Weißlichtspektren

- Weißlichspektren herunterladen

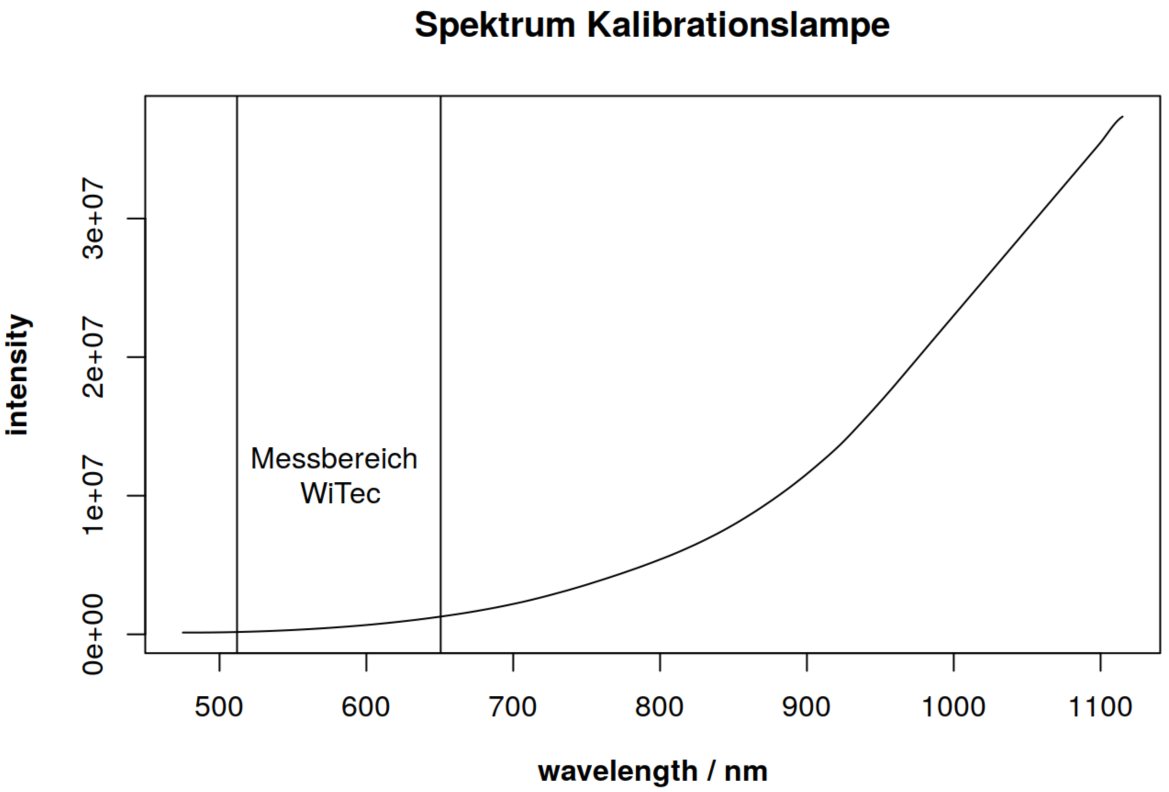
```
#
# CHARACTERISING THE WITEC DETECTOR
#
# How does the detector response changes when changing the orientation of the lasers plane
of polarisation?

#
# Get some libraries and functions used for characterising the detector and plotting stuff
#
source("../bauteilCharakterisierung/charakterisierungDetektor_utilities.R")



# Fetch experimental data from elabFTW
# First try
detector.spectra1 <- GET.elabftw.bycaption(76, header=T, outputHTTP=T) %>% parseTimeSerie
s.elab(., header=F, sep="")
# Second try
detector.spectra2 <- GET.elabftw.bycaption(81, header=T, outputHTTP=T) %>% parseTimeSerie
s.elab(., header=F, sep="")
```

- Berechnen des gemittelten Spektrums
- Berechnen von absoluter und relativer Differenz zwischen Spektren und ihrem Mittel

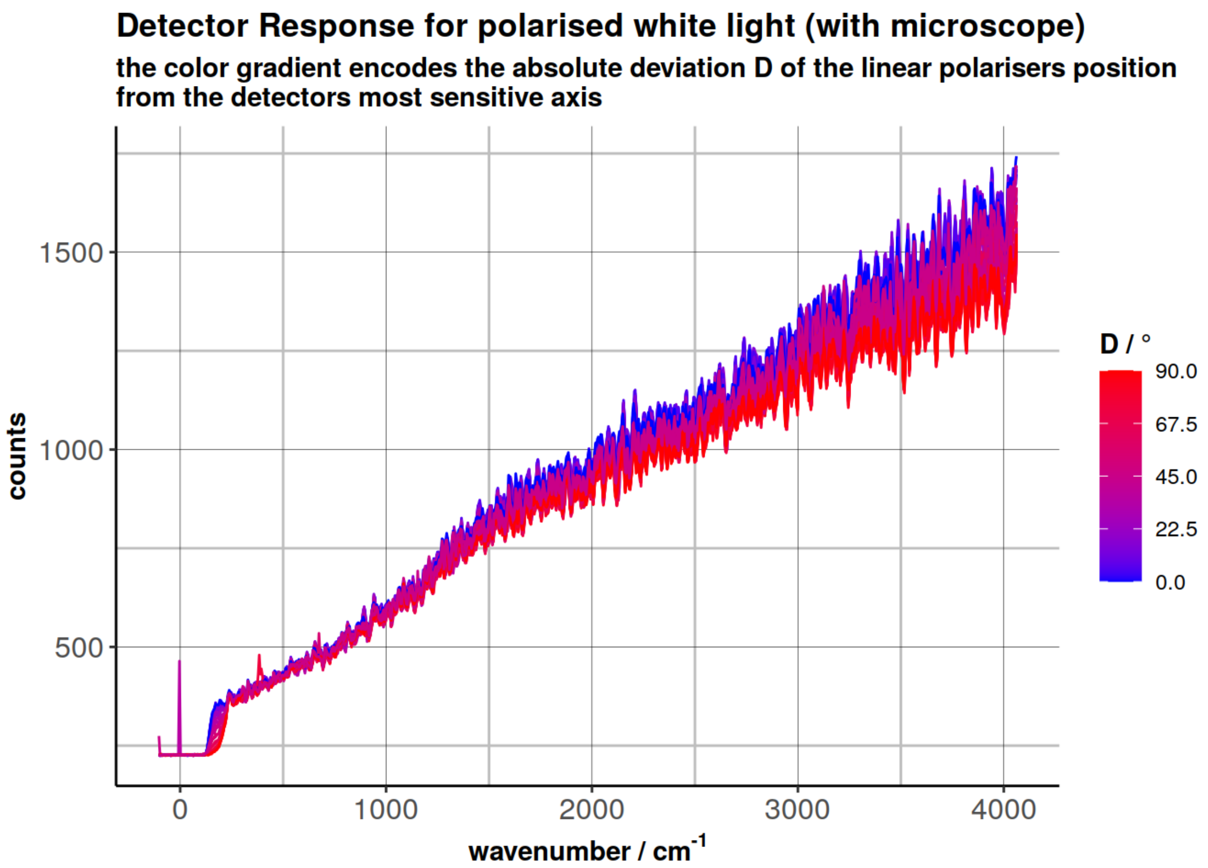
```
# Select one data set for evaluation
detector.spectra <- detector.spectra2

#
# PREPROCESS SPECTRA
# Vector normalisation and wavenumber conversion and mean calculation
#
# Wavelength of the WiTecs laser
laser.wavelength <- 514.624
detector.spectra <- lapply(detector.spectra, function(spec) {
  # Which columns contain the measured white lamp spectra?
  data.selector <- which(colnames(spec) %in% c("wavenumber", "wavelength", "mean") == F)

  # Convert raman shift in wavenumbers into absolute wavelength
  spec$wavelength <- 1/( 1/laser.wavelength - spec$wavenumber*1e-7 )

  # Vector normalisation of the spectra
  # spec[, data.selector] <- apply(spec[, data.selector], 2, function(spec) { spec / sum(s
pec^2) })

  # Compute mean spectrum and add it to the data.frame
  spec$mean <- rowMeans(spec[, data.selector])

  # Reorder data.frame
  spec <- spec[,c( which(colnames(spec) == "wavenumber"),
                   which(colnames(spec) == "wavelength"),
                   which(colnames(spec) == "mean"),
                   data.selector )]
  # Return
  return(spec)
})

#
# HOW DOES THE INFLUENCE OF THE POLARISATION CHANGE WITH THE WAVENUMBER?
#
detector.absDifference <- lapply(detector.spectra, function(spectra) {
  # Copy white lamp spectrum
  diffSpectra <- spectra
  # Compute the absolute difference between white lamp spectra and their mean spectrum
  diffSpectra[, -(1:3)] <- apply(diffSpectra[, -(1:3)], 2, function(spec) {spec - diffSpec
tra$mean})
  # Return result
  return(diffSpectra)
})
detector.relDifference <- lapply(detector.spectra, function(spectra) {
  # Copy white lamp spectrum
  diffSpectra <- spectra
  # Compute the relative difference between white lamp spectra and their mean spectrum
  diffSpectra[, -(1:3)] <- apply(diffSpectra[, -(1:3)], 2, function(spec) {(spec/diffSpect
ra$mean)-1})
  # Return result
  return(diffSpectra)
})
```

- Alle gemessenen Spektren übereinander legen
- Das Spektrum der Kalibrationslampe plotten

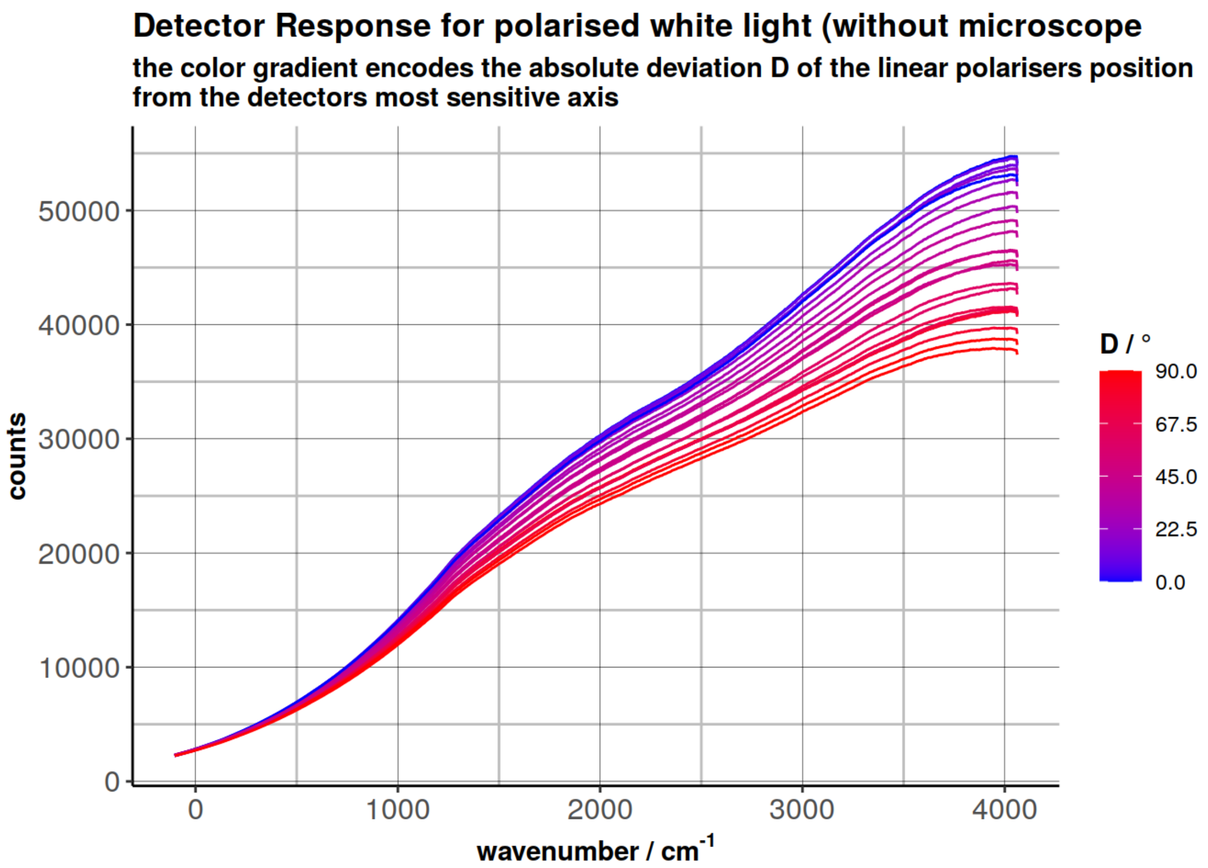
```
#
# PLOT
#

# Get the ideal white lamp spectrum
detector.whitelamp <- read.table(file = "../Weisslichtspektrum_Julian.txt", header = T)
# Plot ideal white lamp spectrum
detector.range <- detector.spectra[[1]]$wavelength[c(1, nrow(detector.spectra[[1]]))]
plot(detector.whitelamp, type = "l",
     main = "Spektrum Kalibrationslampe",
     xlab = expression(bold("wavelength / nm")),
     ylab = expression(bold("intensity")))
abline(v = detector.range)
text( mean(detector.range),
      y = mean(detector.whitelamp$Intensity), expression("Messbereich \n      WiTec") )
```




```
# Plot the white lamp spectra for the detector without the microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.spectra[[1]][, -c(2:3)],
                                                 colorFunc=function(polariserRotation) {mo
d(polariserRotation+45, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Detector Response for polarised white light (with microscop
e)",
                        ylab="counts")
```

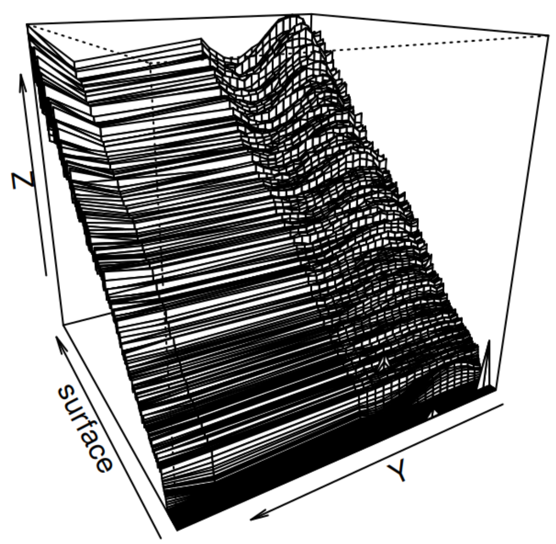


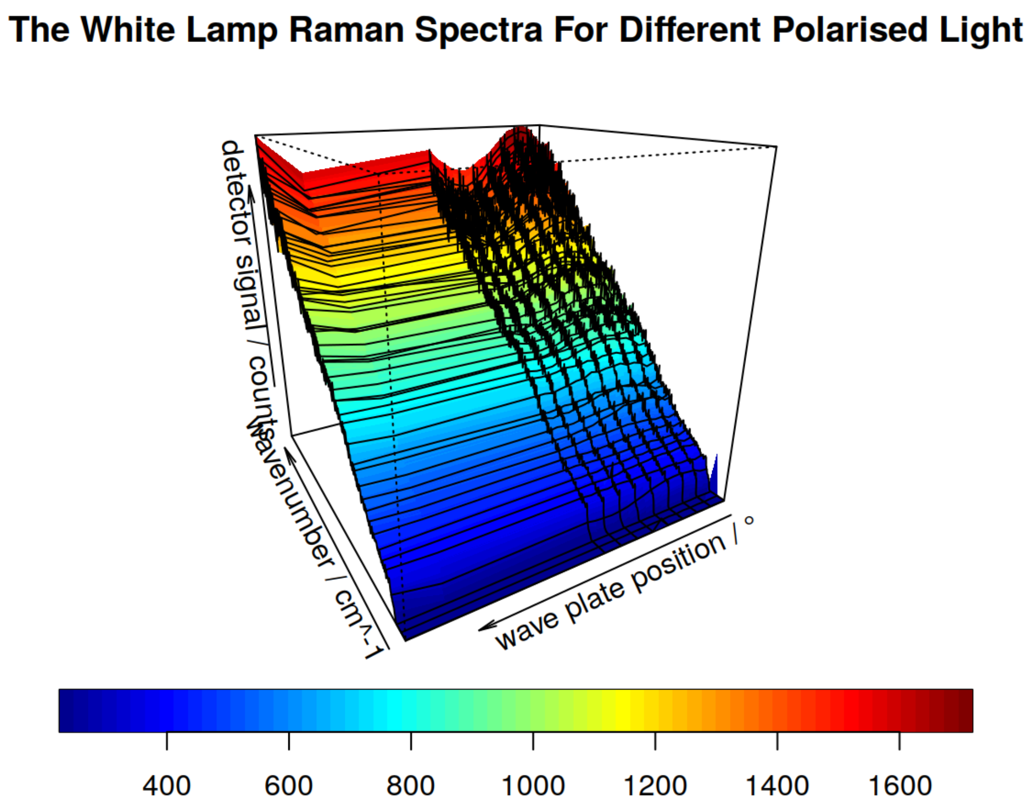

```
# Plot the white lamp spectra for the detector with the microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.spectra[[2]][, -c(2:3)],
                                                  colorFunc=function(polariserRotation) {mo
d(polariserRotation, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Detector Response for polarised white light (without micros
cope",
                        ylab="counts")
```



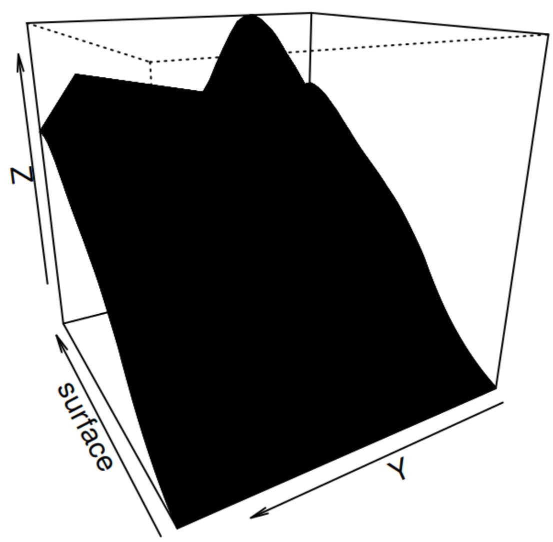
- Alle gemessenen Spektren als 3D-Plot

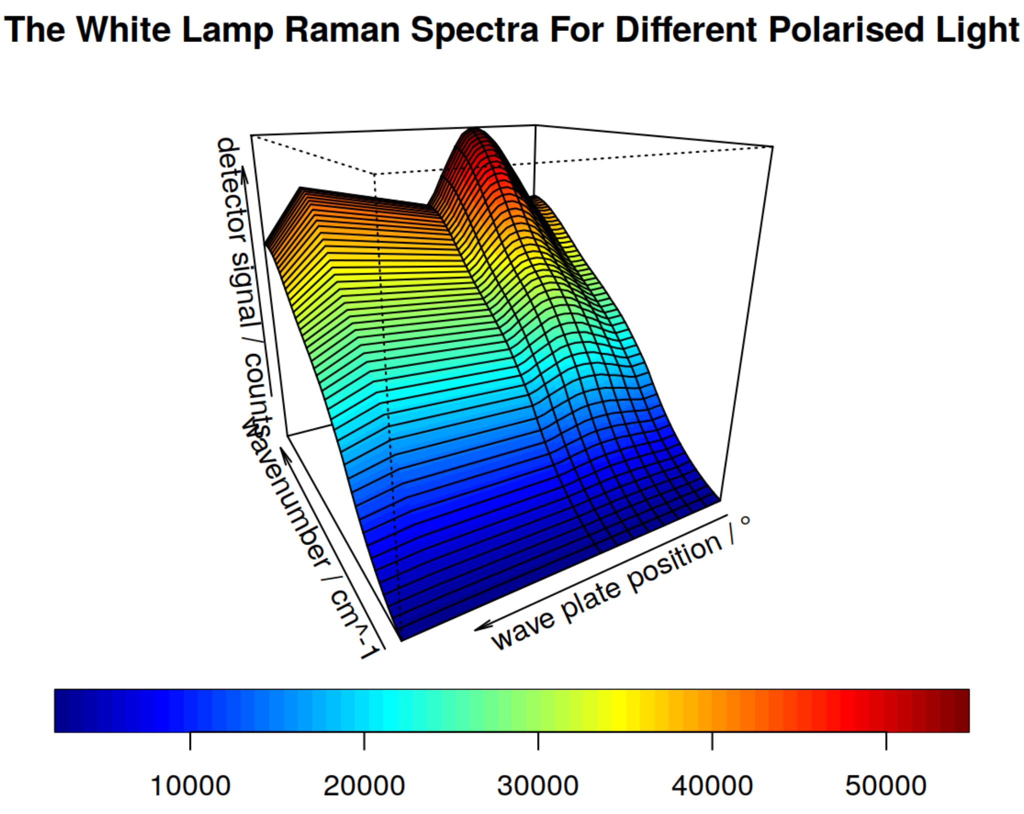
```
# Plot the WHITE LAMP SPECTRA in one 3d plot as 3D SURFACE
plot.detector.allSpectra(detector.spectra[[1]][,-c(2:3,21:24)], theta=240)
```





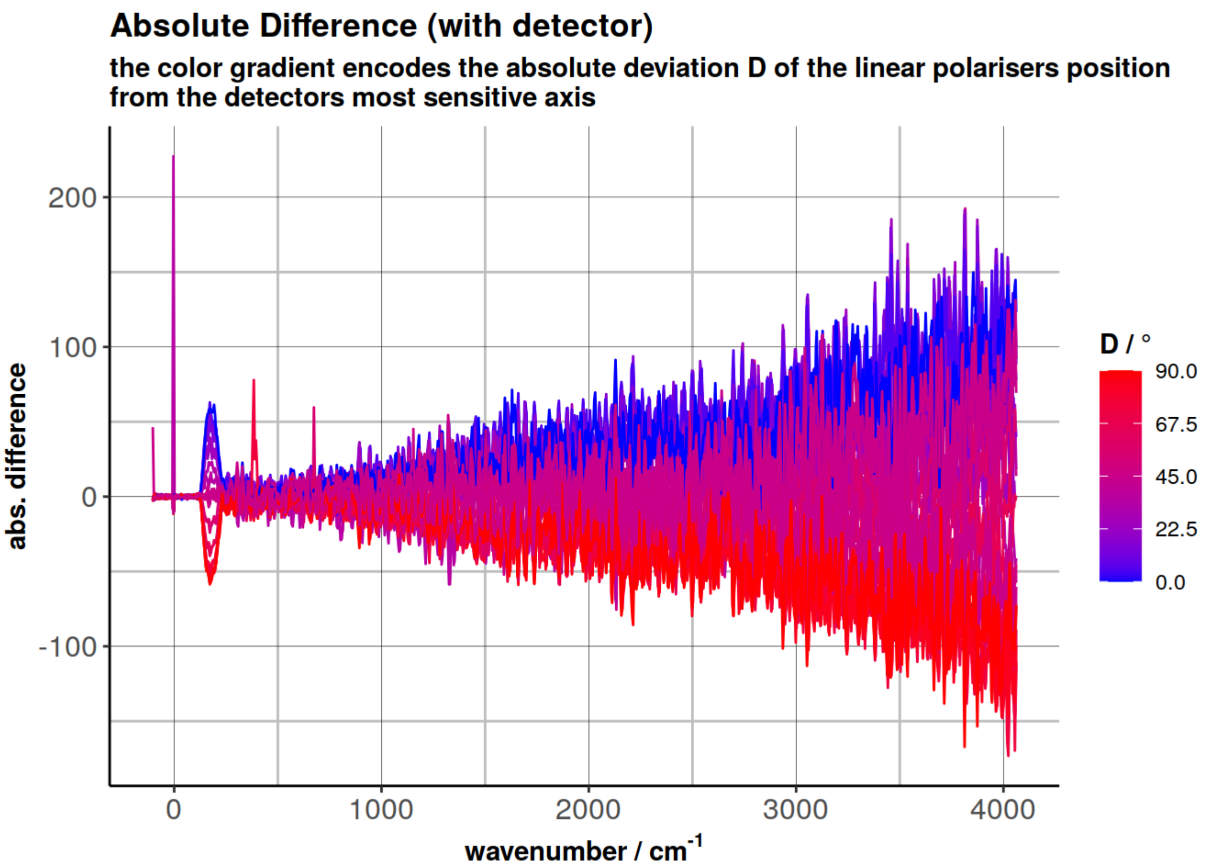

```
plot.detector.allSpectra(detector.spectra[[2]][,-c(2:3,21:24)], theta=240)
```



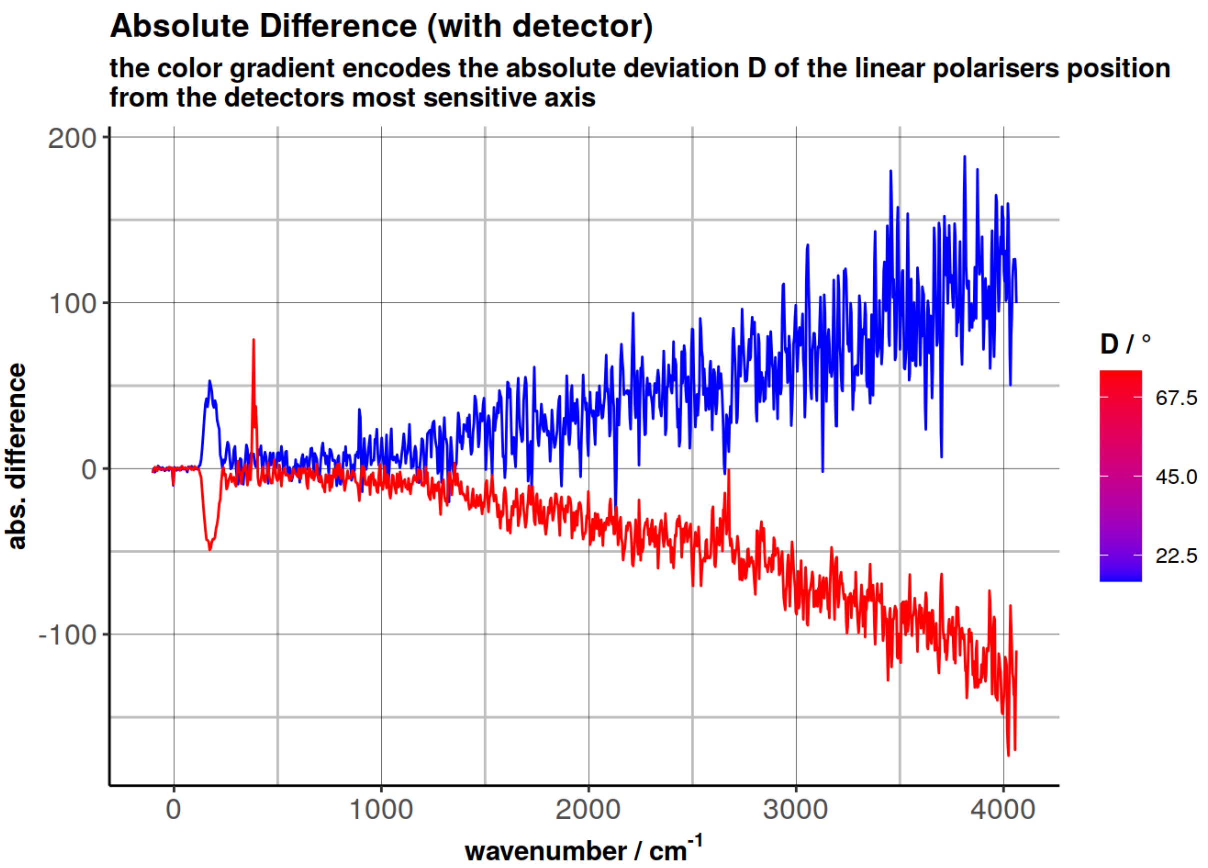


- Auftragen der Differenzspektren
- Von den Spektren, die mit dem Mikroskop gemessen wurden, werden die Spektren mit dem größten Unterschied gezeigt

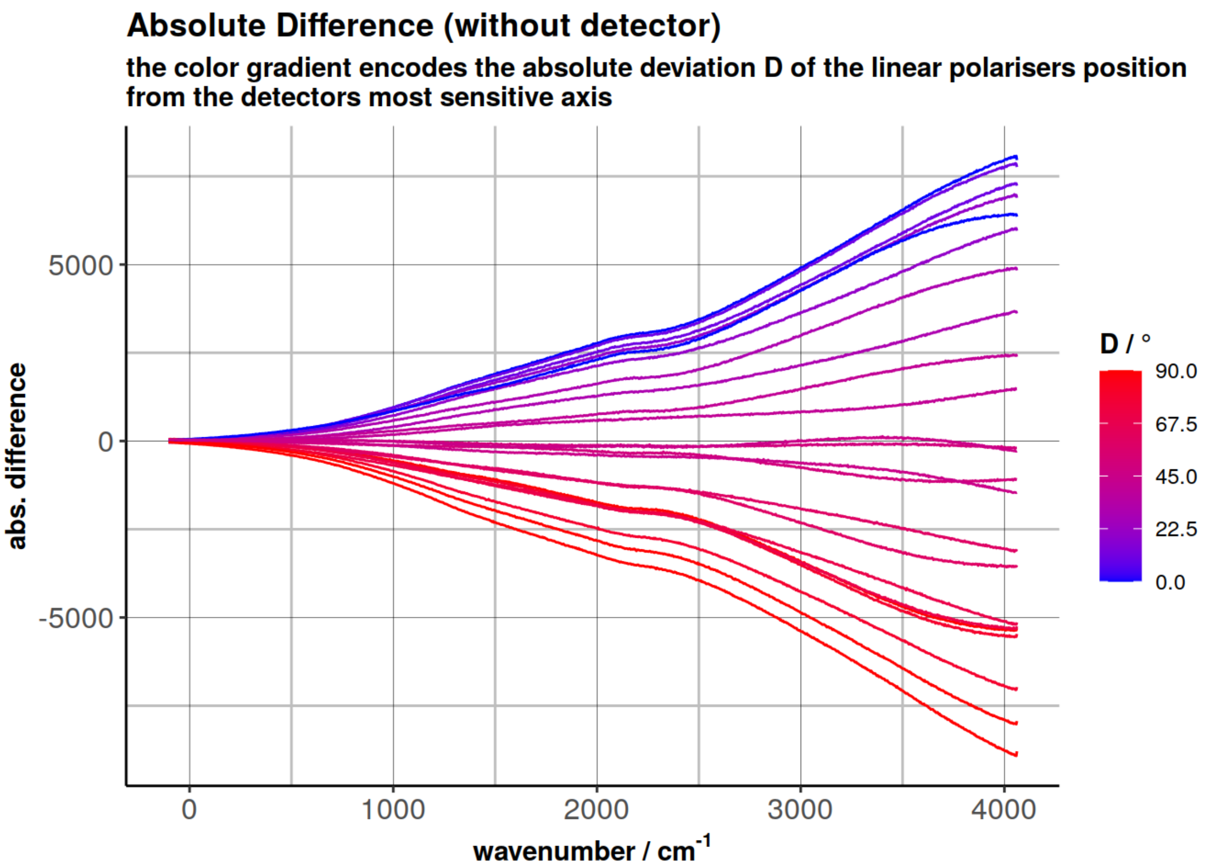
```
# Plot the ABSOLUTE DIFFERENCE between the white lamp spectra and their mean
# with microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.absDifference[[1]][, -c(2:3)],
                                                 colorFunc=function(polariserRotation) {mo
d(polariserRotation+45, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Absolute Difference (with detector)",
                        ylab="abs. difference")
```



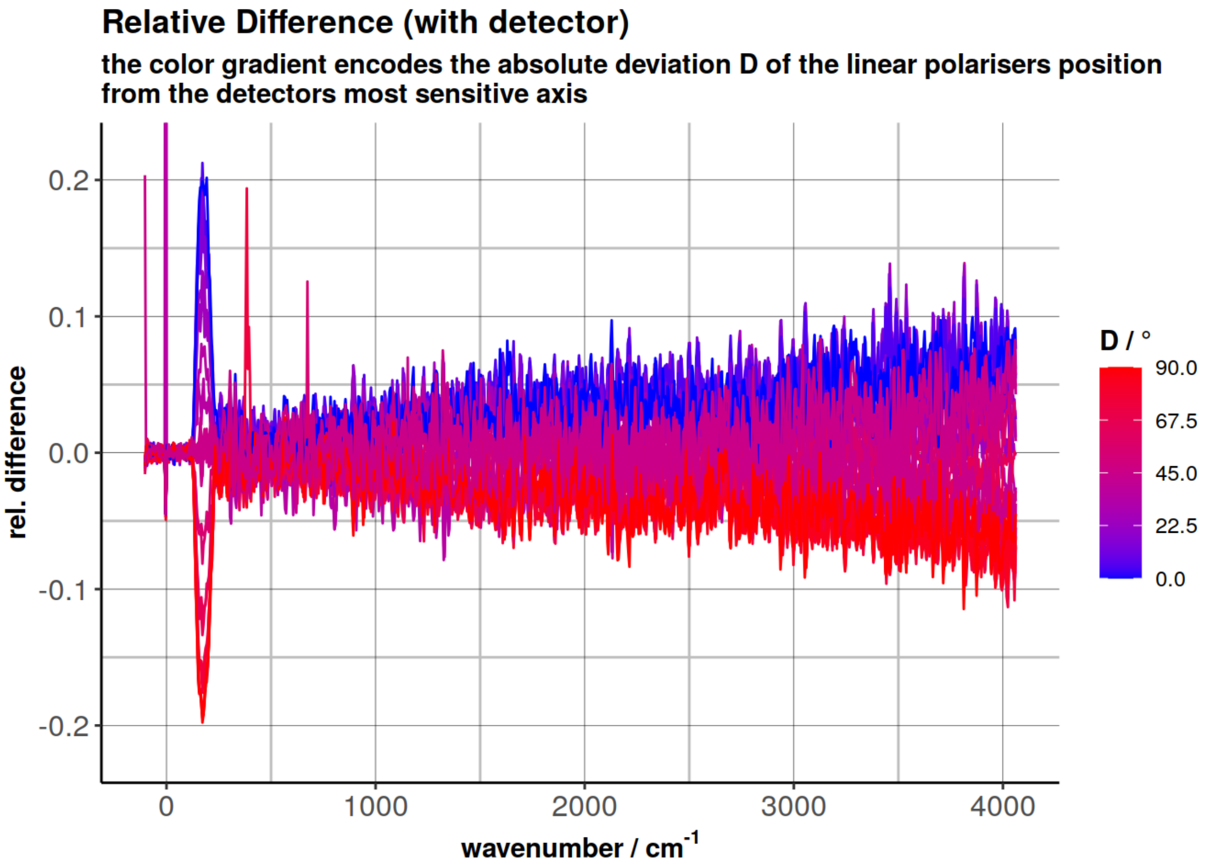

```r
# with microscope, only the extrema
plot.detector.whitelamp(data=makeSpectraPlotable(detector.absDifference[[1]][, c(1, 7, 16)],
                                                  colorFunc=function(polariserRotation) {mod(polariserRotation+45, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Absolute Difference (with detector)",
                        ylab="abs. difference")
```




```
# without microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.absDifference[[2]][, -c(2:3)],
                                                  colorFunc=function(polariserRotation) {mo
d(polariserRotation, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Absolute Difference (without detector)",
                        ylab="abs. difference")
```



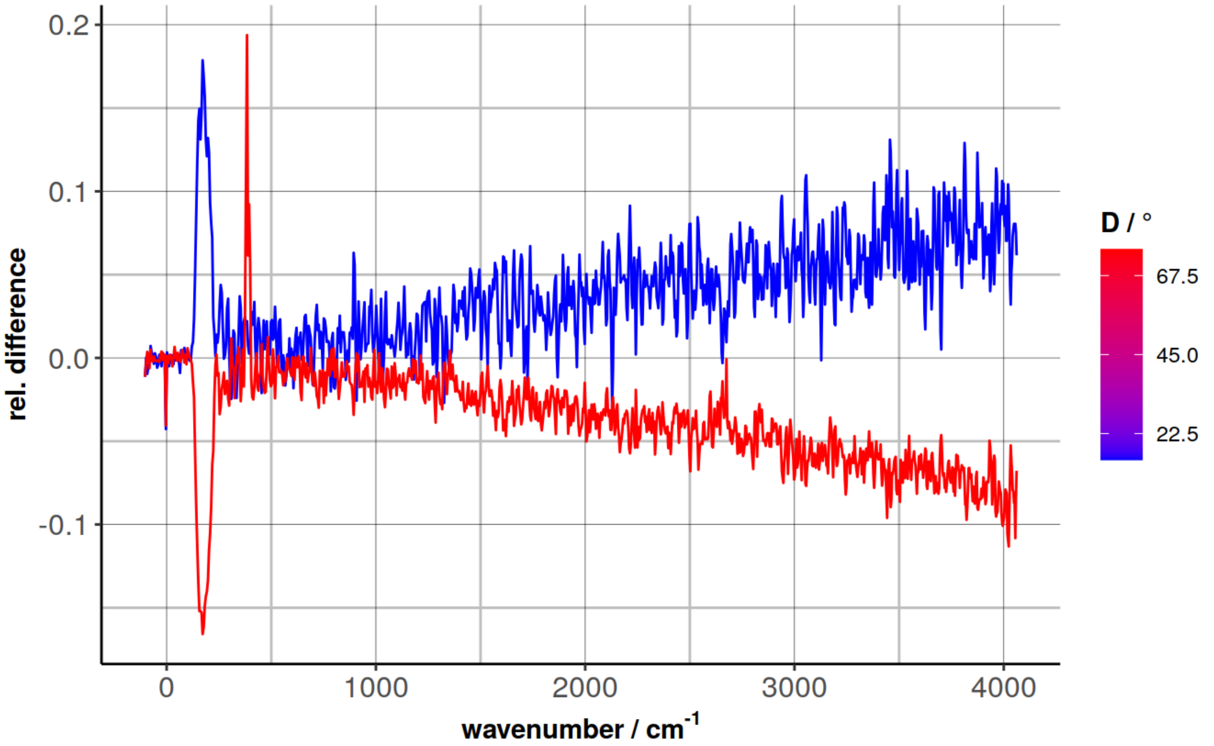
```
# Plot the RELATIVE DIFFERENCE between the white lamp spectra and their mean
# with microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.relDifference[[1]][, -c(2:3)],
                                                 colorFunc=function(polariserRotation) {mo
d(polariserRotation+45, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Relative Difference (with detector)",
                        ylab="rel. difference") +
  coord_cartesian(ylim = c(-0.22, 0.22))
```




```
# with microscope, only the extrema
plot.detector.whitelamp(data=makeSpectraPlotable(detector.relDifference[[1]][, c(1, 7, 1
6)],
                                                 colorFunc=function(polariserRotation) {mo
d(polariserRotation+45, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Relative Difference (with detector)",
                        ylab="rel. difference")
```

Relative Difference (with detector)

the color gradient encodes the absolute deviation D of the linear polarisers position from the detectors most sensitive axis




```
# without microscope
plot.detector.whitelamp(data=makeSpectraPlotable(detector.relDifference[[2]][, -c(2:3)],
                                                  colorFunc=function(polariserRotation) {mo
d(polariserRotation, 180) %>% `-`(.,90) %>% abs(.)} ),
                        title="Relative Difference (without detector)",
                        ylab="rel. difference")
```

Relative Difference (without detector)

the color gradient encodes the absolute deviation D of the linear polarisers position from the detectors most sensitive axis