Agilent 1290 Infinity LC with ISET under Waters Empower control – Emulation of Agilent 1100 Series LC

Technical Overview

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Abstract

The Agilent Instrument Control Framework (ICF) enables other LC data acquisition and processing software providers to simplify the development of third-party software control of Agilent LCs. Waters Empower, in combination with Agilent ICF, provides enhanced control functions for all Agilent LCs, for example, the Agilent Intelligent System Emulation Technology (ISET) as implemented in the Agilent 1290 Infinity Binary Pump. ISET harnesses the wide power range and the superior accuracy and performance of the Agilent 1290 Infinity Binary LC to emulate other systems for seamless transfer of methods between LCs, regardless of brand. It makes the Agilent 1290 Infinity Binary LC the world's first truly universal LC system as it can execute methods from other HPLC and UHPLC instruments and deliver the same chromatographic results without any change of the instrument or the original method.

This Technical Overview demonstrates that methods from an Agilent 1100 Series Quaternary LC can easily be transferred to an Agilent 1290 Infinity LC System using ISET within the Waters Empower environment.

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Introduction

Many labs must reduce costs, limit training time, and simplify regulatory compliance. The implementation of a single vendor's chromatographic data system throughout the lab is one way to accomplish these goals. If a lab is standardized on a non-Agilent data system, it can still use its favorite Agilent LCs. To achieve this, the software provider can take advantage of the Agilent Instrument Control Framework (ICF), which accelerates and simplifies the development effort for third-party software control of Agilent LCs. Using this tool, special 1290 Infinity Binary Pump implementations such as ISET become available in non-Agilent data systems.

The 1290 Infinity Binary LC with ISET[1] enables seamless LC method transfer without changing the original method by the user by adding isocratic steps, for example. Legacy methods can run unchanged, and the user can still take full advantage of the UHPLC speed, resolution, and sensitivity of the 1290 Infinity Binary LC if new validated methods are transferred to any other department. Method development labs are able to speed up their method development with UHPLC performance and then fine tune the new method by emulating the target system, and be confident that the method will run as intended.

This Technical Overview shows:

- How to set up ISET within the Empower software
- Method transfer from an Agilent 1100 Quaternary LC to an Agilent 1290 Infinity Binary LC with ISET under Empower
- Performance results, such as agreement of retention times and resolution

Experimental

Prerequisites for the Combination of Empower and ICF

- All Agilent LC modules must have minimum firmware version, see http://www.chem.agilent.com/en-US/Products-Services/Instruments-Systems/Liquid-Chromatography/pages/specificationsicf.aspx
- ICF version A.02.01
- Empower 2, feature release 3 or higher or Empower 3 software
- Windows XP with service pack 3 or higher

Instrumentation

	Agilent 1100 Series Quaternary LC	Agilent 1290 Infinity Binary LC with ISET
Module	Product number	Product number
Pump	G1311A	G4220A
Autosampler	G1313A	G4226A
Thermostat	--	G1330B
Column compartment	G1316A	G1316C
Detector	G1315B	G4212A

Chromatographic conditions	
Compound	Uracil, phenol, methyl-, ethyl-, propyl-, butyl- and heptylparaben, Sigma sample: HPLC Gradient System Diagnostic Mix, Order No 48271
Column	Agilent ZORBAX SB C18, 4.6 × 150 mm, 5 µm (p/n 7995218-595)
Mobile phases	Water/Acetonitrile
Gradient	20% to 95% in 10 minutes
Flow rate	1 mL/min
Stop time	12 minutes
Post time	5 minutes
Column temperature	30 °C
Injection volume	5 µL
DAD	250/10 nm Ref. 360/100 nm, 10 Hz

Results and Discussion

Parameter Screen for ISET within the Waters Empower Software

Having configured the 1290 Infinity Binary LC in Waters Empower configuration screens, the user interface for controlling the 1290 Infinity Binary LC occurs in the *RUN SAMPLE* screen, see Figure 1.

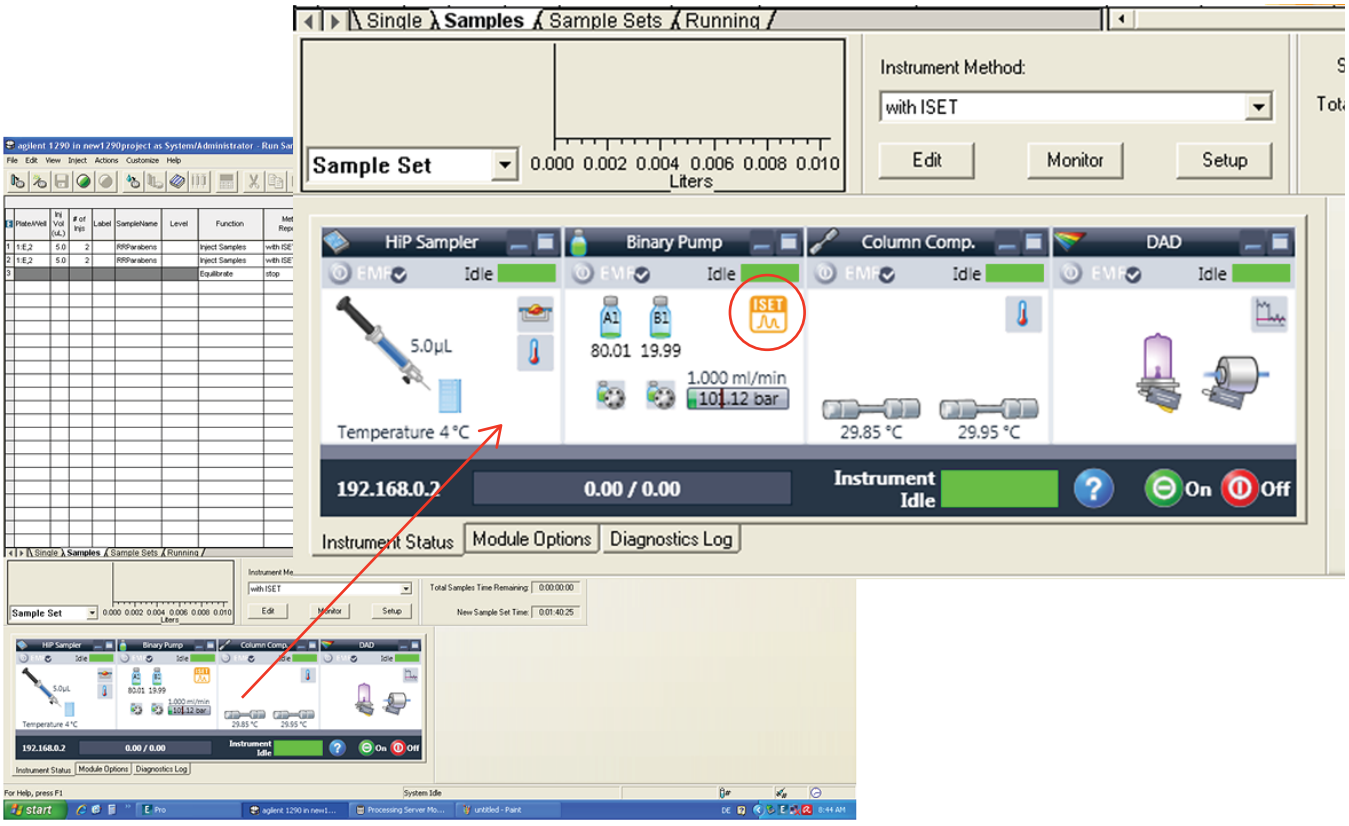

Figure 1. User interface for the Agilent 1290 Infinity Binary LC within Waters Empower, ISET is activated.

Figure 2 shows the method screen of the 1290 Infinity Binary Pump with the ISET part. Chromatographic conditions are set up using *Edit Method*. To initiate ISET, *Enable ISET* has to be selected. In this screen it is mandatory that the correct product number for the originally used pump and autosampler, which should be emulated by the 1290 Infinity Binary LC, is filled in. All other method parameters are filled in with the values, like flow rate and gradient time table from the original method. The agreement between the original chromatogram and the chromatogram received from the 1290 Infinity Binary LC with ISET can be further optimized using the fine tuning option.

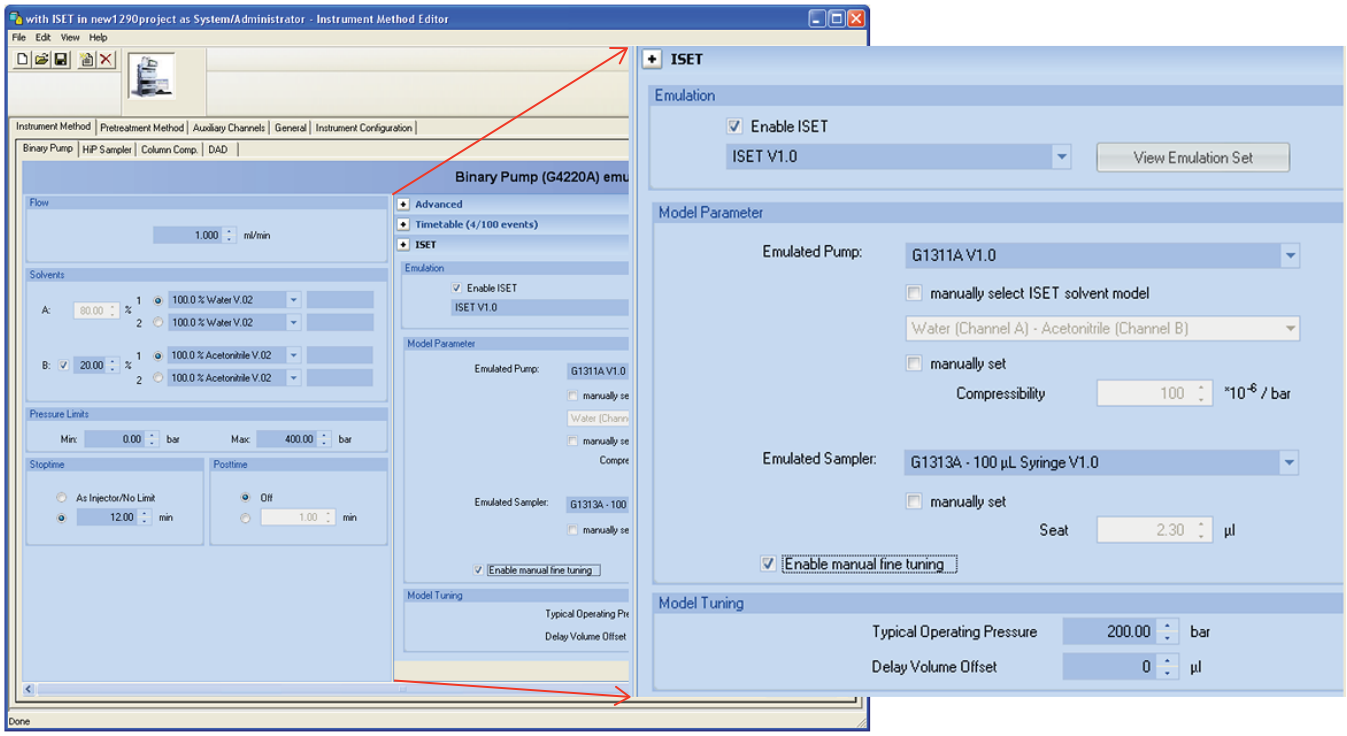

Figure 2. Pump method screen with ISET part enabled within Waters Empower.

Method Transfer from Agilent 1100 Series Quaternary LC System

The method transfer from a conventional HPLC to a UHPLC system is in general problematic due to the significant lower delay and transition volumes of the UHPLC systems.

To overcome this problem two solutions are typically used. Either an isocratic step is used at the beginning of the gradient or the delay volume is increased by adding additional tubing. Both methods can only compensate the smaller delay volume but not the overall gradient behavior (transition volume, mixing performance) over the complete gradient and run time.

The method applied onto the 1100 Series Quaternary LC included a conventional 4.6 × 150 column packed with 5-µm particles. The gradient started with 20% organic going to 95% organic in 10 minutes. The total run time was 12 minutes and the post time was 5 minutes. This conventional method was applied to the 1290 Infinity Binary LC with and without enabling ISET and finally using the fine tuning parameters in addition. The resulting chromatograms are overlaid in Figure 3.

	Visible	Project Name	Vial	Injection	SampleName	Sample Type	Result Codes	Faults	Date Acquired	Acq Method Set	Injection Volume (uL)	Date Processed	Processing Method	Processed As	Processed
1	☑	new1290project	1	1	Parabens	Unknown		☐	9/6/2011 6:12:07 PM	Import	0.00	9/6/2011 6:12:07 PM			
2	☑	new1290project	1:E,2	2	EMPParabens fine	Unknown		☐	3/25/2013 11:28:08 AM CET	with ISET with fine2	5.00	3/25/2013 11:55:07 AM CET	isetfineProcess	Unknown	System/Admin
3	☑	new1290project	1:E,2	1	EMPParabens ISET	Unknown		☐	3/25/2013 12:22:37 PM CET	with ISET	5.00	3/25/2013 12:43:47 PM CET	ISET_process2	Unknown	System/Admin
4	☑	new1290project	1:E,2	1	EMPParabens no ISET	Unknown	I18	☐	3/25/2013 1:34:54 PM CET	no ISET	5.00	3/25/2013 1:47:07 PM CET	NoIsetProcess	Unknown	System/Admin

Figure 3. Overlay of chromatograms applied to an Agilent 1100 Series Quaternary system, to an Agilent 1290 Infinity Binary LC without ISET, to an Agilent 1290 Infinity Binary LC with ISET and to an Agilent 1290 Infinity Binary LC with ISET and fine tuning.

Without ISET all peaks were shifted to lower retention times and also the resolution had changed. Using ISET the agreement for retention times fit already very well to the original chromatogram. A possibility to further improve the agreement was to use the *Enable manual fine tuning* option. Filling in a reduced volume of 300 µL resulted in an optimum agreement with the original chromatogram. In Figure 4 the results comparing the deviation for retention times from the 1100 Series LC results are summarized. Enabling the fine tuning options the deviation of retention times was < ±0.3%. The allowed limit for the deviation of retention times is ±5%. Without enabling the fine tuning option the deviation of retention times was < +3.8%. Without ISET the retention times shifted to lower elution times and the maximum deviation was –13%

The results for the resolution are summarized in Figure 5. Typically the resolution had improved for all peaks especially if ISET or ISET with fine tuning was used. A deviation of < –5% is specified.

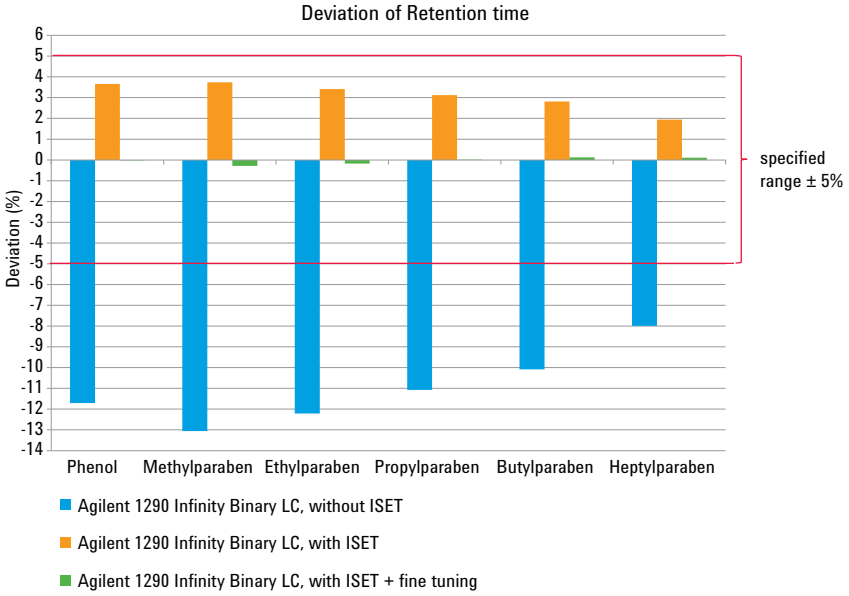

Figure 4. Deviation of retention times compared to Agilent 1100 Series LC results with and without ISET and with ISET plus fine tuning.

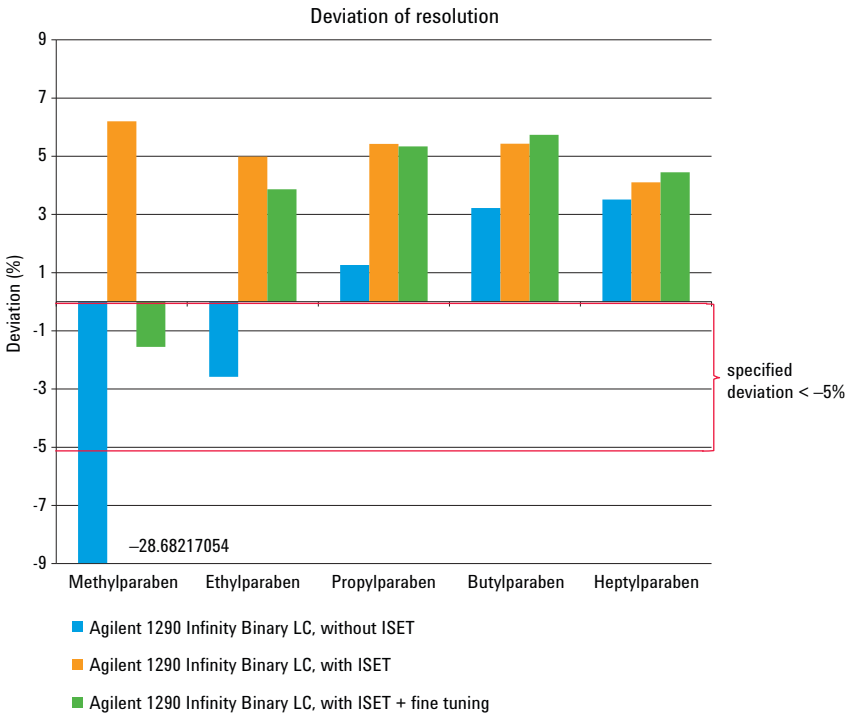

Figure 5. Deviation of resolution compared to Agilent 1100 Series LC results with and without ISET and with ISET plus fine tuning.

Conclusion

The Instrument Control Framework (ICF) is a software component, making it faster and easier for third party software providers to enable and control Agilent Liquid Chromatography (LC) systems in Chromatographic Data Systems or Workstations. In our example the new ICF software was used to control the Agilent 1290 Infinity Binary LC in combination with Waters Empower software enabling special 1290 Infinity Binary Pump functions like the Intelligent System Emulation Technology (ISET).

The 1290 Infinity Binary LC together with Intelligent System Emulation Technology (ISET) allows users to:

- Emulate other (U)HPLC instruments by a simple mouse click
- Run existing (U)HPLC methods without modifying method or system
- Deliver same retention times and peak resolution for infinitely better method transfer
- A conventional LC method developed on an Agilent 1100 Series Quaternary LC was transferred to an Agilent 1290 Infinity LC System using the ISET function within the Waters Empower environment. The resulting chromatograms agreed approximately 100%.

Refrence

1. "Agilent 1290 Infinity LC with Intelligent System Emulation Technology", Agilent Brochure, Publication Number 5990-8670EN, **2011.**

www.agilent.com/chem/ISET

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