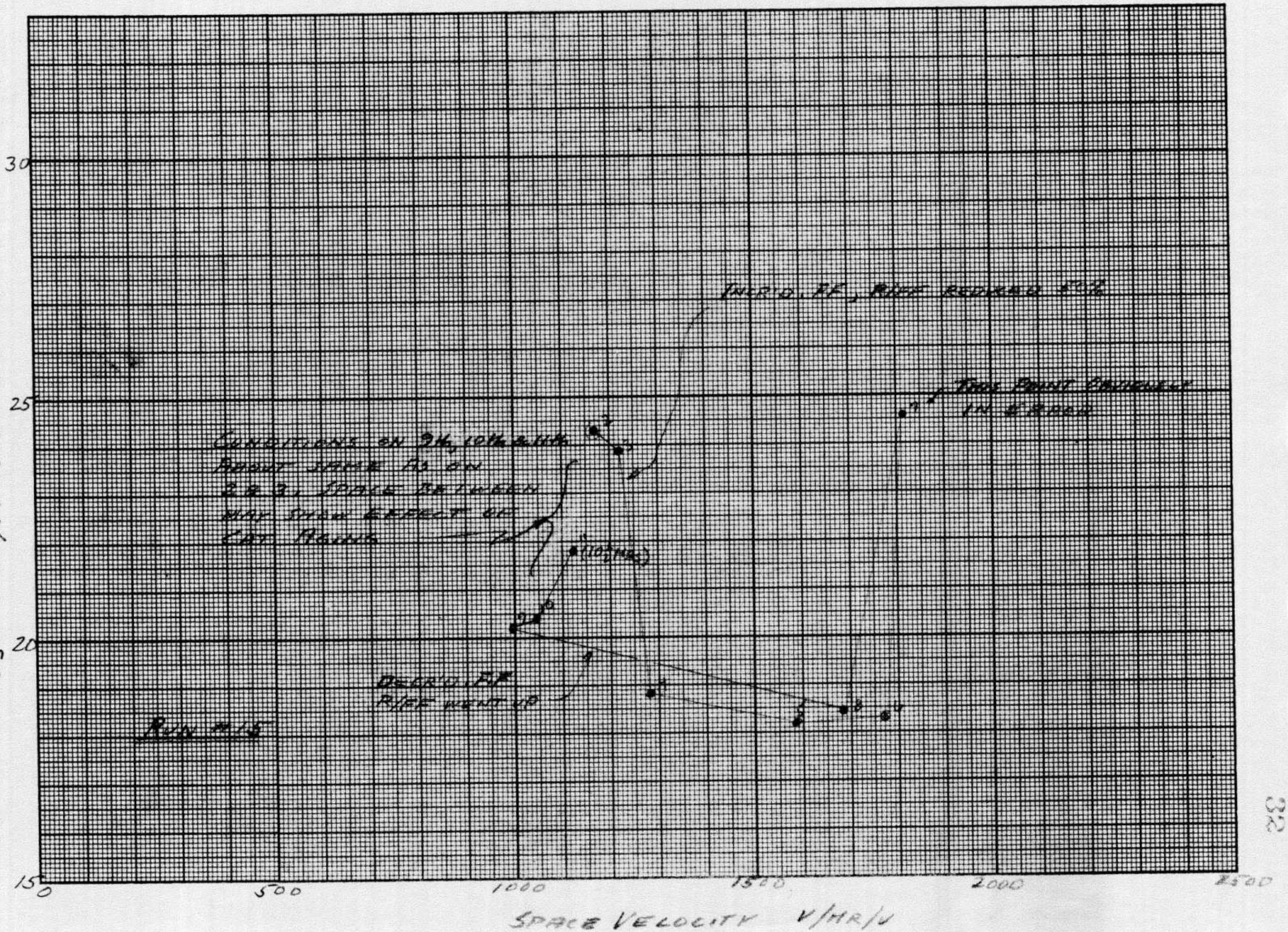
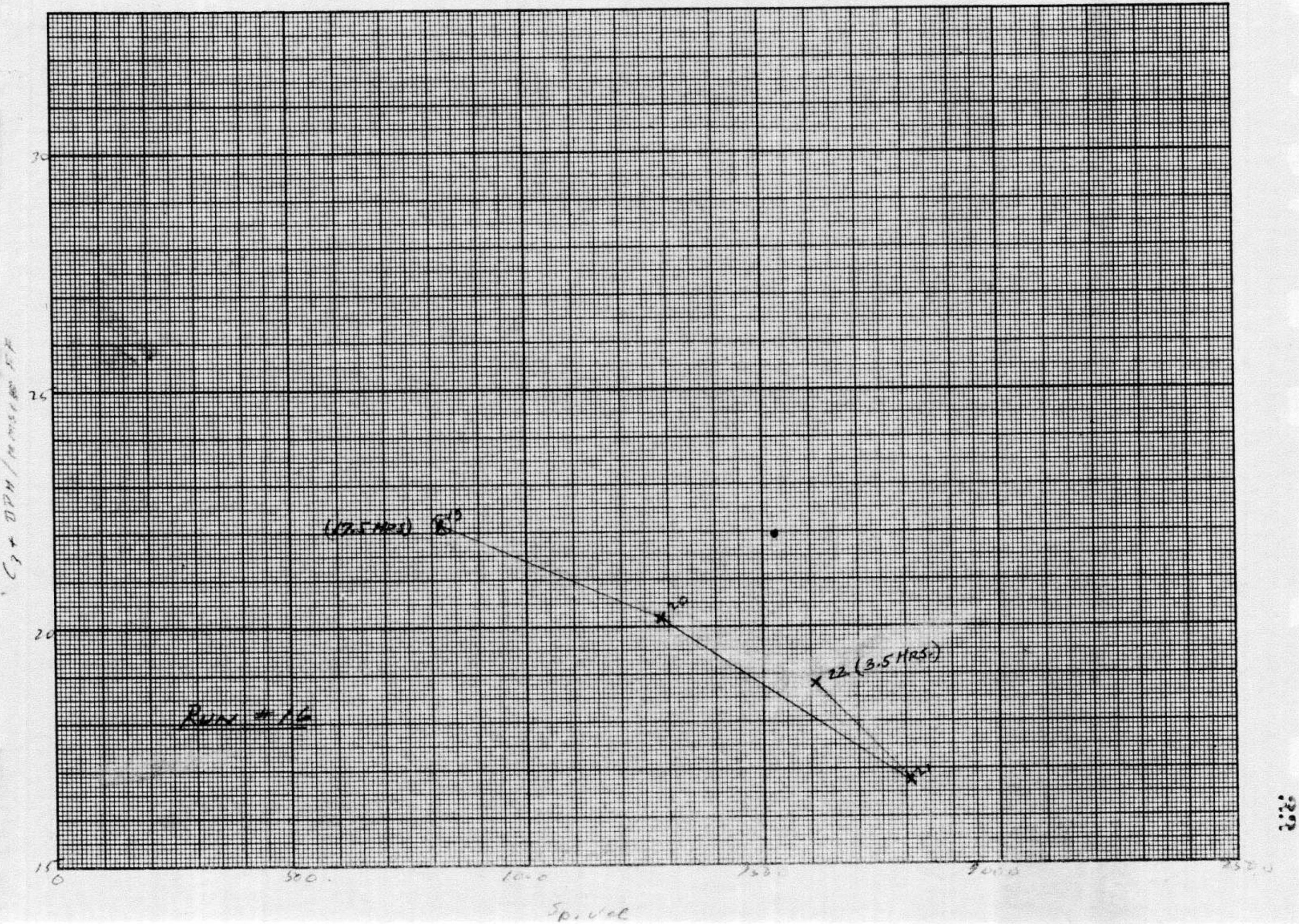
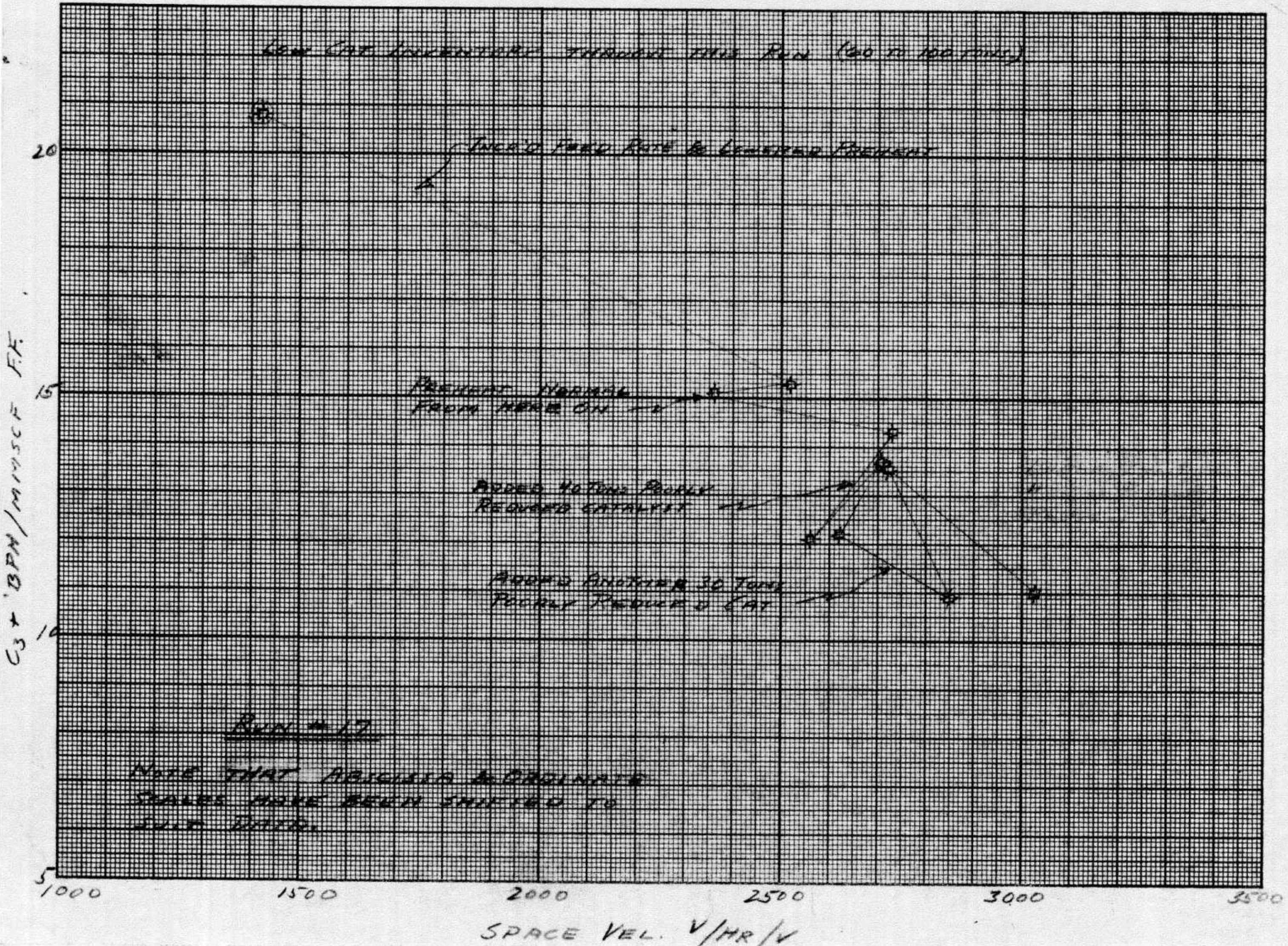

INCR'D. FF, R/FF REDUCED 5%
THIS POINT PROBABLY IN ERROR
CONDITIONS ON 9th, 10th & 11th ABOUT SAME AS ON 2 & 3. SPACE BETWEEN MAY SHOW EFFECT OF CAT. AGING
(10½ HR.)
DECR'D. FF R/FF WENT UP
RUN #15
1
2
3
4
5
6
7
8
9
10
11
30
25
20
15
0
500
1000
1500
2000
2500
C_3+ BPH / MMSCF OF F.F.
SPACE VELOCITY V/HR/V


30
25
20
15
C3 + DPM/MMSCF
0
500.
1000
1500
2000
2500
Sp. Vel
(17.5 HRS.)
19
20
22 (3.5 HRS.)
21
RUN # 16


LOW CAT. INVENTORY THROUGHOUT THIS RUN (60 TO 100 TONS)
INCR'D FEED RATE & LOWERED PREHEAT
PREHEAT NORMAL
FROM HERE ON
ADDED 40 TONS POORLY
REDUCED CATALYST
ADDED ANOTHER 30 TONS
POORLY REDUCED CAT
RUN #17
NOTE THAT ABSCISSA & ORDINATE
SCALES HAVE BEEN SHIFTED TO
SUIT DATA.
20
15
10
5
1000
1500
2000
2500
3000
3500
SPACE VEL. V/HR/V
C3+ BPH/MMSCF F.F.

sharp drop which occurred during the later part of Runs 13 & 8. The drop in Run 13 may have been caused by a sharp change in mass spectrometer operations (could not be pinned down as such however) but that in Run #8 it is too consistent, in spite of maintaining constant operating conditions to be anything but catalyst deactivation.

4. In runs 14, 16 and 17 there is an apparent pronounced effect of space velocity. This is not solely the effect of space velocity however because space velocity was always increased as the run progressed and therefore the effect of catalyst aging is superimposed.

In summary, these individual run graphs indicate that some rapid deactivation takes place the first day. The graphs also indicate that if the runs were longer, some further deactivation would occur as it did in Run 8 where the catalyst apparently went to pot completely. Space velocity has an apparent effect but the magnitude of its effect is clouded by the superimposed catalyst aging and possibly the effect of automatically reducing the combined feed inlet temperature when total feed rate is increased as discussed above.

The point to point data of each individual run are not accurate enough by themselves to show the effect, if any, of other operating variables.

Fig. A H_2+CO Conv. vs % Contraction

In order to get some idea of the consistency of the runs with each other, we have plotted all of the data on the following Fig. A where H_2 + CO conversion is plotted against % contraction. This relationship is almost mathematical and if the methods of measurement and calculations were correct, the points should all

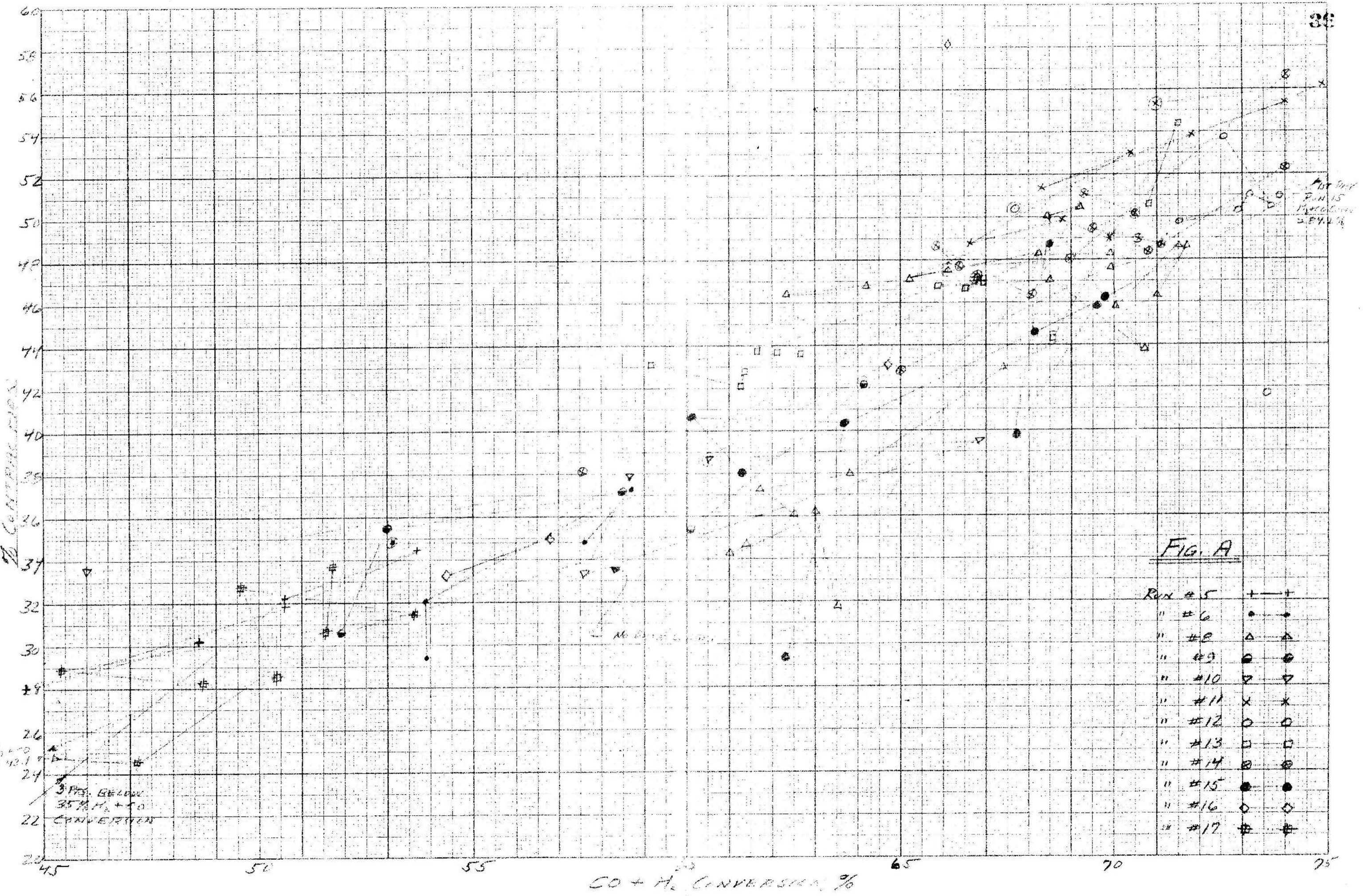


FIG. A

% CONTRACTION
CO + H2 CONVERSION %
60
58
56
54
52
50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
45
50
55
60
65
70
75
Run #5 +—+
" #6 •····•
" #8 △ △
" #9 ◍ ◍
" #10 ▽ ▽
" #11 × ×
" #12 ○ ○
" #13 □ □
" #14 ⊗ ⊗
" #15 ● ●
" #16 ◇ ◇
" #17 ⊕ ⊕
3 Pts. Below 35% H2 + CO Conversion
Pt. Only Run 15 Percent 3.84 %
M. [illegible]
H2 CO 43.1

fall on a single line.

It will be noted that altho the deviation is fairly great, all but a few points fall within a band which should be good enough for our purpose. The points that are outside that band are all unreliable and not real effects of operating conditions. These points cannot be discarded yet however because altho they may be in error so far as % contr. or H_2+CO conv. is concerned they may be correct when other factors are correlated.

Fig. B H_2+CO Conversion vs C_3+ Yields/MMSCF of Feed

Another plot used for the purpose of establishing the consistency of the data with each other is Fig. B where we have shown H_2+CO conversion vs the yield of C_3+ in Bbls/MMSCF of F.F. for all points. Here the scattering is even greater than in Fig. A because the C_3+ yield is numerically dependent on the accuracy of many more values than the % contraction.

All of this merely reiterates that we must draw conclusions from the mass of the data and not try to deduce too much from a point to point comparison.

It will be noted from this Fig. B and also from Fig.1A that the C_3+ yields reported for Run #5 are way out of line. As a matter of fact these yields are stoichoimetrically impossible for the H_2 and CO conversions reported. This particular run was not worked up by the usual stock department procedure and the complete recalculation of the original data might have disclosed the cause of the discrepancy. However, this expenditure of time was not warranted and we have elected to ignore Run #5 instead.

All the data in Run #8 are suspect. This is unfortunate since this is the longest run. An examination of the data discloses that the mass spectrometer analyses on the reactor fresh feed

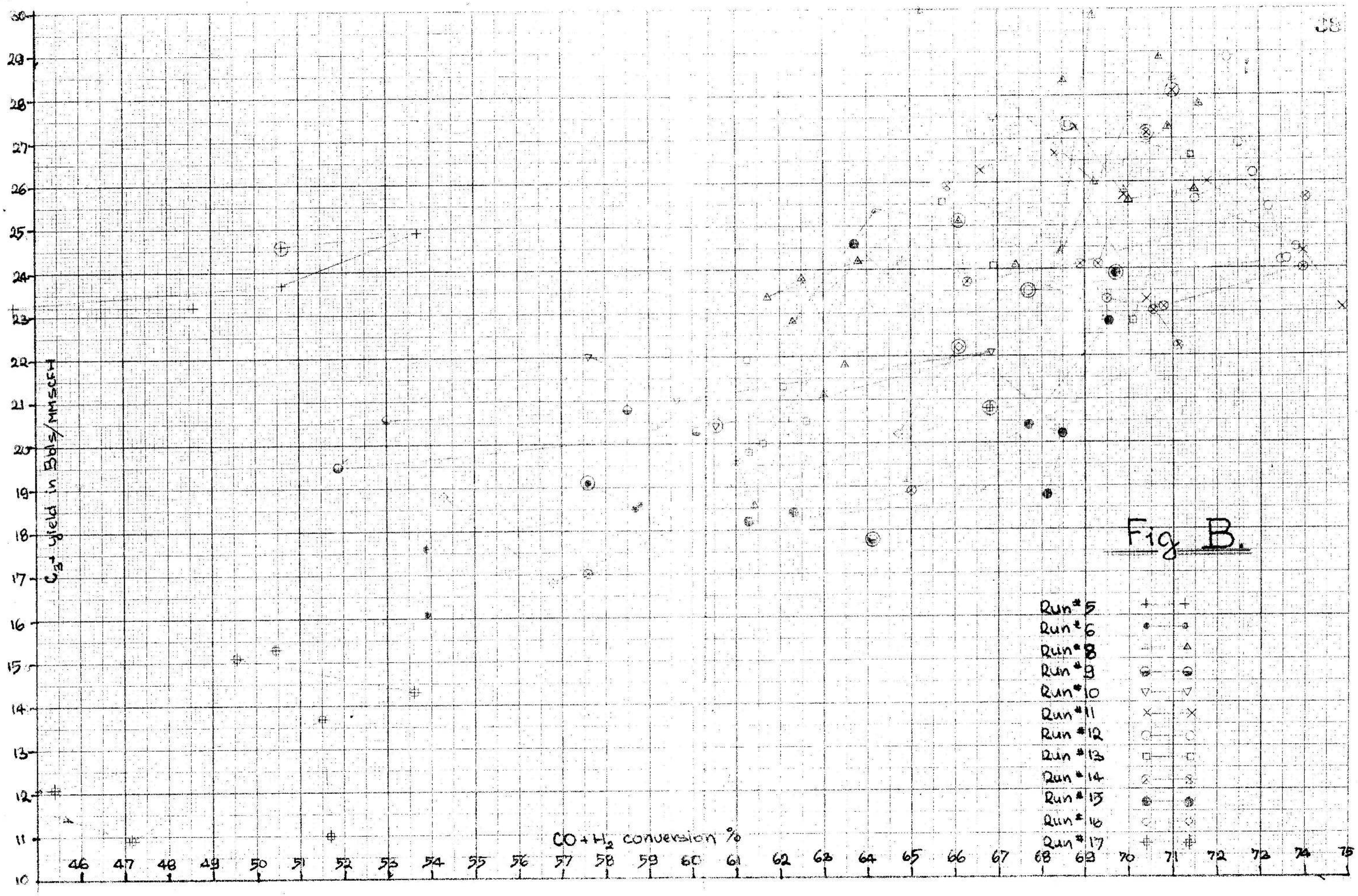

C_3^+ yield in Bbls/MMSCFH
CO + H_2 conversion %
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
Run # 5
Run # 6
Run # 8
Run # 9
Run # 10
Run # 11
Run # 12
Run # 13
Run # 14
Run # 15
Run # 16
Run # 17

Fig. B.

(V-301 effluent) was in error. The H_2/CO ratio averaged about 1.7 instead of the 1.8 in other runs before and after Run #8. This has such a great effect on the correlations which use H_2 conversion or H_2+CO conversion as a base that Run #8 must be ignored for this purpose. The error however was consistent throughout the run and therefore the run may be used to evaluate the effect of operating variables & catalyst age.

We also note from Fig. B that the following points should be treated with suspicion.

1. The last three points in Run #9
2. The last two points in Run #10.

Fig. C Space Velocity vs C_3+ Yields

The following Fig. C is a plot of space velocity vs C_3+ yields in Bbls. per million SCF of synthesis gas feed for all Brownsville Runs from Run #10 on. This plot was made up to see what these recent and more reliable runs, shown on the individual plots above, would look like if superimposed on each other. In general it will be noted that they check each other reasonably well. From examination of this plot and Table II of the appendix there is no clear cut evidence that difference in operating conditions from run to run made any consistent change in results. We were particularly surprised to find no large consistent effect of differences in degree of catalyst reduction. In general it can be concluded that catalyst aging and space velocity, as modified by catalyst aging and perhaps preheat, are the only two factors that make large differences in results.

One might argue that the fine grind catalyst, used in Run #11, was better than coarse catalyst because the results in Run #10 and also in Runs #6 & 9 (see Fig. 1) were not as good as those ob-

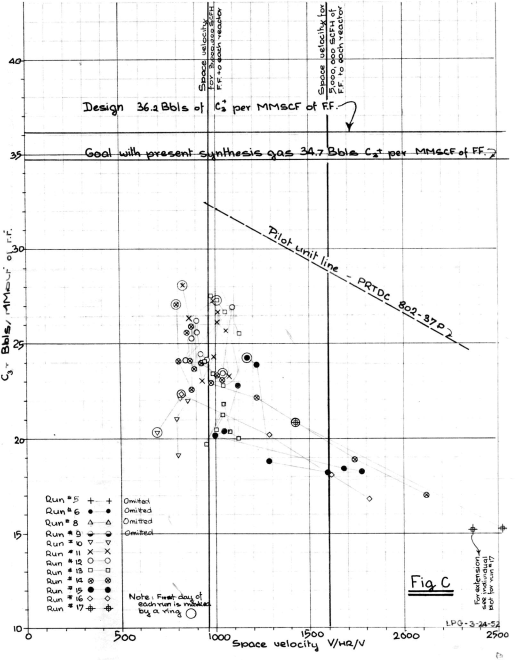


Fig C

LPG-3-24-52

tained in the succeeding runs. (The Run #8 data are unreliable as discussed above)

On this same Fig. C we have shown for comparison the effect of space velocity in pilot unit operations as reported in Table #5, p. 21 of P.R. TDC 802 - 37 P. We have also shown for comparison horizontal lines representing the design goal of C_3+ yields both as originally proposed and as adjusted for the quality of the present synthesis gas as follows: