

|                     |                       |
|---------------------|-----------------------|
| Date                | 30 May 2019           |
| Time                | 13:43:13              |
| Test Number         | 72                    |
| Mixture Composition | 25% CH4 35% CO 40% H2 |
| Ambient Temperature | 14.7 °C               |
| Ambient Pressure    | 970.7                 |
| Wind Speed          | 3.1                   |
| Wind direction      | SSE                   |
| Relative Humidity   | 94.00%                |
| Mass Flow           | 9.6510 kg/s           |
| Equivalence Ratio   | 0.50                  |

**General Comments: (weather, rig configuration)**

Weather: Light wind. Cloudy with occasional light rain.

Rig configuration: 4 x 3m circular duct; expansion section and HRSG attached. End Plate attached. Igniter 258mm from beginning of 2nd circular duct section

Engine Speed: 12.6%; 8,100 rpm

Test on 25% CH4 35% CO and 40% H2 at an intended EQR of 0.50

LOW TEMPERATURE TESTS (NOMINAL 320 oC)

Test gave a strong combustion event which gave a good response on most sensors. Maximum overpressure of 584 mbar was seen on KU1 in the circular duct.

Max overpressure  
1322 mbar

Max. gas temperature  
1345 °C

Ionisation Probes  
Max. flame speed  
142 m/s

Ionisation Rakes  
Max. flame speed  
189 m/s

Optical Probes  
Max. flame speed  
398 m/s

Initial gas temperature  
282 °C

Location of Max. Overpressure

|          |         |
|----------|---------|
| sensor   | KU1     |
| label    | CD4-R2  |
| distance | 9758 mm |

Location of Max. Temperature

|          |         |
|----------|---------|
| sensor   | TC2     |
| label    | CD2-R3  |
| distance | 4258 mm |

Location of Max. Flame Speed

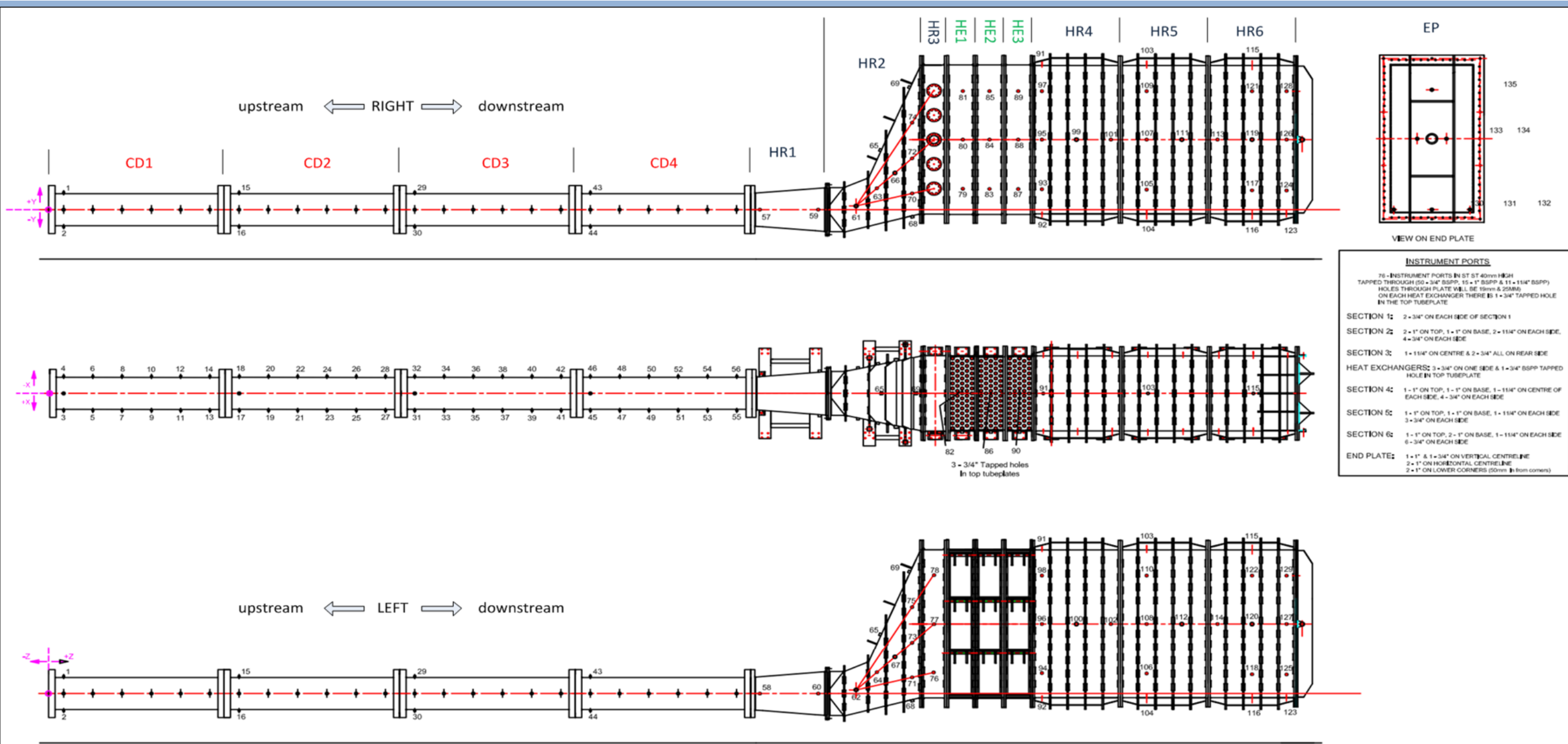
|          |          |
|----------|----------|
| sensor   | IP15     |
| label    | HR4-L5L  |
| distance | 18165 mm |

Location of Max. Flame Speed

|          |          |
|----------|----------|
| sensor   | RA3      |
| label    | HR4-R3M  |
| distance | 17575 mm |

Location of Max. Flame Speed

|          |          |
|----------|----------|
| sensor   | OP2      |
| label    | HR1-R1   |
| distance | 12152 mm |



**Naming Convention**

Section Identifier  
i.e. HE, HR, CD or EP

Section Number (1-6)  
Numbered from  
downstream to upstream

Vertical position in section  
(sides only) i.e. U, M or L.  
Absence of letter denotes  
centreline

Longitudinal position in  
section (numbered from 1)

Side  
i.e. R, L, T or B

**Key**

|           |                |          |   |
|-----------|----------------|----------|---|
| <b>CD</b> | Circular duct  | <b>U</b> | Upper   |
| <b>HR</b> | HRSG           | <b>M</b> | Middle  |
| <b>HE</b> | Heat Exchanger | <b>L</b> | Lower   |
| <b>EP</b> | End Plate      | <b>R</b> | Right Side (when viewed downstream from engine) |
|           |                | <b>L</b> | Left Side                                       |
|           |                | <b>T</b> | Top   |
|           |                | <b>B</b> | Bottom  |

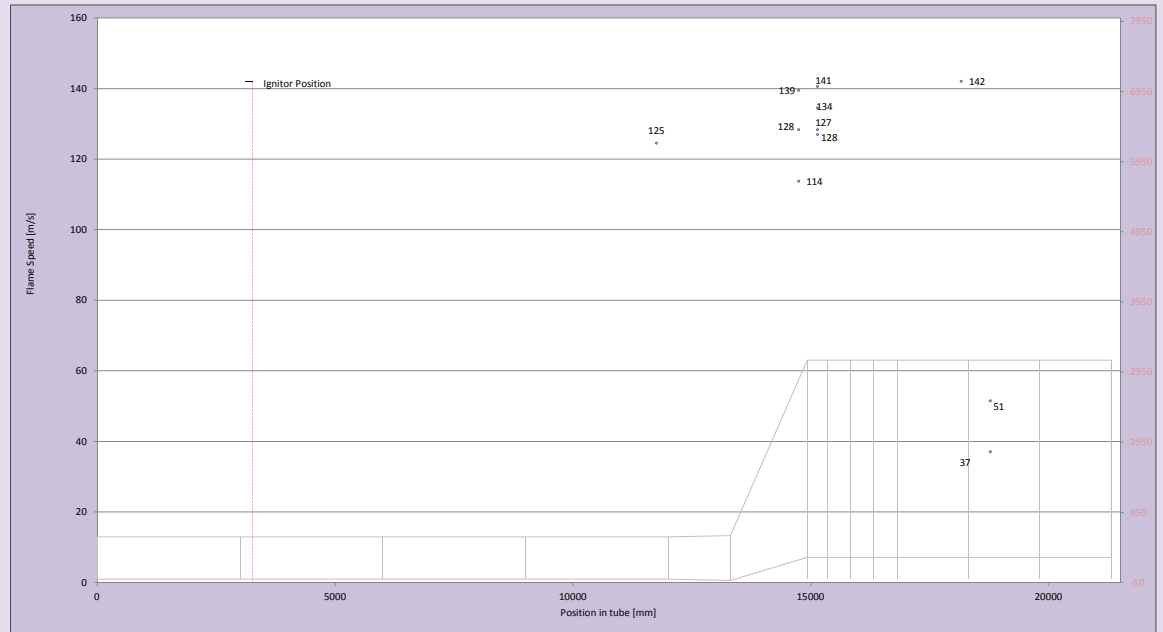
There are 13 sections on the rig

- 4 circular duct sections (CD1 to CD4)
- 6 HRSG sections (HR1 to HR6)
- 3 heat exchanger sections (HE1 to HE3)  
*located between HR3 and HR4*

Location of igniter  mm Time of ignition  seconds

| IP Number | Location label | Data Name           | Position in tube (mm) | Flame arrival time (s) | Avg Flame speed from last sensor (m/s) |
|-----------|----------------|---------------------|-----------------------|------------------------|--|
| IP0       | CD4-L6         | Ionisation probe 0  | 11758                 | 17.39281               | 125                                    |
| IP1       | HR2-L5L        | Ionisation probe 1  | 14745                 | 17.40692               | 139                                    |
| IP2       | HR2-L5M        | Ionisation probe 2  | 14745                 | 17.41410               | 128                                    |
| IP3       | HR2-L5U        | Ionisation probe 3  | 14745                 | 17.42555               | 114                                    |
| IP4       | HR3-R1L        | Ionisation probe 4  | 15140                 | 17.41817               | 127                                    |
| IP5       | HR3-R1LM       | Ionisation probe 5  | 15140                 | 17.40909               | 141                                    |
| IP6       | HR3-R1M        | Ionisation probe 6  | 15140                 | 17.41293               | 134                                    |
| IP7       | HR3-R1U        | Ionisation probe 7  | 15140                 | 17.41715               | 128                                    |
| IP8       | HR3-L1U        | Ionisation probe 8  | 15140                 | 17.43655               |  |
| IP9       | HE2-R1M        | Ionisation probe 9  | 16090                 | 17.41523               |  |
| IP10      | HR4-L1L        | Ionisation probe 10 | 16985                 | 17.41967               |  |
| IP11      | HR4-L1M        | Ionisation probe 11 | 16985                 | 17.42033               |  |
| IP12      | HR4-L1U        | Ionisation probe 12 | 16985                 | 17.42327               |  |
| IP13      | HR4-R1U        | Ionisation probe 13 | 16985                 | 17.42760               |  |
| IP14      | HR4-R3U        | Ionisation probe 14 | 17575                 | 17.44698               |  |
| IP15      | HR4-L5L        | Ionisation probe 15 | 18165                 | 17.42798               | 142                                    |
| IP16      | HR4-L5M        | Ionisation probe 16 | 18165                 |                        |  |
| IP17      | HR4-L5U        | Ionisation probe 17 | 18165                 | 17.45126               |  |
| IP18      | HR4-R5M        | Ionisation probe 18 | 18165                 |                        | 0                                      |
| IP19      | HR5-L2L        | Ionisation probe 19 | 18775                 |                        | 0                                      |
| IP20      | HR5-L2M        | Ionisation probe 20 | 18775                 | 17.45511               | 51                                     |
| IP21      | HR5-L2U        | Ionisation probe 21 | 18775                 | 17.47156               | 37                                     |
| IP22      | HR5-R2U        | Ionisation probe 22 | 18775                 |                        |  |
| IP23      | HR6-L1M        | Ionisation probe 23 | 19985                 |                        |  |

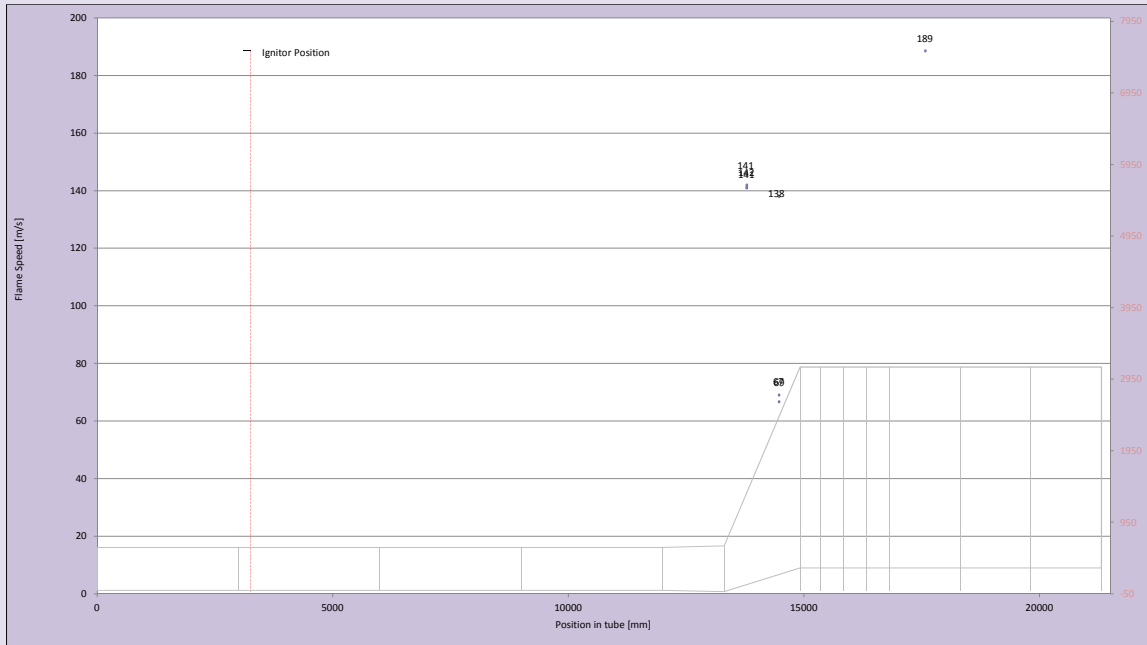
KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working



Location of igniter 3258 mm Time of ignition 17.32454 seconds

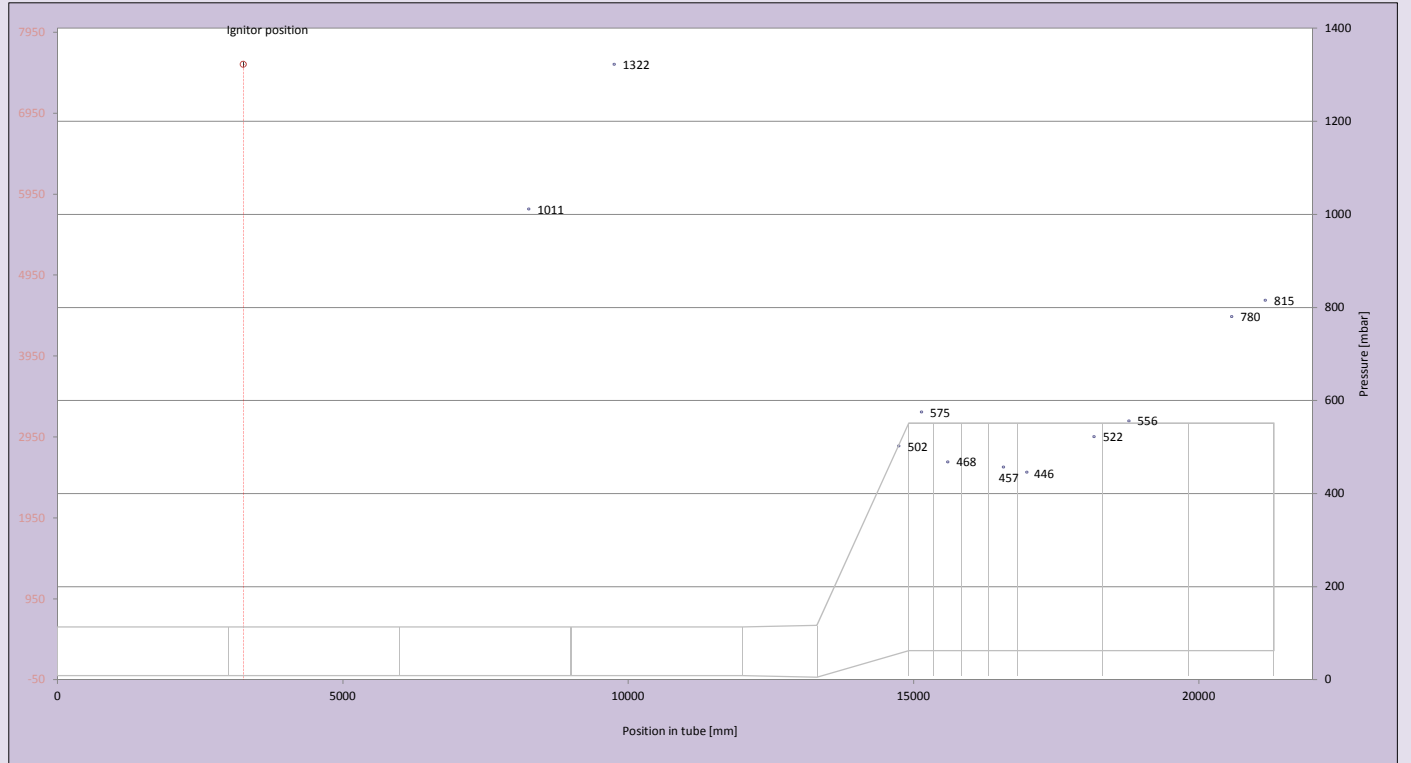
| Rake Number | IP Number | Location label | Data Name | Position in tube (mm) | Flame arrival time (s) | Avg Flame speed from last sensor (m/s) |
|-------------|-----------|----------------|-----------|-----------------------|------------------------|--|
| RA1         | IP24      | HR2-R2M        | IP24      | 13785                 | 17.3987                | 142                                    |
| RA1         | IP25      | HR2-R2M        | IP25      | 13785                 | 17.3992                | 141                                    |
| RA1         | IP26      | HR2-R2M        | IP26      | 13785                 | 17.3991                | 141                                    |
| RA2         | IP27      | HR2-R4M        | IP27      | 14475                 | 17.4087                | 69                                     |
| RA2         | IP28      | HR2-R4M        | IP28      | 14475                 | 17.4095                | 67                                     |
| RA2         | IP29      | HR2-R4M        | IP29      | 14475                 | 17.4041                | 138                                    |
| RA3         | IP30      | HR4-R3M        | IP30      | 17575                 | 17.4251                | 189                                    |
| RA3         | IP31      | HR4-R3M        | IP31      | 17575                 | NW                     |  |
| RA3         | IP32      | HR4-R3M        | IP32      | 17575                 | NW                     |  |
| RA4         | IP33      | HR4-R3L        | IP33      | 17575                 | NW                     |  |
| RA4         | IP34      | HR4-R3L        | IP34      | 17575                 | NW                     |  |
| RA4         | IP35      | HR4-R3L        | IP35      | 17575                 | NW                     |  |

KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working



Location of igniter 3258 mm

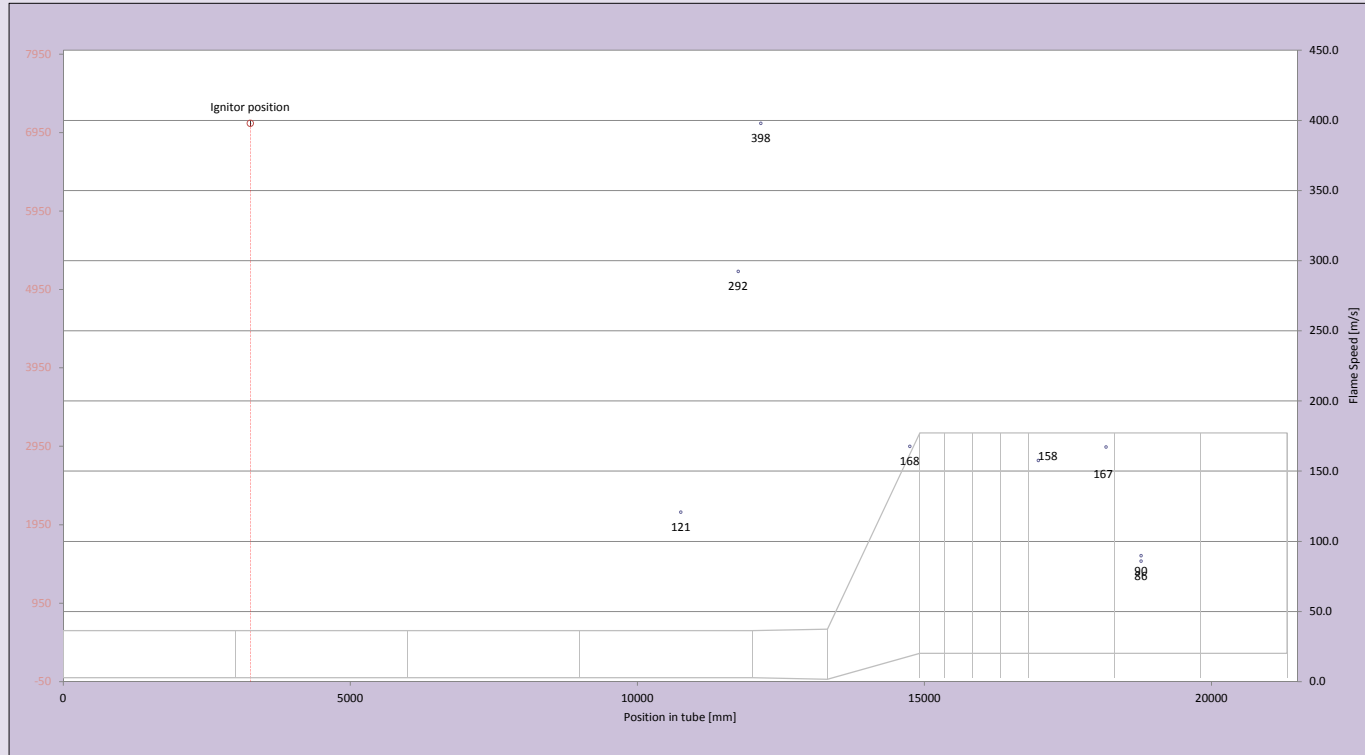
| Transducer number | Location | Position in tube [mm] | $\Delta P_{max}$ [mbar] | Time $\Delta P_{max}$ [sec] |
|-------------------|----------|-----------------------|-------------------------|-----------------------------|
| KU0               | CD3-R5   | 8258                  | 1011                    | 17.4763                     |
| KU1               | CD4-R2   | 9758                  | 1322                    | 17.4763                     |
| KU2               | HR2-T5   | 14745                 | 502                     | 17.4403                     |
| KU3               | HR3-L1L  | 15140                 | 575                     | 17.4824                     |
| KU4               | HE1-R1U  | 15600                 | 468                     | 17.4175                     |
| KU5               | HE3-R1L  | 16580                 | 457                     | 17.4851                     |
| KU6               | HR4-R1L  | 16985                 | 446                     | 17.4356                     |
| KU7               | HR4-R5U  | 18165                 | 522                     | 17.4355                     |
| KU8               | HR5-R2L  | 18775                 | 556                     | 17.4334                     |
| KU9               | HR6-R3L  | 20575                 | 780                     | 17.4298                     |
| KU10              | HR6-LSL  | 21165                 | 815                     | 17.4298                     |
|                   |          |                       |                         |                             |
|                   |          |                       |                         |                             |



Location of igniter 3258 mm Time of ignition 17.32454 seconds

| OP Number | Location label | Position in tube (mm) | Flame arrival time (s) | Average flame speed (m/s) |
|-----------|----------------|-----------------------|------------------------|---------------------------|
| OP0       | CD4-L4         | 10758                 | 17.3866                | 120.9                     |
| OP1       | CD4-R6         | 11758                 | 17.3900                | 292.4                     |
| OP2       | HR1-R1         | 12152                 | 17.3910                | 398.0                     |
| OP3       | HR2-R5M        | 14745                 | 17.4065                | 167.7                     |
| OP4       | HE1-T1         | 15600                 | 17.4115                |                           |
| OP5       | HE2-T1         | 16090                 | 17.4201                |                           |
| OP6       | HE3-T1         | 16580                 | 17.4226                |                           |
| OP7       | HR4-T1         | 16985                 | 17.4235                |                           |
| OP8       | HR4-R1M        | 16985                 | 17.4207                | 157.6                     |
| OP9       | HR4-R5L        | 18165                 | 17.4269                | 167.2                     |
| OP10      | HR5-T2         | 18775                 | 17.4513                | 89.9                      |
| OP11      | HR5-R2M        | 18775                 | 17.4534                | 85.9                      |
|           |                |                       |                        |                           |
|           |                |                       |                        |                           |
|           |                |                       |                        |                           |

KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working

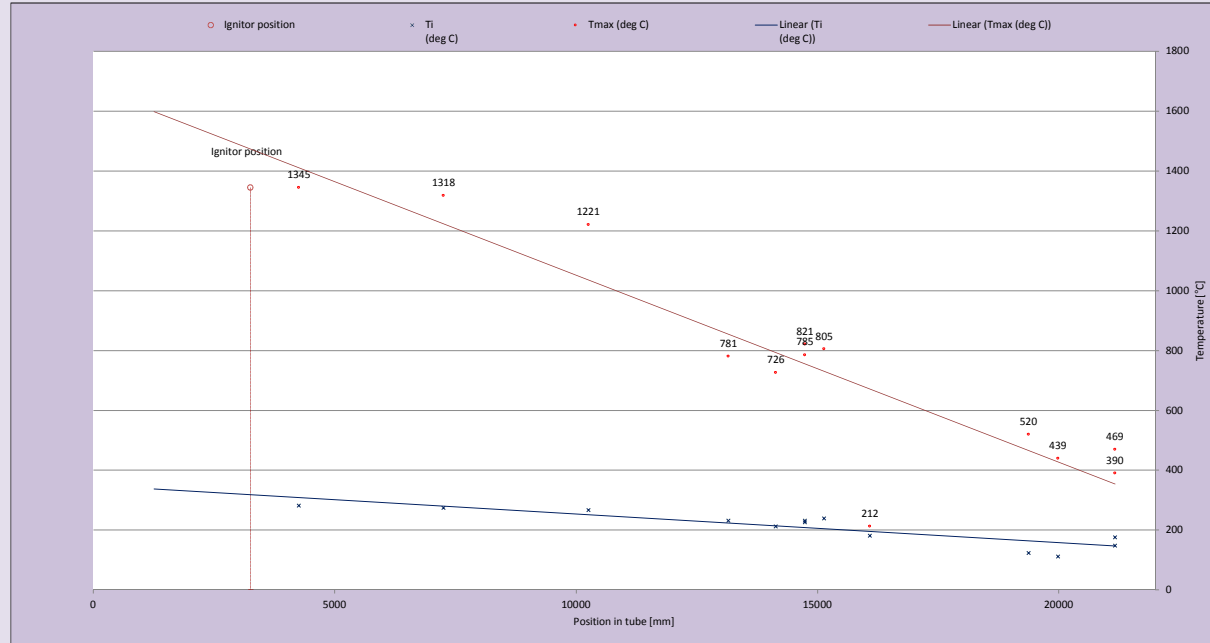


Location of igniter  mm Time of ignition  seconds

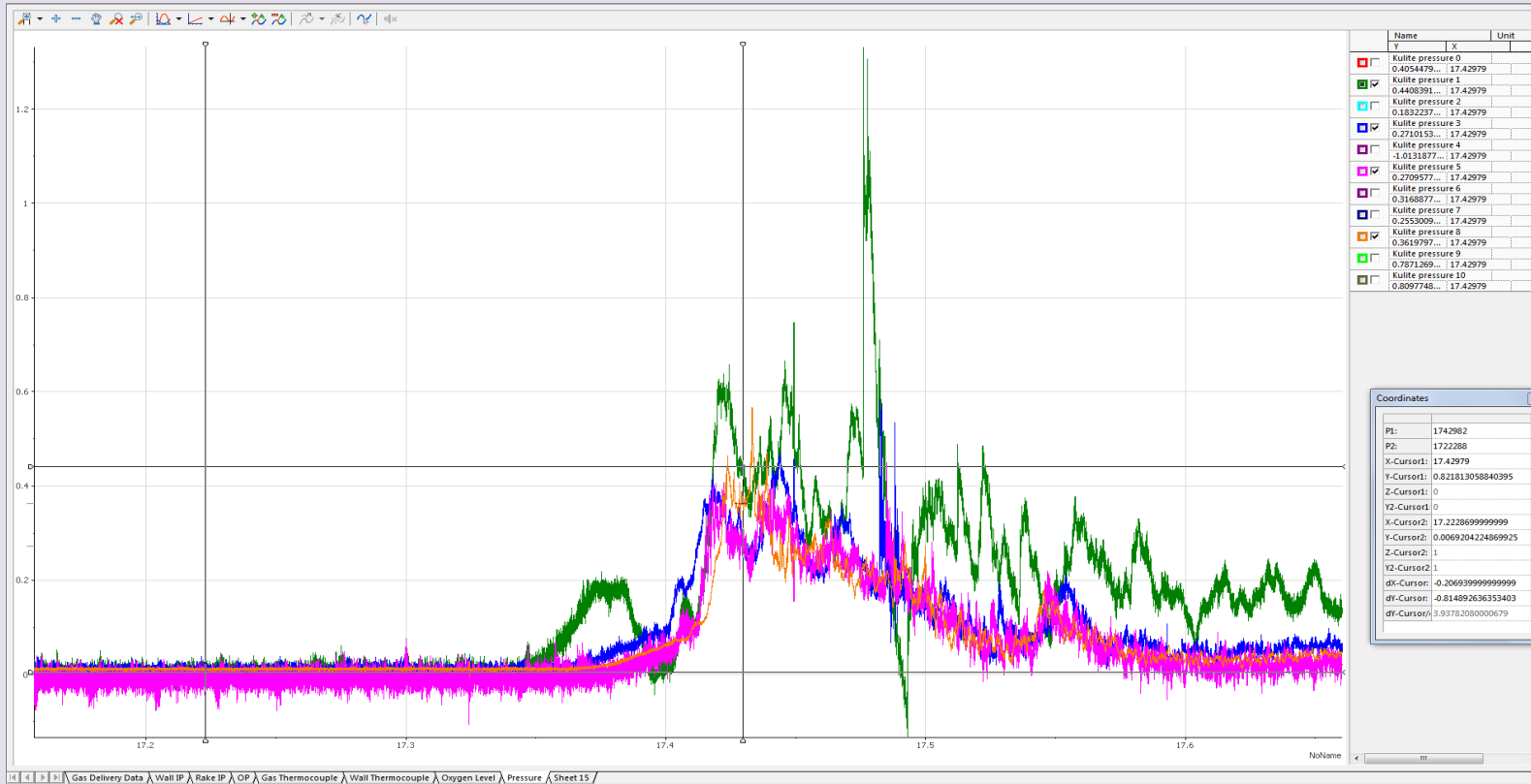
| Thermocouple number | Location | Position in tube (mm) | T <sub>max</sub> (deg C) | T <sub>i</sub> (deg C) |
|---------------------|----------|-----------------------|--------------------------|------------------------|
| TC0                 | CD1-R3   | 1258                  |                          |                        |
| TC2                 | CD2-R3   | 4258                  | 1345                     | 282                    |
| TC4                 | CD3-R3   | 7258                  | 1318                     | 275                    |
| TC6                 | CD4-R3   | 10258                 | 1221                     | 267                    |
| TC8                 | HR1-R2   | 13160                 | 781                      | 232                    |
| TC12                | CD3-T1   | 6258                  | 657                      | 256                    |
| TC13                | CD3-L1   | 6258                  | 679                      | 274                    |
| TC14                | CD3-B1   | 6258                  |                          |                        |
| TC15                | CD3-R1   | 6258                  | 683                      | 288                    |
| TC16                | HR2-R3M  | 14140                 | 726                      | 212                    |
| TC17                | HR2-R5L  | 14745                 | 821                      | 232                    |
| TC18                | HR2-R5U  | 14745                 | 785                      | 226                    |
| TC19                | HR3-L1M  | 15140                 | 805                      | 239                    |
| TC20                | HE2-R1L  | 16090                 |                          |                        |
| TC21                | HE2-R1U  | 16090                 | 212                      | 182                    |
| TC22                | HR5-R4M  | 19375                 | 520                      | 124                    |
| TC23                | HR6-R1M  | 19985                 | 439                      | 112                    |
| TC24                | HR6-R5L  | 21165                 | 390                      | 148                    |
| TC25                | HR6-R5U  | 21165                 | 469                      | 176                    |

surface thermocouples [not plotted]

|     |        |       |     |     |
|-----|--------|-------|-----|-----|
| TC1 | CD1-T2 | 1508  | 124 | 117 |
| TC3 | CD2-T2 | 4508  | 109 | 103 |
| TC5 | CD3-T2 | 7508  | 113 | 107 |
| TC7 | CD4-T2 | 10508 | 95  | 91  |

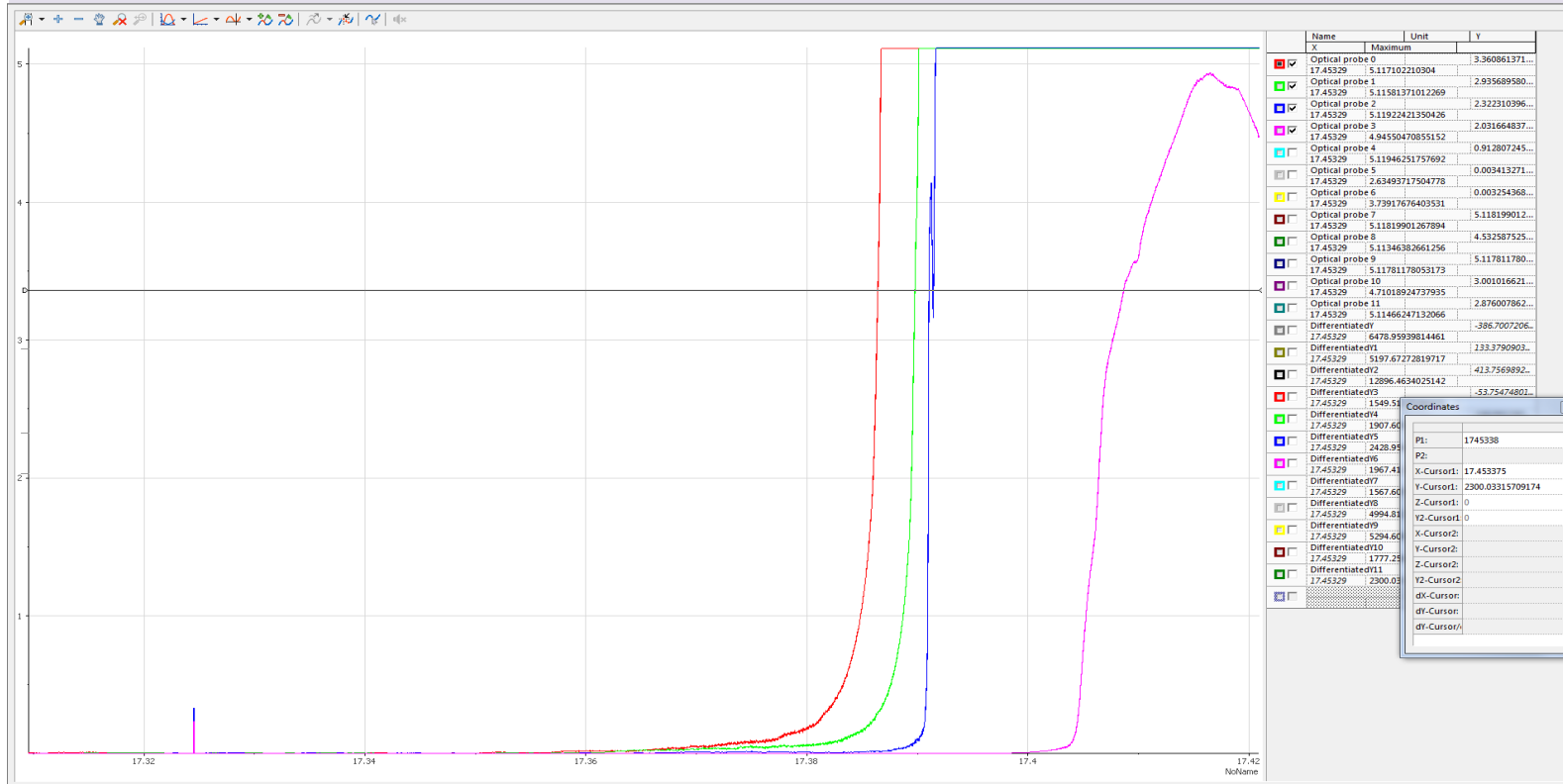


# Pressure





# Optical Probes



| Name              | Unit             | Y               |
|-------------------|------------------|-----------------|
| Optical probe 0   | Maximum          | 3.360861371...  |
| 17.45329          | 5.117102210304   |                 |
| Optical probe 1   |                  | 2.935689580...  |
| 17.45329          | 5.11581371012269 |                 |
| Optical probe 2   |                  | 2.322310396...  |
| 17.45329          | 5.11922421350426 |                 |
| Optical probe 3   |                  | 2.031664837...  |
| 17.45329          | 4.94550470855152 |                 |
| Optical probe 4   |                  | 0.912807245...  |
| 17.45329          | 5.11946251757692 |                 |
| Optical probe 5   |                  | 0.003413271...  |
| 17.45329          | 2.63493717504778 |                 |
| Optical probe 6   |                  | 0.003254368...  |
| 17.45329          | 3.73917676403531 |                 |
| Optical probe 7   |                  | 5.118199012...  |
| 17.45329          | 5.11819901267894 |                 |
| Optical probe 8   |                  | 4.532587525...  |
| 17.45329          | 5.11346382661256 |                 |
| Optical probe 9   |                  | 5.117811780...  |
| 17.45329          | 5.11781178053173 |                 |
| Optical probe 10  |                  | 3.001016621...  |
| 17.45329          | 4.71018924737935 |                 |
| Optical probe 11  |                  | 2.876007862...  |
| 17.45329          | 5.11466247132066 |                 |
| Differentiatedv   |                  | -386.7007206... |
| 17.45329          | 6478.95939814461 |                 |
| Differentiatedv1  |                  | 133.3790903...  |
| 17.45329          | 5197.67272819717 |                 |
| Differentiatedv2  |                  | 413.7568892...  |
| 17.45329          | 12896.4634025142 |                 |
| Differentiatedv3  |                  | -53.75474802... |
| 17.45329          | 1549.54          |                 |
| Differentiatedv4  |                  |                 |
| 17.45329          | 1907.66          |                 |
| Differentiatedv5  |                  |                 |
| 17.45329          | 2428.09          |                 |
| Differentiatedv6  |                  |                 |
| 17.45329          | 1967.44          |                 |
| Differentiatedv7  |                  |                 |
| 17.45329          | 1567.66          |                 |
| Differentiatedv8  |                  |                 |
| 17.45329          | 4894.81          |                 |
| Differentiatedv9  |                  |                 |
| 17.45329          | 5294.66          |                 |
| Differentiatedv10 |                  |                 |
| 17.45329          | 1777.23          |                 |
| Differentiatedv11 |                  |                 |
| 17.45329          | 2300.03          |                 |

**Coordinates**

P1: 1745338

P2:

X-Cursor1: 17.453375

Y-Cursor1: 2900.03315709174

Z-Cursor1: 0

X-Cursor2: 0

Y-Cursor2: 0

Z-Cursor2: 0

X-Cursor3:

Y-Cursor3:

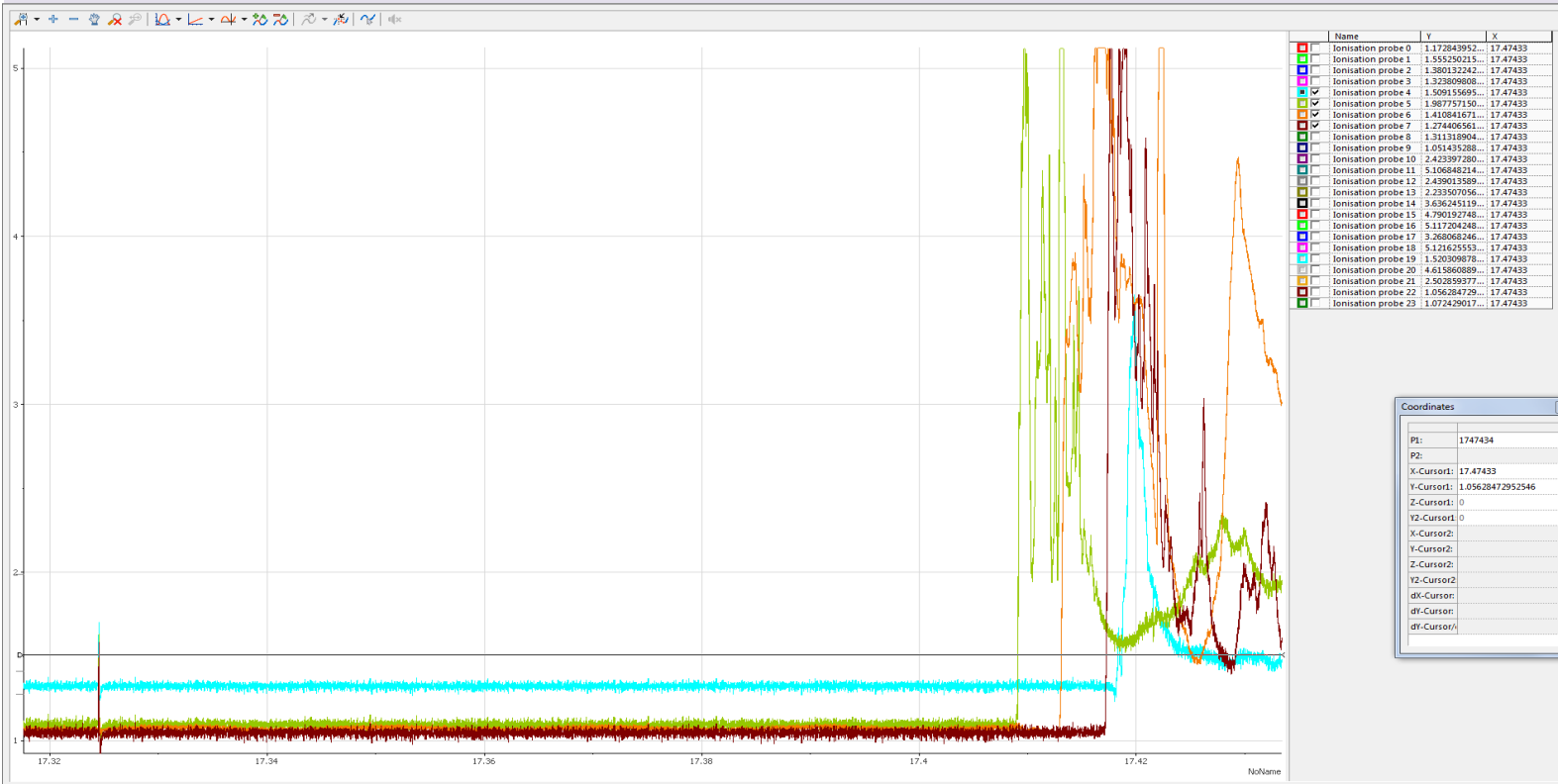
Z-Cursor3:

dX-Cursor:

dY-Cursor:

dZ-Cursor:

# Ionisation Probes



| Name                | Y              | X        |
|---------------------|----------------|----------|
| Ionisation probe 0  | 1.172843952... | 17.47433 |
| Ionisation probe 1  | 1.959290215... | 17.47433 |
| Ionisation probe 2  | 1.380132242... | 17.47433 |
| Ionisation probe 3  | 1.923809806... | 17.47433 |
| Ionisation probe 4  | 1.509155695... | 17.47433 |
| Ionisation probe 5  | 1.987757150... | 17.47433 |
| Ionisation probe 6  | 1.410841671... | 17.47433 |
| Ionisation probe 7  | 1.274406361... | 17.47433 |
| Ionisation probe 8  | 1.911318904... | 17.47433 |
| Ionisation probe 9  | 1.051435288... | 17.47433 |
| Ionisation probe 10 | 2.423997280... | 17.47433 |
| Ionisation probe 11 | 5.108848214... | 17.47433 |
| Ionisation probe 12 | 2.439013589... | 17.47433 |
| Ionisation probe 13 | 2.233507056... | 17.47433 |
| Ionisation probe 14 | 3.636245119... | 17.47433 |
| Ionisation probe 15 | 4.790192748... | 17.47433 |
| Ionisation probe 16 | 5.117204248... | 17.47433 |
| Ionisation probe 17 | 3.268068246... | 17.47433 |
| Ionisation probe 18 | 5.121623553... | 17.47433 |
| Ionisation probe 19 | 1.520309878... | 17.47433 |
| Ionisation probe 20 | 4.615860889... | 17.47433 |
| Ionisation probe 21 | 2.502559377... | 17.47433 |
| Ionisation probe 22 | 1.056284729... | 17.47433 |
| Ionisation probe 23 | 1.072429017... | 17.47433 |

**Coordinates**

P1: 174734

P2:

X-Cursor1: 17.4733

Y-Cursor1: 1.05628472952546

Z-Cursor1: 0

X-Cursor2:

Y-Cursor2:

Z-Cursor2:

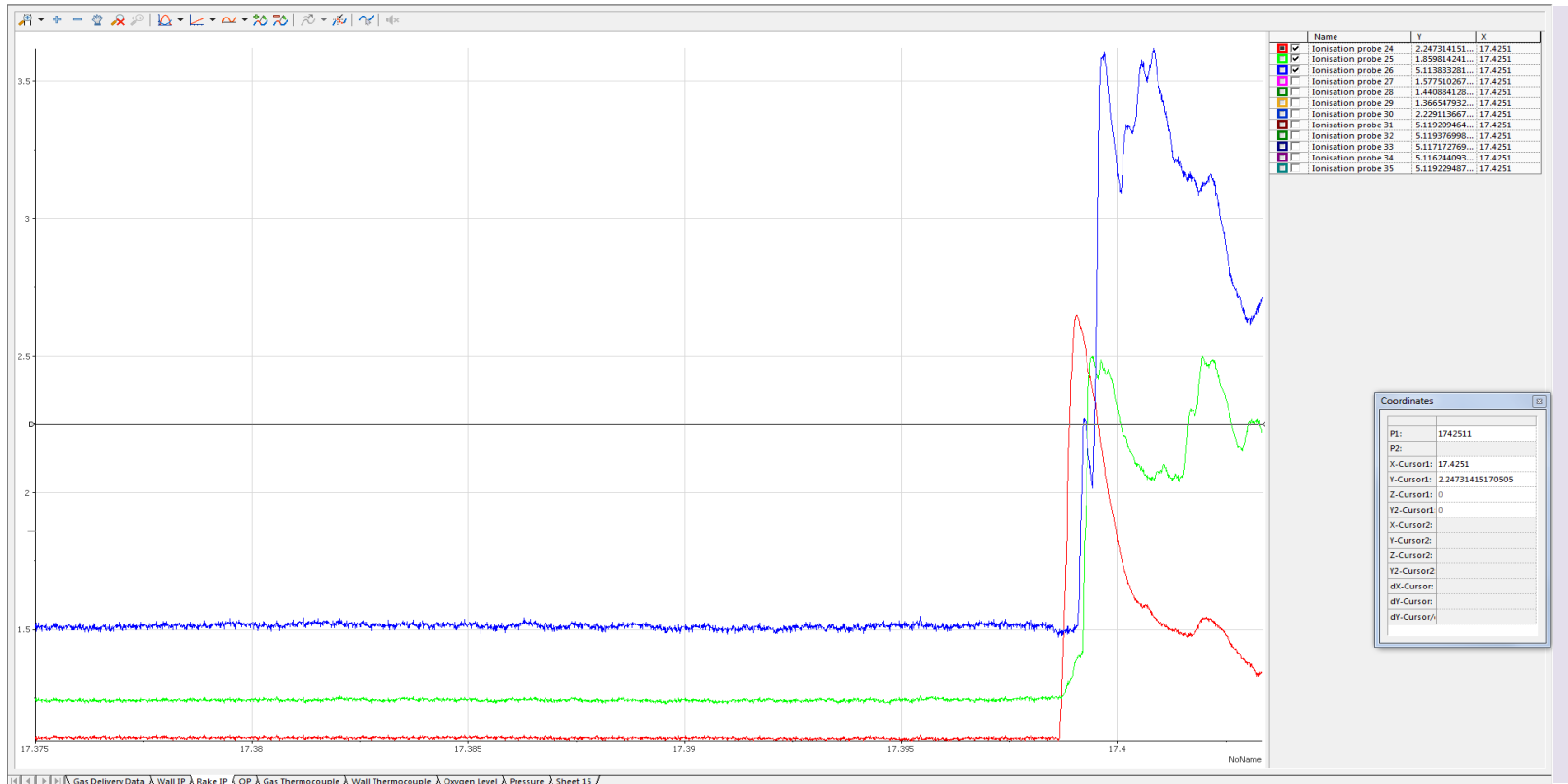
dX-Cursor:

dY-Cursor:

dZ-Cursor:

# Temperature





| Coordinates |                  |
|-------------|------------------|
| P1:         | 1742511          |
| P2:         |                  |
| X-Cursor1:  | 17.4251          |
| Y-Cursor1:  | 2.24731415170505 |
| Z-Cursor1:  | 0                |
| Y2-Cursor1: | 0                |
| X-Cursor2:  |                  |
| Y-Cursor2:  |                  |
| Z-Cursor2:  |                  |
| Y2-Cursor2: |                  |
| dX-Cursor:  |                  |
| dY-Cursor:  |                  |
| dZ-Cursor:  |                  |

| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE      | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|-----------|------|------|-------|
| -      |                 | CD1-T1          | CD      | 1              | T    | 1                   |                   | 1        | 1" BSPP   | 0    | 298  | 258   |
| TC1    | TS1-1           | CD1-T2          | CD      | 1              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 1508  |
| -      |                 | CD1-B1          | CD      | 1              | B    | 1                   |                   | 2        | 1" BSPP   | 0    | -298 | 258   |
| -      | NS1-1           | CD1-R1          | CD      | 1              | R    | 1                   |                   | 3        | 3/4" BSPP | 298  | 0    | 258   |
| -      | FS1-1           | CD1-L1          | CD      | 1              | L    | 1                   |                   | 4        | 3/4" BSPP | -298 | 0    | 258   |
| -      | NS1-2           | CD1-R2          | CD      | 1              | R    | 2                   |                   | 5        | 3/4" BSPP | 298  | 0    | 758   |
| -      | FS1-2           | CD1-L2          | CD      | 1              | L    | 2                   |                   | 6        | 3/4" BSPP | -298 | 0    | 758   |
| TC0    | NS1-3           | CD1-R3          | CD      | 1              | R    | 3                   |                   | 7        | 3/4" BSPP | 298  | 0    | 1258  |
| -      | FS1-3           | CD1-L3          | CD      | 1              | L    | 3                   |                   | 8        | 3/4" BSPP | -298 | 0    | 1258  |
| -      | NS1-4           | CD1-R4          | CD      | 1              | R    | 4                   |                   | 9        | 3/4" BSPP | 298  | 0    | 1758  |
| -      | FS1-4           | CD1-L4          | CD      | 1              | L    | 4                   |                   | 10       | 3/4" BSPP | -298 | 0    | 1758  |
| -      | NS1-5           | CD1-R5          | CD      | 1              | R    | 5                   |                   | 11       | 3/4" BSPP | 298  | 0    | 2258  |
| -      | FS1-5           | CD1-L5          | CD      | 1              | L    | 5                   |                   | 12       | 3/4" BSPP | -298 | 0    | 2258  |
| -      | NS1-6           | CD1-R6          | CD      | 1              | R    | 6                   |                   | 13       | 3/4" BSPP | 298  | 0    | 2758  |
| -      | FS1-6           | CD1-L6          | CD      | 1              | L    | 6                   |                   | 14       | 3/4" BSPP | -298 | 0    | 2758  |
| IGN    |                 | CD2-T1          | CD      | 2              | T    | 1                   |                   | 15       | 1" BSPP   | 0    | 298  | 3258  |
| TC3    | TS2-1           | CD2-T2          | CD      | 2              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 4508  |
| -      |                 | CD2-B1          | CD      | 2              | B    | 1                   |                   | 16       | 1" BSPP   | 0    | -298 | 2358  |
| -      | NS2-1           | CD2-R1          | CD      | 2              | R    | 1                   |                   | 17       | 3/4" BSPP | 298  | 0    | 3258  |
| -      | FS2-1           | CD2-L1          | CD      | 2              | L    | 1                   |                   | 18       | 3/4" BSPP | -298 | 0    | 3258  |
| -      | NS2-2           | CD2-R2          | CD      | 2              | R    | 2                   |                   | 19       | 3/4" BSPP | 298  | 0    | 3758  |
| -      | FS2-2           | CD2-L2          | CD      | 2              | L    | 2                   |                   | 20       | 3/4" BSPP | -298 | 0    | 3758  |
| TC2    | NS2-3           | CD2-R3          | CD      | 2              | R    | 3                   |                   | 21       | 3/4" BSPP | 298  | 0    | 4258  |
| -      | FS2-3           | CD2-L3          | CD      | 2              | L    | 3                   |                   | 22       | 3/4" BSPP | -298 | 0    | 4258  |
| -      | NS2-4           | CD2-R4          | CD      | 2              | R    | 4                   |                   | 23       | 3/4" BSPP | 298  | 0    | 4758  |
| -      | FS2-4           | CD2-L4          | CD      | 2              | L    | 4                   |                   | 24       | 3/4" BSPP | -298 | 0    | 4758  |
| -      | NS2-5           | CD2-R5          | CD      | 2              | R    | 5                   |                   | 25       | 3/4" BSPP | 298  | 0    | 5258  |
| -      | FS2-5           | CD2-L5          | CD      | 2              | L    | 5                   |                   | 26       | 3/4" BSPP | -298 | 0    | 5258  |
| -      | NS2-6           | CD2-R6          | CD      | 2              | R    | 6                   |                   | 27       | 3/4" BSPP | 298  | 0    | 5758  |
| -      | FS2-6           | CD2-L6          | CD      | 3              | L    | 6                   |                   | 28       | 3/4" BSPP | -298 | 0    | 5758  |
| TC12   |                 | CD3-T1          | CD      | 3              | T    | 1                   |                   | 29       | 1" BSPP   | 0    | 298  | 6258  |
| TC5    | TS1-1           | CD3-T2          | CD      | 3              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 7508  |
| TC14   |                 | CD3-B1          | CD      | 3              | B    | 1                   |                   | 30       | 1" BSPP   | 0    | -298 | 6258  |
| TC15   | NS3-1           | CD3-R1          | CD      | 3              | R    | 1                   |                   | 31       | 3/4" BSPP | 298  | 0    | 6258  |
| TC13   | FS3-1           | CD3-L1          | CD      | 3              | L    | 1                   |                   | 32       | 3/4" BSPP | -298 | 0    | 6258  |
| -      | NS3-2           | CD3-R2          | CD      | 3              | R    | 2                   |                   | 33       | 3/4" BSPP | 298  | 0    | 6758  |
| -      | FS3-2           | CD3-L2          | CD      | 3              | L    | 2                   |                   | 34       | 3/4" BSPP | -298 | 0    | 6758  |
| TC4    | NS3-3           | CD3-R3          | CD      | 3              | R    | 3                   |                   | 35       | 3/4" BSPP | 298  | 0    | 7258  |
| -      | FS3-3           | CD3-L3          | CD      | 3              | L    | 3                   |                   | 36       | 3/4" BSPP | -298 | 0    | 7258  |
| -      | NS3-4           | CD3-R4          | CD      | 3              | R    | 4                   |                   | 37       | 3/4" BSPP | 298  | 0    | 7758  |
| -      | FS3-4           | CD3-L4          | CD      | 3              | L    | 4                   |                   | 38       | 3/4" BSPP | -298 | 0    | 7758  |
| KU0    | NS3-5           | CD3-R5          | CD      | 3              | R    | 5                   |                   | 39       | 3/4" BSPP | 298  | 0    | 8258  |
| -      | FS3-5           | CD3-L5          | CD      | 3              | L    | 5                   |                   | 40       | 3/4" BSPP | -298 | 0    | 8258  |
| -      | NS3-6           | CD3-R6          | CD      | 3              | R    | 6                   |                   | 41       | 3/4" BSPP | 298  | 0    | 8758  |
| -      | FS3-6           | CD3-L6          | CD      | 3              | L    | 6                   |                   | 42       | 3/4" BSPP | -298 | 0    | 8758  |
| -      |                 | CD4-T1          | CD      | 4              | T    | 1                   |                   | 43       | 1" BSPP   | 0    | 298  | 9258  |
| TC7    | TS1-1           | CD4-T2          | CD      | 4              | T    | 2                   |                   | NA       | SURFACE   | 0    | 298  | 10508 |
| -      |                 | CD4-B1          | CD      | 4              | B    | 1                   |                   | 44       | 1" BSPP   | 0    | -298 | 9258  |
| -      | NS4-1           | CD4-R1          | CD      | 4              | R    | 1                   |                   | 45       | 3/4" BSPP | 298  | 0    | 9258  |
| -      | FS4-1           | CD4-L1          | CD      | 4              | L    | 1                   |                   | 46       | 3/4" BSPP | -298 | 0    | 9258  |
| KU1    | NS4-2           | CD4-R2          | CD      | 4              | R    | 2                   |                   | 47       | 3/4" BSPP | 298  | 0    | 9758  |
| -      | FS4-2           | CD4-L2          | CD      | 4              | L    | 2                   |                   | 48       | 3/4" BSPP | -298 | 0    | 9758  |
| TC6    | NS4-3           | CD4-R3          | CD      | 4              | R    | 3                   |                   | 49       | 3/4" BSPP | 298  | 0    | 10258 |
| -      | FS4-3           | CD4-L3          | CD      | 4              | L    | 3                   |                   | 50       | 3/4" BSPP | -298 | 0    | 10258 |
| -      | NS4-4           | CD4-R4          | CD      | 4              | R    | 4                   |                   | 51       | 3/4" BSPP | 298  | 0    | 10758 |
| OP0    | FS4-4           | CD4-L4          | CD      | 4              | L    | 4                   |                   | 52       | 3/4" BSPP | -298 | 0    | 10758 |
| -      | NS4-5           | CD4-R5          | CD      | 4              | R    | 5                   |                   | 53       | 3/4" BSPP | 298  | 0    | 11258 |
| -      | FS4-5           | CD4-L5          | CD      | 4              | L    | 5                   |                   | 54       | 3/4" BSPP | -298 | 0    | 11258 |
| OP1    | NS4-6           | CD4-R6          | CD      | 4              | R    | 6                   |                   | 55       | 3/4" BSPP | 298  | 0    | 11758 |

| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE           | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|----------------|------|------|-------|
| IP0    | FS4-6           | CD4-L6          | CD      | 4              | L    | 6                   |                   | 56       | 3/4" BSPP      | -298 | 0    | 11758 |
| OP2    |                 | HR1-R1          | HR      | 1              | R    | 1                   |                   | 57       | 3/4" BSPP      | 308  | 0    | 12152 |
| -      |                 | HR1-L1          | HR      | 1              | L    | 1                   |                   | 58       | 3/4" BSPP      | -308 | 0    | 12152 |
| TC8    |                 | HR1-R2          | HR      | 1              | R    | 2                   |                   | 59       | 3/4" BSPP      | 393  | 0    | 13160 |
| -      |                 | HR1-L2          | HR      | 1              | L    | 2                   |                   | 60       | 3/4" BSPP      | -393 | 0    | 13160 |
| RA1    |                 | HR2-R2M         | HR      | 2              | R    | 2                   | M                 | 61       | 11/4" BSPP     | 448  | 70   | 13785 |
| RA1    |                 | HR2-L2M         | HR      | 2              | L    | 2                   | M                 | 62       | 11/4" BSPP     | -448 | 70   | 13785 |
| TC16   |                 | HR2-R3M         | HR      | 2              | R    | 3                   | M                 | 63       | 3/4" BSPP      | 528  | 410  | 14140 |
| -      |                 | HR2-L3M         | HR      | 2              | L    | 3                   | M                 | 64       | 3/4" BSPP      | -528 | 410  | 14140 |
| -      |                 | HR2-T3          | HR      | 2              | T    | 3                   |                   | 65       | 1" BSPP        | 0    | 1122 | 14215 |
| RA2    |                 | HR2-R4M         | HR      | 2              | R    | 4                   | M                 | 66       | 11/4" BSPP     | 598  | 700  | 14475 |
| RA2    |                 | HR2-L4M         | HR      | 2              | L    | 4                   | M                 | 67       | 11/4" BSPP     | -598 | 700  | 14475 |
| -      |                 | HR2-B5          | HR      | 2              | B    | 5                   |                   | 68       | 1" BSPP        | 0    | -100 | 14745 |
| KU2    |                 | HR2-T5          | HR      | 2              | T    | 5                   |                   | 69       | 1" BSPP        | 0    | 2315 | 14745 |
| TC17   |                 | HR2-R5L         | HR      | 2              | R    | 5                   | L                 | 70       | 3/4" BSPP      | 662  | 310  | 14745 |
| IP1    |                 | HR2-L5L         | HR      | 2              | L    | 5                   | L                 | 71       | 3/4" BSPP      | -662 | 310  | 14745 |
| OP3    |                 | HR2-R5M         | HR      | 2              | R    | 5                   | M                 | 72       | 3/4" BSPP      | 662  | 975  | 14745 |
| IP2    |                 | HR2-L5M         | HR      | 2              | L    | 5                   | M                 | 73       | 3/4" BSPP      | -662 | 975  | 14745 |
| TC18   |                 | HR2-R5U         | HR      | 2              | R    | 5                   | U                 | 74       | 3/4" BSPP      | 662  | 1660 | 14745 |
| IP3    |                 | HR2-L5U         | HR      | 2              | L    | 5                   | U                 | 75       | 3/4" BSPP      | -662 | 1660 | 14745 |
| KU3    |                 | HR3-L1L         | HR      | 3              | L    | 1                   | L                 | 76       | 3/4" BSPP      | -700 | 400  | 15140 |
| TC19   |                 | HR3-L1M         | HR      | 3              | L    | 1                   | M                 | 77       | 11/4" BSPP     | -700 | 1335 | 15140 |
| IP8    |                 | HR3-L1U         | HR      | 3              | L    | 1                   | U                 | 78       | 3/4" BSPP      | -700 | 2270 | 15140 |
| IP4    |                 | HR3-R1L         | HR      | 3              | R    | 1                   | L                 | 136      | 3/4" BSPP      | 700  | 400  | 15140 |
| IP5    |                 | HR3-R1LM        | HR      | 3              | R    | 1                   | LM                | 137      | 3/4" BSPP      | 700  | 868  | 15140 |
| IP6    |                 | HR3-R1M         | HR      | 3              | R    | 1                   | M                 | 138      | 3/4" BSPP      | 700  | 1335 | 15140 |
| -      |                 | HR3-R1UM        | HR      | 3              | R    | 1                   | UM                | 139      | 3/4" BSPP      | 700  | 1802 | 15140 |
| IP7    |                 | HR3-R1U         | HR      | 3              | R    | 1                   | U                 | 140      | 3/4" BSPP      | 700  | 2270 | 15140 |
| -      |                 | HE1-R1L         | HE      | 1              | R    | 1                   | L                 | 79       | 3/4" BSPP      | 700  | 400  | 15600 |
| -      |                 | HE1-R1M         | HE      | 1              | R    | 1                   | M                 | 80       | 3/4" BSPP      | 700  | 1335 | 15600 |
| KU4    |                 | HE1-R1U         | HE      | 1              | R    | 1                   | U                 | 81       | 3/4" BSPP      | 700  | 2270 | 15600 |
| TC20   |                 | HE2-R1L         | HE      | 2              | R    | 1                   | L                 | 83       | 3/4" BSPP      | 700  | 400  | 16090 |
| IP9    |                 | HE2-R1M         | HE      | 2              | R    | 1                   | M                 | 84       | 3/4" BSPP      | 700  | 1335 | 16090 |
| TC21   |                 | HE2-R1U         | HE      | 2              | R    | 1                   | U                 | 85       | 3/4" BSPP      | 700  | 2270 | 16090 |
| KU5    |                 | HE3-R1L         | HE      | 3              | R    | 1                   | L                 | 87       | 3/4" BSPP      | 700  | 400  | 16580 |
| -      |                 | HE3-R1M         | HE      | 3              | R    | 1                   | M                 | 88       | 3/4" BSPP      | 700  | 1335 | 16580 |
| -      |                 | HE3-R1U         | HE      | 3              | R    | 1                   | U                 | 89       | 3/4" BSPP      | 700  | 2270 | 16580 |
| OP4    |                 | HE1-T1          | HE      | 1              | T    | 1                   |                   | 82       | 3/4" BSPP HOLE | -47  | 2735 | 15600 |
| OP5    |                 | HE2-T1          | HE      | 2              | T    | 1                   |                   | 86       | 3/4" BSPP HOLE | 0    | 2735 | 16090 |
| OP6    |                 | HE3-T1          | HE      | 3              | T    | 1                   |                   | 90       | 3/4" BSPP HOLE | -47  | 2735 | 16580 |
| OP7    |                 | HR4-T1          | HR      | 4              | T    | 1                   |                   | 91       | 1" BSPP        | 0    | 2735 | 16985 |
| -      |                 | HR4-B1          | HR      | 4              | B    | 1                   |                   | 92       | 1" BSPP        | 0    | -65  | 16985 |
| KU6    |                 | HR4-R1L         | HR      | 4              | R    | 1                   | L                 | 93       | 3/4" BSPP      | 700  | 400  | 16985 |
| IP10   |                 | HR4-L1L         | HR      | 4              | L    | 1                   | L                 | 94       | 3/4" BSPP      | -700 | 400  | 16985 |
| OP8    |                 | HR4-R1M         | HR      | 4              | R    | 1                   | M                 | 95       | 3/4" BSPP      | 700  | 1335 | 16985 |
| IP11   |                 | HR4-L1M         | HR      | 4              | L    | 1                   | M                 | 96       | 3/4" BSPP      | -700 | 1335 | 16985 |
| IP13   |                 | HR4-R1U         | HR      | 4              | R    | 1                   | U                 | 97       | 3/4" BSPP      | 700  | 2270 | 16985 |
| IP12   |                 | HR4-L1U         | HR      | 4              | L    | 1                   | U                 | 98       | 3/4" BSPP      | -700 | 2270 | 16985 |
| RA3    |                 | HR4-R3M         | HR      | 4              | R    | 3                   | M                 | 99       | 11/4" BSPP     | 700  | 1335 | 17575 |
| RA3    |                 | HR4-L3M         | HR      | 4              | L    | 3                   | M                 | 100      | 11/4" BSPP     | -700 | 1335 | 17575 |
| RA4    |                 | HR4-R3L         | HR      | 4              | R    | 3                   | L                 | 141      | 11/4" BSPP     | 700  | 400  | 17575 |
| IP14   |                 | HR4-R3U         | HR      | 4              | R    | 3                   | U                 | 142      | 3/4" BSPP      | 700  | 2270 | 17575 |
| RA4    |                 | HR4-L3L         | HR      | 4              | L    | 3                   | L                 | 143      | 11/4" BSPP     | -700 | 400  | 17575 |
| -      |                 | HR4-L3U         | HR      | 4              | L    | 3                   | U                 | 144      | 3/4" BSPP      | -700 | 2270 | 17575 |
| IP18   |                 | HR4-R5M         | HR      | 4              | R    | 5                   | M                 | 101      | 3/4" BSPP      | 700  | 1335 | 18165 |
| IP16   |                 | HR4-L5M         | HR      | 4              | L    | 5                   | M                 | 102      | 3/4" BSPP      | -700 | 1335 | 18165 |
| OP9    |                 | HR4-R5L         | HR      | 4              | R    | 5                   | L                 | 145      | 3/4" BSPP      | 700  | 400  | 18165 |
| KU7    |                 | HR4-R5U         | HR      | 4              | R    | 5                   | U                 | 146      | 3/4" BSPP      | 700  | 2270 | 18165 |
| IP15   |                 | HR4-L5L         | HR      | 4              | L    | 5                   | L                 | 147      | 3/4" BSPP      | -700 | 400  | 18165 |

| Sensor | OLD DESIGNATION | NEW DESIGNATION | Section | Section Number | Side | Horizontal Location | Vertical Location | PORT REF | SIZE       | "X"  | "Y"  | "Z"   |
|--------|-----------------|-----------------|---------|----------------|------|---------------------|-------------------|----------|------------|------|------|-------|
| IP17   |                 | HR4-L5U         | HR      | 4              | L    | 5                   | U                 | 148      | 3/4" BSPP  | -700 | 2270 | 18165 |
| -      |                 | HR5-R1M         | HR      | 5              | R    | 1                   | M                 | NA       | SURFACE    | 700  | 1200 | 18455 |
| OP10   |                 | HR5-T2          | HR      | 5              | T    | 2                   |                   | 103      | 1" BSPP    | 0    | 2735 | 18775 |
| -      |                 | HR5-B2          | HR      | 5              | B    | 2                   |                   | 104      | 1" BSPP    | 0    | -65  | 18775 |
| KU8    |                 | HR5-R2L         | HR      | 5              | R    | 2                   | L                 | 105      | 3/4" BSPP  | 700  | 400  | 18775 |
| IP19   |                 | HR5-L2L         | HR      | 5              | L    | 2                   | L                 | 106      | 3/4" BSPP  | -700 | 400  | 18775 |
| OP11   |                 | HR5-R2M         | HR      | 5              | R    | 2                   | M                 | 107      | 3/4" BSPP  | 700  | 1335 | 18775 |
| IP20   |                 | HR5-L2M         | HR      | 5              | L    | 2                   | M                 | 108      | 3/4" BSPP  | -700 | 1335 | 18775 |
| IP22   |                 | HR5-R2U         | HR      | 5              | R    | 2                   | U                 | 109      | 3/4" BSPP  | 700  | 2270 | 18775 |
| IP21   |                 | HR5-L2U         | HR      | 5              | L    | 2                   | U                 | 110      | 3/4" BSPP  | -700 | 2270 | 18775 |
| TC22   |                 | HR5-R4M         | HR      | 5              | R    | 4                   | M                 | 111      | 11/4" BSPP | 700  | 1335 | 19375 |
| -      |                 | HR5-L4M         | HR      | 5              | L    | 4                   | M                 | 112      | 11/4" BSPP | -700 | 1335 | 19375 |
| TC23   |                 | HR6-R1M         | HR      | 6              | R    | 1                   | M                 | 113      | 3/4" BSPP  | 700  | 1335 | 19985 |
| IP23   |                 | HR6-L1M         | HR      | 6              | L    | 1                   | M                 | 114      | 3/4" BSPP  | -700 | 1335 | 19985 |
| -      |                 | HR6-T3          | HR      | 6              | T    | 3                   |                   | 115      | 1" BSPP    | 0    | 2735 | 20575 |
| -      |                 | HR6-B3          | HR      | 6              | B    | 3                   |                   | 116      | 3/4" BSPP  | 0    | -65  | 20575 |
| KU9    |                 | HR6-R3L         | HR      | 6              | R    | 3                   | L                 | 117      | 3/4" BSPP  | 700  | 400  | 20575 |
| -      |                 | HR6-L3L         | HR      | 6              | L    | 3                   | L                 | 118      | 3/4" BSPP  | -700 | 400  | 20575 |
| -      |                 | HR6-R3M         | HR      | 6              | R    | 3                   | M                 | 119      | 11/4" BSPP | 700  | 1335 | 20575 |
| -      |                 | HR6-L3M         | HR      | 6              | L    | 3                   | M                 | 120      | 11/4" BSPP | -700 | 1335 | 20575 |
| -      |                 | HR6-R3U         | HR      | 6              | R    | 3                   | U                 | 121      | 3/4" BSPP  | 700  | 2270 | 20575 |
| -      |                 | HR6-L3U         | HR      | 6              | L    | 3                   | U                 | 122      | 3/4" BSPP  | -700 | 2270 | 20575 |
| -      |                 | HR6-B5          | HR      | 6              | B    | 5                   |                   | 123      | 1" BSPP    | 0    | -65  | 21165 |
| TC24   |                 | HR6-R5L         | HR      | 6              | R    | 5                   | L                 | 124      | 3/4" BSPP  | 700  | 400  | 21165 |
| KU10   |                 | HR6-L5L         | HR      | 6              | L    | 5                   | L                 | 125      | 3/4" BSPP  | -700 | 400  | 21165 |
| -      |                 | HR6-R5M         | HR      | 6              | R    | 5                   | M                 | 126      | 3/4" BSPP  | 700  | 1335 | 21165 |
| -      |                 | HR6-L5M         | HR      | 6              | L    | 5                   | M                 | 127      | 3/4" BSPP  | -700 | 1335 | 21165 |
| TC25   |                 | HR6-R5U         | HR      | 6              | R    | 5                   | U                 | 128      | 3/4" BSPP  | 700  | 2270 | 21165 |
| -      |                 | HR6-L5U         | HR      | 6              | L    | 5                   | U                 | 129      | 3/4" BSPP  | -700 | 2270 | 21165 |
| -      |                 | EP-1L           | EP      |                |      | 1                   | L                 | 130      | 1" BSPP    | 650  | -15  | 21330 |
| -      |                 | EP-2L           | EP      |                |      | 2                   | L                 | 131      | 1" BSPP    | 0    | -15  | 21330 |
| -      |                 | EP-3L           | EP      |                |      | 3                   | L                 | 132      | 1" BSPP    | -650 | -15  | 21330 |
| -      |                 | EP-1M           | EP      |                |      | 1                   | M                 | 133      | 1" BSPP    | 250  | 1335 | 21330 |
| -      |                 | EP-2M           | EP      |                |      | 2                   | M                 | 134      | 1" BSPP    | -250 | 1335 | 21330 |
| -      |                 | EP-1U           | EP      |                |      | 1                   | U                 | 135      | 3/4" BSPP  | 0    | 2270 | 21330 |

