beyond the technology

CSols

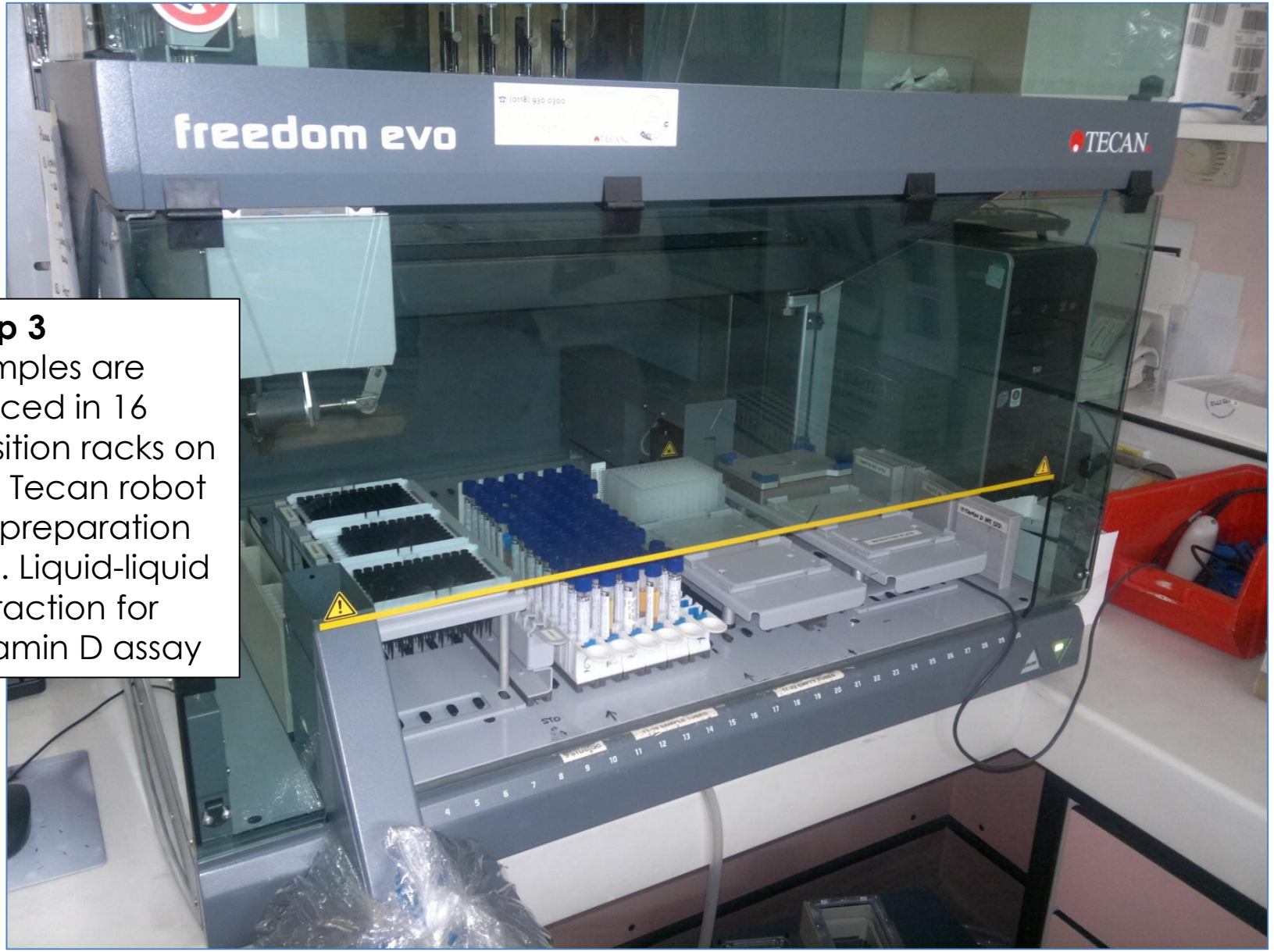
laboratory systems integration

# Heartlands Instrument Integration

## Vitamin D Workflow

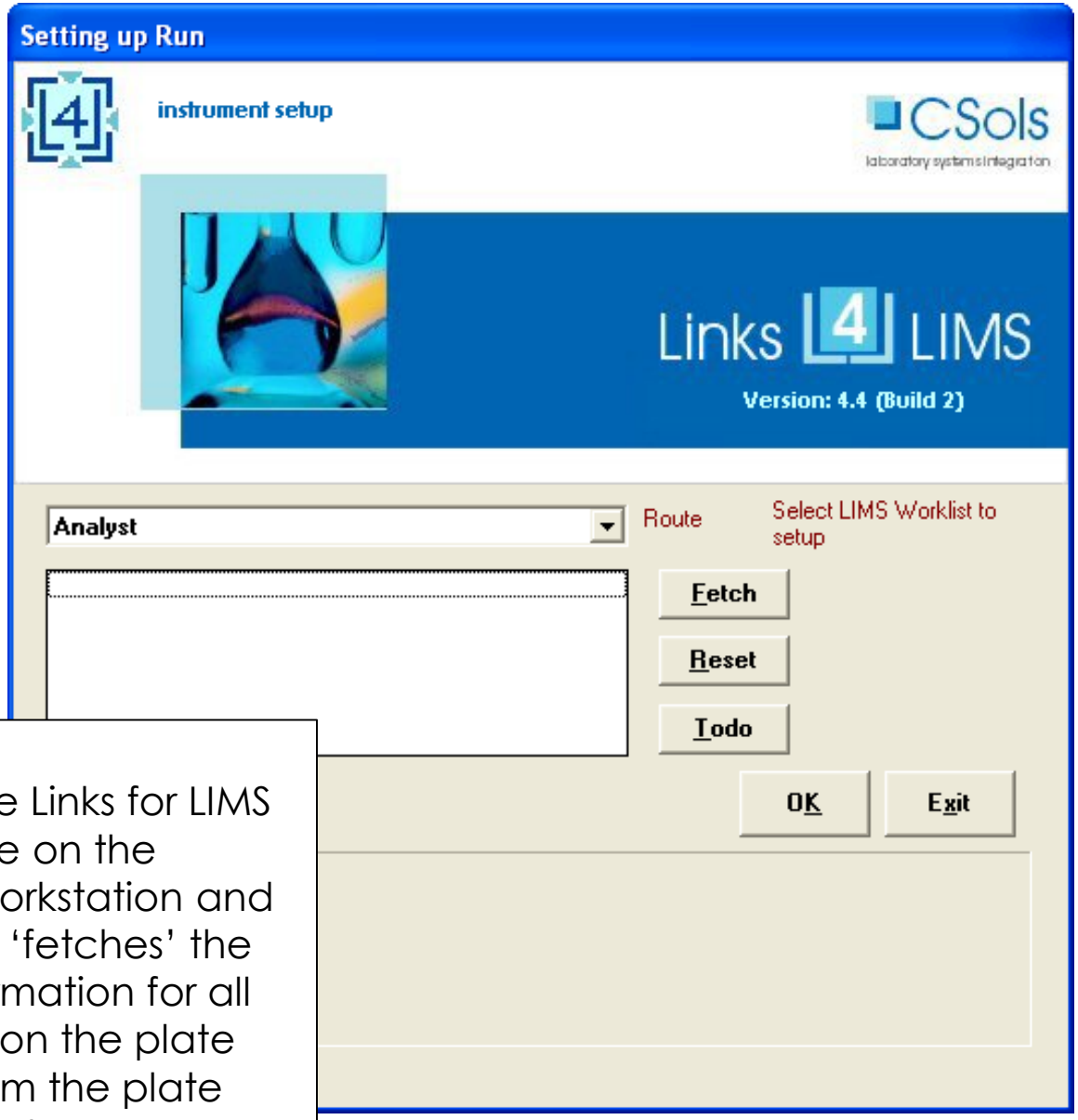
**Step 1**
Samples received in the pathology reception are checked, given unique barcode labels & then the new ids and patient details are registered in Telepath


**Step 2**
Most samples arrive in biochemistry after being processed in the clinical chemistry unit.



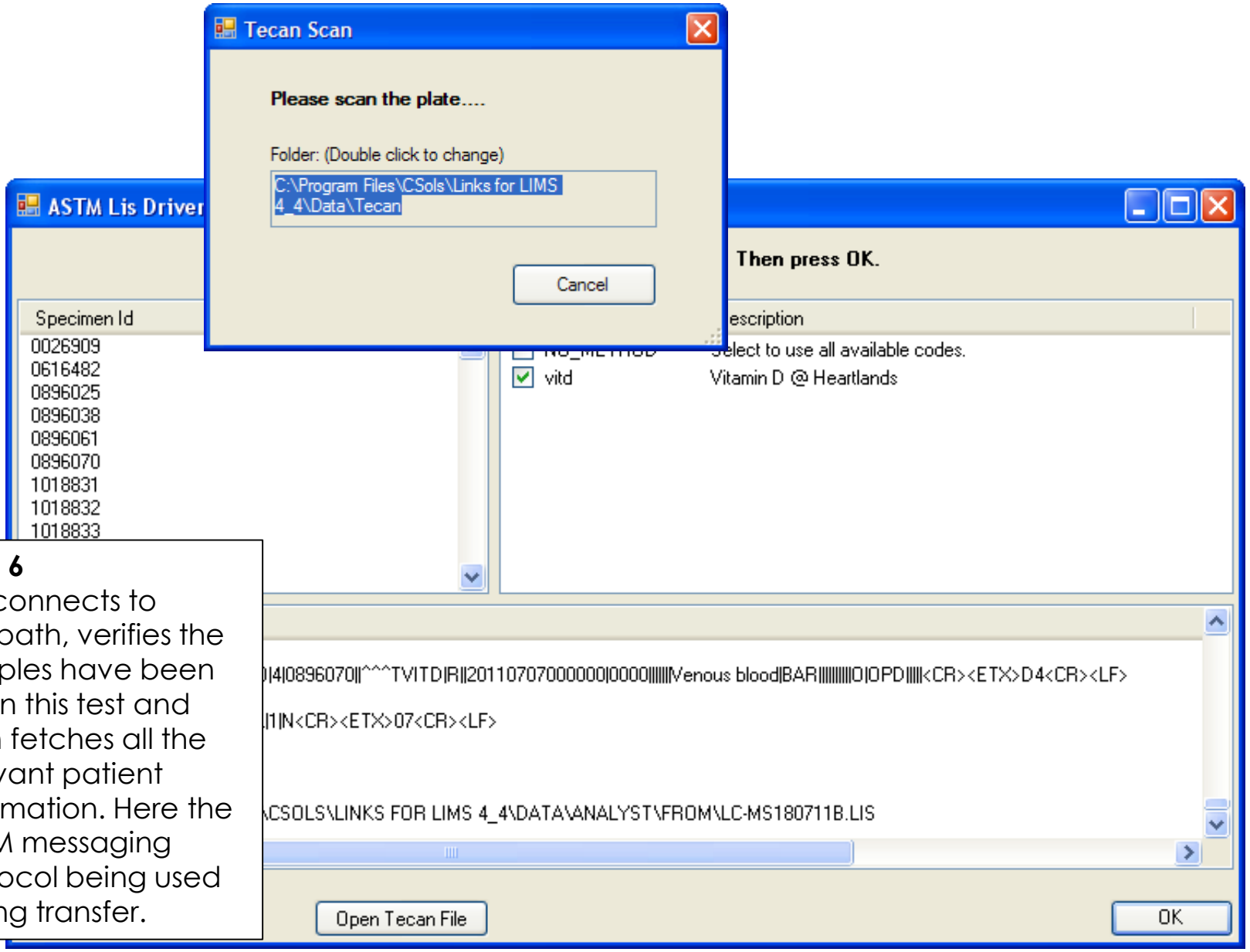

**Step 3**
Samples are placed in 16 position racks on the Tecan robot for preparation e.g. Liquid-liquid Extraction for Vitamin D assay

**Step 4**
The barcode reader mounted on the Tecan reads barcodes from the samples tubes and a unique label applied to the destination 'deep well' plate, before processing the samples. On completion the Tecan software produces a file linking the sample ids and their respective position in the destination plate.




**Step 5**

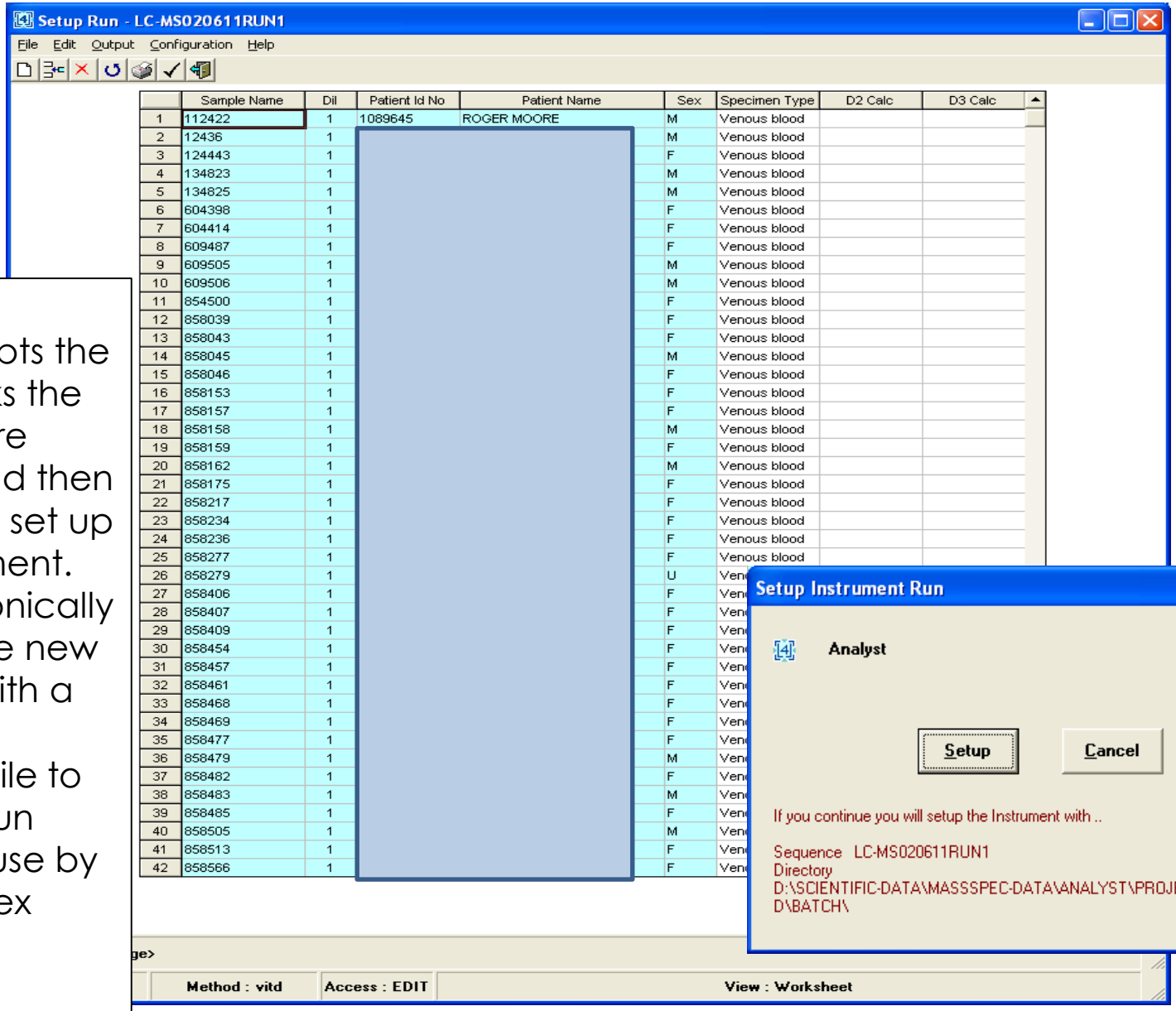
User starts the Links for LIMS (L4L) software on the instrument workstation and the software 'fetches' the LIMS/LIS information for all the samples on the plate identified from the plate barcode label

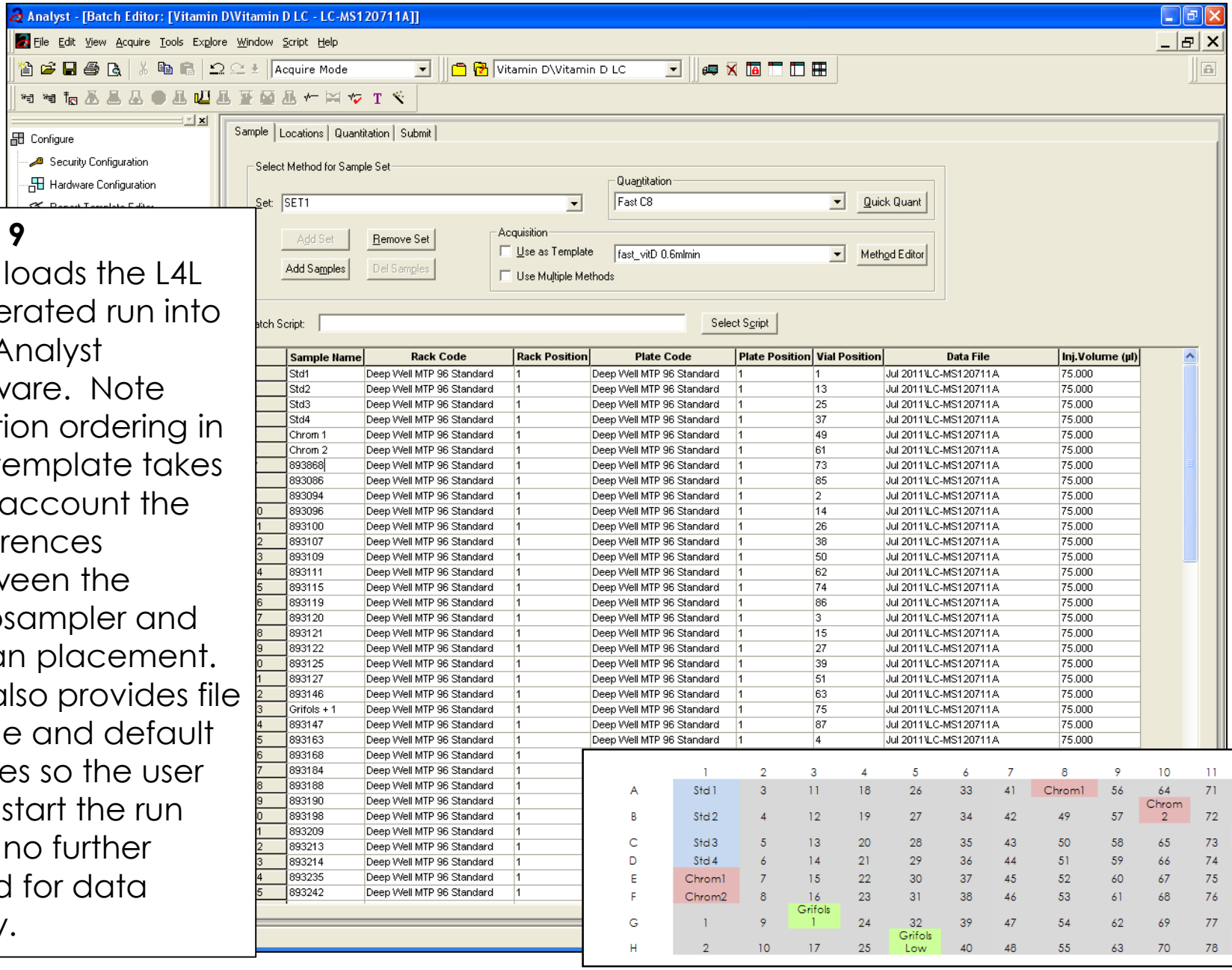



**Step 6**
L4L connects to Telepath, verifies the samples have been given this test and then fetches all the relevant patient information. Here the ASTM messaging protocol being used during transfer.


**Step 7**
The 96 well plate is placed in the AB Sciex LC-MS/MS instrument autosampler tray

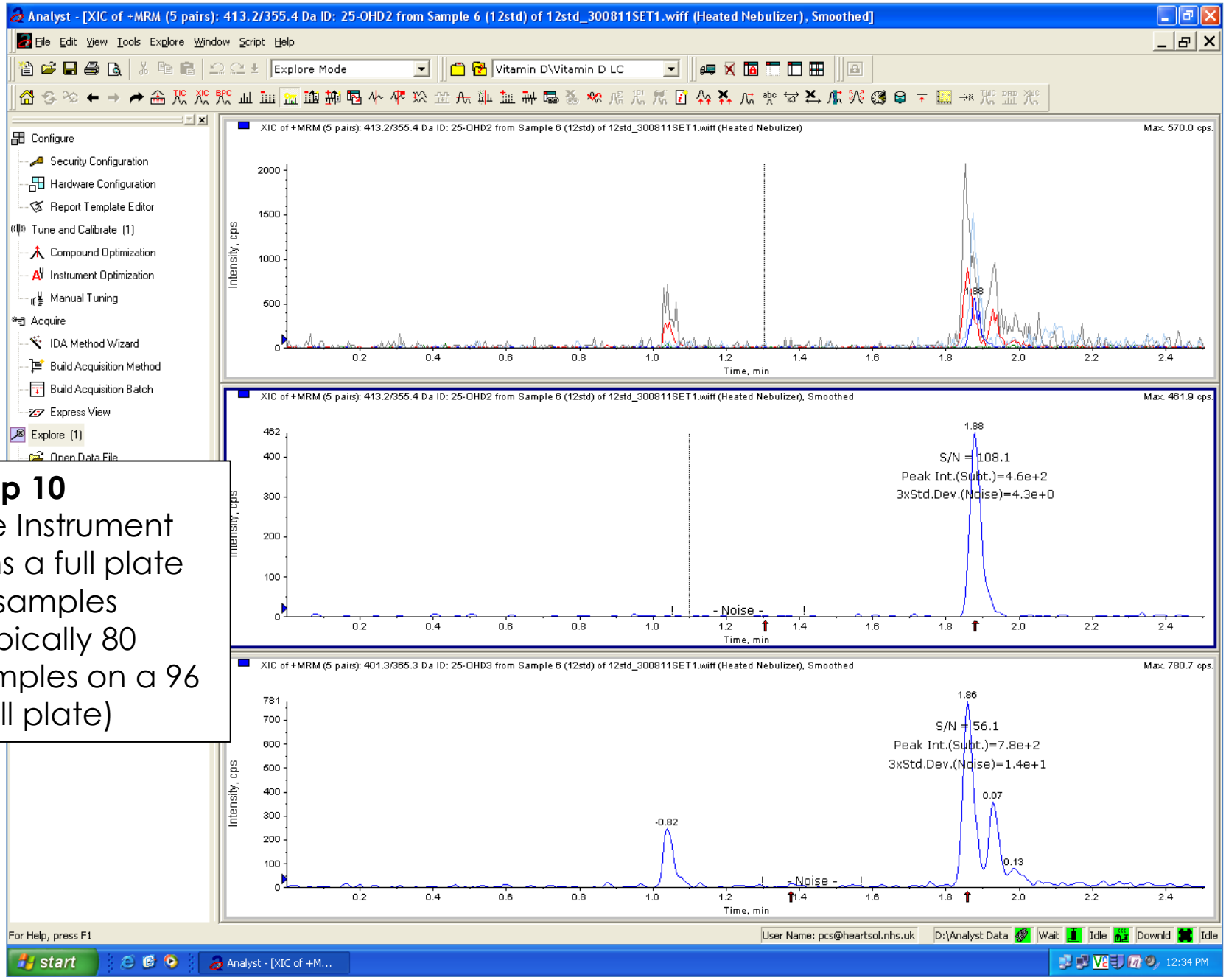
**Step 8**
User accepts the run, checks the samples are correct and then uses L4L to set up the instrument. L4L electronically merges the new samples with a standard template file to create a run ready for use by the AB Sciex Analyst instrument software



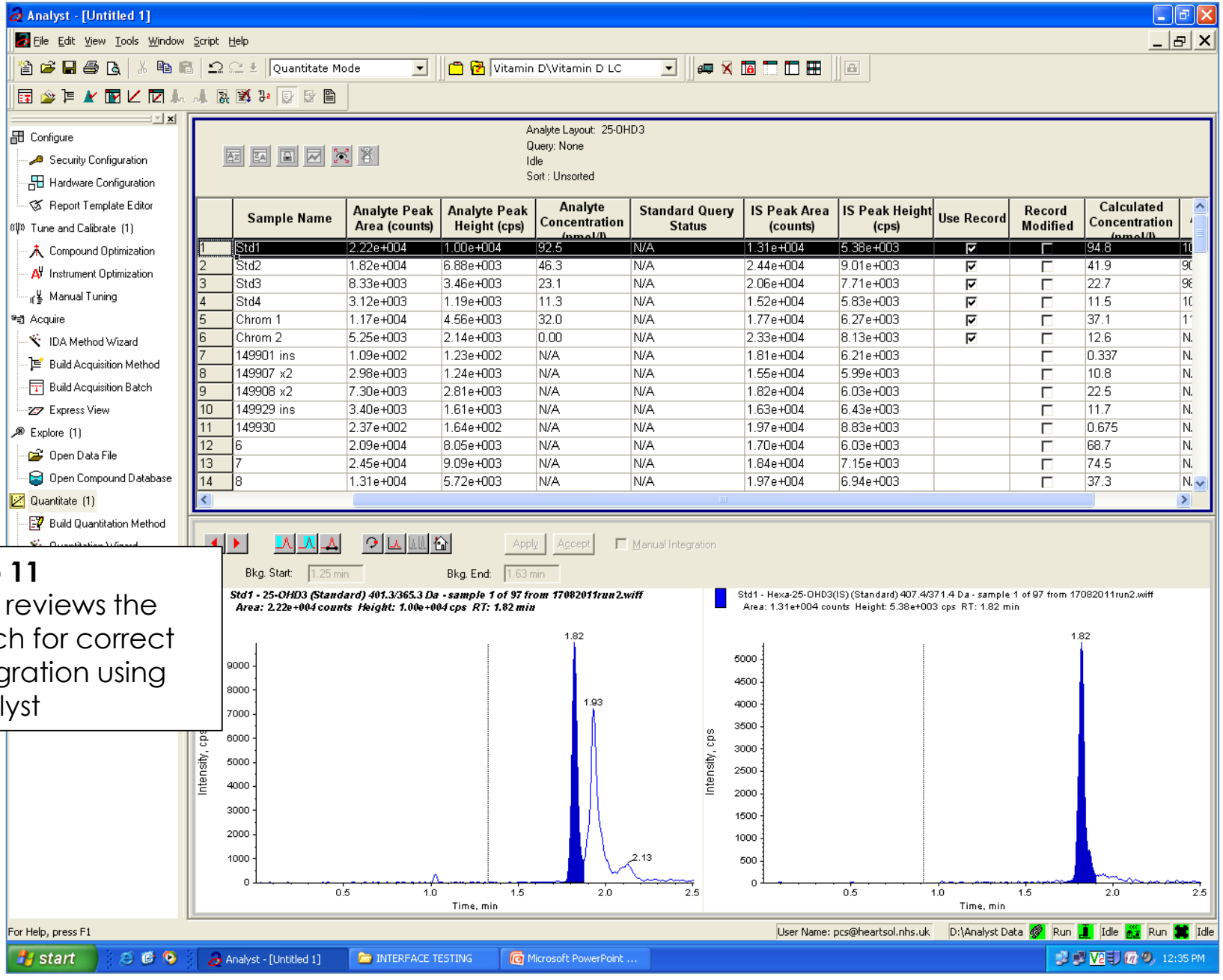



**Step 9**

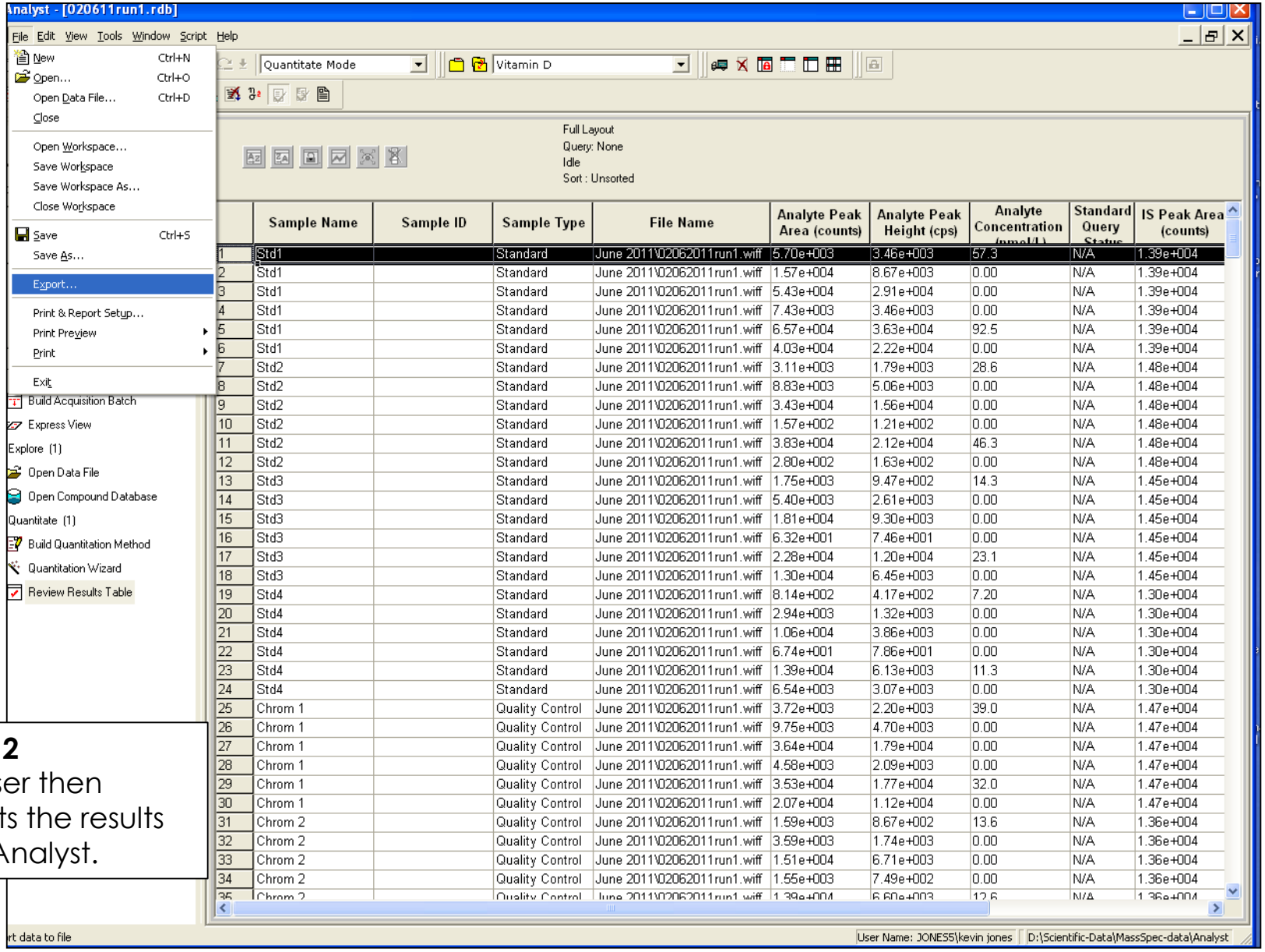
User loads the L4L generated run into the Analyst software. Note position ordering in the template takes into account the differences between the autosampler and Tecan placement. L4L also provides file name and default entries so the user can start the run with no further need for data entry.




**Step 10**
The Instrument runs a full plate of samples (typically 80 samples on a 96 well plate)



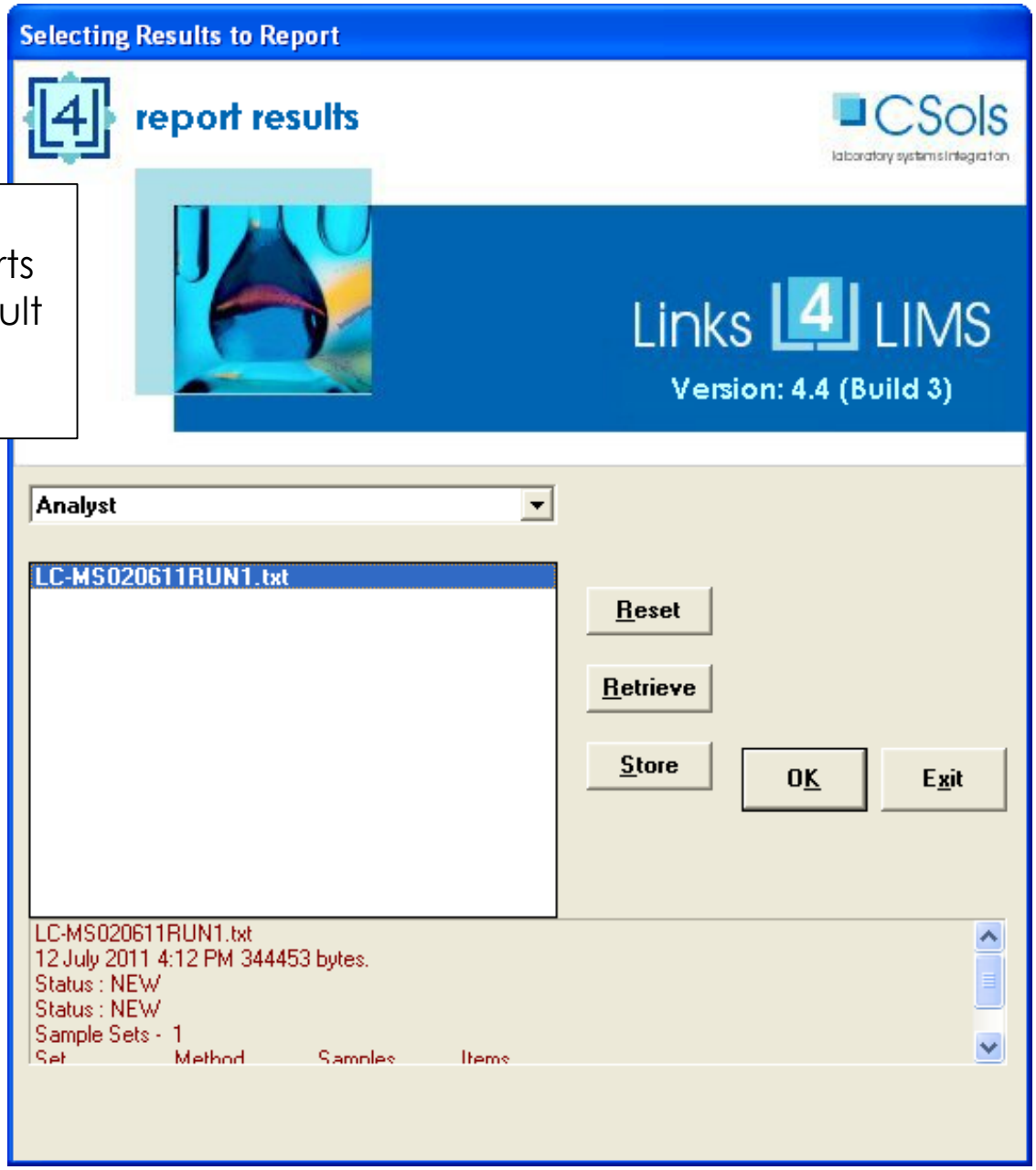

**Step 11**
User reviews the batch for correct integration using Analyst




| | Sample Name | Sample ID | Sample Type | File Name | Analyte Peak Area (counts) | Analyte Peak Height (cps) | Analyte Concentration | Standard Query Status | IS Peak Area (counts) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Std1 | | Standard | June 2011\02062011run1.wiff | 5.70e+003 | 3.46e+003 | 57.3 | N/A | 1.39e+004 |
| 2 | Std1 | | Standard | June 2011\02062011run1.wiff | 1.57e+004 | 8.67e+003 | 0.00 | N/A | 1.39e+004 |
| 3 | Std1 | | Standard | June 2011\02062011run1.wiff | 5.43e+004 | 2.91e+004 | 0.00 | N/A | 1.39e+004 |
| 4 | Std1 | | Standard | June 2011\02062011run1.wiff | 7.43e+003 | 3.46e+003 | 0.00 | N/A | 1.39e+004 |
| 5 | Std1 | | Standard | June 2011\02062011run1.wiff | 6.57e+004 | 3.63e+004 | 92.5 | N/A | 1.39e+004 |
| 6 | Std1 | | Standard | June 2011\02062011run1.wiff | 4.03e+004 | 2.22e+004 | 0.00 | N/A | 1.39e+004 |
| 7 | Std2 | | Standard | June 2011\02062011run1.wiff | 3.11e+003 | 1.79e+003 | 28.6 | N/A | 1.48e+004 |
| 8 | Std2 | | Standard | June 2011\02062011run1.wiff | 8.83e+003 | 5.06e+003 | 0.00 | N/A | 1.48e+004 |
| 9 | Std2 | | Standard | June 2011\02062011run1.wiff | 3.43e+004 | 1.56e+004 | 0.00 | N/A | 1.48e+004 |
| 10 | Std2 | | Standard | June 2011\02062011run1.wiff | 1.57e+002 | 1.21e+002 | 0.00 | N/A | 1.48e+004 |
| 11 | Std2 | | Standard | June 2011\02062011run1.wiff | 3.83e+004 | 2.12e+004 | 46.3 | N/A | 1.48e+004 |
| 12 | Std2 | | Standard | June 2011\02062011run1.wiff | 2.80e+002 | 1.63e+002 | 0.00 | N/A | 1.48e+004 |
| 13 | Std3 | | Standard | June 2011\02062011run1.wiff | 1.75e+003 | 9.47e+002 | 14.3 | N/A | 1.45e+004 |
| 14 | Std3 | | Standard | June 2011\02062011run1.wiff | 5.40e+003 | 2.61e+003 | 0.00 | N/A | 1.45e+004 |
| 15 | Std3 | | Standard | June 2011\02062011run1.wiff | 1.81e+004 | 9.30e+003 | 0.00 | N/A | 1.45e+004 |
| 16 | Std3 | | Standard | June 2011\02062011run1.wiff | 6.32e+001 | 7.46e+001 | 0.00 | N/A | 1.45e+004 |
| 17 | Std3 | | Standard | June 2011\02062011run1.wiff | 2.28e+004 | 1.20e+004 | 23.1 | N/A | 1.45e+004 |
| 18 | Std3 | | Standard | June 2011\02062011run1.wiff | 1.30e+004 | 6.45e+003 | 0.00 | N/A | 1.45e+004 |
| 19 | Std4 | | Standard | June 2011\02062011run1.wiff | 8.14e+002 | 4.17e+002 | 7.20 | N/A | 1.30e+004 |
| 20 | Std4 | | Standard | June 2011\02062011run1.wiff | 2.94e+003 | 1.32e+003 | 0.00 | N/A | 1.30e+004 |
| 21 | Std4 | | Standard | June 2011\02062011run1.wiff | 1.06e+004 | 3.86e+003 | 0.00 | N/A | 1.30e+004 |
| 22 | Std4 | | Standard | June 2011\02062011run1.wiff | 6.74e+001 | 7.86e+001 | 0.00 | N/A | 1.30e+004 |
| 23 | Std4 | | Standard | June 2011\02062011run1.wiff | 1.39e+004 | 6.13e+003 | 11.3 | N/A | 1.30e+004 |
| 24 | Std4 | | Standard | June 2011\02062011run1.wiff | 6.54e+003 | 3.07e+003 | 0.00 | N/A | 1.30e+004 |
| 25 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 3.72e+003 | 2.20e+003 | 39.0 | N/A | 1.47e+004 |
| 26 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 9.75e+003 | 4.70e+003 | 0.00 | N/A | 1.47e+004 |
| 27 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 3.64e+004 | 1.79e+004 | 0.00 | N/A | 1.47e+004 |
| 28 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 4.58e+003 | 2.09e+003 | 0.00 | N/A | 1.47e+004 |
| 29 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 3.53e+004 | 1.77e+004 | 32.0 | N/A | 1.47e+004 |
| 30 | Chrom 1 | | Quality Control | June 2011\02062011run1.wiff | 2.07e+004 | 1.12e+004 | 0.00 | N/A | 1.47e+004 |
| 31 | Chrom 2 | | Quality Control | June 2011\02062011run1.wiff | 1.59e+003 | 8.67e+002 | 13.6 | N/A | 1.36e+004 |
| 32 | Chrom 2 | | Quality Control | June 2011\02062011run1.wiff | 3.59e+003 | 1.74e+003 | 0.00 | N/A | 1.36e+004 |
| 33 | Chrom 2 | | Quality Control | June 2011\02062011run1.wiff | 1.51e+004 | 6.71e+003 | 0.00 | N/A | 1.36e+004 |
| 34 | Chrom 2 | | Quality Control | June 2011\02062011run1.wiff | 1.55e+003 | 7.49e+002 | 0.00 | N/A | 1.36e+004 |
| 35 | Chrom 2 | | Quality Control | June 2011\02062011run1.wiff | 1.39e+004 | 6.60e+003 | 12.6 | N/A | 1.36e+004 |

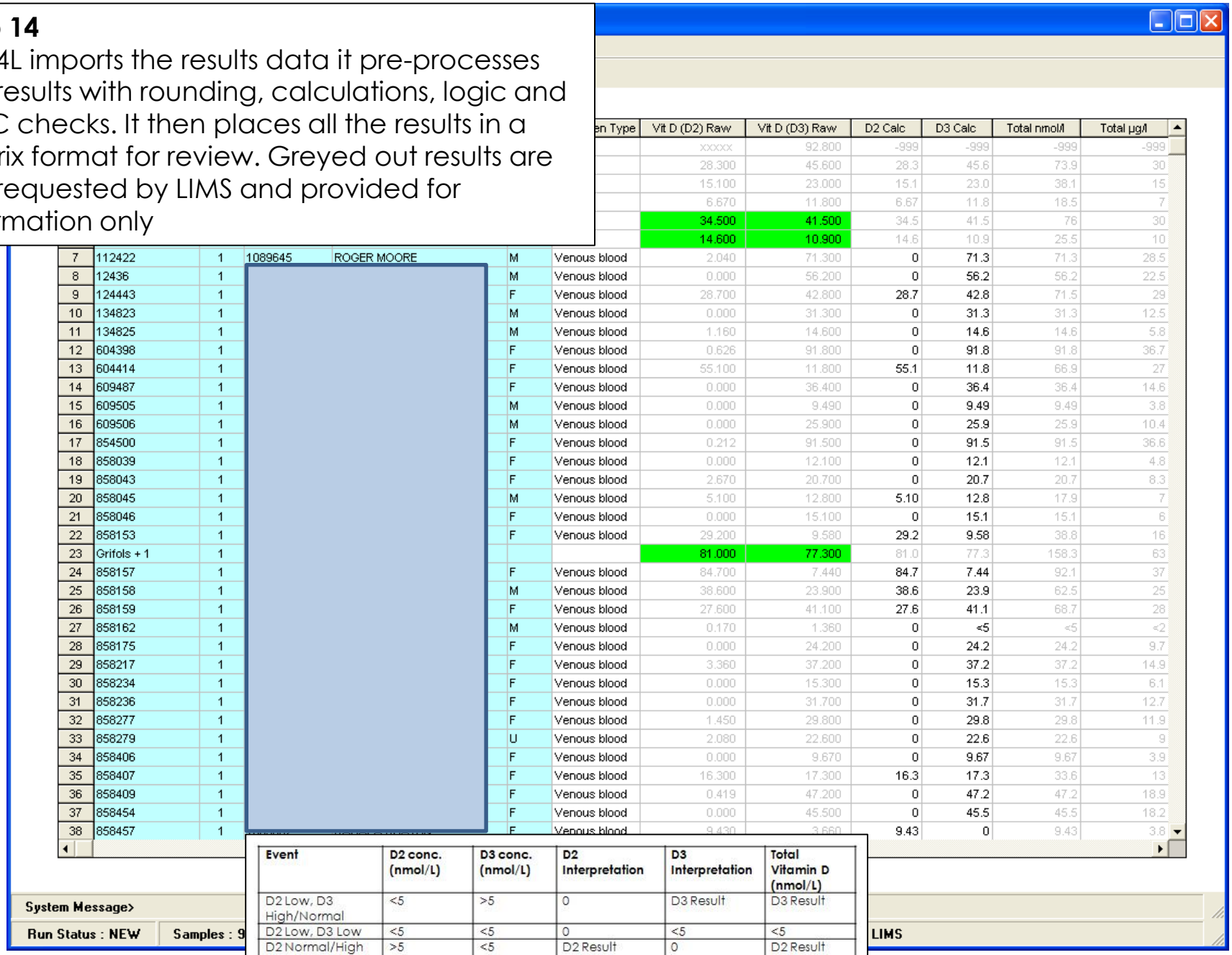
**Step 12**
The user then exports the results from Analyst.

**Step 13**
The user then starts the L4L report result program and selects the run



**Step 14**

As L4L imports the results data it pre-processes the results with rounding, calculations, logic and AQC checks. It then places all the results in a matrix format for review. Greyed out results are not requested by LIMS and provided for information only

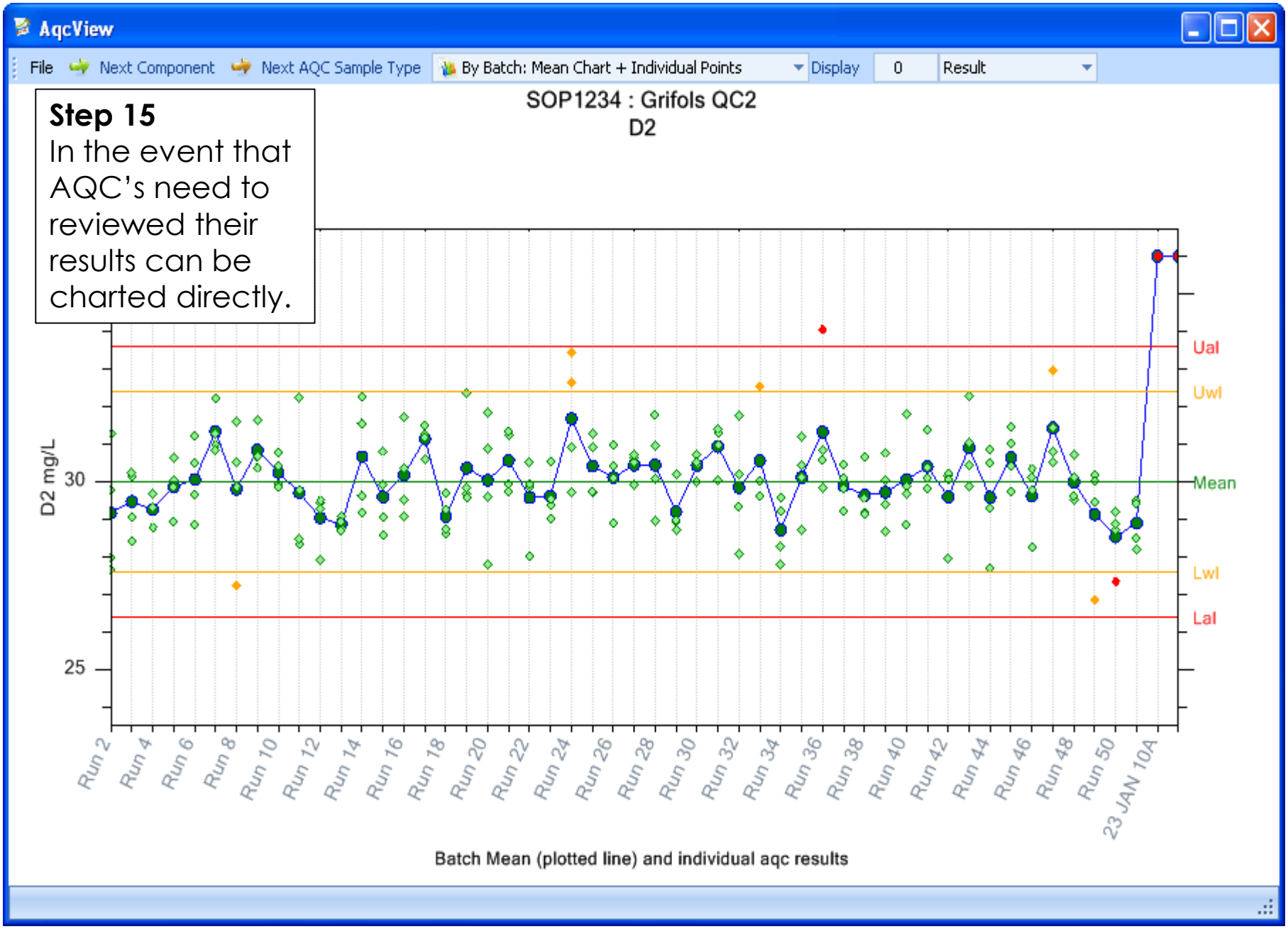


| | | | | | | en Type | Vit D (D2) Raw | Vit D (D3) Raw | D2 Calc | D3 Calc | Total nmol/l | Total µg/l |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | xxxxx | 92.800 | -999 | -999 | -999 | -999 |
| | | | | | | | 28.300 | 45.600 | 28.3 | 45.6 | 73.9 | 30 |
| | | | | | | | 15.100 | 23.000 | 15.1 | 23.0 | 38.1 | 15 |
| | | | | | | | 6.670 | 11.800 | 6.67 | 11.8 | 18.5 | 7 |
| | | | | | | | 34.500 | 41.500 | 34.5 | 41.5 | 76 | 30 |
| | | | | | | | 14.600 | 10.900 | 14.6 | 10.9 | 25.5 | 10 |
| 7 | 112422 | 1 | 1089645 | ROGER MOORE | M | Venous blood | 2.040 | 71.300 | 0 | 71.3 | 71.3 | 28.5 |
| 8 | 12436 | 1 | | | M | Venous blood | 0.000 | 56.200 | 0 | 56.2 | 56.2 | 22.5 |
| 9 | 124443 | 1 | | | F | Venous blood | 28.700 | 42.800 | 28.7 | 42.8 | 71.5 | 29 |
| 10 | 134823 | 1 | | | M | Venous blood | 0.000 | 31.300 | 0 | 31.3 | 31.3 | 12.5 |
| 11 | 134825 | 1 | | | M | Venous blood | 1.160 | 14.600 | 0 | 14.6 | 14.6 | 5.8 |
| 12 | 604398 | 1 | | | F | Venous blood | 0.626 | 91.800 | 0 | 91.8 | 91.8 | 36.7 |
| 13 | 604414 | 1 | | | F | Venous blood | 55.100 | 11.800 | 55.1 | 11.8 | 66.9 | 27 |
| 14 | 609487 | 1 | | | F | Venous blood | 0.000 | 36.400 | 0 | 36.4 | 36.4 | 14.6 |
| 15 | 609505 | 1 | | | M | Venous blood | 0.000 | 9.490 | 0 | 9.49 | 9.49 | 3.8 |
| 16 | 609506 | 1 | | | M | Venous blood | 0.000 | 25.900 | 0 | 25.9 | 25.9 | 10.4 |
| 17 | 854500 | 1 | | | F | Venous blood | 0.212 | 91.500 | 0 | 91.5 | 91.5 | 36.6 |
| 18 | 858039 | 1 | | | F | Venous blood | 0.000 | 12.100 | 0 | 12.1 | 12.1 | 4.8 |
| 19 | 858043 | 1 | | | F | Venous blood | 2.670 | 20.700 | 0 | 20.7 | 20.7 | 8.3 |
| 20 | 858045 | 1 | | | M | Venous blood | 5.100 | 12.800 | 5.10 | 12.8 | 17.9 | 7 |
| 21 | 858046 | 1 | | | F | Venous blood | 0.000 | 15.100 | 0 | 15.1 | 15.1 | 6 |
| 22 | 858153 | 1 | | | F | Venous blood | 29.200 | 9.580 | 29.2 | 9.58 | 38.8 | 16 |
| 23 | Grifols + 1 | 1 | | | | | 81.000 | 77.300 | 81.0 | 77.3 | 158.3 | 63 |
| 24 | 858157 | 1 | | | F | Venous blood | 84.700 | 7.440 | 84.7 | 7.44 | 92.1 | 37 |
| 25 | 858158 | 1 | | | M | Venous blood | 38.600 | 23.900 | 38.6 | 23.9 | 62.5 | 25 |
| 26 | 858159 | 1 | | | F | Venous blood | 27.600 | 41.100 | 27.6 | 41.1 | 68.7 | 28 |
| 27 | 858162 | 1 | | | M | Venous blood | 0.170 | 1.360 | 0 | <5 | <5 | <2 |
| 28 | 858175 | 1 | | | F | Venous blood | 0.000 | 24.200 | 0 | 24.2 | 24.2 | 9.7 |
| 29 | 858217 | 1 | | | F | Venous blood | 3.360 | 37.200 | 0 | 37.2 | 37.2 | 14.9 |
| 30 | 858234 | 1 | | | F | Venous blood | 0.000 | 15.300 | 0 | 15.3 | 15.3 | 6.1 |
| 31 | 858236 | 1 | | | F | Venous blood | 0.000 | 31.700 | 0 | 31.7 | 31.7 | 12.7 |
| 32 | 858277 | 1 | | | F | Venous blood | 1.450 | 29.800 | 0 | 29.8 | 29.8 | 11.9 |
| 33 | 858279 | 1 | | | U | Venous blood | 2.080 | 22.600 | 0 | 22.6 | 22.6 | 9 |
| 34 | 858406 | 1 | | | F | Venous blood | 0.000 | 9.670 | 0 | 9.67 | 9.67 | 3.9 |
| 35 | 858407 | 1 | | | F | Venous blood | 16.300 | 17.300 | 16.3 | 17.3 | 33.6 | 13 |
| 36 | 858409 | 1 | | | F | Venous blood | 0.419 | 47.200 | 0 | 47.2 | 47.2 | 18.9 |
| 37 | 858454 | 1 | | | F | Venous blood | 0.000 | 45.500 | 0 | 45.5 | 45.5 | 18.2 |
| 38 | 858457 | 1 | | | F | Venous blood | 9.430 | 3.660 | 9.43 | 0 | 9.43 | 3.8 |

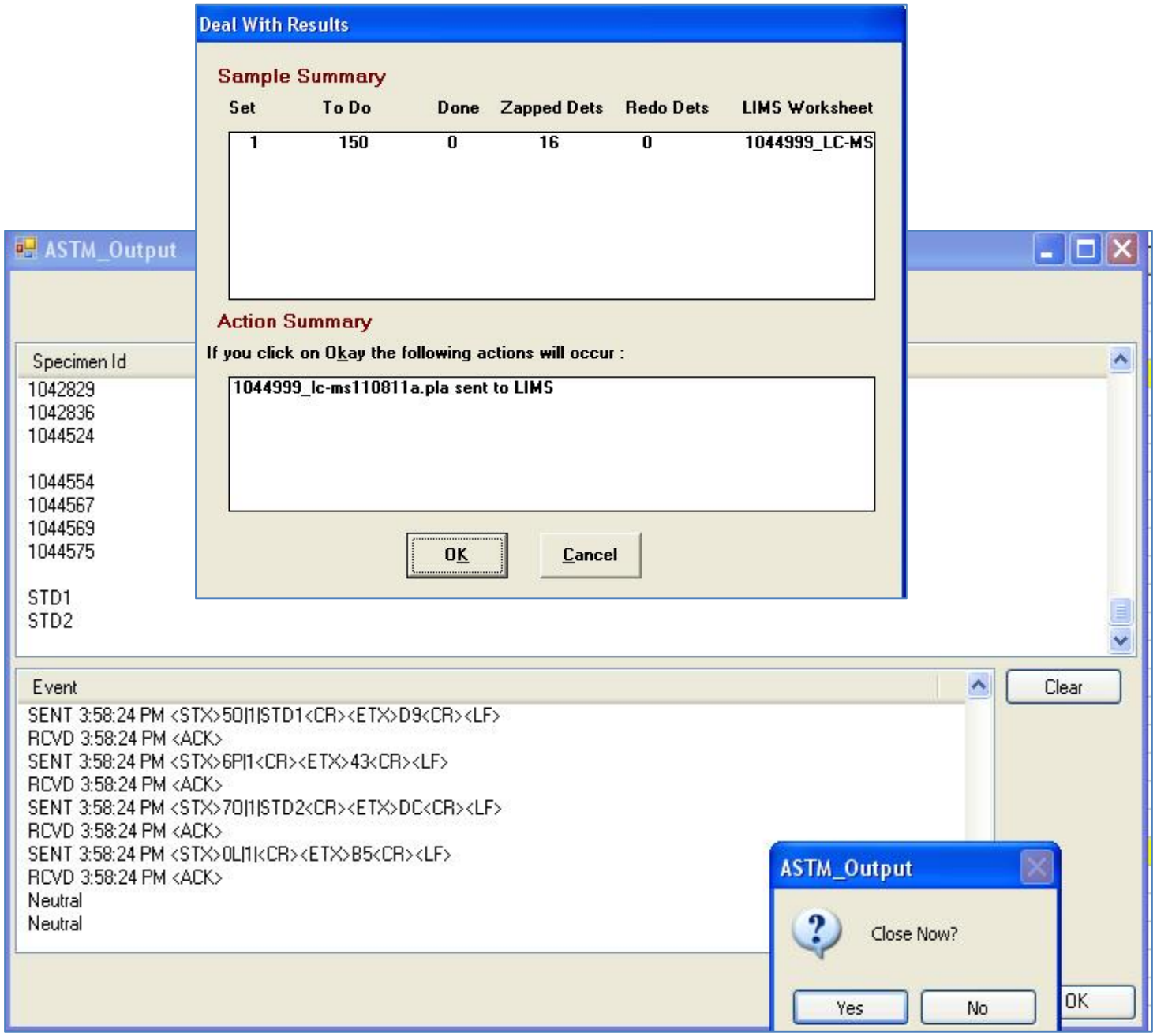
System Message>

Run Status : NEW  Samples : 9  LIMS

| Event | D2 conc. (nmol/L) | D3 conc. (nmol/L) | D2 Interpretation | D3 Interpretation | Total Vitamin D (nmol/L) |
|---|---|---|---|---|---|
| D2 Low, D3 High/Normal | <5 | >5 | 0 | D3 Result | D3 Result |
| D2 Low, D3 Low | <5 | <5 | 0 | <5 | <5 |
| D2 Normal/High D3 Low | >5 | <5 | D2 Result | 0 | D2 Result |
| D2 & D3 Normal/High | >5 | >5 | D2 Result | D3 Result | D2 Result + D3 Result |


AqcView
File
Next Component
Next AQC Sample Type
By Batch: Mean Chart + Individual Points
Display
0
Result
Step 15
In the event that AQC's need to reviewed their results can be charted directly.
SOP1234 : Grifols QC2
D2
D2 mg/L
30
25
Ual
Uwl
Mean
Lwl
Lal
Run 2
Run 4
Run 6
Run 8
Run 10
Run 12
Run 14
Run 16
Run 18
Run 20
Run 22
Run 24
Run 26
Run 28
Run 30
Run 32
Run 34
Run 36
Run 38
Run 40
Run 42
Run 44
Run 46
Run 48
Run 50
23 JAN 10A
Batch Mean (plotted line) and individual aqc results

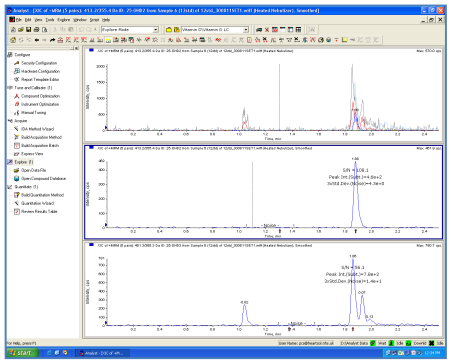
**Step 16**
Results in black meet AQC rules and can be sent to Telepath, while Suspect results can be 'zapped' or set aside for reanalysis in the next run.
L4L then opens a connection and Telepath and uploads all results electronically and then archives all the data files for later auditing



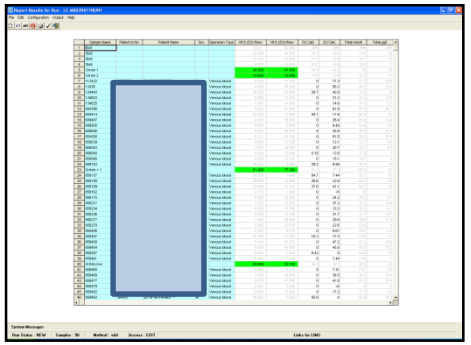
# Summary


Sample Preparation
& Analyst time

Instrument set up
2 mins
Analyst time
2 mins



Instrument run
288 mins
Analyst Time
0 mins



Results review & upload
5 mins
Analyst time 5 mins