COMPASS_Synoptic_TGW_2022: Sept & Oct part 1

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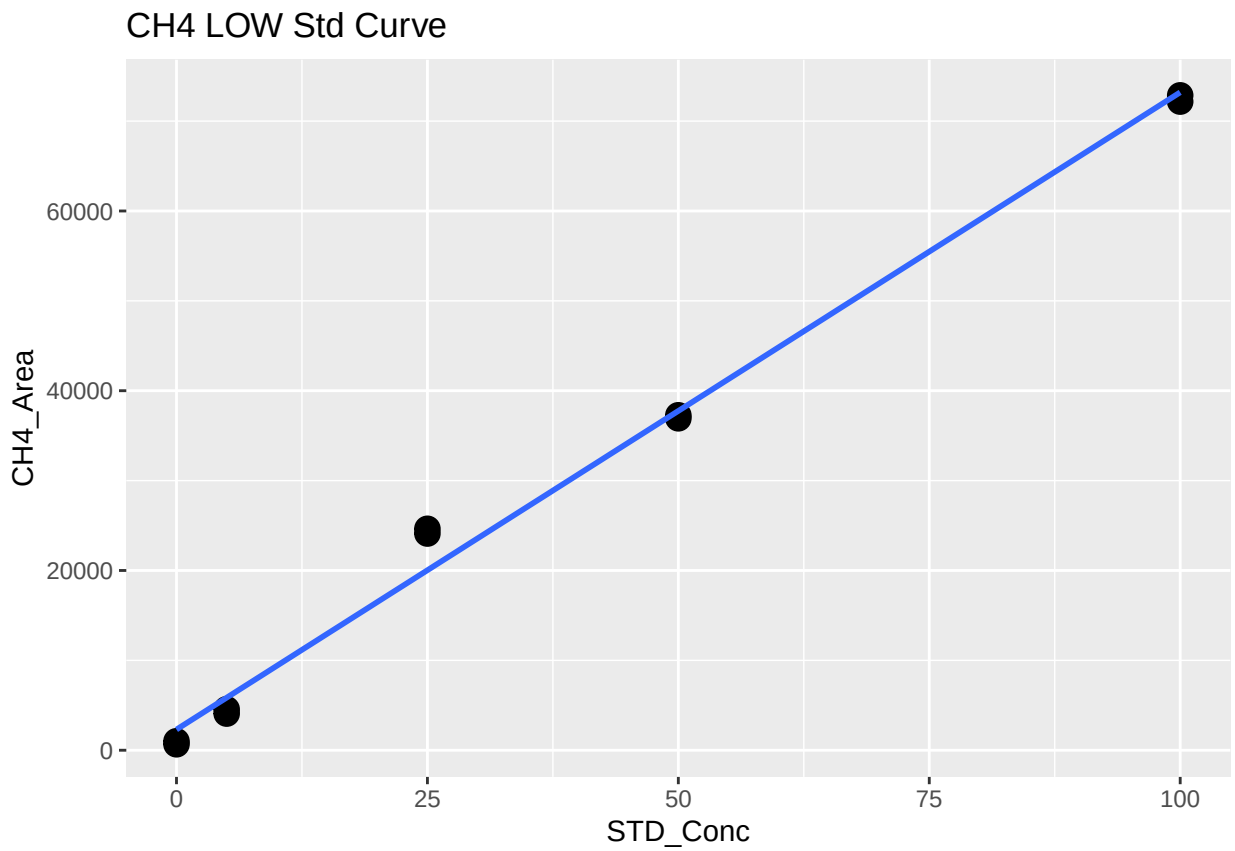
2023-01-14

##Set Up

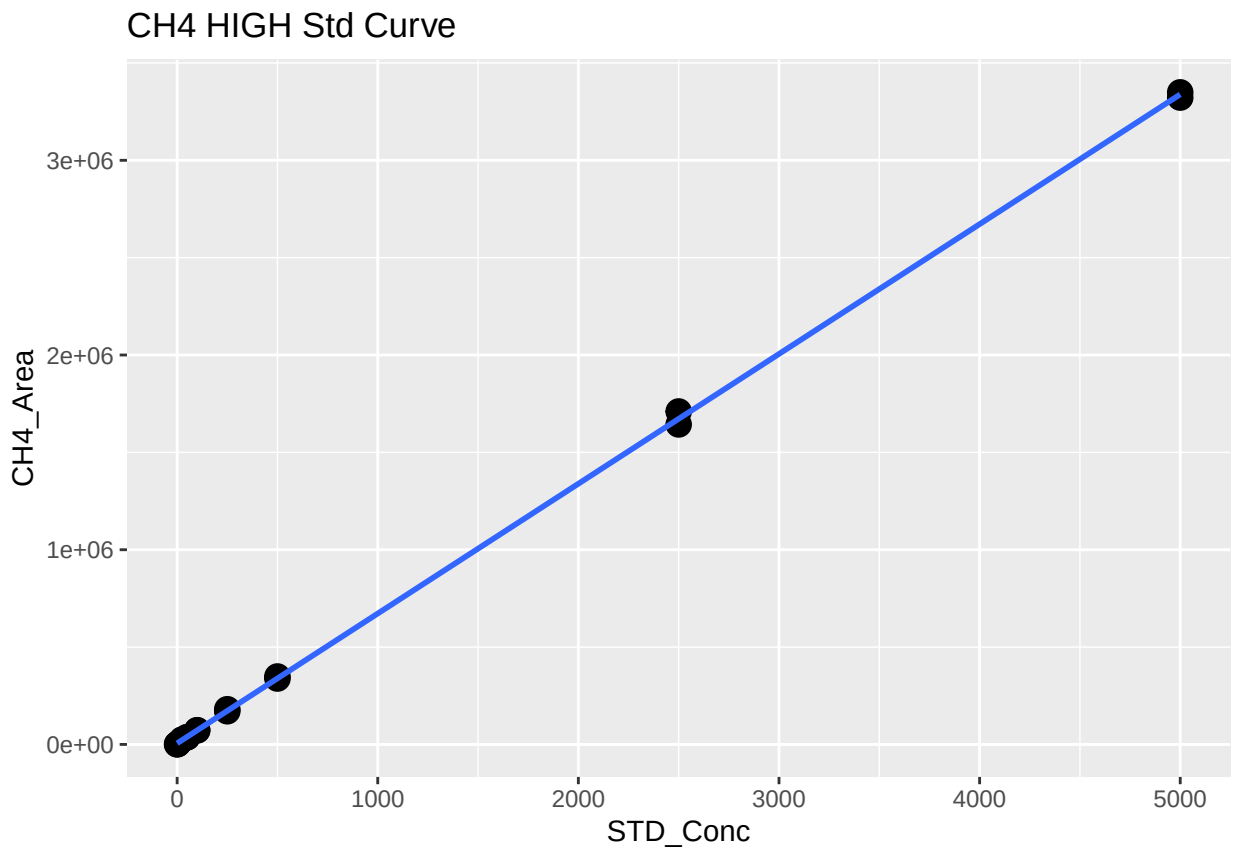
Read in first data file and assess standard curves

```
##     Machine                User Run_Date Sample_Type Type1 Sample_Year
## 1 Varian GC Stephanie J. Wilson   202212     Chk_STD  TGAS        2022
## 2 Varian GC Stephanie J. Wilson   202212     Chk_STD  TGAS        2022
## 3 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 4 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 5 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 6 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
##   Sample_Month        Sample_ID Dilution_Factor STD_Conc CH4_Area CO2_Area
## 1         <NA>       100ppm chk               1      100    61383       NA
## 2         <NA>   500ppm CO2 chk               1      500       NA    93076
## 3    September MSM_TGAS_UP_SF_1               2       NA    31673  4381503
## 4    September MSM_TGAS_UP_SF_2               2       NA    66560  4874844
## 5    September MSM_TGAS_UP_SF_3               2       NA    11339  7003458
## 6    September MSM_TGAS_UP_SF_4               2       NA     9099  5176853
##   Field.Notes Lab.Notes
## 1          NA        NA
## 2          NA        NA
## 3          NA        NA
## 4          NA        NA
## 5          NA        NA
## 6          NA        NA
```

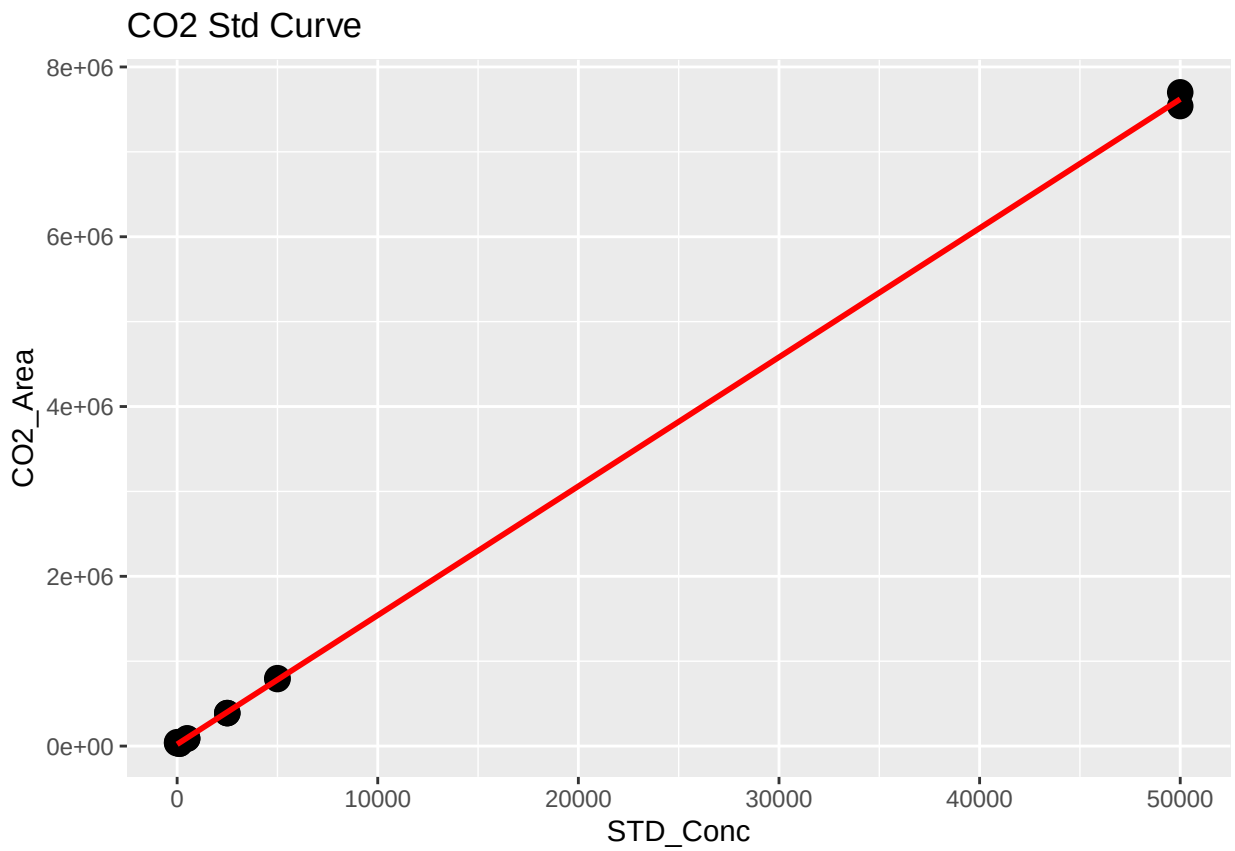
```
## `geom_smooth()` using formula = 'y ~ x'
```



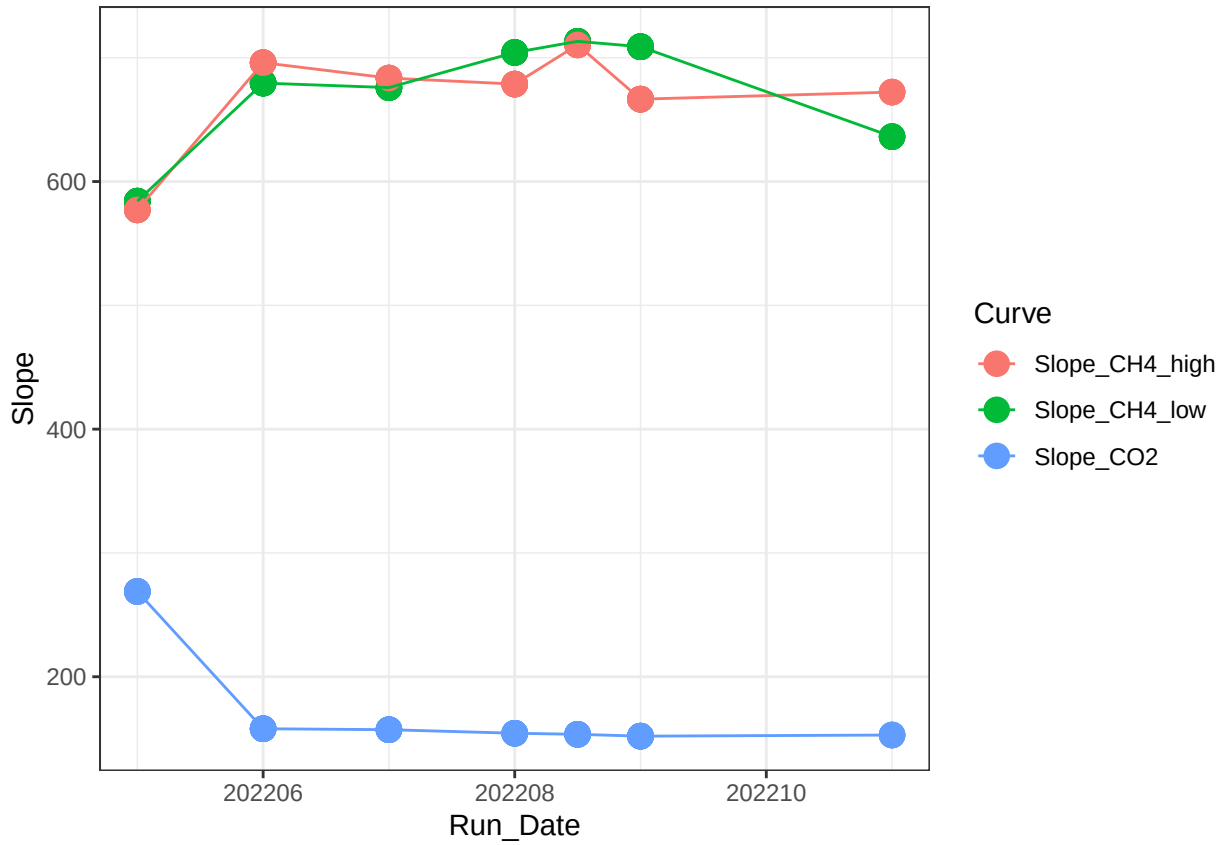

```
##
## Call:
## lm(formula = stds_ch4_low$CH4_Area ~ stds_ch4_low$STD_Conc)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1777.5 -1300.3  -928.8  -370.2  4611.0
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)            2306.85    1101.37   2.095   0.0695 .
## stds_ch4_low$STD_Conc   708.93      21.48  33.010 7.74e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 2480 on 8 degrees of freedom
## Multiple R-squared:  0.9927, Adjusted R-squared:  0.9918
## F-statistic:  1090 on 1 and 8 DF,  p-value: 7.738e-10

## `geom_smooth()` using formula = 'y ~ x'
```




```
##
## Call:
## lm(formula = stds_ch4$CH4_Area ~ stds_ch4$STD_Conc)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -28677  -4679  -1195   2106  37909
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)       5738.283   3679.618   1.559    0.138
## stds_ch4$STD_Conc  666.556      1.964 339.304   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 13520 on 16 degrees of freedom
## Multiple R-squared:  0.9999, Adjusted R-squared:  0.9999
## F-statistic: 1.151e+05 on 1 and 16 DF,  p-value: < 2.2e-16

## `geom_smooth()` using formula = 'y ~ x'
```




```
##
## Call:
## lm(formula = stds_co2$CO2_Area ~ stds_co2$STD_Conc)
##
## Residuals:
##    Min     1Q Median     3Q    Max
## -81507 -11491  -8260  14038  80240
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)       2.104e+04  1.267e+04    1.66    0.128
## stds_co2$STD_Conc 1.520e+02  6.169e-01  246.38   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 38710 on 10 degrees of freedom
## Multiple R-squared:  0.9998, Adjusted R-squared:  0.9998
## F-statistic: 6.07e+04 on 1 and 10 DF,  p-value: < 2.2e-16

##   X          Curve        R2    Slope  Intercept Run_Date
## 1 1  Slope_CH4_low 0.9989050 584.1700   292.6667   202205
## 2 2 Slope_CH4_high 0.9988404 577.1458 -1829.3469   202205
## 3 3      Slope_CO2 0.8941001 268.8803 82323.2843   202205
## 4 4  Slope_CH4_low 0.9989050 584.1700   292.6667   202205
## 5 5 Slope_CH4_high 0.9988404 577.1458 -1829.3469   202205
## 6 6      Slope_CO2 0.8941001 268.8803 82323.2843   202205
```



Now calculate the CH4 & CO2 concentrations in ppm

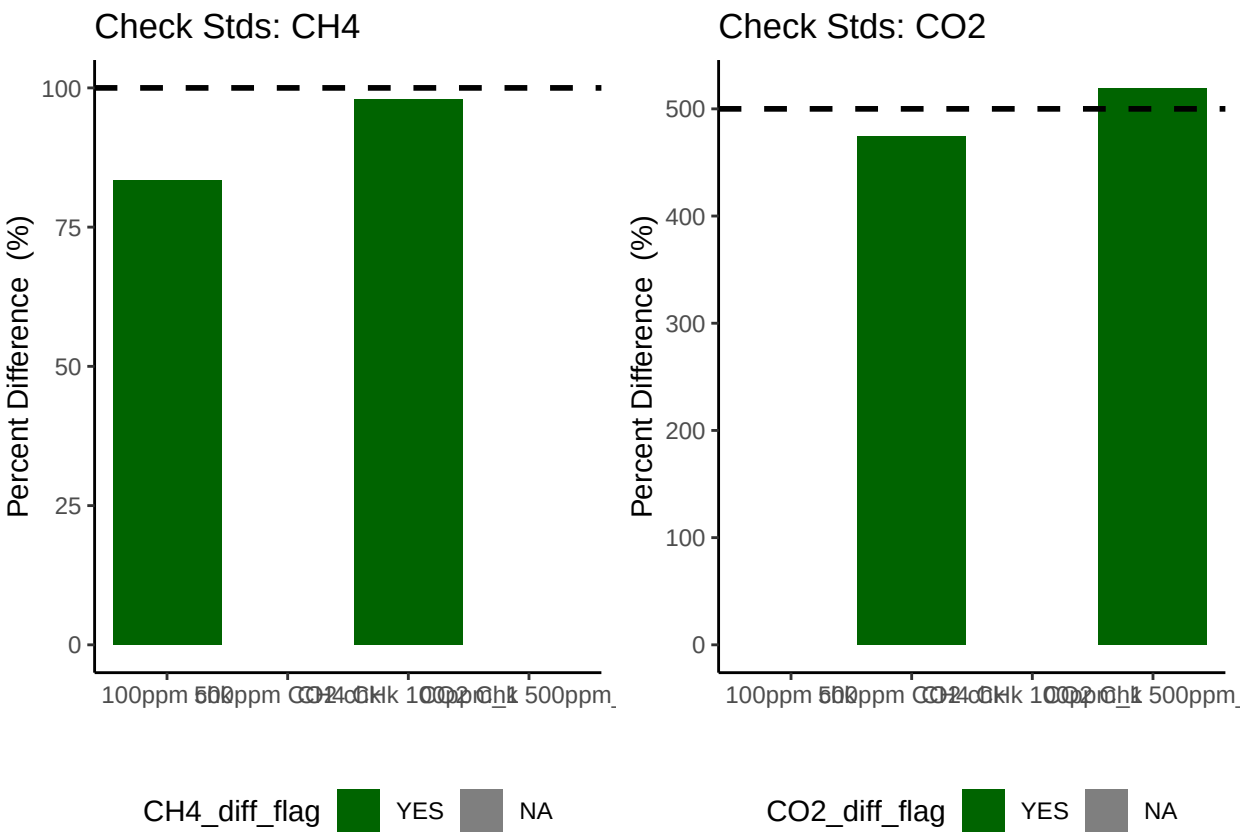
```
#head(raw)

#pull out methane standards
Samples <-  raw %>%
  filter(!str_detect(Sample_Type, "STD_CH4")) %>%
  filter(!str_detect(Sample_Type, "STD_CO2")) %>%
  filter(!str_detect(Sample_Type, "Blank")) %>%
  filter(!str_detect(Sample_Type, "Chk_STD")) %>%
   filter(!str_detect(Sample_Type, "CHKSTD")) %>%
  filter(!str_detect(Sample_Type, "CHK_STD")) %>%
  filter(!str_detect(Sample_Type, "NA"))
#head(Samples)

#Now flag any areas that are above the 100ppm area for CH4
Samples$CH4_Curve <- ifelse(Samples$CH4_Area >71000, "High", "Low")
#head(Samples)

#Calculate CH4 concentrations in ppm
Samples$CH4_Conc_ppm <- ifelse(Samples$CH4_Area >71000, (Samples$CH4_Area-Slope_CH4_high$Intercept)/Slo

#Calculate CO2 concentrations in ppm
Samples$CO2_Conc_ppm <- ((Samples$CO2_Area-Slope_CO2$Intercept)/Slope_CO2$Slope)
```

```r
#head(Samples)

##########make flags for any dilutions needed
#highest CH4 standard = 10000
#highest CO2 standard = 50000

Samples$CH4_Flag <- ifelse(Samples$CH4_Conc_ppm >10000, "Needs Dilution", "Within Range")
Samples$CO2_Flag <- ifelse(Samples$CO2_Conc_ppm >50000, "Needs Dilution", "Within Range")
#head(Samples)
```

Check the Check Standards

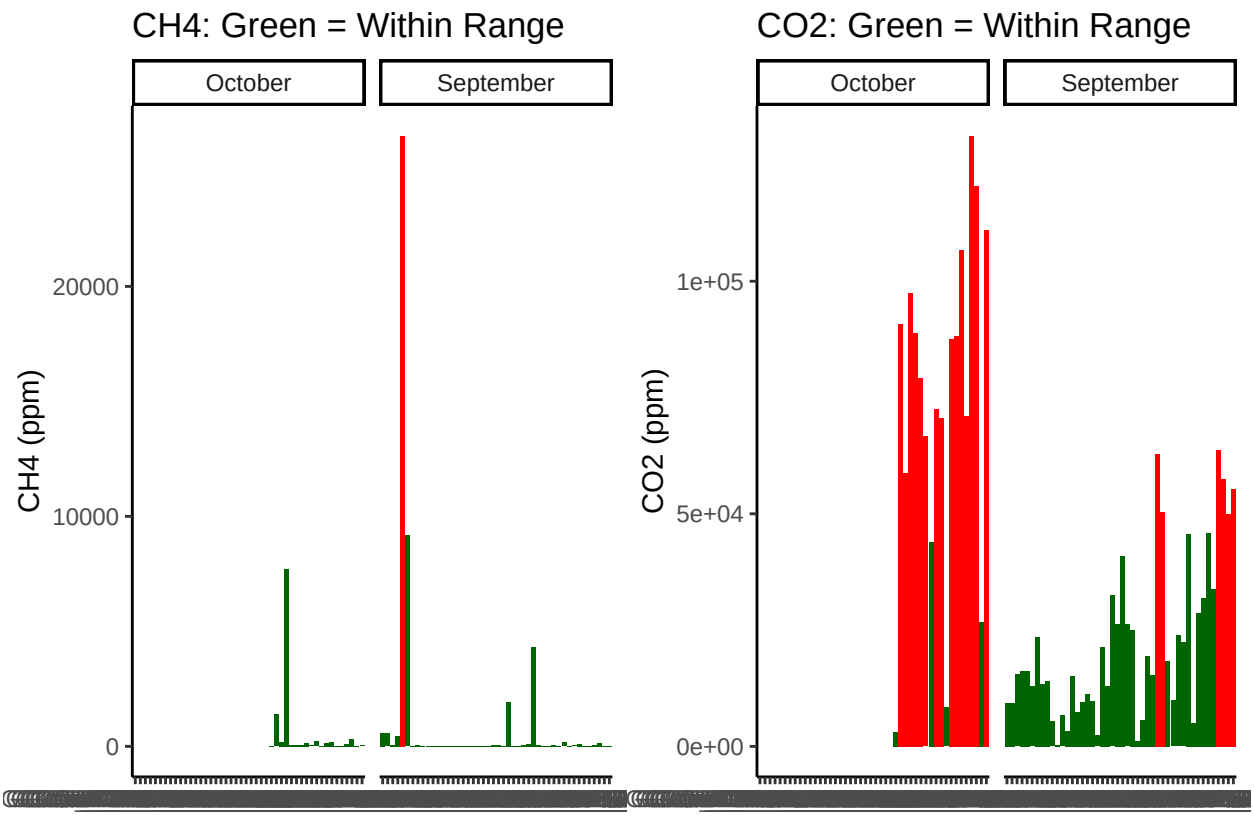
```
## Warning: Using 'size' aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use 'linewidth' instead.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```

```
## Warning: Removed 2 rows containing missing values or values outside the scale range
## ('geom_bar()').
## Removed 2 rows containing missing values or values outside the scale range
## ('geom_bar()').
```



Dilution correct samples

```
#multiply the concentration by the dilution factor
Samples$CH4_Conc_ppm_dilcorr <- (Samples$CH4_Conc_ppm * Samples$Dilution_Factor)

Samples$CO2_Conc_ppm_dilcorr <- (Samples$CO2_Conc_ppm * Samples$Dilution_Factor)

#check results
#head(Samples)

#quick first look at the samples
ch4_samples <-  ggplot(data = Samples, aes(x = Sample_ID, y = CH4_Conc_ppm, fill=CH4_Flag)) +
       geom_bar(stat = 'identity') +
        scale_fill_manual(values=c( "red","darkgreen" ))+
        #scale_fill_gradient2(low='red', mid='white', high='blue', space='Lab') +
        theme_classic() + labs(x= " ", y="CH4 (ppm)", title="CH4: Green = Within Range") +
        theme(legend.position="none") +
        facet_grid(~Sample_Month)


co2_samples <-  ggplot(data = Samples, aes(x = Sample_ID, y = CO2_Conc_ppm, fill=CO2_Flag)) +
       geom_bar(stat = 'identity') +
        scale_fill_manual(values=c("red","darkgreen" ))+
        #scale_fill_gradient2(low='red', mid='white', high='blue', space='Lab') +
        theme_classic() + labs(x= " ", y="CO2 (ppm)", title="CO2: Green = Within Range") +
        theme(legend.position="none") +
        facet_grid(~Sample_Month)

ggarrange(ch4_samples, co2_samples, nrow=1, ncol=2)
```



Write out processed data & slopes

```
#check results
head(Samples)
```

```
##     Machine                User Run_Date Sample_Type Type1 Sample_Year
## 1 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 2 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 3 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 4 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 5 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
## 6 Varian GC Stephanie J. Wilson   202212     Unknown  TGAS        2022
##   Sample_Month        Sample_ID Dilution_Factor STD_Conc CH4_Area CO2_Area
## 1    September MSM_TGAS_UP_SF_1               2       NA    31673  4381503
## 2    September MSM_TGAS_UP_SF_2               2       NA    66560  4874844
## 3    September MSM_TGAS_UP_SF_3               2       NA    11339  7003458
## 4    September MSM_TGAS_UP_SF_4               2       NA     9099  5176853
## 5    September MSM_TGAS_UP_SF_5               2       NA    37421  9708735
## 6    September MSM_TGAS_UP_SF_6               2       NA    93715  8766135
##   Field.Notes Lab.Notes CH4_Curve CH4_Conc_ppm CO2_Conc_ppm     CH4_Flag
## 1          NA        NA       Low    41.423412     28688.29 Within Range
## 2          NA        NA       Low    90.634445     31934.07 Within Range
## 3          NA        NA       Low    12.740603     45938.61 Within Range
## 4          NA        NA       Low     9.580896     33921.04 Within Range
```

```
## 5          NA        NA       Low    49.531447     63737.13 Within Range
## 6          NA        NA      High   131.987083     57535.59 Within Range
##         CO2_Flag CH4_Conc_ppm_dilcorr CO2_Conc_ppm_dilcorr
## 1   Within Range             82.84682             57376.58
## 2   Within Range            181.26889             63868.14
## 3   Within Range             25.48121             91877.23
## 4   Within Range             19.16179             67842.09
## 5 Needs Dilution             99.06289            127474.26
## 6 Needs Dilution            263.97417            115071.18
```

```
#pull out what we need
Samples1 <- Samples[ ,c(1:3,5:9,13, 18:21)]
head(Samples1)
```

```
##     Machine                User Run_Date Type1 Sample_Year Sample_Month
## 1 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
## 2 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
## 3 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
## 4 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
## 5 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
## 6 Varian GC Stephanie J. Wilson   202212  TGAS        2022    September
##          Sample_ID Dilution_Factor Field.Notes     CH4_Flag       CO2_Flag
## 1 MSM_TGAS_UP_SF_1               2          NA Within Range   Within Range
## 2 MSM_TGAS_UP_SF_2               2          NA Within Range   Within Range
## 3 MSM_TGAS_UP_SF_3               2          NA Within Range   Within Range
## 4 MSM_TGAS_UP_SF_4               2          NA Within Range   Within Range
## 5 MSM_TGAS_UP_SF_5               2          NA Within Range Needs Dilution
## 6 MSM_TGAS_UP_SF_6               2          NA Within Range Needs Dilution
##   CH4_Conc_ppm_dilcorr CO2_Conc_ppm_dilcorr
## 1             82.84682             57376.58
## 2            181.26889             63868.14
## 3             25.48121             91877.23
## 4             19.16179             67842.09
## 5             99.06289            127474.26
## 6            263.97417            115071.18
```

```
Samples1 <- Samples1 %>%
  separate(Sample_ID, into = c("Site", "Gas_Sample", "Zone", "Tree_Code", "Replicate"), sep = "_", remov
  mutate(Tree_Info = case_when(
    Tree_Code == "DS" ~ "Dead Standing",
    Tree_Code == "SF" ~ "Sapflow Monitoring",
    TRUE ~ "Other"  # Optional: handles any values that aren't DS or SF
  )) %>%
  mutate(Status = case_when(
    Tree_Code == "DS" ~ "Dead Standing",
    Tree_Code == "SF" ~ "Living",
    TRUE ~ "Other"
  )) %>%
  mutate(Project = "COMPASS: Synoptic",
         Region = "CB") %>%
  rename( Year = Sample_Year,
          Month = Sample_Month,
          CH4_ppm = CH4_Conc_ppm_dilcorr ,
```

```
          CO2_ppm = CO2_Conc_ppm_dilcorr )  %>%
  mutate(CH4_Flag = case_when(
    CH4_Flag == "Needs_Dilution" ~ "Over Std Curve Range",
    TRUE ~ "Within Std Curve Range"
  )) %>%
  mutate(CO2_Flag = case_when(
    CO2_Flag == "Needs_Dilution" ~ "Over Std Curve Range",
    TRUE ~ "Within Std Curve Range"
  ))

final <- Samples1 %>%
  select( "Project", "Region" , "Year","Month" ,"Site", "Zone", "Gas_Sample",
          "Sample_ID", "Tree_Code", "Replicate", "Status", "Tree_Info",
          "CH4_ppm", "CH4_Flag", "CO2_ppm", "CO2_Flag")

write.csv(final, "Processed Data/COMPASS_Synoptic_TGW_202209-10_Processed.csv")
```

#end