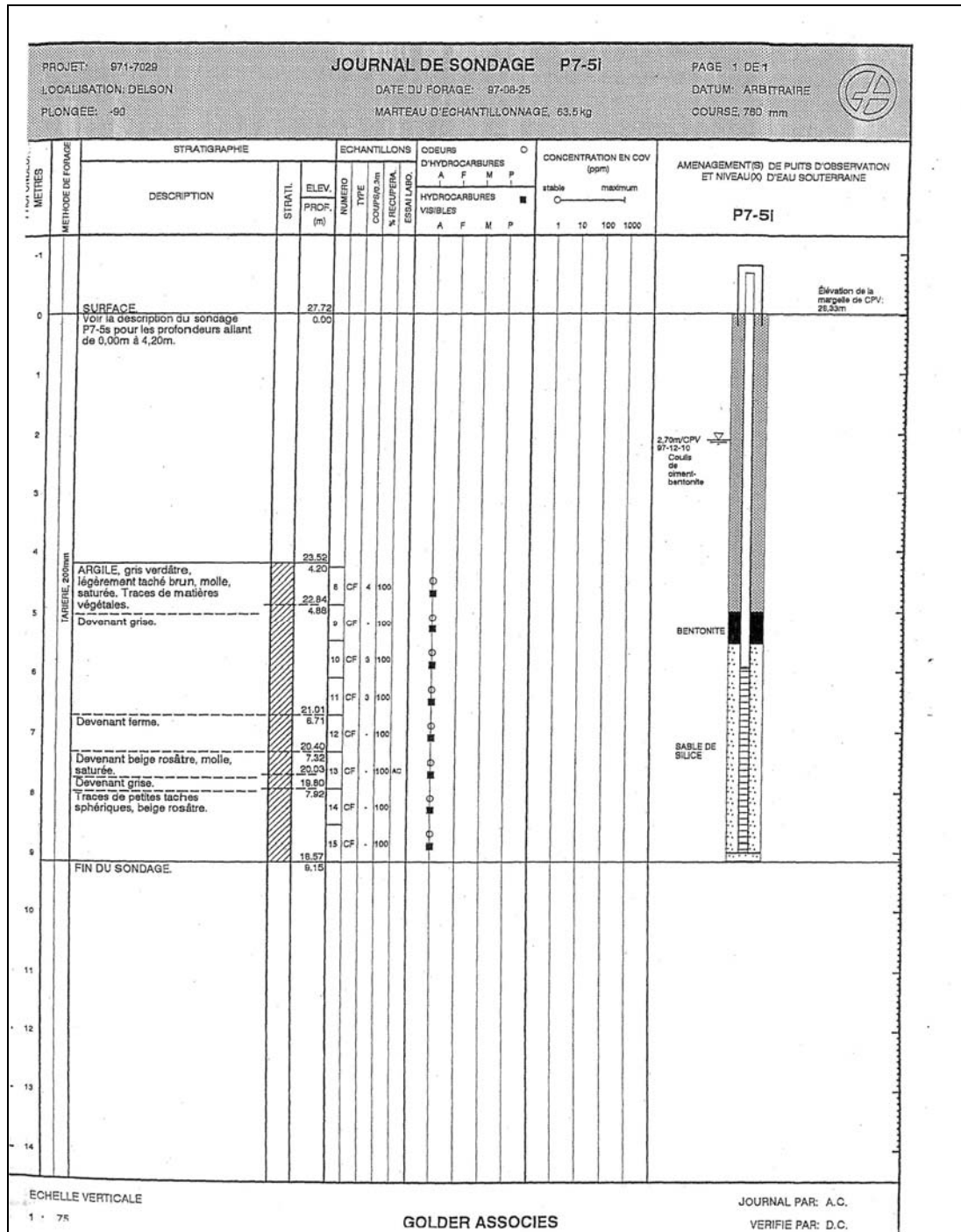


Annexe A
Schémas de construction des puits



PROJET: 941-7057-S

LOCALISATION: VOIR FIGURE 1

PLONGEE: -90

JOURNAL DE SONDAGE PZ-23B

DATE DU FORAGE: 23 SEPT. 1994

MARTEAU D'ECHANTILLONNAGE, 63.5 kg

PAGE 1 DE 1

DATUM:

COURSE, 760 mm

PROFONDEUR METRES	METHODE DE FORAGE	STRATIGRAPHIE		ECHANTILLONS					HYDROCARBURES VISIBLES ODEURS D'HYDROCARBURES	AMENAGEMENT(S) DE PUIITS D'OBSERVATION ET NIVEAU(D) D'EAU SOUTERRAINE
		DESCRIPTION	STRAT.	ELEV. PROF. (m)	NUMERO	TYPE	COUPES 3m % RECUP.	ESSAI LABO.		
-2										
-6		SURFACE DU SOL		28.72						
-1				0.00						
1		VOIR PZ-23A								
2										
3				26.22						
4				2.50	1	CF	1-1	100		
5		ARGILE silteuse, microfissures, peu humide, raide, brune.			2	CF	2-2	100		
6					3	CF	1-2	100		
7				24.71						
8				4.00	4	CF	1-1	100		
9		ARGILE silteuse, pas de microfissures, humide, molle, grise.			5	CF	1	100		
10					6	CF	1	100		
11					7	CF	1	100		
12				22.71						
13				6.00	8	CF	1	100		
14		ARGILE silteuse, microfissures, peu humide, ferme, grise.			9	CF	1	100		
15					10	CF	1	100		
16				21.22						
17				7.50						
18		FIN DU FORAGE								

ENTREE DE L'EAU

3°C

ECHELLE VERTICALE

1 : 50

JOURNAL PAR: A.P.

VERIFIE PAR: M.P.

PROJET: P41-7057		JOURNAL DE SONDAGE PZ-25C		PAGE 1 DE 2		
LOCALISATION: VOIR FIGURE 1		DATE DU FORAGE: 22 SEPT. 1994		DATUM:		
PLONGEE: -90		MARTEAU D'ECHANTILLONNAGE: 63.5 kg		COURSE: 760 mm		
PROFONDEUR METRES	METHODE DE FORAGE	STRATIGRAPHIE		ECHANTILLONS		AMENAGEMENT(S) DE PUITS D'OBSERVATION ET NIVEAU(X) D'EAU SOUTERRAINE
		DESCRIPTION	SITATL ELEV. PROF. (m)	NUMERO TYPE COURSURE 3m % RECUP. ESSAI LARG.	HYDROCARBURES VISIBLES ODEURS D'HYDROCARBURES AUCUN TRACES FAIBLE MOYEN PRONONCE	
4						
1						
0		SURFACE DU SOL	28.57 0.00			
1						
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3						
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PROJET: 841-7057		JOURNAL DE SONDAGE PZ-25C		PAGE 2 DE 2			
LOCALISATION: VOIR FIGURE 1		DATE DU FORAGE: 22 SEPT. 1994		DATUM:			
PLONGEE: -90		MARTEAU D'ECHANTILLONNAGE: 63.5 kg		COURSE: 780 mm			
PROFONDEUR METRES	METHODE DE FORAGE	STRATIGRAPHIE		ECHANTILLONS		HYDROCARBURES VISIBLES ODEURS D'HYDROCARBURES	AMENAGEMENT(S) DE PUIS D'OBSERVATION ET NIVEAUX D'EAU SOUTERRAINE
		DESCRIPTION	STRATIL ELEV. PROF. (m)	NUMERO TYPE COURS m N° RECUP. ESSAI LABO	AUCUN TRACES FAIBLE MOYEN PRONONCE		
8	ACHESON, SENSIVCOOP ENVIRONNEMENTAL TARRENE CYCLOE 20 cm ext.	SUITE DE PAGE PRECEDENTE		20.62			
9		ARGILE silteuse, pas de microfissures, humide, molle, brune rougeatre.	2	CF 1-0 100			
			3	CF 1-0 100			
			4	CF 1-0 100			
10		ARGILE silteuse, pas de microfissures, humide, ferme, brunatre.	5	CF 1-0 100			
			6	CF 1-1 100			
			7	CF 1-1 100			
11			8	CF 5-6 60			
			9	CF 5-8 44			
12		TILL constitue de sable fin, silt et argile avec traces de gravier, raide, grise.	11.40				
	FIN DU FORAGE	12.00					
13							
14							
15							
16							
17							
18							

ENTREE DES G

ECHELLE VERTICALE
1 : 50

GOLDER ASSOCIES

JOURNAL PAR: A.P.
VERIFIE PAR: M.P.



☐ WELL
☐ TEST PIT

☐ PIEZOMETER
☒ OBSERVATION WELL

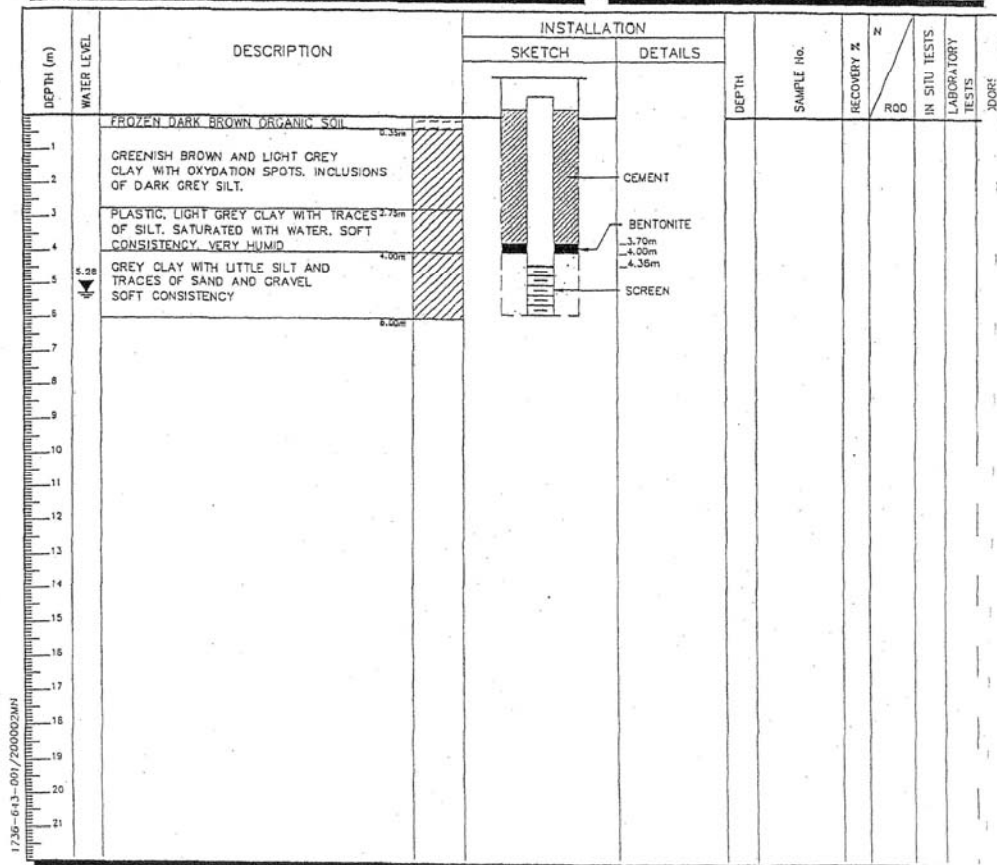
NO. **PO-1B**

PROJECT : LOCATION : VILLE MERCIER DATE : 93/03/04 PROJECT No: 1735-643-001 SUPERVISOR: I. ROBILLARD

DRILLING METHOD : AUGER DRILL : ACKER SENTRY
SAMPLING METHOD : SS ☒ TS ☐ CO ☐ DEVELOPMENT : METHOD : BAILER
Dimensions: LENGTH: 45cm Ø: 5.08cm TIME : -

TOTAL DEPTH : 5.86m COORDINATES
SURFACE ELEVATION: 47.409m X: 287117.982
ELEVATION OF COLLAR: 48.029m Y: 5015877.134
WATER LEVEL:
DEPTH: 4.65m EL: 43.38m DATE: 93/03/23

ADDITIONAL INFORMATION:					
TUBING			SCREEN		
TYPE	Ø int.	Ø ext.	LENGTH	Ø	OPENING
PVC	5.08cm	6.05cm	1.50m	5.08cm	0.1cr



APPROVED BY : MARTIN POULIN

ADS GROUPE-CONSEIL INC. ENVIRONNEMENT		<input type="checkbox"/> WELL <input type="checkbox"/> TEST PIT		<input type="checkbox"/> PIEZOMETER <input checked="" type="checkbox"/> OBSERVATION WELL		NO. PO-2B	
PROJECT :				PROJECT No: 1736-643-001			
LOCATION : VILLE MERCIER		DATE : 93/03/04		SUPERVISOR: I.ROBILLARD			
DRILLING METHOD HOLLOW STEM AUGER				DRILL: ACKER SENTRY			
SAMPLING METHOD SS <input checked="" type="checkbox"/> TS <input type="checkbox"/> CD <input type="checkbox"/>				DEVELOPMENT : METHOD : BAILER			
Dimensions: LENGTH: 45cm Ø: 5,08cm				TIME : -			
TOTAL DEPTH : 6.10m SURFACE ELEVATION: 46.918m ELEVATION OF COLLAR: 47.558m WATER LEVEL: DEPTH.: 5.70m				COORDINATES X: 287168.729 Y: 5015773.782 DATE: 93/03/23			
ADDITIONAL INFORMATION:							
TUBING				SCREEN			
TYPE		int.		ext.		LENGTH	
PVC		5.08cm		6.08cm		1.52m	
						OPENING	
						0.1cm	

DEPTH (m)	WATER LEVEL	DESCRIPTION	INSTALLATION		DEPTH	SAMPLE No.	RECOVERY %	N	IN SITU TEST	LABORATORY TESTS	ODORS	
			SKETCH	DETAILS								
1		FROZEN DARK BROWN ORGANIC SOIL GREENISH BROWN AND LIGHT GREY CLAY WITH OXYDATION SPOTS INCLUSION OF DARK GREY SILT MEDIUM PLASTICITY AND CONSISTENCY		CEMENT BENTONITE 3.85m 4.15m 4.47m SILICA SAND SCREEN								
2		PLASTIC, LIGHT GREY CLAY WITH TRACES OF SILTY SAND. SOFT CONSISTENCY. VERY HUMID										
3		PLASTIC, BROWNISH GREY CLAY WITH TRACES OF SAND AND GRAVEL SOFT CONSISTENCY										
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												

APPROVED BY : MARTIN POULIN



☐ WELL
☐ TEST PIT

☐ PIEZOMETER
☒ OBSERVATION WELL

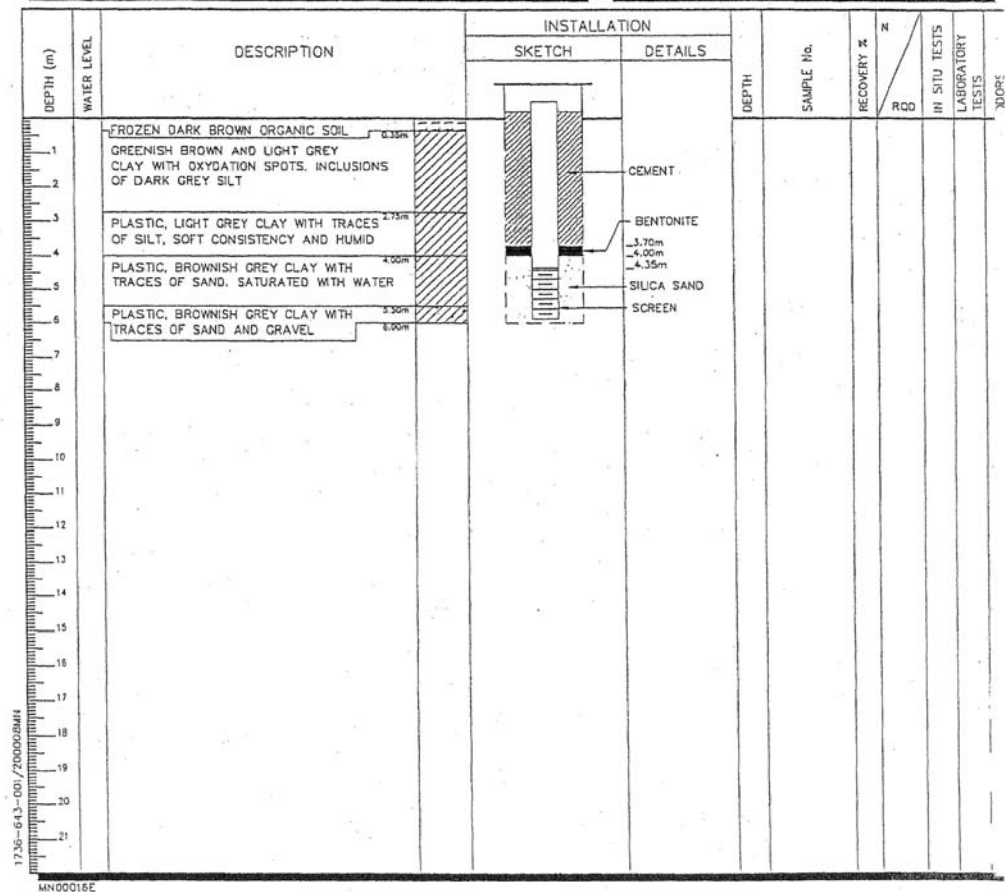
NO. PO-3B

PROJECT : LOCATION : VILLE MERCIER DATE : 93/03/16 PROJECT No: 1736-643-001 SUPERVISOR: I.ROBILLARD

DRILLING METHOD HOLLOW STEM AUGER DRILL: ACKER SENTRY
SAMPLING METHOD SS ☒ TS ☐ CD ☐ DEVELOPMENT : METHOD : WATER PUMP
Dimensions: LENGTH: Ø: TIME : -

TOTAL DEPTH : 6.00m COORDINATES
SURFACE ELEVATION: 47.790m X: 287269.274
ELEVATION OF COLLAR: 48.480m Y: 5015910.213
WATER LEVEL:
DEPTH: 5.46m EL.: 43.02m DATE: -

ADDITIONAL INFORMATION:
TUBING SCREEN
TYPE eint. ext. LENGTH Ø OPENING
PVC 5.08cm 6.08cm 1.52m 5.08cm 0.1cm



APPROVED BY : MARTIN POULIN



SCHEMA D'INSTALLATION DE PIEZOMETRE

IDENTIFICATION: F-303 B

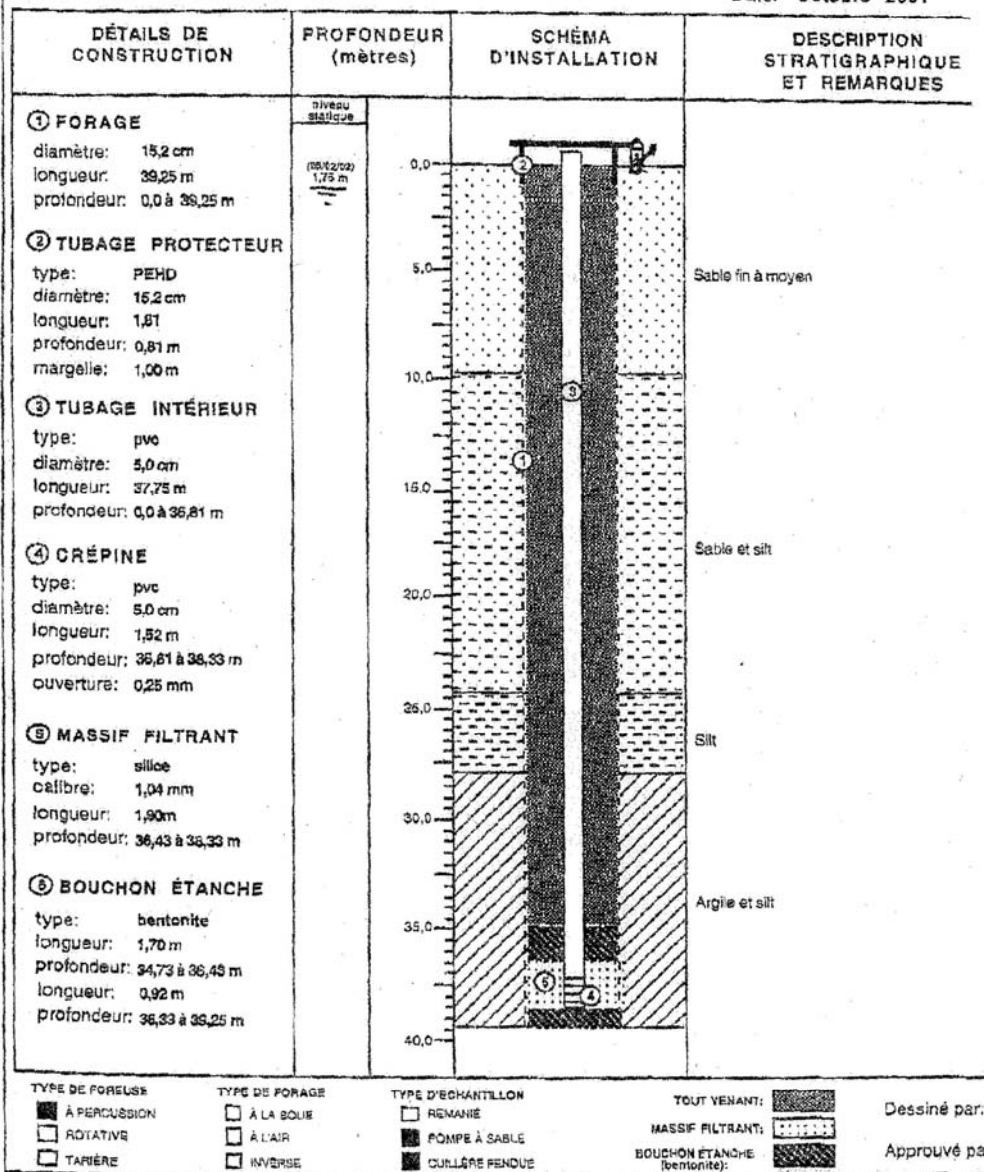
No. de dossier: HGE-01-1984

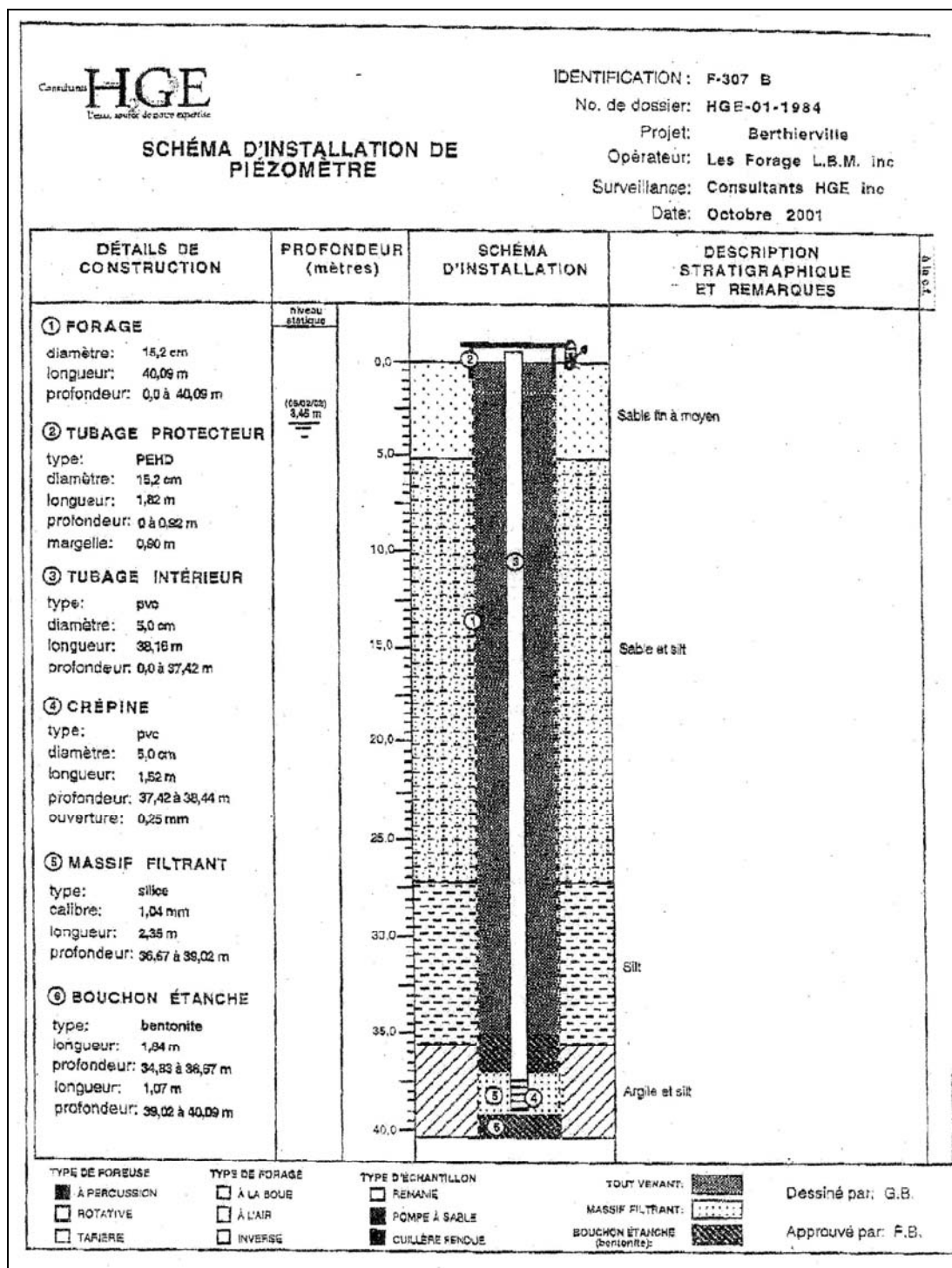
Projet: Berthierville

Opérateur: Les Forage L.B.M

Surveillance: Consultants HGE

Date: Octobre 2001





Annexe B
Résultats d'analyse complémentaires effectués par une firme de consultants

PUITS : P7-5i

SITE : Delson

INTERPRÉTATION : Hvorslev

TYPE D'ESSAI : Niveau remontant

PROJET : 971-7029

DATE : 22-09-97

EFFECTUÉ PAR : Alain Calame

VÉRIFIÉ PAR : Martin Poulin

Temps (min)	Profondeur Eau (m)	Rabattement Hi (m)	Hi/Ho
0	9.39	6.52	1.00
1	9.36	6.49	0.99
2	9.34	6.47	0.99
3	9.33	6.46	0.99
5	9.31	6.44	0.99
10	9.27	6.40	0.98
20	9.22	6.35	0.97
30	9.18	6.31	0.97
1023	8.81	5.94	0.91
3088	8.43	5.56	0.85
4513	8.20	5.33	0.82
10284	7.38	4.51	0.69
11622	7.13	4.26	0.65
13214	6.95	4.08	0.63
19788	5.42	2.55	0.39
21061	5.13	2.26	0.35
23024	4.78	1.91	0.29

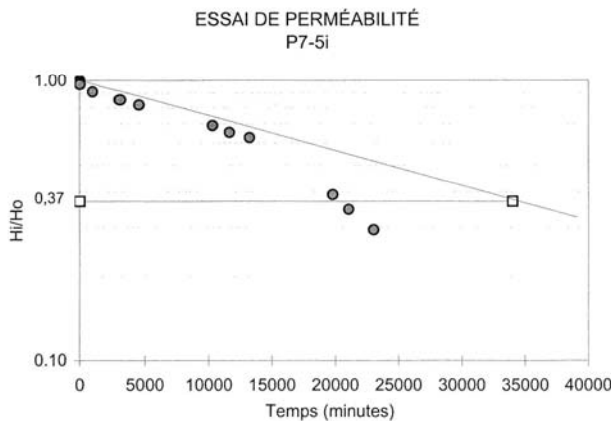
POINT DE MESURES : PVC
 ÉLÉV. PT. DE MESURES : 28.33 mètres
 ÉLÉVATION DU SOL : 27.72 mètres

NIVEAU STAT., H : 2.87 mètres / pnt de mesure
 VOL. RETIRÉ : 35 litres
 CHARGE INIT., Ho : 6.52 mètres

DIAM. TUBAGE, d : 5.1 centimètres
 DIAM. FORAGE, D : 20.3 centimètres
 LONG. ENTRÉE, L : 345.0 centimètres

LONG. CRÉPINE : 3.0 mètres
 ÉLÉV. BAS CRÉPINE : 9.00 mètres
 STRATIGRAPHIE : Argile et silt molle

REMARQUES :



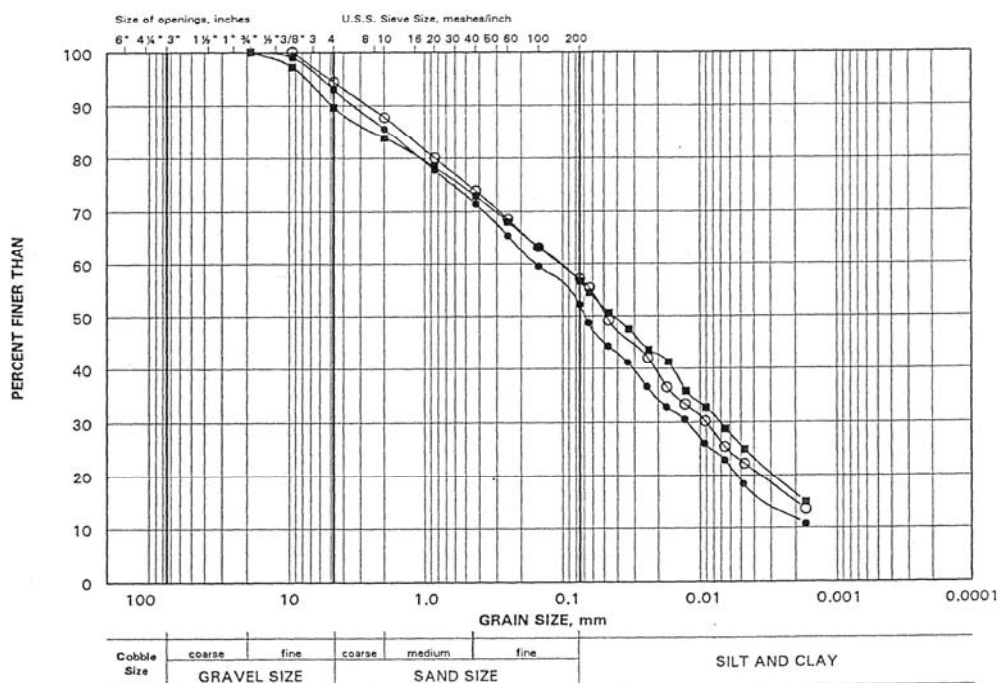
TEMPS @ 0,37 T : 34000 minutes

$$Kh = \frac{dd \ln(2mL/D)}{8LT}$$

Kh=**1.62E-08 cm/sec**

GRAIN SIZE DISTRIBUTION

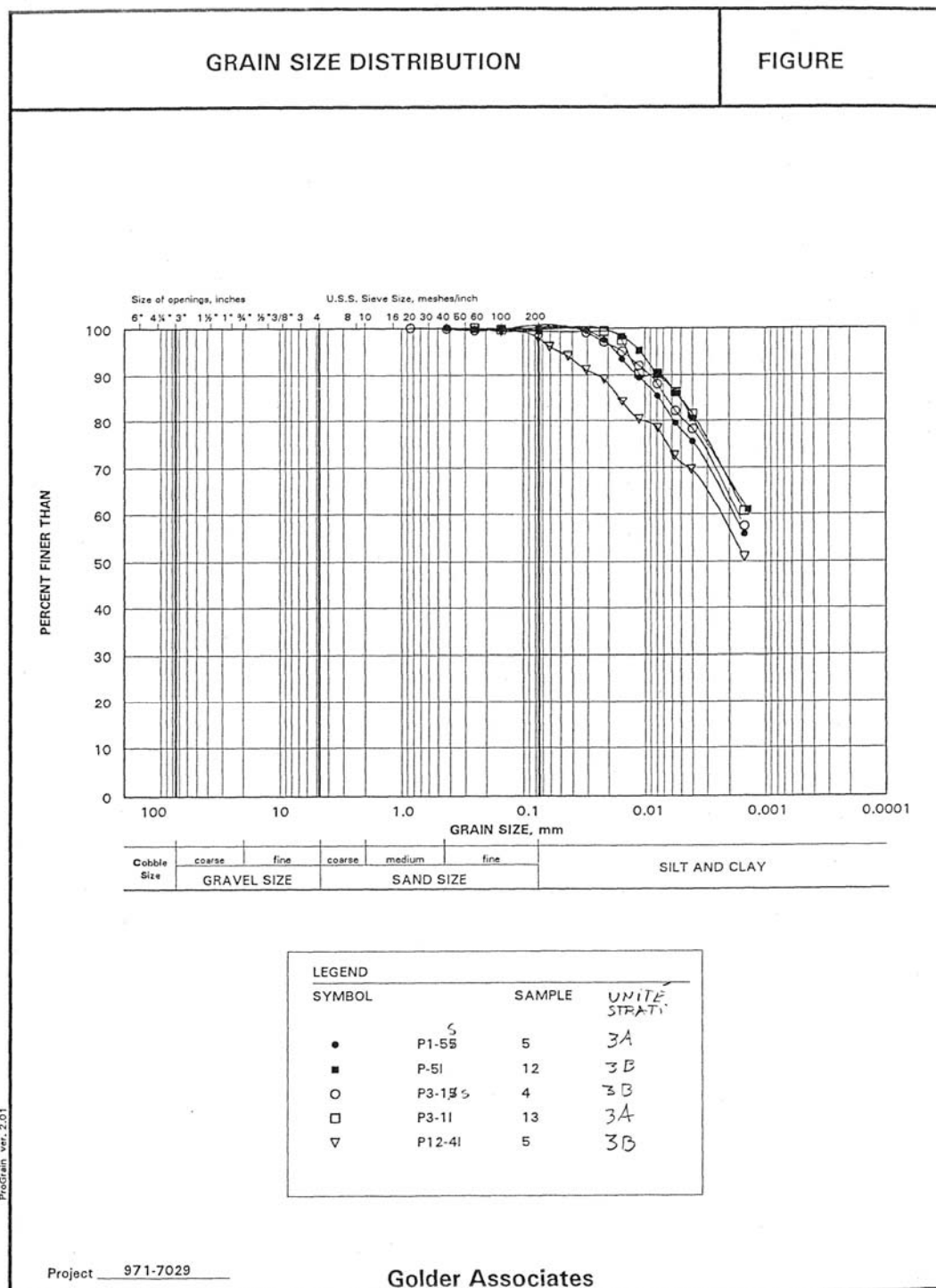
FIGURE



LEGEND		
SYMBOL		SAMPLE
●	P12-4I	9
■	P1-5P	22
○	P3-1P	24

REMARKS	
Sample	Moisture Content
P12-41-9	11.8% *
P12-41-5	44.9%

*Note: Sample jar for P12-41-9 was broken in shipping.



Annexe C

Formulaire pour le traitement des données d'essais de type slug test

PROJET: Maîtrise CB				PUITS D'OBSERVATION P7-5i			
LOCALISATION: Delson				SOL: Argile Champlain			
DATE: 9/10/2003							

PROF. PUIITS $z_p = 9.48$ m NIV. PIÉZOMÉTRIQUE HYP. $NP = 3.63$ m PROF. EAU AVANT L'ESSAI $z_w = 3.69$ m VOL. EAU ÉQ. INJECTÉ $Ve = 89.57$ cm ³ TÊTE INITIALE TOT. IMPOSÉE $\Delta H_i = 45$ cm DIA. BURETTE INJ. EQ. $d = 2.72$ cm	PROF. CAPTEUR $z_c = 6.50$ m NB TIGES INSTR. $n = 4.00$ m PROF. OBTURATEUR $z_o = 5.25$ m DÉPASSEMENT SUP. TIGE $S = 0.32$ m VOL. SS OBTURATEUR $V_o = 0.11$ m ³
---	---

FACTEURS DE FORME	Seep/w Lefranc or Hvorslev Cassan	$c = 615$ cm 615 cm	Hvorslev 614.8 cm L (cm) = 345.0 cm D (cm) = 20.3 cm L/D = 17.0
-------------------	--	--------------------------	--

CALCUL DE K

$S_{inj} = 5.790$ cm²

CONSTANTE $C = S_{inj}/c$

$C = 0.0094$ cm

ETAPE 1

GRAPH H_{moy} vs $\Delta H/\Delta t$

P=pente de la droite de tendance

$P = 1.578E+02$ s

$K = C/P = 5.97E-05$ cm/s

ETAPE 2

CORRECTION DE LA DIFFÉRENCE DE CHARGE H PAR L'ERREUR PIÉZOMÉTRIQUE OBTENUE PAR L'ODONNÉE A L'ORIGINE H_o DU GRAPHIQUE DES VITESSES ALORS QUE LA VITESSE dH/dt EST NULLE

$H_o = 179.6$ cm

Fixé à la main = 0 cm

GRAPH $\ln H_r$ vs t

P'=pente de la droite de tendance

$P' = -7.16E-03$ s⁻¹

$K = P'C = 6.75E-05$ cm/s

MESURÉ AVEC: Sonde Levellogger

PRÉCISION:

REMARQUES:

ESSAI DE CHOC HYDRAULIQUE

Temps écoulé, t	interval Δt	p	H	ΔH	H_{moy}	$\Delta H/\Delta t$	H_r	$\ln H_r$
s	s	cm	cm	cm	cm	cm/s	cm	(---)
2.00E+00		482.1182	195.1				15.47	2.739
5.80E+01	5.40E+01	477.51528	190.5	4.6	192.82	8.52E-02	10.87	2.386
1.48E+02	9.20E+01	472.94939	185.9	4.6	188.23	4.96E-02	6.30	1.841
3.11E+02	1.63E+02	468.33698	181.3	4.6	183.64	2.83E-02	1.69	0.524
8.72E+02	5.61E+02	463.7	176.7	4.6	179.04	8.18E-03	-2.90	#NOMBRE!

MANIPULATEURS: C.B. et A.G.

CALCULÉ PAR: C.B.

VÉRIFIÉ PAR:

Annexe D
Programmes de calcul construits dans MatLab

```

plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 5');
save('lisslpoly5.txt', 'P', 'Z', '-ascii', '-tabs');

n=6;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot (3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 6');
save('lisslpoly6.txt', 'P', 'Z', '-ascii', '-tabs');

n=7;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot (3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 7');
save('lisslpoly7.txt', 'P', 'Z', '-ascii', '-tabs');

n=8;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot (3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 8');
save('lisslpoly8.txt', 'P', 'Z', '-ascii', '-tabs');

n=9;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot (3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 9');
save('lisslpoly9.txt', 'P', 'Z', '-ascii', '-tabs');

```



```

%Ce programme produit un filtre passe-bande linéaire (fenetre trapézoidale)

i=1;
j=1;
k=1;
%load F10_1cm.txt; t10=F10_1cm(:,1); datain=F10_1cm(:,2); dt=1;
load F10_2cm.txt; t10=F10_2cm(:,1); datain=F10_2cm(:,2); dt=2;

%Permet le choix entre les données échantillonnées aux 1cm ou 2cm

F1=0.0001;
F2=0.001;
F3=0.1;
F4=0.11;
seuil=[F1 F2 F3 F4];
[f, in_freq, out_freq, dataout]=bandpass(datain,F1,F2,F3,F4,dt)

%Filtre passe-bande linéaire (fenetre trapézoidale)

subplot(3,2,2);
plot(datain,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)');
ylabel ('Vitesse moyenne DHr/Dt (cm/s)');
Title('Graphique des vitesses initial, puits p7-5i essai 10, pas 2cm');

%Illustre le graphique des vitesses pour fins de comparaison

for i=1:length(f)
    m10(i)=abs(in_freq(i));
    i=i+1;
end
m10(1)=0;
subplot(3,2,1);
plot(f,m10,'k');
grid on;
xlabel('Fréquence (cm-1)');
ylabel ('Amplitude (cm/s)');
Title('Résultat de la transformée de Fourier, puits p7-5i essai 10, pas 2cm');
xlim([0 f(end)]);

%Met en graphique le domaine fréquentiel non filtré

for j=1:length(f)
    m10f(j)=abs(out_freq(j));
    j=j+1;
end
m10f(1)=0;
subplot(3,2,3);
plot(f,m10f,'k');
grid on;
xlabel('Fréquence (cm-1)');
ylabel ('Amplitude (cm/s)');
Title('Bande filtrée, signal principal, puits p7-5i essai 10, pas 2cm');
xlim([0 f(end)]);

```

```

%Met en graphique le domaine fréquentiel filtré

subplot(3,2,4);
plot(dataout,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)');
ylabel ('Vitesse moyenne DHr/Dt (cm/s)');
Title('Graphique des vitesses sans ondulation, puits p7-5i essai 10, pas 2cm');

%Illustre le graphique des vitesses a l'aide des données filtrées

F5=0.1;
F6=0.1001;
F7=0.22;
F8=0.22001;
seuil2=[F5 F6 F7 F8];
[f, in_freq2, out_freq2, dataout2]=bandpass(datain,F5,F6,F7,F8,dt)

%Filtre passe-bande linéaire (fenetre trapézoïdale)

for k=1:length(f)
    m10f2(k)=abs(out_freq2(k));
    k=k+1;
end
m10f2(1)=0;
subplot(3,2,5);
plot(f,m10f2,'k');
grid on;
xlabel('Fréquence (cm-1)');
ylabel ('Amplitude (cm/s)');
Title('Bande filtrée, signal secondaire, puits p7-5i essai 10, pas 2cm');
xlim([0 f(end)]);

%Met en graphique le domaine fréquentiel filtré

subplot(3,2,6);
plot(dataout2,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)');
ylabel ('Vitesse moyenne DHr/Dt (cm/s)');
Title('Graphique des vitesses de l''ondulation, puits p7-5i essai 10, pas 2cm');

%Illustre le graphique des vitesses a l'aide des données filtrées

save('freq10_1cm.txt', 'f', '-ascii', '-tabs')
save('ampli10_1cm.txt', 'm10', '-ascii', '-tabs')
save('amplif10_1cm_1.txt', 'seuil', 'm10f', '-ascii', '-tabs')
save('v10f_1cm_1.txt', 'seuil', 'dataout', '-ascii', '-tabs')
save('amplif210_1cm_1.txt', 'seuil2', 'm10f2', '-ascii', '-tabs')
save('v210f_1cm_1.txt', 'seuil2', 'dataout2', '-ascii', '-tabs')

```

```

%Ce programme produit un filtre Chebyshev type II

i=0;
j=0;
seuil=[0.2 0.33];
[b,a]=cheby2(9,20,seuil/nyquist);

%Fournit les vecteurs requis pour un filtre Chebyshev type II ou n est
l'ordre, 20dB est l'atténuation

y10_B = fft(x10).*fft(b,N)'./fft(a,N)';

%Applique la transformée de Fourier et un filtre passe-bande dans le domaine
fréquentiel

for i=0:(N/2);
    i=i+1;
    m10_B(i)=abs(y10_B(i));
end
m10_B(1)=0;

%Donne la magnitude

subplot(3,2,3);
plot(freq10,m10_B,'k');
grid on;
xlabel('Fréquence (cm-1)');
ylabel('Amplitude (cm/s)');
Title('Bande isolée par filtre avec seuils f=0.2 et f=0.33, puits p7-5i essai
10');
xlim([0 nyquist]);

%Met en graphique le domaine fréquentiel filtré

x10_B=ifft(y10_B);

%Applique la transformée de Fourier inverse

subplot(3,2,4);
plot(x10_B,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)');
ylabel('Vitesse moyenne DHr/Dt (cm/s)');
Title('Graphique des vitesses de la bande de fréquences, puits p7-5i essai
10');

%Illustre le graphique des vitesses a l'aide des données filtrées

[b,a]=cheby2(9,20,seuil/nyquist,'stop');

%Fournit les vecteurs requis pour un filtre Chebyshev type II ou n est
l'ordre, 20dB est l'atténuation

y10_s = fft(x10).*fft(b,N)'./fft(a,N)';

%Applique la transformée de Fourier et un filtre coupe-bande dans le domaine

```

```

fréquentiel

for j=0:(N/2);
    j=j+1;
    m10_s(j)=abs(y10_s(j));
end
m10_s(1)=0;

%Donne la magnitude

subplot(3,2,5);
plot(freq10,m10_s,'k');
grid on;
xlabel('Fréquence (cm-1)'); ylabel ('Amplitude (cm/s)');
Title('Bande filtrée entre les seuils f=0.2 et f=0.33, puits p7-5i essai 10');
xlim([0 nyquist]);

%Met en graphique le domaine fréquentiel filtré

x10_s=ifft(y10_s);

%Applique la transformée de Fourier inverse

subplot(3,2,6);
plot(x10_s,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)'); ylabel ('Vitesse moyenne
DHr/Dt (cm/s)');
Title('Graphique des vitesses des fréquences hors-bande, puits p7-5i essai
10');

%Illustre le graphique des vitesses de l'ondulation meme

m10_B=m10_B';
m10_s=m10_s';

%Transpose les vecteurs de sortie en colonnes

save('ampli10_bande_1cm_2_33.txt', 'seuil', 'm10_B', '-ascii', '-tabs')
save('v10_bande_1cm_2_33.txt', 'seuil', 'x10_B', '-ascii', '-tabs')
save('ampli10_stopbande_1cm_2_33.txt', 'seuil', 'm10_s', '-ascii', '-tabs')
save('v10_stopbande_1cm_2_33.txt', 'seuil', 'x10_s', '-ascii', '-tabs')

```

```

%Ce programme illustre le résultat de la transformée de Fourier

r=0;
load F10_1cm.txt; t10=F10_1cm(:,1); x10=F10_1cm(:,2); I=1;
%load F10_2cm.txt; t10=F10_2cm(:,1); x10=F10_2cm(:,2); I=2;

%Permet le choix entre les données échantillonnées aux 1cm ou 2cm

subplot(3,2,2);
plot(x10,t10,'k');
grid on;
xlabel('Différence de charge moyenne Hr moy (cm)');
ylabel('Vitesse moyenne DHr/Dt (cm/s)');
Title('Graphique des vitesses initial, puits p7-5i essai 10');

%Illustre le graphique des vitesses pour fins de comparaison

y10=fft(x10);

%Effectue la transformée de Fourier rapide

N=length(y10);
M=round(N/2-0.1);

%Arrondit au plus petit nombre entier

for r=0:(N/2);
    r=r+1;
    m10(r)=abs(y10(r));
end

%Fournit la magnitude

m10(1)=0;

%Remplace le premier terme (somme des données de x10) par zéro

freq10=(0:M)*(1/I)/(N/2)*(1/2);

%Fréquence; 1/2 permet d'obtenir la fréquence Nyquist soit la moitié de la
fréquence d'échantillonnage

subplot(3,2,1);
plot(freq10,m10,'k');
grid on;

xlabel('Fréquence (cm-1)');
ylabel('Amplitude (cm/s)');
Title('Résultat de la transformée de Fourier, puits p7-5i essai 10');
nyquist=(M)*(1/I)/(N/2)*(1/2);
xlim([0 nyquist]);

%Met en graphique le domaine fréquentiel non filtré

```

%Ce programme approche les données par des polynômes de différents degrés

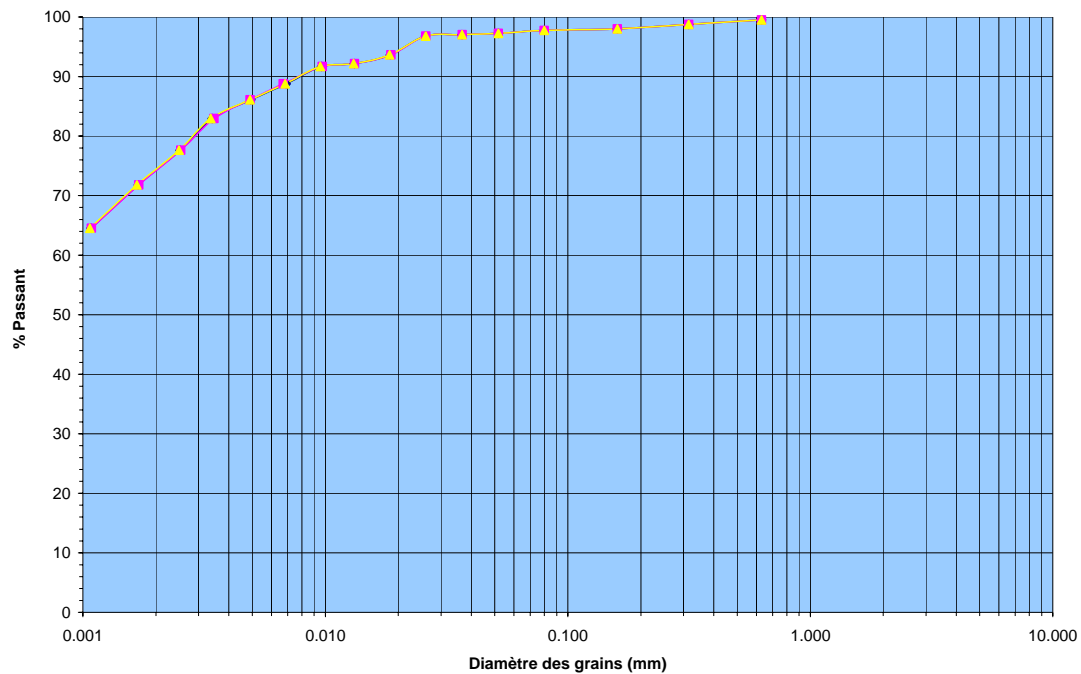
```

n=0;
load Lissagel.txt;
X=Lissagel(:,1); Y=Lissagel(:,2);
n=1;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot(3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 1');
save('lisslpoly1.txt', 'P', 'Z', '-ascii', '-tabs');
n=2;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot(3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 2');
save('lisslpoly2.txt', 'P', 'Z', '-ascii', '-tabs');
n=3;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot(3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 3');
save('lisslpoly3.txt', 'P', 'Z', '-ascii', '-tabs');
n=4;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot(3,3,n);
plot(X,Z,'-',X,Y,'-');
grid on;
axis([0 50 935 980]);
xlabel('Temps (s)');
ylabel('Pression (cm eau)');
Title('Polynome de degré 4');
save('lisslpoly4.txt', 'P', 'Z', '-ascii', '-tabs');
n=5;
[P,S]=polyfit(X,Y,n);
Z=polyval(P,X);
subplot(3,3,n);

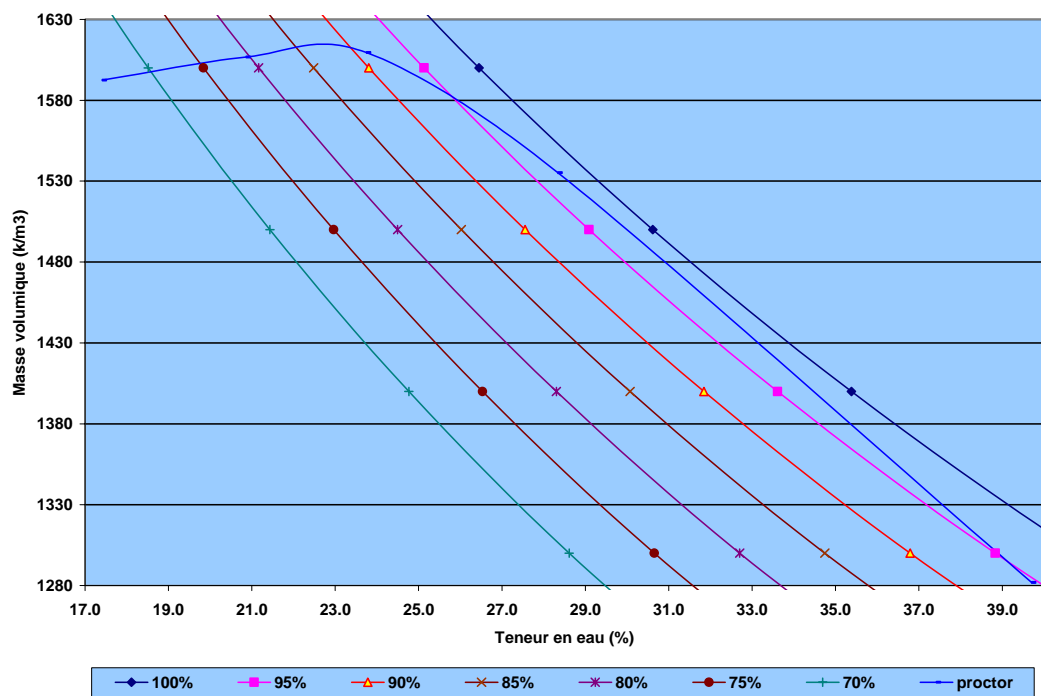
```

Annexe E
Résultats des essais géotechniques effectués sur l'argile du montage en
laboratoire

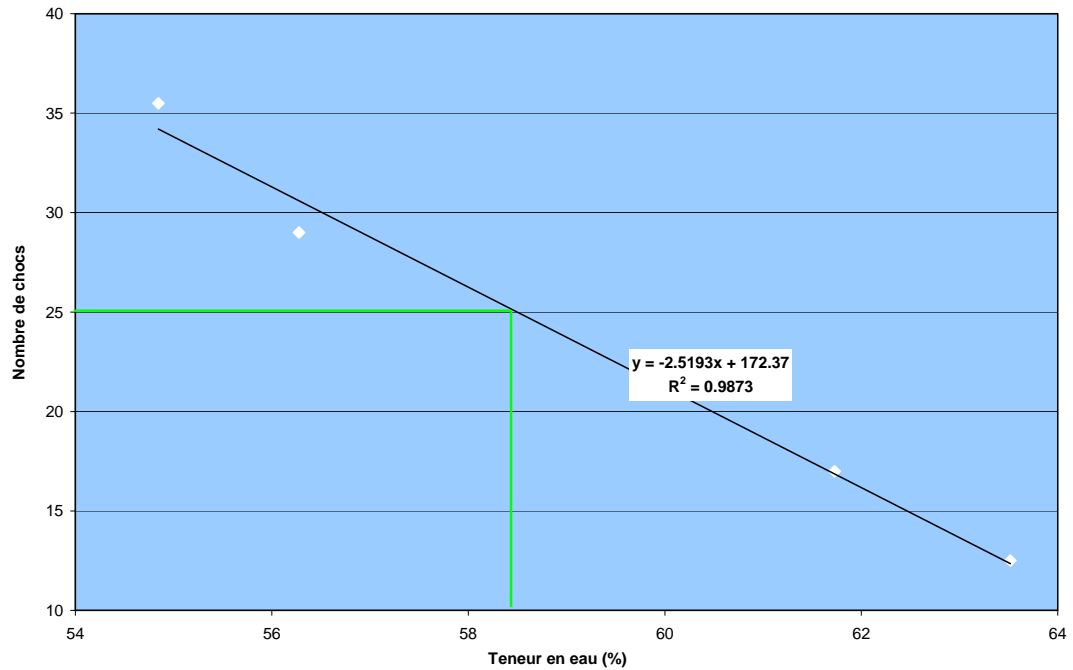
Distribution granulométrique des grains de l'argile étudiée



Courbe de compaction Proctor



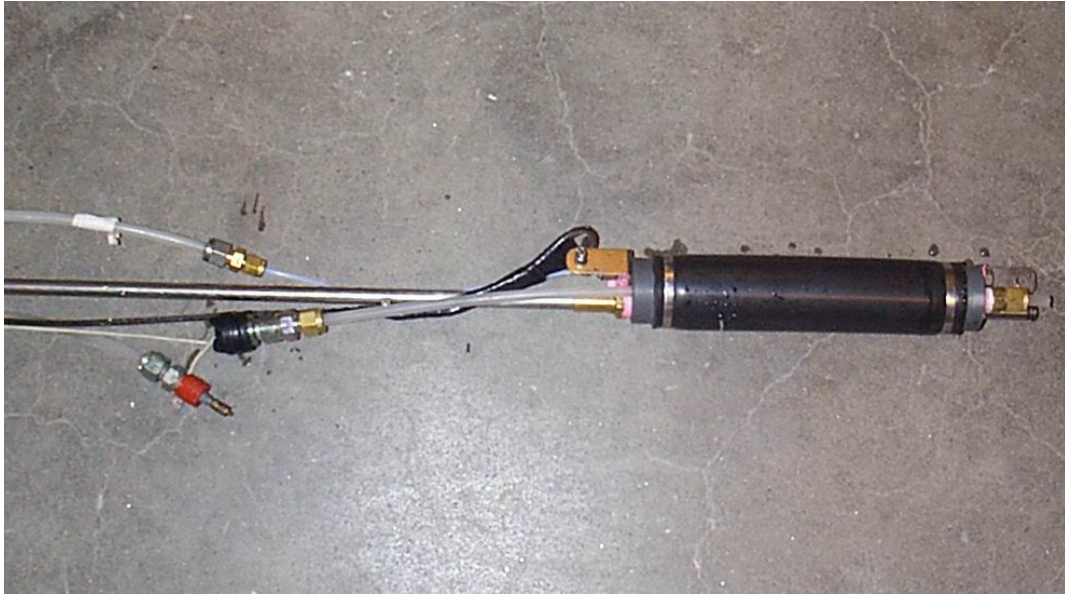
Détermination de la limite de liquidité



Limite de plasticité (%)		
Essai 1	Essai 2	Essai 3
24.35	26.94	25.60

Densité relative des grains solides								
Essai 1		Essai 2			Essai 3			MOYENNE
Ballon 1	Ballon 2	Ballon 1	Ballon 2	Ballon 3	Ballon 1	Ballon 2	Ballon 3	
2.769	2.761	2.768	2.812	2.750	2.780	2.779	2.774	2.774

Annexe F
Montage photographique



Photographie 1 : Instrument pour produire le choc hydraulique



Photographie 2 : Capteur de pression Levelogger ©



Photographie 3 : Pompe à pied pour le gonflement de l'obturateur



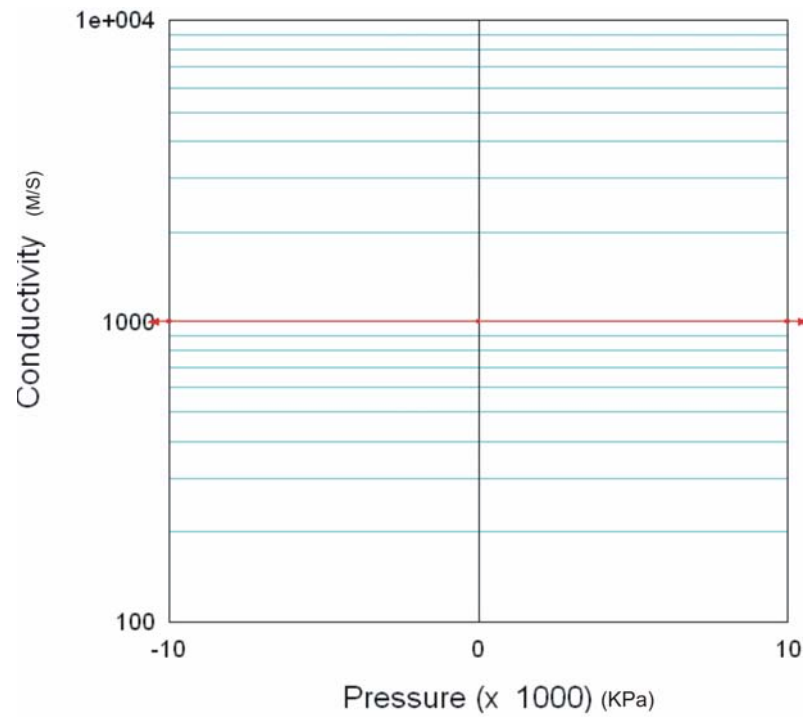
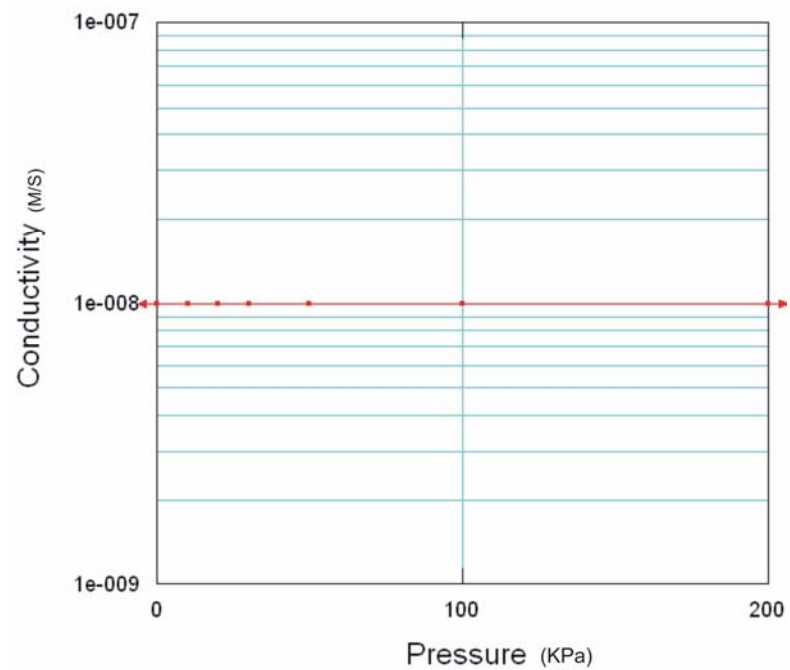
Photographie 4 : Montage d'argile en laboratoire

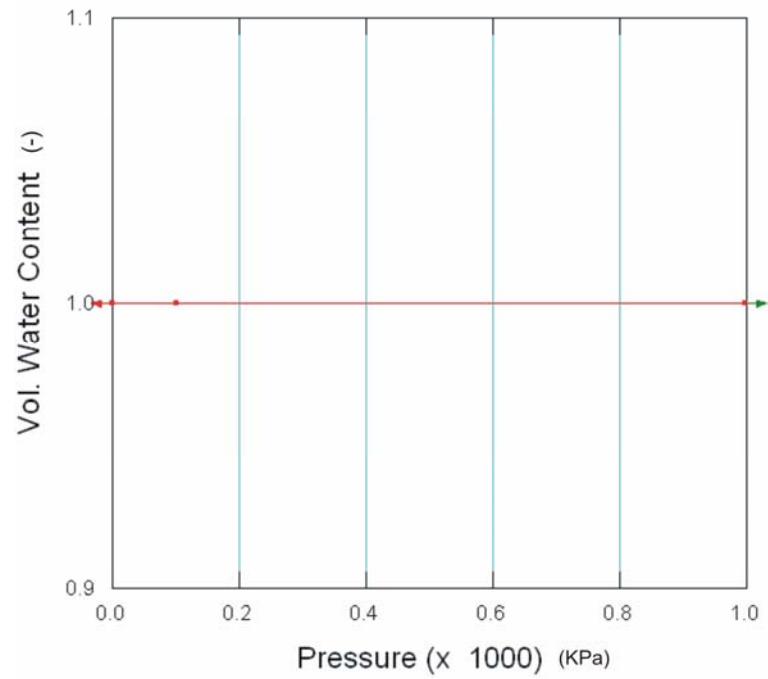
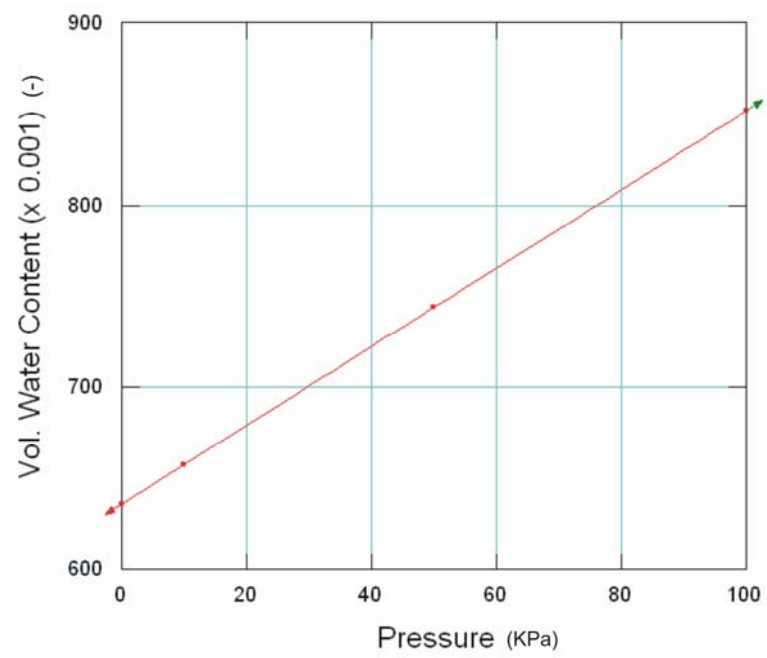


*Photographie 5 : Montage de
mortier en laboratoire*

Annexe G

**Conditions imposées au modèle pour la simulation de l'essai de
perméabilité à charge constante**

Conductivité hydraulique de la lanterne du puits**Conductivité hydraulique du matériau du sol**

Teneur en eau volumique pour la lanterne du puits**Teneur en eau volumique pour le matériau du sol**

Conditions de convergence imposées à Seep/W

The screenshot shows the 'Analysis Settings' dialog box with the 'Convergence' tab selected. The 'Convergence' section has a 'Max # of Iterations' field set to 50 and a 'Tolerance' field set to 0.1. The 'Conductivity Change (in Orders of Magnitude)' section has a 'Maximum Change' field set to 11, a 'Minimum Change' field set to 1e-011, and a 'Rate of Change' field set to 1.1. The 'Equation Solver' section has two radio buttons: 'Direct Equation Solver' (selected) and 'Iterative Equation Solver'. Below the 'Iterative Equation Solver' radio button are fields for 'Max. # of Iterations' (1000) and 'Tolerance' (1e-006). The 'Potential Seepage' section has a 'Max. # of Reviews' field set to 10. At the bottom right are 'OK' and 'Cancel' buttons.

Project ID	Type	Control	Convergence	Time
Convergence				
Max # of Iterations:		50	Tolerance:	0.1
Conductivity Change (in Orders of Magnitude)				
Maximum Change:		11	Rate of Change:	1.1
Minimum Change:		1e-011		
Equation Solver				
<input checked="" type="radio"/> Direct Equation Solver				
<input type="radio"/> Iterative Equation Solver				
Max. # of Iterations:		1000	Tolerance:	1e-006
Potential Seepage				
Max. # of Reviews:		10		

Conditions de convergence imposées à Sigma/W

The screenshot shows the 'Analysis Settings' dialog box with the 'Convergence' tab selected. The 'Convergence' section has a 'Max # of Iterations' field set to 50. The 'Tolerance (%)' section has two checkboxes: 'Displacement Norm' (checked) with a value of 0.1, and 'Unbalanced Load Norm' (unchecked) with a value of 1. The 'Equation Solver' section has two radio buttons: 'Direct Equation Solver' (selected) and 'Iterative Equation Solver'. Below the 'Iterative Equation Solver' radio button are fields for 'Max. # of Iterations' (1000) and 'Tolerance' (1e-006). At the bottom right are 'OK' and 'Cancel' buttons.

Project ID	Type	Control	Convergence	Time
Convergence				
Max # of Iterations:		50		
Tolerance (%)				
<input checked="" type="checkbox"/> Displacement Norm:		0.1		
<input type="checkbox"/> Unbalanced Load Norm:		1		
Equation Solver				
<input checked="" type="radio"/> Direct Equation Solver				
<input type="radio"/> Iterative Equation Solver				
Max. # of Iterations:		1000	Tolerance:	1e-006

Annexe H
Résultats de l'analyse de signal

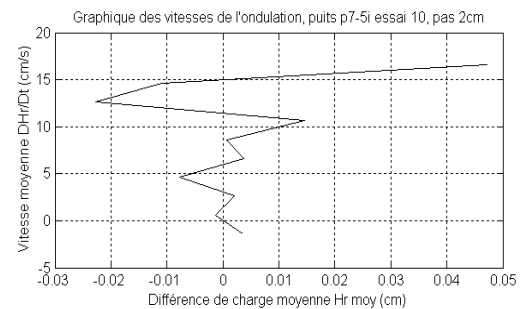
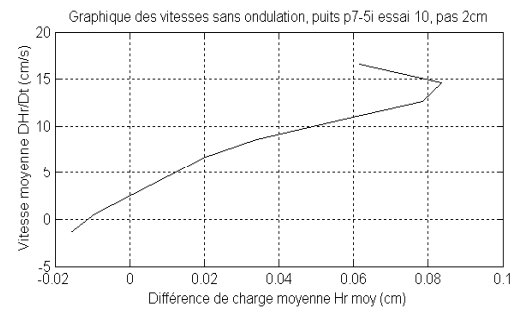
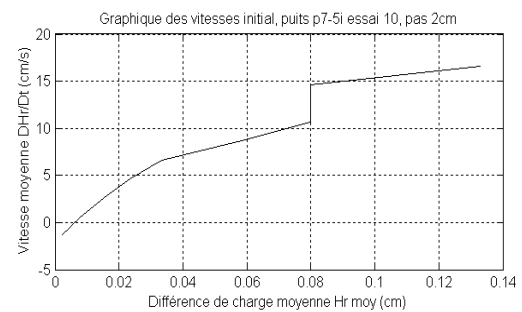
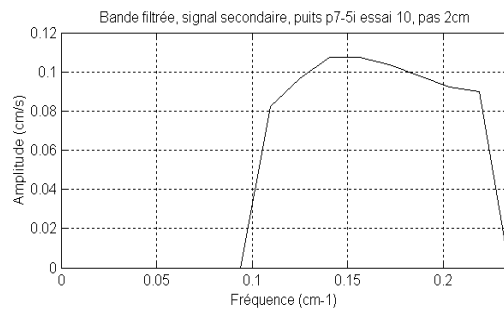
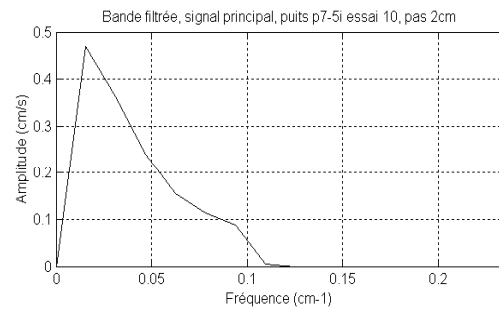
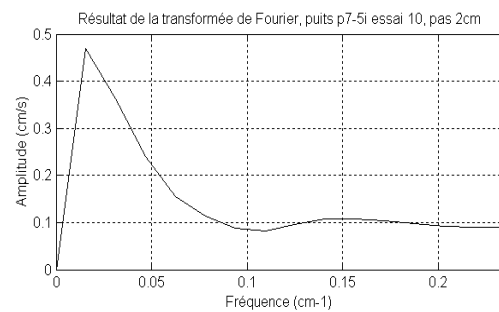
Filtre trapézoidal maison

Seuils de la fenêtre pour le signal principal :

$f_1=0.0001$; $f_2=0.001$; $f_3=0.1$; $f_4=0.11$;

Seuils de la fenêtre pour le signal secondaire :

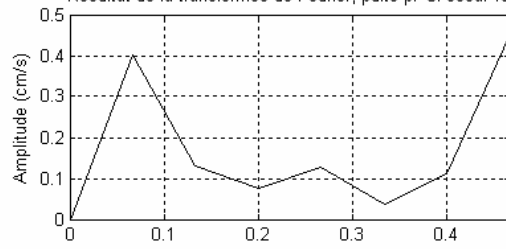
$f_5=0.1$; $f_6=0.1001$; $f_7=0.22$; $f_8=0.22001$;



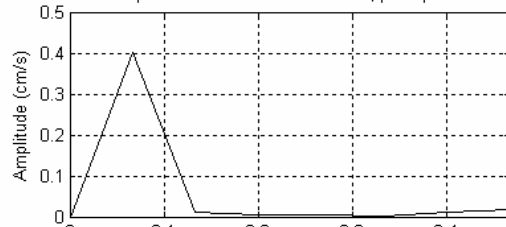
Filtre Chebychev passe-bas et passe haut
Pas d'échantillonnage : 1cm

Seuil : $f=0,12$

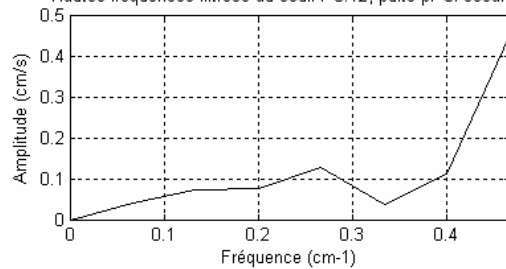
Résultat de la transformée de Fourier, puits p7-5i essai 10



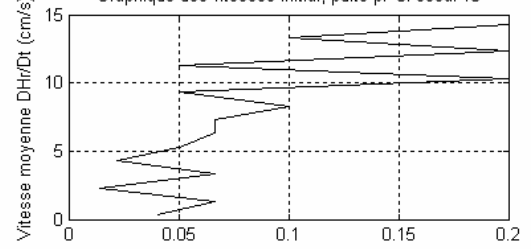
Basses fréquences filtrées au seuil $f=0,12$, puits p7-5i essai 10



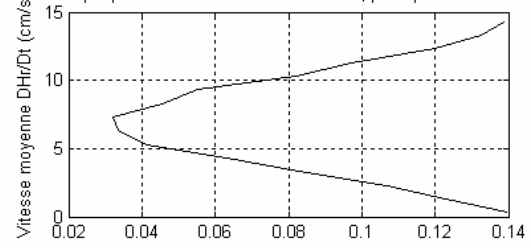
Hautes fréquences filtrées au seuil $f=0,12$, puits p7-5i essai 10



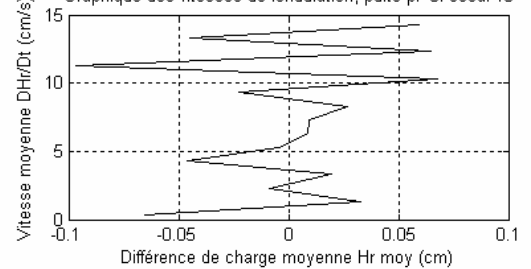
Graphique des vitesses initial, puits p7-5i essai 10



Graphique des vitesses sans ondulation, puits p7-5i essai 10

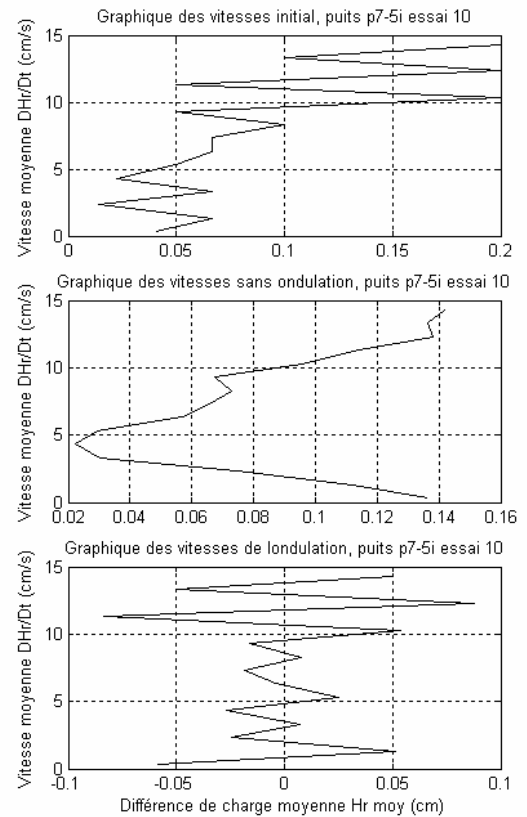
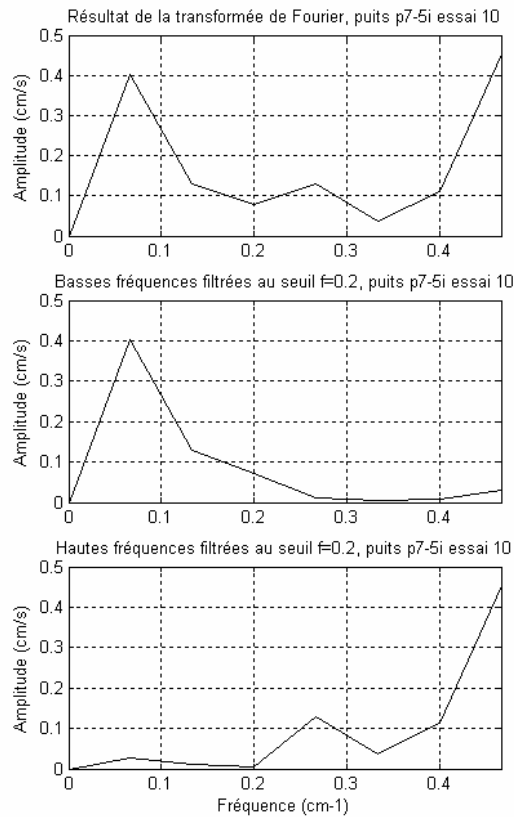


Graphique des vitesses de ondulation, puits p7-5i essai 10



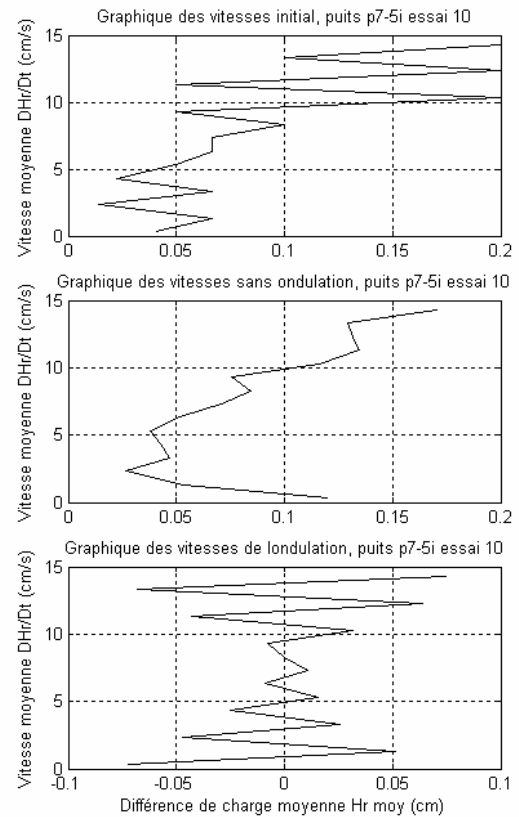
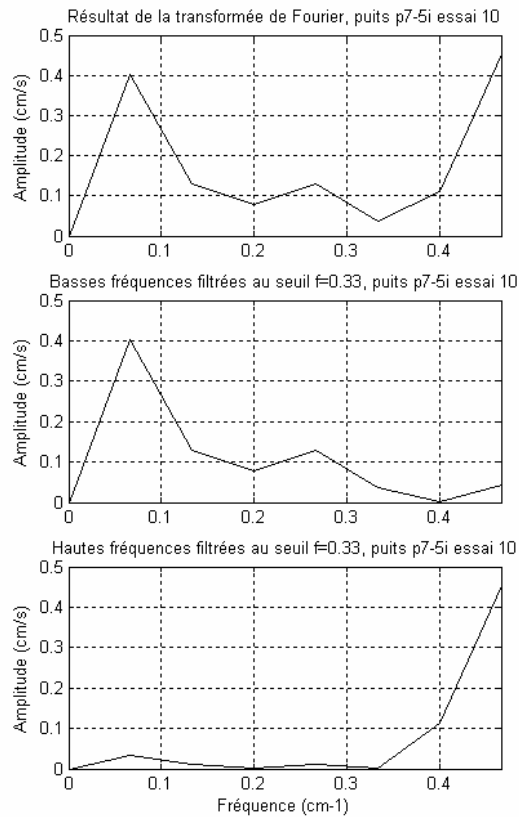
Filtre Chebychev passe-bas et passe haut
Pas d'échantillonnage : 1cm

Seuil : $f=0,2$



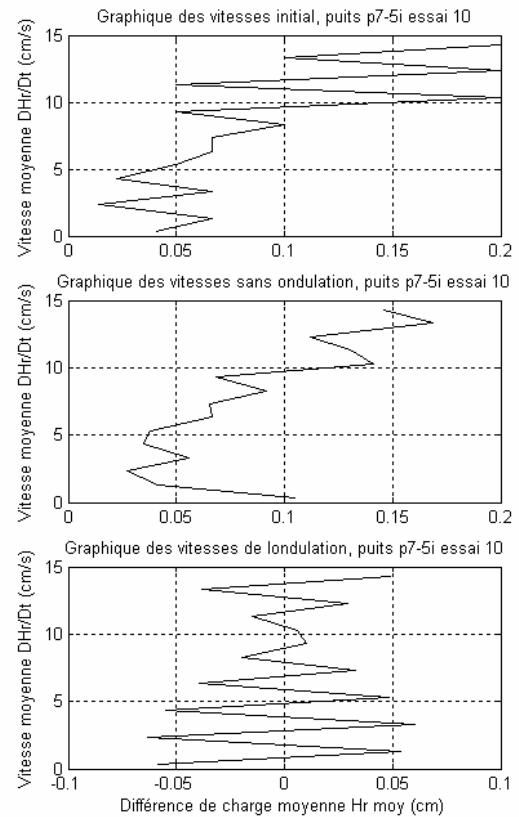
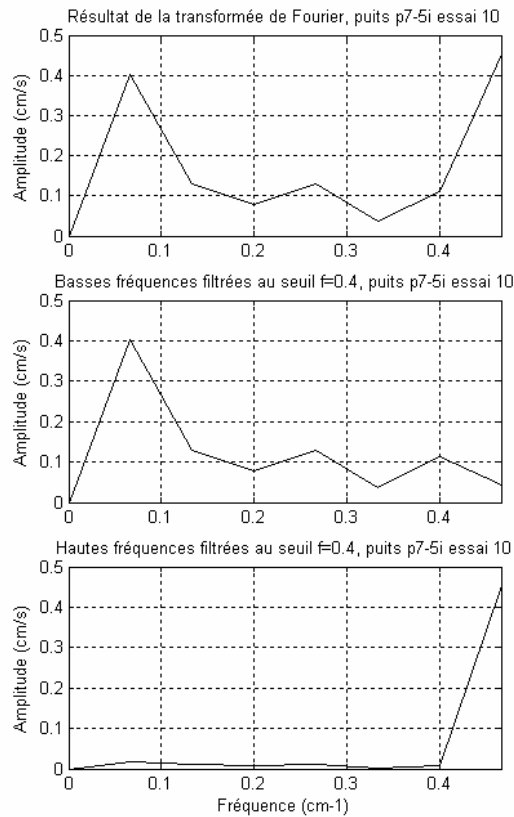
Filtre Chebychev passe-bas et passe haut
Pas d'échantillonnage : 1cm

Seuil : $f=0,33$



Filtre Chebychev passe-bas et passe haut
Pas d'échantillonnage : 1cm

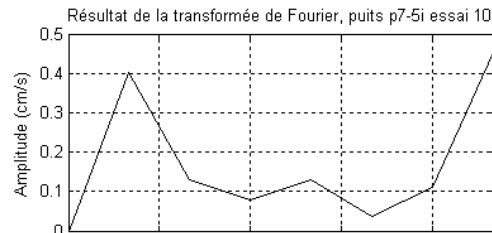
Seuil : $f=0,4$



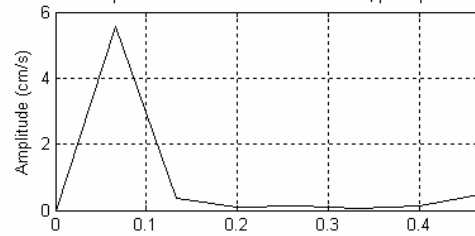
Filtre Chebychev passe-bande et coupe-bande

Pas d'échantillonnage : 1cm

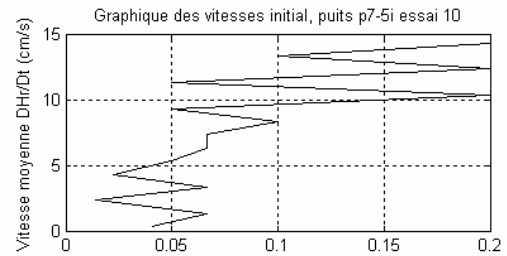
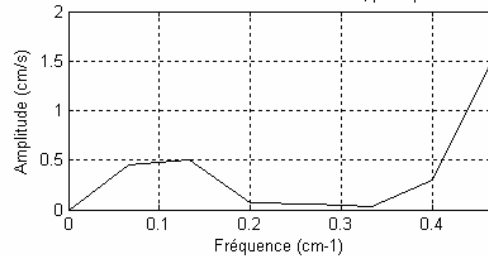
Seuils : $f_1=0,12$ et $f_2=0,4$



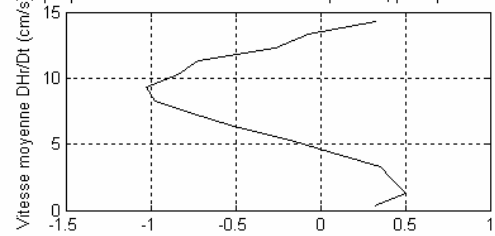
Bande isolée par filtre avec seuils $f=0,12$ et $f=0,4$, puits p7-5i essai 10



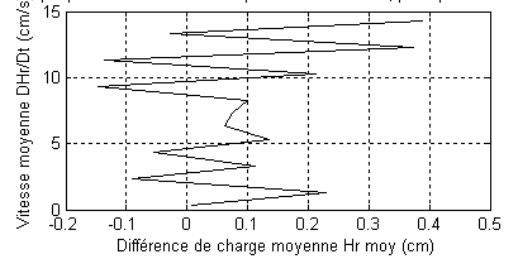
Bande filtrée entre les seuils $f=0,12$ et $f=0,4$, puits p7-5i essai 10



Graphique des vitesses de la bande de fréquences, puits p7-5i essai 10



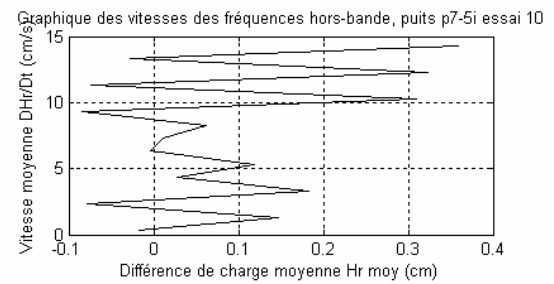
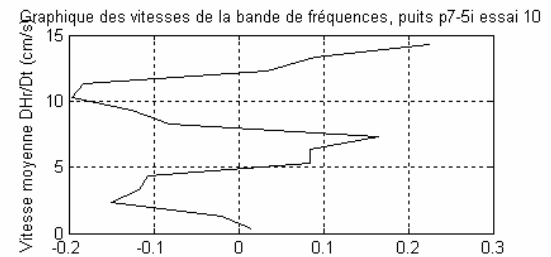
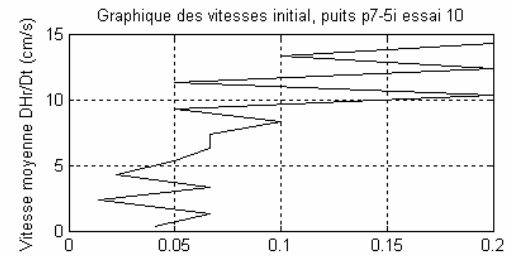
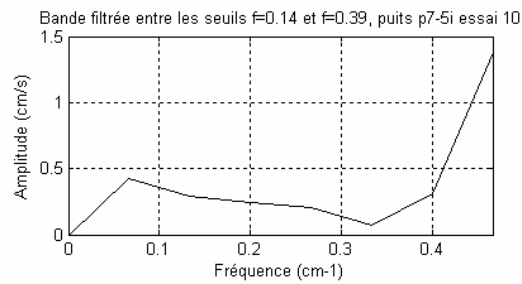
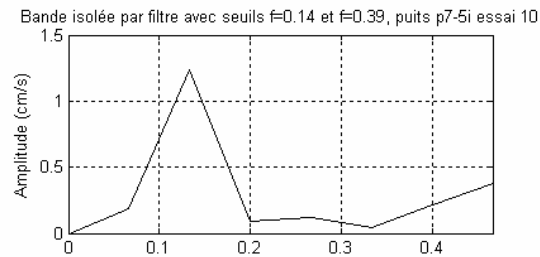
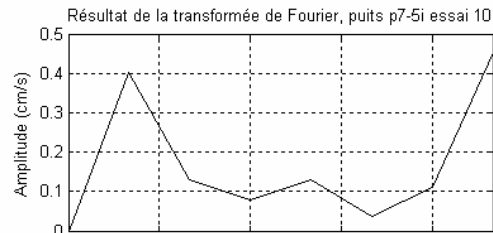
Graphique des vitesses des fréquences hors-bande, puits p7-5i essai 10



Filtre Chebychev passe-bande et coupe-bande

Pas d'échantillonnage : 1cm

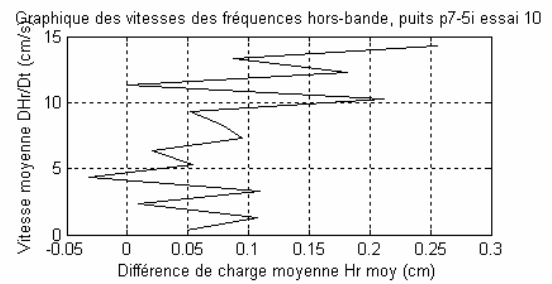
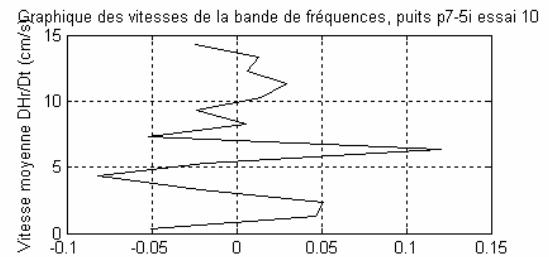
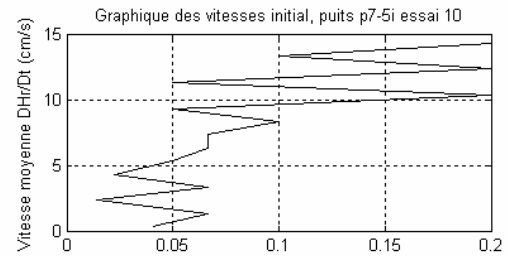
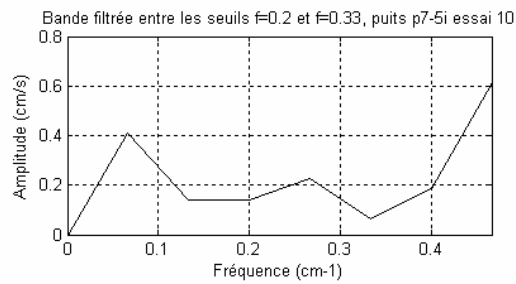
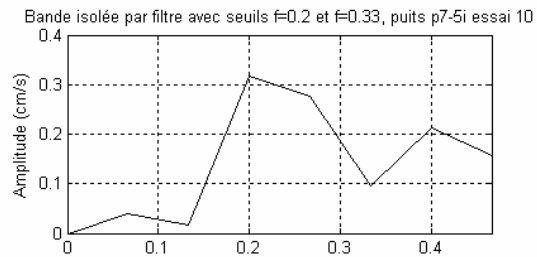
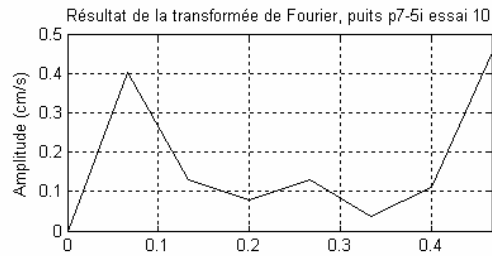
Seuils : $f_1=0,14$ et $f_2=0,39$



Filtre Chebychev passe-bande et coupe-bande

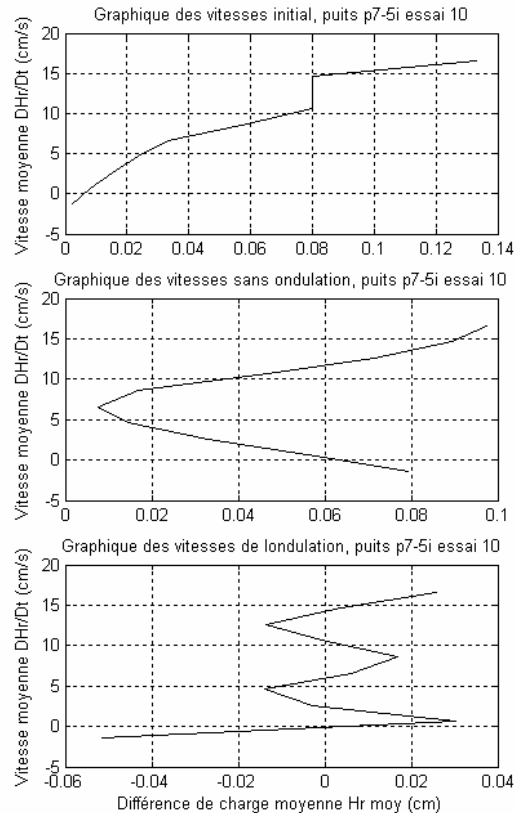
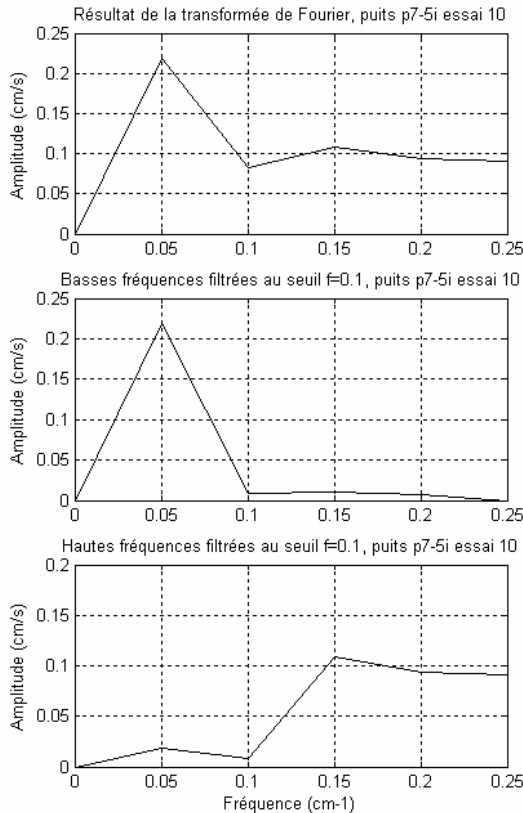
Pas d'échantillonnage : 1cm

Seuils : $f=0,2$ et $f=0,33$



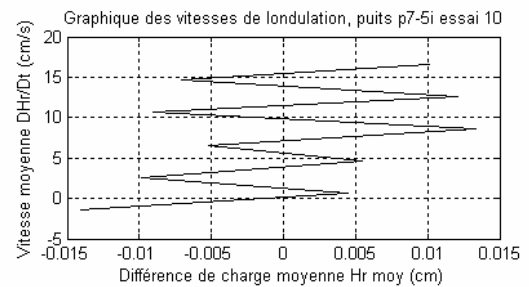
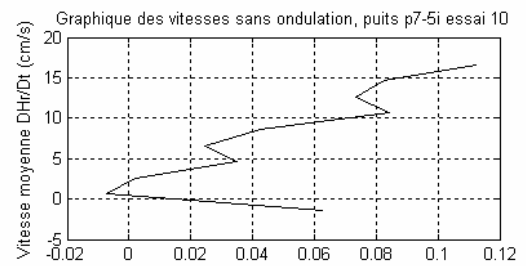
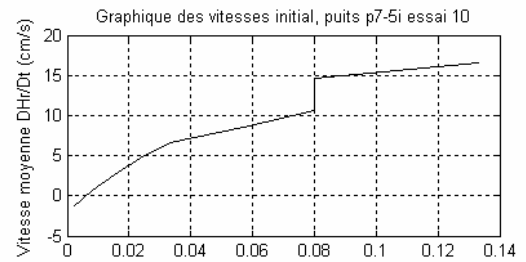
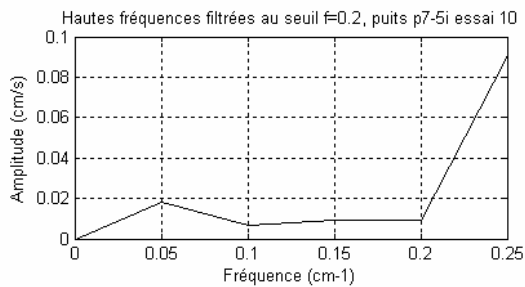
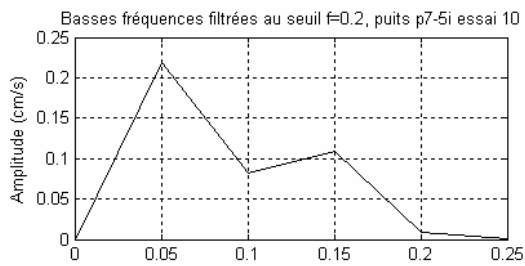
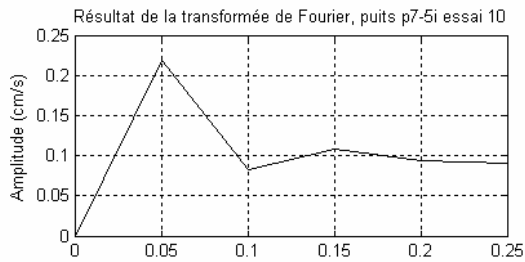
Filtre Chebychev passe-bas et passe-haut
Pas d'échantillonnage : 2cm

Seuil : $f=0,1$



Filtre Chebychev passe-bas et passe-haut
Pas d'échantillonnage : 2cm

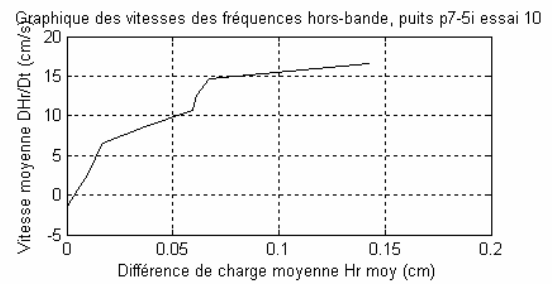
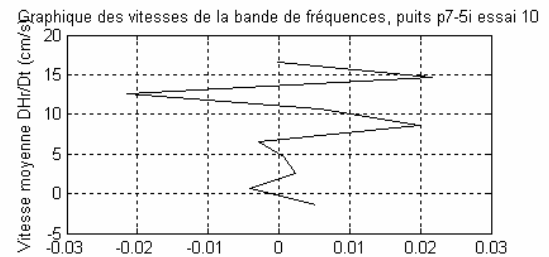
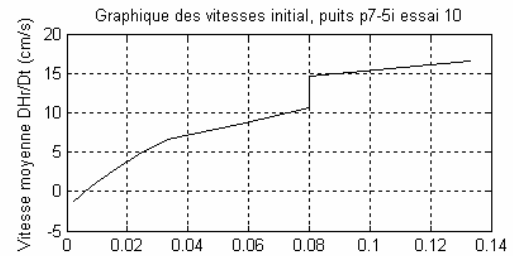
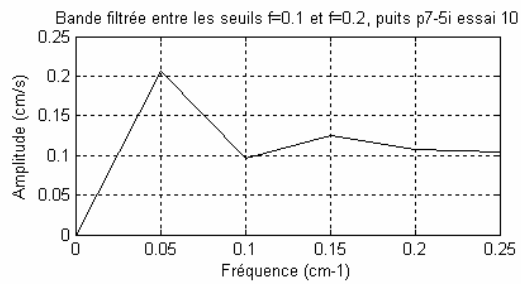
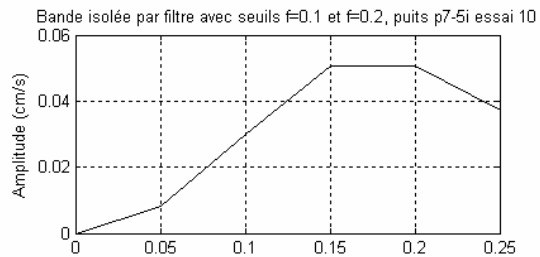
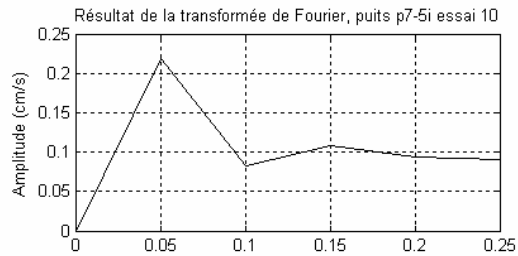
Seuil : $f=0,2$



Filtre Chebychev passe-bande et coupe-bande

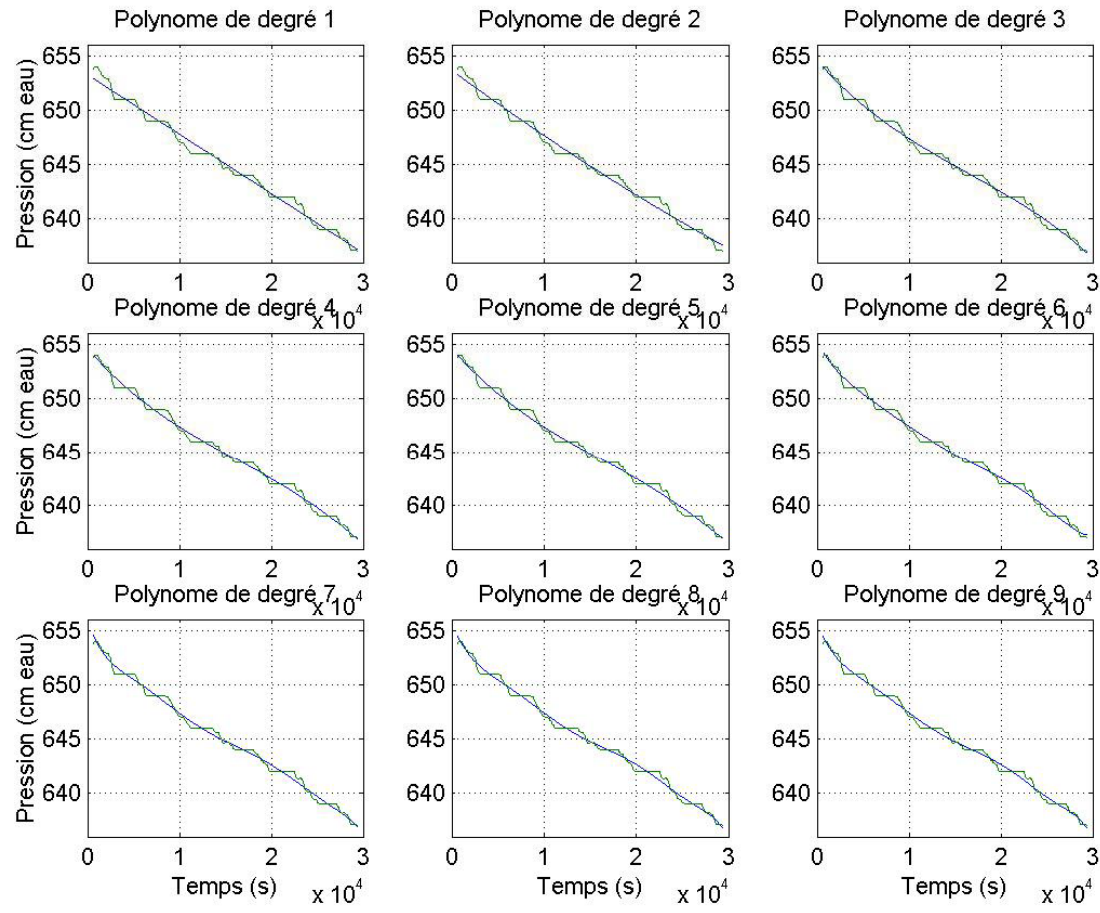
Pas d'échantillonnage : 2cm

Seuils : $f=0,1$ et $f=0,2$

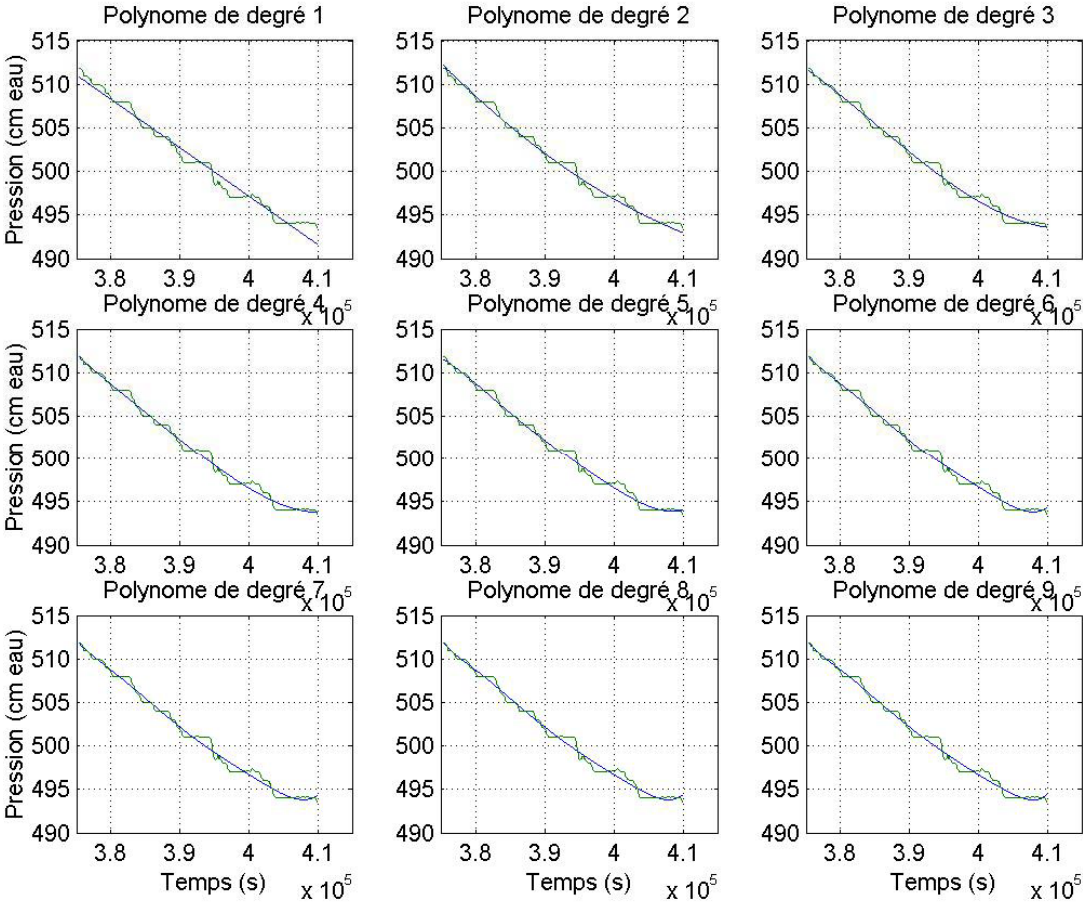


Annexe I
Résultats de l'approximation polyomiale

F305B niveau descendant essai1

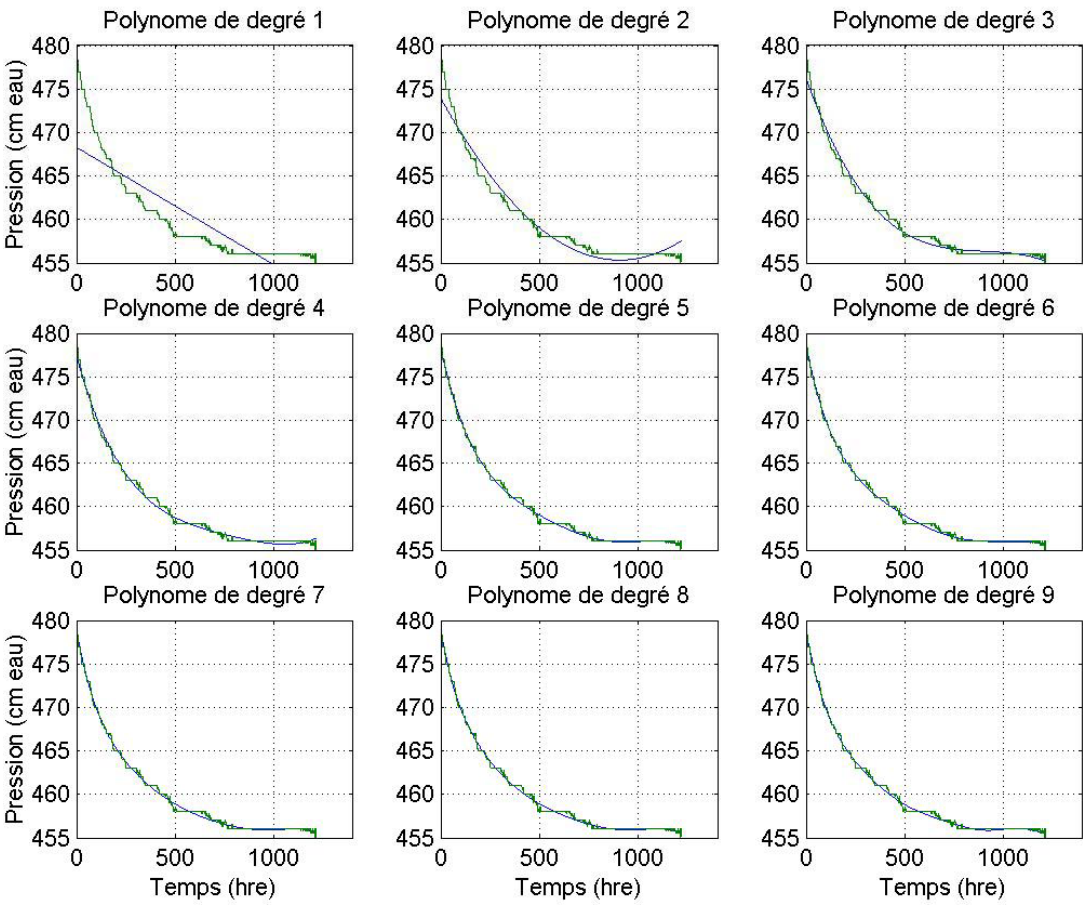


F305B niveau descendant essai 6

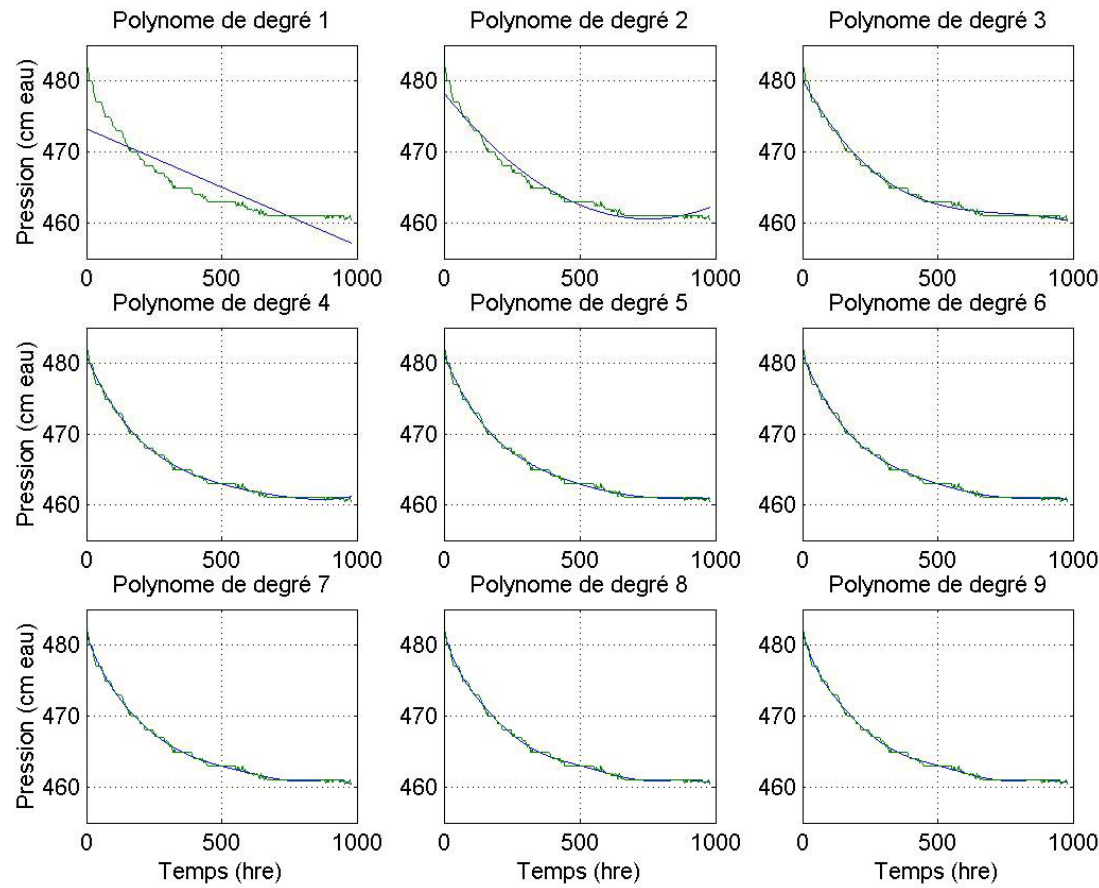


Essais de choc hydraulique

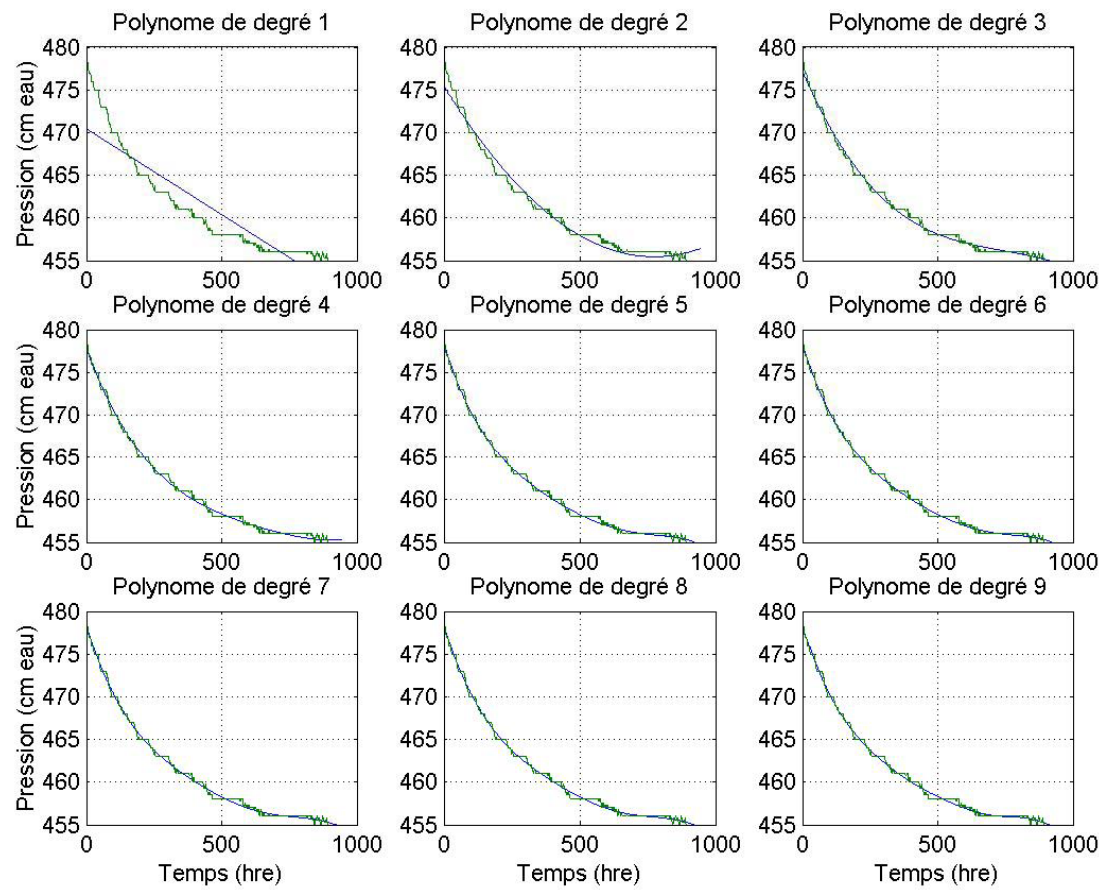
p7-5i essai 4



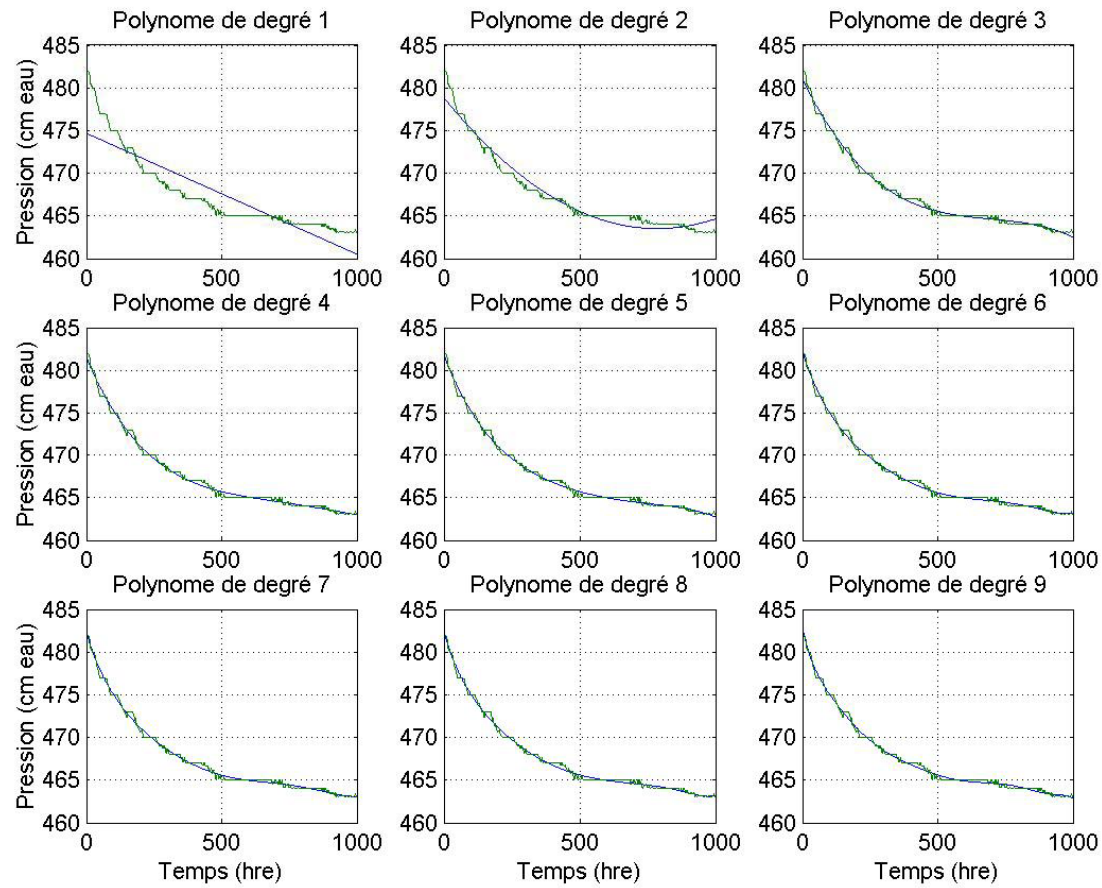
p7-5i essai 5



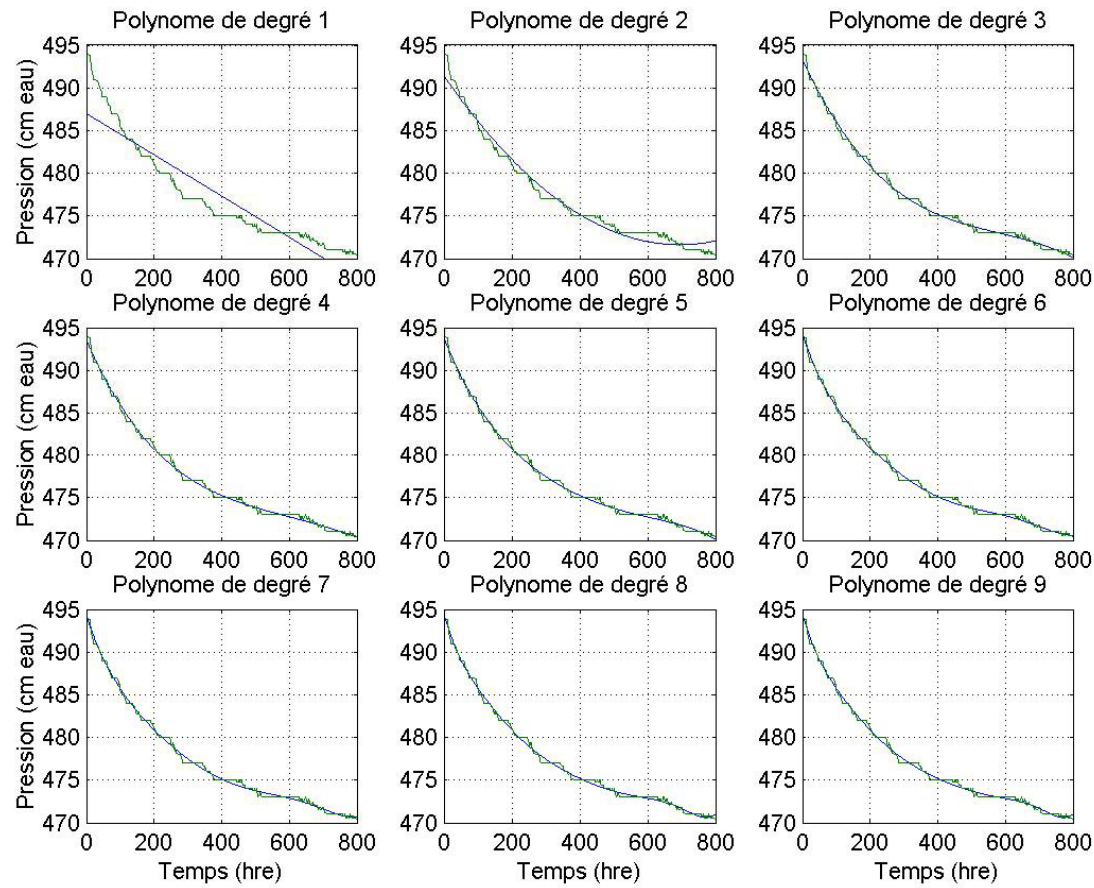
p7-5i essai 6



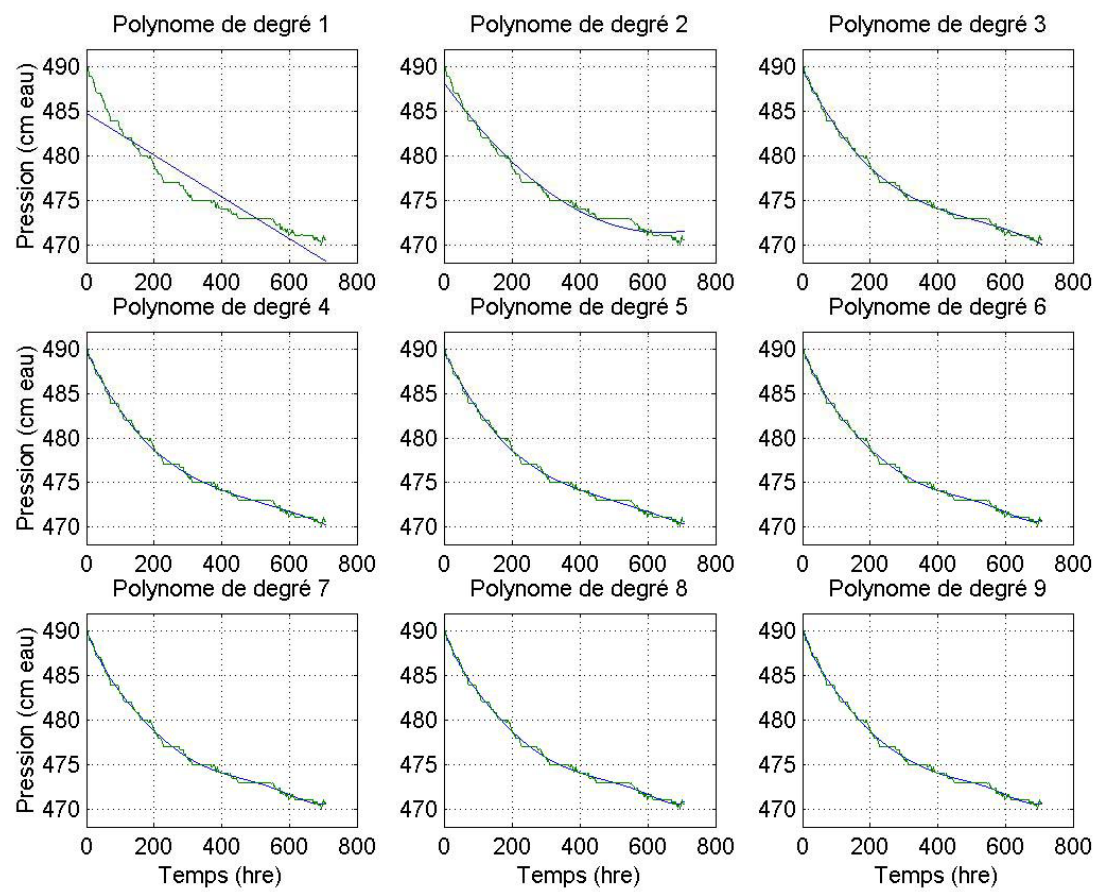
p7-5i essai 7



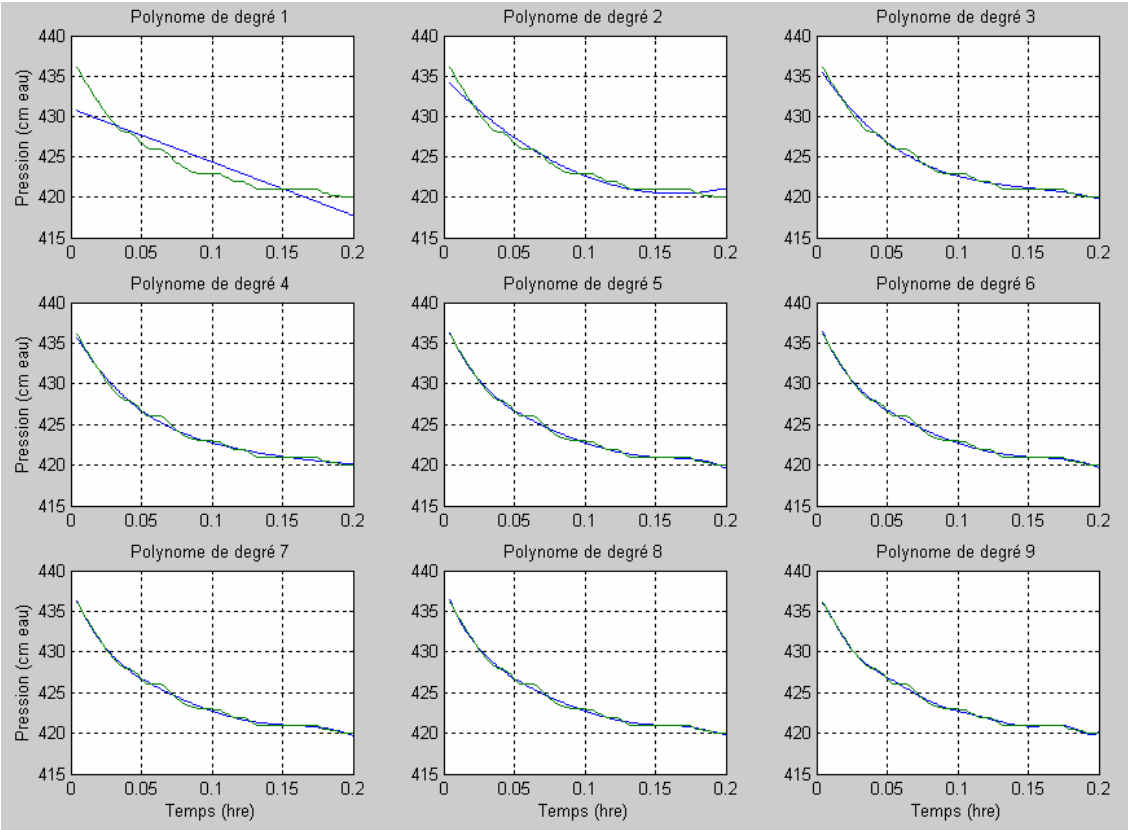
p7-5i essai 8

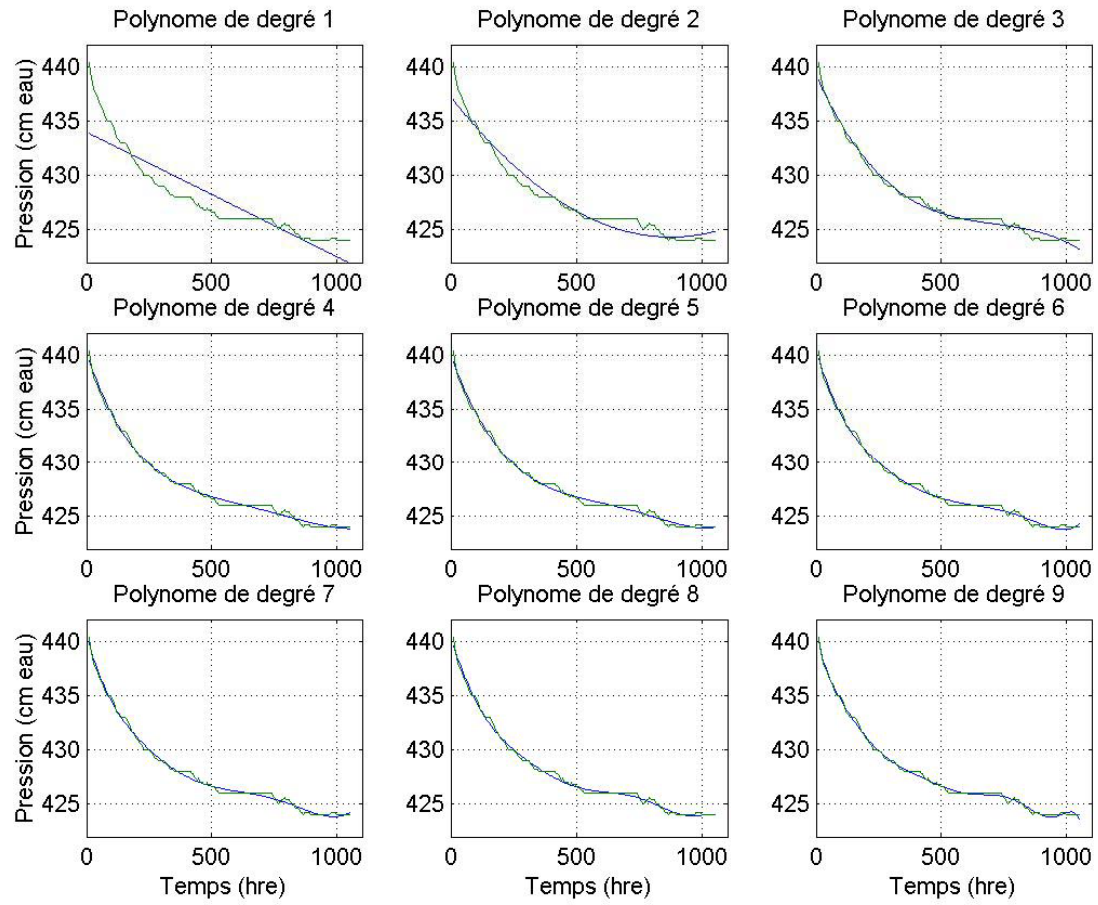


p7-5i essai 9

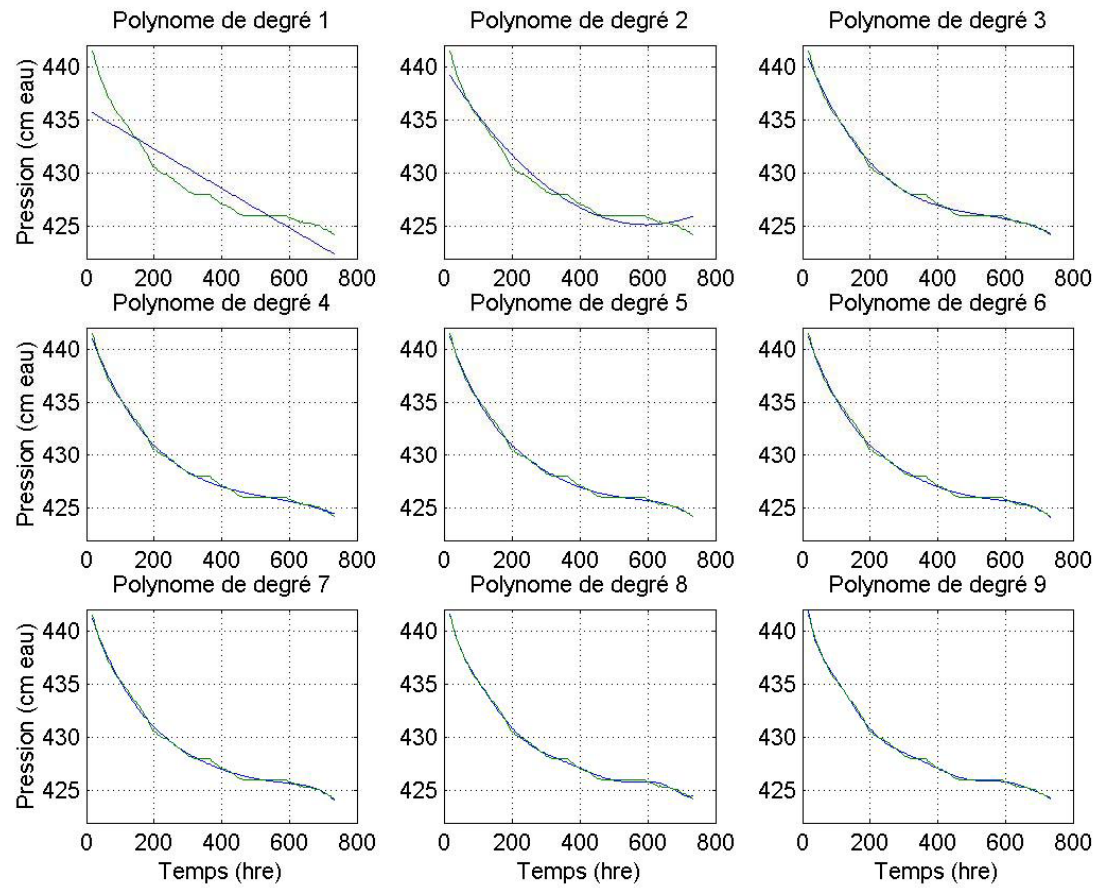


p7-5i essai 10

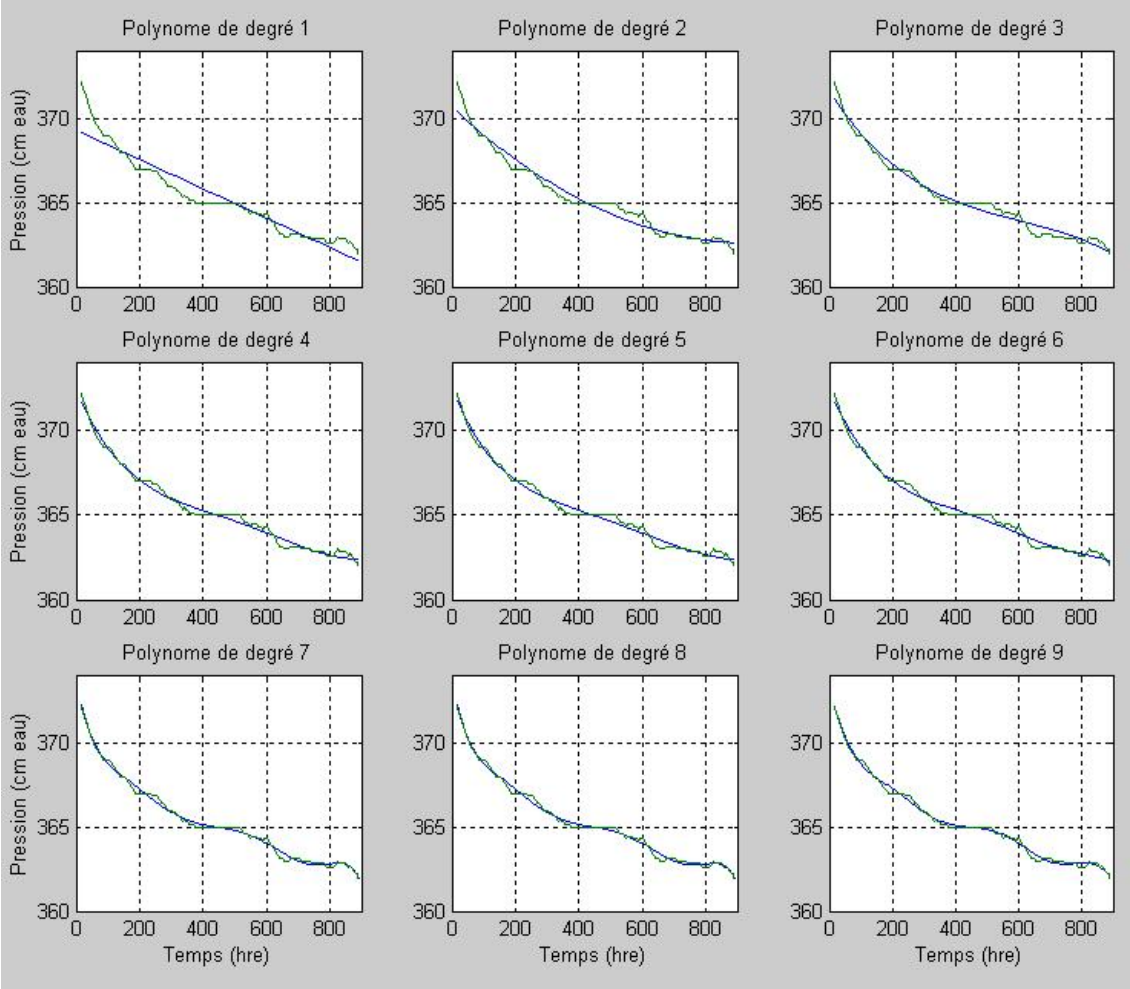


p7-5i essai 11

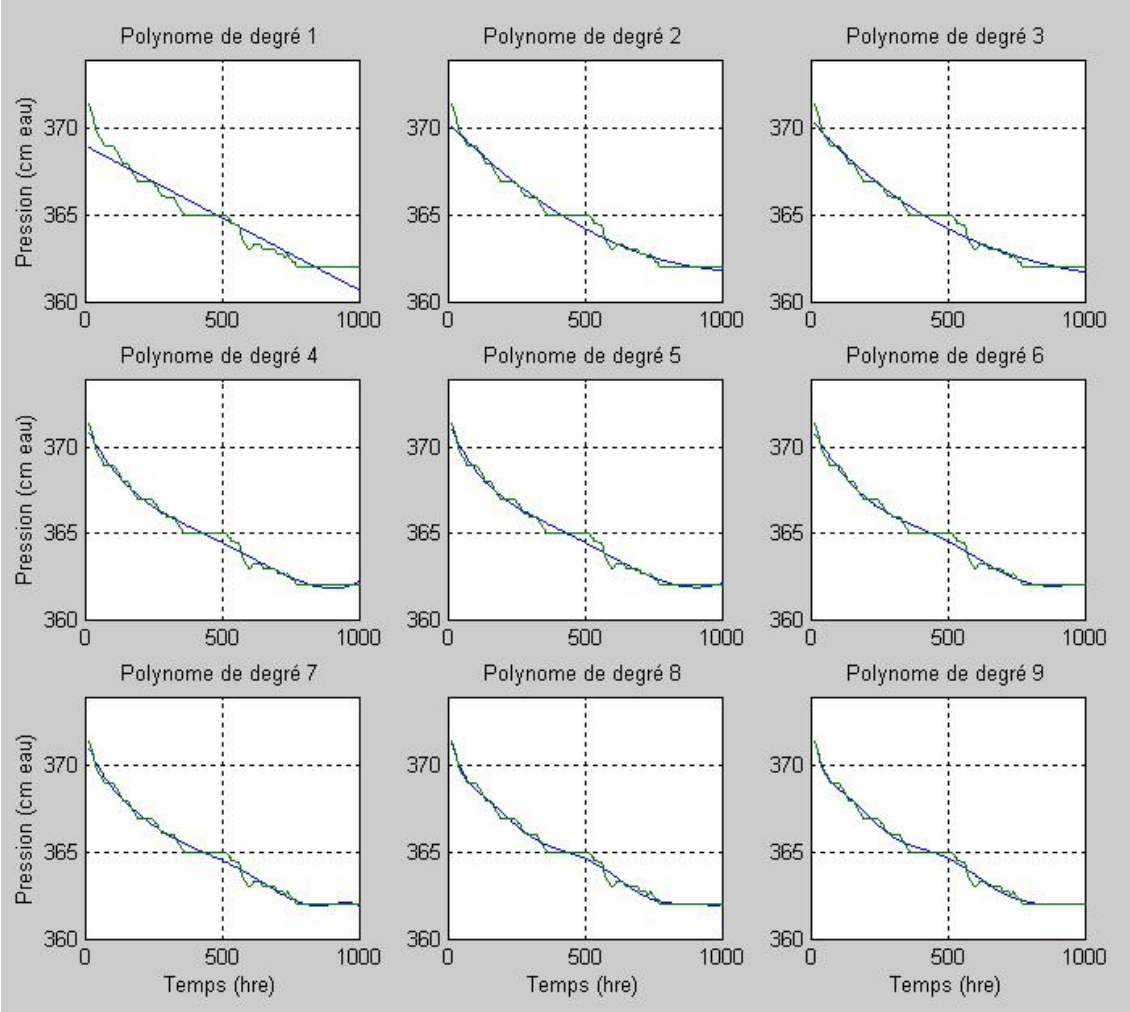
p7-5i essai 12

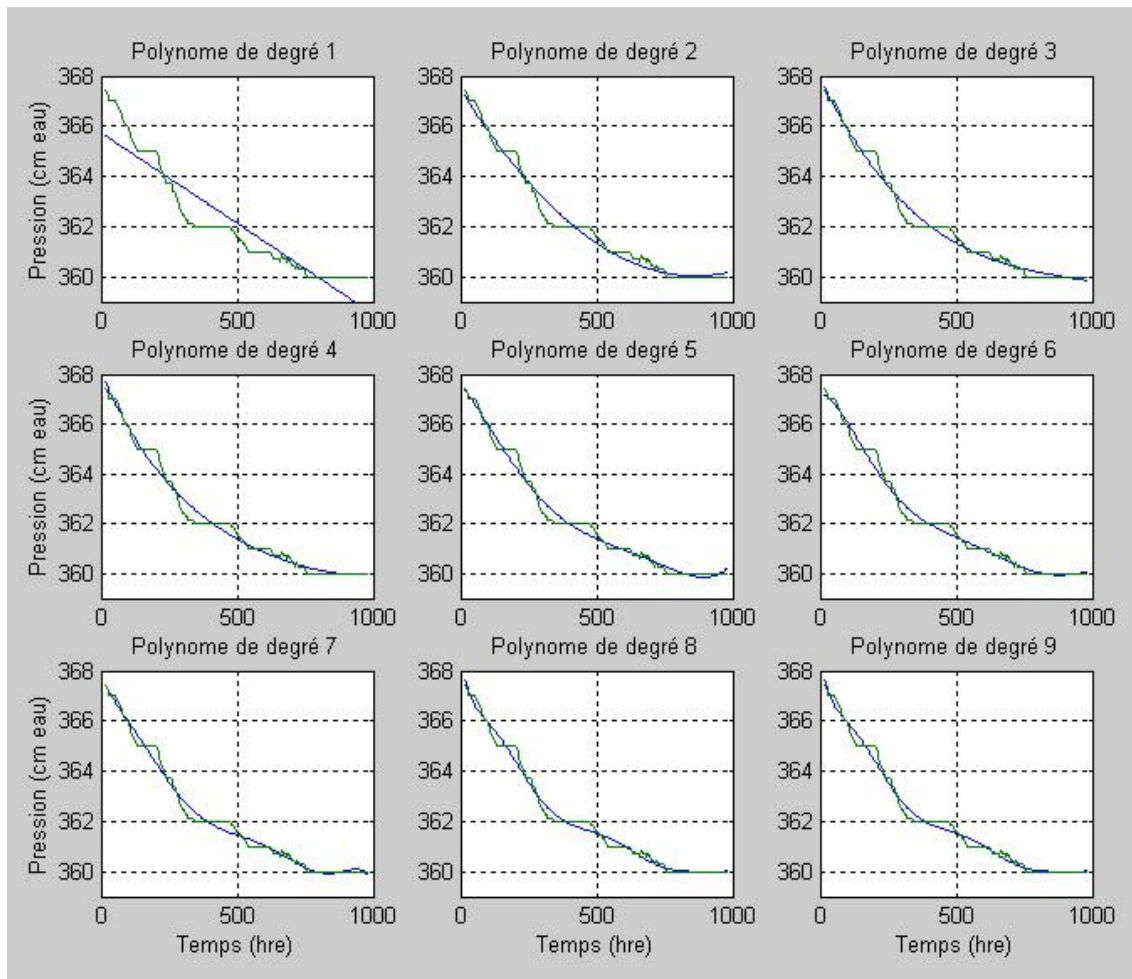


pZ-23b essai 1

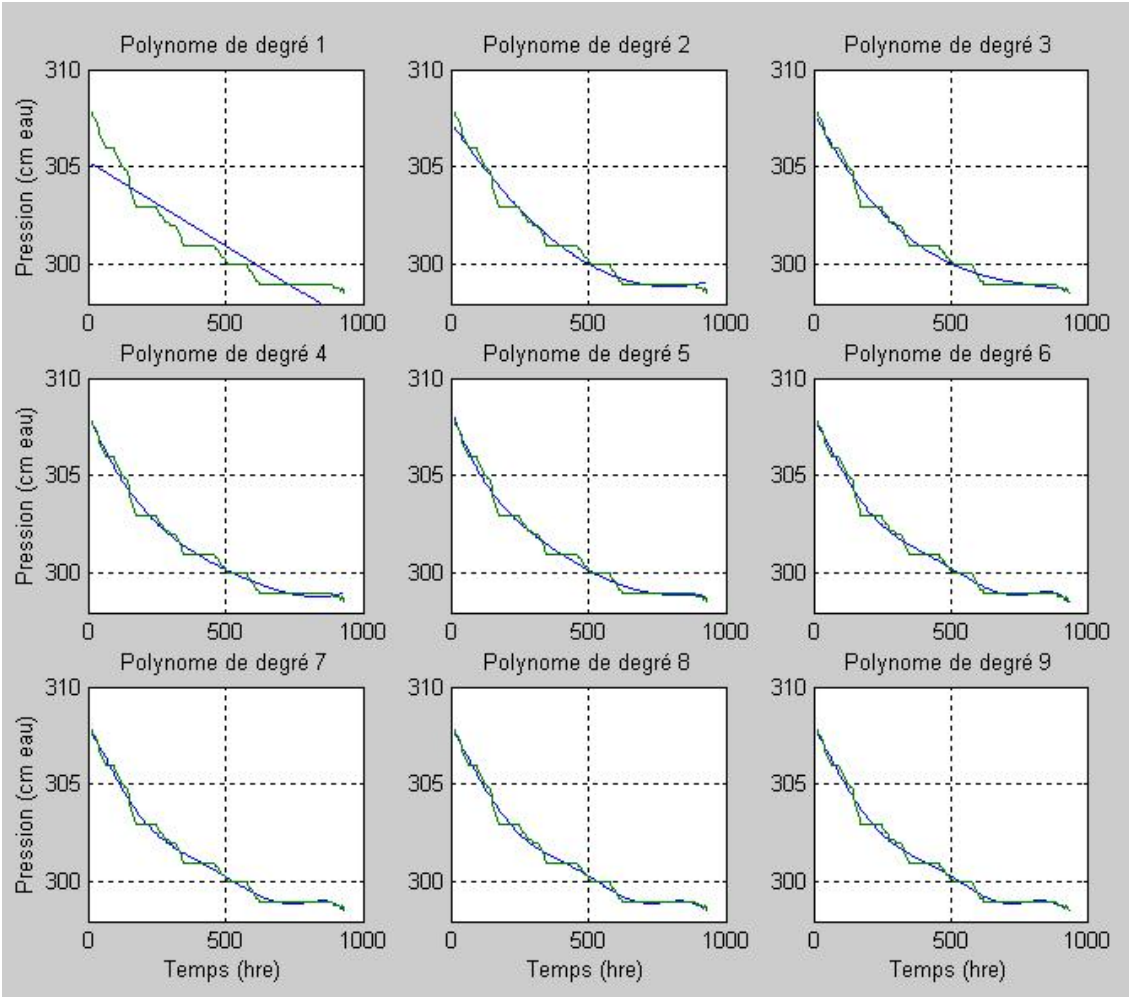


pZ-23B essai 2

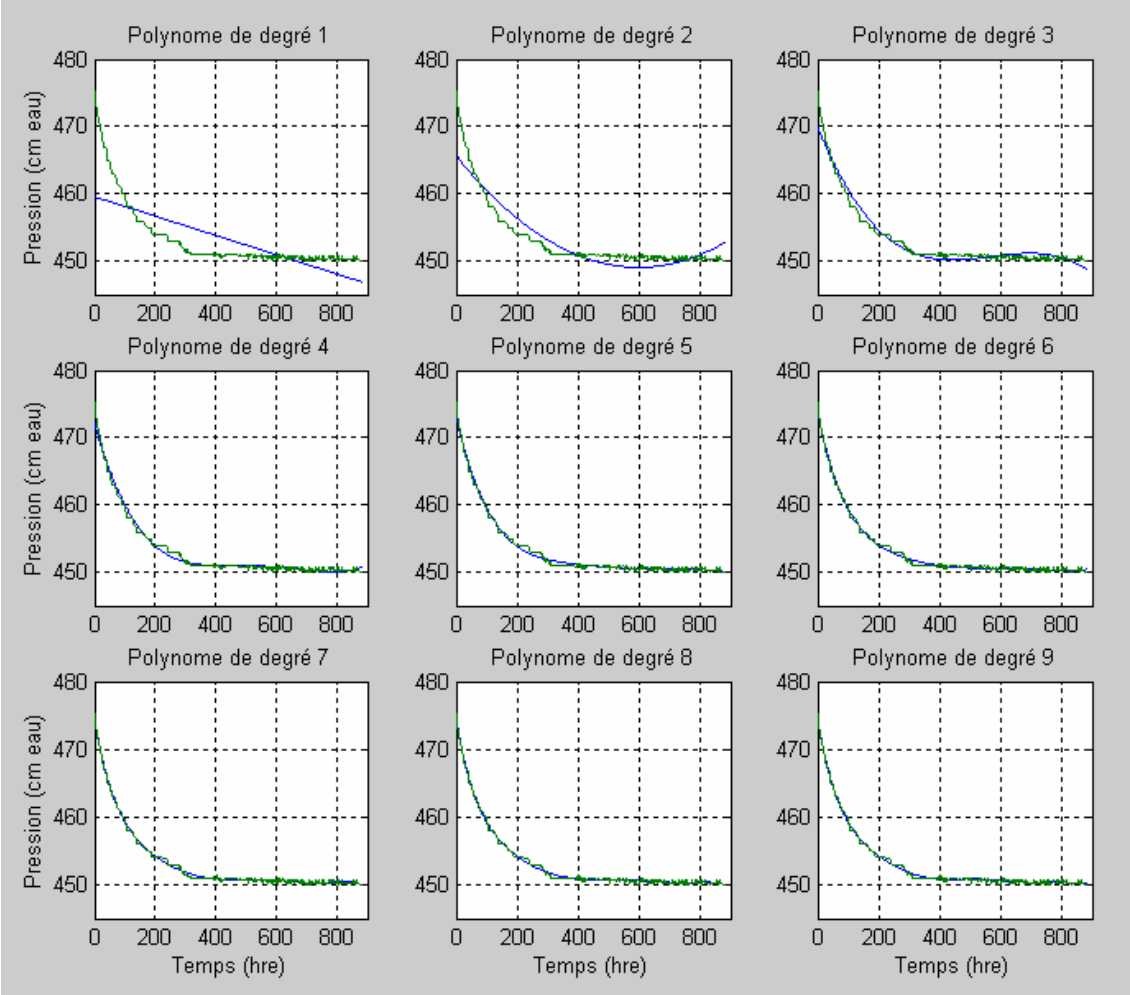


pZ-23B essai 3

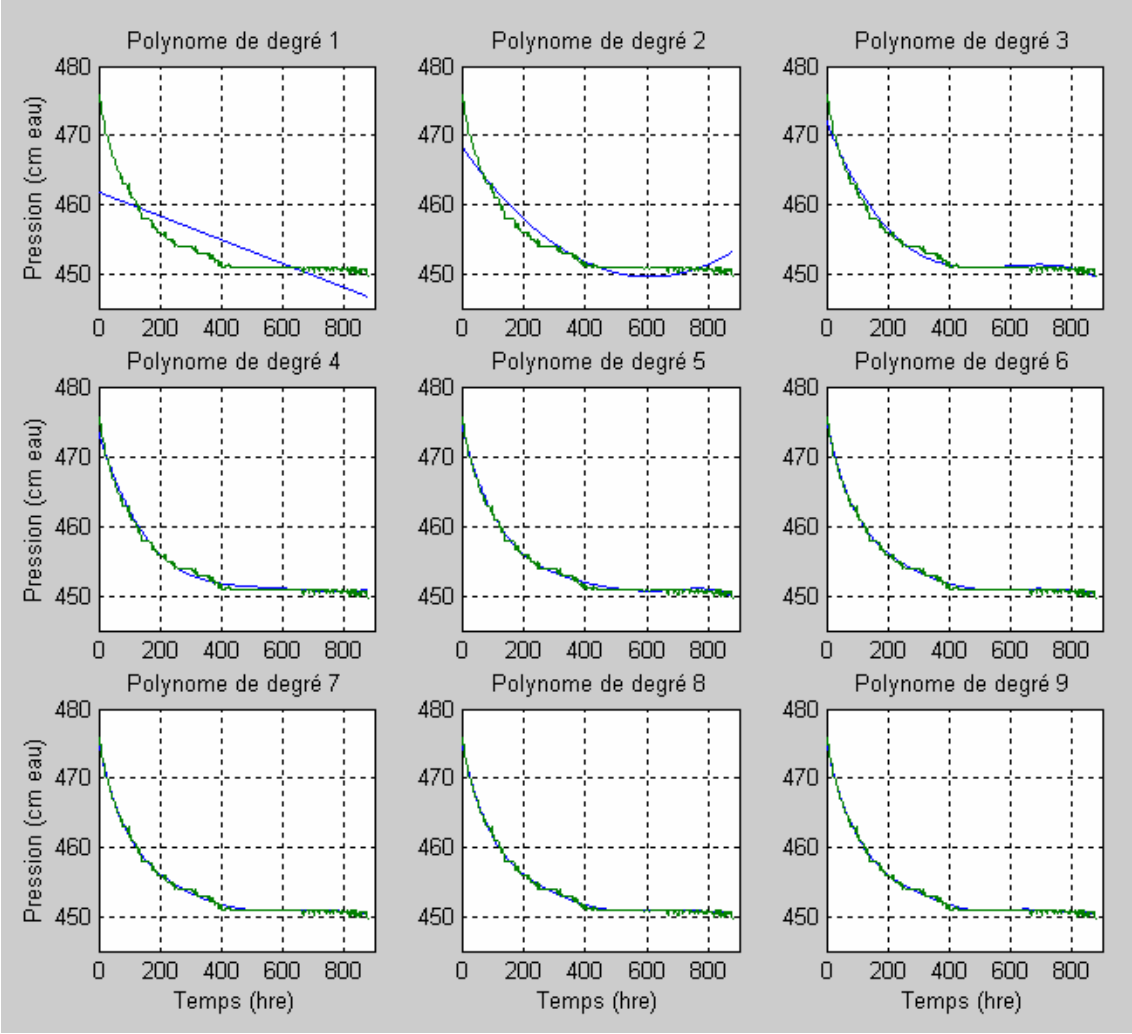
pZ-25C essai 2



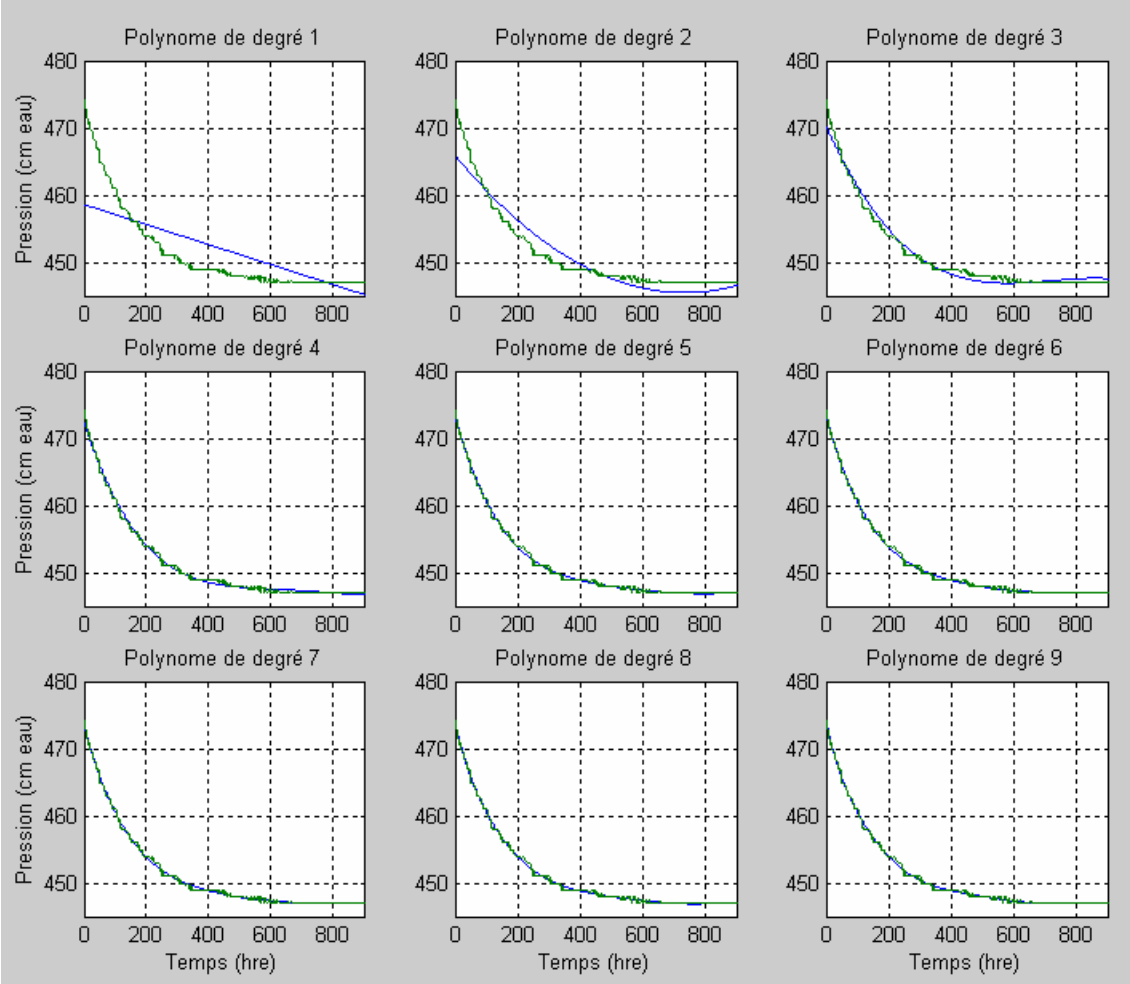
pZ-25C essai 3



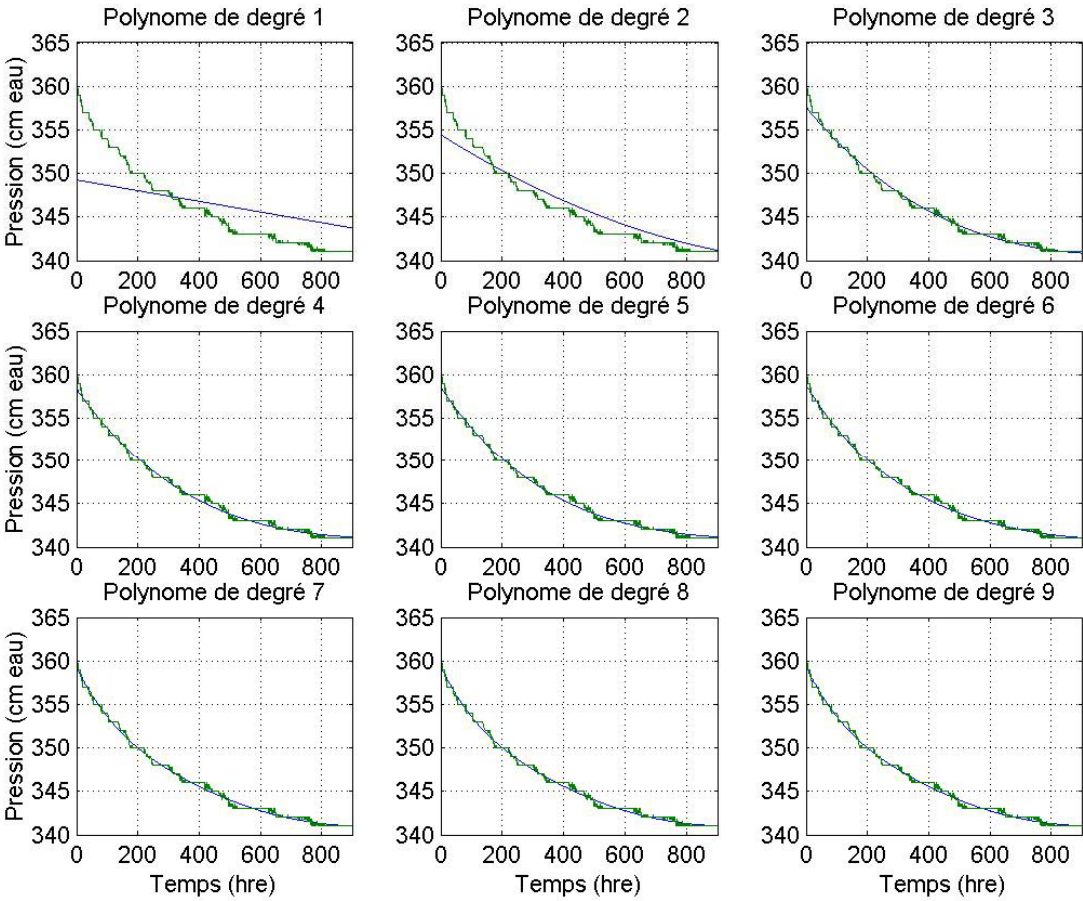
pZ-25C essai 4



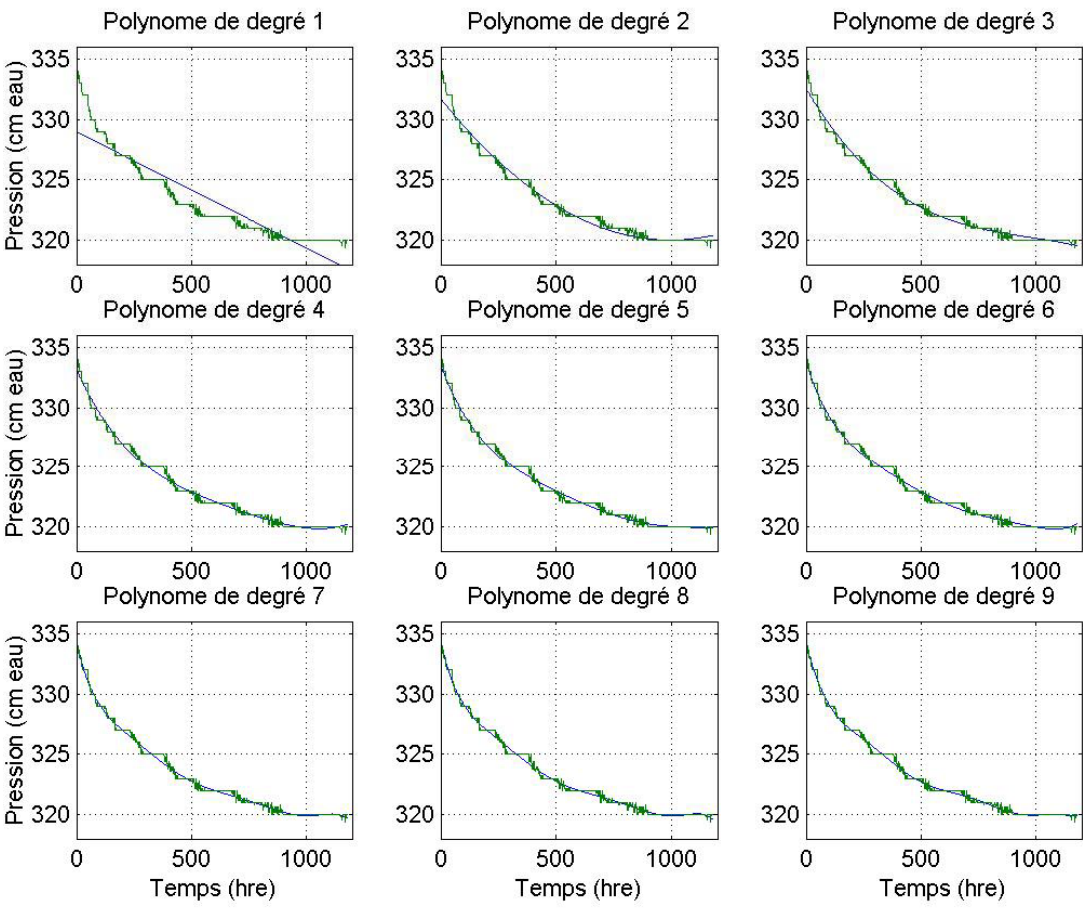
pZ-25C essai 5



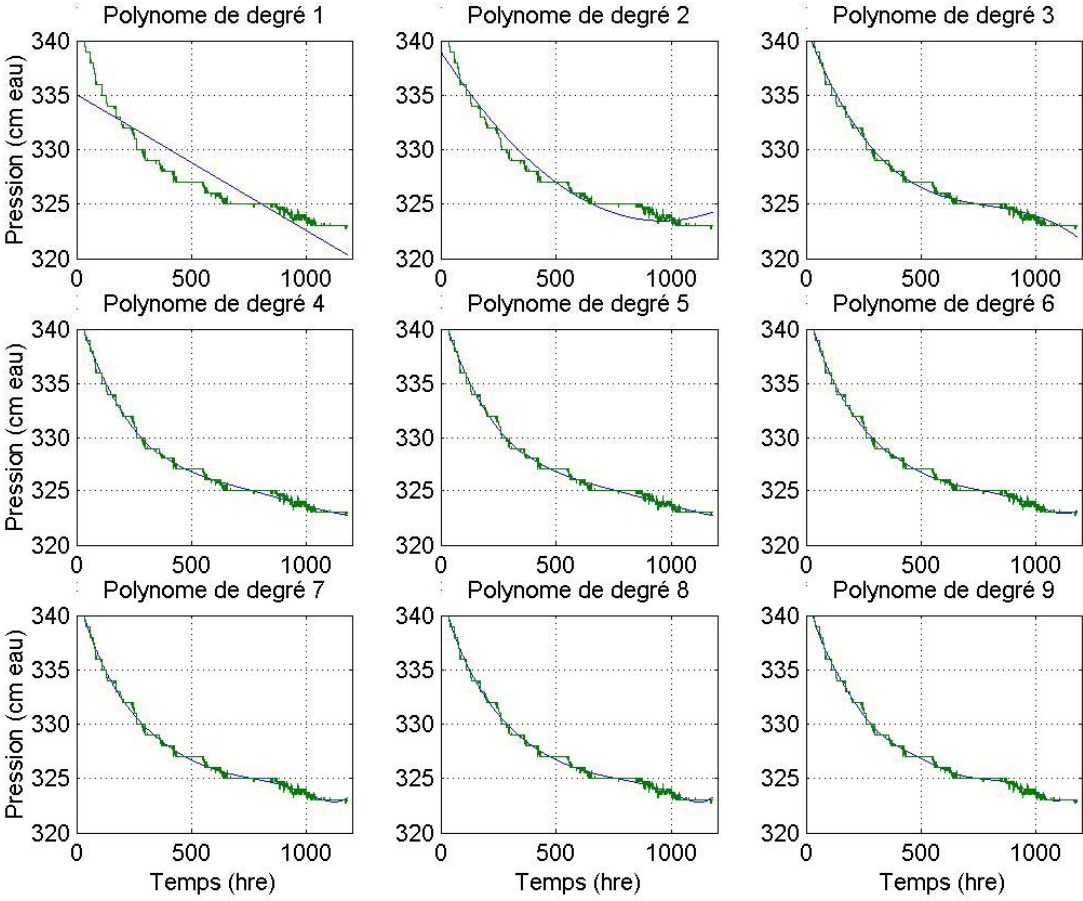
PO-1B essai 1



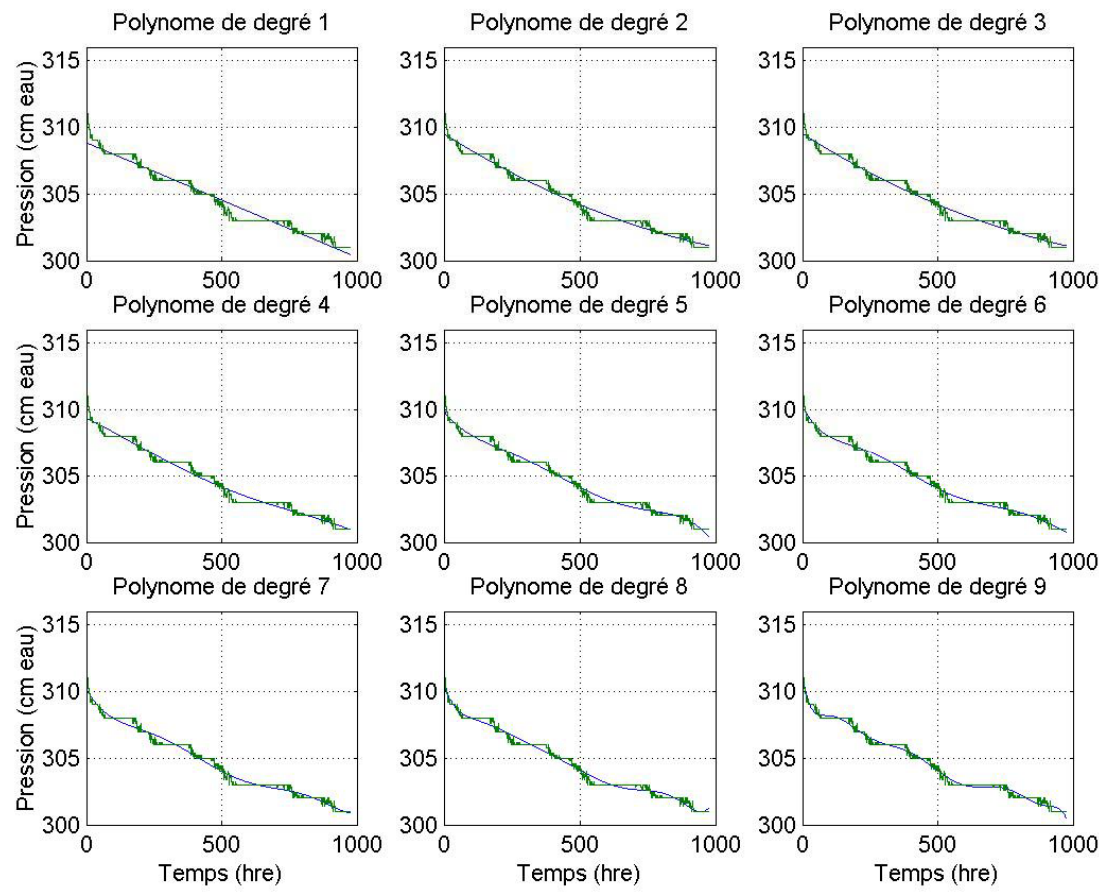
PO-1B essai 2



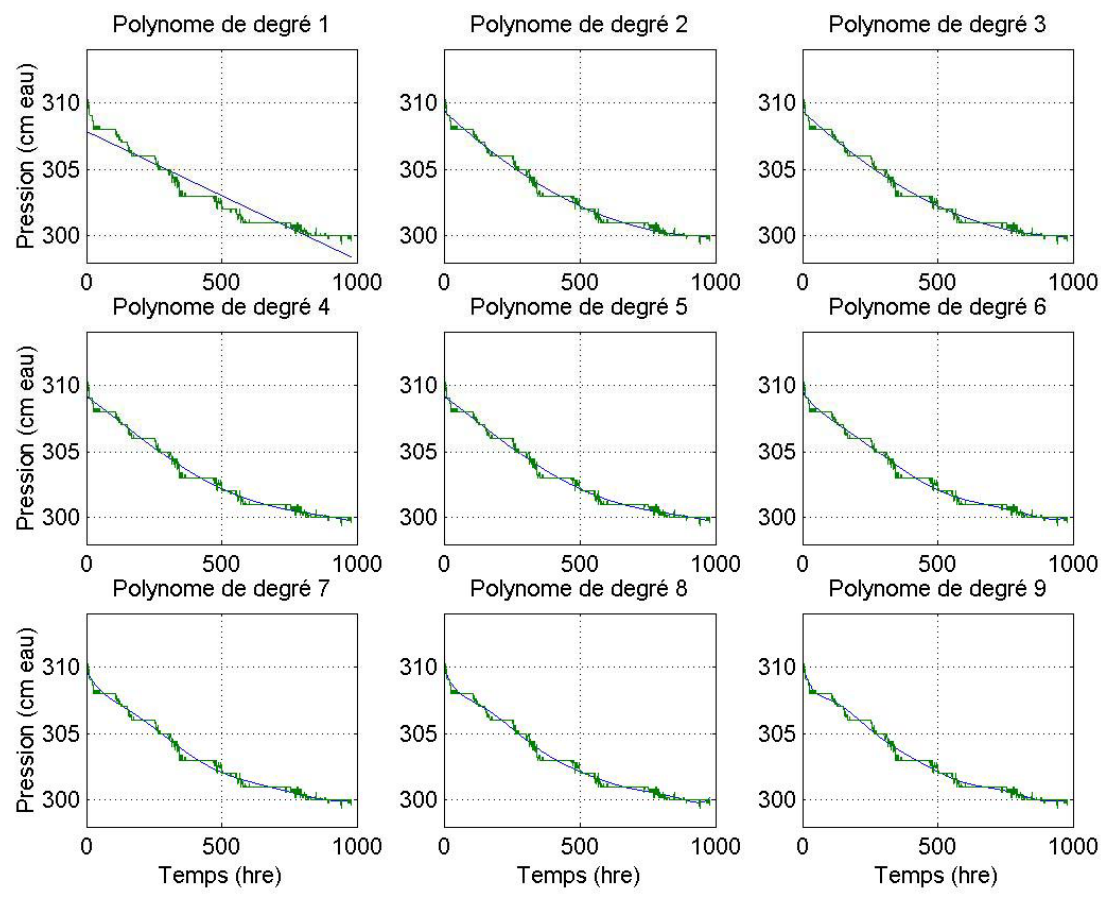
PO-1B essai 3



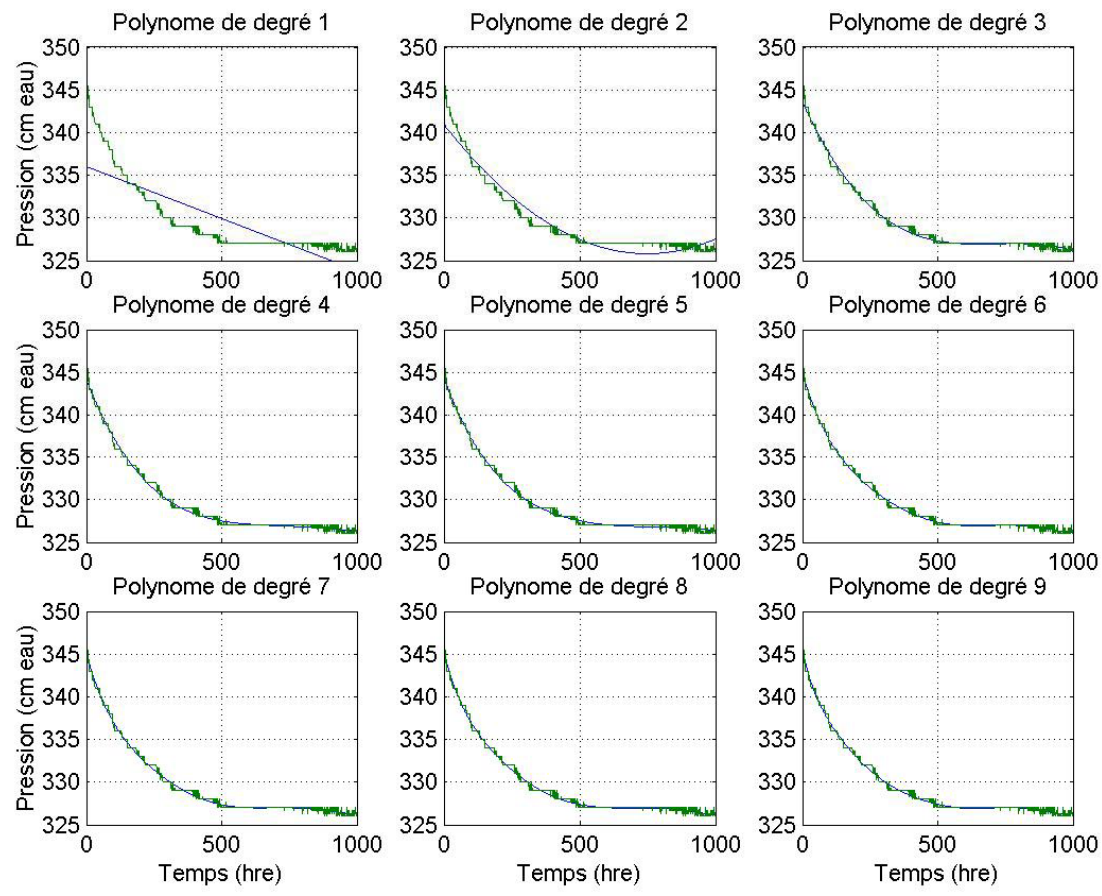
PO-2B essai 1



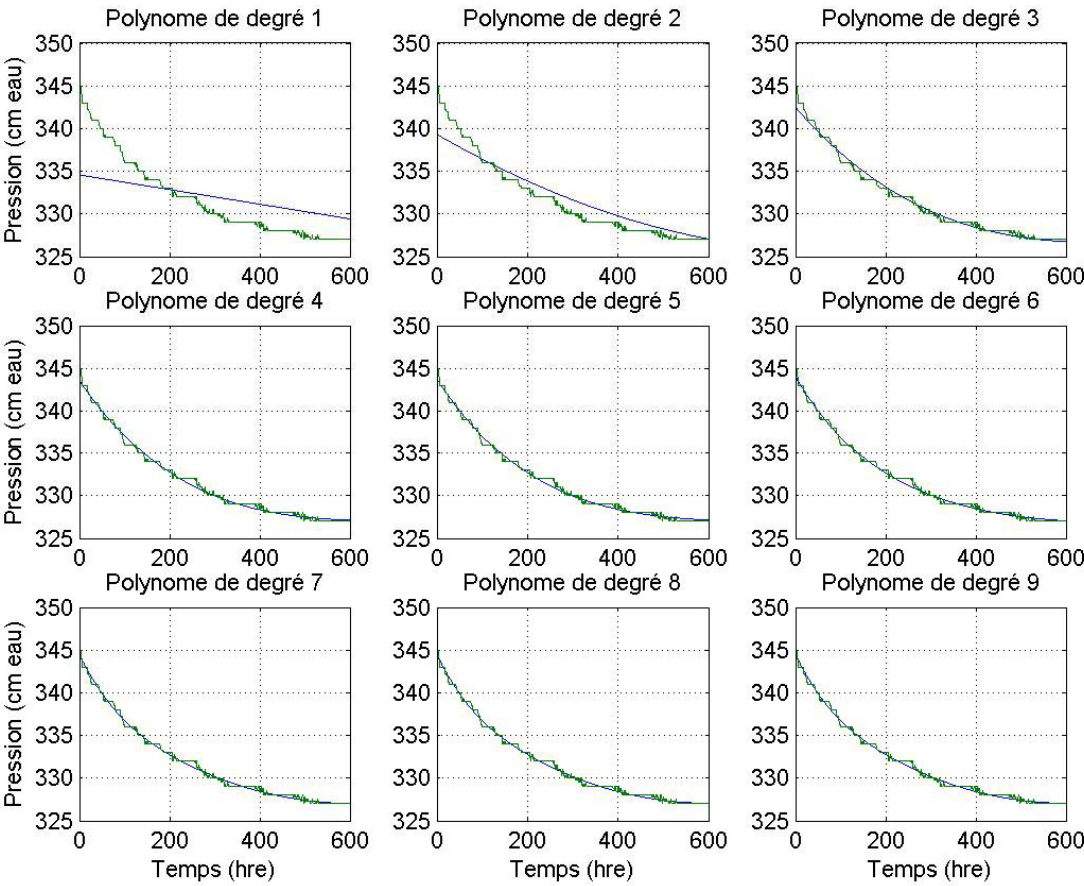
PO-2B essai 2



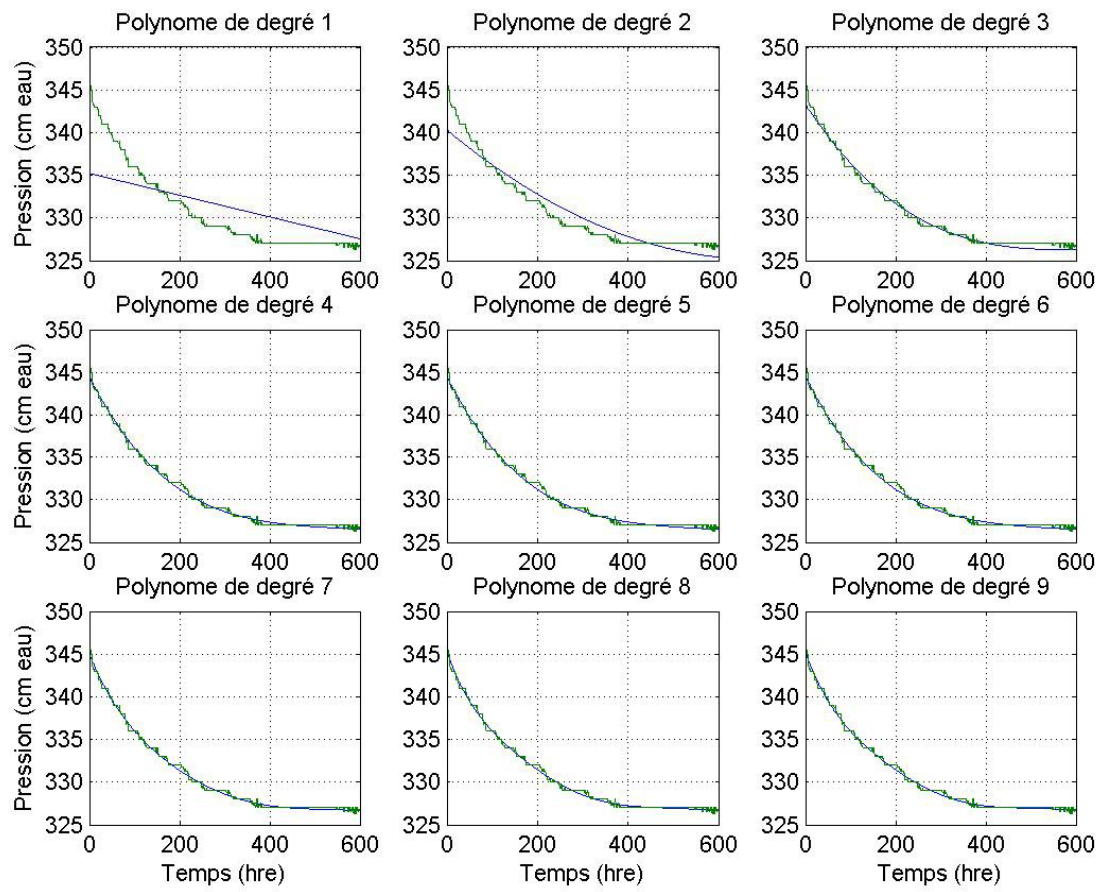
PO-3B essai 1



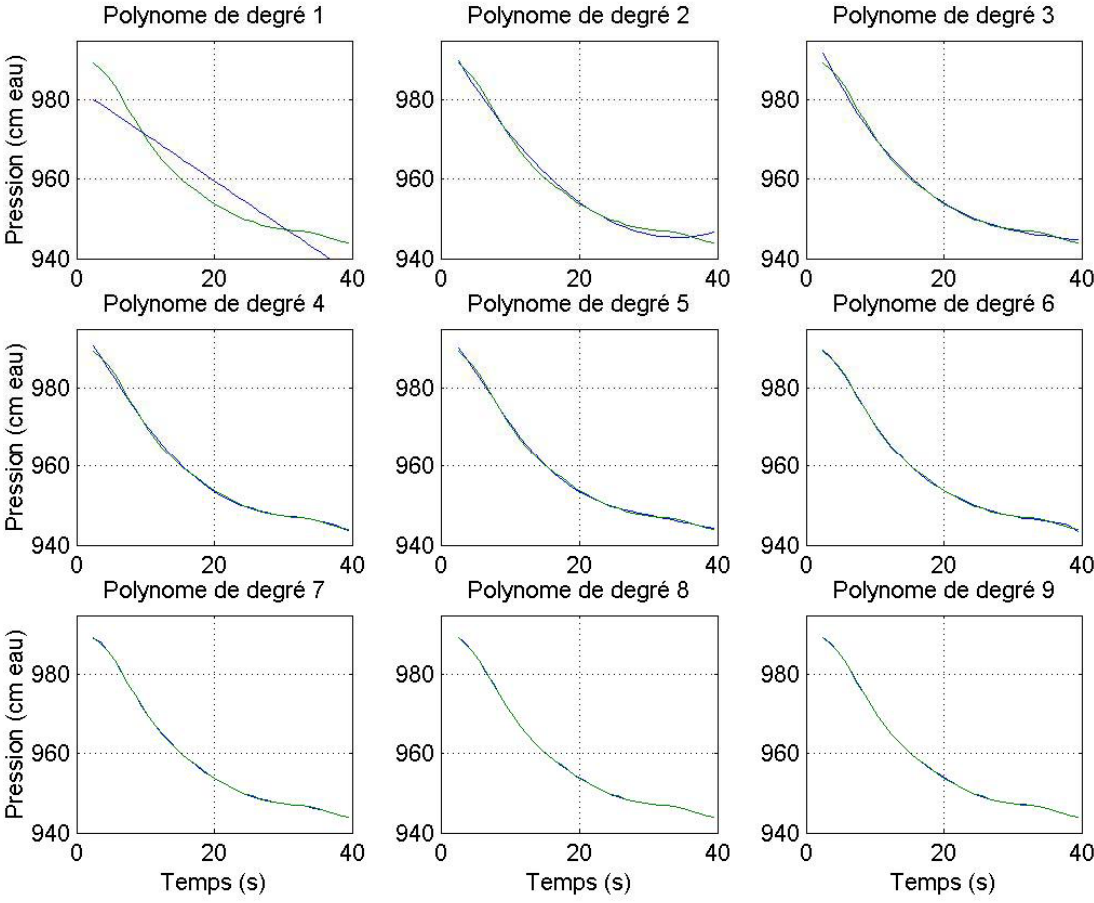
PO-3B essai 2

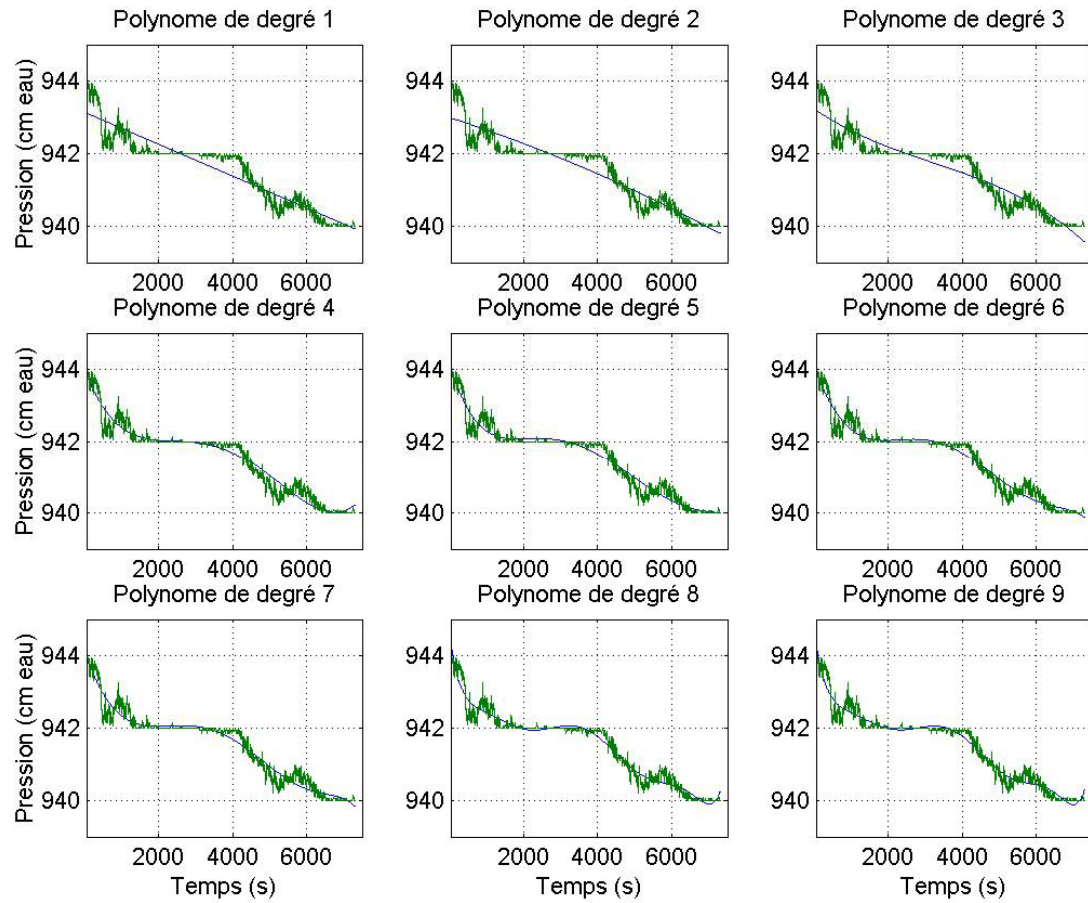


PO-3B essai 3

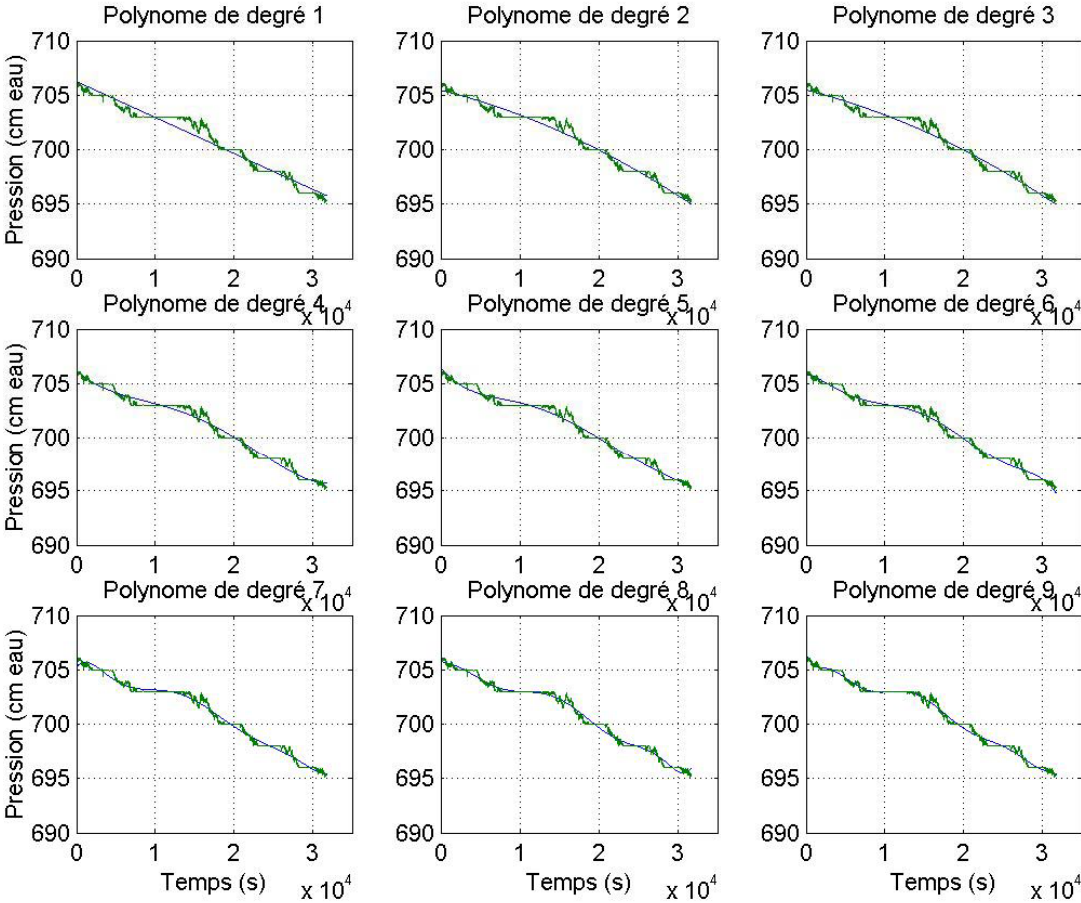


F303B essai1 portion vitesse rapide

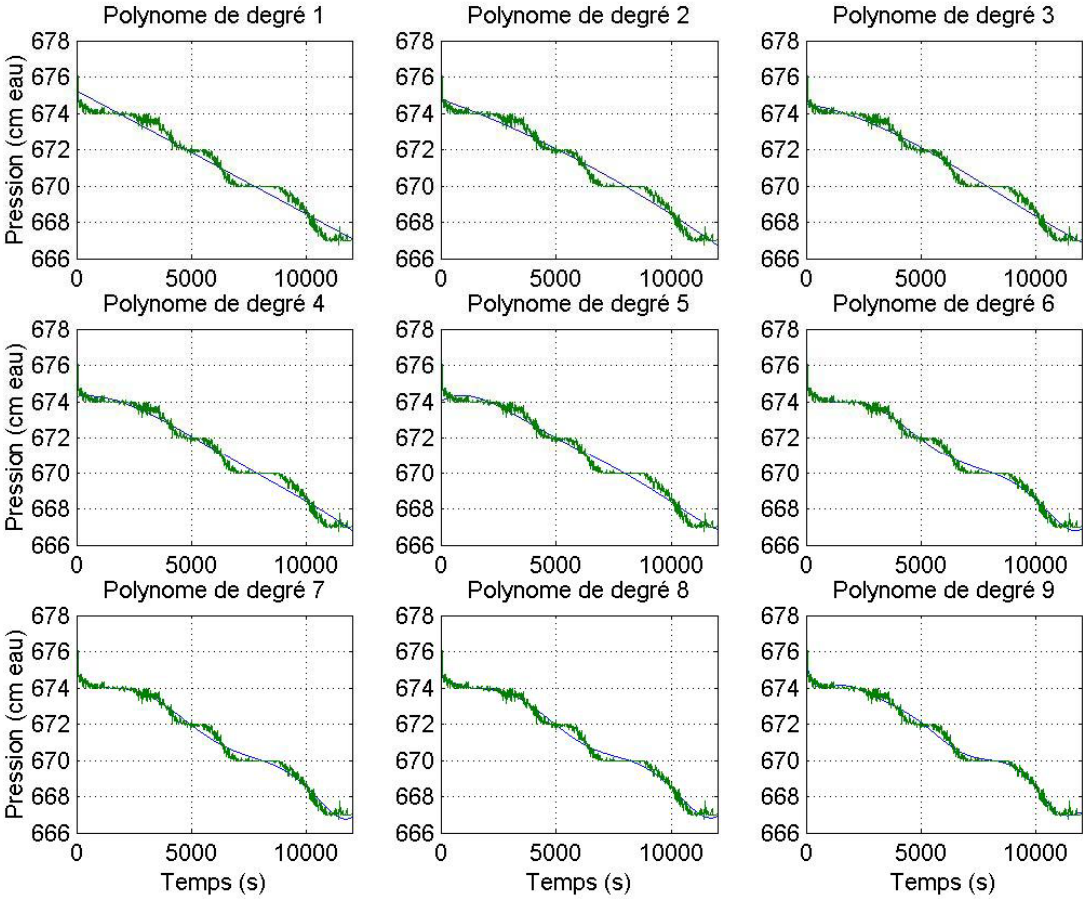


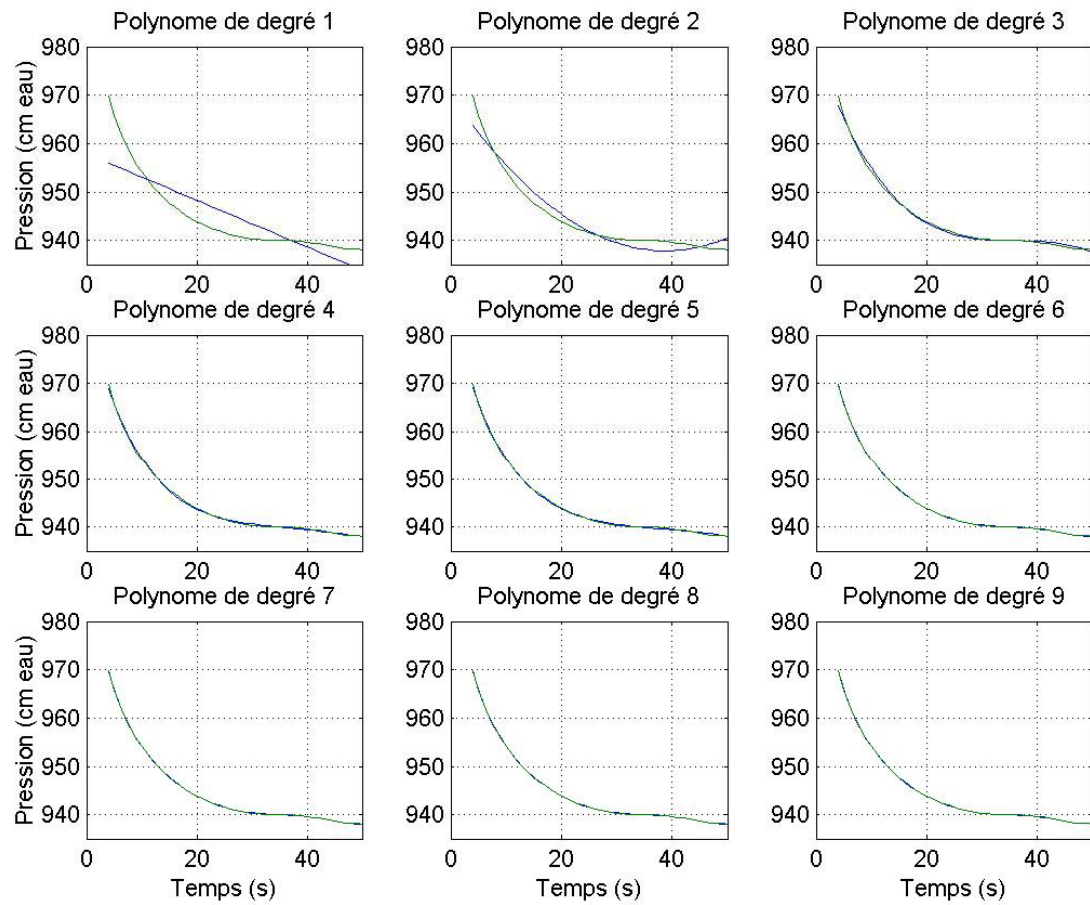
F303B essai 1 portion vitesse lente

F303B essai 2 portion vitesse lente

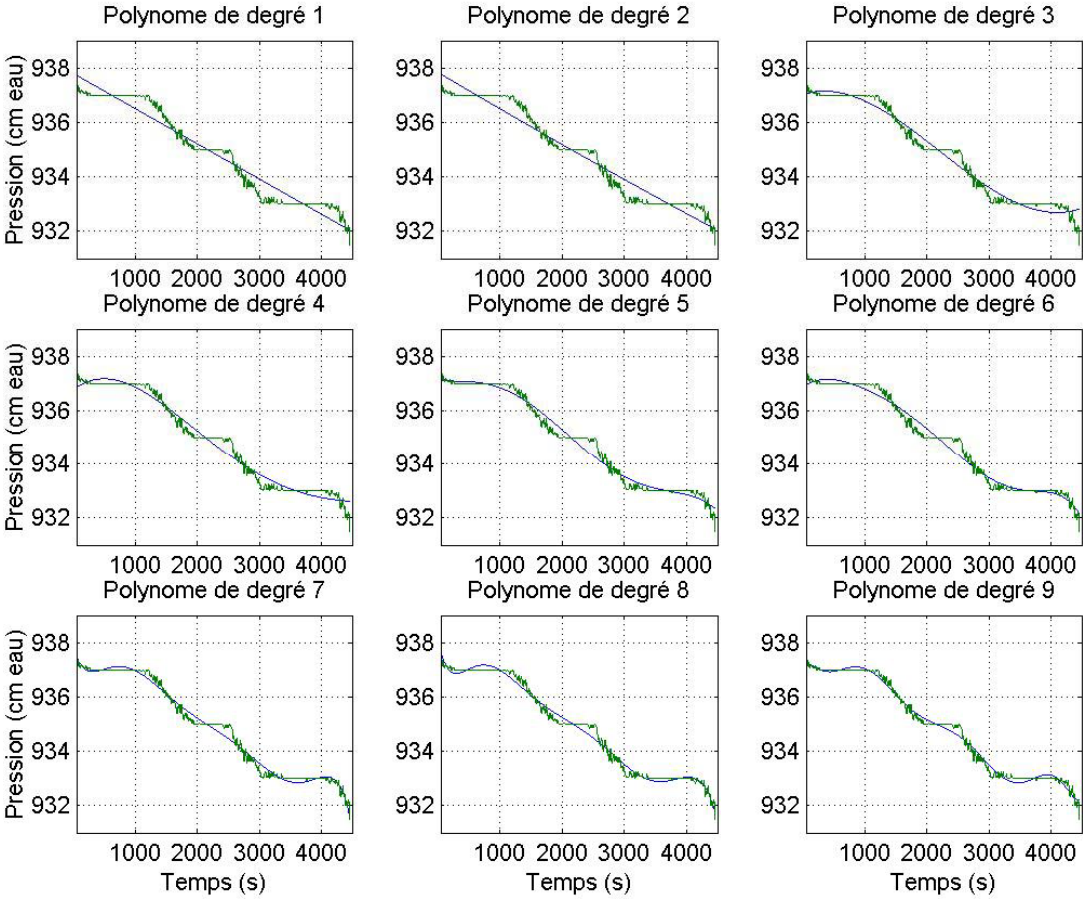


F303B essai 3 portion vitesse lente

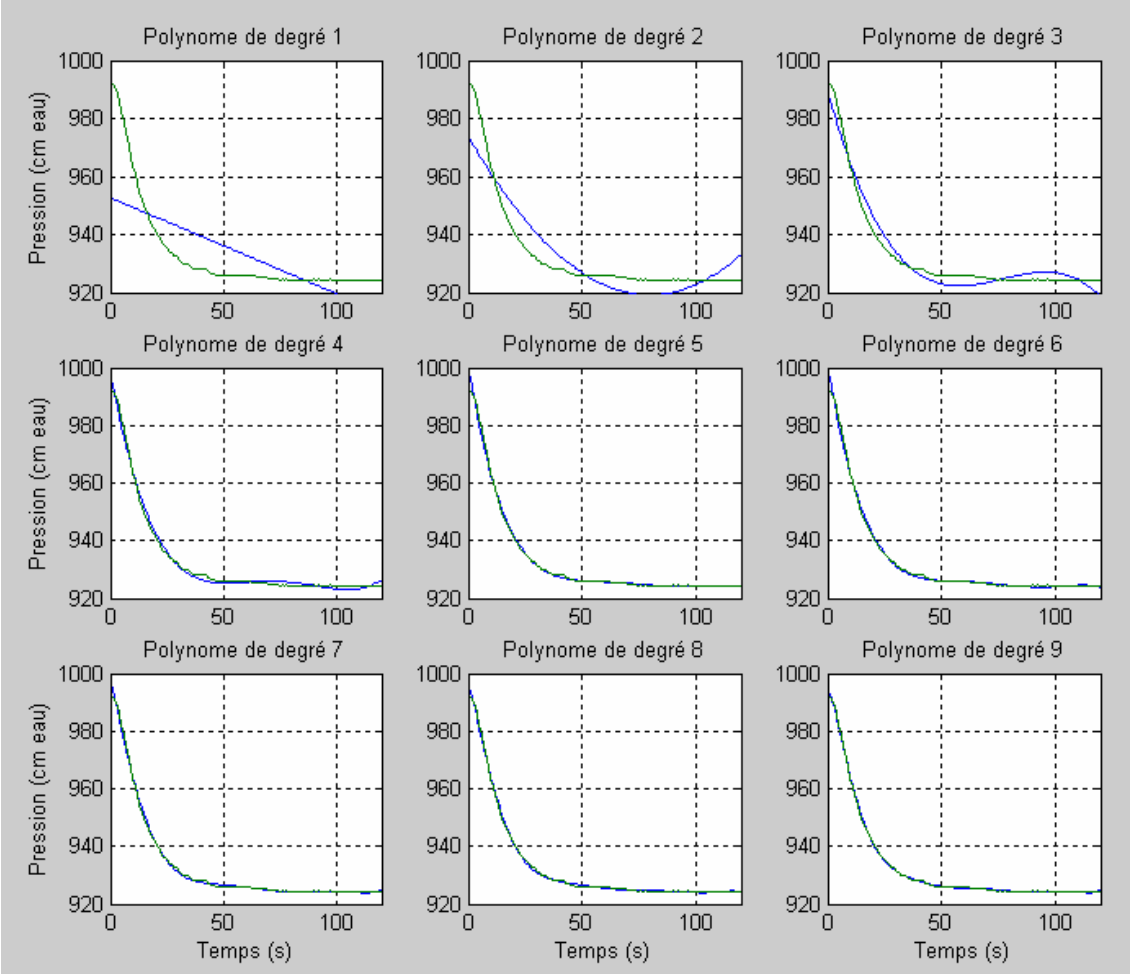


F305B essai 1 portion vitesse rapide

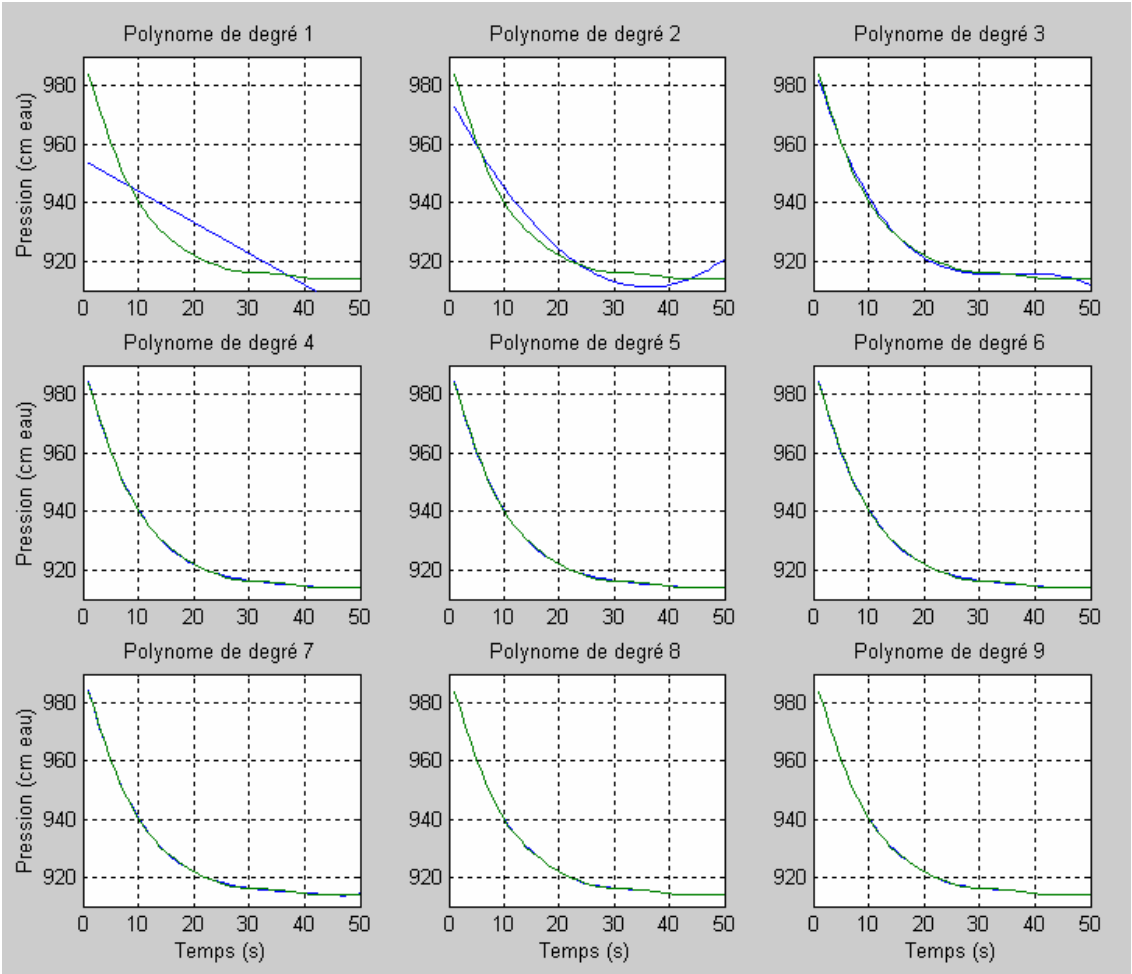
F305B essai 1 portion vitesse lente



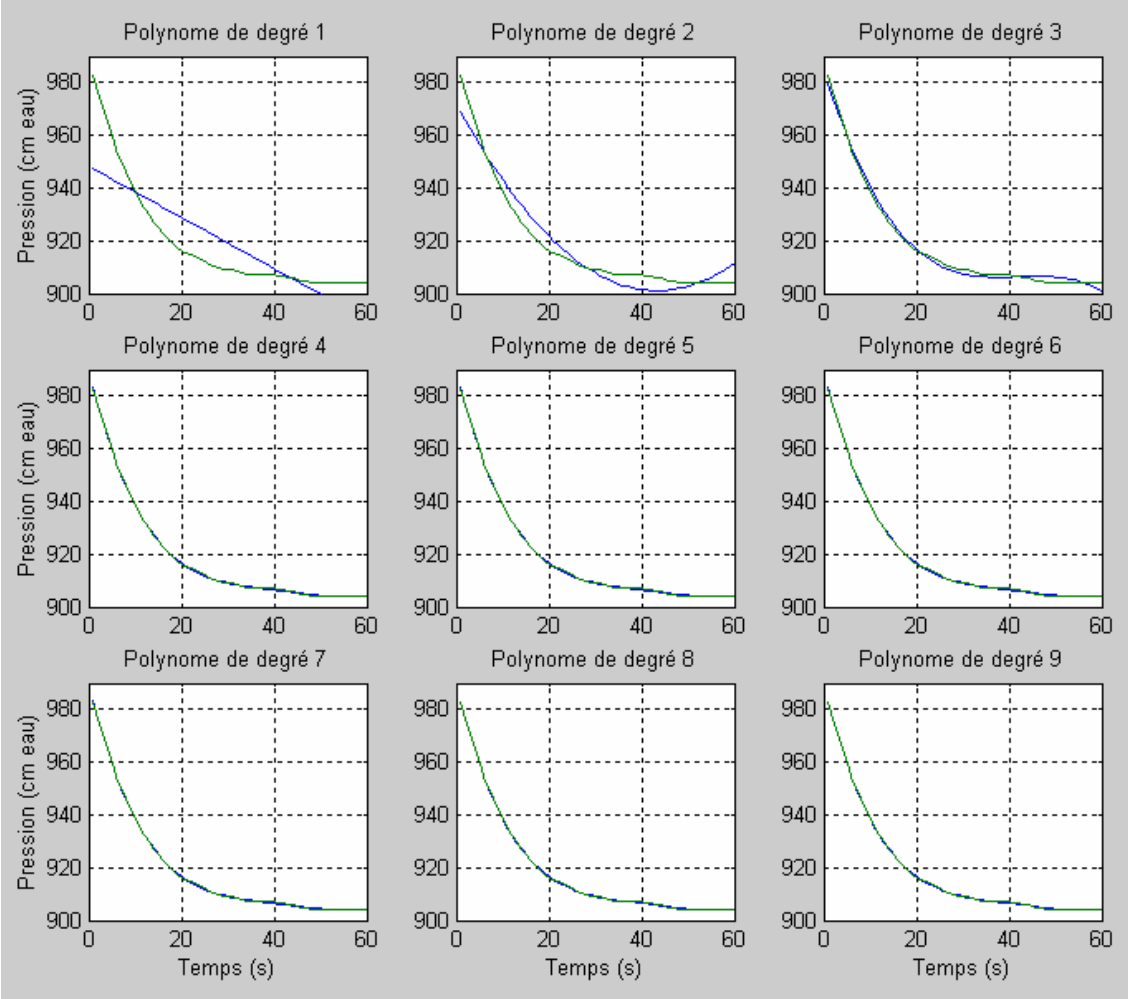
F305B essai 2 portion vitesse rapide



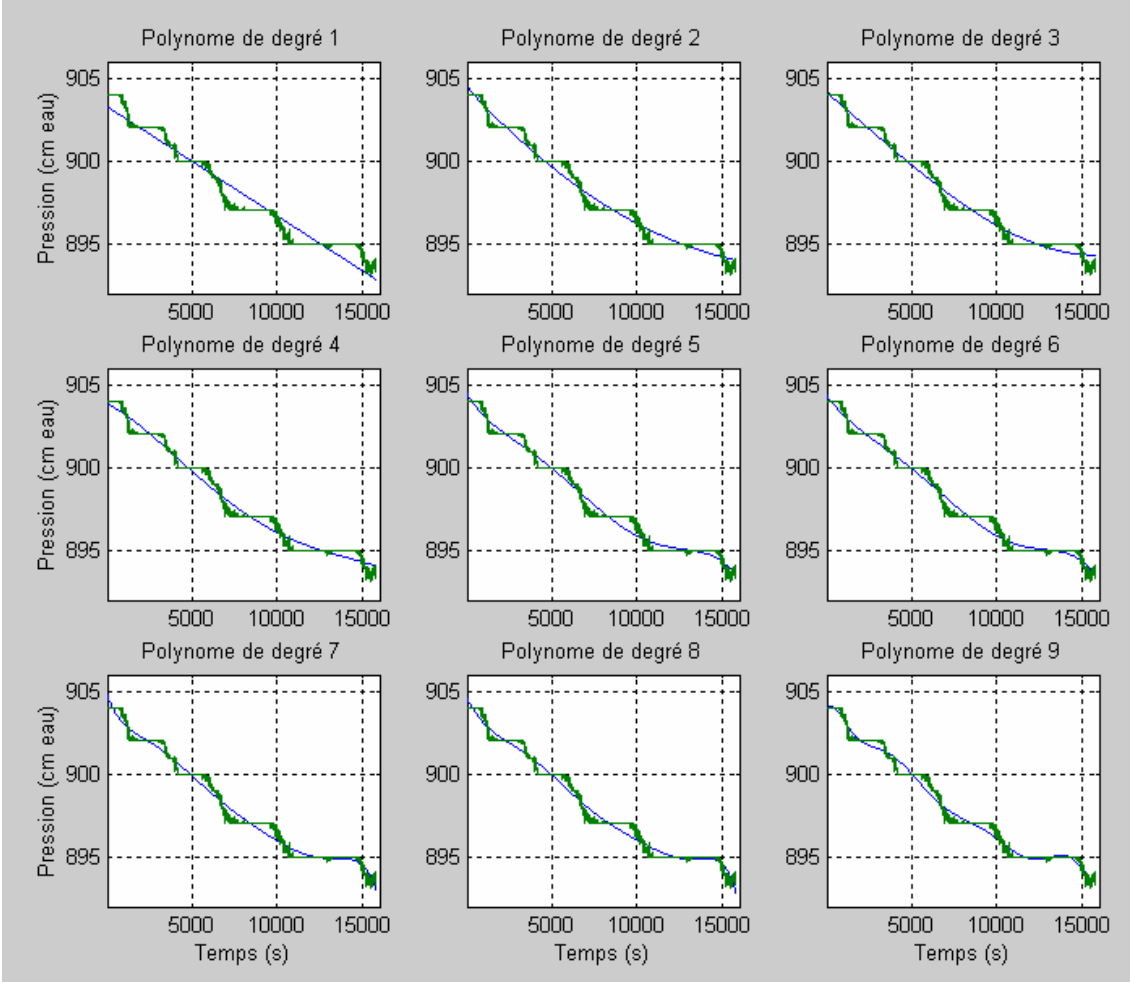
F305B essai 3 portion vitesse rapide



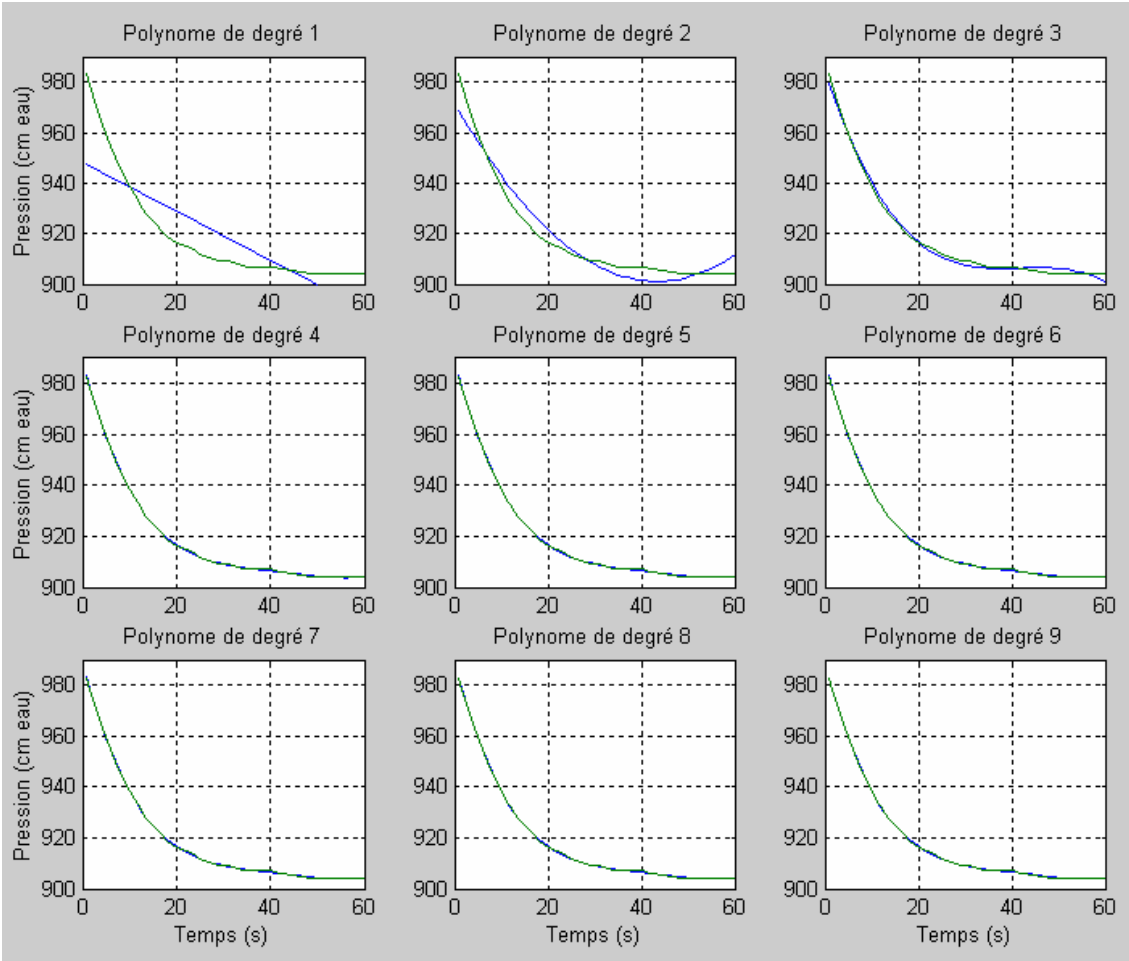
F305B essai 4 portion vitesse rapide



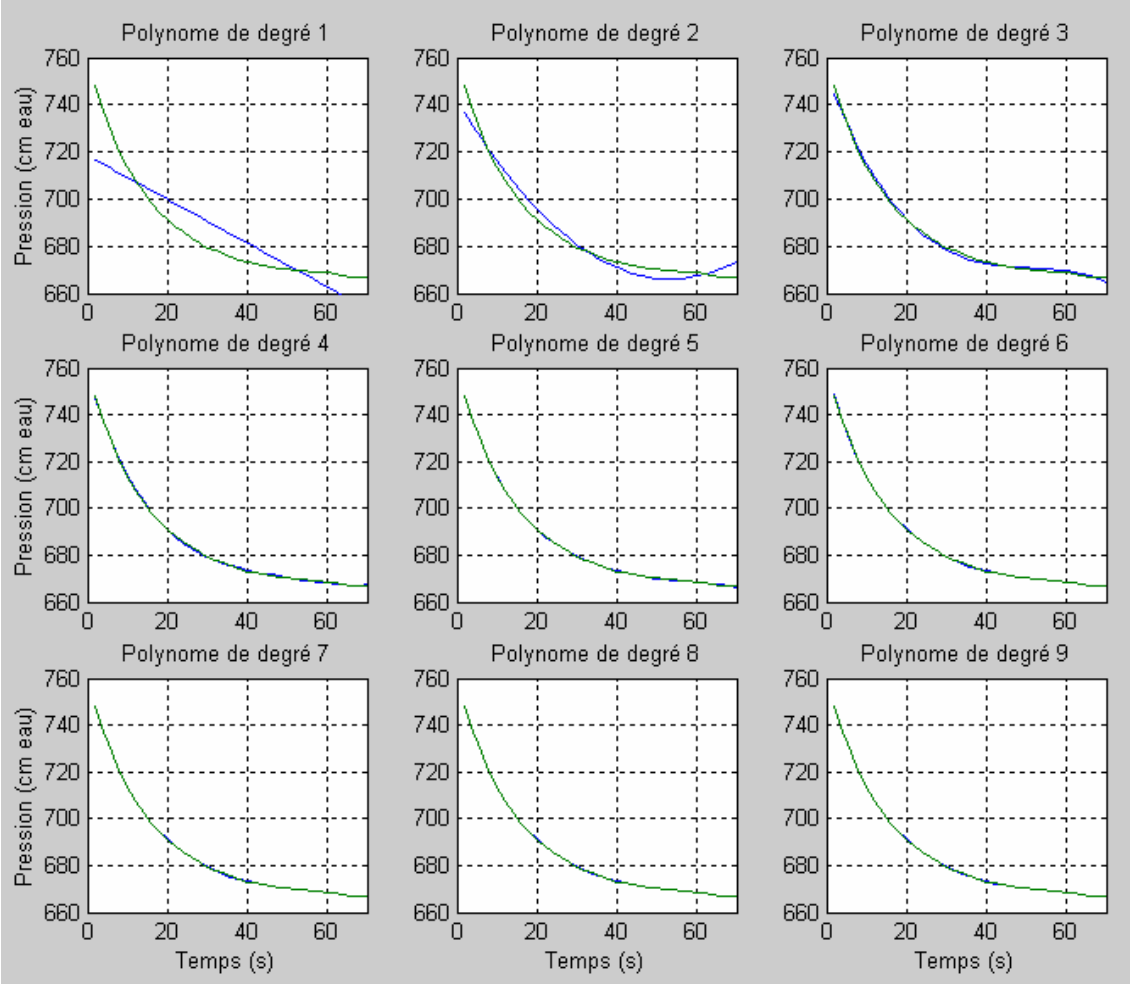
F305B essai 4 portion vitesse lente



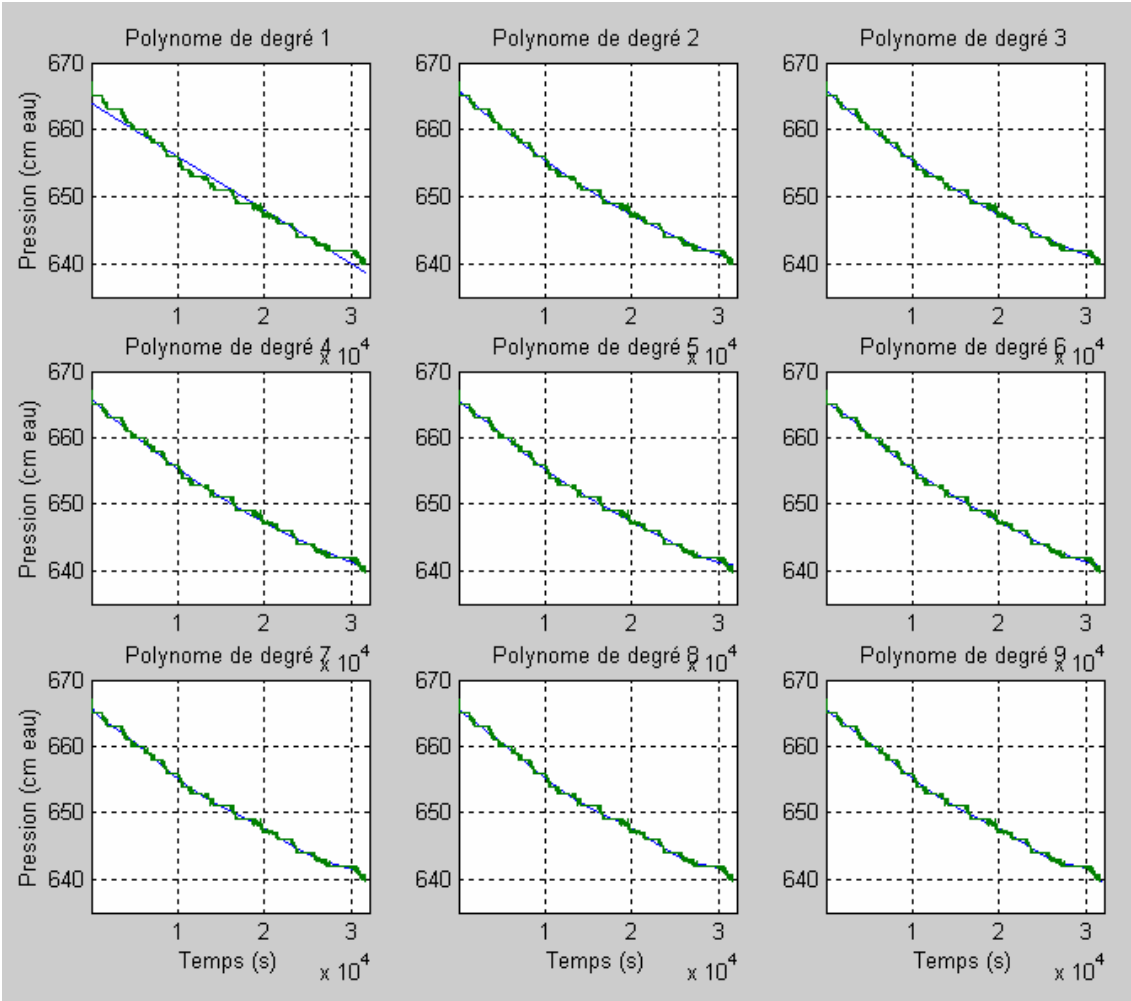
F307B essai 1 portion vitesse rapide



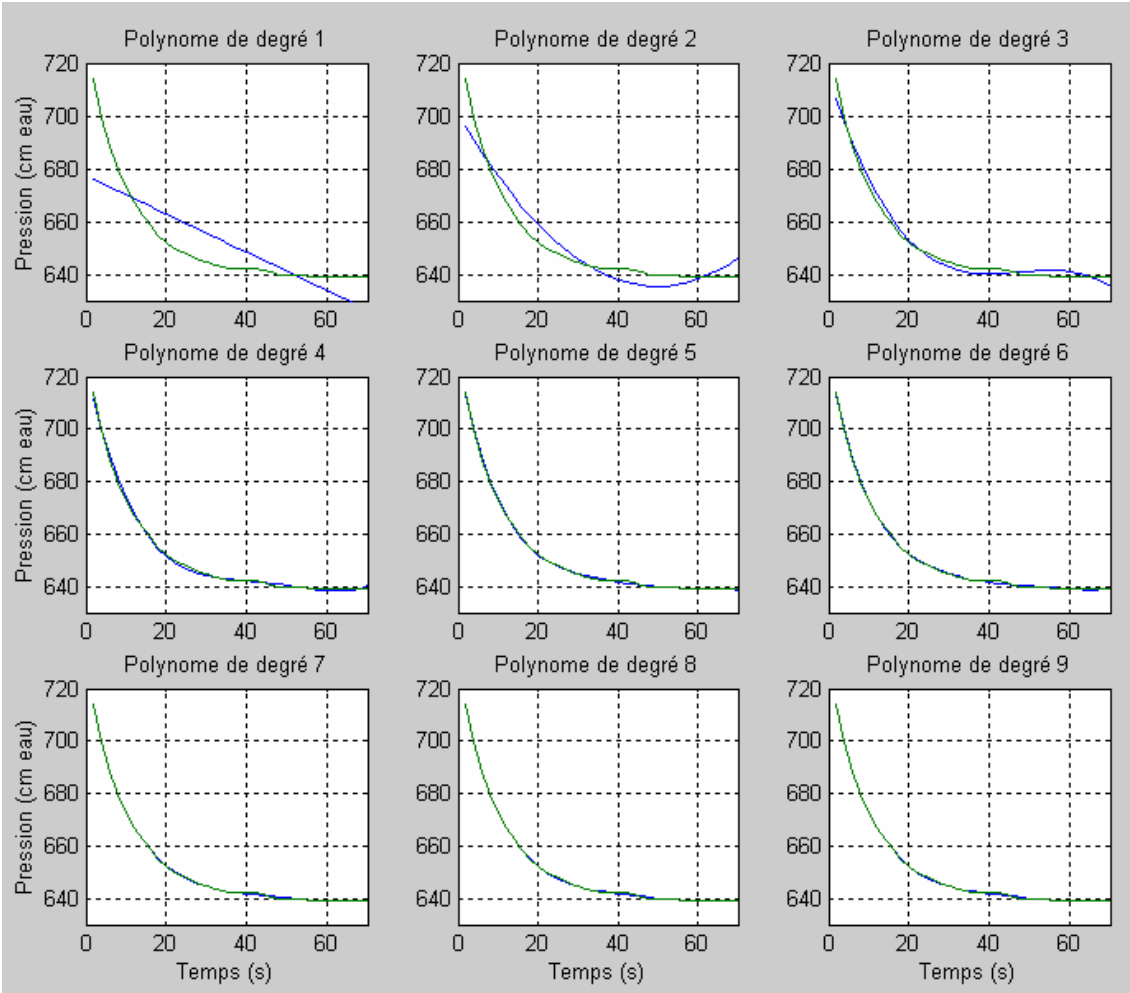
F307B essai 2 portion vitesse rapide



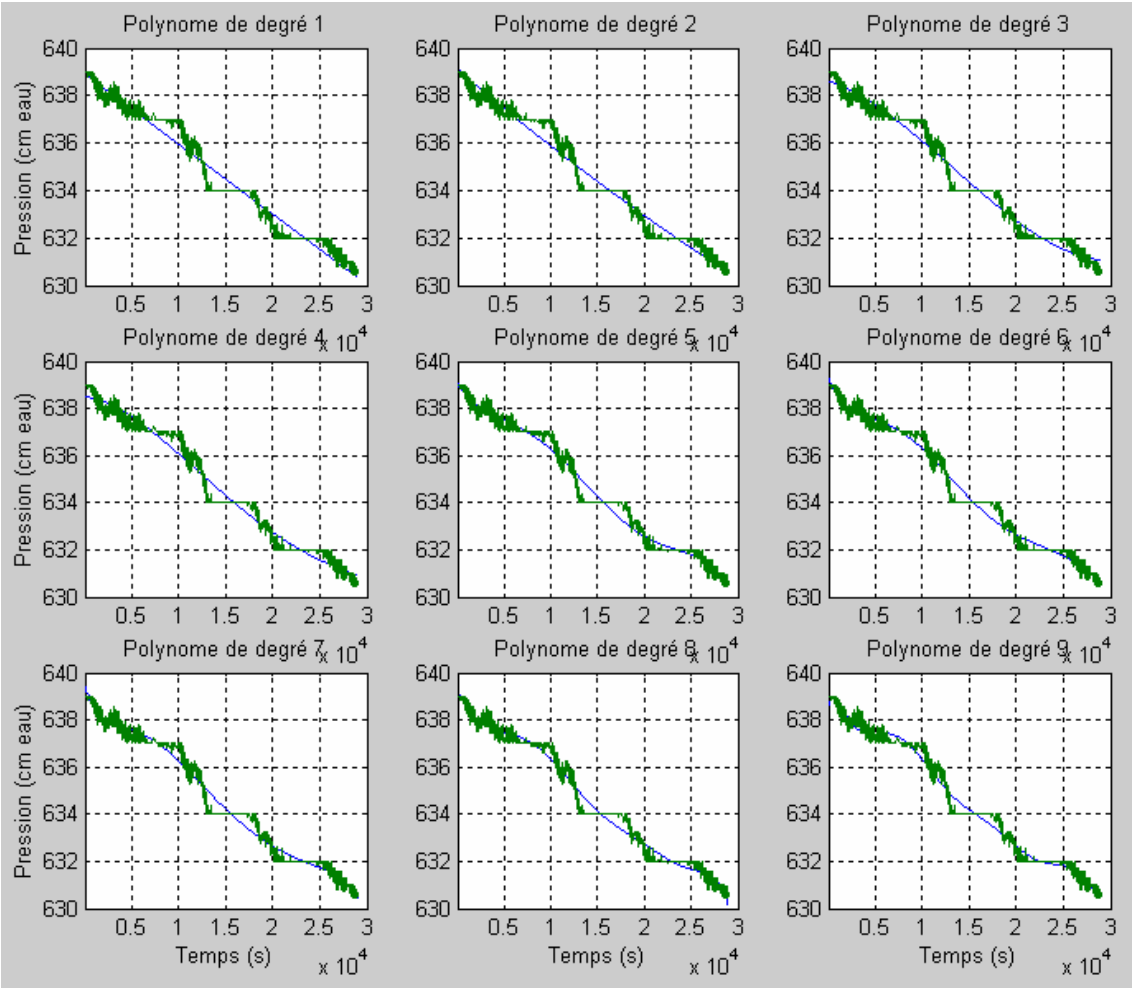
F307B essai 2 portion vitesse lente



F307B essai 3 portion vitesse rapide



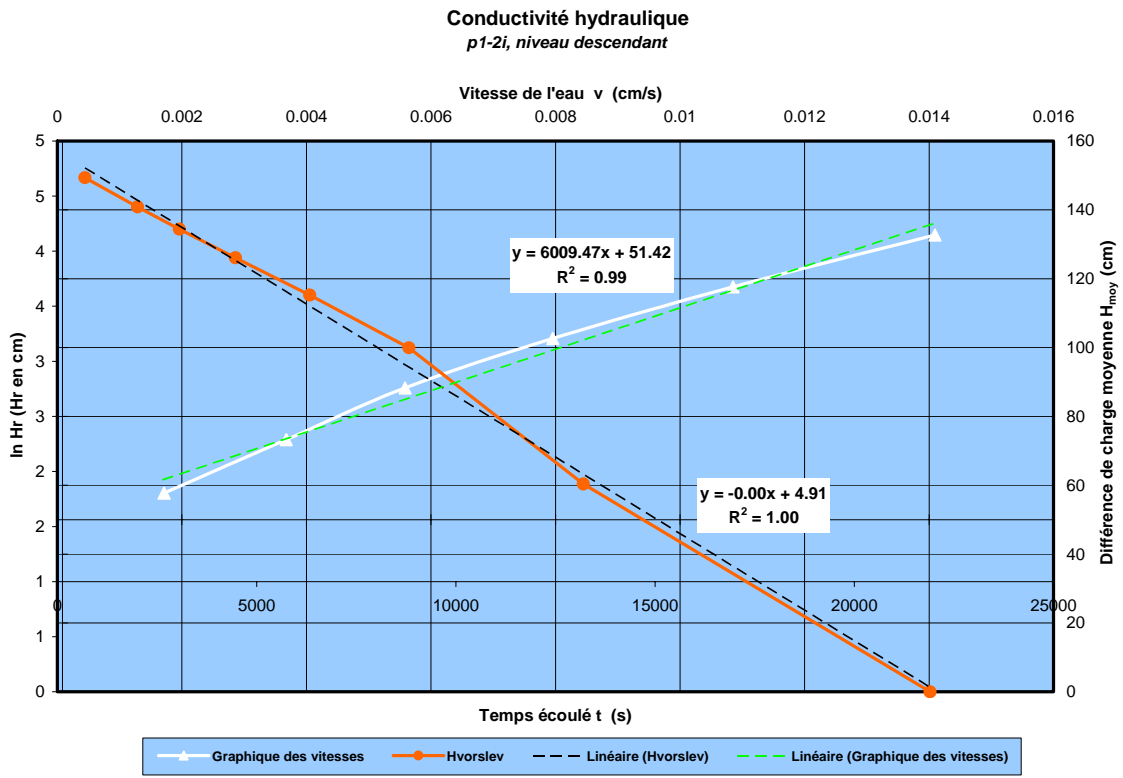
F307B essai 3 portion vitesse lente

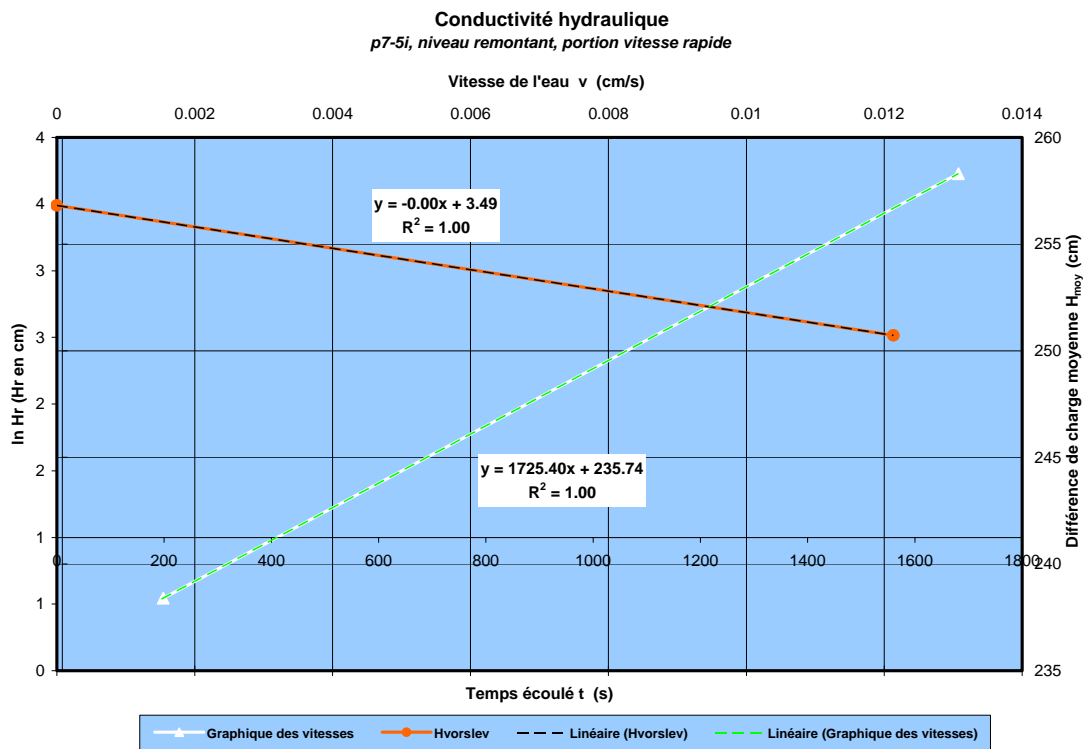
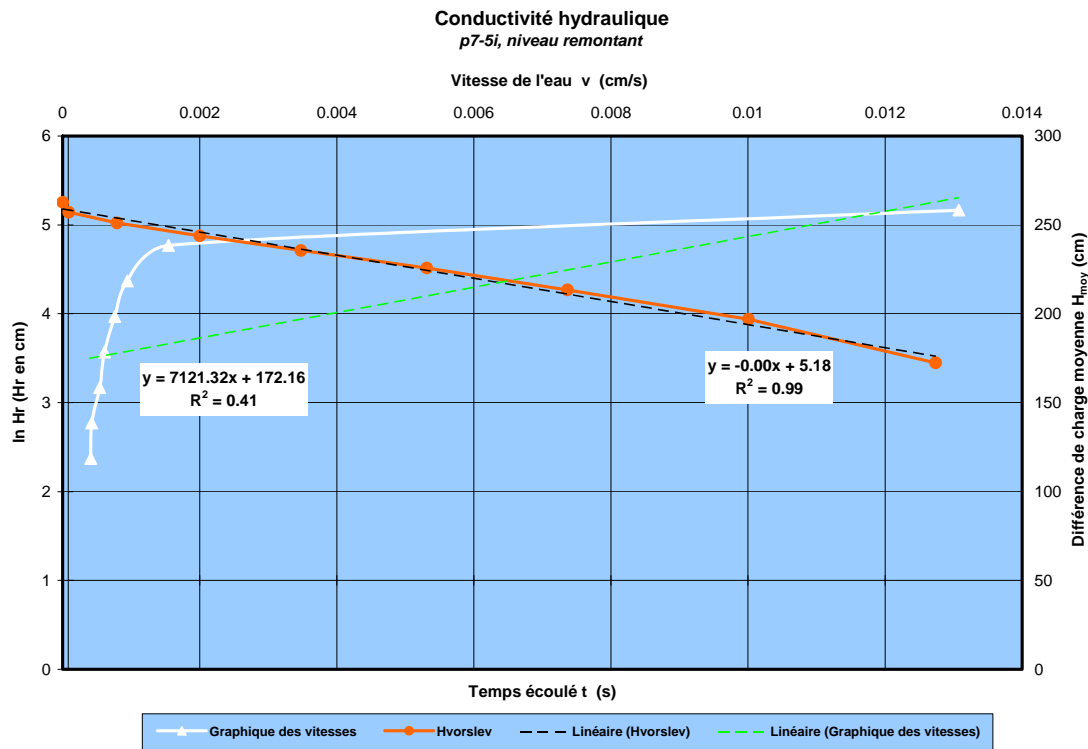


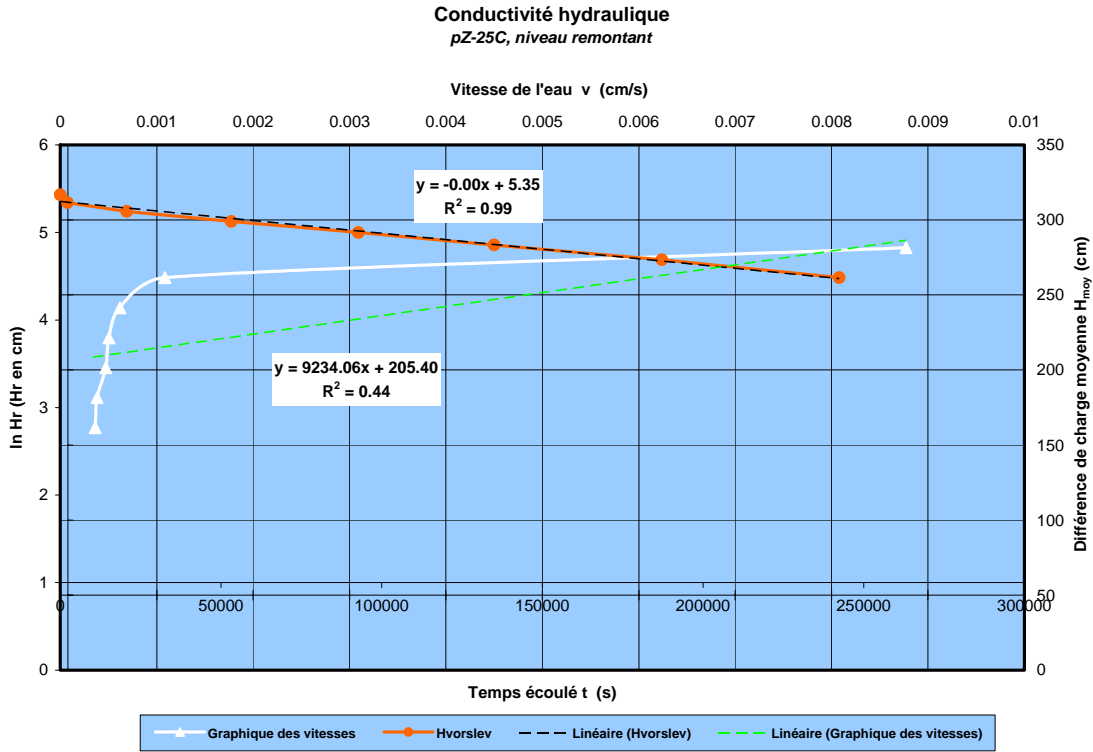
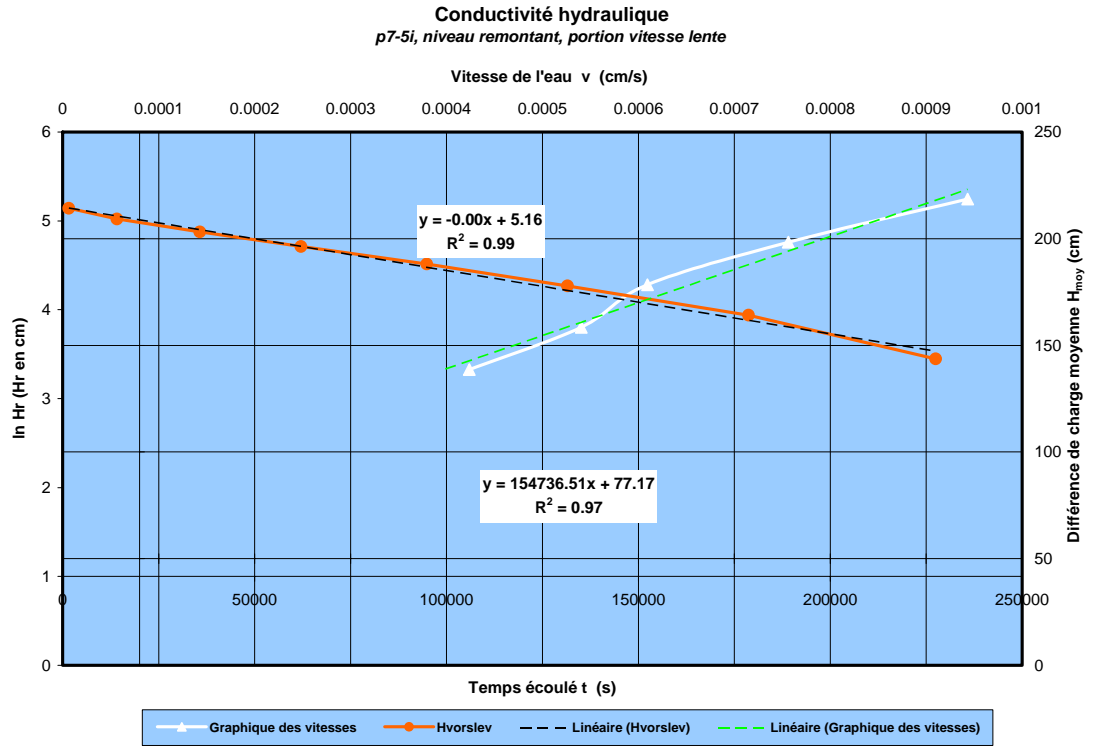
Annexe J

Graphiques des vitesses et relation de Hvorslev

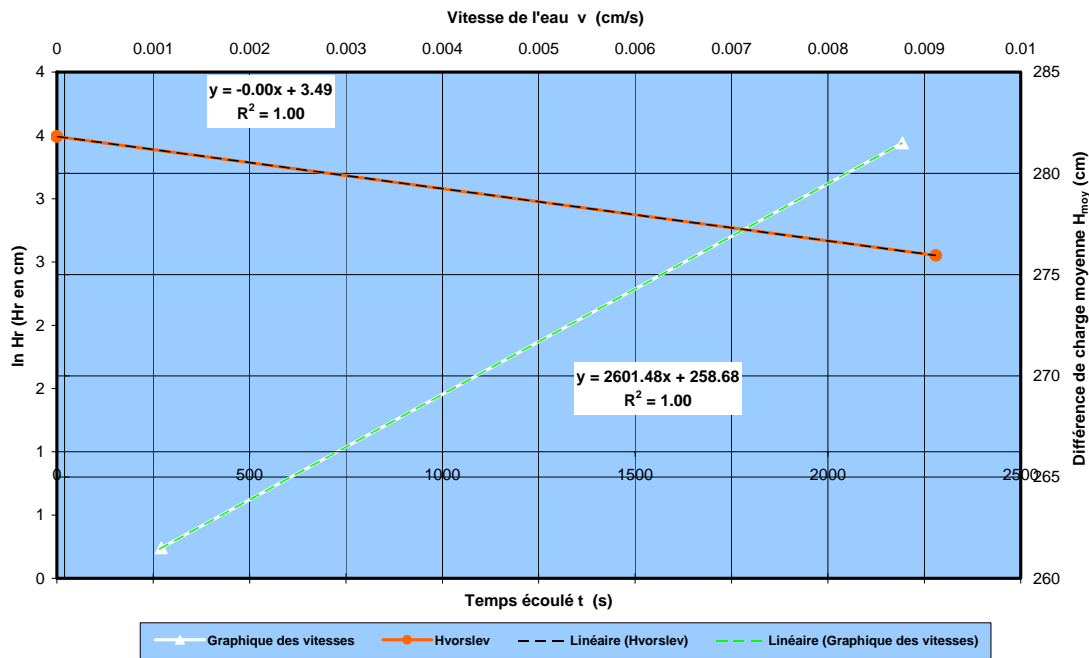
Essais à niveau variable



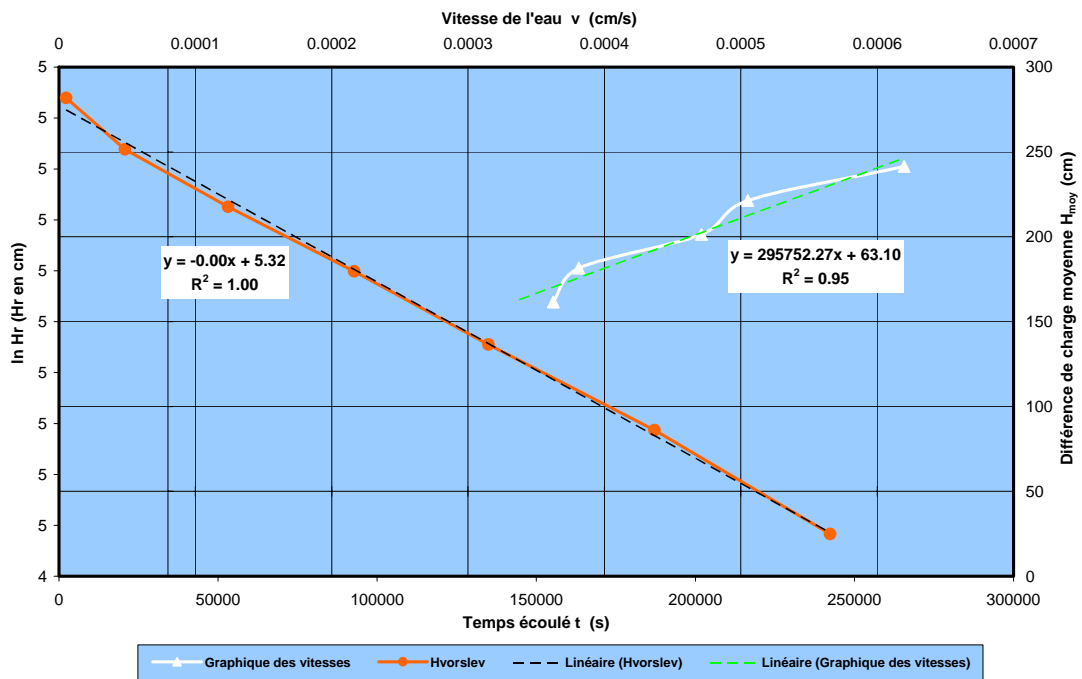


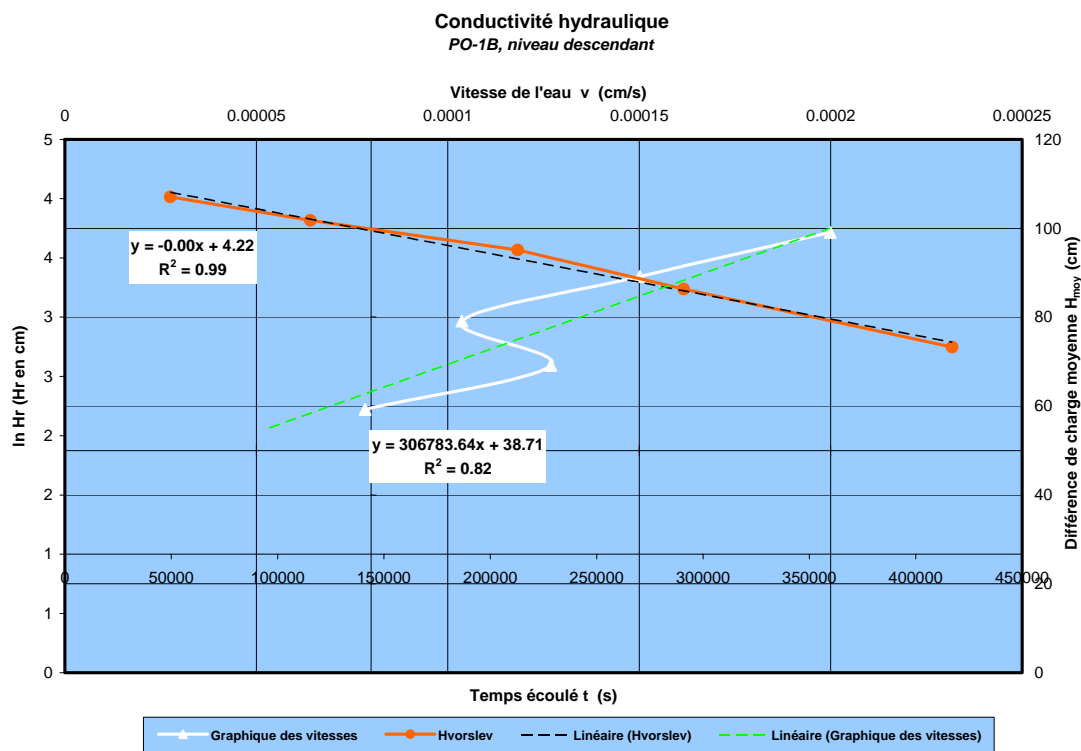
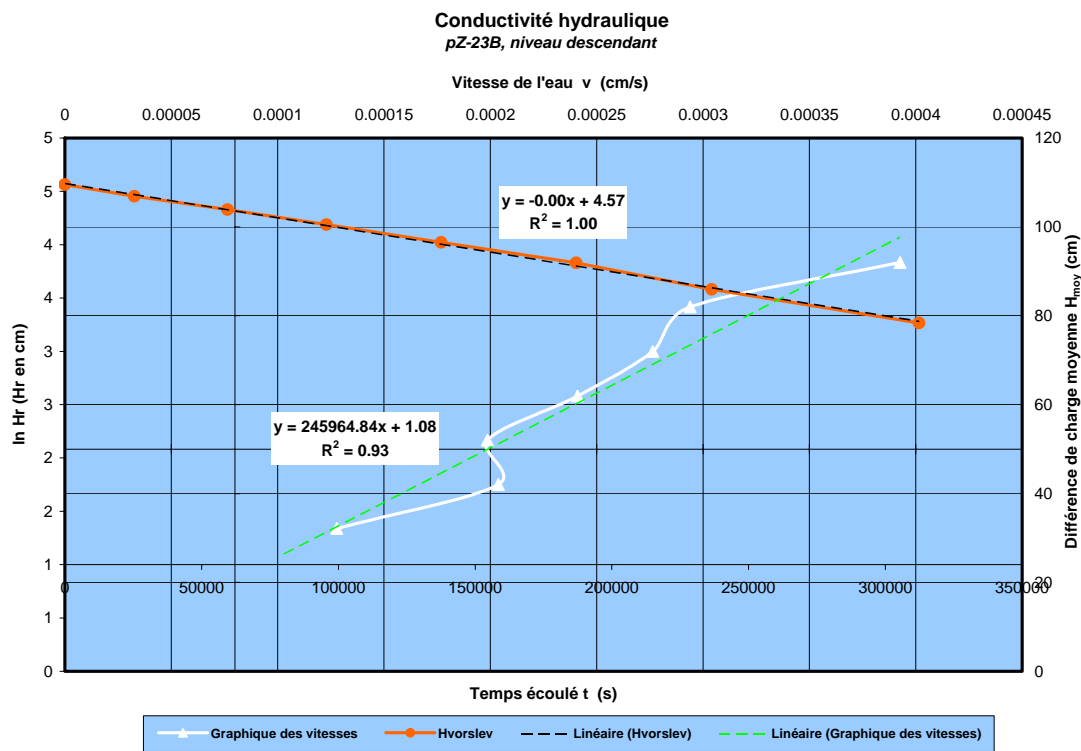


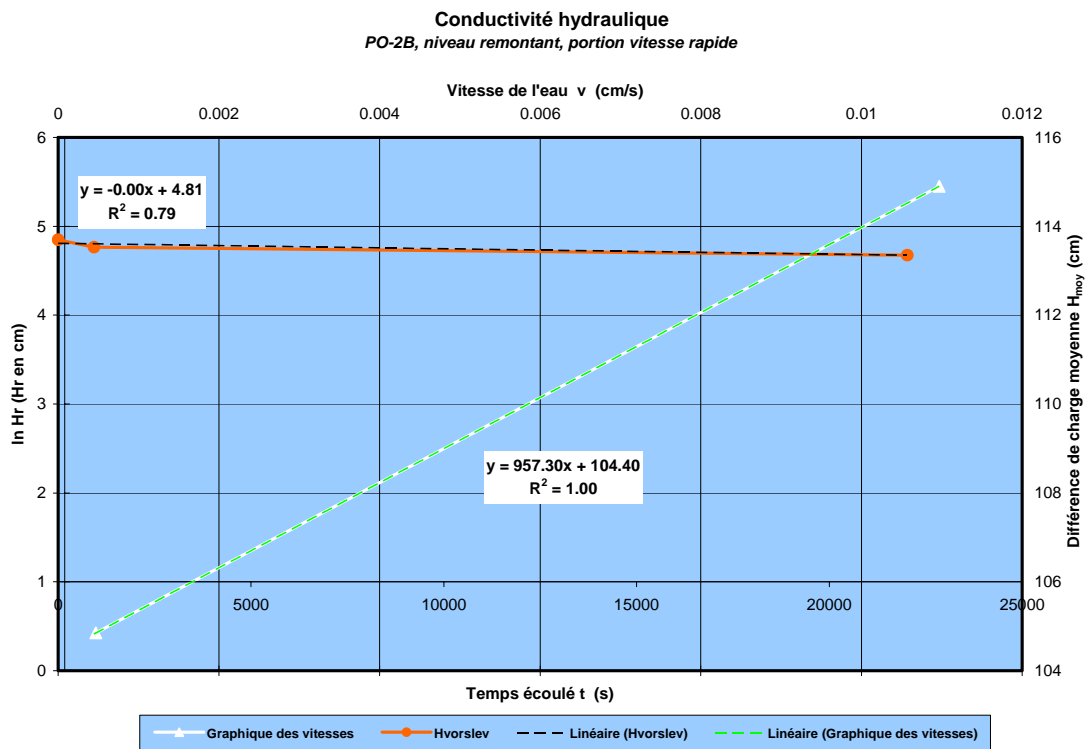
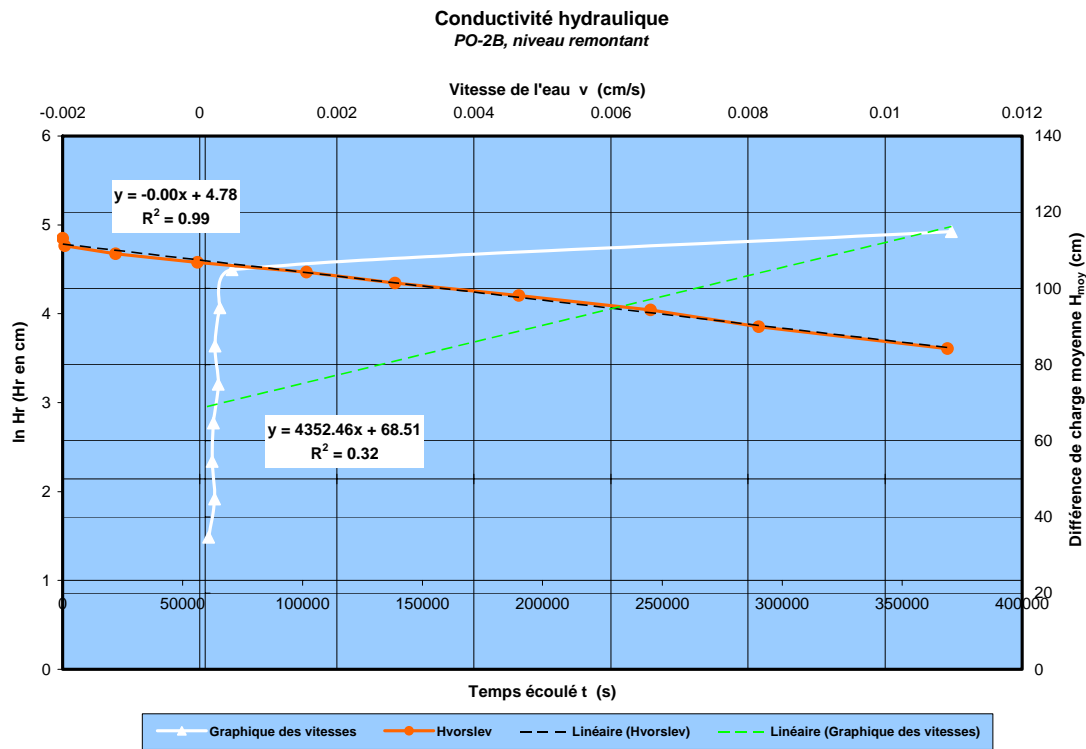
Conductivité hydraulique
pZ-25C, niveau remontant, portion vitesse rapide



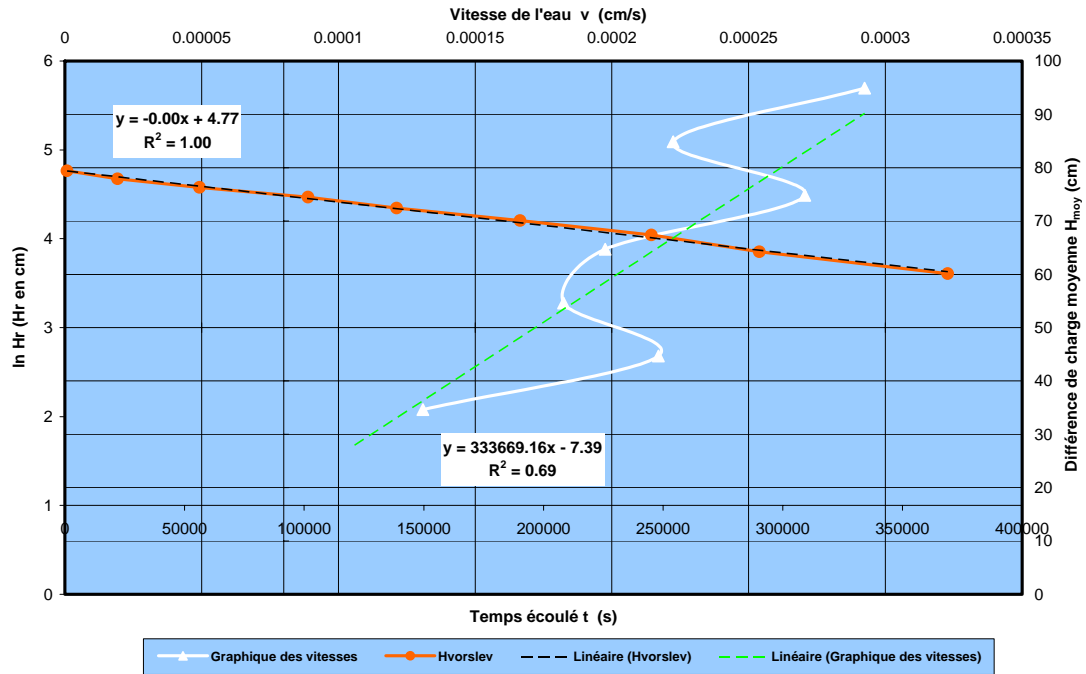
Conductivité hydraulique
pZ-25C, niveau remontant, portion vitesse lente



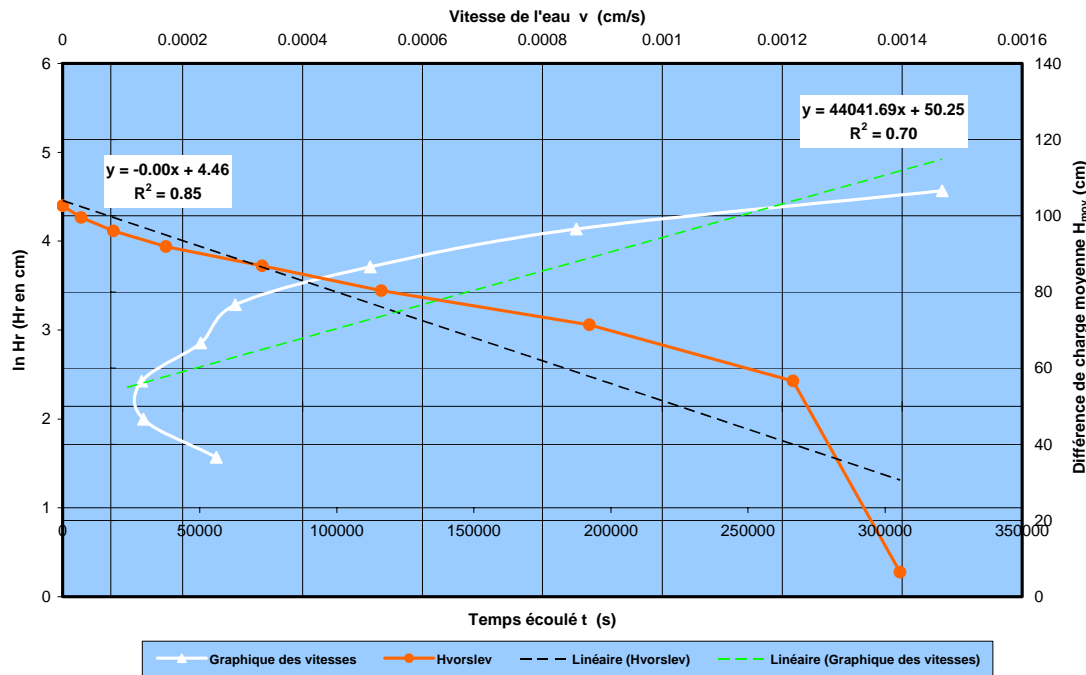


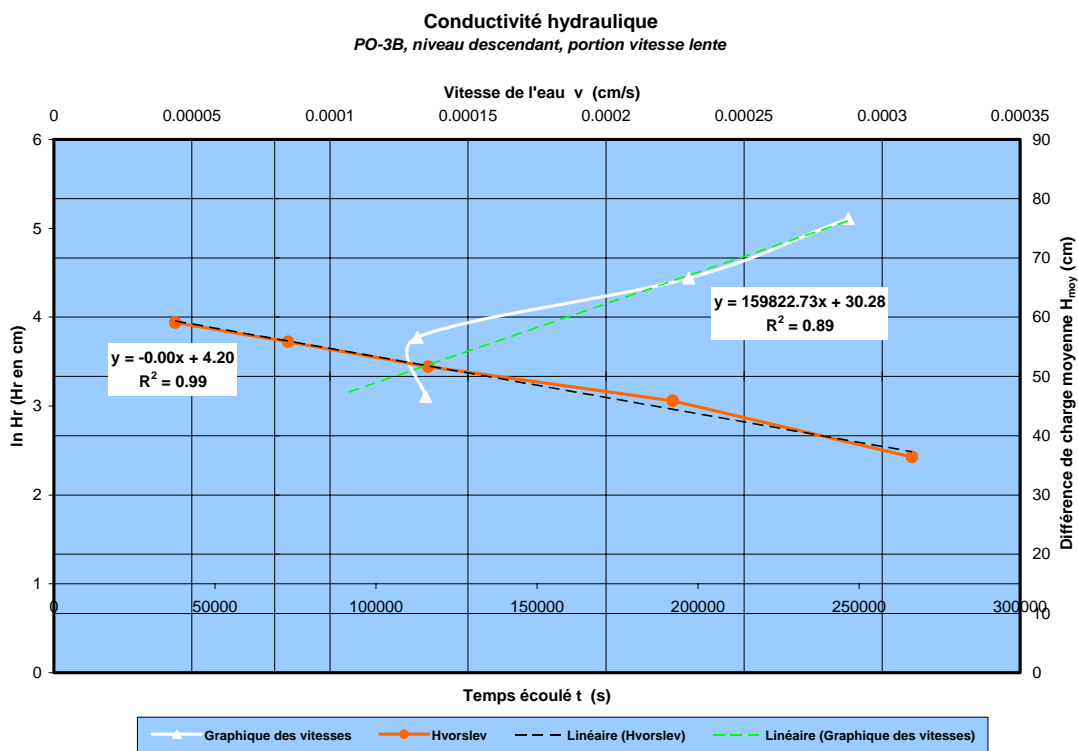
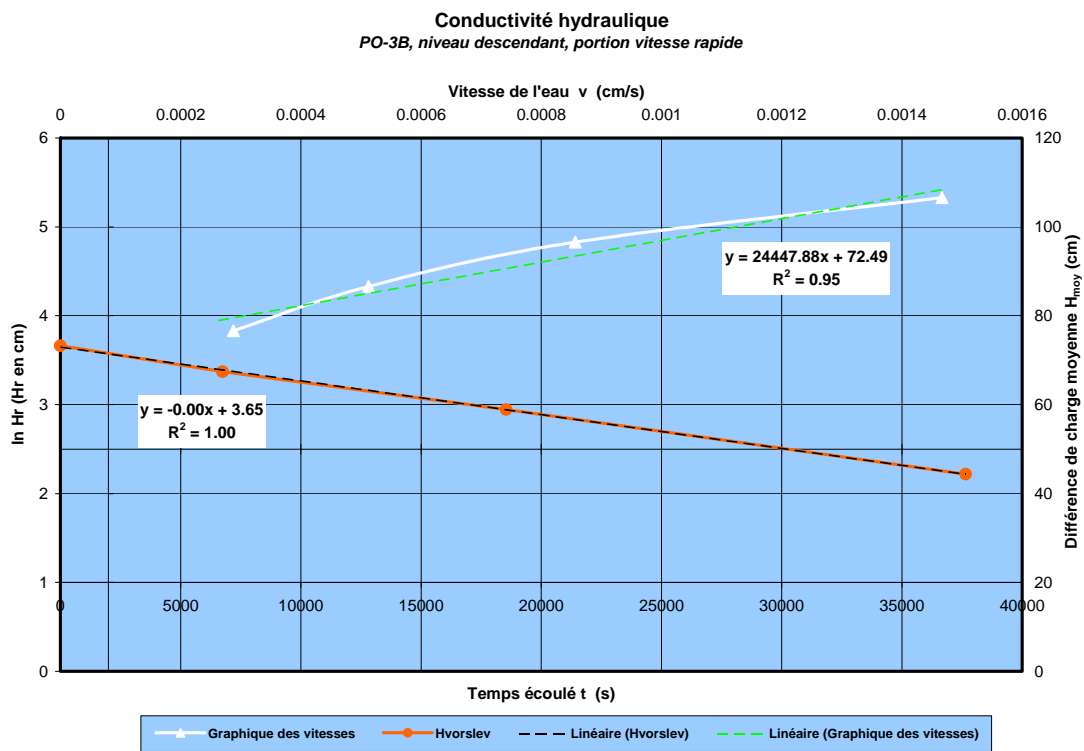


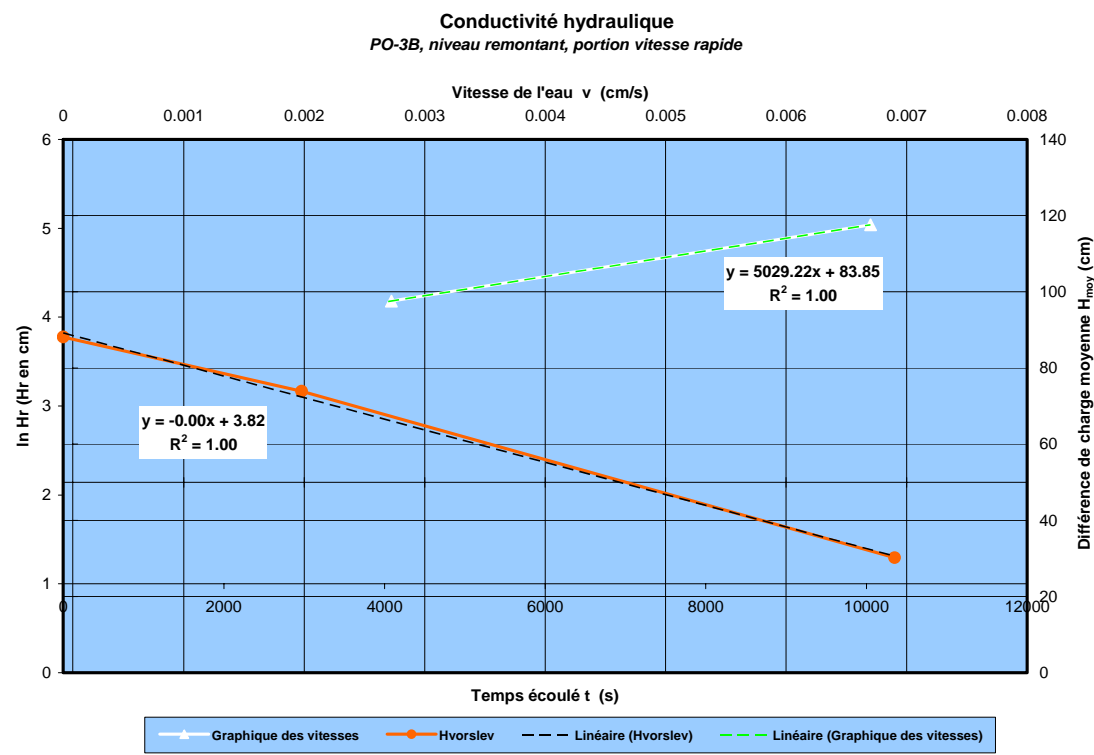
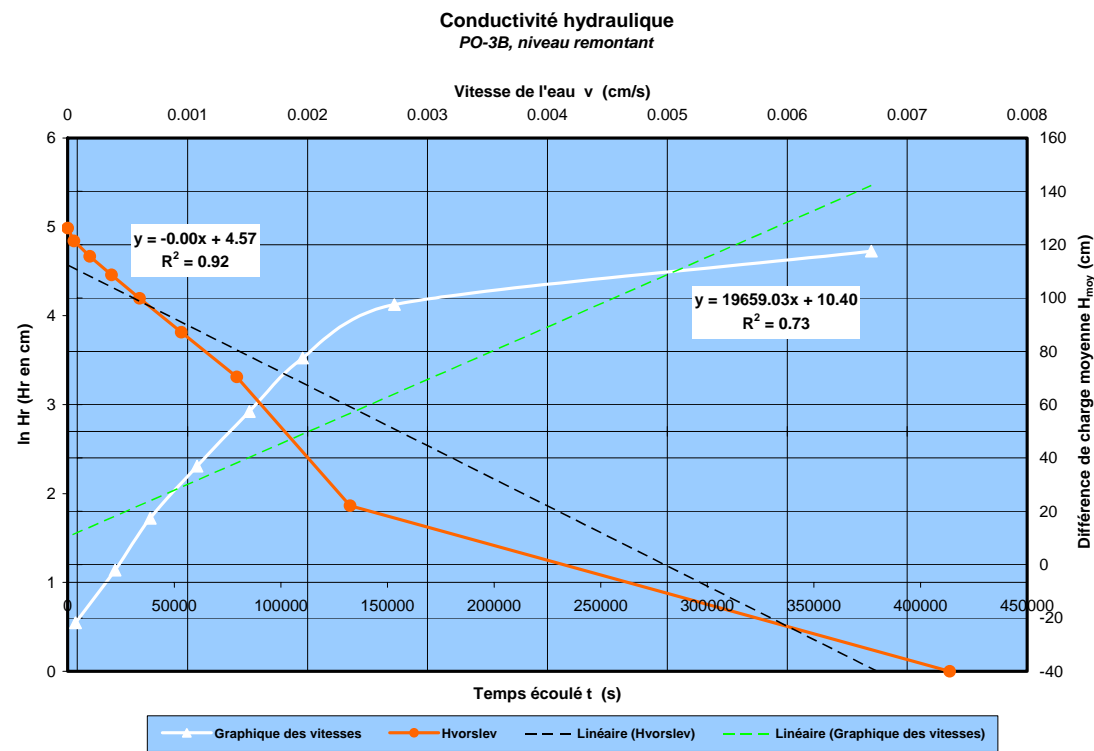
Conductivité hydraulique
PO-2B, niveau remontant, portion vitesse lente

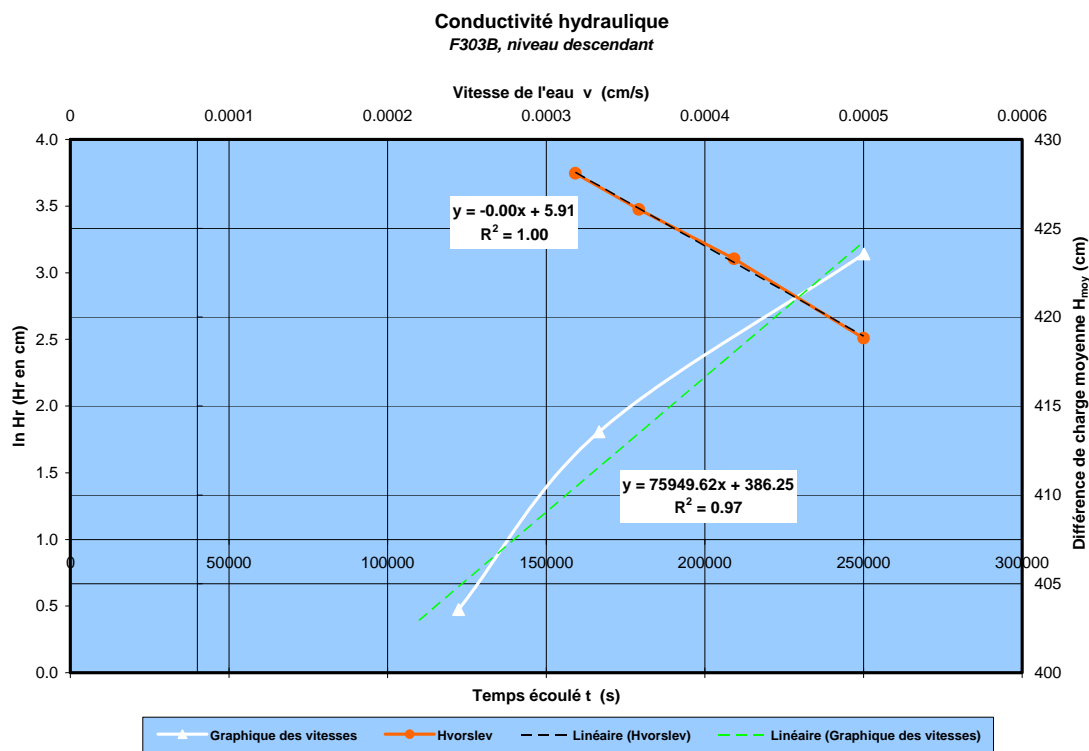
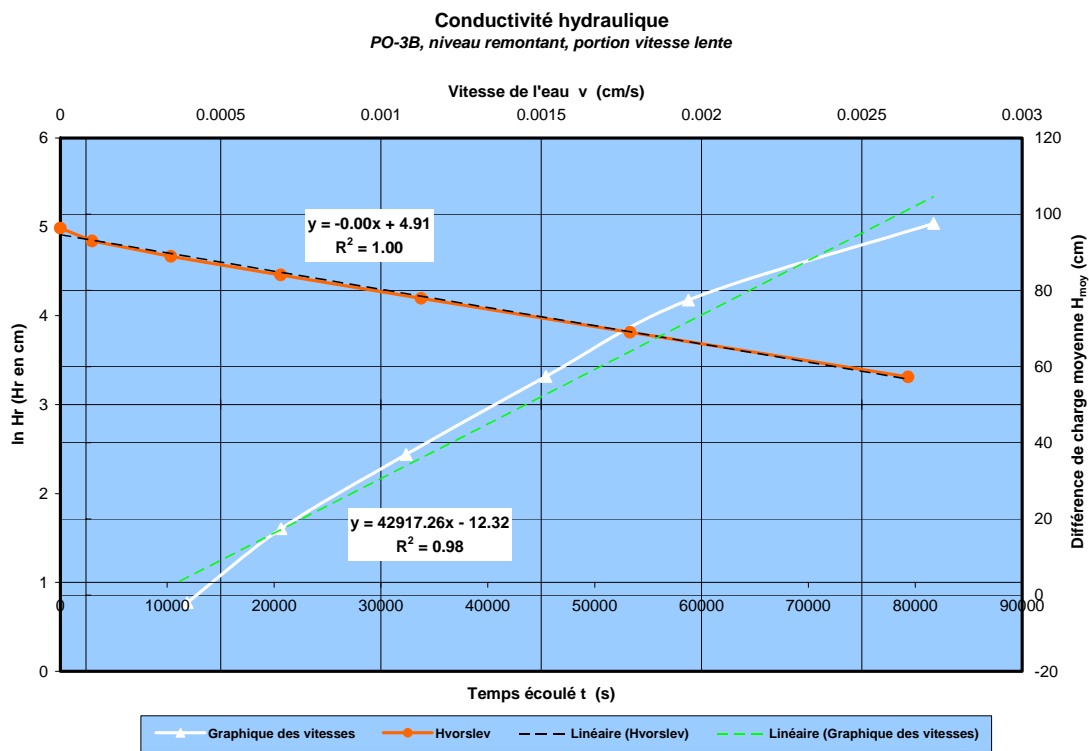


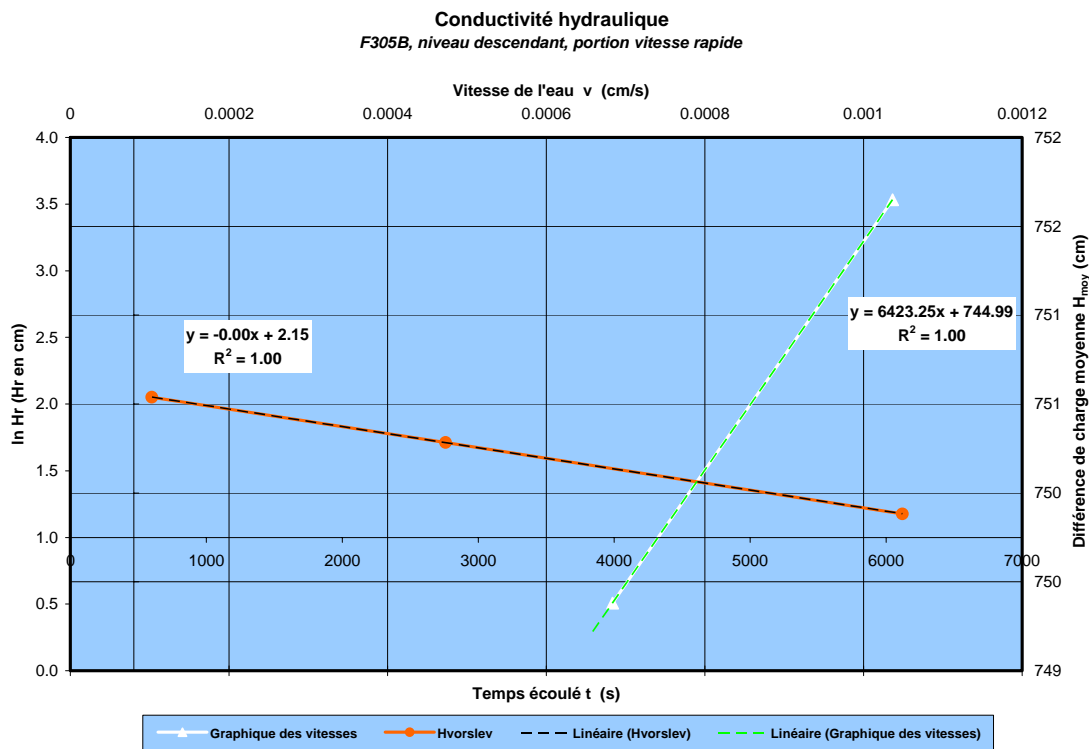
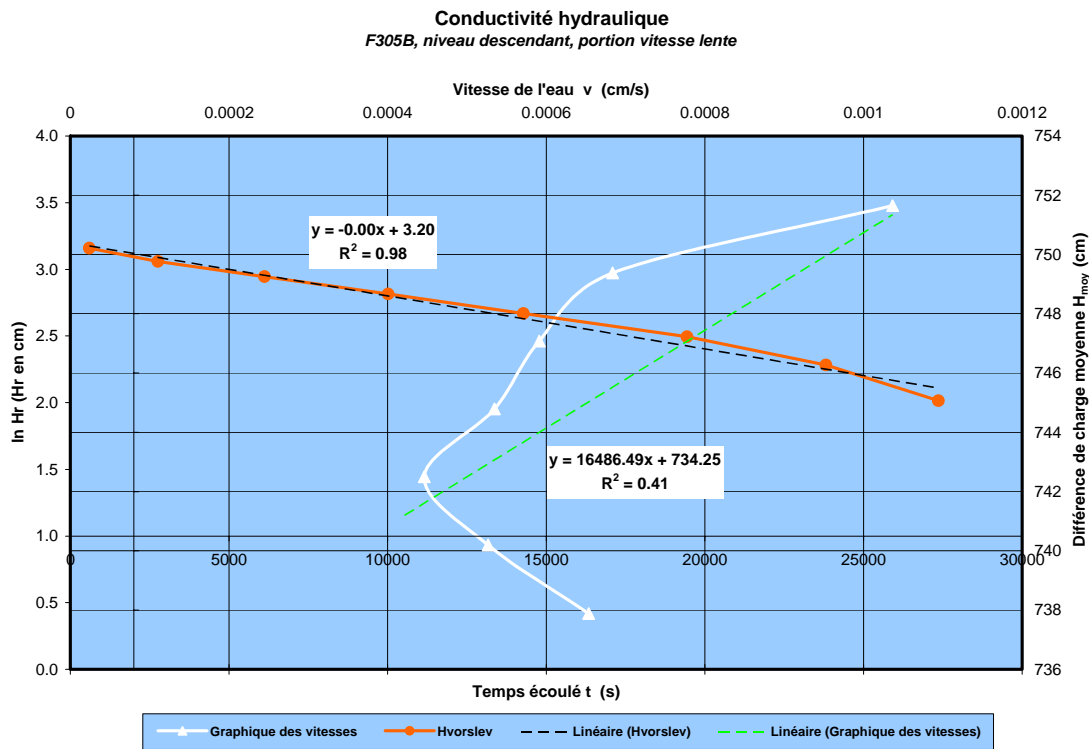
Conductivité hydraulique
PO-3B, niveau descendant

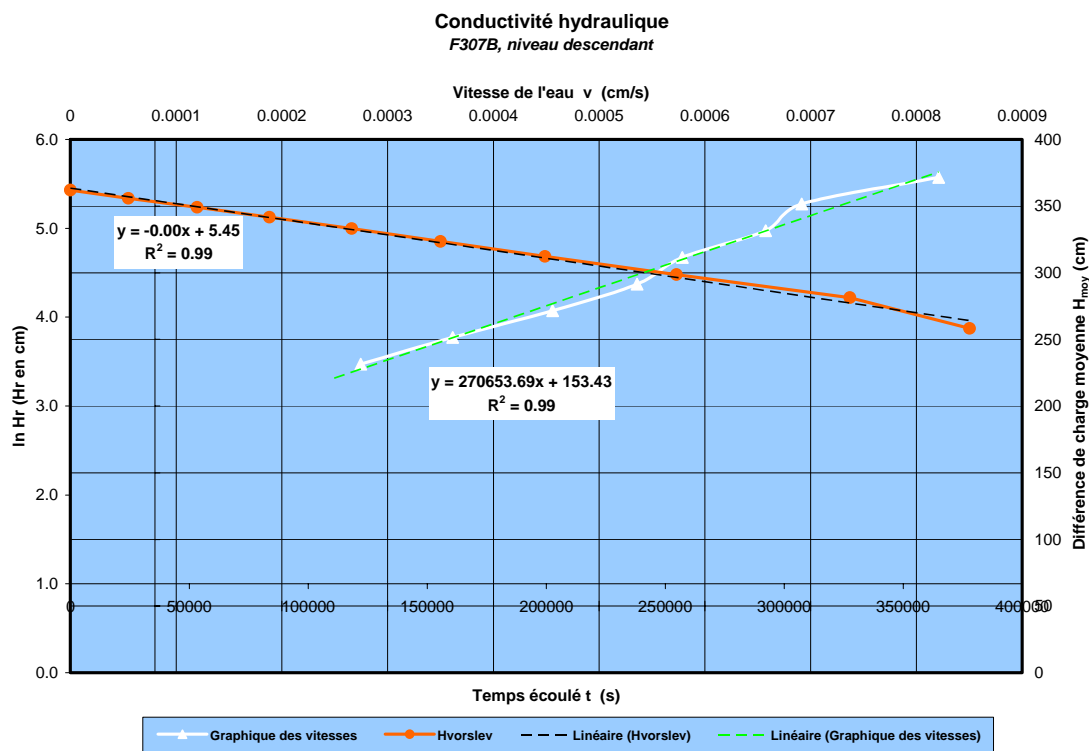
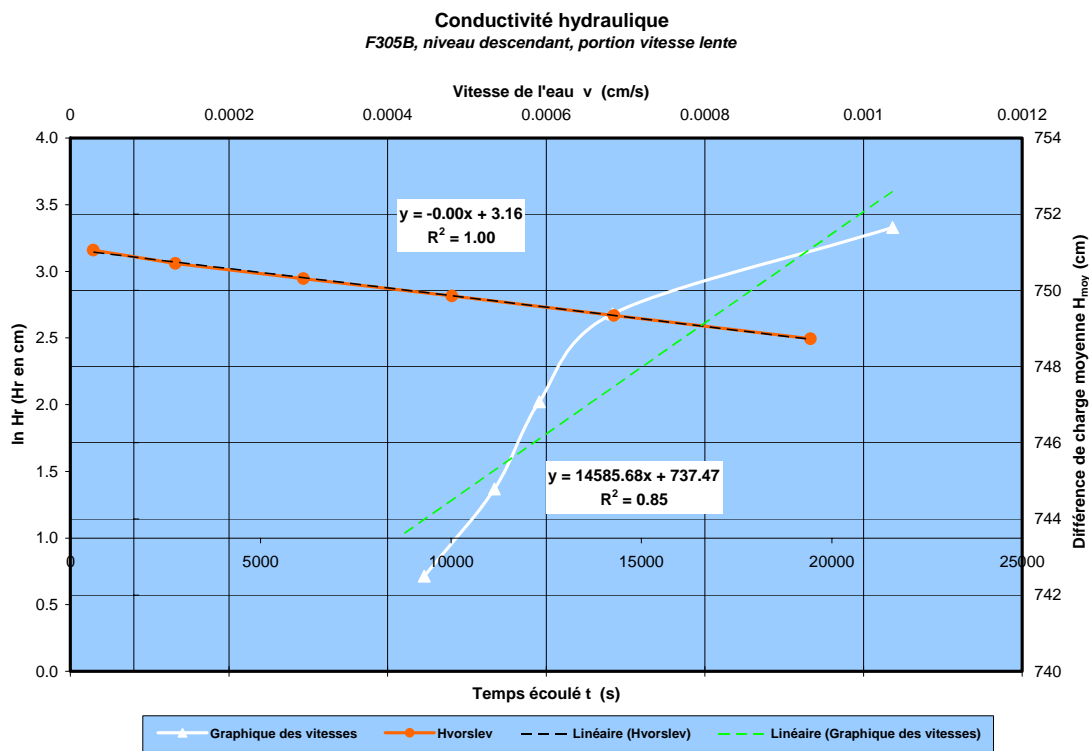












Essais de choc hydraulique

