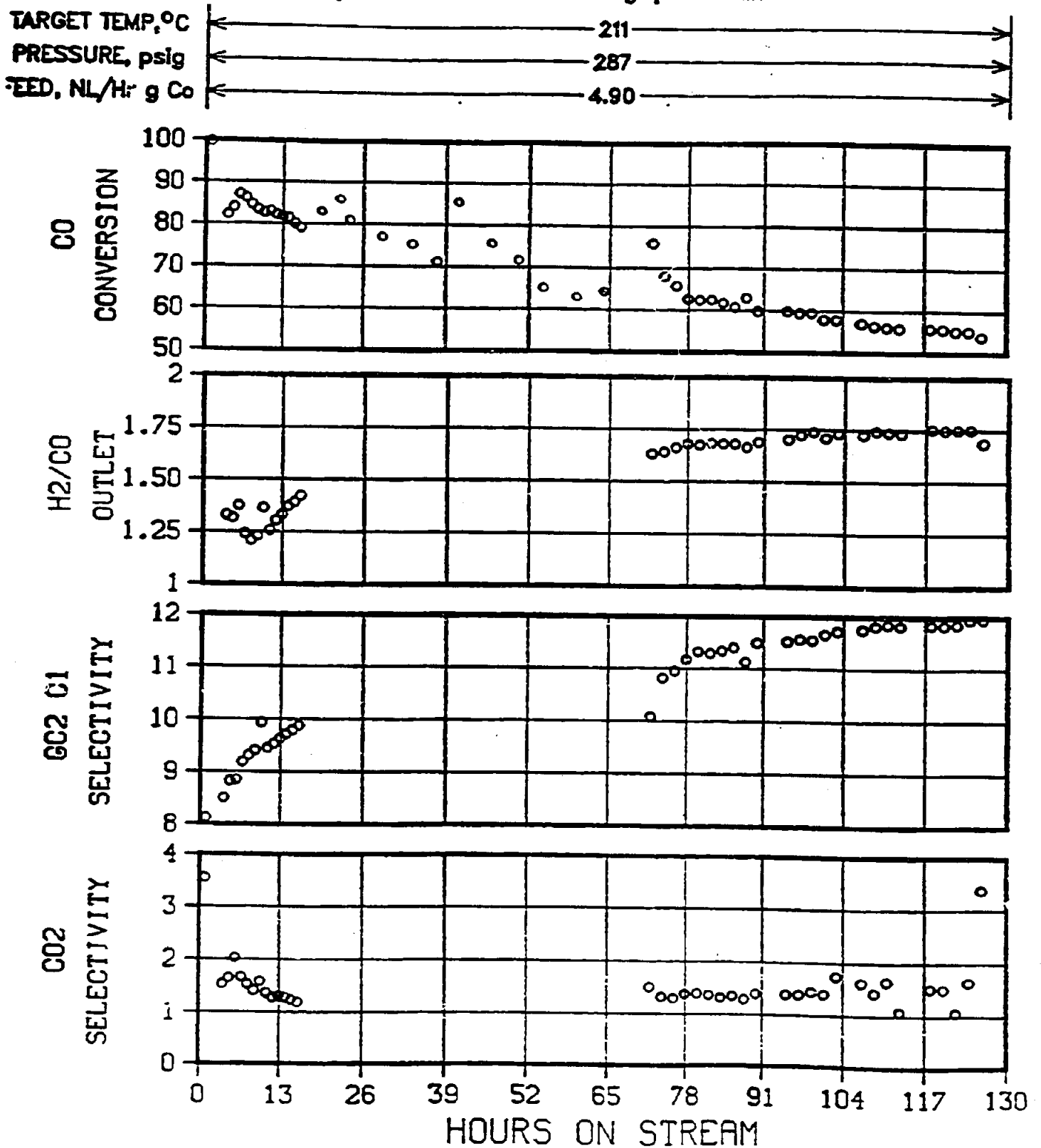


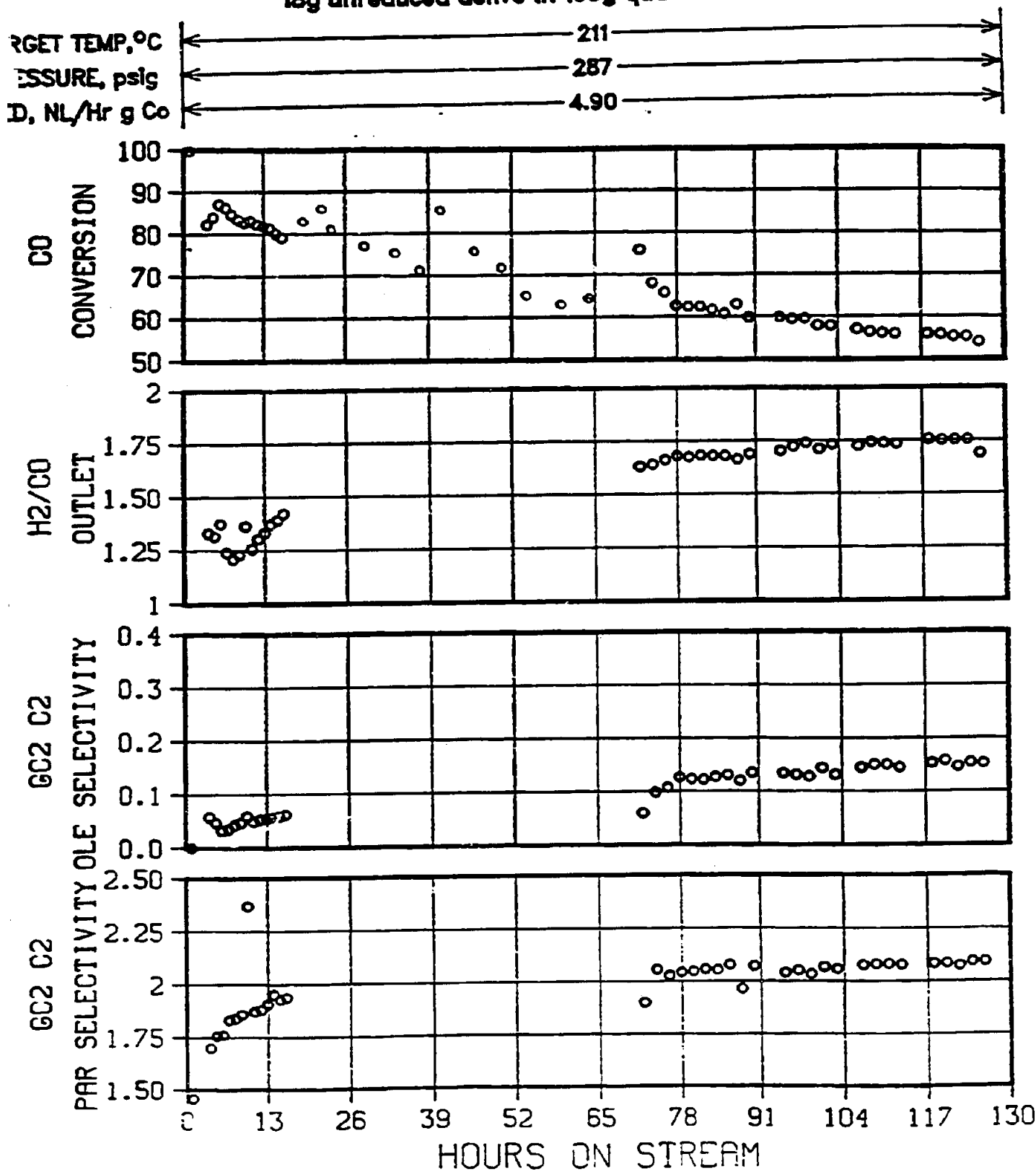
**FIGURE 98**

**PLANT 700 RUN 99 Co, Mn, Zr, Ru on HCl washed Y**  
**6827-83 w/12.7 % Co via eth-glycol pore fill**  
**18g unreduced active in 160g quartz sand**



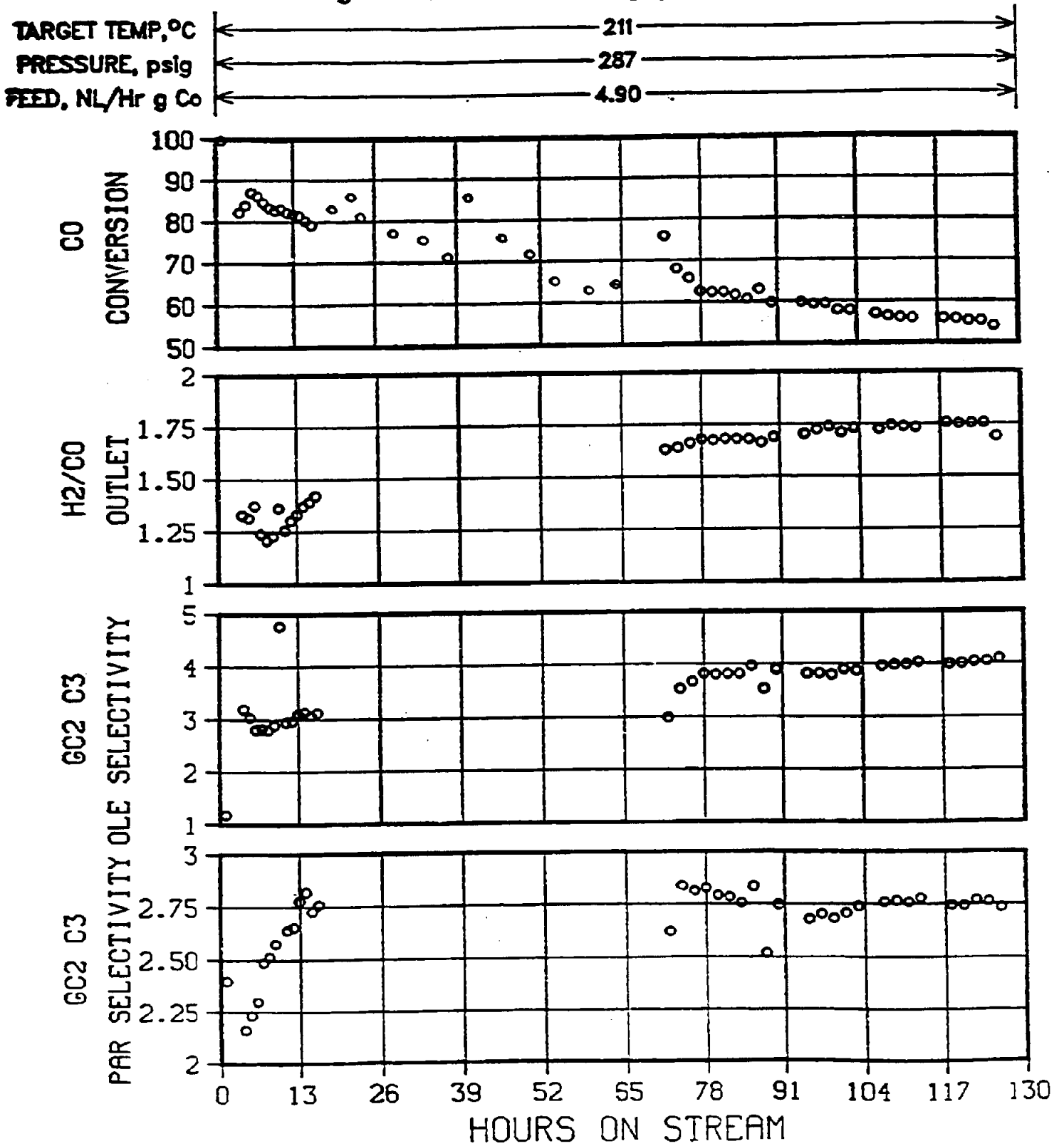
# FIGURE 99

PLANT 700 RUN 99 Co,Mn,Zr,Ru on HCl washed Y  
 6827-83 w/12.7 % Co via eth-glycol pore fill  
 18g unreduced active in 160g quartz sand



**FIGURE 100**

**PLANT 700 RUN 99 Co,Mn,Zr,Ru on HCl washed Y**  
**6827-83 w/12.7 % Co via eth-glycol pore fill**  
**18g unreduced active in 160g quartz sand**

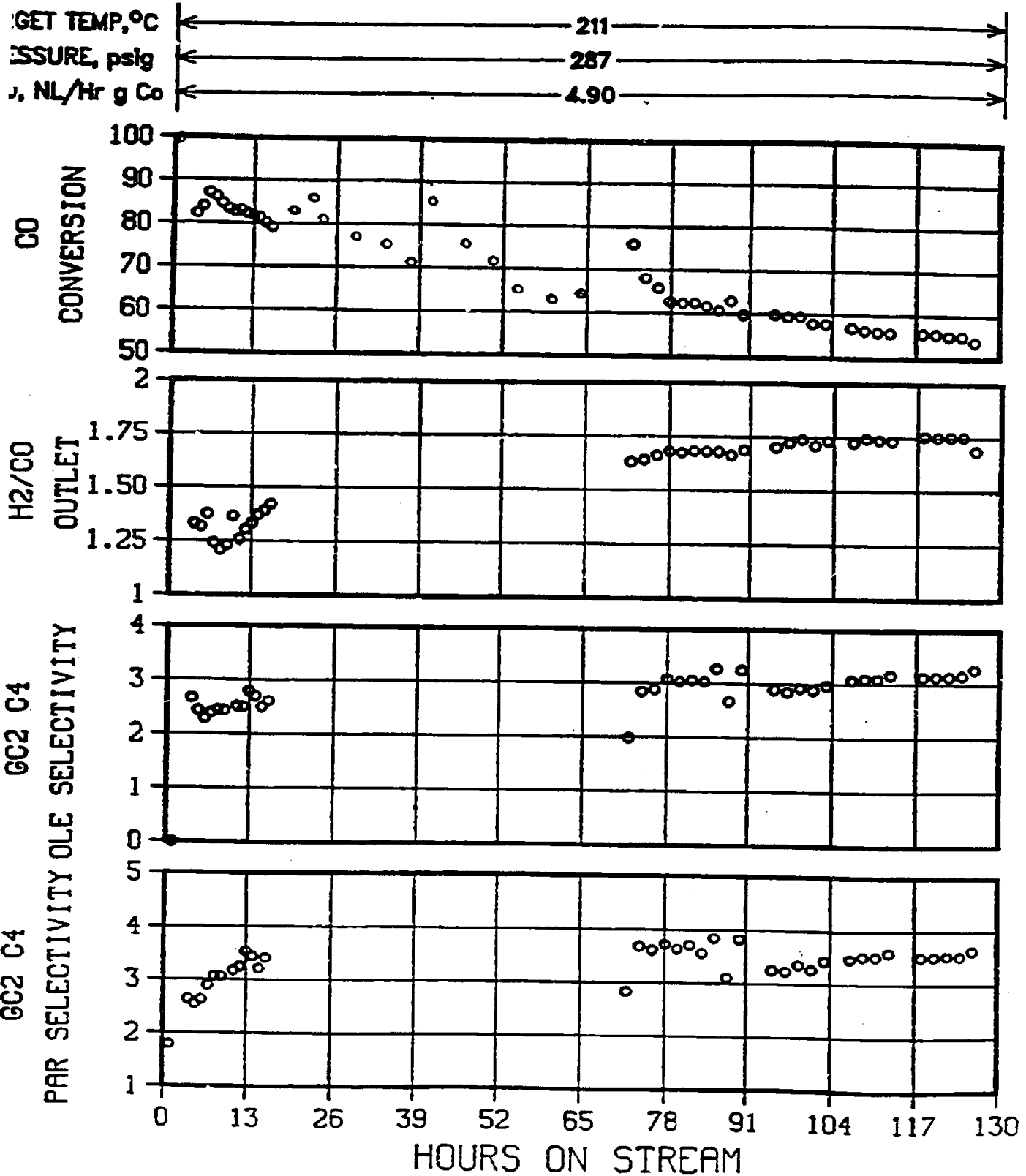


**FIGURE 101**

**PLANT 700 RUN 99 Co,Mn,Zr,Ru on HCl washed Y**

**6827-83 w/12.7 % Co via eth-glycol pore fill**

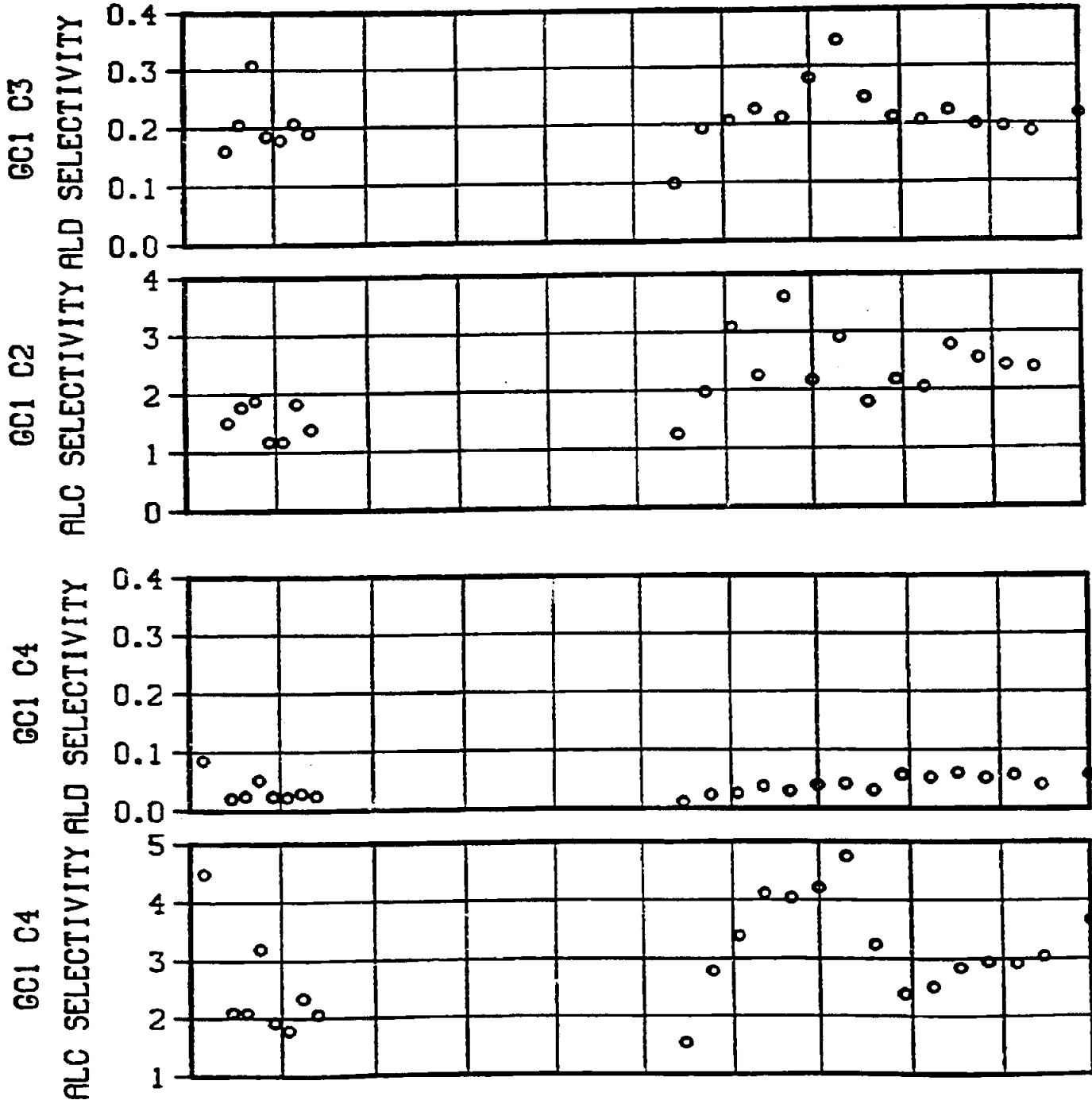
**18g unreduced active in 160g quartz sand**



**FIGURE 102**

**PLANT 700 RUN 99 Co,Mn,Zr,Ru on HCl washed Y**  
**6/27-83 w/12.7 % Co via eth-glycol pore fill**  
**18g unreduced active in 160g quartz sand**

TARGET TEMP, °C ← 211 →  
PRESSURE, psig ← 287 →  
FEED, NL/Hr g Co ← 4.90 →



PERFORMANCE OF UNBOUND AND BOUND CATALYSTS

FIGURE 103

PLT/RUN NO.	700/97	700/99	701/61
REACTOR	TUBE		
LOADING CATALYST/DILUENT	UNBOUND/13 QUARTZ SAND/160	BOUND/18 QUARTZ SAND/160	BOUND/18 C <sub>3</sub> OIL/290
CATALYST PRETREATMENT	350°C/H <sub>2</sub> /2 HRS		
FEED H <sub>2</sub> :CO	2.1		
TEST CONDITIONS			
FEED RATE (NL/HR · G Co)	4.9	4.9	4.9
TEMP, °C	211(INLET)	211(INLET)	221
PRESS, PSIG	287	287	287
PERFORMANCE SUMMARY			
CONVERSION, %			
CO	72	55	58
H <sub>2</sub>	80	60	60
SELECTIVITY, MOL%			
C <sub>1</sub>	13	12	10
C <sub>2</sub>	1.8	2.1	1.9
C <sub>3</sub>	0.1	0.1	0.1
CO <sub>2</sub>	0.8	1.5	2.0
1. AT 130 HOURS ON STREAM			

# Temp Profiles RUN 99

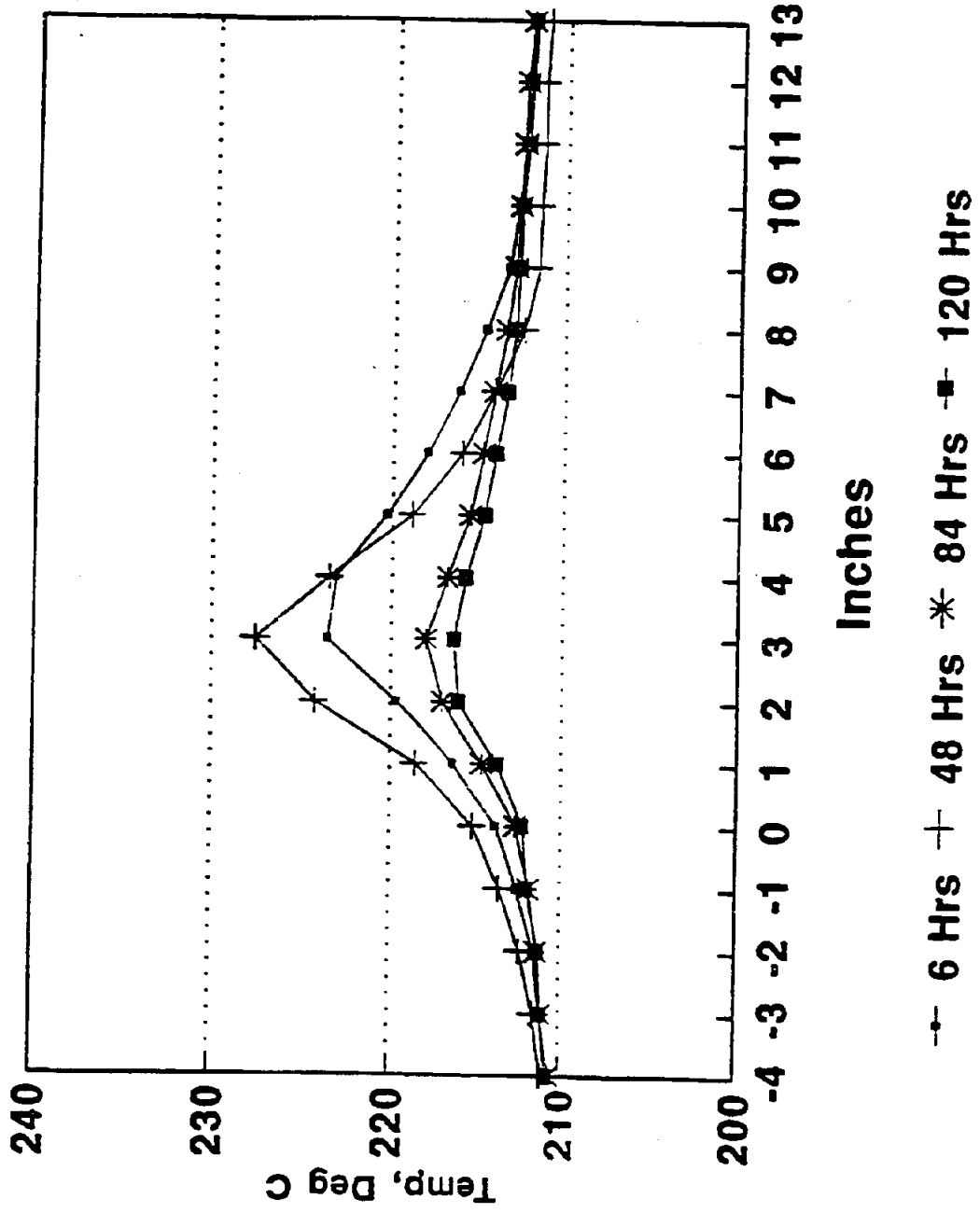


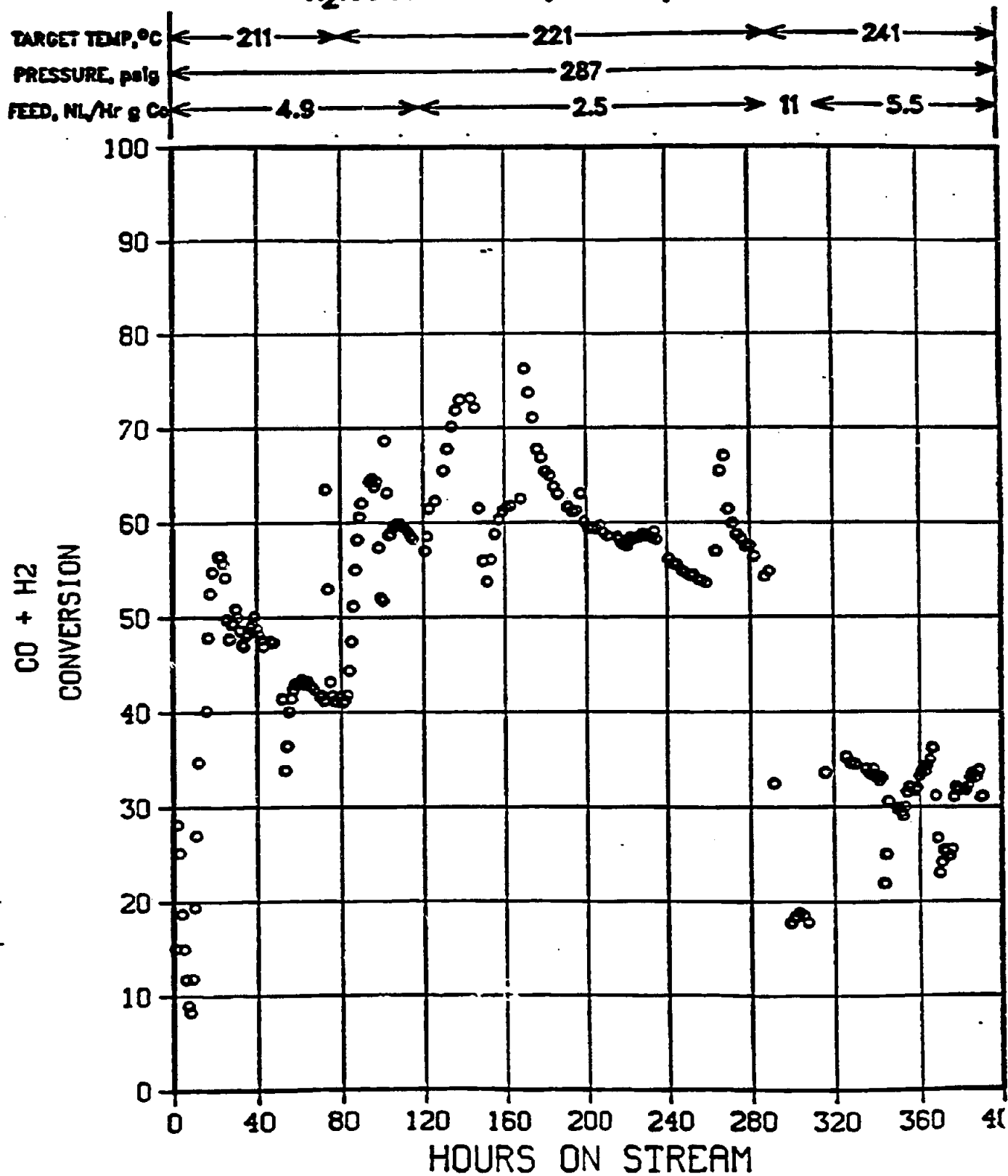
FIGURE 104

**FIGURE 105**

**COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR**

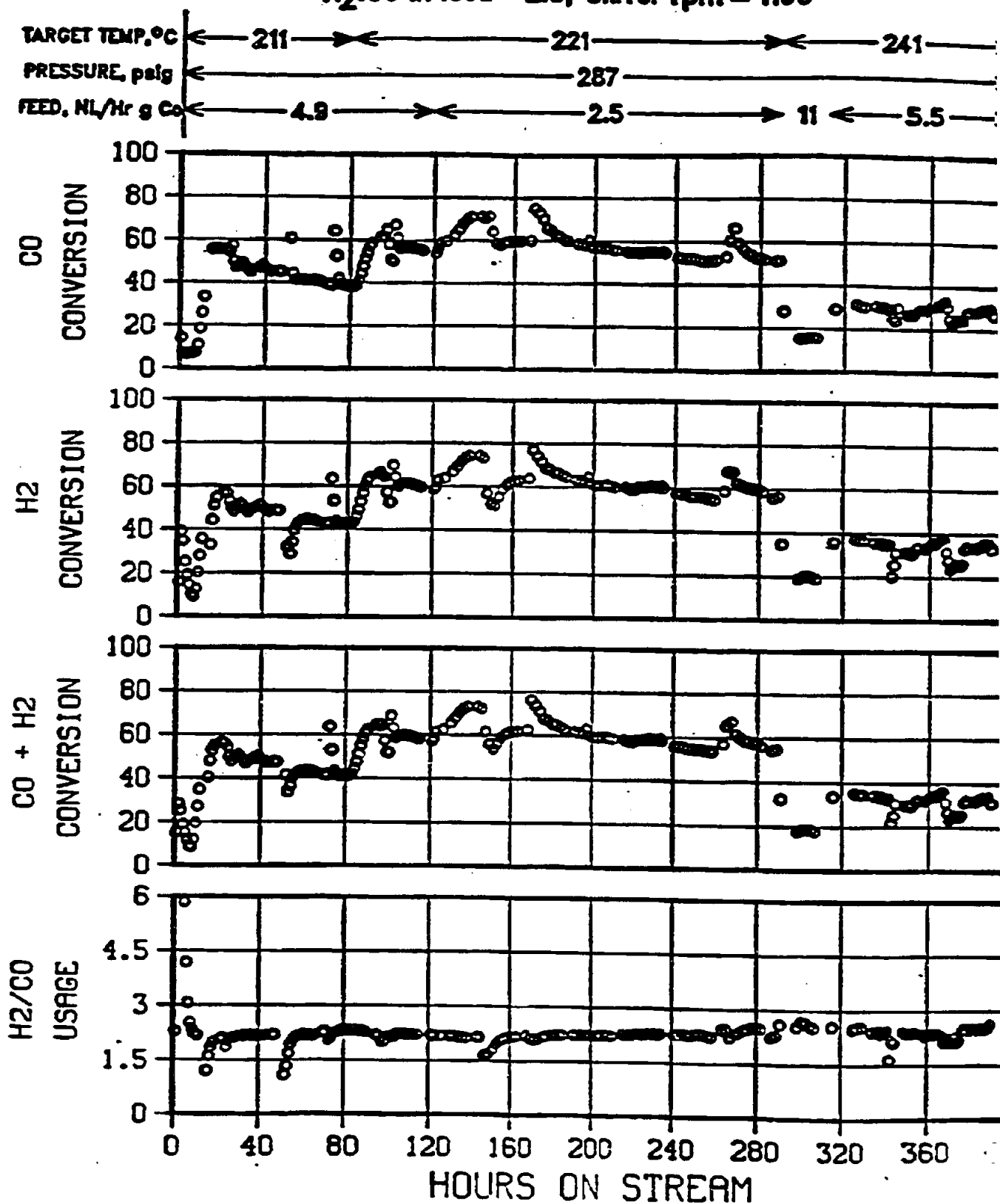
PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil

H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100





**FIGURE 106**  
**COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR**  
**PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil**  
**H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100**



**FIGURE 107**

**COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR**

PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil

H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100

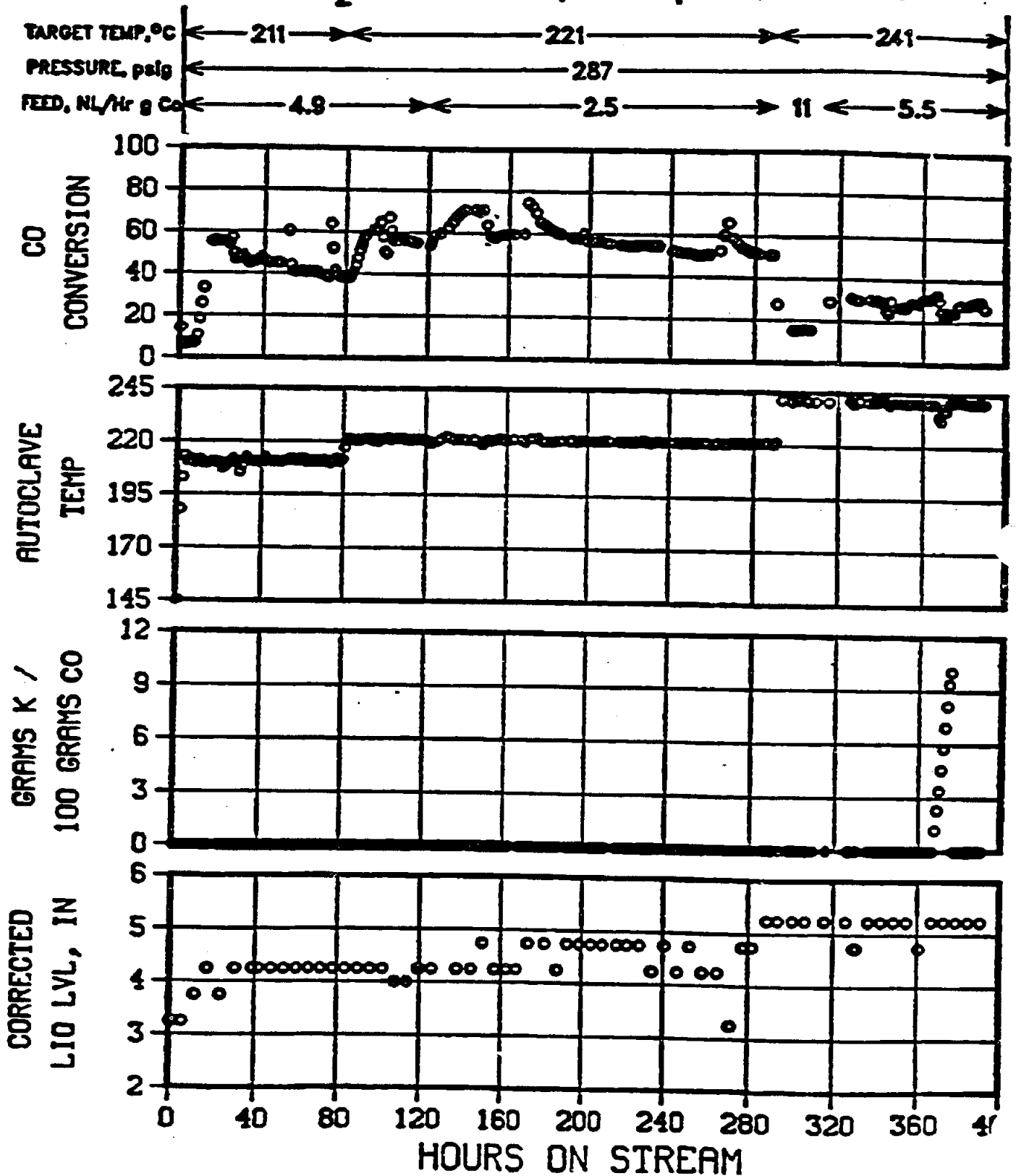


FIGURE 108

COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACT

PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil

H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100

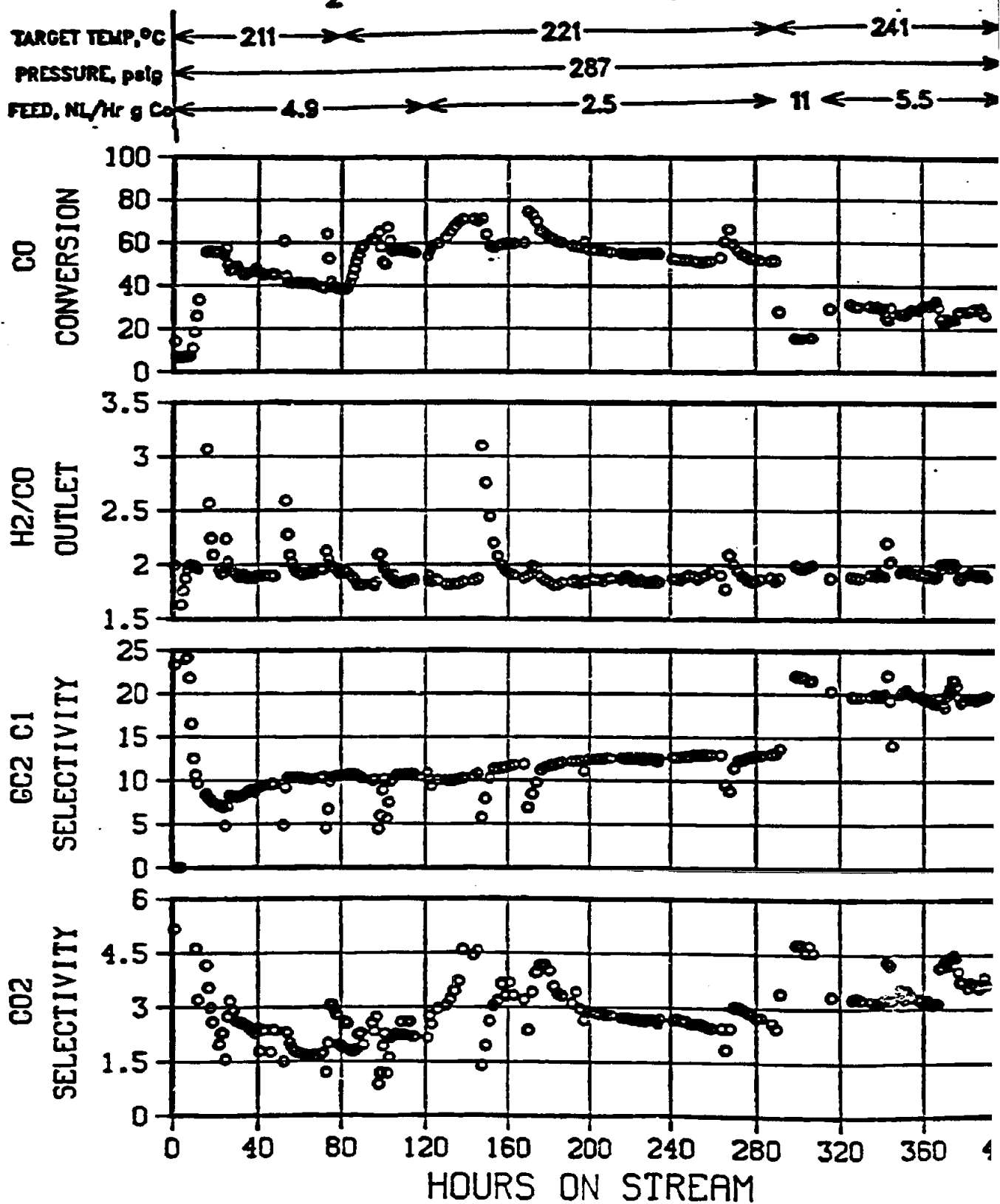


FIGURE 10

COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR

PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil

H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100

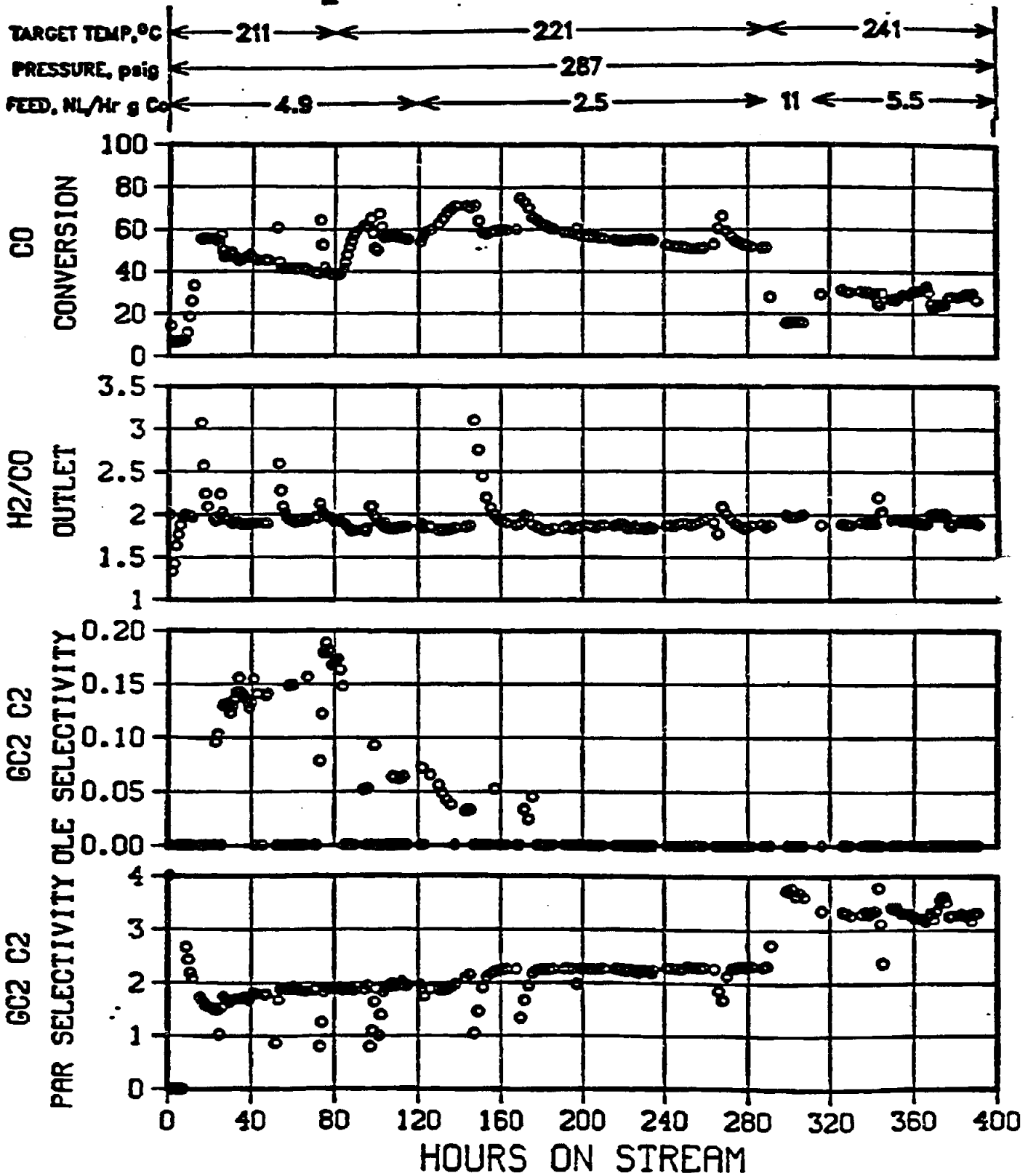
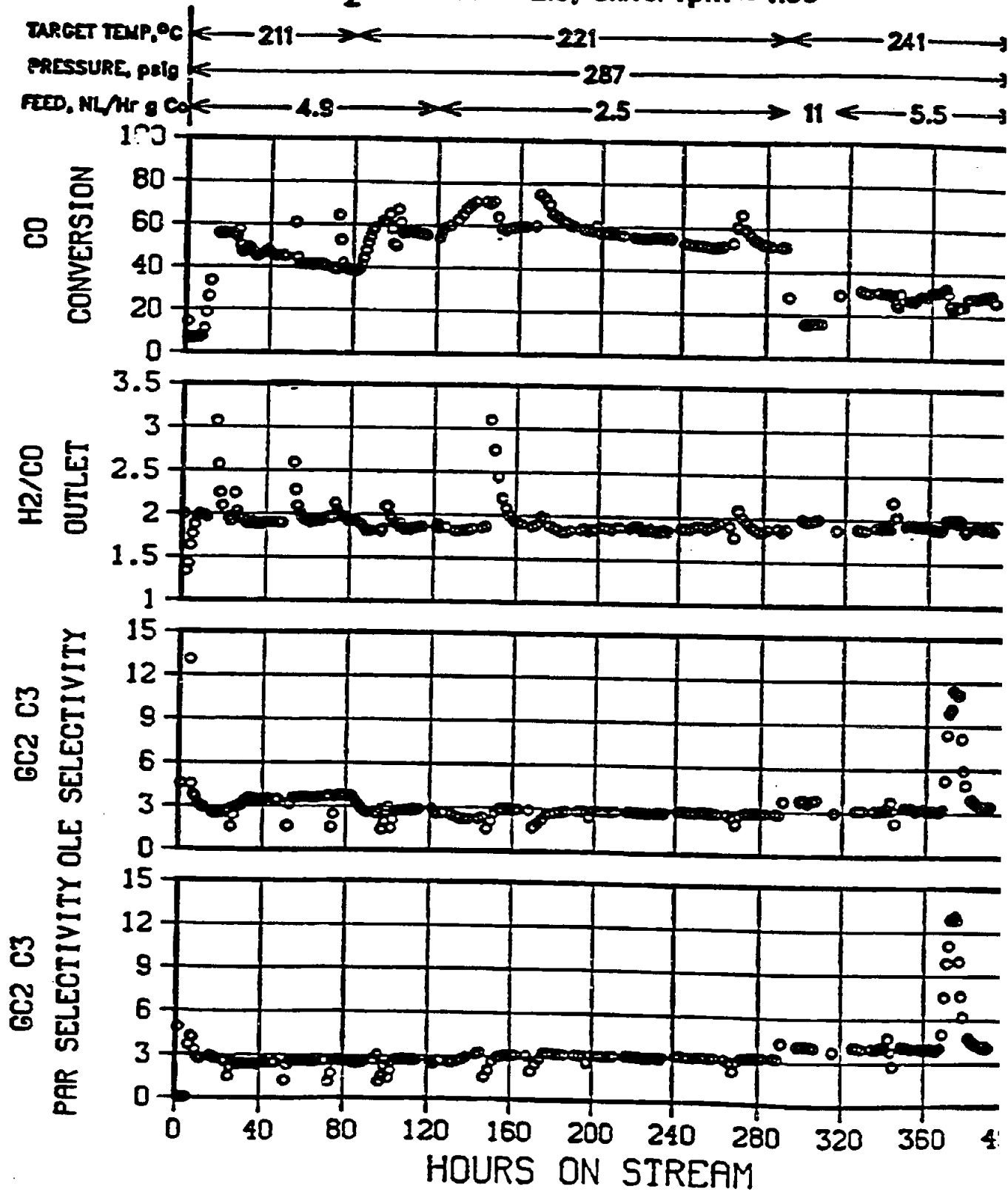


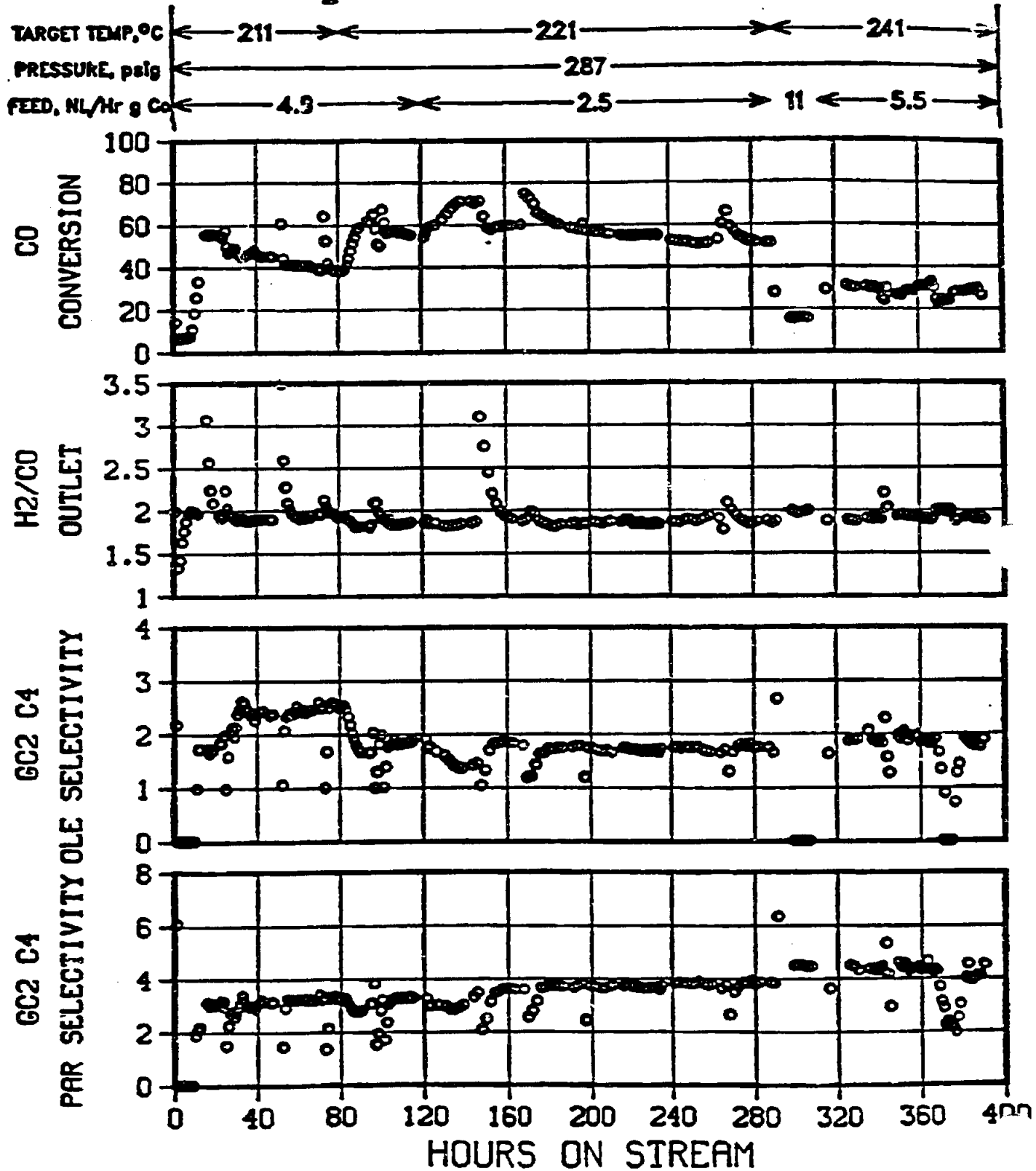
FIGURE 110

COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REAC  
PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil  
H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100

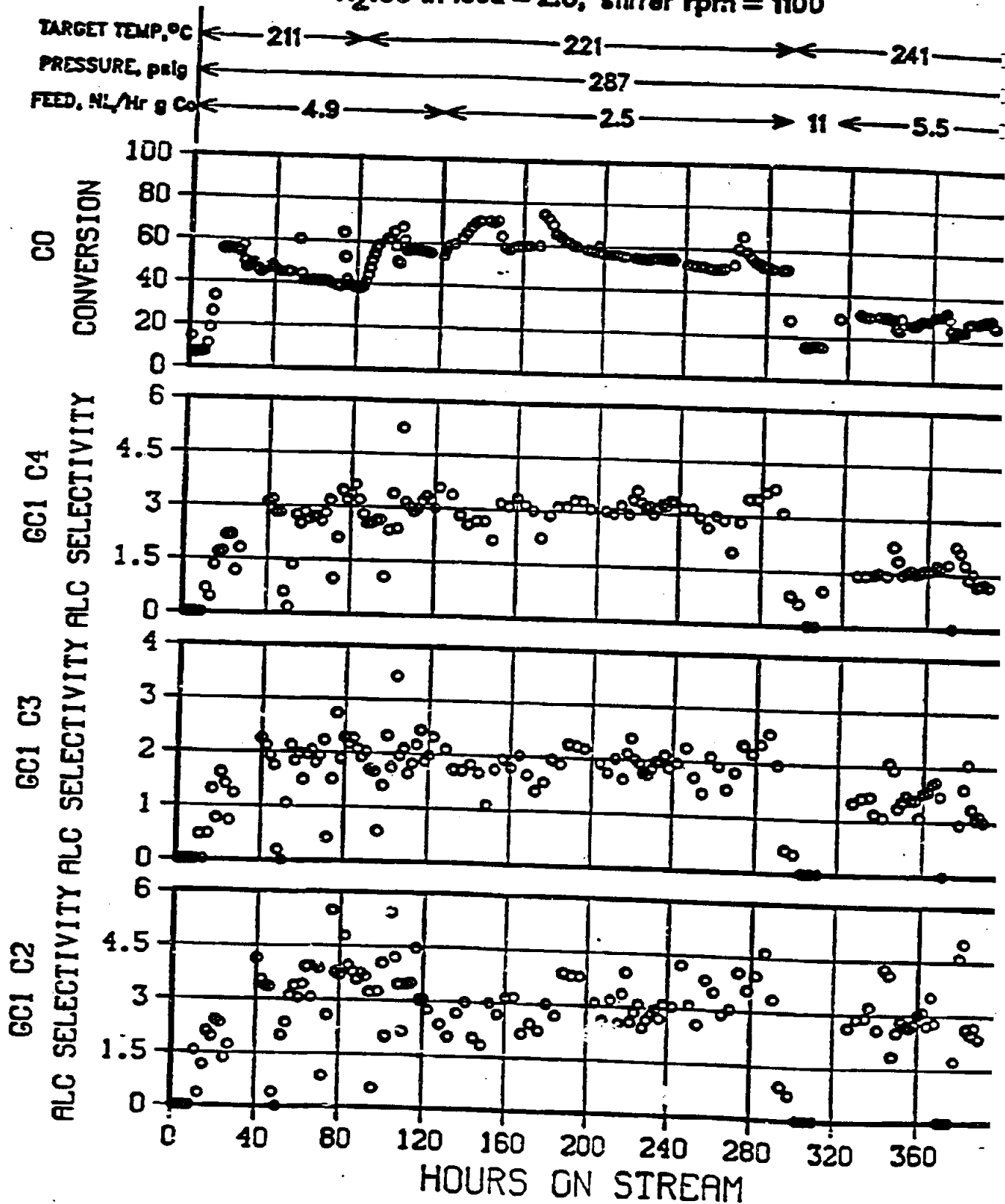


**FIGURE 111**

**COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REACTOR**  
**PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil**  
**H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100**



**FIGURE 112**  
**COBALT BASE CATALYST IN THE SLURRY AUTOCLAVE REAC**  
**PLT 701 R-61 18g 6827-105 in 290g C<sub>30</sub> oil**  
**H<sub>2</sub>:CO in feed = 2.0, stirrer rpm = 1100**



**FIGURE 113**

**EFFECT OF REDUCTION CONDITIONS ON CATALYST PERFORMANCE  
SUMMARY OF SCREENING IN FIXED-BED PLANT**

RUN NO.	104	97	102
<b>LOADING</b> CATALYST, G DILUENT, G		13 160	
<b>CATALYST PRETREAT.</b>	325°/H <sub>2</sub> /2 HRS	350°/H <sub>2</sub> /2 HRS	375°/H <sub>2</sub> /2 HRS
<b>TEST CONDITIONS</b> FEED H <sub>2</sub> /CO FEED RATE (NL/HR · G Co) TEMP, °C PRESSURE, PSIG	2.1 4.9 211(INLET) 287		
<b>PERFORMANCE SUMMARY<sup>1</sup></b>			
<b>CONVERSION, %</b> CO + H <sub>2</sub> CO	72 67	78 72	49 47
<b>SELECTIVITY, MOLE %</b> C <sub>1</sub> C <sub>2</sub> C <sub>2</sub> <sup>-</sup> C <sub>3</sub> C <sub>3</sub> <sup>-</sup> CO <sub>2</sub>	11.8 1.9 0.1 3.1 2.0 1.8	13 1.8 0.1 3.0 2.1 0.8	13 2.0 0.2 3.5 2.7 1.0

1. AT 100 HOURS ON STREAM



# FIGURE 114

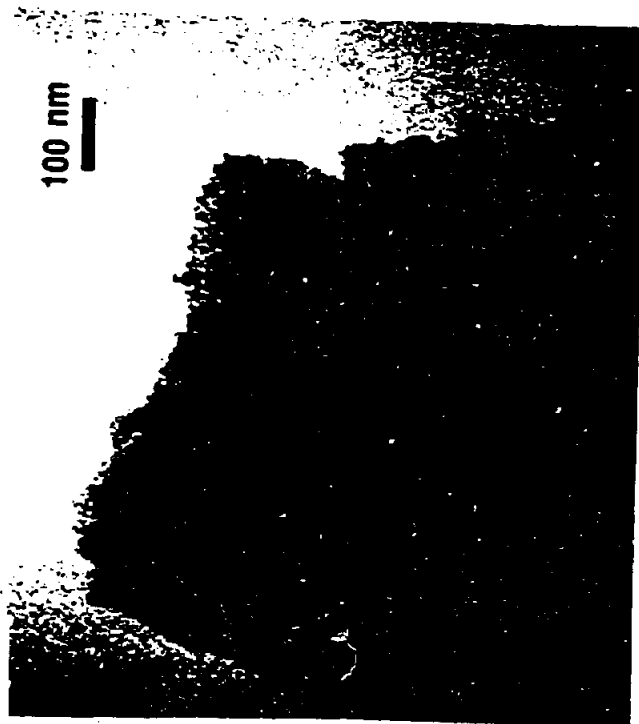


Figure 2 - Composition of Crystallites for 6827-99

Location	% Mn	% Co	% Ru
D	8.1	88.9	3.0
E	12.6	87.4	
F	7.2	90.3	2.5
G	12.0	83.4	3.6



Figure 1 - Composition of Crystallites for 6827-99

Location	% Mn	% Co	% Ru
A	9.3	88.3	2.4
B	15.4	78.8	5.8
C	15.6	80.1	4.3



Figure 3 - Composition of Crystallites for 6827-99

Location	% Mn	% Co	% Ru
H	10.9	89.1	
I	17.0	87.0	
J	14.3	66.9	16.5
K	15.4	78.8	5.8



Figure 4 - Composition of Crystallites for 6827-123

Location	% Mn	% Co	% Ru
1	2.8	97.3	
2	4.7	95.3	
3	8.4	90.7	0.7
4	6.3	93.1	0.6
5	4.2	95.8	
6	10.0	87.9	2.1



100 nm



Figure 5 - Composition of Crystallites for 6827-123

Location	% Mn	% Co	% Ru
a	3.1	96.9	
b	8.5	90.6	0.9
c	2.0	98.0	
d	3.9	96.1	
e	2.9	97.1	
f	.31	96.9	
g	8.7	89.5	1.8

## FIGURE 115

Figure 6 - Raney-Type Morphology for 6827-123

## FIGURE 116

COMPOSITION OF CRYSTALLITES FOR 6827-99  
(atomic percent)

Size Range (nm)	Mn	Co	Zr	Ru
≥ 30	11.4 ± 4.4	85.5 ± 4.0	1.4 ± 2.4	2.5 ± 1.8
3-30	12.8 ± 5.9	78.6 ± 8.9	8.1 ± 5.3	1.3 ± 2.3
<3	14.5 ± 4.7	71.6 ± 4.1	11.8 ± 5.3	2.1 ± 2.9

COMPOSITION OF CRYSTALLITES FOR 6827-123  
(atomic percent)

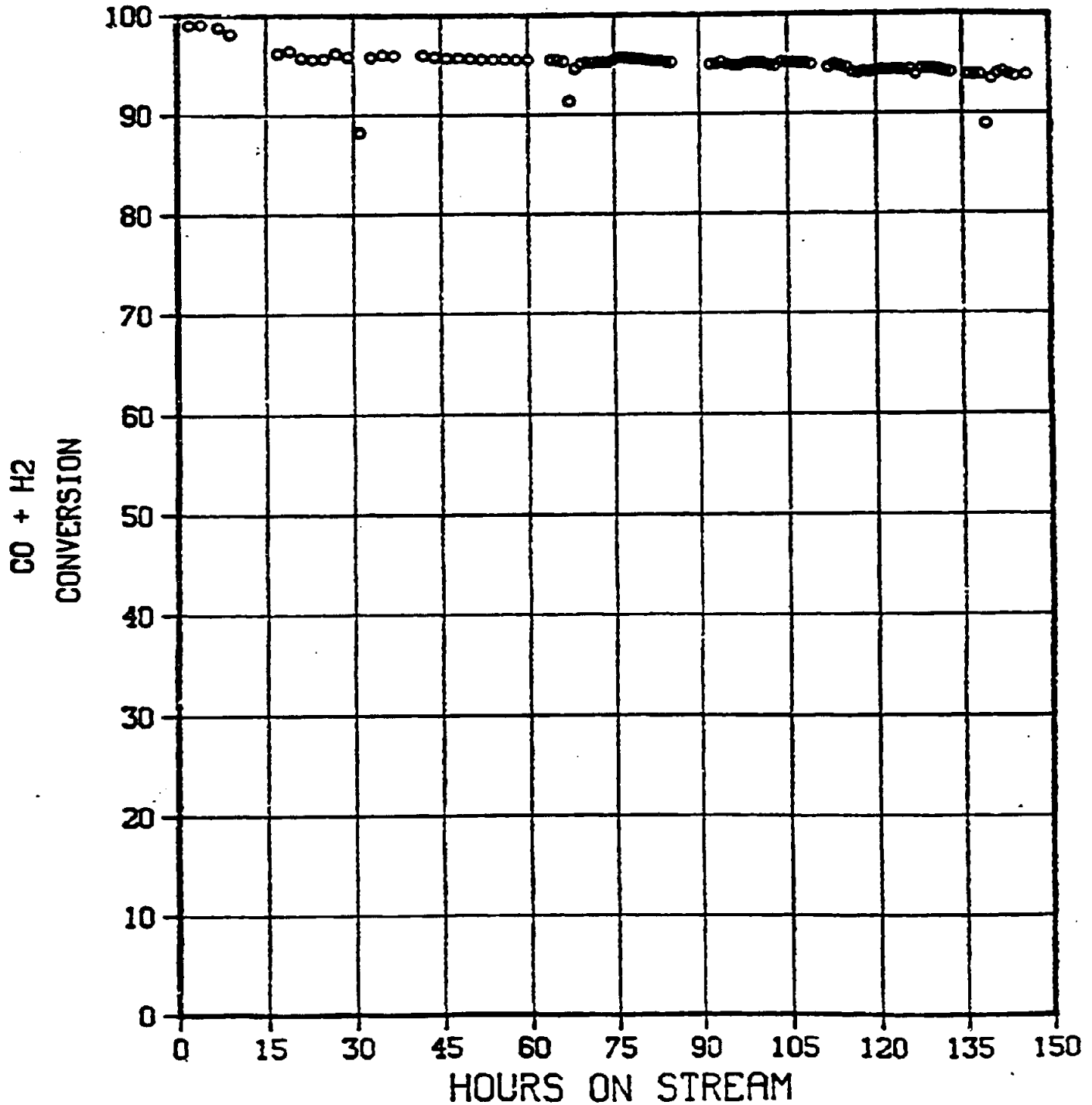
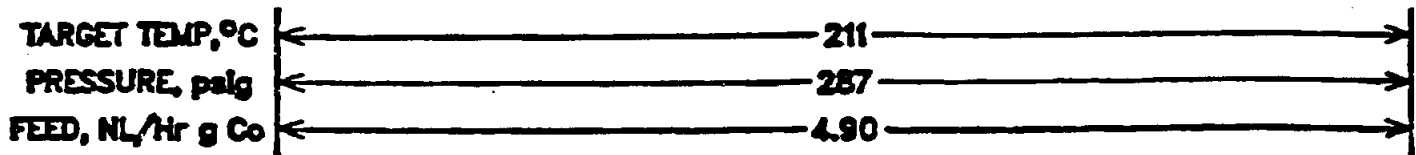
Size Range (nm)	Mn	Co	Zr	Ru
≥ 30	4.2 ± 2.0	95.4 ± 2.2	0.04 ± 0.14	0.4 ± 0.4
3-30	6.4 ± 1.9	92.9 ± 2.2	0.4 ± 0.4	0.4 ± 0.5
<3	8.6 ± 1.3	89.4 ± 1.3	1.9 ± 0.4	0.1 ± 0.2

**FIGURE 117**

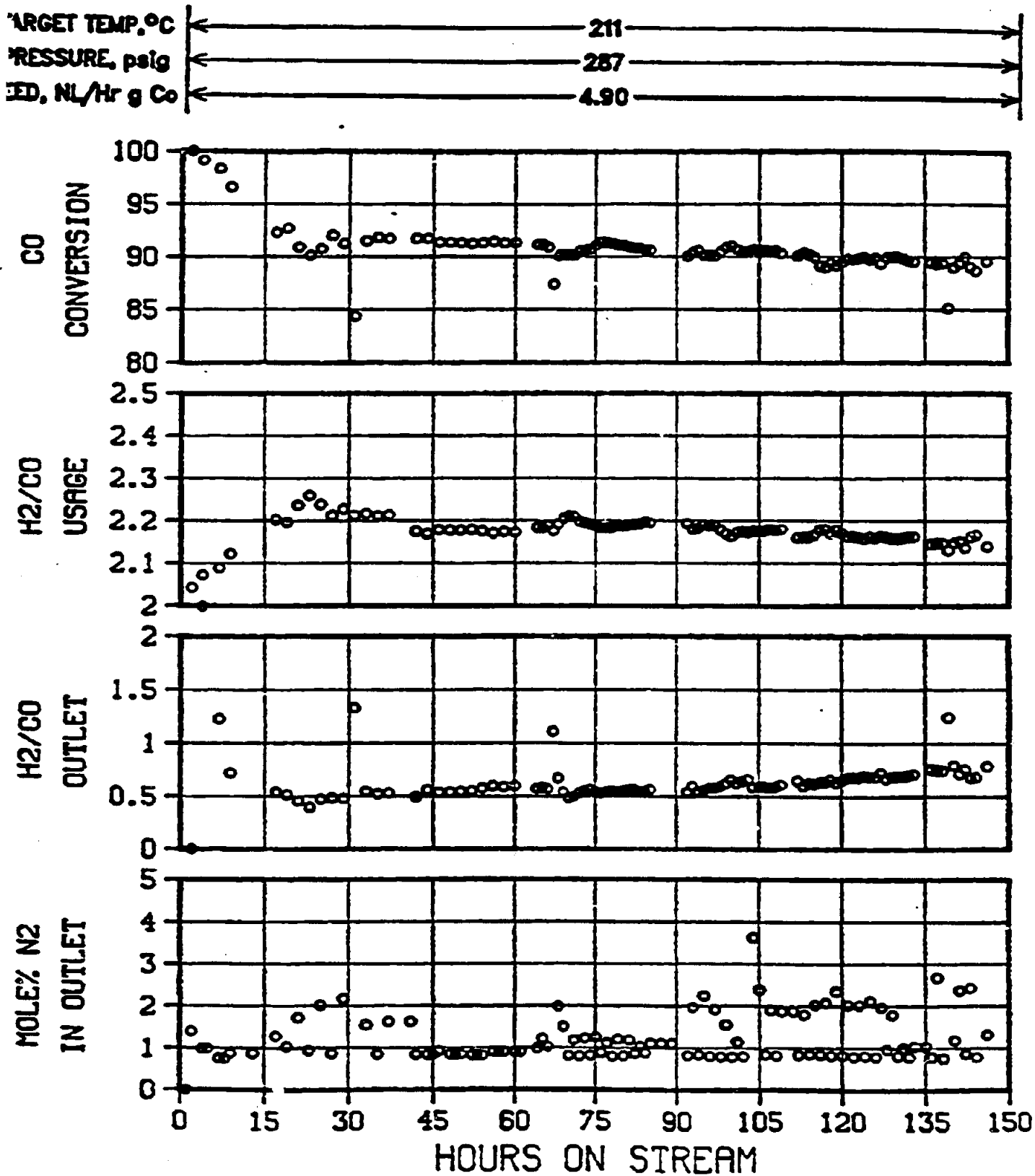
**PLANT 700 RUN 101 Co,Mn,Zr,Ru ON HCL Washed Y**

6827-95 w/27.4 % Co via eth-glycol pore fill

18g unreduced active in 160g quartz sand



**FIGURE 118**  
**PLANT 700 RUN 101 Co,Mn,Zr,Ru ON HCL Washed Y**  
 6827-95 w/27.4 % Co via eth-glycol pore fill  
 18g unreduced active in 160g quartz sand

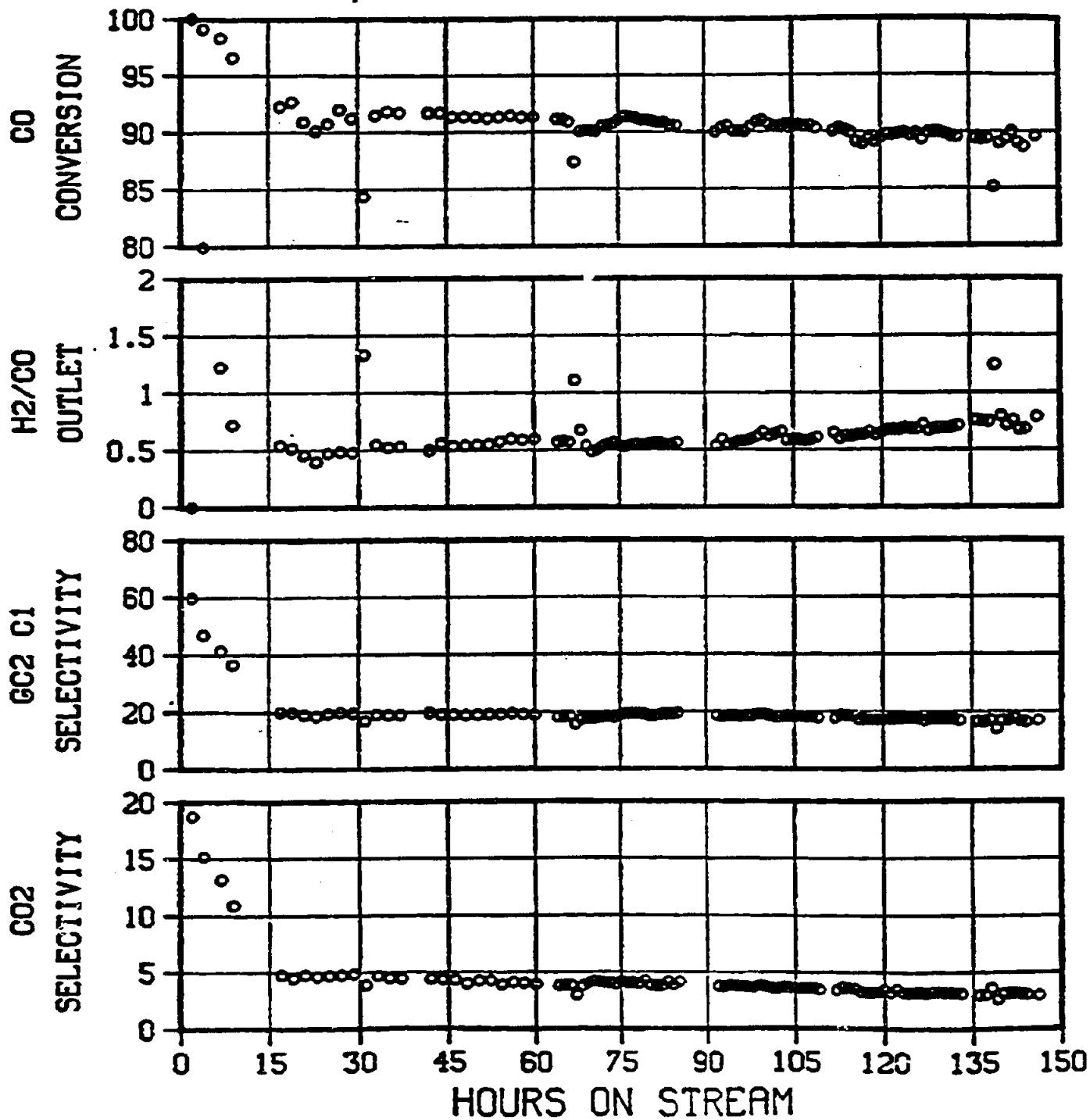
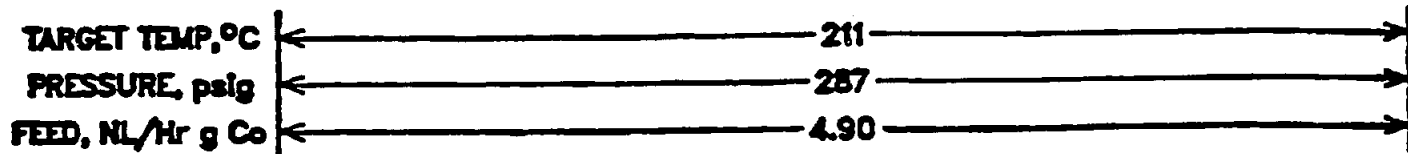


**FIGURE 119**

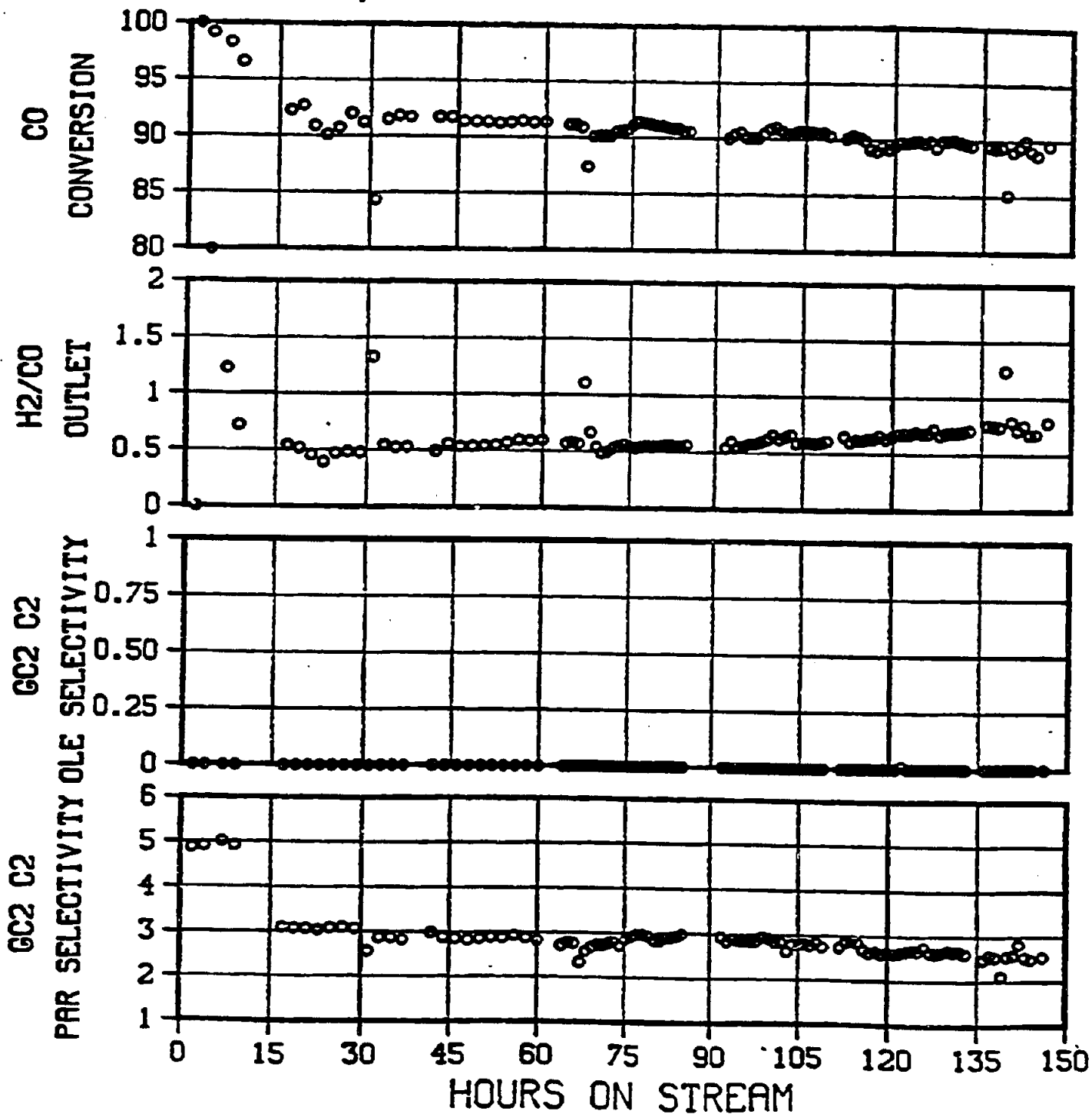
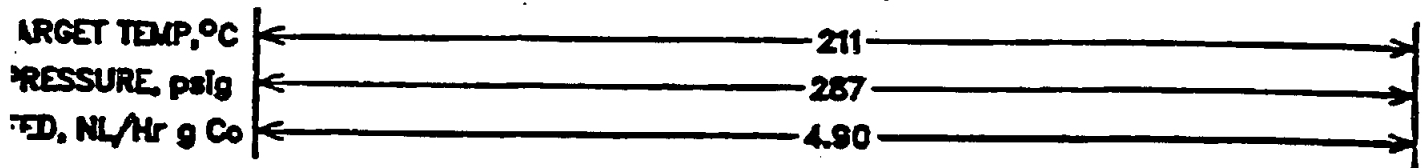
**PLANT 700 RUN 101 Co,Mn,Zr,Ru ON HCL Washed Y**

6&Z1-95 w/71.4 % Co via eth-glycol pore fill

18g unreduced active in 160g quartz sand



**FIGURE 120**  
**PLANT 700 RUN 101 Co, Mn, Zr, Ru ON HCL Washed Y**  
 6827-95 w/27.4 % Co via eth-glycol pore fill  
 18g unreduced active in 160g quartz sand

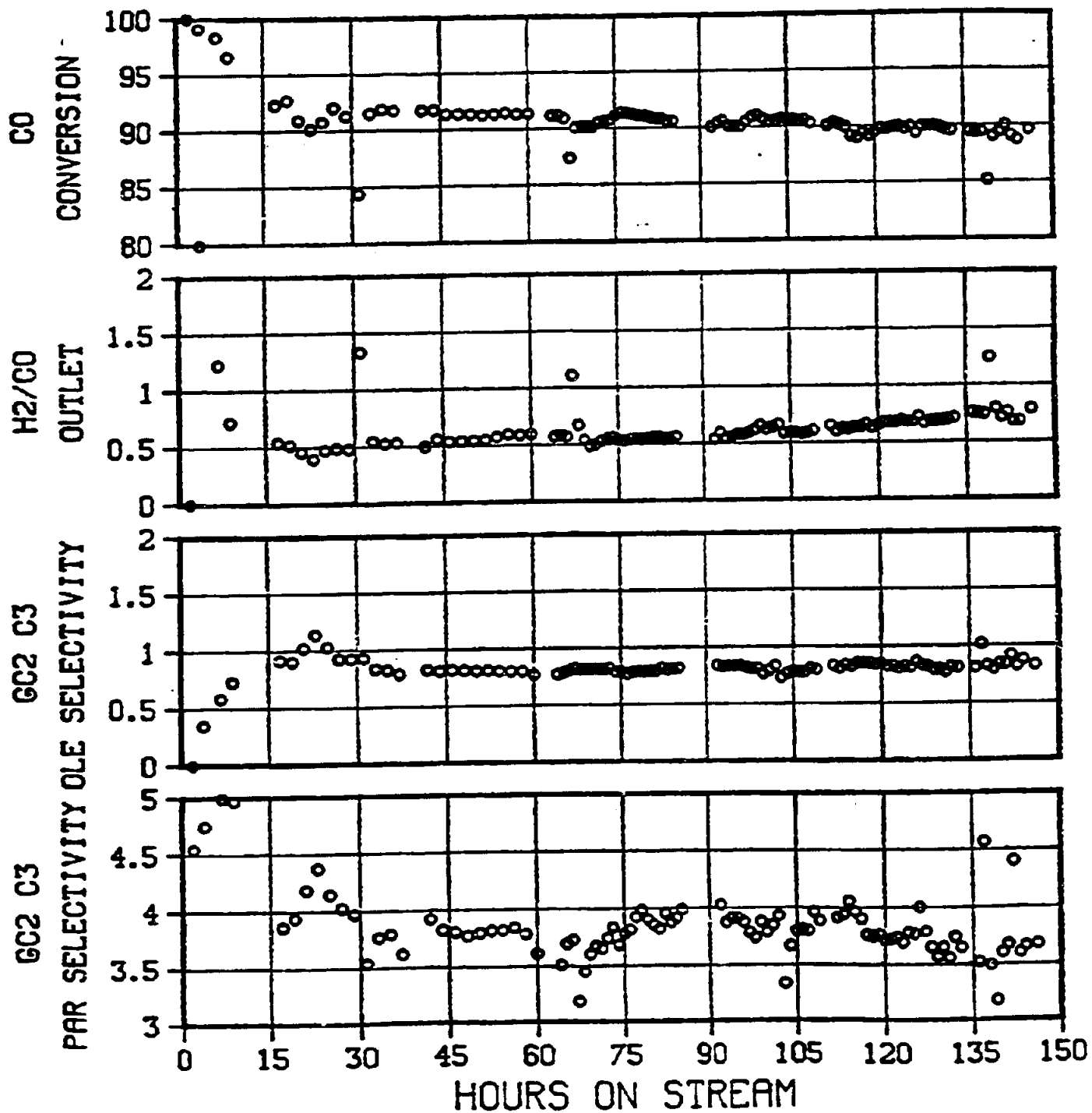
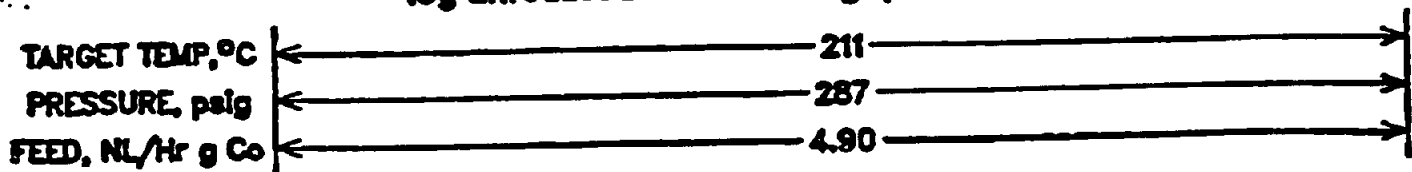


**FIGURE 121**

**PLANT 700 RUN 101 Co,Mn,Zr,Ru ON HCL Washed Y**

6827-95 w/27.4 % Co via eth-glycol pore fill

18g unreduced active in 160g quartz sand





**FIGURE 122**

**PLANT 700 RUN 101 Co, Mn, Zr, Ru ON HCL Washed Y**

6827-95 w/27.4 % Co via eth-glycol pore fill

18g unreduced active in 150g quartz sand

