	926.3	924.6	925.3	925.4	925.4	0.698	0.487	0.9	*2
ES_1	925.4	925.6	925.6	925.6	925.6	0.100	0.010	1.3	
ES_5	925.5	925.5	925.4	925.8	925.6	0.173	0.030	1.3	
HU_1	925.9	926.1	925.9	925.7	925.9	0.163	0.027	2.2	
ES_2	926.2	926.0	925.8	926.5	926.1	0.299	0.089	2.8	
NO_1	925.9	925.5	927.3	926.0	926.2	0.780	0.609	2.9	*2
LK_1	927.0	927.0	926.0	927	926.8	0.500	0.250	4.3	
HR_1	927.3	927.4	925.5	927.1	926.8	0.908	0.824	4.5	*2
RS_1	929.5	929.0			929.3	0.354	0.125	10.6	*4
all results					results without outliers	(ES_4, HR_1, NO_1, LV_1, RS_1)			
Great mean μ / μ_{fp}					923.59	925.02	0.1		
Great standard deviation σ / σ_{fp}					11.80	0.40	1.0		
MEDIAN					924.95	924.95			
difference between μ / μ_{fp} and MEDIAN					-1.36	0.08			
MIN _{mean}					836.23	924.30			
MAX _{mean}					929.25	926.75			
RANGE _{mean}					93.03	2.45			
p					57	52			

International Association of Assay Offices - Round Robin 18 - Chemical Testing (Scheme 2008)

Legend:

μ	Great mean, all results
μ_{fp}	Great mean "fitness for purpose", without outliers
σ	Great standard deviation σ , all results
σ_{fp}	Great standard deviation, "fitness for purpose", without outliers
p	Number of Labs
*1	straggler according to Cochran test
*2	outlier according to Cochran test
*3	straggler according to Grubbs test
*4	outlier according to Grubbs test

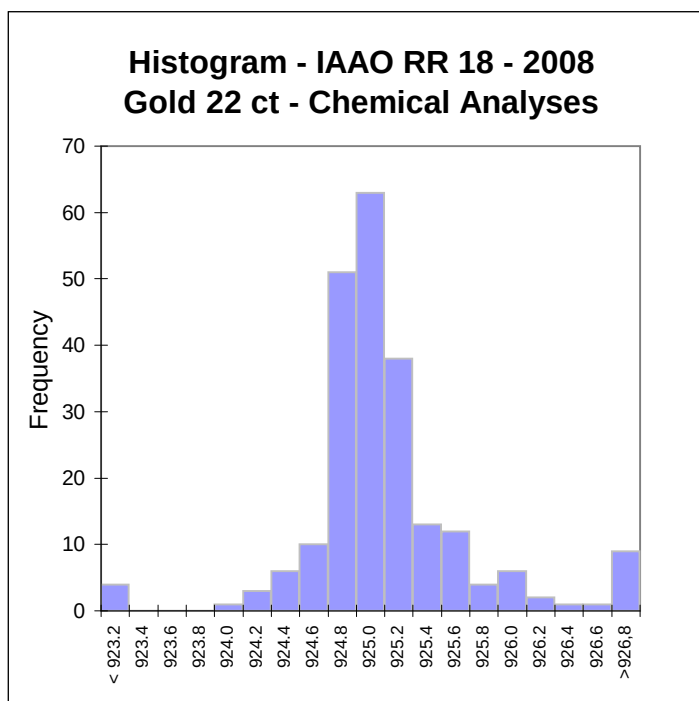
Numerical Outlier Tests

Cochran's test for within-laboratory variabilities - IAAO-2008 RR18 (Au)					
	Test 1	Test 2	Test 3	Test 4	Test 5
Lab Code	ES_4	HR_1	NO_1	LV_1	LK_1
Σs^2	7.280	3.905	3.081	2.471	1.985
$s^2_{\max}$	3.376	0.824	0.609	0.487	0.250
C	0.464	0.211	0.198	0.197	0.126
result of test	outlier reject	outlier reject	outlier reject	outlier reject	pass
p	57	56	55	54	53
n	4	4	4	4	4
critical values for 5%	0.126	0.126	0.126	0.126	0.126
critical values for 1%	0.151	0.151	0.151	0.151	0.151

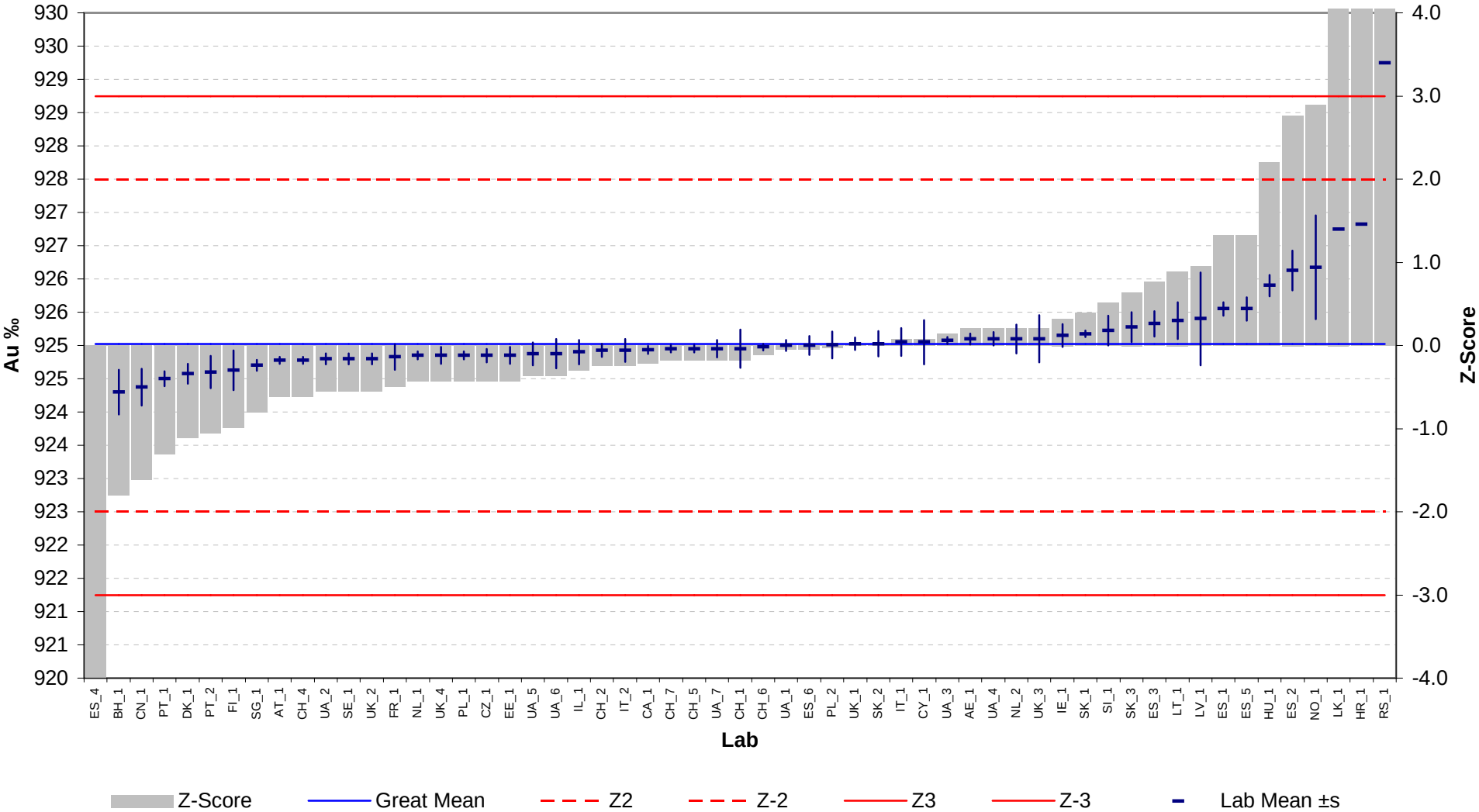
Grubb's test between laboratories consistency (mean values) - IAAO-2008 RR18 (Au)				
	Test 1		Test 2	
	G_P (highest)	G_1 (lowest)	G_P (highest)	G_1 (lowest)
	5.833	1.147	2.308	1.147
Lab Code	RS_1	BH_1	LK_1	BH_1
p	53	52	52	52
critical values for 5%	3.036	3.036	3.036	3.036
critical values for 1%	3.381	3.381	3.381	3.381
result of test	outlier reject	pass	pass	pass
result of test	outlier reject	pass	pass	pass

Frequency chart (single results)

Parameters	Bin	Frequency	
min	834.4	< 923.2	4
max	929.5	923.4	0
classes	18	923.6	0
step	0.20	923.8	0
count data	224	924.0	1
sum freq	224	924.2	3
median	924.95	924.4	6
	-1	924.6	10
rounding	0.1	924.8	51
		925.0	63
		925.2	38
		925.4	13
		925.6	12
		925.8	4
		926.0	6
		926.2	2
		926.4	1
		926.6	1
		>926.8	9



International Association of Assay Offices - Round Robin 18
(Scheme 2008) Chemical Testing Gold 22 Carat



International Association of Assay Offices - Round Robin 18 - Chemical Testing (Scheme 2008)

Participants

Code	Name	Address_1	Address_2	Address_3	Country	e-mail (Person of contact)
AE_1	Dubai Central Laboratory	Dubai Municipality	P.O. Box 67	Dubai	United Arab Emirates	MNSAEED@dm.gov.ae
AT_1	Edelmetallkontrolllabor	Technische Untersuchungsanstalt	Vordere Zollamtsstrasse 3	1030 Vienna	Austria	Kazem.Rezwan@bmf.gv.at
BH_1	Directorate of Precious Metals & Gemstone Testing	Ministry of Commerce and Industry	P.O. Box 5479	Manama	Bahrain	aalbosta@commerce.gov.bh
CA_1	Competition Bureau	Royal Canadian Mint	6850 East, Sherbrooke St.	Montreal, H1N 1E1, Quebec	Canada	forrest@mint.ca
CH_1	Swiss Assay Office Berne	Zentralamt für Edelmetallkontrolle	Monbijoustrasse 40	3007 Bern	Switzerland	philippe.schrago@ezv.admin.ch
CH_2	Swiss Assay Office Basel	Edelmetallkontrolle	Post-Passage 5	4002 Basel	Switzerland	urs.bangerter@ezv.admin.ch
CH_4	Swiss Assay Office Chiasso	Controllo federale dei metalli preziosi	22, via Motta	6830 Chiasso	Switzerland	massimo.tela@ezv.admin.ch
CH_5	Contrôle des métaux précieux Genève	Rue des Gares 12	Case postale 2294	1211 Genève	Switzerland	francois.jenny@ezv.admin.ch
CH_6	Swiss Assay Office La Chaux-de-Fonds	BCMP	67, av. Léopold Robert	2300 La Chaux-de-Fonds	Switzerland	roland.gogniat@ezv.admin.ch
CH_7	Swiss Assay Office Zurich	Edelmetallkontrolle	Molkenstrasse 8	8004 Zürich	Switzerland	thomas.kohler@ezv.admin.ch
CN_1	National Jewellery Quality Supervision & Inspection Center	Da Tun Road	Chao Yang District	Beijing 100101	China	njqsic@vip.sohu.com
CY_1	The Cyprus Assay Office		P.O. Box 45047	Aradippou, 7110	Cyprus	assavcy@logosnet.cy.net
CZ_1	Prague Assay Office	Puncovní urad	Kozi 4	110 00 Prague 1	Czech Republic	iuska@puncovniurad.cz
DK_1	FORCE Technology	Brøndby	Park Allé 345	2605 Brøndby	Denmark	op@force.dk
EE_1	Eesti Proovikoda / Assay Office of Estonia		Kadaka tee 36	Tallin 10621	Estonia	laser@assav.ee
ES_1	Instituto Tecnológico Metal-Mecánico AIMME	Parque Tecnológico	Av. Leonardo da Vinci 38	46980 Paterna	Spain	ajuares@aimme.es
ES_2	Centro de Laboratorios de Madrid		c/Valentin Beato 16	28034 Madrid	Spain	aca@clysim.com
ES_3	SAVECO - Dpto. Verificación y Análisis	Ctra. Palma del Rio Km 3.3	Fábrica 59	14005 Córdoba	Spain	gerencia@saveco.es
ES_4	Laboratorio Oficial Contratación de Metales Preciosos	rua Torres Quevedo 3-5	A Grela	15071 A Coruña	Spain	luis.ortiz.rilo@xunta.es
ES_5	LGAI Technological Center	Campus de la UAB	Apartado de Correos 18	08193 Bellaterra - Barcelona	Spain	emendez@appluscorp.com
ES_6	Instituto Tecnológico de la Bisutería	c/Artrux 3	07714 POIMA Maó	Menorca - Illes Balears	Spain	adominquez@iteb.es
FI_1	Inspecta Oy		Miestentie 3 B	02150 Espoo	Finland	jouni.hallikainen@inspecta.fi
FR_1	Laboratoire SCL de Paris	Att. Mr. François Auger	1, rue Gabriel Vicaire	75141 Paris, Cedex 03	France	francois.auger@scl.finances.gouv.fr
HR_1	Central Assay Office-Zagreb	State Office for Metrology	Ulica grada Vukovara 284/1	10002 Zagreb	Croatia	miroslav.banic@dzm.hr
HU_1	Hungarian Precious Metal Assaying Co.		Bláthy Ottó u. 3-5	1089 Budapest	Hungary	horvath@nemesfemvizsgalo.hu
IE_1	Dublin Assay Office		Dublin Castle	Dublin 2	Ireland	ana@assav.ie
IL_1	The Standards Institution of Israel		42, Haim Levanon st.	Tel Aviv 69977	Israel	dvarom@sii.org.il
IT_1	Laboratorio Metalli Preziosi	Camera di Commercio I.A.A.	Via Isonzo, 19	36077 Altavilla Vicentina (VI)	Italy	elio.poma@vi.camcom.it
IT_2	SAGOR	Via Spallanzani 29		52100 Arezzo	Italy	mauro.caneschi@ar.camcom.it
LK_1	National Gem and Jewellery Authority	25, Galle Face Terrace	Galle Road	Colombo 03	Sri Lanka	nqjassav@sltnet.lk
LT_1	Assaying and Hallmarking Laboratory	VI Lietuvos prabavimo rumai	M.K.Ciurlionio 65	66164 Druskininkai	Lithuania	ingrida@lpr.lt
LV_1	State Assay Supervision Inspectorate of Republic of Latvia		Teatra Str. 9	1050 RIGA	Latvia	janis.upmalis@vpui.gov.lv
NL_1	Waarborg Holland		P.O. Box 1075	2800 BB Gouda	Netherlands	i.vanpelt@waarborg.nl
NL_2	Edelmetaal Waarborg Nederland BV		Postbus 17	8500 AA Joure	Netherlands	zondervan@ewnederland.nl
NO_1	Norwegian Assay Office	Akersveien 24 C	Pb 2608 St. Hanshaugen	0131 Oslo	Norway	jens.fredrik.blegstad@teknologisk.no
PL_1	Krakow Regional Assay Office		ul. Rakowicka 3	31-511 Krakow	Poland	dyrektor.oup.krakow@gum.gov.pl
PL_2	Warsaw Regional Assay Office	Okręgowy Urząd Probierczy	ul.Elektoralna 2	00-139 Warsaw	Poland	wzolek@oup.neostrada.pl
PT_1	Contrastaria de Lisboa		Av. Dr. António José de Al	1000-042 Lisboa	Portugal	armanda.petrucci@incm.pt
PT_2	Contrastaria do Porto		Rua do Viconde de Bóbede	4000-109 Porto	Portugal	conceicao@incm.pt
RS_1	Bureau of Measures and Precious Metals		Mike Alasa 14	11000 Belgrade	Serbia	dmilosevic@szmdm.sv.gov.vu
SE_1	SP Technical Research Institute of Sweden		Box 5608	114 86 Stockholm	Sweden	britt-louise.eriksson-aberg@sp.se
SG_1	Singapore Assay Office		249 Jalan Boon Lay	Singapore 619523	Singapore	nqsiwuhua@stengq.com
SI_1	Metrology Institute of the Republic of Slovenia MIRS	Department for precious metals	Gruđnovo nabrežje 17	1000 Ljubljana	Slovenia	Irena.Grabec@gov.si
SK_1	Assay Office Bratislava	Puncovy urad SR	Medena, 10	814 56 Bratislava	Slovak Republic	janosic@puncurad.gov.sk
SK_2	Assay Office Branch Trencin	Puncovy urad SR	Medena, 10	814 56 Bratislava	Slovak Republic	janosic@puncurad.gov.sk
SK_3	Assay Office Branch Kosice	Puncovy urad SR	Medena, 10	814 56 Bratislava	Slovak Republic	janosic@puncurad.gov.sk
UA_1	State Assay Office of Ukraine		26 Otto Schmidta Street	Kiev 04107	Ukraine	rezvan@assav.gov.ua
UA_2	Central State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UA_3	Eastern State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UA_4	Western State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UA_5	Southern State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UA_6	Dnipropetrovsk' State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UA_7	Donetsk' State Enterprise of Assay Control	c/o State Assay Office of Ukraine			Ukraine	rezvan@assav.gov.ua
UK_1	Birmingham Assay Office	Newhall Street	P.O. Box 151	Birmingham B3 1SB	United Kingdom	dippal.manchanda@theassayoffice.co.uk
UK_2	Edinburgh Assay Office	Goldsmiths Hall	24, Broughton Street	Edinburgh EH1 3RH	United Kingdom	graham.moodie@assay-office.co.uk
UK_3	London Assay Office		Gutter Lane	London EC2V 8AQ	United Kingdom	Chris.Walne@assavofficelondon.co.uk
UK_4	Sheffield Assay Office	Guardians' Hall	137 Portobello Street	Sheffield S1 4DS	United Kingdom	carsona@assavoffice.co.uk

International Association of Assay Offices - Round Robin 18 - Chemical Testing (Scheme 2008)

Remarks by the participants

Code	Convention = 1 IAAO only = 0	accredited test method = 1 non accredited test method = 0	Analytical method: name + ISO Ref.	Remarks
ES_4	0	1		
BH_1	0	0	Cupellation (Fire Assay) ISO 11426	
CN_1	0	1	Cupellation(fire assay) ISO 11426	Determination of gold in gold jewellery alloys
PT_1	1	1	Microcupellation ISO 11426:1993	Internal method
DK_1	1	1	Cupellation-modified method DS/EN. ISO 11426 modified	
PT_2	1	1	Microcupellation ISO 11426	Sample of 12mg.
FI_1	1	1	Cupellation ISO 11426	
SG_1	0	1	Fire Assay Method	Assay weight using in-house validated sample weight which is 100mg per sample.
AT_1	1	1	Cupellation ISO 11426	
CH_4	1	1	Cupellation SN ISO 11426	
UA_2	0	1		
SE_1	1	1	ISO 11426	
UK_2	1	1	Cupellation* ISO 2237	*Fire Assay. Samples prepared prior to analysis.
FR_1	0	1	ISO 11426	Determination of gold in gold jewellery alloys.
NL_1	1	1	Cupellation ISO 11426	
UK_4	1	1	Gold cupellation ISO 11426	In-house method based on ISO standard.
PL_1	1	0	ISO 11426	
CZ_1	1	1	Cupellation	
EE_1	0	0	ISO 11426	
UA_5	0	1		
UA_6	0	1		
IL_1	1	1	SI 299* ISO 11426	* Marking and Testing of Silver? Articles
CH_2	1	1	Cupellation ISO 11426	
IT_2	0	0	ISO 11426/2000	
CA_1	0	0	Fire Assay*	*Au and Ag-Rev 4. Based on both ASTM E1335 & ISO 11426:1997 (E) methods
CH_7	1	1	Cupellation ISO 31427	
CH_5	1	1	Cupellation ISO 11426	
UA_7	0	1		
CH_1	1	1	Cupellation ISO 11426	
CH_6	1	1	Cupellation ISO 11426	
UA_1	0	1		
ES_6	0	1	Cupellation ISO 11426:1997	Determination of gold in gold jewellery alloys. Uncertainty: ± 0,5 ‰
PL_2	1	0	ISO 11426	
UK_1	1	1	ISO 11426	
SK_2	1	1	Cupellation	
IT_1	0	1	UNI EN ISO 11426/00	
CY_1	1	0	Cupellation ISO 11426	
UA_3	0	1		
AE_1	0	1	Cupellation BS EN ISO 11426: 1999	Determination of gold in gold jewellery alloys - cupellation method (fire assay)
UA_4	0	1		
NL_2	1	1	Cupellation NEN-ISO 11426	
UK_3	1	1	Fire Assay-Cupellation ISO 11426	
IE_1	1	0	Cupellation ISO 11426:1999	
SK_1	1	1	Cupellation	
SI_1	0	1	Cupellation ISO 11426	It was agreed that the composition of RR samples should be similar to most frequently analysed samples at Assay Offices. By us the most frequently analysed samples are gold 585 and 750 (more than 95% of all gold samples).
SK_3	1	1	Cupellation	
ES_3	0	1	Cupellation*	*Internal method: SAV-004T
LT_1	1	1	LST EN ISO 11426:1999*	*According to ISO 11426:1997.
LV_1	1	1	Cupellation* ISO 11426	Determination of gold in gold jewellery alloys - *(fire assay)
ES_1	0	1	Cupellation method (fire assay) ISO 11426:1997	
ES_5	0	1		
HU_1	1	1	Cupellation ISO 11426:1993	
ES_2	0	1	PE-1-1-1.*	Rev.6 (Cupellation)
NO_1	1	0	Cupellation 11426	
LK_1	0			
HR_1	0	0	Cupellation ISO 11426	Our laboratory is in the process of accreditation according to ISO 17025
RS_1	0	0	Potentiometric Not according to ISO 17025	We do not posses XRF