

Further Instrumentation		
Location	Sensor	Working
TS1-1	TC8	
TS2-1	TC10	
TS3-1	TC12	
TS4-1	TC14	
R1-1	IP3	
R1-2	IP4	
R1-3	IP5	
R2-1	IP7	
R2-2	IP8	
R2-3	IP9	
R3-1	IP11	
R3-2	IP12	
R3-3	IP13	
R4-1	IP15	
R4-2	IP16	
R4-3	IP17	
R5-1	IP19	
R5-2	IP20	
R5-3	IP21	
KU3	TC9	
KU4	#N/A	
KU6	TC5	
pitot	TC11	

	Ionisation Probe
	Pressure Transducer
	Thermocouple
	Optical Probe

Item	Location	DAQ	Channel	Measurement	Instrument	Supplier	Range	Signal	Excitation	S/R
IP0	FS1-3	PXIe	PXI Slot2/ai0	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP1	FS1-6	PXIe	PXI Slot2/ai1	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP2	FS2-3	PXIe	PXI Slot2/ai2	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP3	R1-1	PXIe	PXI Slot2/ai3	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP4	R1-2	PXIe	PXI Slot2/ai4	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP5	R1-3	PXIe	PXI Slot2/ai5	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP6	FS2-6	PXIe	PXI Slot2/ai6	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP7	R2-1	PXIe	PXI Slot2/ai7	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP8	R2-2	PXIe	PXI Slot6/ai0	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP9	R2-3	PXIe	PXI Slot6/ai1	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP10	FS3-4	PXIe	PXI Slot6/ai2	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP11	R3-1	PXIe	PXI Slot6/ai3	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP12	R3-2	PXIe	PXI Slot6/ai4	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP13	R3-3	PXIe	PXI Slot6/ai5	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP14	FS3-6	PXIe	PXI Slot6/ai6	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP15	R4-1	PXIe	PXI Slot6/ai7	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP16	R4-2	PXIe	PXI Slot7/ai0	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP17	R4-3	PXIe	PXI Slot7/ai1	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP18	FS4-2	PXIe	PXI Slot7/ai2	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP19	R5-1	PXIe	PXI Slot7/ai3	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP20	R5-2	PXIe	PXI Slot7/ai4	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP21	R5-3	PXIe	PXI Slot7/ai5	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP22	FS4-5	PXIe	PXI Slot7/ai6	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
IP23	FS4-6	PXIe	PXI Slot7/ai7	Flame Presence	Ionisation Probe	Bruce Ewan	TBC	-5 to 5V	60V	100 kHz
OP0	NS2-5	PXIe	PXI1Slot4/ai0	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
OP1	NS3-5	PXIe	PXI1Slot4/ai1	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
OP2	NS4-2	PXIe	PXI1Slot4/ai2	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
OP3	NS4-5	PXIe	PXI1Slot4/ai3	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
OP4	NS4-5	PXIe	PXI1Slot4/ai4	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
OP5	NS1-6	PXIe	PXI1Slot4/ai5	Flame Presence	Optical Probe	Bruce Ewan	TBC	-5 to 5V	30V	100 kHz
TC0	NS1-3	PXIe	SC1Mod4/Wall	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC1	NS1-5	PXIe	SC1Mod4/ai1	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC2	NS2-2	PXIe	SC1Mod4/ai2	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC3	NS1-4	PXIe	SC1Mod4/ai3	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC4	NS1-6	PXIe	SC1Mod4/ai4	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC5	Ku6	PXIe	SC1Mod4/ai5	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC6	NS3-2	PXIe	SC1Mod4/ai6	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC7	NS1-3	PXIe	SC1Mod4/ai7	Gas Temperature (Wall)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC8	TS1-1	PXIe	SC1Mod4/ai8	Temperature (surface)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC9	KU3	PXIe	SC1Mod4/ai9	Temperature (kulite body)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC10	TS2-1	PXIe	SC1Mod4/ai10	Temperature (surface)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC11	pitot	PXIe	SC1Mod4/ai11	Temperature (kulite body)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC12	TS3-1	PXIe	SC1Mod4/ai12	Temperature (surface)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC13	NS1-6	PXIe	SC1Mod4/ai13	Temperature (kulite body)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC14	TS4-1	PXIe	SC1Mod4/ai14	Temperature (surface)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
TC15	NS4-3	PXIe	SC1Mod4/ai15	Temperature (pitot)	K-Type Thermocouple	TC-Direct	1100°C	Conditioned	None	5 kHz
KU0	NS3-6	PXIe	SC1Mod1/ai0	Pressure	Kulite					100 kHz
KU1	NS3-6	PXIe	SC1Mod1/ai1	Pressure	Kulite					100 kHz
KU2	NS3-6	PXIe	SC1Mod1/ai2	Pressure	XTEH-190M-50BARA			0-100 mV		100 kHz
KU3	NS2-3	PXIe	SC1Mod1/ai3	Pressure	Kulite					100 kHz
KU4	NS3-6	PXIe	SC1Mod1/ai4	Pressure	Kulite					100 kHz
KU5	NS3-4	PXIe	SC1Mod1/ai5	Pressure	Kulite					100 kHz
KU6	NS3-1	PXIe	SC1Mod1/ai6	Pressure	Kulite					100 kHz
KU7	NS4-6	PXIe	SC1Mod1/ai7	Pressure	Kulite					100 kHz
PB1	NS3-6	PXIe	PXI Slot3/ai0	Pressure	113B24	PCB	68 bar	0-5 V	20-30 V	1 MHz
PB2	TS3-6	PXIe	PXI Slot3/ai0	Pressure	113B25	PCB	68 bar	0-5 V	20-30 V	1 MHz

Date	29 April 2015
Time	15:17:00
Test Number	49
Mixture Composition	40%H2/60%CO
Ambient Temperature	3 oC
Ambient Pressure	961 mbar
Wind Speed	2 m/s
Wind direction	SW
Relative Humidity	65.00%
Equivalence Ratio	0.65

General Comments: (weather, rig configuration)

Weather: Cool but sunny and dry.
 Tube configuration:
 4 x 3m tube sections
 igniter 250mm from beginning of tube section

Test with 15 rows of congestion (row 8 on central flange with 7 rows projecting upstream into tube 2 and 7 rows projecting downstream into tube 3. This test uses a 40/60 H2/CO mixture at a relatively high EQR. The combustion is very strong with very clear signals on both IPs and OPs. Exit flame speed is around 2000 m/s and the evidence is for the existence of a detonation where the pressure is high (10.3 bar) and the exit shock wave is coincident with the exit flame front.

Headlines

Max overpressure
 mbar

Max. flame speed
 m/s
 [ionisation probes]

Max. temperature
 °C

Mass Flow
 kg/s

m/s
 [optical probes]

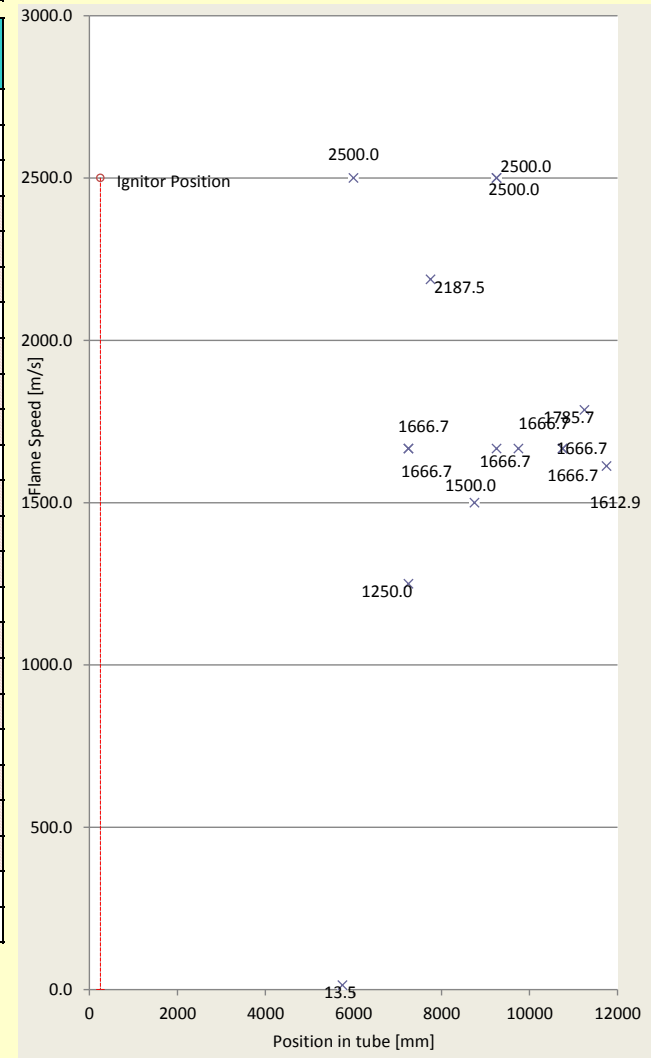
Initial Temperature
 °C

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)
REF	#N/A	Flameion_0	#N/A		
IP1	FS1-6	Flameion_1	2750		
IP2	FS2-3	Flameion_2	4250	13.5513	
IP3	R1-1	Flameion_3	4750	13.5487	
IP4	R1-2	Flameion_4	4750	NS	
IP5	R1-3	Flameion_5	4750	13.5549	
IP6	FS2-6	Flameion_6	5750	13.5435	13.5
IP7	R2-1	Flameion_7	6000	13.5436	2500.0
IP8	R2-2	Flameion_8	6000	disconnected	
IP9	R2-3	Flameion_9	6000	disconnected	
IP10	FS3-4	Flameion_10	7750	13.5444	2187.5
IP11	R3-1	Flameion_11	7250	13.5441	1666.7
IP12	R3-2	Flameion_12	7250	13.5441	1666.7
IP13	R3-3	Flameion_13	7250	13.5440	1250.0
IP14	FS3-6	Flameion_14	8750	13.5450	1500.0
IP15	R4-1	Flameion_15	9250	13.5453	1666.7
IP16	R4-2	Flameion_16	9250	13.5452	2500.0
IP17	R4-3	Flameion_17	9250	13.5452	2500.0
IP18	FS4-2	Flameion_18	9750	13.5455	1666.7
IP19	R5-1	Flameion_19	10750	13.5461	1666.7
IP20	R5-2	Flameion_20	10750	NS	
IP21	R5-3	Flameion_21	10750	13.5461	1666.7
IP22	FS4-5	Flameion_22	11250	13.5464	1785.7
IP23	FS4-6	Flameion_23	11750	13.5467	1612.9

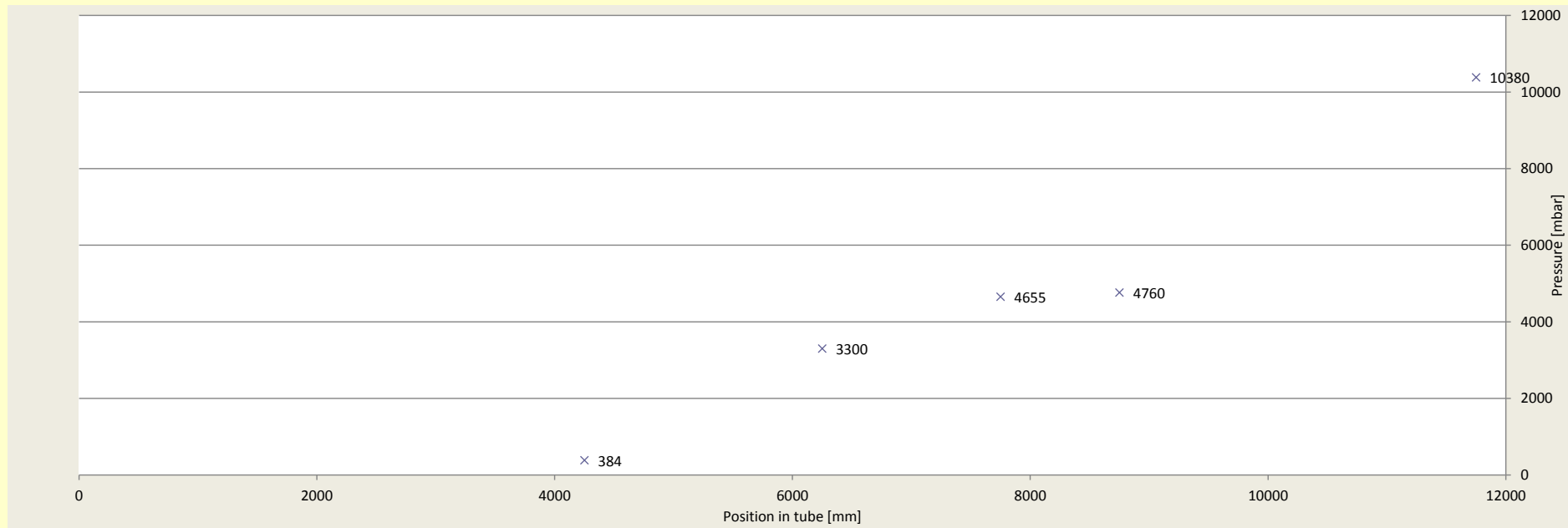
2500.0



Location of igniter mm

Transducer number	Location	Position in tube [mm]	ΔP_{max} [mbar]
KU0	NS3-6	8750	4760
KU1	0	#N/A	
KU2	0	#N/A	
KU3	NS2-3	4250	384
KU4	0	#N/A	
KU5	NS3-4	7750	4655
KU6	NS3-1	6250	3300
KU7	NS4-6	11750	10380

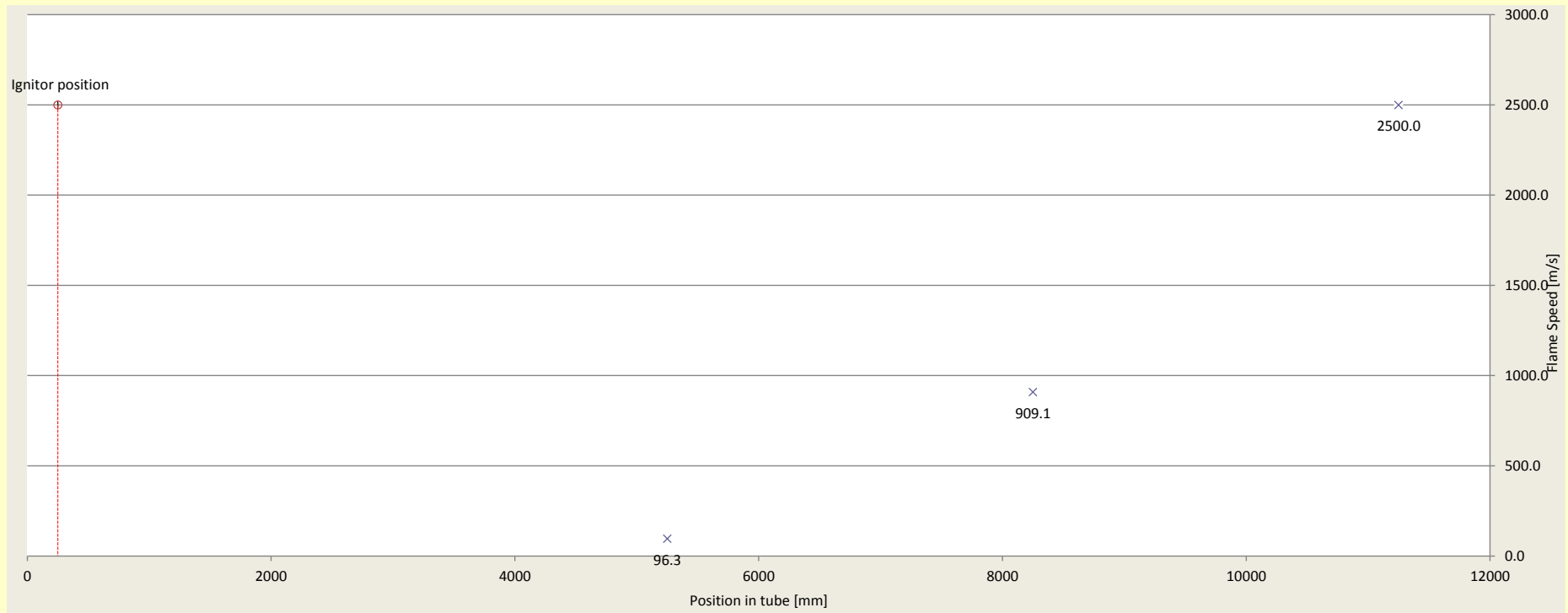
PCB = 11080 mbar



Location of igniter mm

Time of ignition seconds

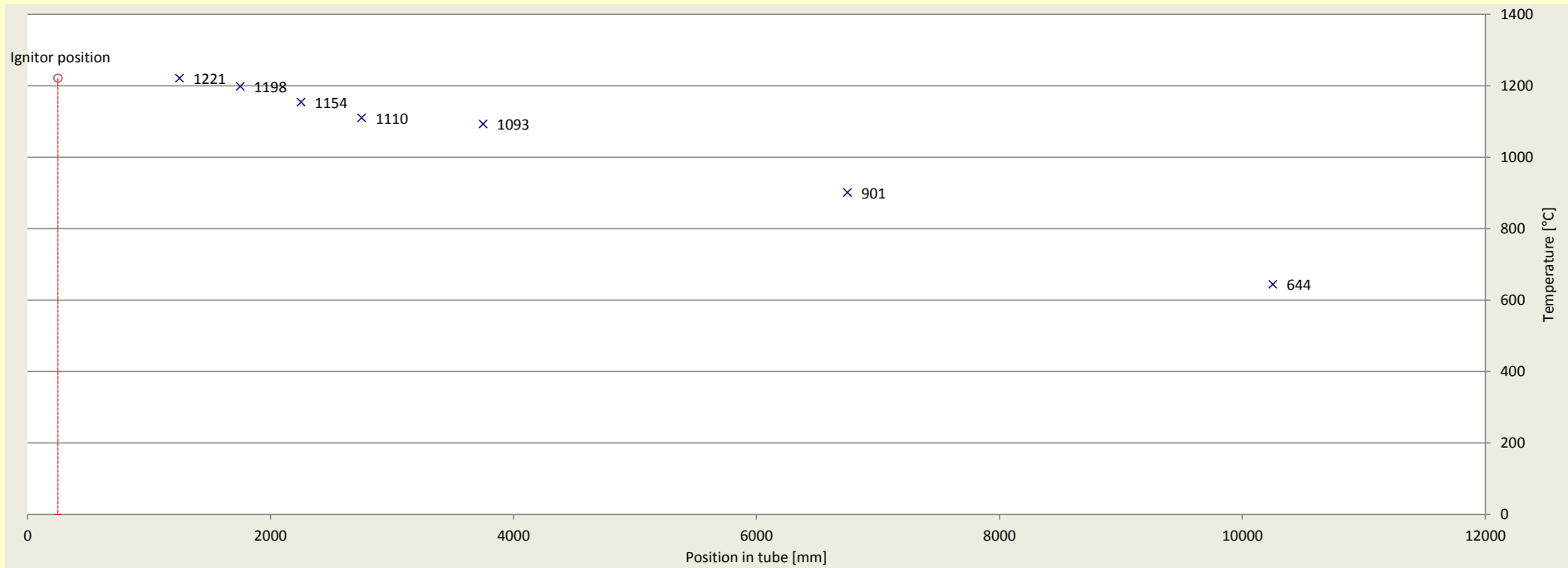
OP Number	Location label	Position in tube (mm)	Flame arrival time (s)	Average flame speed (m/s)
OP0	NS2-5	5250	13.5424	96.3
OP1	NS3-5	8250	13.5457	909.1
OP2	NS4-2	9750	NS	
OP3	NS4-5	11250	13.5469	2500.0
OP4	0	#N/A		
OP5	0	#N/A		

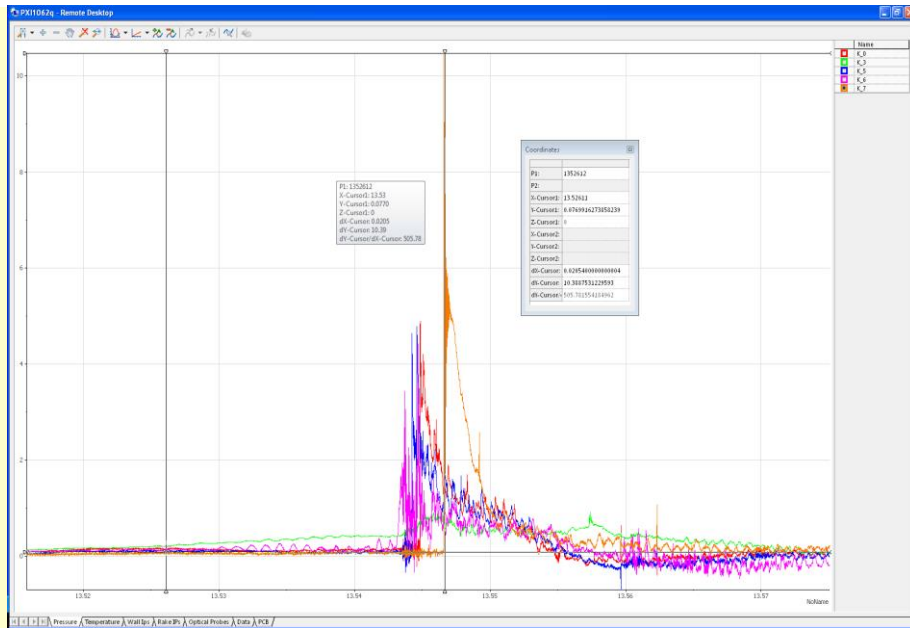


Location of igniter mm

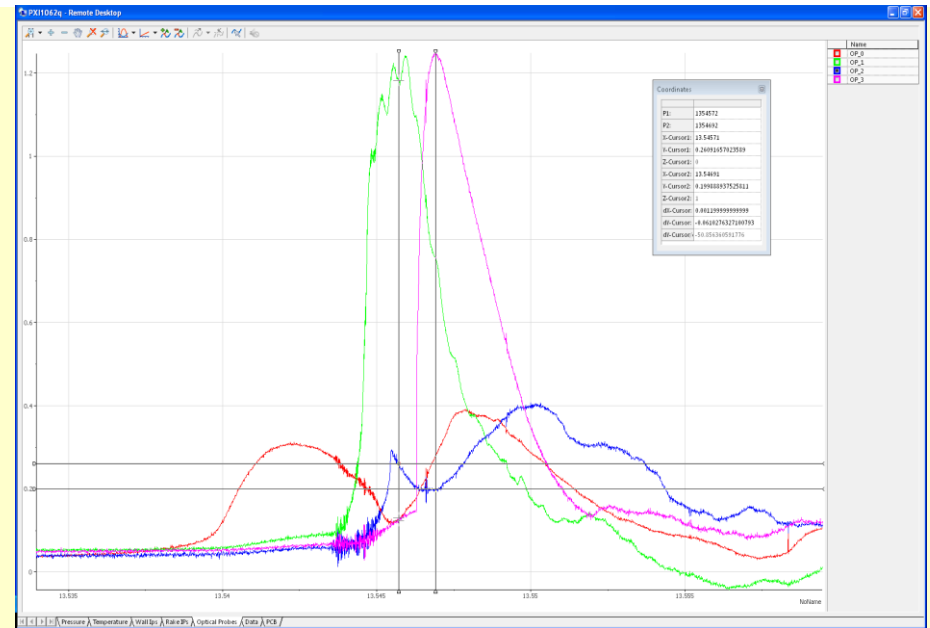
Thermocouple number	Location	Position in tube (mm)	T _{max} (deg C)
TC0	NS1-3	1250	1221
TC1	NS1-5	2250	1154
TC2	NS2-2	3750	1093
TC3	NS1-4	1750	1198
TC4	NS1-6	2750	1110
TC5	Ku6	#N/A	
TC6	NS3-2	6750	901
TC15	NS4-3	10250	644

temperature values still rising

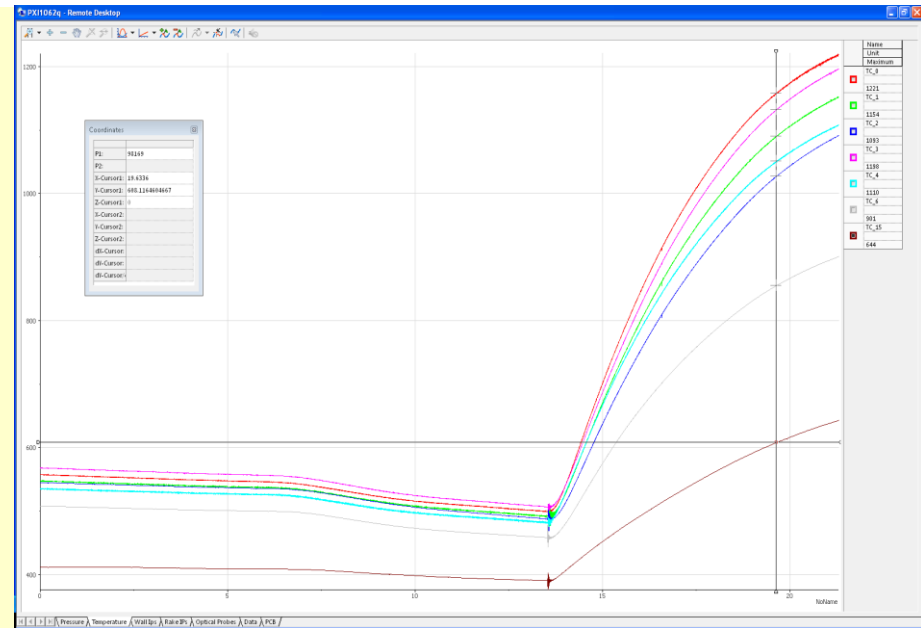
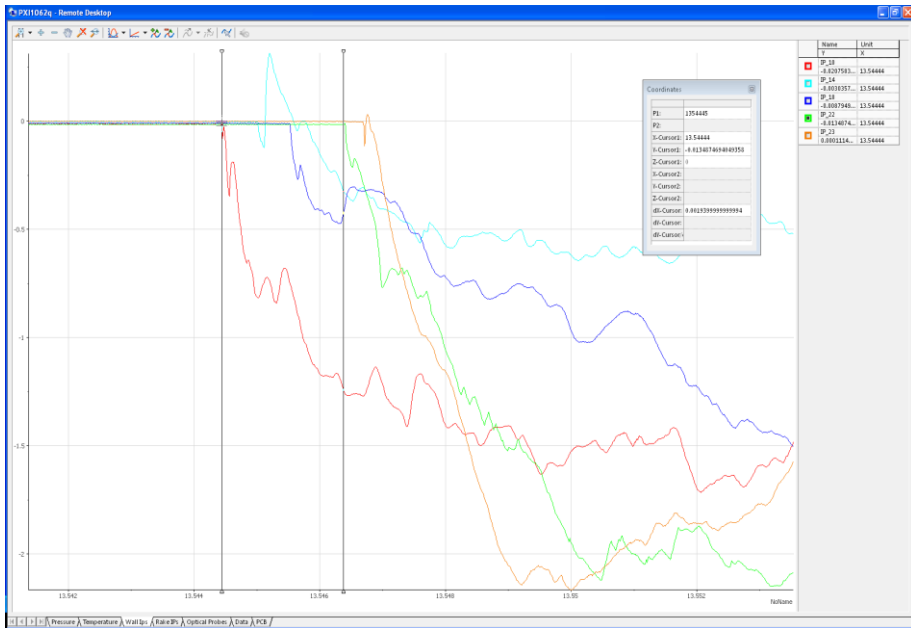




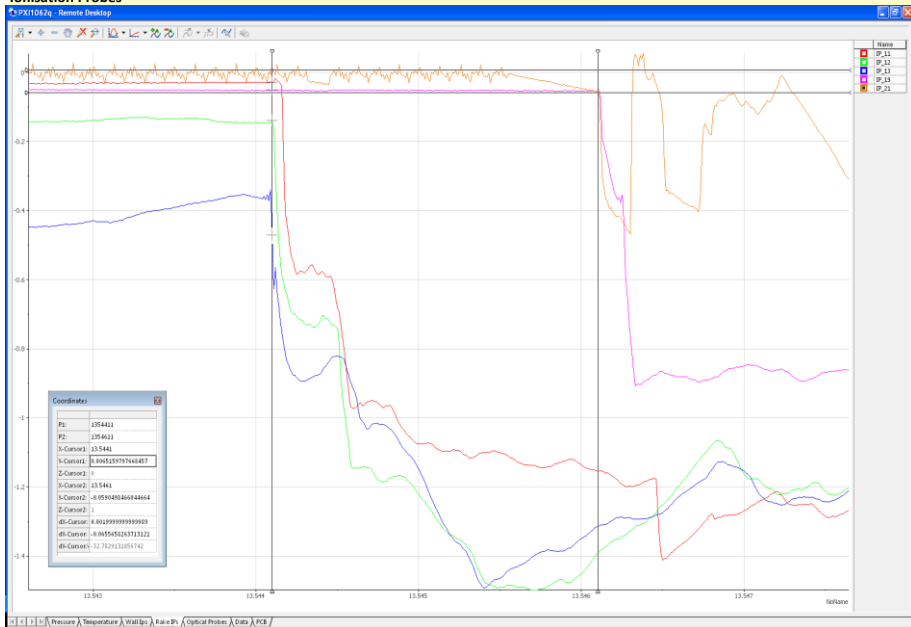
Pressure



Optical Probes



Ionisation Probes



Temperature