



# Brewer direct irradiance measurements: polarization effects

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## Outline

Introduction. Problem description

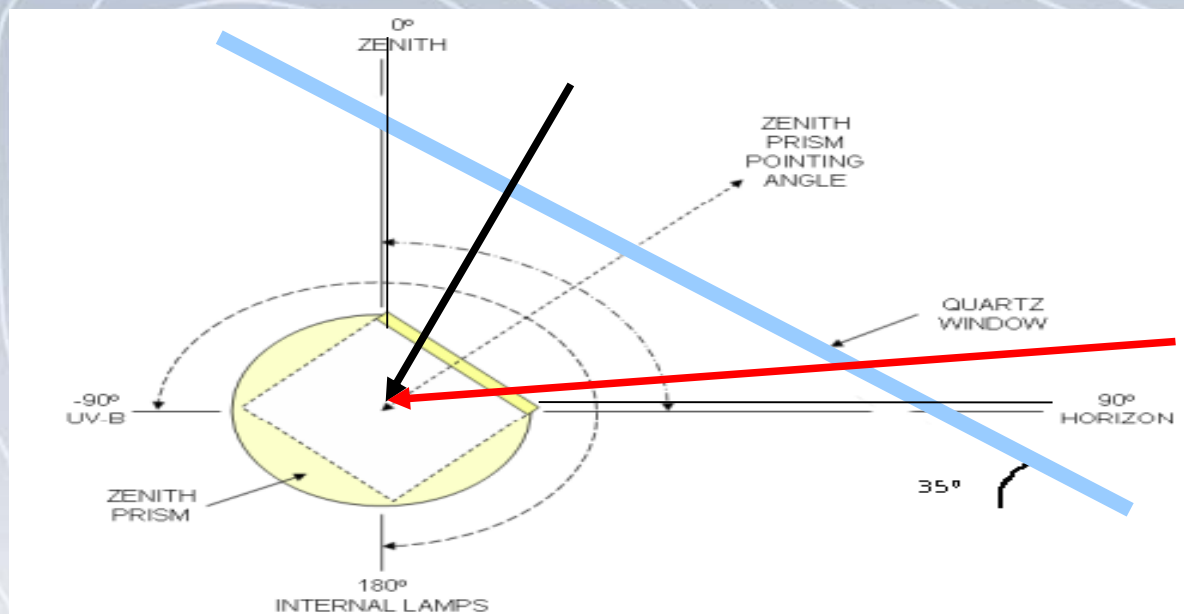
Measurement method

Results: Field measurements

Work in progress

# Introduction

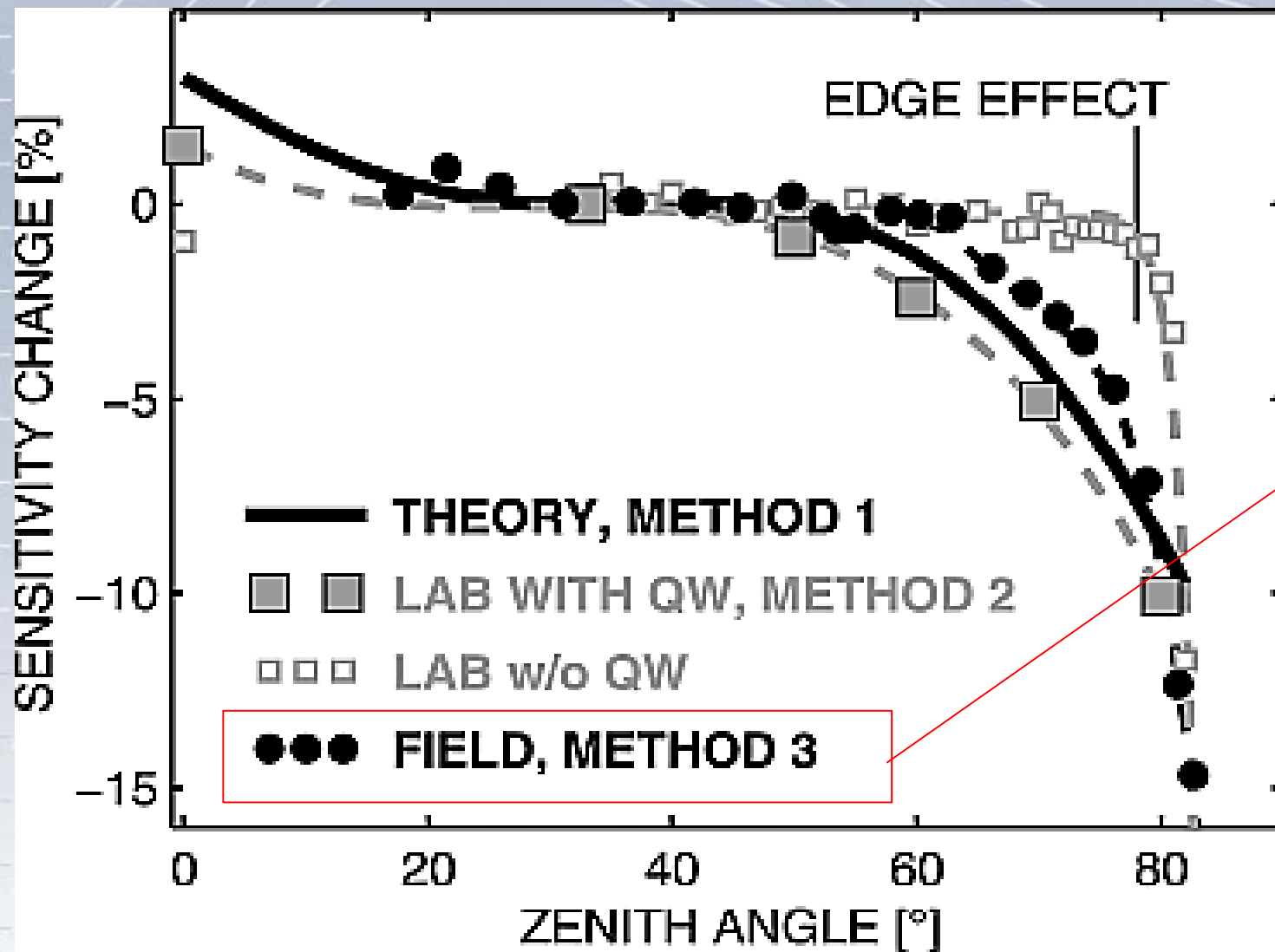
The sensitivity of direct-sun measurements from Brewer spectrophotometers changes with the solar zenith angle(SZA)



The combination of **the effect of the flat quartz window** and the effect of the diffraction grating produce a remarkable sensitivity decrease at high SZAs when measuring absolute irradiances by the Brewer.

(Cede et al., 2004 and 2006)

# Introduction



What we try to measure...



## Measurement method

We measured at different SZAs with/without the window (more resolution in the interest zones), then, calculated the ratios and compared them to the ratio at  $35^\circ$  SZA (beam perpendicular to the window and no Fresnel effects) (Cede et al., 2006)

The ratio of the measurements with and without QW at  $SZA = 35^\circ$  represent the transmission of the QW for normal incidence

# Data reduction



- Extraction of the experiment raw data from the B file.
- Calculate the count rates

$$F_i = \frac{F_i - F_1}{CY_x IT} \quad i=0,2\dots6$$

- Adjust for Dead time.
- No temperature correction needed.
- Calculate the ratios Window/No window.

## Data reduction II



- Make sure that there are no measurements with filter change, and discard these measurements in case there is any occurrence.
- We have to interpolate to calculate the ratio with/without window at the same time. A simple time interpolation would introduce spectral dependence (1)

Better solution...

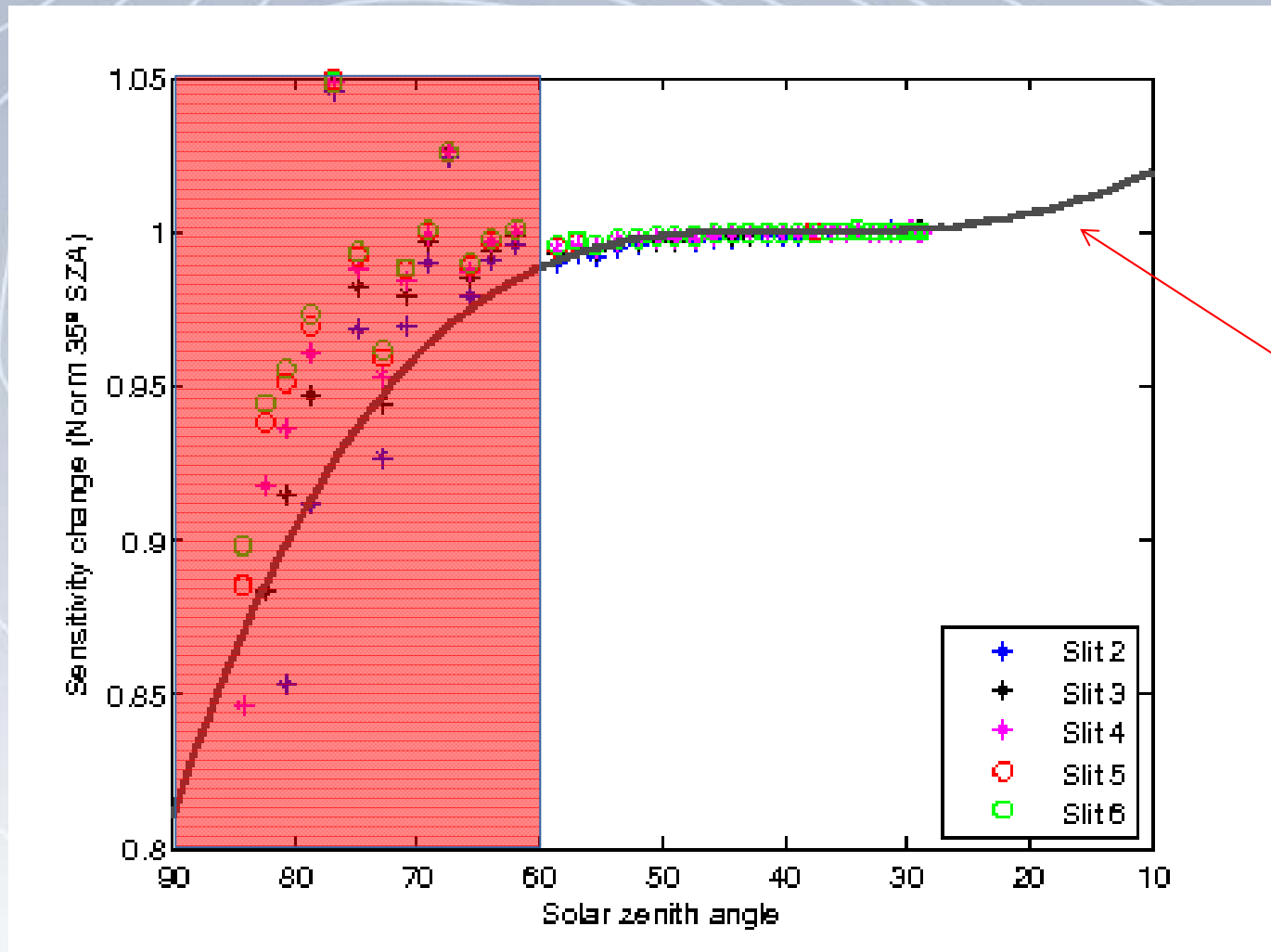
- Physical law (i.e., Bouguer-Lambert-Beer law): linear interpolation of  $\log(I)$  vs ozone airmass, removing the Rayleigh contribution before the regression, then reintroducing it (1)

(1) Dr. H. Diemoz presentation during the Cost Action 1207 meeting, El Arenosillo, Huelva, Spain, 25th – 26th May 2015

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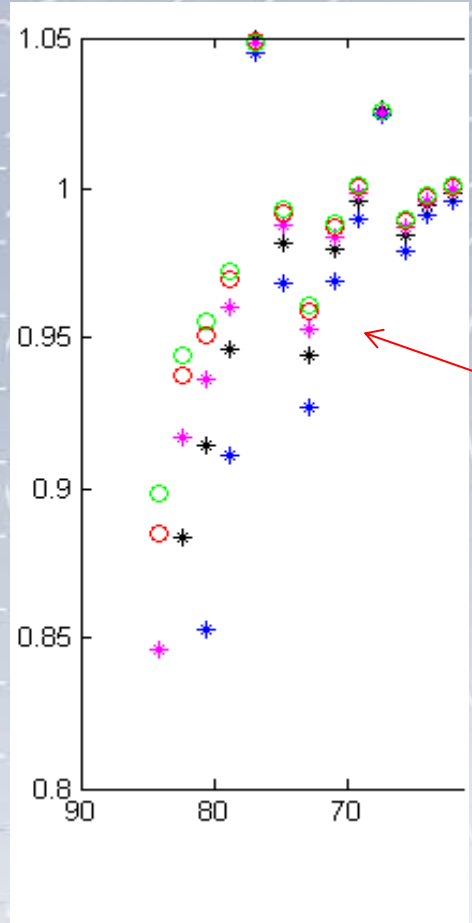


# Field measurements



Theoretical curve, 100% horizontal polarizer





Until 60° SZA...





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For the rest of the winter  
we have had a very  
beautiful set of clouds...  
but not good for our  
purposes...

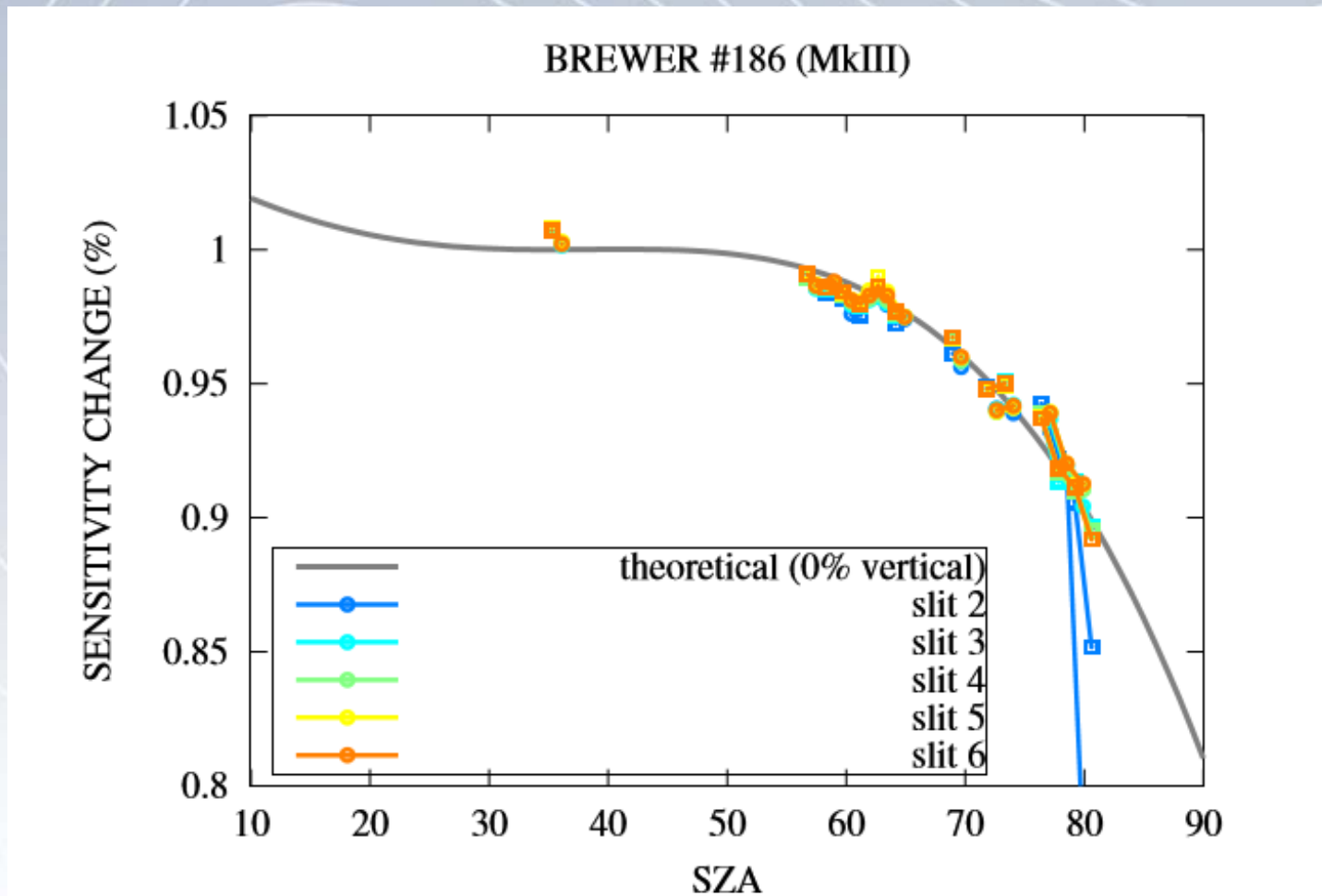


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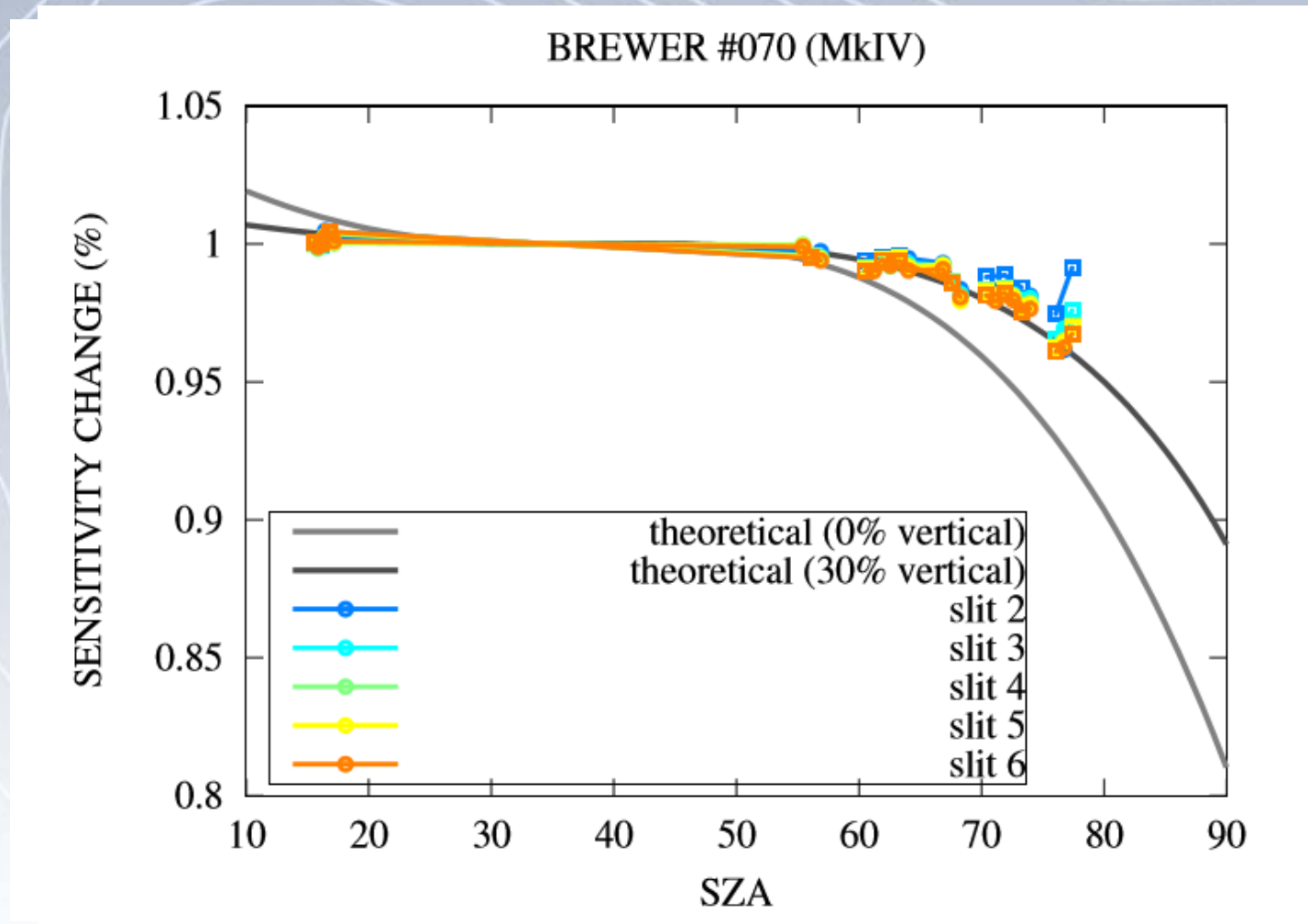
# Results

Using the measurements we took during the last RBCC-E campaign at Huelva and processed by Dr. Henri Diemoz.

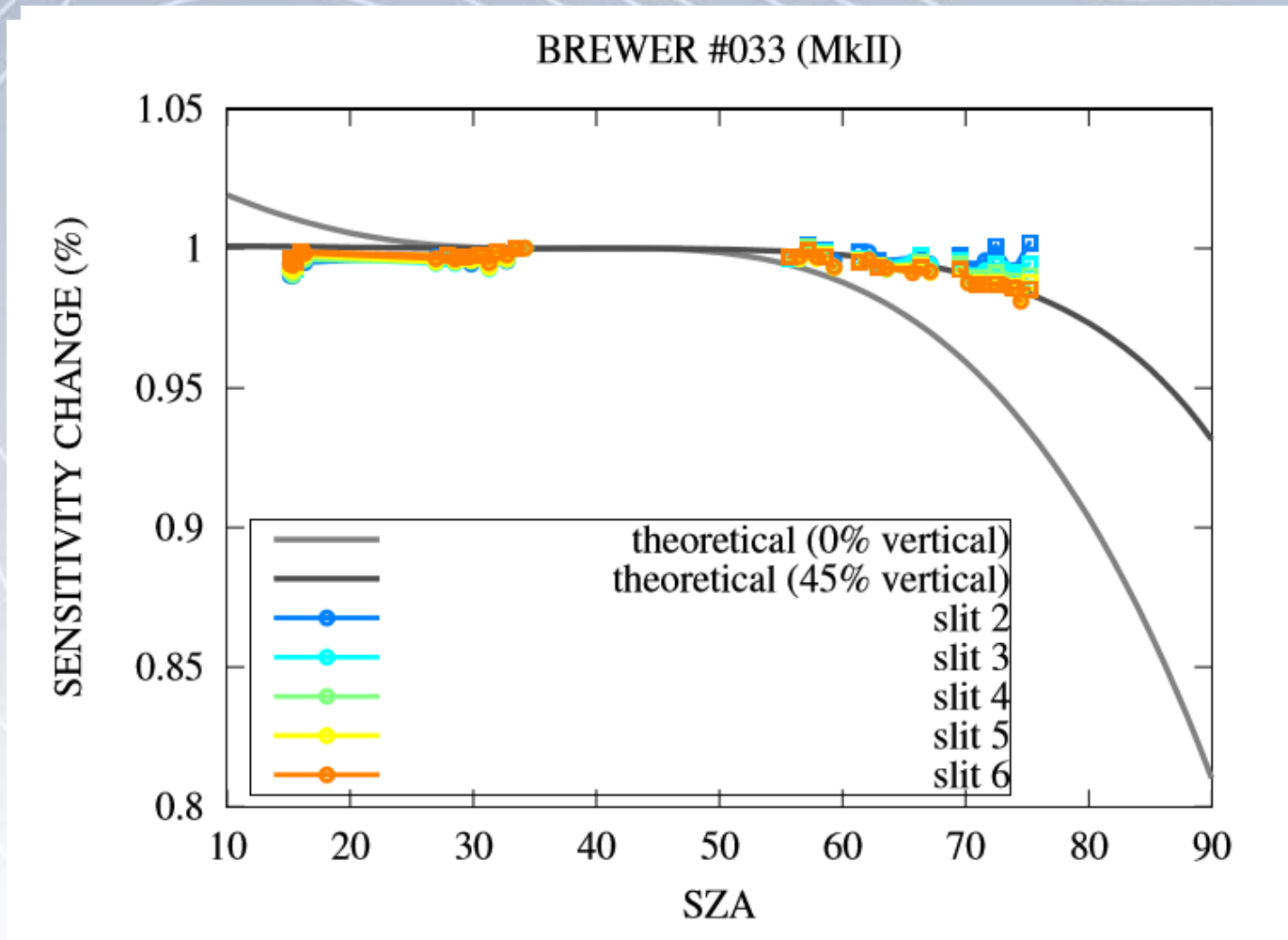




# Results

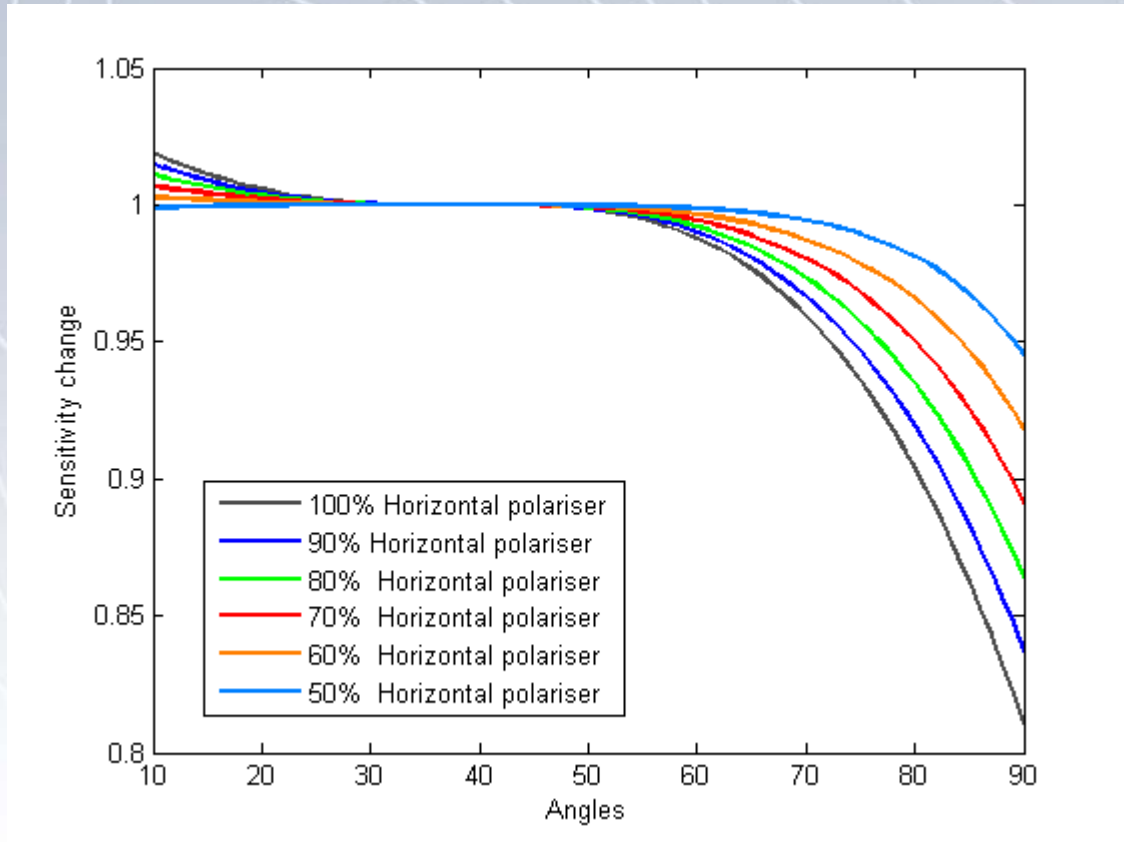


# Results



# Results

The difference in the curvature from the theoretical curve can be explained by the fact that diffraction gratings are not necessarily linear polarisers





## Ongoing work



- Repeat the experiment with the correct weather conditions.
- Calculate a correction for the direct measurements.... **important for absolute Langley's and AOD measurements.**
- Measure at least with two different brewers to ensure that the same correction can be used in all the brewers of the same kind.



Thank you for your attention !