

Date	16 January 2019
Time	15:00:15
Test Number	HRSG Test 36
Mixture Composition	100% H2
Ambient Temperature	3.0 °C
Ambient Pressure	952 mbar
Wind Speed	2.5 m/s
Wind direction	NW
Relative Humidity	94.00%
Mass Flow	9.6010 kg/s
Equivalence Ratio	0.48

General Comments: (weather, rig configuration)

Weather: Overcast and cold. Light wind. 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: 35%; 11,500 rpm

Test on 100% H2 at an intended EQR of 0.47

The test gave a fairly strong combustion event. Most sensors provided an identifiable response.

Highest overpressure of 1158 mbar seen in HR6 on KU10 near end plate.

Ionisation Probes

Max. flame speed
183 m/s

Ionisation Rakes

Max. flame speed
299 m/s

Optical Probes

Max. flame speed
283 m/s

Max overpressure
1158 mbar

Max. gas temperature
1132 °C

Initial gas temperature
405 °C

Location of Max. Overpressure

sensor	KU10
label	HR6-L5L
distance	21165 mm

Location of Max. Temperature

sensor	TC0
label	CD1-R3
distance	1258 mm

Location of Max. Flame Speed

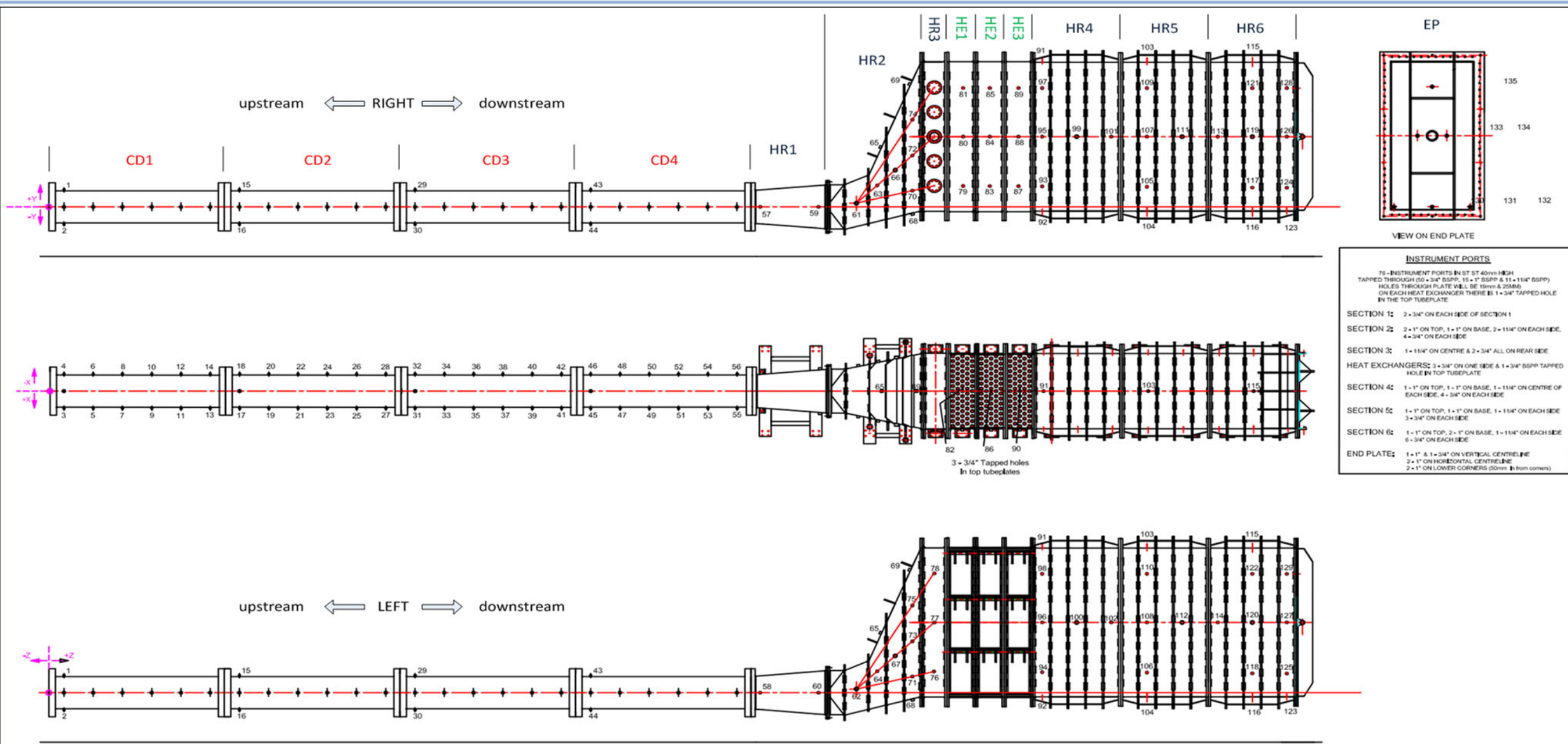
sensor	IP1
label	HR2-L5L
distance	14745 mm

Location of Max. Flame Speed

sensor	RA3
label	HR4-R3M
distance	17575 mm

Location of Max. Flame Speed

sensor	OP1
label	CD4-R6
istance	11758 mm



INSTRUMENT PORTS

75 - INSTRUMENT PORTS IN ST 37 40mm H24
 TAPPED THROUGH 50 x 3/4" BSPP, 15 x 1" BSPP & 11 x 11/4" BSPP
 HOLES THROUGH PLATE WILL BE 15mm & 25mm
 ON EACH HEAT EXCHANGER THERE IS 1 x 3/4" TAPPED HOLE
 IN THE TOP TUBEPLATE

SECTION 1: 2 x 3/4" ON EACH SIDE OF SECTION 1
 SECTION 2: 2 x 1" ON TOP, 1 x 1" ON BASE, 2 x 11/4" ON EACH SIDE, 4 x 3/4" ON EACH SIDE
 SECTION 3: 1 x 11/4" ON CENTRE & 2 x 3/4" ALL ON REAR SIDE
 HEAT EXCHANGERS: 3 x 3/4" ON ONE SIDE & 1 x 3/4" BSPP TAPPED HOLE IN TOP TUBEPLATE
 SECTION 4: 1 x 1" ON TOP, 1 x 1" ON BASE, 1 x 11/4" ON CENTRE OF EACH SIDE, 4 x 3/4" ON EACH SIDE
 SECTION 5: 1 x 1" ON TOP, 1 x 1" ON BASE, 1 x 11/4" ON EACH SIDE, 3 x 3/4" ON EACH SIDE
 SECTION 6: 1 x 1" ON TOP, 2 x 1" ON BASE, 1 x 11/4" ON EACH SIDE, 6 x 3/4" ON EACH SIDE
 END PLATE: 1 x 1" & 1 x 3/4" ON VERTICAL CENTRELINE
 2 x 1" ON HORIZONTAL CENTRELINE
 2 x 1" ON LOWER CORNERS (25mm from corners)

Naming Convention

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

Key

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

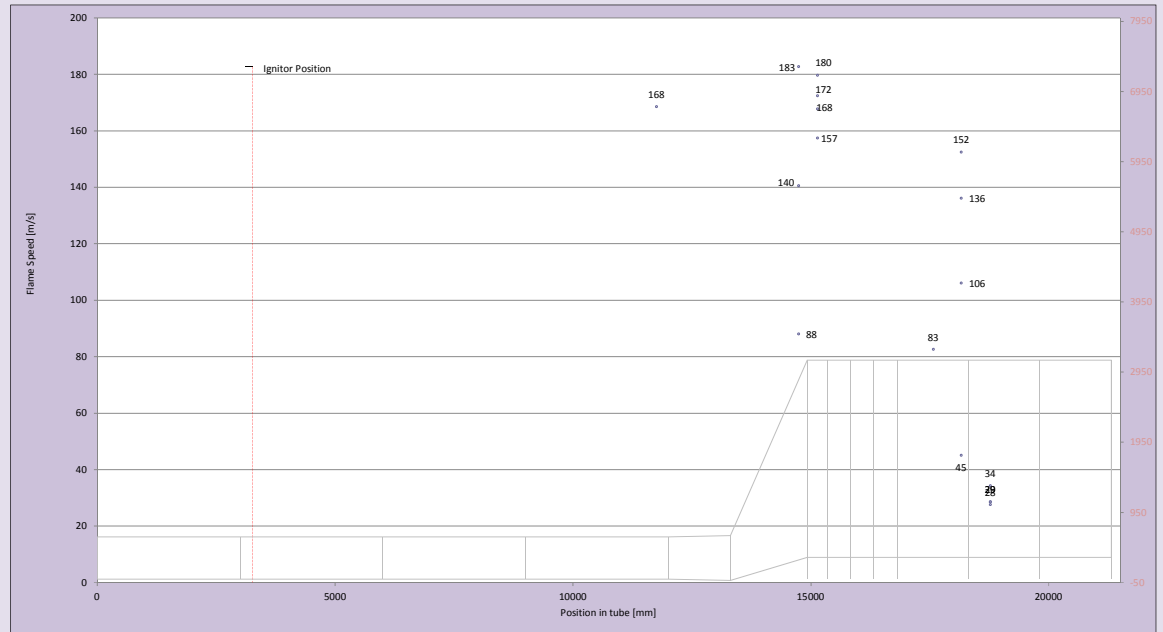
There are 13 sections on the rig

- 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	21.67288	168
IP1	HR2-L5L	Ionisation probe 1	14745	21.68923	183
IP2	HR2-L5M	Ionisation probe 2	14745	21.69414	140
IP3	HR2-L5U	Ionisation probe 3	14745	21.70680	88
IP4	HR3-R1L	Ionisation probe 4	15140	21.68859	180
IP5	HR3-R1LM	Ionisation probe 5	15140	21.69135	172
IP6	HR3-R1M	Ionisation probe 6	15140	21.69327	168
IP7	HR3-R1U	Ionisation probe 7	15140	21.69793	157
IP8	HR3-L1U	Ionisation probe 8	15140	21.70506	
IP9	HE2-R1M	Ionisation probe 9	16090	21.69499	
IP10	HR4-L1L	Ionisation probe 10	16985	21.69628	
IP11	HR4-L1M	Ionisation probe 11	16985	21.69839	
IP12	HR4-L1U	Ionisation probe 12	16985	21.70000	
IP13	HR4-R1U	Ionisation probe 13	16985	21.70000	
IP14	HR4-R3U	Ionisation probe 14	17575	21.70715	83
IP15	HR4-L5L	Ionisation probe 15	18165	21.70495	136
IP16	HR4-L5M	Ionisation probe 16	18165	21.70952	106
IP17	HR4-L5U	Ionisation probe 17	18165	21.72619	45
IP18	HR4-R5M	Ionisation probe 18	18165	21.70860	152
IP19	HR5-L2L	Ionisation probe 19	18775	21.72276	34
IP20	HR5-L2M	Ionisation probe 20	18775	21.73084	29
IP21	HR5-L2U	Ionisation probe 21	18775	21.74758	29
IP22	HR5-R2U	Ionisation probe 22	18775	21.75070	28
IP23	HR6-L1M	Ionisation probe 23	19985		

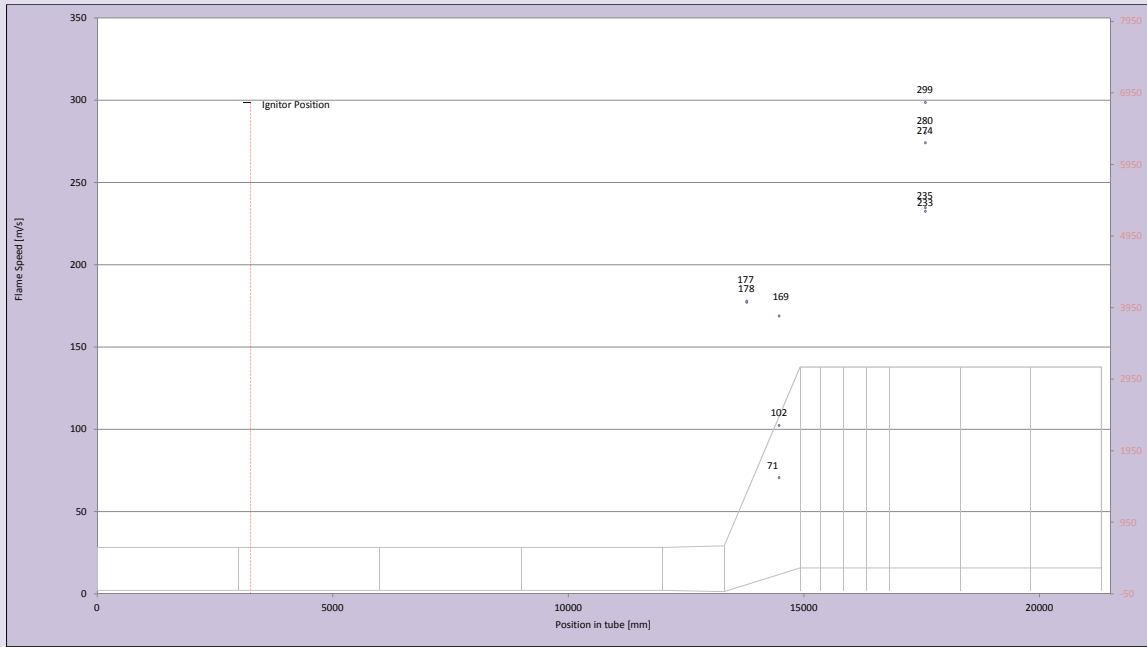
KEY: ND - not detected - sensor working but flame too weak to be picked up
 NW - not working - sensor not working



Location of igniter 3258 mm Time of ignition 21.62243 seconds

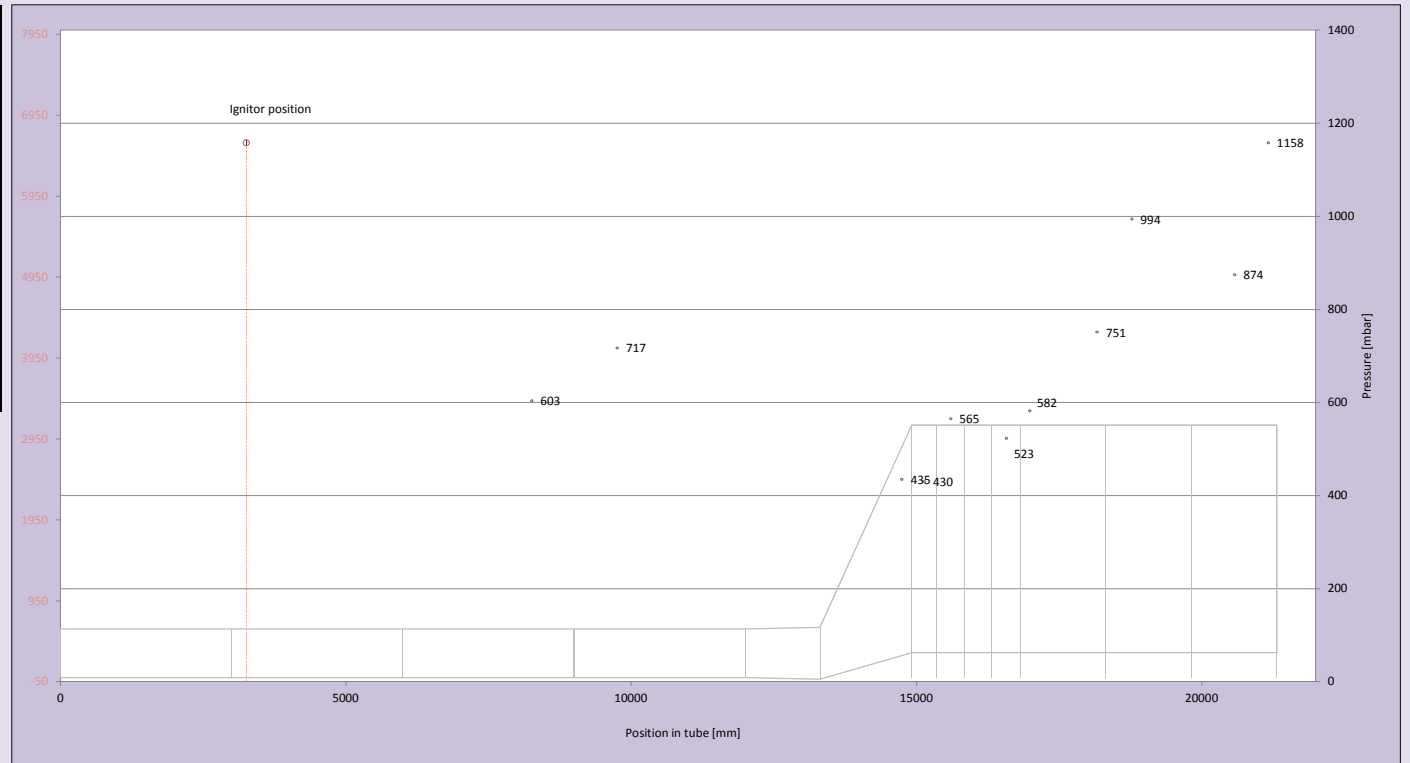
Rake Number	IP Number	Location label	Data Name	Position in tube (mm)	Flame arrival time (s)	Avg Flame speed from last sensor (m/s)
RA1	IP24	HR2-R2M	IP24	13785	NW	
RA1	IP25	HR2-R2M	IP25	13785	21.6818	177
RA1	IP26	HR2-R2M	IP26	13785	21.6816	178
RA2	IP27	HR2-R4M	IP27	14475	21.6885	102
RA2	IP28	HR2-R4M	IP28	14475	21.6888	169
RA2	IP29	HR2-R4M	IP29	14475	21.6913	71
RA3	IP30	HR4-R3M	IP30	17575	21.7018	235
RA3	IP31	HR4-R3M	IP31	17575	21.7021	233
RA3	IP32	HR4-R3M	IP32	17575	21.7017	299
RA4	IP33	HR4-R3L	IP33	17575	21.6999	274
RA4	IP34	HR4-R3L	IP34	17575	21.6999	280
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

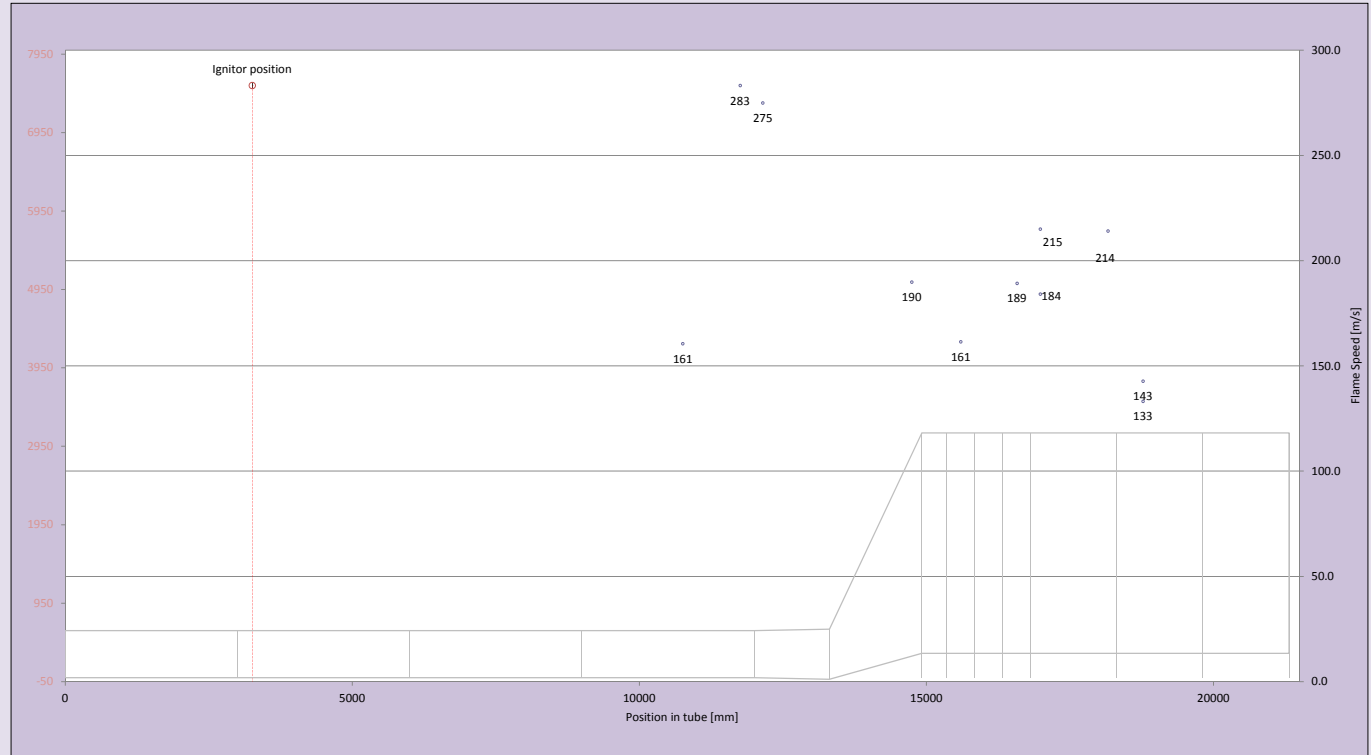
Transducer number	Location	Position in tube [mm]	ΔP_{max} [mbar]	Time ΔP_{max} [sec]
KU0	CD3-R5	8258	603	21.7250
KU1	CD4-R2	9758	717	21.7239
KU2	HR2-T5	14745	435	21.7017
KU3	HR3-L1L	15140	430	21.7000
KU4	HE1-R1U	15600	565	21.6967
KU5	HE3-R1L	16580	523	21.7150
KU6	HR4-R1L	16985	582	21.7146
KU7	HR4-R5U	18165	751	21.7016
KU8	HR5-R2L	18775	994	21.7051
KU9	HR6-R3L	20575	874	21.7080
KU10	HR6-LSL	21165	1158	21.7079



Location of igniter 3258 mm Time of ignition 21.62243 seconds

OP Number	Location label	Position in tube (mm)	Flame arrival time (s)	Average flame speed (m/s)
OP0	CD4-L4	10758	21.6691	160.5
OP1	CD4-R6	11758	21.6727	283.3
OP2	HR1-R1	12152	21.6742	275.0
OP3	HR2-R5M	14745	21.6901	189.9
OP4	HE1-T1	15600	21.6991	161.5
OP5	HE2-T1	16090	21.6990	
OP6	HE3-T1	16580	21.6999	189.3
OP7	HR4-T1	16985	21.7030	184.2
OP8	HR4-R1M	16985	21.6981	215.0
OP9	HR4-R5L	18165	21.7037	214.1
OP10	HR5-T2	18775	21.7253	142.8
OP11	HR5-R2M	18775	21.7293	133.2

KEY: ND - not detected - sensor working but flame too weak to be picked up
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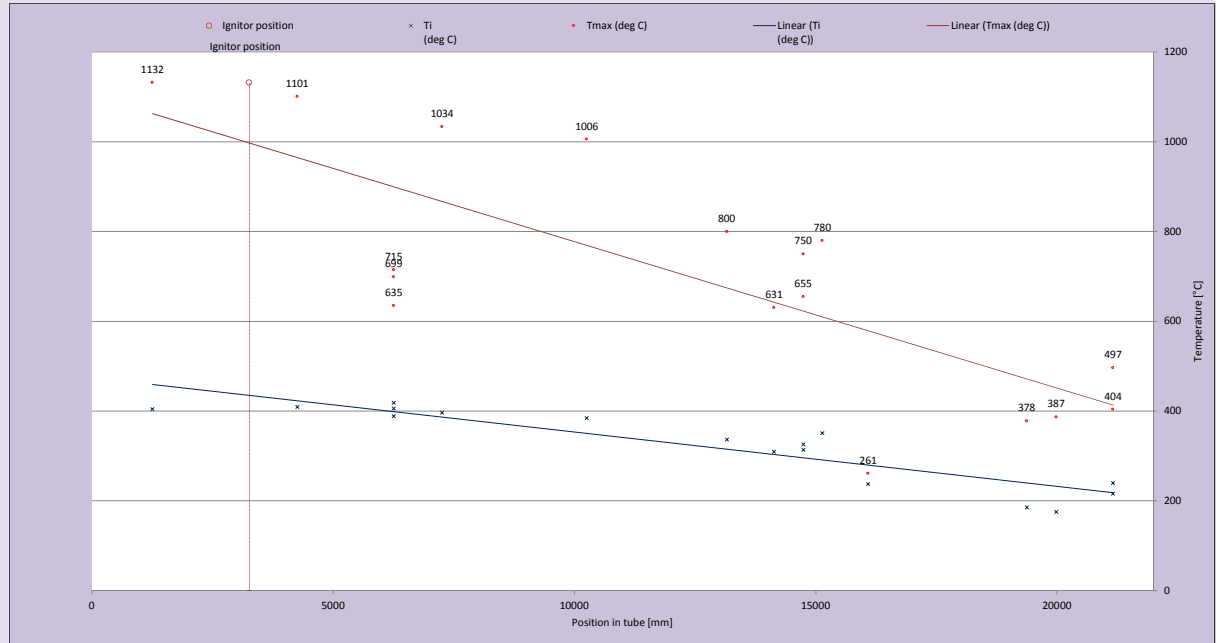
Location of igniter mm Time of ignition seconds

Thermocouple number	Location	Position in tube (mm)	Flame arrival time (s)	Average flame speed (m/s)	T _{max} (deg C)	T _i (deg C)
TC0	CD1-R3	1258			1132	405
TC2	CD2-R3	4258	21.709	12	1101	410
TC4	CD3-R3	7258	21.721	41	1034	397
TC6	CD4-R3	10258	21.729	66	1006	385
TC8	HR1-R2	13160	21.746	80	800	337
TC12	CD3-T1	6258			635	389
TC13	CD3-L1	6258			715	406
TC14	CD3-B1	6258				
TC15	CD3-R1	6258			699	419
TC16	HR2-R3M	14140	21.748	87	631	310
TC17	HR2-R5L	14745	21.755	87	750	326
TC18	HR2-R5U	14745	21.763	82	655	314
TC19	HR3-L1M	15140	21.765	84	780	351
TC20	HE2-R1L	16090	NW			
TC21	HE2-R1U	16090	21.764	91	261	238
TC22	HR5-R4M	19375	21.827	79	378	186
TC23	HR6-R1M	19985	21.865	69	387	176
TC24	HR6-R5L	21165	21.969	52	404	216
TC25	HR6-R5U	21165	21.957	54	497	240

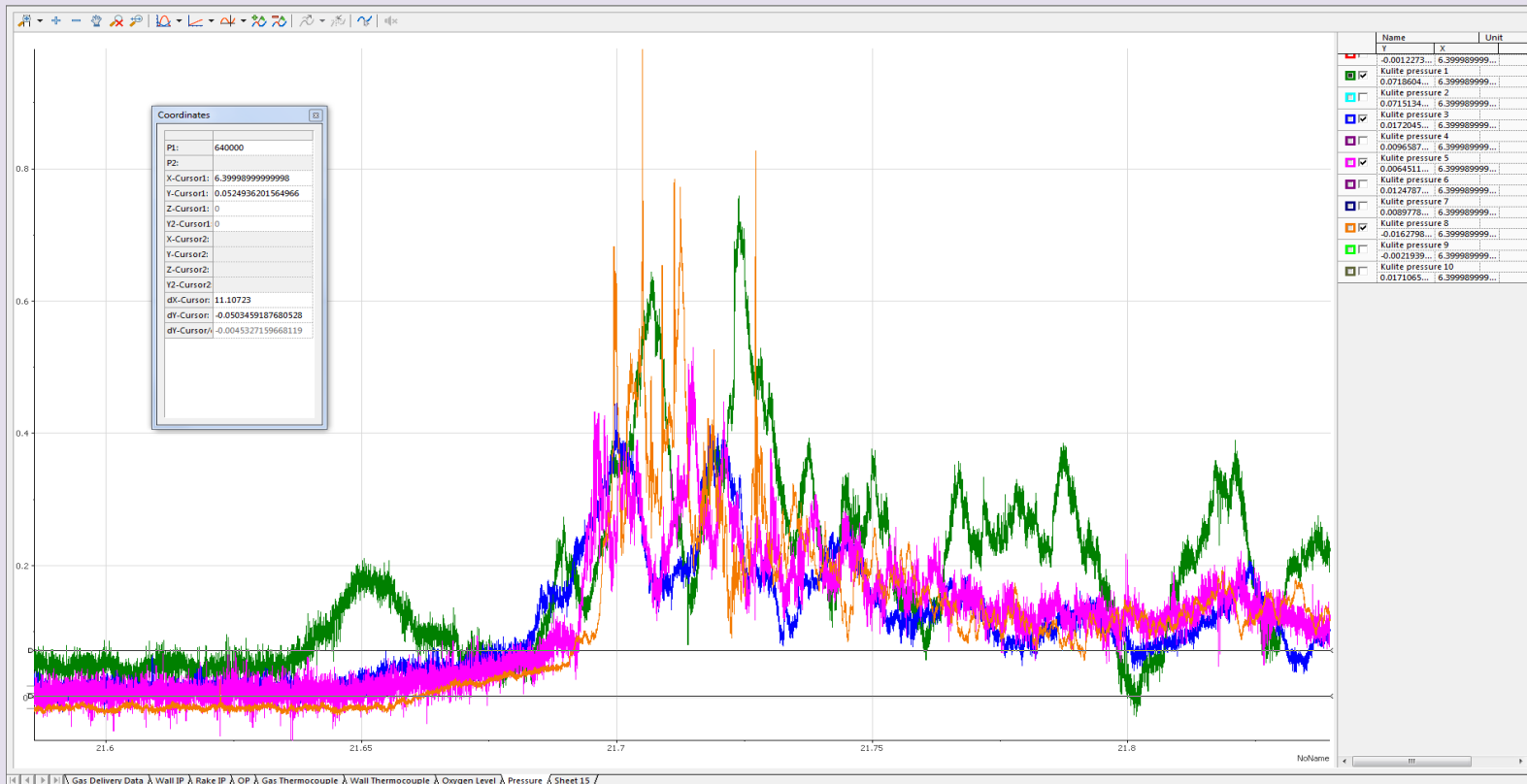
surface thermocouples [not plotted]

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

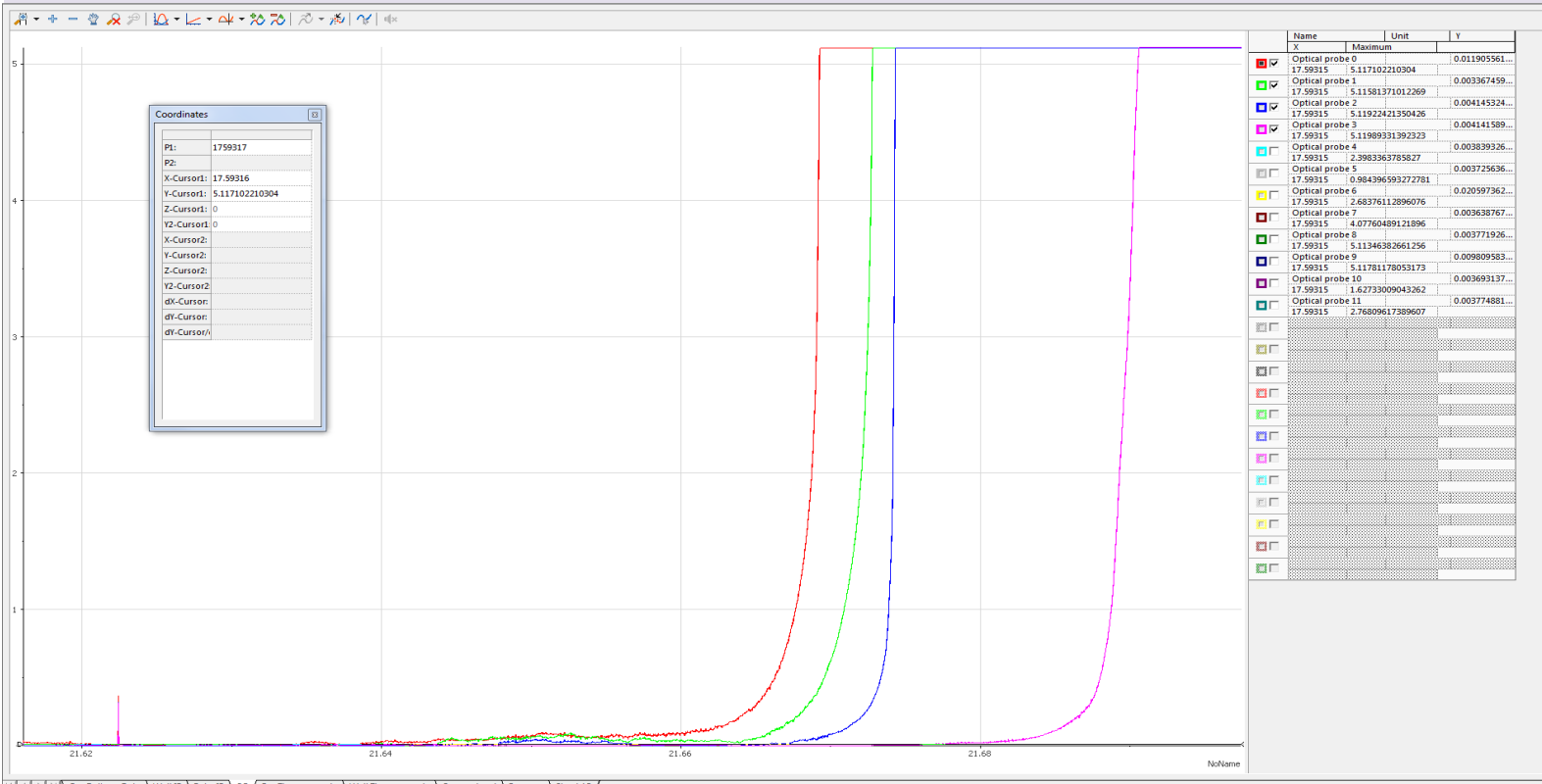
185	176
178	169
196	188
173	169



Pressure



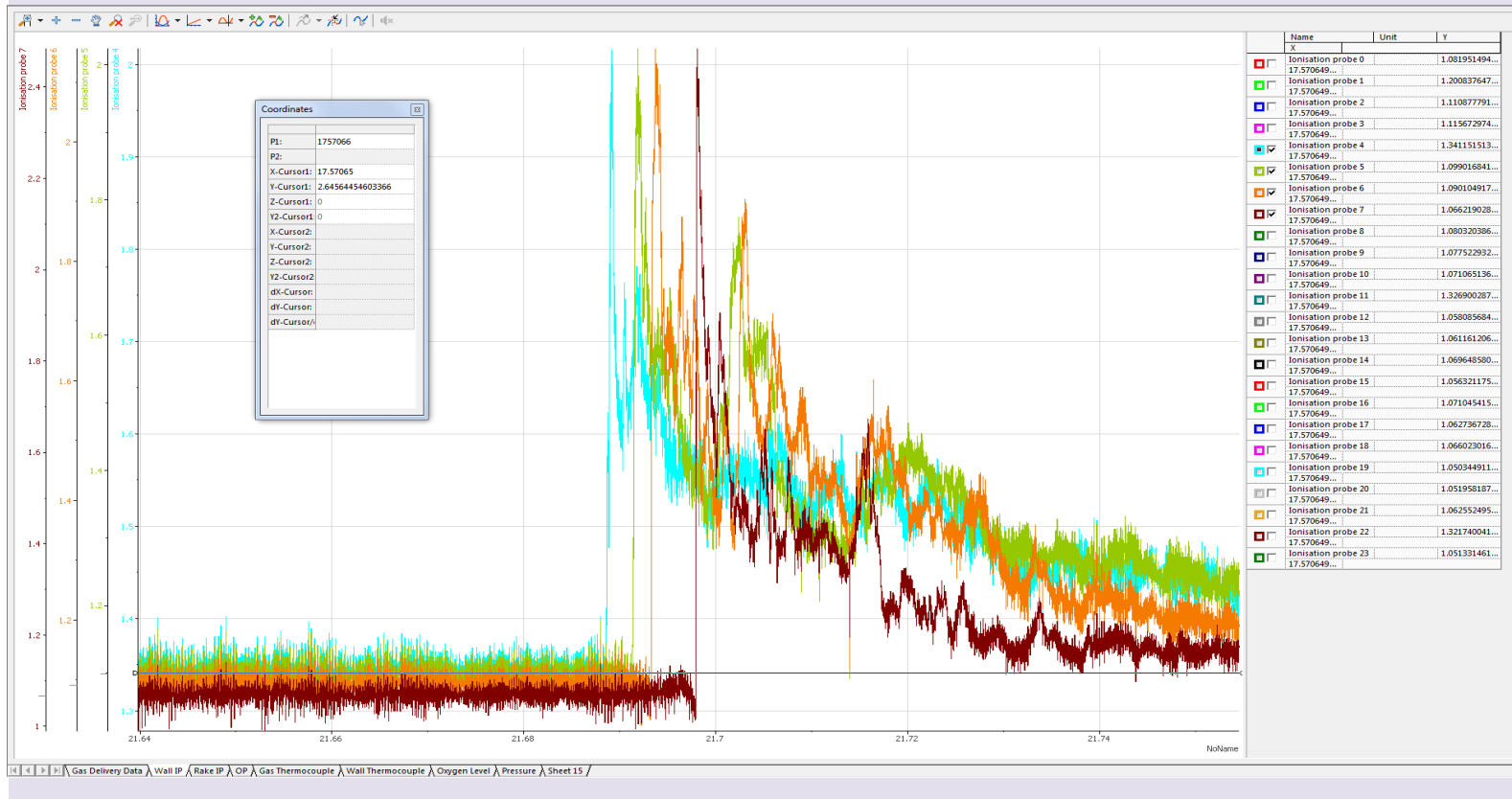
Optical Probes



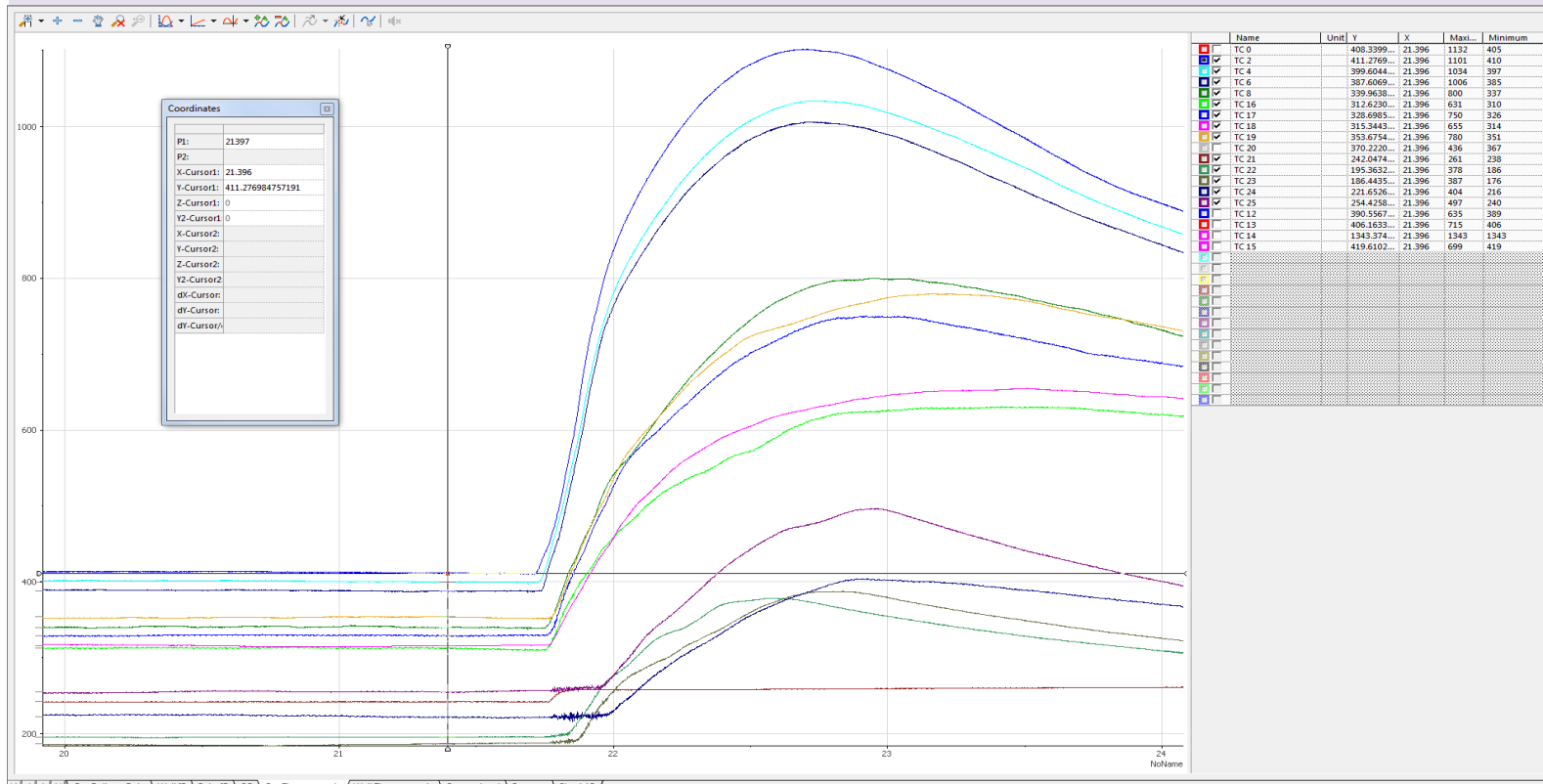
Coordinates	
P1:	1759317
P2:	
X-Cursor1:	17.59316
Y-Cursor1:	5.117102210304
Z-Cursor1:	0
Y2-Cursor1:	0
X-Cursor2:	
Y-Cursor2:	
Z-Cursor2:	
Y2-Cursor2:	
dX-Cursor:	
dY-Cursor:	
dZ-Cursor:	

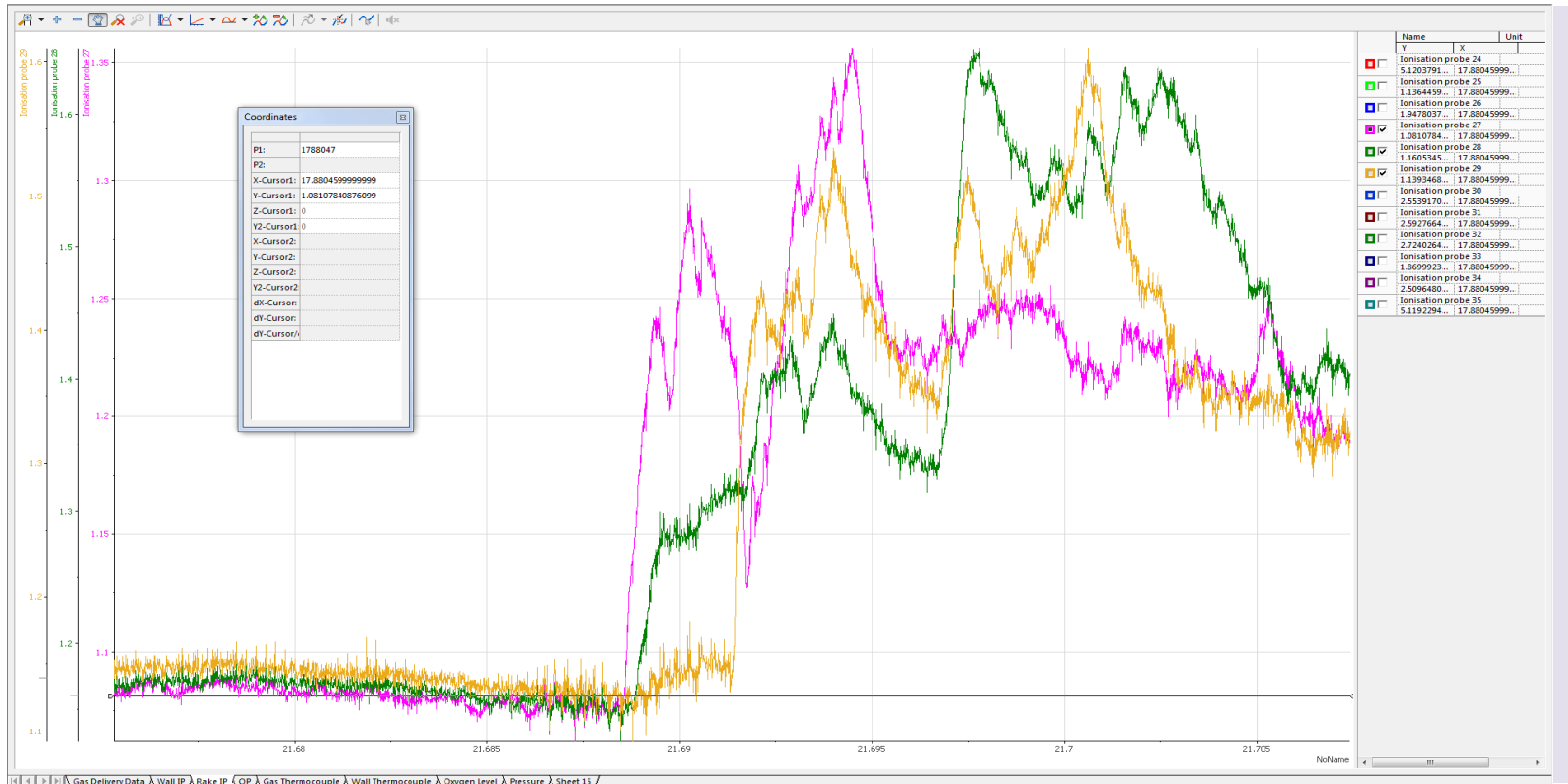
Name	Unit	Y
X	Maximum	
<input checked="" type="checkbox"/> Optical probe 0		0.011905561...
17.59315	5.117102210304	
<input checked="" type="checkbox"/> Optical probe 1		0.003367459...
17.59315	5.11581371012269	
<input checked="" type="checkbox"/> Optical probe 2		0.004145324...
17.59315	5.11922421350426	
<input checked="" type="checkbox"/> Optical probe 3		0.004141589...
17.59315	5.11989331392323	
<input type="checkbox"/> Optical probe 4		0.003839326...
17.59315	2.3983363785827	
<input type="checkbox"/> Optical probe 5		0.003725636...
17.59315	0.984396593272781	
<input type="checkbox"/> Optical probe 6		0.020597362...
17.59315	2.68376112896076	
<input type="checkbox"/> Optical probe 7		0.003638767...
17.59315	4.07760489121896	
<input type="checkbox"/> Optical probe 8		0.003771926...
17.59315	5.11346382661256	
<input type="checkbox"/> Optical probe 9		0.009809583...
17.59315	5.11781178053173	
<input type="checkbox"/> Optical probe 10		0.003693137...
17.59315	1.62733009043262	
<input type="checkbox"/> Optical probe 11		0.003774881...
17.59315	2.76809617389607	

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

