R&D sul campo: misurare il processo per capire la simulazione

16-10-2019

R&D @ Costamp: «PUZZLE DIE»

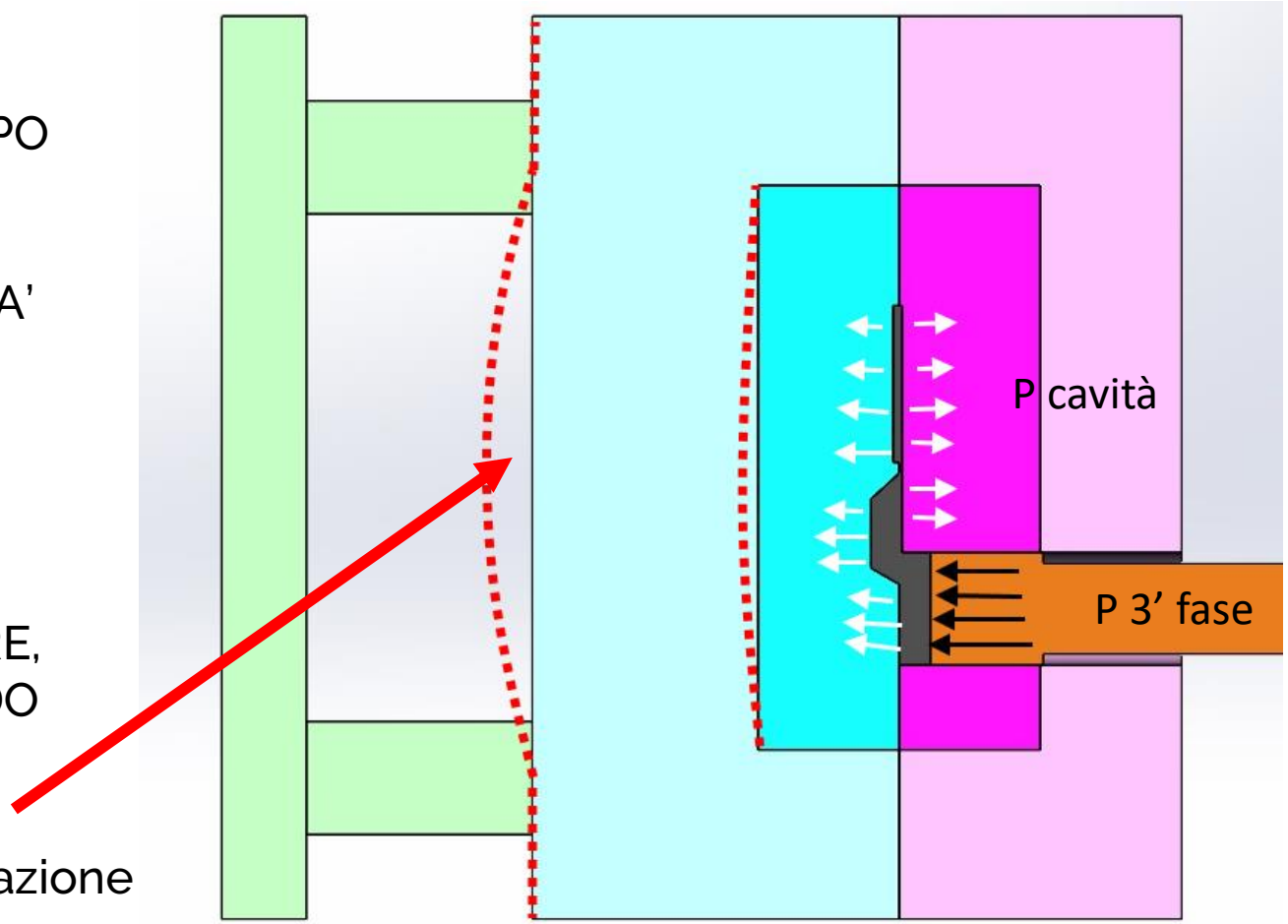
SOFTWARE «SEMPLICE» PER CALCOLI STRUTTRALI SUGLI STAMPI

- CALCOLO FATICA TERMOMECCANICA PER PROGETTARE IN MANIERA NON EMPIRICA STAMPI IN CONFIGURAZIONE «PUZZLE»
- VERIFICA DIMENSIONAMENTO PORTASTAMPI
- PROGETTO FINANZIATO DA UE ALL'INTERNO DEL PROGRAMMA **SME H2020**

Misure sperimentali

STAMPO STRUMENTATO ALLO SCOPO DIRETTO DI OTTENERE :

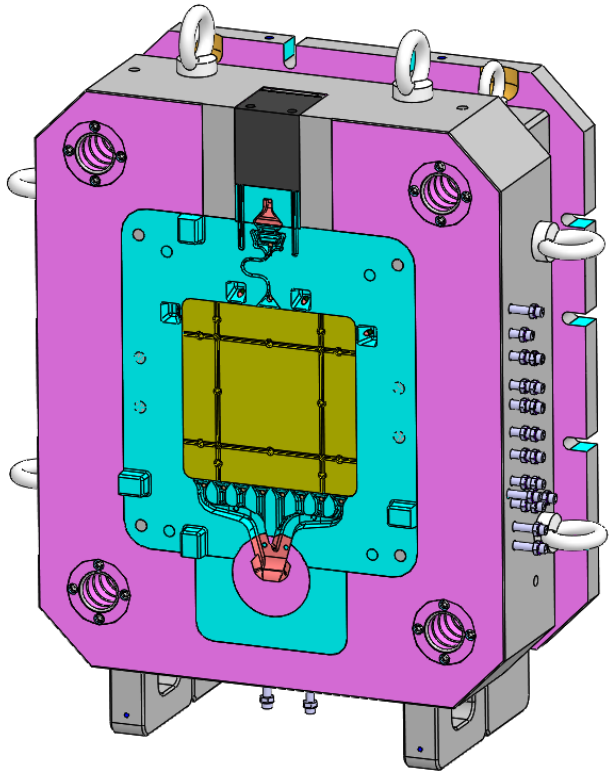
- TARATURA SOFTWARE vs. REALTA'
- CORRELAZIONE PARAMETRI DI PROCESSO vs. SOLLECITAZIONI MECCANICHE
- LO STAMPO, PER LE PRIME MISURE, NON AVEVA I «PUNTONI» IN MODO DA AVERE DEFORMAZIONI RILEVANTI

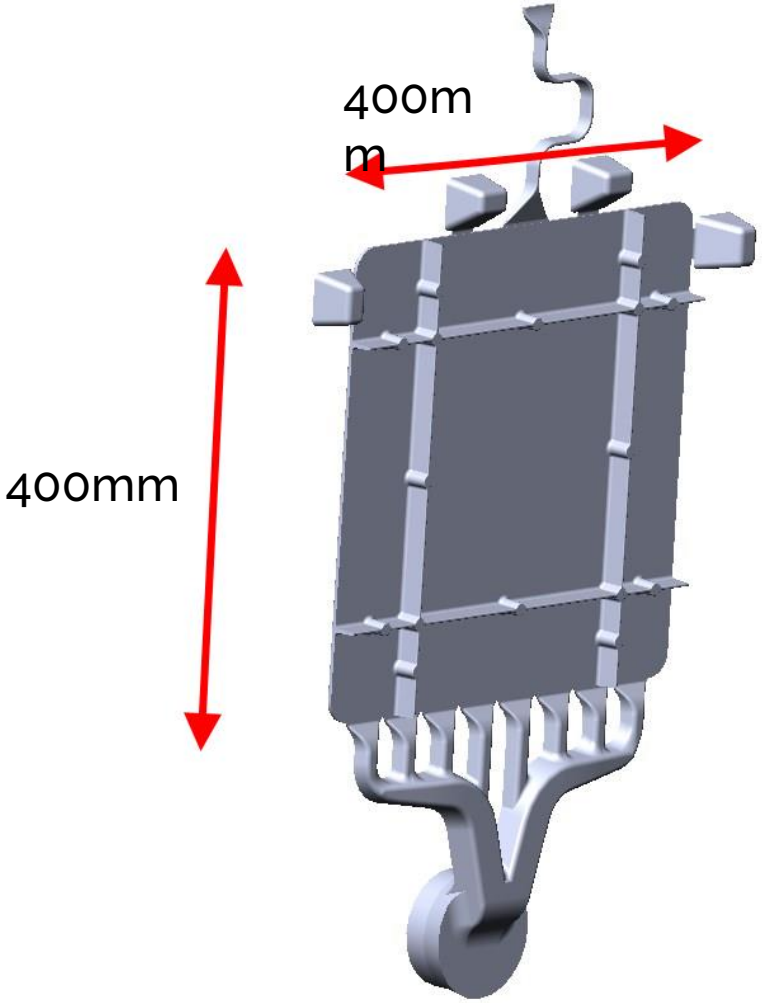


Stampo sperimentale

STAMPO E STAMPATA MOLTO SEMPLICI

PEZZO: 400x400mm
PRESSA: IDRA 1900

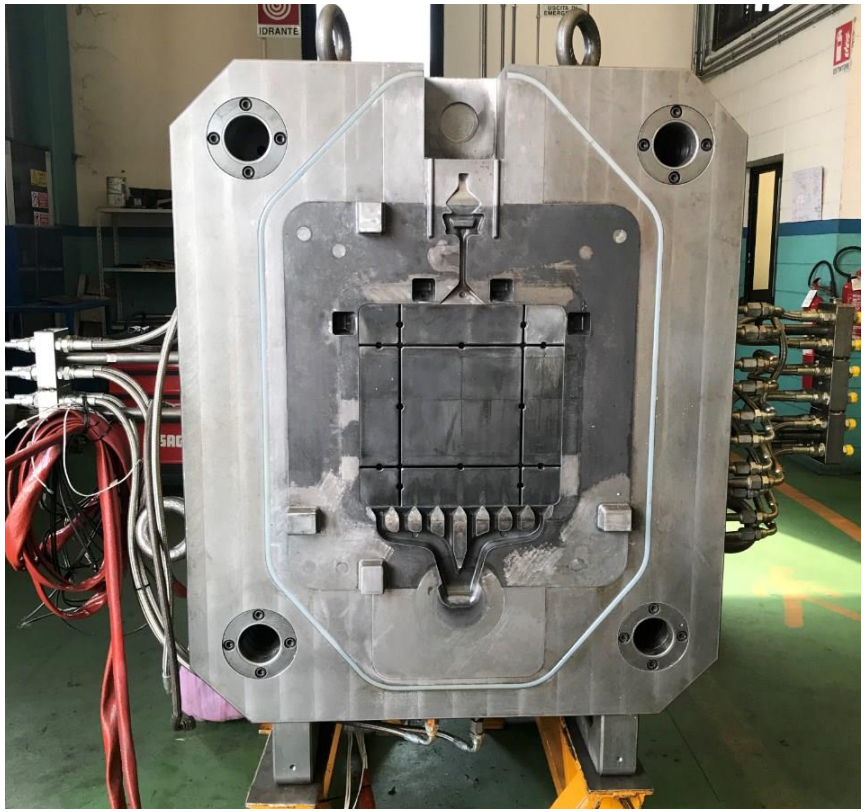


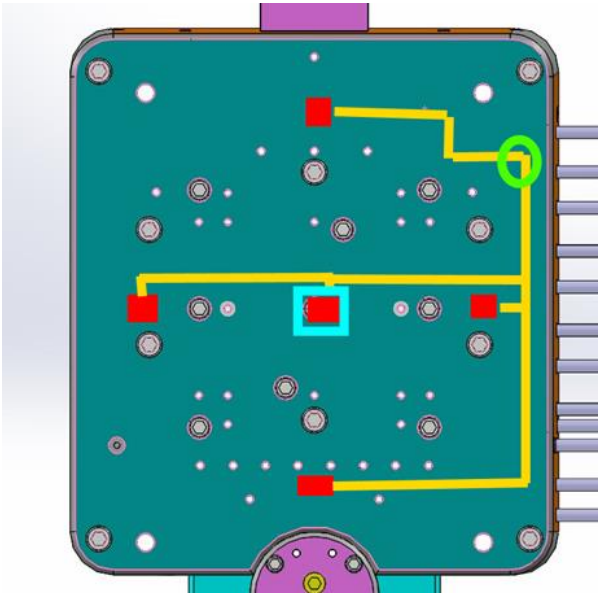


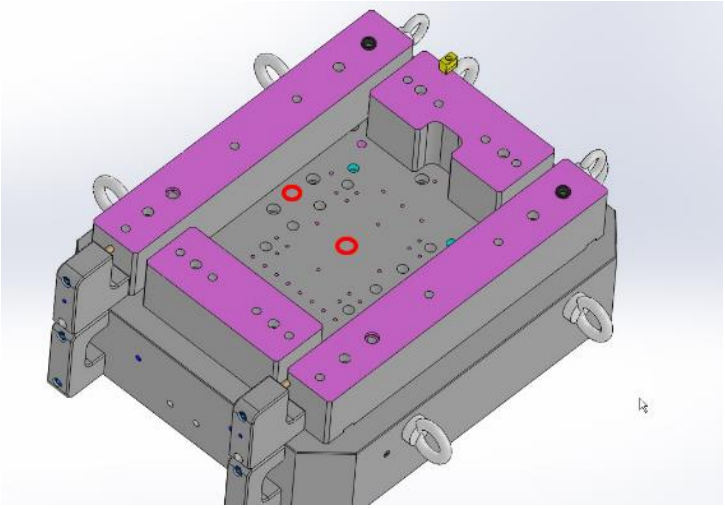
Stampo sperimentale

SENSORISTICA: PARTE MOBILE

Collaborazione UNIBS



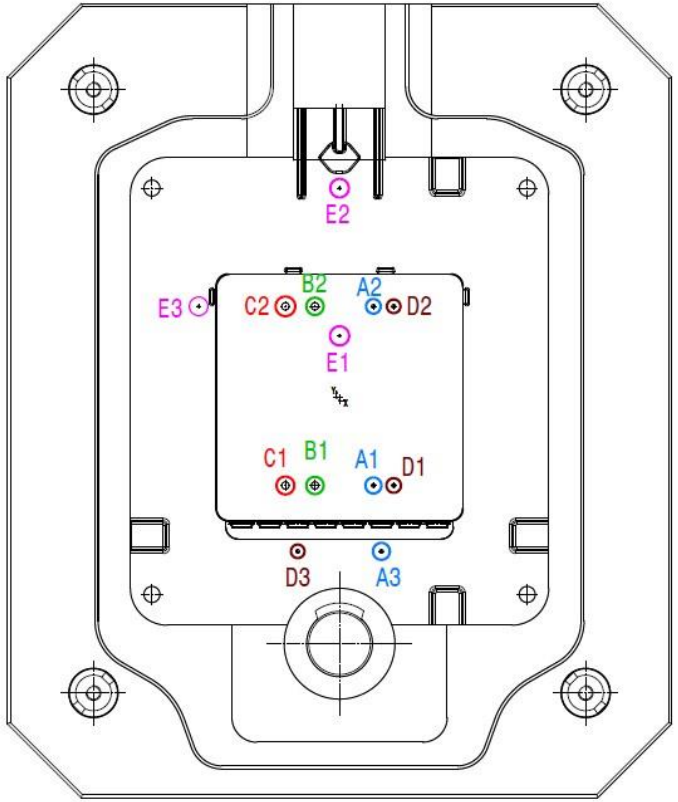




Stampo sperimentale

SENSORISTICA: PARTE FISSA

Collaborazione Electronics GmbH



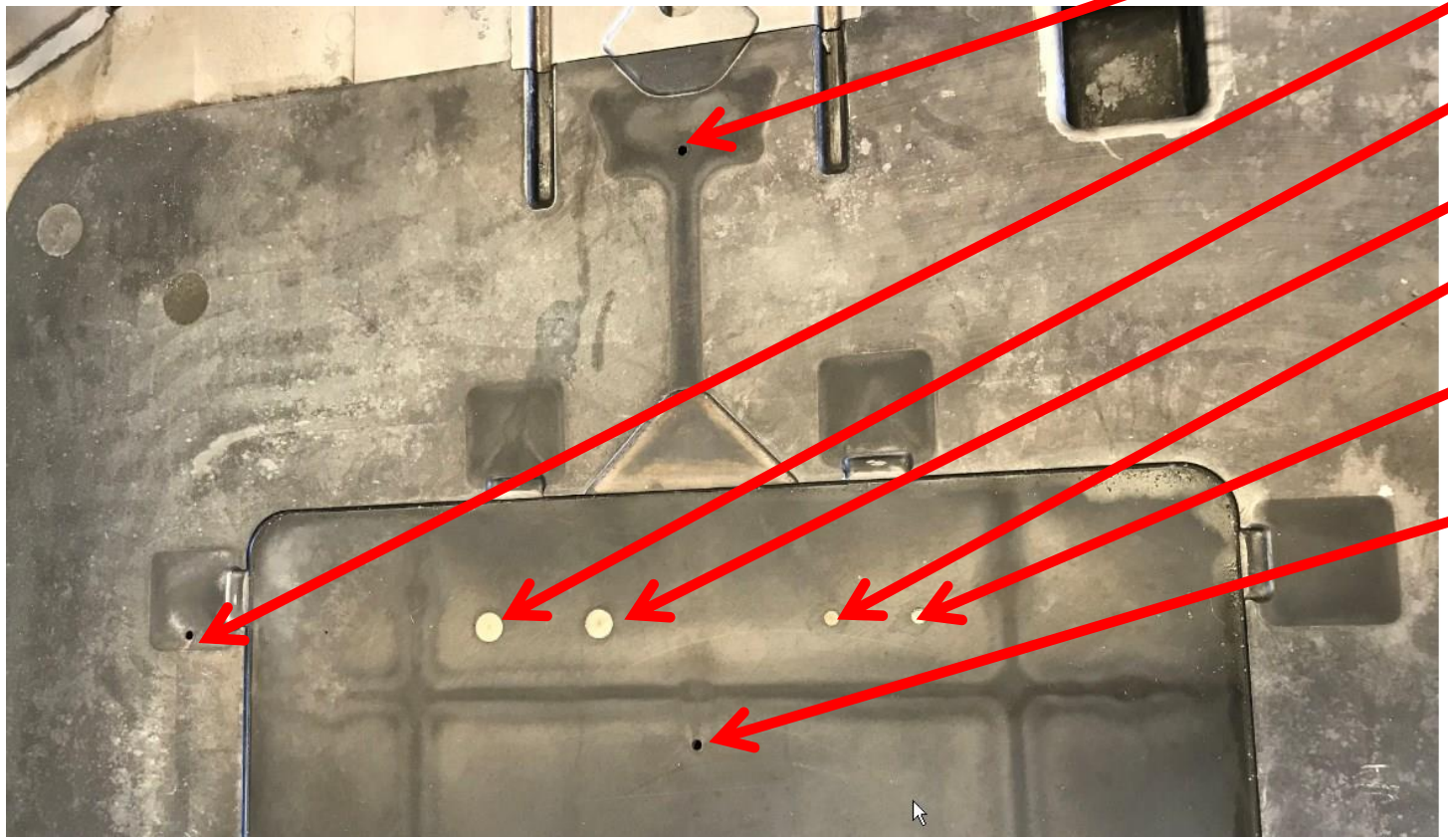
SENSORI "TEMPERATURA"	
RIF.	CODICE
C1	EHS0083-7 T5-LIVELLO 0.1.2.5
B1	EHS0083-9 T5-LIVELLO 10-20-40
A1	EHS0083-15 T1-LIVELLO
A2	EHS0083-15 T1-LIVELLO
B2	EHS0083-9 T5-LIVELLO 10-20-40
C2	EHS0083-7 T5-LIVELLO 0.1.2.5
A3	EHS0085-15 T1-LIVELLO

SENSORI "ALLUMINIO"	
RIF.	CODICE
D1	EHS0085-10-P-ALL
D2	EHS0085-10-P-ALL
D3	EHS0085-10-P-ALL

SENSORI "ARIA"	
RIF.	CODICE
E1	EHS0015-P-AIR
E2	EHS0015-P-AIR
E3	EHS0015-P-AIR

Stampo sperimentale

SENSORISTICA: PARTE FISSA



P (aria)

P (aria)

T (0,1,2,3,4)

T (0,10,20,30,40)

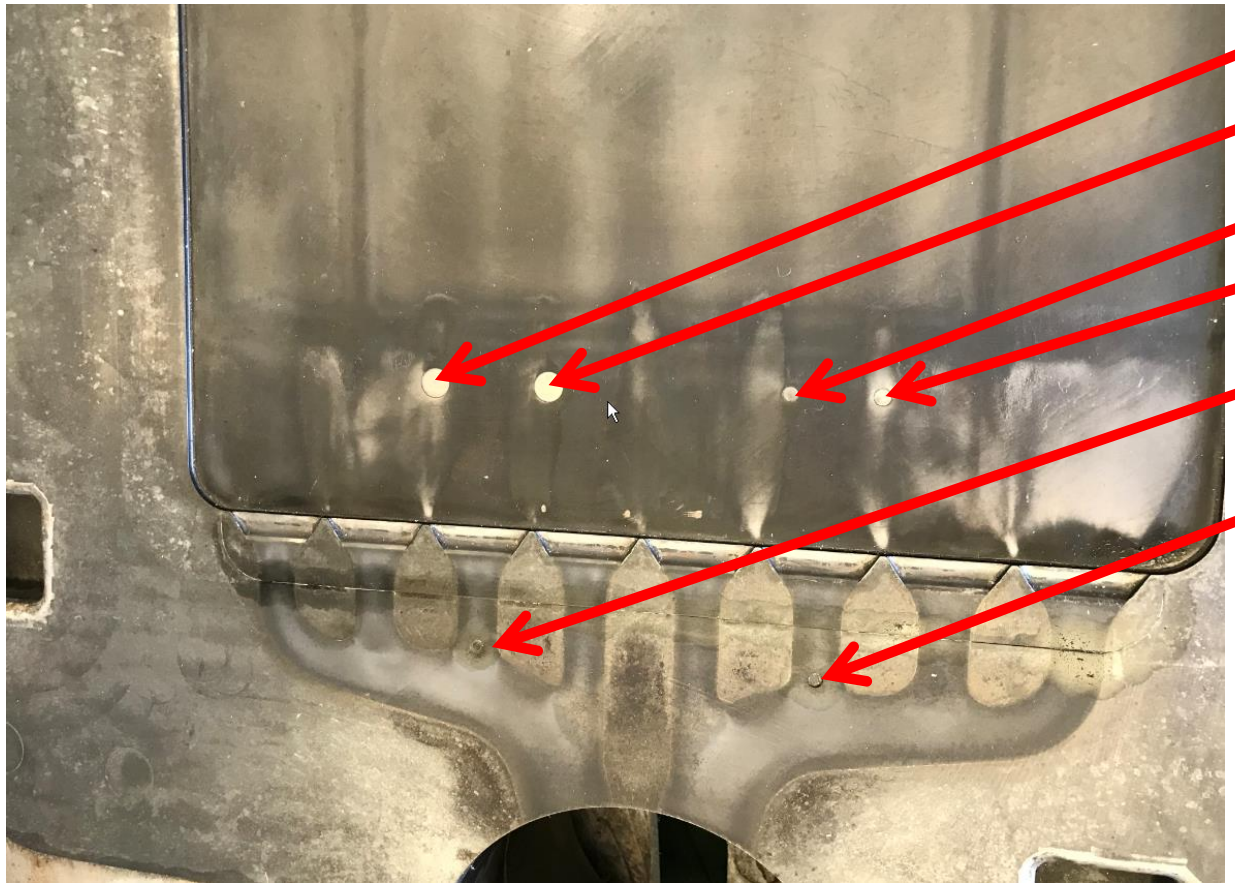
T (0 level)

P Aluminum

P (aria)

Stampo sperimentale

SENSORISTICA: PARTE FISSA



T (0,1,2,3,4)

T (0,10,20,30,40)

T (0 level)

P Aluminum

T (0 level)

P Aluminum

Risultati investigati

1) DEFORMAZIONE STAMPO vs PRESSIONE IN CAVITA'

2) PRESSIONE IN CAVITA' vs PRESSIONE 3' FASE MACCHINA

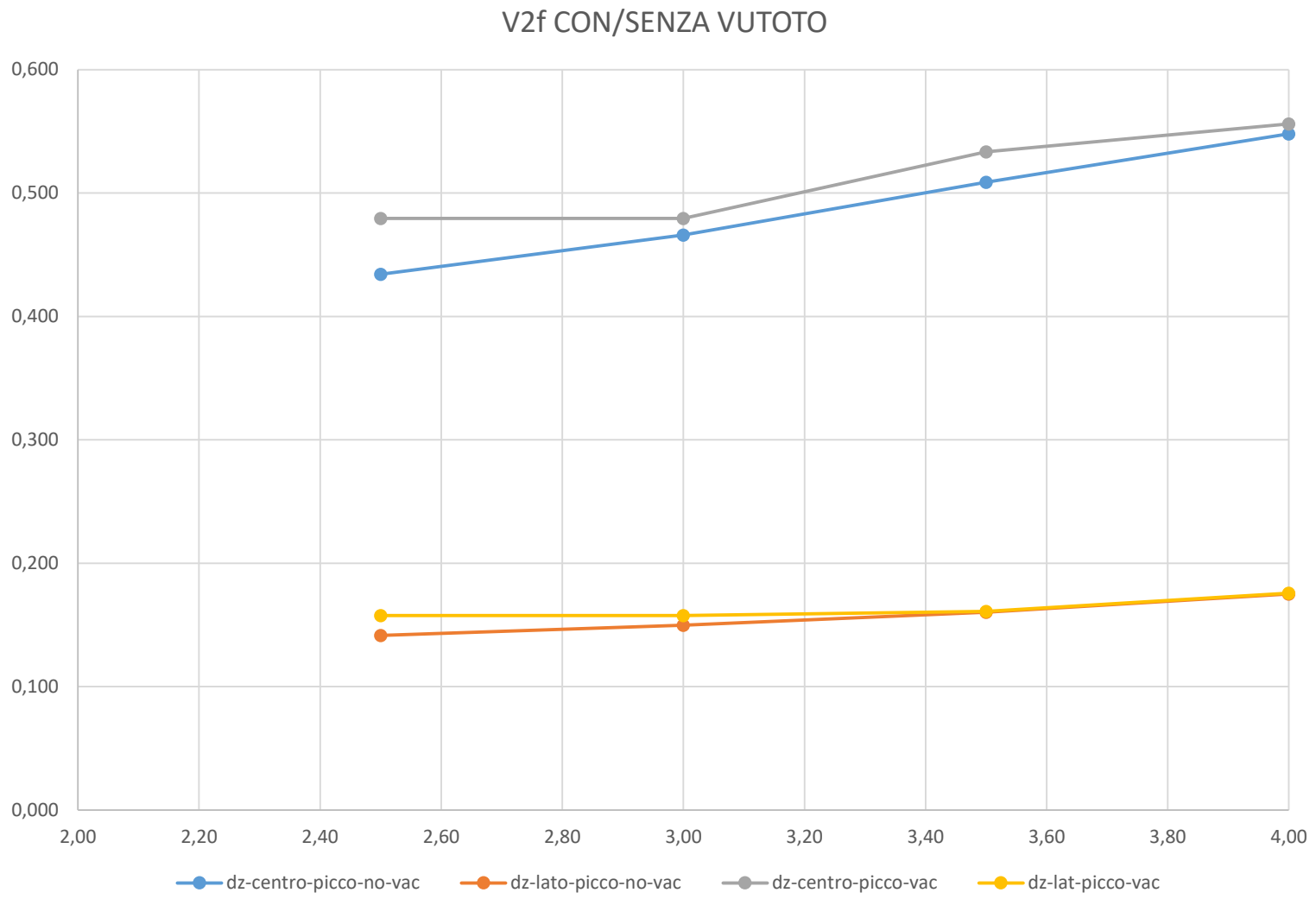
   a) PRESSIONE CAVITA' vs SPESSORE PEZZO
   b) PRESSIONE CAVITA' vs VELOCITA' 2' FASE
   c) PRESSIONE CAVITA' vs VUOTO (ATTIVO/PASSIVO/NO)

3) TEMPERATURE durante CICLO

4) PRESSIONE ARIA IN CAVITA' vs. SISTEMA DI ASPIRAZIONE

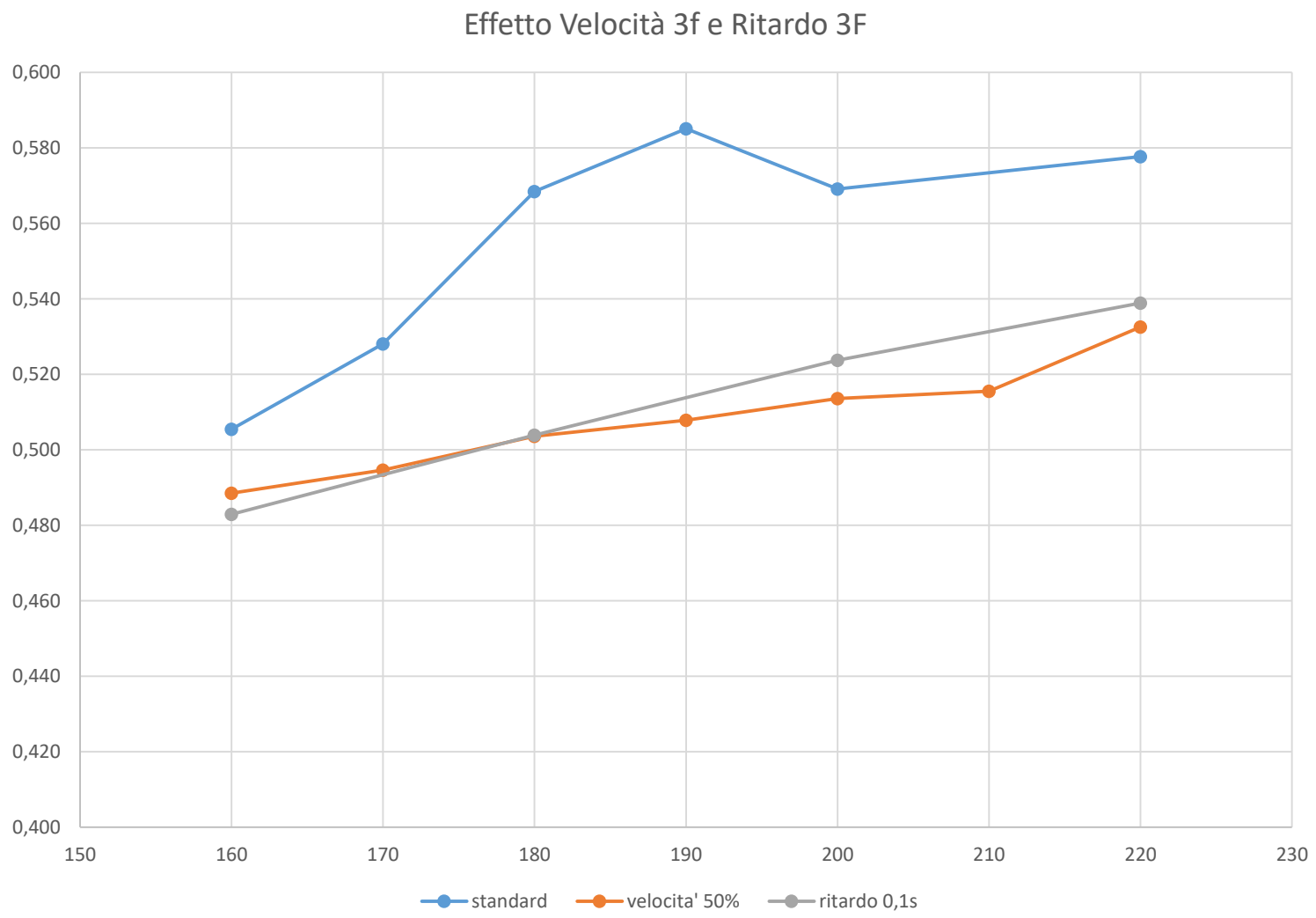
DEFORMAZIONE STAMPO

Variazione deformazione con velocità 2' fase, con e senza vuoto attivo



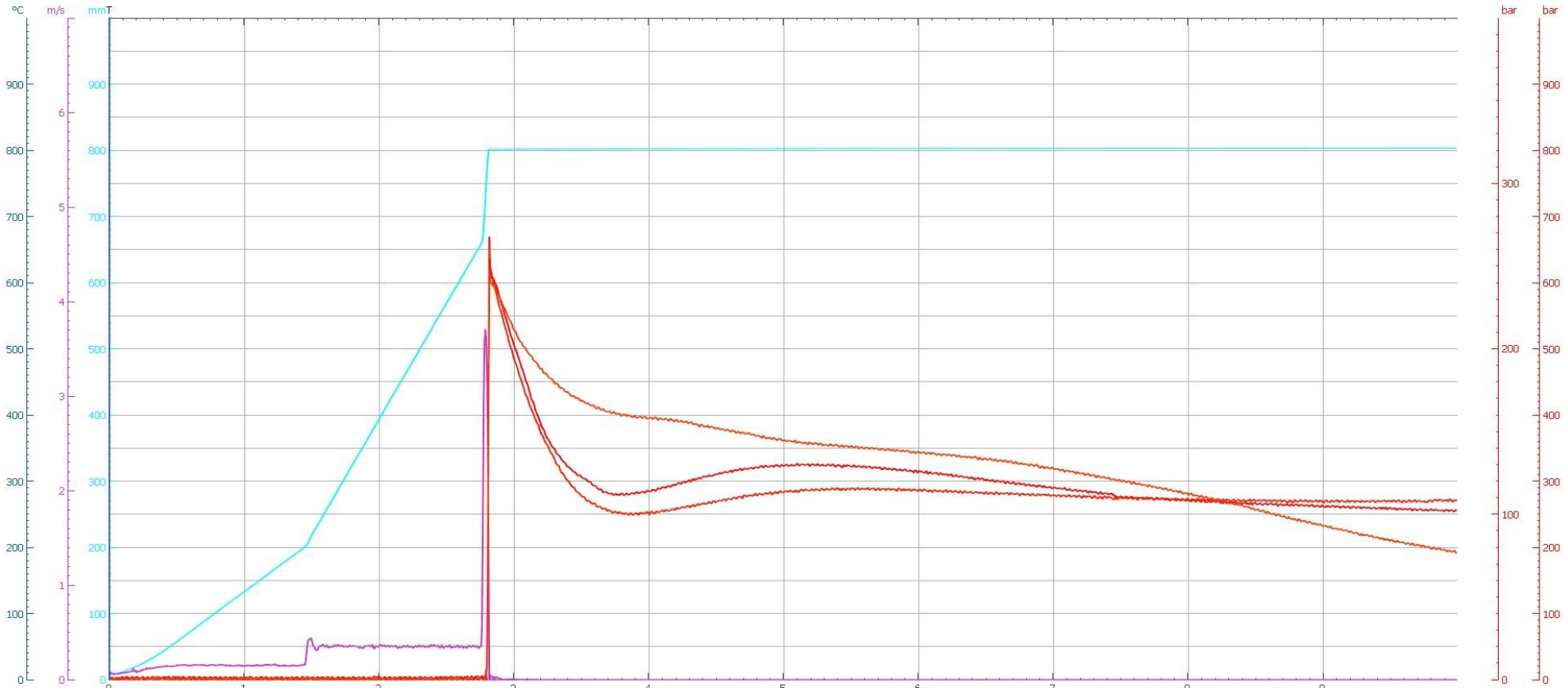
DEFORMAZIONE STAMPO

Variazione deformazione in funzione della Pressione 3' fase, sua velocità, e ritardo



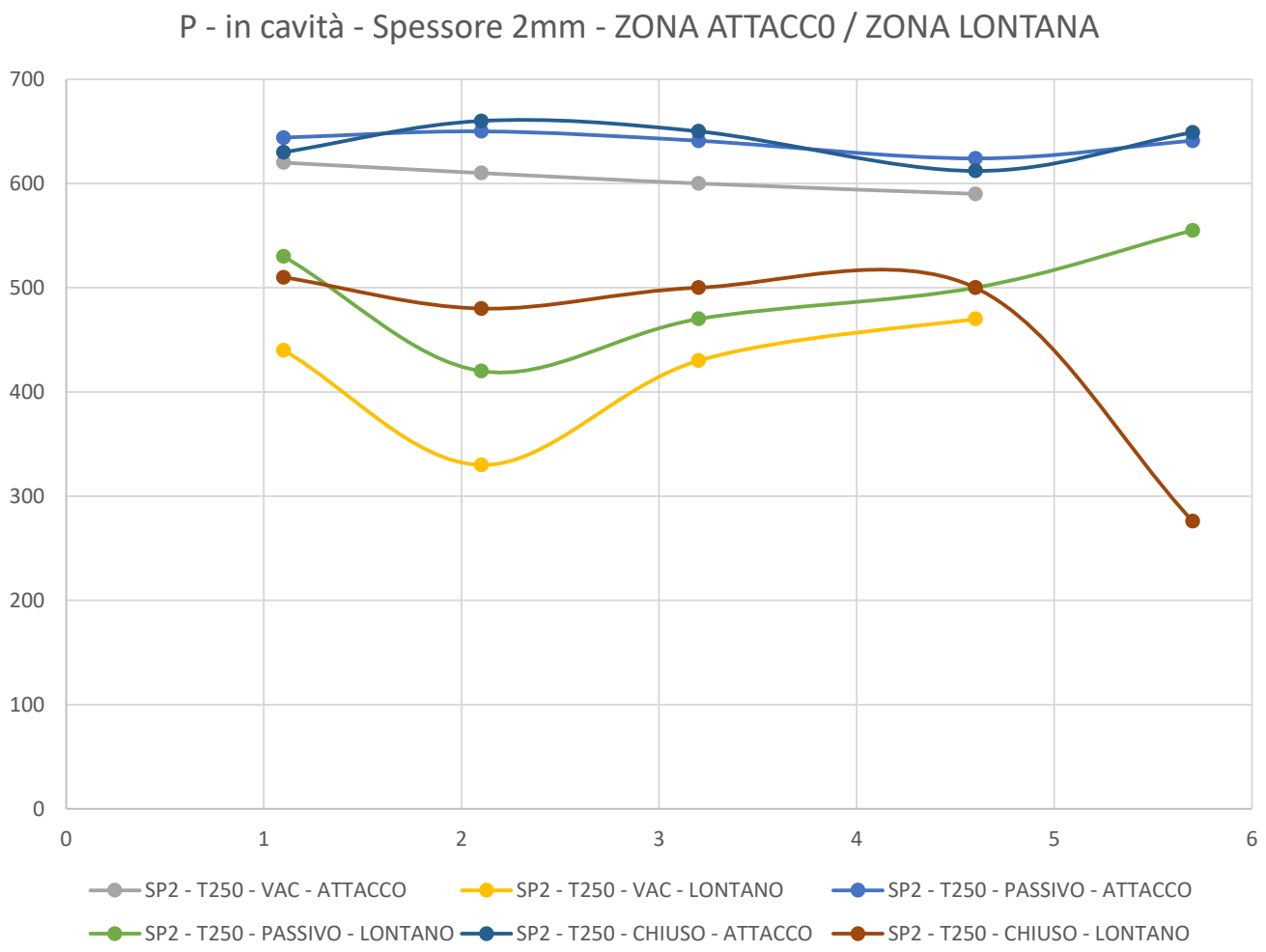
PRESSIONE in CAVITA'

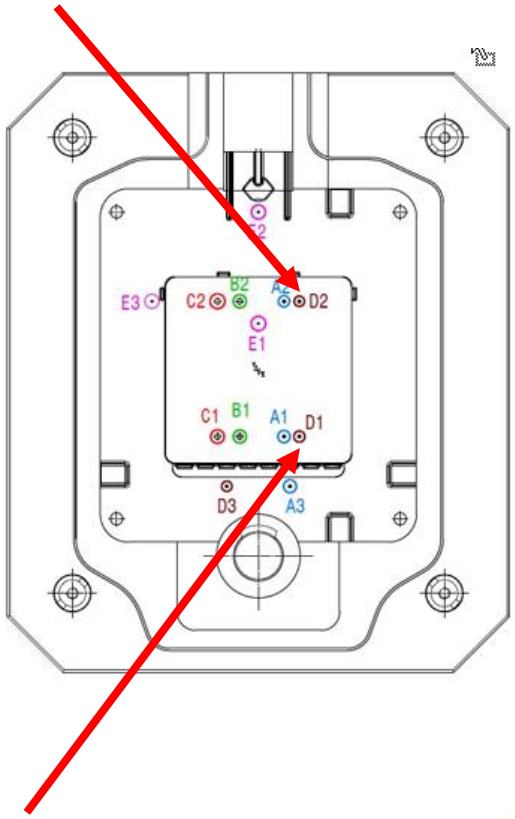
P3 –nominale 810 bar- pezzo spessore 2mm



PRESSIONE in CAVITA'

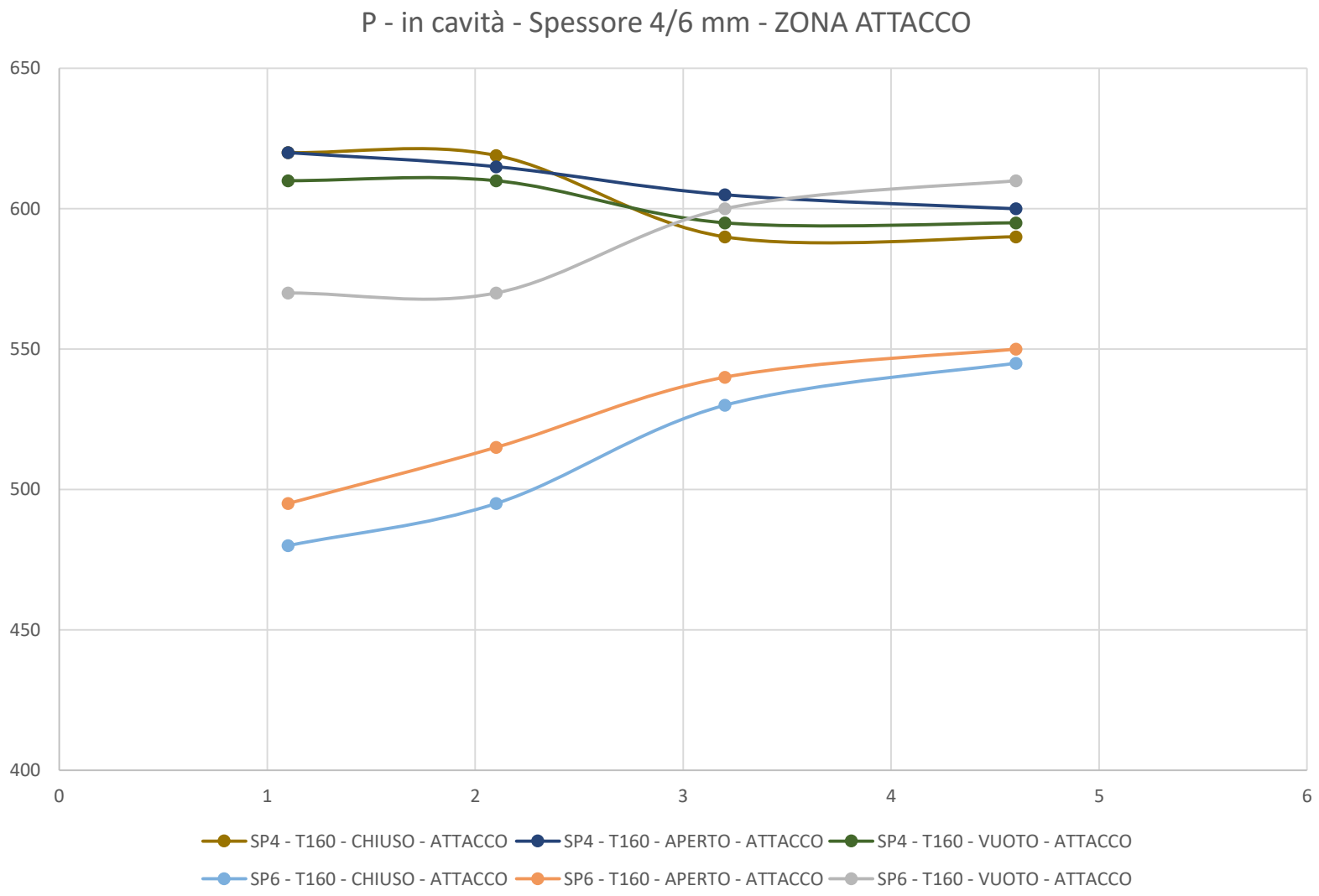
P3 –nominale 810 bar- pezzo spessore 2mm



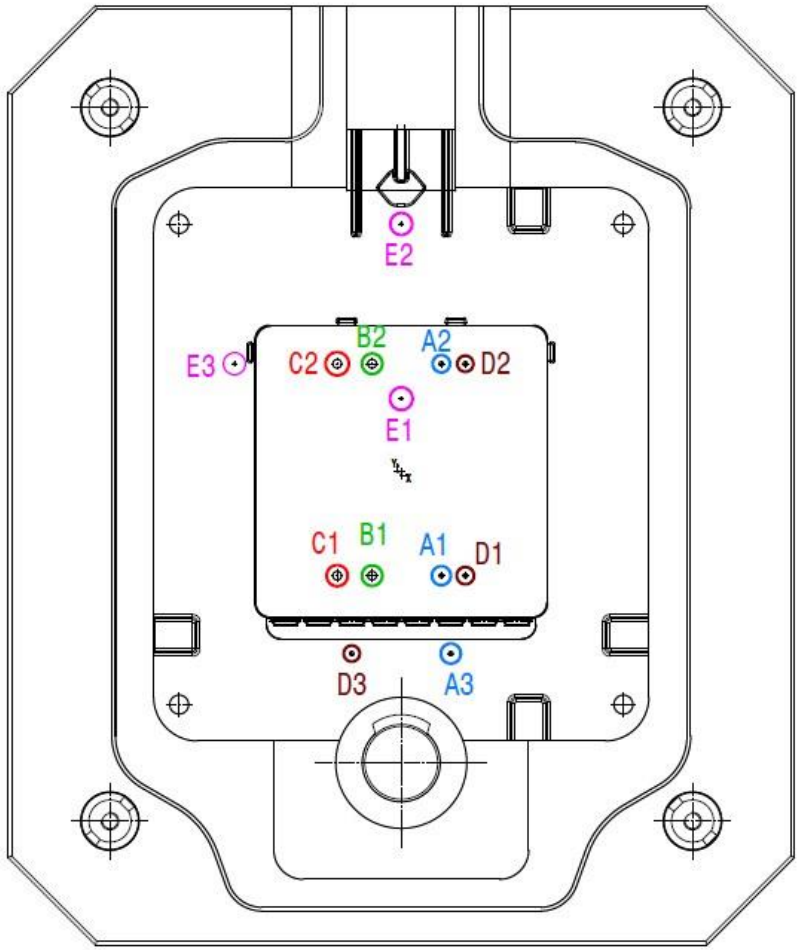


PRESSIONI in CAVITA'

P3 –nominale 810 bar



PRESSIONI ARIA



SENSORI "TEMPERATURA"	
RIF.	CODICE
C1	EHS0083-7 T5-LIVELLO 0.1.2.5
B1	EHS0083-9 T5-LIVELLO 10-20-40
A1	EHS0083-15 T1-LIVELLO
A2	EHS0083-15 T1-LIVELLO
B2	EHS0083-9 T5-LIVELLO 10-20-40
C2	EHS0083-7 T5-LIVELLO 0.1.2.5
A3	EHS0085-15 T1-LIVELLO

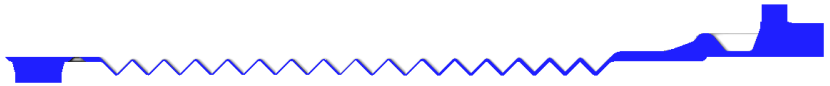
SENSORI "ALLUMINIO"	
RIF.	CODICE
D1	EHS0085-10-P-ALL
D2	EHS0085-10-P-ALL
D3	EHS0085-10-P-ALL

SENSORI "ARIA"	
RIF.	CODICE
E1	EHS0015-P-AIR
E2	EHS0015-P-AIR
E3	EHS0015-P-AIR

PRESSIONI ARIA

TEST CON O SENZA ASPIRAZIONE

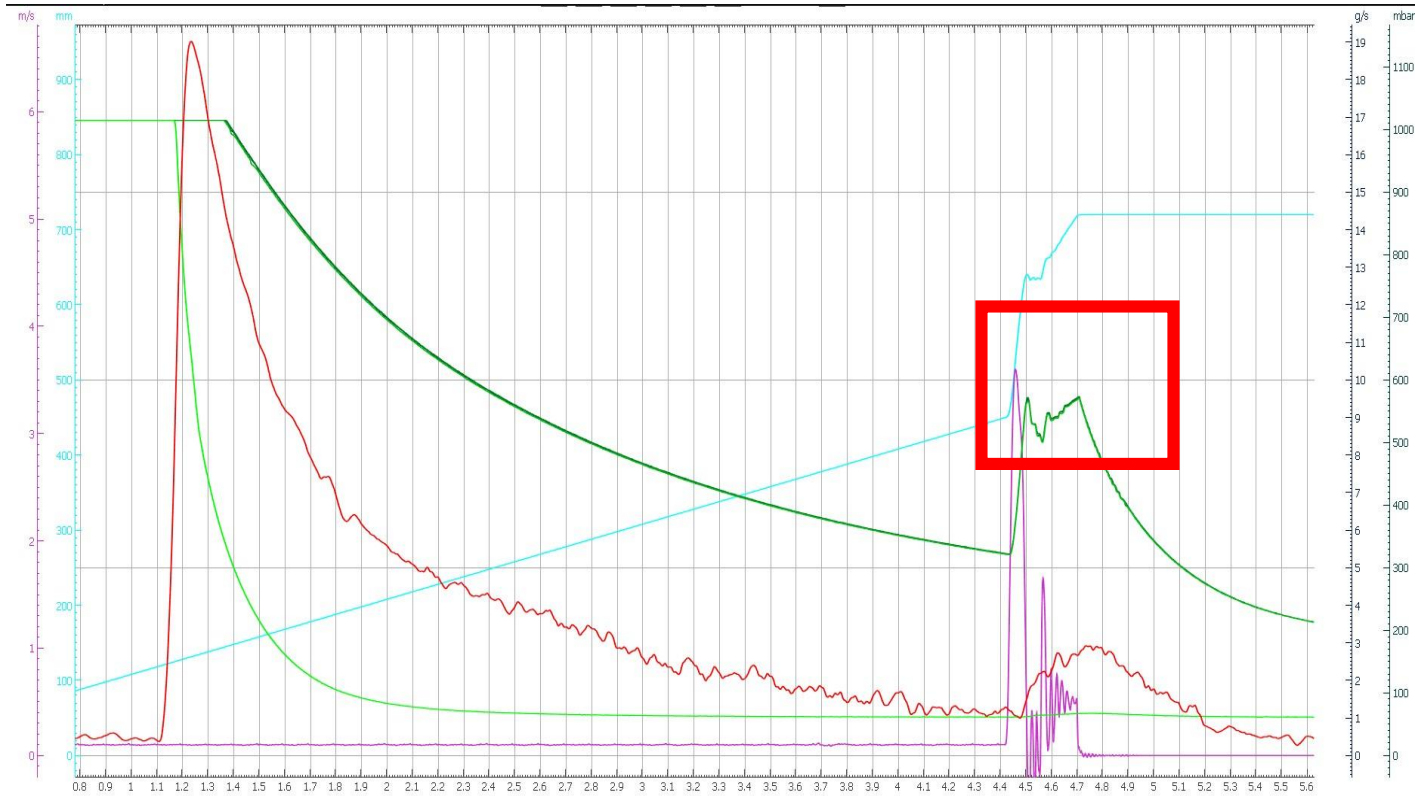
1) CHILL VENT STANDARD , SPESSORE 0,7
2) CHILL VENT STANDARD , SPESSORE 0,5
3) CHILL VENT CON CRESTE APPUNTITE
4) VALVOLA FONDAREX MACRO

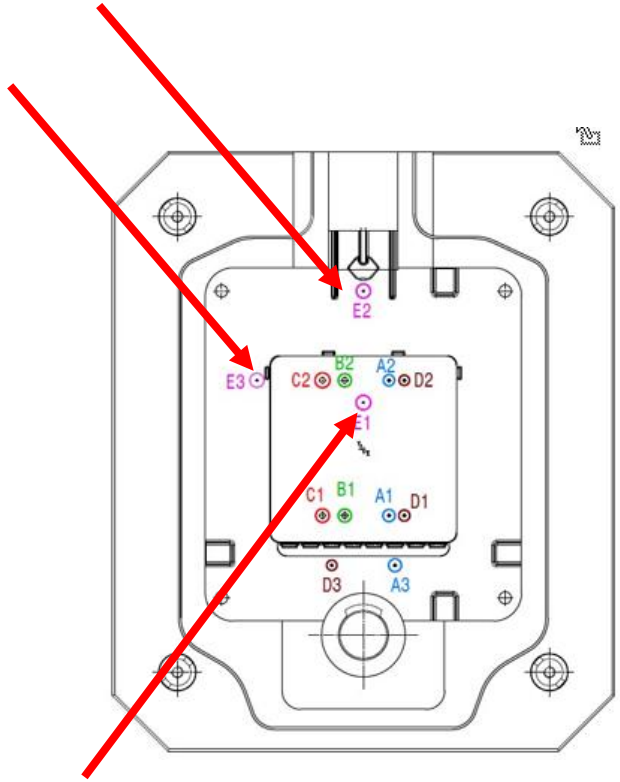


Scopo di questo test era quello di creare un algoritmo più preciso per Castle Air.

Condizioni al contorno più precise per CastleBody

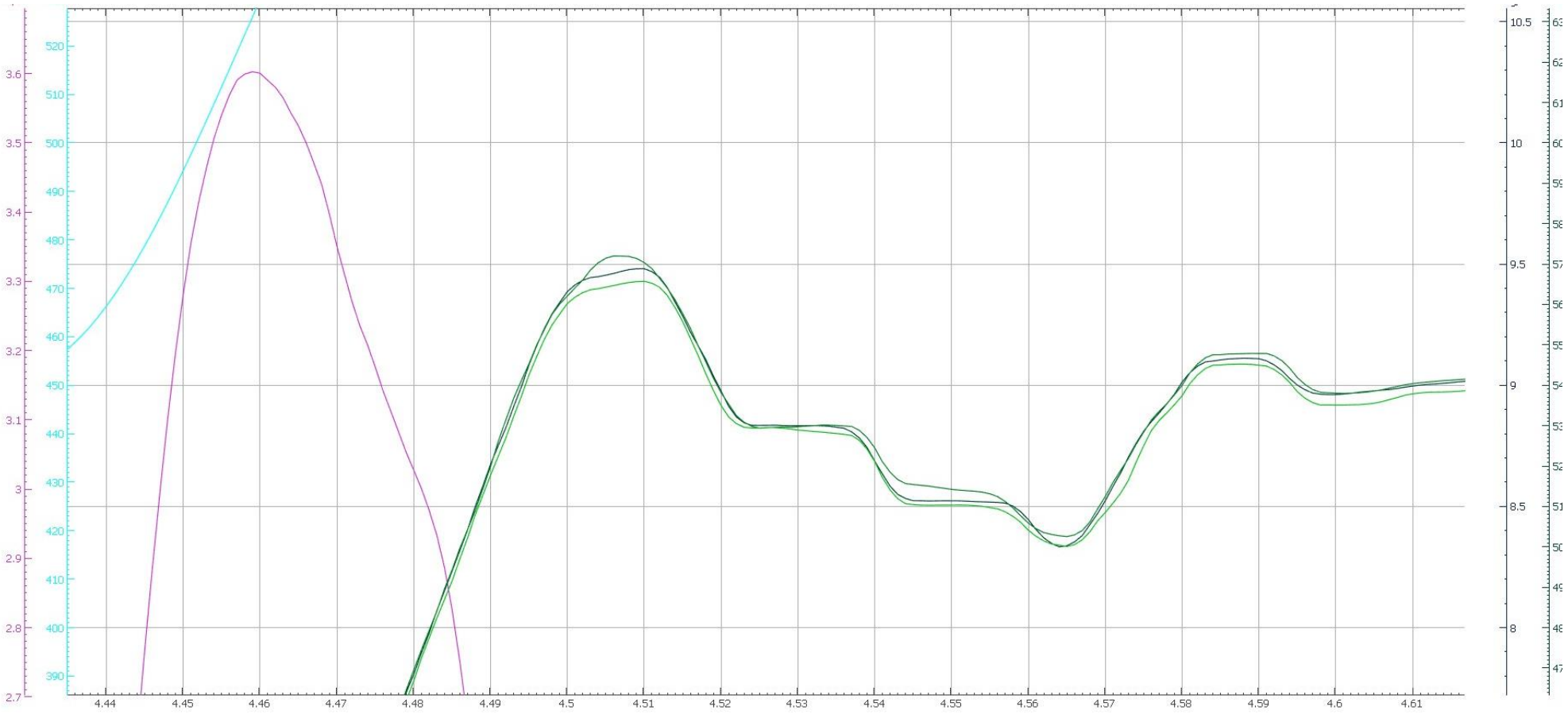
PRESSIONI ARIA





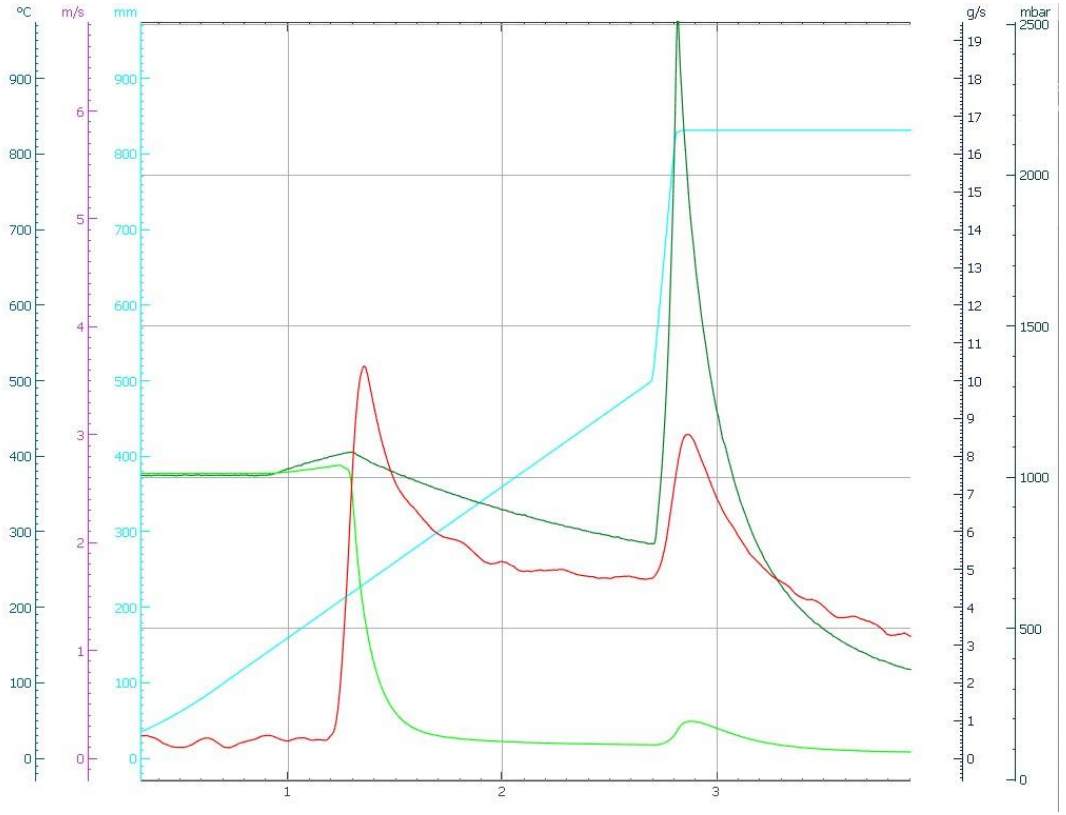
PRESSIONI ARIA

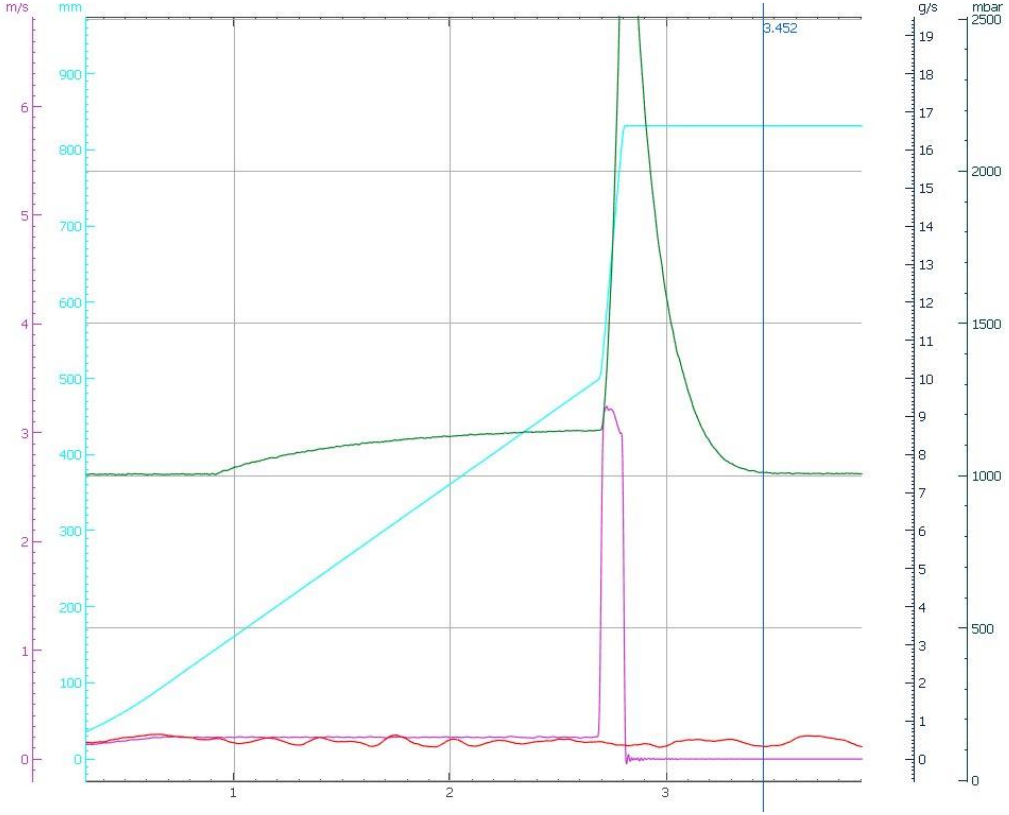
Le curve pressione in cavità sono sovrapponibili



PRESSIONI ARIA

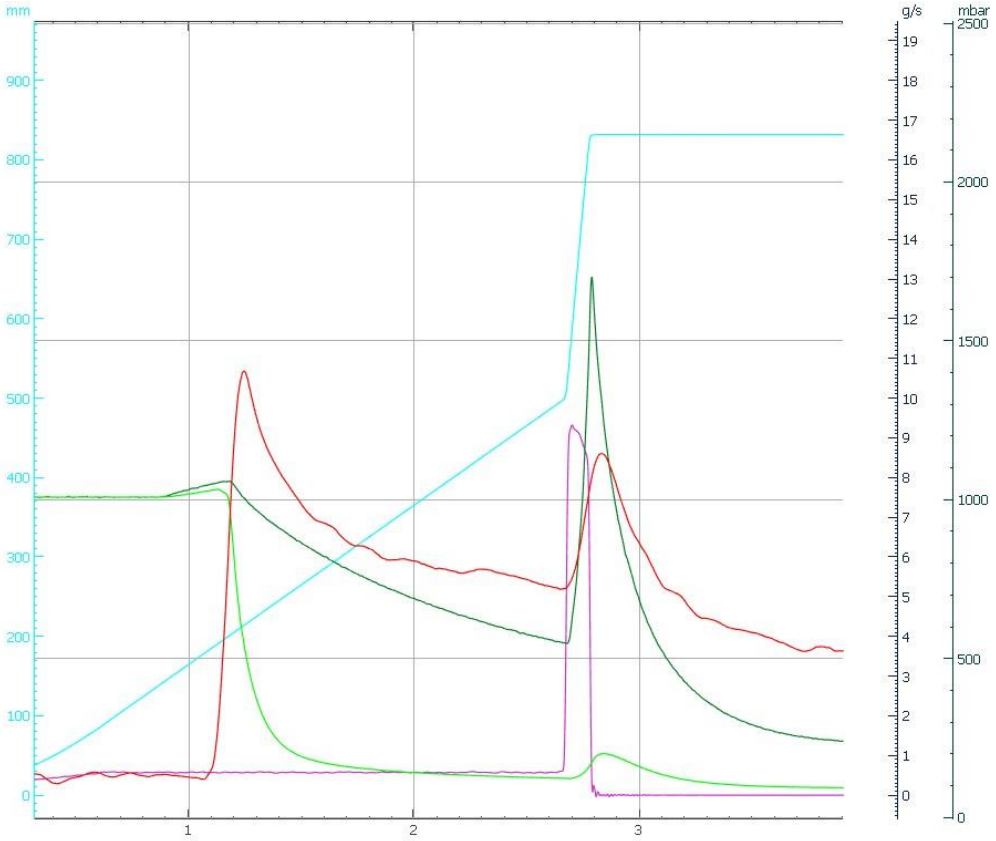
Chill vent «standard» attivo/passivo – spessore 0,5

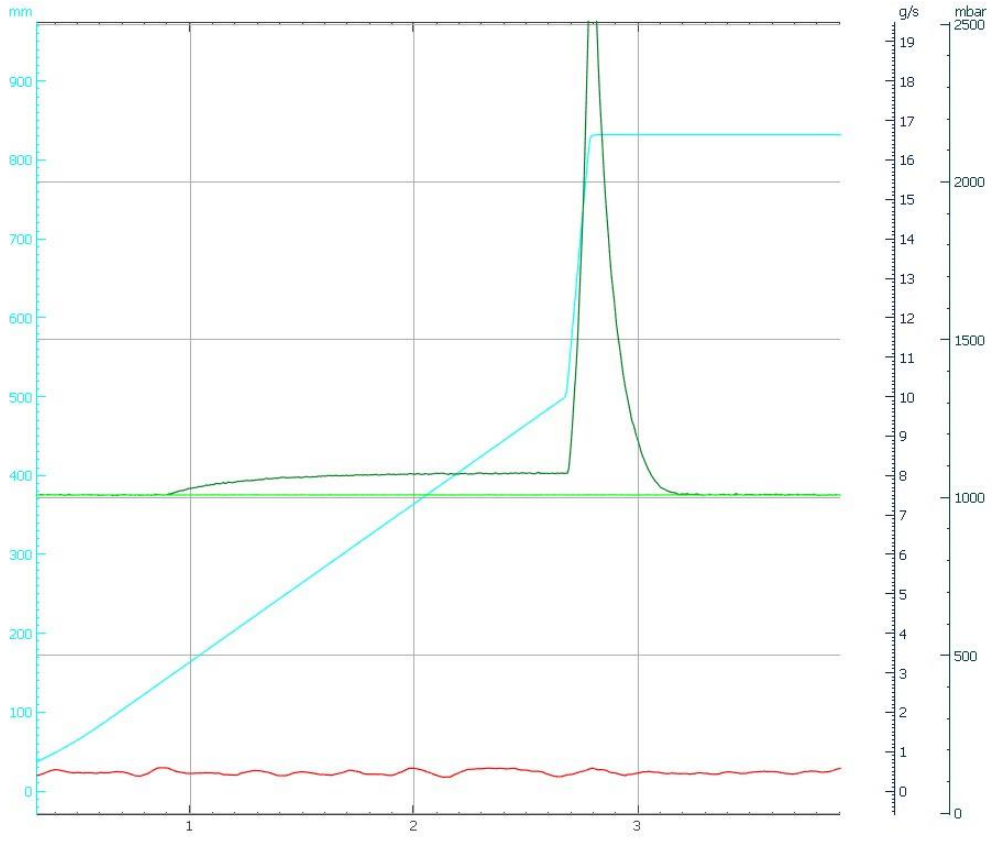




PRESSIONI ARIA

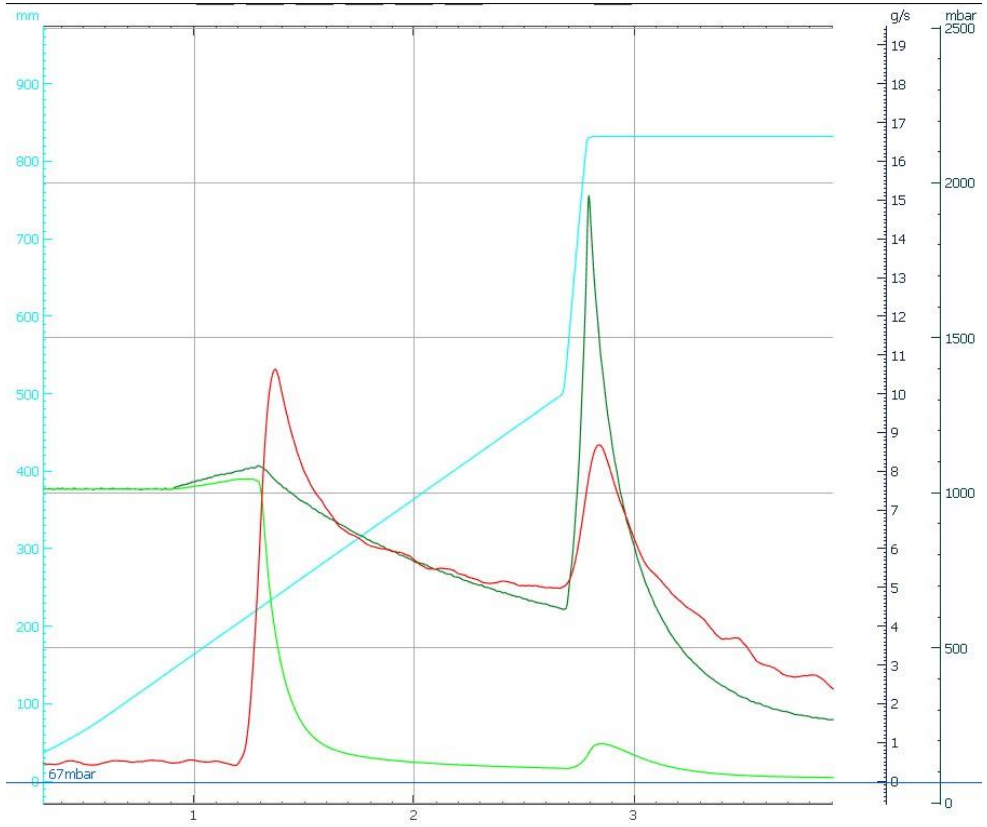
Chill vent «standard» attivo/passivo – spessore 0,7

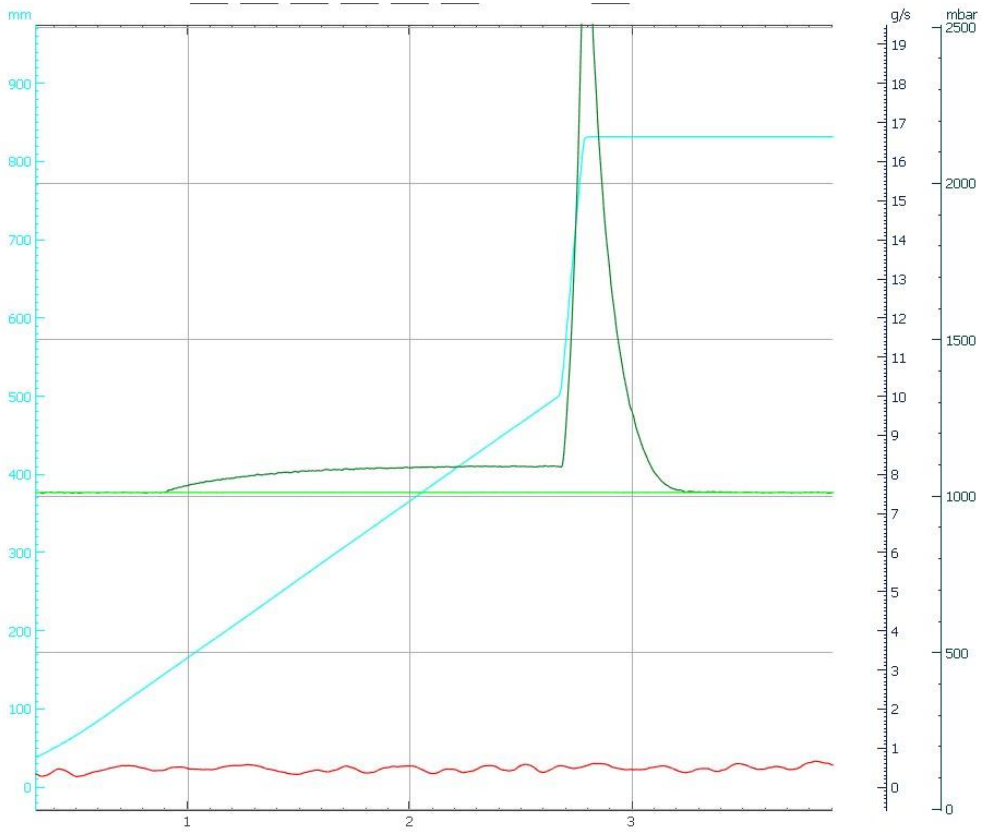




PRESSIONI ARIA

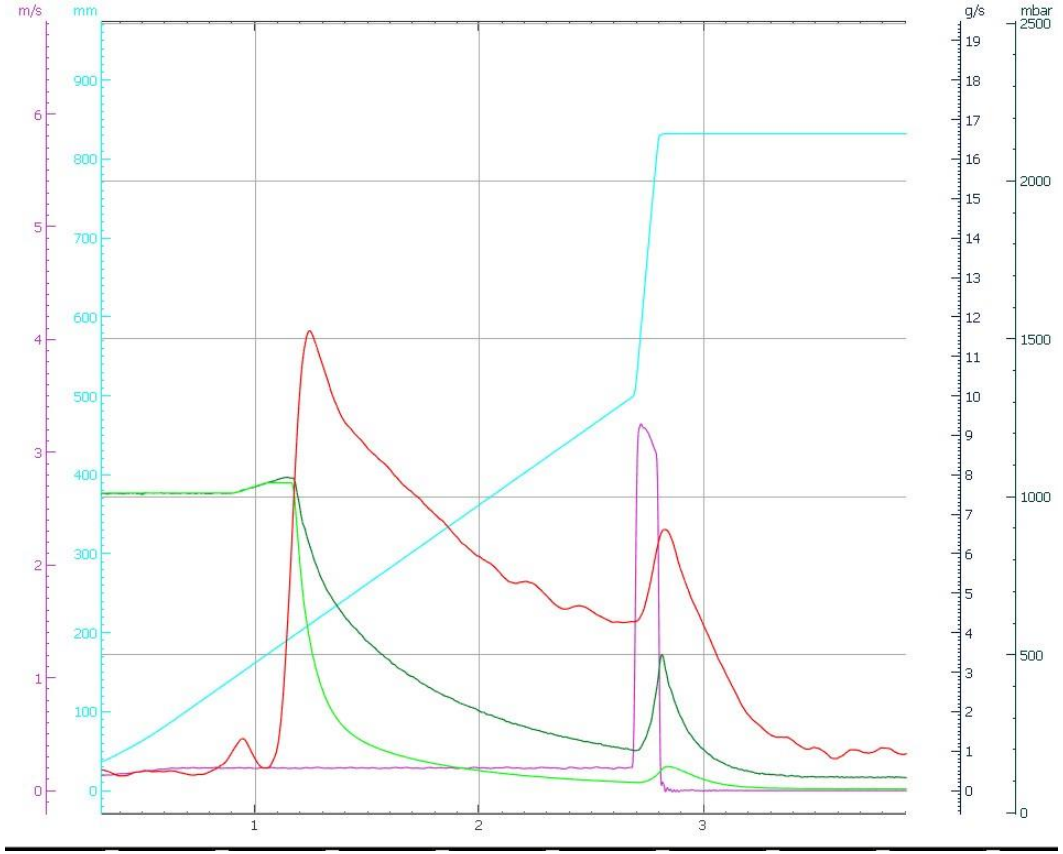
Chill vent «appuntito» attivo/passivo – spessore 0,7





PRESSIONI ARIA

Valvola Fondarex attivo/passivo



PRESSIONI ARIA

Riassumendo

Pressione inizio 2' fase	APERTO	ASPIRAZIONE
CHILL VENT STANDARD SPESSORE 0,5	1147	778
CHILL VENT STANDARD SPESSORE 0,7	1078	544
CHILL VENT APPUNTITO SPESSORE 0,7	1092	621
FONDAREX	1010	189

PRESSIONI ARIA

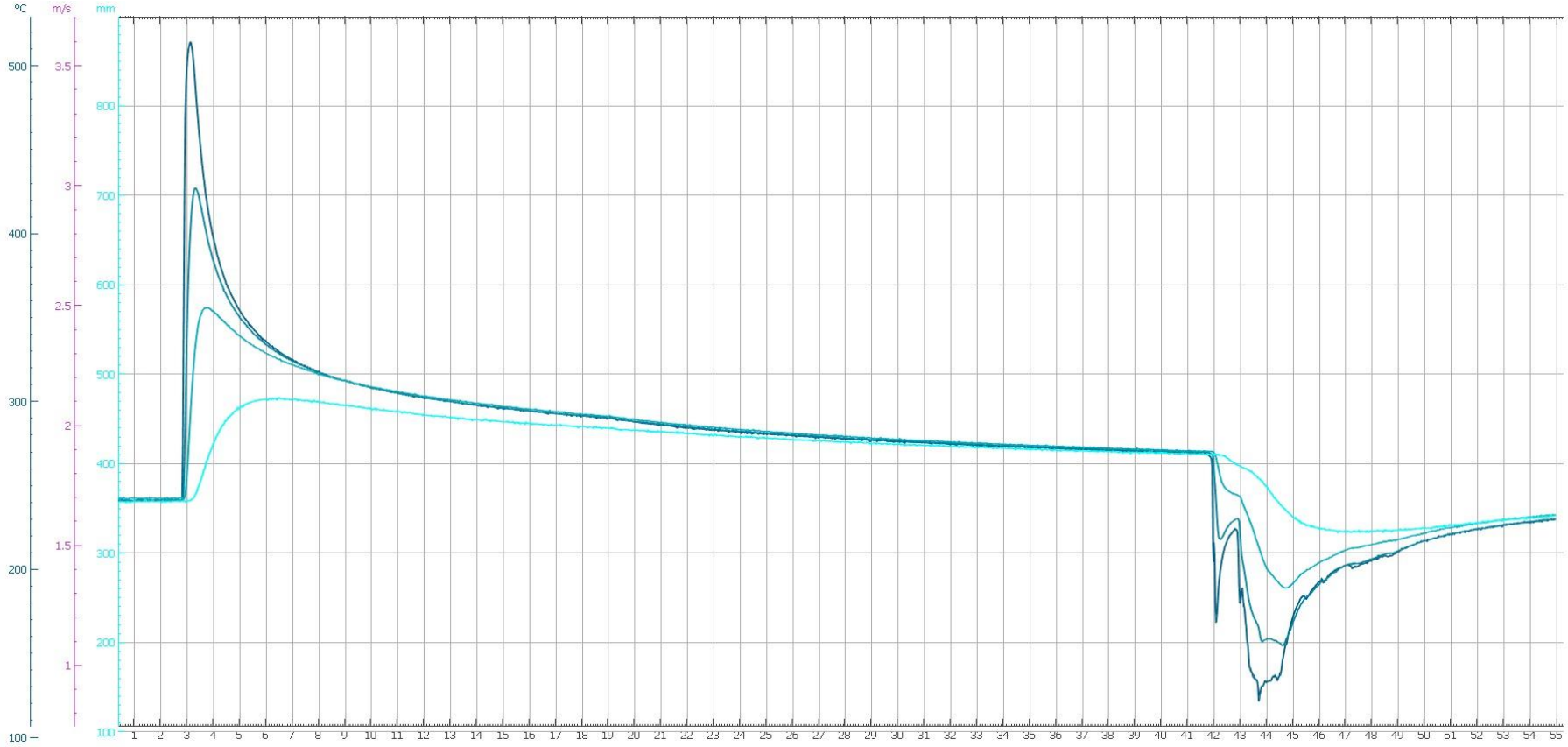
Riassumendo

- NON SERVE SEMPRE LA VALVOLA PIU' PERFORMANTE
- DIPENDE DA GEOMETRIA / VOLUMI DEL GETTO
- DIPENDE DA GRANDEZZE DEL PROCESSO

CASTLE AIR è fatto per dare suggerimenti.

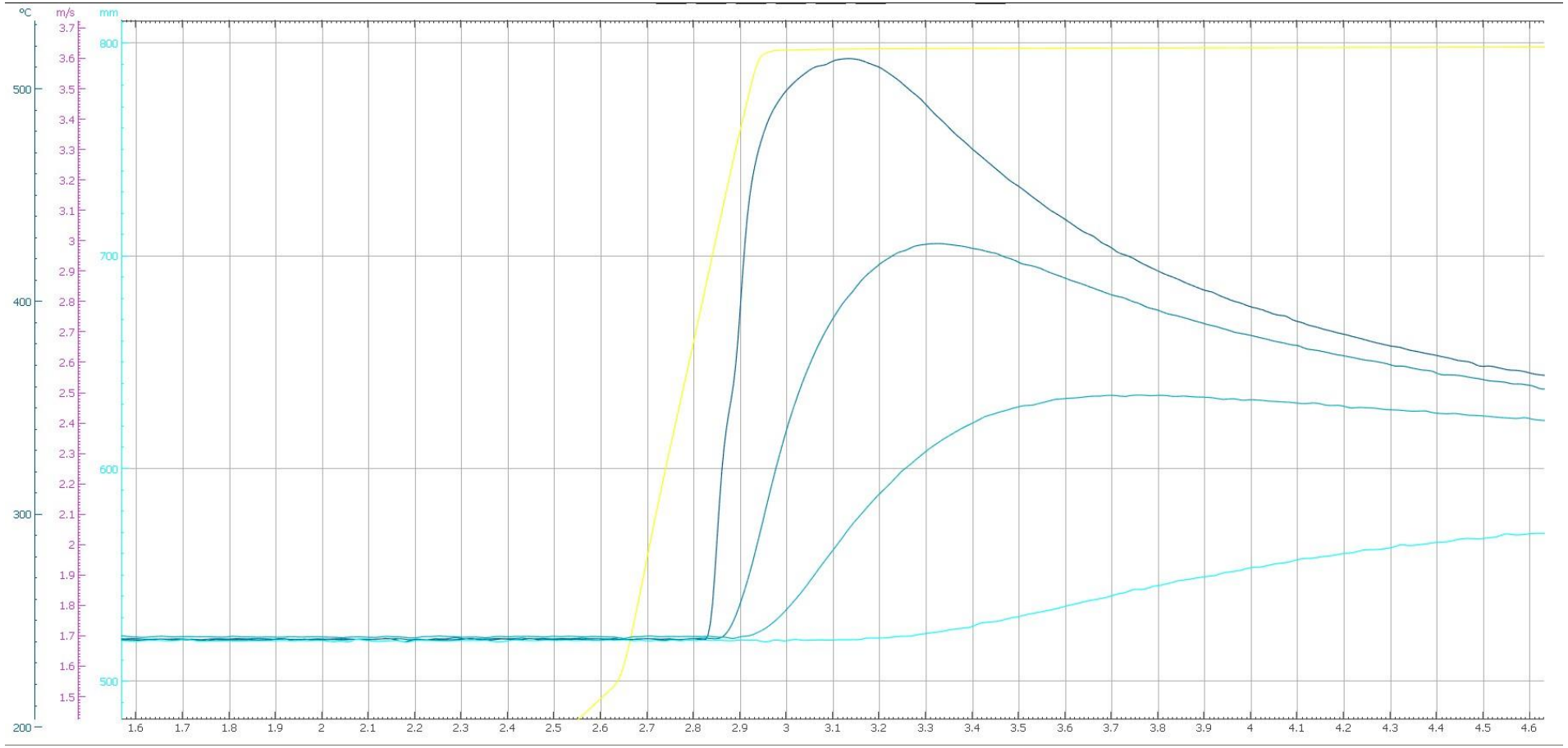
TEMPERATURE

Andamento T durante ciclo



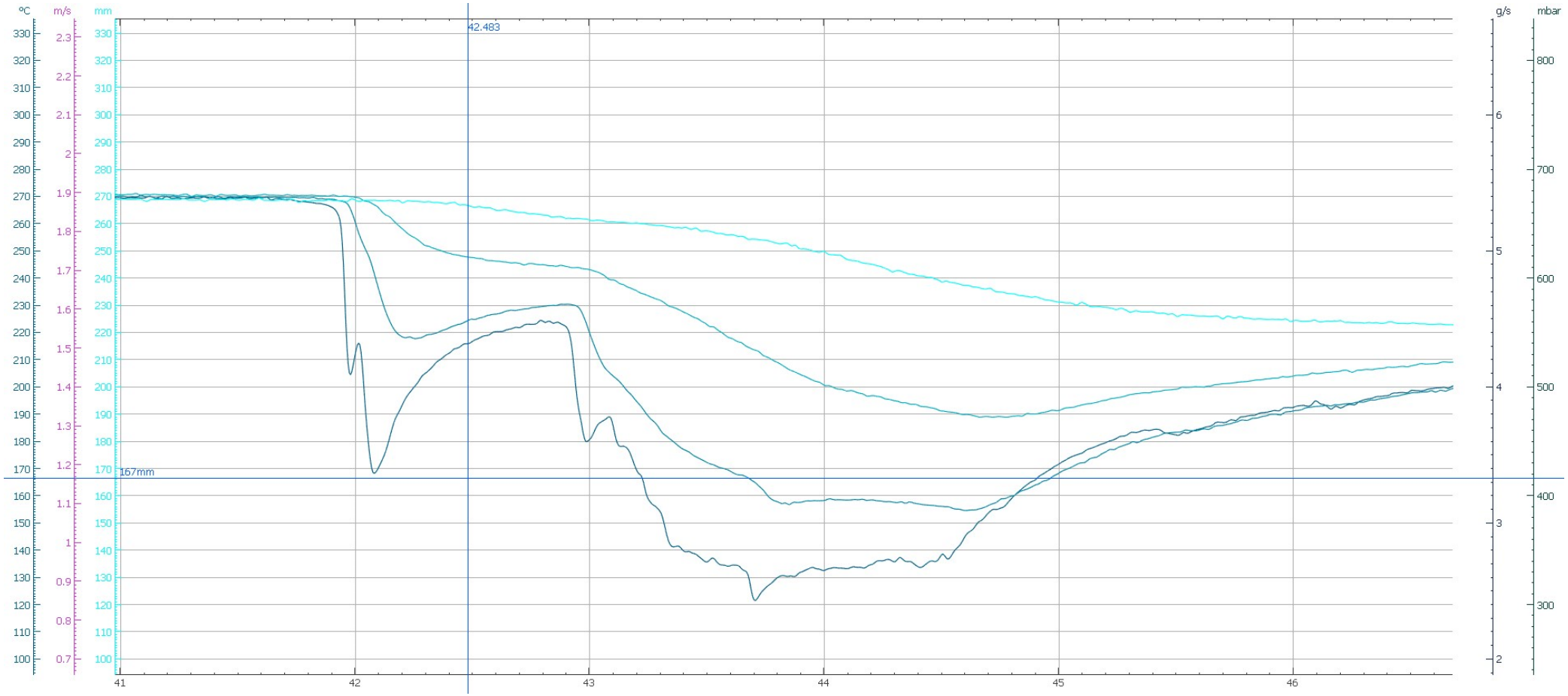
TEMPERATURE

Andamento T : iniezione e solidificazione



TEMPERATURE

Andamento T : lubrifica



RISULTATI QUALITATIVI

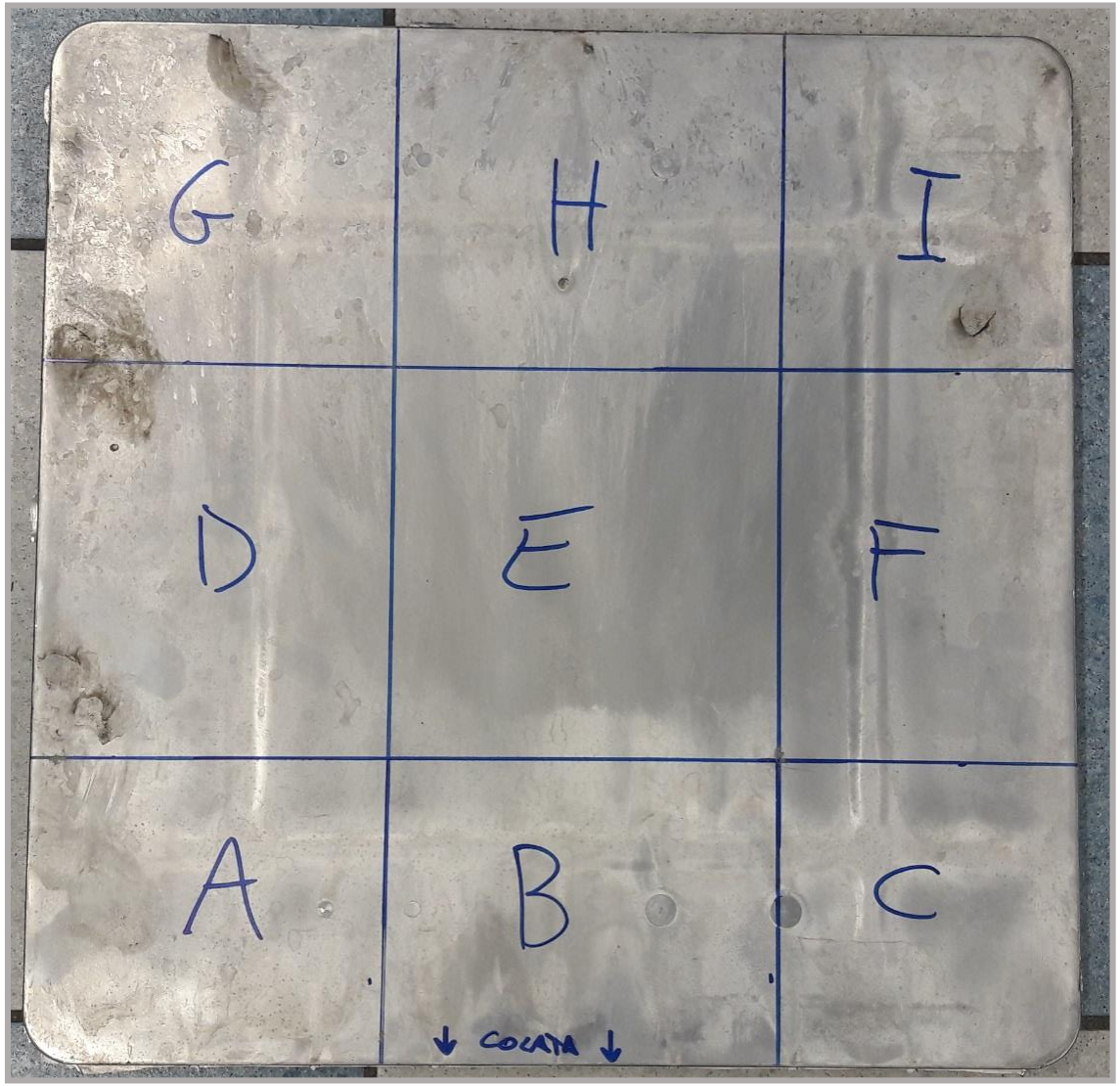
QUALITA’ DEI PEZZI VERIFICATI AI RAGGI «X» PER POROSITA’ DA RITIRO NELLE BORCHIE

1) QUALITA’ vs SPESSORE PEZZO
3) QUALITA’ vs VELOCITA’ FASE
4) QUALITA’ vs VUOTO (ATTIVO/PASSIVO/NO)

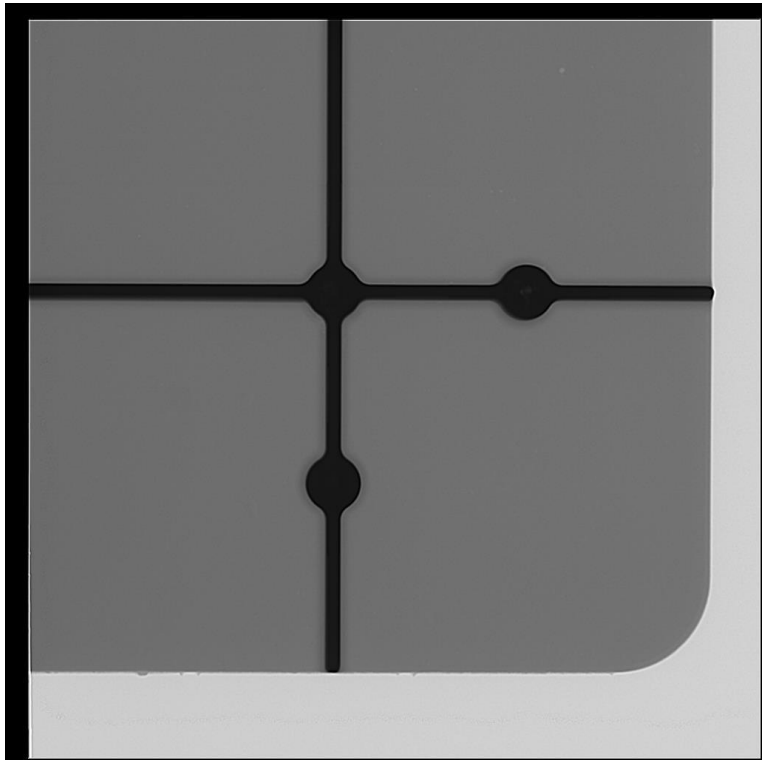
RISULTATI QUALITATIVI

Analisi RX

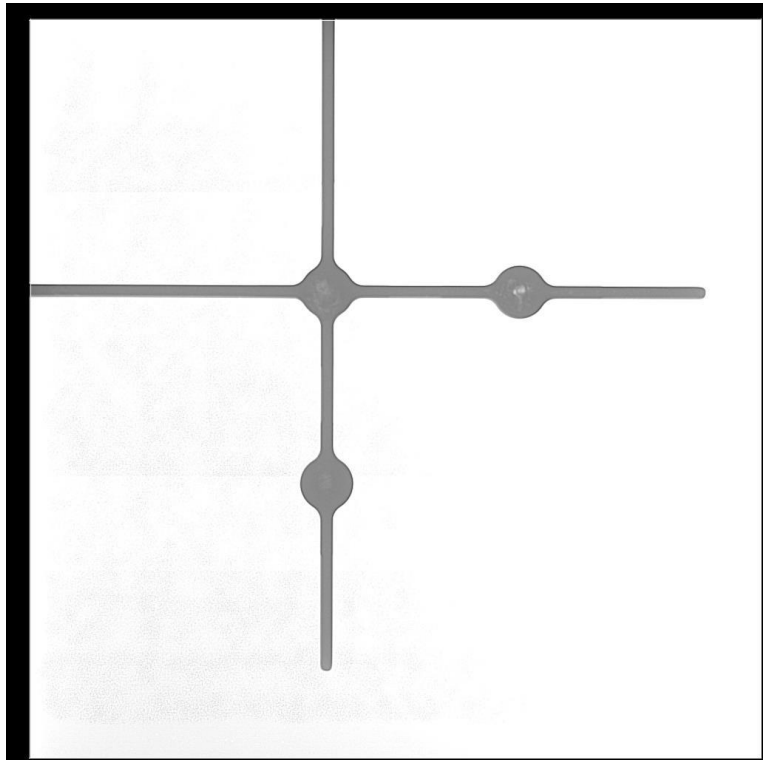
Posizionamenti



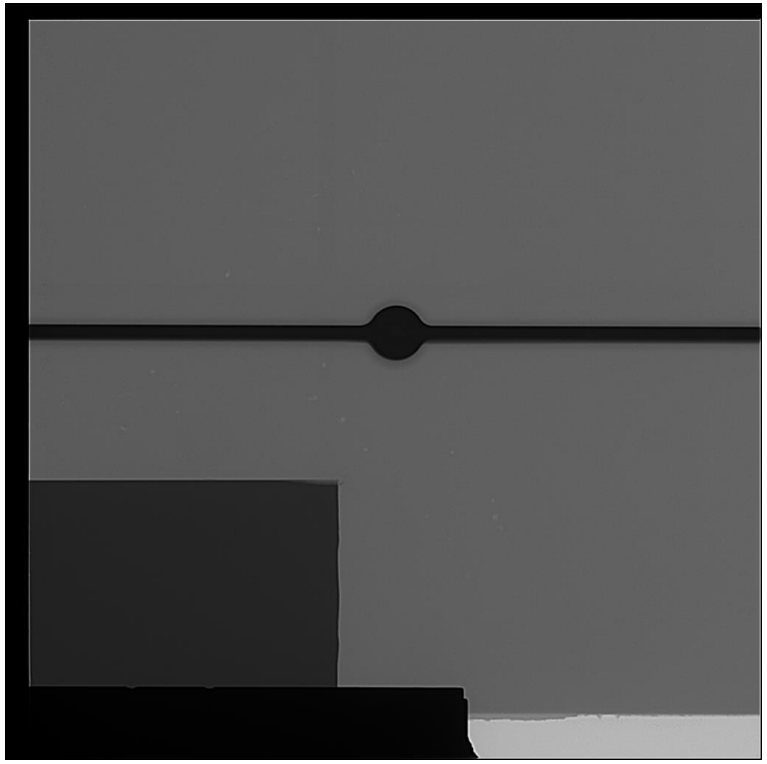
Part serial number 230662
X ray scans



Spot A
Low voltage scan

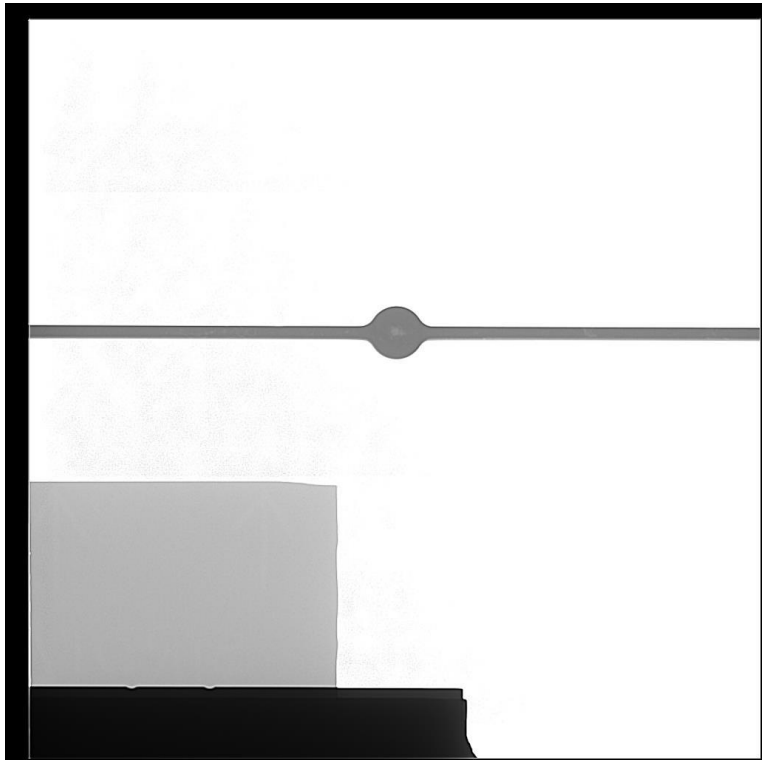


Spot A
High voltage scan

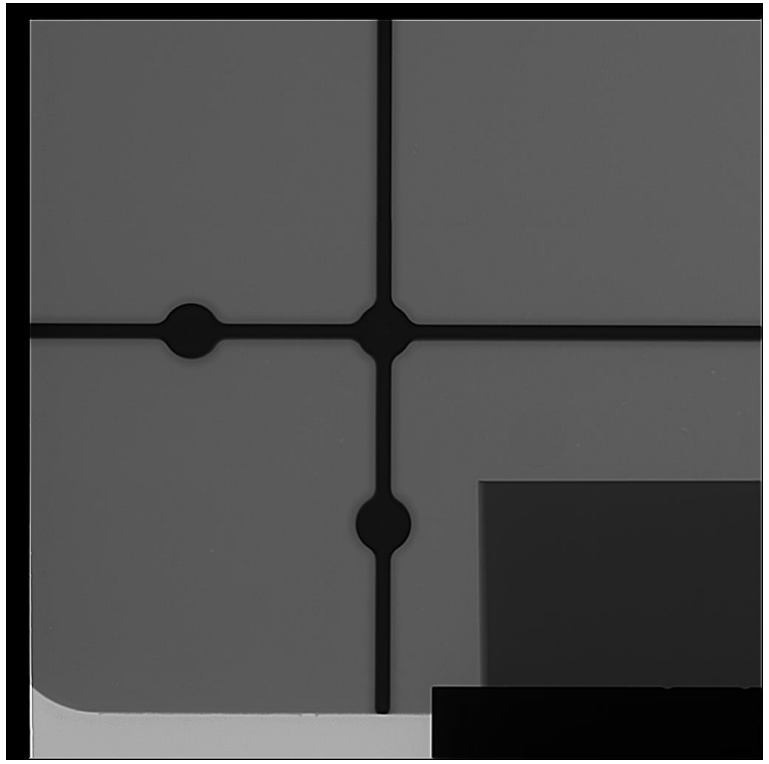


Spot B
Low voltage scan

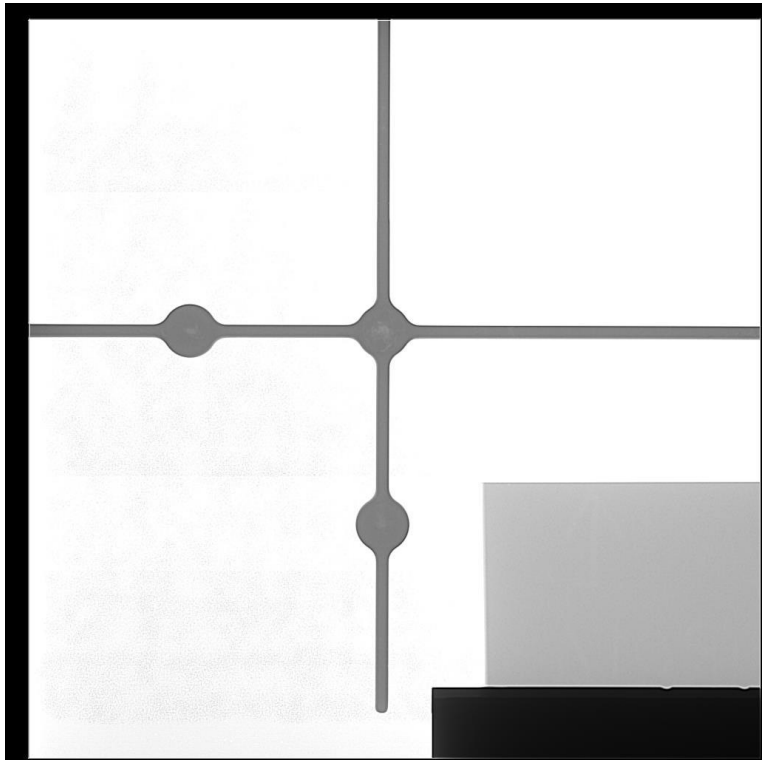
Part serial number 230662
X ray scans



Spot B
High voltage scan

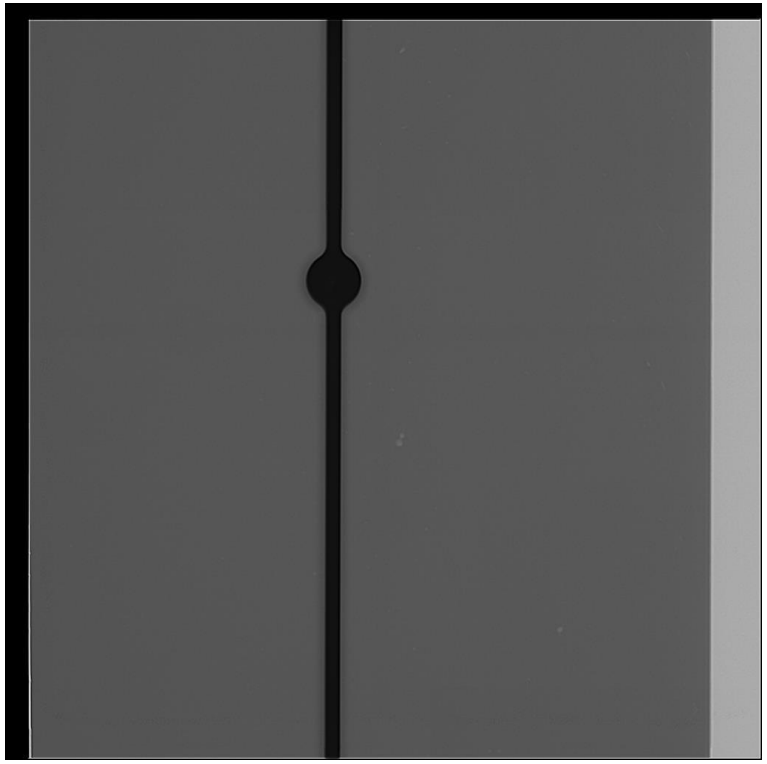


Spot C
Low voltage scan

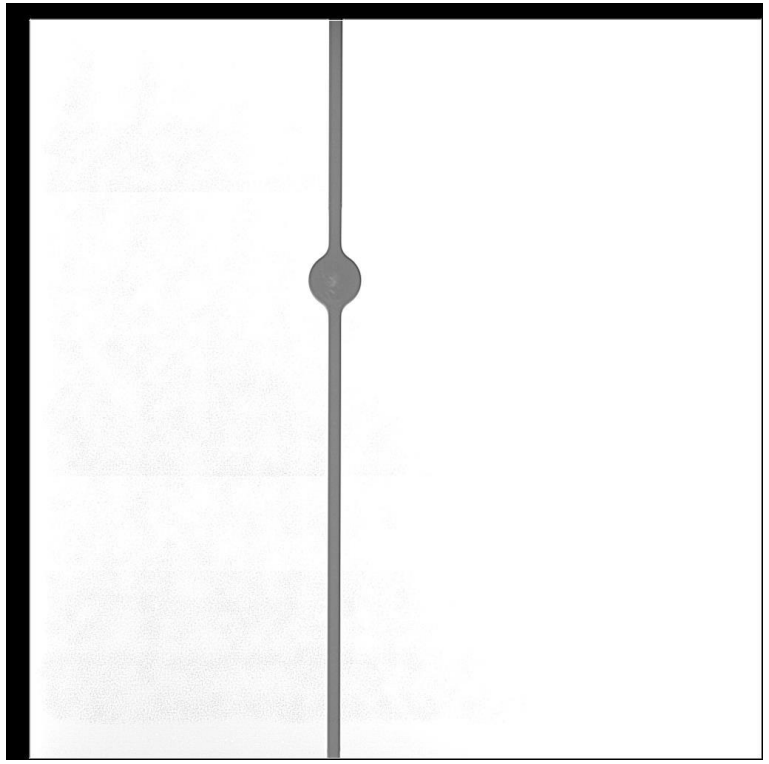


Spot C
High voltage scan

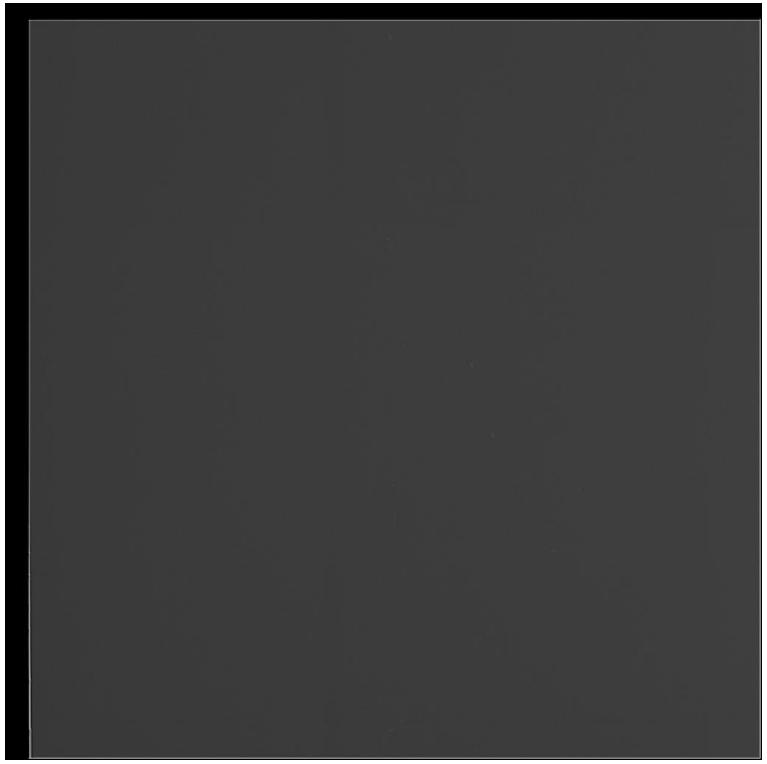
Part serial number 230662
X ray scans



Spot D
Low voltage scan

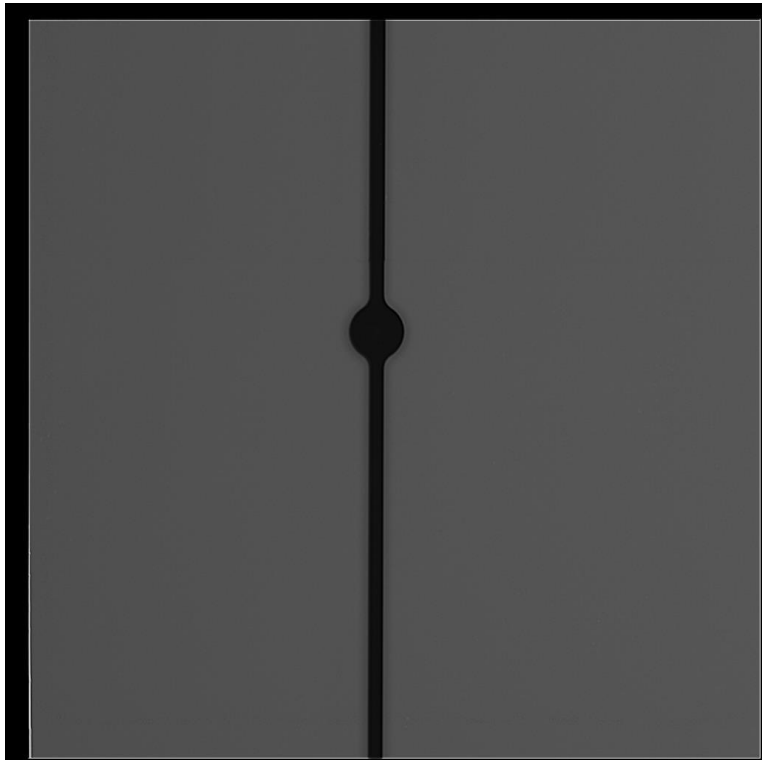


Spot D
High voltage scan

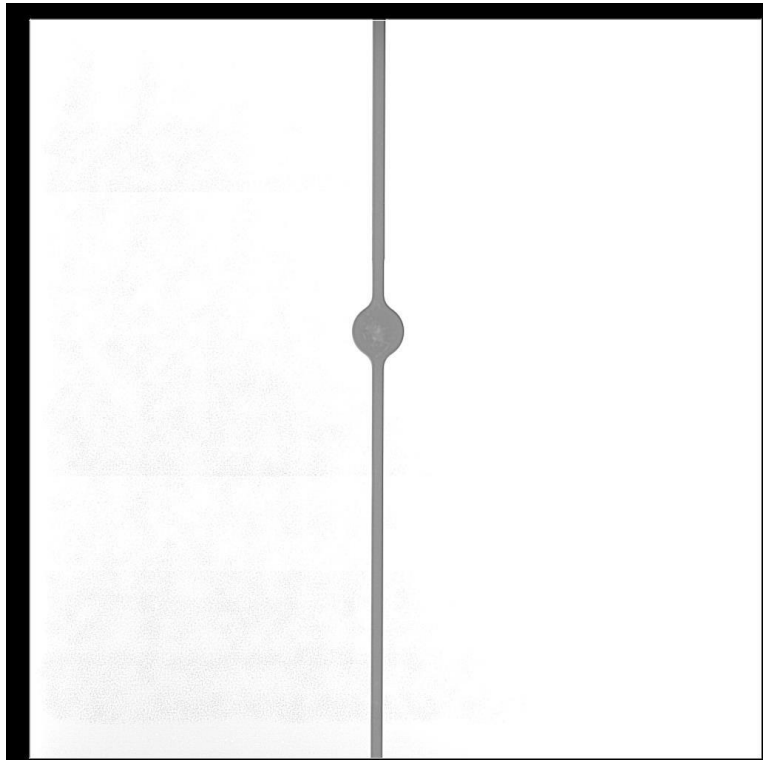


Spot E
Low voltage scan

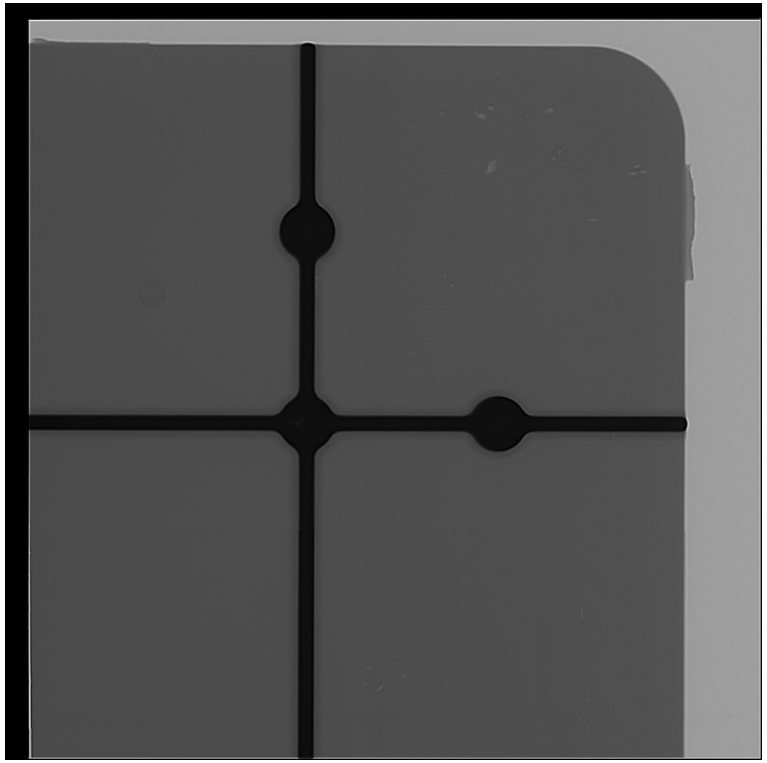
Part serial number 230662
X ray scans



Spot F
Low voltage scan

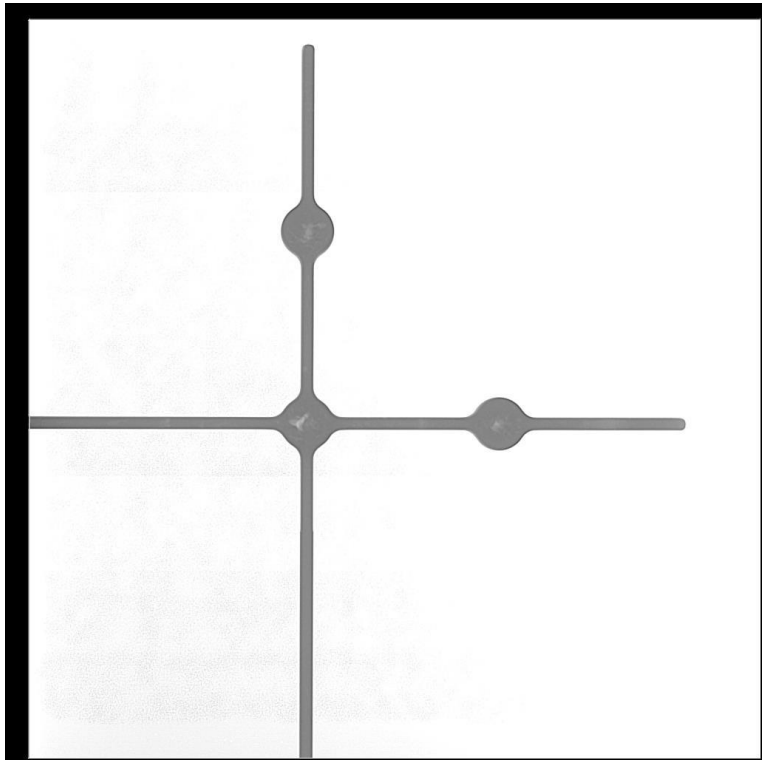


Spot F
High voltage scan

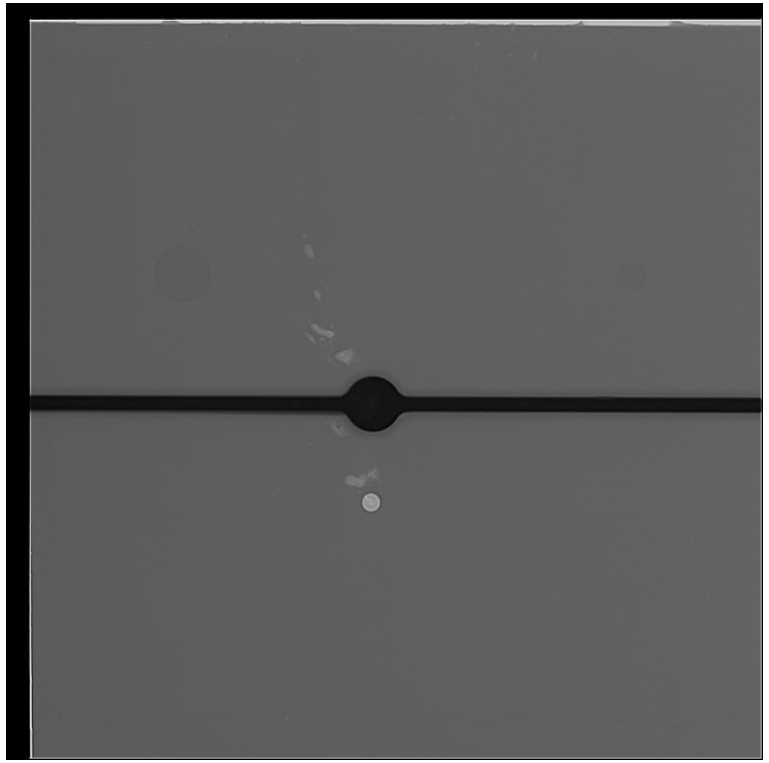


Spot G
Low voltage scan

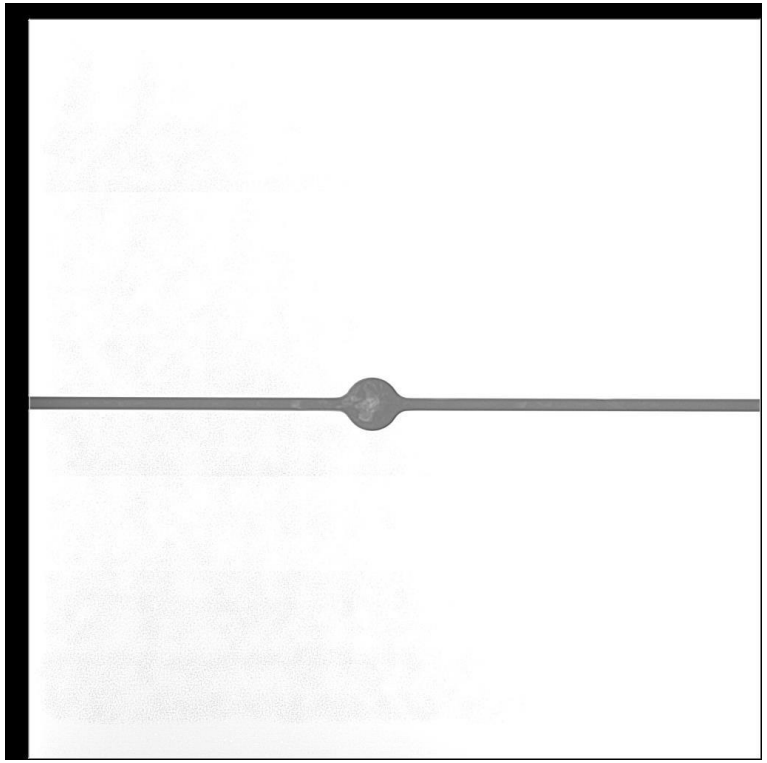
Part serial number 230662
X ray scans



Spot G
High voltage scan

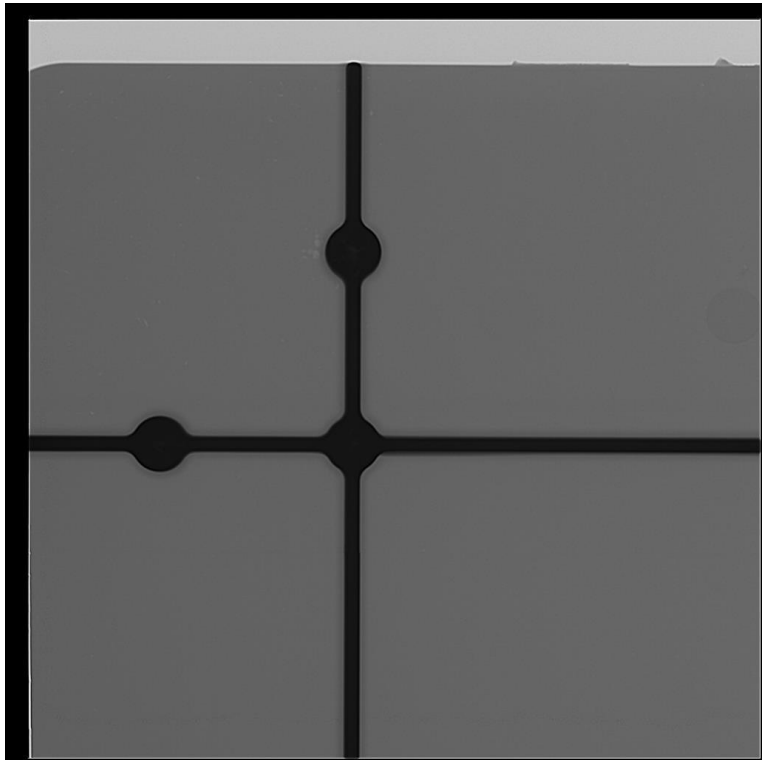


Spot H
Low voltage scan

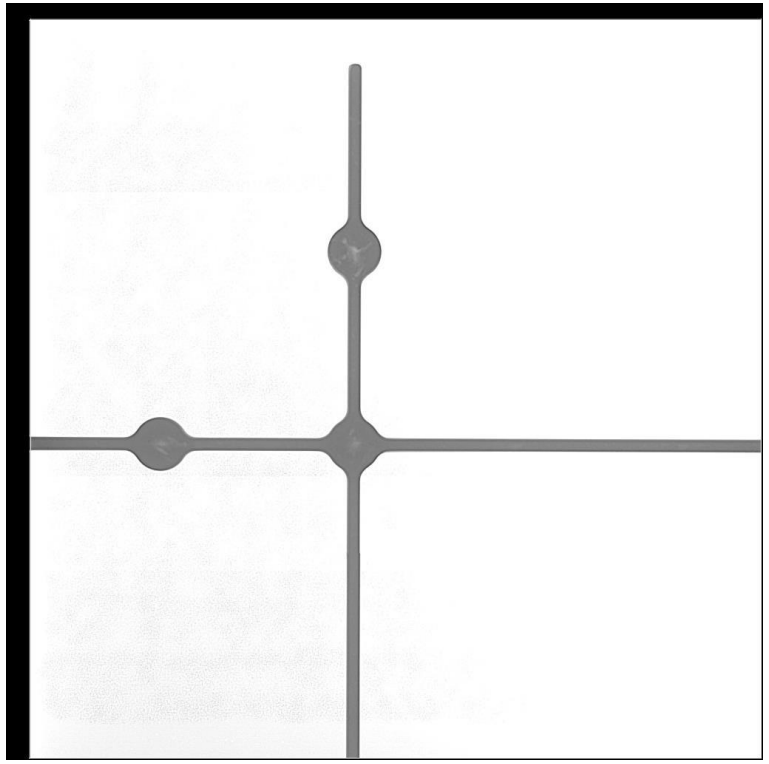


Spot H
High voltage scan

Part serial number 230662
X ray scans



Spot I
Low voltage scan



Spot I
High voltage scan

RISULTATI QUALITATIVI

TABELLA GENERALE RISULTATI

- ✓ V1 fissa a 0,35
- ✓ Switch da 1f a 2f fisso
- ✓ T variabile (700C° o 670C°)
- ✓ V2 Variabile
- ✓ P3 input fissa
- ✓ Chill Vent passivo o attivo

Parte		Zona A	Zona B	Zona C	Zona D	Zona E	Zona F	Zona G	Zona H	Zona I	V1 (m/s)	V2 (m/s)	Vacuum (mbar)	T (°C)	P1 (bar)
230	662	2	3	1	2	2	1	3	4	2	0,35	1,00	No	700	395
230	665	3	1	3	1	1	2	4	4	3	0,35	1,50	No	700	412
230	668	1	1	1	1	1	1	3	3	2	0,35	2,00	No	700	477
230	671	1	1	1	2	1	1	2	4	3	0,35	2,50	No	700	552
230	674	1	1	1	1	1	1	2	3	3	0,35	3,00	No	700	634
230	677	1	1	1	1	1	1	2	2	2	0,35	3,50	No	700	734
230	682	1	1	1	1	1	1	1	1	2	0,35	4,00	No	700	725
230	693	1	1	1	1	1	1	2	4	2	0,35	3,00	No	700	658
230	704	2	2	1	2	2	1	2	2	2	0,35	1,00	200	700	357
230	707	1	1	1	1	1	1	3	4	3	0,35	1,50	200	700	405
230	710	1	1	1	2	1	1	4	4	3	0,35	2,00	200	700	484
230	713	1	1	1	1	1	1	3	3	2	0,35	2,50	200	700	561
230	716	1	1	1	1	1	1	2	2	2	0,35	3,00	200	700	635
230	719	1	1	1	1	1	2	2	3	1	0,35	3,50	200	700	723
230	722	1	1	1	1	1	1	2	1	1	0,35	4,00	200	700	738
230	730	1	1	1	1	1	1	3	1	1	0,35	3,00	200	700	646
230	824	2	1	1	2	2	2	2	4	3	0,35	1,00	200	670	340
230	827	2	1	1	1	1	1	3	3	3	0,35	1,50	200	670	372
230	830	1	1	1	2	1	1	2	4	2	0,35	2,00	200	670	451
230	833	1	1	1	1	1	1	2	4	3	0,35	2,50	200	670	512
230	836	2	1	1	1	1	1	3	3	3	0,35	3,00	200	670	599
230	839	1	1	1	1	1	1	2	2	2	0,35	3,50	200	670	689
230	842	1	1	1	1	1	1	2	2	2	0,35	4,00	200	670	709
230	848	1	1	1	2	1	1	2	2	3	0,35	3,00	200	670	544
230	872	2	2	2	1	2	2	2	3	2	0,35	1,00	No	670	338
230	875	2	1	1	1	1	1	3	4	3	0,35	1,50	No	670	362
230	878	1	1	1	1	1	1	3	3	3	0,35	2,00	No	670	432
230	881	1	1	1	1	1	1	2	4	3	0,35	2,50	No	670	490
230	884	1	1	1	1	1	1	2	3	3	0,35	3,00	No	670	599
230	887	1	1	1	1	1	1	2	3	3	0,35	3,50	No	670	669
230	890	1	1	1	1	1	1	3	3	2	0,35	4,00	No	670	724
230	896	2	1	1	2	1	1	2	3	2	0,35	3,00	No	670	568

RISULTATI QUALITATIVI

VUOTO/TEMPERATURA 4m/s

Parte		Zona A	Zona B	Zona C	Zona D	Zona E	Zona F	Zona G	Zona H	Zona I	V1 (m/s)	V2 (m/s)	Vacuum (mbar)	T (°C)	P1 (bar)
230	682	1	1	1	1	1	1	1	1	2	0,35	4,00	No	700	725
230	722	1	1	1	1	1	1	2	1	1	0,35	4,00	200	700	738
230	842	1	1	1	1	1	1	2	2	2	0,35	4,00	200	670	709
230	890	1	1	1	1	1	1	3	3	2	0,35	4,00	No	670	724

VUOTO/TEMPERATURA 3 m/s

Parte		Zona A	Zona B	Zona C	Zona D	Zona E	Zona F	Zona G	Zona H	Zona I	V1 (m/s)	V2 (m/s)	Vacuum (mbar)	T (°C)	P1 (bar)
230	674	1	1	1	1	1	1	2	3	3	0,35	3,00	No	700	634
230	730	1	1	1	1	1	1	3	1	1	0,35	3,00	200	700	646
230	848	1	1	1	2	1	1	2	2	3	0,35	3,00	200	670	544
230	896	2	1	1	2	1	1	2	3	2	0,35	3,00	No	670	568

RISULTATI QUALITATIVI

VELOCITA' 2F CON VUOTO

Parte		Zona A	Zona B	Zona C	Zona D	Zona E	Zona F	Zona G	Zona H	Zona I	V1 (m/s)	V2 (m/s)	Vacuum (mbar)	T (°C)	P1 (bar)
230	704	2	2	1	2	2	1	2	2	2	0,35	1,00	200	700	357
230	710	1	1	1	2	1	1	4	4	3	0,35	2,00	200	700	484
230	716	1	1	1	1	1	1	2	2	2	0,35	3,00	200	700	635
230	722	1	1	1	1	1	1	2	1	1	0,35	4,00	200	700	738

VELOCITA 2F SENZA VUOTO

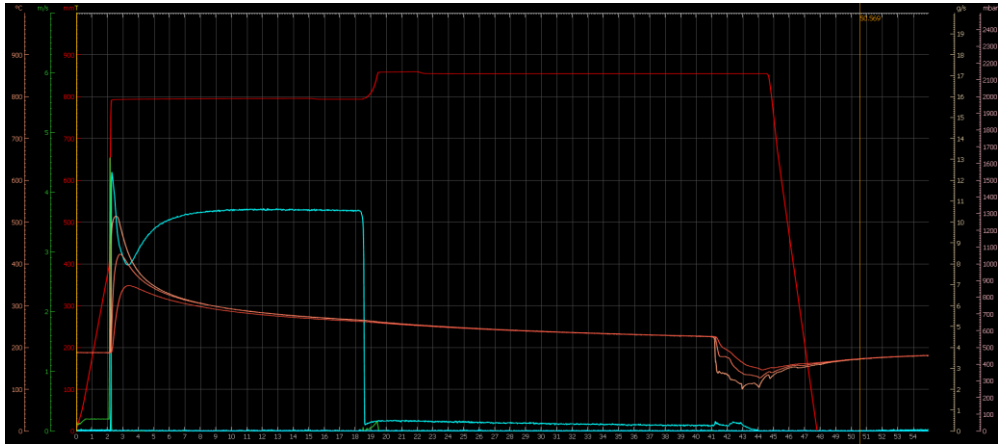
Parte		Zona A	Zona B	Zona C	Zona D	Zona E	Zona F	Zona G	Zona H	Zona I	V1 (m/s)	V2 (m/s)	Vacuum (mbar)	T (°C)	P1 (bar)
230	662	2	3	1	2	2	1	3	4	2	0,35	1,00	No	700	395
230	668	1	1	1	1	1	1	3	3	2	0,35	2,00	No	700	477
230	674	1	1	1	1	1	1	2	3	3	0,35	3,00	No	700	634
230	682	1	1	1	1	1	1	1	1	2	0,35	4,00	No	700	725

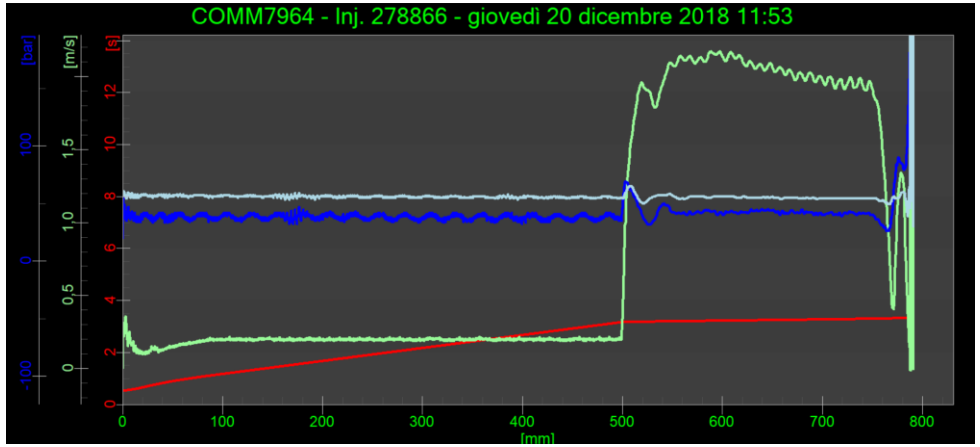
CONCLUSIONI

I RISULTATI MOSTRATI IN COSI' BREVE TEMPO SONO LA CONCLUSIONE DI UN LUNGO LAVORO DI ANALISI ED ESTRAPOLAZIONE

- I VALORI DI V1,V2,P, etc.. SONO OTTENUTI ANALIZZANDO IL SINGOLO GRAFICO DI CIRCA 500 CICLI DI PRODUZIONE

- I GRAFICI ANALIZZATI ERANO 2 PER CICLO, QUELLO DERIVANTE DALLA CENTRALINA DI ACQUISIZIONE E QUELLI REGISTARTI DALLA MACCHINA HPDC





CONCLUSIONI

- LA PRESSOCOLATA E’ UNA MATERIA COMPLESSA PERCHE’ IL «PRODOTTO» E’ IL RISULTATO DI MOLTI PARAMETRI CHE SI INFLUENZANO FRA DI LORO.

- MOLTE DELLE NOSTRE OPINIONI «EMPIRICHE» SONO BASATE SU CASI NON GENERICI

- COME NORMALE NELLA SPERIMENTAZIONE, SAREBBE NECESSARIO CHE QUESTI TEST, O ALMENO UNA LORO PARTE, FOSSERO RIPETUTI IN UN’ALTRA FONDERIA, MAGARI CON ALTRI MEZZI DI MISURA

- E SAREBBE NECESSARIO CHE GLI STESSI DATI E LE RELATIVE CONCLUSIONI FOSSERO ANALIZZATI DA UNA PERSONA DIVERSA DA QUELLA CHE L’HA FATTO FINO AD ORA.

- SE QUALCUNO VUOLE PROVARCI

Grazie

Thank you