

08 January 2019
15:24:16
HRSR Test 29

40/60 H2/CH4
4.1 °C
979 mbar
4.9 m/s
NW
84.00%

9.9450 kg/s

0.51

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

Weather: Sunny part cloud. Cold and crisp, light wind.

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

Engine Speed: 40%; 11,800 rpm

Test on 60% CH4 40% H2 at an intended EQR of 0.50

The test gave a strong combustion event and most sensors provided an identifiable response.

Highest overpressure of 250 mbar seen in duct on KU1

**Ionisation Probes**

**Ionisation Rakes**

**Optical Probes**

Max overpressure  
250 mbar

Max. gas temperature  
907 °C

Max. flame speed  
142 m/s

Max. flame speed  
133 m/s

Max. flame speed  
217 m/s

Initial gas temperature  
375 °C

Location of Max. Overpressure  
KU1  
CD4-R2  
9758 mm

sensor  
label  
distance

Location of Max. Temperature  
TC17  
HR2-R5L  
14745 mm

sensor  
label  
distance

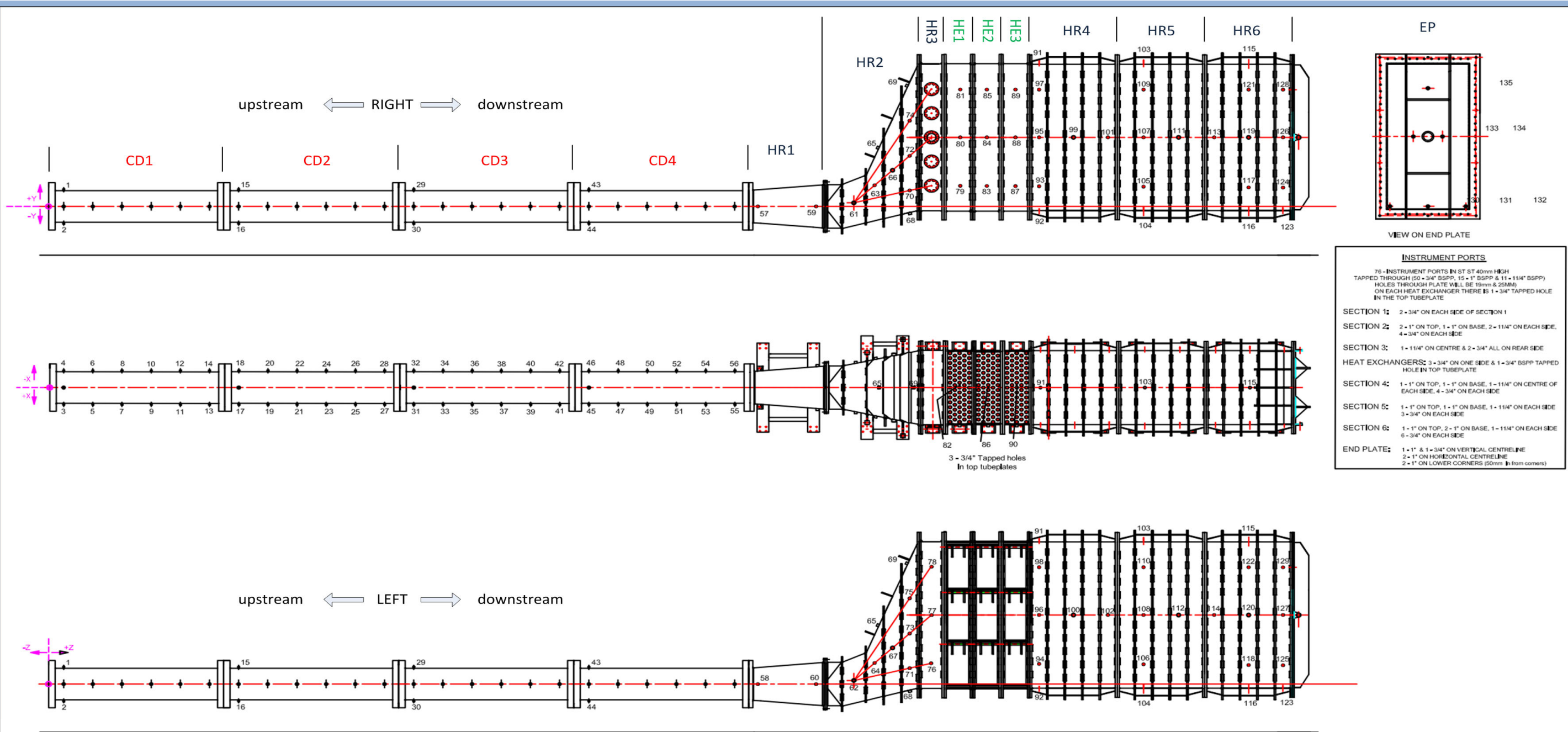
Location of Max. Flame Speed  
IP9  
HE2-R1M  
16090 mm

sensor  
label  
distance

Location of Max. Flame Speed  
RA1  
HR2-R2M  
13785 mm

sensor  
label  
istance

Location of Max. Flame Speed  
OP1  
CD4-R6  
11758 mm



**INSTRUMENT PORTS**

76 - INSTRUMENT PORTS IN ST ST 40mm HIGH TAPPED THROUGH (50 - 3/4" BSPP, 15 - 1" BSPP & 11 - 1/4" BSPP) HOLES THROUGH PLATE WILL BE 19mm & 25mm ON EACH HEAT EXCHANGER THERE IS 1 - 3/4" TAPPED HOLE IN THE TOP TUBEPLATE

**SECTION 1:** 2 - 3/4" ON EACH SIDE OF SECTION 1

**SECTION 2:** 2 - 1" ON TOP, 1 - 1" ON BASE, 2 - 1/4" ON EACH SIDE, 4 - 3/4" ON EACH SIDE

**SECTION 3:** 1 - 1/4" ON CENTRE & 2 - 3/4" ALL ON REAR SIDE

**HEAT EXCHANGERS:** 3 - 3/4" ON ONE SIDE & 1 - 3/4" BSPP TAPPED HOLE IN TOP TUBEPLATE

**SECTION 4:** 1 - 1" ON TOP, 1 - 1" ON BASE, 1 - 1/4" ON CENTRE OF EACH SIDE, 4 - 3/4" ON EACH SIDE

**SECTION 5:** 1 - 1" ON TOP, 1 - 1" ON BASE, 1 - 1/4" ON EACH SIDE, 3 - 3/4" ON EACH SIDE

**SECTION 6:** 1 - 1" ON TOP, 2 - 1" ON BASE, 1 - 1/4" ON EACH SIDE, 6 - 3/4" ON EACH SIDE

**END PLATE:** 1 - 1" & 1 - 3/4" ON VERTICAL CENTRELINE  
2 - 1" ON HORIZONTAL CENTRELINE  
2 - 1" ON LOWER CORNERS (50mm from corners)

**Naming Convention**

<p>Section Identifier i.e. HE, HR, CD or EP</p> <p>Section Number (1-6) Numbered from downstream to upstream</p>	<p><b>HR1 - R1U</b></p> <p>Side i.e. R, L, T or B</p>	<p>Vertical position in section (sides only) i.e. U, M or L. Absence of letter denotes centreline</p> <p>Longitudinal position in section (numbered from 1)</p>
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**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

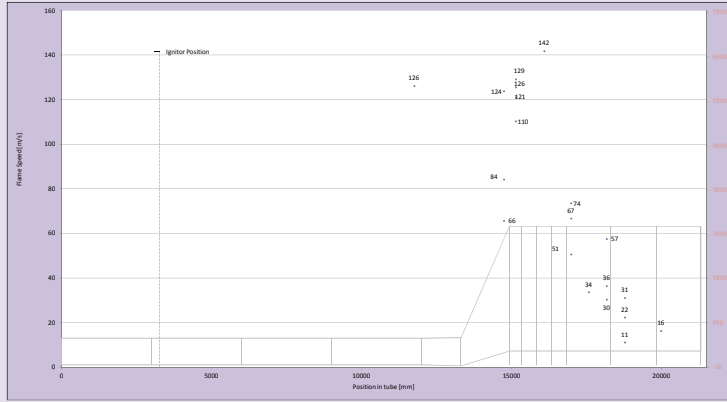
There are 13 sections on the rig

- 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: 3258 mm Time of Ignition: 17.05654 seconds

IP Number	Location label	Data Name	Position in tube (mm)	Flame arrival time (s)	Avg Flame speed from last sensor (m/s)
IP0	CO4-L4	ionisation probe 0	11758	17.12395	126
IP1	HR2-LSL	ionisation probe 1	14745	17.14808	124
IP2	HR2-LSM	ionisation probe 2	14745	17.15946	84
IP3	HR2-LSM	ionisation probe 3	14745	17.16942	66
IP4	HR3-R1L	ionisation probe 4	15140	17.14856	129
IP5	HR3-R1SM	ionisation probe 5	15140	17.15118	126
IP6	HR3-R1SM	ionisation probe 6	15140	17.15472	121
IP7	HR3-R1SM	ionisation probe 7	15140	17.16431	110
IP8	HR3-R1SM	ionisation probe 8	15140	17.16593	
IP9	HR4-R1M	ionisation probe 9	16985	17.16142	142
IP10	HR4-L1L	ionisation probe 10	16985	NW	
IP11	HR4-L1M	ionisation probe 11	16985	17.18990	74
IP12	HR4-L1M	ionisation probe 12	16985	17.20299	67
IP13	HR4-L1M	ionisation probe 13	16985	17.20075	51
IP14	HR4-L1L	ionisation probe 14	17575	17.23682	34
IP15	HR4-L1L	ionisation probe 15	18165	17.19165	
IP16	HR4-L1M	ionisation probe 16	18165	17.21045	57
IP17	HR4-L1M	ionisation probe 17	18165	17.26542	30
IP18	HR4-R1M	ionisation probe 18	18165	17.21856	36
IP19	HR5-L1L	ionisation probe 19	18775	17.21138	31
IP20	HR5-L1M	ionisation probe 20	18775	17.23784	22
IP21	HR5-L1M	ionisation probe 21	18775	17.30786	
IP22	HR5-L1M	ionisation probe 22	18775	17.34503	11
IP23	HR6-L1M	ionisation probe 23	19985	17.31186	16

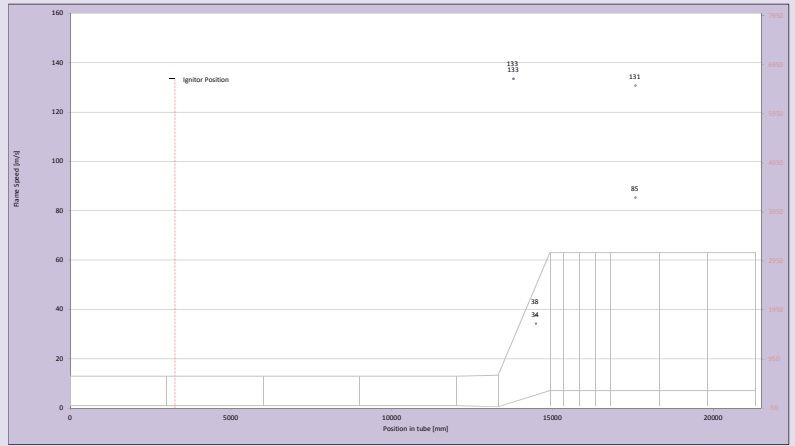
KEY: ND - not detected - sensor working but flame too weak to be picked up  
 NW - not working - sensor not working



Location of igniter: 3258 mm Time of ignition: 17.05656 seconds

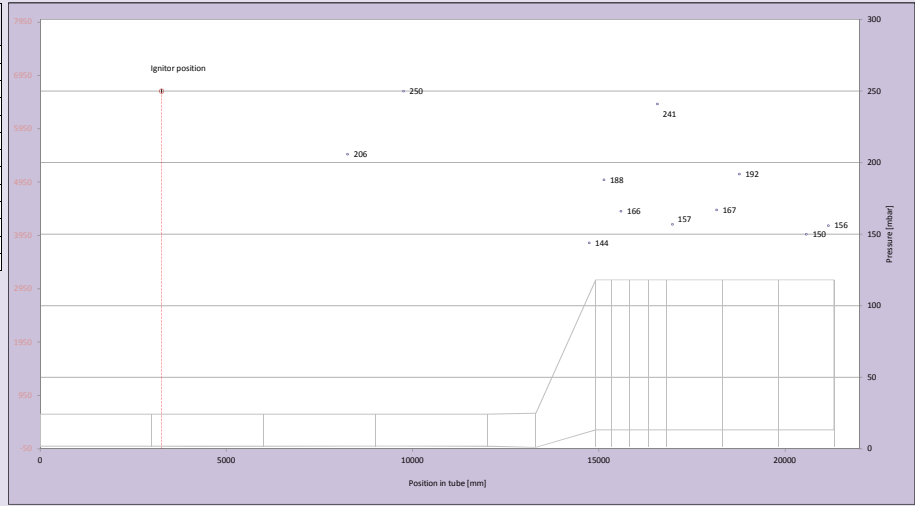
Wake Number	IP Number	Location label	Data Name	Position in tube (mm)	Flame arrival time (s)	Avg Flame speed from last sensor (m/s)
RA1	IP24	HR2-R2M	IP24	13785	17.1354	133
RA1	IP25	HR2-R2M	IP25	13785	17.1355	133
RA1	IP26	HR2-R2M	IP26	13785	NW	
RA2	IP27	HR2-R4M	IP27	14475	17.1556	34
RA2	IP28	HR2-R4M	IP28	14475	17.1538	38
RA2	IP29	HR2-R4M	IP29	14475	17.1531	
RA3	IP30	HR4-R3M	IP30	17575	NW	
RA3	IP31	HR4-R3M	IP31	17575	NW	
RA3	IP32	HR4-R3M	IP32	17575	17.1768	131
RA4	IP33	HR4-R3L	IP33	17575	17.1799	85
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

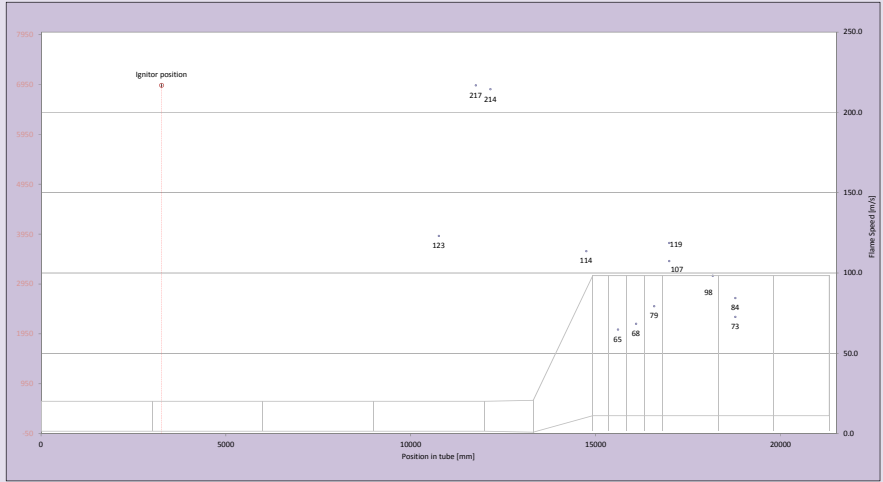
Transducer number	Location	Position in tube [mm]	$\Delta P_{max}$ [mbar]	Time $\Delta P_{max}$ [sec]
KU0	CD3-R5	8258	206	17.1921
KU1	CD4-R2	9758	250	17.1913
KU2	HR2-T5	14745	144	17.0254
KU3	HR3-L1L	15140	188	17.1835
KU4	HE1-R1U	15600	166	17.1828
KU5	HE3-R1L	16580	241	17.2068
KU6	HR4-R1L	16985	157	17.1835
KU7	HR4-R5U	18165	167	17.1834
KU8	HR5-R2L	18775	192	17.1898
KU9	HR6-R2L	20575	150	17.1930
KU10	HR6-L5L	21165	156	17.1930



Location of igniter 3250 mm Time of ignition 17.05656 seconds

OP Number	Location label	Position in tube (mm)	Flame arrival time (s)	Average flame speed (m/s)
OP0	CD4-L4	10758	17.1175	123.1
OP1	CD4-R6	11758	17.1221	216.9
OP2	HR1-R1	12152	17.1240	214.5
OP3	HR2-R5M	14745	17.1526	113.7
OP4	HE1-T1	15600	17.1922	64.8
OP5	HE2-T1	16090	17.1954	68.4
OP6	HE3-T1	16580	17.1908	79.4
OP7	HR4-T1	16985	17.1699	118.8
OP8	HR4-R1M	16985	17.1254	107.5
OP9	HR4-R5L	18165	17.1929	98.3
OP10	HRS-T2	18775	17.2124	84.5
OP11	HRS-R2M	18775	17.2277	72.7

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



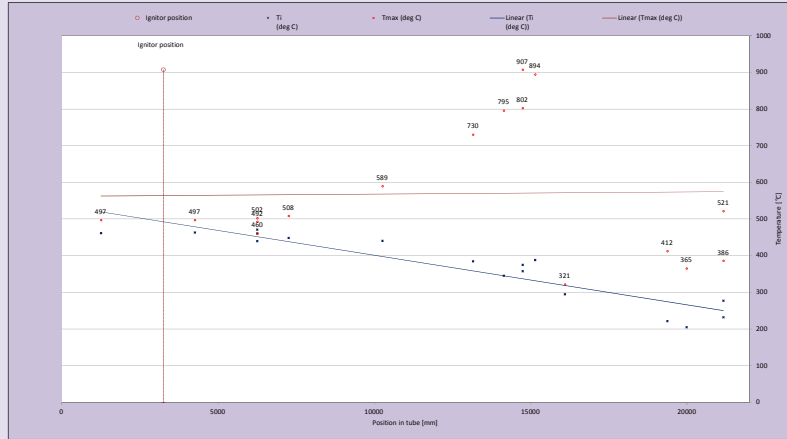
Location of igniter 3258 mm Time of ignition 17.05656 seconds

Thermocouple number	Location	Position in tube (mm)	Flame arrival time (s)	Average flame speed (m/s)	T <sub>max</sub> (deg C)	T <sub>i</sub> (deg C)
TC0	CD1-R3	1258			497	461
TC2	CD2-R3	4258			497	463
TC4	CD3-R3	7258	17.175	34	508	448
TC5	CD4-R3	10258	17.187	250	589	440
TC8	HR1-R2	13160	17.216	100	730	384
TC12	CD3-T1	6258			460	439
TC13	CD3-L1	6258			492	460
TC14	CD3-B1	6258				
TC15	CD3-R1	6258			502	471
TC16	HR2-R3M	14140	17.216	68	795	345
TC17	HR2-R5L	14745	17.230	66	807	375
TC18	HR2-R5U	14745	17.249	60	802	357
TC19	HR3-L1M	15140	17.240	65	894	388
TC20	HE2-R1L	16090				
TC21	HE2-R1U	16090	17.256	65	321	294
TC22	HR5-R4M	19375	17.374	51	412	221
TC23	HR6-R1M	19985	17.420	46	365	204
TC24	HR6-R5L	21165	17.701	28	386	231
TC25	HR6-R5U	21165	17.638	31	521	277

surface thermocouples (not plotted)

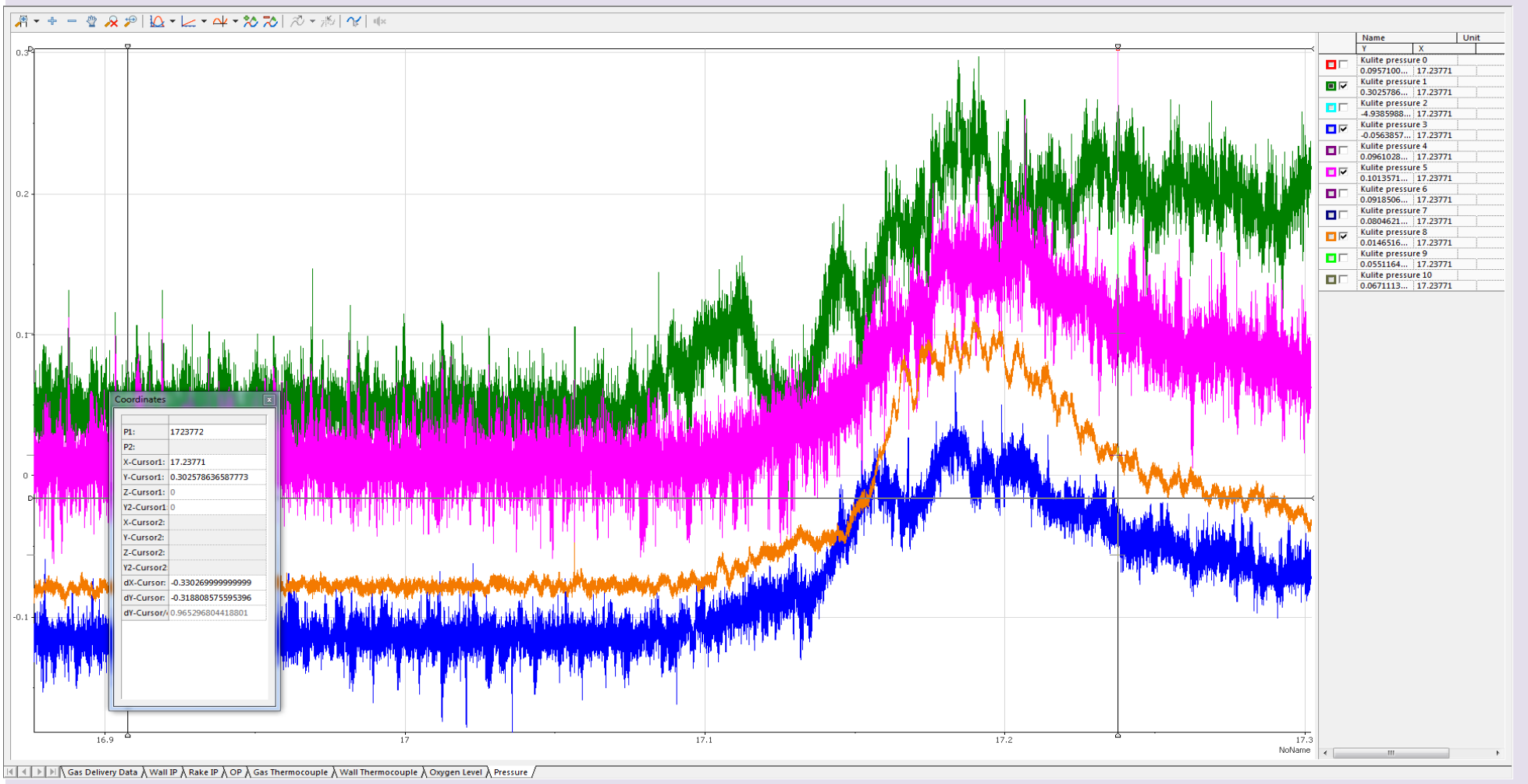
TC1	CD1-T2	1508
TC3	CD2-T2	4508
TC5	CD3-T2	7508
TC7	CD4-T2	10508

244	235
213	193
223	216
194	190



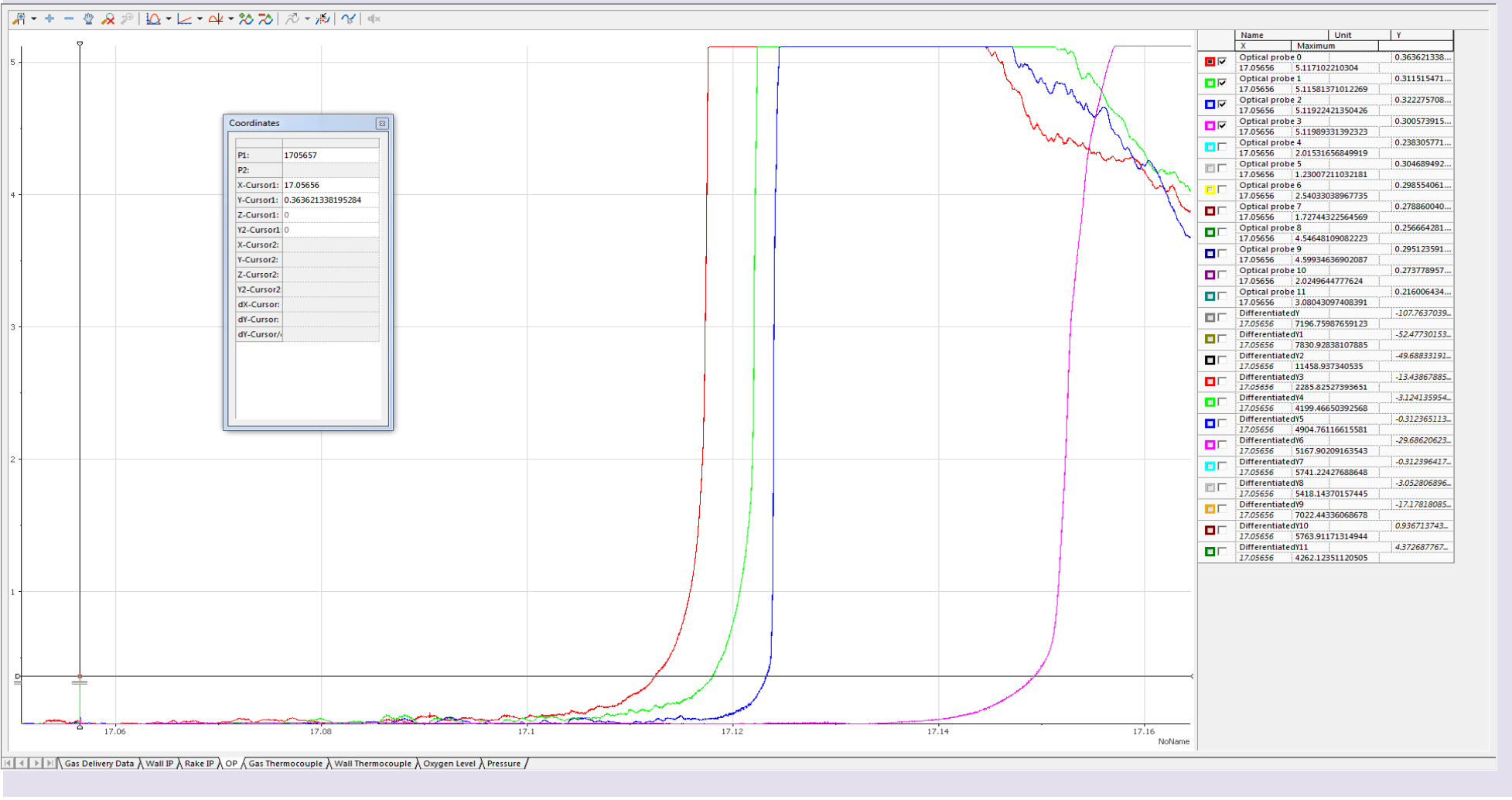
432 435 423 404 345 291 315 303 343 330 216 174 157 195 228

# Pressure



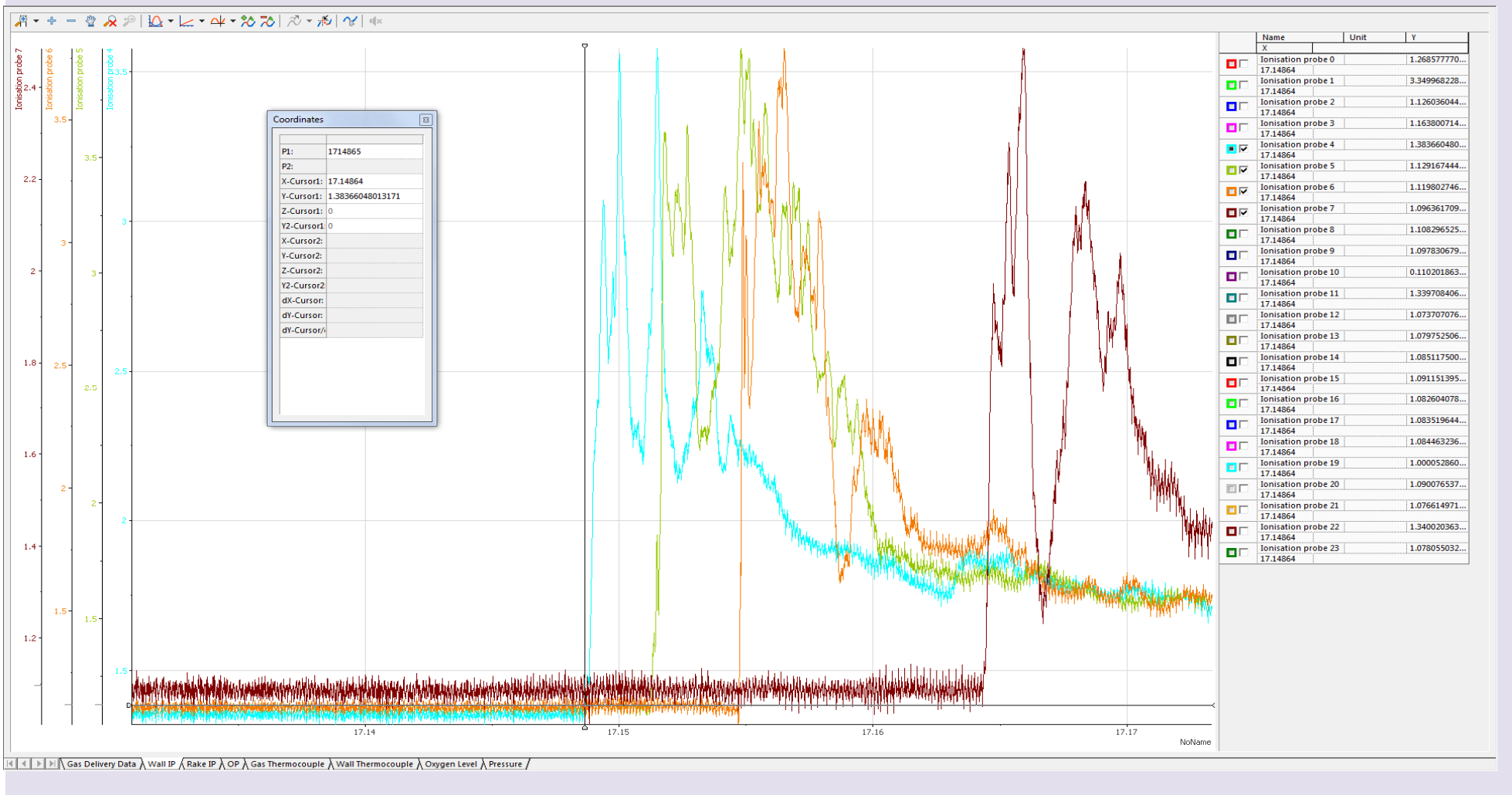


# Optical Probes

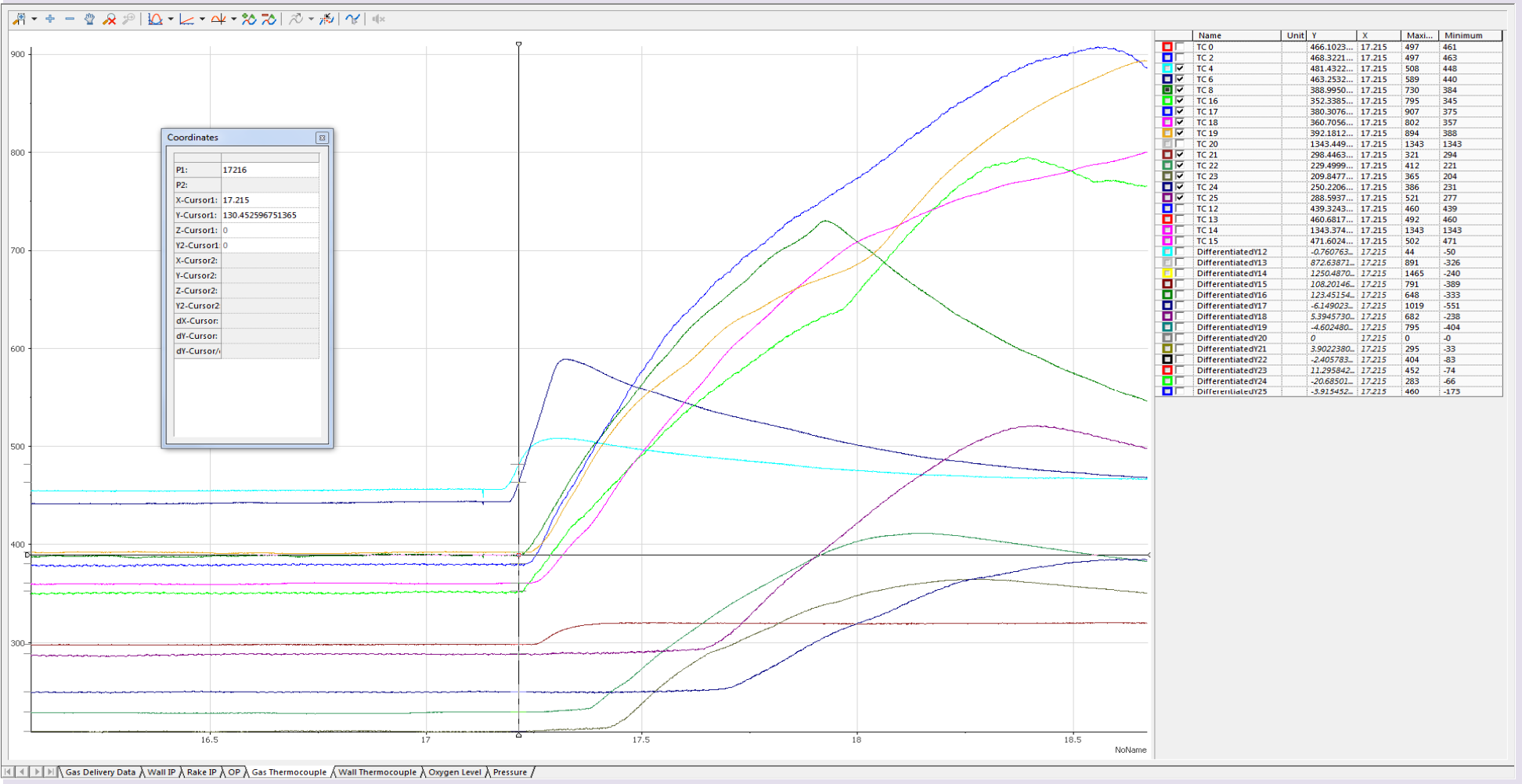


Gas Delivery Data \ Wall IP \ Rake IP \ OP \ Gas Thermocouple \ Wall Thermocouple \ Oxygen Level \ Pressure

# Ionisation Probes



# Temperature



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

