



ACQUITY I-Class Overview



Rev. 2.0

1/26/2011



Global Training
& Development

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ACQUITY UPLC I-Class Attributes - Meaningful Impact



Pinnacle of
Chromatographic
performance

Robust, proven
performance built
on 7 years of user-
based design
innovation

I-Class delivers
the highest
throughput without
compromising
performance

Seamless transfer
of existing UPLC
methods



I-Class is designed
to optimize the
performance of any
Mass Spectrometer

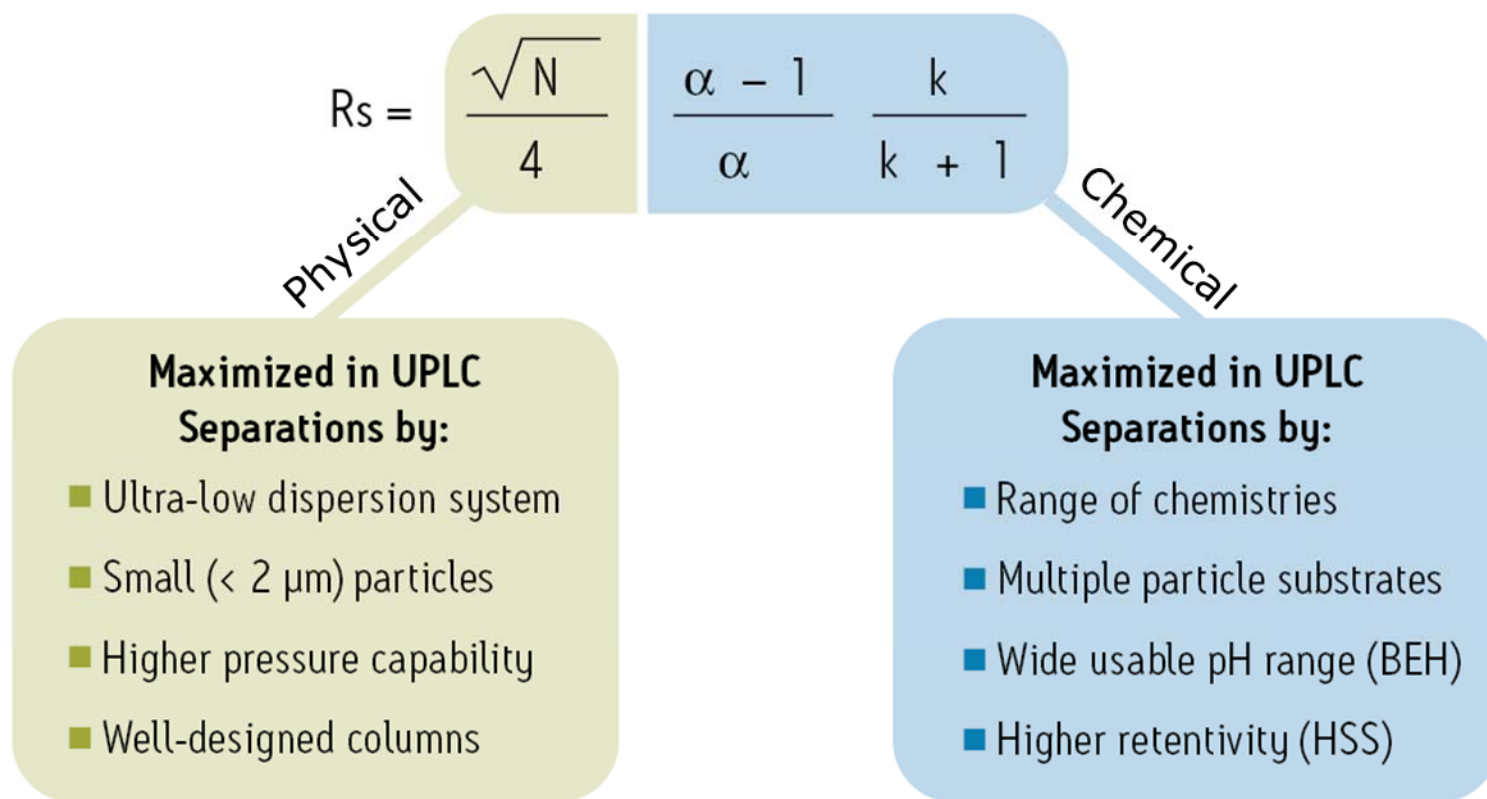
Naming Convention



- Reinforces that each ACQUITY UPLC Family member has a unique feature set - “built for purpose” to address specific user needs
- The name support the expansion of the brand...
- ...introducing ACQUITY UPLC I-Class
 - *Inlet*
 - *Innovative*
 - *Investigative*



Resolution Management is Critical in UPLC



Instrument factors

Instrument Contribution to Extra-Column Effects



$$\sigma_{v,total}^2 = \sigma_{v,injector}^2 + \sigma_{v,precolumn}^2 + \sigma_{v,column}^2 + \sigma_{v,postcolumn}^2 + \sigma_{v,detector}^2 + \tau_{detector}^2 \cdot F^2$$

Injection
volume
+
injector
band-
spreading

Tubing
between
injector
and
column

Column
volume
+
frits

Tubing
between
column
and
detector

Band-
spreading
inside the
detector
cell
+
tubing

Time-based
Band-
spreading
in the
Detector
(Sampling
Rate; Time
Constant)

- Engineering developments have specifically improved dispersion
 - Injector, fittings, flow path, sealing surfaces
 - Reduced tubing volumes
 - Improved flow cell dispersion

Tubing Size, $\mu\text{L}/\text{foot}$ and Usage



Transfer lines from pump to autosampler
(250 μL per foot)



0.040" ID

Transfer lines and pump plumbing
(0.020" ID - 62 μL per foot)



0.020" ID

Transfer lines from pump, injector, column,
detector and outlet of detector if appropriate
(0.009" ID - 12 μL per foot)



0.009" ID

Narrowbore systems
(0.005" ID - 3.5 μL per foot)



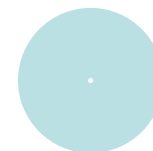
0.005" ID

H-Class system APH
(0.004" ID - 2.5 μL per foot)



0.004" ID

I-Class system APH
(0.003" ID - 1.3 μL per foot)



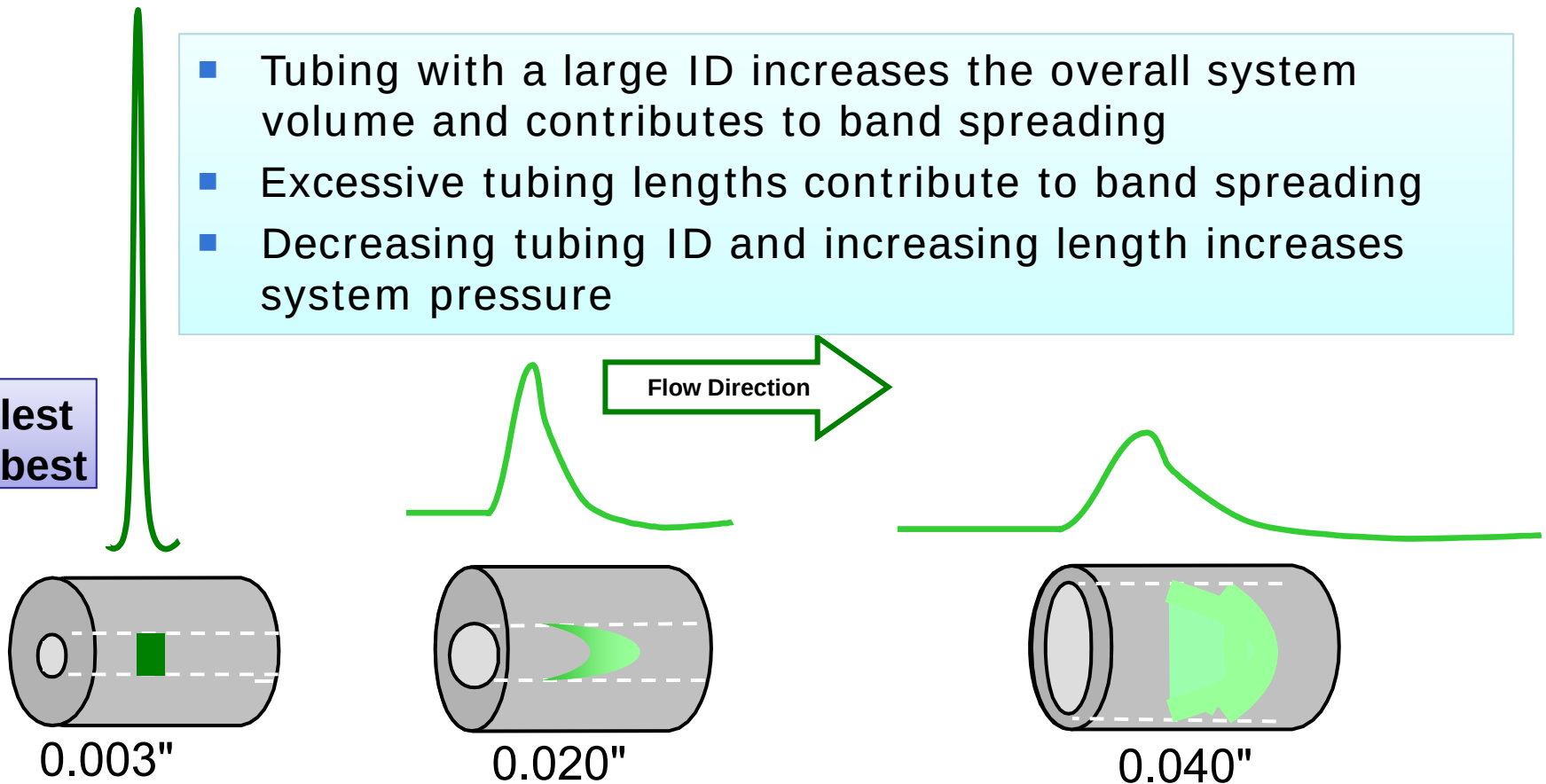
0.003" ID

System Band Spreading: Effect of Tubing ID and Length

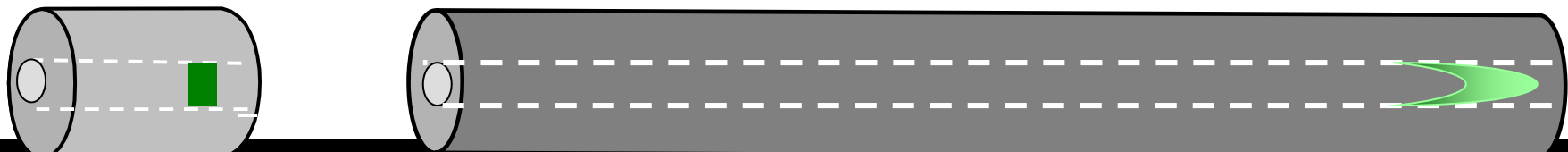


- Tubing with a large ID increases the overall system volume and contributes to band spreading
- Excessive tubing lengths contribute to band spreading
- Decreasing tubing ID and increasing length increases system pressure

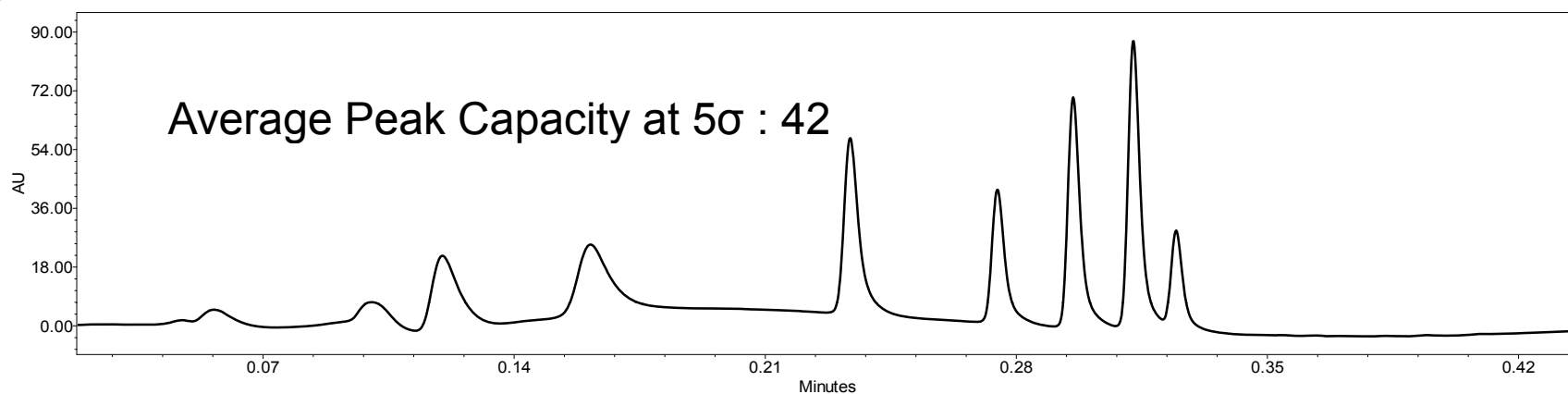
Smallest ID is best



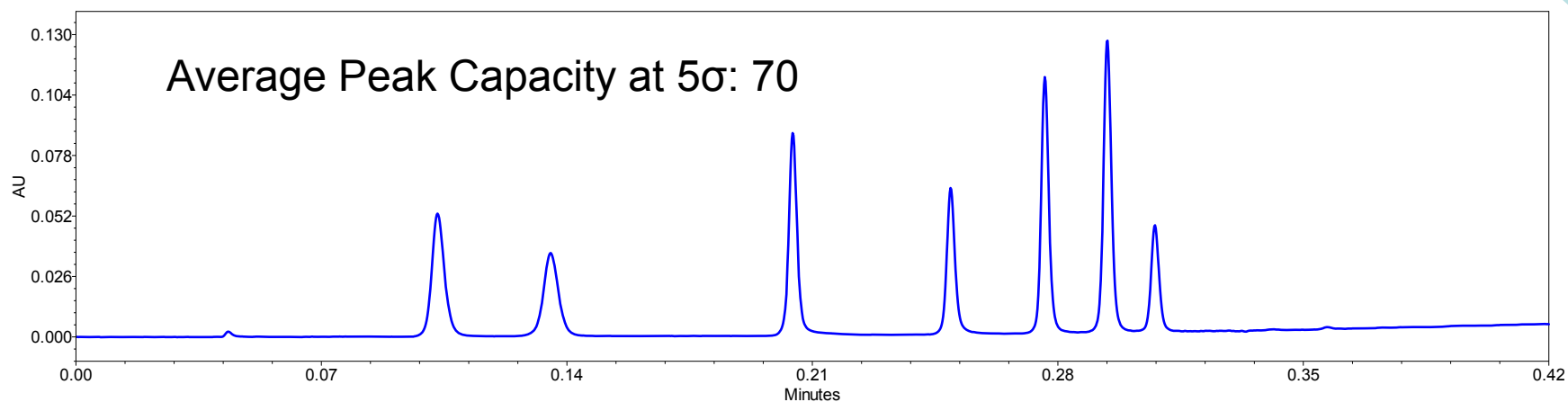
Shortest length is best



Lower Dispersion I-Class versus Competitor

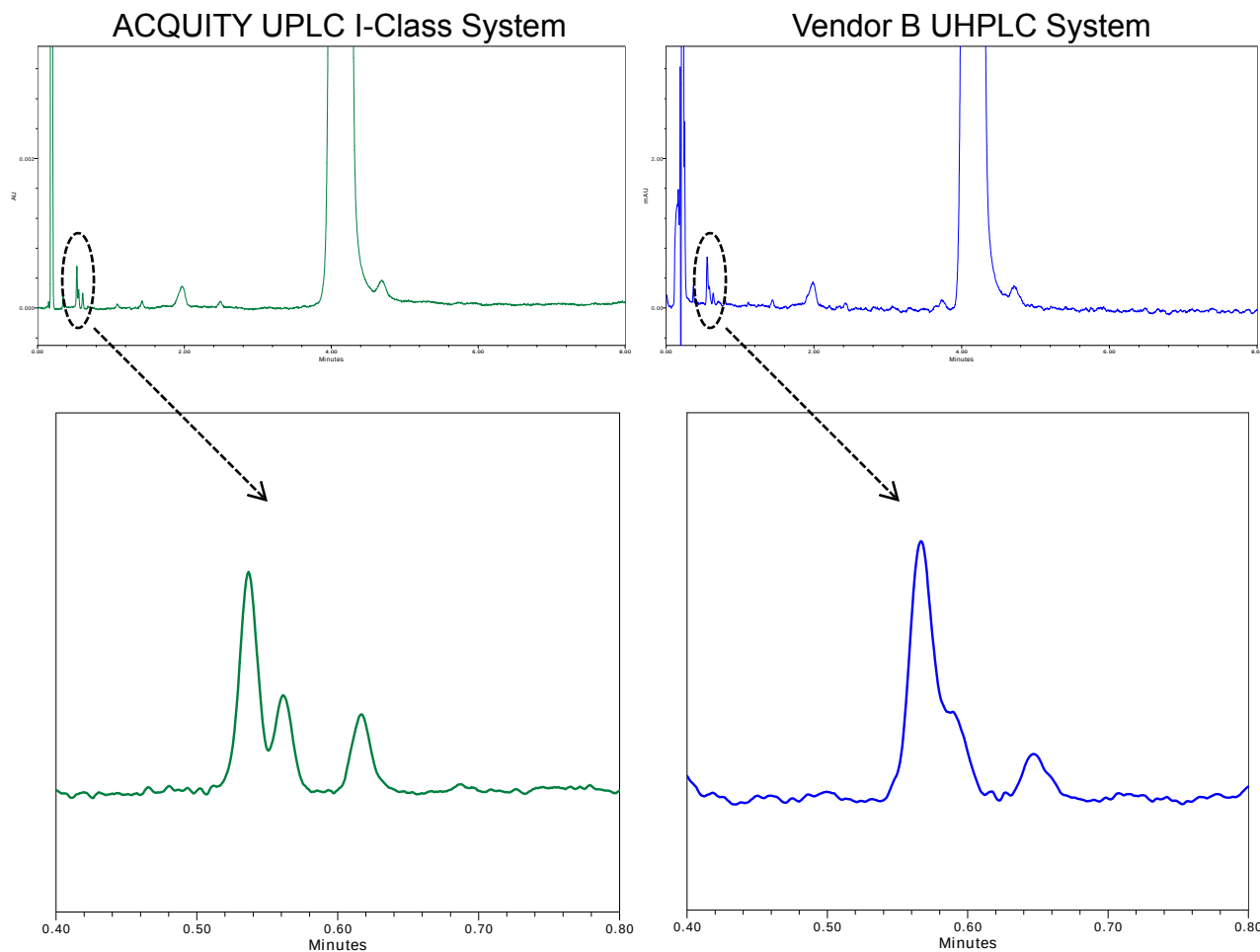


Competitive UHPLC System: 21 μ L extra column band spread



ACQUITY UPLC I-Class: 5 μ L extra column band spread

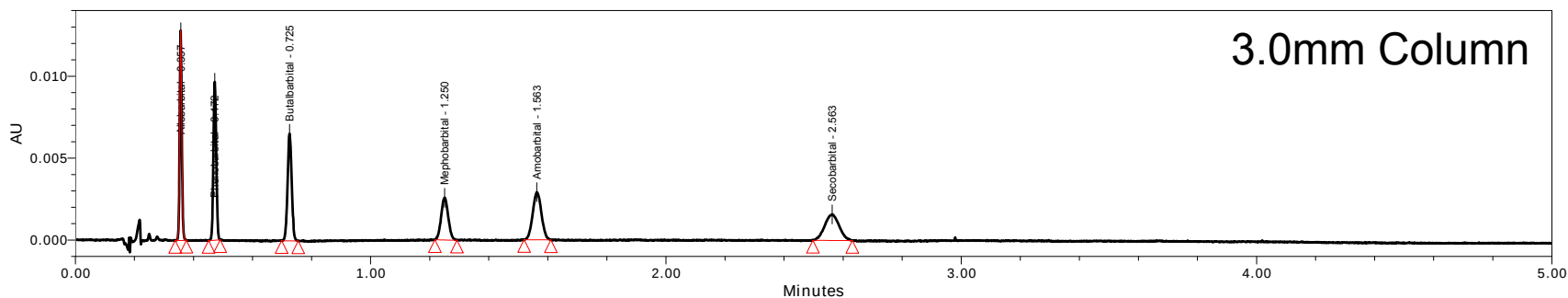
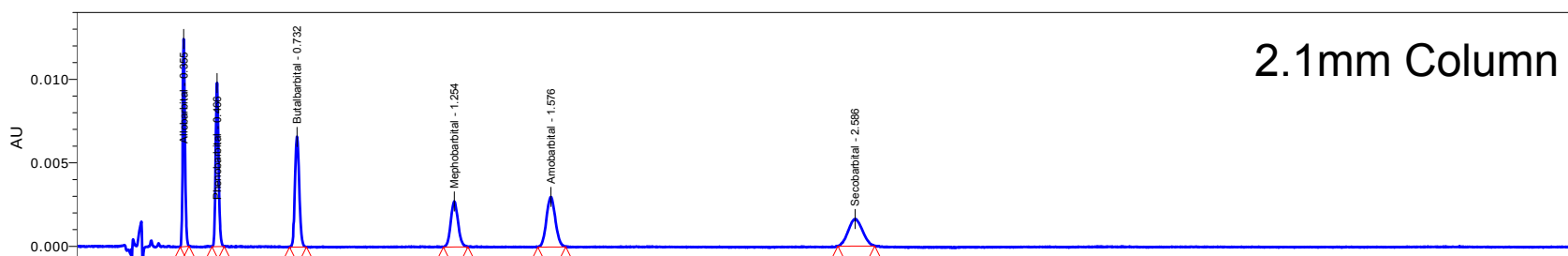
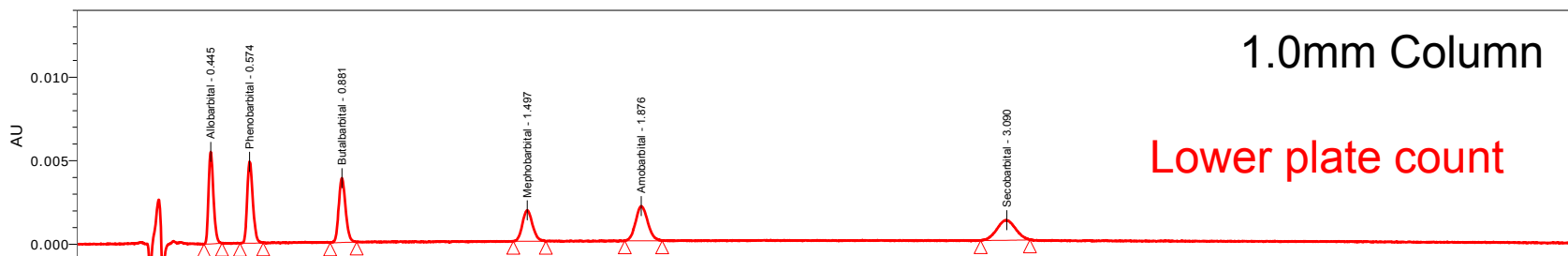
Improved Dispersion



Resolution and sensitivity is improved

Isocratic Separation of Tetracaine and Impurities

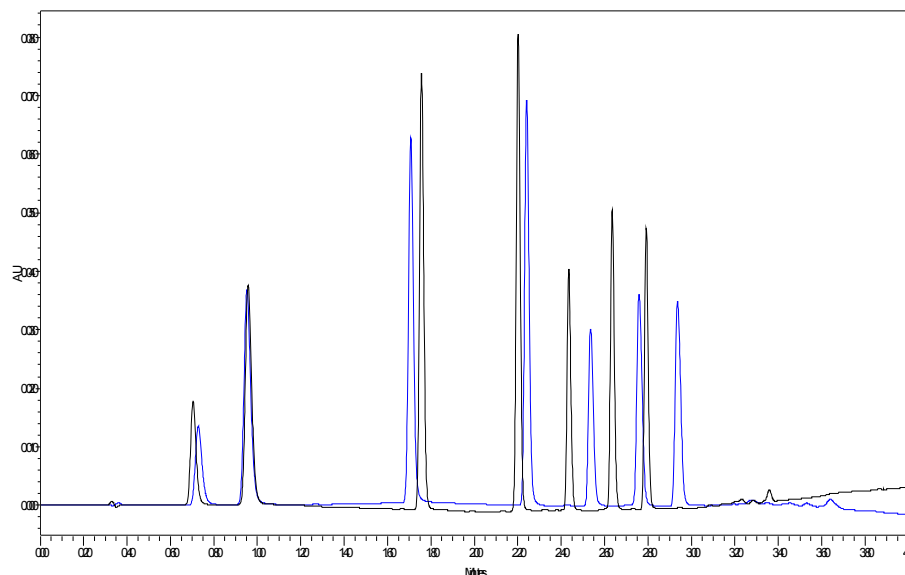
Comparing 3.0mm, 2.1mm, and 1.0mm Columns



Isocratic Elution of Barbiturates
2.1 x 50mm BEH C₁₈ 1.7μm

Peak Capacity Measurements: 1.0 mm ID Columns

Waters
THE SCIENCE OF WHAT'S POSSIBLE.™



CPSM-FL in black FTN in blue

Compound	FTN 5 Sigma PW (min.)	FTN 5 Sigma Peak Cap.	FL 5 Sigma PW (min.)	FL 5 Sigma Peak Cap.
2-acetylfuran	0.0768	36.2	0.0612	45.1
acetanilide	0.0776	35.8	0.0718	38.6
acetophenone	0.0557	49.4	0.0454	60.5
propiophenone	0.0506	54.3	0.0418	65.6
butylparaben	0.0512	53.8	0.0407	67.3
benzophenone	0.0560	49.2	0.0430	63.8
valerophenone	0.0581	47.5	0.0417	65.8



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PW = peak width

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I-Class BSM

Technology Overview

ACQUITY UPLC I-Class System Binary Solvent Manager



- What's New?
 - 18,000 psi pressure envelope
 - Hardware to support 18,000 psi
 - Heads
 - High pressure seals
 - Seal wash housings
 - Vent valve
 - Mixers (50, 100, and 380 μ L)
 - Gold gasket check valves standard
 - Some tubing changed to MP35N
 - Transducers
 - THF/Hexane kit available



ACQUITY UPLC I-Class BSM

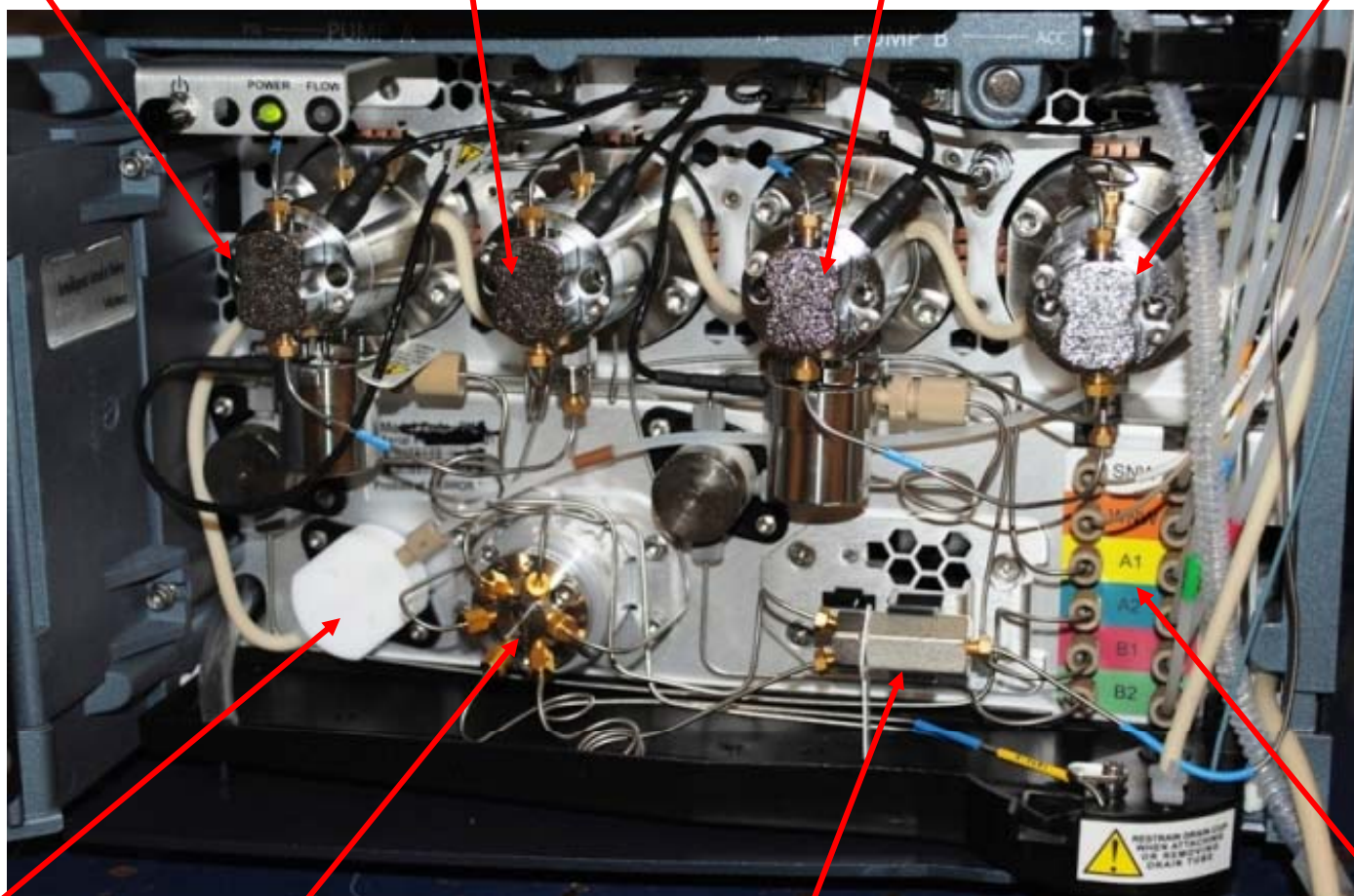


Pump A- Primary Head

Pump A- Accumulator Head

Pump B- Primary Head

Pump B- Accumulator Head



Seal Wash Pump

Vent Valve

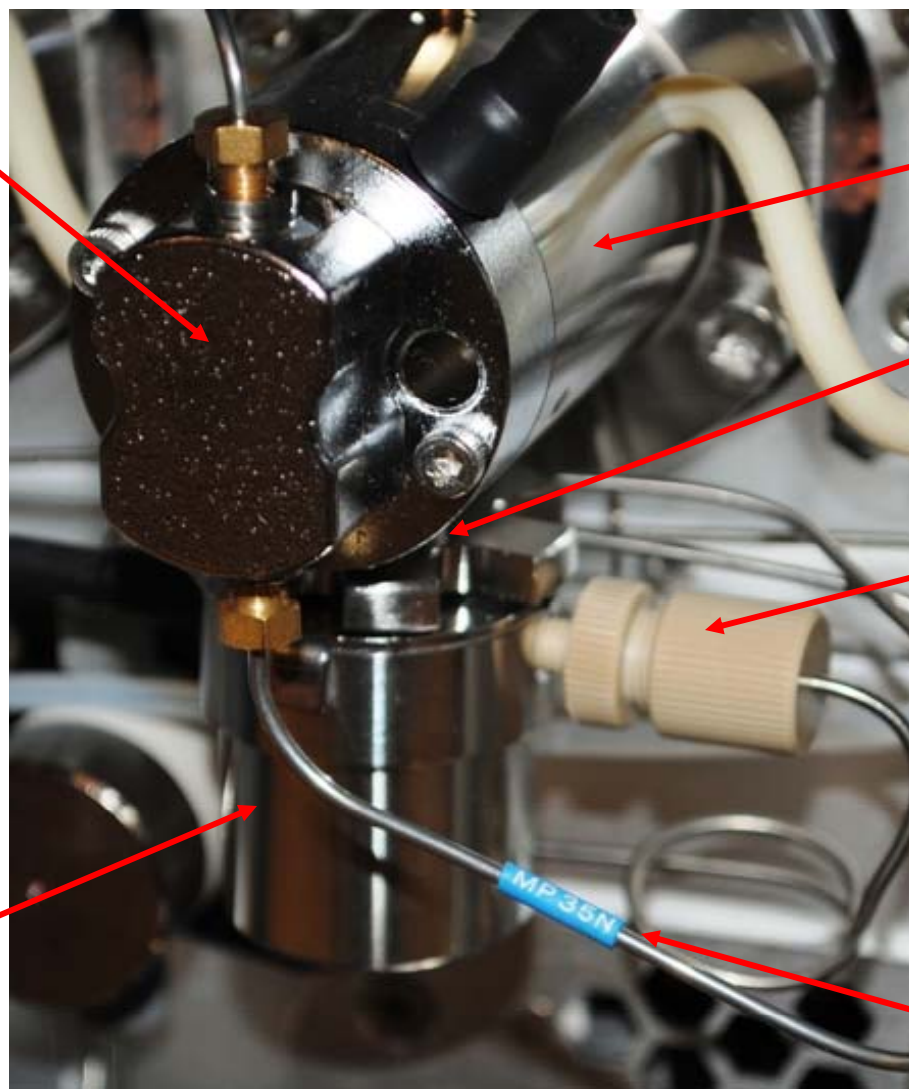
18K 50ul Mixer

Degasser Chamber

BSM- Primary Head Closup



20K Transducer



18K Pump Head Assy

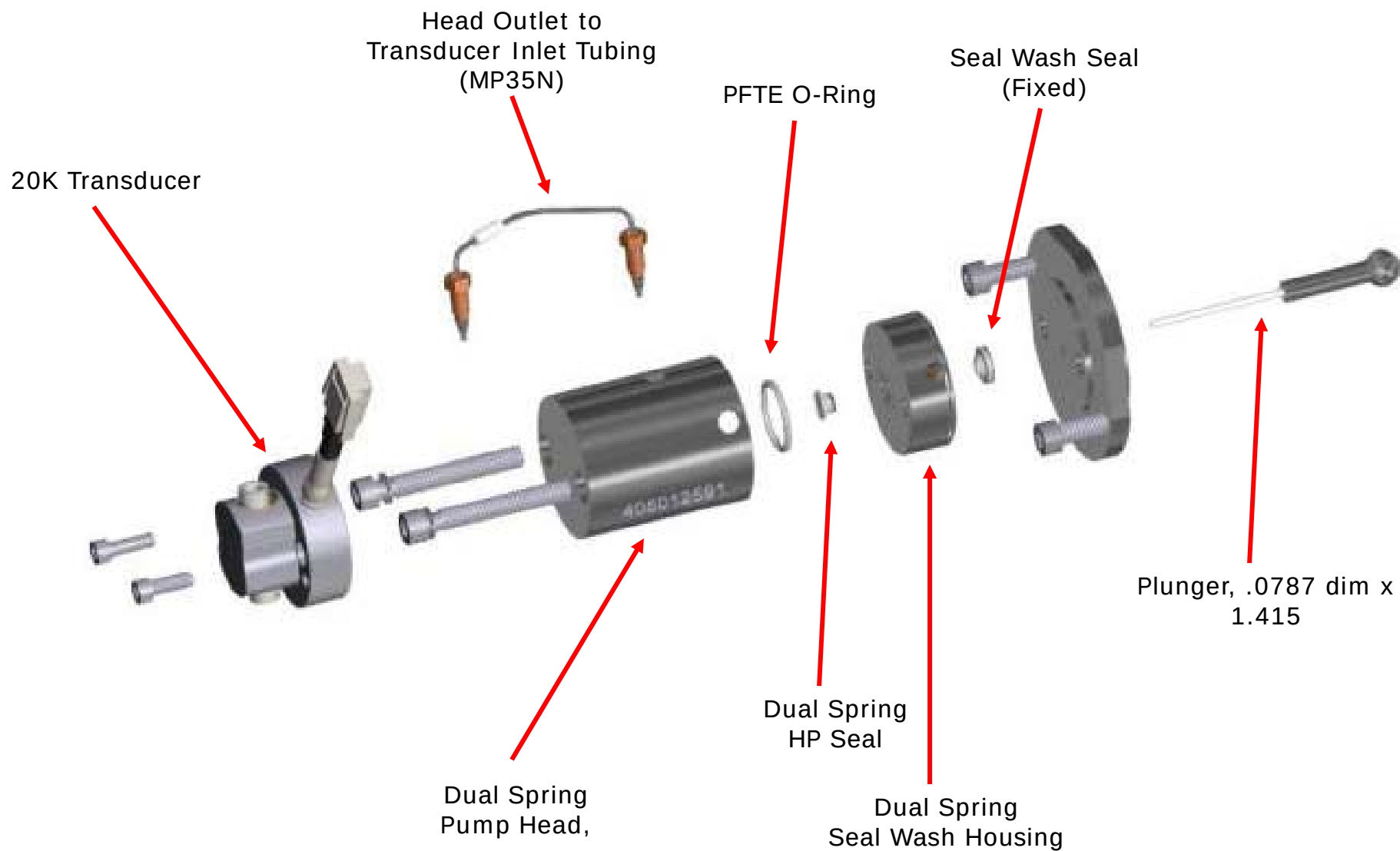
Gold Gasket
Check Valve Cartridge

Inlet Filter

I²V Valve

MP35N Tubing

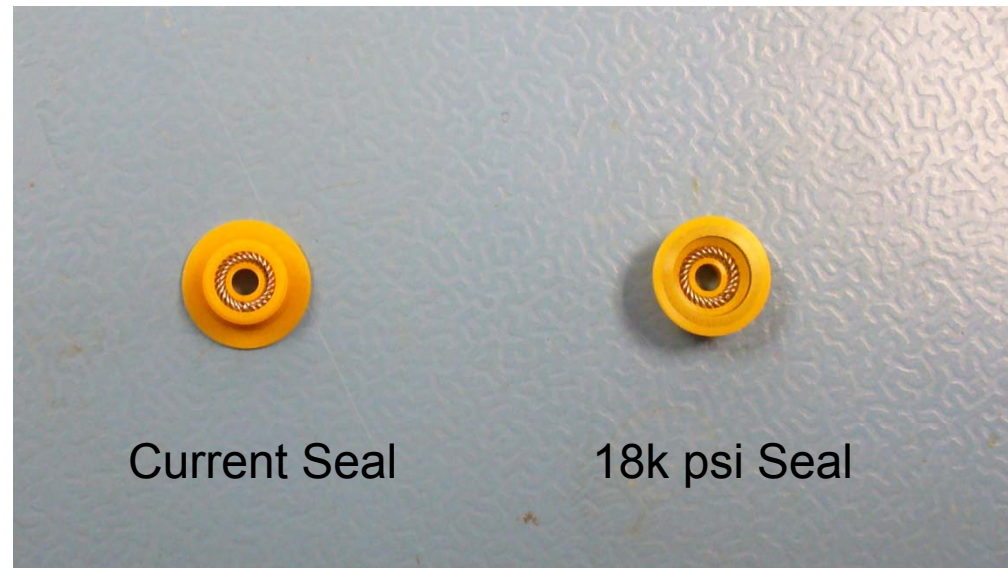
BSM 18K Pump Head Assembly



Updates to Heads, Seals, and Seal Wash Housing



- New 18k psi seals have 2 sealing surfaces
 - Better seal lifetime
- New seal design requires new heads and seal wash housings
- A new 0.045 High Pressure Seal and Seal Wash Housing has been implemented into the I-Class Binary Solvent Manager beginning with serial number G12BUR641M
 - See I-Class BSM Service Note for retrofit procedure



Updated Mixers



- Torque increased for robustness at 18k psi
- Inlet nut and cartridge housing material change from SS to Nitronic 60 to improve sealing
- Same volumes available 50 μ L, 100 μ L, and 380 μ L



Updated Tubing Material

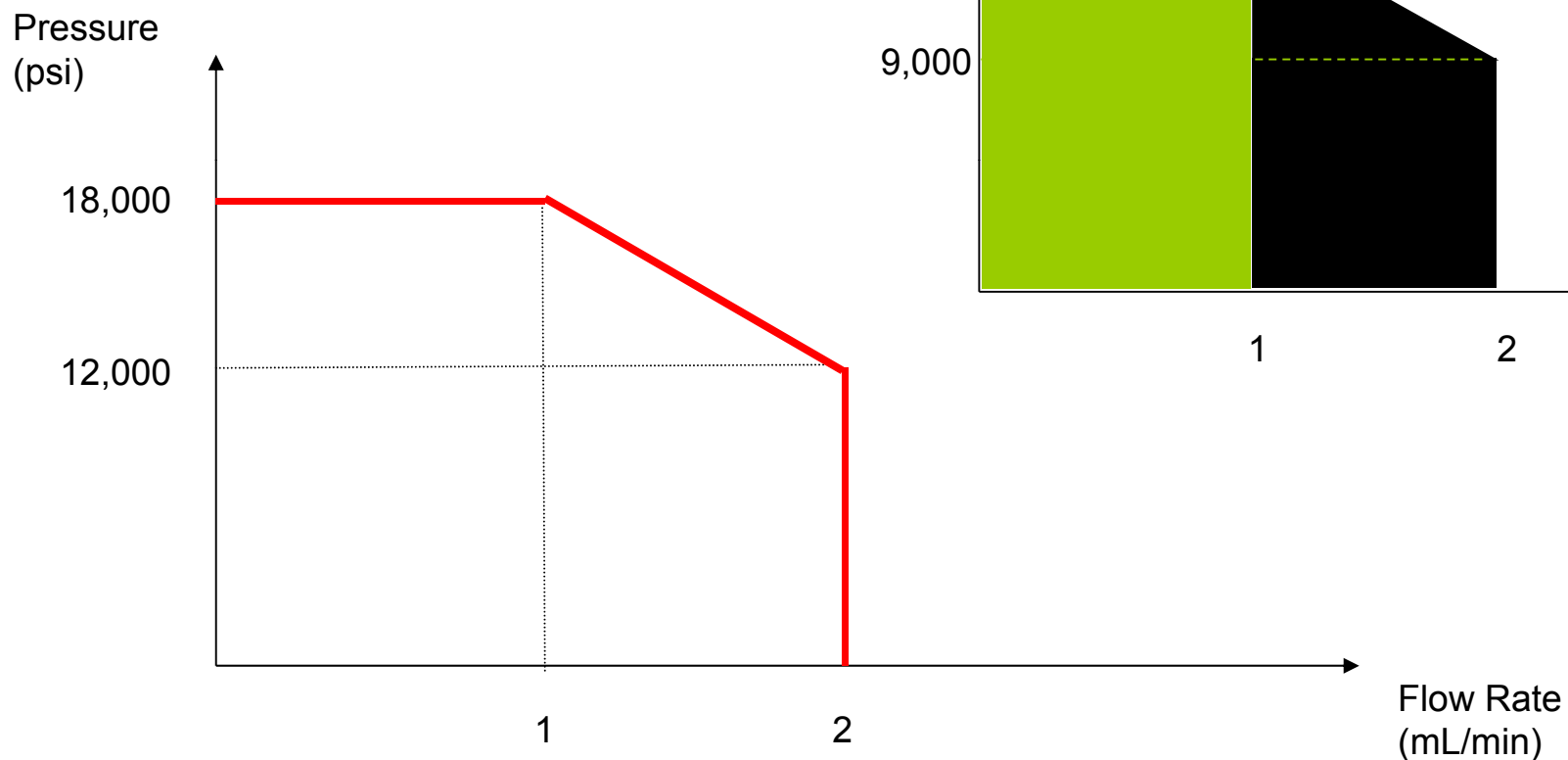
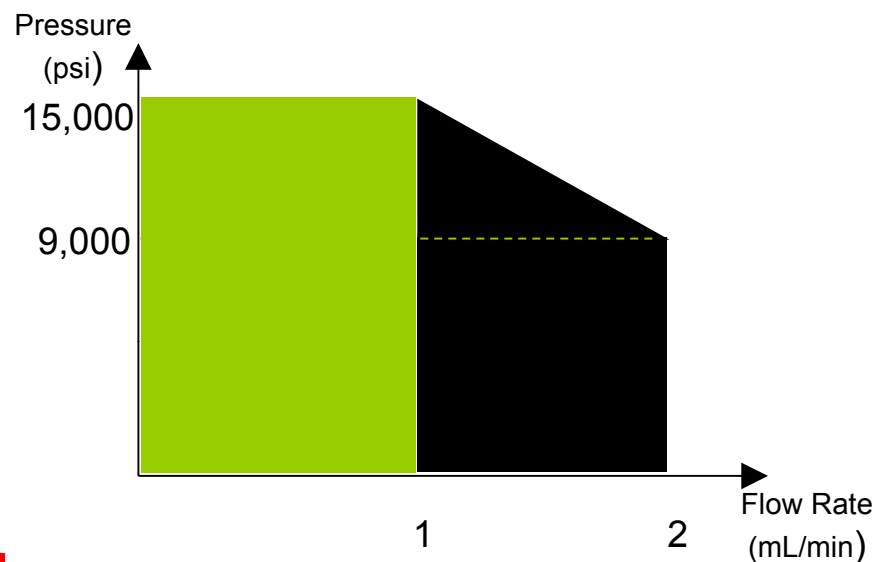


- Tubing in the pump flow path that experiences high pressure swings can develop pin holes from the stress and leak
- New MP35N lines have a smoother interior surface and are more robust to this phenomenon

Pressure Envelope



ACQUITY UPLC Pressure Envelope



ACQUITY UPLC I-Class Pressure Envelope

Pressure Table- Flow Rates above 1mL/min



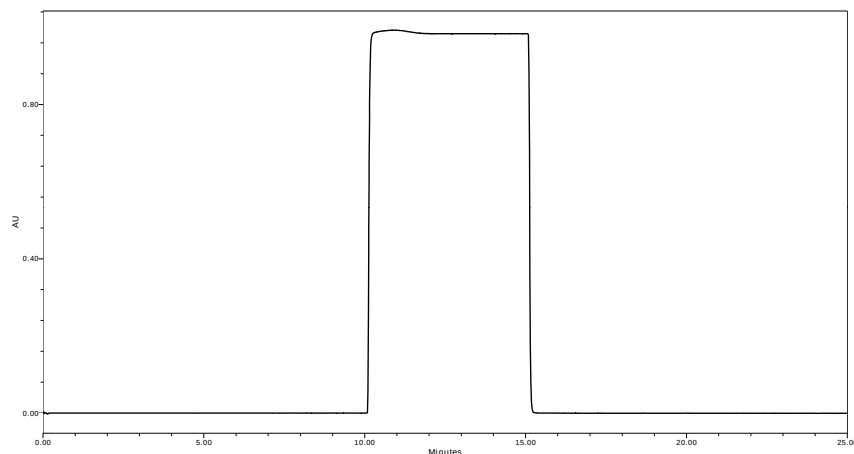
The pressure limit stays above 15000 psi for most of the flow rate conditions

		Mobile Phase composition (%B)										
		0	10	20	30	40	50	60	70	80	90	100
Flow Rate (mL/min)	1	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000	18000
	1.1	17400	18000	18000	18000	18000	18000	18000	18000	18000	18000	17400
	1.2	16800	17520	18000	18000	18000	18000	18000	18000	18000	17520	16800
	1.3	16200	16980	17760	18000	18000	18000	18000	18000	17760	16980	16200
	1.4	15600	16440	17280	18000	18000	18000	18000	18000	17280	16440	15600
	1.5	15000	15900	16800	17700	18000	18000	18000	17700	16800	15900	15000
	1.6	14400	15360	16320	17280	18000	18000	18000	17280	16320	15360	14400
	1.7	13800	14820	15840	16860	17880	18000	17880	16860	15840	14820	13800
	1.8	13200	14280	15360	16440	17520	18000	17520	16440	15360	14280	13200
	1.9	12600	13740	14880	16020	17160	18000	17160	16020	14880	13740	12600
	2	12000	13200	14400	15600	16800	18000	16800	15600	14400	13200	12000

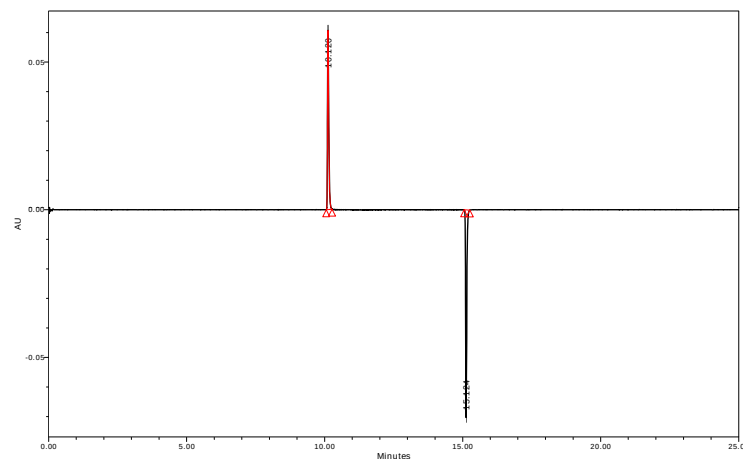
System Volume Measurements



Program Step Gradient



First Derivative



System	Measured System Volume (μL)
FTN	92.8μL
FL	85.1μL
H-Class (FTN)	360μL

Matching System Volumes



Acquity Binary Solvent Manager
UPLC*

General | Analog Out | Events

Solvents

A1 ▼ Water ▼ 

B1 ▼ Acetonitrile ▼

Pressure Limits

Low: 0 psi

High: 15000 psi

Seal Wash: ?

5.0 min



Gradient:

	Time (min)	Flow (mL/min)	%A	%B	Curve	
1	Initial	0.600	100.0	0.0	Initial	▲
2						
3						
4						
5						
6						▼

Comment: ...

Gradient Start:

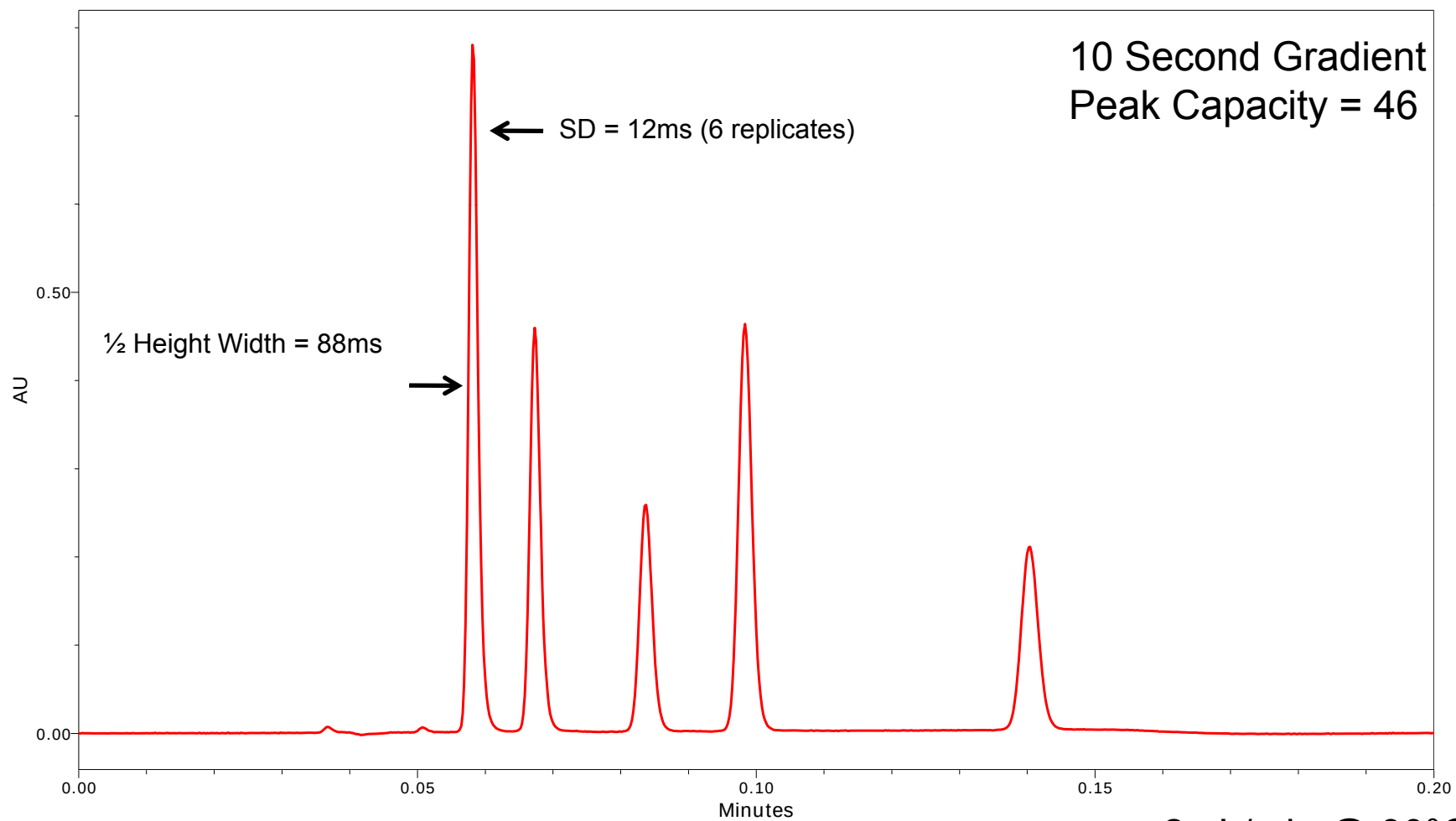
☐ At injection

☒ Before injection

☐ After injection

10 uL

Ballistic Gradient



2mL/min @ 90°C

BSM Method Editor Improvements



Modify ACQUITY Binary Solvent Manager Instrument Method

Acquity Binary Solvent Manager Run Time: 4.00 min

General | Data | Analog Out | Events

Solvents: A1 Water B1 Acetonitrile

Pressure Limits: Low: 0 psi High: 17000 psi

Seal Wash: 5.0 min

Gradient

	Time (min)	Flow (mL/min)	%A	%B	Curve
1	Initial	0.600	90.0	10.0	Initial
2	0.75	0.600	90.0	10.0	6
3	3.00	0.600	5.0	95.0	6
4	3.10	0.600	5.0	95.0	6
5	3.30	0.600	90.0	10.0	6
6	30.00	0.600	90.0	10.0	11

Gradient Start: ☒ At injection ☐ Before injection ☐ After injection

Comment:

OK Cancel

Modify ACQUITY Binary Solvent Manager Instrument Method

Acquity Binary Solvent Manager Run Time: 4.00 min

General | Data | Analog Out | Events

100 % 0 min 30.00

Gradient

	Time (min)	Flow (mL/min)	%A	%B	Curve
1	Initial	0.600	90.0	10.0	Initial
2	0.75	0.600	90.0	10.0	6
3	3.00	0.600	5.0	95.0	6
4	3.10	0.600	5.0	95.0	6
5	3.30	0.600	90.0	10.0	6
6	30.00	0.600	90.0	10.0	11

Gradient Start: ☒ At injection ☐ Before injection ☐ After injection

Comment:

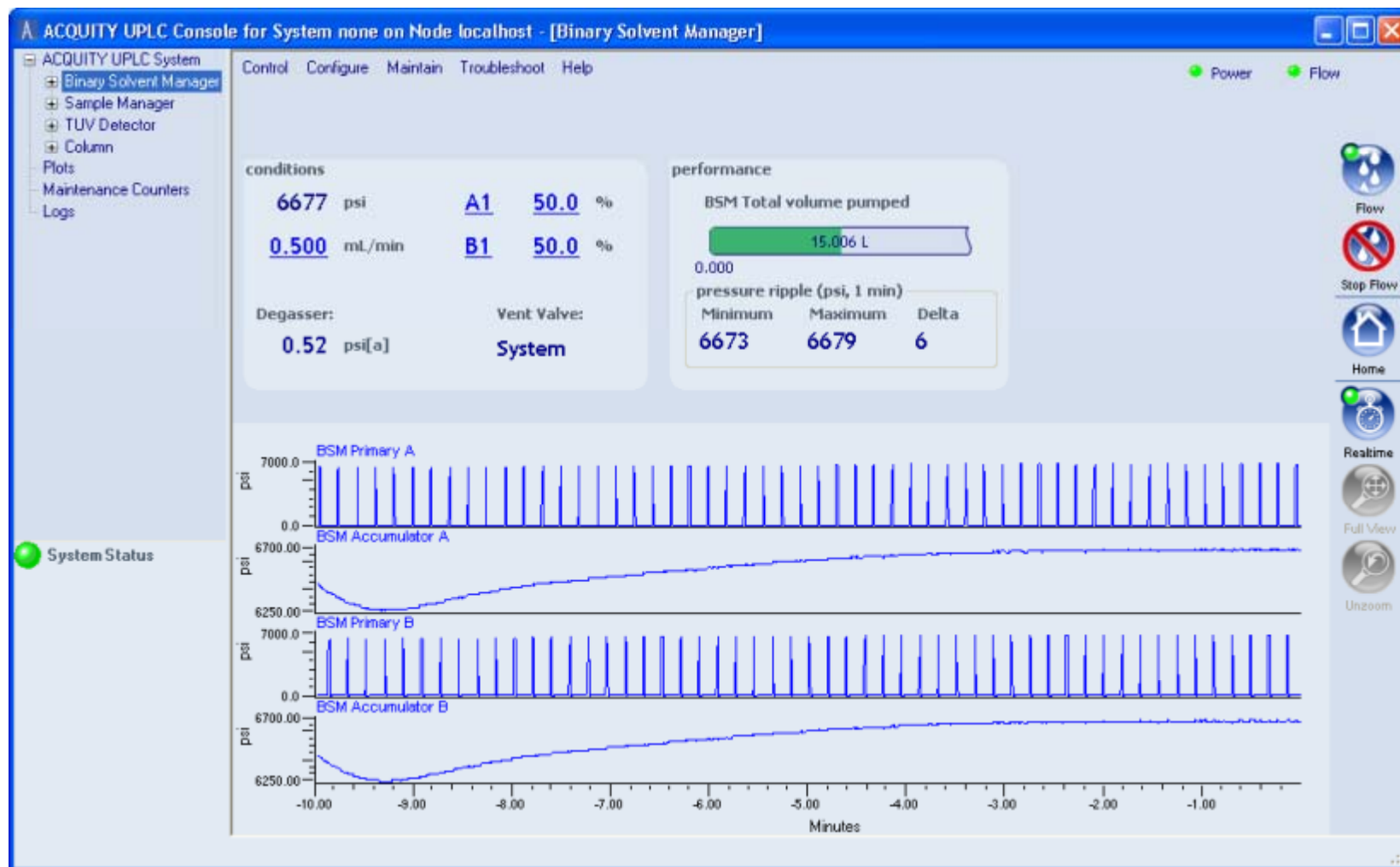
OK Cancel

Gradient

	Time (min)	Flow (mL/min)	%A	%B	Curve
1	Initial	0.600	90.0	10.0	Initial
2	0.75	0.600	90.0	10.0	6
3	3.00	0.600	5.0	95.0	6
4	3.10	0.600	5.0	95.0	6
5	3.30	0.600	90.0	10.0	6
6	30.00	0.600	90.0	10.0	11
7					
8					
9					
10					
11					
12					
13					
14					
15					

OK Cancel

BSM Top Level Menu



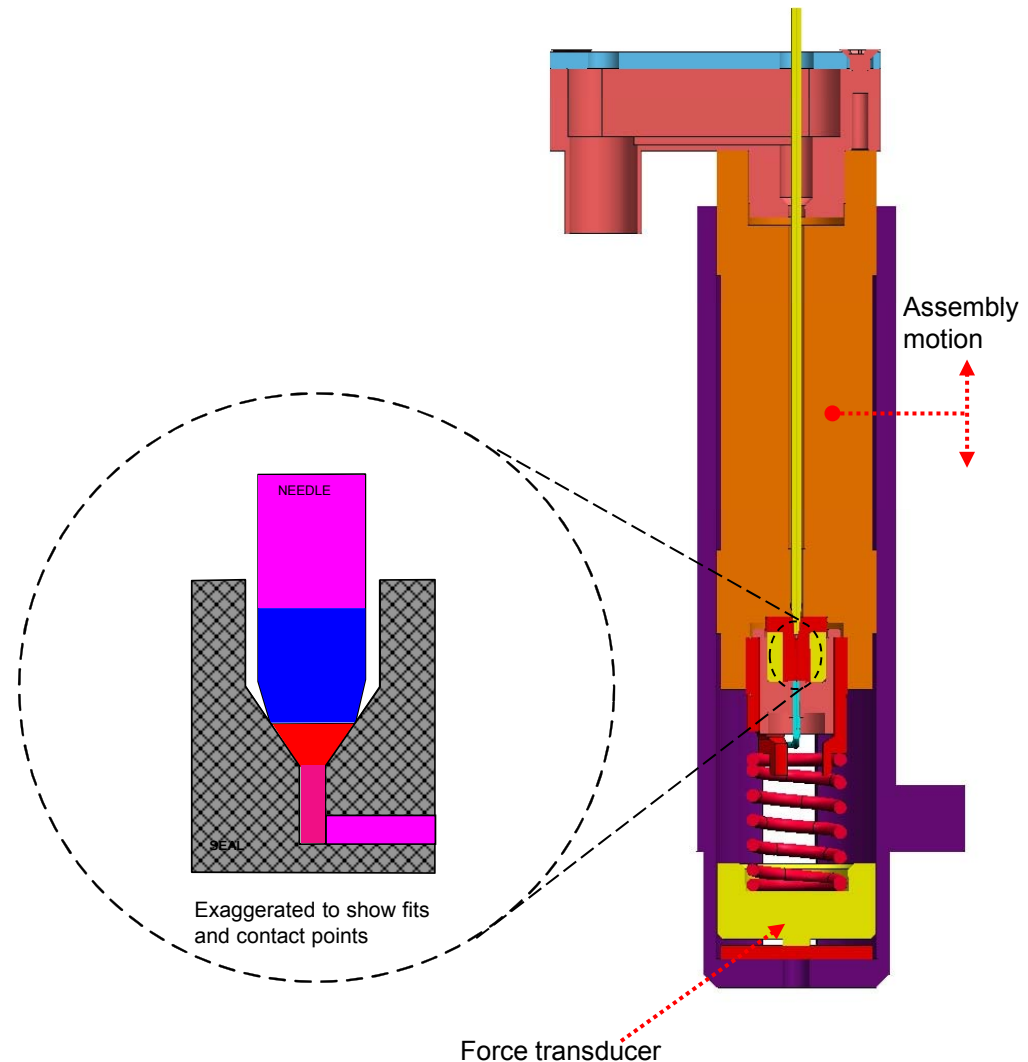
I-Class SM-FTN Fluidics



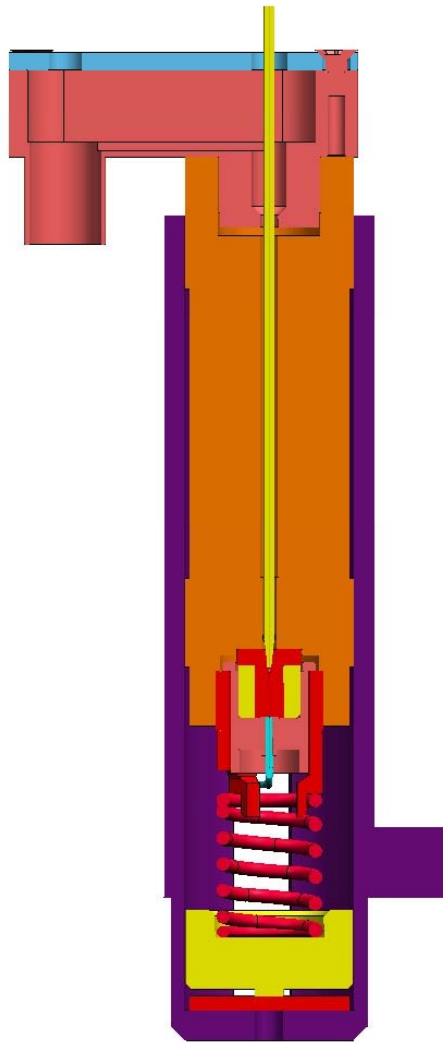
SM-FTN Mechanics: Sealing Procedure



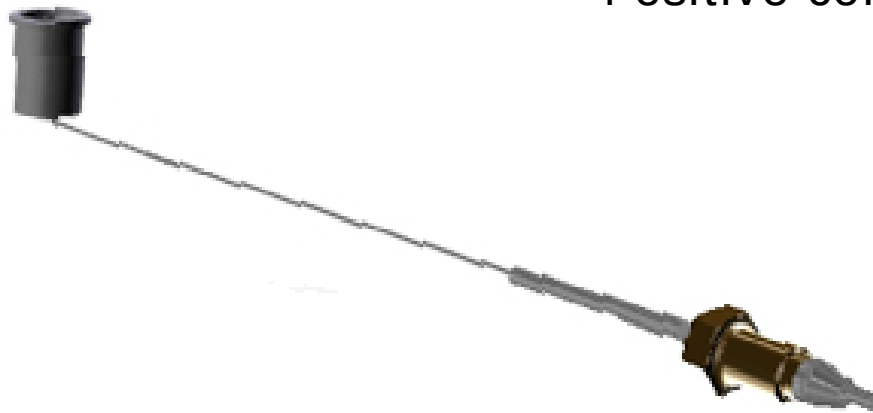
- Hardware in injection port stays the same as the H-Class
- Sealing force increased to enable 18k psi



Seal Extension Tube



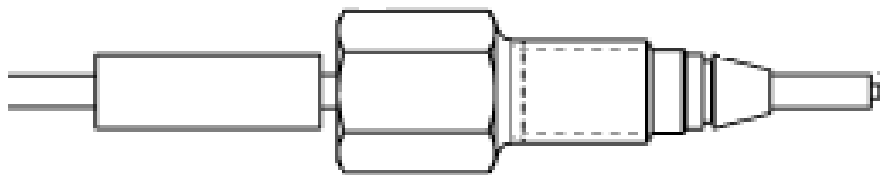
- Improved Dispersion
 - 0.003" ID Tubing
 - Protruded end
 - Modified "V" Detail
 - Positive contact point



Hypo-Extended Tubing



- The hypo-extended tubing benefits
 - Aids in a better mating of the tube with the injector valve stator port surface
 - Allows for more repeatable and acceptable installation of the tubing into the injector valve
 - Reduces the risk of carryover within the system by eliminating chances of dead volume at the tube and port interface



Hypo-Extended Tubing Installation

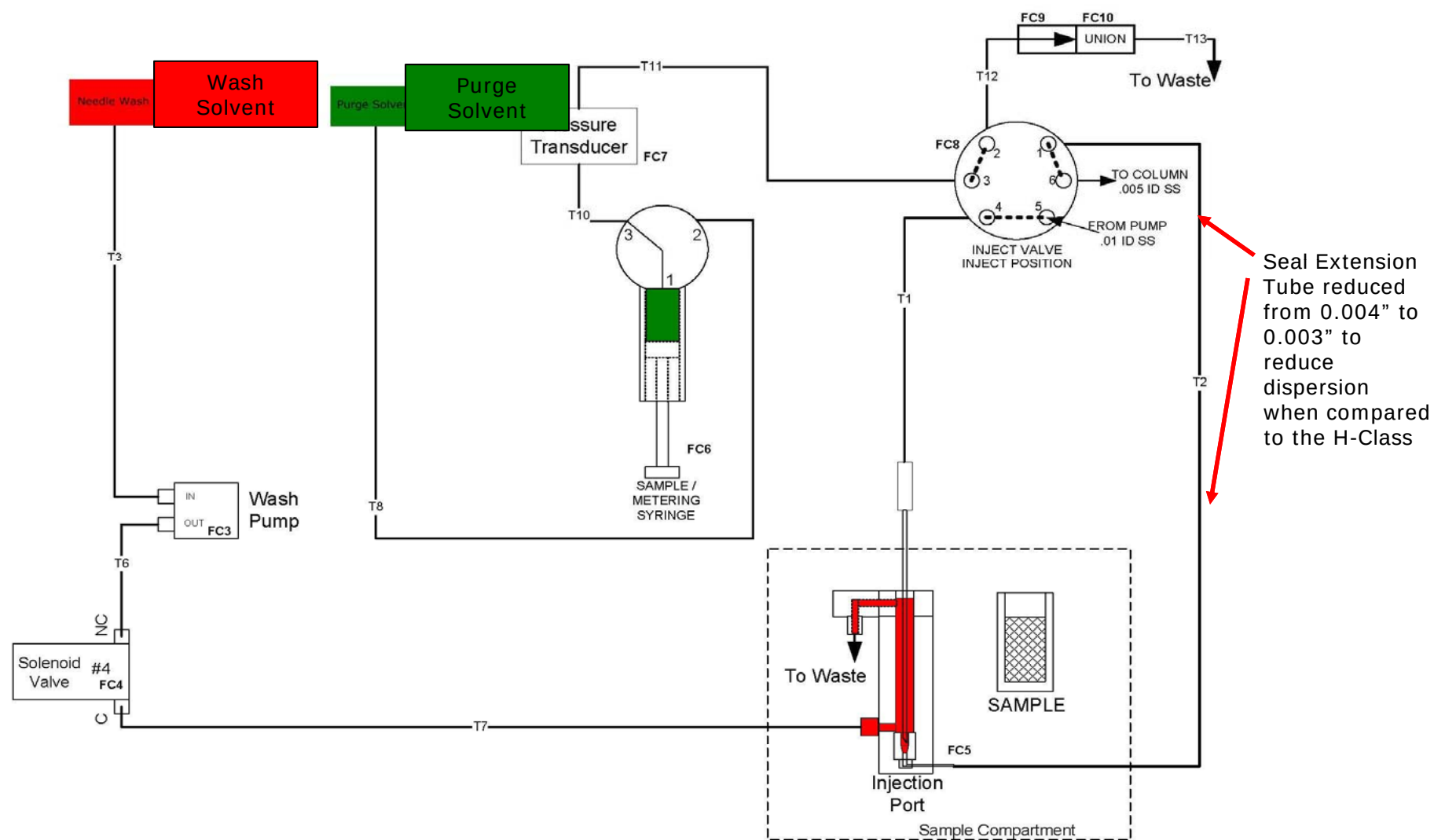


- Connection guidelines for a new fitting:
 - Caution: Carefully tighten so that the hypo tip is not damaged or crushed.
 - Use your fingers to tighten the fitting into the port and stop as soon as you feel resistance.
 - Use a 1/4-inch wrench and tighten until you feel the resistance on the wrench.
 - Tighten an additional 1/2 turn with the wrench to finish.
- Hypo-extended tubing fitting connection guidelines for a previously installed fitting:
 - Note: Reconnect only to the same port
 - Use your fingers to tighten the fitting into the port and stop as soon as you feel resistance.
 - Use a 1/4-inch wrench and tighten until you feel the resistance on the wrench.
 - Tighten an additional 1/6 turn with the wrench to finish.

SM-FTN Flow Diagram



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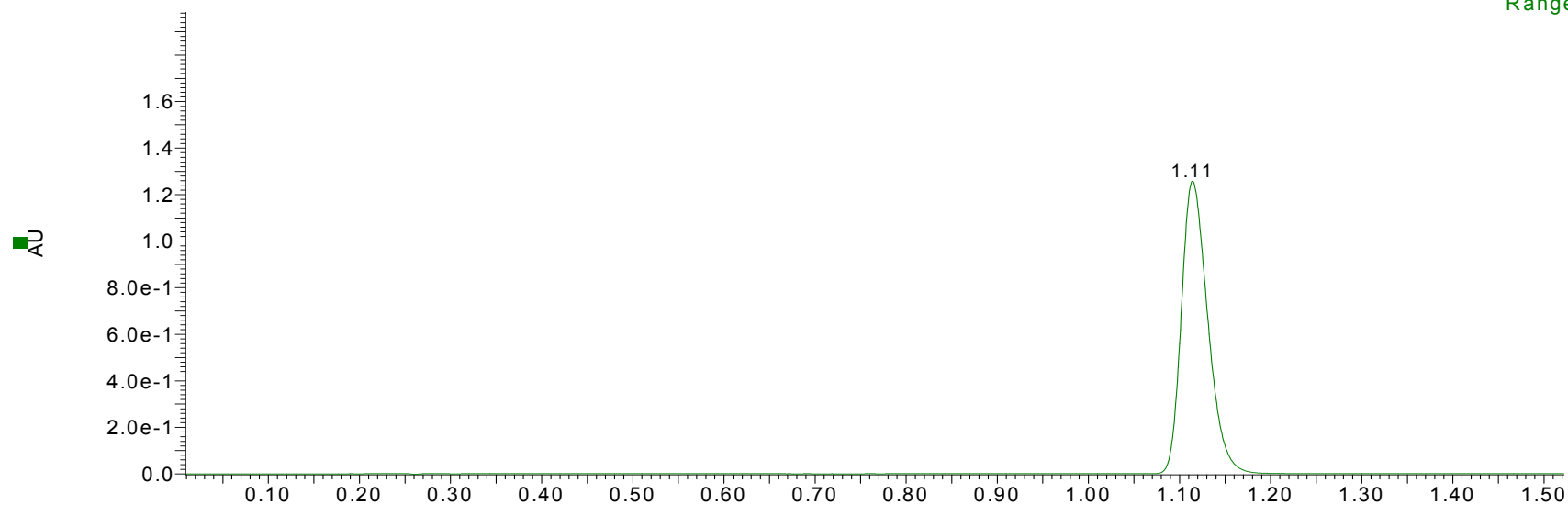


Wrong Seal Extension Tube Effect



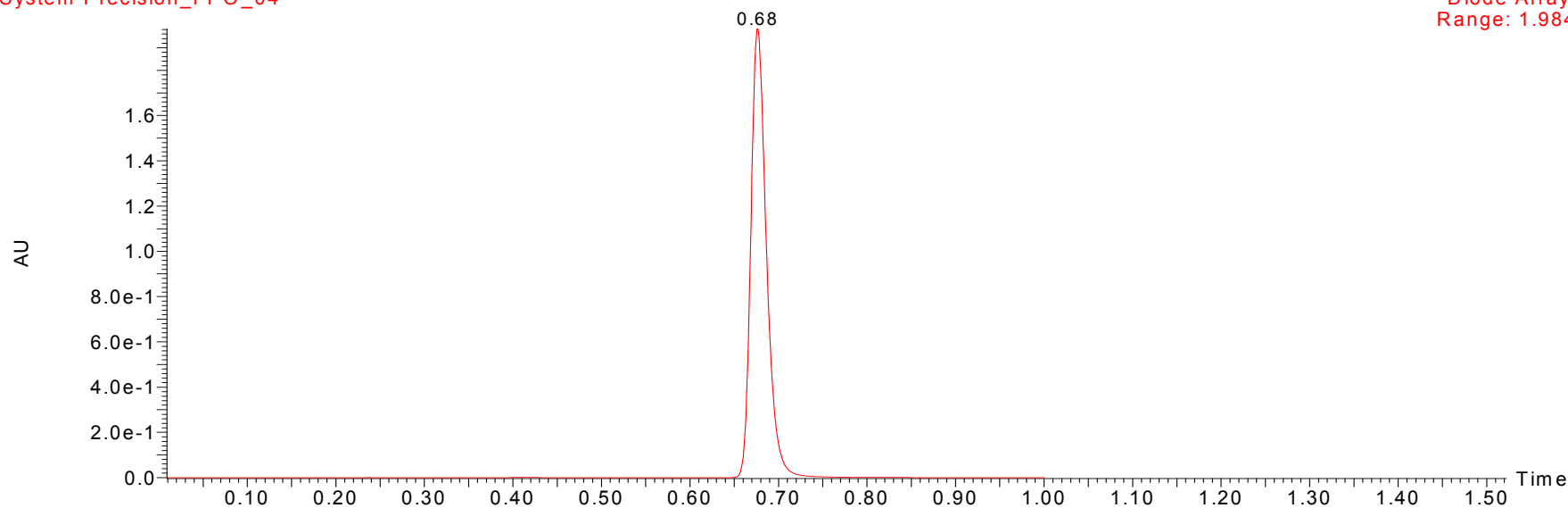
NEW ACN

Diode Array
Range: 1.26



System Precision_FPO_04

Diode Array
Range: 1.984



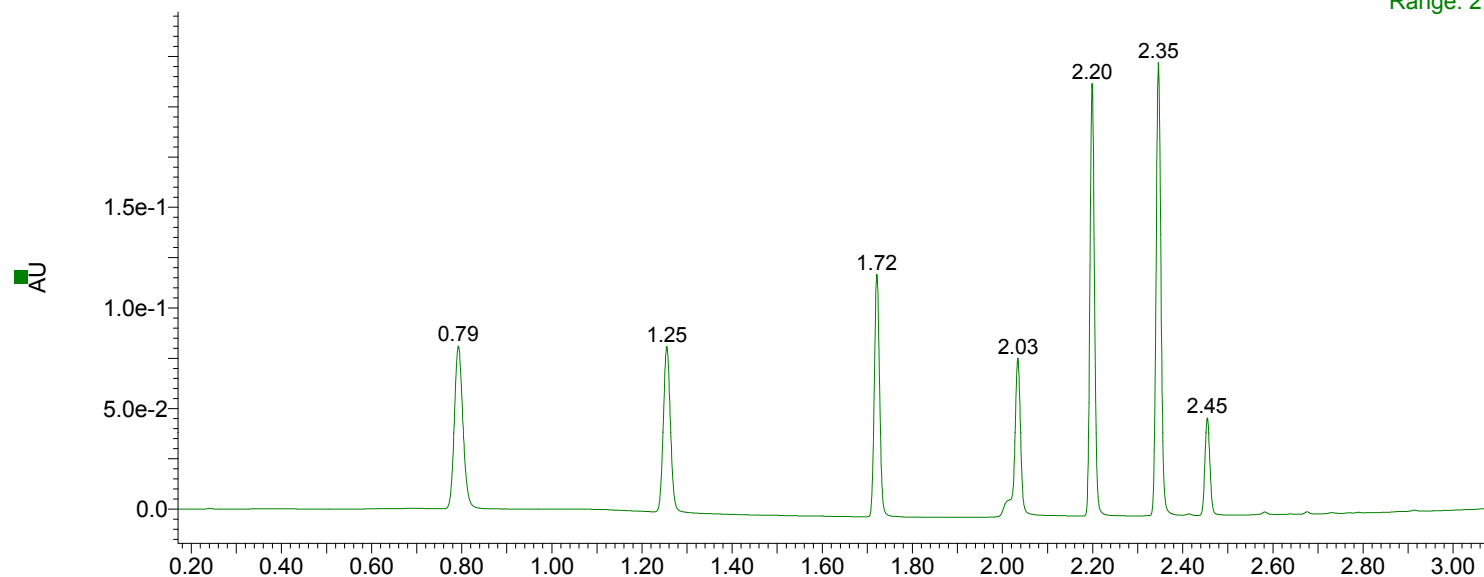
Wrong Seal Extension Tube Effect



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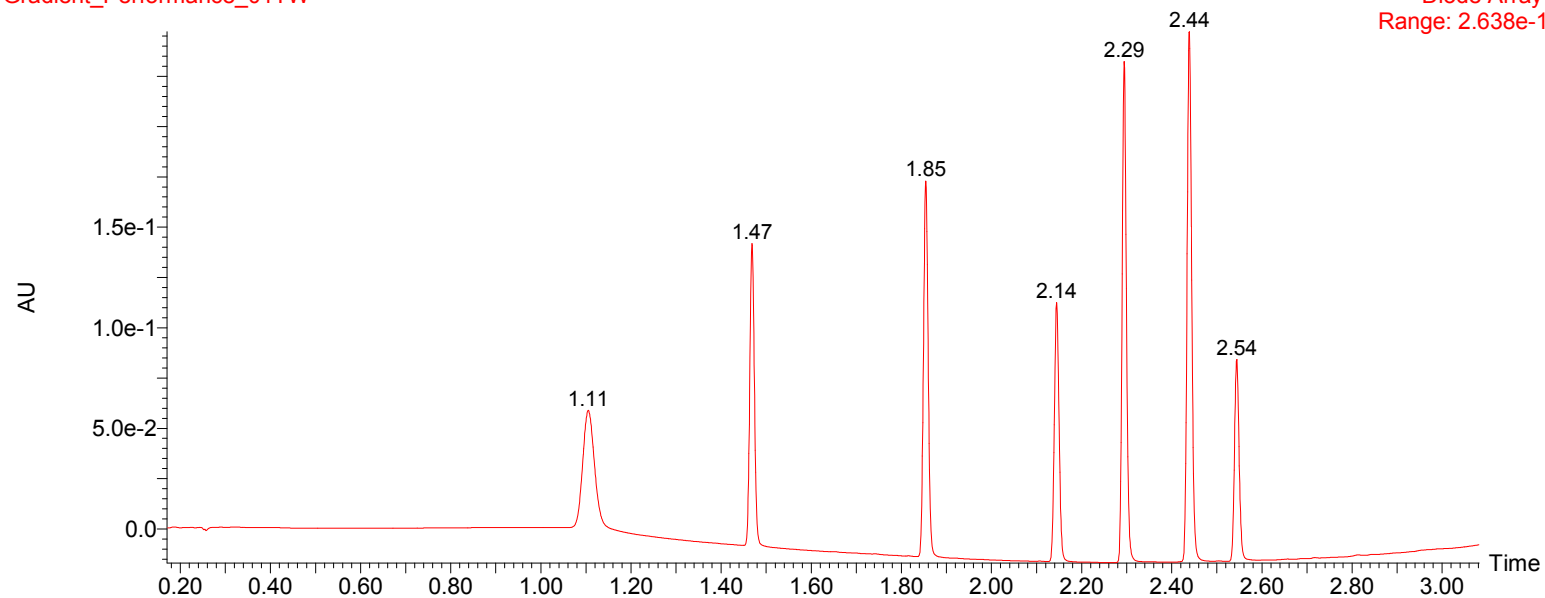
Gradient_Performance_02_JP

Diode Array
Range: 2.261e-1

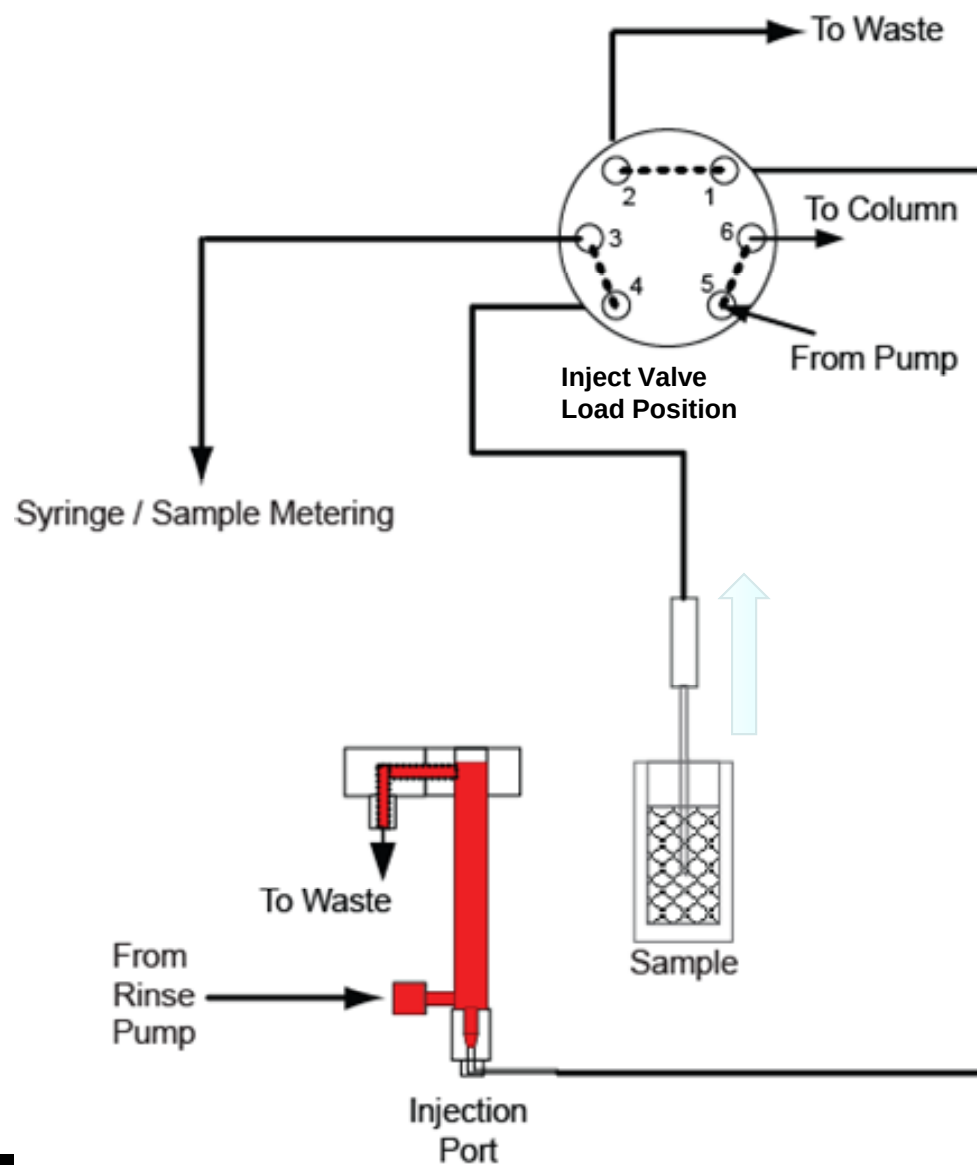


Gradient_Performance_01TW

Diode Array
Range: 2.638e-1



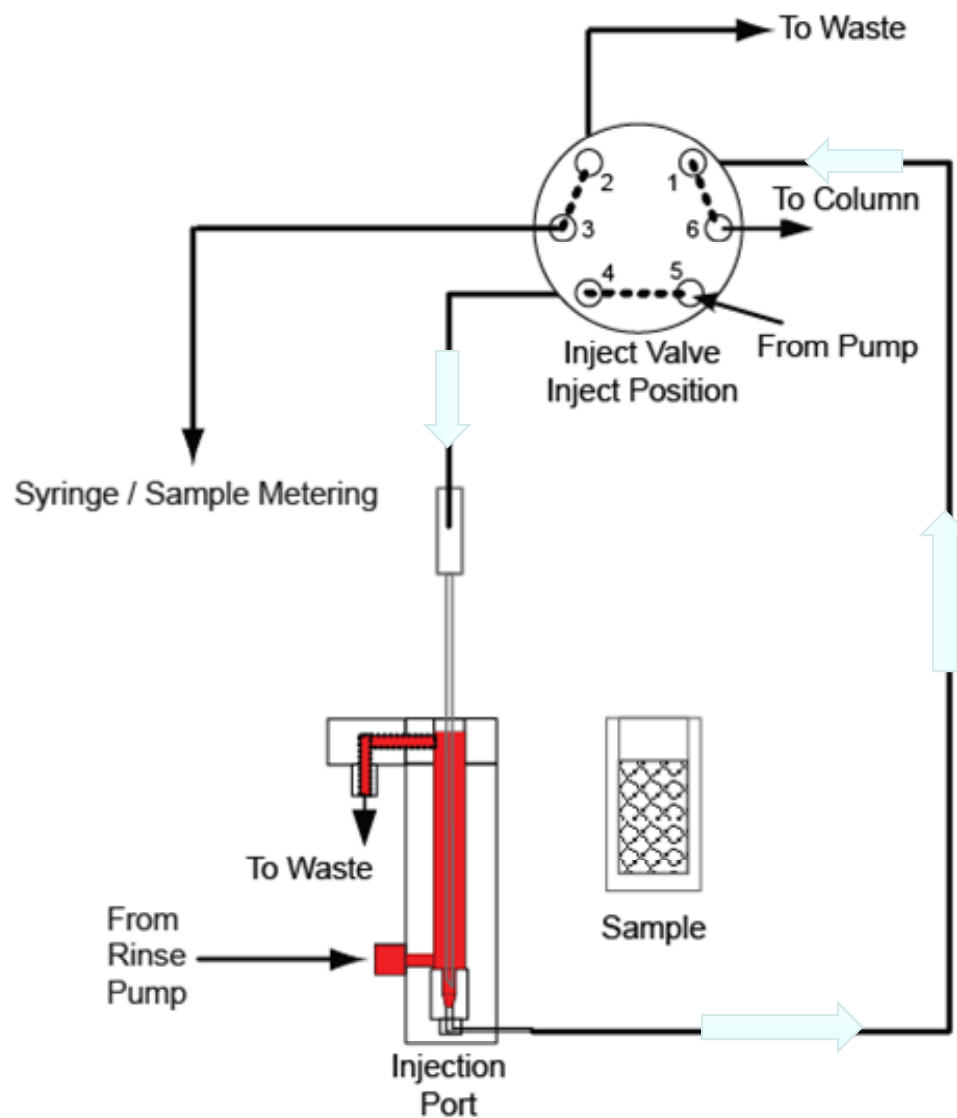
SM-FTN Sample Loading



SM-FTN Sample Injection



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SM-FTN: Injection Cycle Times



Cycle Steps	Inject-to-Inject Cycle Time
Base Cycle Time (with Empower Overhead)	~17s
Time/ μ L	+2s/ μ L
Post Wash	0s
Pre Wash	time configured
PDA	+3s (average)
Pre-Injection Volume	0s (if time to deliver is subtracted from re-equil time)
Load Ahead (with Empower Overhead)	~17s

SM-FTN Priming Recommendations



To Refresh Solvents

Prime

☒ Wash Solvent: 15 sec

☒ Purge Solvent: 5 cycles

OK Cancel

For New Solvents

Prime

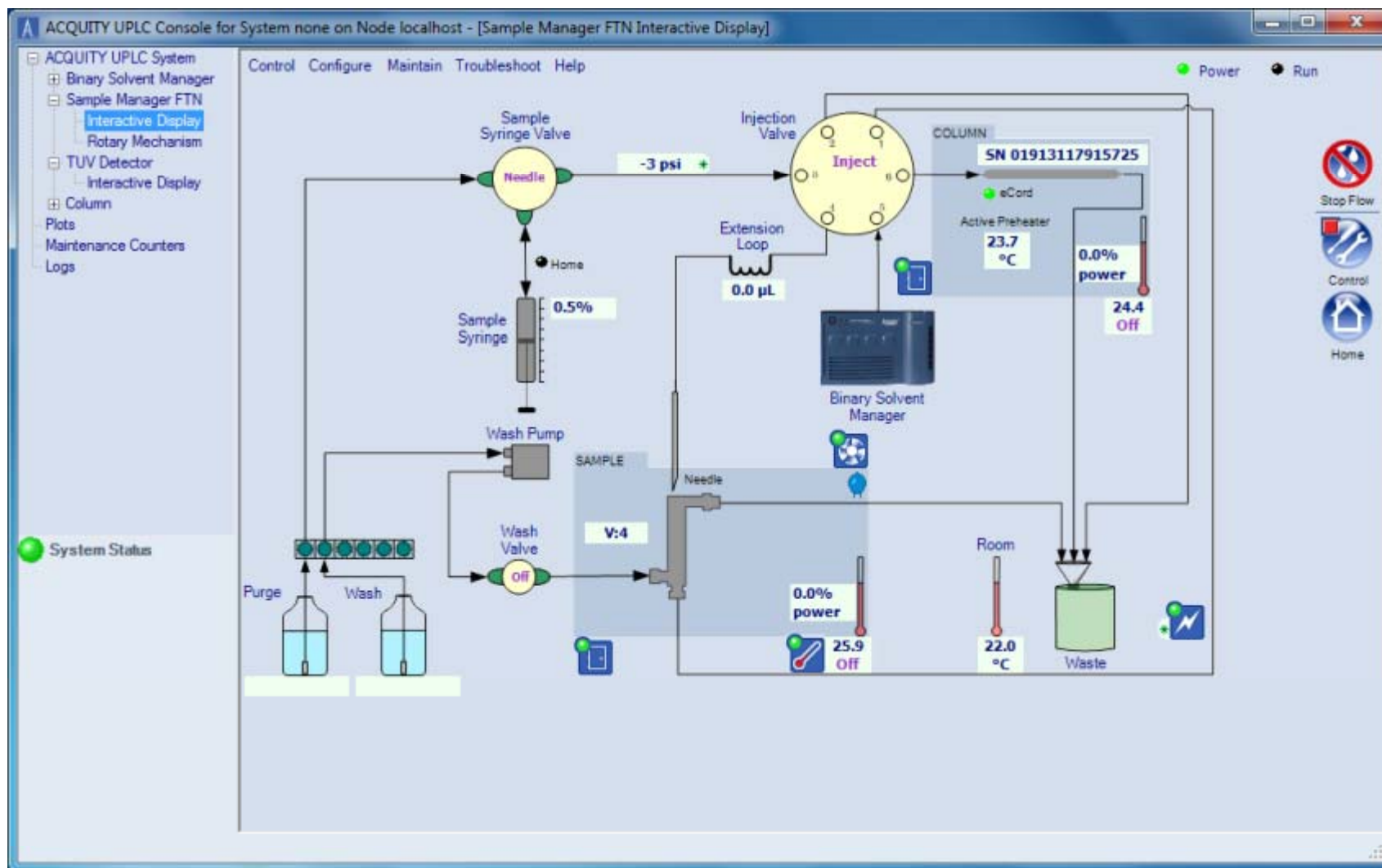
☒ Wash Solvent: 120 sec

☒ Purge Solvent: 50 cycles

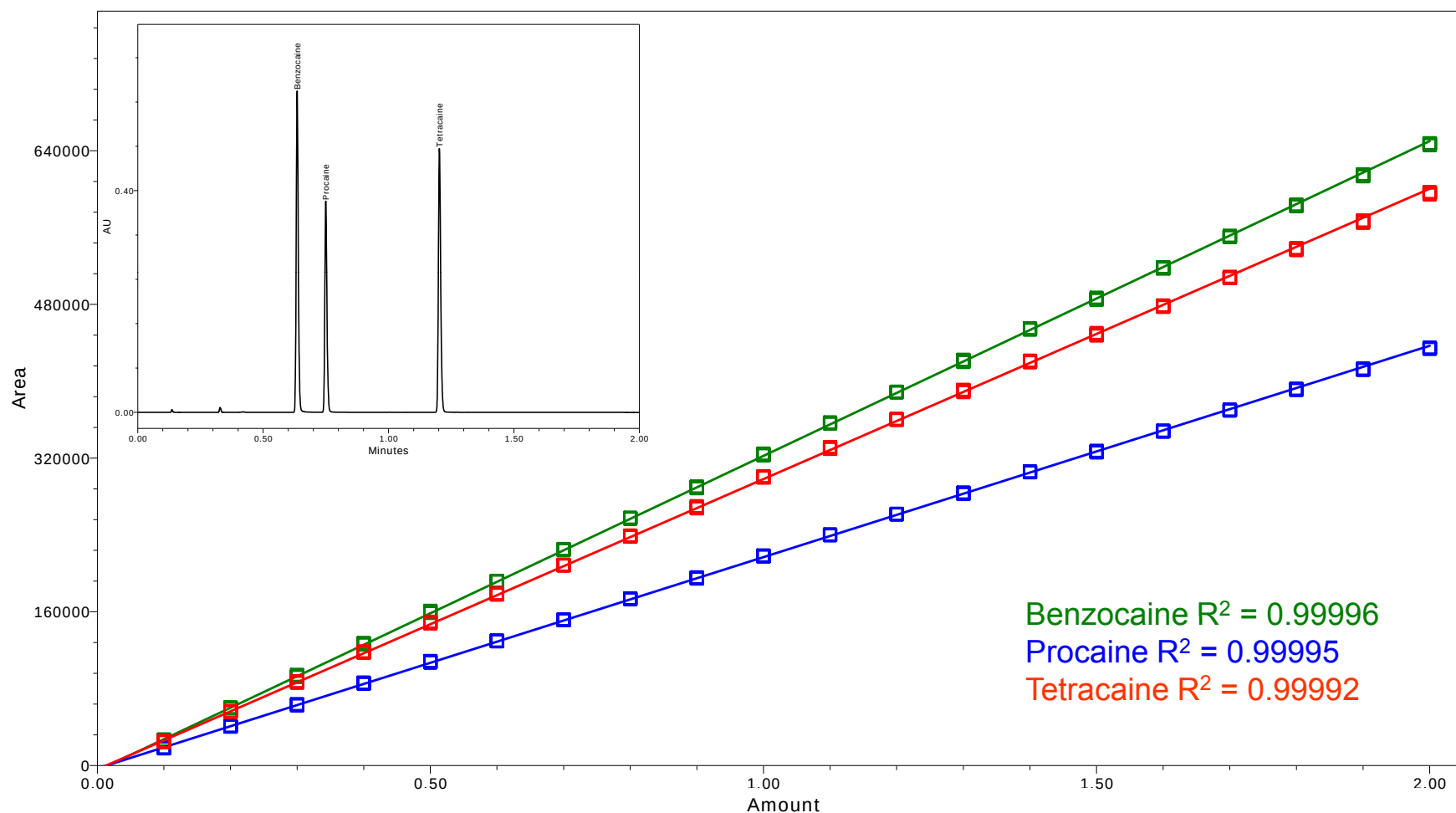
OK Cancel

- Selecting Wash Solvents
 - Sample should be very soluble in the wash solvent
 - Purge solvent does not contact sample (use wash solvent)
 - Purge solvent should not contain additives

I-Class with SM-FTN Interactive Menu



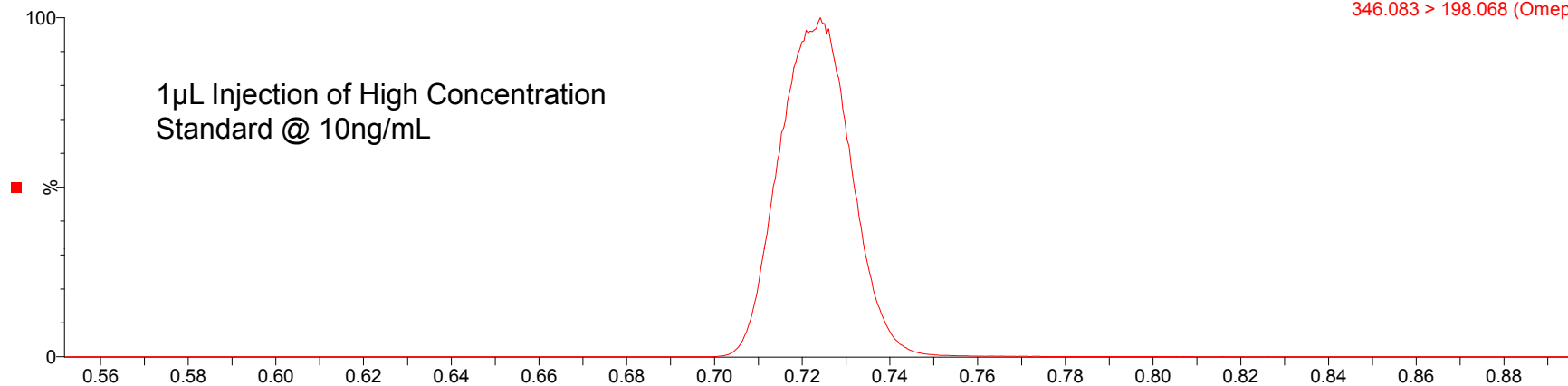
SM-FTN: Low Volume Injection Linearity



SM-FTN: MS Carryover of Omeprazole

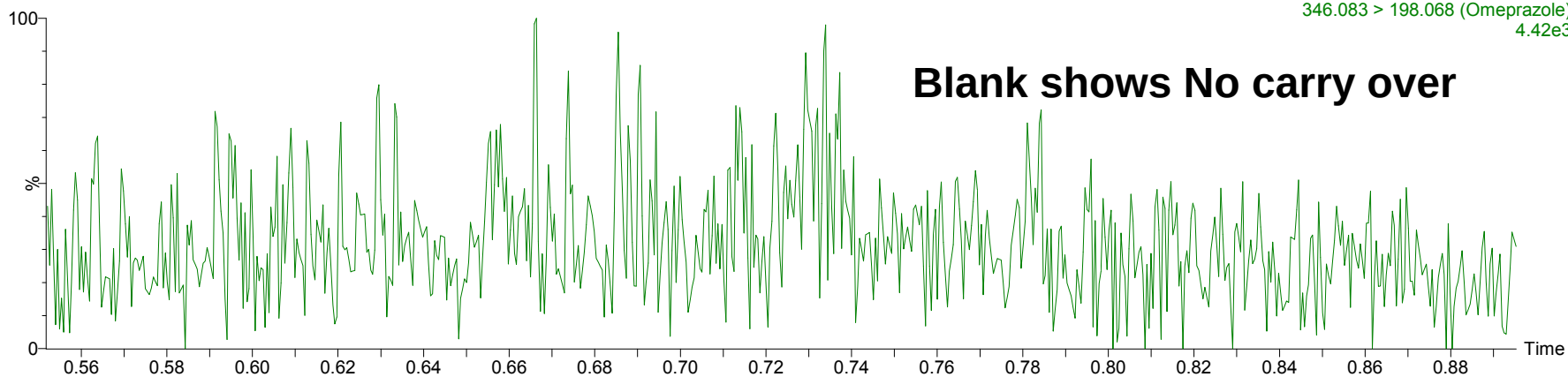


Omeprazole 10ng 0403



MRM of 1 Channel ES+
346.083 > 198.068 (Omeprazole)
7.06e7

Blank1 10ng 0403

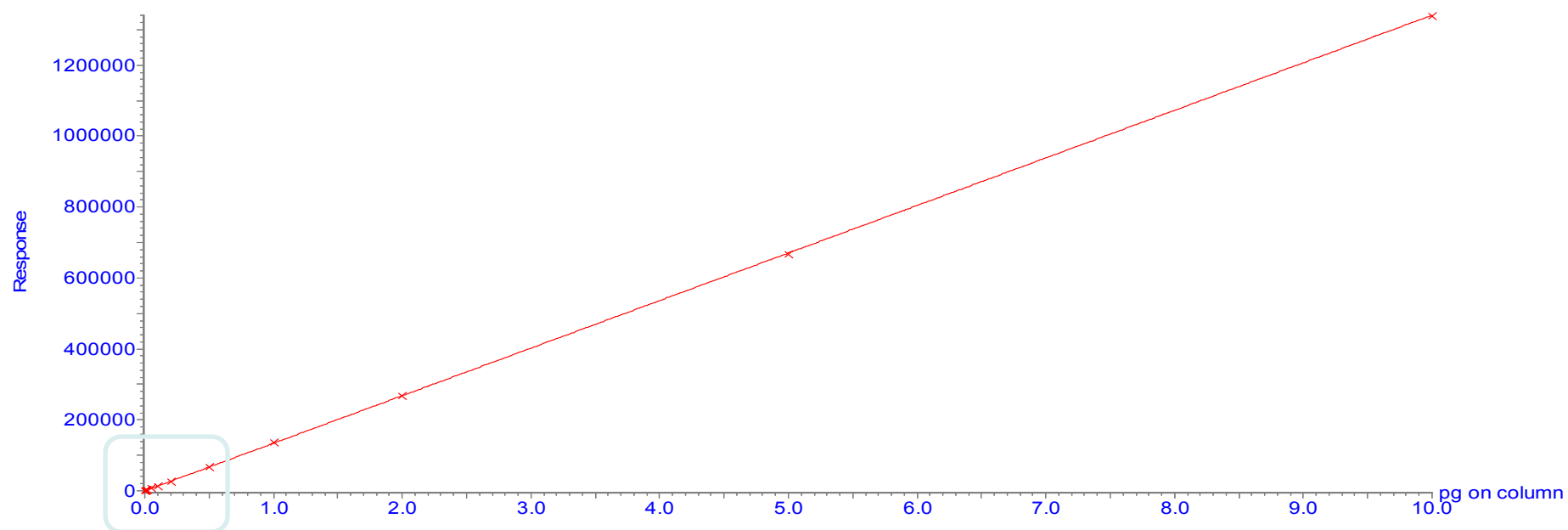


MRM of 1 Channel ES+
346.083 > 198.068 (Omeprazole)
4.42e3

SM-FTN: Low Carryover Extends Quantification Ranges in MS



Compound name: Omeprazole
Correlation coefficient: $r = 0.999985$, $r^2 = 0.999970$
Calibration curve: $134101 \cdot x + -12.3789$
Response type: External Std., Area
Curve type: Linear, Origin: Exclude, Weighting: $1/x$, Axis trans: None



I-Class SM-FL Fluidics

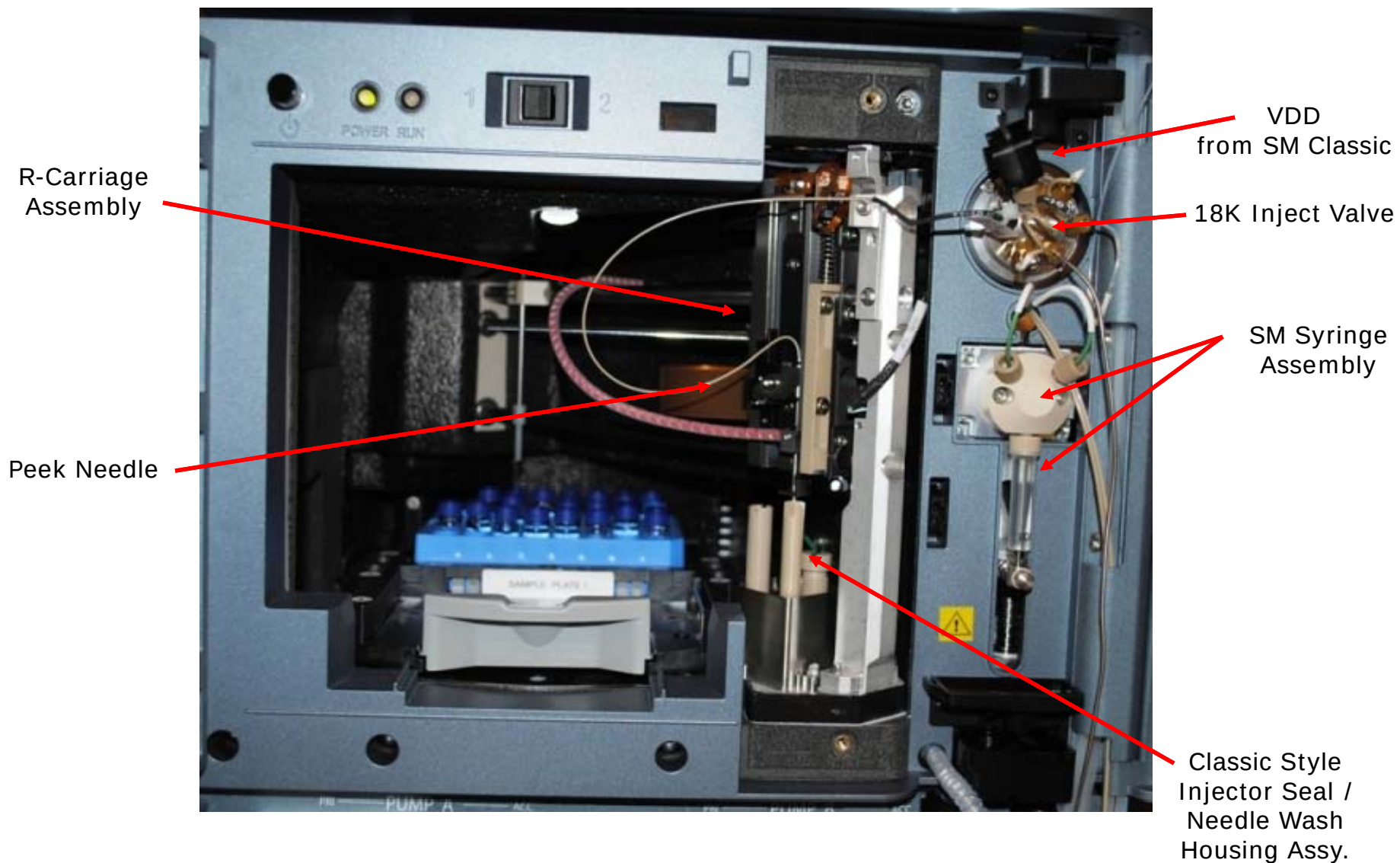


SM-FL Overview



- Implementation of the ACQUITY Classic fixed loop injection technique on the new Common Platform SM
- Most parts not specific to fixed loop injection and post injection washing are the same as the SM_FTN
- 18K psi capable
- Lower dispersion
- Reduced carryover
- New Wash Syringe drive
- Updated valve manifold

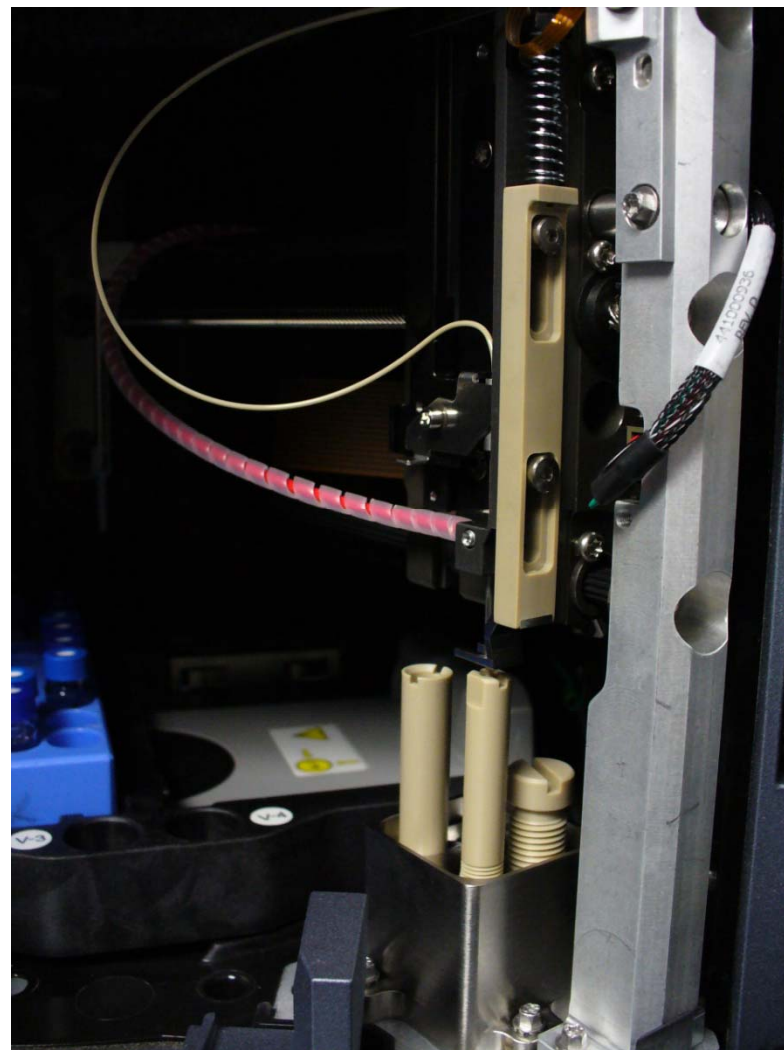
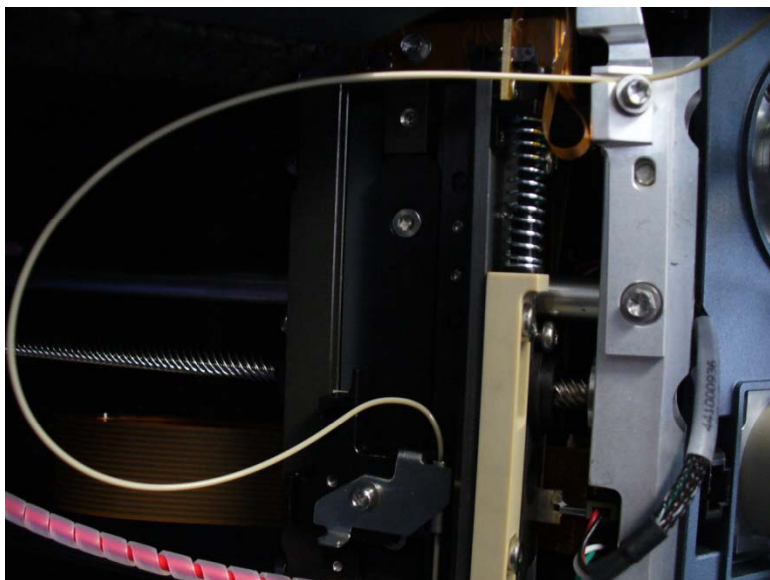
SM-FL (Fixed Loop)- I-Class Only



SM-FL: Injection Port

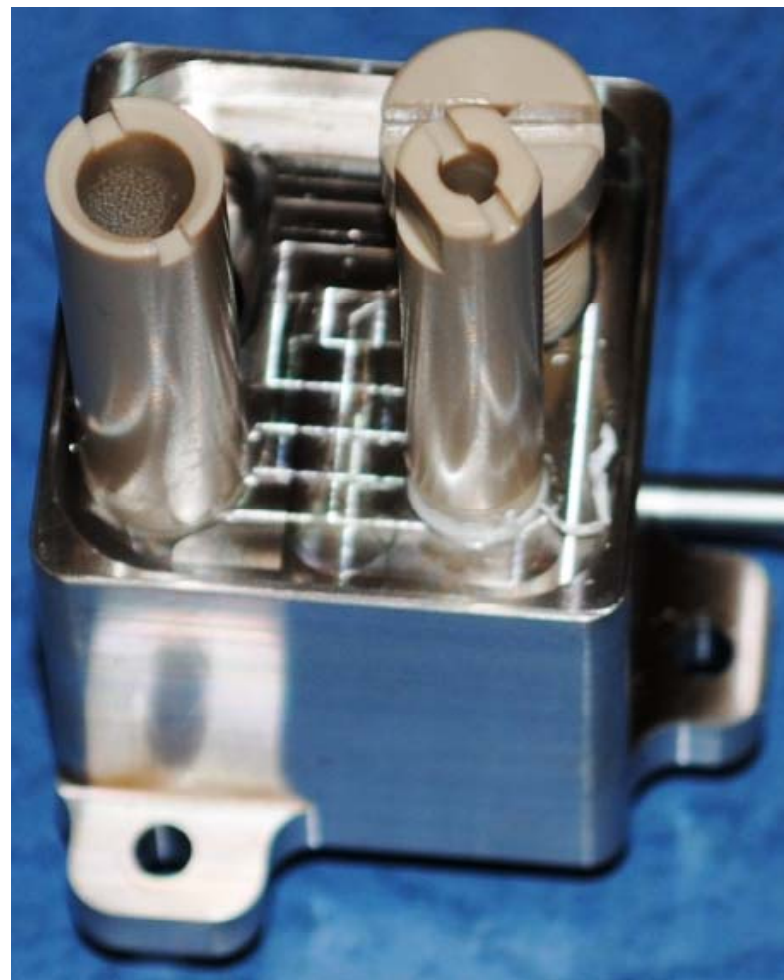
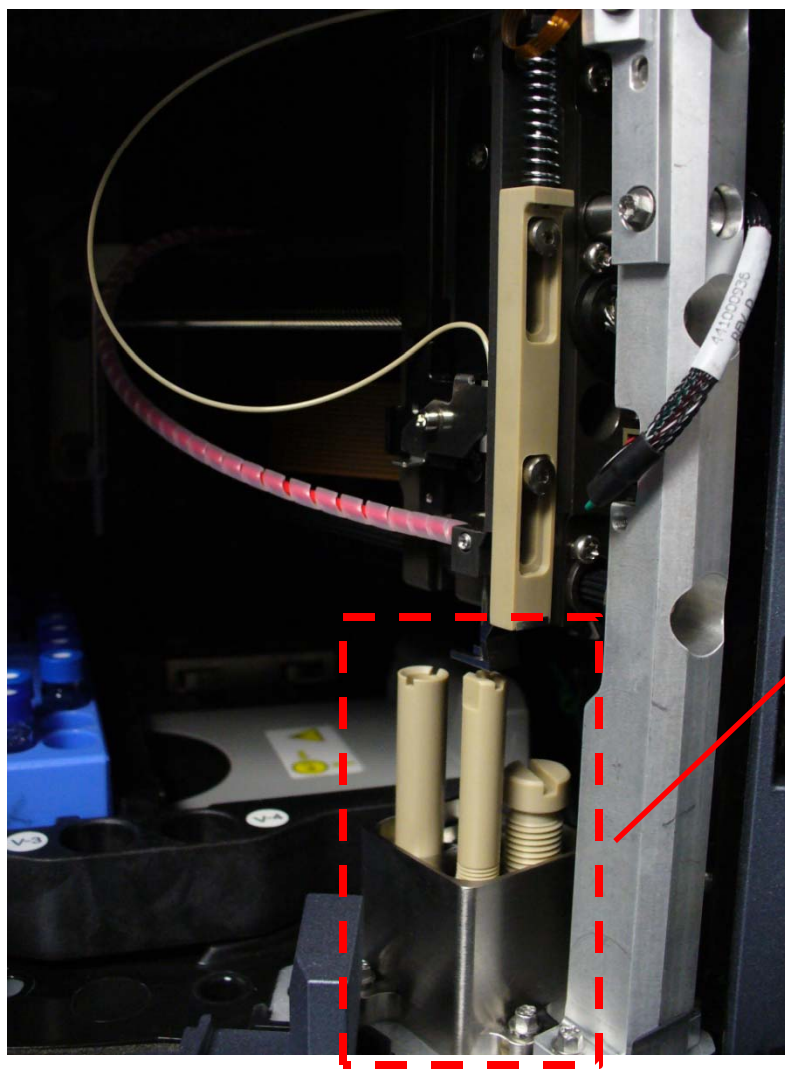


- Injection port moved to front of SM-FL
- Needle volume reduced
- New routing of needle in sample manager



SM-FL: Injection Port

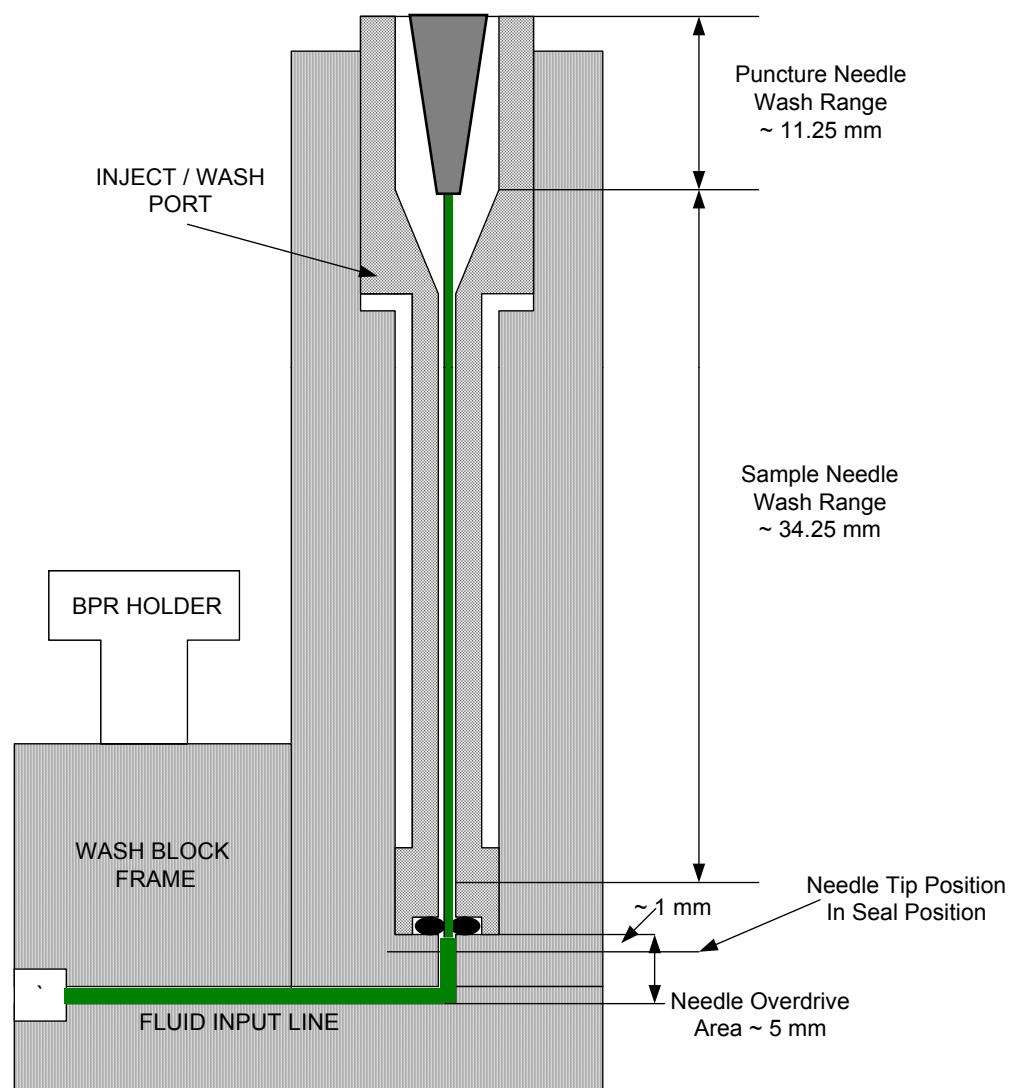
Same function different position.



Wash Block- Pressure Assist Function

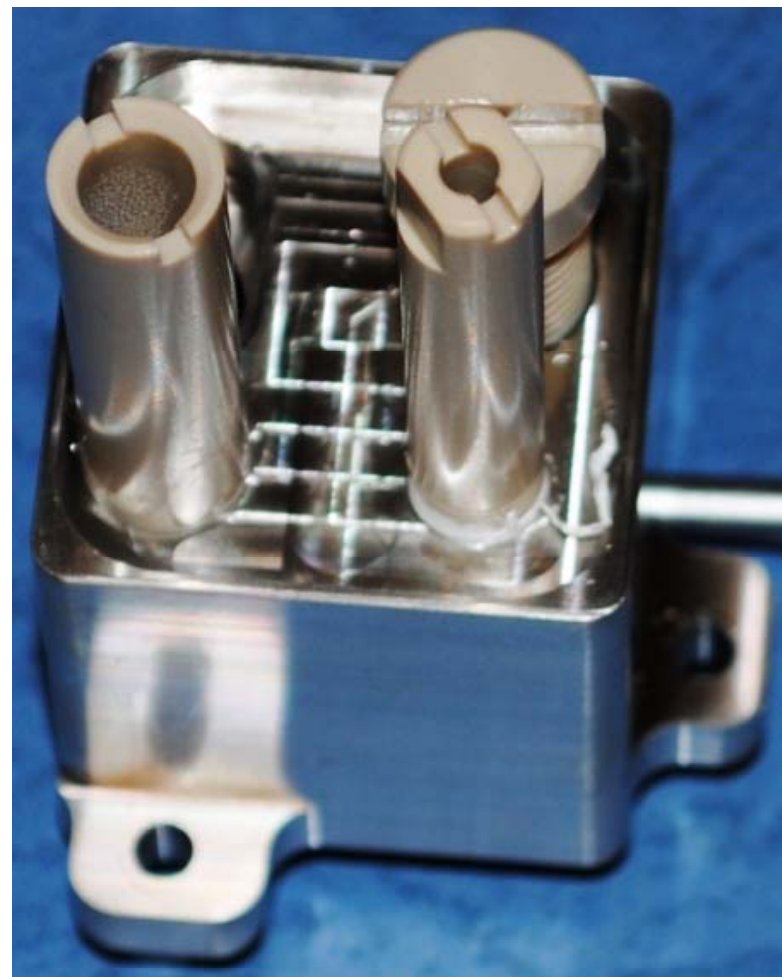
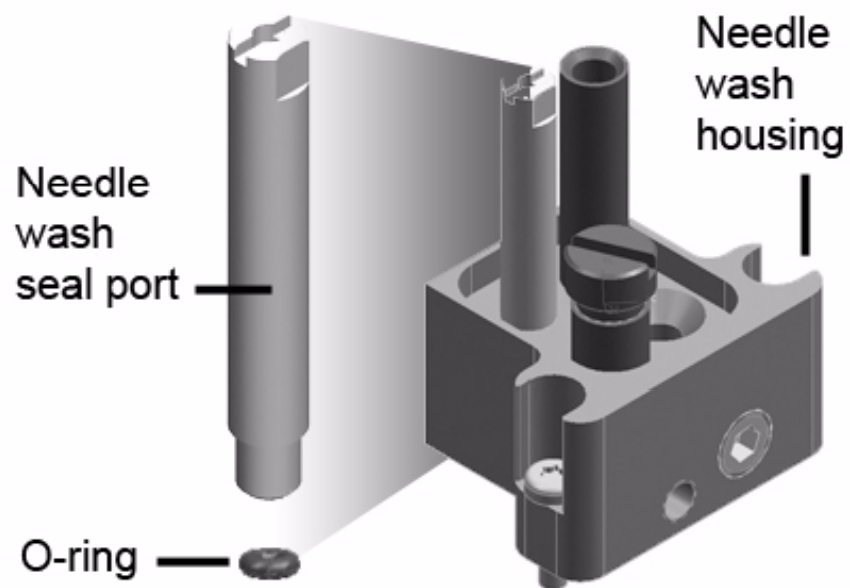


Wash / Inject Block Internal Detail



WASH / INJECT BLOCK

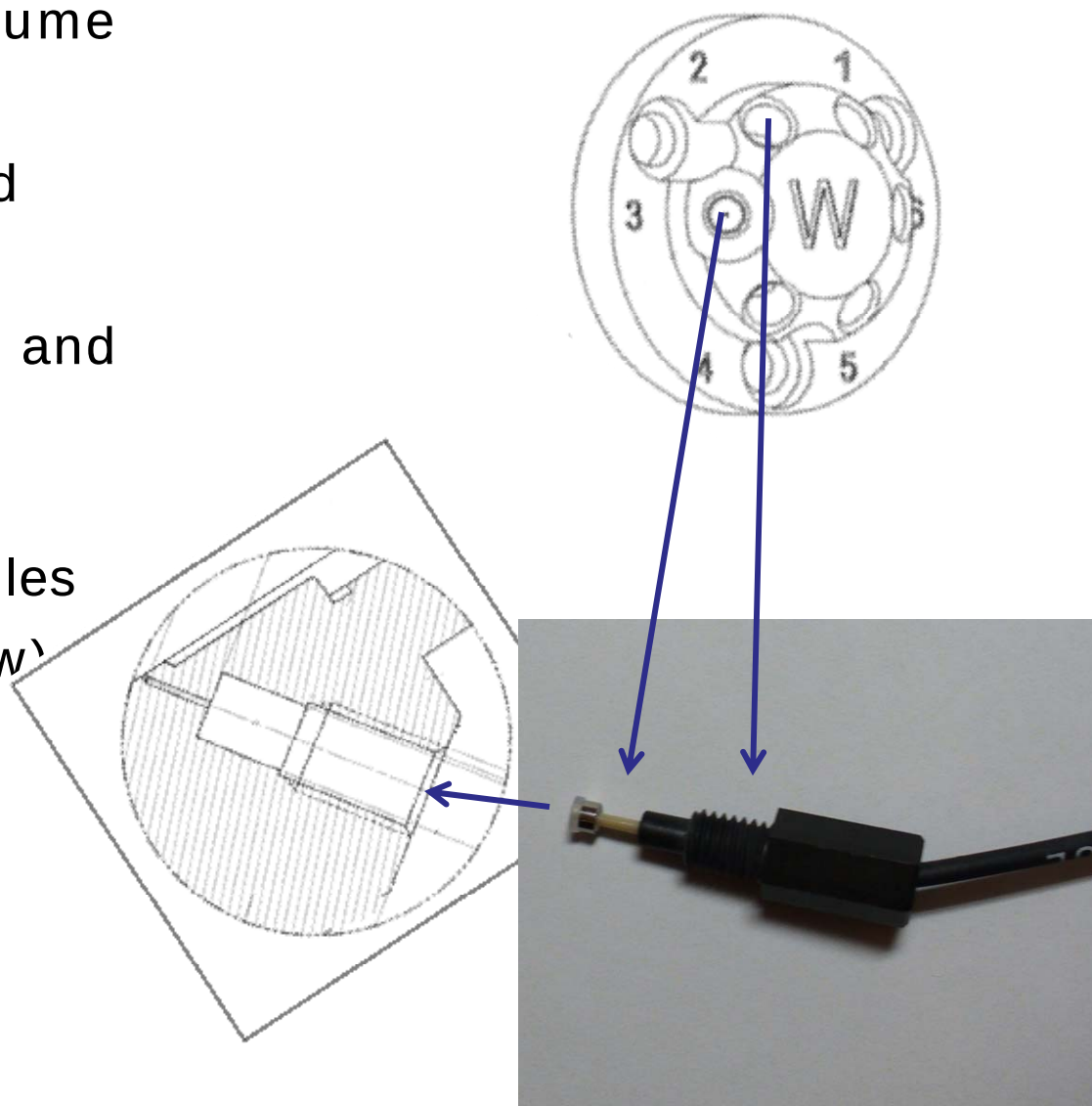
Seal Port O-Ring Replacement



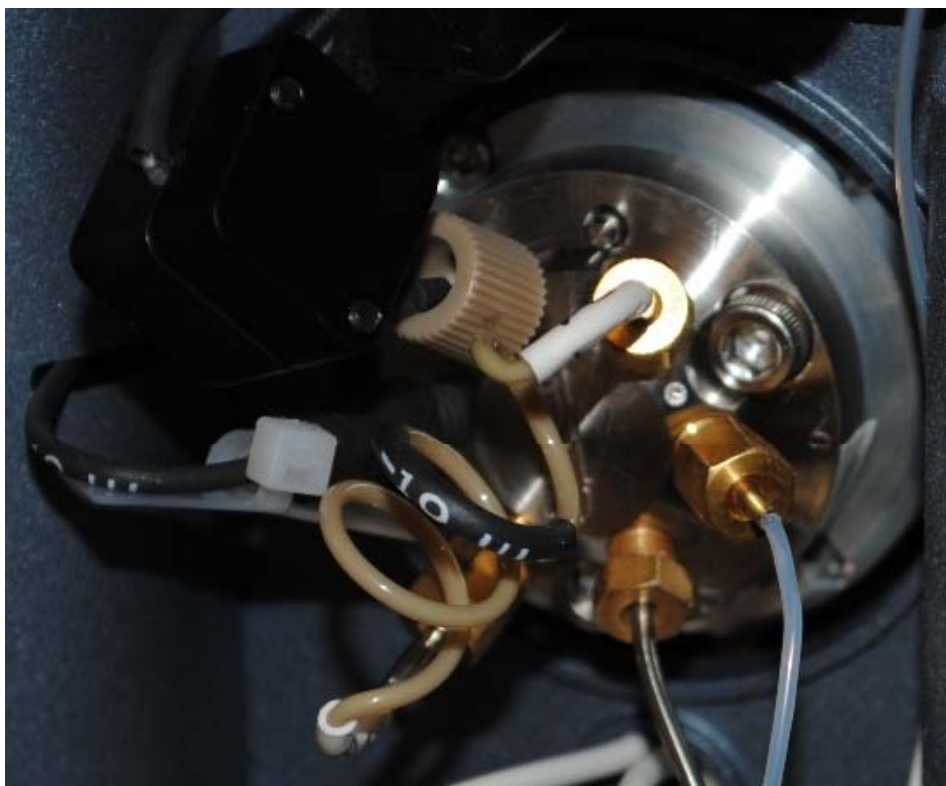
SM-FL: New Sample Needle



- New default needle volume
- Needle volume reduced
- New fittings for Needle and VDD
- Available Sample Needles
 - PEEK (Available Now)
 - PEEKSi
 - Steel
 - FEP



SM-FL: Inject Valve

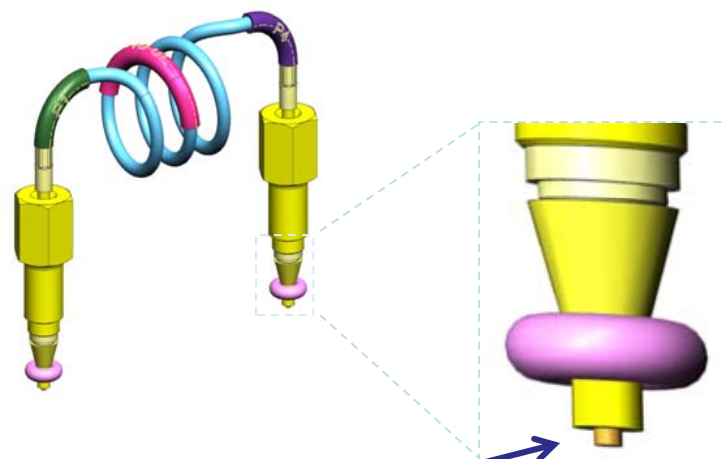


- Inject Valve
 - 18k psi compatibility
 - New rotor
 - Pod not interchangeable with ACQUITY UPLC
 - Minimized dispersion
 - Improved carryover
- New sample loops

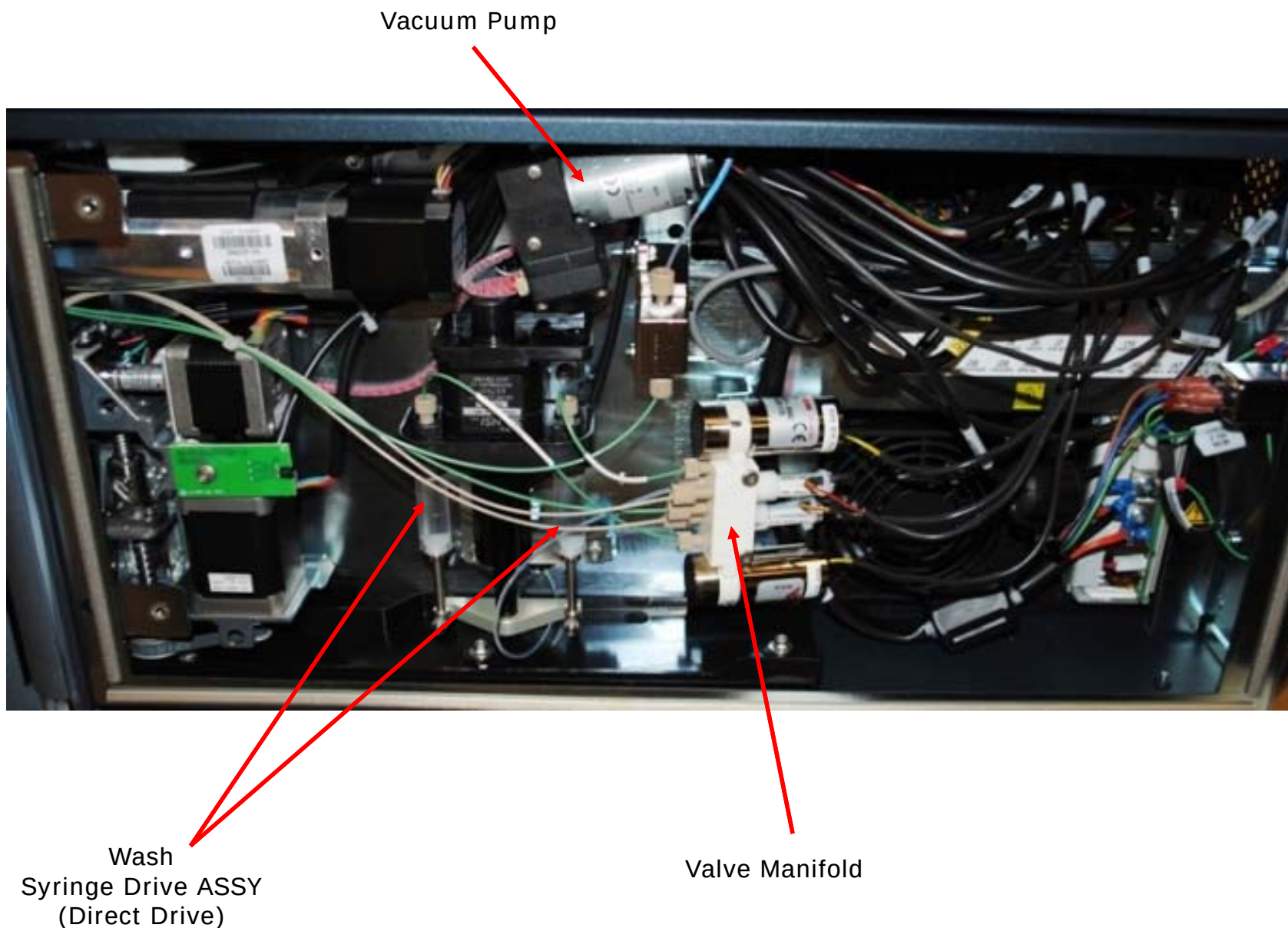
SM-FL: New Loops



- New sample loops
 - Pre-swaged to prevent poor installation
 - Smaller o.d. tubing with more consistent i.d. for better loop to loop consistency
 - Better carryover performance due to hypo fitting



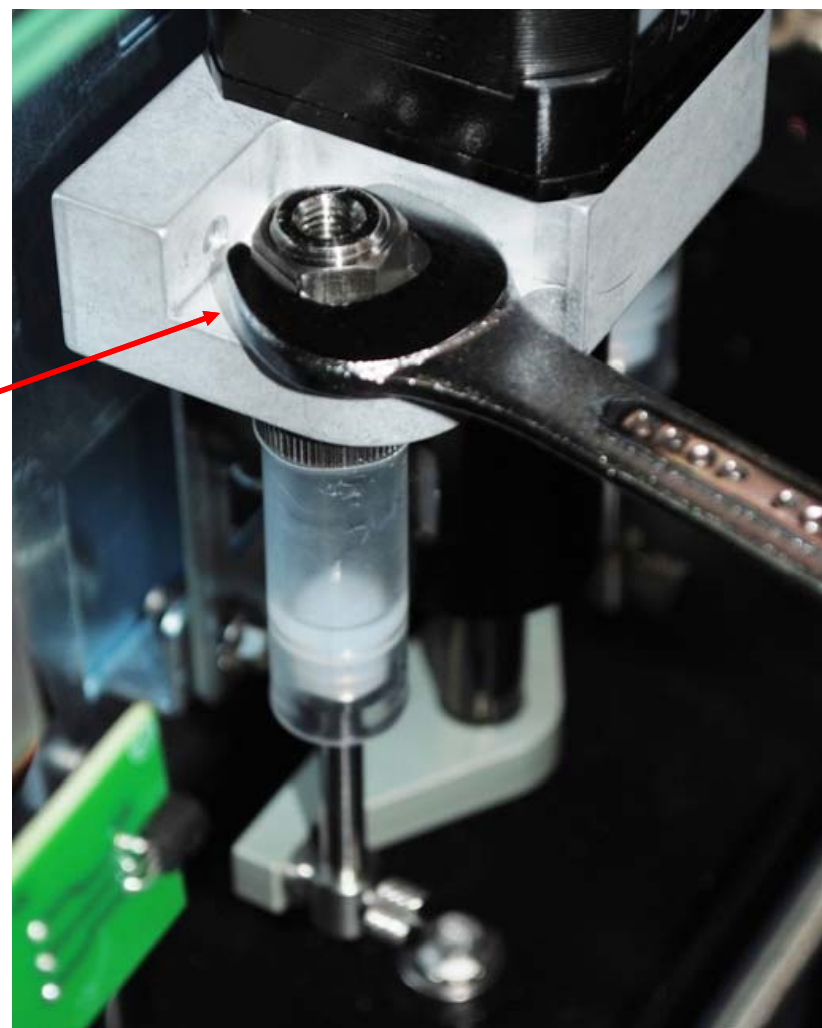
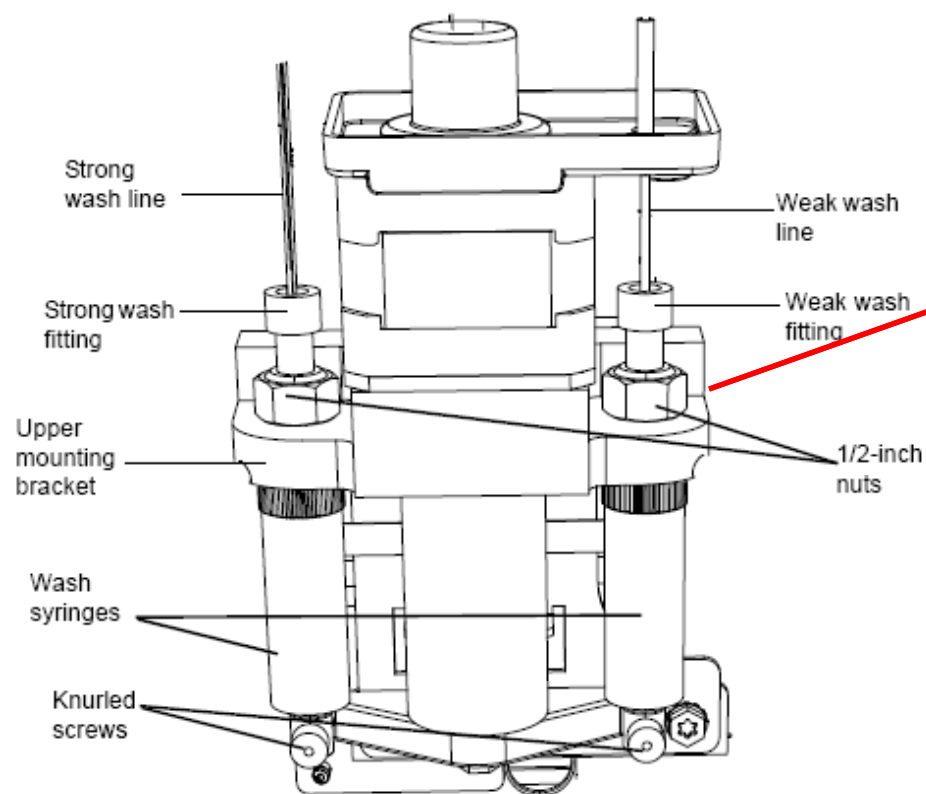
SM-FL Component Overview



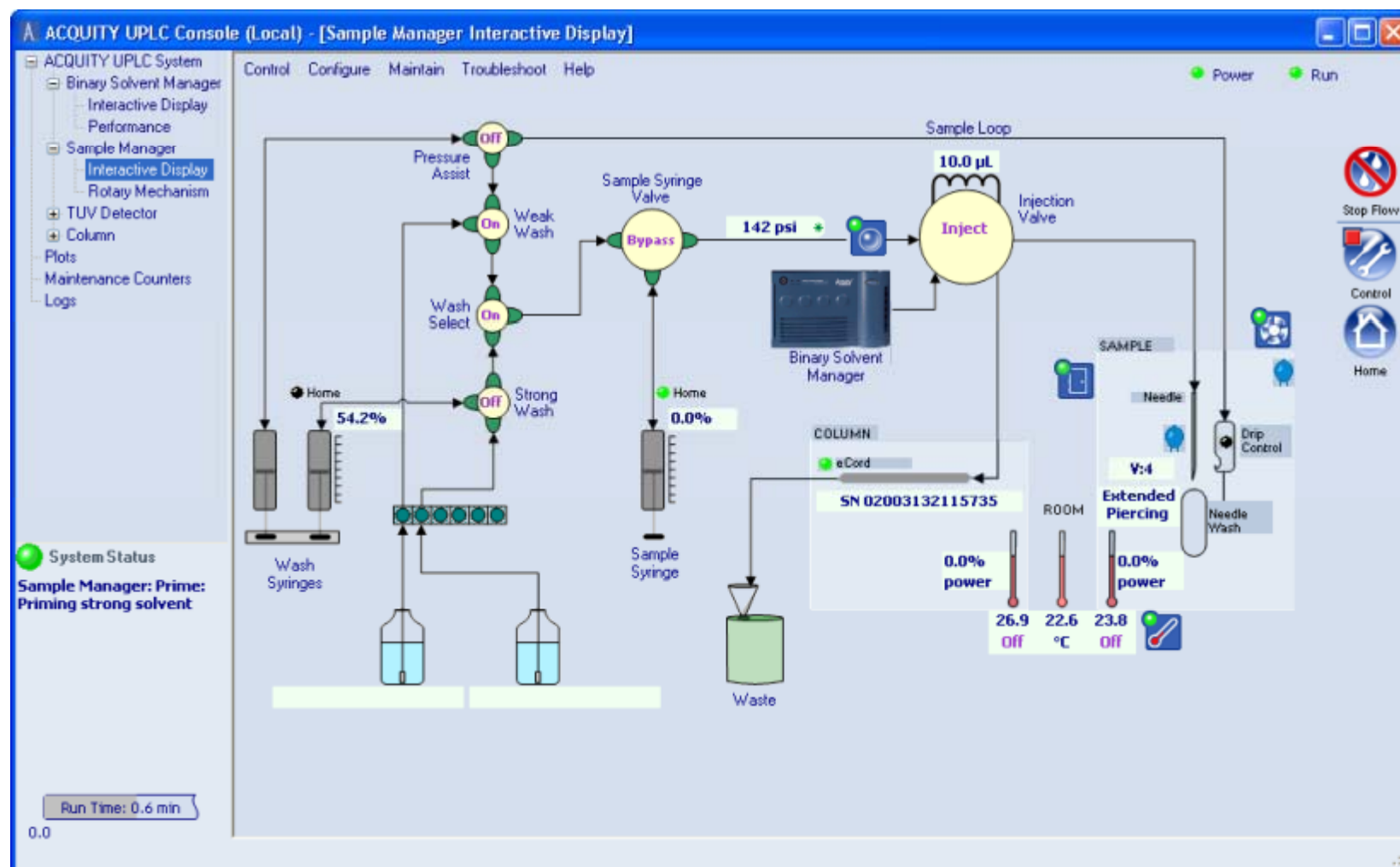
Wash Syringe Drive Assembly



Global Training
& Development



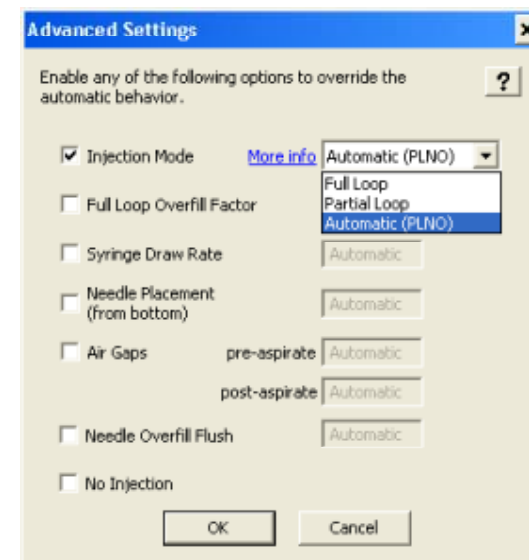
I-Class SM-FL Interactive Menu



SM-FL: Injection Mode Recommendations

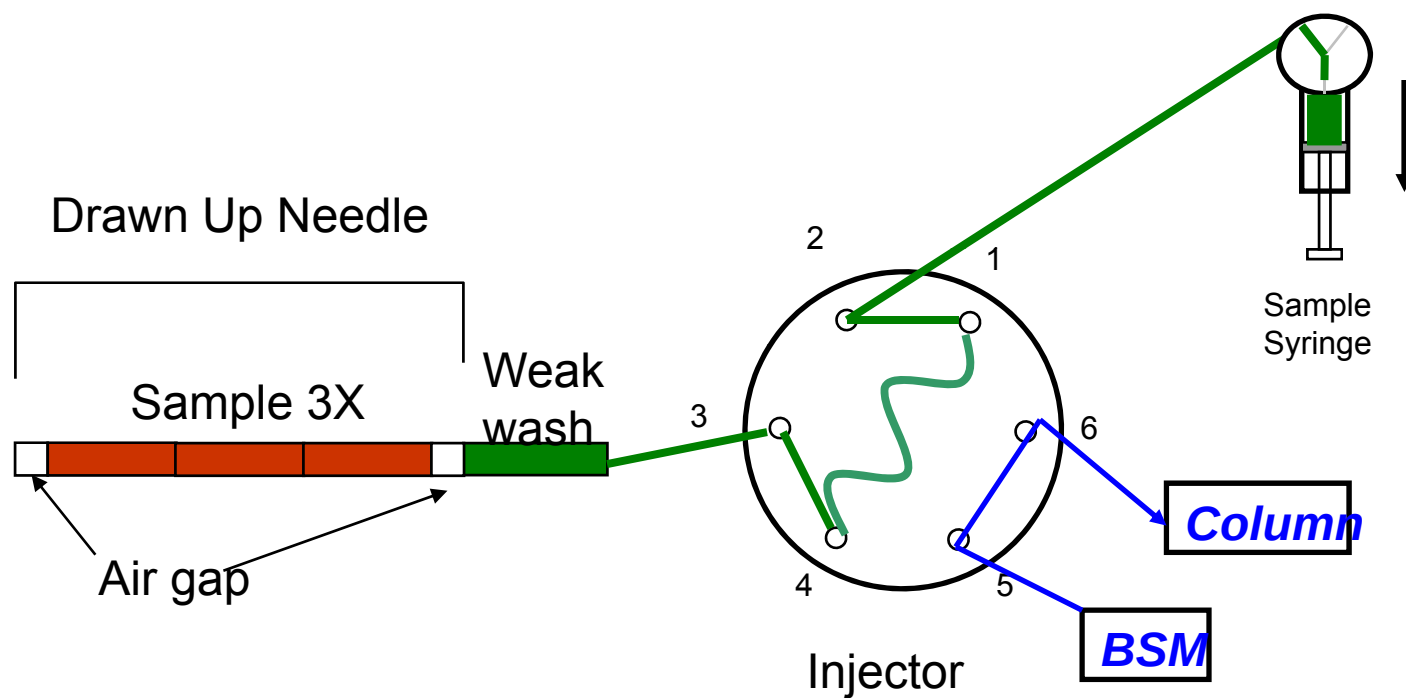


- Specified in the Advanced Settings
 - Full loop
 - Best precision
 - Requires lots of sample - 3x or more
 - Partial loop with pressure assist
 - Weak wash injected along with the sample
 - Inject up to 50% of loop volume
 - Recommended only for 20 and 50µL loops
 - Recommended for fast injection-to-injection cycles
 - No extra sample consumed
 - Partial loop needle overfill
 - Widest injection volume range: 10-75% of loop volume
 - More reproducible than partial loop with pressure assist
 - Requires minimum 3 µL more than the injection volume
 - Default will be less than 15µL, TBD

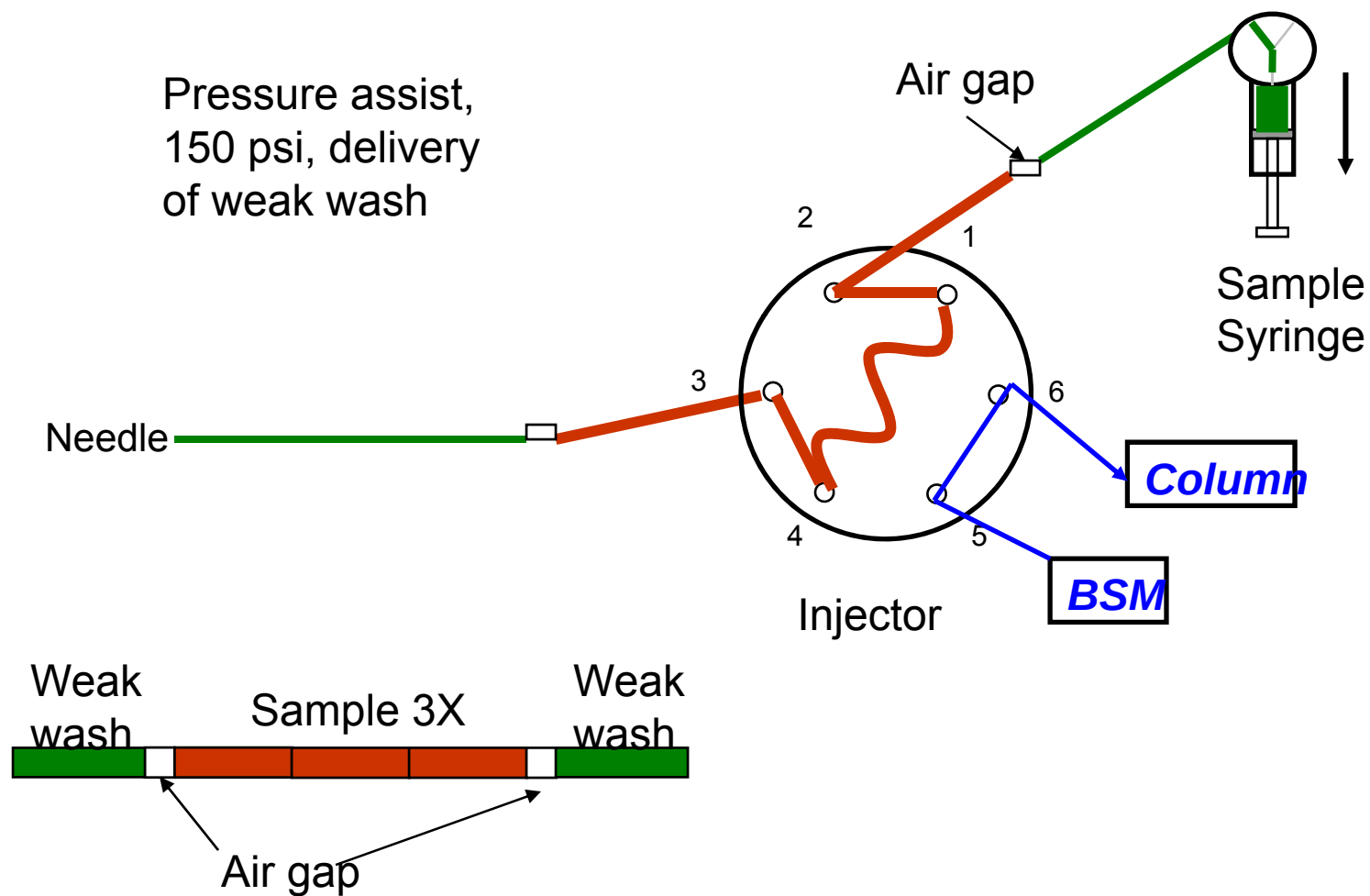


SM-FL: Full Loop - 1

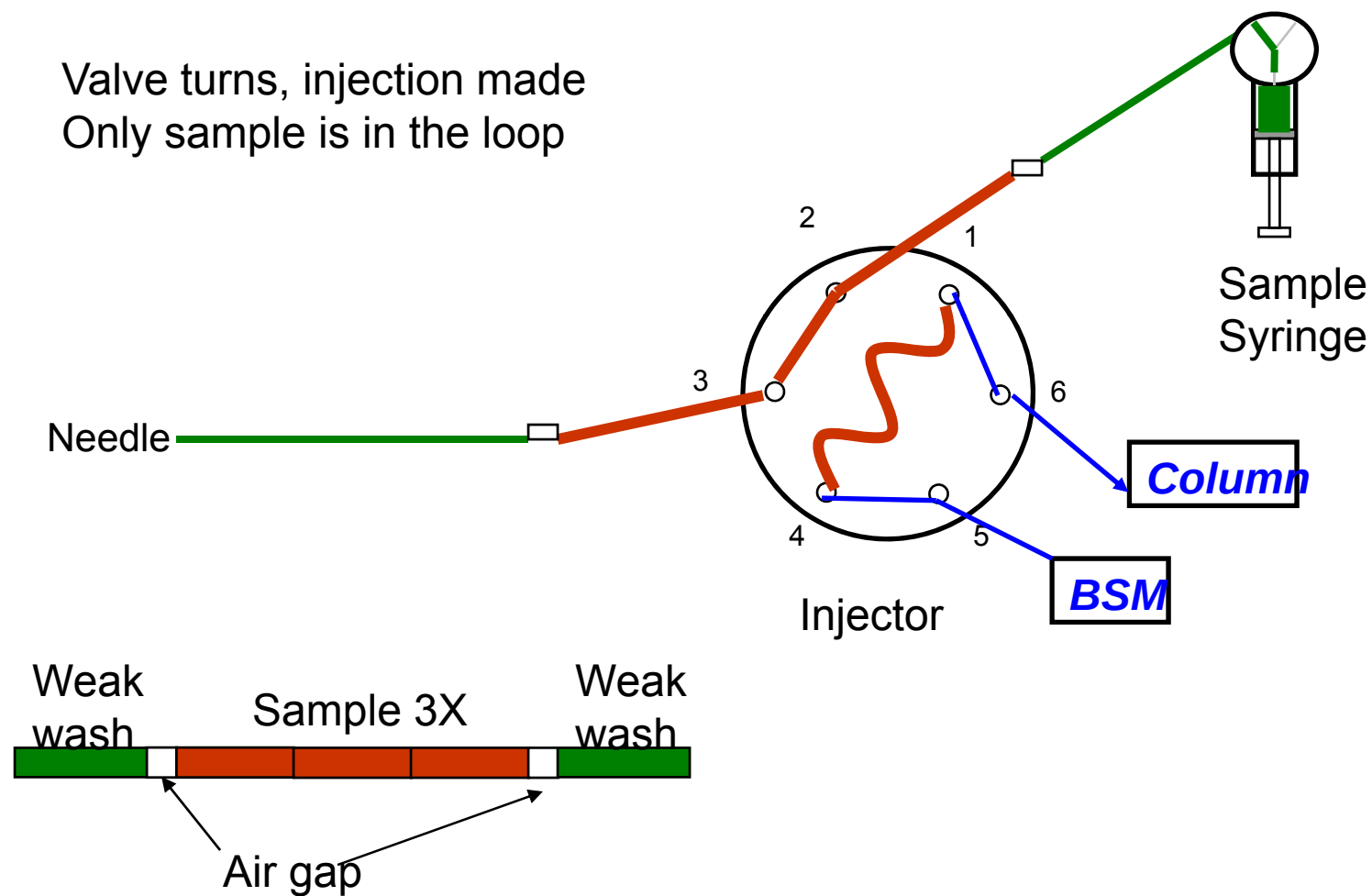
Sample Drawn



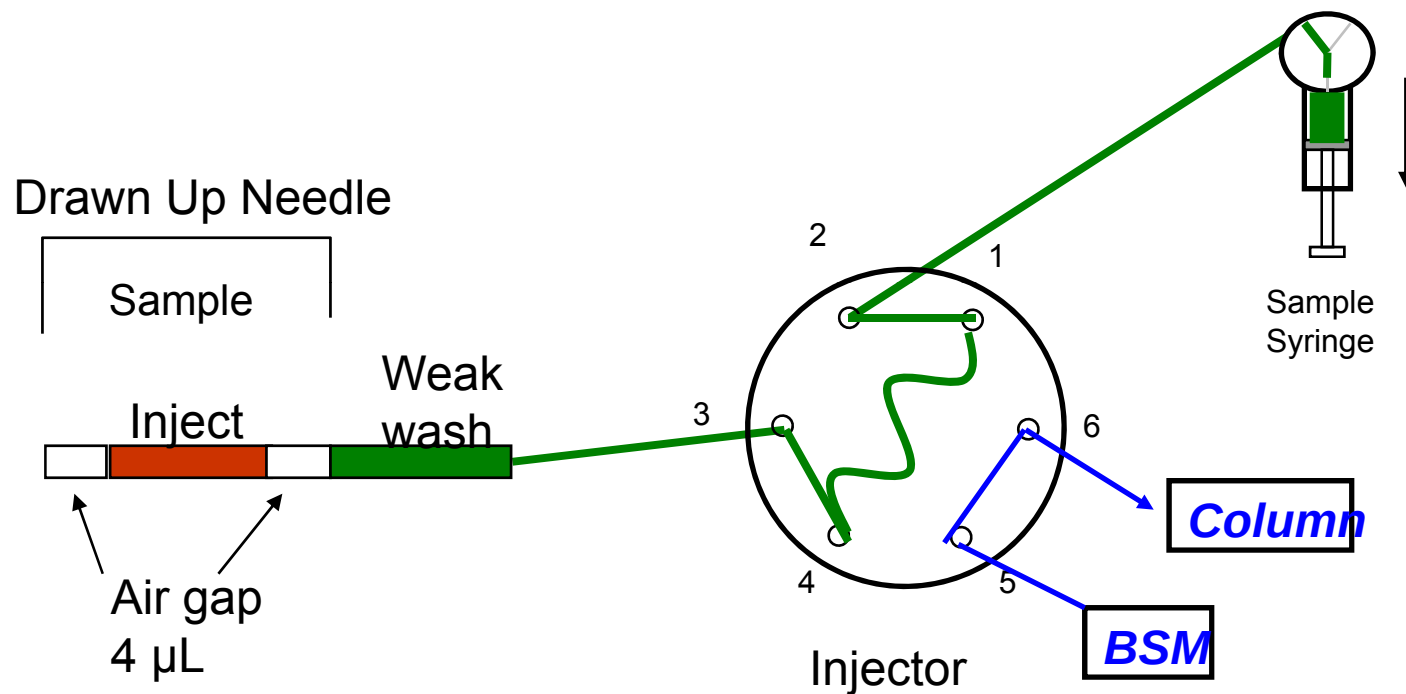
SM-FL: Full Loop - 2



SM-FL: Full Loop – 3 Sample Injected

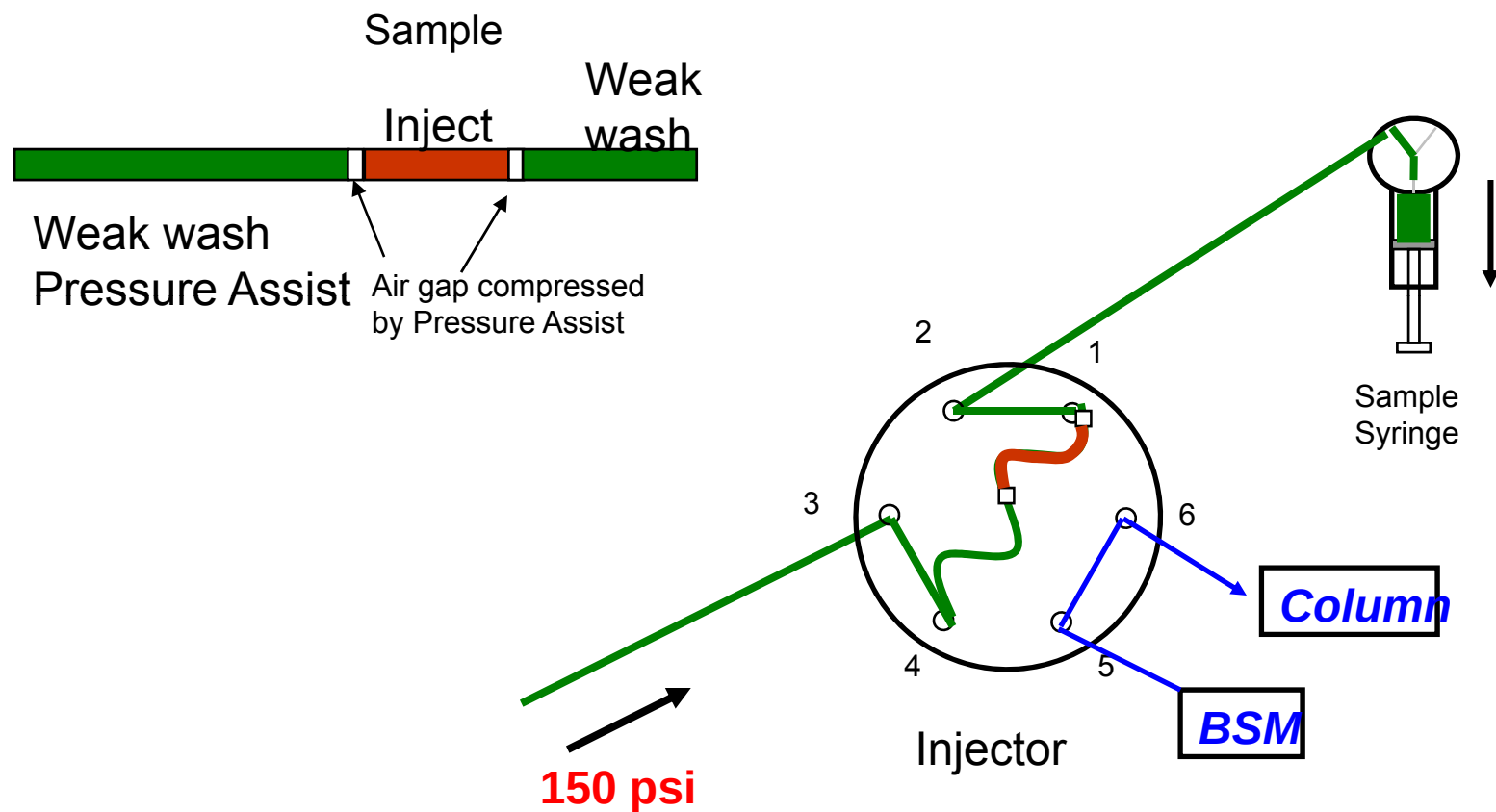


SM-FL: Partial Loop (Pressure Assist) - 1 Sample Drawn



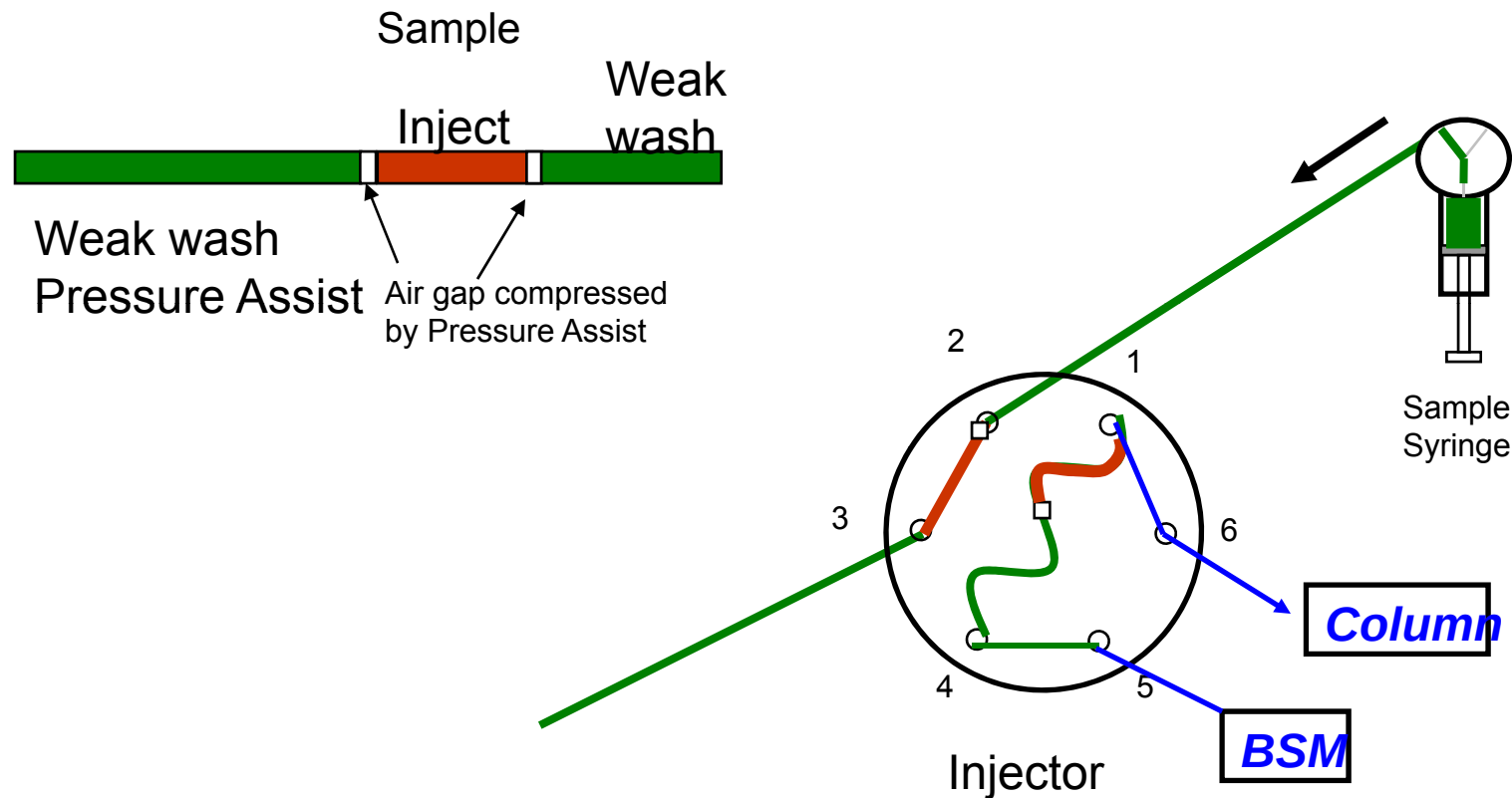
SM-FL: Partial Loop - 2

Sample Positioned



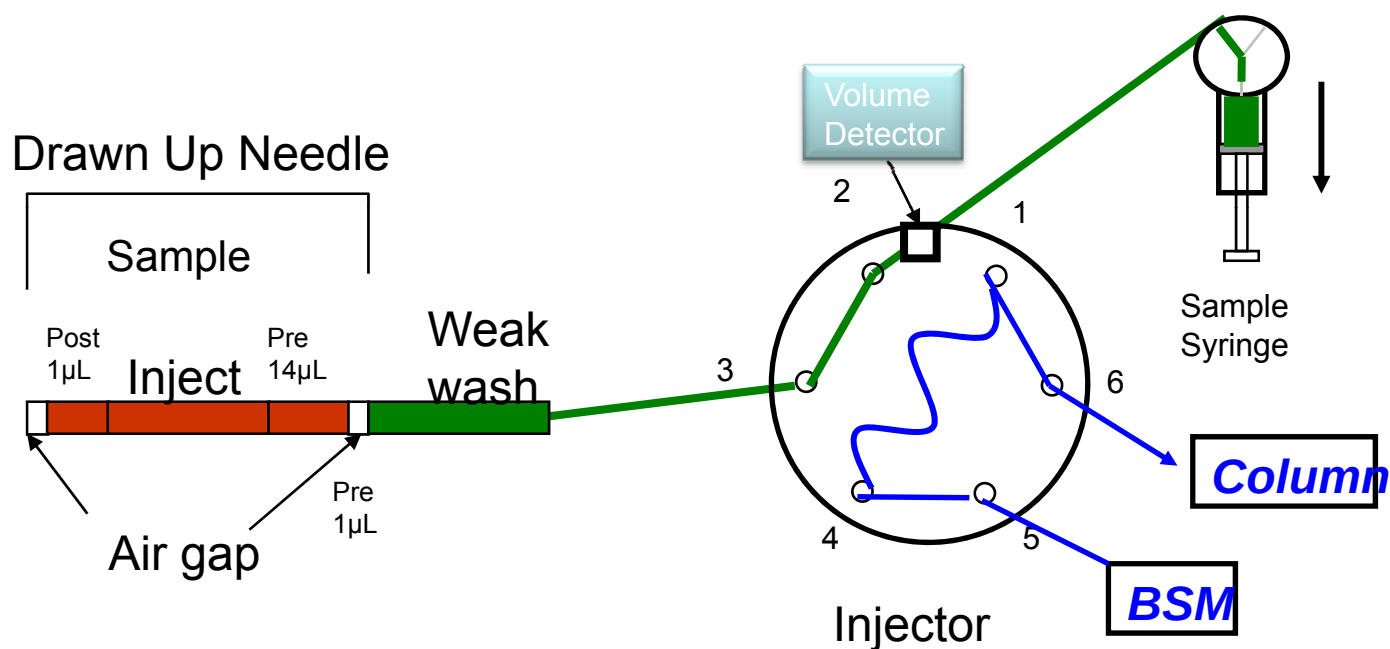
SM-FL: Partial Loop - 3

Sample Injected



NOTE: Air gap injected

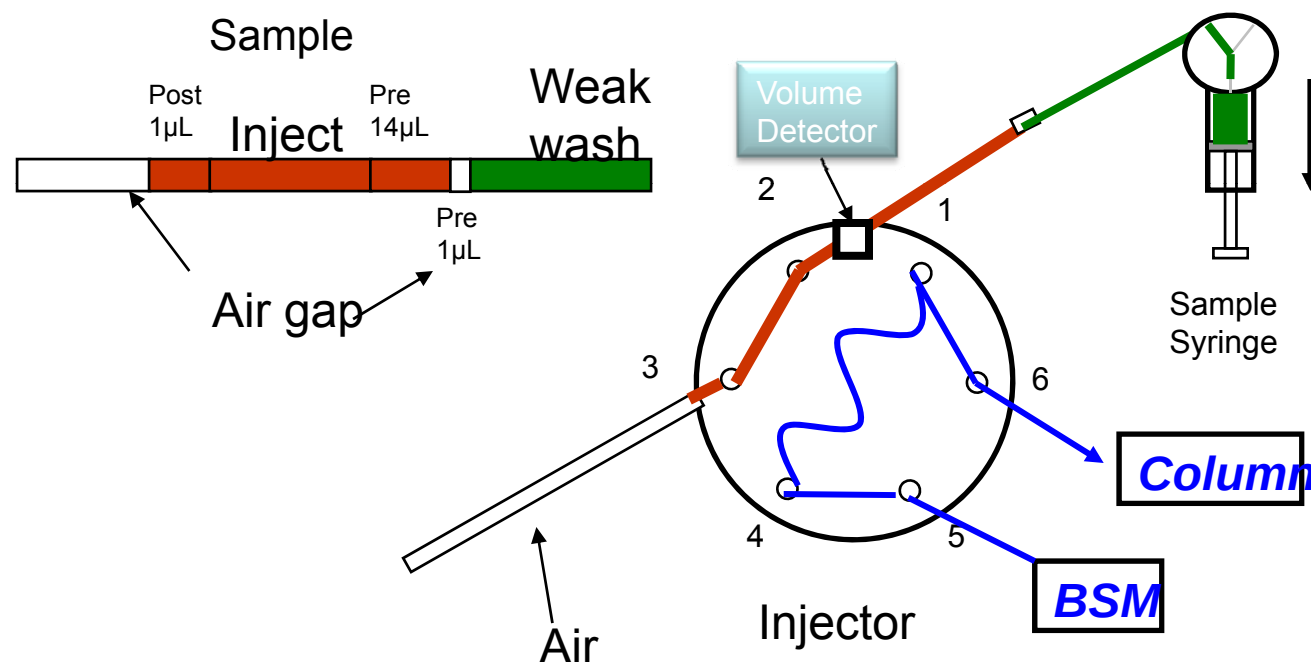
SM-FL: Partial Loop Needle Overfill (PLUNO) – 1 Sample Drawn



Note: Since ICOP version 1.30 the default setting is 15 μ L extra sample per injection. This can be modified

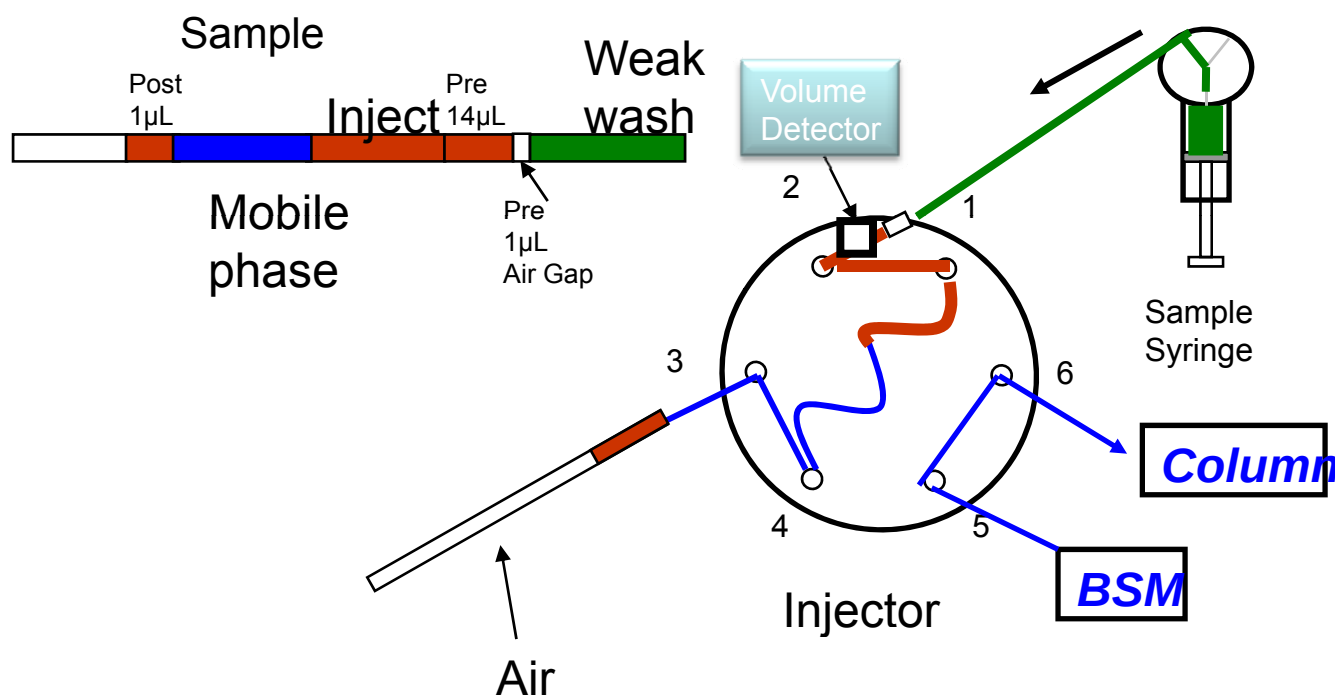
SM-FL: Partial Loop Needle Overfill - 2

Sample Positioned



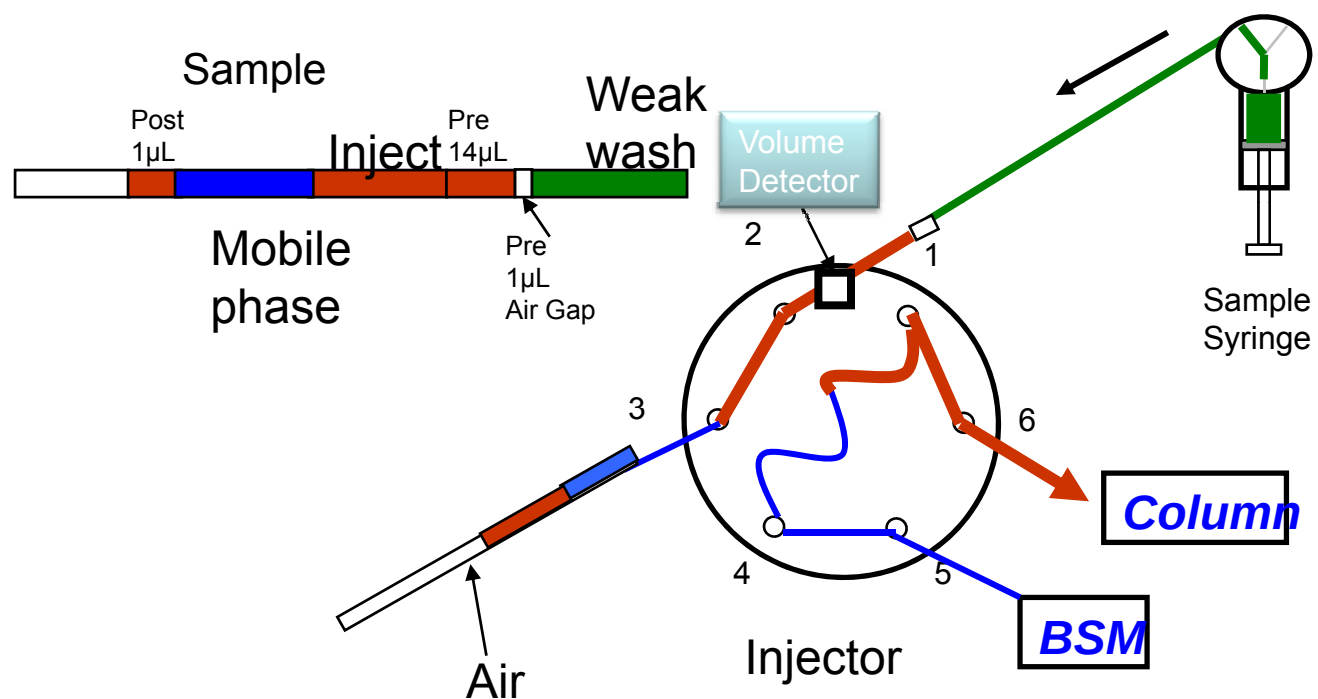
- Sample positioned after the Injector Valve in the Volume Detector tube

SM-FL: Partial Loop Needle Overfill – 3 Sample Loaded



- Sample pushed into the Injector loop
- Mobile phase fills remainder of loop

SM-FL: Partial Loop Needle Overfill – 4 Sample Injected

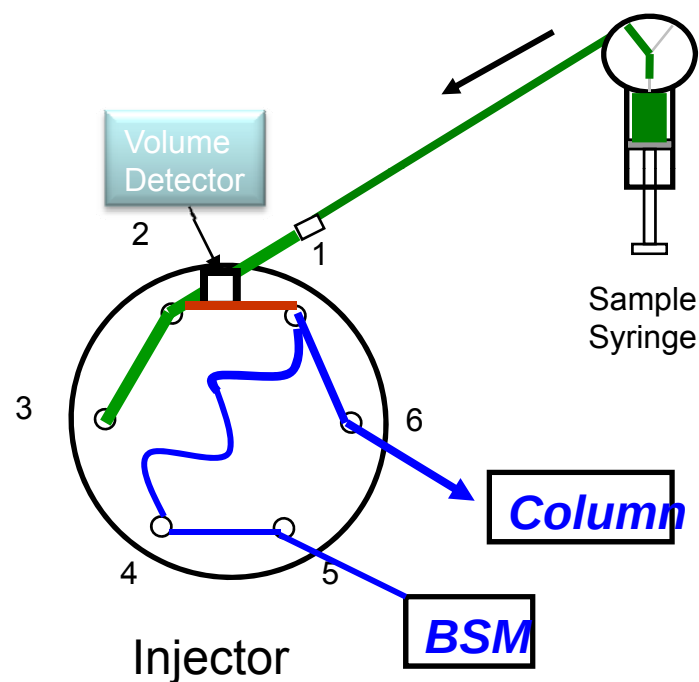


- Sample injected with some mobile phase
- No weak wash solvent injected
- No air injected

SM-FL: 'Double-Click'



- After injection and cleaning of the valve and sampling mechanism there is a part of the valve fact that is not cleaned (Noted in RED)
- By actuating the valve during the run the material is pushed into the sample loop and then 'injected' during the end of the gradient



SM-FL: Cycle Inject Valve



Modify ACQUITY Sample Manager Instrument Method

Acquity Sample Manager
UPLC*

Run Time: 6.50 min

General | Data | Events

Initial Switch States

1: No Change 3: No Change
2: No Change 4: No Change

Chart Out: Sample Pressure

☒ Run Events

	Time (min)	Event
1	2.00	Cycle Inject Valve
2		Switch 1
3		Switch 2
4		Switch 3
5		Switch 4
6		Sample Temperature
-		Column Temperature
-		Sample Temperature Off
-		Column Temperature Off
-		Cycle Inject Valve

Modify ACQUITY Sample Manager Instrument Method

Acquity Sample Manager
UPLC*

Run Time: 6.50 min

General | Data | Events

Initial Switch States

1: No Change 3: No Change
2: No Change 4: No Change

Chart Out: Sample Pressure

☒ Run Events

	Time (min)	Event	Action
1	3.00	Cycle Inject Valve	
2			
3			
4			
5			
6			
-			

OK Cancel

Determining Duration of Gradient Time



Modify ACQUITY Binary Solvent Manager Instrument Method

Acquity Binary Solvent Manager UPLC[®] Run Time: 2.00 min

General | Data | Analog Out | Events

Solvents:

A1 90%water/10% ACN

B2 Acetonitrile

Pressure Limits: Low: 0 psi High: 15000 psi Seal Wash: 5.0 min

Gradient:

	Time (min)	Flow (mL/min)	%A	%B	Curve
1	Initial	0.600	5.0	95.0	Initial
2	30.00	0.600	5.0	95.0	11
3					
4					
5					
6					

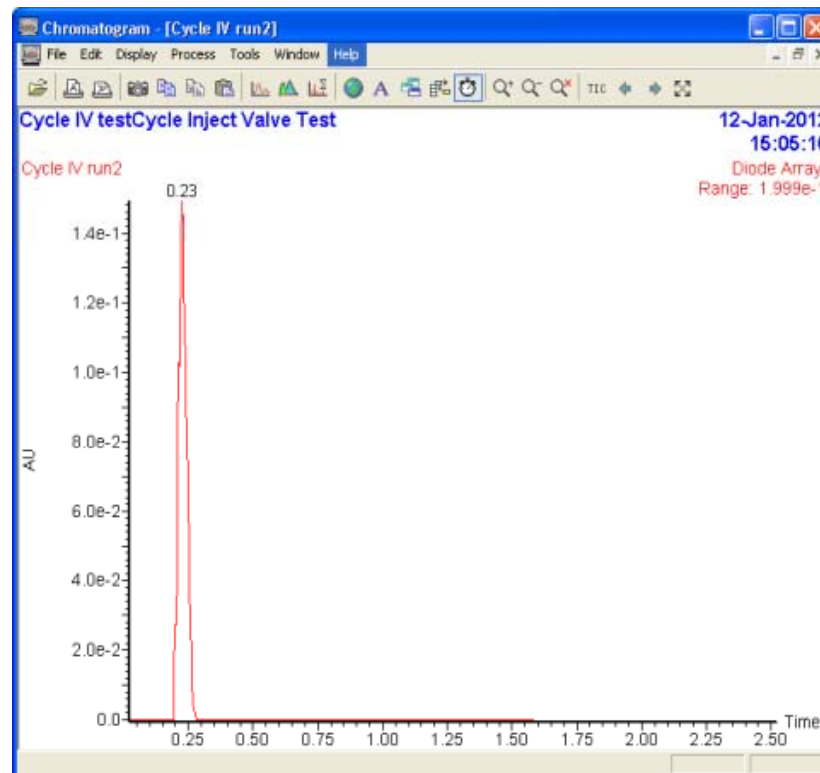
Gradient Start: ☒ At injection ☐ Before injection ☐ After injection

0 uL

Comment:

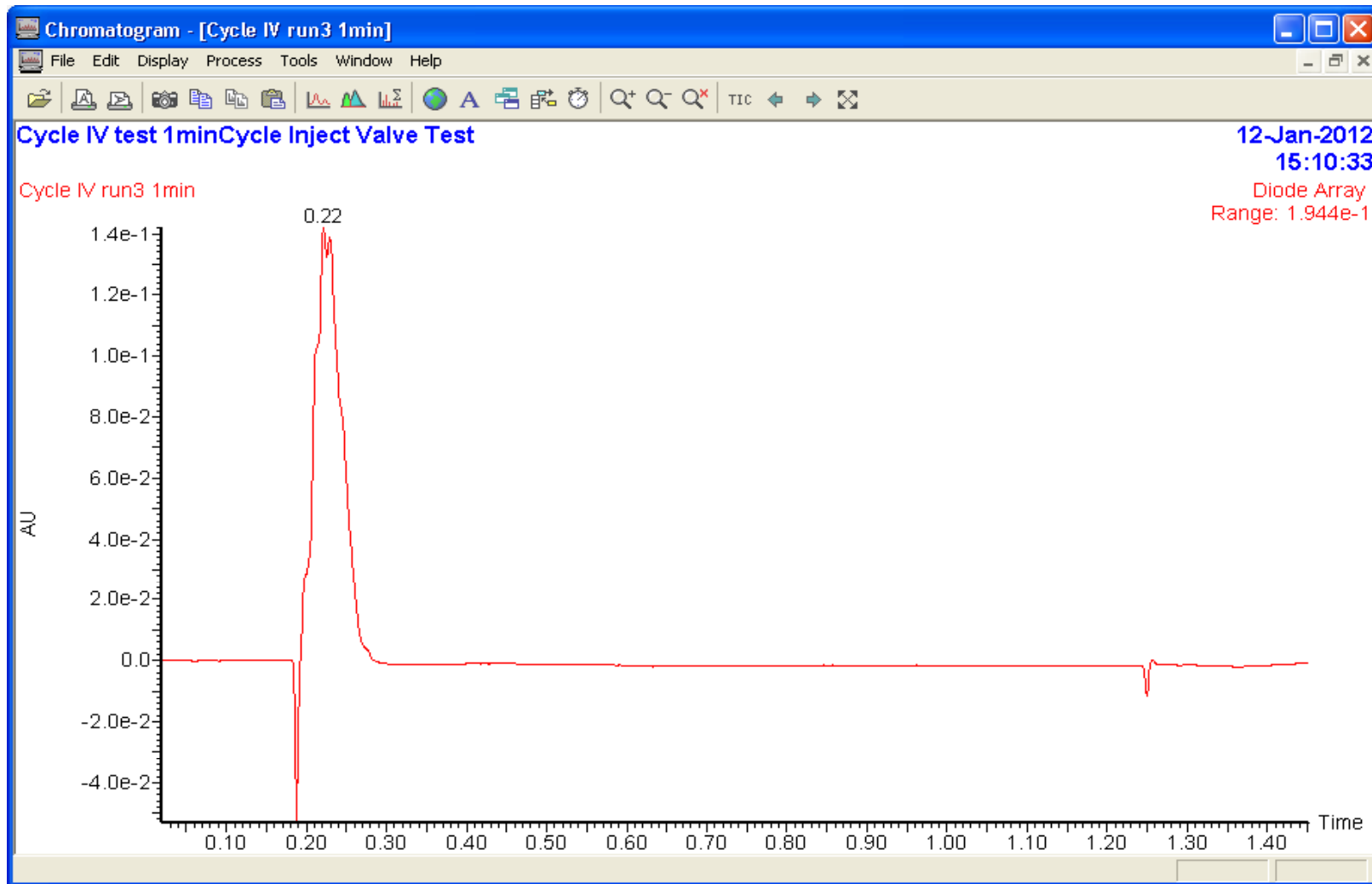
OK Cancel

Set up an isocratic method to run at the end conditions (highest percent organic) of your gradient method.



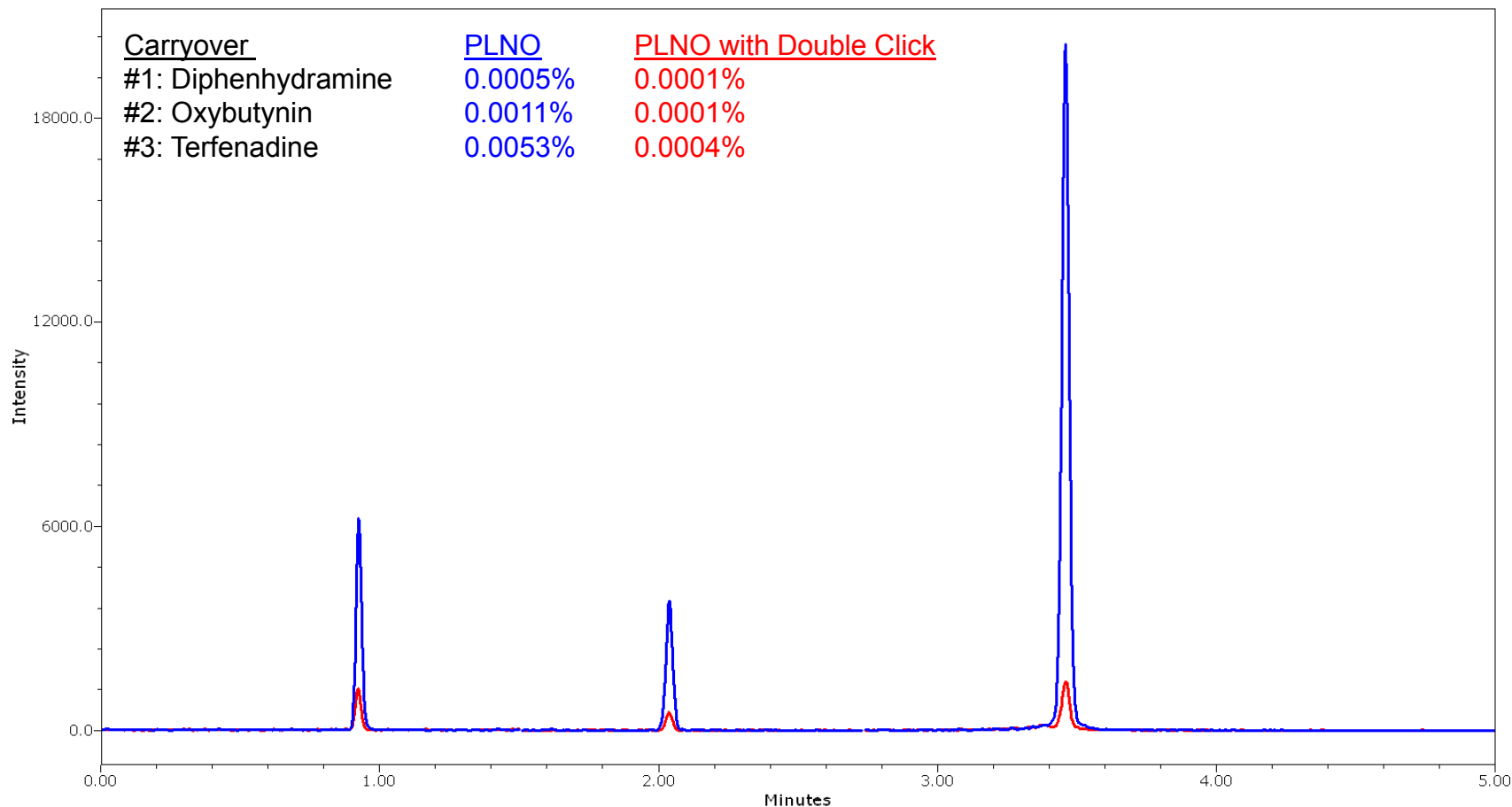
Inject your sample and determine the time it takes for all your compounds of interest to elute. If the organic is high enough, the compounds will most likely co-elute (as seen above). This would indicate the time you need to add to your end condition segment.

Evaluating Cycle Inject Valve Result



In this example, a Cycle Inject Valve event was set for 1 minute end condition conditions. at the time it takes for all your compounds of interest to elute. The compounds of interest co-elute at 0.22 min. A slight blip in the baseline can be seen at 1.22 min. indicating possible carryover of material between ports 1 and 2.

SM-FL: MS Carryover Improvement with 'Double Click'



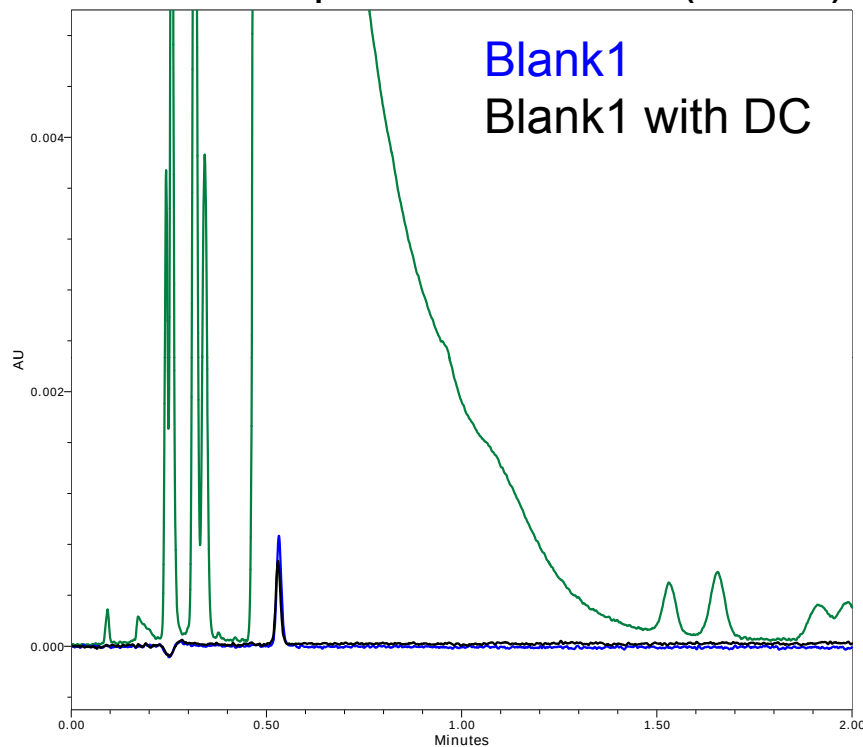
1st Blank Injection after High Concentration Standard PLNO

1st Blank Injection after High Concentration Standard PLNO with 'Double Click'

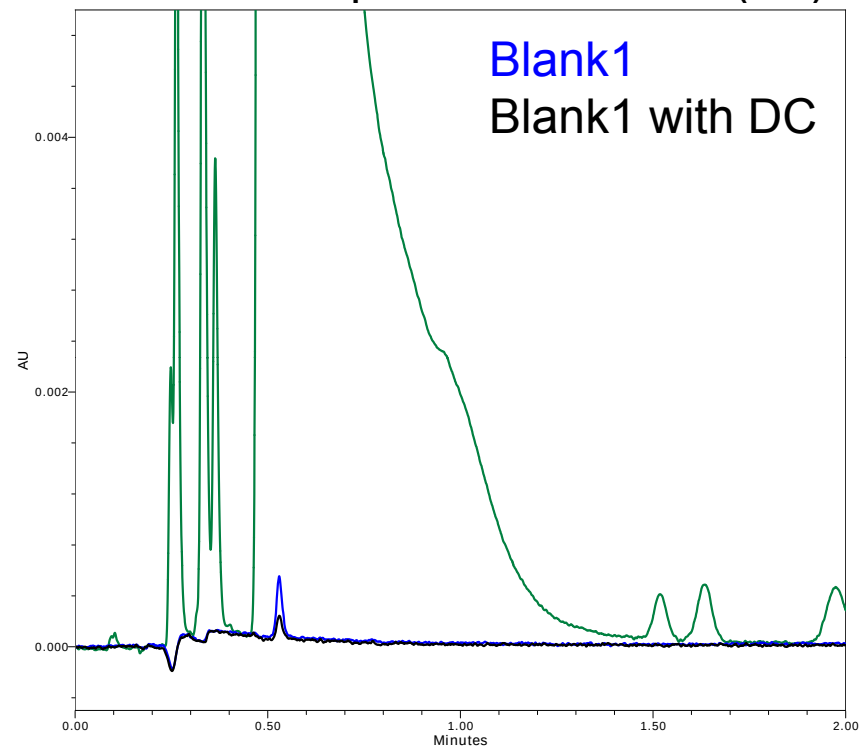
SM-FL: UV Carryover Improvement with 'Double Click' - Caffeine



Partial Loop Needle Overfill (PLNO)



Partial Loop Pressure Assist (PL)

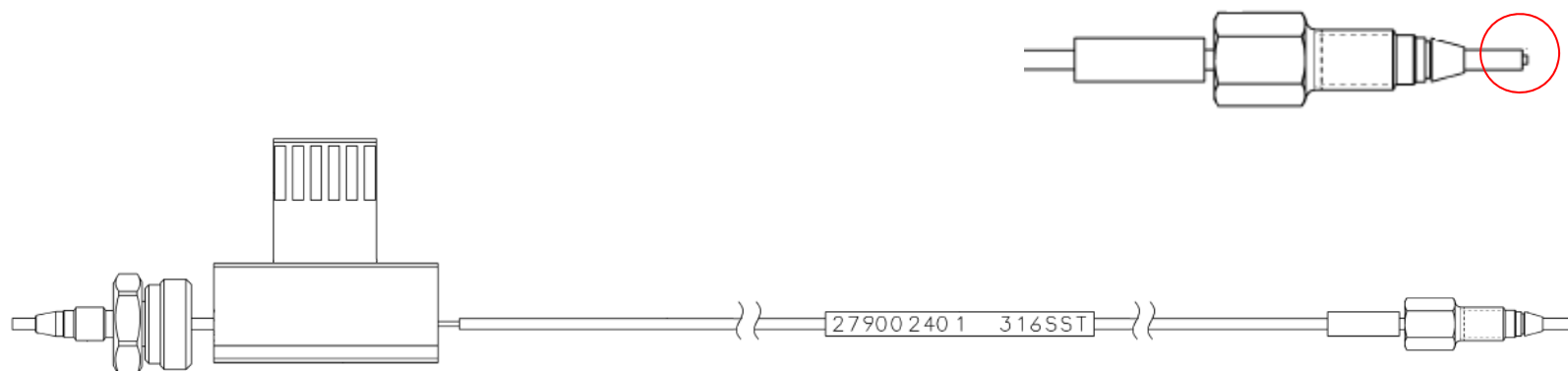
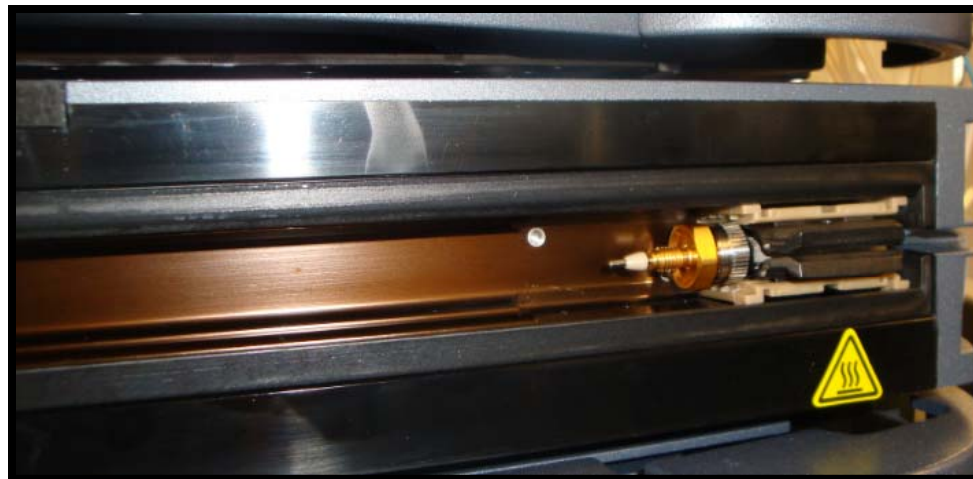


Injection Mode	Double-Click	Carryover
PLNO	No	0.00100%
PLNO	Yes	0.00062%
PL	No	0.00064%
PL	Yes	0.00024%
FTN	--	0.00034%

NEW Active Pre-Heater



- 18,000 PSI capable
- Improved Dispersion
 - 0.003" ID Tubing
 - Protruded end
 - Modified "V" Detail
 - Positive contact point



Improved Active PreHeaters

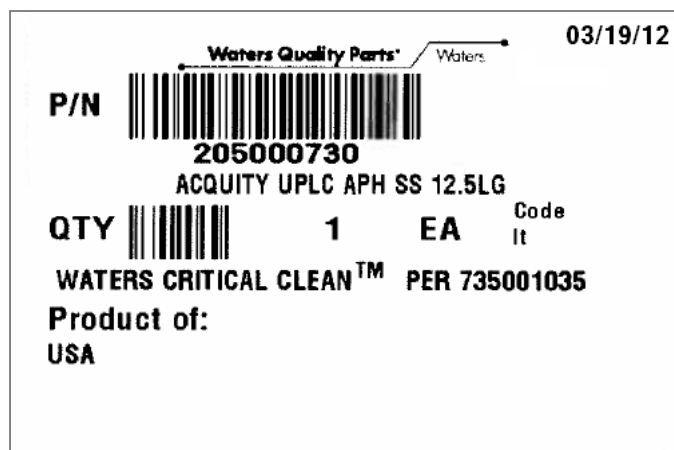


- Annealed 5X improved APH

- Label on the APH,
279002309



Dated code on the box is
March, 19 2012
(03/19/12) and later



- Original APH

- Label on the APH,
279002002



- Dated code on the box is
18-March-2012
(03/18/12) and earlier

Where is 205000730 used?



Part number	Description	Where used			
		CM-A	CM-Aux	CH-30A	CH-A
205000730	ACQUITY UPLC APH SS 12.5LG <i>Standard length used in 2-column and 4-column con- figurations</i>	✓	✓	✓	✓

ACQUITY UPLC I-Class System Column Management



- What's New?
 - 2 supported configurations
 - Single Column Heater
 - Dual Column Manager
 - Not recommended with 4-50mm columns because of dispersion
 - Aux Column Manager
 - Not recommended because of dispersion
 - CH-30A is compatible where HPLC columns must be supported
 - H-Class performance only



Column Management



	I-Class CH-A	I-Class CM-A
Column Capacity	Single column	Up to 2 columns
Dimensions	Max. 150mm length x 1.0 or 4.6 mm ID w/ prefilter or guard column in-line	Max. 150mm length x 1.0 or 4.6 mm ID w/ prefilter or guard column in-line
Temperature Range	Ambient +5°C to 90 °C	4 °C to 90 °C
Solvent Conditioning	Active Pre-Heating (APH)	independent control of each column with Active Pre-Heating (APH)
Access to MS inlet	Door slides across	Inlet/Outlet configurable Left or Right
Column Fittings	18 K PSI- New design	18 K PSI- New design
Advanced Functionality	None	Column selection or 2D
High Pressure Valve Configuration	None	TWO valves - 18 K PSI, Dual 9 port valve 2-column selector
2D Functionality	None	TWO valves - 18 K PSI, Dual 2 position column selector

- Column management options equivalent to H-Class, lower dispersion, higher pressure, optimized fittings
- Maximum 2 columns and 1 Column Manager

ACQUITY UPLC I-Class System

Optical Detection



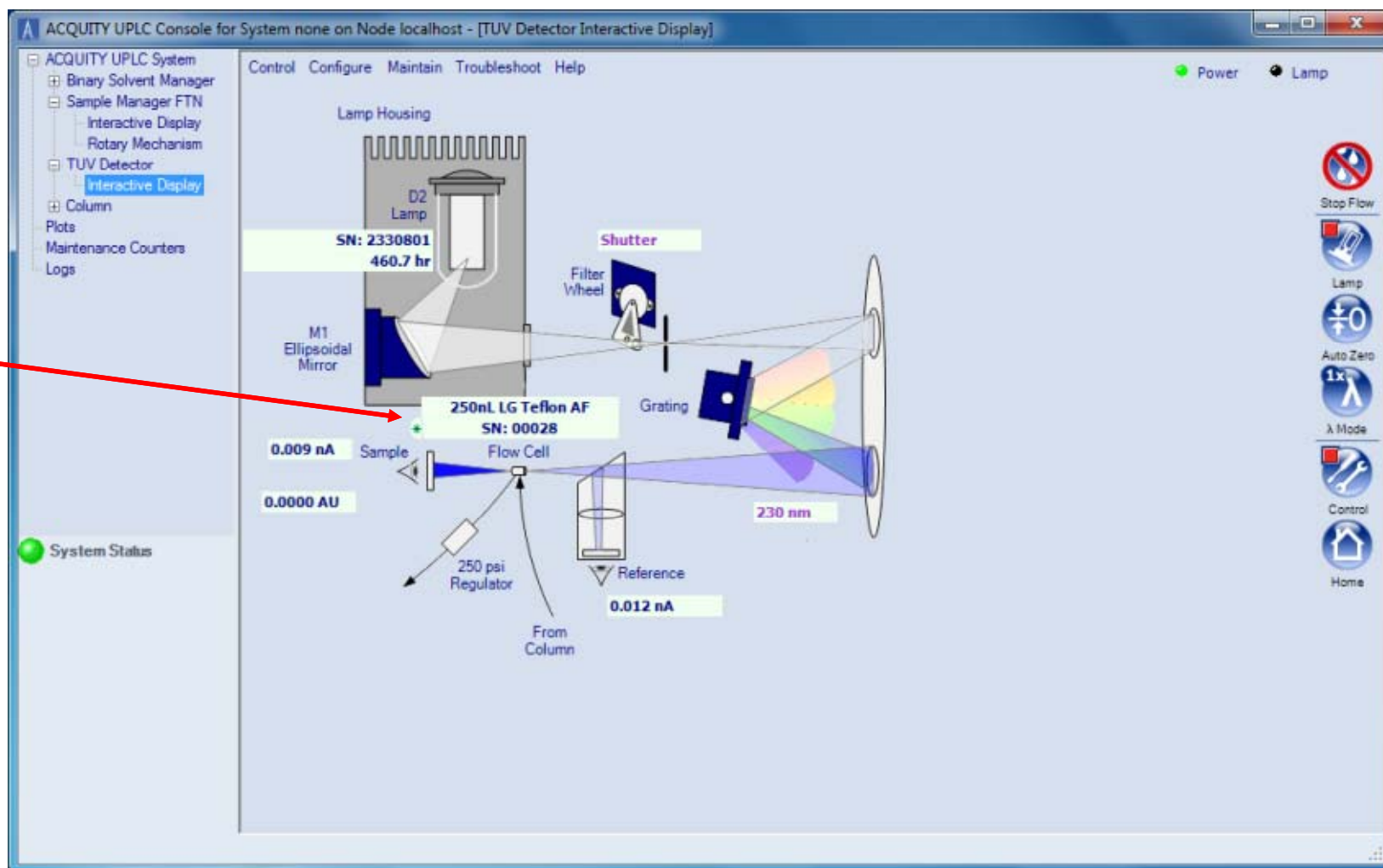
- What's New?
 - 500nL flow cell has been optimized for reduced dispersion
 - Flow cell body is the same
 - Inlet and outlet tubing i.d. has been reduced
 - .0025" ID inlet PEEK tubing
 - .0035" ID outlet PEEK tubing
 - 250nL / 183 μ m version for 1mm chemistry
 - Reduced flow rate range
 - still being characterized – information available via shortly.



TUV Interactive Display



Flow Cell type
and S/N is read
from chip



New TUV Preferences Menu



TUV Preferences

Shutter Control

Close shutter:

☒ After 10 minutes of inactivity

☐ Never

Optics Temperature Stabilization

Setting:

☒ Normal temperature

☐ Elevated temperature

☐ Maximum cooling

Component Identification Requirement

Require for operation:

☐ Lamp resident identification

☐ Flow cell resident identification

OK Cancel

You can set the type of environment that is present in your lab, based on a general temperature rating.

In the Optics Temperature Stabilization field, you can specify the following settings:

Normal temperature - Use this setting if the temperature in your lab is normal room temperature.

Elevated temperature - Use this setting if the temperature in your lab is slightly higher than normal room temperature.

Maximum cooling - Use this setting if the temperature in your lab is consistently much higher than normal room temperature.

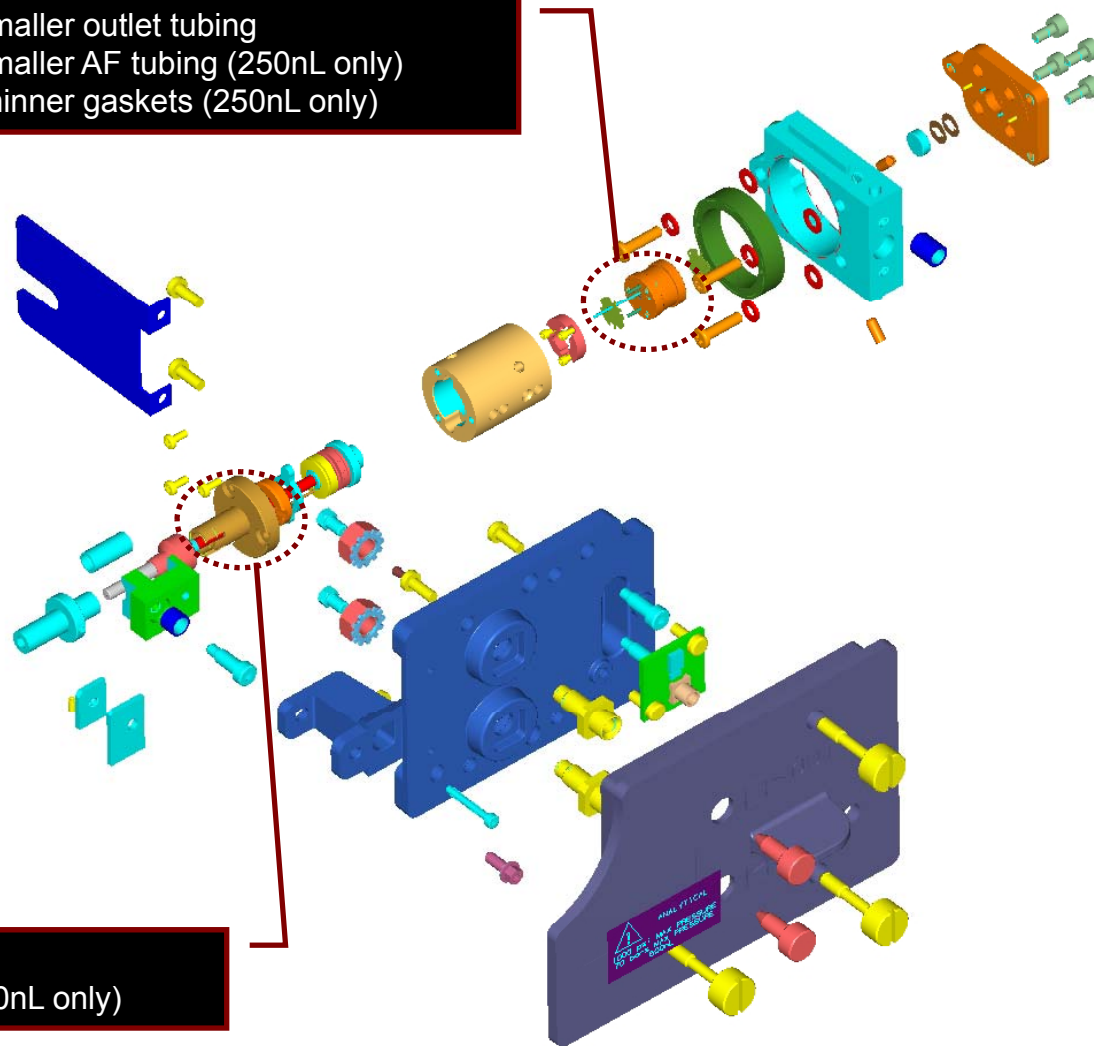
Require for Operation

If the fields are checked, it would require the presence of the electronic Lamp and/or Flow Cell serial numbers to be present to start a run.

I-Class PDA Flow Cell



- Smaller outlet tubing
- Smaller AF tubing (250nL only)
- Thinner gaskets (250nL only)



- Smaller inlet tubing
- Thinner gaskets (250nL only)

Current and New Flow Cell Configurations



Flow Cell	Pathlength	Teflon AF ID	Inlet ID	Outlet ID
Current Analytical	10 mm	240 μ m	.005"	.005"
Low Disp Analytical	10 mm	240 μ m	.0025"	.0035"
New 250nL	10 mm	183 μ m	.0025"	.0025"

Volume (nL) & Bandspreading Improvements



Flow Cell	Inlet Tube Volume	Optical Volume	Outlet Tube Volume	Total Volume
Current Analytical	1078	448	1207	2733
Low Disp Analytical	270	448	591	1309
New 250nL	270	263	302	835

Flow Cell	Band Spread	Improvement over Analytical
Standard Analytical	6.38 μ L	--
Analytical with 0.0025"	5.78 μ L	9.4%