Max-Planck-Institut für Plasmaphysik

Report 04/07/2020

P. Hacker

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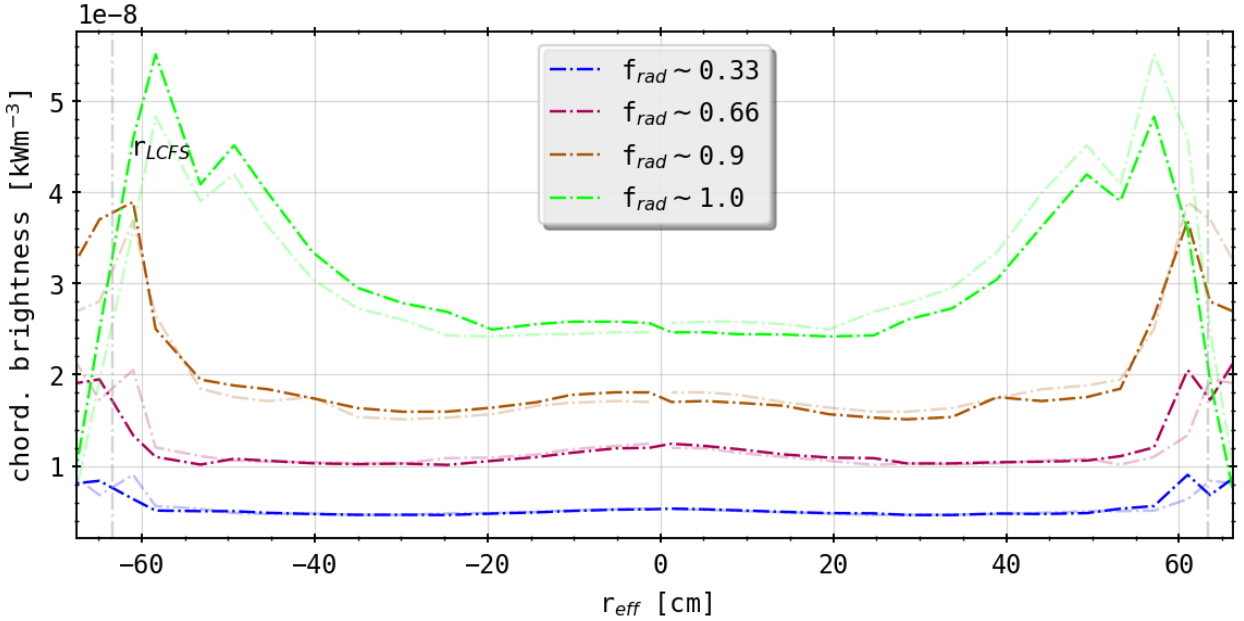
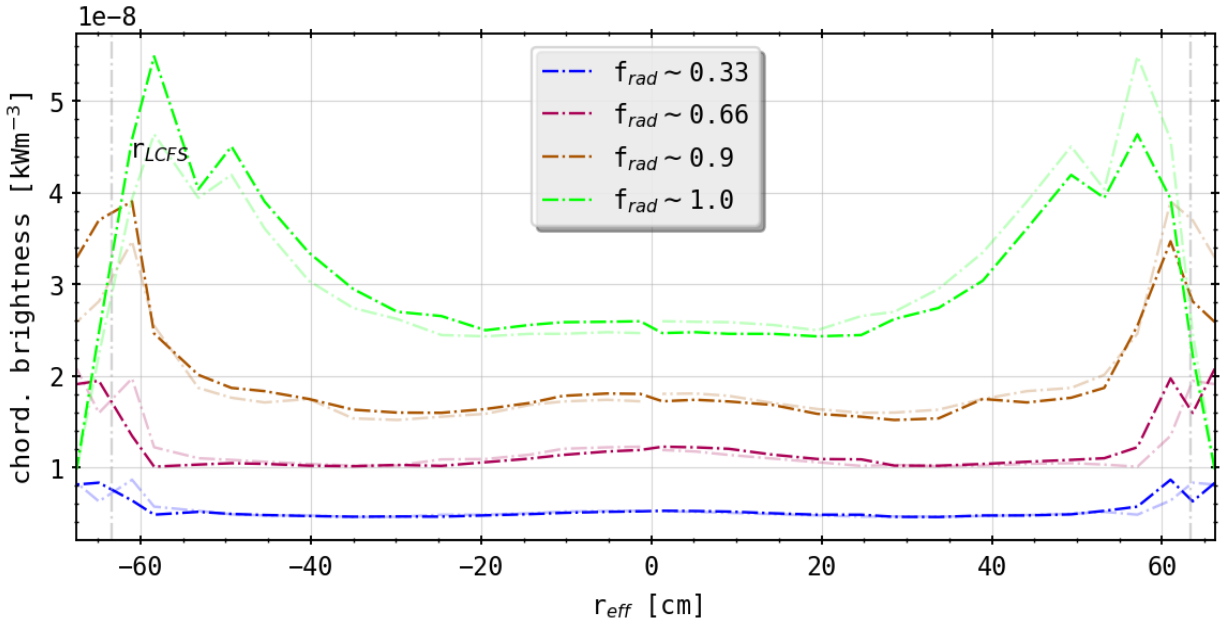
‘Standard’ Case vs. Planar Fix



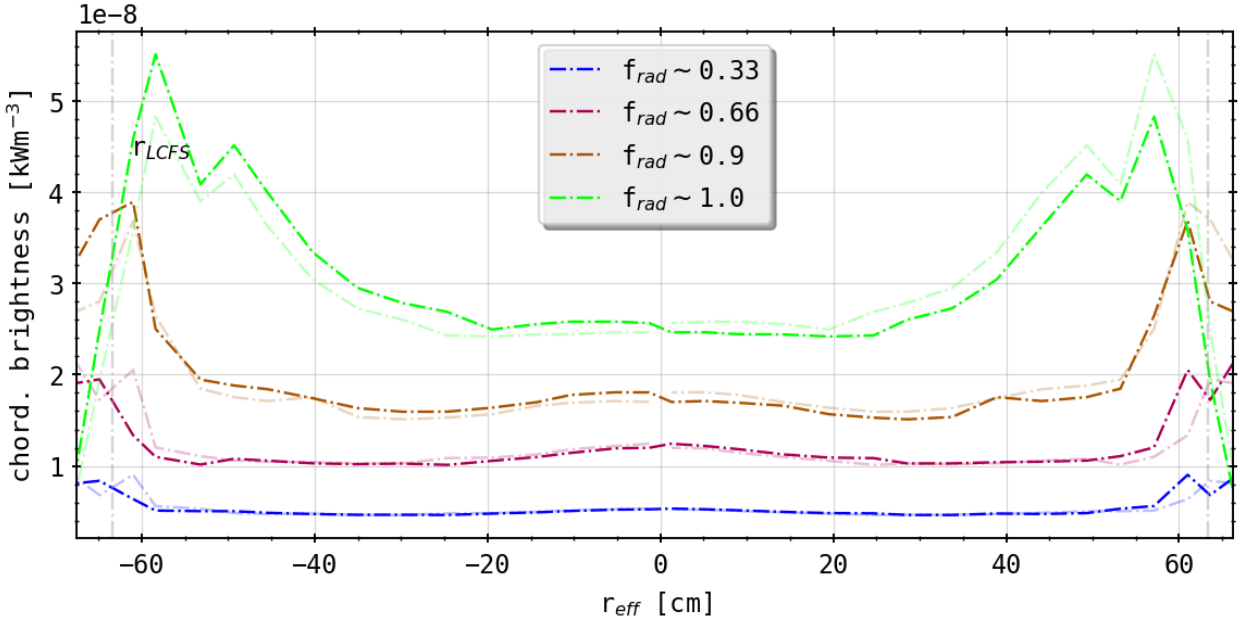
(forward integration of STRAHL simulations)



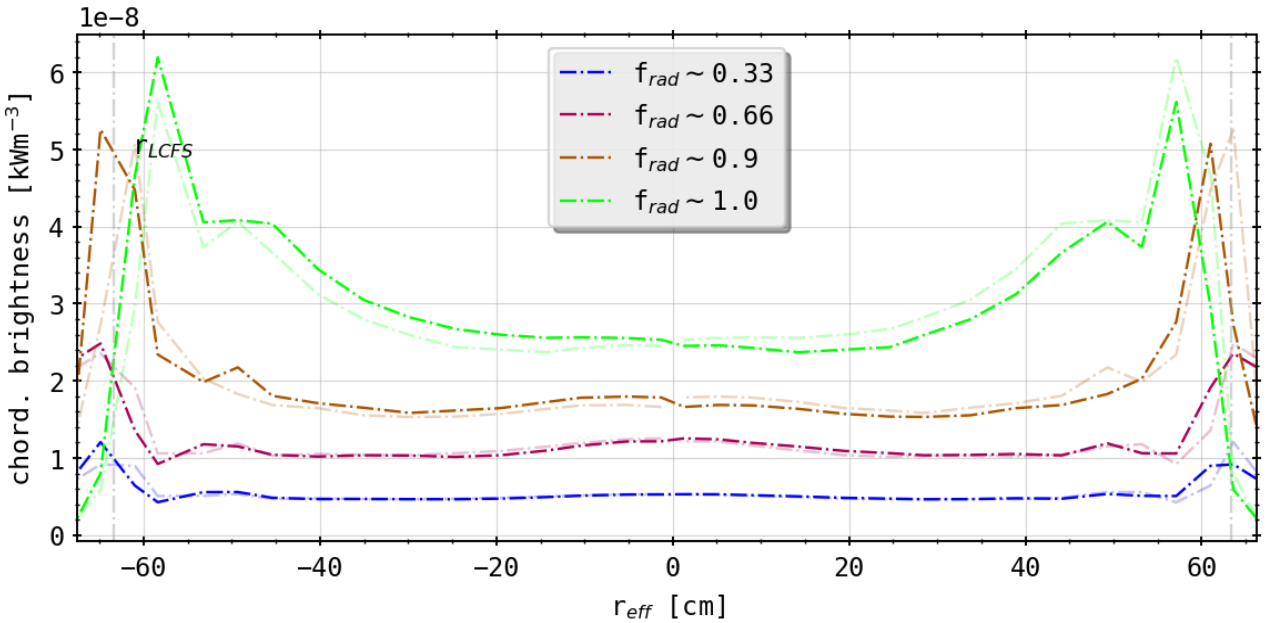
(forward integration of STRAHL simulations with ‘fixed’ LoS)

➢**virtually no changes?**

‘Standard’ Case vs. Toroidal Transformation



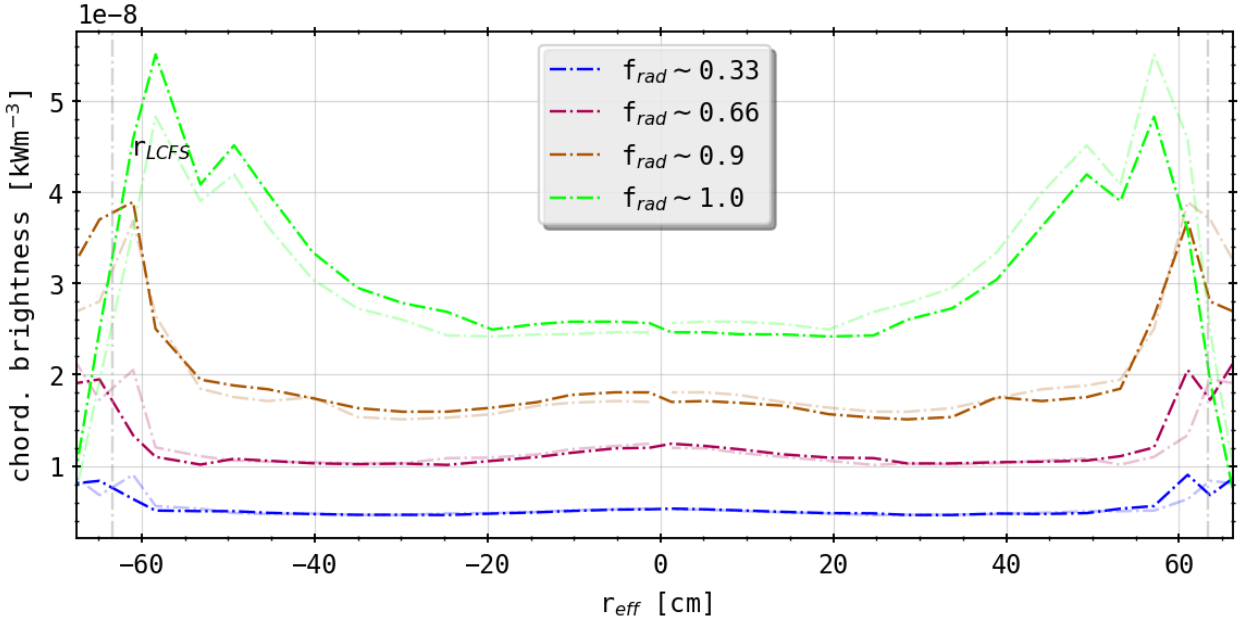
(forward integration of STRAHL simulations)



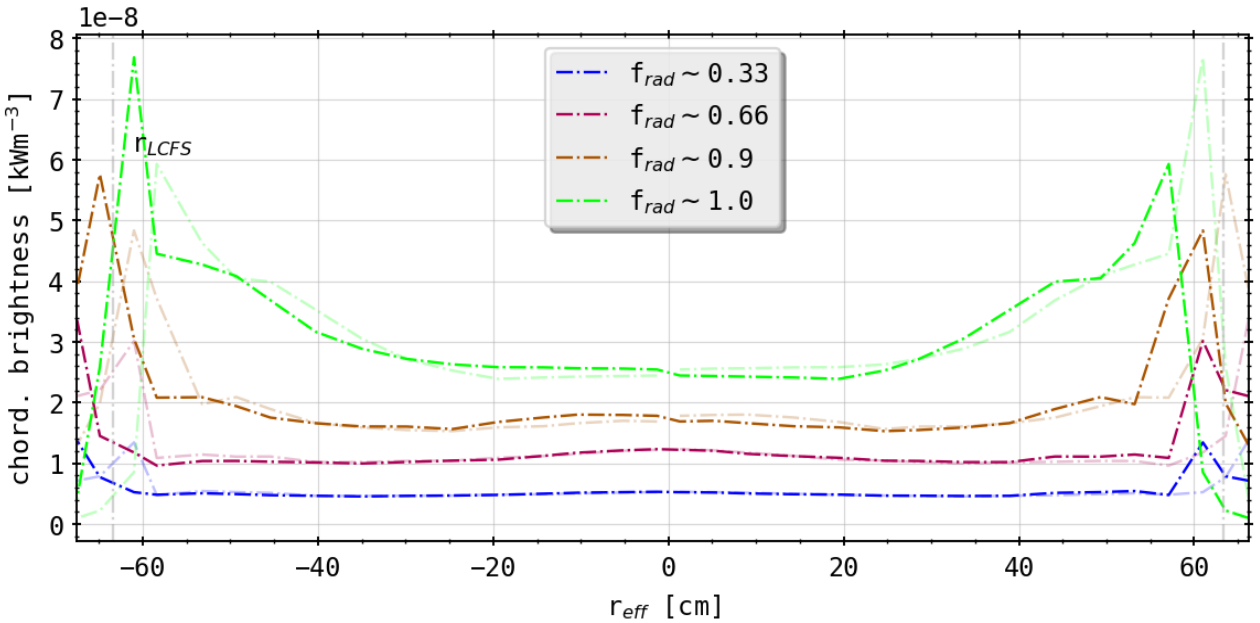
(geometry matrix in Bolometer plane at 108° with symmetric LoS orientation)

- qualitatively small changes: SOL radiation zones now more peaked
- radially no shift/difference in forward calculation
- comparatively same level of asymmetry remains (fault in own calculation?)

‘Standard’ Case vs. Toroidal Transformation and Tilt



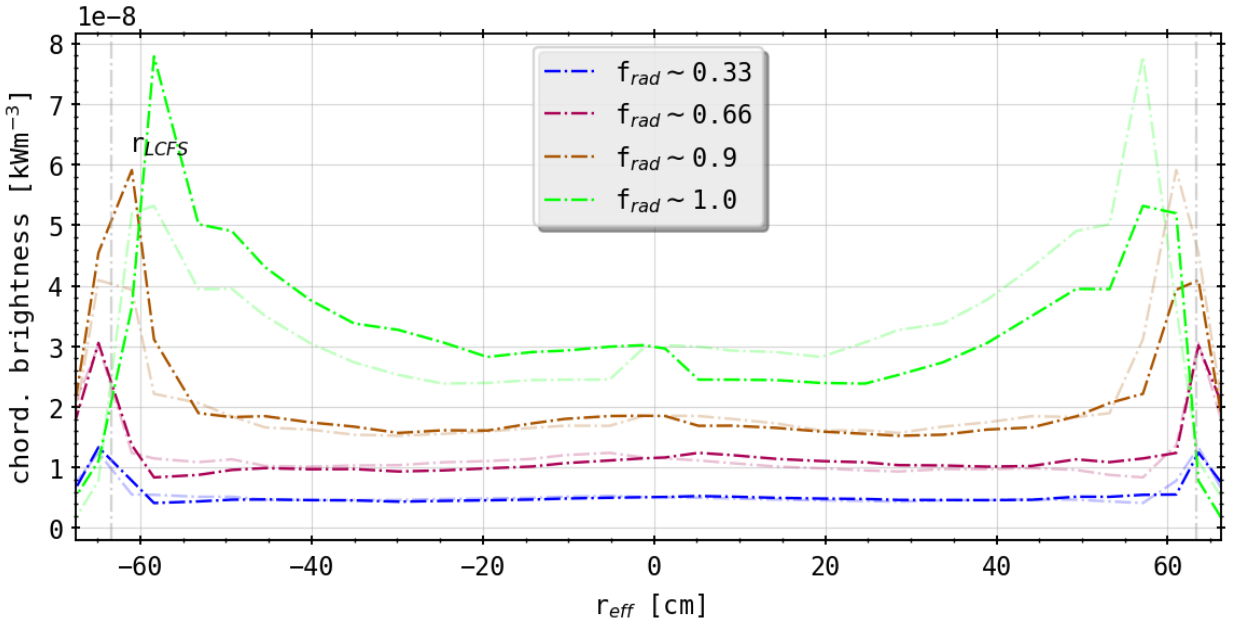
(forward integration of STRAHL simulations)



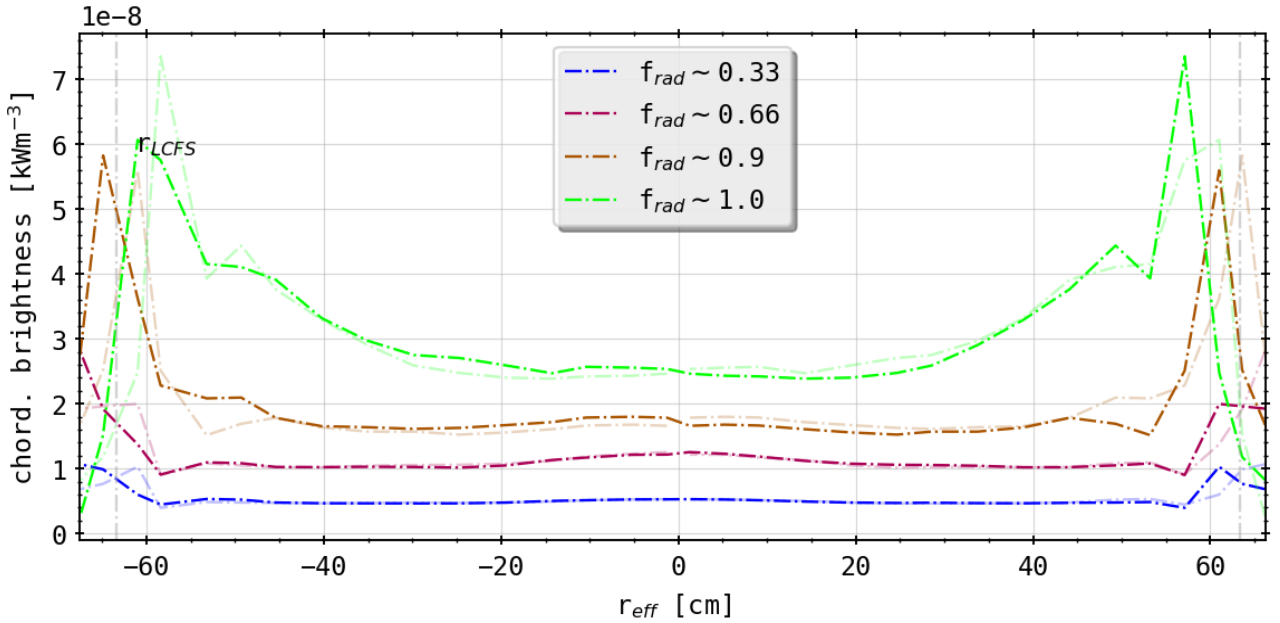
(geometry matrix in Bolometer plane at 108° with symmetric LoS orientation and -1.0° tilt (up))

- asymmetry becomes stronger
- left hand side or brightness for ‘negative’ radii more peaked
- alignment with fluxsurfaces better
- also radial movement of radiation peaks further out (instead of inwards)

Different Tilts



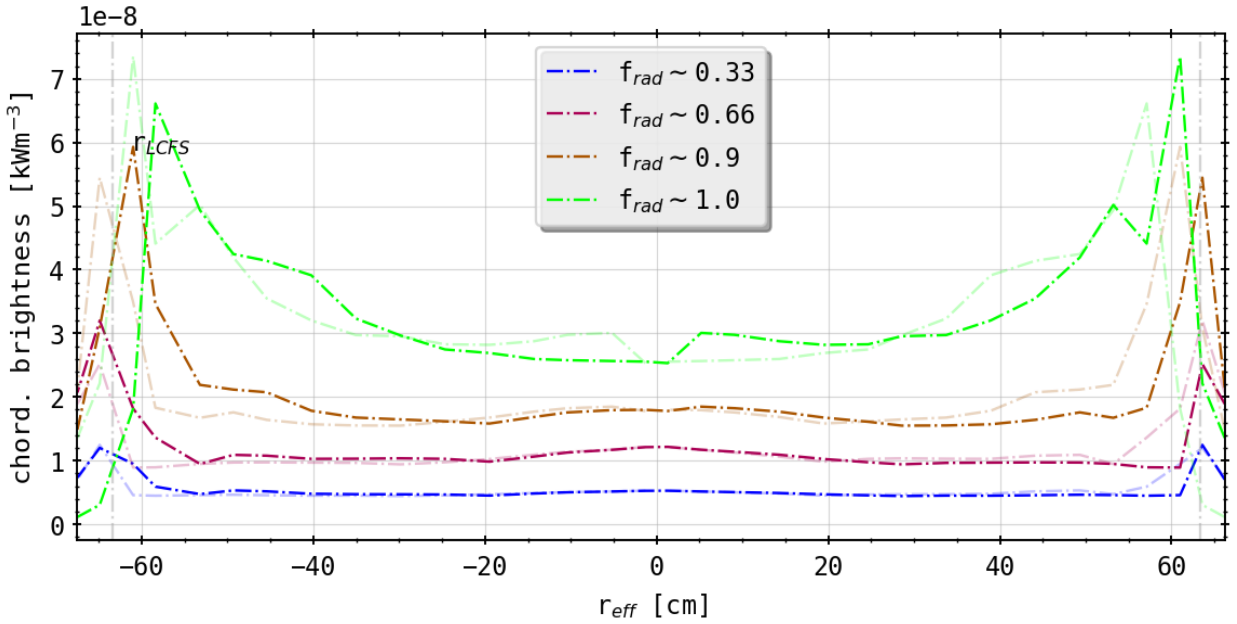
(0.5° tilt (down))



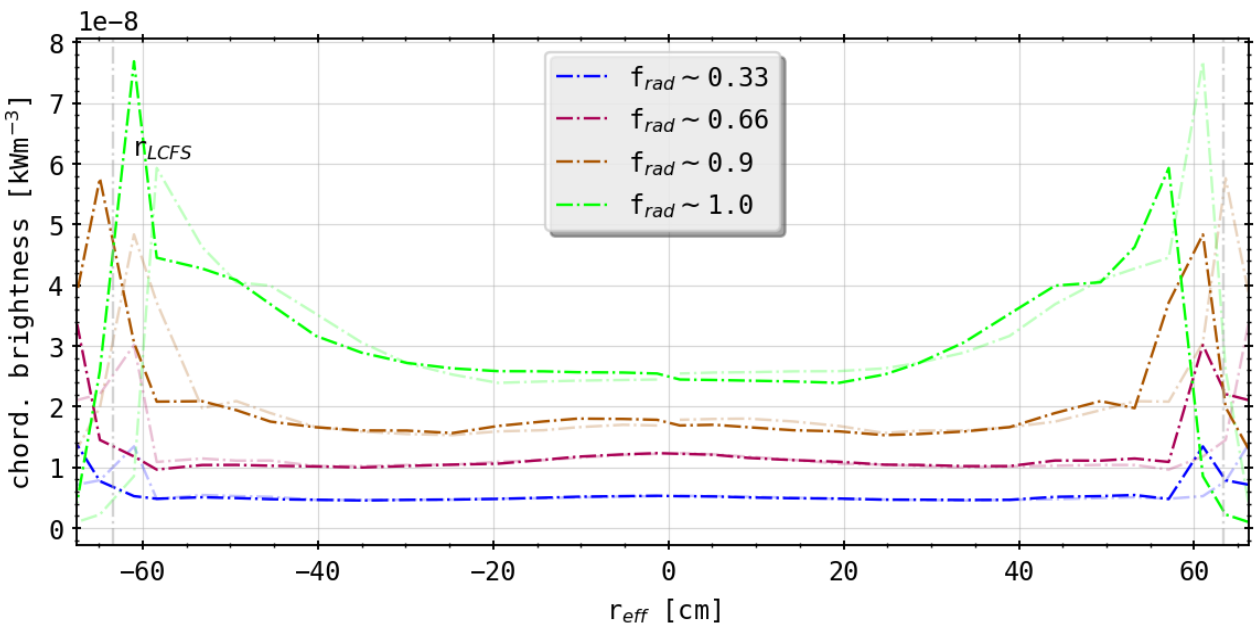
(-0.5° tilt (up))

- asymmetry switched around
- alignment better now upside (tilt down!)
- likewise radial movement as before!

Different Tilts

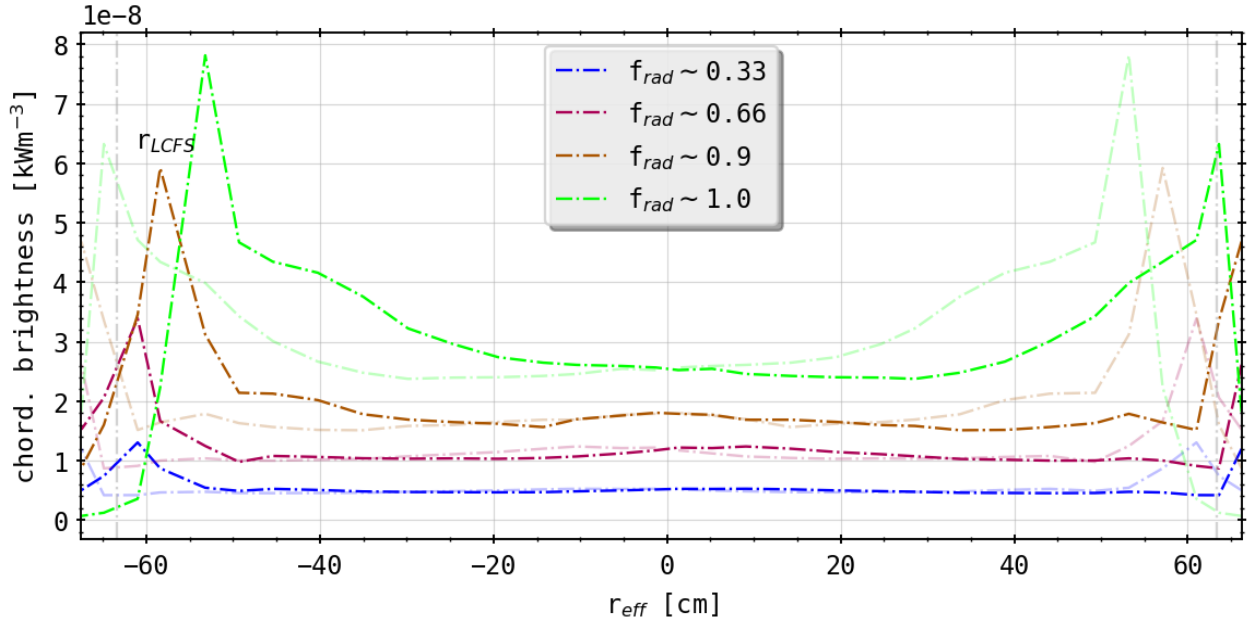


(1.0° tilt (down))

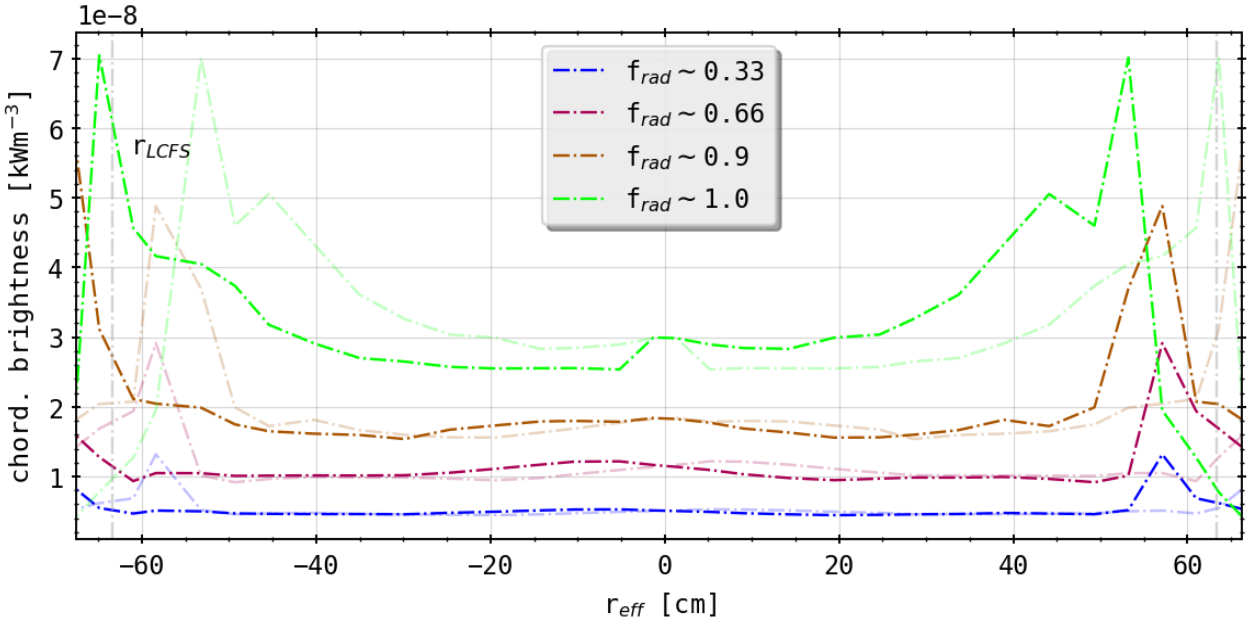


(-1.0° tilt (up))

Different Tilts



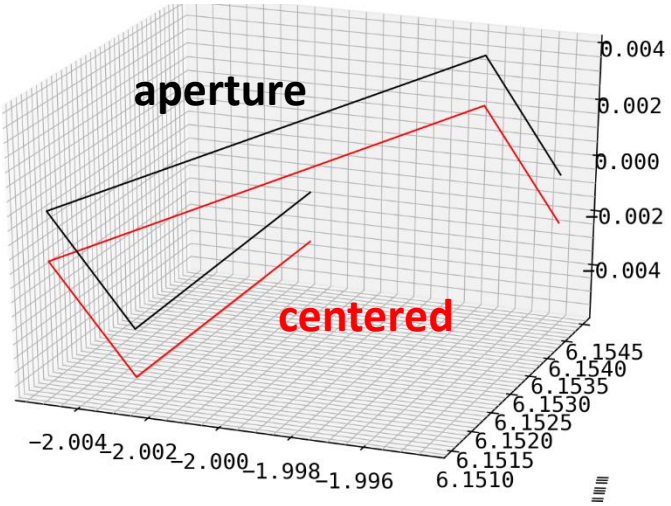
(2.5° tilt (down))



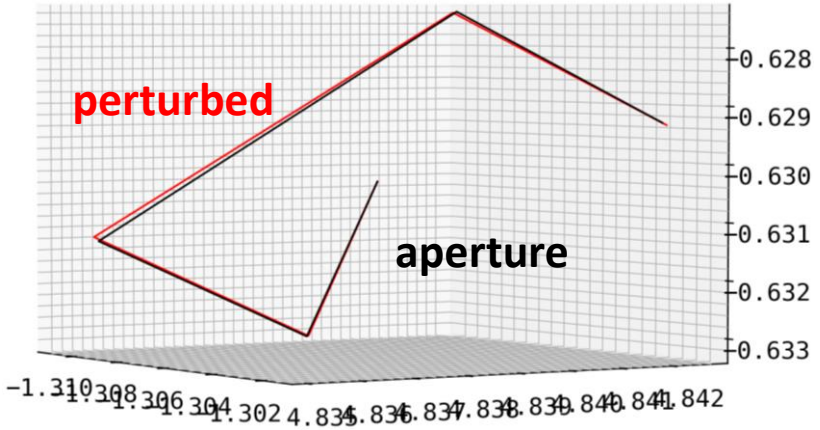
(-2.5° tilt (up))

Centering of Aperture and Random Error

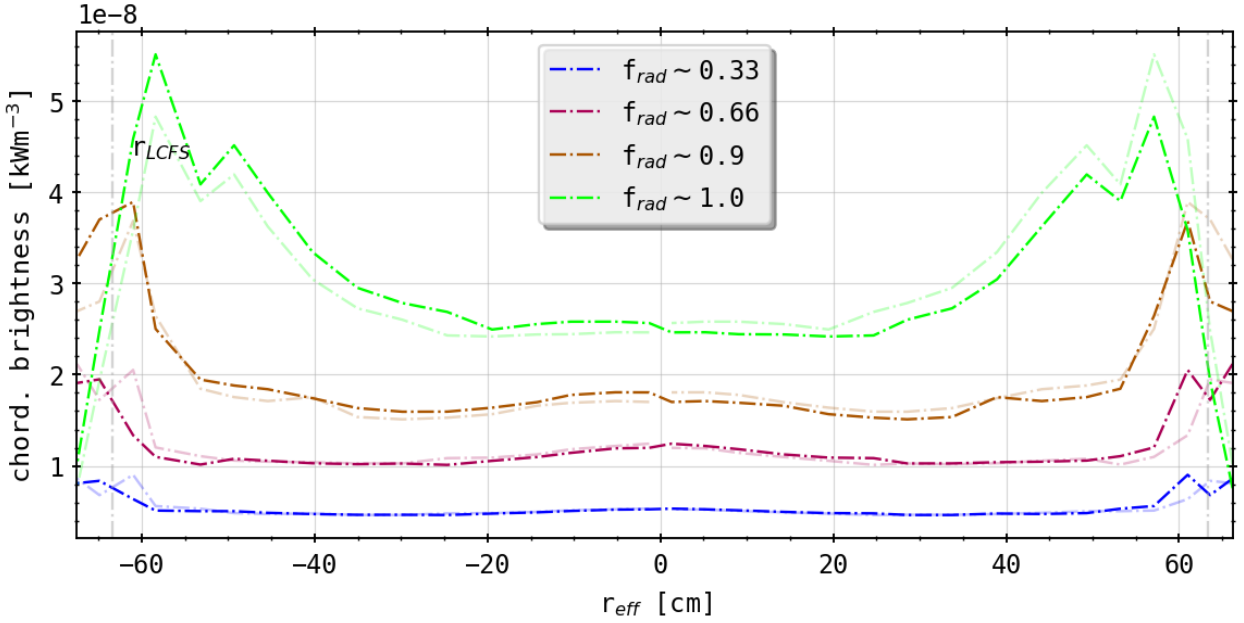
- center the aperture center (black) on z = 0 axis and shift entire array accordingly to red



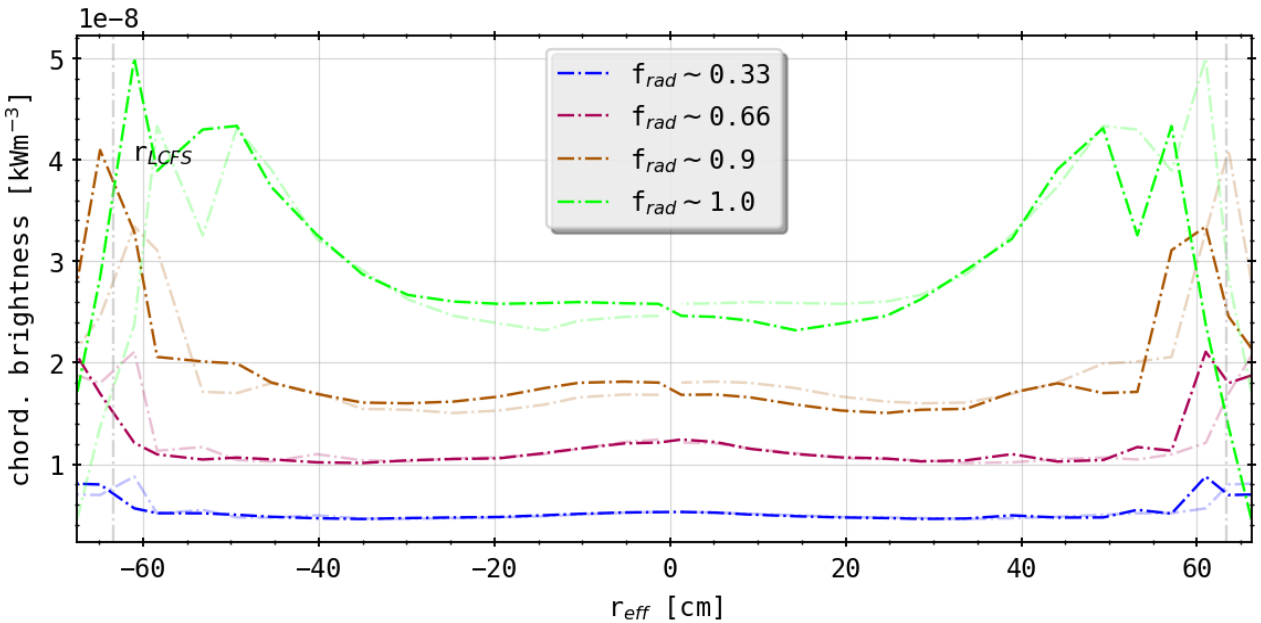
- introduce measurement error to aperture and detector positions of maximum 0.1mm (randomly distributed) and see resulting tilt in camera fan
- degree of tilt 0.5° - 2.0°, but omnidirectional



Standard v. Centered Aperture



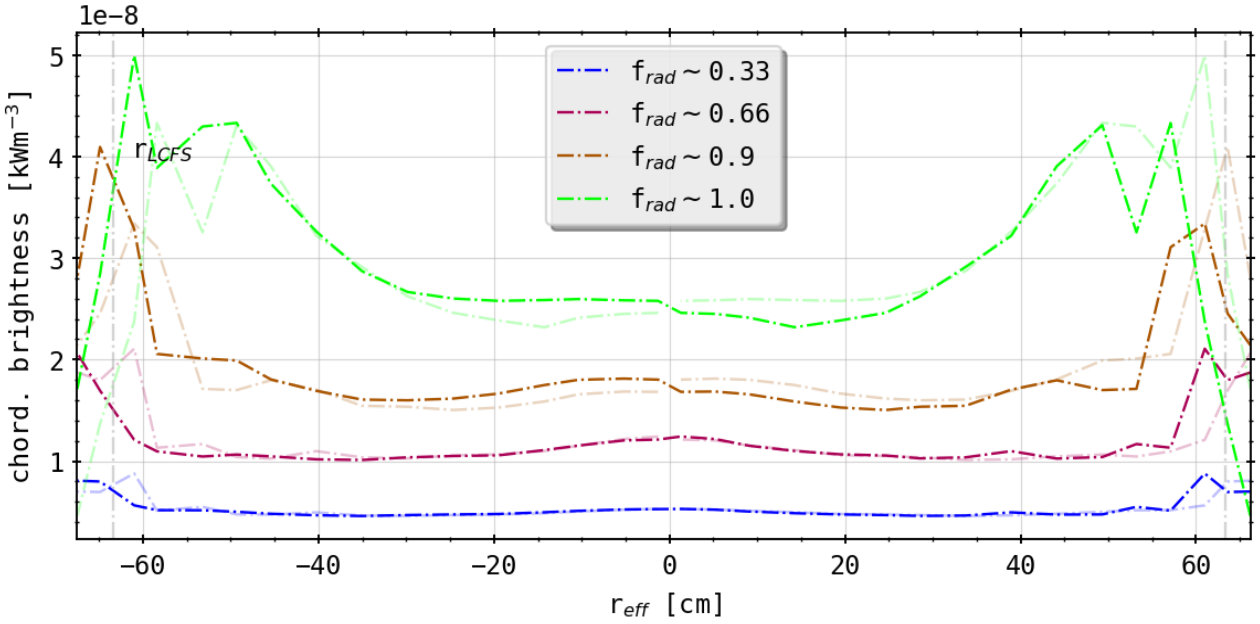
(standard case)



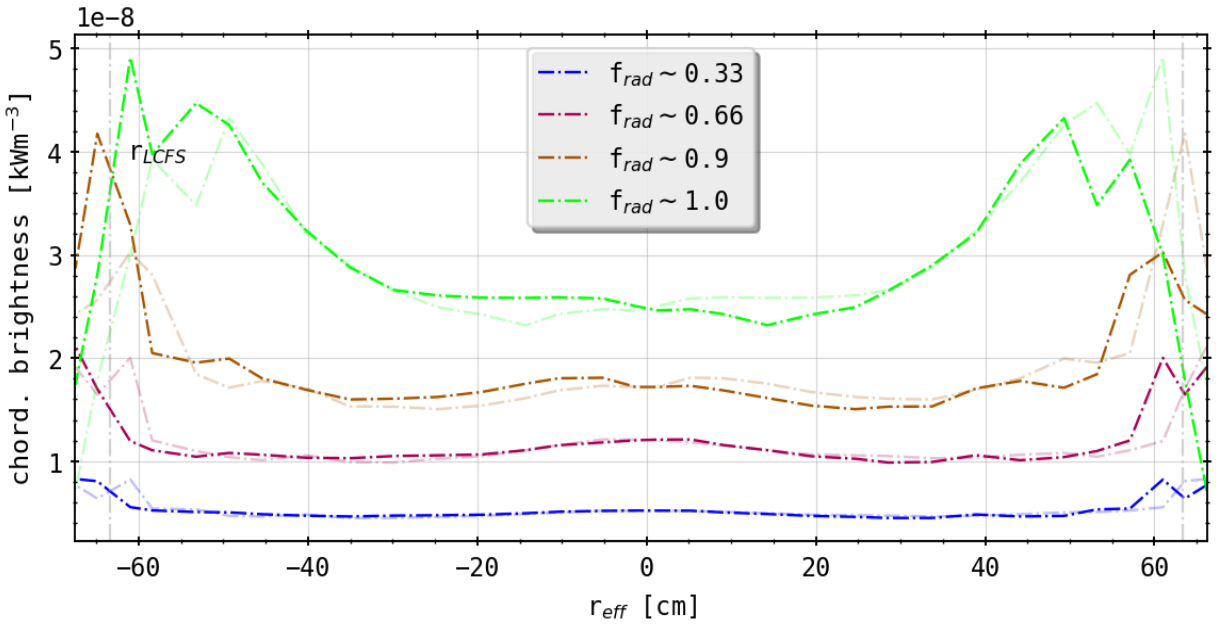
(centered aperture)

- introduction of some more asymmetry close to SOL
- possibly resolvable by one of earlier transformations

Standard v. Centered Aperture



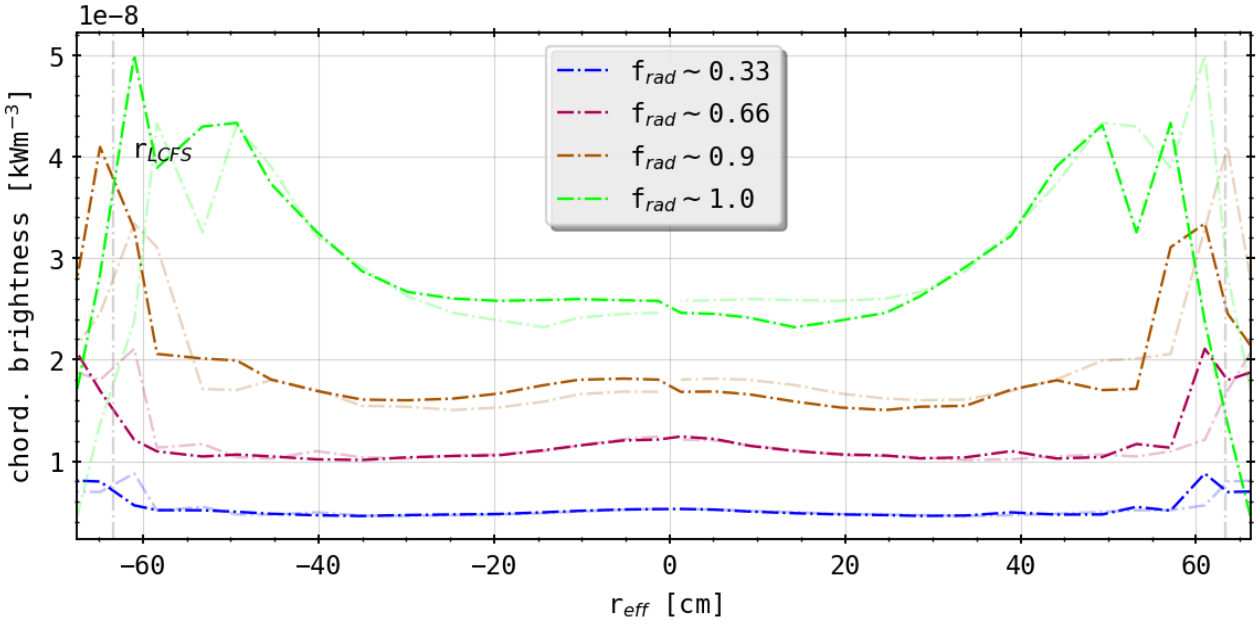
(centered aperture)



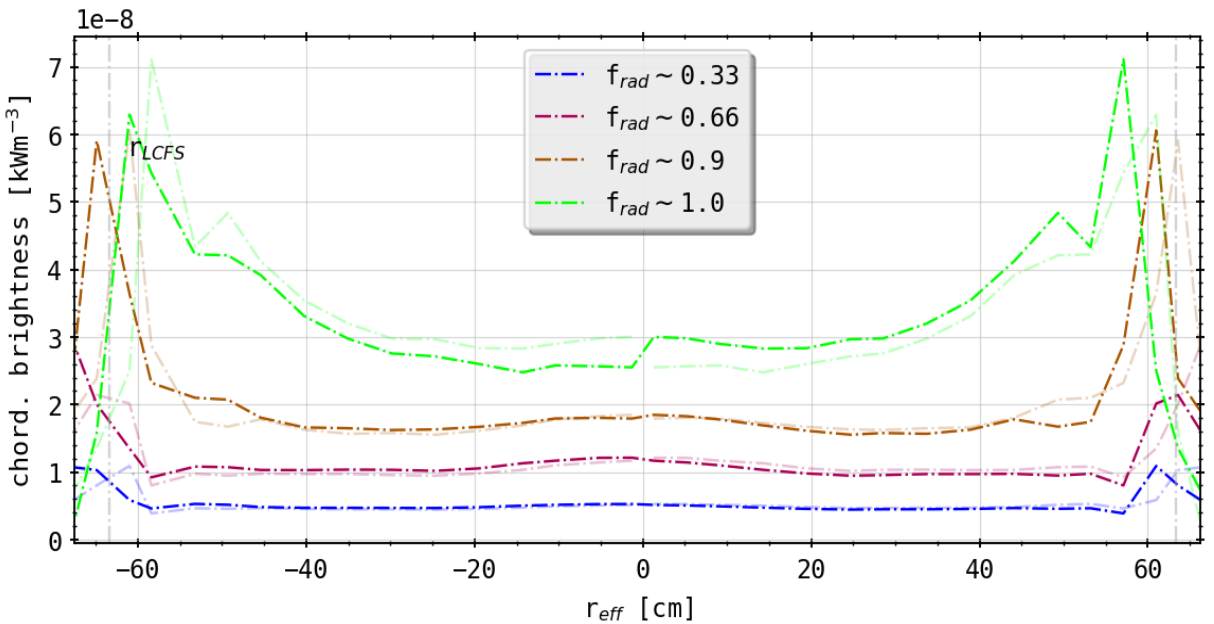
(centered aperture and ‘planar fix’)

➢still not symmetric, aperture normal and LoS fan tilted still

Standard v. Centered Aperture



(centered aperture)



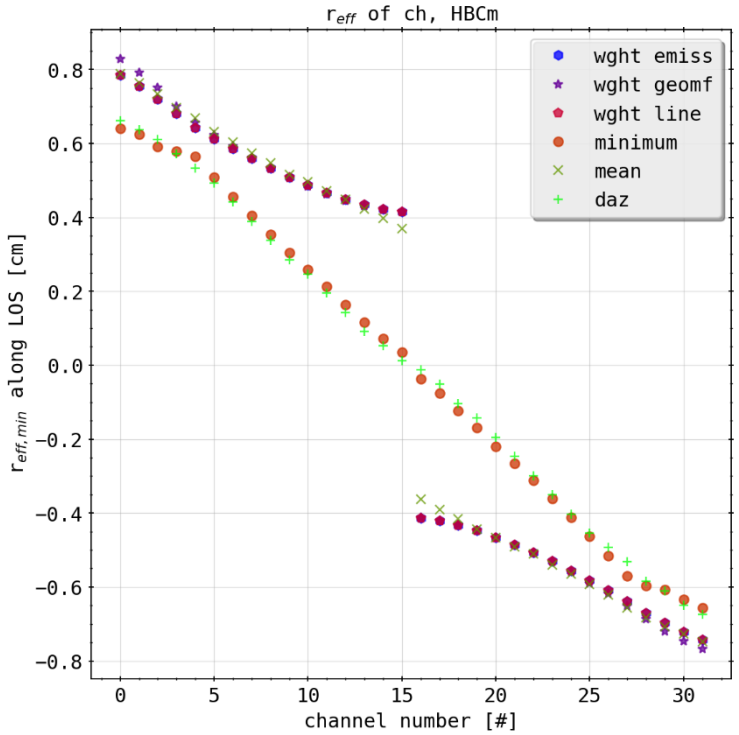
(centered aperture and toroidal transformation)

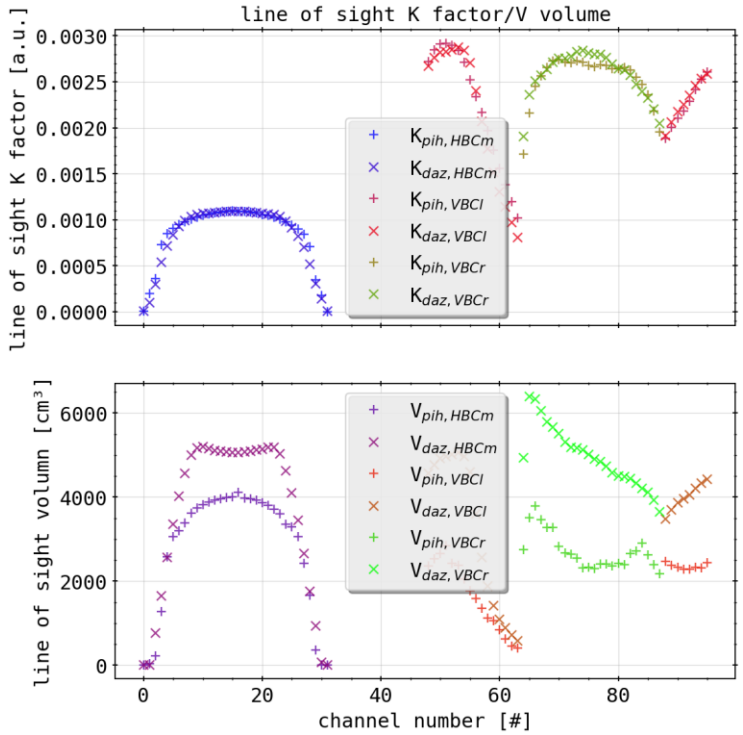
➤???

Old Conclusions

- intrinsic tilt and toroidal shift indicate the asymmetry from inherently symmetric radiation distribution
- possibly flawed inversion if geometry used?
- symmetric chordal profiles produced by 0.5° tilt down (from STRAHL)

(effective radii with also different weighting methods)

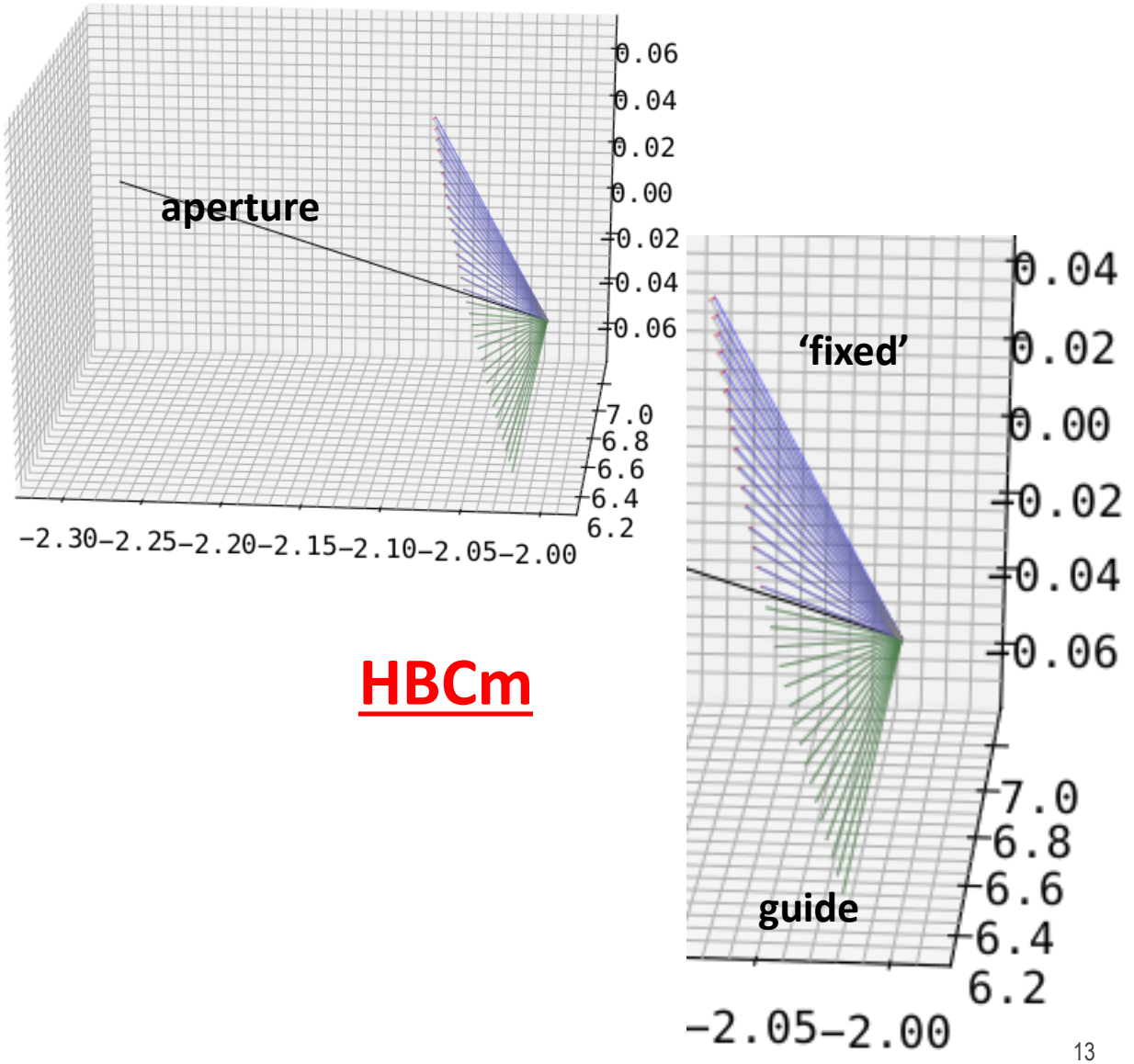




(K factors and LoS volumes from simple 2D projection)

1.: ‘Fix’ Bolometer Planar Error

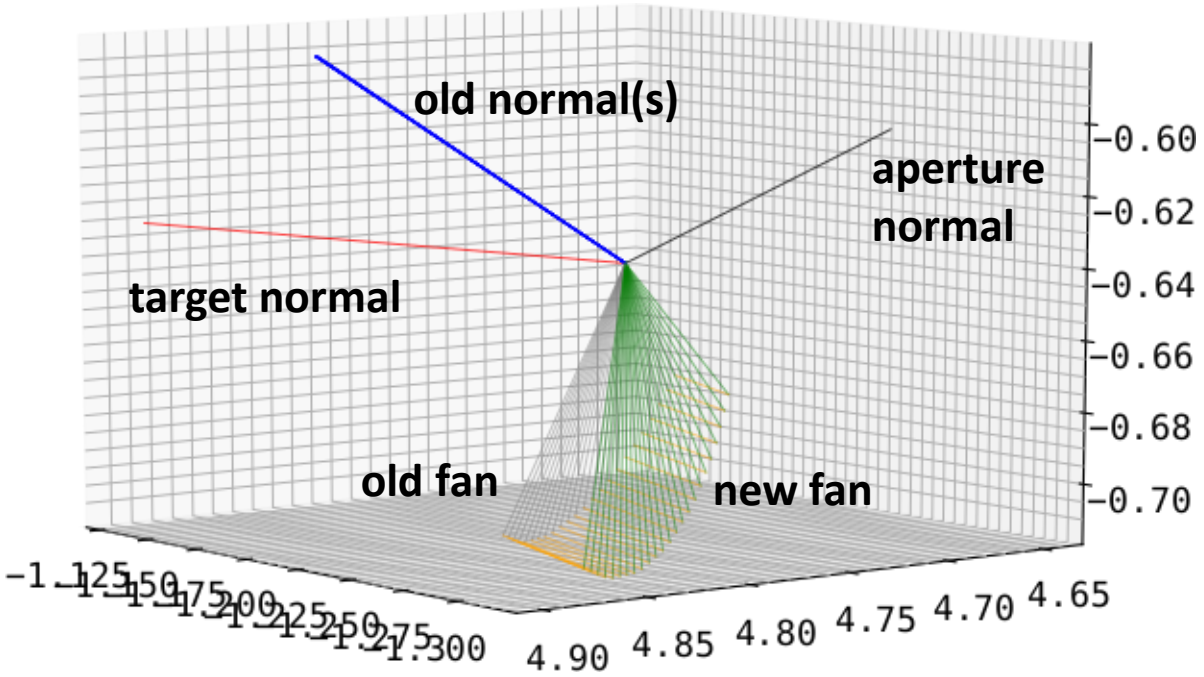
- guided by lower half of detector array (green)
- observe difference (red) between opposite channel (e.g. CH#0 <-> CH#31) through rotating around aperture normal by 180° and measuring angle
- transforming second channel through rotating it by angle from before (blue)
- only really easy for HBCm, because central aperture axis alignment; VBC cameras not possible



HBCm

2.: Toroidal Transformation to Axis Plane

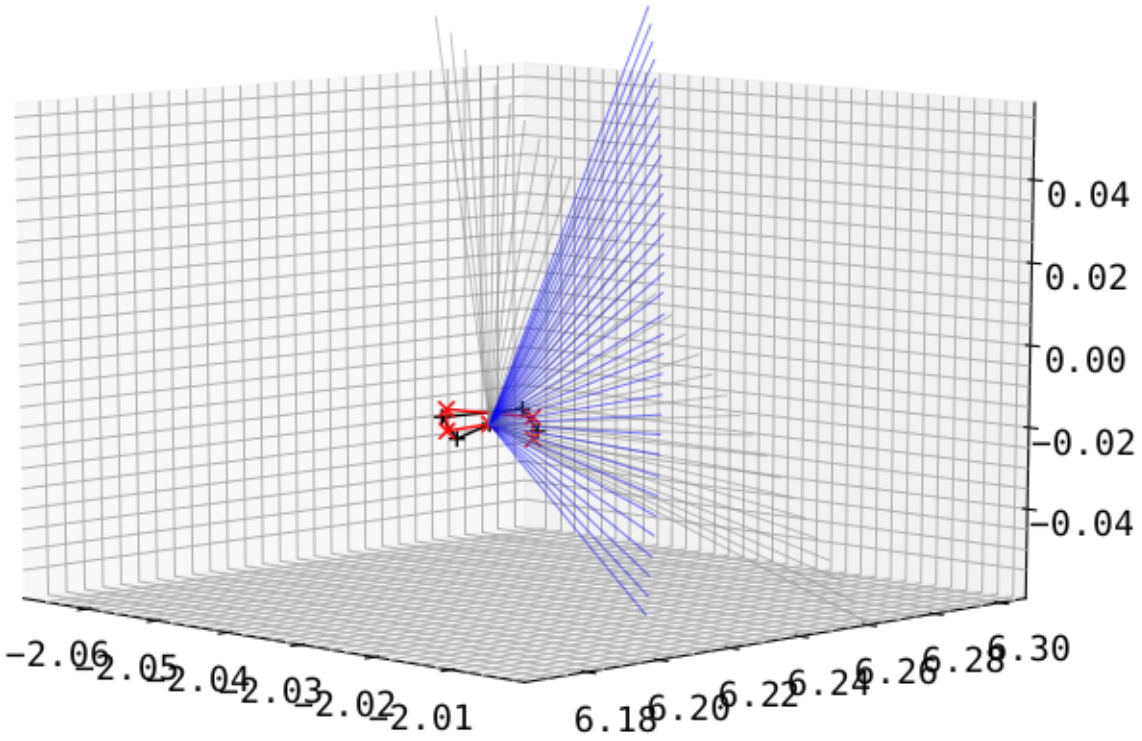
- guide is normal of plane constructed by detector fan (blue)
- transforming all channels so that normal points in/at toroidal direction (red)
- transformation for each channel individual (see previous argument (1.)) (orange)
- done for all cameras individually



VBCr

3.: Tilting the Detector Fan Up/Down

- take results of (2.) and tilt the entire fan including the aperture poloidally (grey to blue and black to red)



(results for (2.) with aperture change included)

HBCm