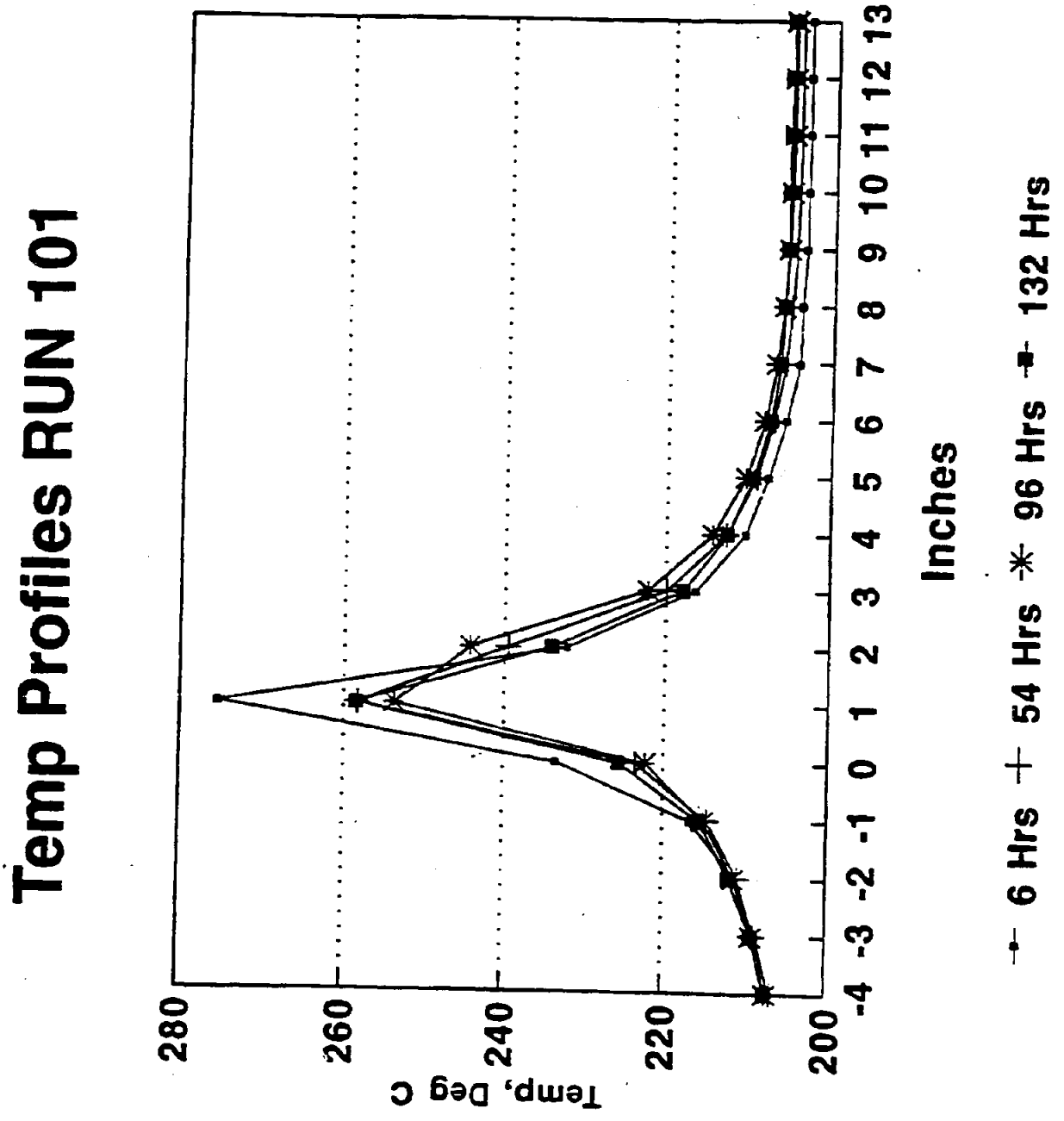
FIGURE 123


Temp Profiles RUN 101
Temp, Deg C
280
260
240
220
200
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Inches
6 Hrs
54 Hrs
96 Hrs
132 Hrs

[redacted]

FIGURE 124

PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y

6827–123 w/26.8 % Co via eth–glycol pore fill

6.5 unreduced active in 166.5g quartz sand

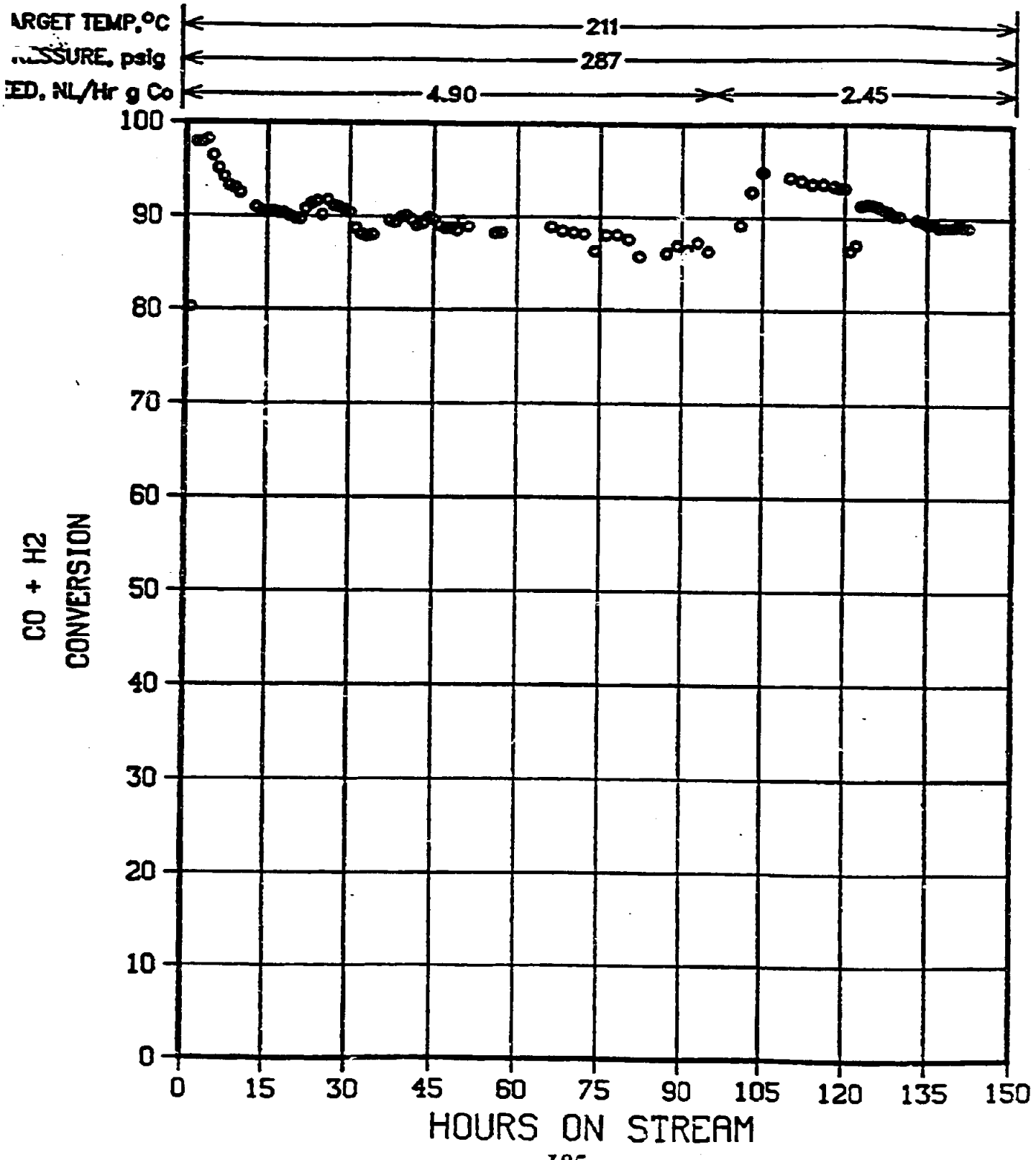


FIGURE 125

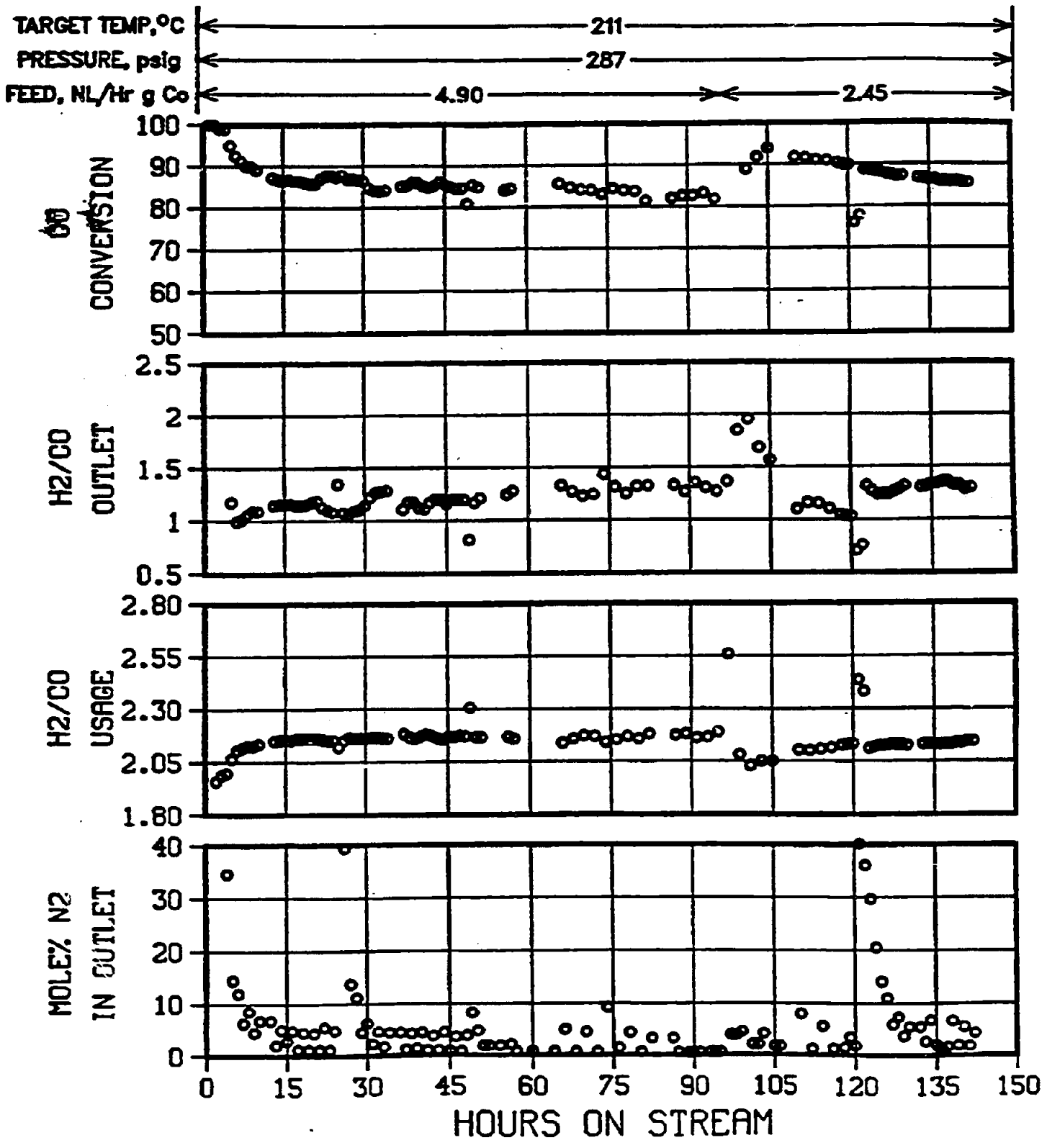

PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y
6827-123 w/26.8 % Co via eth-glycol pore fill
6.5 unreduced active in 166.5g quartz sand
TARGET TEMP,°C
211
PRESSURE, psig
287
FEED, NL/Hr g Co
4.90
2.45
CO CONVERSION
100
90
80
70
60
50
H2/CO OUTLET
2.5
2
1.5
1
0.5
H2/CO USAGE
2.80
2.55
2.30
2.05
1.80
MOLE% N2 IN OUTLET
40
30
20
10
0
0
15
30
45
60
75
90
105
120
135
150
HOURS ON STREAM

FIGURE 126

PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y

6827–123 w/26.8 % Co via eth–glycol pore fill

6.5 unreduced active in 166.5g quartz sand

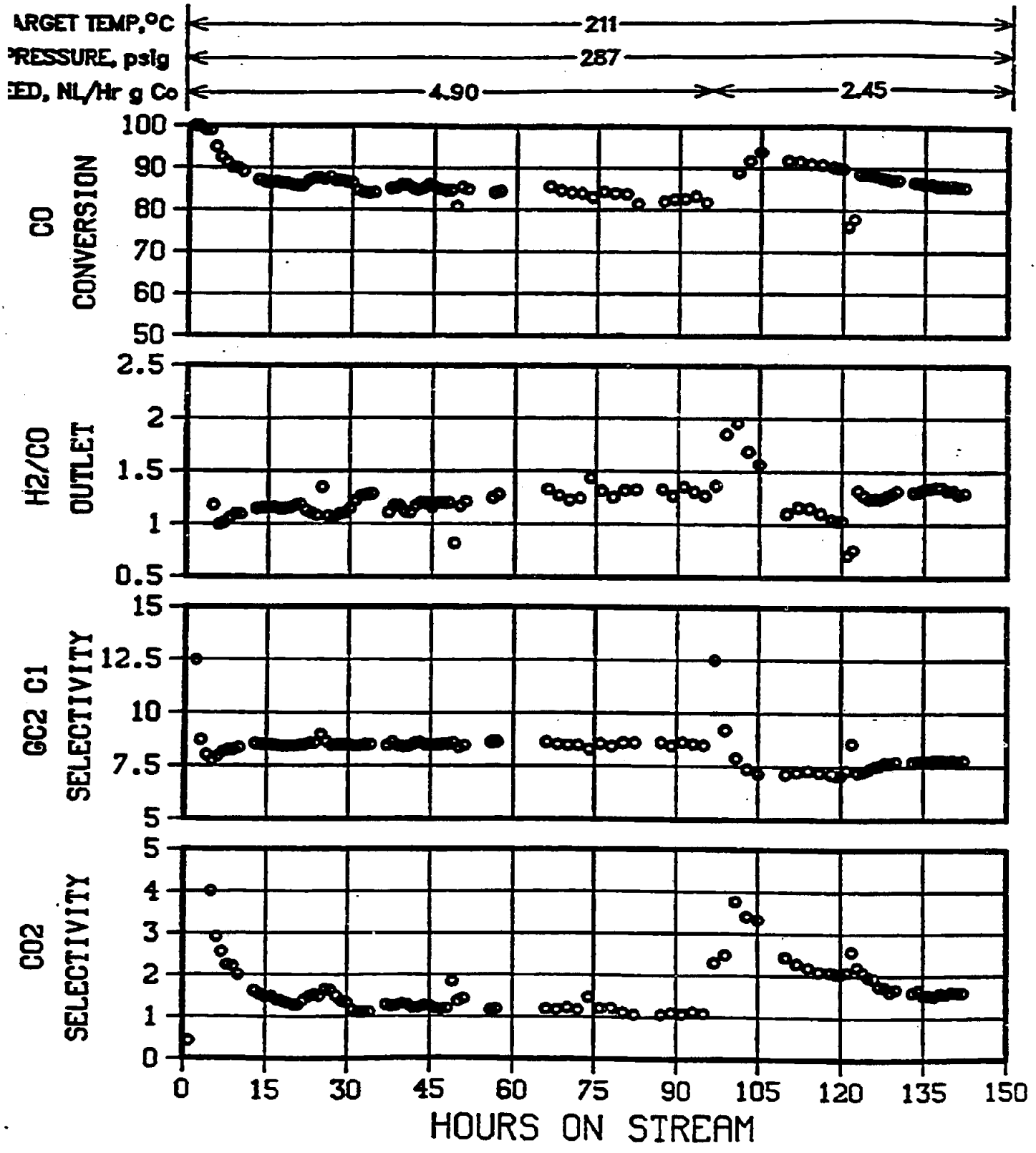


FIGURE 127

PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y

6827-123 w/26.8 % Co via eth-glycol pore fill

6.5 unreduced active in 166.5g quartz sand

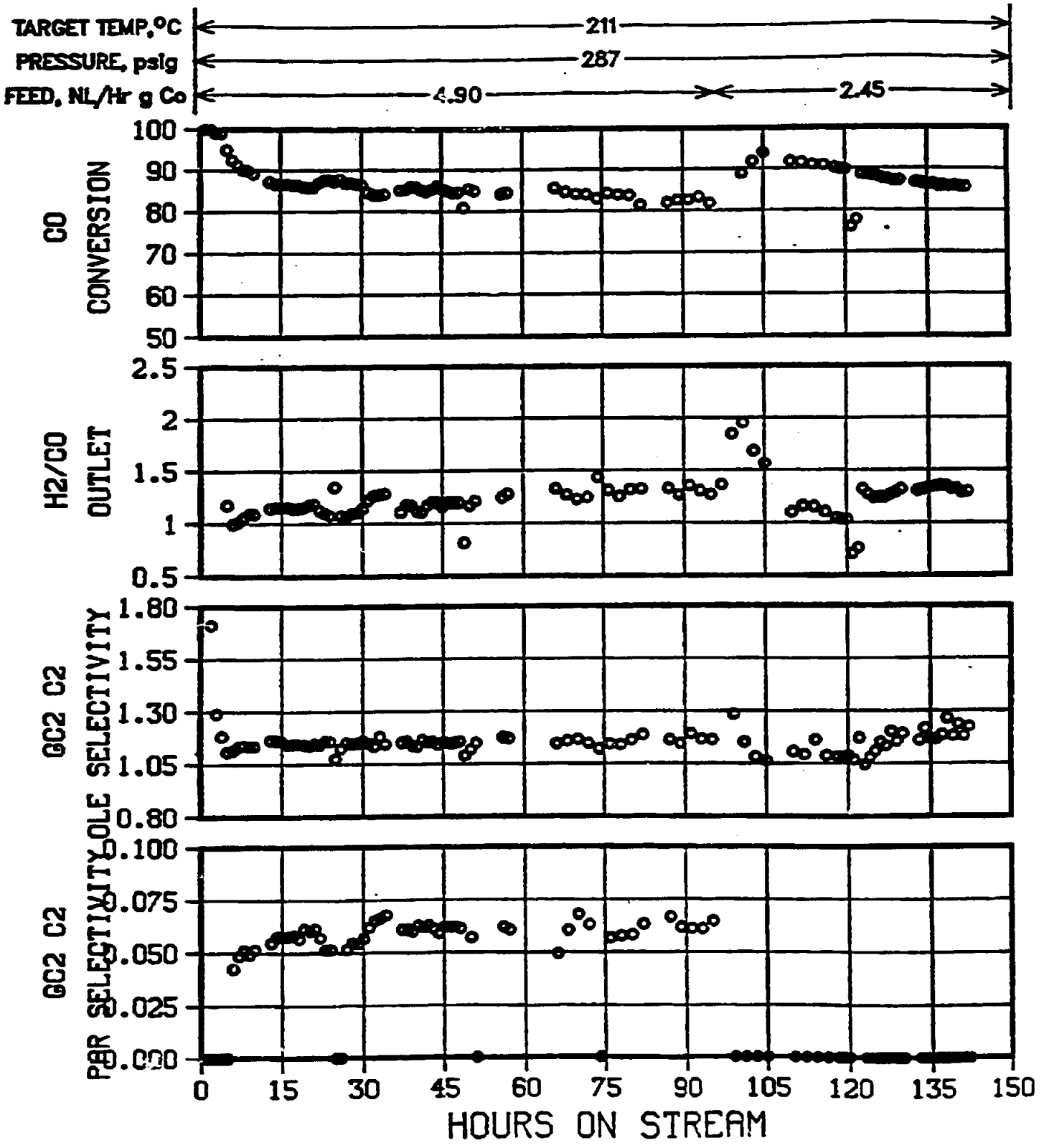


FIGURE 128

PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y

6827–123 w/26.8 % Co via eth–glycol pore fill

6.5 unreduced active in 166.5g quartz sand

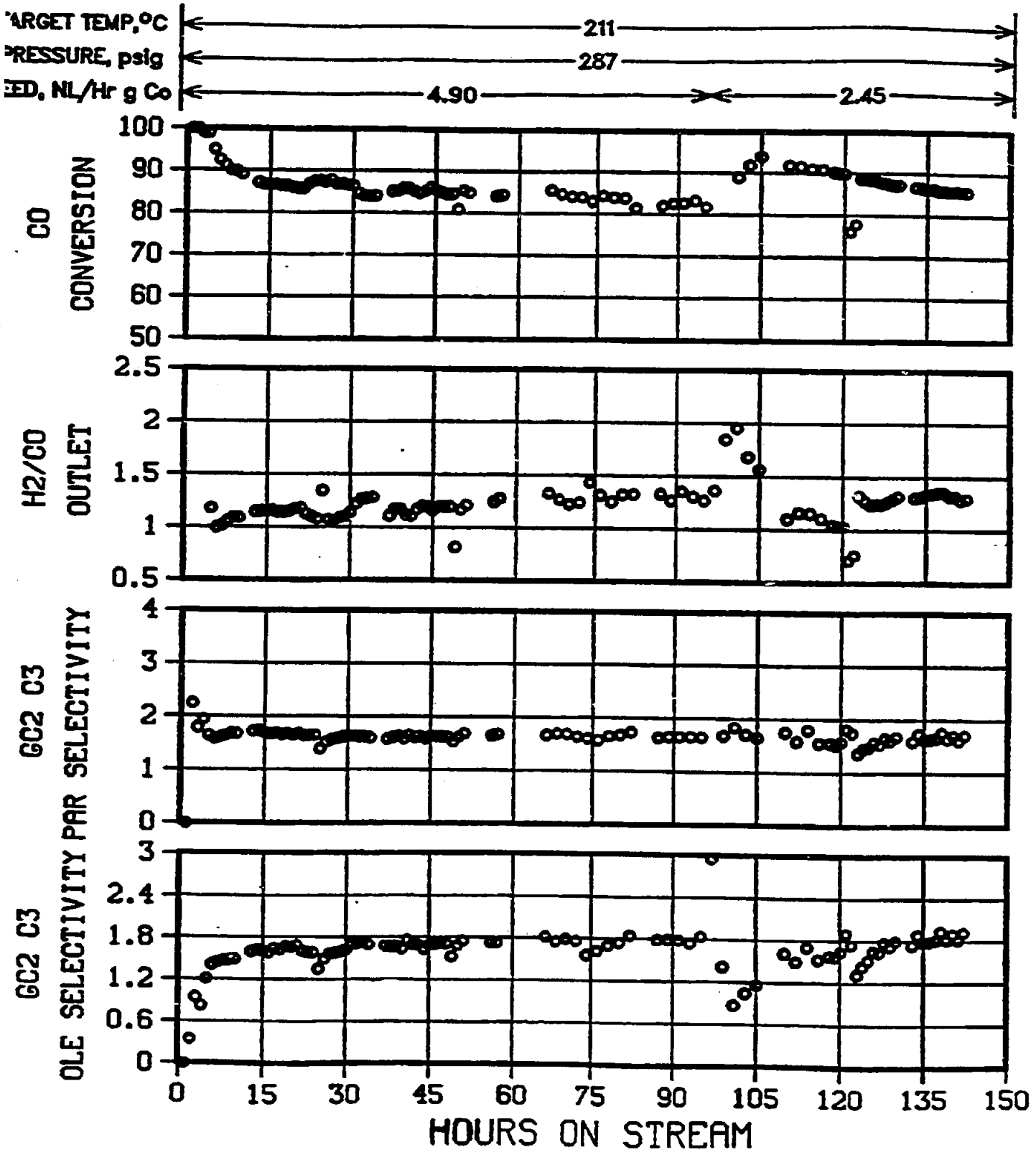
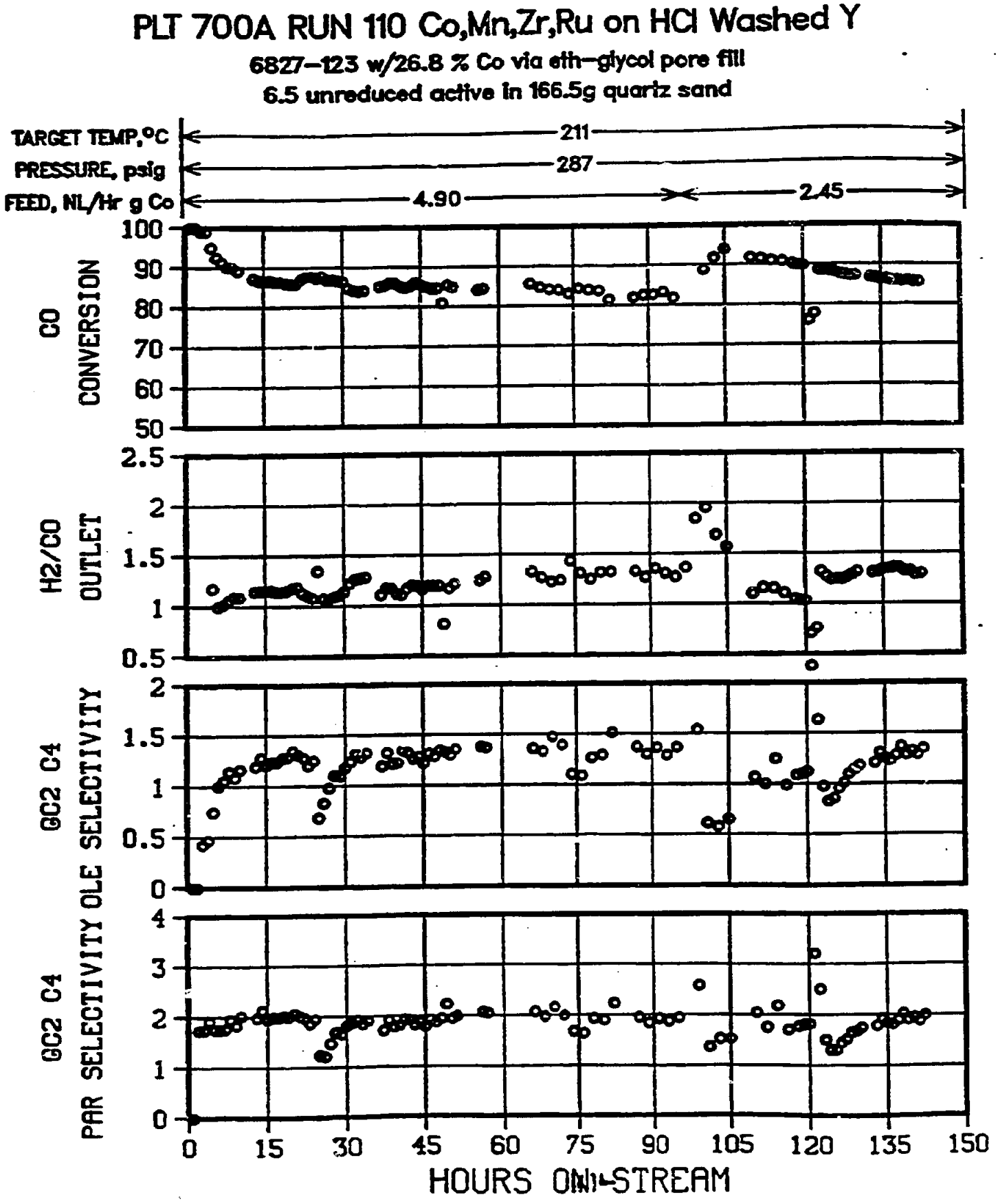


FIGURE 129


PLT 700A RUN 110 Co,Mn,Zr,Ru on HCl Washed Y
6827-123 w/26.8 % Co via eth-glycol pore fill
6.5 unreduced active in 166.5g quartz sand
TARGET TEMP,°C
211
PRESSURE, psig
287
FEED, NL/Hr g Co
4.90
2.45
CO CONVERSION
100
90
80
70
60
50
H2/CO OUTLET
2.5
2
1.5
1
0.5
GC2 C4 PAR SELECTIVITY OLE SELECTIVITY
4
3
2
1
0
0
15
30
45
60
75
90
105
120
135
150
HOURS ON-STREAM

Temp Profiles RUN 110

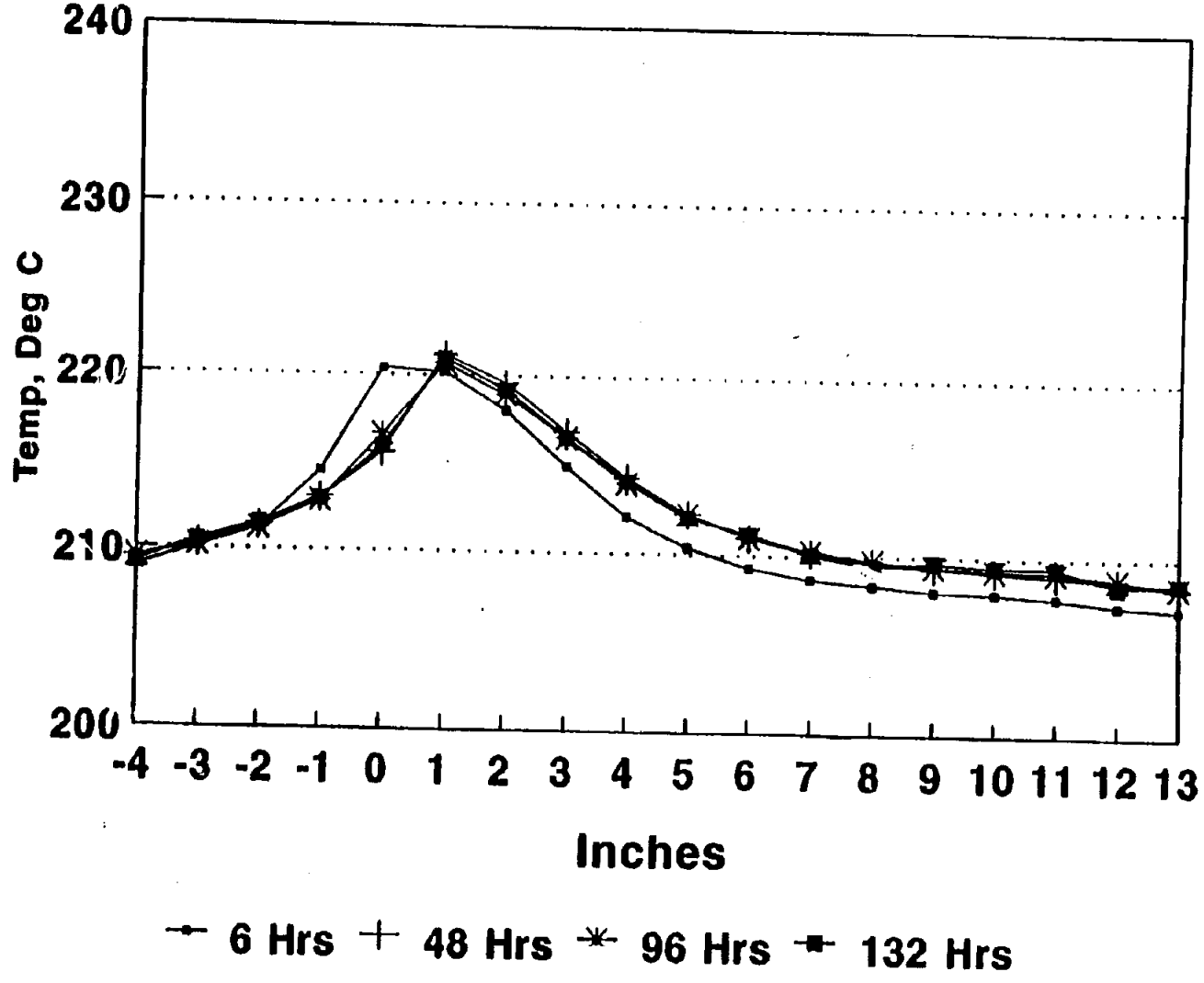
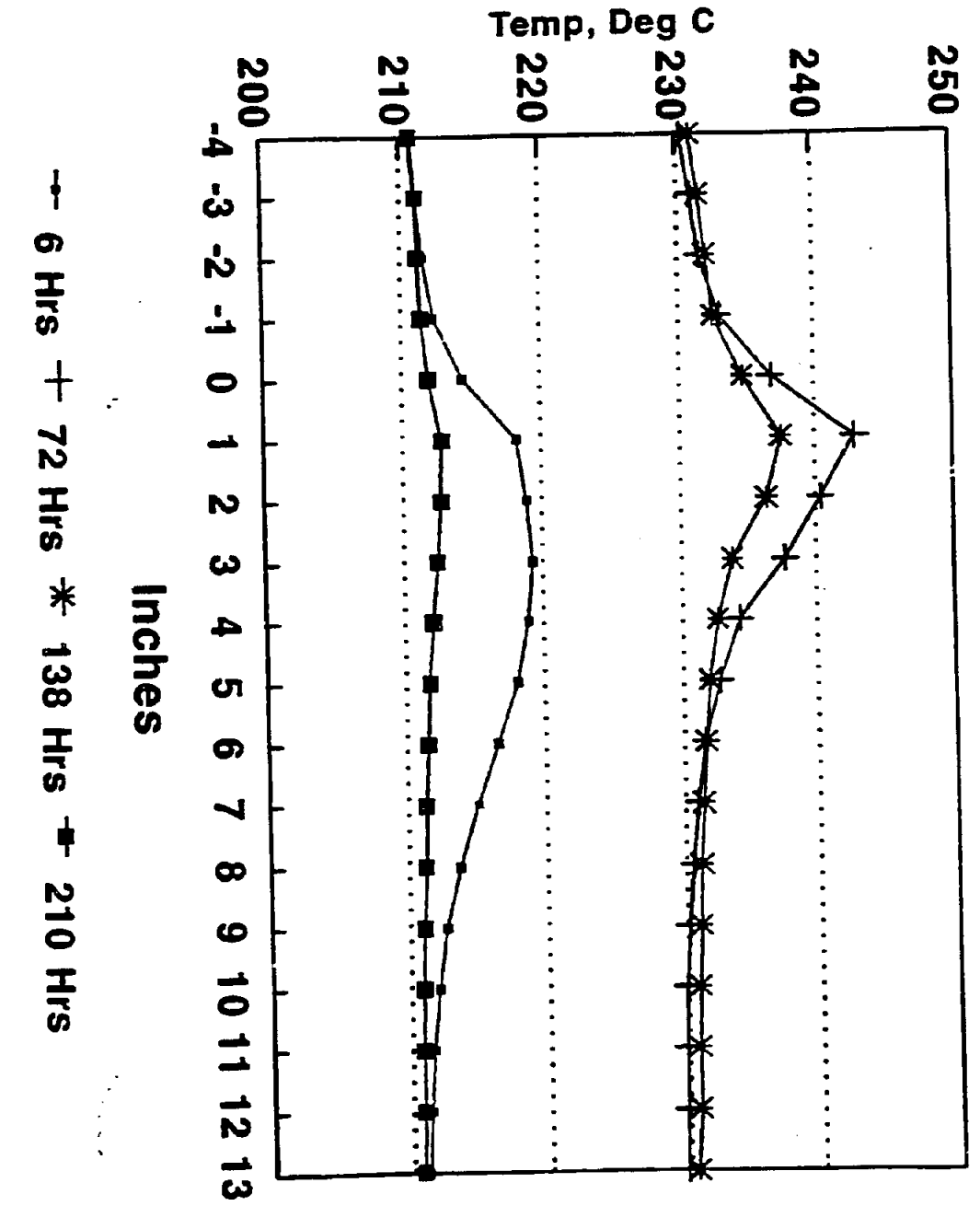


FIGURE 130

FIGURE 131


Temp Profiles RUN 97
Temp, Deg C
200
210
220
230
240
250
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Inches
6 Hrs
72 Hrs
138 Hrs
210 Hrs

COMPARISON OF HIGH AND VERY HIGH COBALT LEVEL CATALYSTS
SUMMARY OF SCREENING IN FIXED-BED PLANT

RUN NO.	97	101	110
LOADING			
CATALYST, G	13 (17.6% Co)	13 (27.4% Co)	6.5 (26.8% Co)
DILUENT, G	160	160	166.5
CATALYST PRETREAT.	350° C/H_2/2 HRS		
TEST CONDITIONS			
FEED H_2/CO	2.1		
FEED RATE (NL/HR · G Co)	4.9		
TEMP, °C	211(INLET)		
PRESSURE, PSIG	287		
PERFORMANCE SUMMARY[1]			
CONVERSION, %			
CO + H_2	78	95	86
CO	72	90	82
SELECTIVITY, MOLE %			
C_1	13	20	8.6
C_2	1.8	2.6	1.2
$C_2^=$	0.1	0.0	0.0
C_3	3.0	3.7	1.8
$C_3^=$	2.1	0.8	1.8
CO_2	0.8	3.0	1.0

1. AT 100 HOURS ON STREAM

FIGURE 132

CATALYST PRECURSORS: SUPPORTED OXIDES ON STEAMED/ACID-WASHED Y ZEOLITES

SUPPORT PROPERTIES				CATALYST NO./ RUN NO.	CATALYST METALS, AAS WT%			
TRTMNTS	X-RAY[1]	SA[2]/PV[3]	Al[4]		Co	Mn	Zr	Ru
STMD/ HCl[5]	84.2 ± 0.3[6]	582/0.56[7]	0.46	6827-81/97	17.6	2.0	1.6	1.0
	84.5 ± 0.3[6]	574/0.54[7]	0.48	6827-95/101	27.4	1.1	1.6	0.3
		561/0.54[7]	0.37	6827-123/110	26.8	2.3	1.0	0.4
		588/0.55[8]	0.59	6827-160/122	28.5	1.7	1.3	0.5
		588/0.55[8]	0.59	6827-161/123	28.7	1.8	1.1	

1. ABSOLUTE INTENSITY VS. LZ 210 (UNSTEAMED Y ZEOLITE) WHICH = 99.7 ± 1.7.
2. m^2/g
3. cc/g
4. wt %
5. WASH 3 HOURS WITH 4M HCl.
6. BEFORE ACID WASH: 591 m^2/g, 0.5 cc/g.
7. BEFORE ACID WASH: 86.3 ± 0.3.
8. FROM WASH OF THE SECOND OF TWO COMMERCIAL STEAMED Y-ZEOLITES USED IN THIS WORK.

FIGURE 133

FIGURE 134

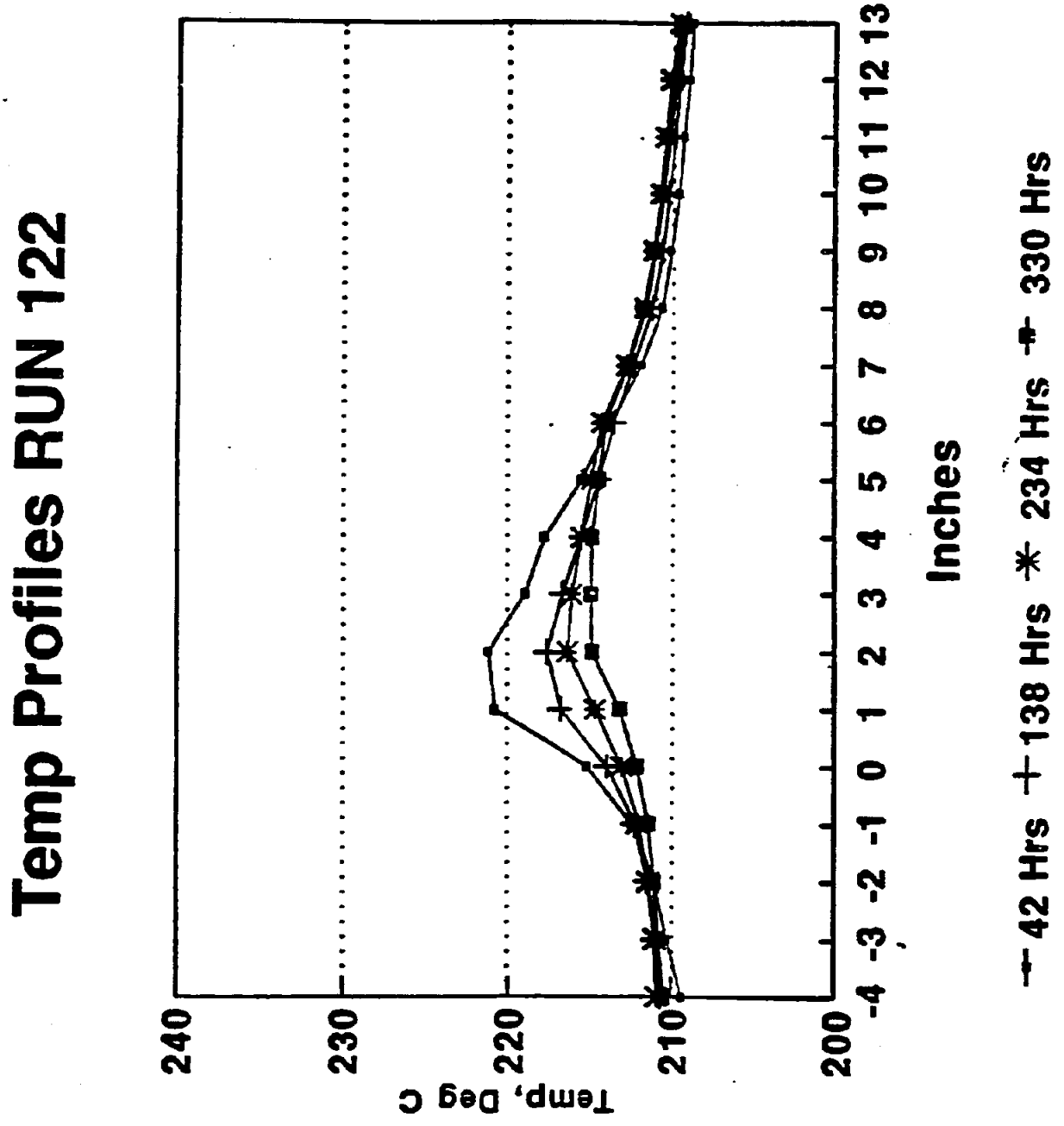

Temp Profiles RUN 122
Temp, Deg C
240
230
220
210
200
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Inches
42 Hrs
138 Hrs
234 Hrs
330 Hrs

FIGURE 133

PLT 700 RUN 122 Co;Mn,Zr,Ru On steamed, acid washed Y-Z

6827-160w/28.5 % Co via eth-glycol pore fill

6.5g active in 166.5g quartz sand 5/31--->6/14/93

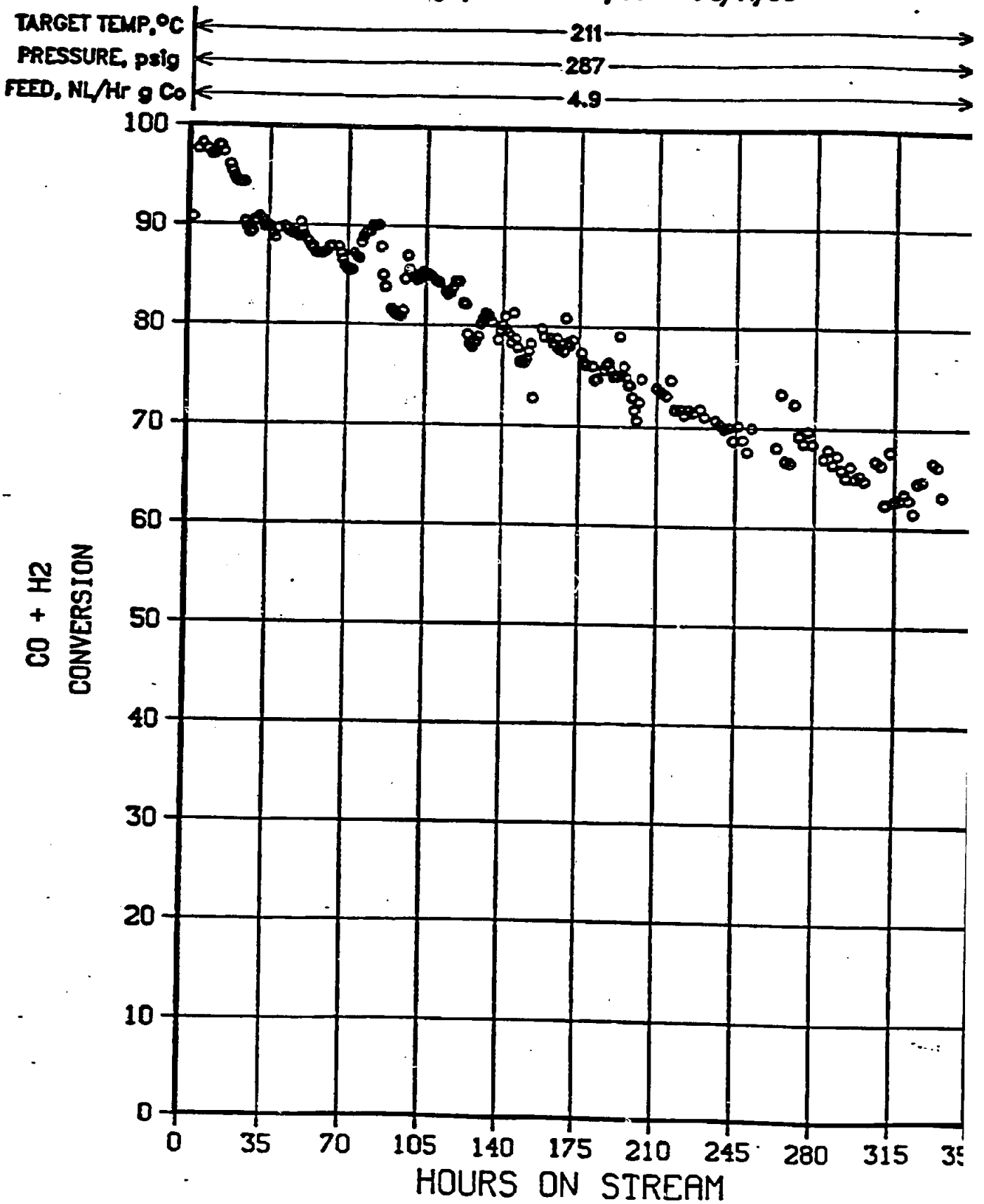


FIGURE 136

700 RUN 122 Co,Mn,Zr,Ru On steamed, acid washed Y–ZLT

6827–160w/28.5 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 5/31–––>6/14/93

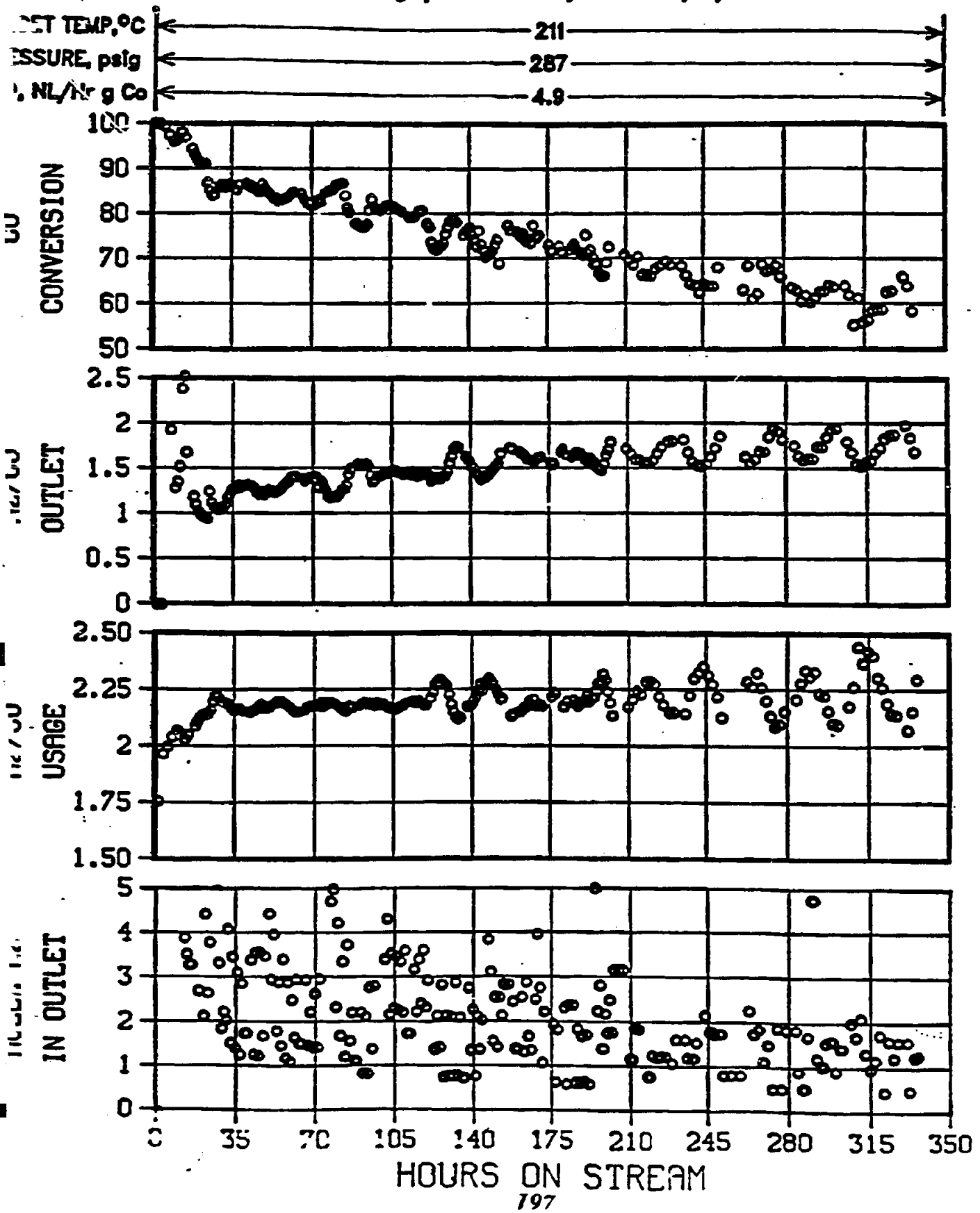


FIGURE 137

PLT 700 RUN 122 Co,Mn,Zr,Ru On steamed, acid washed Y–ZLT

5827–160 w/28.5 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 5/31–––>6/14/93

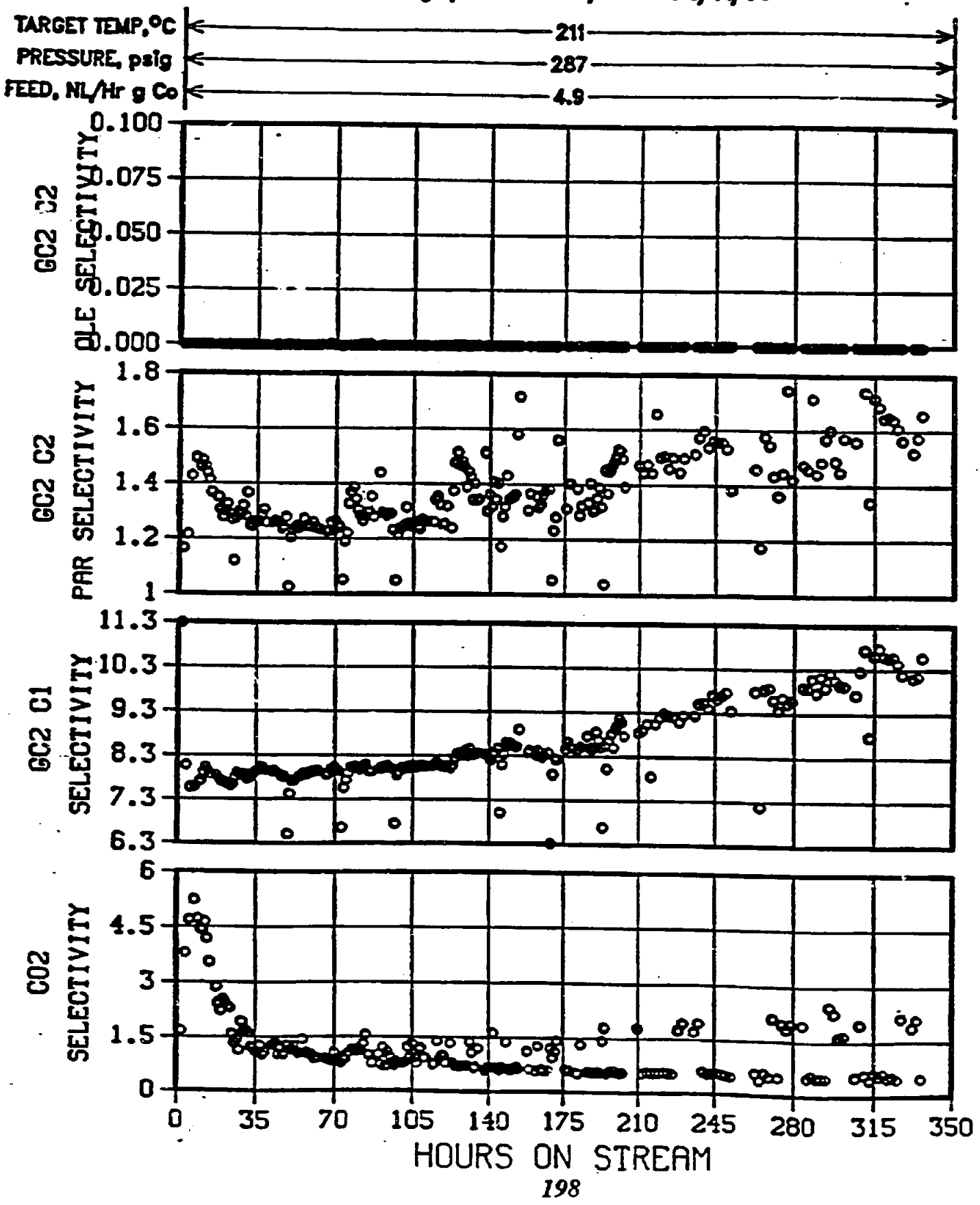


FIGURE 138

T 700 RUN 122 Co,Mn,Zr,Ru On steamed, acid washed Y–ZLT

6827–160w/28.5 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 5/31–––>6/14/93

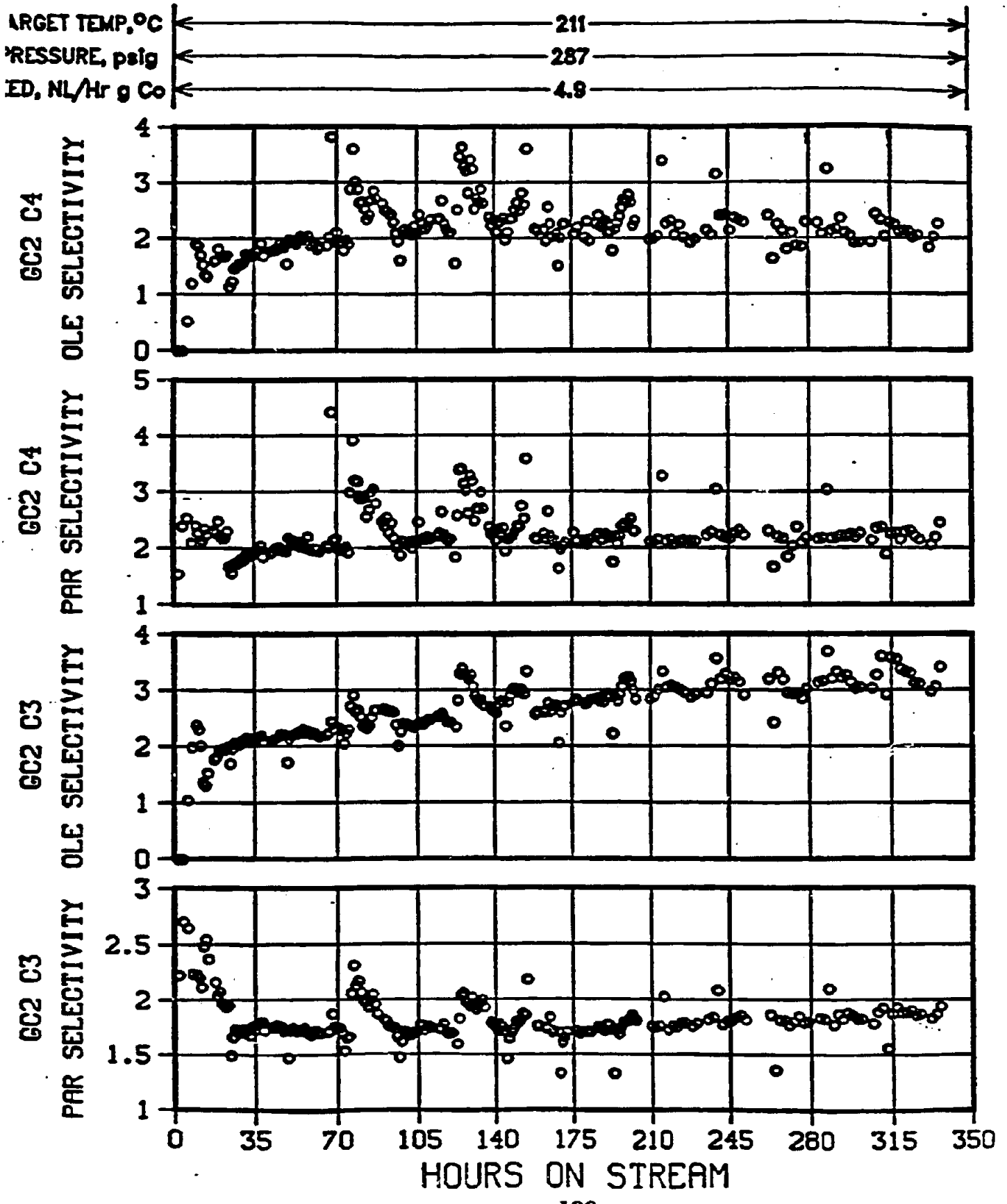


FIGURE 139

PLT 700 RUN 122 Co,Mn,Zr,Ru On steamed, acid washed Y–ZLT

6827–160w/28.5 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 5/31--->6/14/93

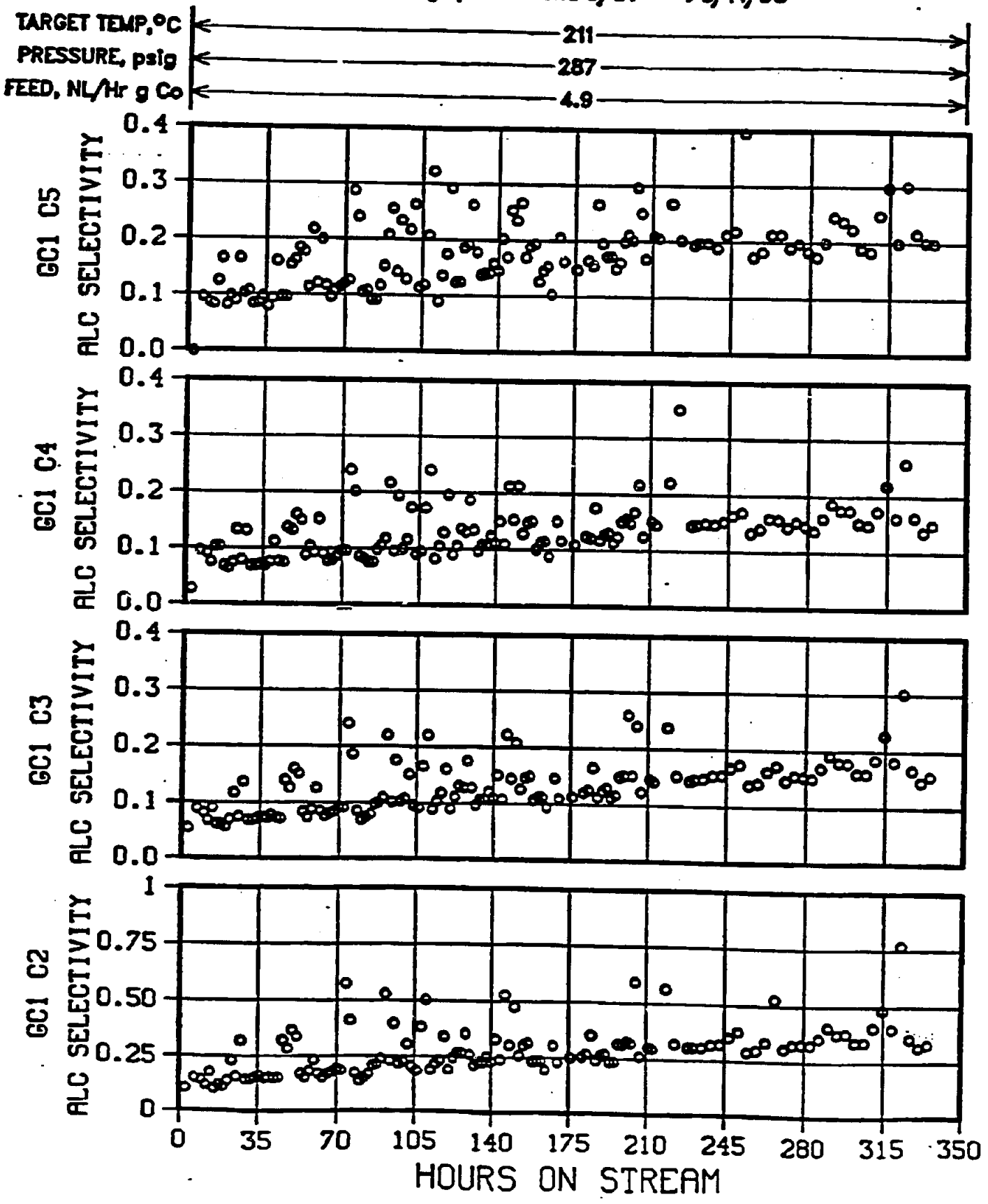
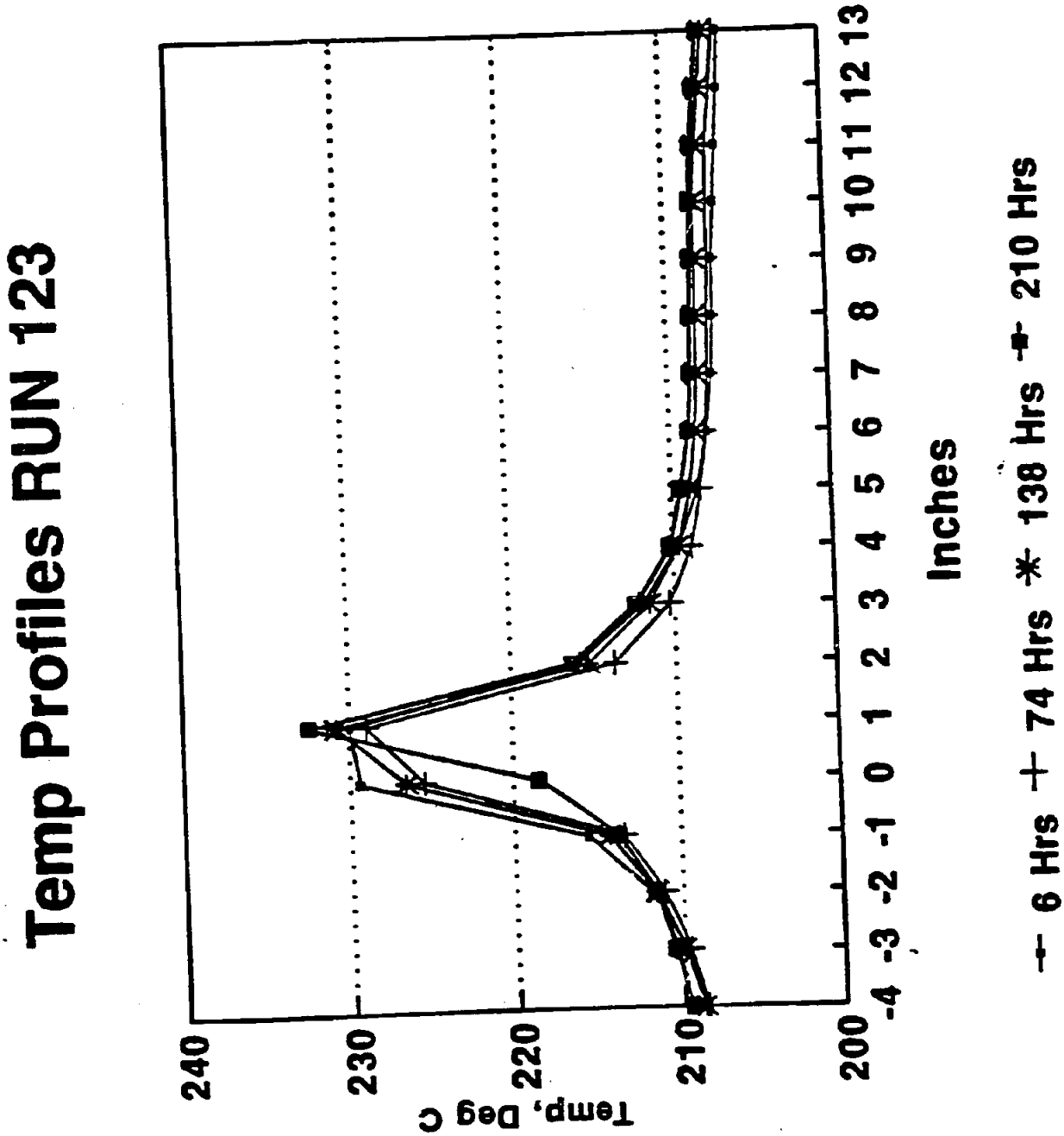


FIGURE 140


Temp Profiles RUN 123
Temp, Deg C
240
230
220
210
200
-4 -3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Inches
6 Hrs
74 Hrs
138 Hrs
210 Hrs

COMPARISON OF HIGH COBALT CATALYSTS WITH AND WITHOUT RUTHENIUM SUMMARY OF SCREENING IN FIXED-BED PLANT

RUN NO.	110	123
LOADING		
CATALYST, G	6.5 (26.8% Co/0.4% Ru)	6.5 (28.7% Co)
DILUENT, G	166.5	166.5
CATALYST PRETREAT.	350° C/H_2/2 HRS	
TEST CONDITIONS		
FEED H_2/CO	2.1	
FEED RATE (NL/HR·G Co)	4.9	
TEMP, °C	211(INLET)	
PRESSURE, PSIG	287	
PERFORMANCE SUMMARY[1]		
CONVERSION, %		
CO + H_2	86	90
CO	82	85
SELECTIVITY, MOLE %		
C_1	8.6	10.5
C_2	1.2	1.5
$C_2^=$	0.0	0.0
C_3	1.8	2.1
$C_3^=$	1.8	1.0
CO_2	1.0	2.5

1. AT 100 HOURS ON STREAM

FIGURE 141

FIGURE 142

PLT 700 RUN 123 Co,Mn,Zr On steamed, acid washed Y–ZLT.

6827–161 w/28.7 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 6/20——>6/29/93

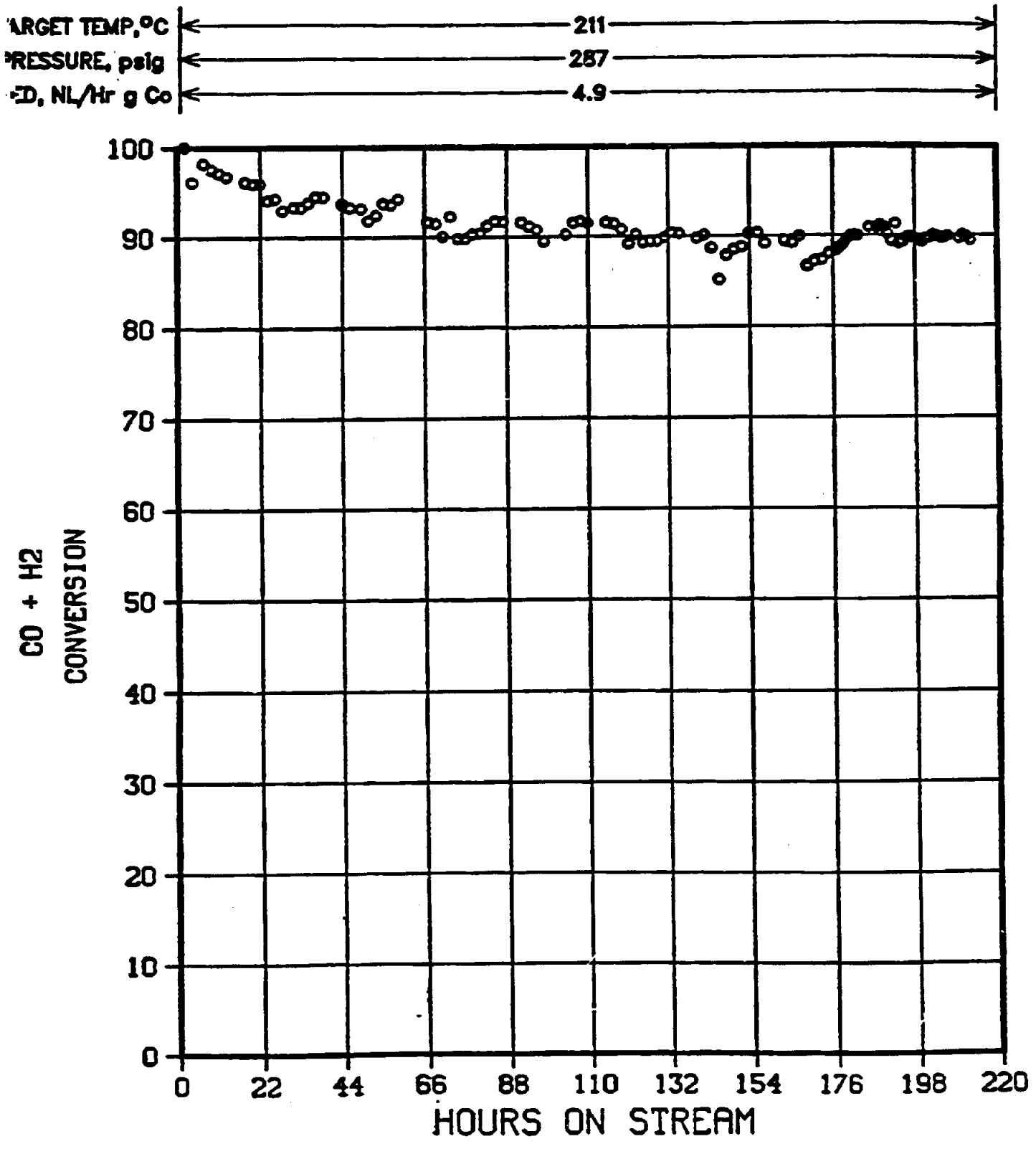


FIGURE 143

PLT 700 RUN 123 Co,Mn,Zr On steamed, acid washed Y–ZLT.

6827–161 w/28.7 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 6/20——>6/29/93

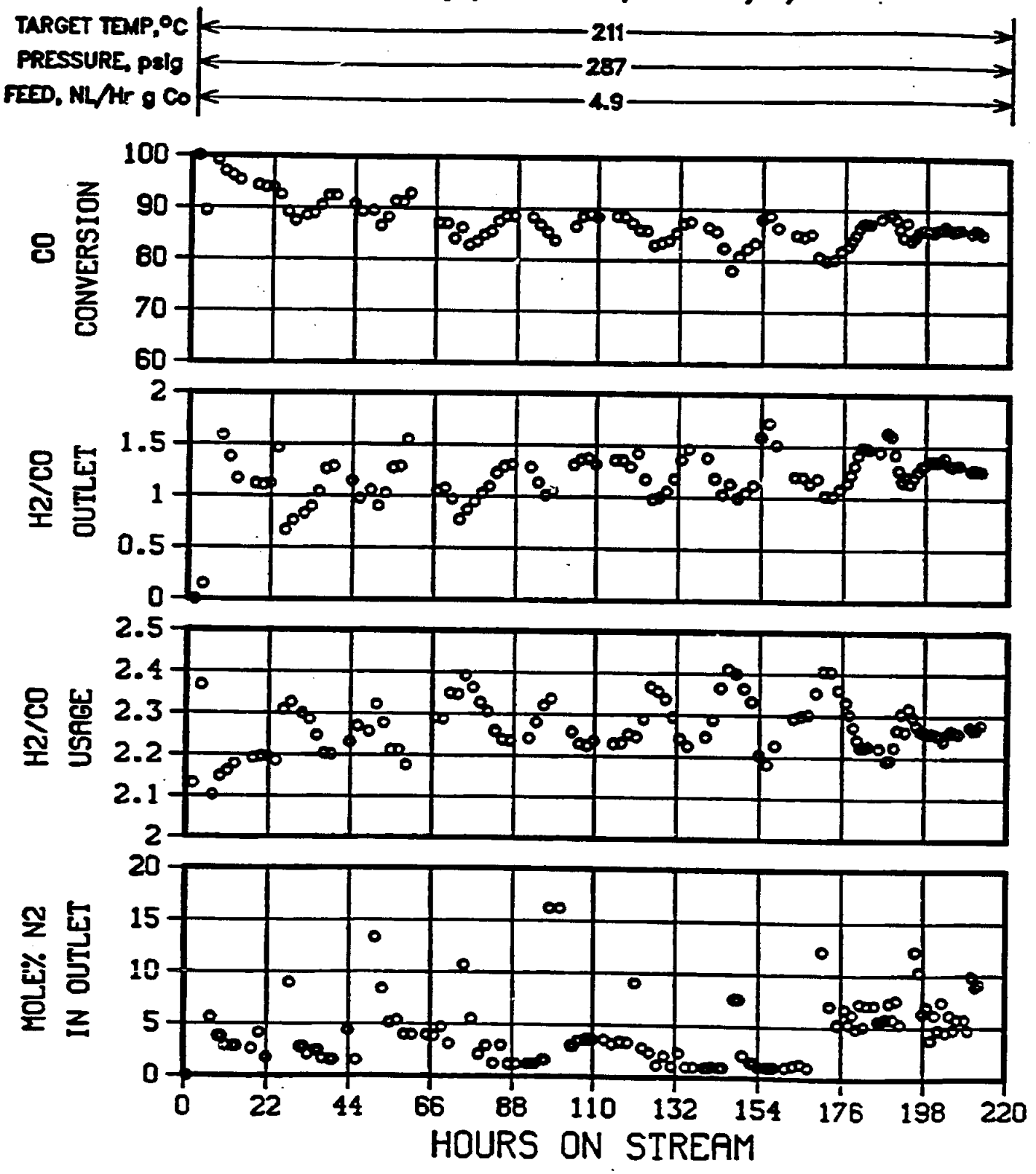


FIGURE 144

PLT 700 RUN 123 Co,Mn,Zr On steamed, acid washed Y–ZLT.

6827–161 w/28.7 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 6/20——>6/29/93

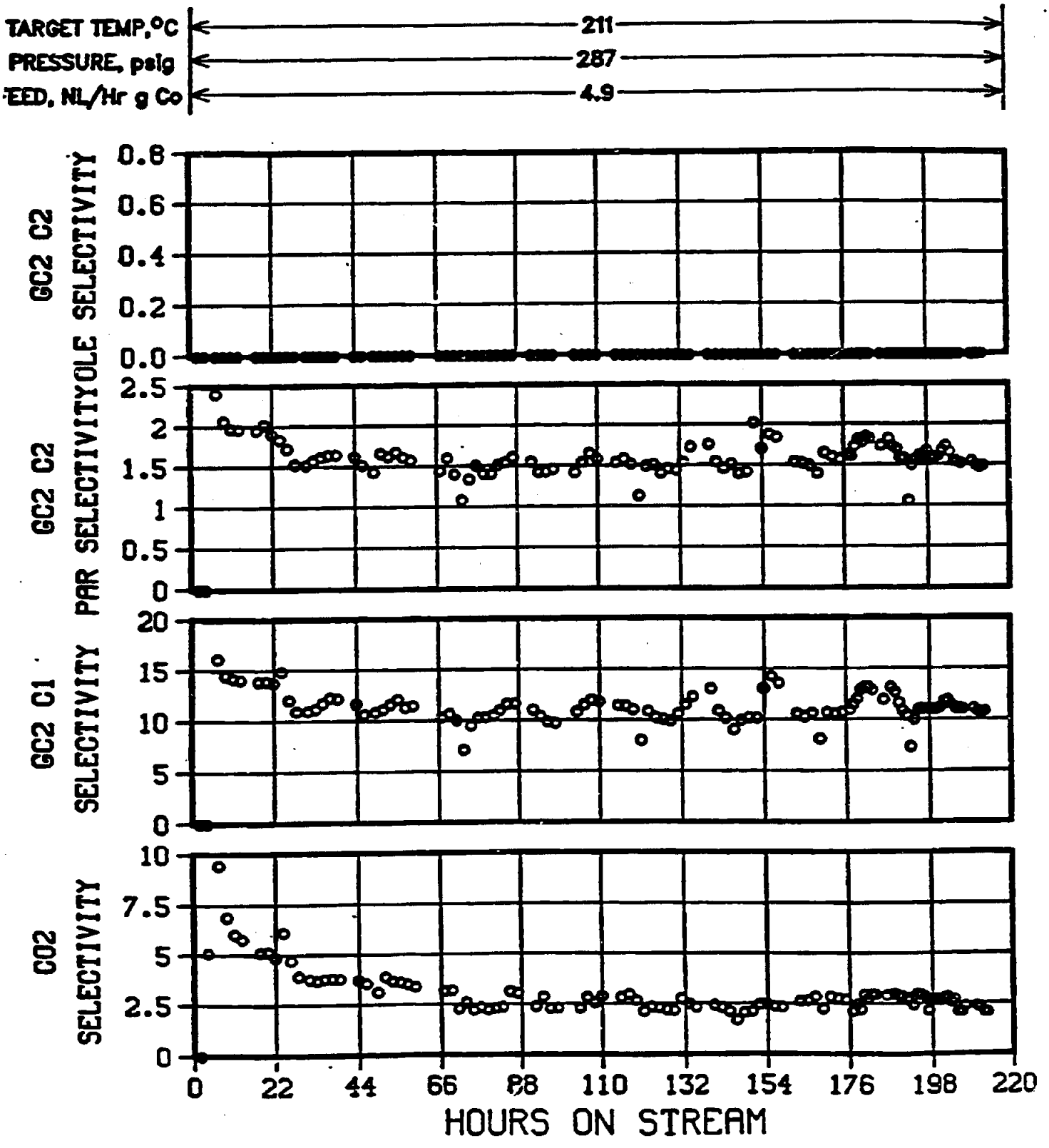


FIGURE 145

PLT 700 RUN 123 Co,Mn,Zr On steamed, acid washed Y–ZLT.

6827–161 w/28.7 % Co via eth–glycol pore fill

6.5g active in 166.5g quartz sand 6/20——>6/29/93

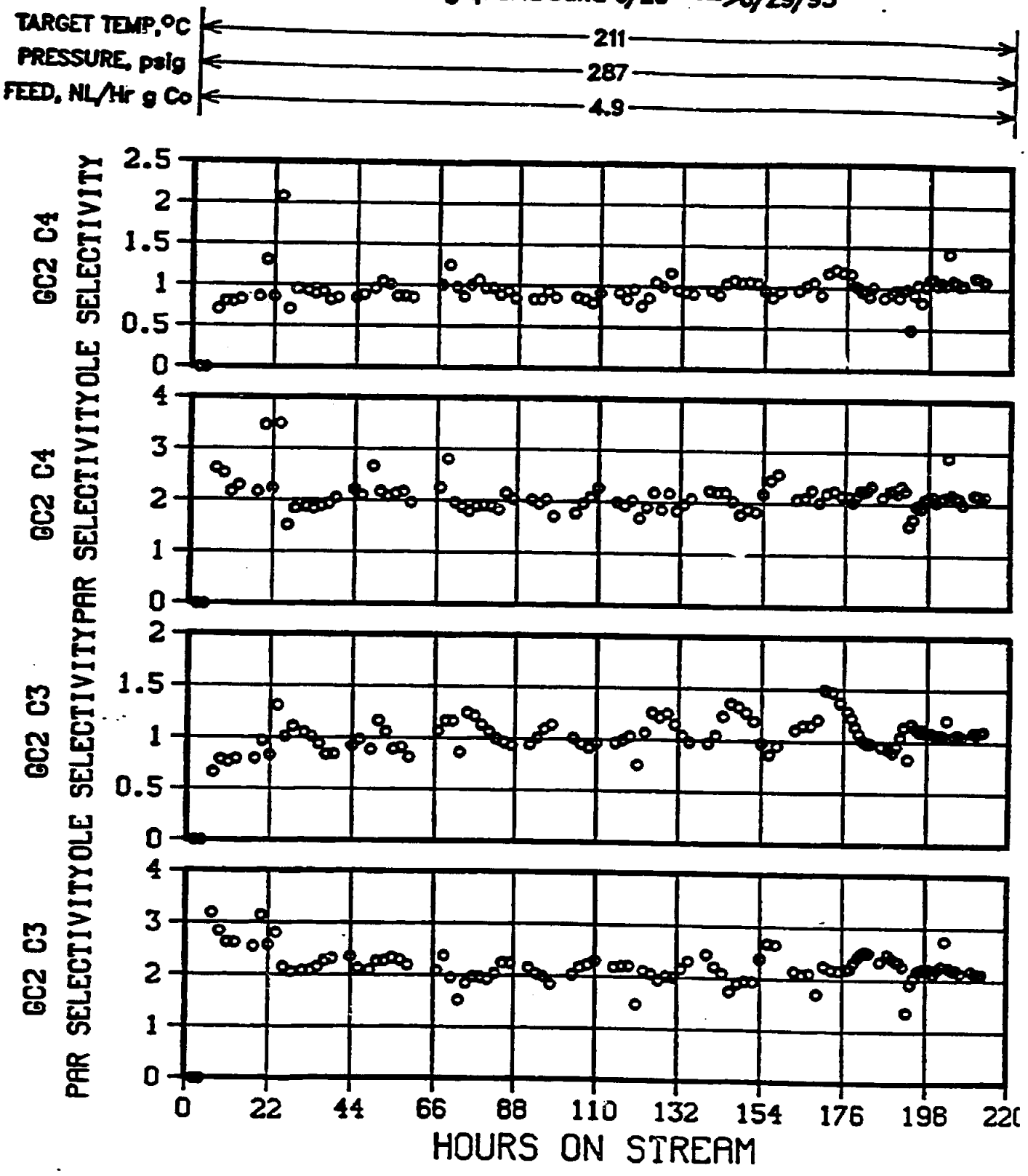


FIGURE 146

COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR

PLT 701 R-73 66.5g 6827-178 in 290g C_{30} oil

H_2:CO in feed = 2.0, stirrer rpm = 1100

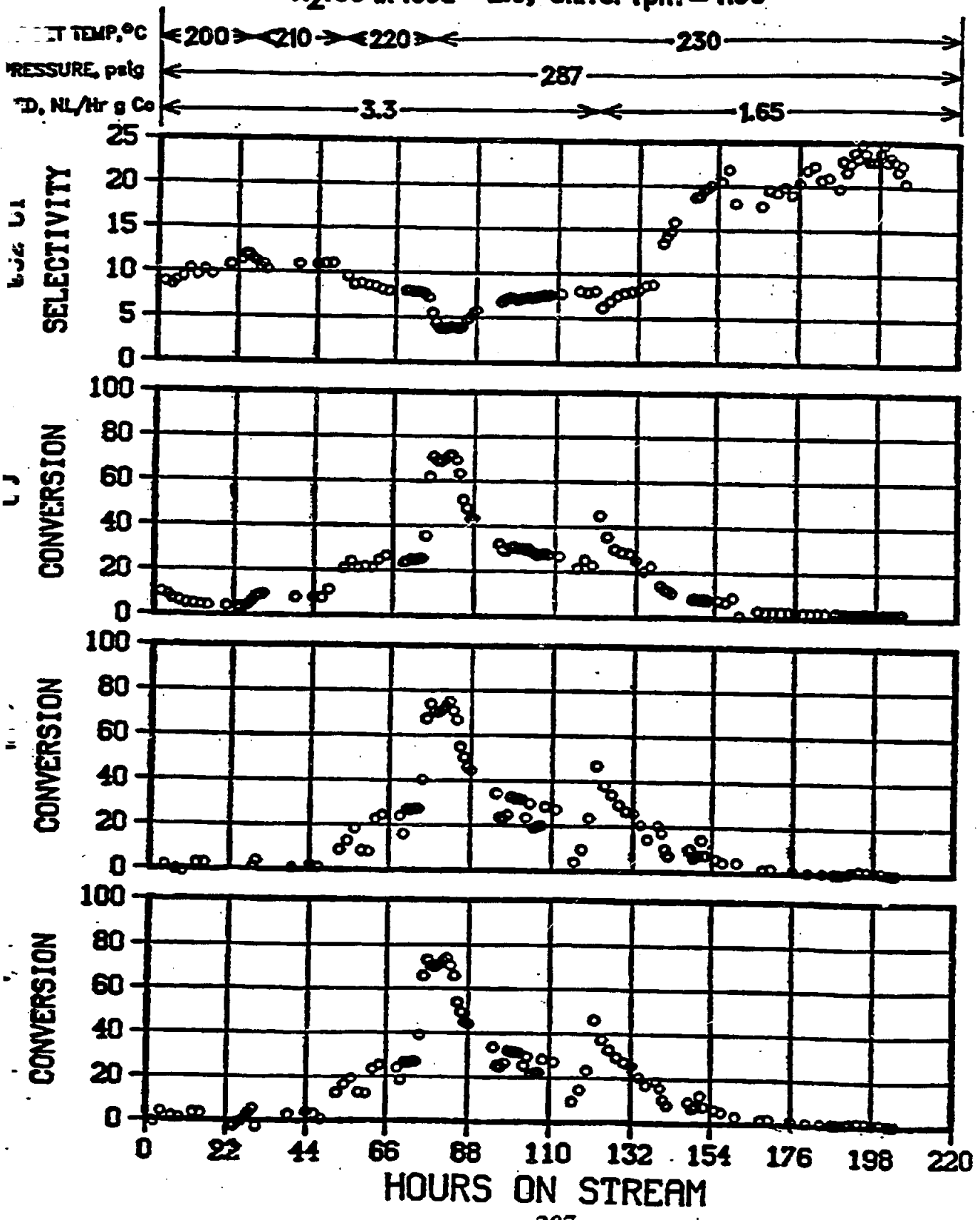


FIGURE 147

COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR

PLT 701 R-73 66.5g 6827-178 In 290g C_{30} oil

H_2:CO in feed = 2.0, stirrer rpm = 1100