TAC linearity summary

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#clear R env

```
rm(list = ls())
```

Load libraries

```
library(ggplot2)
library(ggpmisc)
library(plyr)
library(dplyr)
library(tidyr)
```

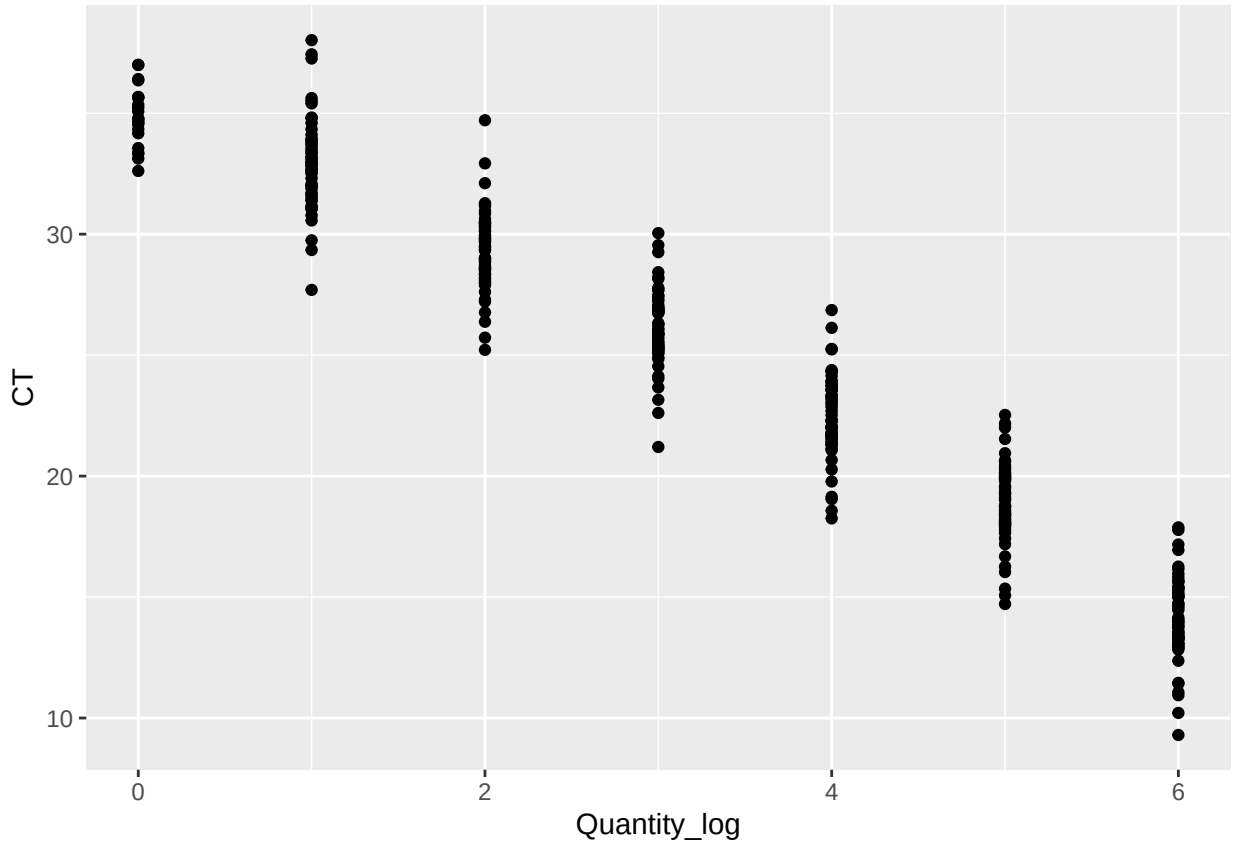
Import data file

```
TAC<-read.csv("sample_data.csv", na.strings=c("","NA"))
```

Plot a standard curve and summarize efficiency for each target

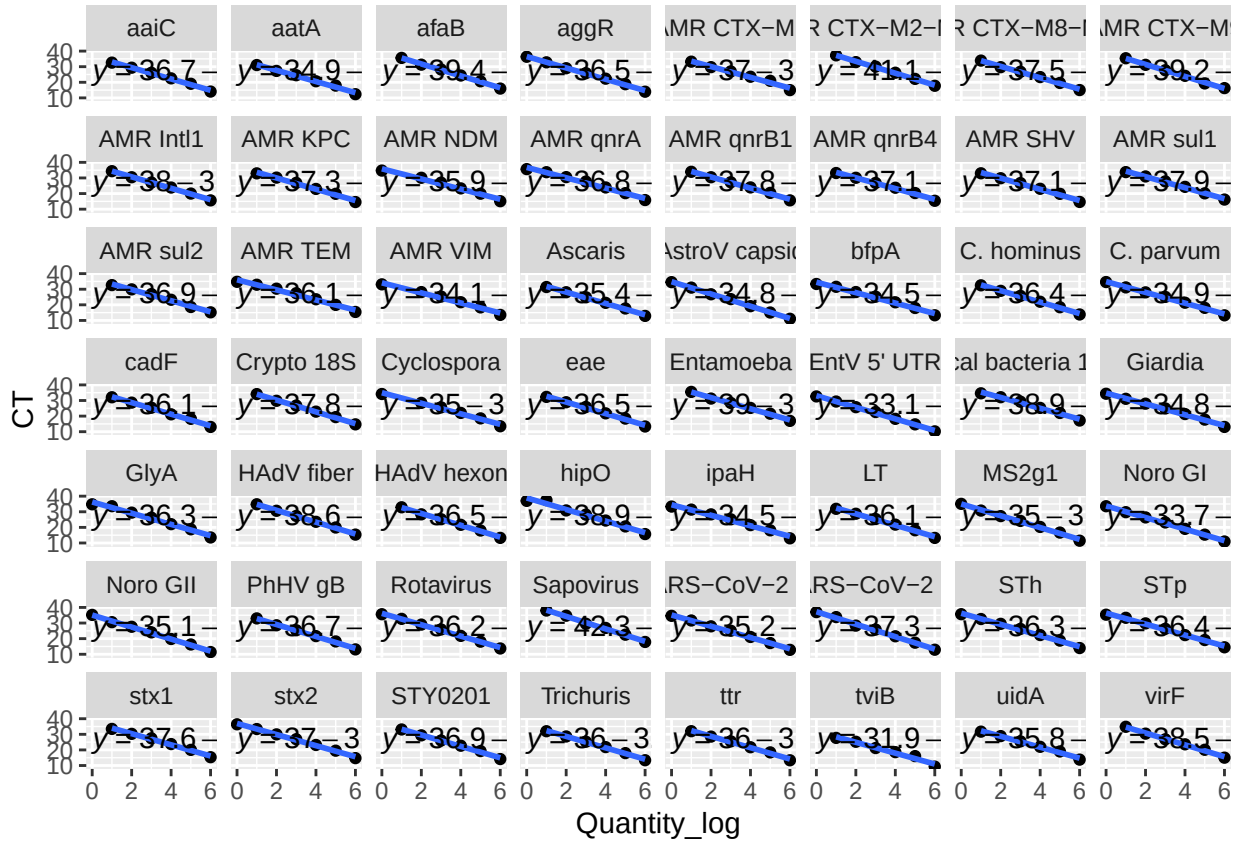
```
#Format data and add column with logs of quantities
TAC$CT<-as.numeric(gsub(",","",TAC$CT))

TAC$Quantity<-as.numeric(gsub(",","",TAC$Quantity))
TAC$Quantity_log<-log10(TAC$Quantity)

#summarize efficiencies
TAC<-TAC[!is.na(TAC$CT),]
TAC<-TAC[!is.na(TAC$Quantity_log),]
TAC<-TAC[rowSums(is.na(TAC)) != ncol(TAC), ]
efficiency_summ<-ddply(TAC, "Target.Name", function(x) {
  model <- lm(CT ~ Quantity_log, data = x)
  coef(model)})

colnames(efficiency_summ) <- c("Target.Name", "Y.intercept","Slope")

efficiency_summ$Efficiency<-10^(-1/efficiency_summ$Slope)-1

#create a list of dataframes by target
targets=by(TAC, TAC[,"Target.Name"], function(x) x)

#plot of standard curve points across all targets
```

```
p<-ggplot(TAC, aes(x = Quantity_log, y = CT)) +
  geom_point()
p
```




```
#plot standard curves for all targets
target_plots <- function(targets){
  ggplot(targets, aes(x = Quantity_log, y = CT)) +
    geom_point()+
    stat_poly_line(formula = y~x, se=FALSE) +
    stat_poly_eq(aes(label = paste(after_stat(eq.label), after_stat(rr.label), sep = "*\", \"*")), formu
  }

q1 <- lapply(targets, target_plots)

q2 <- lapply(seq_along(q1), function(i) {
  q1[[i]] + ggtitle(names(targets)[i])
})

#q2 #careful--this command makes a lot of plots!

#faceted plot with all adjusted standard curves for all targets
r<-ggplot(TAC, aes(x = Quantity_log, y = CT)) +
  geom_point() +
  facet_wrap(~ Target.Name)+
  stat_poly_line(formula = y~x, se=FALSE) +
```

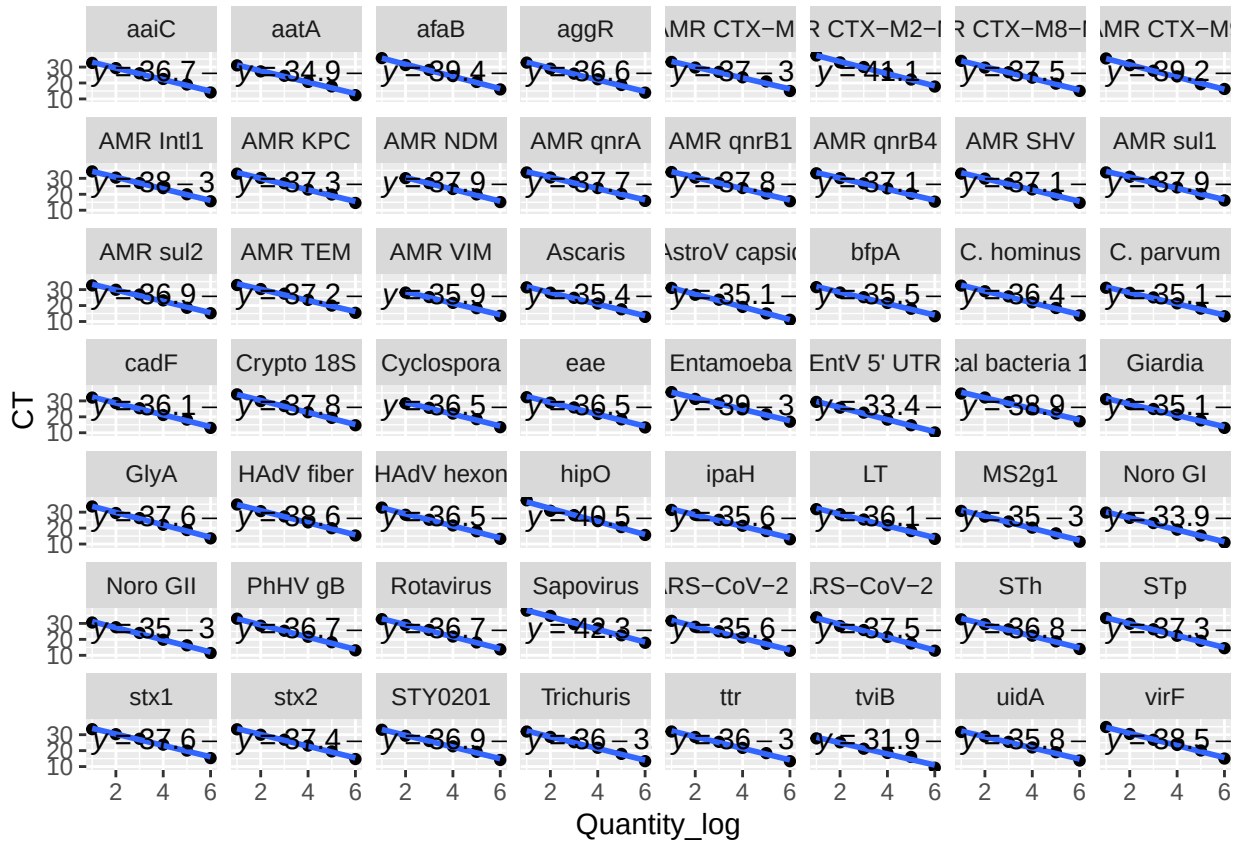
```
  stat_poly_eq(aes(label = paste(after_stat(eq.label), after_stat(rr.label), sep = "*\", \"*")), formula
r
```



Plot standard curves and summarize efficiencies without last point in the curve (where it flattens out as it approaches the LOD)

```
#remove last point on standard curve
TAC_adj <- TAC[TAC$Quantity_log != 0, ]
#TAC_adj <- TAC[TAC$Quantity_log != 0, ] #run this to look at standard curves without last two dilution

#create a list of dataframes by target
targets_adj=by(TAC_adj, TAC_adj[,"Target.Name"], function(x) x)

#plot adjusted standard curves for all targets
target_plots_adj <- function(targets_adj){
  ggplot(targets_adj, aes(x = Quantity_log, y = CT)) +
    geom_point()+
    stat_poly_line(formula = y~x, se=FALSE) +
    stat_poly_eq(aes(label = paste(after_stat(eq.label), after_stat(rr.label), sep = "*\", \"*")), formu
  }

s1 <- lapply(targets_adj, target_plots_adj)

s2 <- lapply(seq_along(s1), function(i) {
  s1[[i]] + ggtitle(names(targets_adj)[i])
})
```

```
#s2 #careful-this command makes a lot of plots!

#faceted plot with all adjusted standard curves for all targets
t<-ggplot(TAC_adj, aes(x = Quantity_log, y = CT)) +
  geom_point() +
  facet_wrap(~ Target.Name)+
  stat_poly_line(formula = y~x, se=FALSE) +
  stat_poly_eq(aes(label = paste(after_stat(eq.label), after_stat(rr.label), sep = "*\", \"*")), formula
t
```



Summarize dilutions with detection and high and low CT values for each target FIX THIS

```
TAC_CT<-TAC %>% select(Target.Name, Sample.Name, CT, R.superscript.2.)

high_low<-TAC_CT %>%
  group_by(Target.Name) %>%
  mutate(
    CT_min=min(CT, na.rm=T),
    CT_max=max(CT, na.rm=T)) %>%
  mutate(
    Dilution_min=min(Sample.Name, na.rm=T),
    Dilution_max=max(Sample.Name, na.rm=T)) %>%
  select(-Sample.Name) %>%
  select(-CT)
```

Summarize adjusted (without lowest dilution) slope, efficiency, and R2 values for each target

```
R2<- TAC_adj %>%
   group_by(Target.Name) %>%
   dplyr::summarise(model = list(lm(CT ~ Quantity_log, data = cur_data())),
             coef = list(coef(model[[1]])),
             R2_adj = summary(model[[1]])$r.sq)%>%
   unnest_wider(coef, names_repair = 'unique')

R2$Efficiency_adj<- 10^(-1/R2$Quantity_log)-1
```

Summarize NTC results

```
TAC_NTC<-read.csv("sample_data.csv", na.strings=c("","NA"))

TAC_NTC <- TAC_NTC %>%
  subset(Sample.Name=="NTC")

TAC_NTC$CT<-as.numeric(gsub(",","",TAC_NTC$CT))
TAC_NTC<- TAC_NTC%>%
  select(Target.Name, CT)%>%
  dplyr::rename(NTC_CT=CT)
```

Summary table

```
summary<-merge(efficiency_summ, R2)
summary<-merge(high_low, summary)
summary<-merge(TAC_NTC, summary)
summary <- summary %>%
  distinct(.keep_all = TRUE) %>%
  select(-model) %>%
  relocate(R.superscript.2., .before=Efficiency) %>%
  relocate(NTC_CT, .before=Y.intercept)%>%
  dplyr::rename(R2=R.superscript.2.) %>%
  dplyr::rename(Y.intercept_adj='(Intercept)') %>%
  dplyr::rename(Slope_adj=Quantity_log)%>%
  mutate_if(is.numeric, round, digits=2)

summary
```

```
##           Target.Name CT_min CT_max Dilution_min Dilution_max NTC_CT
## 1                aaiC  14.07  32.61     PCP 10^1     PCP 10^6     NA
## 2                aatA  12.37  31.06     PCP 10^1     PCP 10^6     NA
## 3                afaB  15.97  35.63     PCP 10^1     PCP 10^6     NA
## 4                aggR  13.97  36.36     PCP 10^0     PCP 10^6     NA
## 5          AMR CTX-M1  14.99  33.21     PCP 10^1     PCP 10^6     NA
## 6      AMR CTX-M2-M74  17.77  37.26     PCP 10^1     PCP 10^6     NA
## 7      AMR CTX-M8-M25  15.03  33.90     PCP 10^1     PCP 10^6     NA
## 8          AMR CTX-M9  16.26  35.41     PCP 10^1     PCP 10^6     NA
## 9           AMR Intl1  15.62  34.34     PCP 10^1     PCP 10^6     NA
## 10             AMR KPC  14.57  32.94     PCP 10^1     PCP 10^6     NA
## 11             AMR NDM  15.10  34.74     PCP 10^0     PCP 10^6     NA
## 12           AMR qnrA  15.82  35.65     PCP 10^0     PCP 10^6     NA
## 13          AMR qnrB1  15.64  33.94     PCP 10^1     PCP 10^6     NA
```

```
## 14          AMR qnrB4  15.37  33.16     PCP 10^1     PCP 10^6     NA
## 15            AMR SHV  14.64  33.00     PCP 10^1     PCP 10^6     NA
## 16           AMR sul1  16.16  33.74     PCP 10^1     PCP 10^6     NA
## 17           AMR sul2  15.20  32.64     PCP 10^1     PCP 10^6     NA
## 18            AMR TEM  15.43  34.76     PCP 10^0     PCP 10^6     NA
## 19            AMR VIM  13.55  33.12     PCP 10^0     PCP 10^6     NA
## 20            Ascaris  12.90  31.42     PCP 10^1     PCP 10^6     NA
## 21      AstroV capsid  11.07  34.54     PCP 10^0     PCP 10^6     NA
## 22               bfpA  13.32  33.36     PCP 10^0     PCP 10^6     NA
## 23        C. hominus  13.84  32.51     PCP 10^1     PCP 10^6     NA
## 24         C. parvum  13.27  34.62     PCP 10^0     PCP 10^6     NA
## 25              cadF  13.05  32.07     PCP 10^1     PCP 10^6     NA
## 26        Crypto 18S  14.72  34.11     PCP 10^1     PCP 10^6     NA
## 27        Cyclospora  13.50  34.17     PCP 10^0     PCP 10^6     NA
## 28               eae  13.35  32.31     PCP 10^1     PCP 10^6     NA
## 29         Entamoeba  16.95  35.51     PCP 10^1     PCP 10^6     NA
## 30       EntV 5' UTR  10.21  32.61     PCP 10^0     PCP 10^6     NA
## 31 Fecal bacteria 16S  17.17  34.60     PCP 10^1     PCP 10^6     NA
## 32           Giardia  13.05  34.34     PCP 10^0     PCP 10^6     NA
## 33              GlyA  13.55  34.79     PCP 10^0     PCP 10^6     NA
## 34        HAdV fiber  15.37  34.80     PCP 10^1     PCP 10^6     NA
## 35        HAdV hexon  13.26  32.87     PCP 10^1     PCP 10^6     NA
## 36              hipO  15.69  37.43     PCP 10^0     PCP 10^6     NA
## 37              ipaH  12.98  33.33     PCP 10^0     PCP 10^6     NA
## 38                LT  13.26  31.89     PCP 10^1     PCP 10^6     NA
## 39            MS2g1  11.46  35.07     PCP 10^0     PCP 10^6     NA
## 40         Noro GII  11.43  35.23     PCP 10^0     PCP 10^6     NA
## 41          PhHV gB  13.12  32.97     PCP 10^1     PCP 10^6     NA
## 42         Rotavirus  13.71  35.65     PCP 10^0     PCP 10^6     NA
## 43         Sapovirus  17.88  38.02     PCP 10^1     PCP 10^6     NA
## 44     SARS-CoV-2 N1  12.83  34.63     PCP 10^0     PCP 10^6  10.66
## 45     SARS-CoV-2 N2  12.91  37.00     PCP 10^0     PCP 10^6  15.00
## 46               STh  13.98  35.67     PCP 10^0     PCP 10^6     NA
## 47               STp  14.46  35.35     PCP 10^0     PCP 10^6     NA
## 48              stx1  15.32  33.46     PCP 10^1     PCP 10^6     NA
## 49              stx2  14.74  36.41     PCP 10^0     PCP 10^6     NA
## 50          STY0201  14.15  33.11     PCP 10^1     PCP 10^6     NA
## 51         Trichuris  13.40  31.99     PCP 10^1     PCP 10^6     NA
## 52               ttr  13.37  32.00     PCP 10^1     PCP 10^6     NA
## 53              tviB   9.30  27.70     PCP 10^1     PCP 10^6     NA
## 54              uidA  13.79  31.71     PCP 10^1     PCP 10^6     NA
## 55              virF  15.04  34.82     PCP 10^1     PCP 10^6     NA
##    Y.intercept Slope   R2 Efficiency Y.intercept_adj Slope_adj R2_adj
## 1        36.67 -3.63 0.99       0.88           36.67     -3.63   0.99
## 2        34.86 -3.59 0.99       0.90           34.86     -3.59   0.99
## 3        39.42 -3.83 1.00       0.82           39.42     -3.83   1.00
## 4        36.50 -3.64 1.00       0.88           36.63     -3.67   1.00
## 5        36.98 -3.45 0.98       0.95           36.98     -3.45   0.98
## 6        41.08 -3.82 1.00       0.83           41.08     -3.82   1.00
## 7        37.53 -3.66 1.00       0.88           37.53     -3.66   1.00
## 8        39.17 -3.86 1.00       0.82           39.17     -3.86   1.00
## 9        38.04 -3.66 1.00       0.88           38.04     -3.66   1.00
## 10       37.26 -3.63 0.99       0.89           37.26     -3.63   0.99
## 11       35.88 -3.26 0.98       1.03           37.94     -3.71   0.99
```

```
## 12       36.75 -3.32 0.99       1.00           37.71     -3.54   0.99
## 13       37.77 -3.57 1.00       0.91           37.77     -3.57   1.00
## 14       37.06 -3.47 0.99       0.94           37.06     -3.47   0.99
## 15       37.06 -3.59 0.99       0.90           37.06     -3.59   0.99
## 16       37.91 -3.54 0.99       0.92           37.91     -3.54   0.99
## 17       36.90 -3.57 0.99       0.91           36.90     -3.57   0.99
## 18       36.05 -3.24 0.98       1.04           37.18     -3.50   0.99
## 19       34.11 -3.22 0.98       1.04           35.89     -3.62   0.99
## 20       35.44 -3.64 1.00       0.88           35.44     -3.64   1.00
## 21       34.83 -3.93 1.00       0.80           35.08     -3.99   1.00
## 22       34.52 -3.35 0.99       0.99           35.52     -3.58   0.99
## 23       36.45 -3.68 1.00       0.87           36.45     -3.68   1.00
## 24       34.89 -3.46 1.00       0.95           35.13     -3.52   0.99
## 25       36.14 -3.73 0.99       0.85           36.14     -3.73   0.99
## 26       37.83 -3.78 1.00       0.84           37.83     -3.78   1.00
## 27       34.99 -3.38 0.99       0.98           36.47     -3.71   0.99
## 28       36.47 -3.73 0.99       0.86           36.47     -3.73   0.99
## 29       38.99 -3.57 0.99       0.90           38.99     -3.57   0.99
## 30       33.06 -3.71 1.00       0.86           33.45     -3.80   1.00
## 31       38.88 -3.47 0.99       0.94           38.88     -3.47   0.99
## 32       34.76 -3.47 1.00       0.94           35.13     -3.56   0.99
## 33       36.28 -3.60 0.98       0.90           37.58     -3.90   1.00
## 34       38.58 -3.80 1.00       0.83           38.58     -3.80   1.00
## 35       36.50 -3.79 1.00       0.84           36.50     -3.79   1.00
## 36       38.88 -3.72 0.97       0.86           40.51     -4.09   0.99
## 37       34.52 -3.38 0.99       0.98           35.56     -3.61   0.99
## 38       36.05 -3.67 0.99       0.87           36.05     -3.67   0.99
## 39       35.01 -3.79 1.00       0.84           34.96     -3.77   0.99
## 40       35.11 -3.85 1.00       0.82           35.01     -3.83   1.00
## 41       36.73 -3.83 1.00       0.82           36.73     -3.83   1.00
## 42       36.22 -3.65 1.00       0.88           36.70     -3.76   1.00
## 43       42.25 -4.00 1.00       0.78           42.25     -4.00   1.00
## 44       35.17 -3.61 1.00       0.89           35.64     -3.72   1.00
## 45       37.26 -4.00 1.00       0.78           37.48     -4.05   0.99
## 46       36.28 -3.57 0.99       0.91           36.81     -3.69   0.99
## 47       36.38 -3.52 0.99       0.92           37.27     -3.73   1.00
## 48       37.57 -3.58 0.99       0.90           37.57     -3.58   0.99
## 49       36.96 -3.56 1.00       0.91           37.44     -3.66   1.00
## 50       36.94 -3.67 0.99       0.87           36.94     -3.67   0.99
## 51       36.02 -3.67 1.00       0.87           36.02     -3.67   1.00
## 52       36.00 -3.64 0.99       0.88           36.00     -3.64   0.99
## 53       31.89 -3.49 0.97       0.93           31.89     -3.49   0.97
## 54       35.75 -3.51 0.99       0.93           35.75     -3.51   0.99
## 55       38.45 -3.81 1.00       0.83           38.45     -3.81   1.00
##    Efficiency_adj
## 1            0.88
## 2            0.90
## 3            0.82
## 4            0.87
## 5            0.95
## 6            0.83
## 7            0.88
## 8            0.82
## 9            0.88
```

```
## 10          0.89
## 11          0.86
## 12          0.92
## 13          0.91
## 14          0.94
## 15          0.90
## 16          0.92
## 17          0.91
## 18          0.93
## 19          0.89
## 20          0.88
## 21          0.78
## 22          0.90
## 23          0.87
## 24          0.93
## 25          0.85
## 26          0.84
## 27          0.86
## 28          0.86
## 29          0.90
## 30          0.83
## 31          0.94
## 32          0.91
## 33          0.81
## 34          0.83
## 35          0.84
## 36          0.76
## 37          0.89
## 38          0.87
## 39          0.84
## 40          0.82
## 41          0.82
## 42          0.84
## 43          0.78
## 44          0.86
## 45          0.77
## 46          0.87
## 47          0.85
## 48          0.90
## 49          0.87
## 50          0.87
## 51          0.87
## 52          0.88
## 53          0.93
## 54          0.93
## 55          0.83
```

```
write.csv(summary,file="TAC_sample_linearity_summary.csv")
```