

I limiti nelle analisi Ambientali

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Matrici



Acqua Potabile



Acqua Scarico



Rifiuti



Aria



Indoor



Terreni

Normative e Limiti

Acque Potabili - Dlgs 31/2001

Elemento	Valore di Parametro ($\mu\text{g/L}$)	LD richiesti
Al	200	20
As	10	1
B	1.000	100
Cd	5,0	0,5
Cr	50	5
Cu	1.000	100
Fe	200	20
Hg	1,0	0,2
Mg	50	5
Na	200	20
Ni	20	2
Pb	10	1
Sb	5,0	1,25
Se	10	1

Acque Scarico - Dlgs 152/2006

Tabella 3. Valori limiti di emissione in acque superficiali e in fognatura.

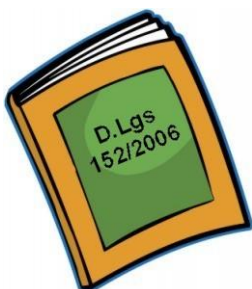
Numero parametro	PARAMETRO	unità di misura	Scarico in acque superficiali	Scarico in rete fognaria (*)
1	pH		5,5-9,5	5,5-9,5
2	Temperatura	°C	1)	(1)
3	colore		non percettibile con diluizione 1:20	non percettibile con diluizione 1:40
4	odore		non deve essere causa di molestie	non deve essere causa di molestie
5	materiali grossolani		assenti	assenti
6	Solidi speciali totali (2)	mg/L	≤ 80	≤ 200
7	BOD5 (come O2) (2)	mg/L	≤ 40	≤ 250
8	COD (come O2) (2)	mg/L	≤ 160	≤ 500
9	Alluminio	mg/L	≤ 1	$\leq 2,0$
10	Arsenico	mg/L	$\leq 0,5$	$\leq 0,5$
11	Bario	mg/L	≤ 20	-
12	Boro	mg/L	≤ 2	≤ 4
13	Cadmio	mg/L	$\leq 0,02$	$\leq 0,02$
14	Cromo totale	mg/L	≤ 2	≤ 4
15	Cromo VI	mg/L	$\leq 0,2$	$\leq 0,20$
16	Ferro	mg/L	≤ 2	≤ 4
17	Manganese	mg/L	≤ 2	≤ 4
18	Mercurio	mg/L	$\leq 0,005$	$\leq 0,005$
19	Nichel	mg/L	≤ 2	≤ 4
20	Piombo	mg/L	$\leq 0,2$	$\leq 0,3$
21	Rame	mg/L	$\leq 0,1$	$\leq 0,4$
22	Selenio	mg/L	$\leq 0,03$	$\leq 0,03$
23	Stagno	mg/L	≤ 10	
24	Zinco	mg/L	$\leq 0,5$	$\leq 1,0$

Rifiuti - DM 3 Agosto 2005

Eluato x accettabilità rifiuti inerti	
Elemento	Limiti di Concentrazione (mg/L)
As	0,05
Ba	2
Cd	0,004
Cr tot	0,05
Cu	0,2
Hg	0,001
Mo	0,05
Ni	0,04
Pb	0,05
Sb	0,006
Se	0,01
Zn	0,4

Eluato x accettabilità rifiuti non pericolosi	
Elemento	Limiti di Concentrazione (mg/L)
As	0,2
Ba	10
Cd	0,02
Cr tot	1
Cu	5
Hg	0,005
Mo	1
Ni	1
Pb	1
Sb	0,07
Se	0,05
Zn	5

Eluato x accettabilità rifiuti pericolosi	
Elemento	Limiti di Concentrazione (mg/L)
As	2,5
Ba	30
Cd	0,2
Cr tot	7
Cu	10
Hg	0,05
Mo	3
Ni	4
Pb	5
Sb	0,5
Se	0,7



Soluzioni per l'Analisi Elementare

- Differenti tecniche per differenti applicazioni
- Ogni tecnica offre diversi vantaggi



1 H																	2 He
3 Li	4 Be											10 Ne					
11 Na	12 Mg											18 Ar					
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	57-76 * Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	89-102 ** Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun	111 Uuu	112 Uub	114 Uuq					

EDX-7k/8k



No Sample Prep

AA-7000



Robustness

ICPE-9800



Fast / Simultaneous

ICPMS-2030



Highest Sensitivity

EDX – AA – ICP

	Fluorescent X-ray	Flame AA	Flameless AA	ICP-AES	ICP-MS
Sensitivity	ppm~%	ppb~ppm	ppt~ppb	ppb~ppm	ppt~ppb
Reproducibility	Good	Average	Average	Good	Average
Accuracy	Average	Good	Good	Excellent	Good
Pretreatment	Not required	Required	Required	Required	Required
Calibration curve samples	Solids / liquids	Solution	Solution	Solution	Solution
Spectral interference	Good	Good	Good	Average	Good
Chemical and Ionization interference	Average	Average	Poor	Excellent	Good
Physical interference	Good	Good	Good	Average	Average
Operability	Excellent	Good	Average	Excellent	Good
Multi-element analysis	Possible	Not possible	Not possible	Possible	Possible
Versatility	Excellent	Excellent	Good	Good	Good

EDX



No Sample Prep

EDX



Dimensioni (W × D × H)

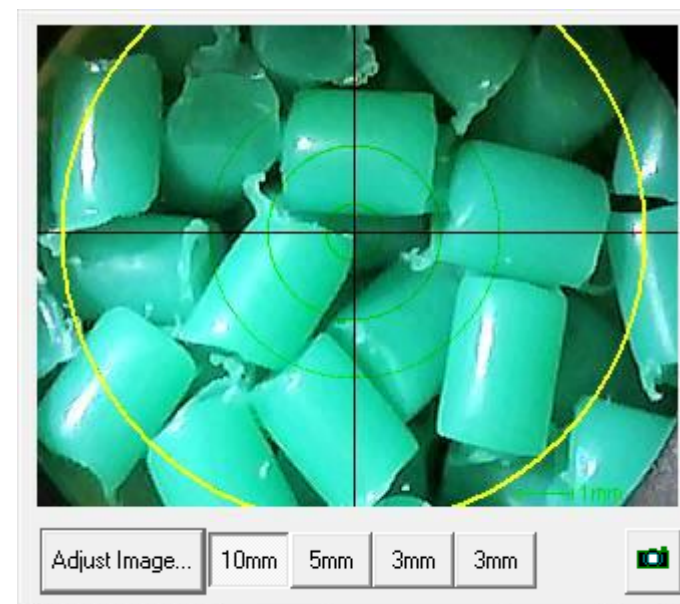
460 mm × 590 mm × 360 mm

Camera Portacampioni (W × D × H)

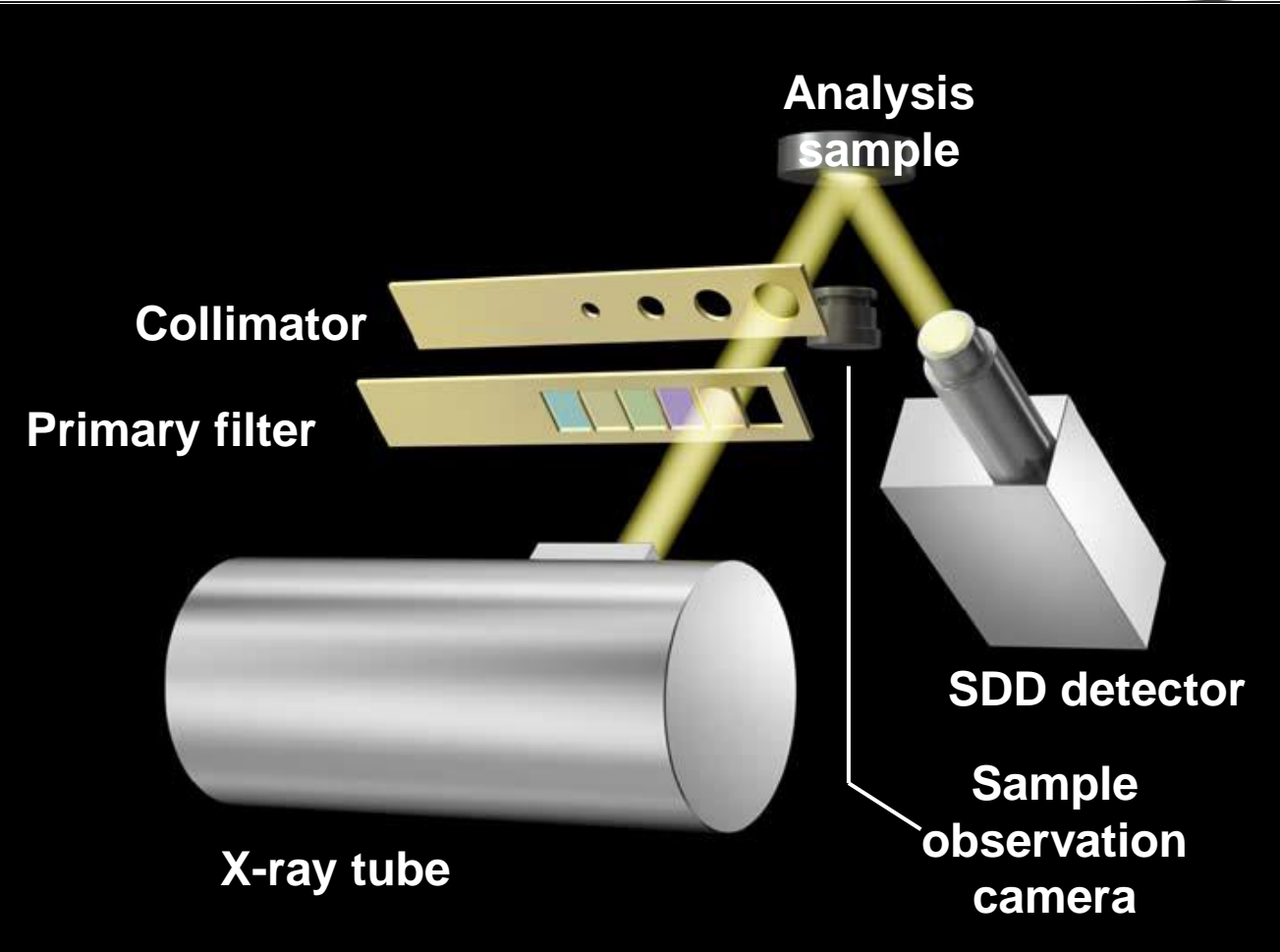
300 mm × 275 mm × approx. 100 mm



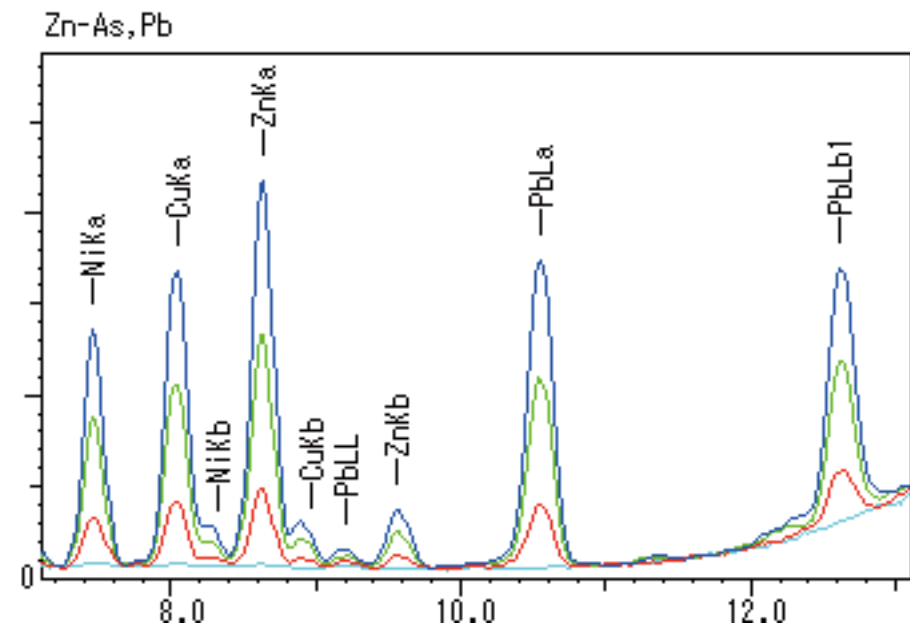
Color Camera View



EDX



- Non richiede pretrattamento del campione
- Campioni solidi e liquidi
- Analisi non distruttiva



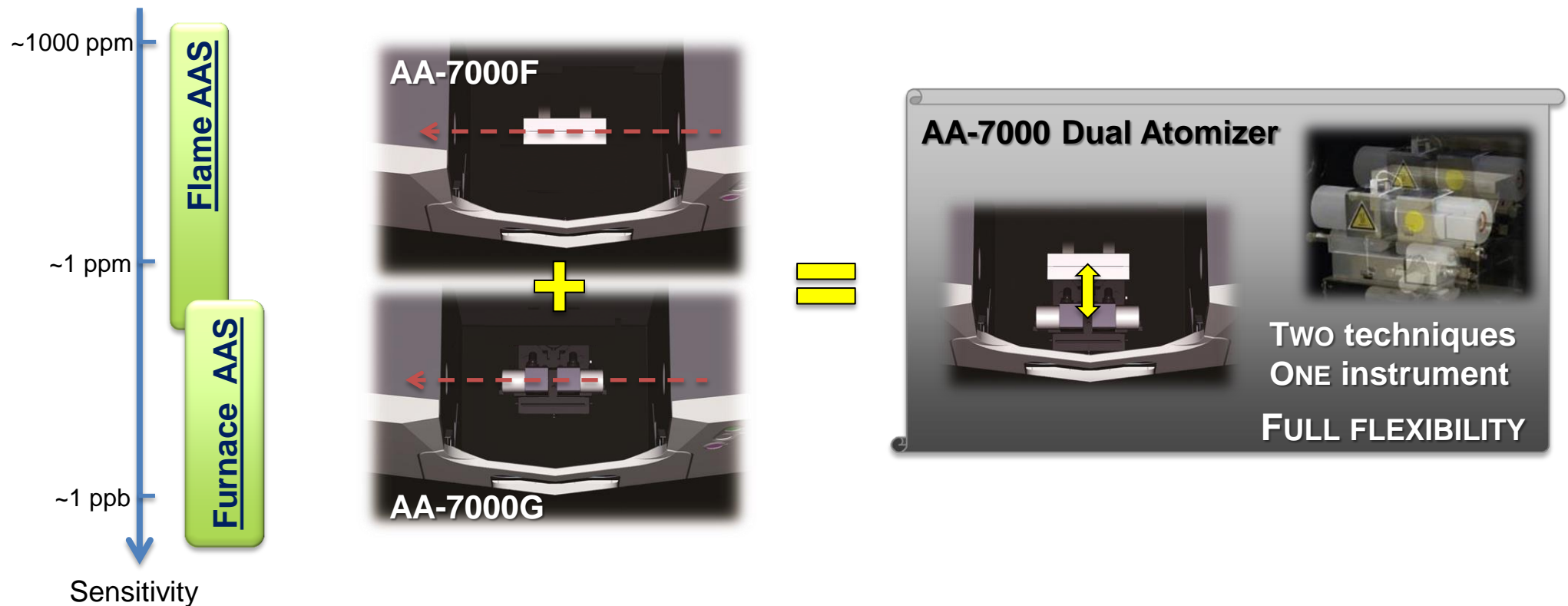
AA-7000



Robustness

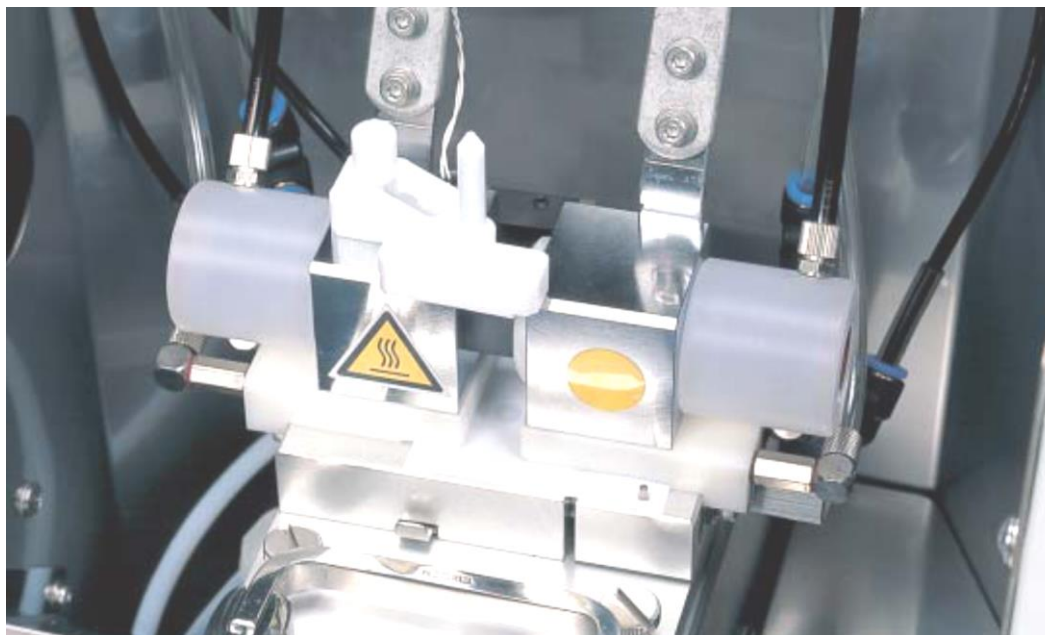
Due strumenti in uno

- Configurazione Fiamma, Fornetto o entrambe montate contemporaneamente
- Centratatura automatica dei due sistemi
- Unico autocampionatore per entrambe le tecniche



AA-7000G

- Atomizzatori a fornetto di grafite di ultima generazione:
- Controllo digitale ed ottico delle temperature
- Controllo digitale dei gas (stop flow)
- Possibilità di alloggiamento vari tubi di grafite



Accessories

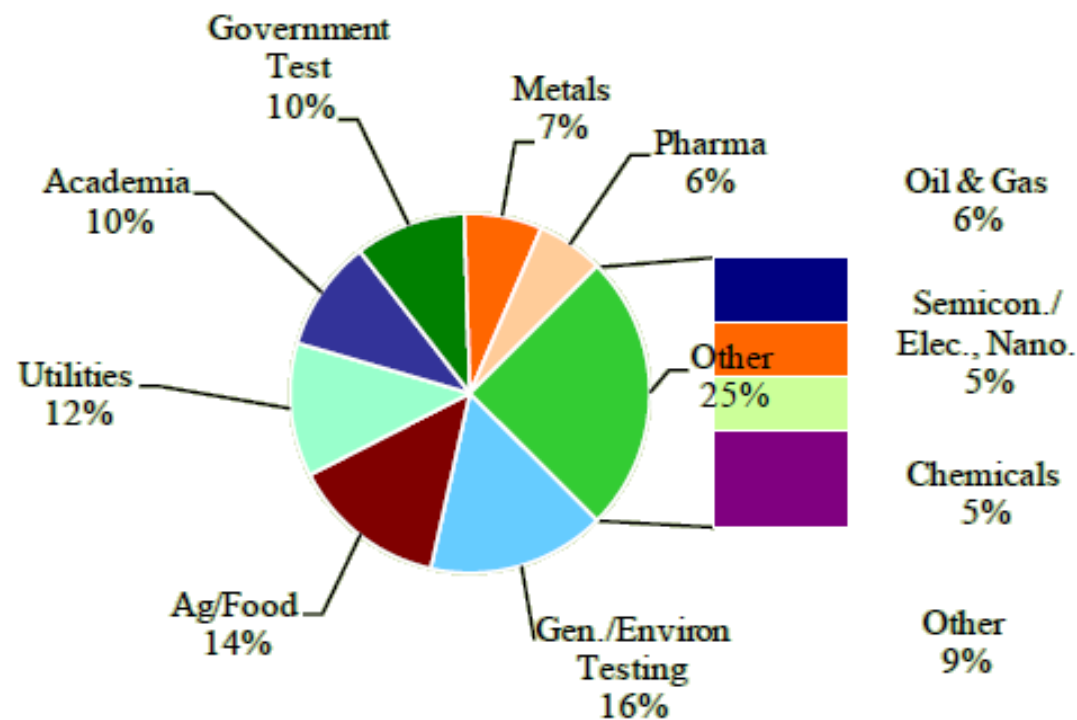
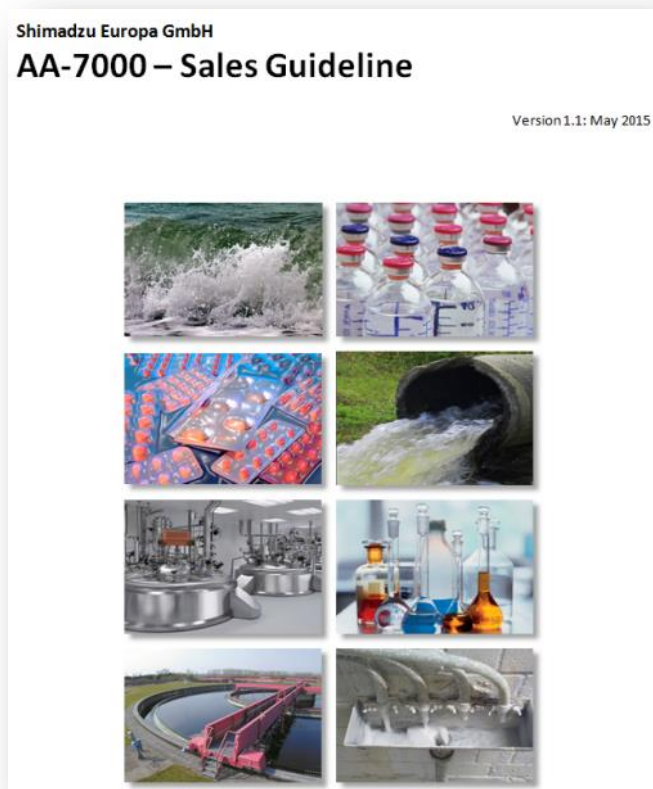
- Un solo autocampionatore per fiamma e fornetto
- Kit per microcampionamento
- HVG – generatore di idruri



Application

- **Diverse applicazioni**

- Application Notes
- Shimadzu News
- Configuration list
- Sales Guideline



ICPE-9800 Series

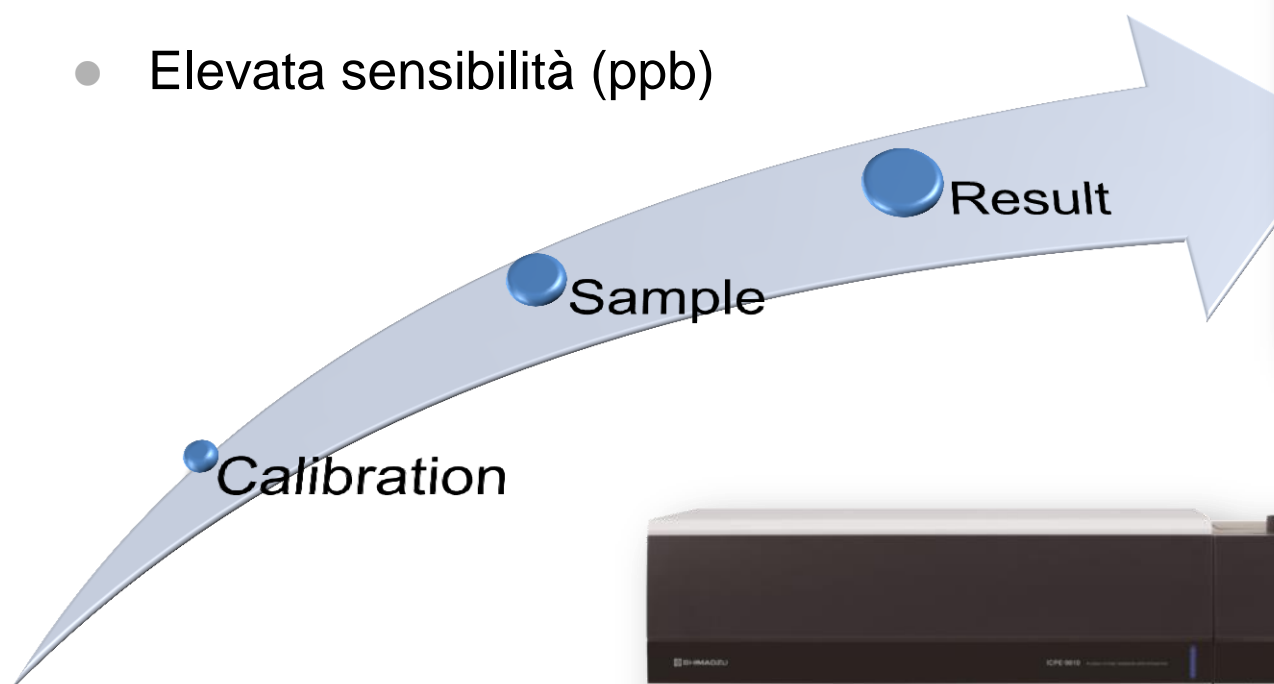


Fast / Simultaneous

Analisi simultanee ? ... ICP-9800

● Analisi Multielemento

- Analisi simultanea di oltre 70 elementi
- Elevata sensibilità (ppb)



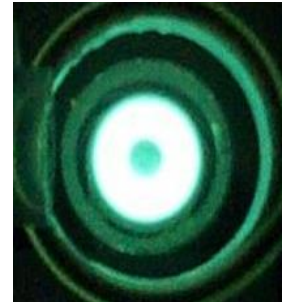
1	2											13	14	15	16	17	18	
1	H																He	
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	* 57-71	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	** 89-103	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Fl	Uup	Lv	Uus	Uuo
6	*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
7	**	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

Below 1 ppb 1 to 10 ppb 10 to 100 ppb 100 ppb and above

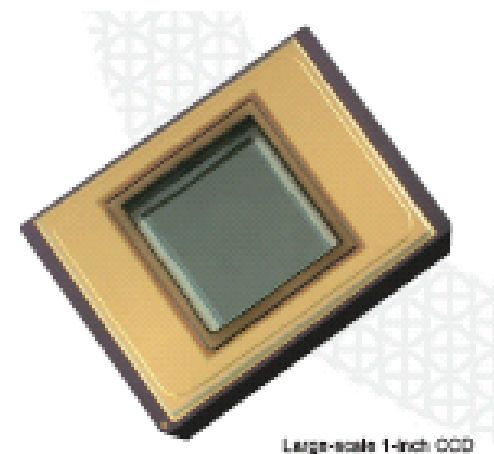
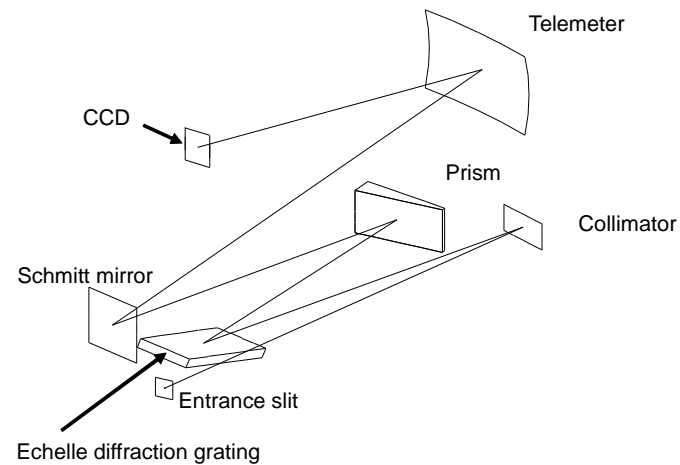


Dual View - Simultaneo

- **Visione Assiale e Radiale**



- **Ottica Echelle e CCD Detector: analisi veloci e simultanee**

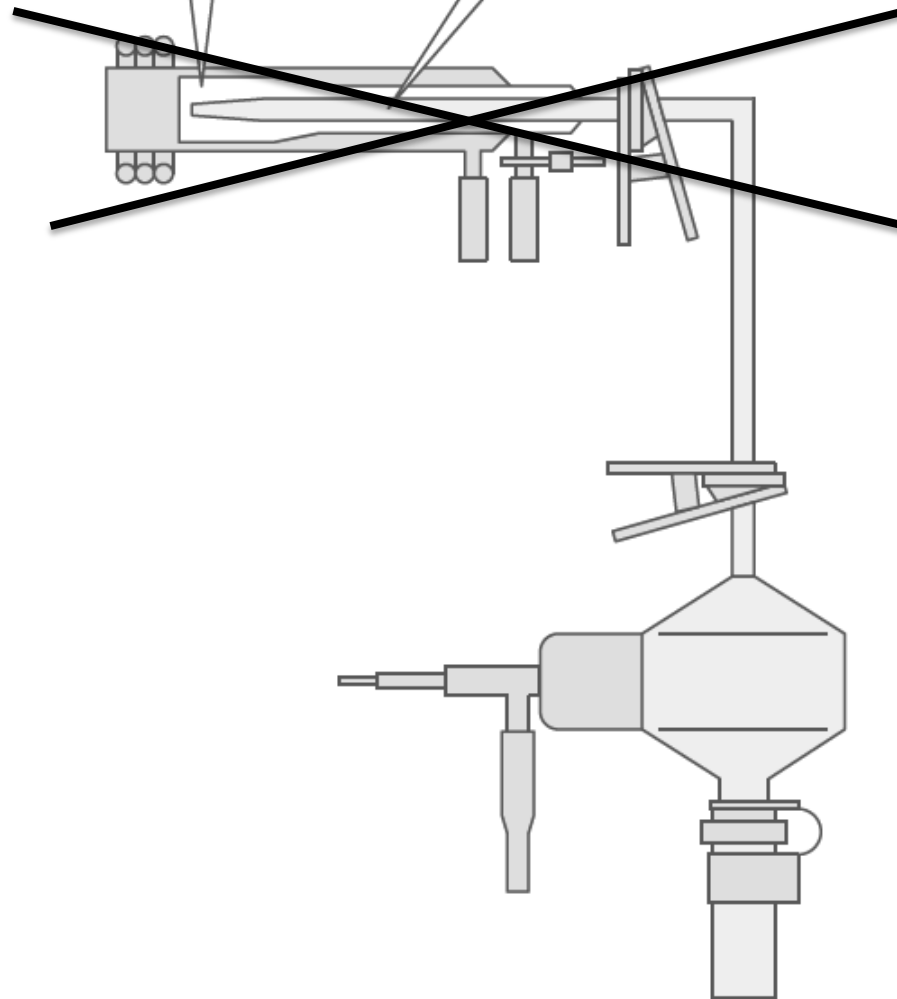
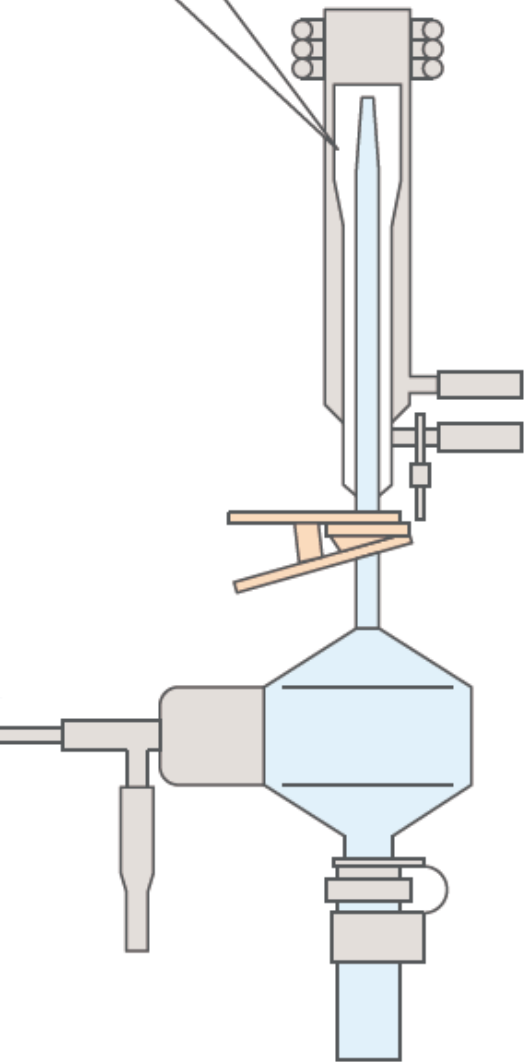


Torcia Verticale

Sample solutions fall naturally by gravity.
→ Analytical elements do not remain.

Salts precipitate.
→ Clogs easily.

Prone to residual sample solution.
→ High analytical element memory effects!



Bassi costi di gestione senza compromessi



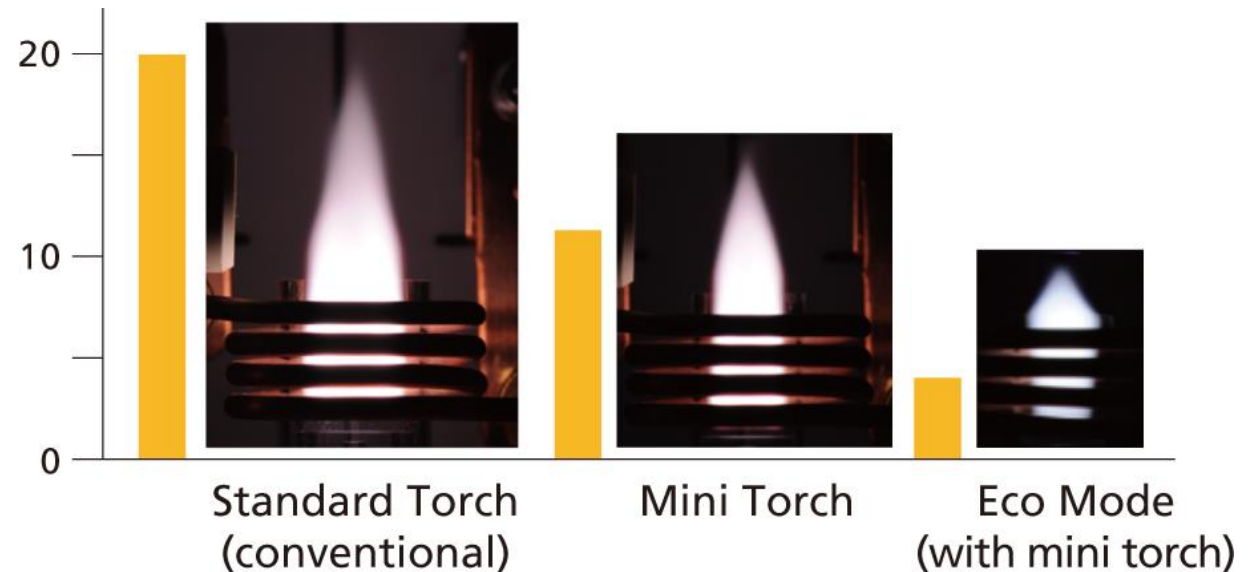
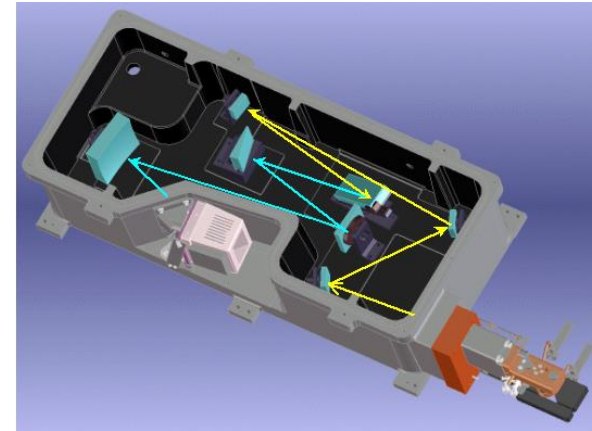
- **Mini torch**
 - 10 L/min Plasma gas
 - - 40% consumo Argon



- **Vacuum Optics**
 - No purge gas



- **Eco Mode**
 - 0,4 kW RF
 - 5 l/min Ar



ICPE-9800 Series Application field

Food Products/ Agriculture

- ▶ Enhanced throughput
- ▶ Optimal methods
- ▶ Reduced operating costs



Environment/ Tap Water/Waste Water

- ▶ Reduced analysis times
- ▶ Superior stability over long periods
- ▶ High sensitivity



Medical/ Pharmaceutical

- ▶ High sensitivity
- ▶ Automatic correction for spectral interference
- ▶ No need for oxygen when introducing organic solvents
- ▶ 21 CFR Part 11 support



Chemicals/ Petrochemicals

- ▶ Stable injection of organic solvent samples and high-salt samples
- ▶ User-friendly software
- ▶ Reduced operating costs



Metals/Mining/ Electrical and Electronic

- ▶ Easy to check for interference from matrix components
- ▶ High accuracy
- ▶ Long-term performance stability

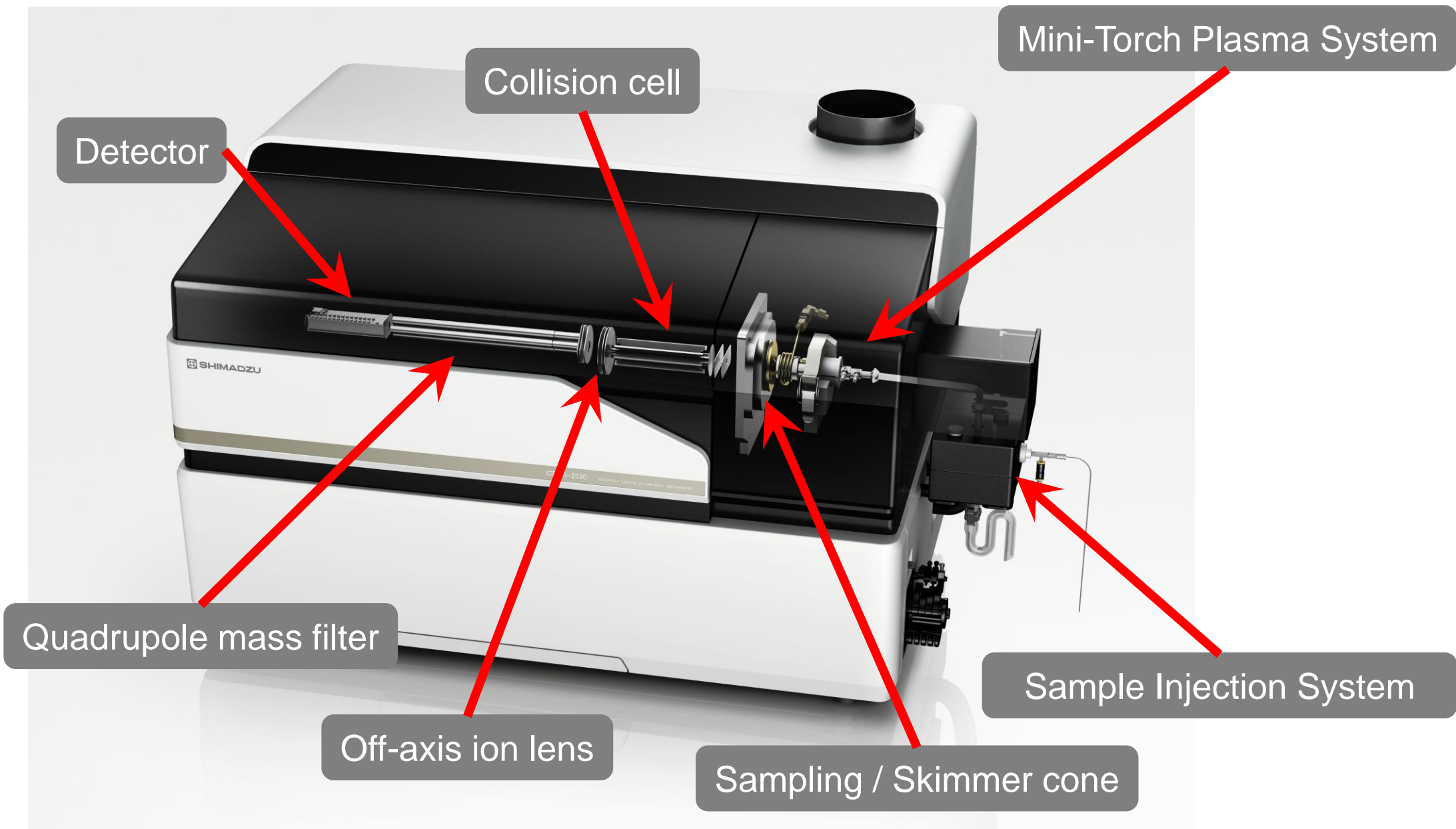


ICPMS-2030



Highest Sensitivity

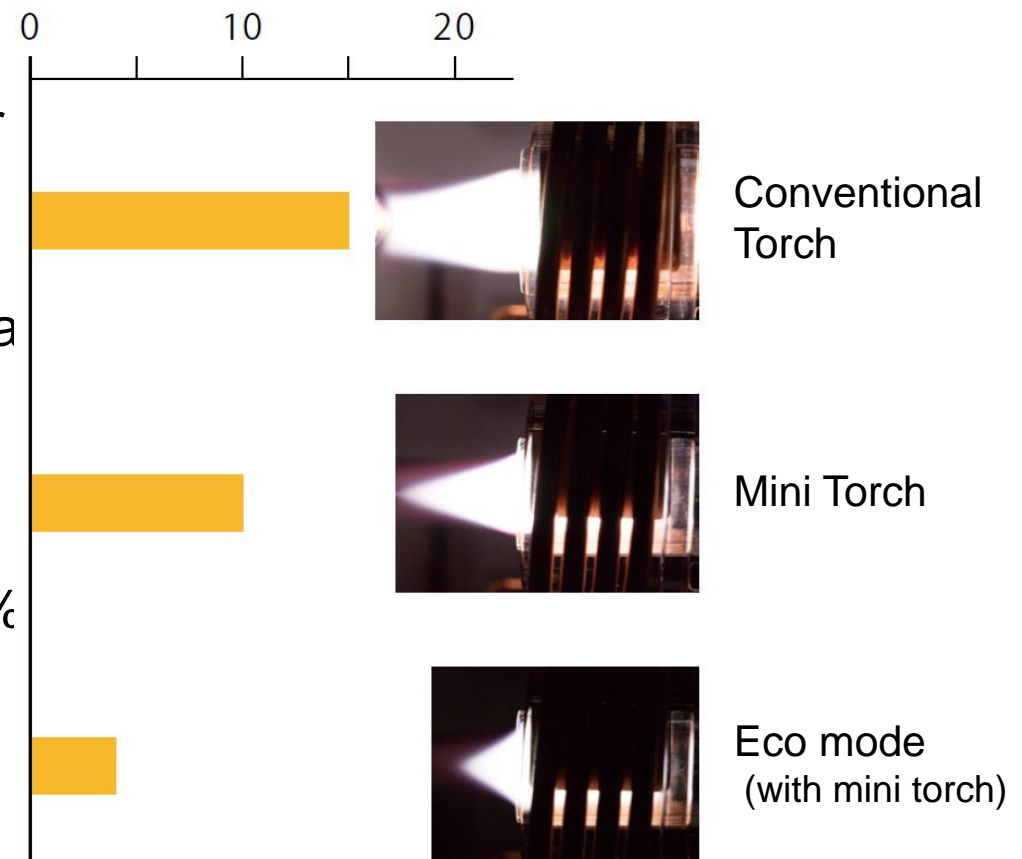
ICPMS-2030



ICPMS-2030 Technology

● Mini-Torch Plasma System

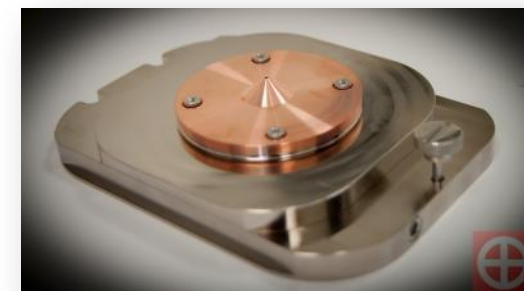
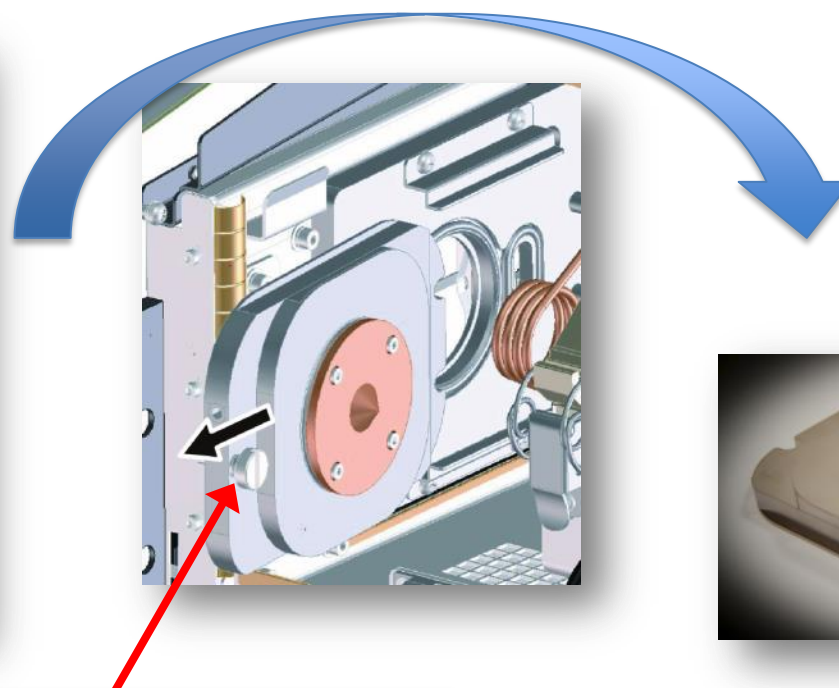
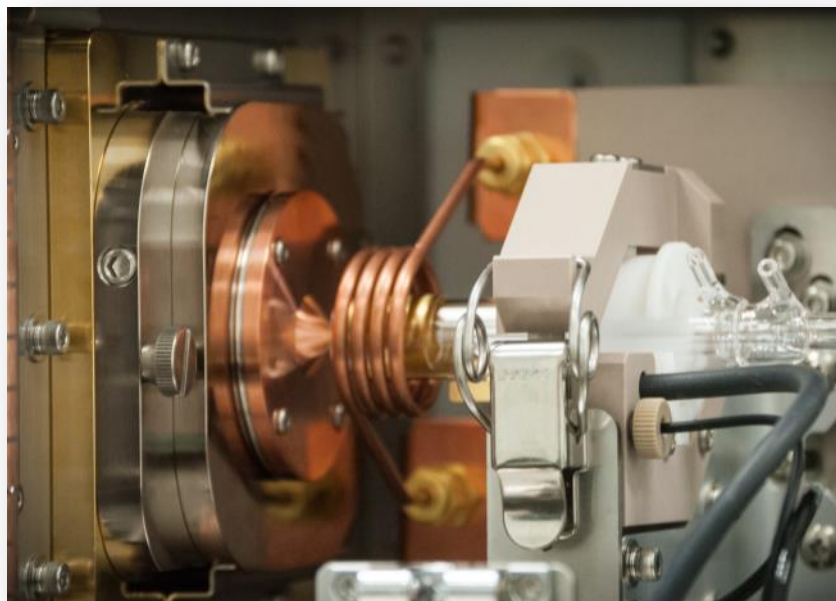
- Mini-torch
 - Consuming two-thirds the argon gas (10 L/min) as conventional plasma torches
- Eco mode
 - The plasma gas flow and power reduced to 5 L/min and 0.5 kW during standby
 - Analysis can be started immediately with no loss of productivity
- Low-Purity Argon Compatible
 - Using argon gas (99.95%)
 - Not require high-purity (99.999% argon gas)



ICPMS-2030 Technology

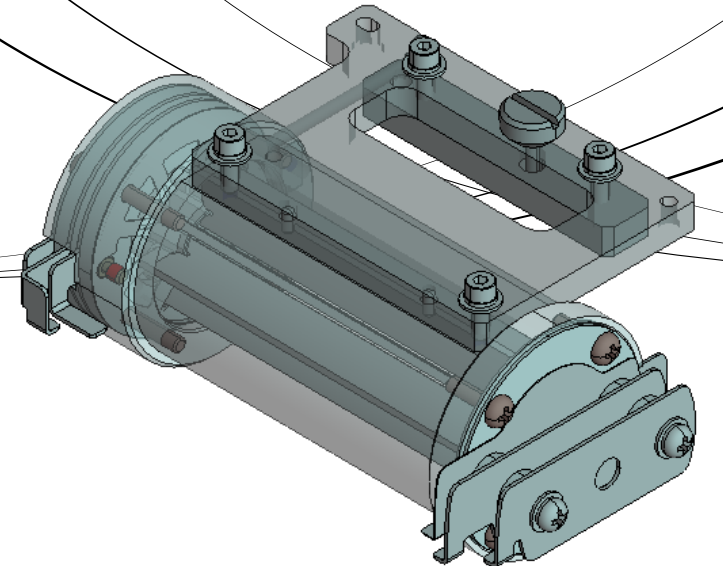
- **Sampling / Skimmer cone**

- Remove the vacuum interface within seconds
 - It can be removed and installed from/to without the need for tools
 - Enables fast and safety cleaning outside the instrument



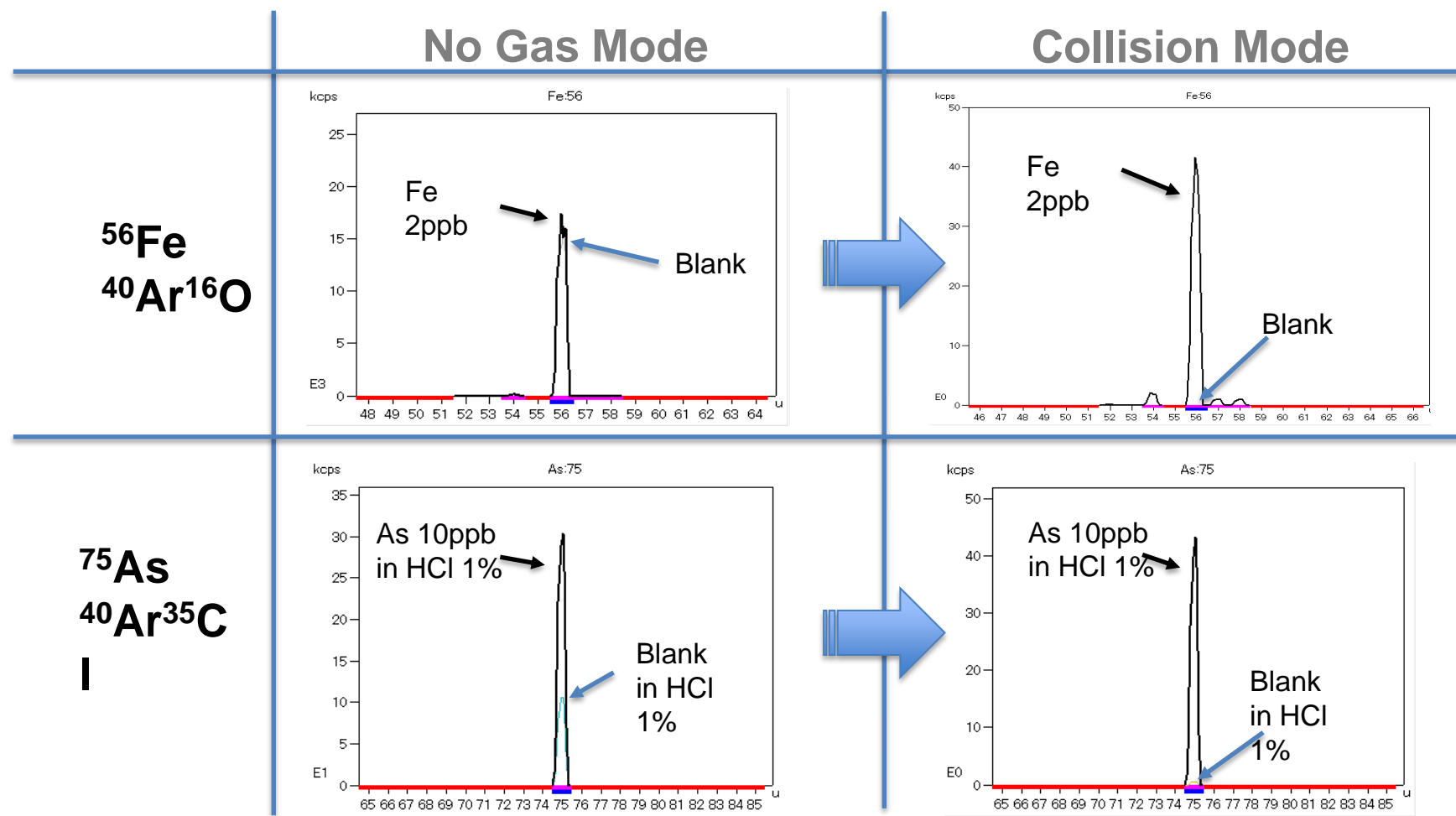
Without the need for tools

ICPMS-2030 Technology



● He Collision Cell

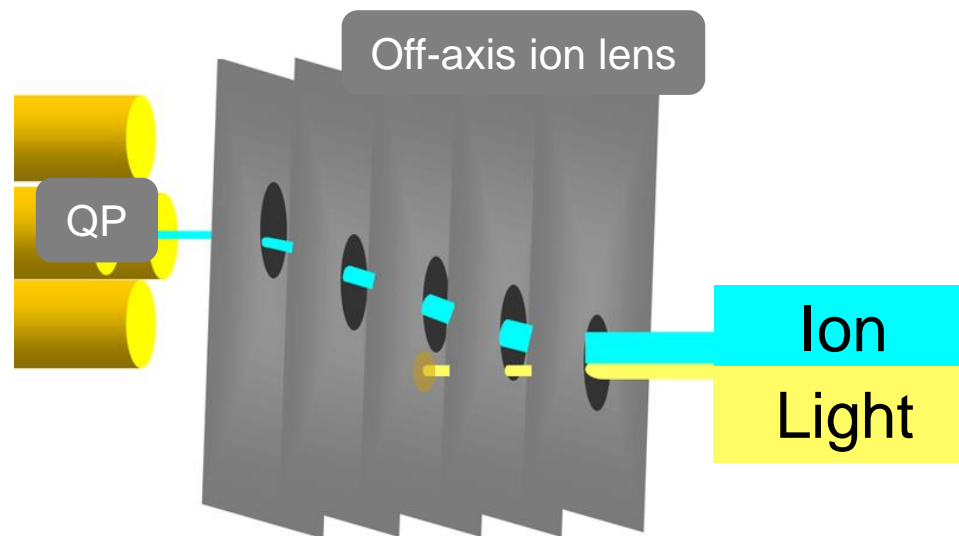
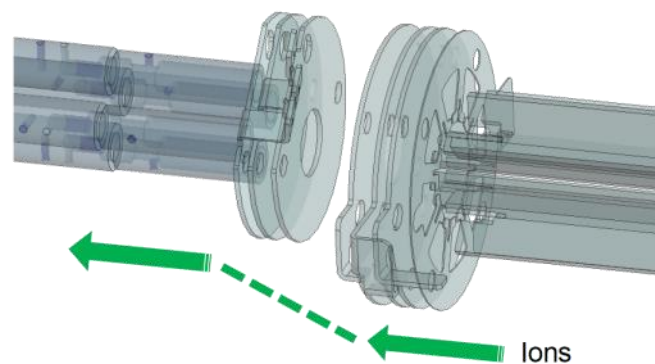
- 0 – 10 ml/min He (typical 5 ml/min)
- Purity $\geq 99.999\%$



ICPMS-2030 Technology

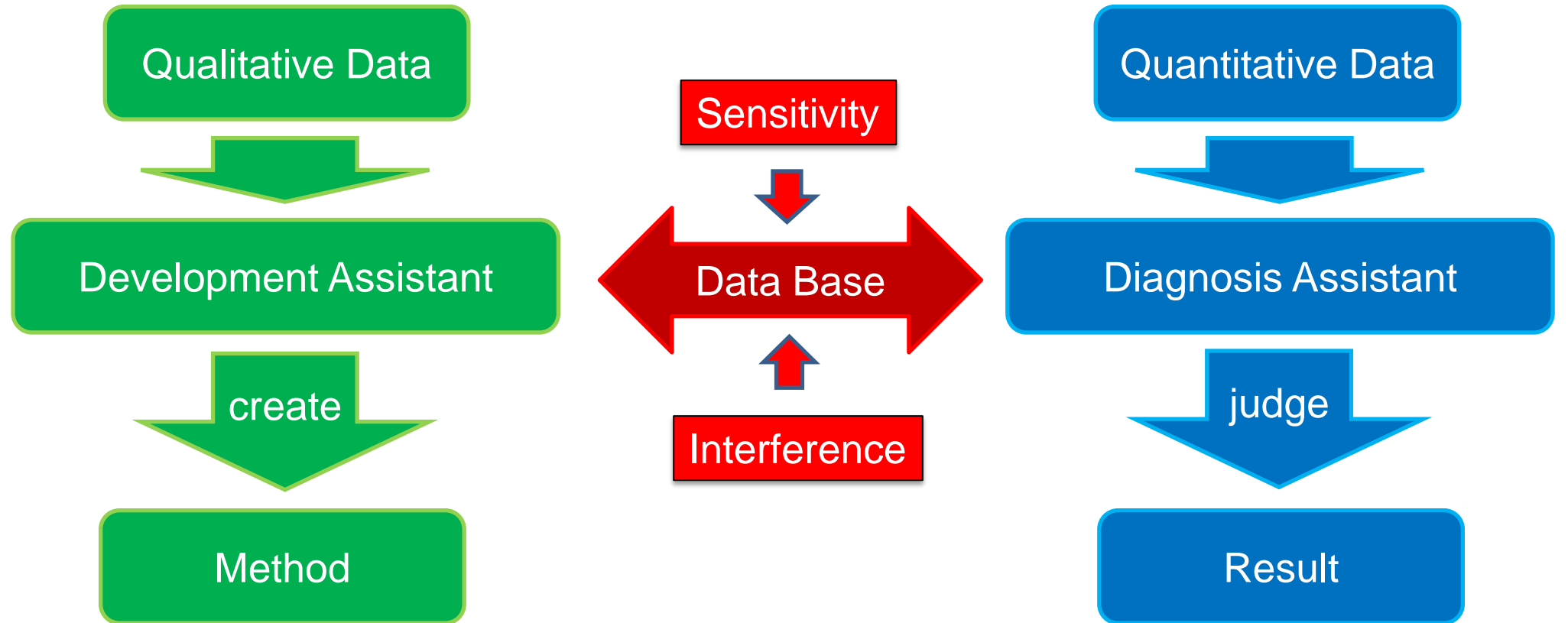
- **Off-Axis Ion lens**

- Ions are separated light and neutral material
- Located behind the collision cell
 - Neutral material is less than front
 - High elemental ion transmission, less collision with neutral materials
 - No contamination – no maintenance



LabSolutions ICPMS

● Assistant Functions



- Analytical mass
- Internal element
- Standard sample concentration

- Interference
- Sensitivity
- Concentration of standers

TOC – L Series



Parametri

TC

TOC

IC

NPOC

POC

TOC = Total Organic Carbon

- Total organic carbon (TOC) is a measure of the carbon content of organic matter presented in different matrix.
- TOC is a measure for the pollution rate of organic impurities in water and waste water

It does not give information of the nature of the organic substance



Il parametro TOC

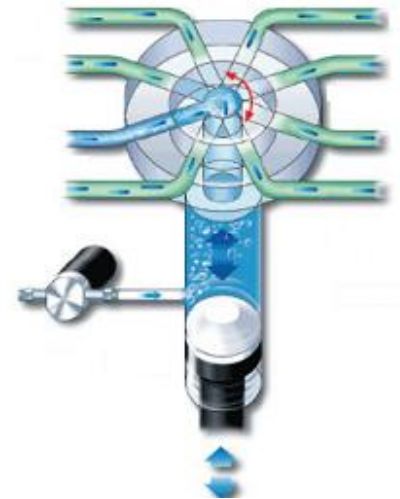
- Parametro aspecifico richiesto nel settore ambientale e nel settore alimentare per il controllo e la caratterizzazione delle acque.
- Nel settore alimentare : acqua potabile (D.lgs nr.31 del 2001)
- Acque di scarico e Acque di mare
- Acque superficiali e di falda
- Controllo sistemi di trattamento e depurazione delle acque
- Rifiuti: liquidi e solidi (Definizione dei criteri di ammissibilità dei rifiuti in discarica. D.M. 03/08/05)

Tecnica di Analisi

- **Combustione catalizzata a 680°C / rivelazione NDIR**
- **Shimadzu ha sviluppato catalizzatori specifici ad alta e bassa sensibilità**
- **Massima efficienza di ossidazione**
(anche per matrici critiche: es. acqua di mare, acidi umici, tensioattivi)
- **Ideale per ogni tipo di applicazione, dalle acque più pure alle acque di scarico**

Sistema di campionamenti e iniezione

- Sistema con valvola a 8 vie e microsiringa (gestione di tutti i fluidi)
- Ampio range di analisi: da 4 ug/l fino a 25.000 mg/l
- Trattamento del campione in siringa
- Permette funzioni quali:
 - diluizione del campione,
 - autodiluizione per over-range,
 - lavaggi,
 - avvinamenti,
 - creazione di curve multipunto da singola soluzione



Da laboratorio . . .



Standalone



PC controlled



Autocampionatore

Modulo SSM per i solidi



TOC-4200 Online



... Grazie