

# Sample Manager

ACQUITY UPLC™ Service Training

# Agenda for This Section

- Overview of Sample Manager Components
- Theory of Operation
  - Overview of fluidic components
  - Injection Sequence
- AQUITY Console Functions and Diagnostics
- Hands-on practice of major service procedures

# ACQUITY UPLC™

## *Sample Manager*

|                                    | UPLC                       | Alliance           |
|------------------------------------|----------------------------|--------------------|
| <b>Technology</b>                  | Loop based                 | Direct flow inject |
| <b>Cycle time</b>                  | 30s or 11s with load ahead | Not specified      |
| <b>Sample Capacity</b>             | 2 well plates              | 120 x 2 mL vials   |
| <b>Needlewash</b>                  | 2 solvents                 | 1 solvent          |
| <b>Temperature control samples</b> | Yes standard               | Yes standard       |
| <b>Carryover spec</b>              | < 5 nL                     | < 20 nL            |
| <b>% RSD</b>                       | <0.3% 5-50 uL              | <0.5% 5-80 uL      |
| <b>Injection Range</b>             | 0.5- 50 uL                 | 0.1- 100 uL        |



# ACQUITY UPLC™

## *Sample Manager*

- Benefits this module provides to the user:
  - Reproducible small injection volumes (<1 µL) appropriate to small ID columns
  - Speed of injection
  - Low dispersion design
  - UPLC pressure capabilities – sub 2 µm
  - Low carryover
  - Multiple sample formats



# SM Major Systems

- Fluidics
  - Sample Injection
  - Needle-wash system (Carryover prevention)
- Electronics
  - Power Supply and distribution
  - Control boards- CPU2000, Personality card, Barrier PCB
- XYZZ Assembly
  - XY- motion to support various ANSI STD plates
  - ZZ-Vial piercing, Sampling needle and Wash/Inject movement
- Sample Heating and Cooling
- Column Heater
- Software Console Functions
  - Instrument methods
  - Firmware
  - Console functions

# Fluidic Components

ACQUITY UPLC™ Sample Manager

8 7 6 5 4 3 2 1

T17 T6 MSV  
METERING SYRINGE VALVE (MSV)  
3-WAY ROTARY VALVE  
31A 21B  
1(S)  
SAMPLE SYRINGE

T14 P  
T13VDD

T4 T3  
FROM PUMP  
TO COLUMN  
ALL LEAKS INTO INJECTION VALVE LEAK TRAY

T2  
PUNCTURE PROBE AND B.O.S. ASSEMBLY  
T24

T5 TB  
B.O.S. PUMP  
ALL WASTE INTO MAIN DRIP TRAY

WASH BLOCK ASSEMBLY  
T10

T12  
WASH SYRINGES

T22 T23

WASH SELECT VALVE (WSH SLC VLV) (DE-ENERGIZED) T21  
STRONG WASH VALVE (STR WSH VLV) (DE-ENERGIZED) T19  
WEAK WASH VALVE (WK WSH VLV) (DE-ENERGIZED) T15  
WASH BLOCK VALVE (WSH BLK VLV) (DE-ENERGIZED) T16

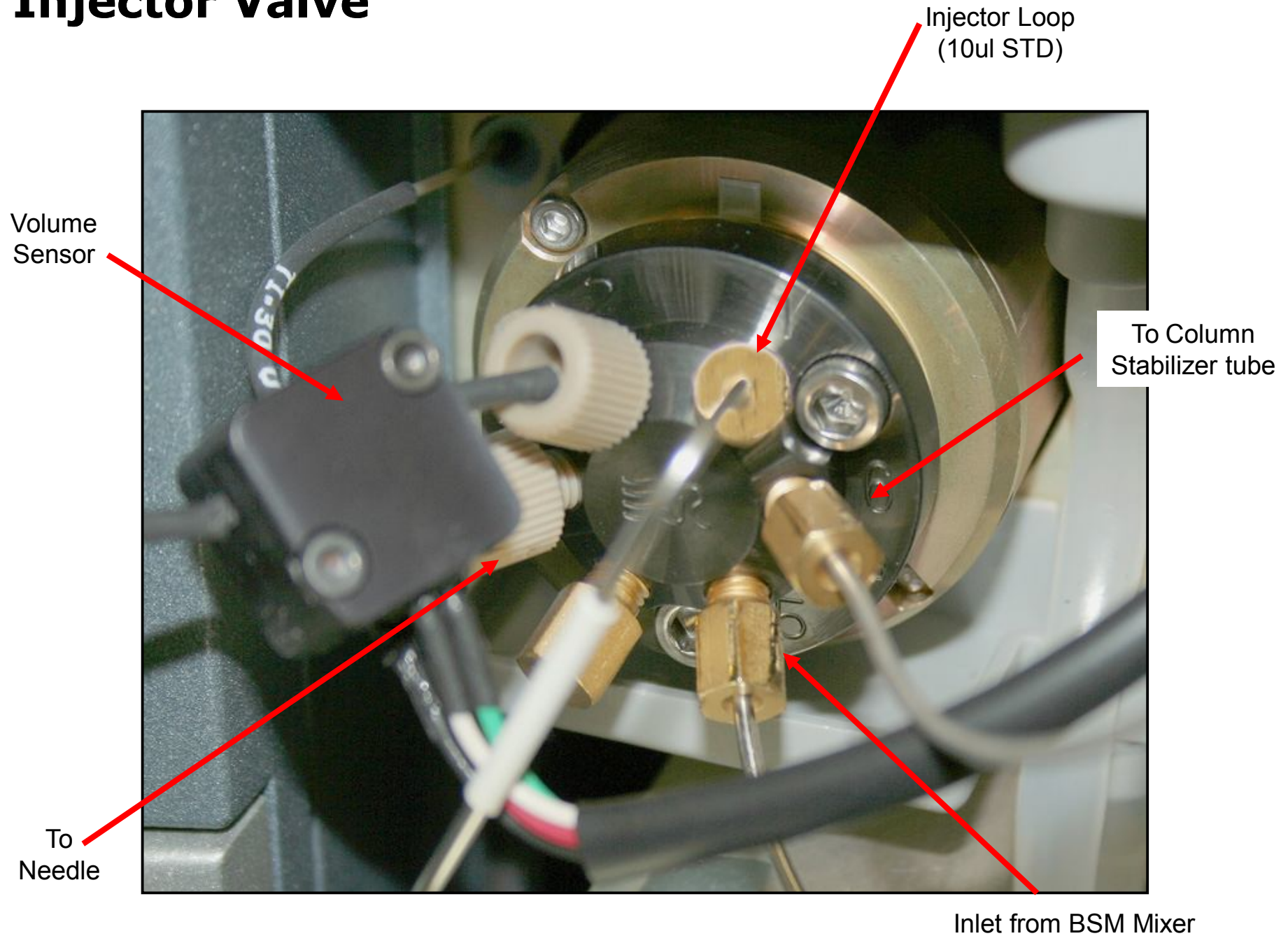
FROM STRONG SOLVENT DEGASSER  
T18  
FROM WEAK SOLVENT DEGASSER  
T20

SOLENOID TERMS  
C - COMMON PORT  
NC - OPEN WHEN ENERGIZED  
NO - OPEN WHEN DE-ENERGIZED  
WEAK WASH - DE-GASSED  
STRONG WASH - DE-GASSED

ALL COMPONENTS MOUNTED ON FLUIDIC PULL OUT TRAY  
ALL LEAKS FLOW INTO FLUIDICS TRAY LEAK TRAY

FOR INFORMATION AND USE ONLY  
DATE: 10/1/80  
BY: J. L. WOODS  
CHECKED: J. L. WOODS  
APPROVED: J. L. WOODS  
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# Injector Valve



# Sample Manager Injector Valve

- The S/M is designed to minimize system volume
  - essentially this is the loop volume and injection-valve dead volume
- The injector is a 2 position, six port valve that transfers the sample from the S/M to the Column
- A make-before-break channel is incorporated into stator at port 5 to minimize pressure pulse on column
- The Valve assembly (POD) is a replaceable modular from Valve drive assembly (pod = rotor/stator assembly)
- The Injector Valve assembly turns ever 2 Hr. when in idle mode
  - Protect the rotor seal from flowing into make-before-break channel

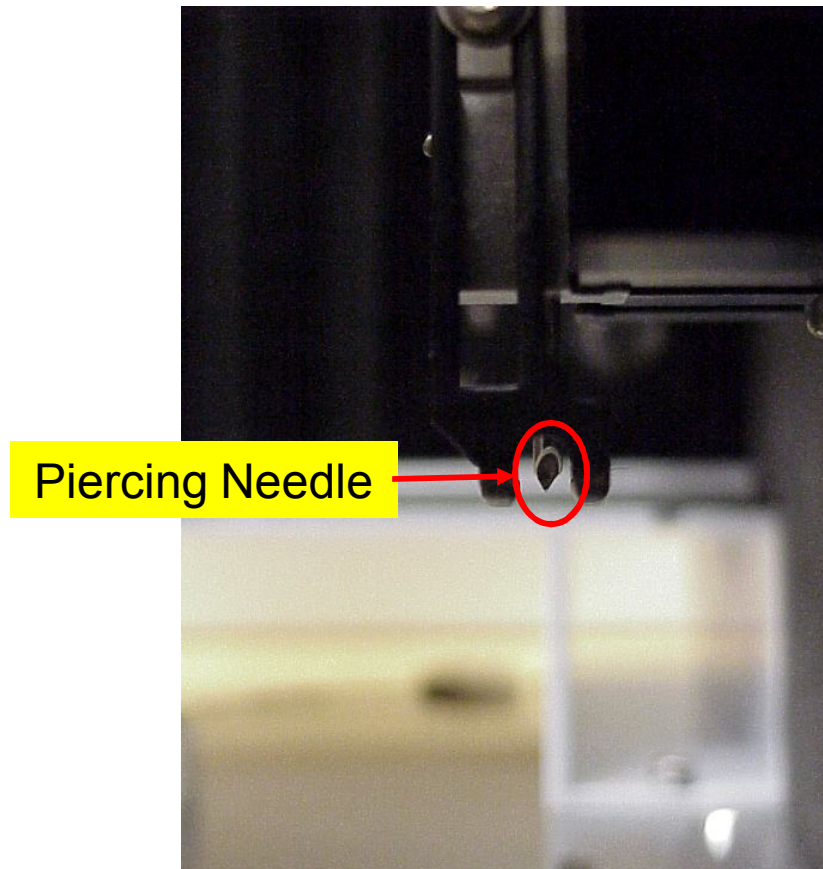
## Inject Valve- New Out of Box



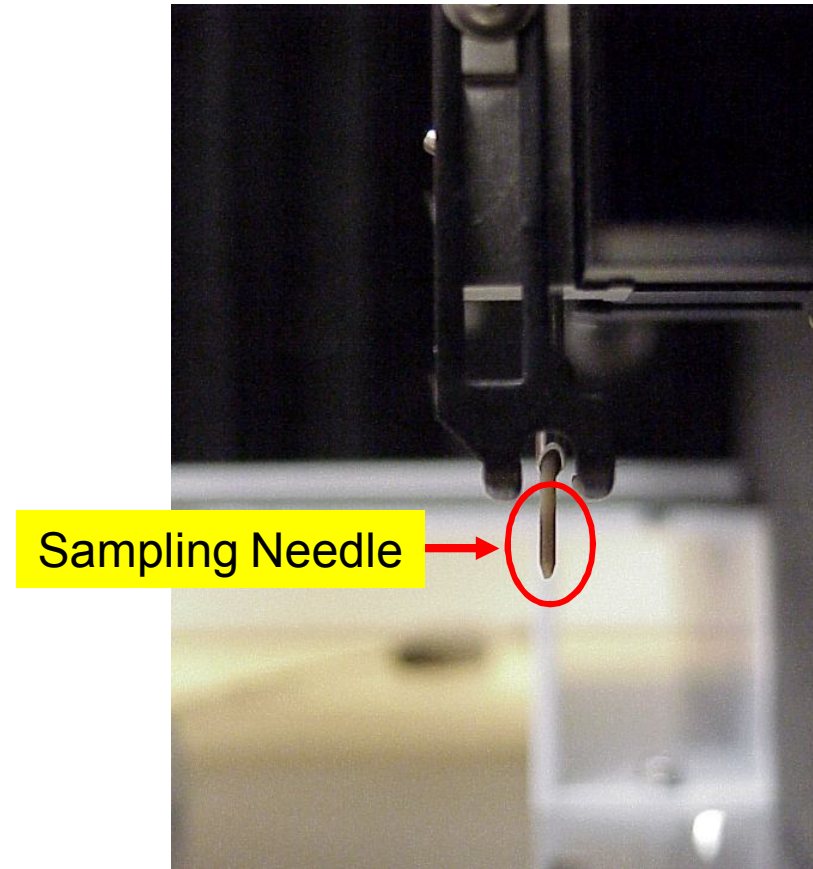
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# Sampling and Puncture Needles

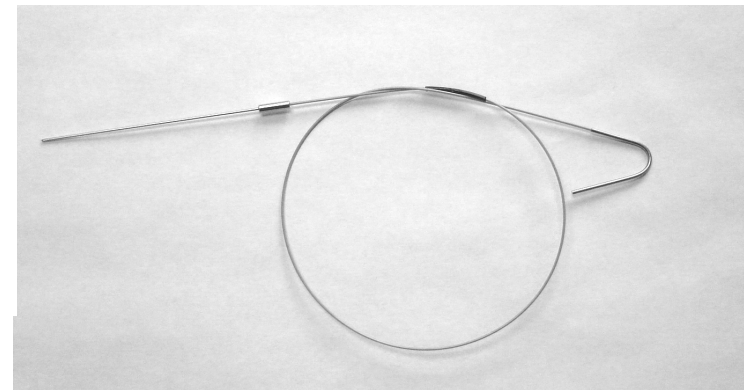
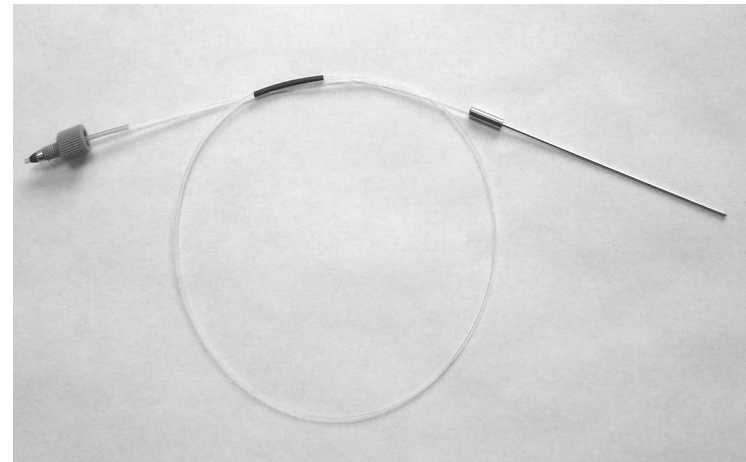
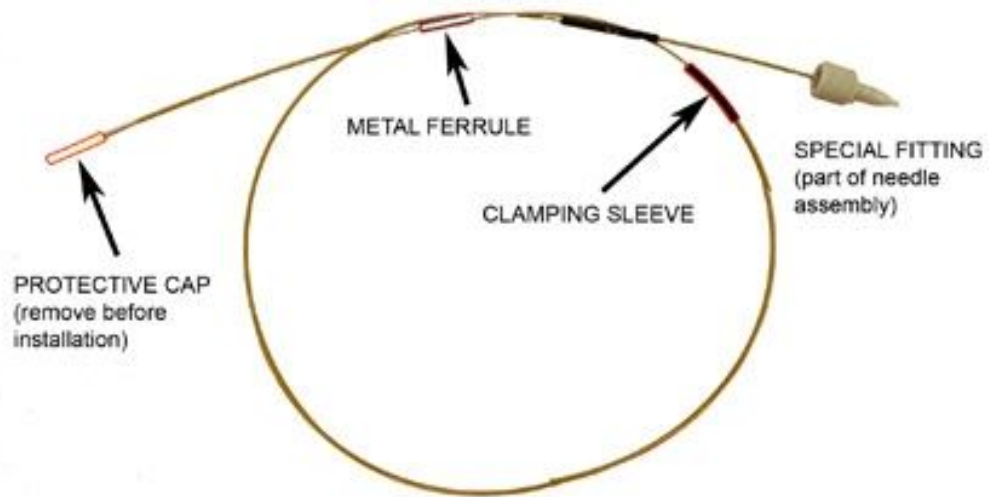
- Piercing Needle



- Sampling Needle



# Sample Needles- Types and Sizes

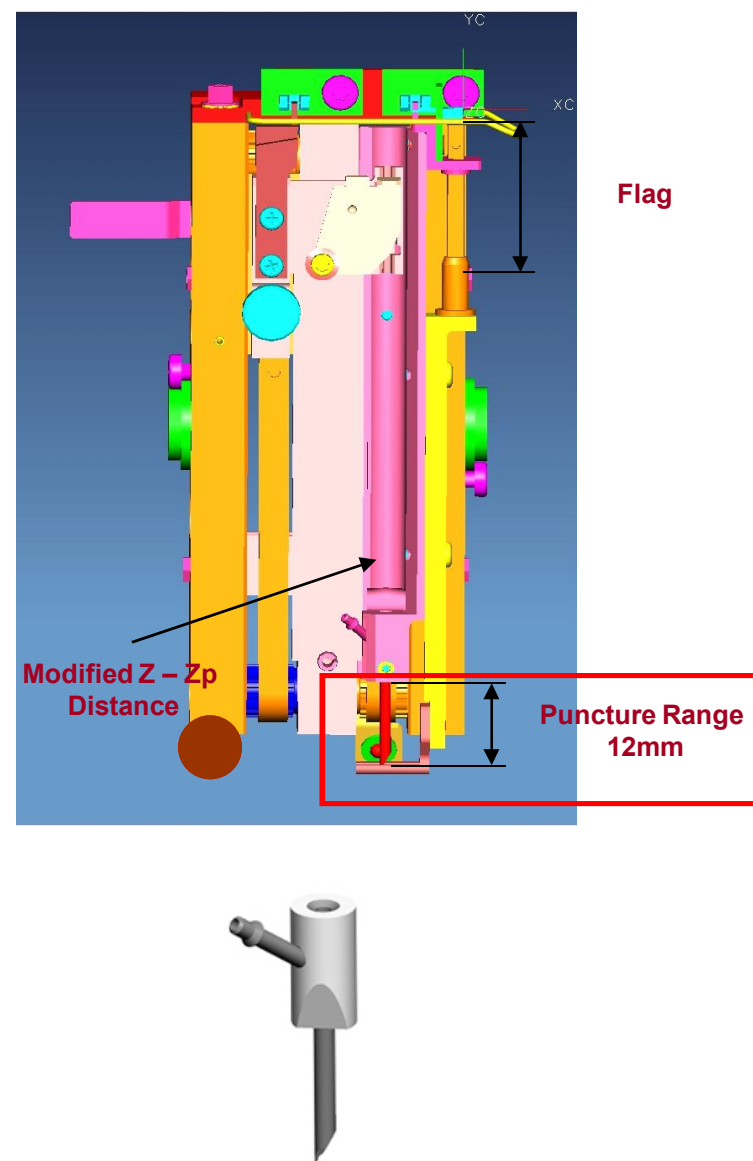


# Sample Needles- Recommendations

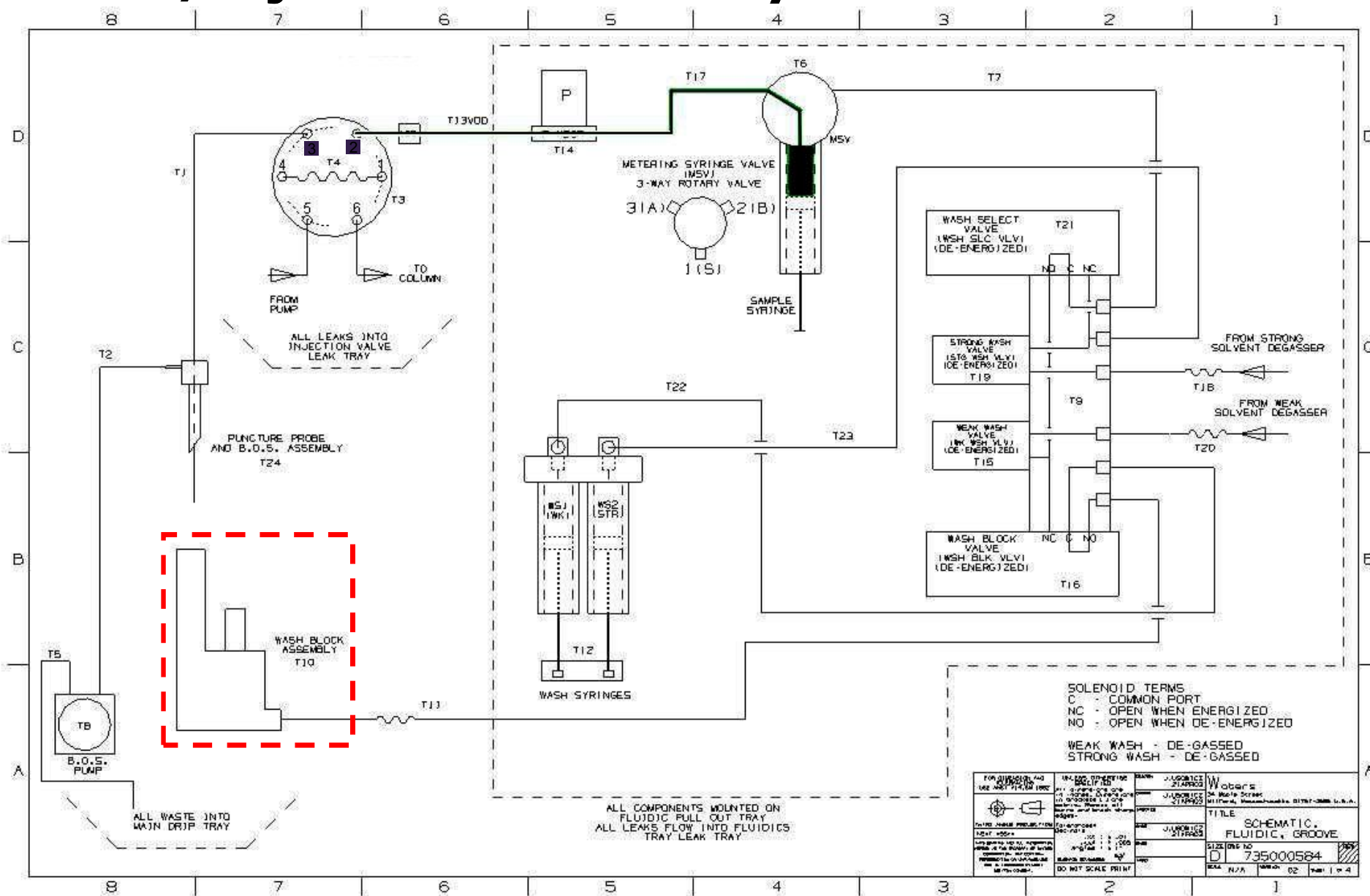
| Part Number | Description                               | Wetted Material                     | Recommended Applications                                                                                                                                          | Recommended Needlewash Solvent                    | Recommended Sample Format                                                                                                                                                                                                            |
|-------------|-------------------------------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 700002644   | Sample Needle, 30uL, PEEK                 | All PEEK                            | Configured as default needle. Not recommended for hydrophobic compounds                                                                                           | Reversed Phase solvents, excluding THF and Hexane | For original needle design – only vials or heat sealed Plate foils - <b>Not recommended for use with cap mats or re-sealable caps, unless new extended range Y-carriage installed on ACQUITY SM's Serial # A08UPA918M and higher</b> |
| 205000369   | Sample Needle, 30uL, FEP Tubing w/ SS Tip | FEP Teflon with stainless steel tip | Lower cost alternative to stainless steel, alternate surface to PEEK. Less interaction with hydrophobic compounds compared to PEEK                                | Reversed Phase solvents, excluding THF and Hexane | Any recommended Plate or Vial format, recommended for use with Sample Manager Firmware version 1.30.                                                                                                                                 |
| 205000362   | Sample Needle, 30uL, SS Tubing w/ SS Tip  | All stainless steel tip and tubing  | Recommended for strongly hydrophobic compounds                                                                                                                    | Reversed Phase solvents, including THF and Hexane | Any recommended Plate or Vial format, recommended for use with Sample Manager Firmware version 1.30.                                                                                                                                 |
| 205000363   | Sample Needle, 15uL, SS Tubing w/ SS Tip  | All stainless steel tip and tubing  | Recommended for strongly hydrophobic compounds. With reduced aspiration speeds, which will impact injection cycle time, the smaller volume can increase precision | Reversed Phase solvents, including THF and Hexane | Any recommended Plate or Vial format, recommended for use with Sample Manager Firmware version 1.30.                                                                                                                                 |

# New-More Robust Needle Piercing

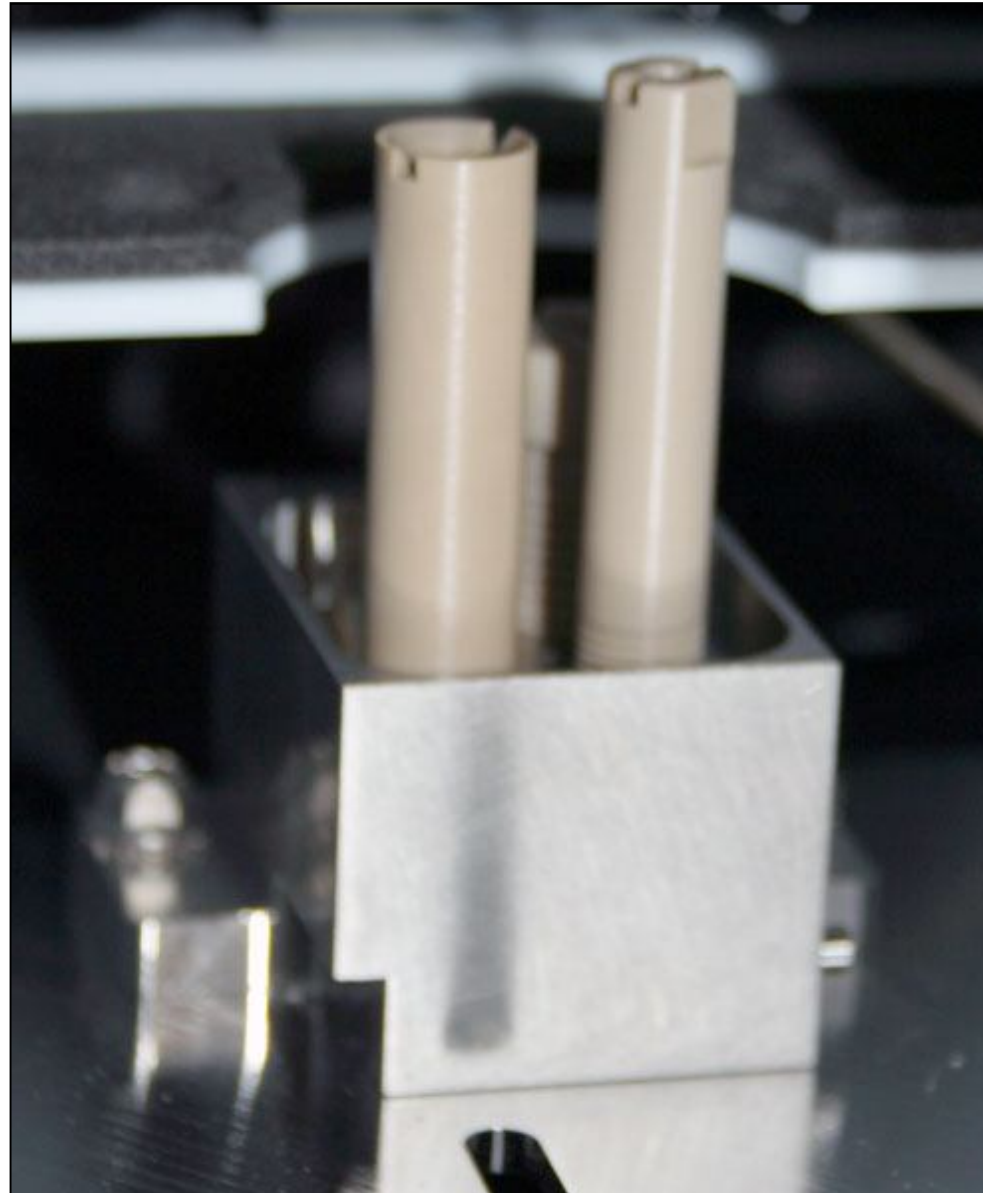
- New Y-carriage Assembly
  - Old = Red
  - New = Grey
- Extends the range of piercing depth
- Sharper cutting edge
- Requires ACQUITY UPLC System Driver v1.30
  - Backwards compatible with v1.23, without additional range



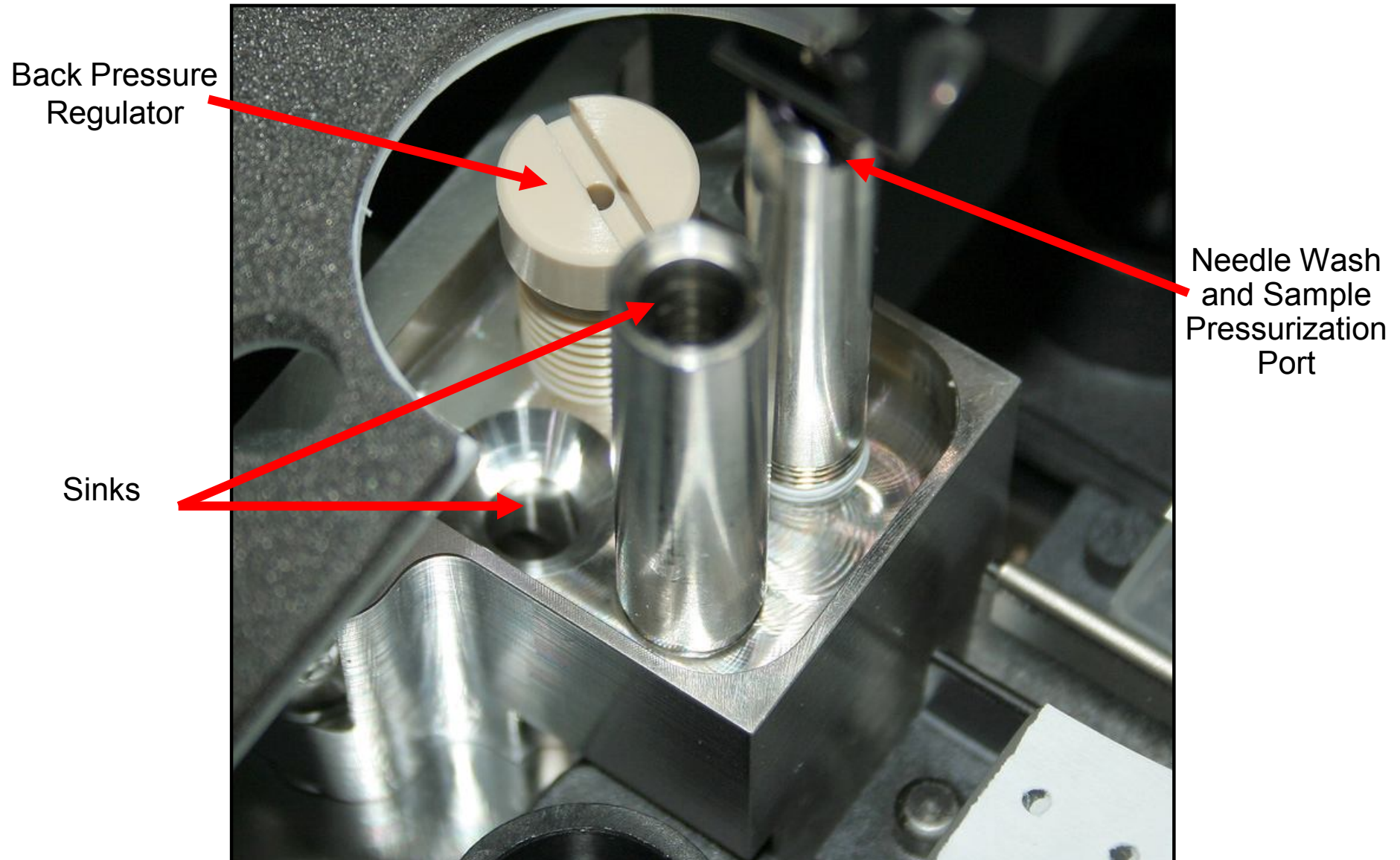
# Wash/Inject Block Assembly



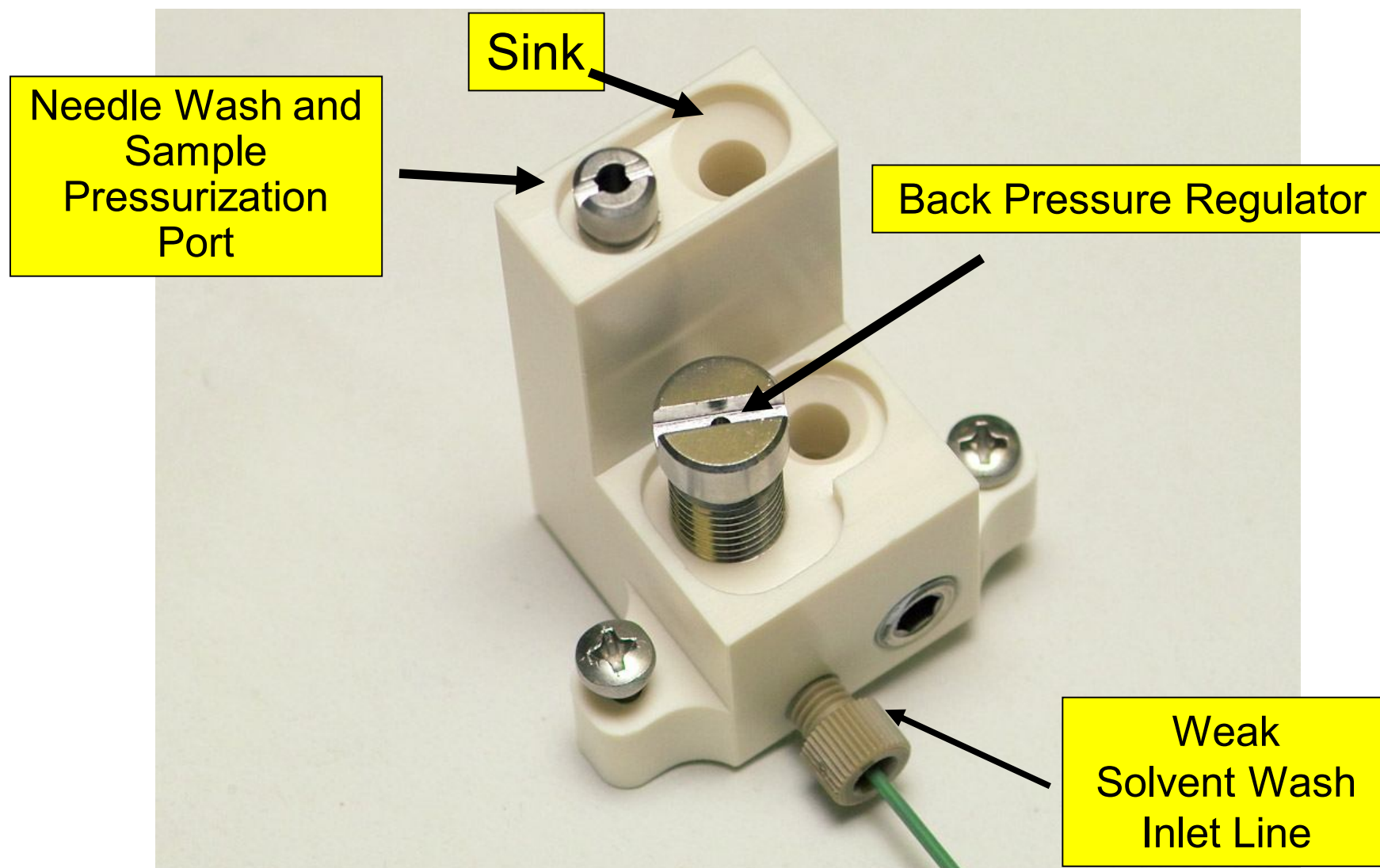
## **Wash/Inject Block Assembly- New Style**



# Wash/Inject Block Assembly- Older Style

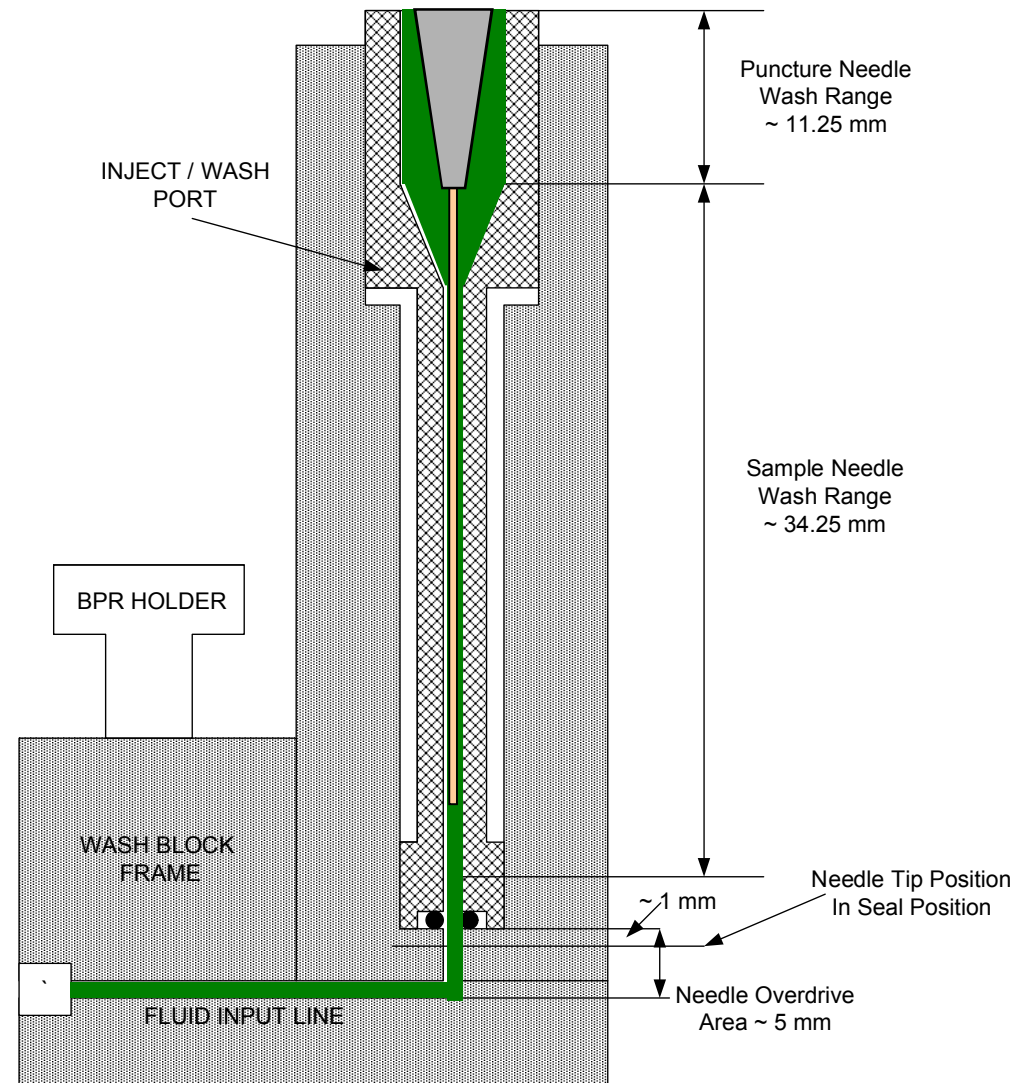


# Wash/Inject Block Assembly- Oldest Style



# Wash Block- Needle Wash Function

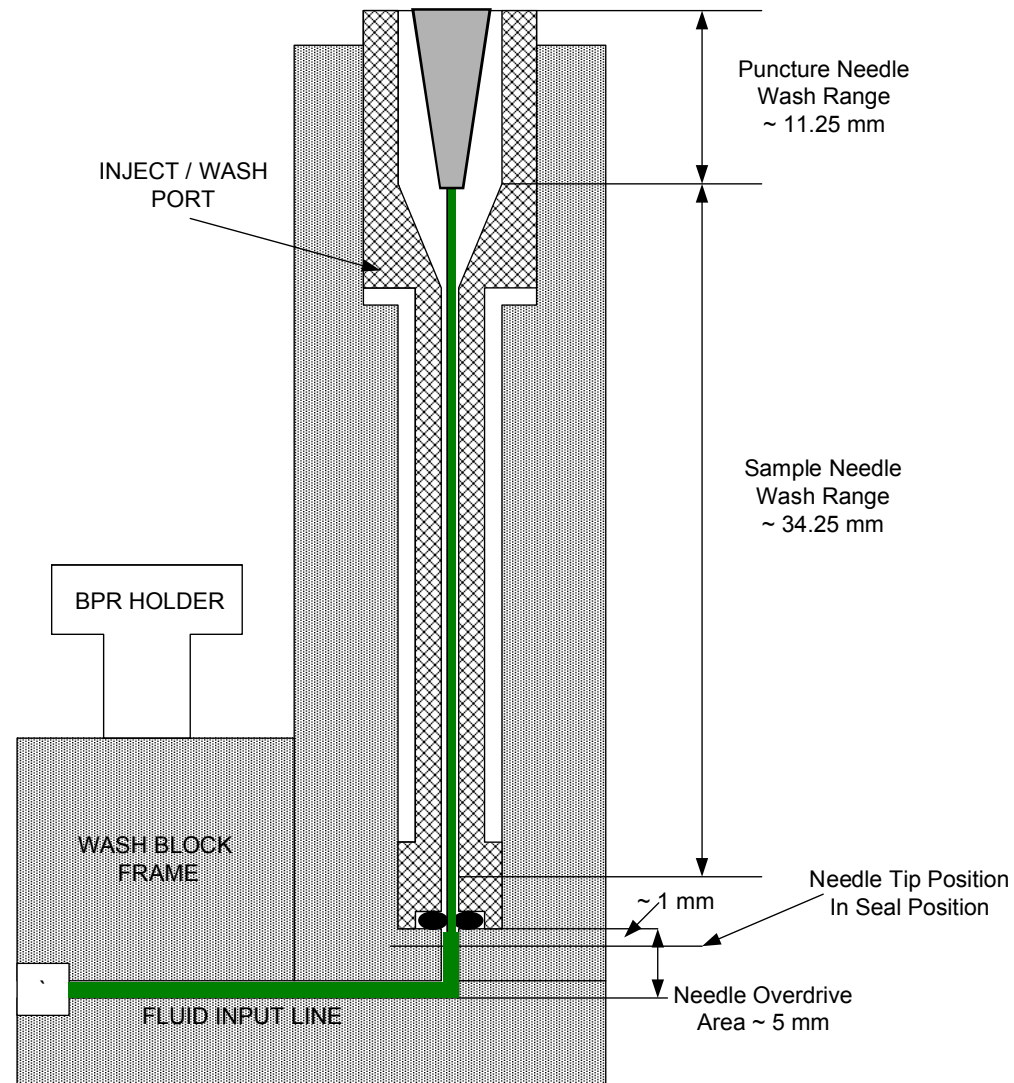
## Wash / Inject Block Internal Detail



WASH / INJECT BLOCK  
CROSS SECTION

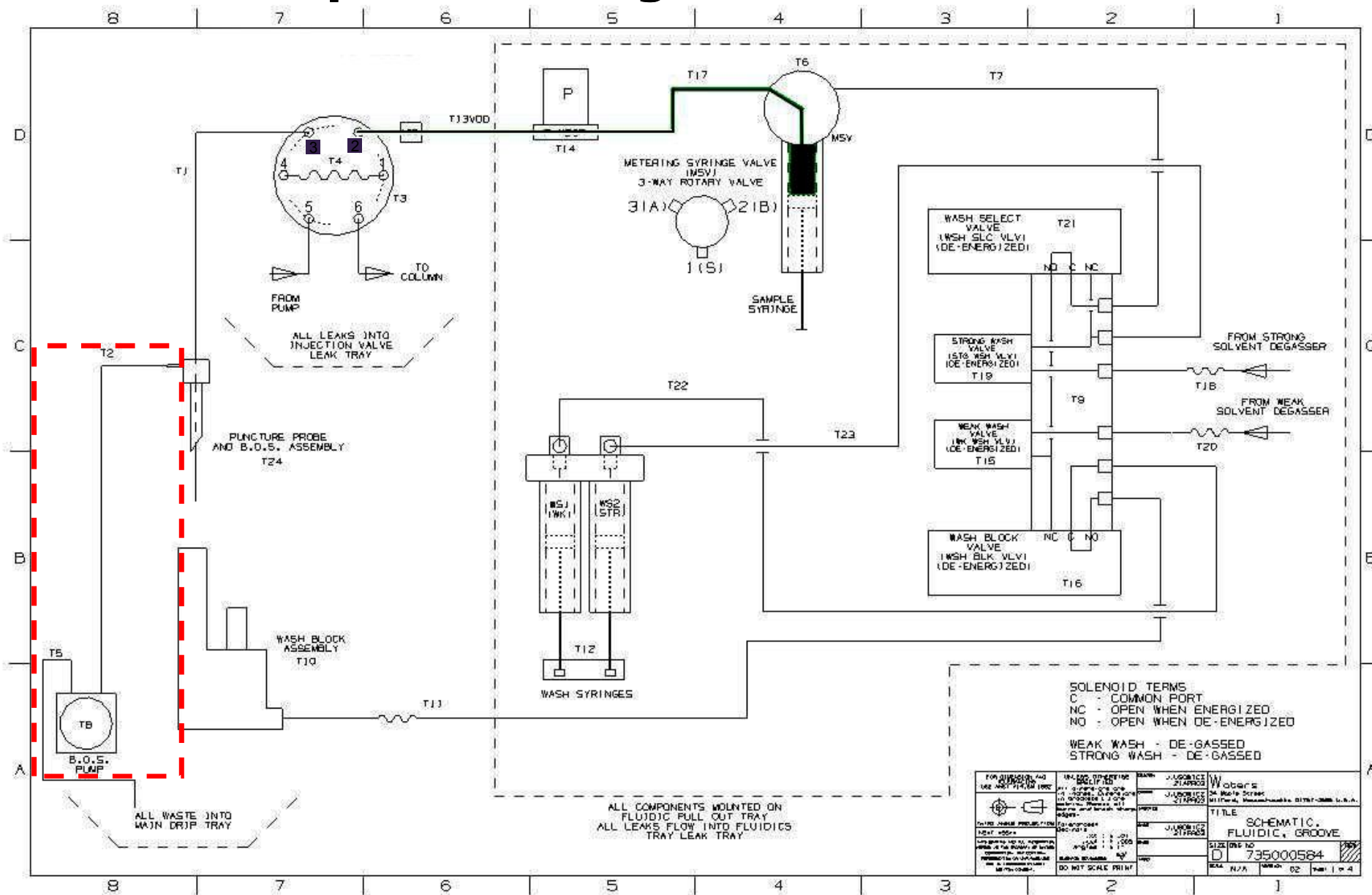
# Wash Block- Pressure Assist Function

## Wash / Inject Block Internal Detail

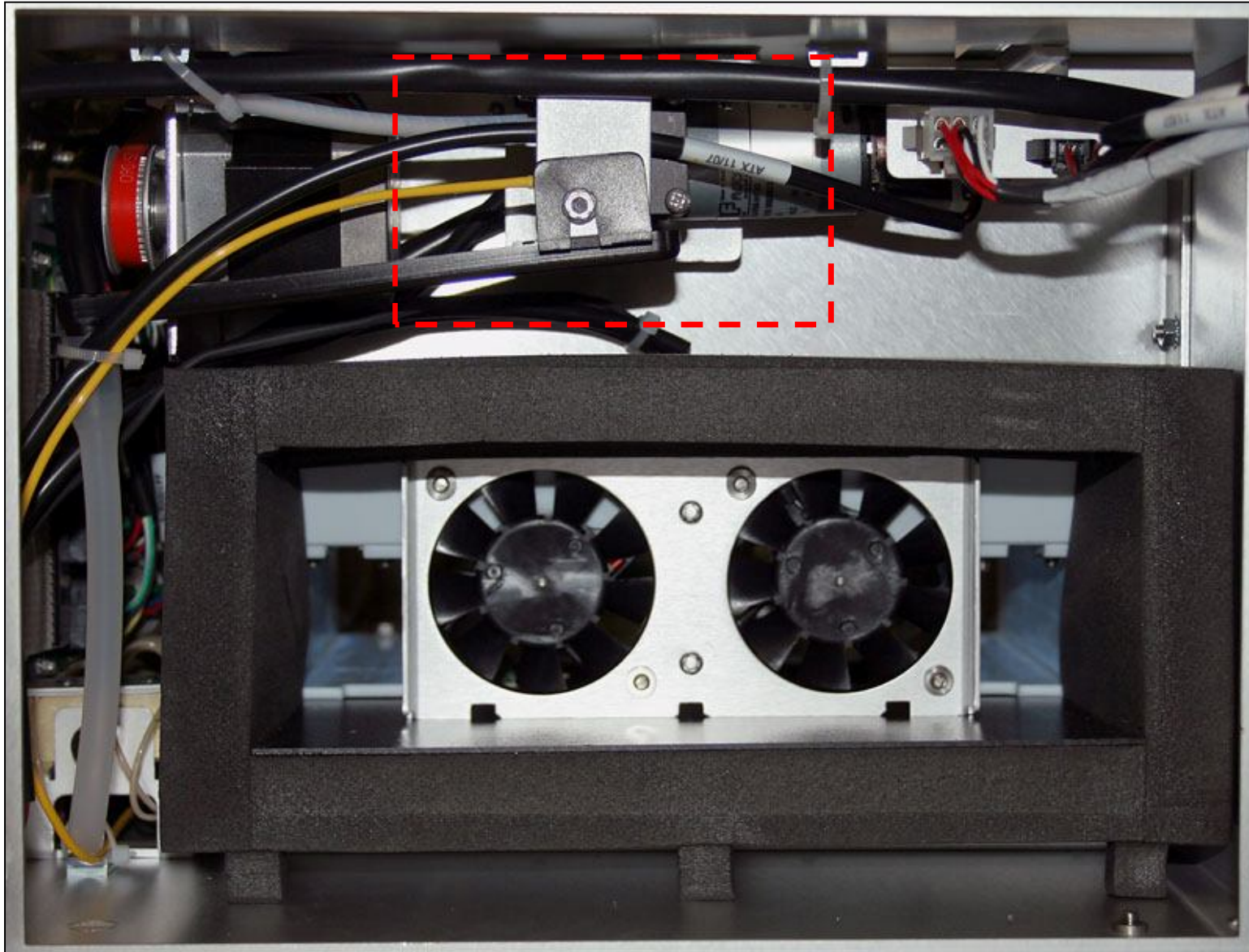


WASH / INJECT BLOCK  
CROSS SECTION

# B.O.S. Pump and Tubing Connection

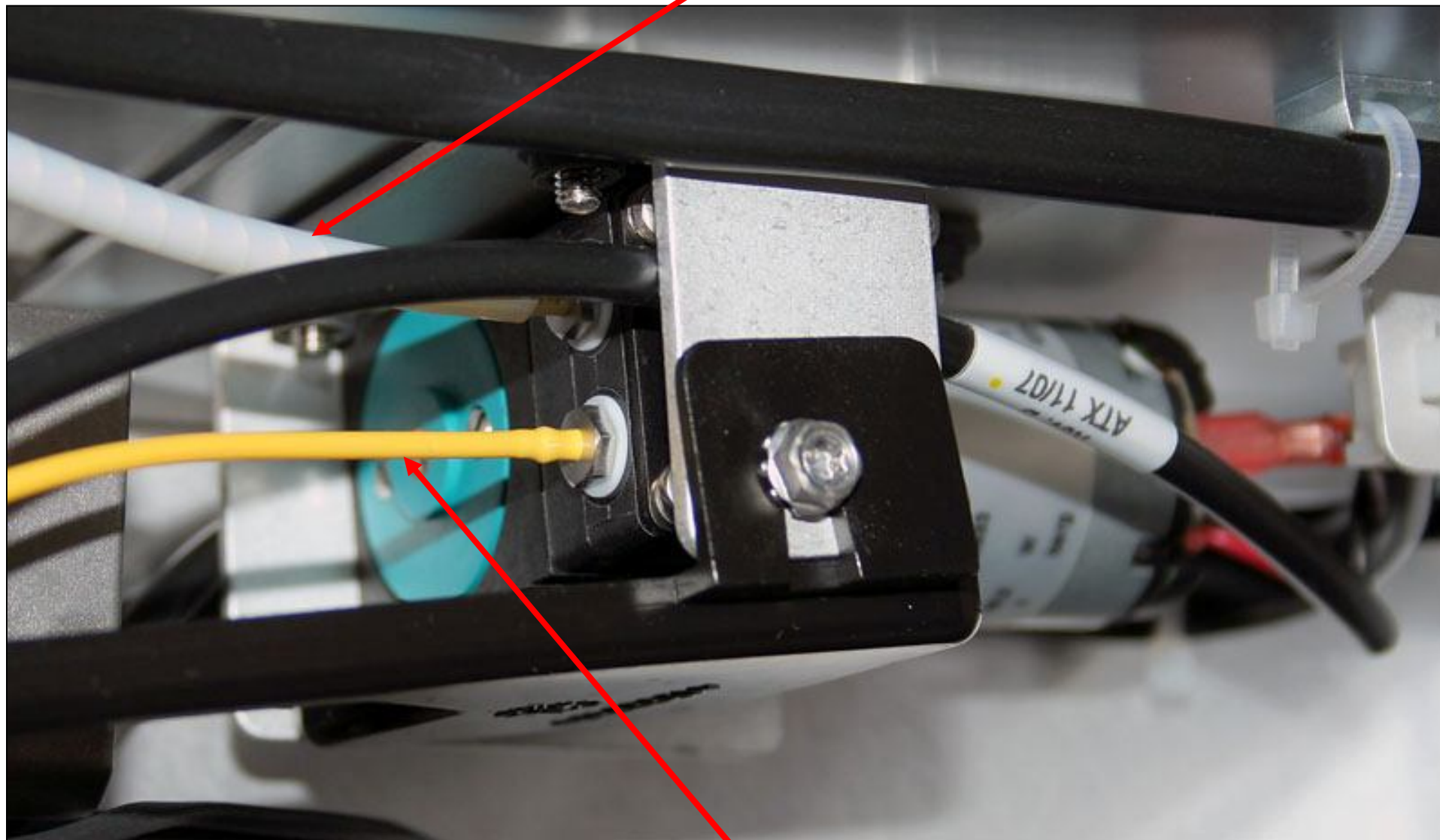


# BOS Pump Assembly



# BOS Pump Assembly

Tubing to Piercing Needle

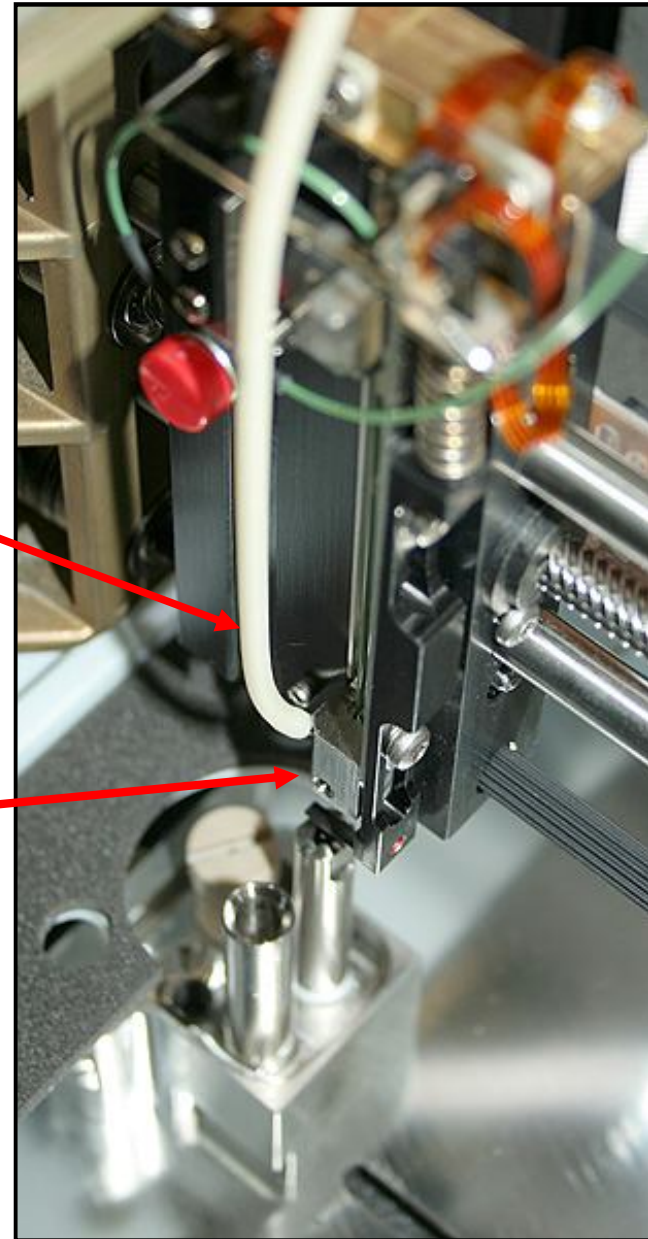


Tubing to Waste

# Needle Wash System- BOS Pump

Tubing to BOS Pump

Piercing Needle



8 7 6 5 4 3 2 1

D

C

B

A

8 7 6 5 4 3 2 1



# Fluidic Tray

- To make the S/M more serviceable it has been designed with easy to reach electronics and slide-out fluidics tray
- The majority of the fluidic elements are located on a self-contained tray, they include:
  - Transducer
  - Valve Manifold
  - Two Wash syringe drive assembly
  - Sample Syringe drive assembly
  - Metering Syringe Valve ( MSV ) assembly
- The Fluidic Tray can slide out for diagnostics or viewing, in which the Solvents line alone with the Electrical cables uncoiled
- It can be fully removed for ease of service

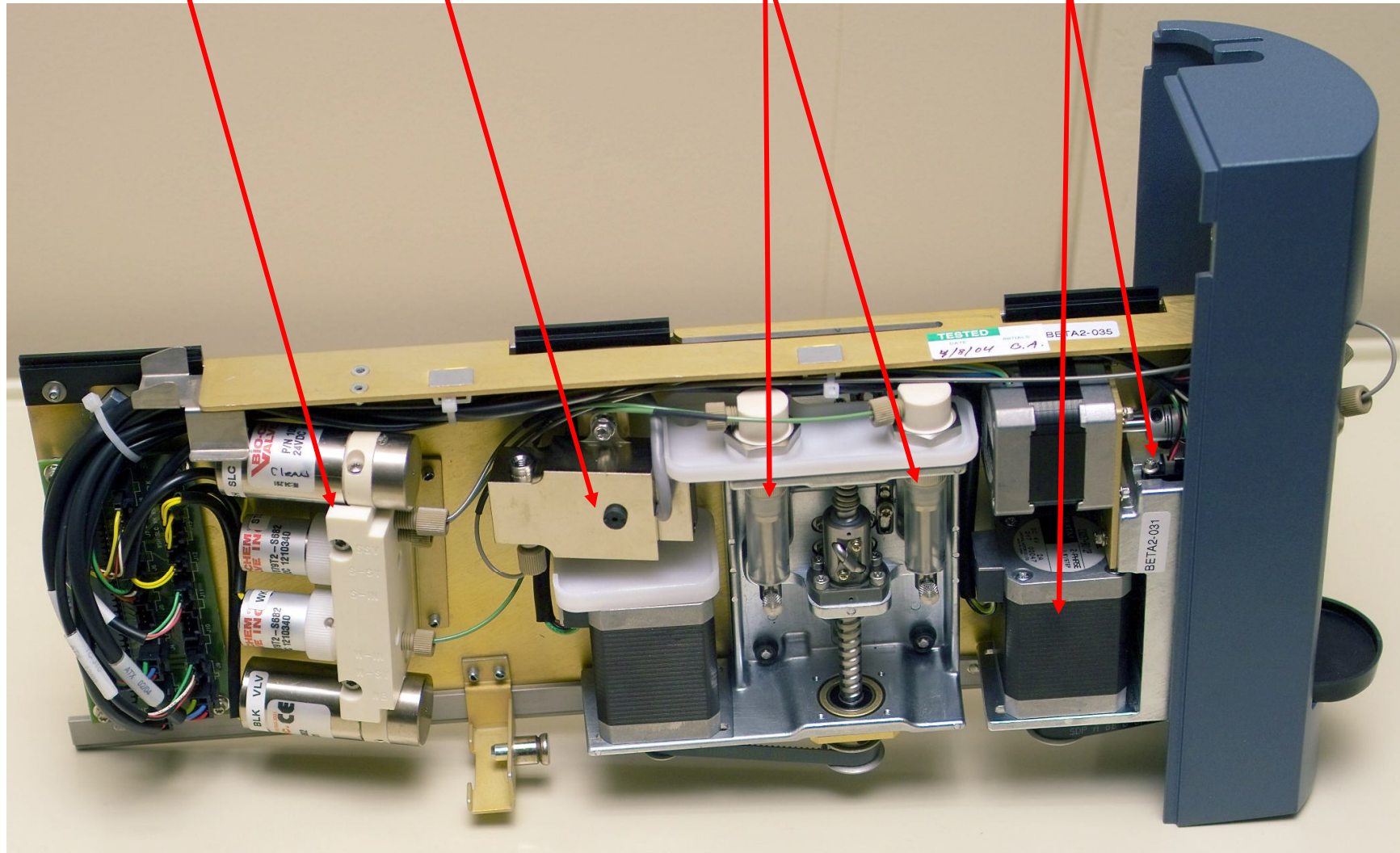
# Fluidics Tray- Major Assemblies

Valve Pack

Pressure  
Transducer

Wash Syringes

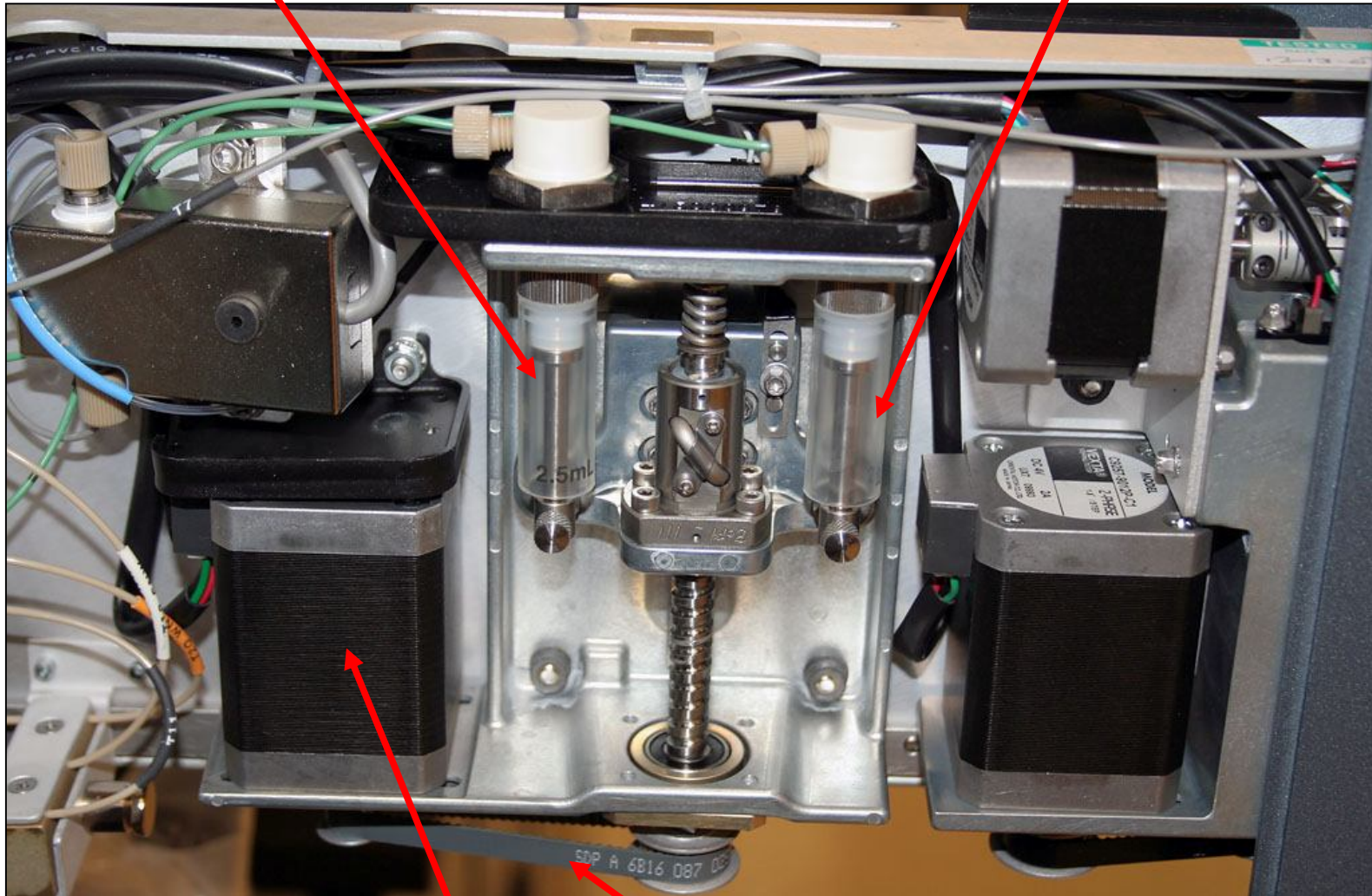
Sample Metering Syringe  
Drive Assembly



# Wash Syringes

Weak Wash Syringe

Strong Wash Syringe



Wash Syringe Drive Motor and Belt

# Valve Manifold Connections

to Strong Wash Syringe

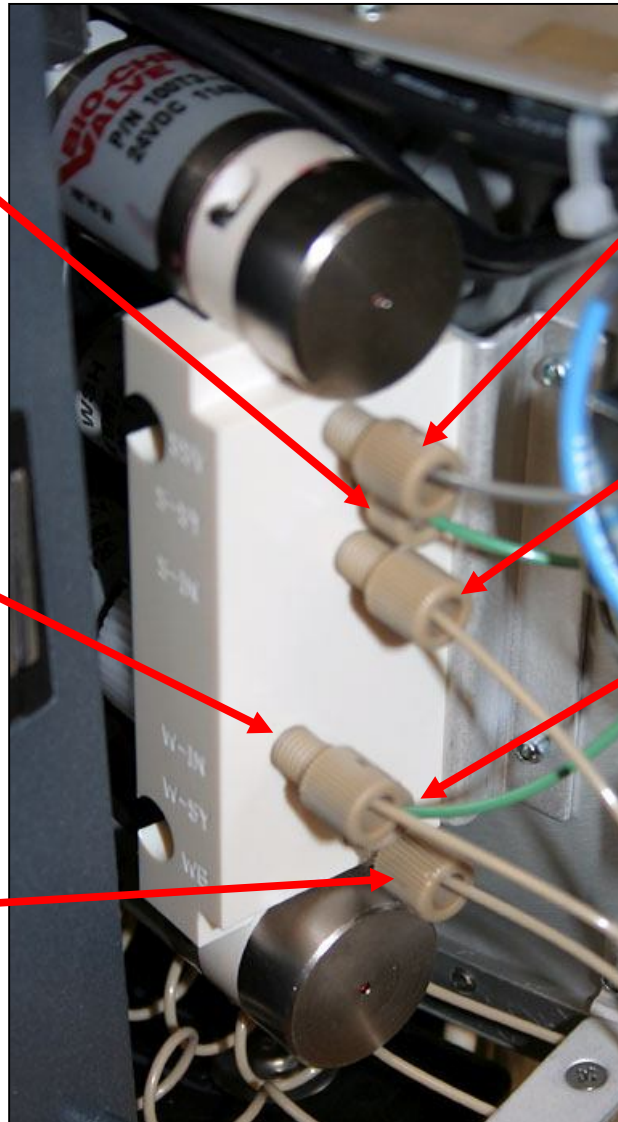
to Sample Metering Valve-  
Right Connection

to Weak Wash in  
(orange line)

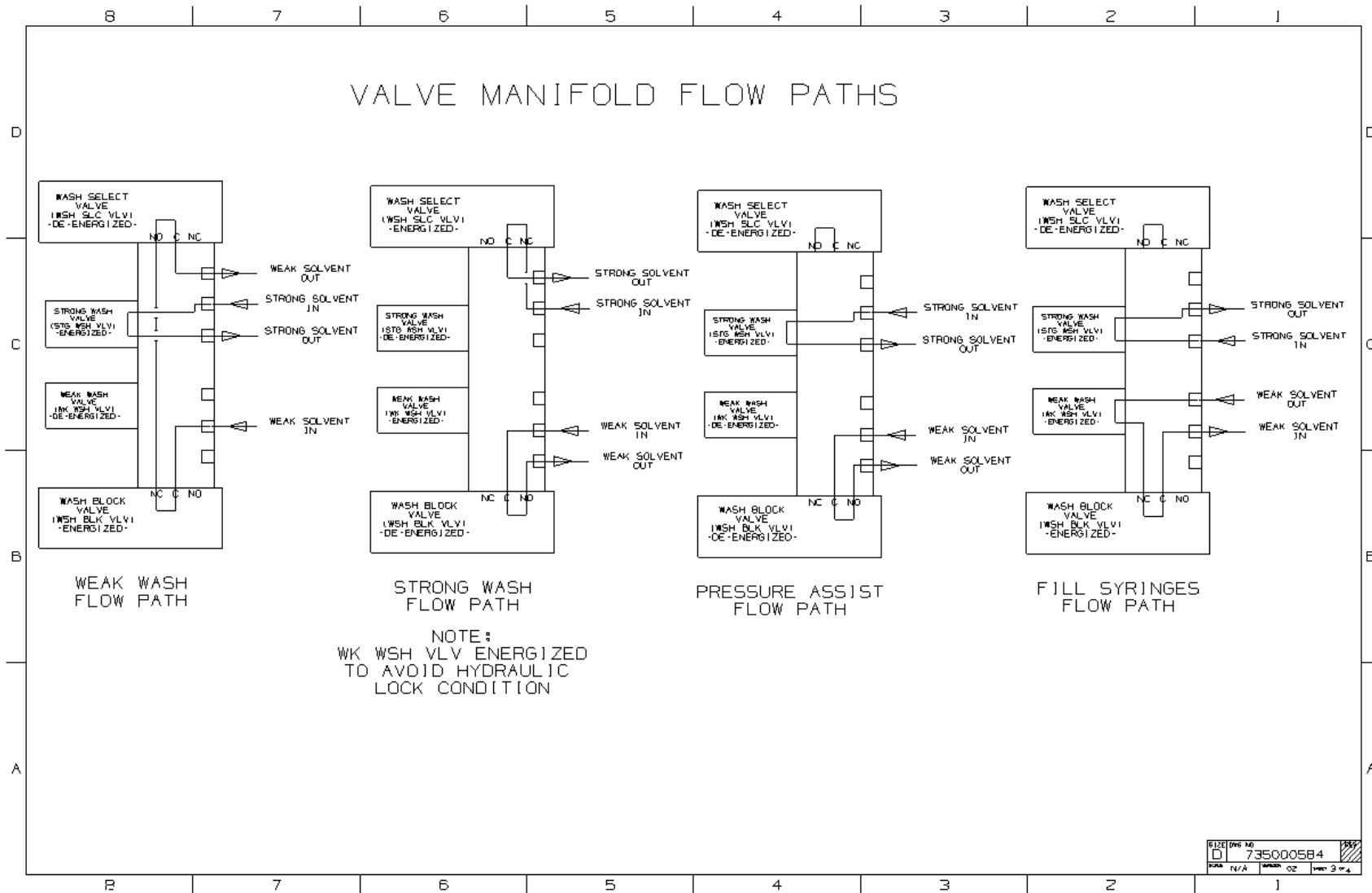
to Strong Wash in  
(white line)

to Weak Wash Syringe

Weak Wash out  
to Wash Block



# Valve Manifold Flow Paths



# **Sample Manager Injection Methods**

# Sample Manager- Injection Options

- There are three injection techniques available with the ACQUITY UPLC™ Sample Manager
  - **Full Loop**
  - **Partial Loop Using Needle Overfill (PLUNO)**
  - **Partial Loop** using pressure assist

# Sample Manager Method Editor

The screenshot displays the 'Acquity Sample Manager' software interface. At the top, there is a toolbar with icons for file operations and a row of four application buttons: 'Acquity UPLC Sample Manager ACQ-SM', 'Acquity UPLC Binary Solvent Manager ACQ-B5M', 'Acquity UPLC PDA Detector ACQ-PDA', and 'Acquity UPLC ELSD ACQ-ELSD'. The main window features a tabbed interface with 'General', 'Data', and 'Events' tabs. The 'General' tab is active, showing several configuration sections. The 'Sample Loop Option' section includes three radio buttons: 'Partial Loop', 'Partial Loop With Needle Overfill' (which is selected), and 'Full Loop'. A blue link labeled 'Please Read' is positioned to the right of these options. The 'Wash Solvents' section contains two rows: 'Weak' with a dropdown menu set to 'Water' and a volume of '600 µL', and 'Strong' with a dropdown menu set to 'Water' and a volume of '200 µL'. The 'Temperature' section has two rows: 'Column' and 'Sample', each with a dropdown menu set to 'Off' and a temperature value of '50 °C' and '5 °C' respectively. An 'Alarm Band' checkbox is also present. A 'Loop Offline' section includes a dropdown menu set to 'Disable' and a unit 'min', along with a 'Load Ahead' checkbox. A 'Comment' text box is located at the bottom left, and an 'Advanced...' button is at the bottom right. A help icon (?) is visible in the top right corner of the main window.

Acquity Sample Manager

General | Data | Events

Sample Loop Option [Please Read](#)

☐ Partial Loop

☒ Partial Loop With Needle Overfill

☐ Full Loop

Loop Offline [?](#)

Disable min

☐ Load Ahead

Wash Solvents

Weak:

Water 600 µL

Strong:

Water 200 µL

Temperature

Column: Alarm Band

Off 50 °C

Sample:

Off 5 °C

Comment:

Advanced...

# What are the Specifications?

- Remember these are used for competitive marketing
- Full Loop
  - 0.3% RSD (full loop) 1 - 250  $\mu$ L with 3 $\times$  overfill
- Partial Loop with PA and PLNO?
  - 1% RSD (PA PL)
    - Large loop volumes applicable to HPLC
  - 1.0% RSD (PLNO PL)
    - Small loop volumes more applicable to UPLC
    - Better with slower syringe speed for viscous sample diluents (DMSO)

# Sample Manager

## *Injection Modes*

| Loop volume | Partial loop with needle overfill mode<br><br>Recommended sample injection volume range (µL) | Partial loop (pressure assist) mode<br><br>Recommended sample injection volume range (µL) | Full loop mode<br>Recommended sample injection volume (µL) | Automatic overfill factor |
|-------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------------------------------------------------|---------------------------|
| 1 µL        | 0.2 to 0.75                                                                                  | Not recommended                                                                           | 1                                                          | 5.8                       |
| 2 µL        | 0.4 to 1.5                                                                                   | Not recommended                                                                           | 2                                                          | 5.6                       |
| 5 µL        | 1.0 to 3.8                                                                                   | Not recommended                                                                           | 5                                                          | 5.0                       |
| 10 µL       | 2.0 to 7.5                                                                                   | 2.0 to 5.0                                                                                | 10                                                         | 4                         |
| 20 µL       | 4.0 to 15.0                                                                                  | 4.0 to 10.0                                                                               | 20                                                         | 3                         |
| 50 µL       | 10.0 to 37.5                                                                                 | 10.0 to 25.0                                                                              | 50                                                         | 2                         |
| 100 µL      | 20.0 to 75.0                                                                                 | 20.0 to 50.0                                                                              | 100                                                        | 2                         |
| 250 µL      | 40 to 150                                                                                    | 40 to 125                                                                                 | 250                                                        | 1.5                       |

Criteria for partial loop modes:

$R^2$ : > 0.999

Area %RSD: < 1%

Criteria for full loop mode:

$R^2$ : > 0.999

Area %RSD: < 0.3%

**Limitation:** Using 100-µL sample loops with 250-µL syringes, the injection linearity is restricted to 60% of the loop volume. The linearity for other combinations is 75% of the loop volume.

# Full Loop

- Should be chosen whenever accuracy and precision are the primary concerns
- It is the same injection technique that has always existed in HPLC injectors
  - Shares all the same advantages, disadvantages, and operating constraints.
- No flexibility in injection volume without changing the loop
- Customer should design QC analysis to compensate
  - Standard same concentration as sample
  - Dilutions made to reflect constant injection volume

# Partial Loop – Pressure Assist

- Should be reserved for the following situations only:
  - Where analysis time takes precedence over any other concern
  - Where the sample volume is very limited
  - When sample diluent is different than initial condition mobile phase (stronger organic content) and the diluent has a noticeable effect on the chromatography with the PLUNO and Full Loop modes

## **Partial Loop Using Needle Overfill Mode**

- The best general purpose mode for partial loop injection
- Provides optimum performance when injection volumes are kept within a range of 10 – 75% nominal loop volume
- It provides the best partial loop accuracy, precision and linearity for a wide range of samples including
  - strong and weak acids and bases
  - hydrophilic and hydrophobic compounds.

# ACQUITY UPLC™ Loops available



1 µL  
2 µL  
5 µL  
**10 µL (STD)**  
20 µL  
50 µL  
100 µL  
250 µL

# Loop Installation

## Tip:

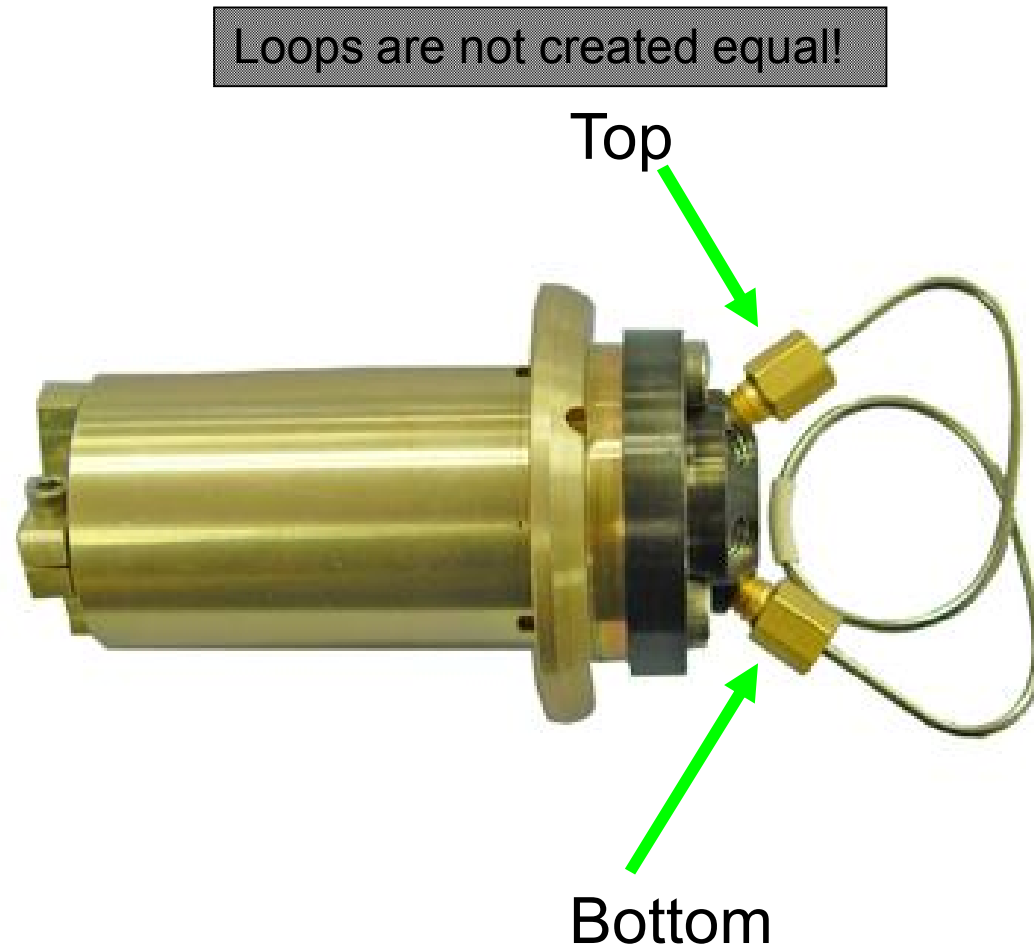
Label the loop top/bottom to indicate original installation position. Loop must be reinstalled in original position for best performance

## Better Idea:

Single Use Loop and Single Tighten Fittings

## Best Idea:

Dedicated POD with Single Use Loop and Single Tighten Fittings



# **Full Loop and Partial Loop Mode (Both with Pressure Assist)**

# Full Loop and Partial Loop (Pressure Assist)

## ■ Similarities

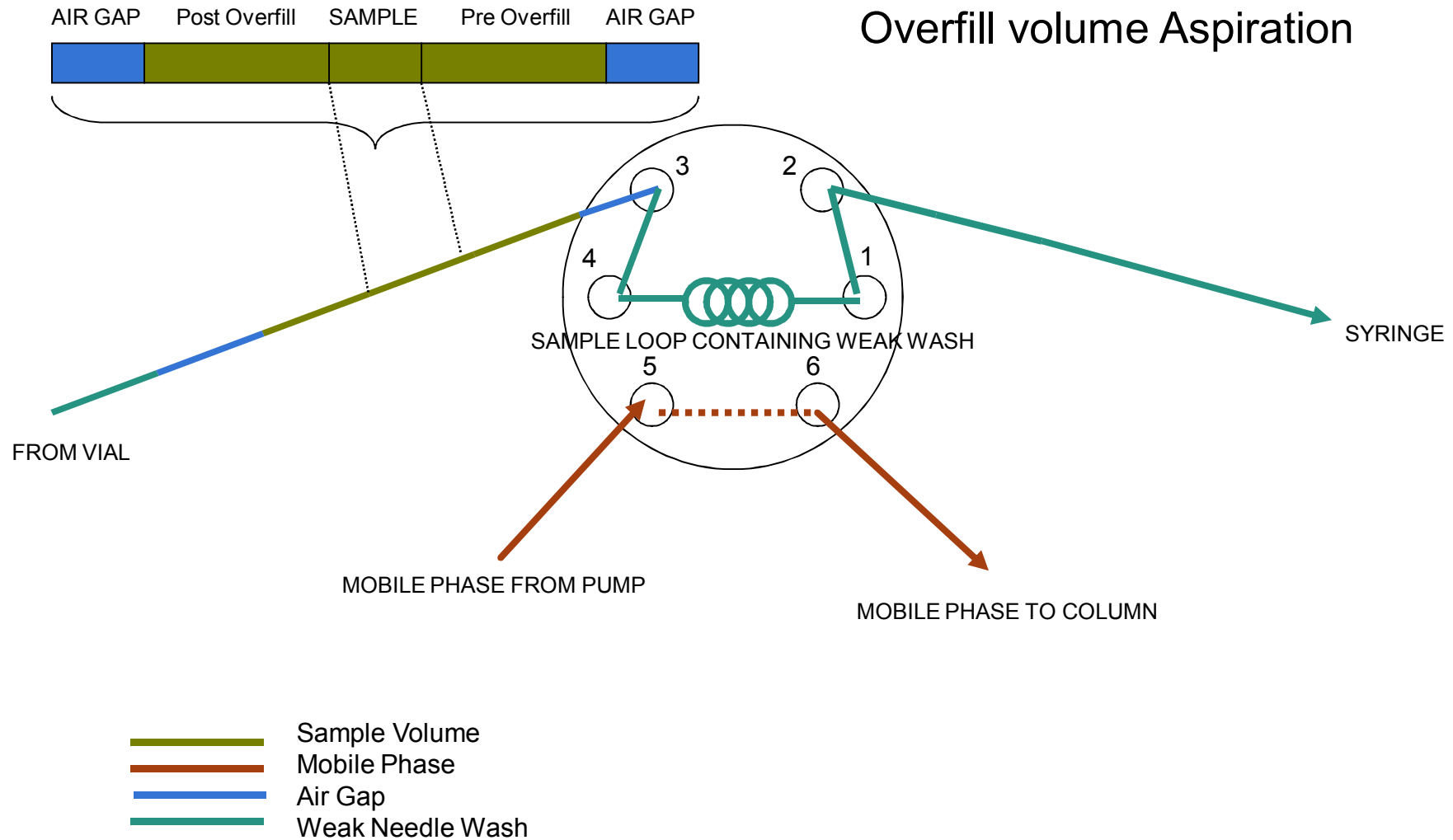
- The same basic delivery mechanism to the sample loop
- Both use Pressure Assist function to keep cycle time down
- Both surround the sample bolus with air gaps

## ■ Differences

- Partial loop (PA) uses only the amount of sample programmed into the injection volume field in the sample set (or sample list)
  - Air gaps are injected unto the column
- Full loop uses extra sample to flush the loop before the loop is filled with sample and ignores the injection volume field
  - Air gaps are not injected unto the column

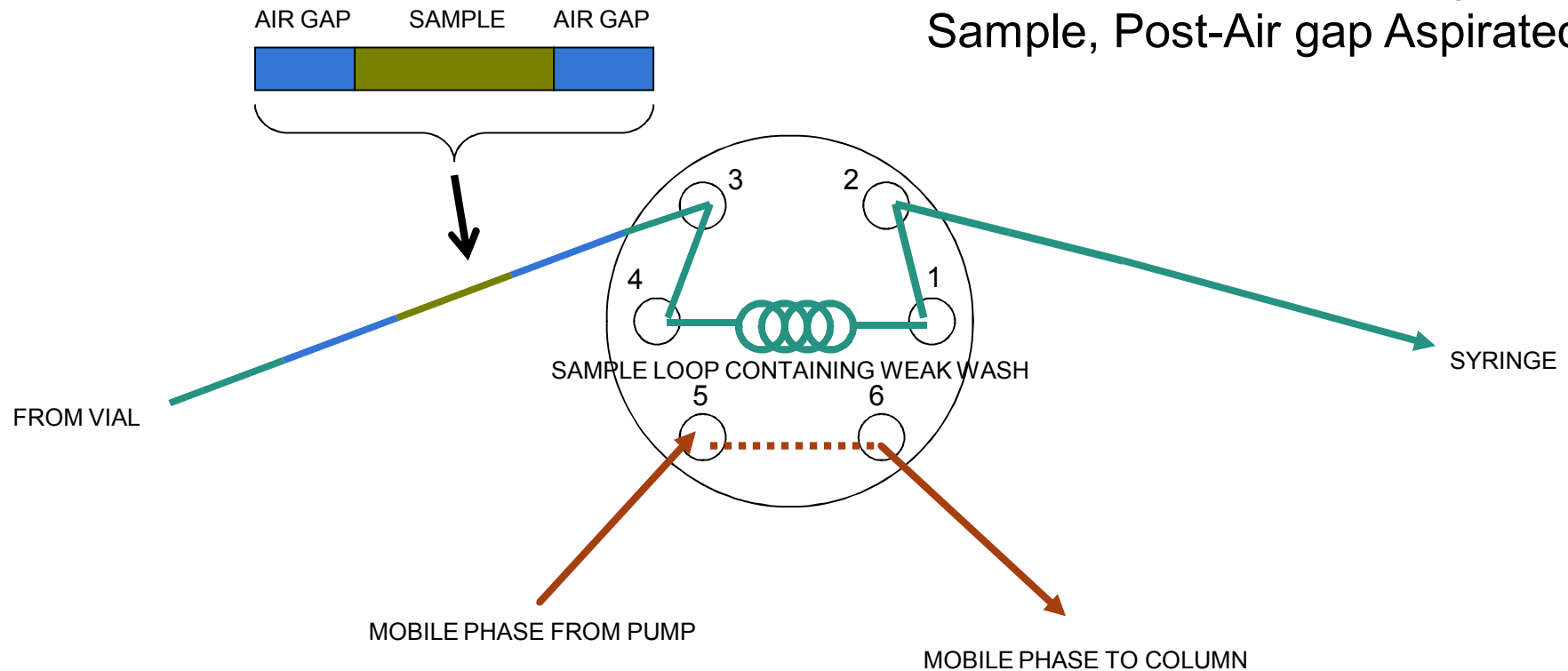
# Full Loop Injection Sequence - Step 1

Step 1 : Air Gap, Sample, Overfill volume Aspiration

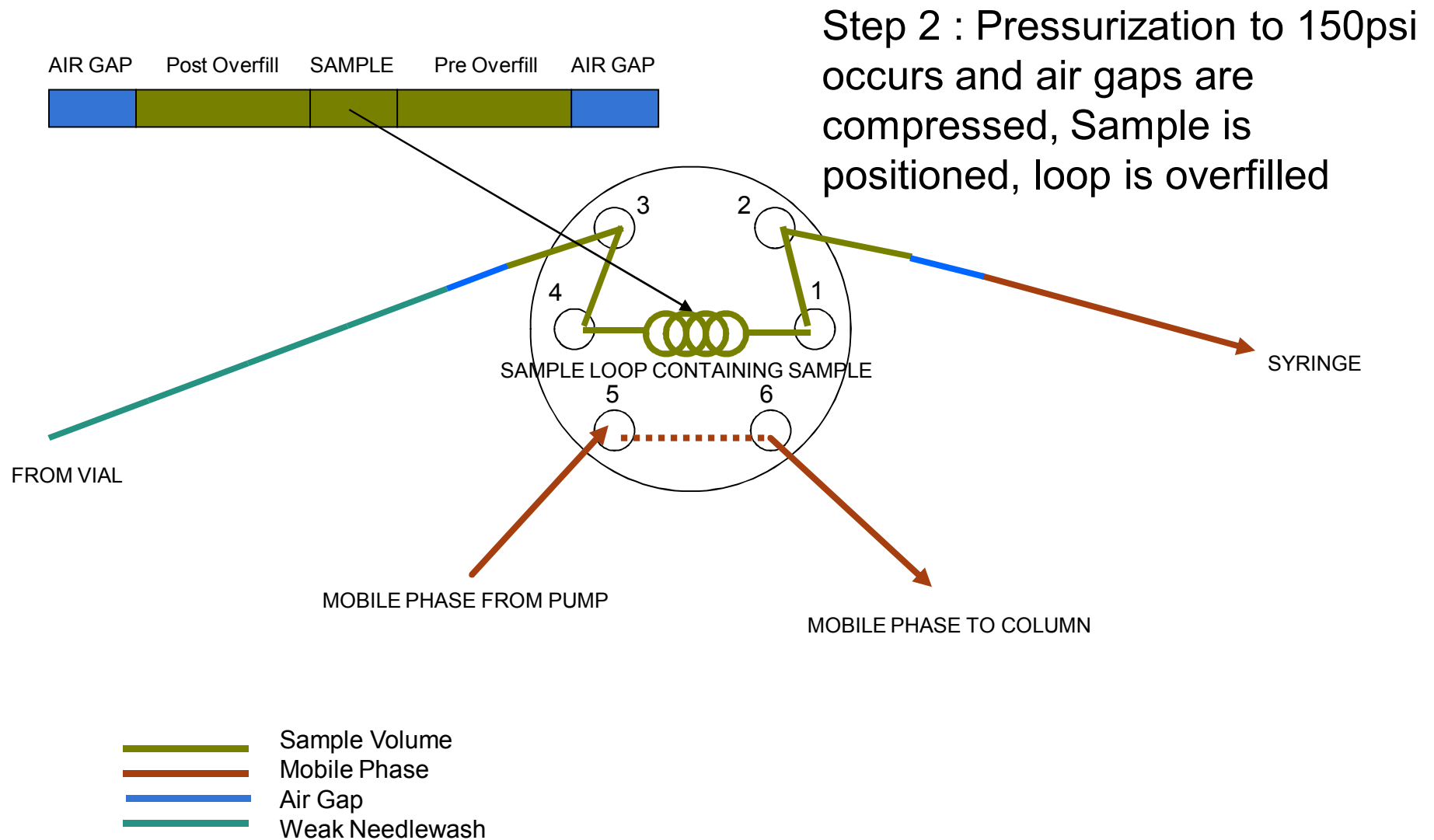


# Pressure Assist Injection Sequence - Step 1

Step 1 : Air Gap, Pre-Air gap,  
Sample, Post-Air gap Aspirated.

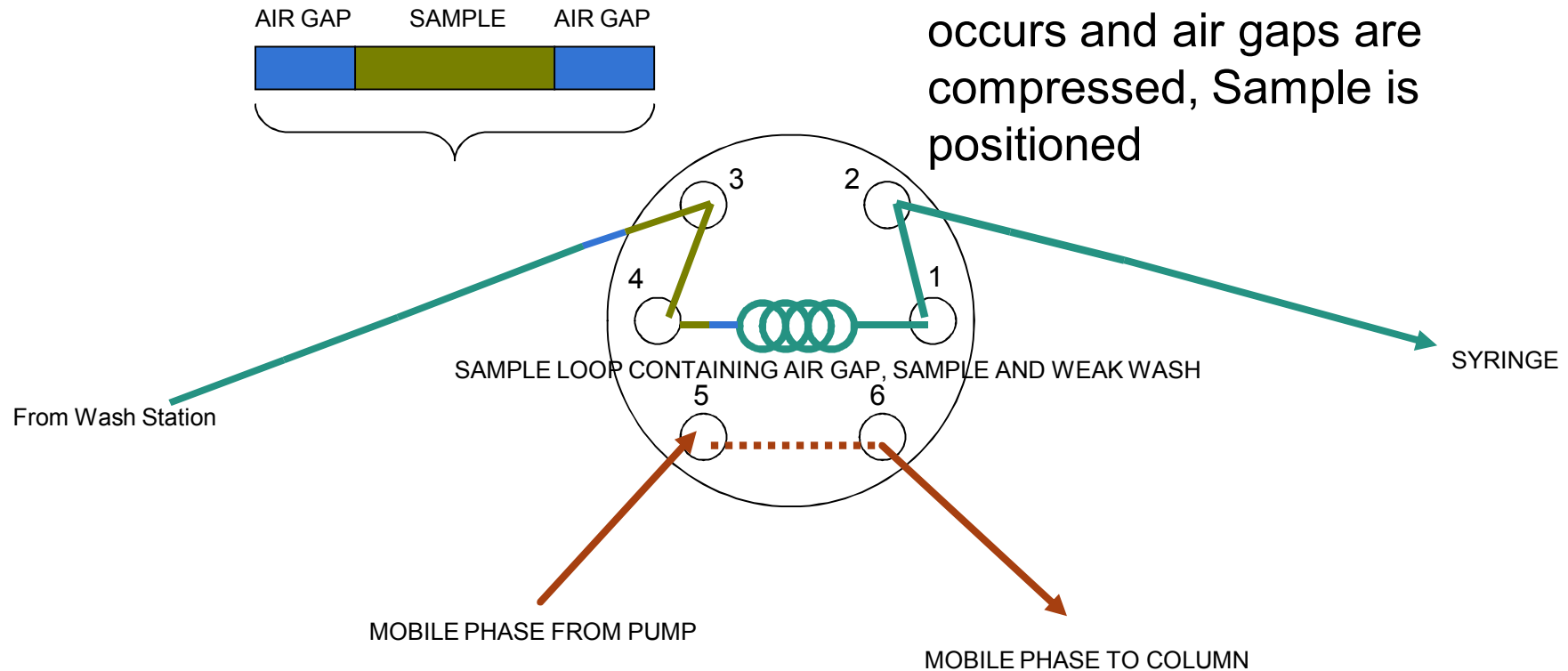


## Full Loop Injection Sequence - Step 2



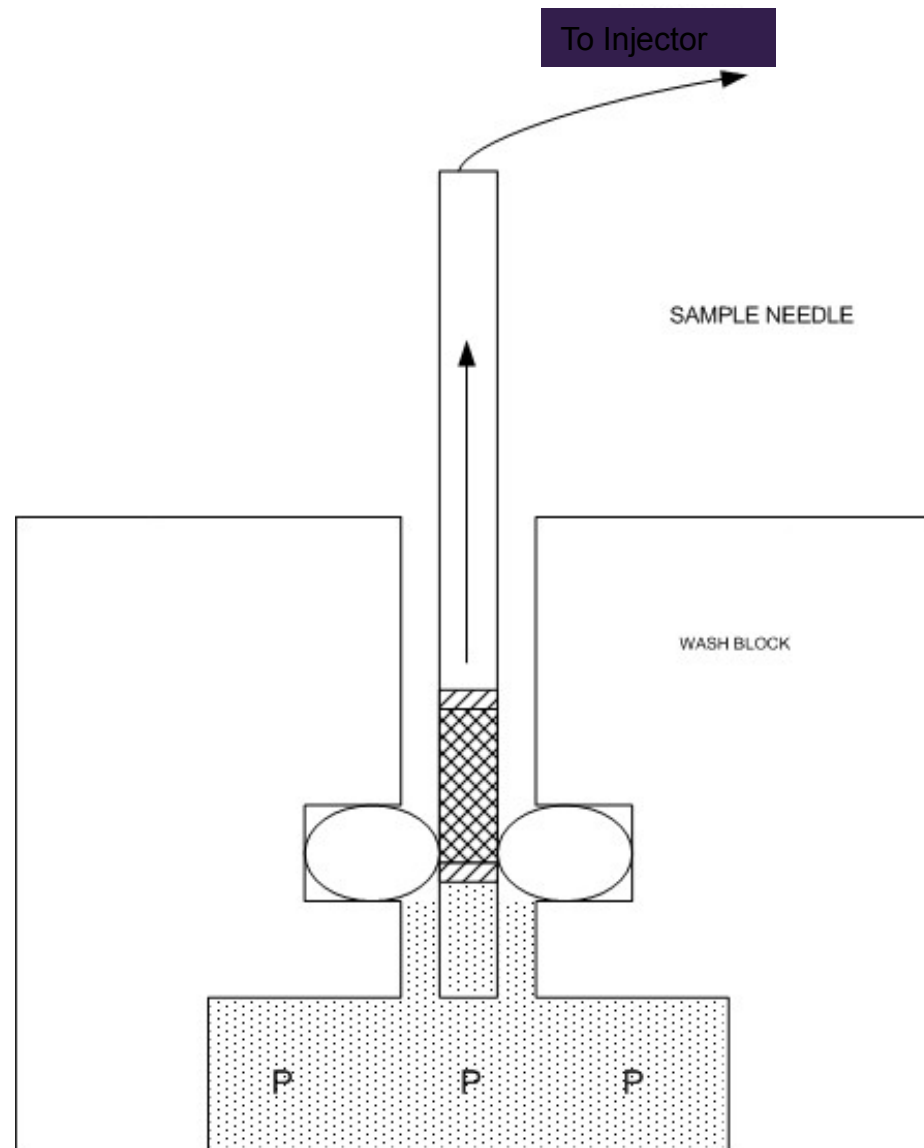
## Pressure Assist Injection Sequence - Step 2

Step 2 : Pressurization to 150psi occurs and air gaps are compressed, Sample is positioned

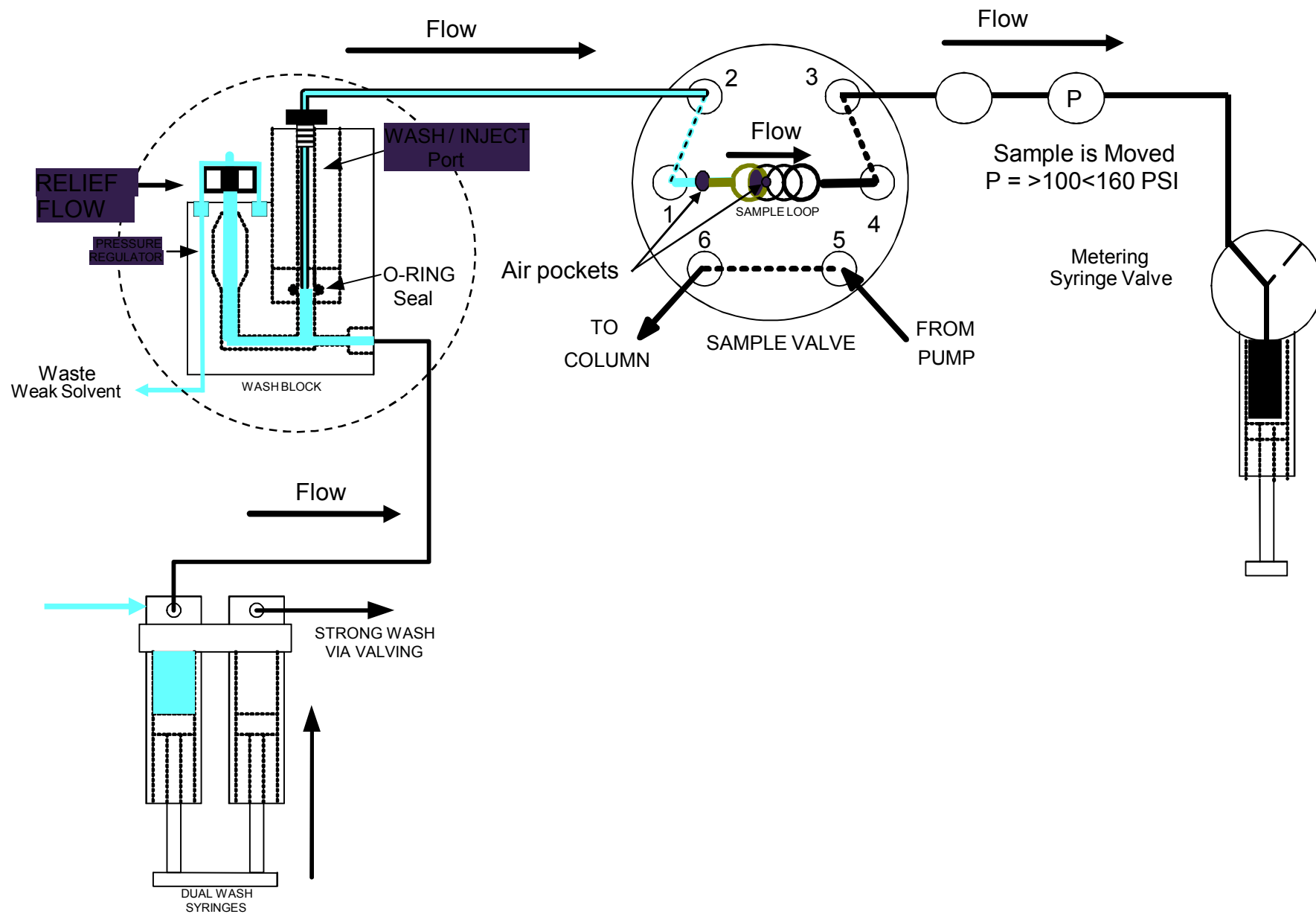


- Sample Volume
- Mobile Phase
- Air Gap
- Weak Needle Wash

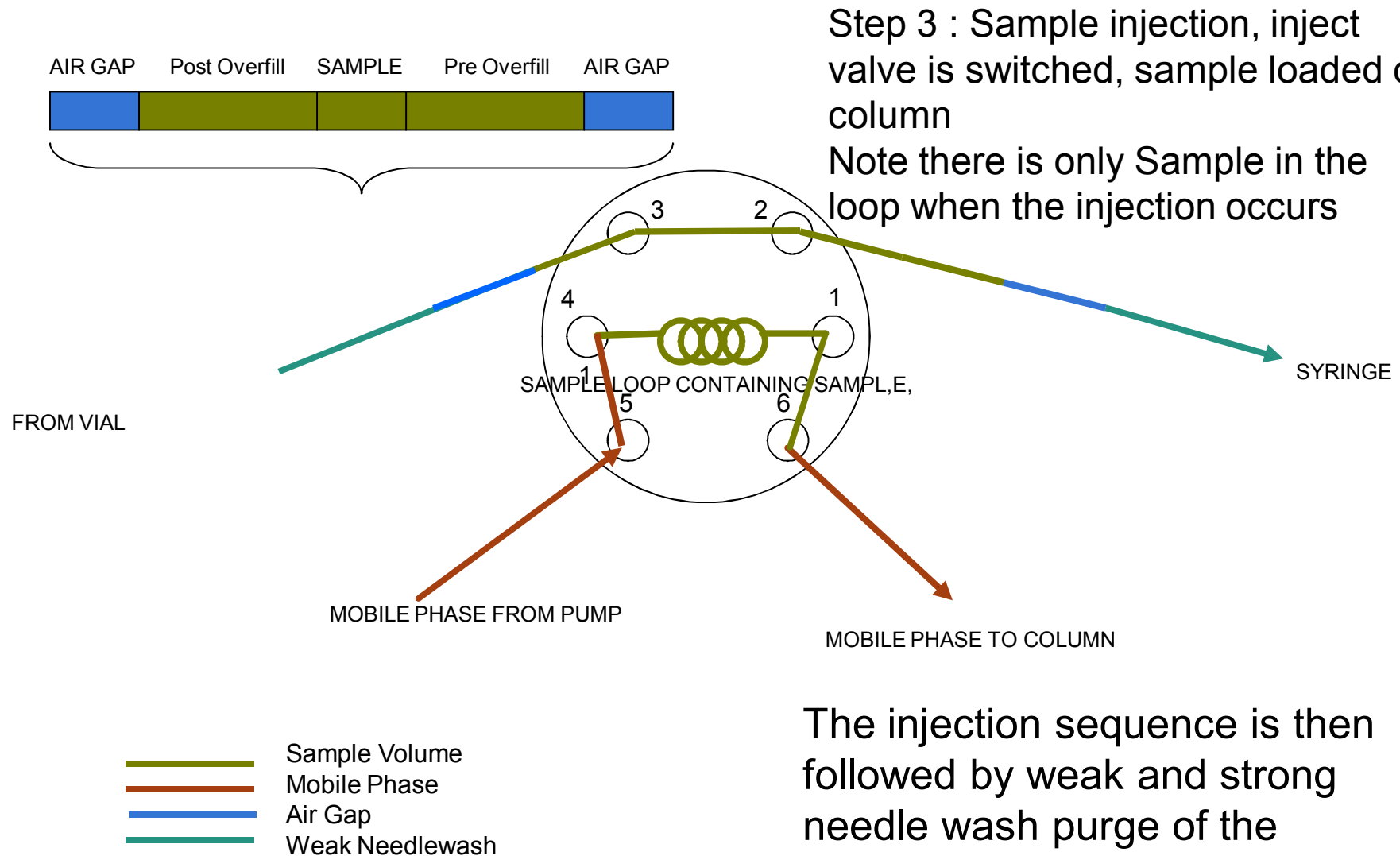
# Sample Needle Pressurization



# Pressure Assist Sample Movement

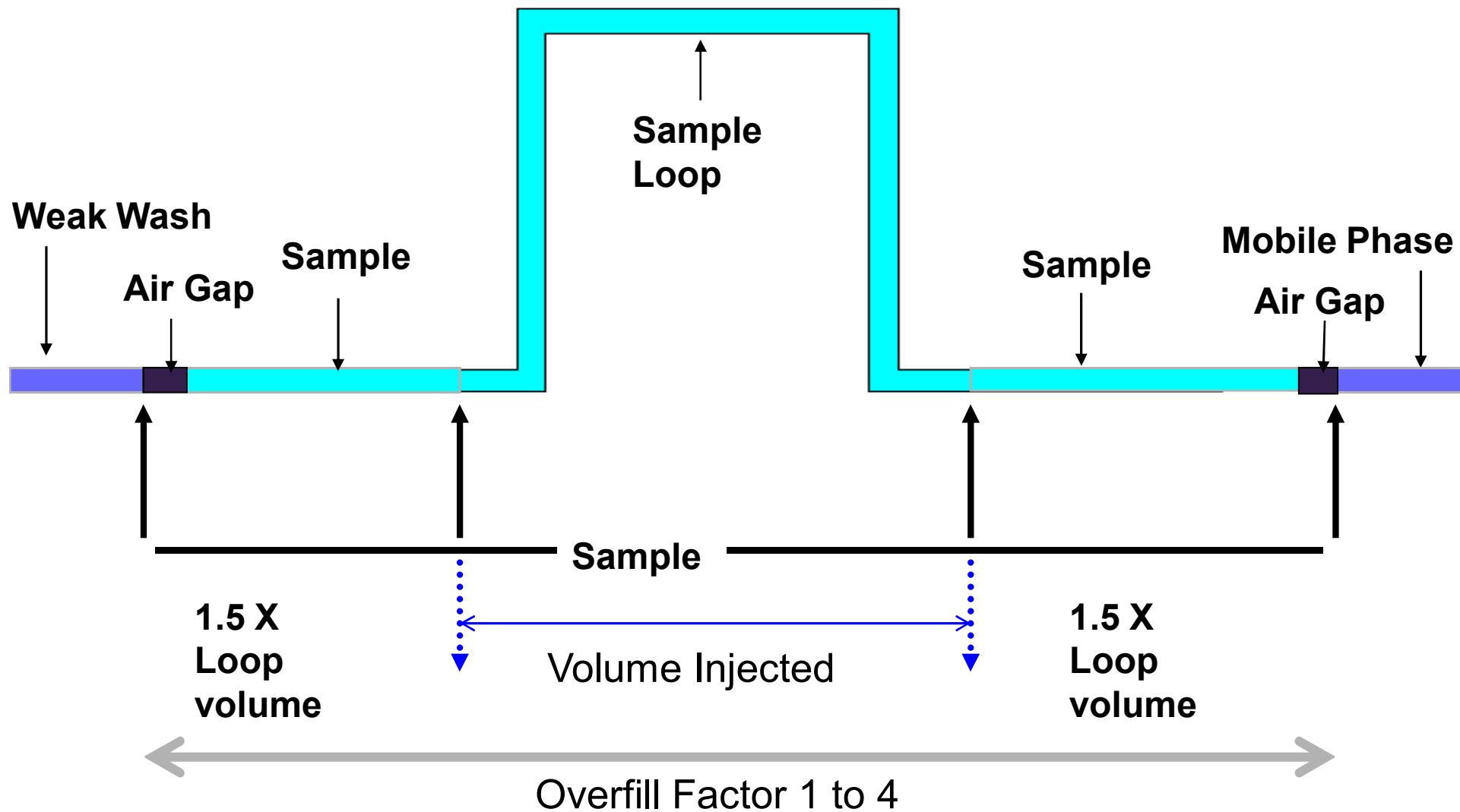


## Full Loop Injection Sequence - Step 3

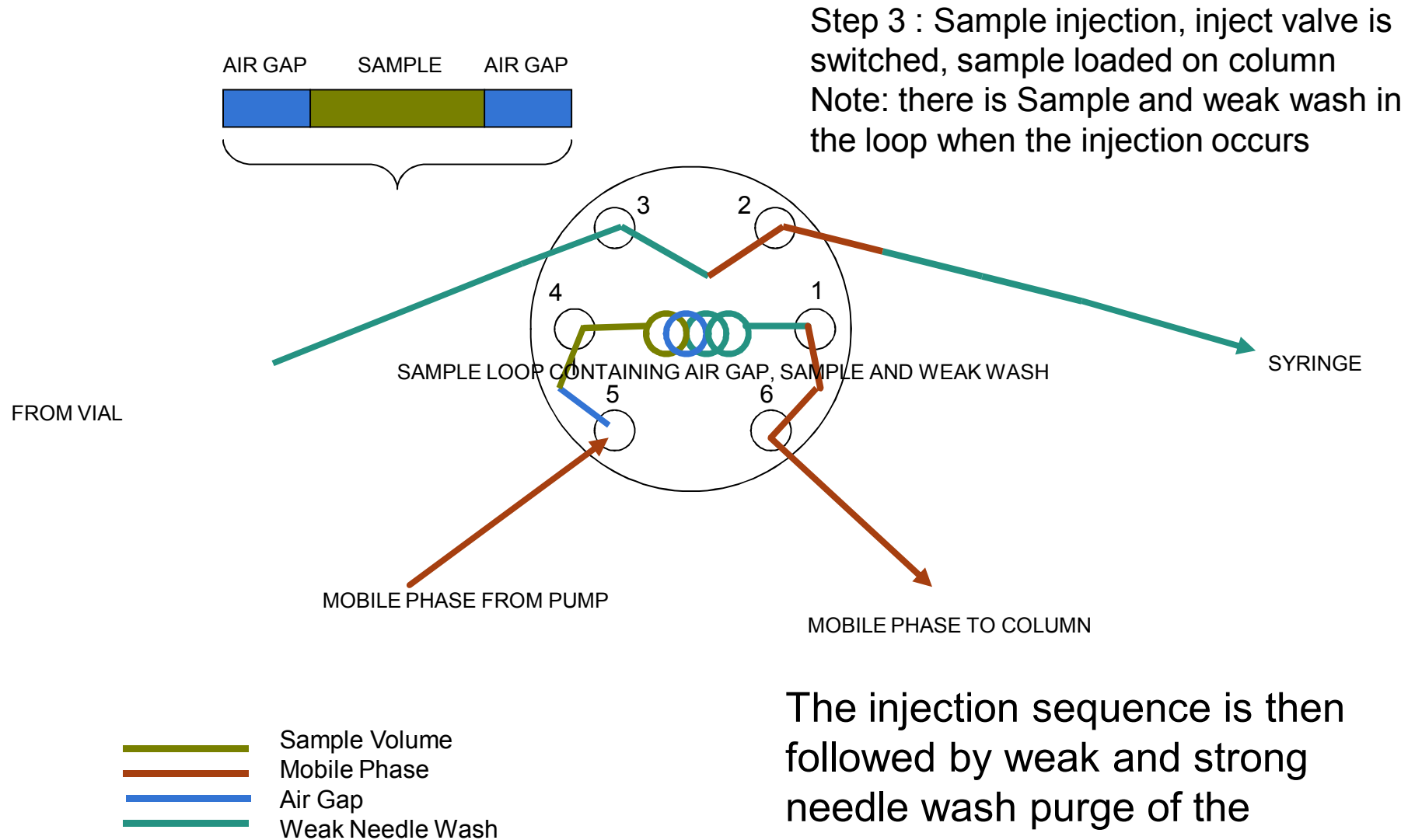


The injection sequence is then followed by weak and strong needle wash purge of the entire sample manager fluidics

# Injection Loop Contents- Full Loop

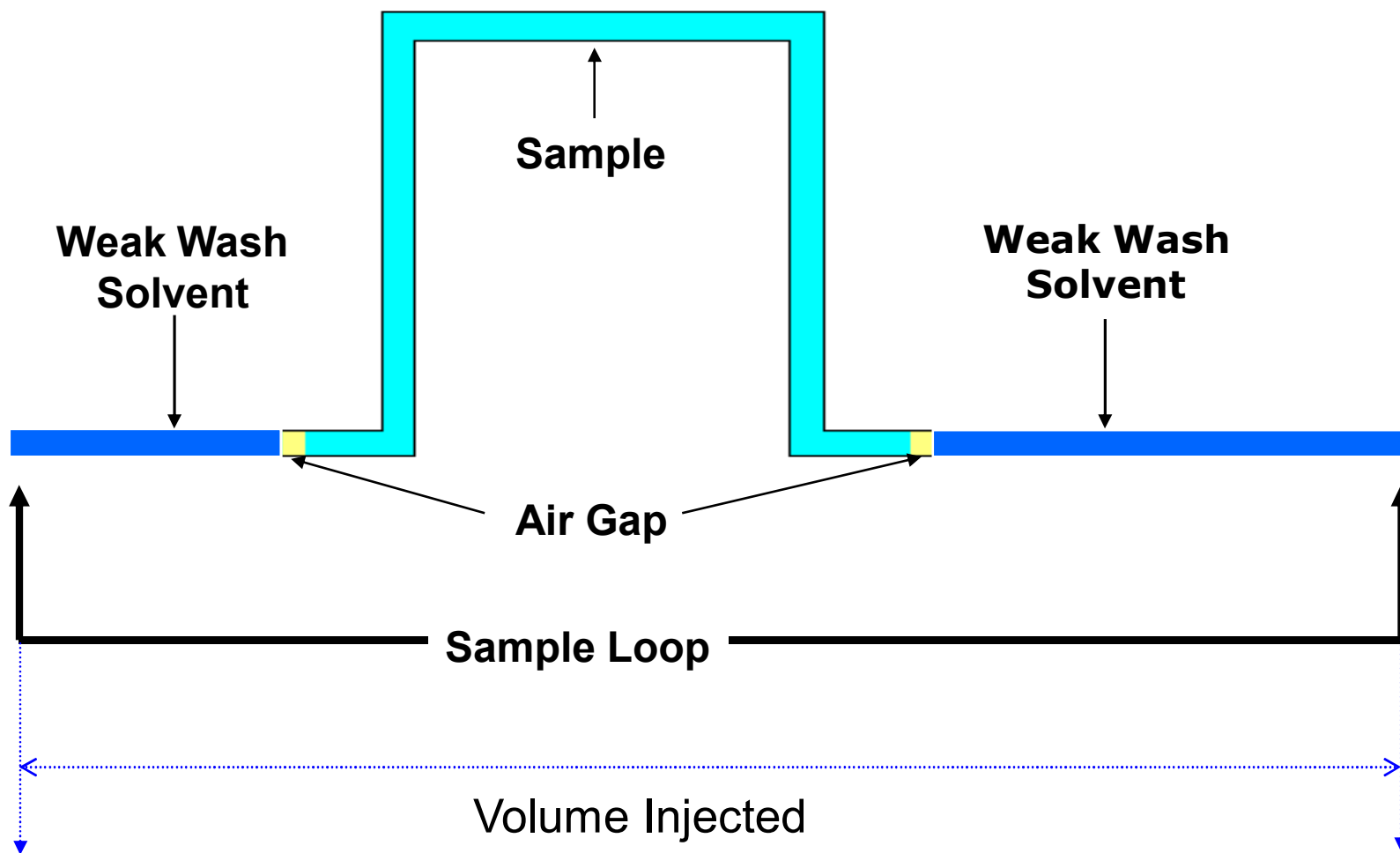


## Partial Loop Injection Sequence- Step 3

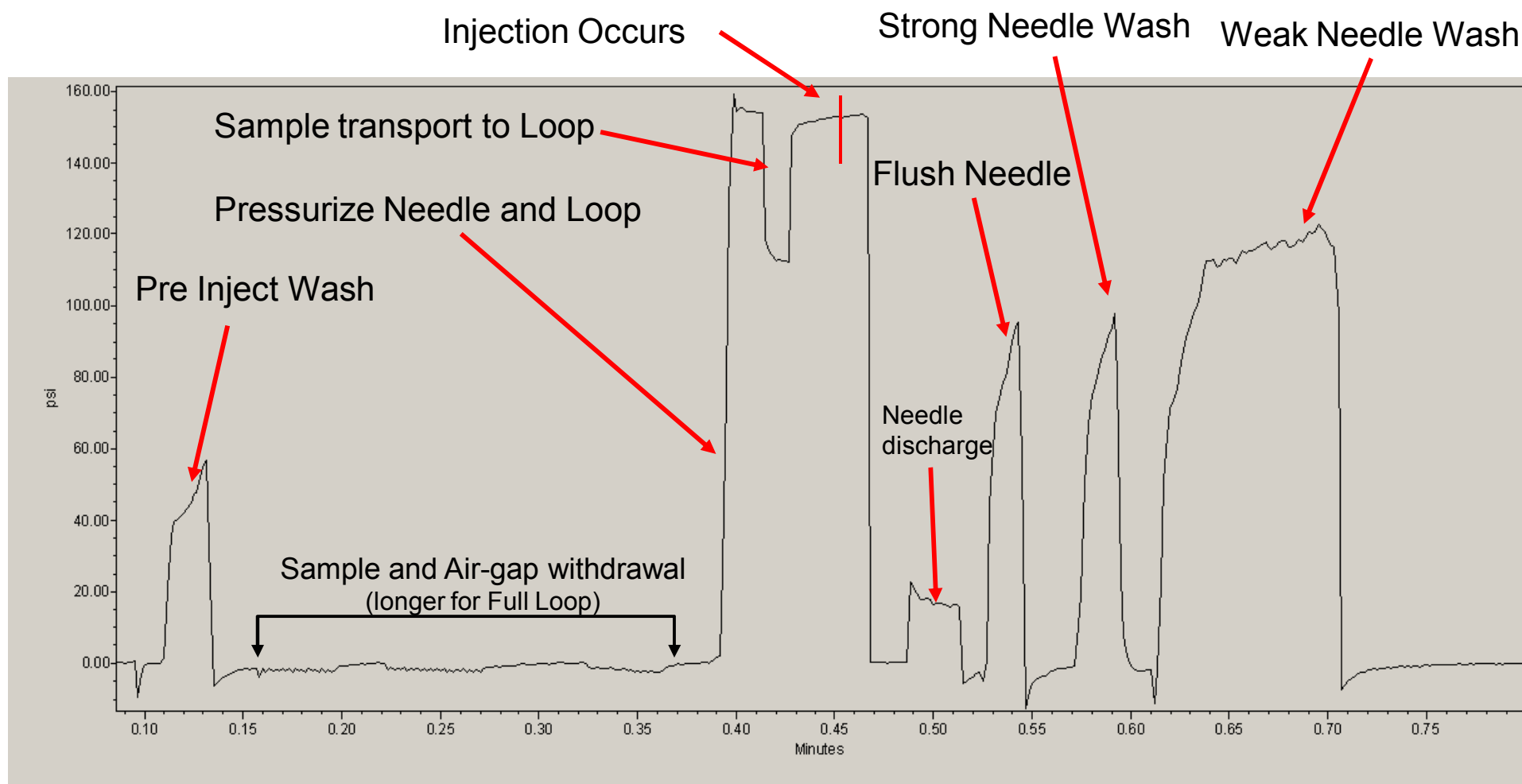


The injection sequence is then followed by weak and strong needle wash purge of the entire sample manager fluidics

## Injection Loop Contents- Pressure Assist



# Sample Pressure Trace- Full and Partial Loop with Pressure Assist

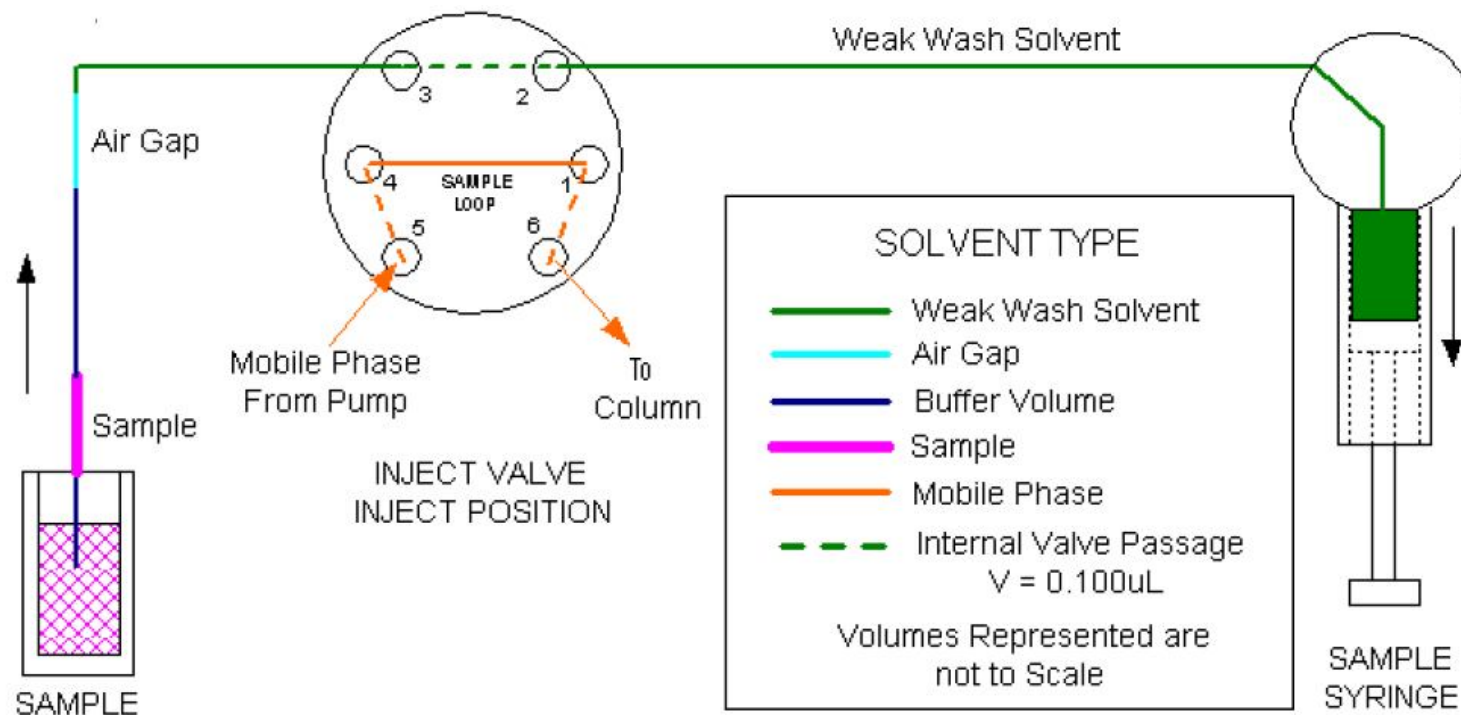


# **Partial Loop Using Needle Overfill Mode**

# PLUNO

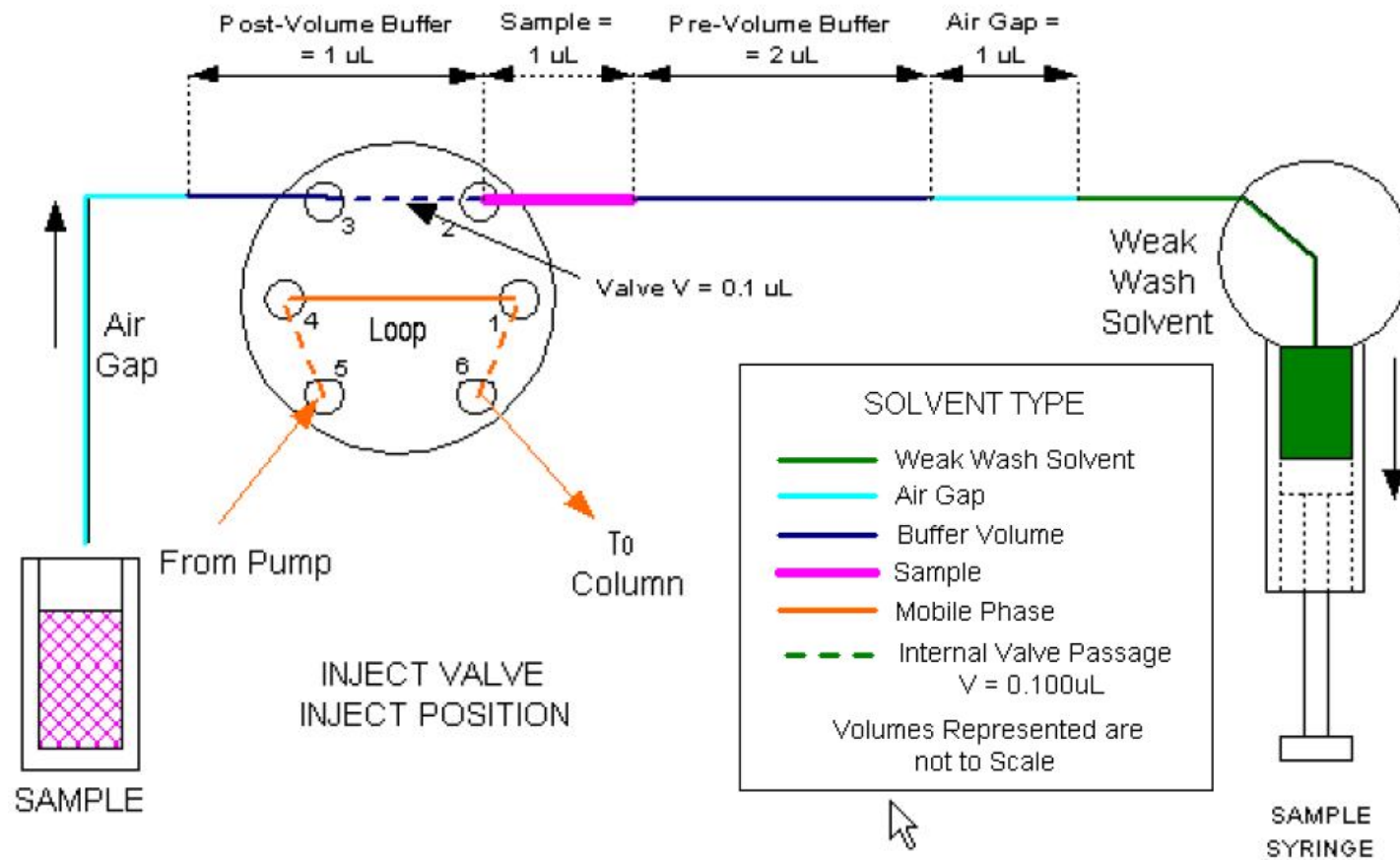
## ■ Step 1

- Sample Loop is in the Inject position
- Sample Syringe draws an air gap and the sample volume plus 15ul
  - We call this the Buffer volume, 14uL pre and 1ul post volume



# PLUNO

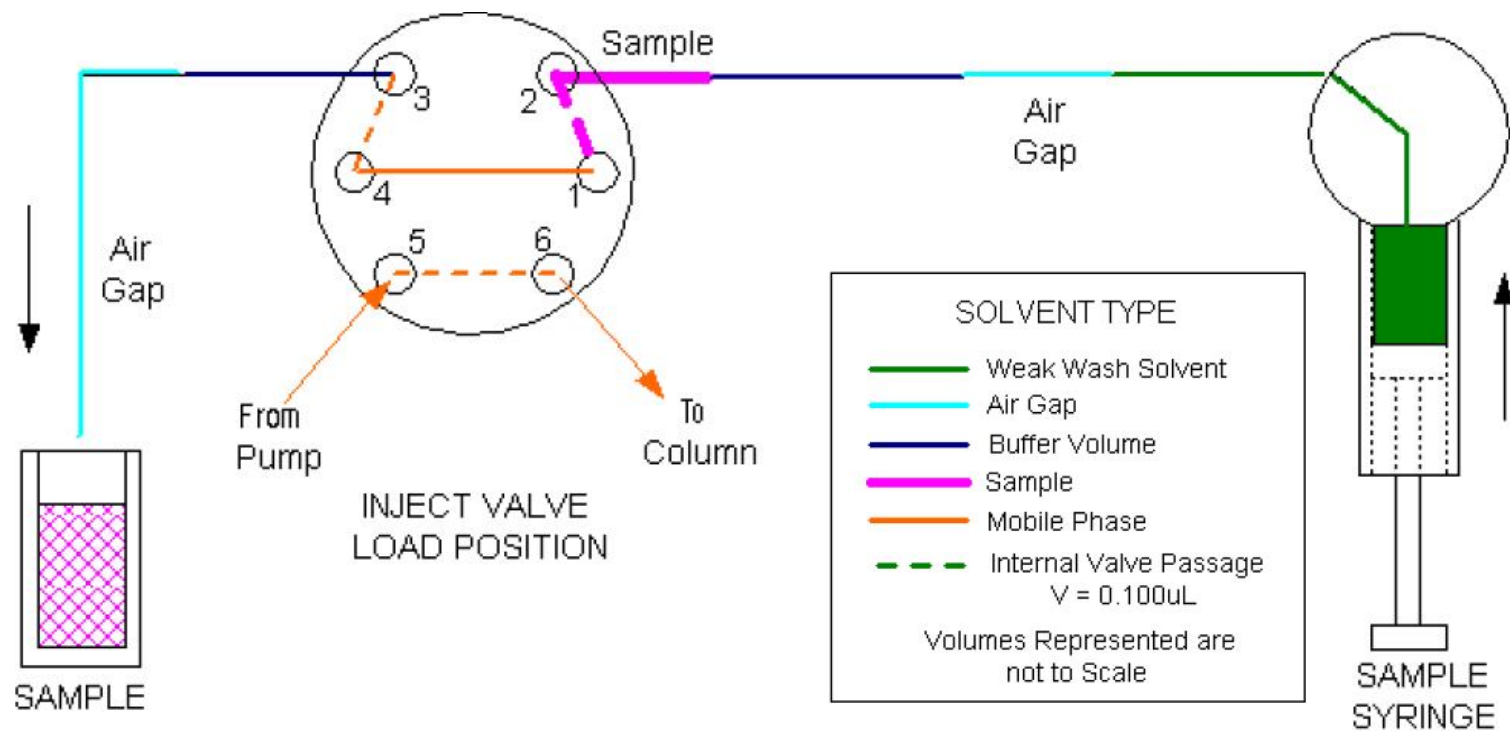
- Step 2
  - The metering syringe pulls the sample Inject Valve.



# PLUNO

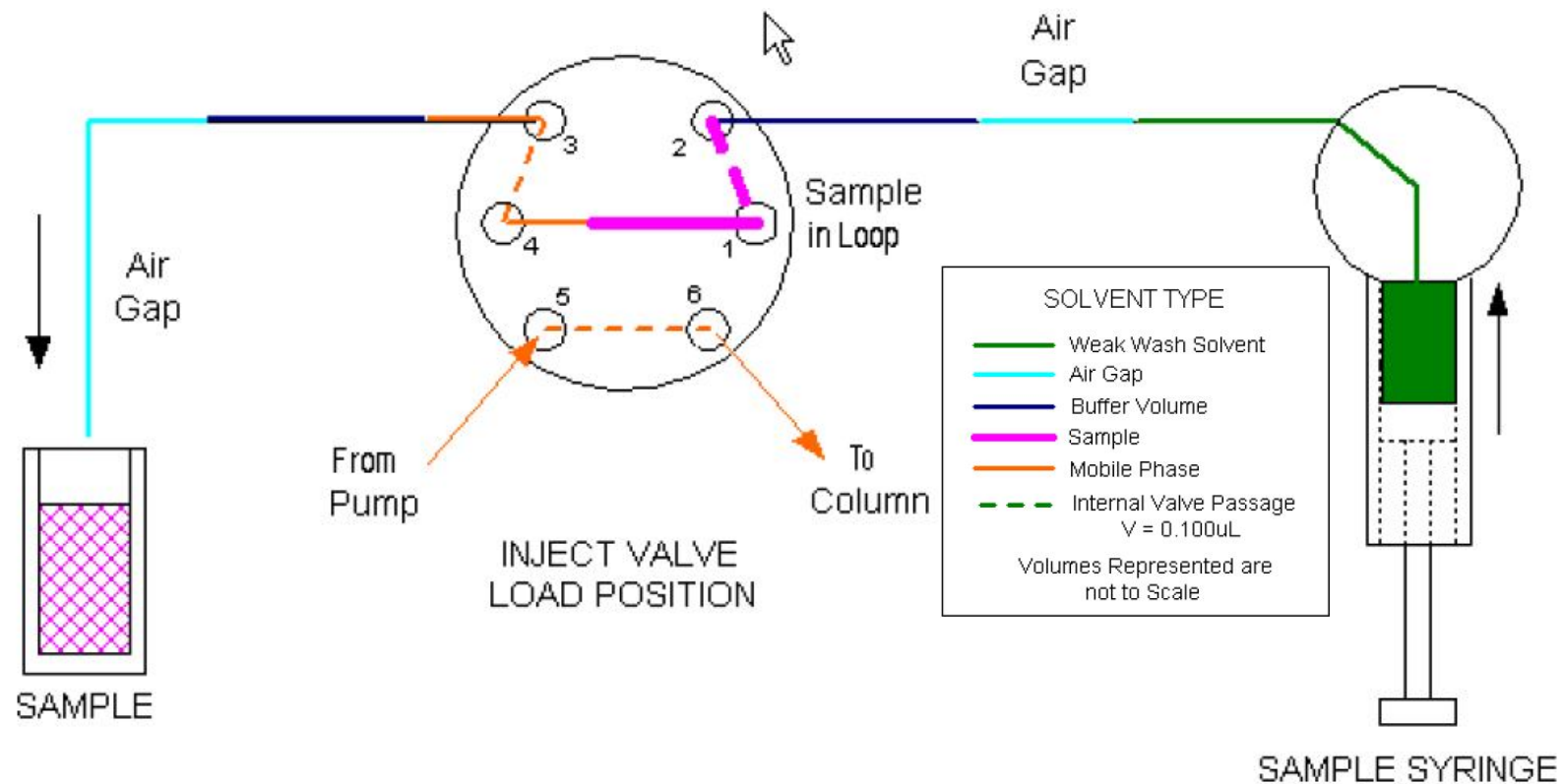
- Step 3:

- The valve actuates bringing the sample loop into the Load position
- The sample syringe pushed the sample back towards the needle



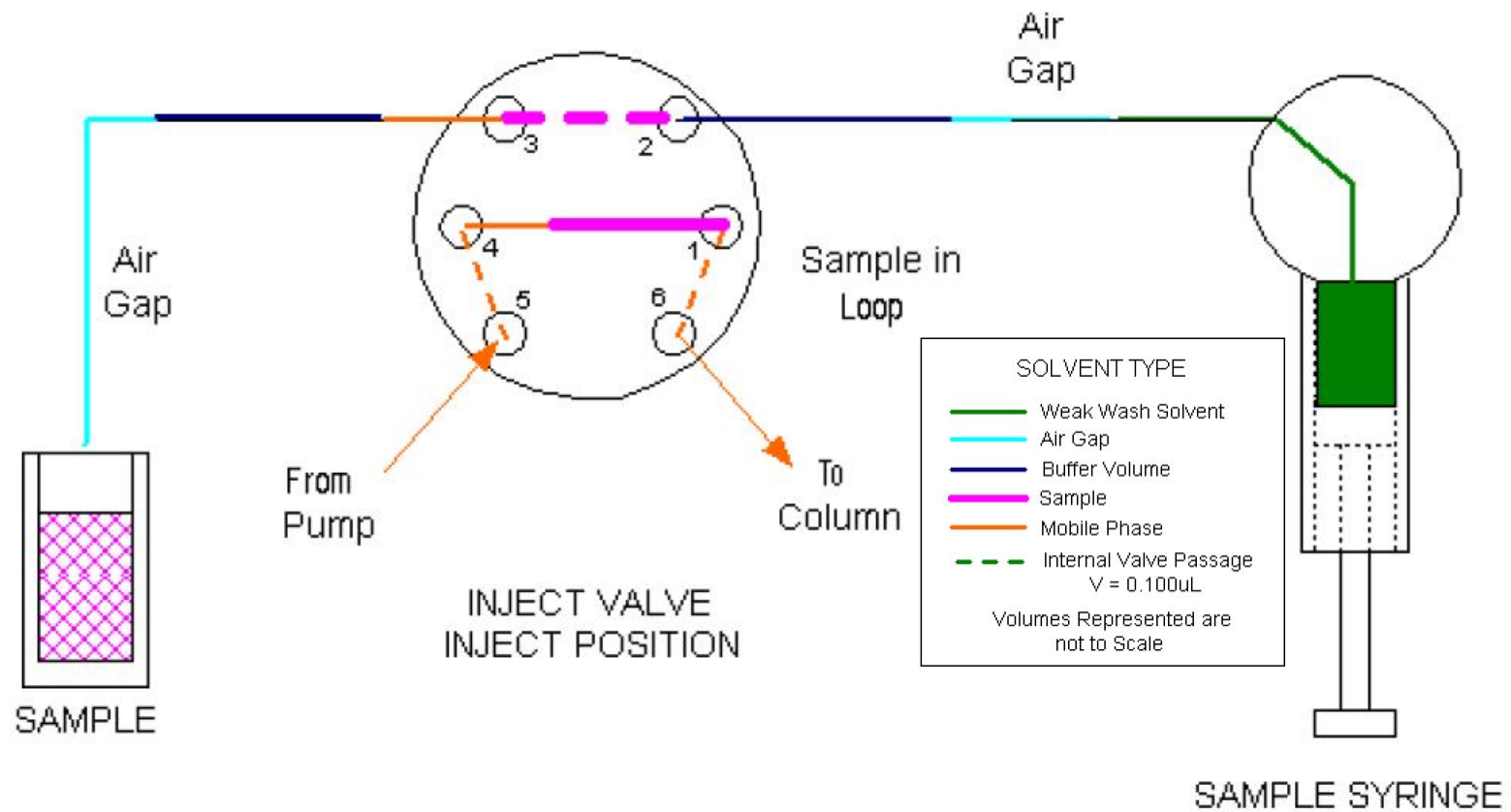
# PLUNO

- Step 4:
  - Only the volume selected in the method is back loaded onto the Sample Loop

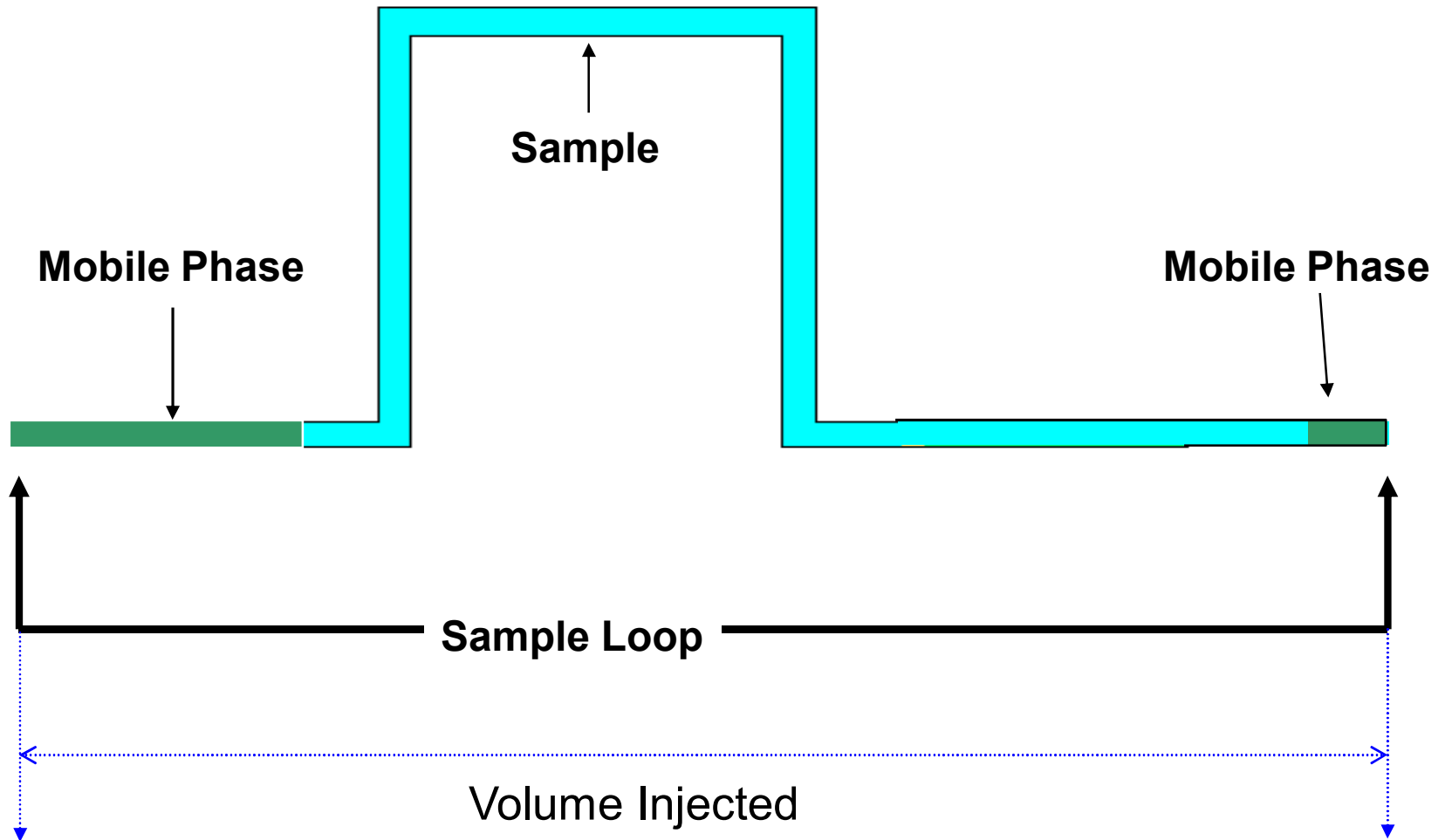


# PLUNO

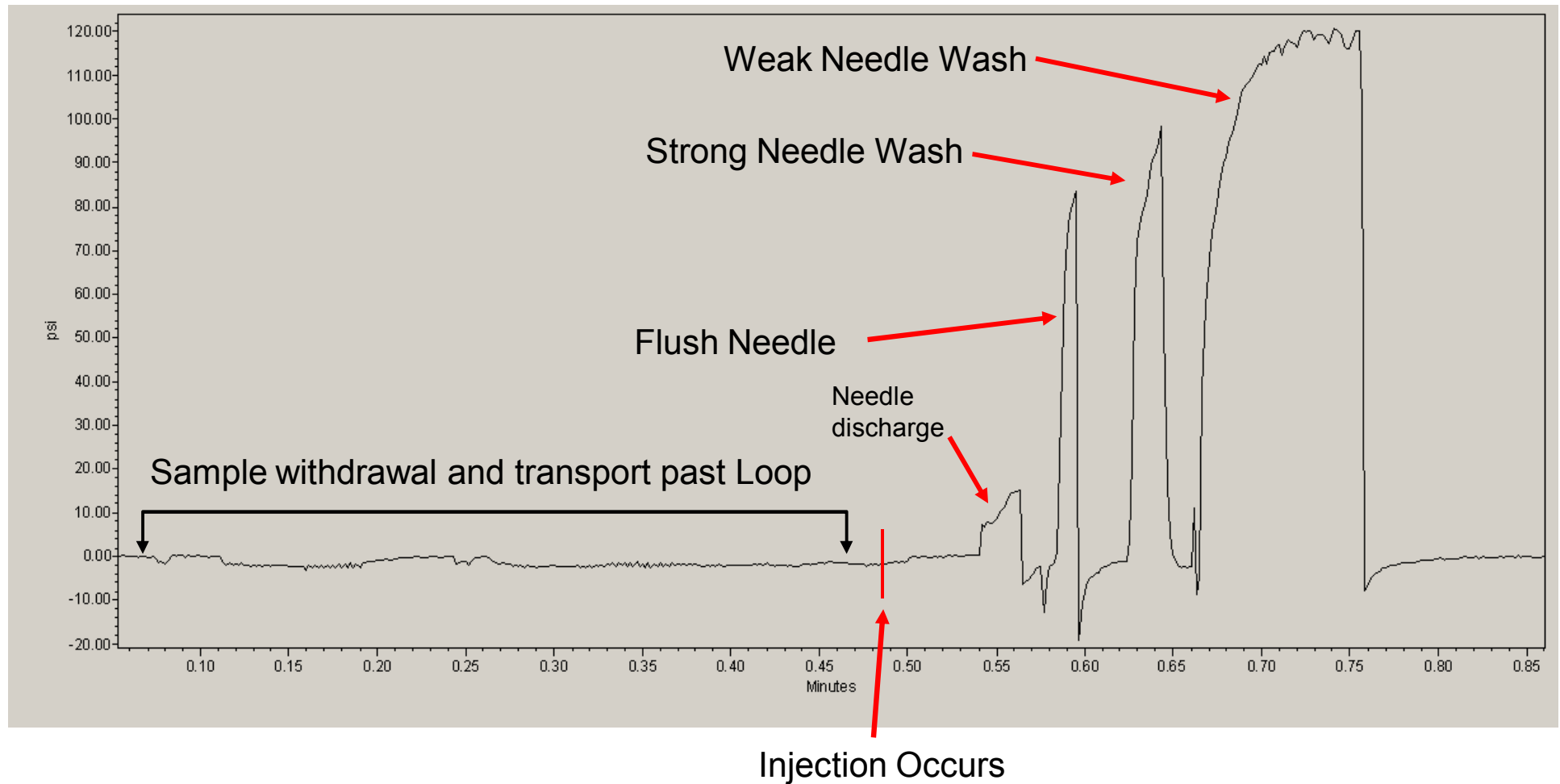
- Step 5:
  - The Inject Valve actuates bringing the sample loop into the "Inject" position
  - The sample is loaded on to the column



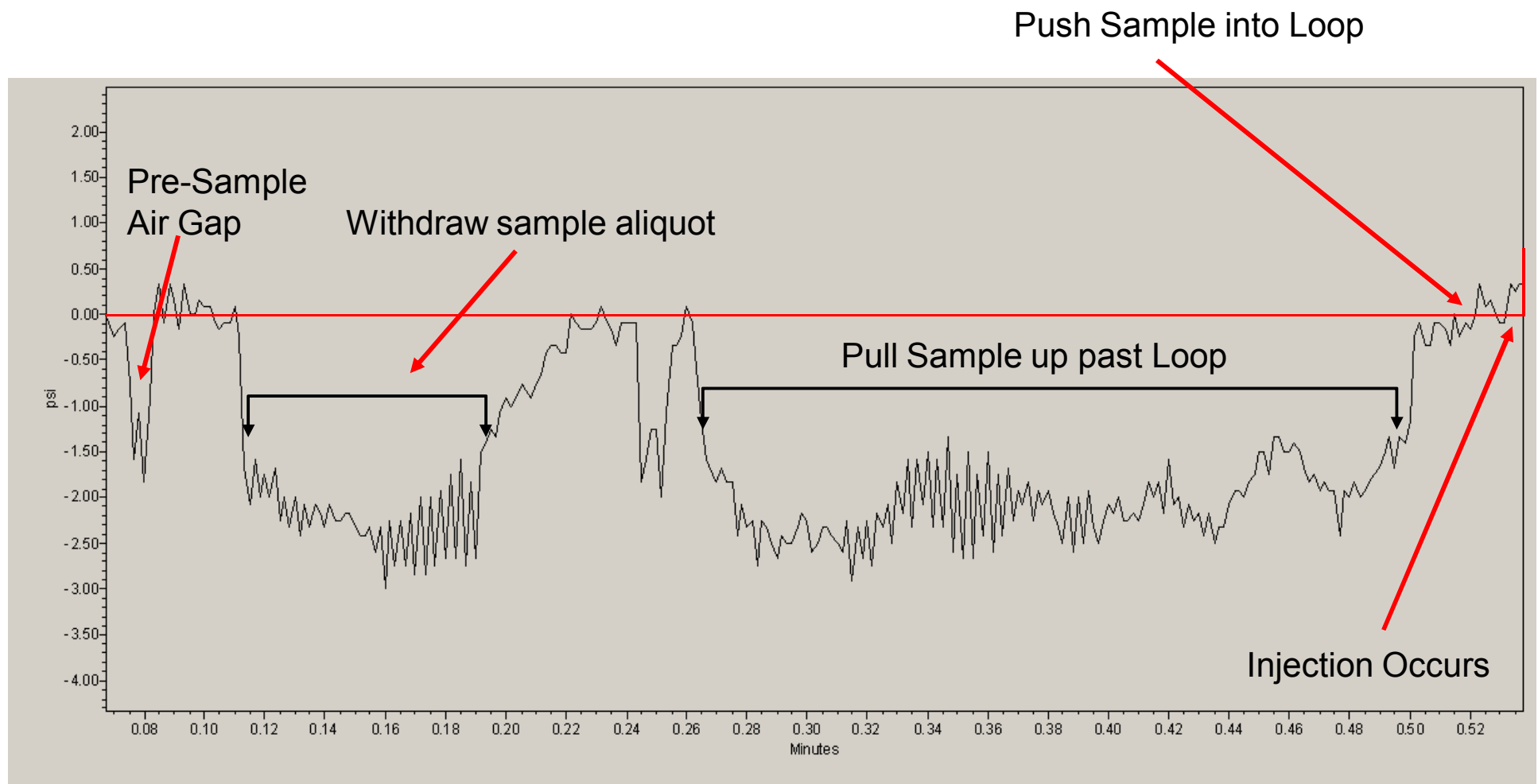
# Injection Loop Contents- PLUNO



# Sample Pressure Trace- PLUNO



# Sample Pressure Trace- PLUNO



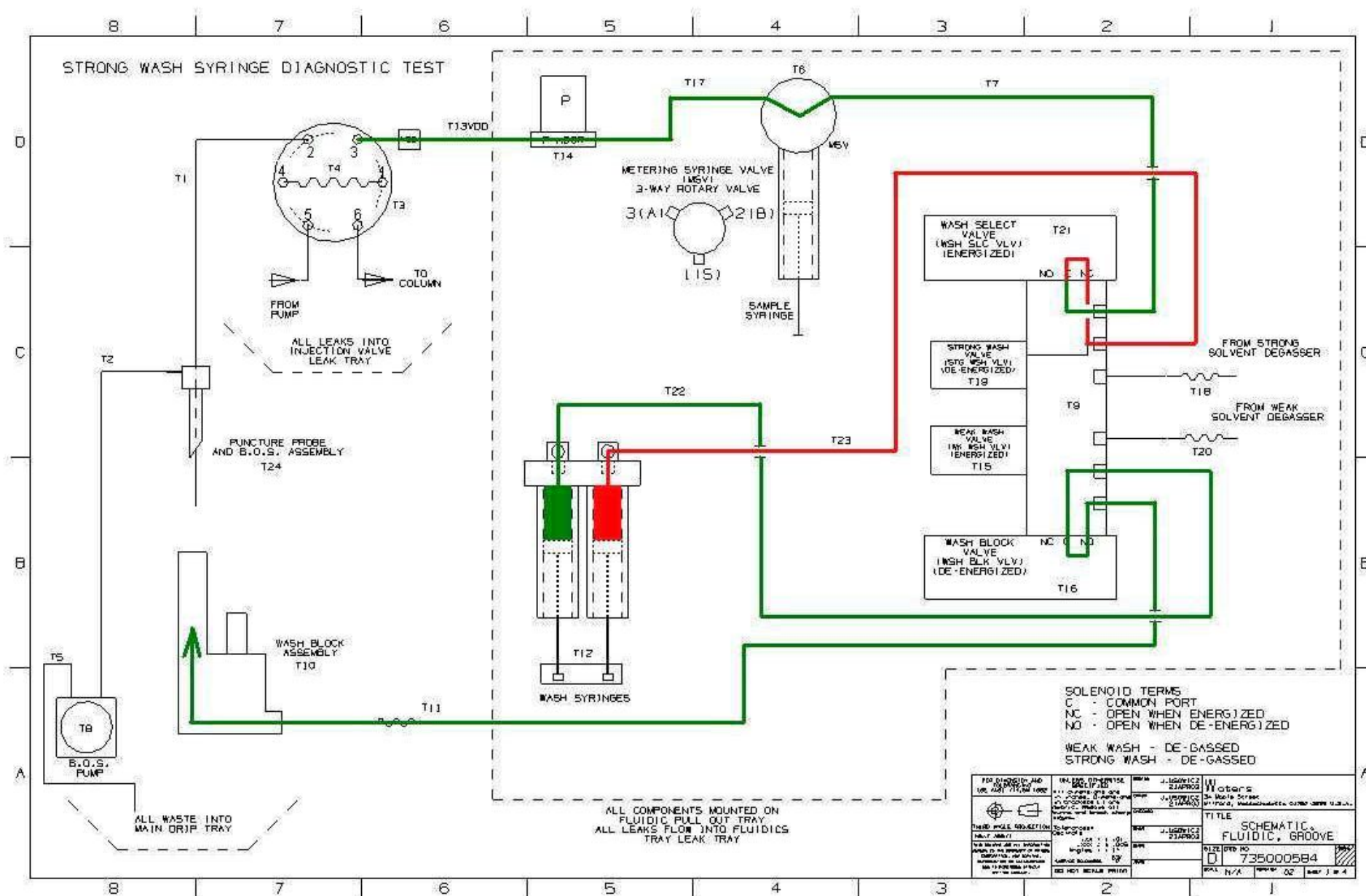
## **Partial Loop Using Needle Overfill Mode**

- The best general purpose mode for partial loop injection
- Provides optimum performance when injection volumes are kept within a range of 10 – 75% nominal loop volume
- It provides the best partial loop accuracy, precision and linearity for a wide range of samples including
  - strong and weak acids and bases
  - hydrophilic and hydrophobic compounds.

# **Needle-Wash System**

ACQUITY UPLC™ Sample Manager

## Diagram of Strong Wash Function



[illegible]

# Wash Solvent Considerations

ACQUITY UPLC™ Service Training

# Wash Solvent Considerations

- As a general principle, strong and weak solvents should include the same organic species
  - This may not always be practicable, especially in the case of “sticky” samples. You may, however use a 100% organic strong wash solvent
- For best results, weak wash solvent should be equivalent to the following (excluding buffers):
  - mobile phase composition (for isocratic separations)
  - initial gradient condition (for gradient separations)
  - If you dilute the samples, match the weak wash solvent to the sample diluent
- Do not use salt buffers in wash solvents

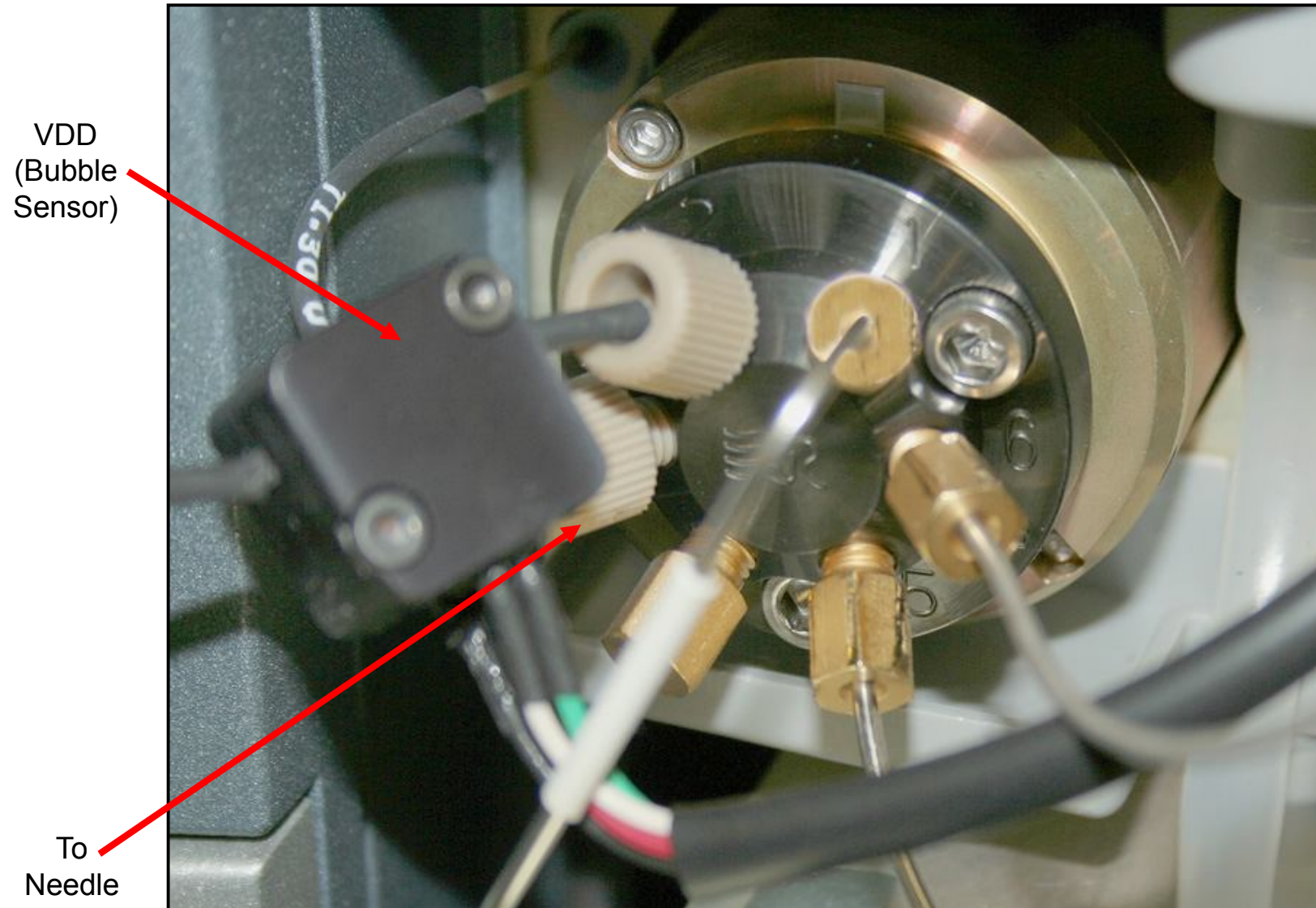
# Wash Solvent Considerations

- Strong solvent should be no stronger than the concentration needed to reduce carryover to an acceptable level
- Strong wash solvent should not contact the sample
- Wash volume ratio (weak to strong)
  - Should be about 3:1, weak wash to strong
  - Sufficient to ensure the weak wash flushes the strong from the needle and sample loop
- For more details on solvents, see the section titled “Selecting weak wash and strong wash solvents” in the ACQUITY Operators Guide

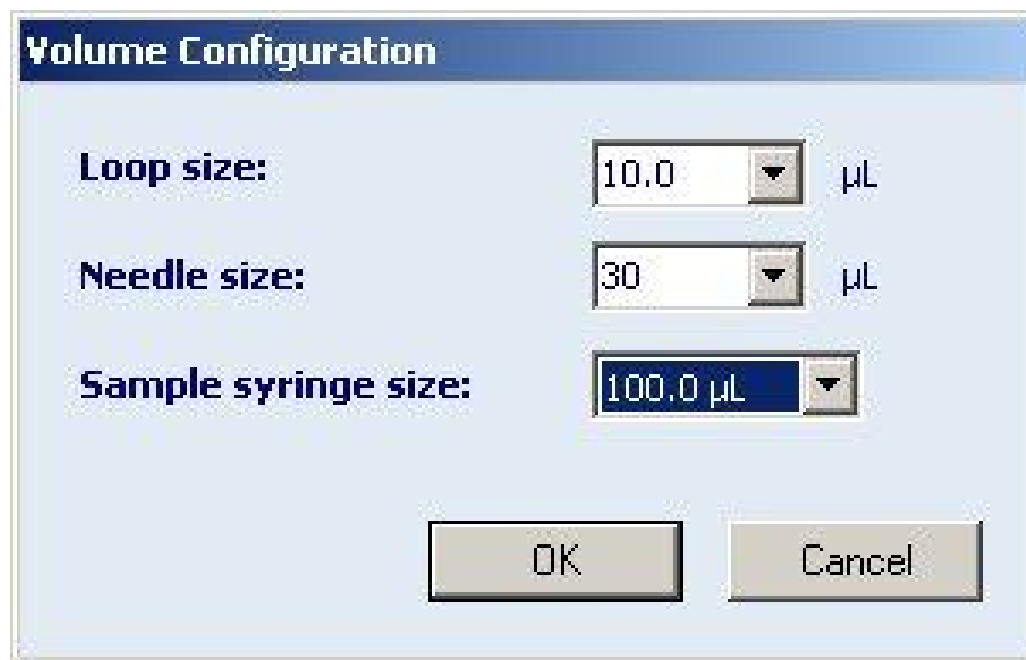
# Characterizing the Needle and Loop Volume

ACQUITY UPLC™ Sample Manager

# Volume Detection Device (Bubble Sensor)



# Volume Configuration Menu



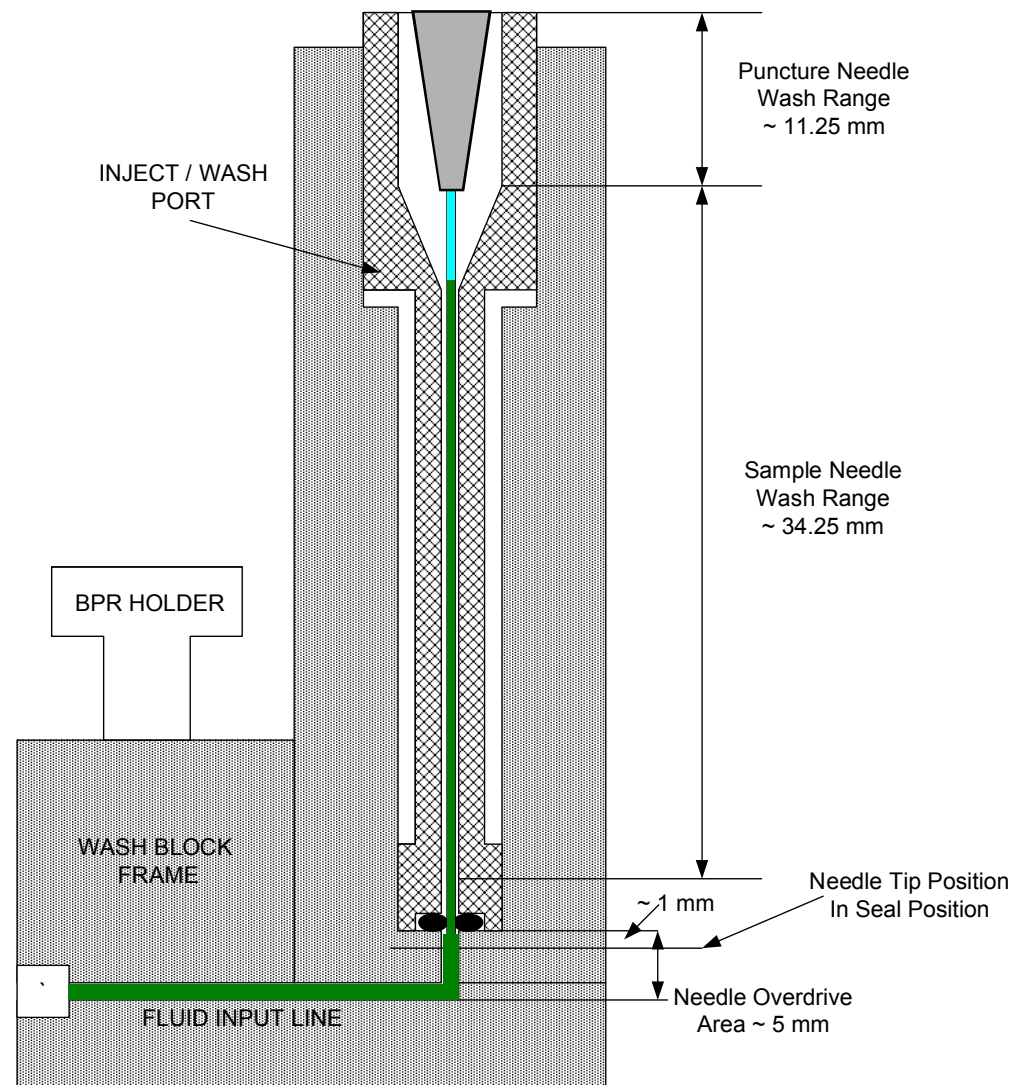
The image shows a 'Volume Configuration' dialog box with a light blue background and a dark blue title bar. It contains three configuration options, each with a text label, a numeric input field, a unit label, and a dropdown arrow. The 'Loop size' is set to 10.0 µL, 'Needle size' is set to 30 µL, and 'Sample syringe size' is set to 100.0 µL. At the bottom, there are 'OK' and 'Cancel' buttons.

| Parameter            | Value | Unit |
|----------------------|-------|------|
| Loop size:           | 10.0  | µL   |
| Needle size:         | 30    | µL   |
| Sample syringe size: | 100.0 | µL   |

Before running the Characterize Needle and Loop Volume function, make sure the proper volumes are configured in the Volumes Configuration menu.  
The above values are standard for the currently shipping ACQUITY system.

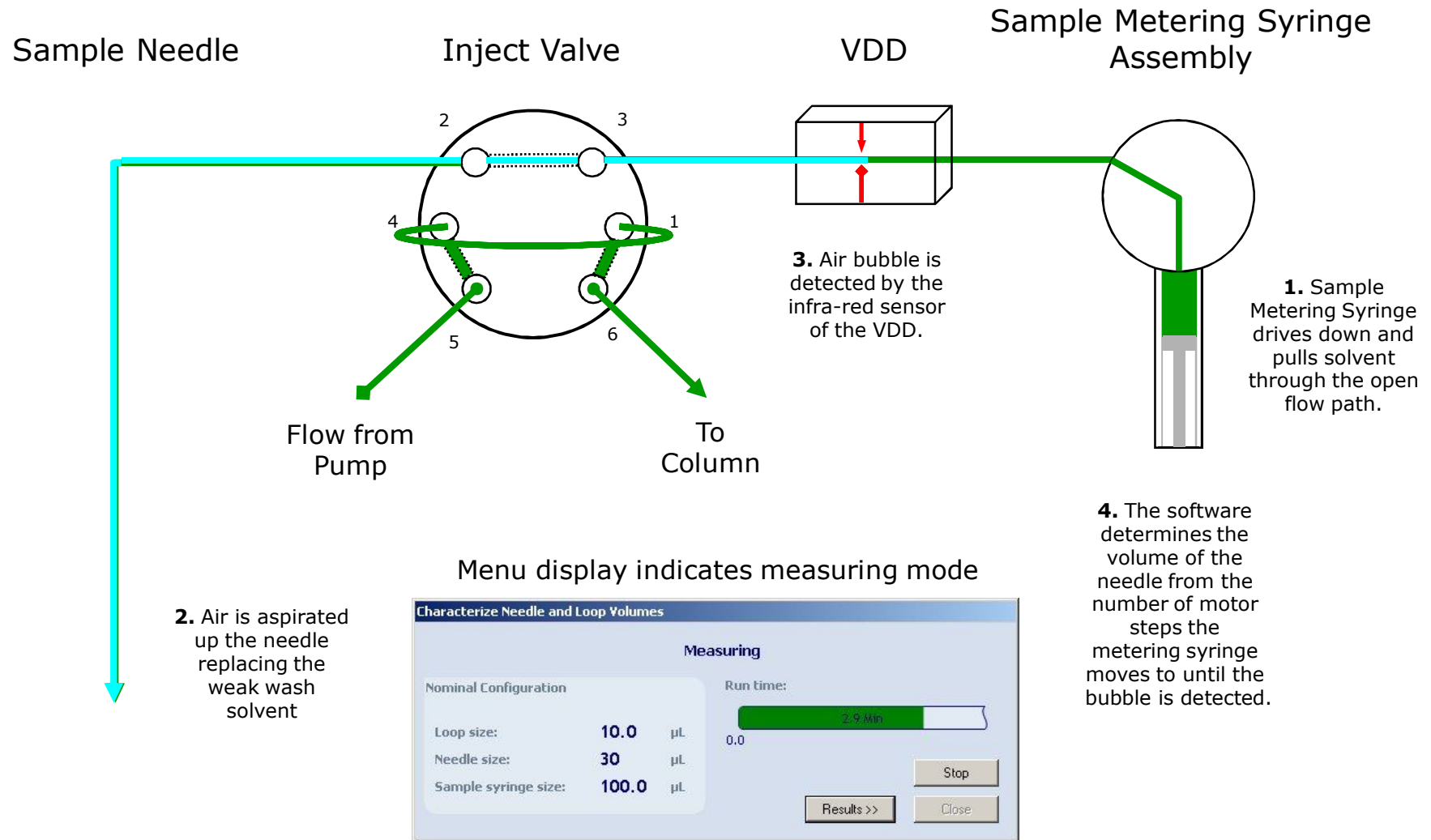
# Wash Block- Pressure Assist Function

## Wash / Inject Block Internal Detail

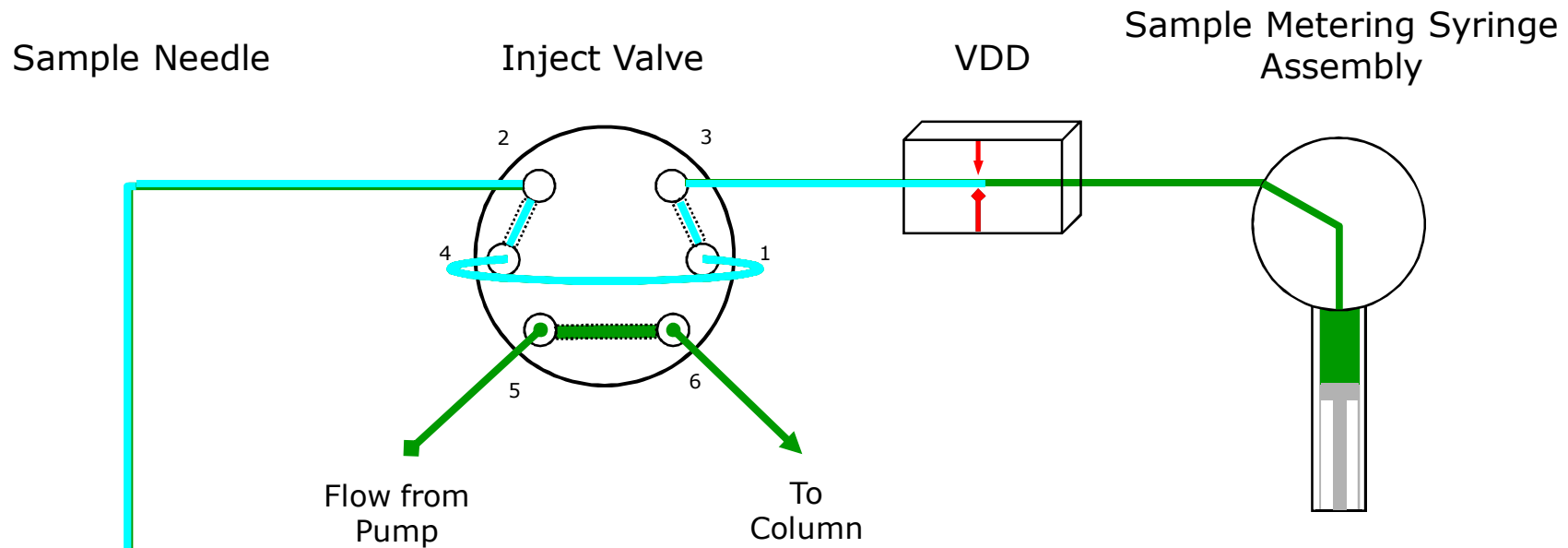


WASH / INJECT BLOCK  
CROSS SECTION

# Characterize Needle Volume Function



# Characterize Needle and Loop Volume Function



**The same steps are repeated, this time the flow is routed through the injector loop.**

**The results are calculated and displayed in the results menu**

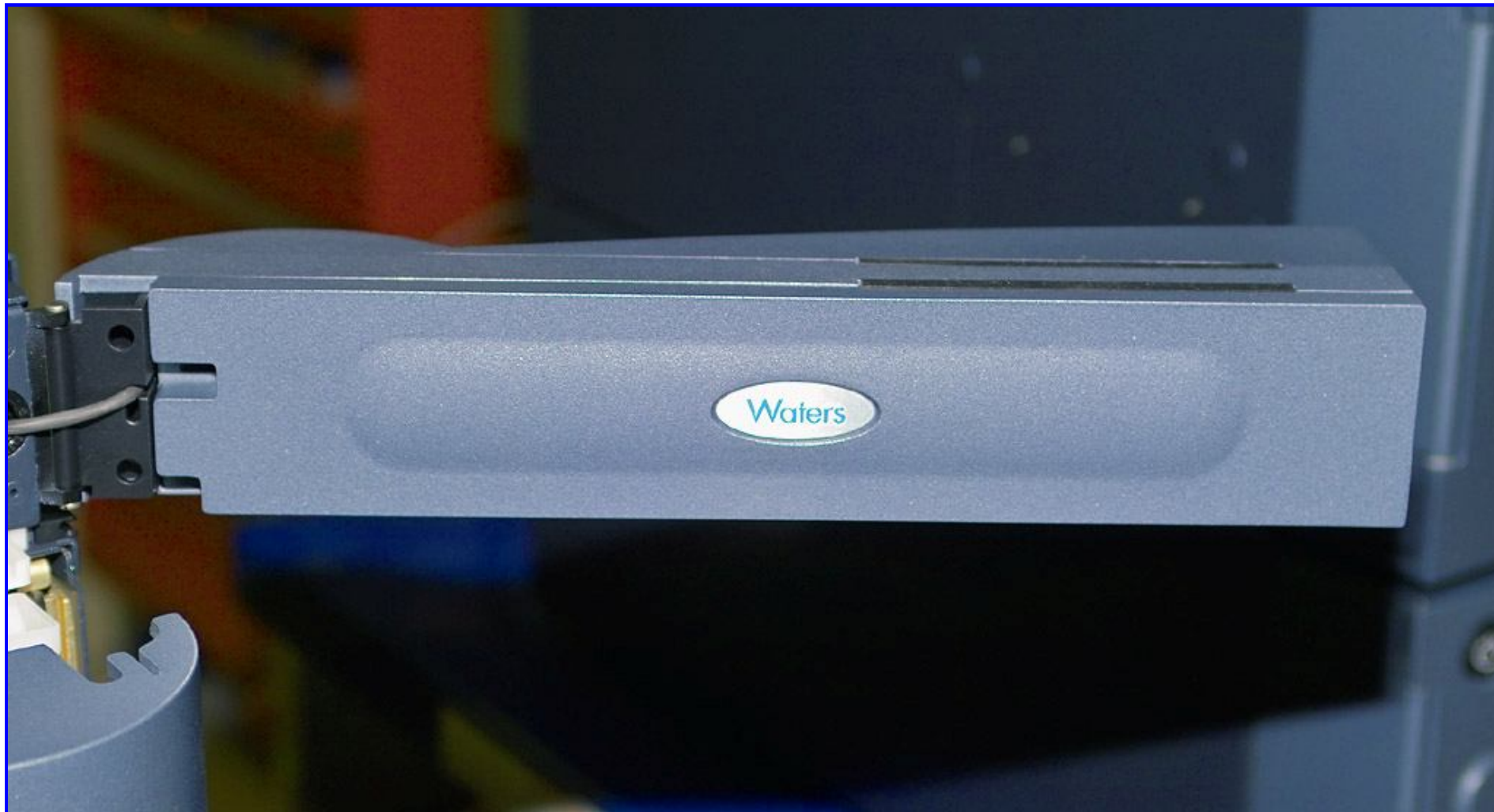
# Column Heating Compartment



# Column Heater

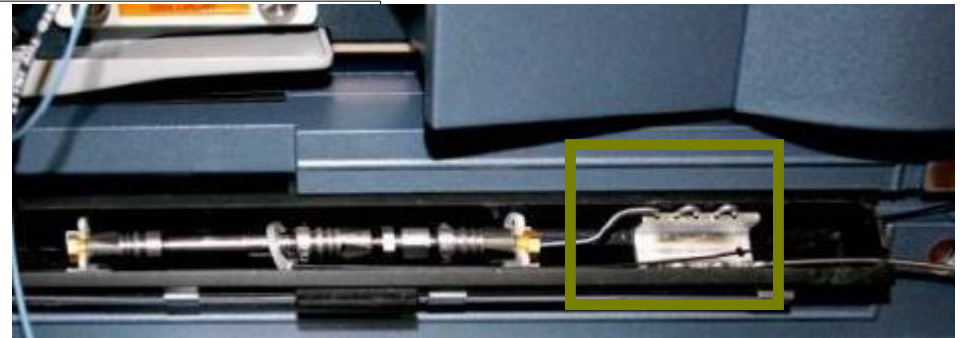
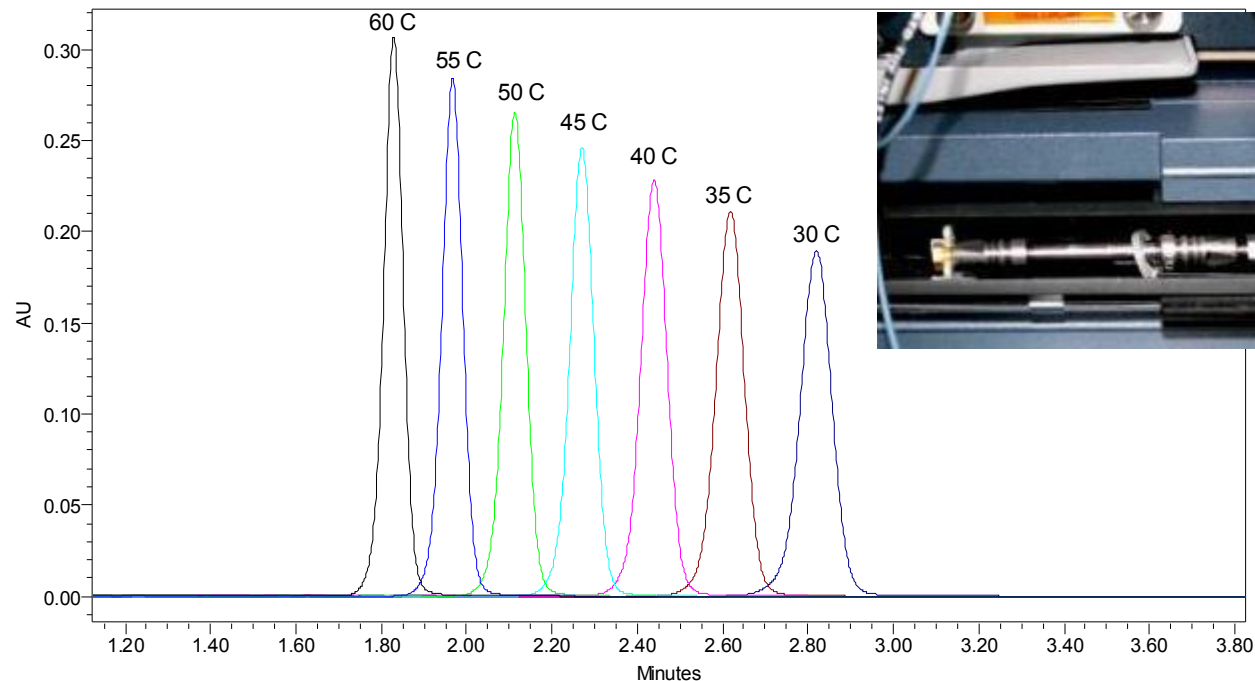
- The Column Heater (C/H) sits on top of the S/M – doubling as the top cover of the Sample Manager
- When a Mass Spec is to be employed the C/H pivots out 180 degrees to the 'away' position.
  - This feature allows the inter-connective tubing, between the S/M and C/H and the C/H to Detector (or Mass Spec), to be minimized the volume

## Column compartment at 180 °

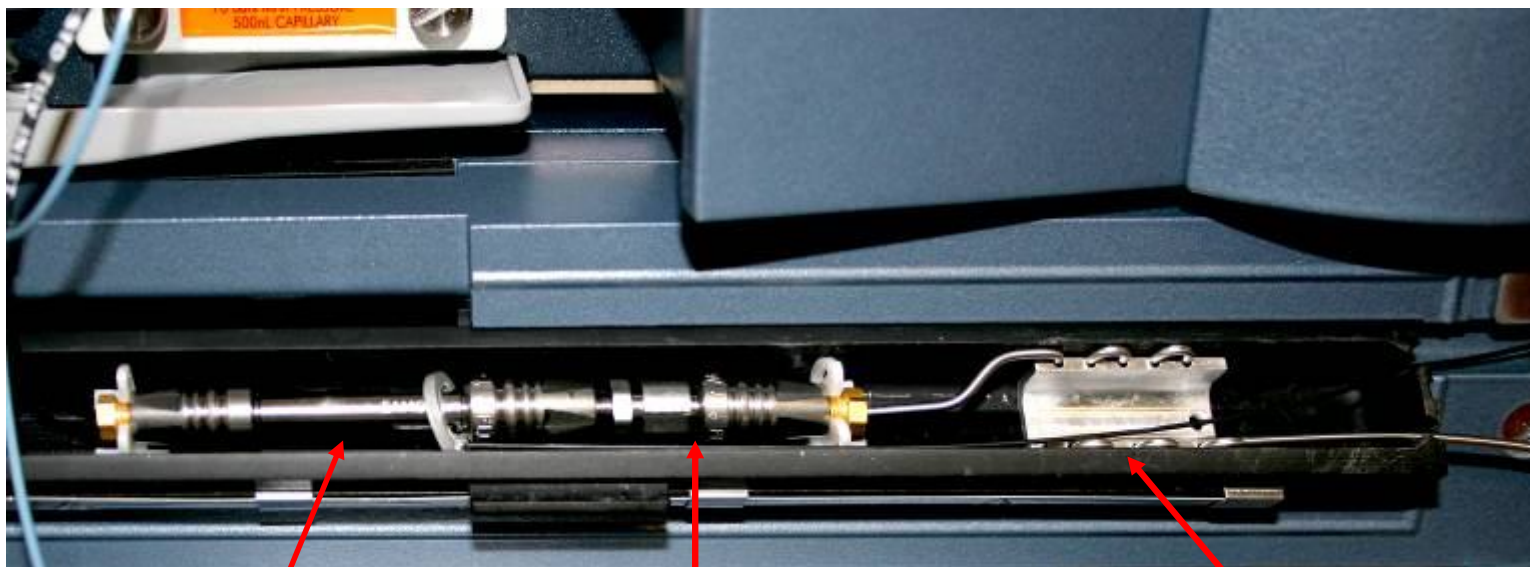


# Column Heating

- Column heating requires the Column Stabilizer Tube Assembly
  - Consistent temperature for RT stability – low residency time
  - Solvent viscosity is lower at higher temperatures
  - Lower backpressures at higher temperatures
  - Solvent residency time is short in small columns at high flow rate



## Column In-Line Filter Installed

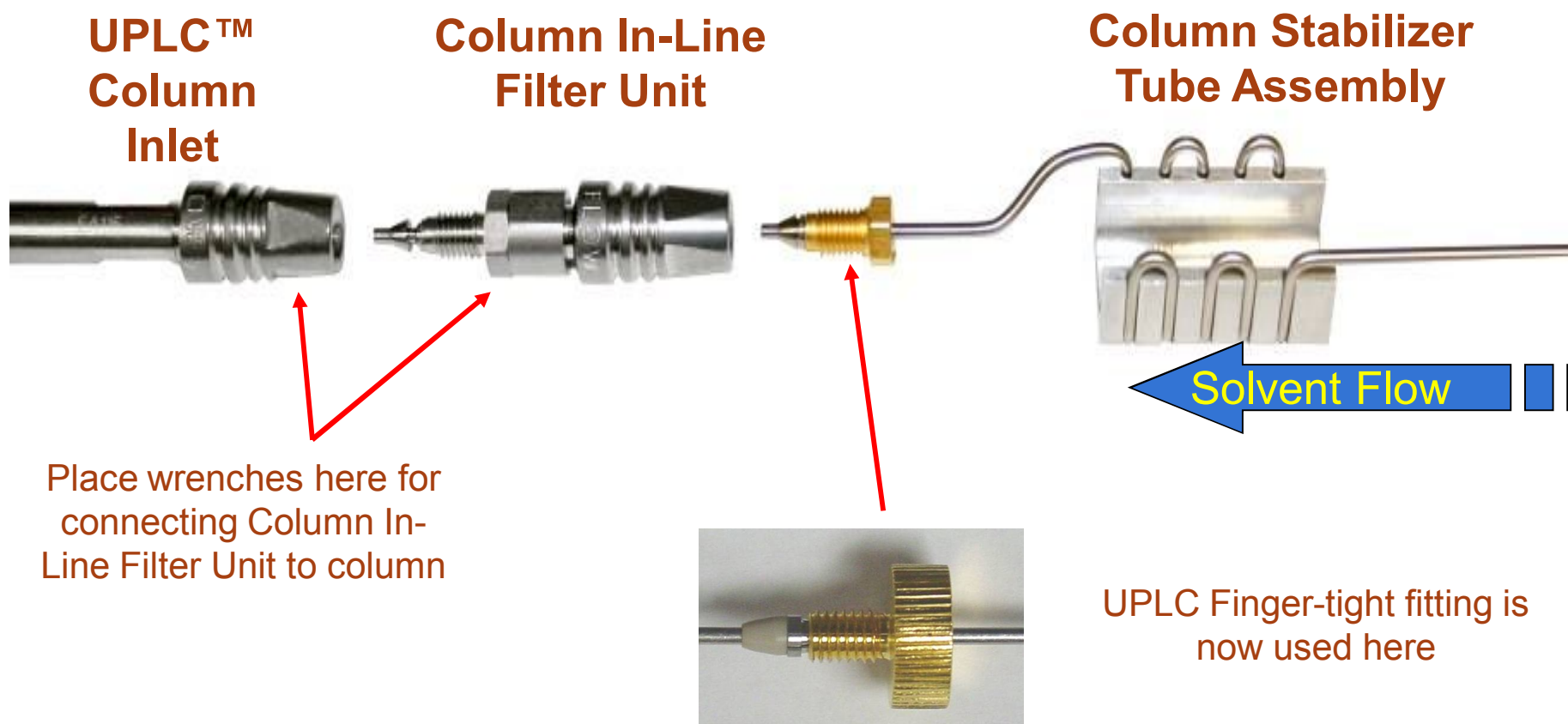


50 mm Length  
ACQUITY UPLC™  
Column

Column In-Line  
Filter

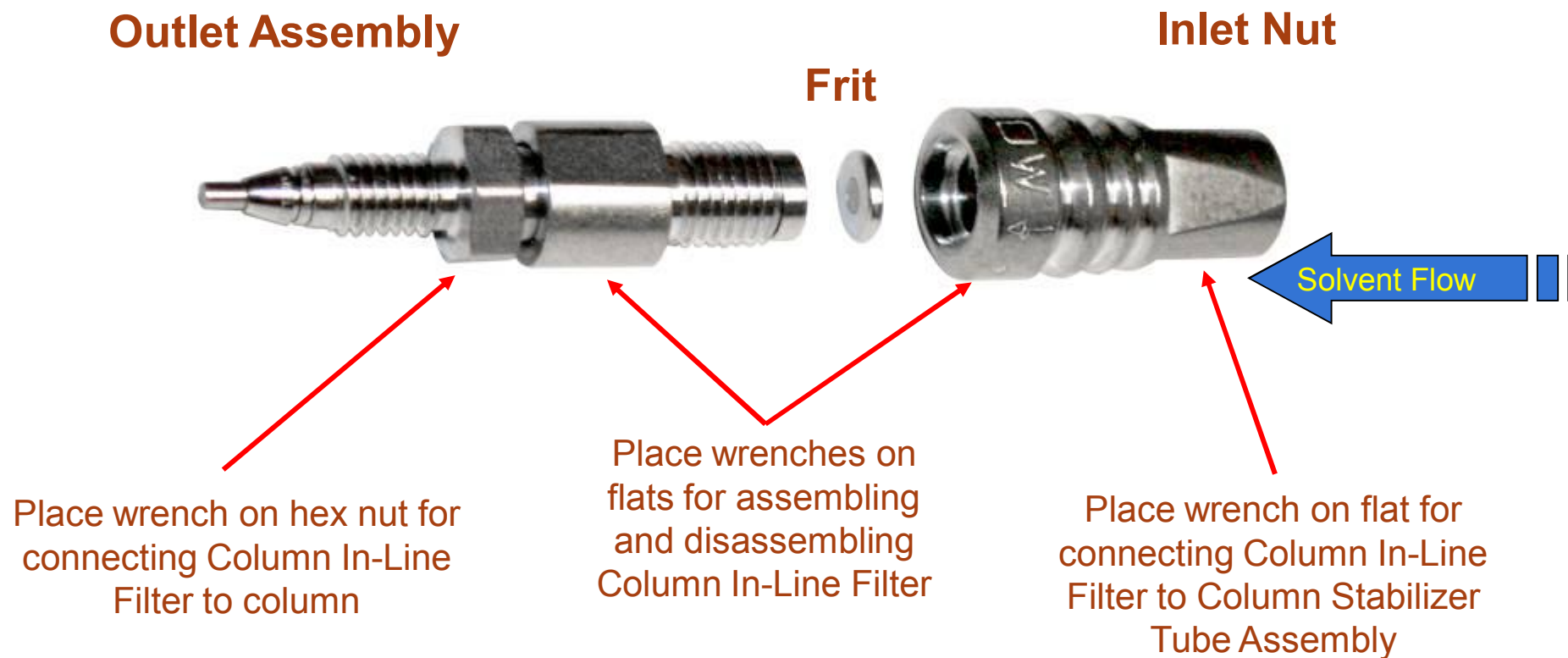
Column Stabilizer  
Tube Assembly

# Column In-Line Filter - 205000343



Service Note Dated 8/5/2005

# Column In-Line Filter Assembly – P/N 205000343



700002775 –Replacement Frits, 5 Pack

# UPLC™ Fingertight Fitting

Ferrule PEEK  
700003114

Reusable Gold  
Compression Screw  
700003169

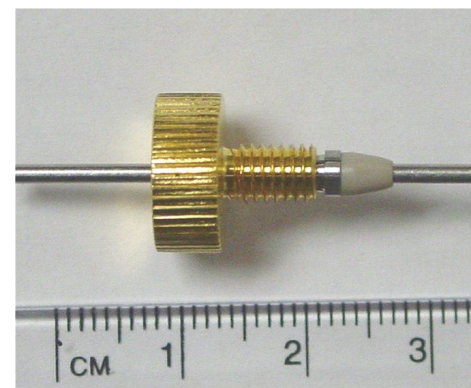


Collet HPFT  
700003168



Spiked end

Collet Removal Tool



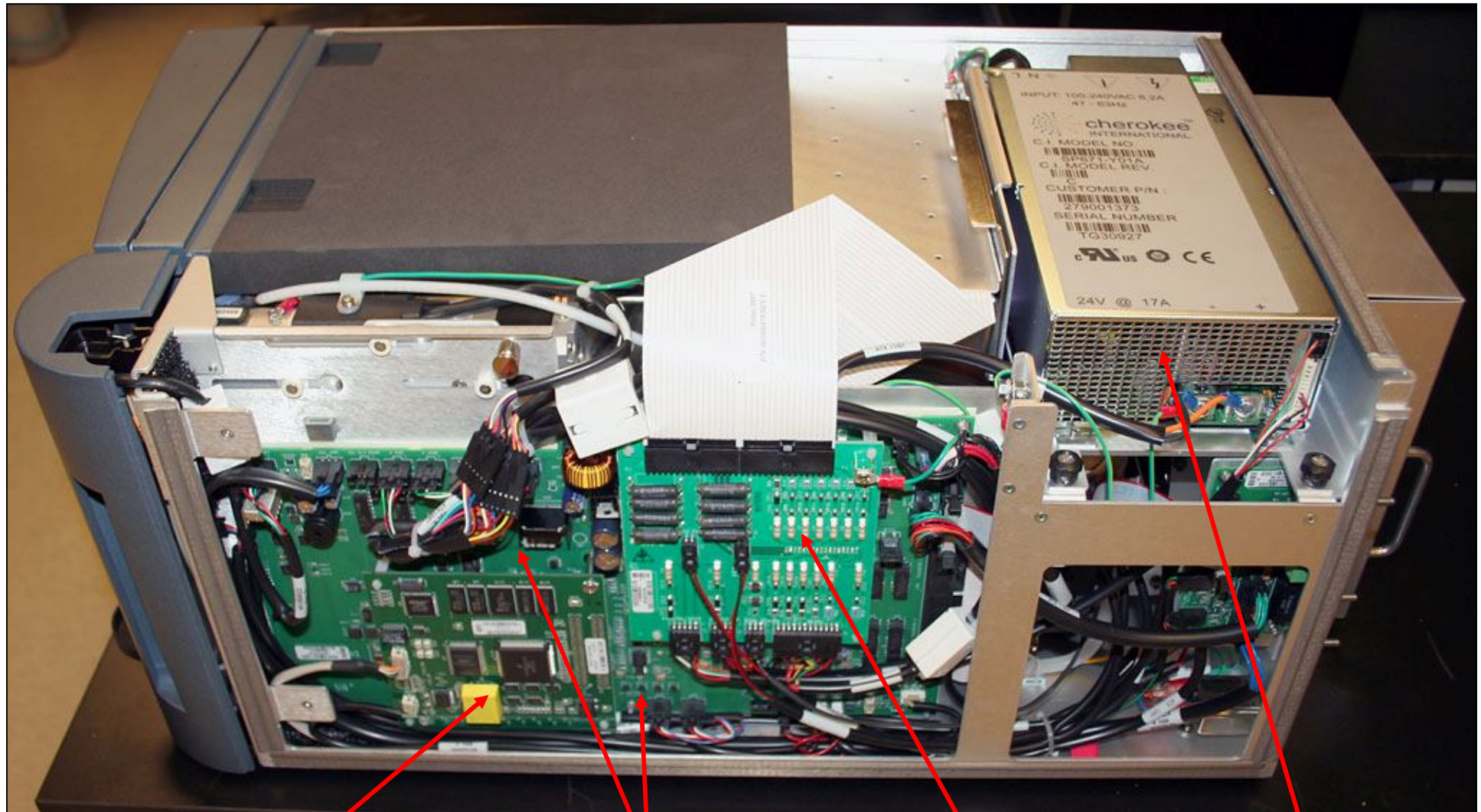
# Lab Exercise Overview

- Exercise 4A – Sample Manager Fluidics- Console Diagnostics and Procedures
  - Sample Manager Console Diagnostics
  - Injection Modes observations
  - PM Procedure practice
    - Replacing the Sample Needle
    - Sample and Wash syringes replacement
    - Injector Valve removal and reassembly
    - Wash block o-ring

# Electronics

ACQUITY UPLC™ Sample Manager

# SM Side View



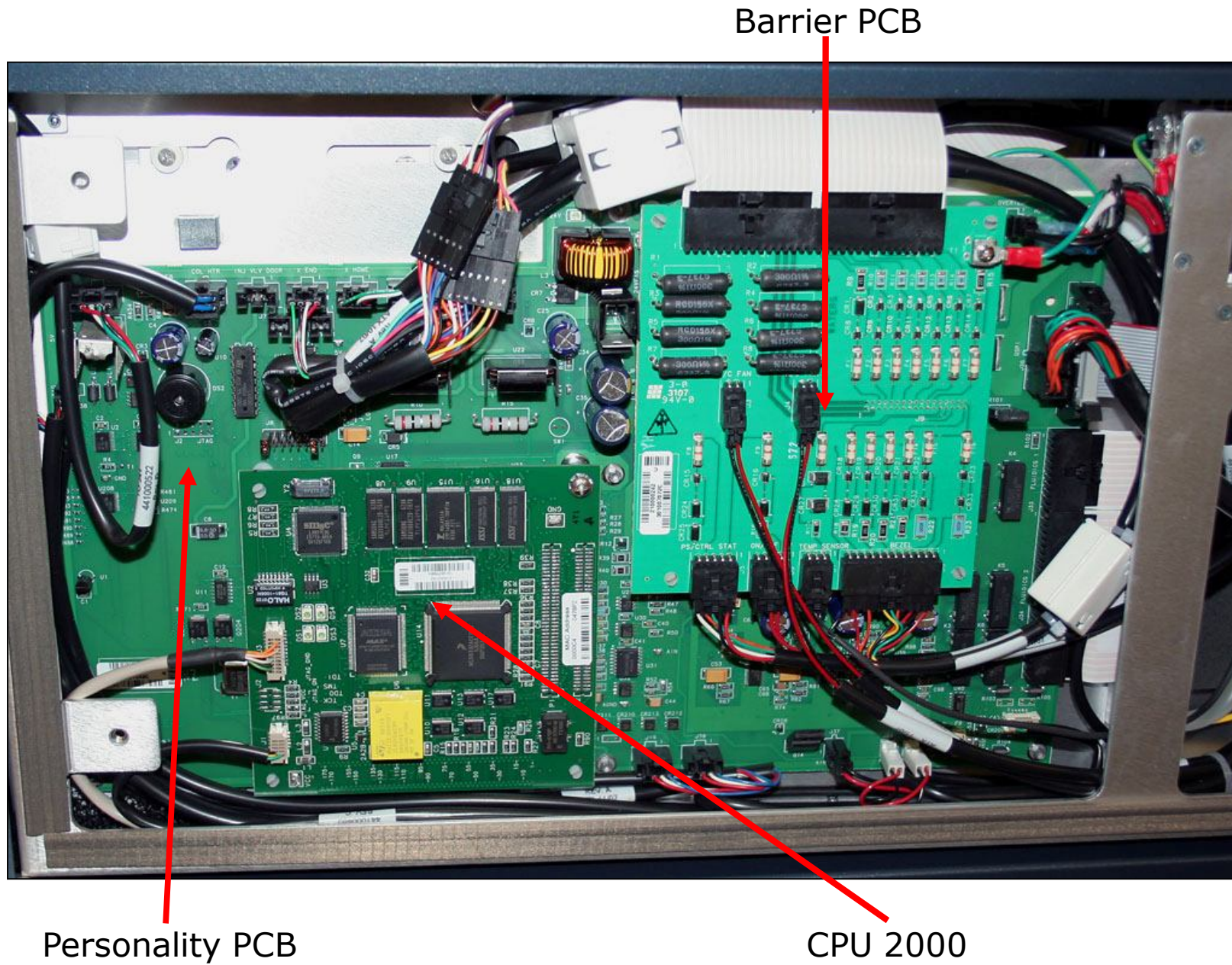
CPU 2000 PCB

Personality PCB

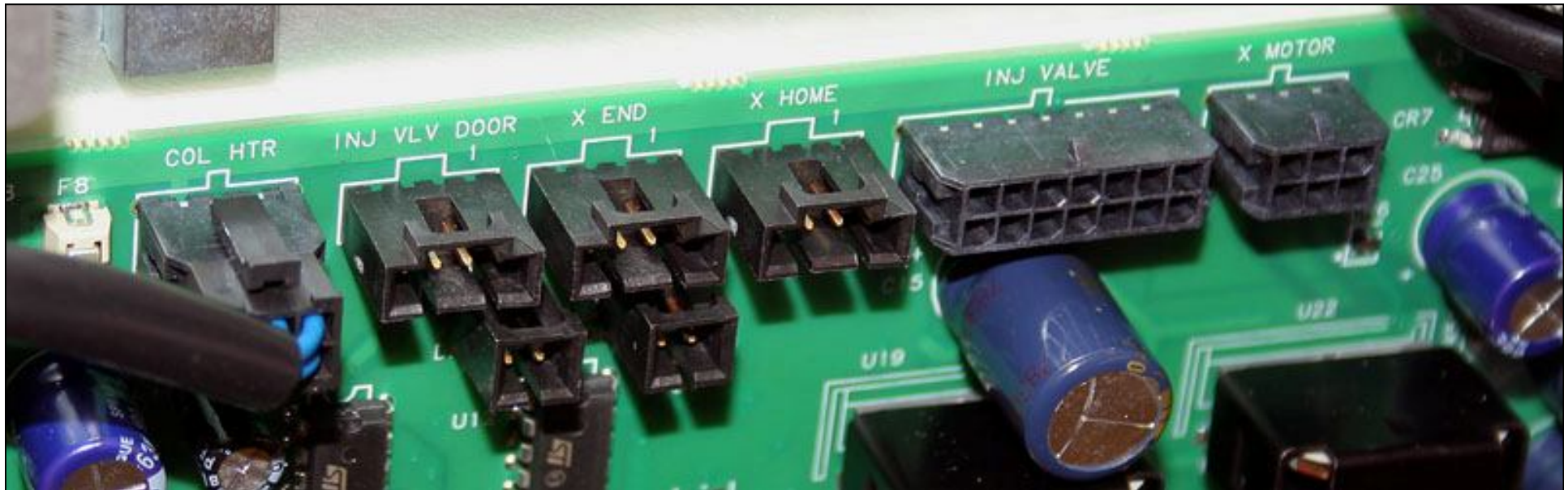
Barrier PCB

Power Supply

# Right Side Panel



# Personality PCB Connections



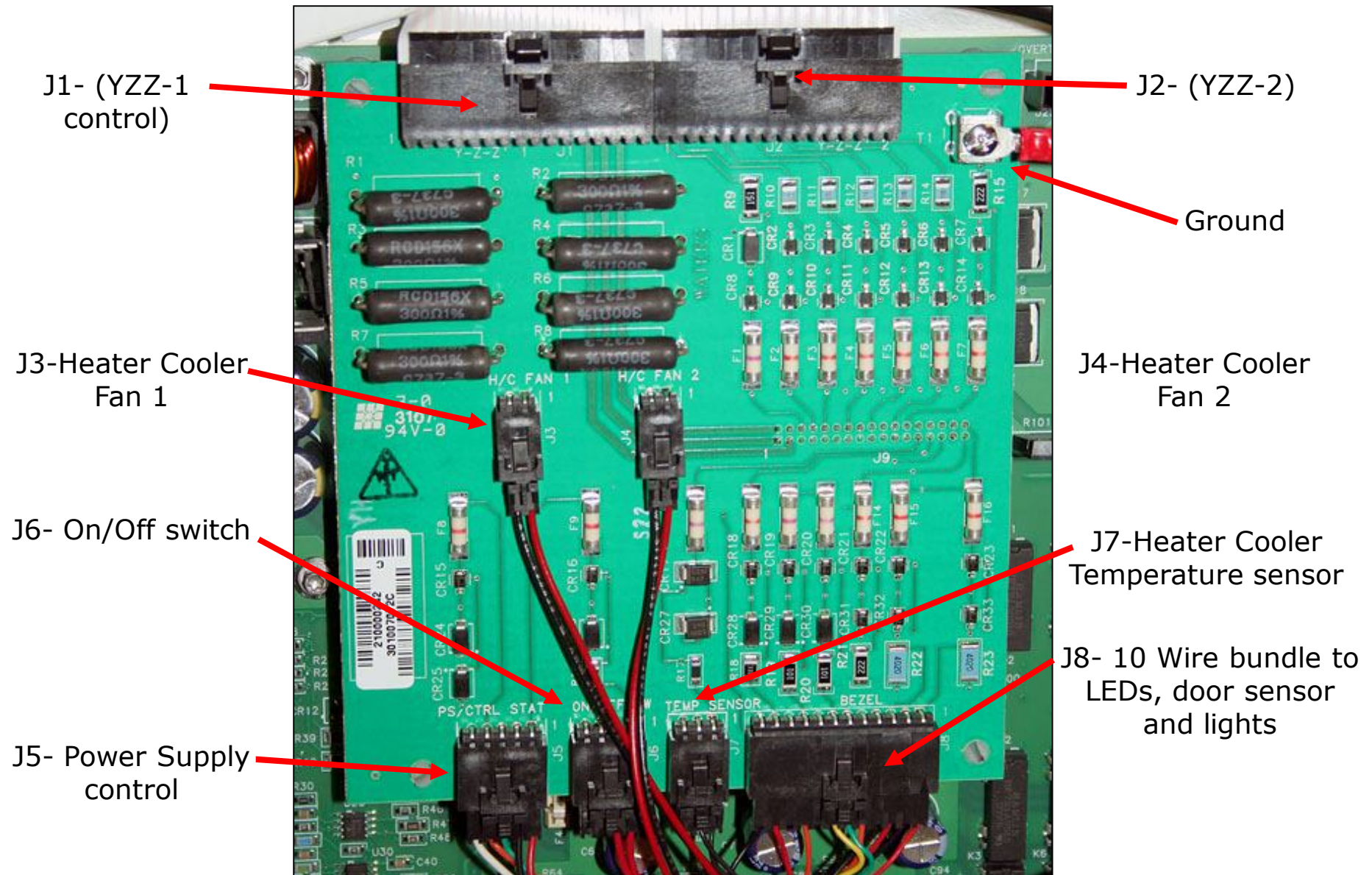
# **Personality PCB Connections (Detailed in Service Procedure)**

- **Ref Name Functional Description Location**
- J3 COLUMN HEATER Column Heater control & Temperature Sensor J10 X END X End sensor
- J12 INJ VALVE Injection Valve motor and home sensors
- J14 CPU20002000 CPU20002000 PCB interface
- J15 X HOME X Home sensor
- J17 X MOTOR X Motor drive
- J18 BARRIER Barrier PCB interface
- J19 LEAK DET 2 Dual thermistors of lower Leak Detector assembly
- J21 FAN 1 Electronics Cooling Fan 1
- J22 FAN 2 Electronics Cooling Fan 2
- J25 OVERTEMP Over-temperature sensor of Heater/Cooler A
- J26 POWER IN 24VDC Power Input

# Personality PCB Connections

- J28 H/C+ Heater/Cooler positive connection
- J29 H/C- Heater Cooler negative connection
- J32 RS-232 (A) 3-wire RS-232 Serial Communications Port
- J33 FLUIDICS 1 10-wire Flex cable to Fluidics Interface PCB  
(Fluidics solenoids, Pressure Transducer)
- J34 FLUIDICS 2 24-wire Flex cable to Fluidics Interface PCB  
(Fluidics motors and sensors)
- J35 EVENT I/O 2 Event Inputs, 6 Event Outputs, 1 Chart Output
- J36 QSPI QSPI interface
- J37 AIR PUMP Needle vacuum cleaner air pump
- J38 TAG Column Tag interface
- J39 LEAK DET 1 Dual thermistors of upper Leak Detector assembly
- J41 BUBBLE DET Optical sensor for Bubble Detector

# Barrier PCB Connections



# Barrier PCB Functions

- XYZZ control
- Heater/Cooler FAN control
- Power Supply control
- ON/OFF power switch connection
- TEMP SENSOR for Sample Compartment Thermistor in unit
- Control of LEDs, door sensor and sample chamber lamp

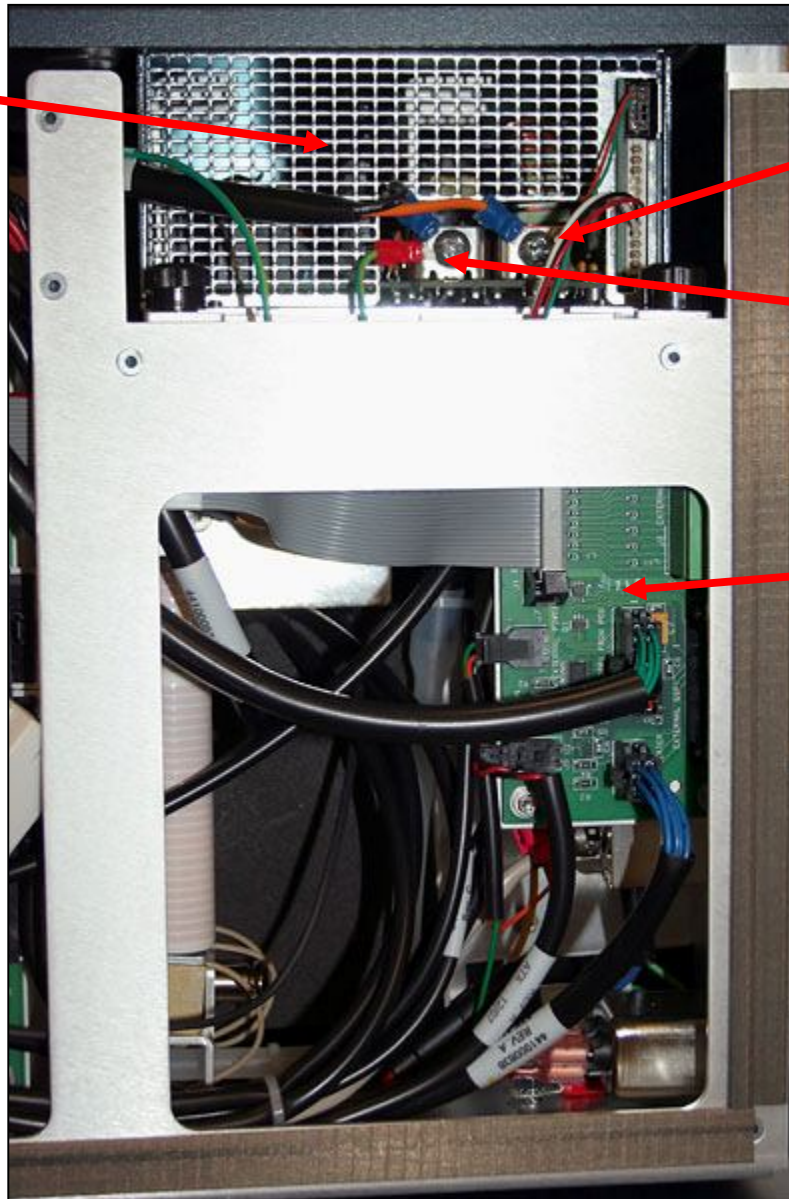
# Right-Rear Side Panel

Power Supply

+24V Supply

Ground

Serial Ports PCB



# Power Supply



Ground

+24V Supply

# SM- Rear Panel



# **XYZz' Assembly**

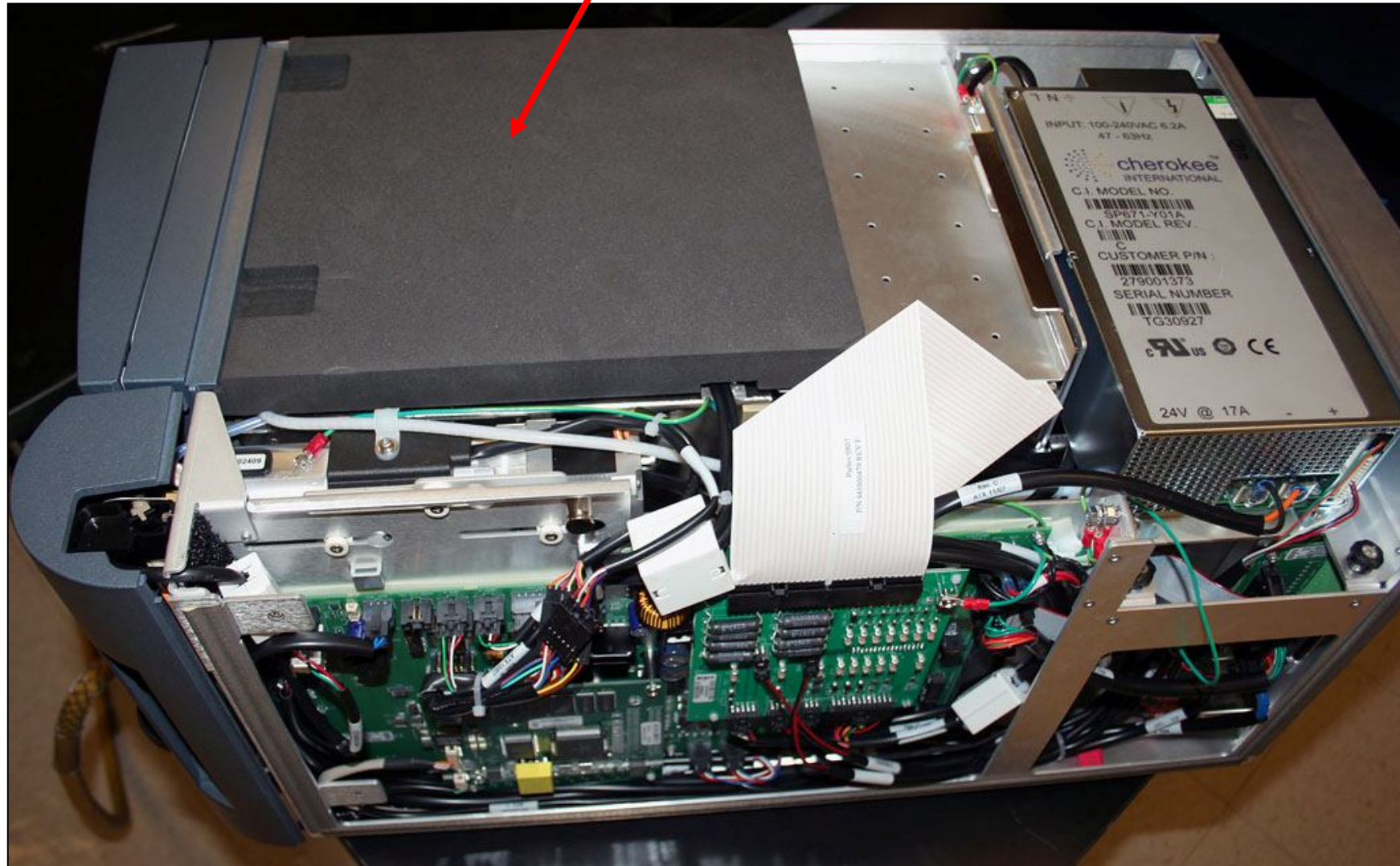
ACQUITY UPLC™ Sample Manager

# XYZz' Mechanism Assembly

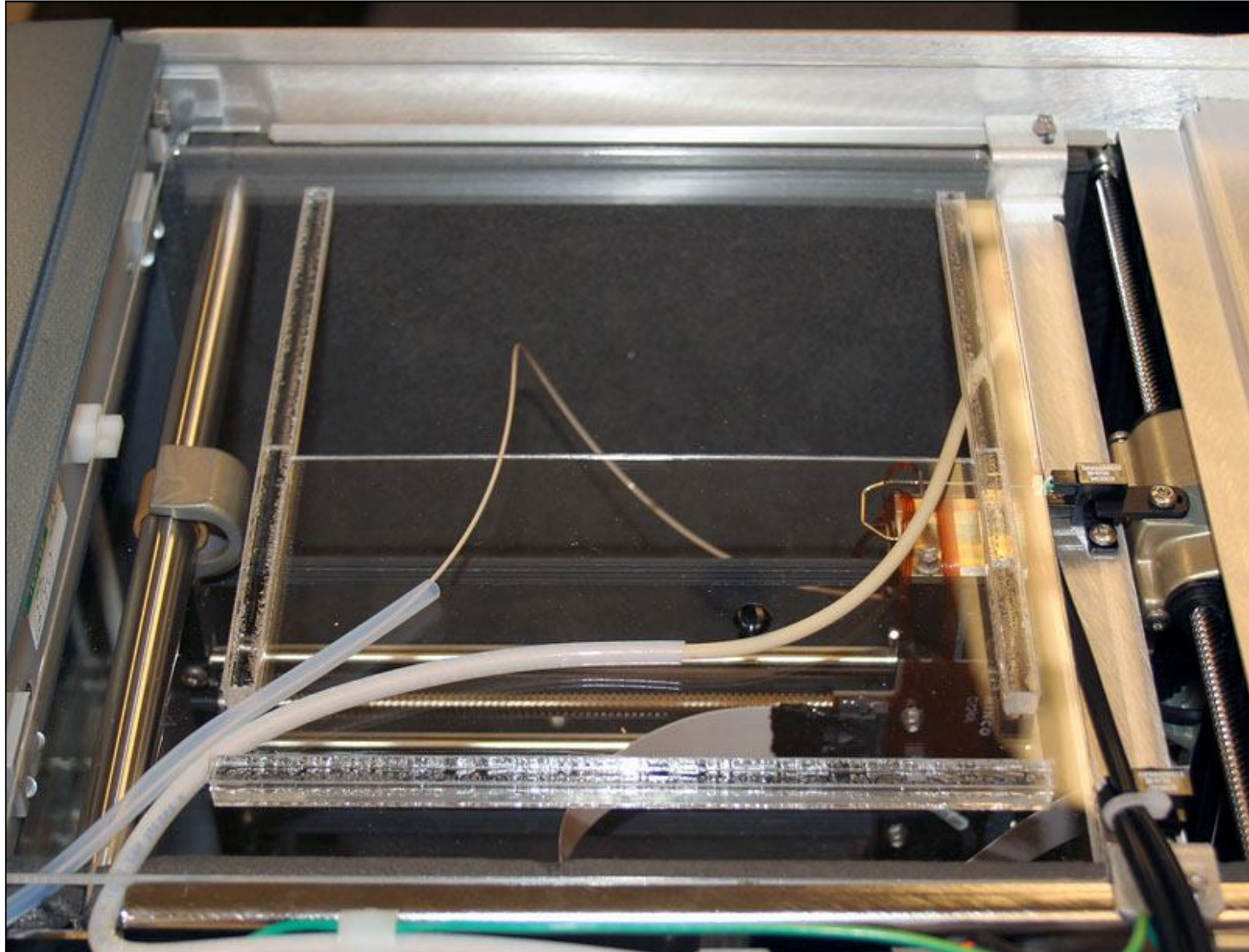
- The XYZ<sub>n</sub>z<sub>p</sub> Mechanism provides for all non-fluidic S/M motion
  - well to well translation to and across sample plates (in the X-Y plane)
  - to Septum puncture (Z<sub>p</sub>-axis)
  - Sample Needle manipulation (Z<sub>n</sub>-axis)
- Four separate stepper motors are used to drive the needle with exacting precision to the desired location

# SM Top Side View

Insulation for Sample Compartment



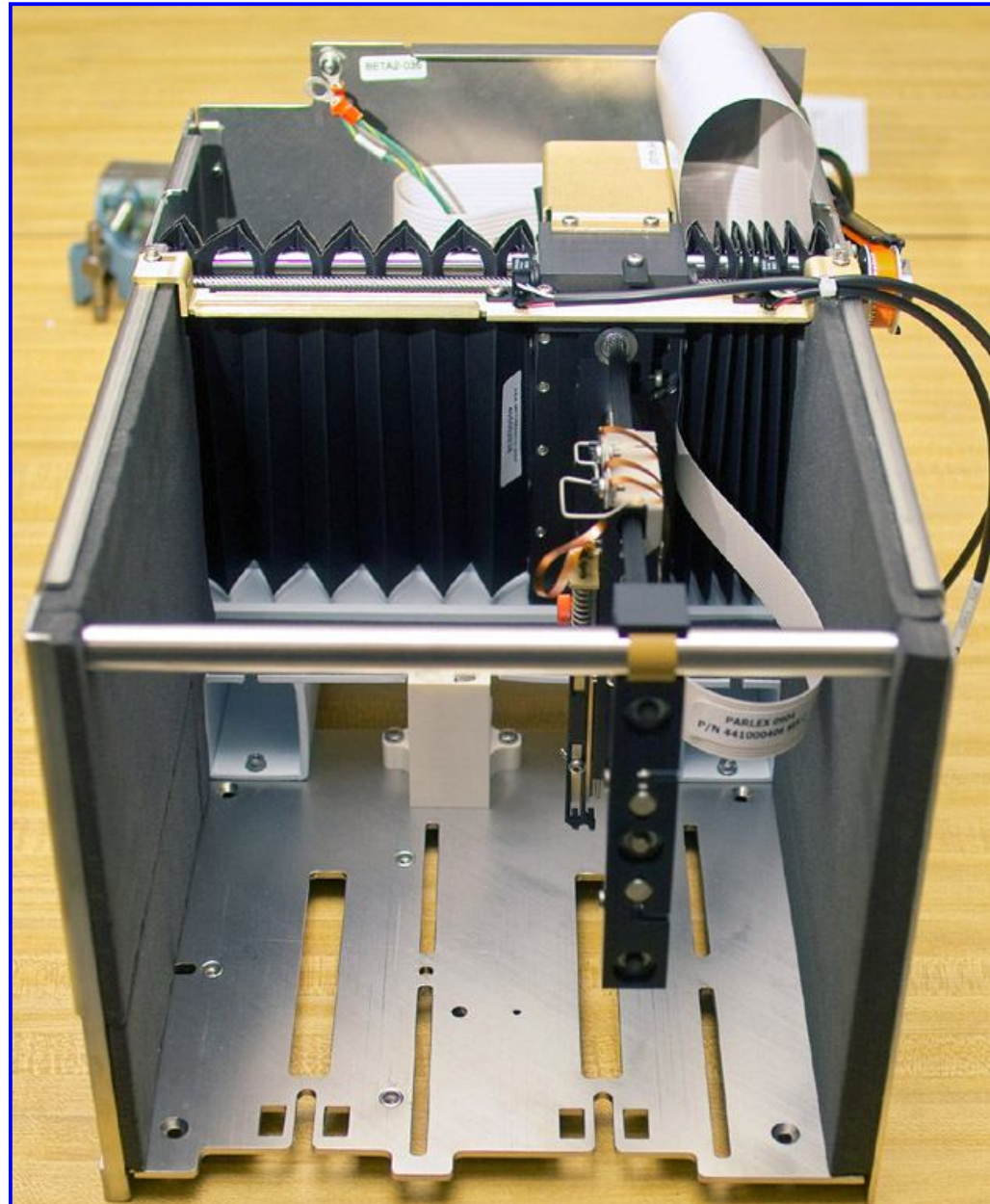
# Sample Compartment



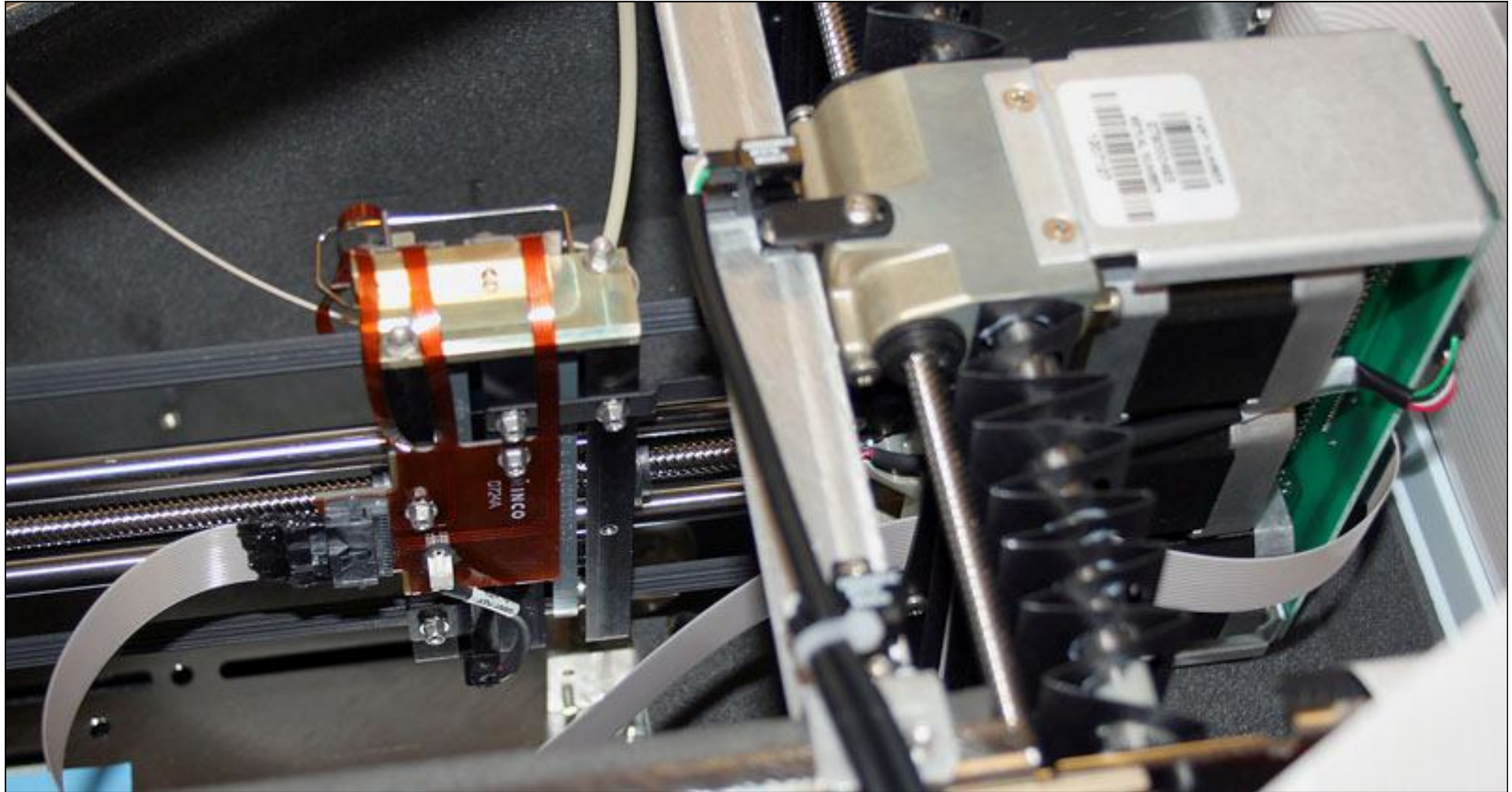
# XYZZ Assembly



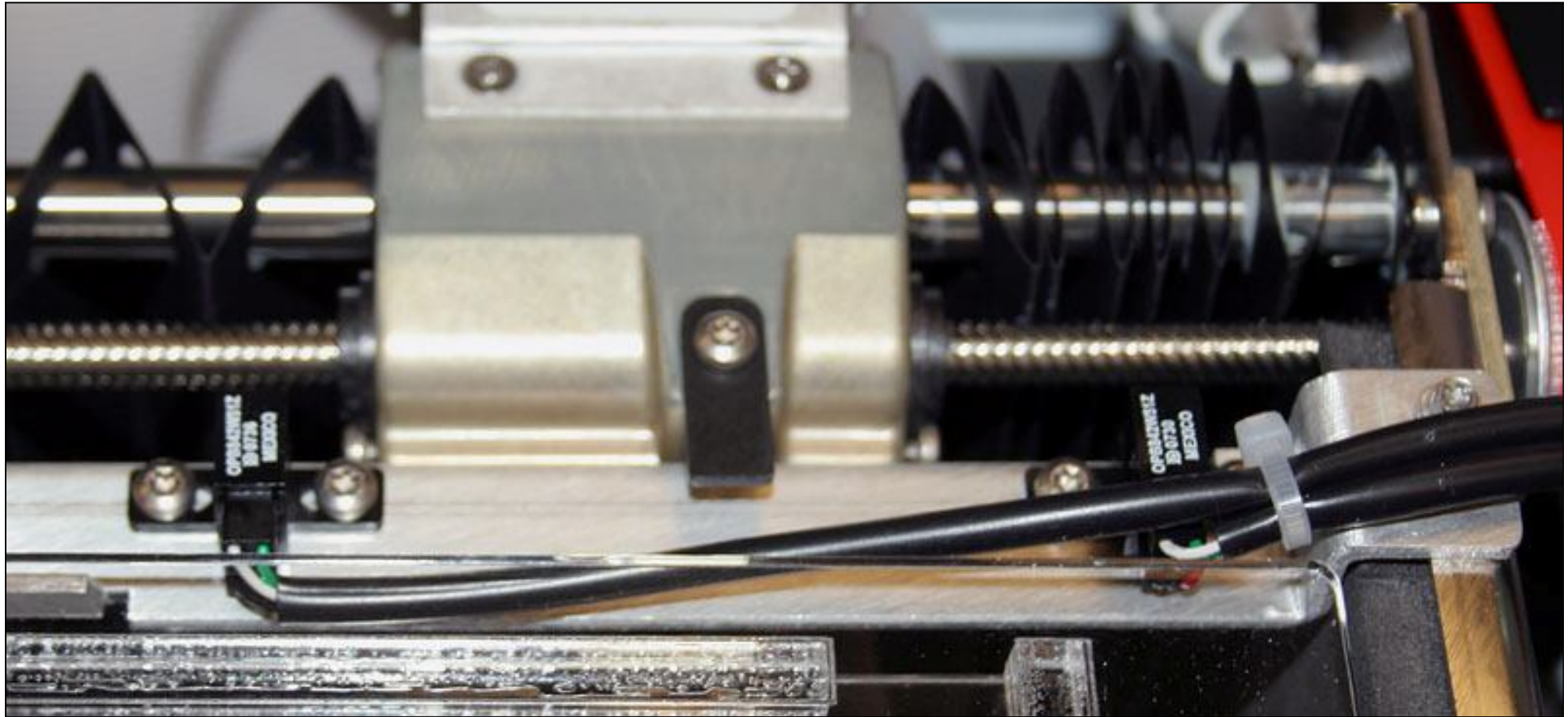
# XYZz' Assembly



## XYZZ Assembly- Y-Carriage Cable



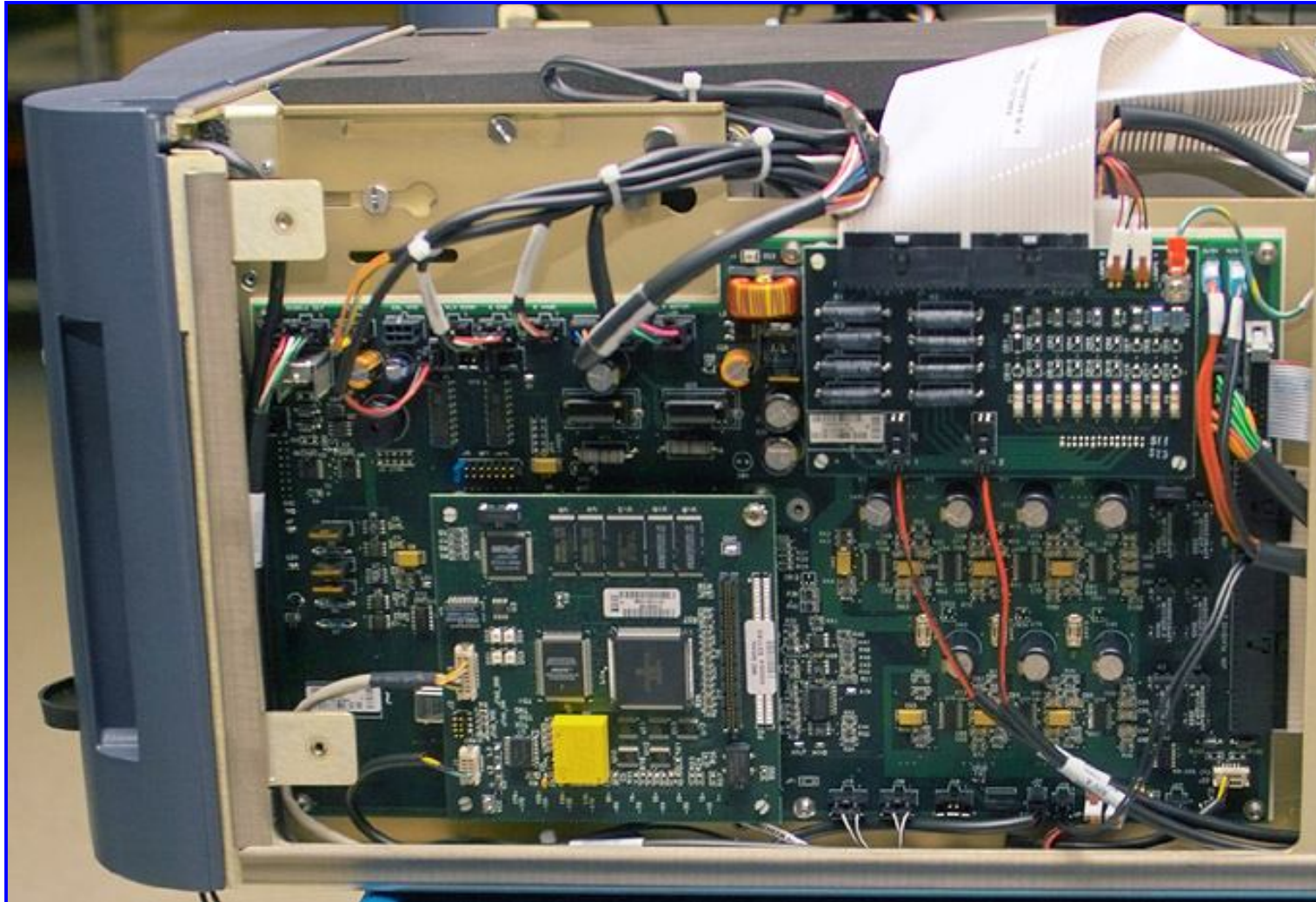
# XYZZ Home Sensors and Flag



# XYZ<sub>p</sub>Z<sub>n</sub> Position Calibration

- The “XYZ<sub>p</sub>&Z<sub>n</sub> Calibration” calibrates the instrument for mechanical tolerances
  - Z<sub>p</sub> = Punch Pin
  - Z<sub>n</sub> = Sample Needle
- This test needs to be performed every time the following repairs are performed on the XYZ<sub>p</sub>Z<sub>n</sub> mechanism:
  - Replace or adjust any axis flag.
  - Replace or adjust a home or reference sensor
  - NVRam Battery failure.
  - Z<sub>n</sub> when Replacement Needle
  - Z<sub>p</sub> when Punch Pin Replace

# Printed Circuit Boards



# Heater/Cooler System

ACQUITY UPLC™ Sample Manager

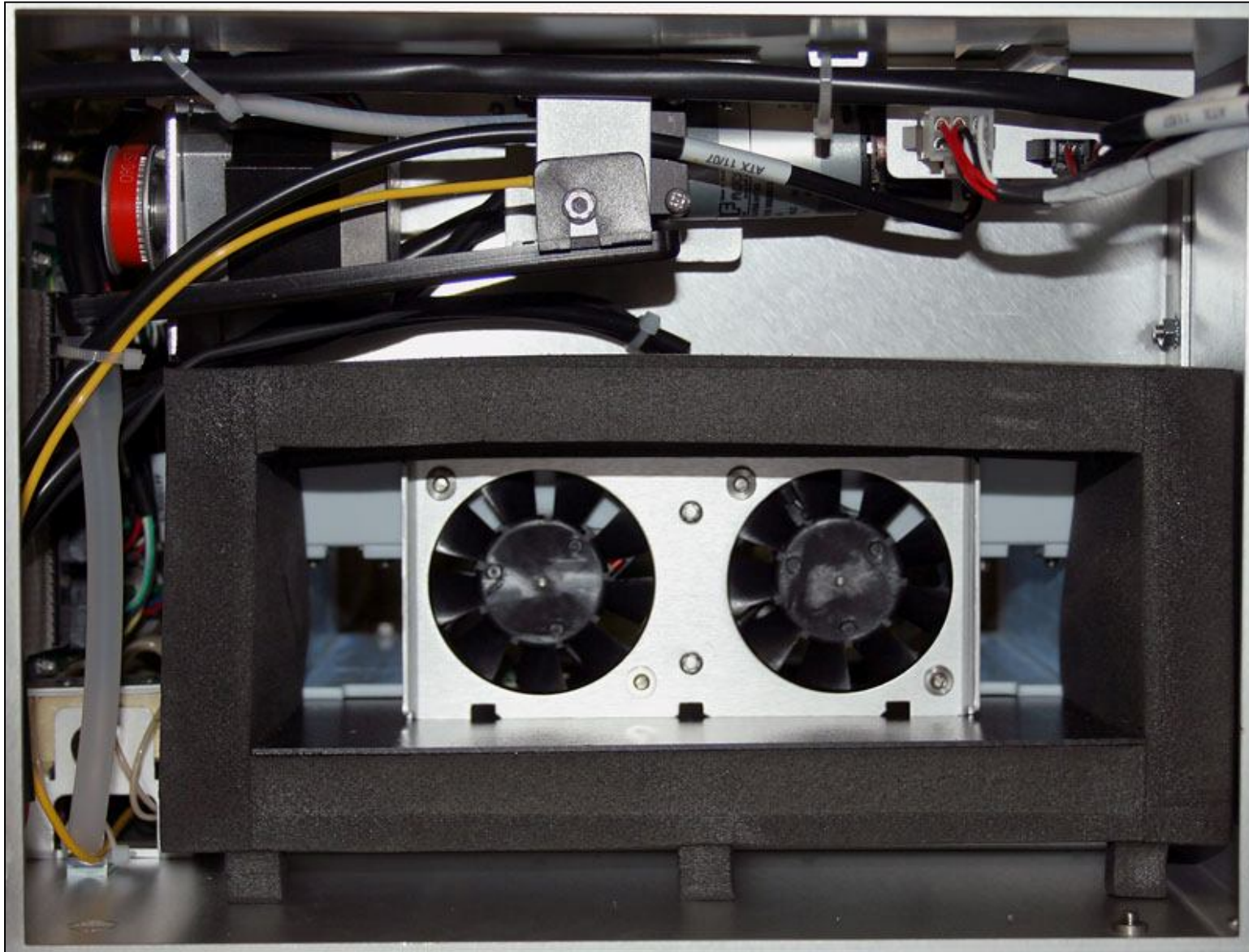
# Sample Conditioning

- Sample conditioning is achieved by means of a Heater/Cooler (H/C)
- This employs solid-state P & N type semiconductor based thermo-electric cooling chips to actively cool (or heat) a set of internal fins
- Leaks and condensate is captured and managed by a set of drip trays
- They are arranged so that any accumulated liquid cascades down through the S/M in an organized manner

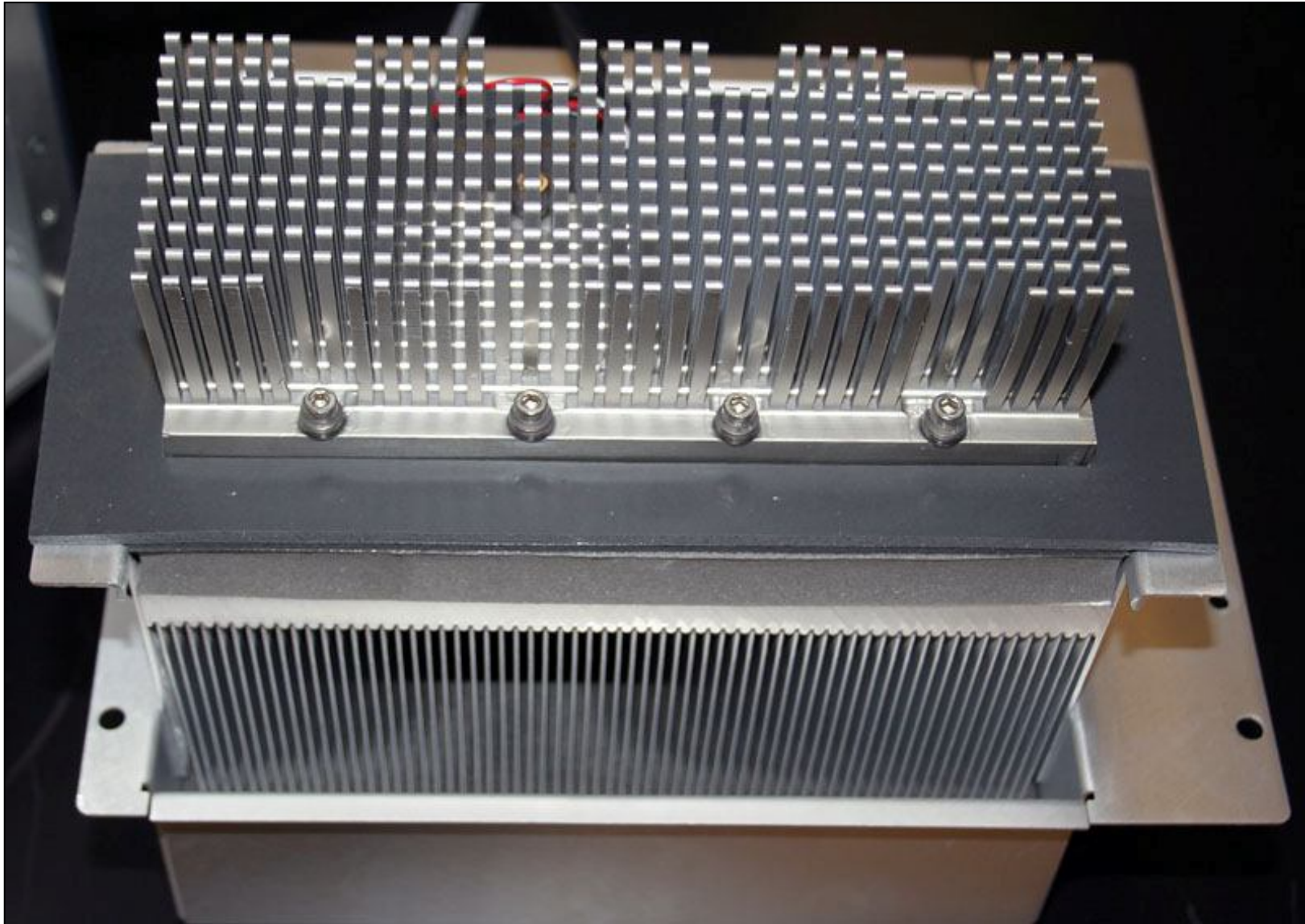
# Heater Cooler Assembly



# Heater Cooler Assembly- Insulation and Circulating Fans

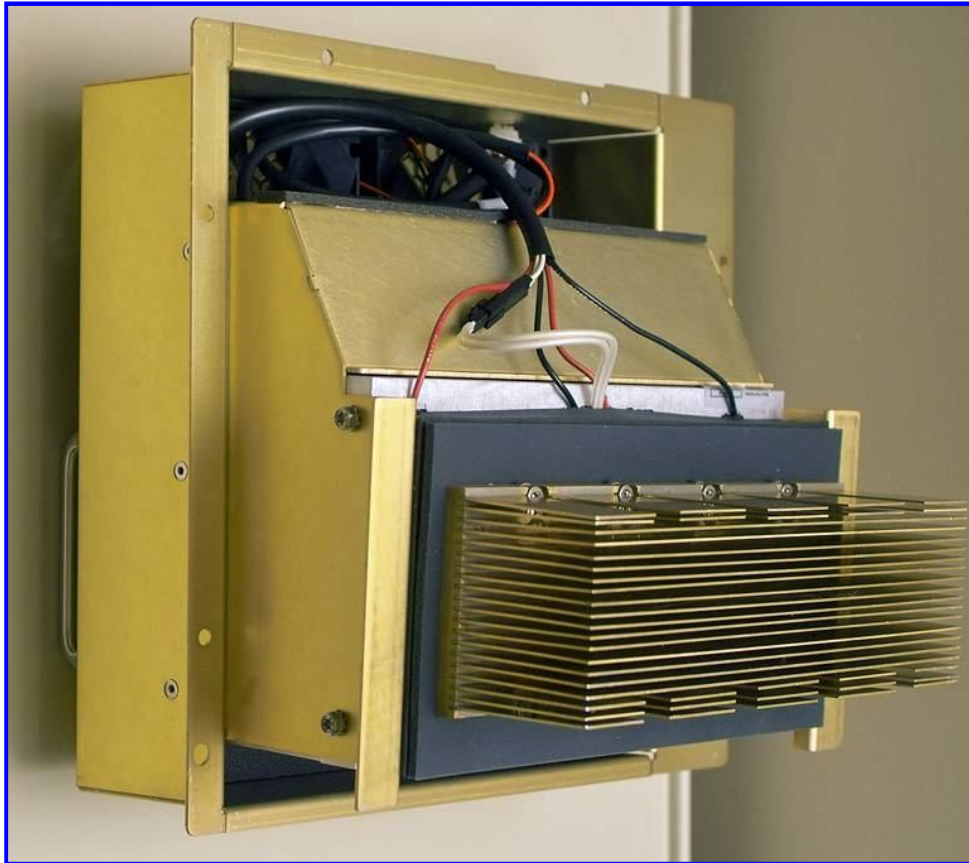


# Heater Cooler Assembly

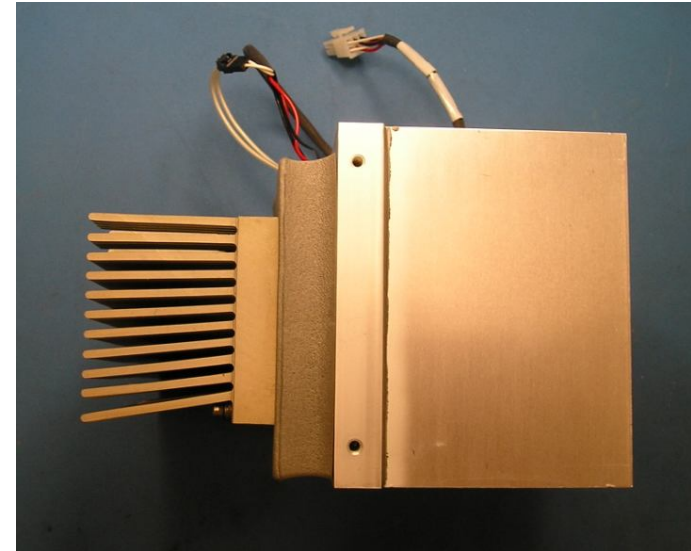


# Heater Cooler Engine

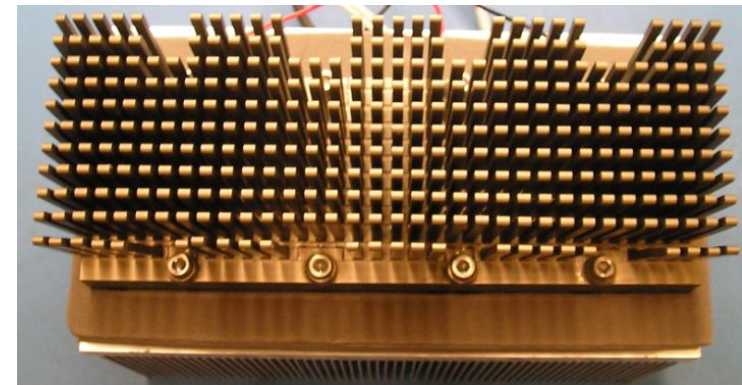
Old Style



Old Style



New Style



# Lab Exercise Overview

- Exercise 4B – Sample Manager Electronics and XYZZ
  - Calibrating the XYZZ Mechanism
  - Replacing the Sample Needle
  - Heater-cooler removal
  - Electronics