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Report 03/26/2020

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EUROfusion

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the Euratom research and training programme 2014-2018 and 2019-2020 under grant agreement No 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.

Agenda: Line of Sight Geometry and Local Emissivity

➢ investigate intrinsic dependency of chordal profile to line of sight (LoS) geometry

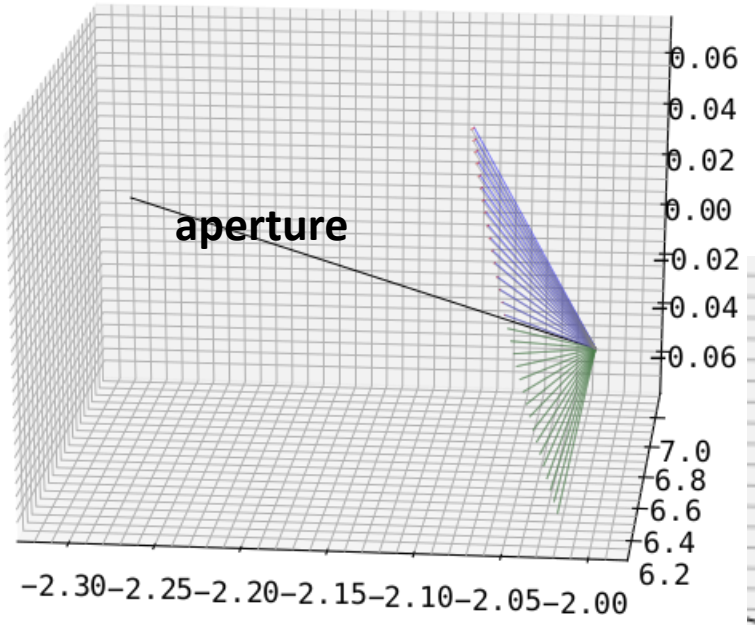
➢ therefore deliberately change detector arrangement/geometry in pre-processing:

1. fixing possible non-planar distribution; relative to plane created by one side of detector fan and aperture normal vector (only HBCm possible, aperture centered)
2. transforming detector fan from tilted plane in toroidal direction to vertical arrangement at 107.94° (tor. angle)
3. tilting detector fan in poloidal direction up/down by -1.0° <-> 5.0°

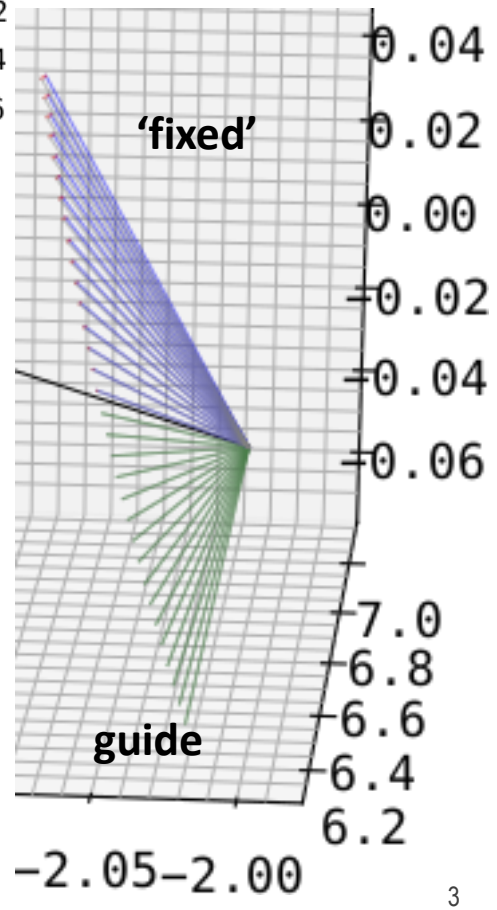
➢ changes in geometry matrix from LoS geometry used in forward integration of poloidally symmetric STRAHL simulation results (line radiation of impurity carbon)

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

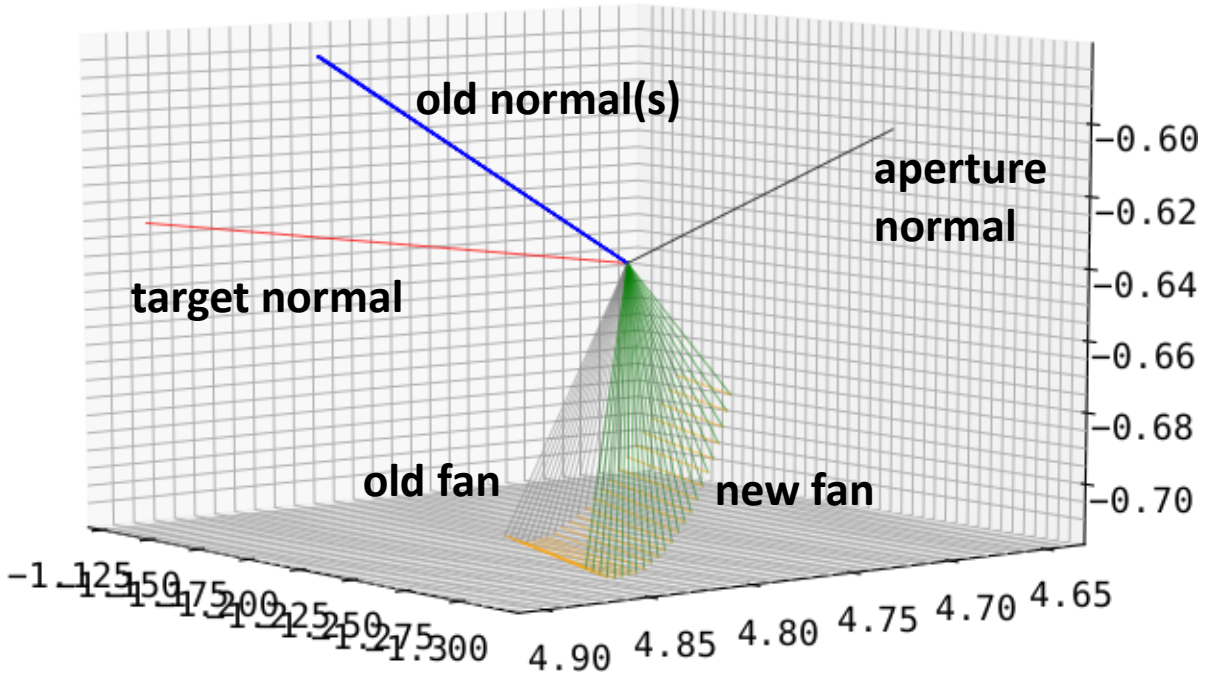


HBCm



2.: Toroidal Transformation to Axis Plane

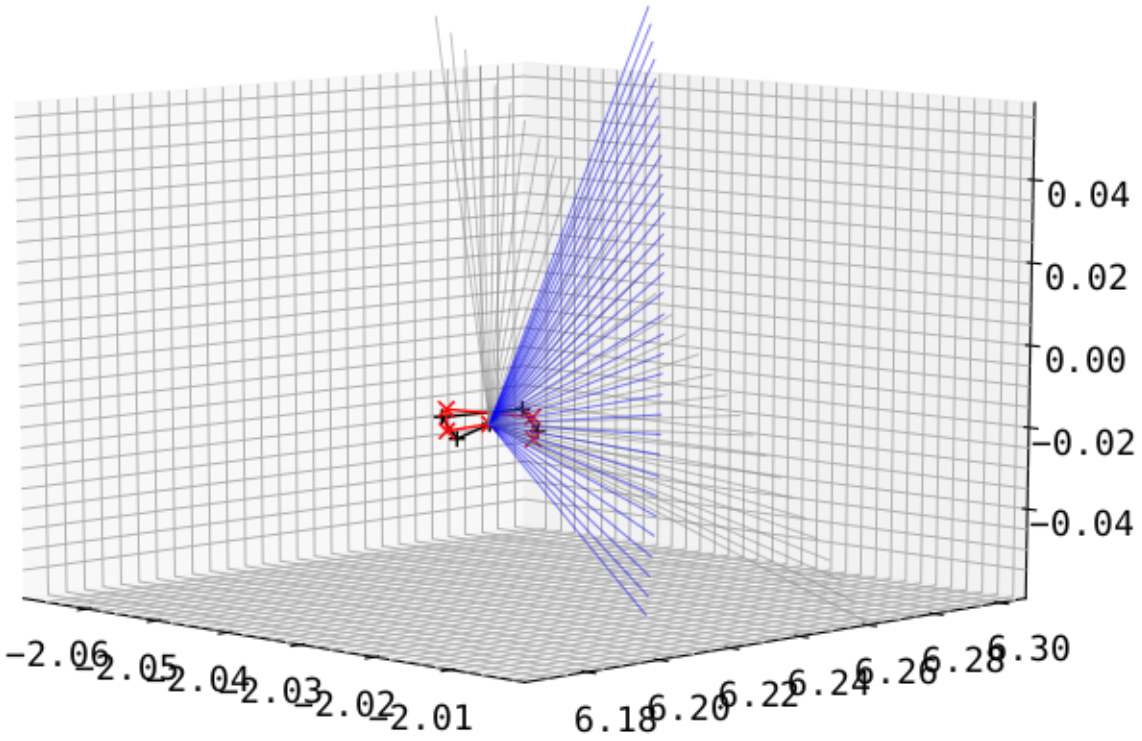
- guide is normal of plane constructed by detector fan (blue)
- transforming all channels so that normal points in/at toroidal direction (red)
- transformation for each channel individual (see previous argument (1.)) (orange)
- done for all cameras individually



VBCr

3.: Tilting the Detector Fan Up/Down

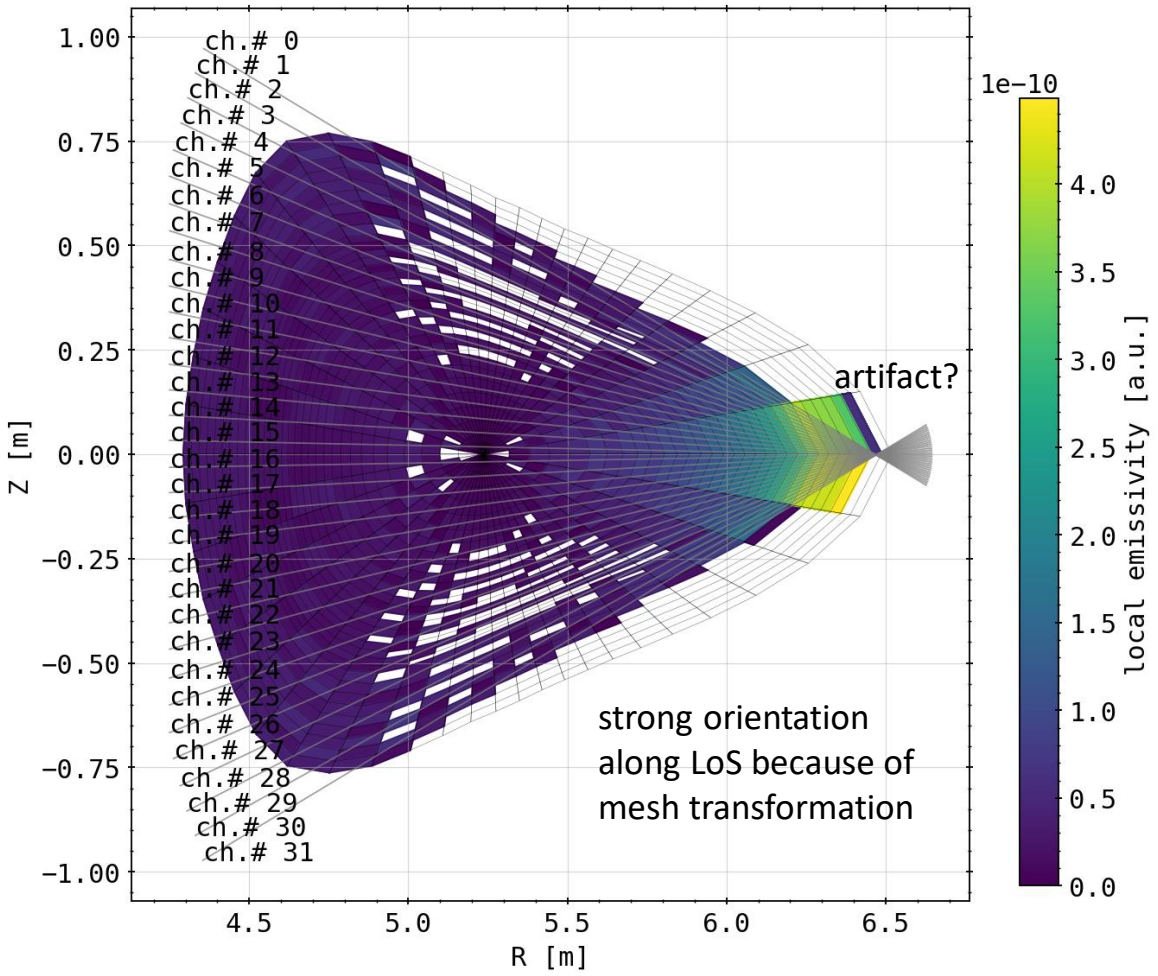
- take results of (2.) and tilt the entire fan including the aperture poloidally (grey to blue and black to red)



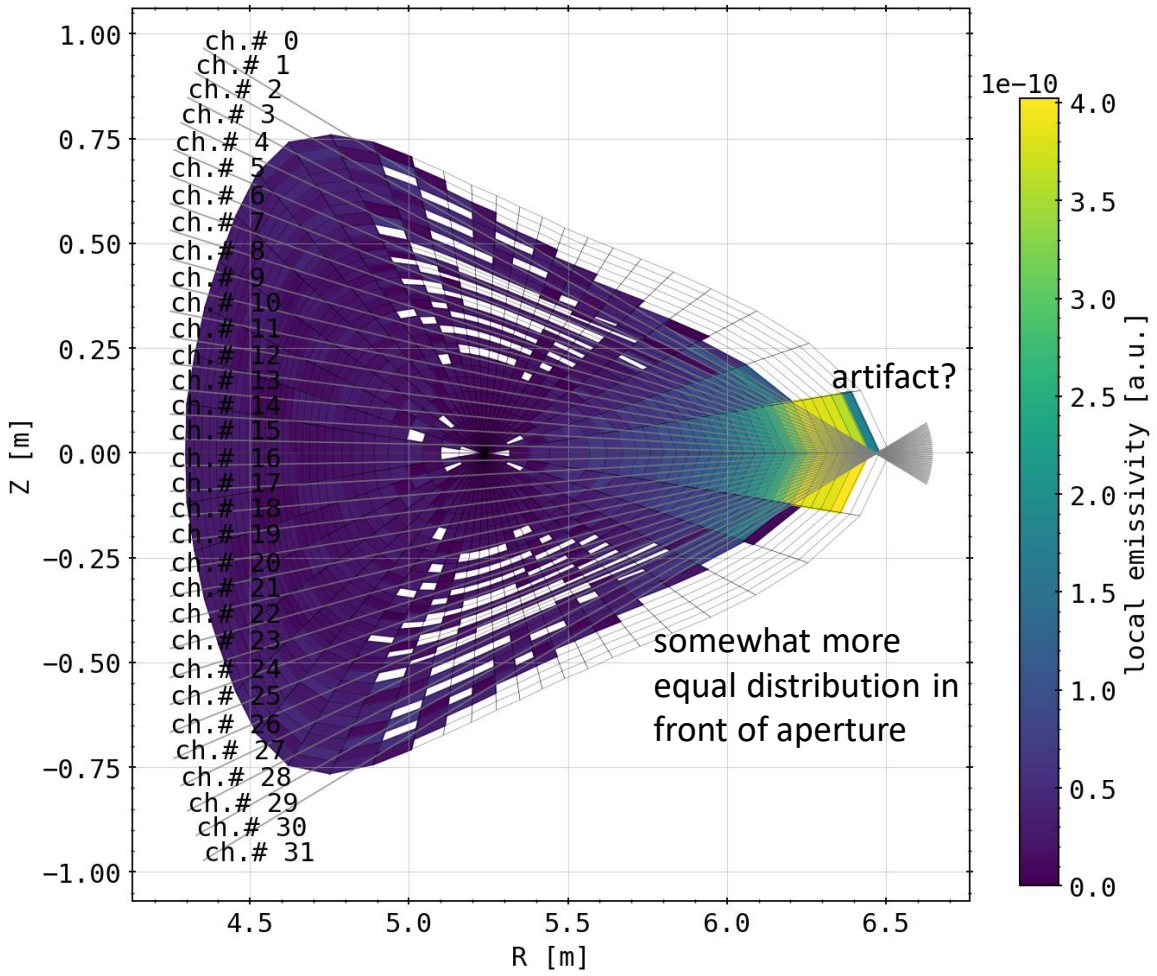
HBCm

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

‘Standard’ Case vs. Planar Fix

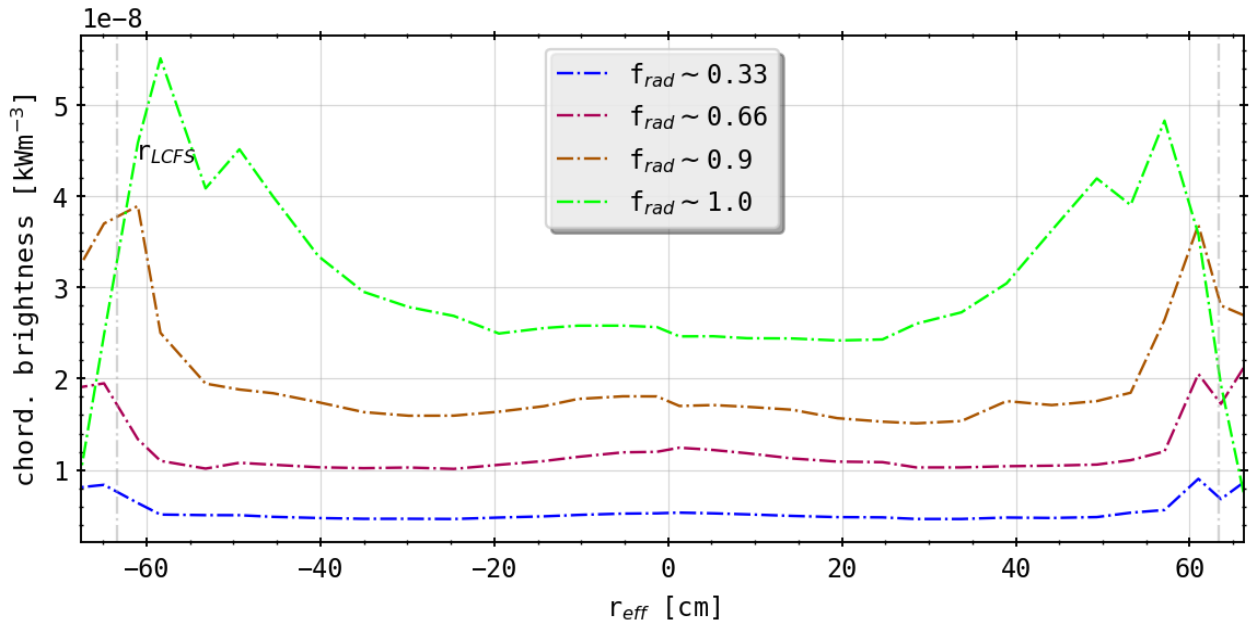


(geometry matrix in Bolometer plane)

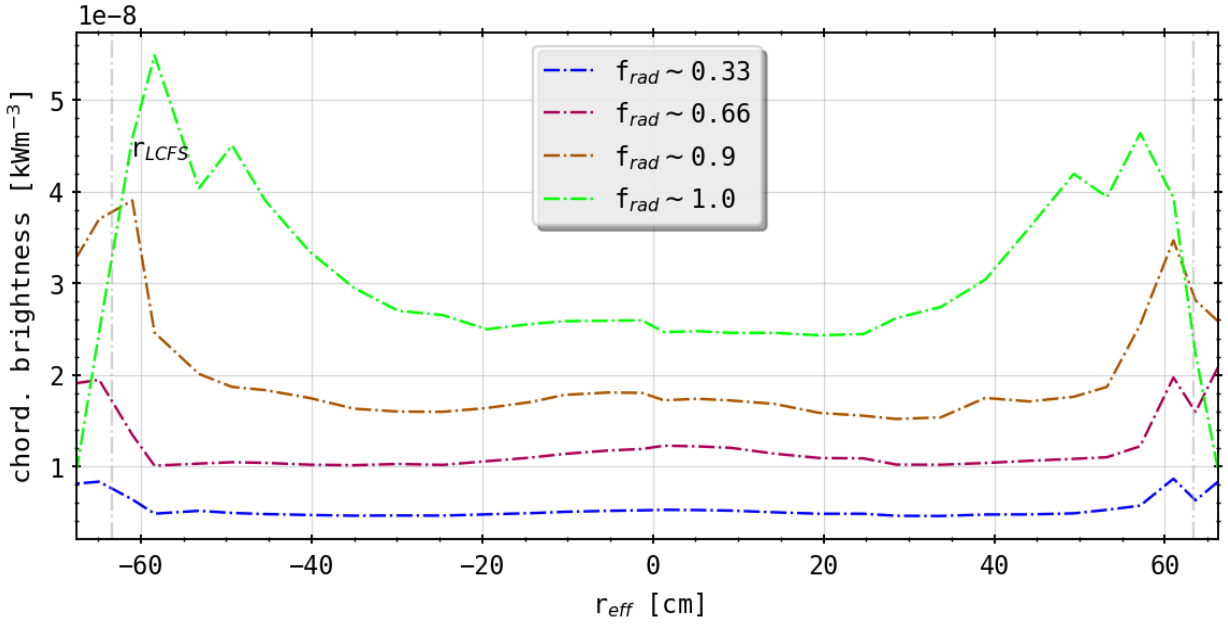


(geometry matrix in Bolometer plane with ‘fixed’ LoS)

‘Standard’ Case vs. Planar Fix



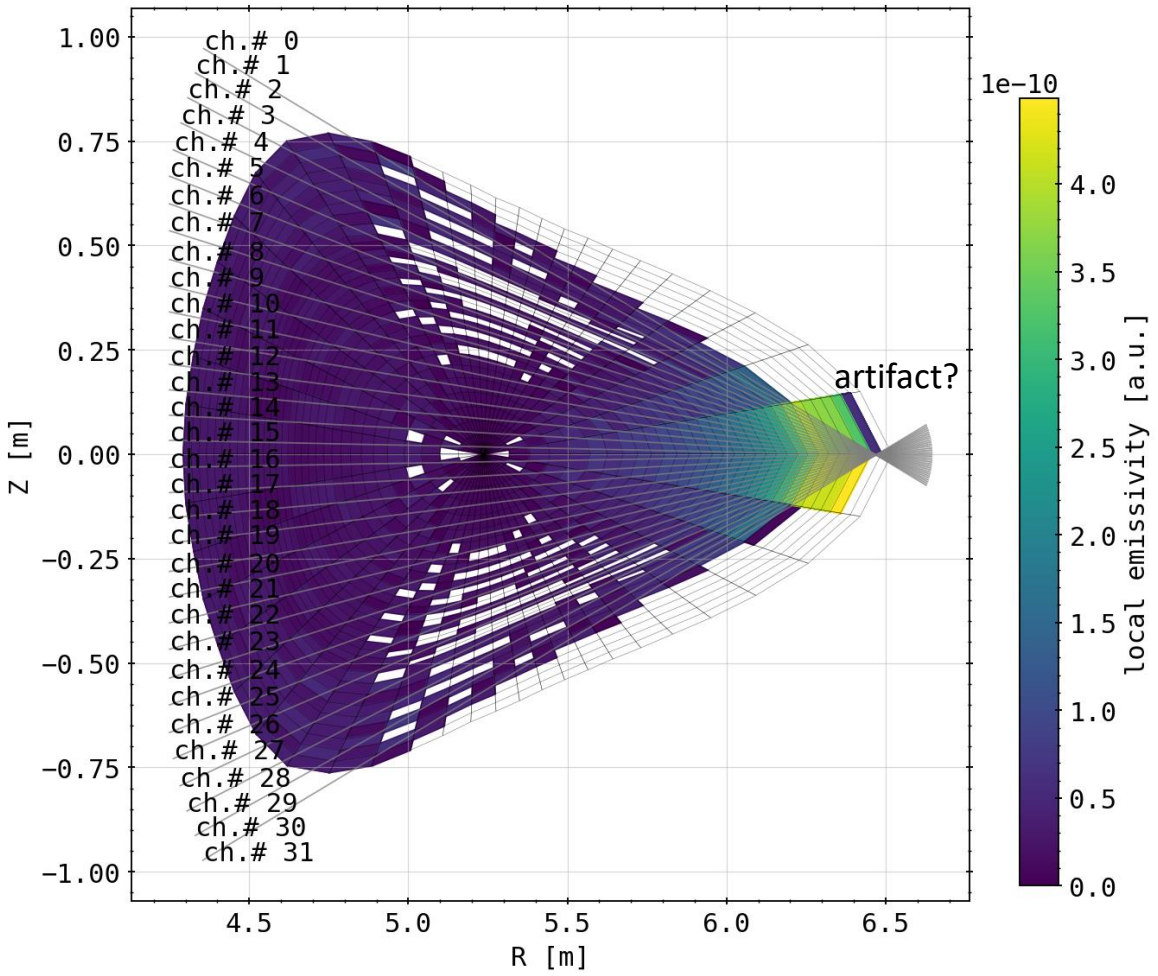
(forward integration of STRAHL simulations)



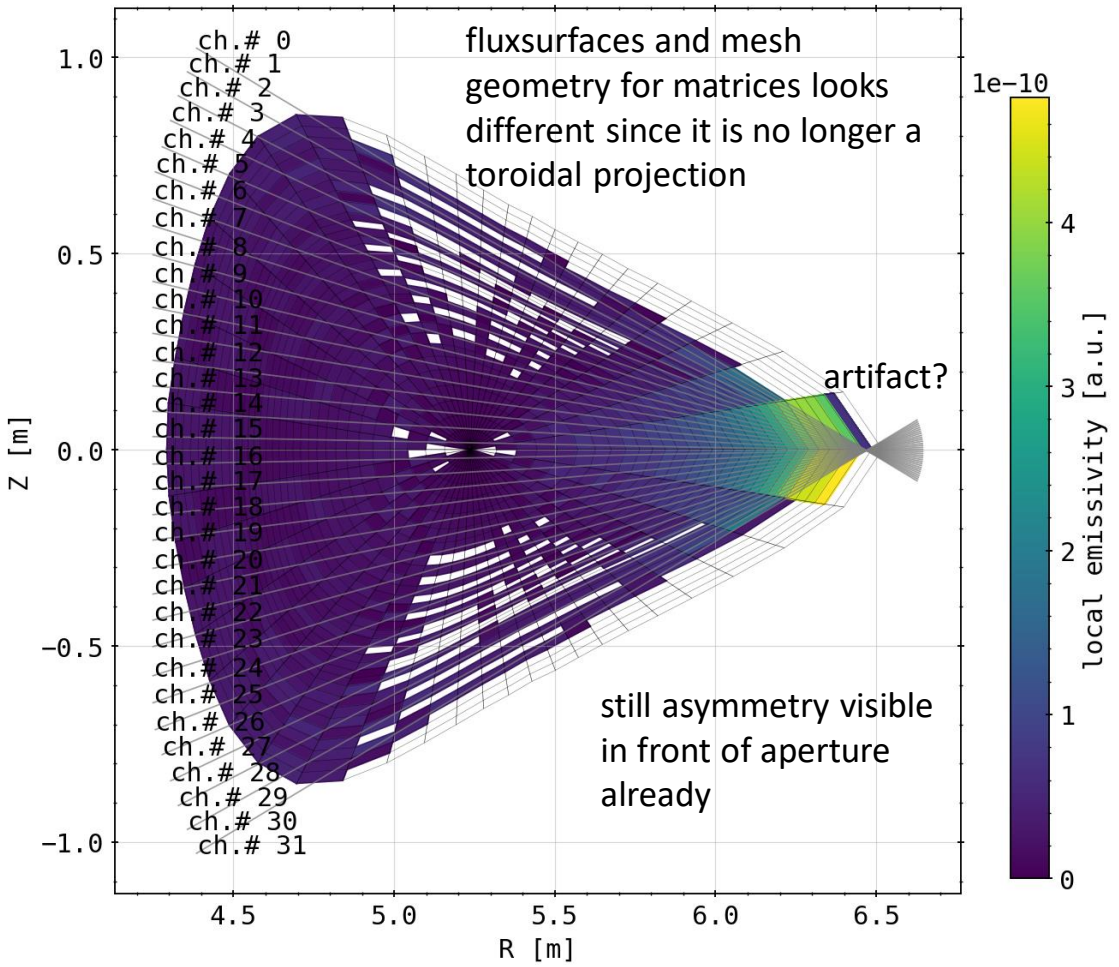
(forward integration of STRAHL simulations with ‘fixed’ LoS)

➢**virtually no changes?**

‘Standard’ Case vs. Toroidal Transformation

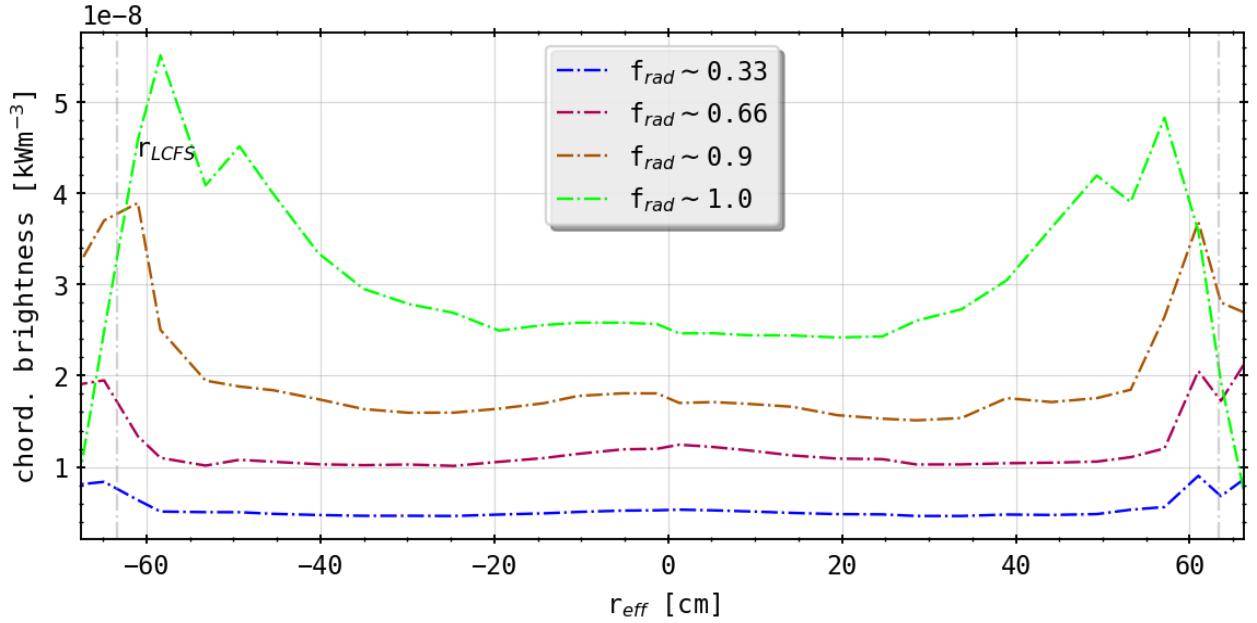


(geometry matrix in Bolometer plane)

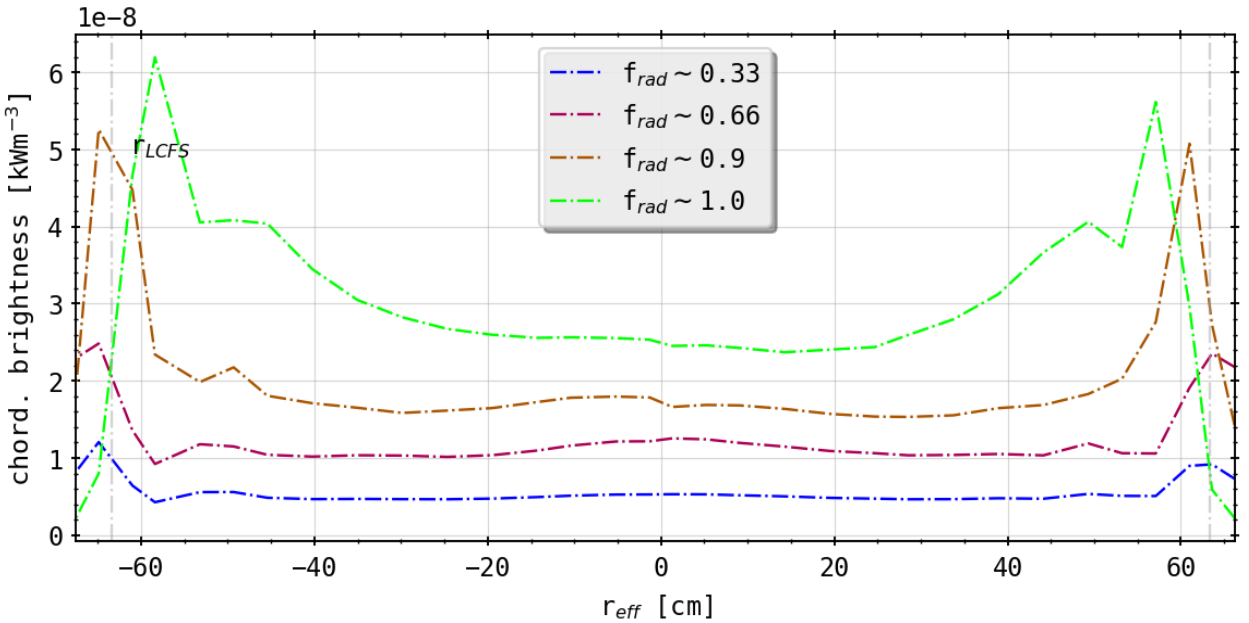


(geometry matrix in Bolometer plane at 108° with symmetric LoS orientation)

‘Standard’ Case vs. Toroidal Transformation



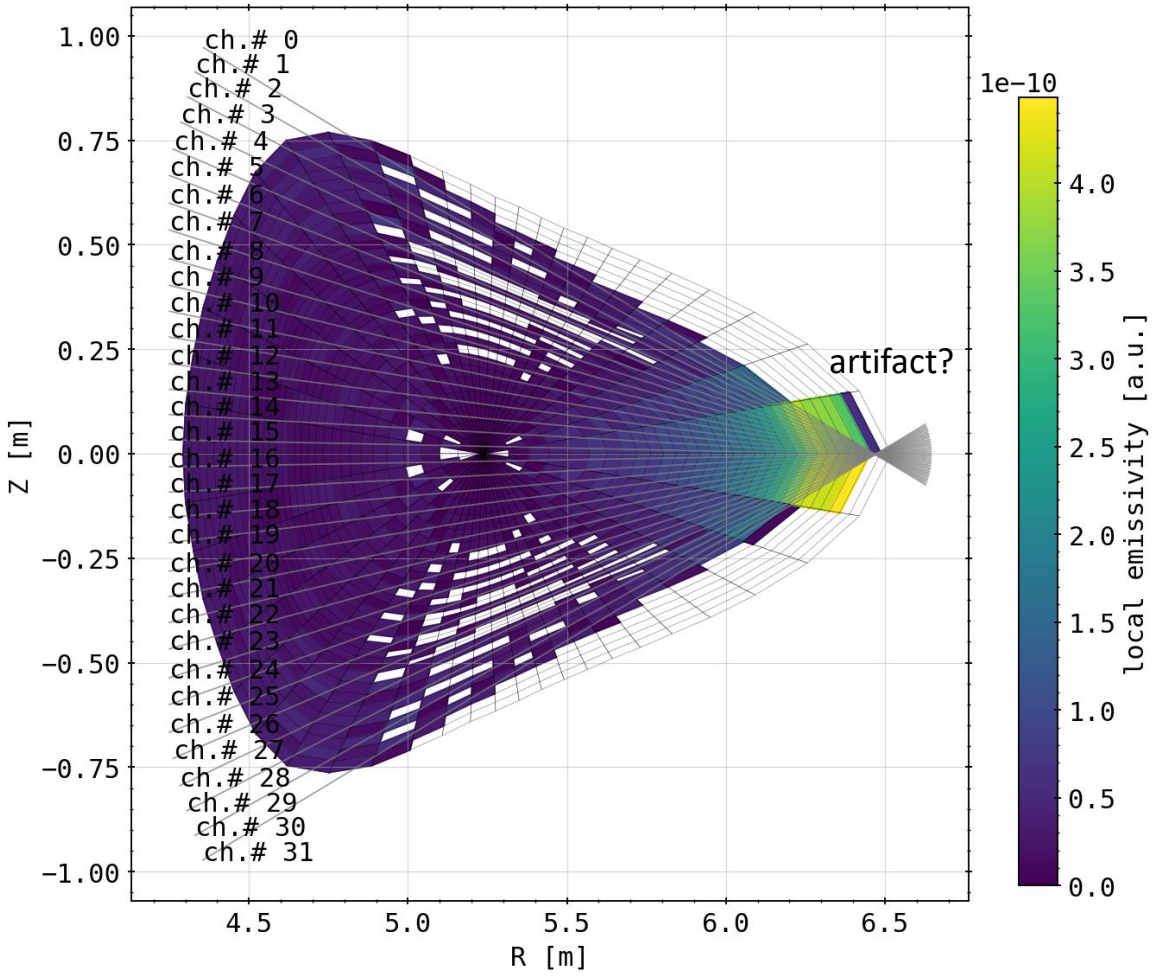
(forward integration of STRAHL simulations)



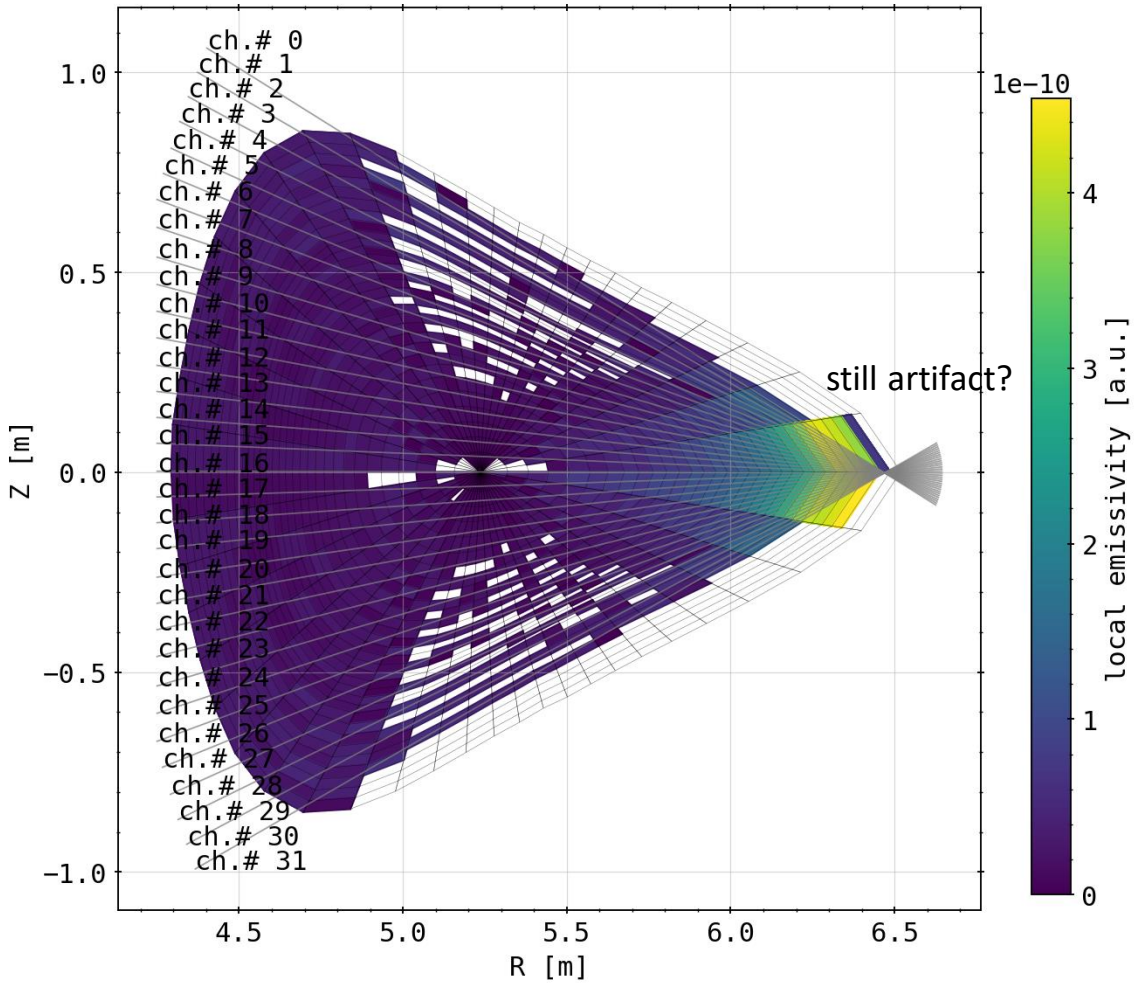
(geometry matrix in Bolometer plane at 108° with symmetric LoS orientation)

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

‘Standard’ Case vs. Toroidal Transformation and Tilt

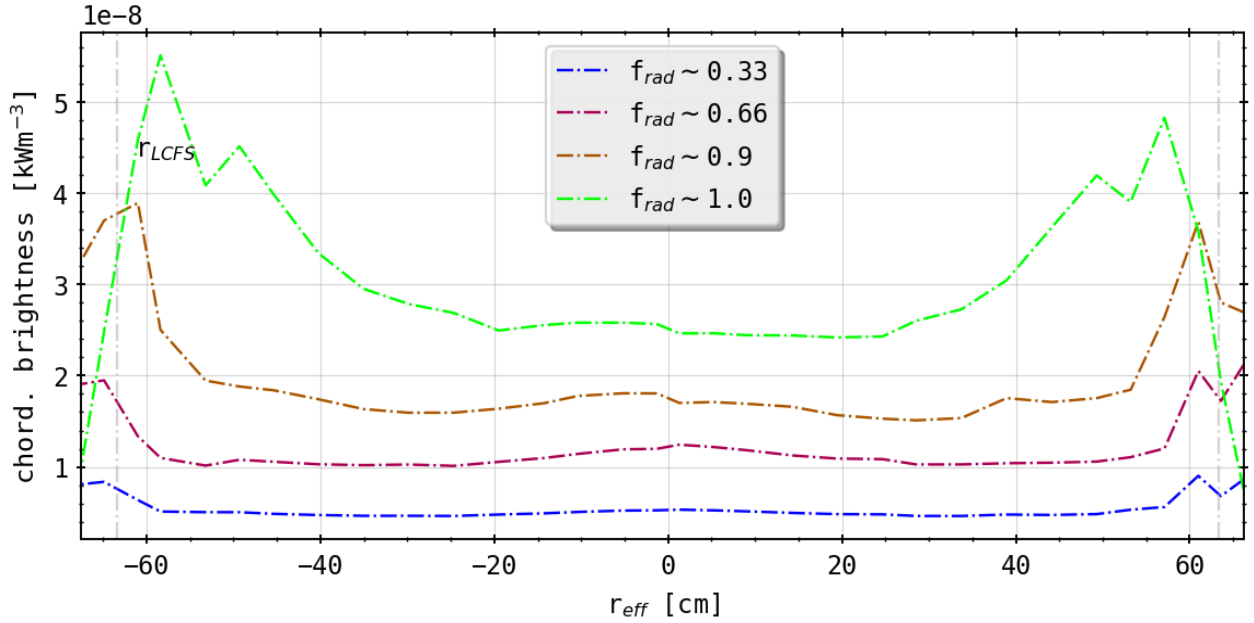


(geometry matrix in Bolometer plane)

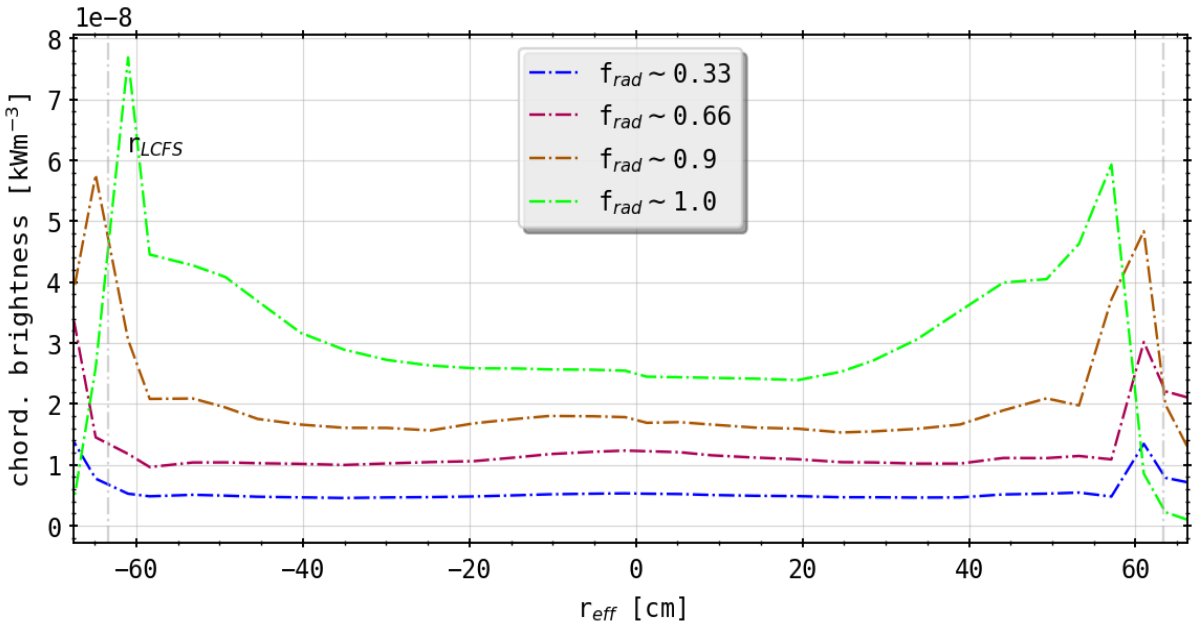


(geometry matrix in Bolometer plane at 108° with symmetric LoS orientation and -1.0° tilt (up))

‘Standard’ Case vs. Toroidal Transformation and Tilt



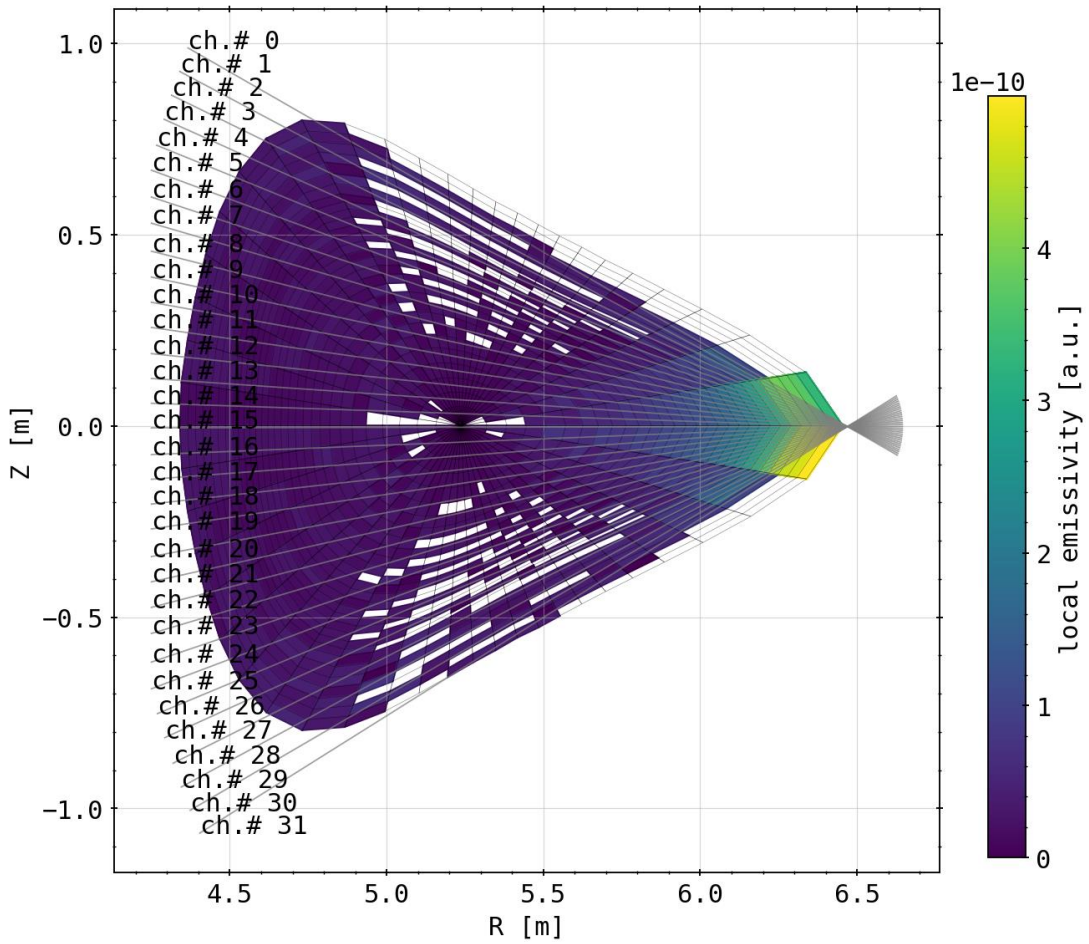
(forward integration of STRAHL simulations)



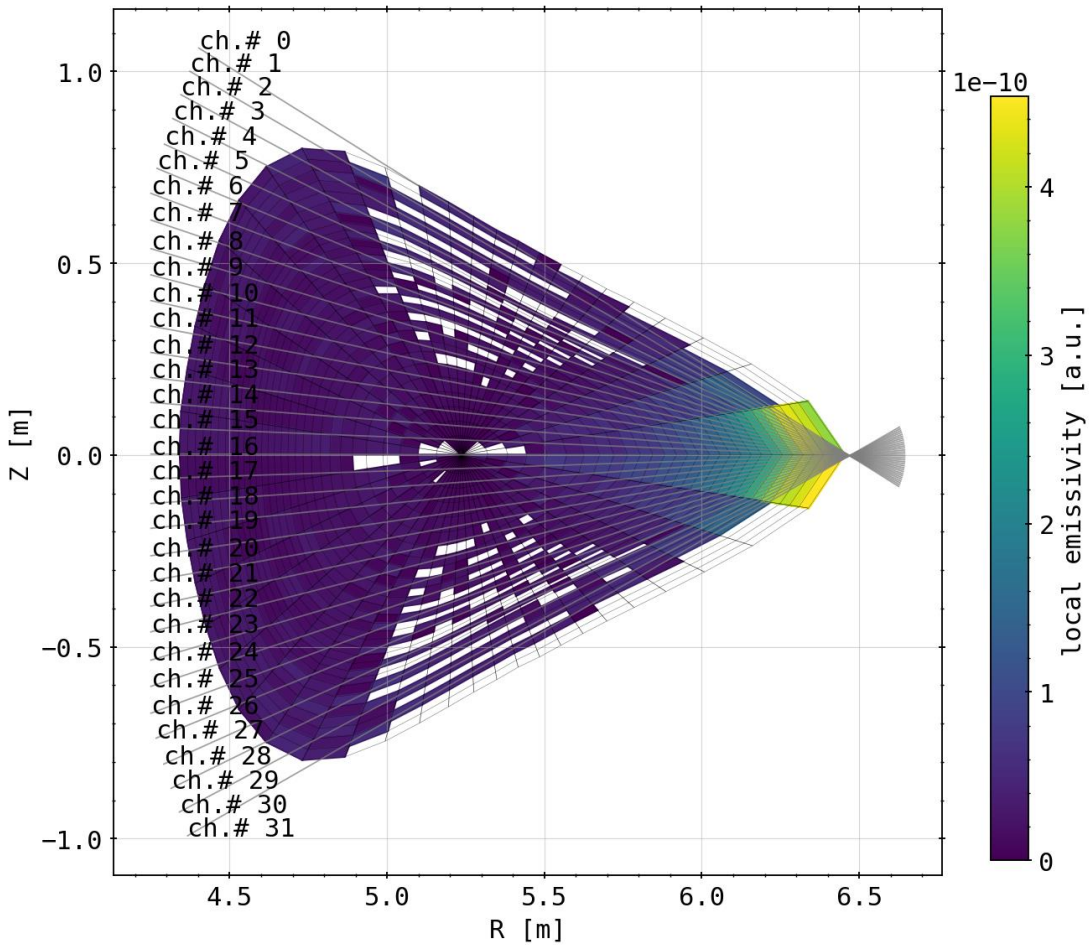
(geometry matrix in Bolometer plane at 108° with symmetric LoS orientationand -1.0° tilt (up))

- asymmetry becomes stronger
- left hand side (down in cell plot) or ‘negative’ radius became more peaked again
- alignment with fluxsurfaces better
- also radial movement of radiation peaks further out (instead of inwards)

Different Tilts

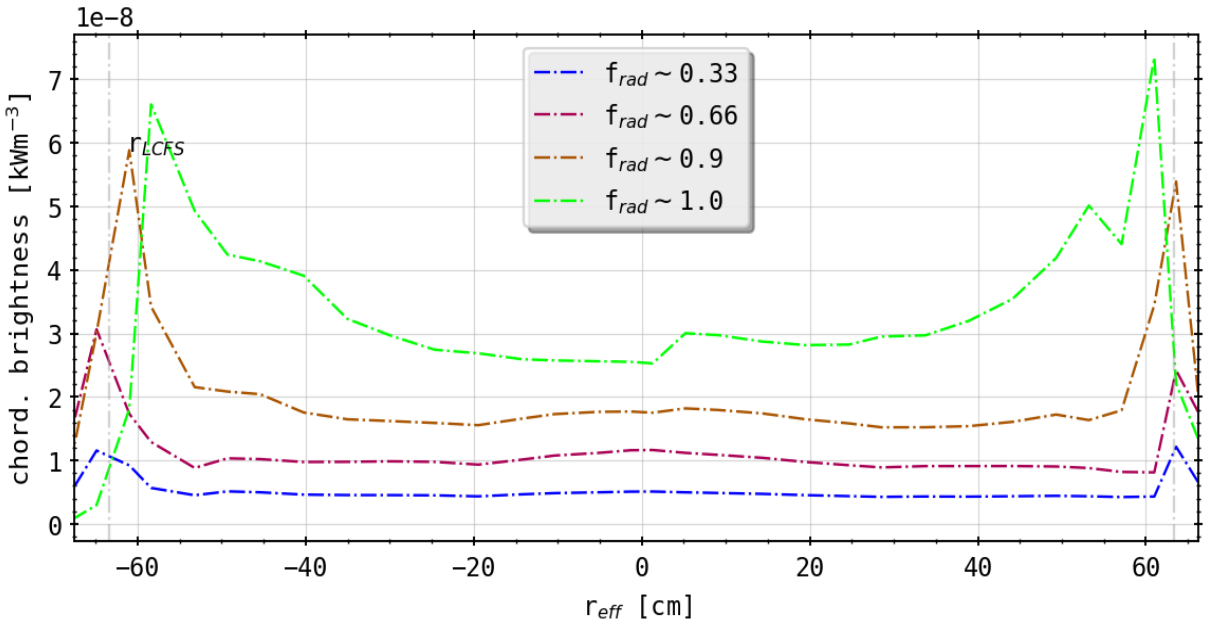


(1.0° tilt (down))

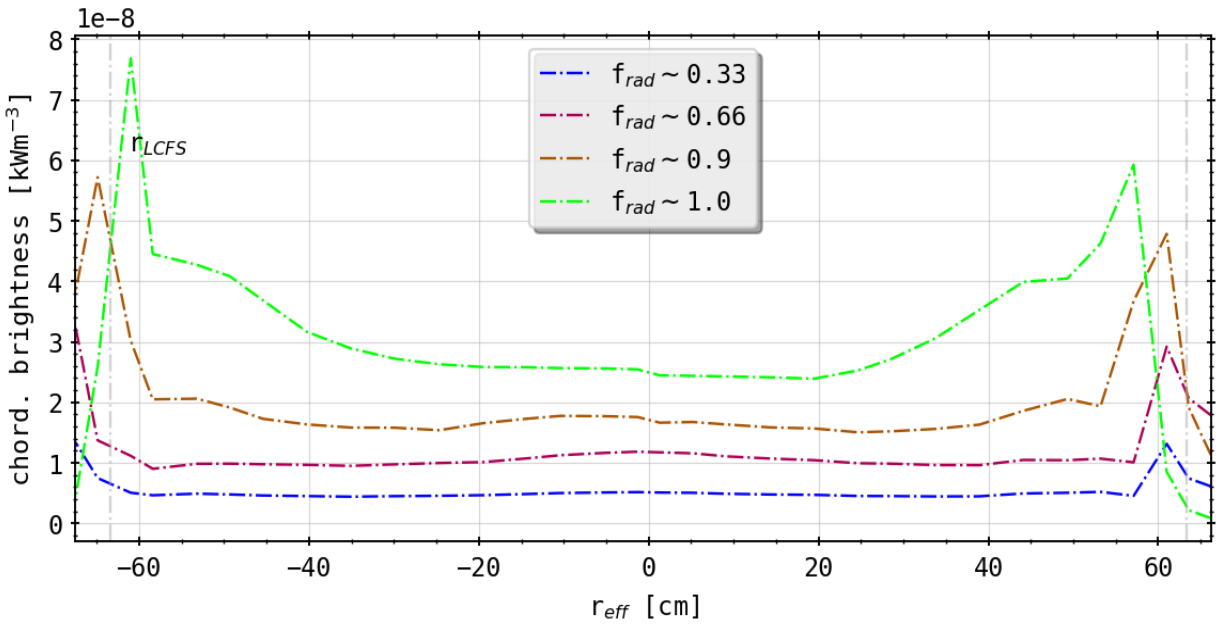


(-1.0° tilt (up))

Different Tilts



(1.0° tilt (down))



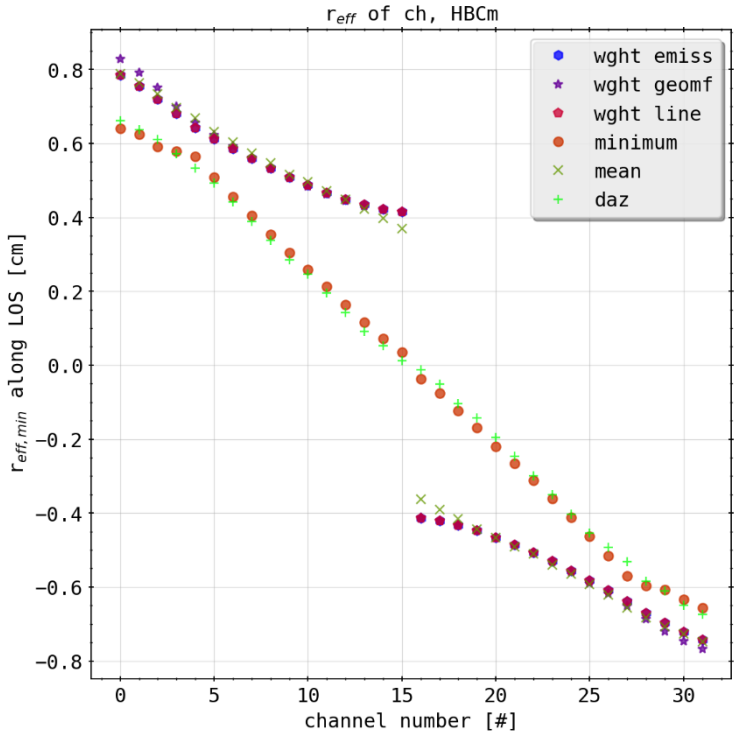
(-1.0° tilt (up))

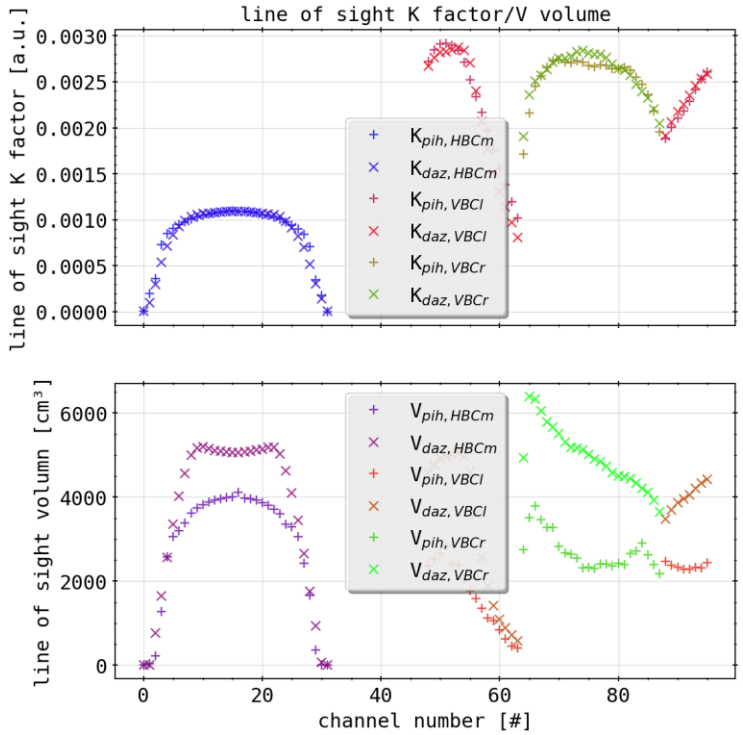
- asymmetry switched around
- alignment better now upside (tilt down!)
- likewise radial movement as before!

Preliminary 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)