

# Adding Nebulized Aerosol to Laser Ablated Aerosols



## PFA-LS Nebulizers

- Designed to work with laser systems
- 20  $\mu\text{L}/\text{min}$  sample uptake reduces solvent load
- Nebulizer gas flow 0.2 to 0.3 L/min
- Allows higher flow through laser chamber even when nebulized aerosol is added to sample stream

## Dual Quartz Laser Chamber

- Ablated aerosol and nebulized solution mixed together
- Homogenized aerosol produces stable signal
- Large particles removed by cyclonic chamber
- Additional gas port included



# Liquid Calibration of LA-ICP-MS using LS-20 Nebulizer

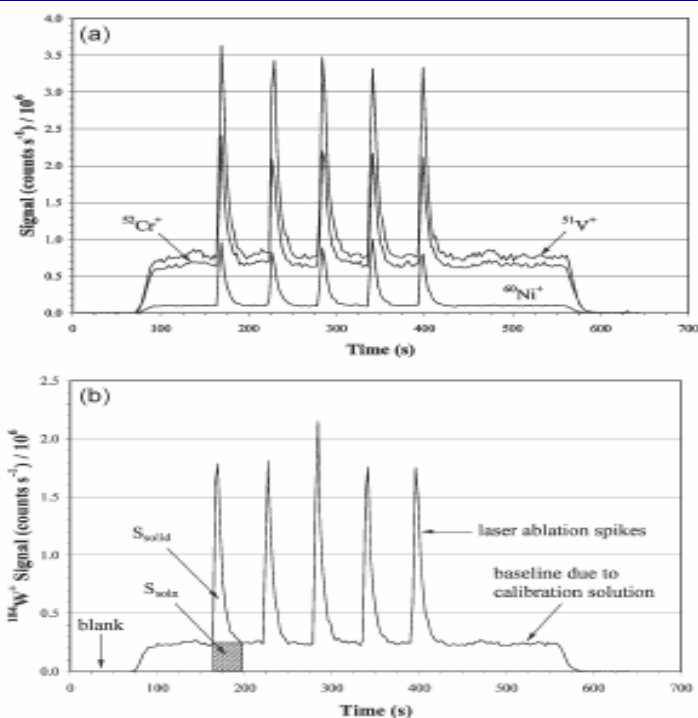


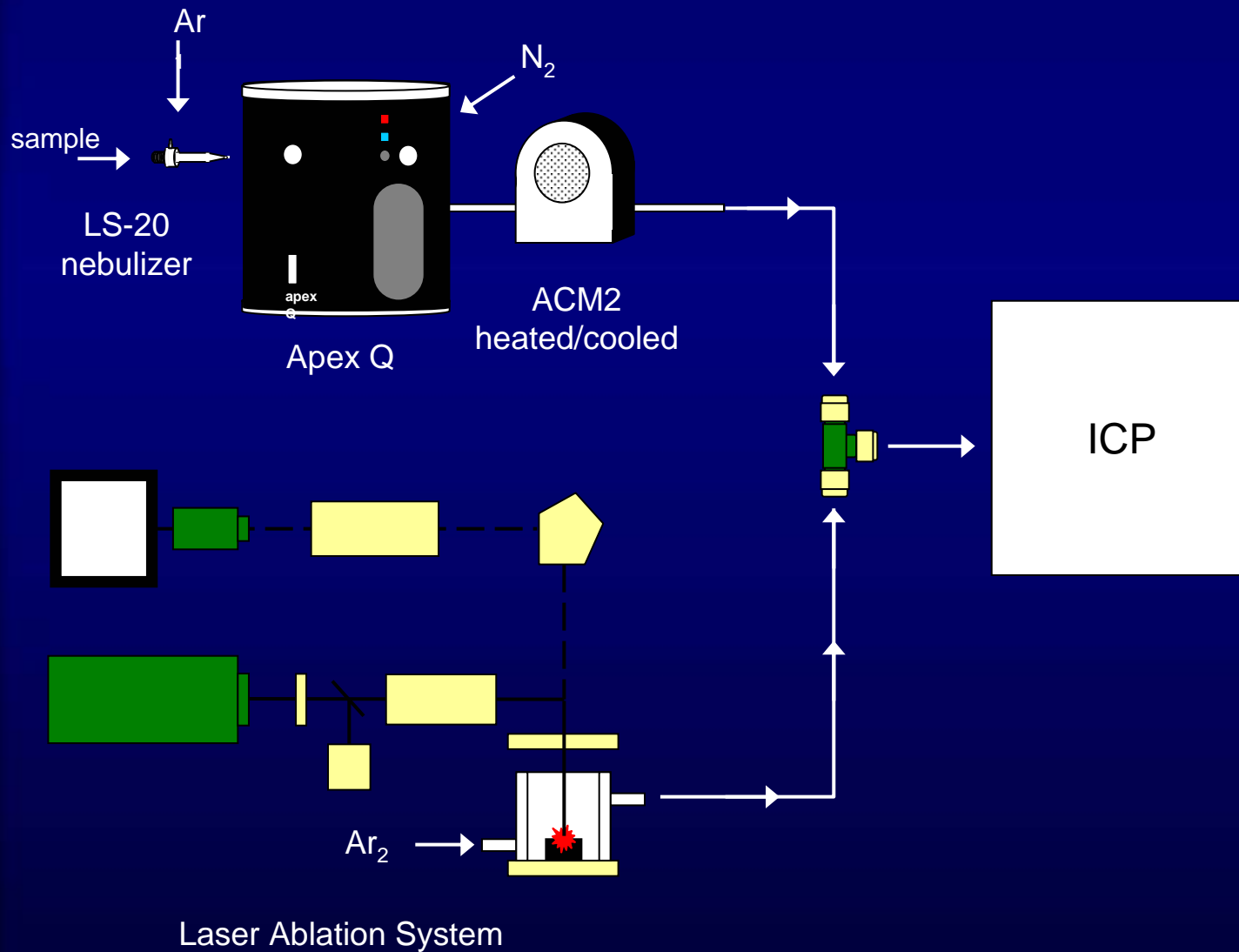
Fig. 2 Signal vs. time profiles for ablation of five localized spots on NIST SRM 1264a steel, 50 laser shots per sample spike; (a)  $^{51}\text{V}^+$ ,  $^{52}\text{Cr}^+$  and  $^{60}\text{Ni}^+$ , (b)  $^{184}\text{W}^+$ . Boxed areas in Fig. 2(b) show signals integrated for calibration procedure. Concentrations in weight percent are V 0.106%, Cr 0.066%, Ni 0.142%, W 0.102%.

	Concentration (ppm)		
	Measured	Certified (information) values	Rel. difference (%)
Mn	40.8 ± 7.9	39.6	3.0
Fe	51.6 ± 6.1	51	1.2
Co	36.0 ± 4.7	35.5	1.4
Ni	39.2 ± 4.7	38.8	1.0
Cu	38.5 ± 6.7	37.7	2.1
Ba	41.6 ± 5.5	(41)	1.5
Nd	36.2 ± 2.6	(36)	0.56
Sm	39.5 ± 4.7	(39)	1.3
Eu	36.5 ± 4.7	(36)	1.4
Dy	35.1 ± 2.5	(35)	0.29
Er	39.3 ± 4.2	(39)	0.77
Tl	15.8 ± 1.6	(15.7)	0.64
Pb	39.2 ± 5.8	38.57	1.6

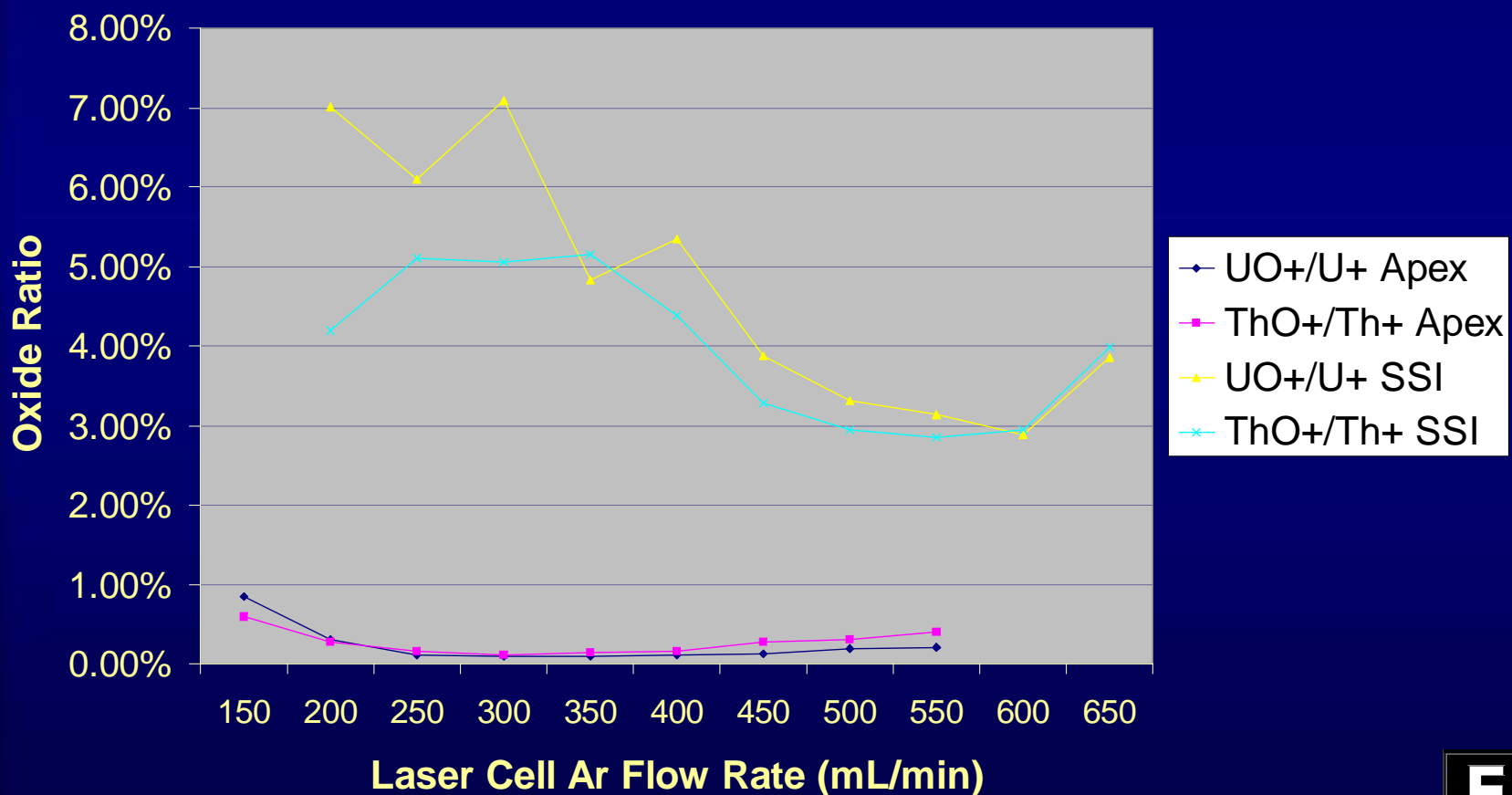
Houk et al, J. Anal. At. Spectrom., 2003, 18, 872-877.



# Schematic of combination of nebulized solution and laser ablated material



# Nebulized Aerosol Addition to Ablated NIST 612 Apex-ACM2 vs. SSI



Guard Electrode On  
H Cones



# Laser Ablation Oxide Levels

	Sensitivity $^{238}\text{U}$	Oxide Levels $\text{UO}^+/\text{U}^+$
Laser + $\text{N}_2$	1914271	0.10%
Laser + LS-20 Laser Chamber + $\text{N}_2$	2154110	4.47%
Laser + LS-20 Apex	2011899	0.10%

Guard Electrode On

H Cones



## Low Flow Nebulizers

- High absolute and relative sensitivity at low flow rates
- Robust for wide variety of samples
- Improved stability through self-aspiration
- High transport efficiency by combining with desolvating inlet system
- Compatible with laser ablation optimization and standardization

