Wendelstein 7-X

IPP Max-Planck-Institut für Plasmaphysik

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EUROfusion

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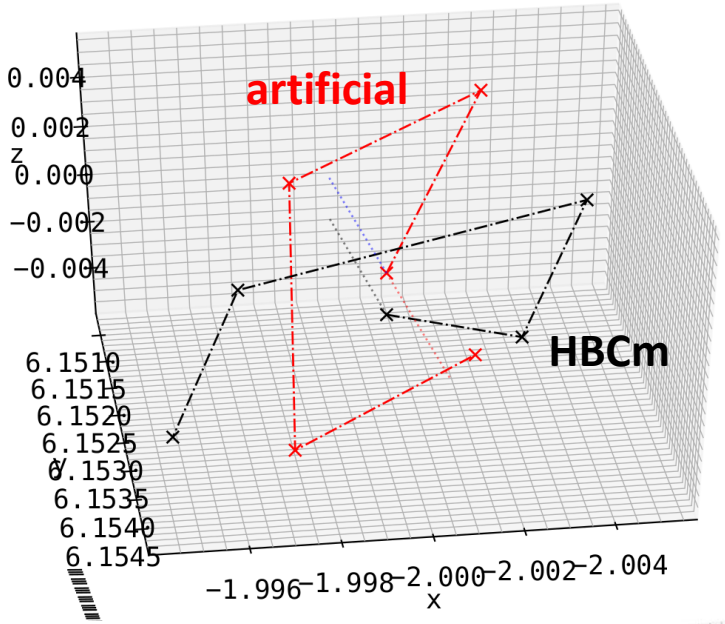
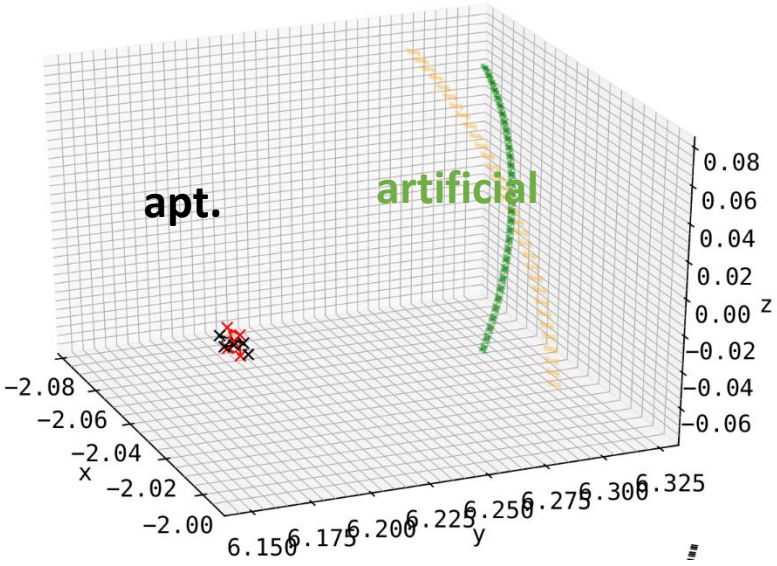
Setup

- creating **symmetric, upright, rectangular aperture** at location of old one (HBCm) with plane normal exactly pointing at (0.0, 0.0, 0.0)
- **detector array** equidistant to aperture and to each other behind pinhole and in-line with plane normal
- detector plane normal has no angle with pointing vector between aperture and center

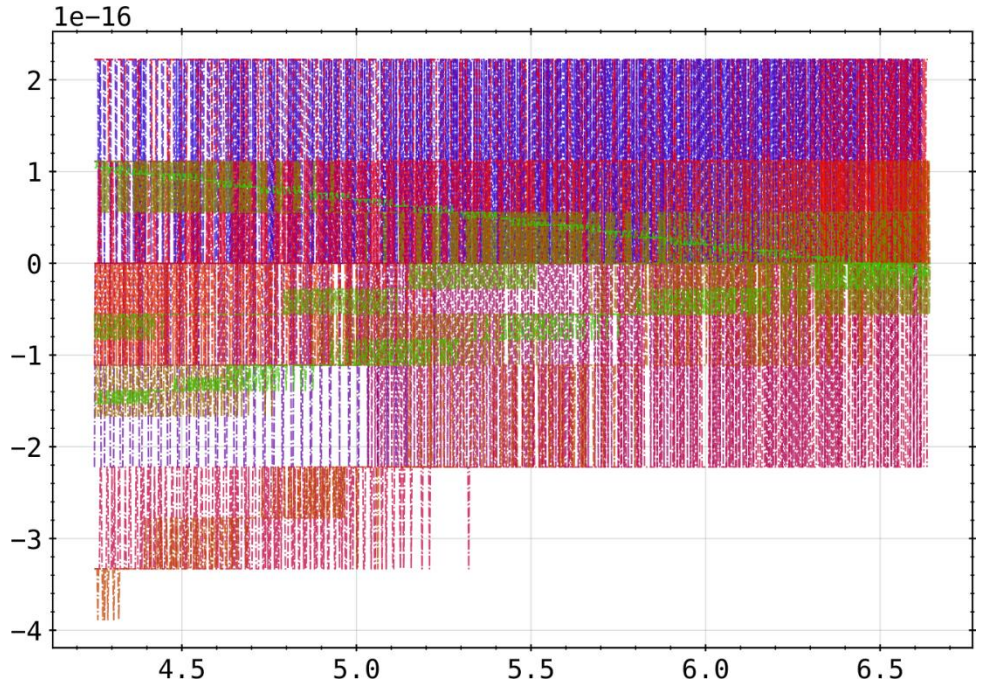


HBCm

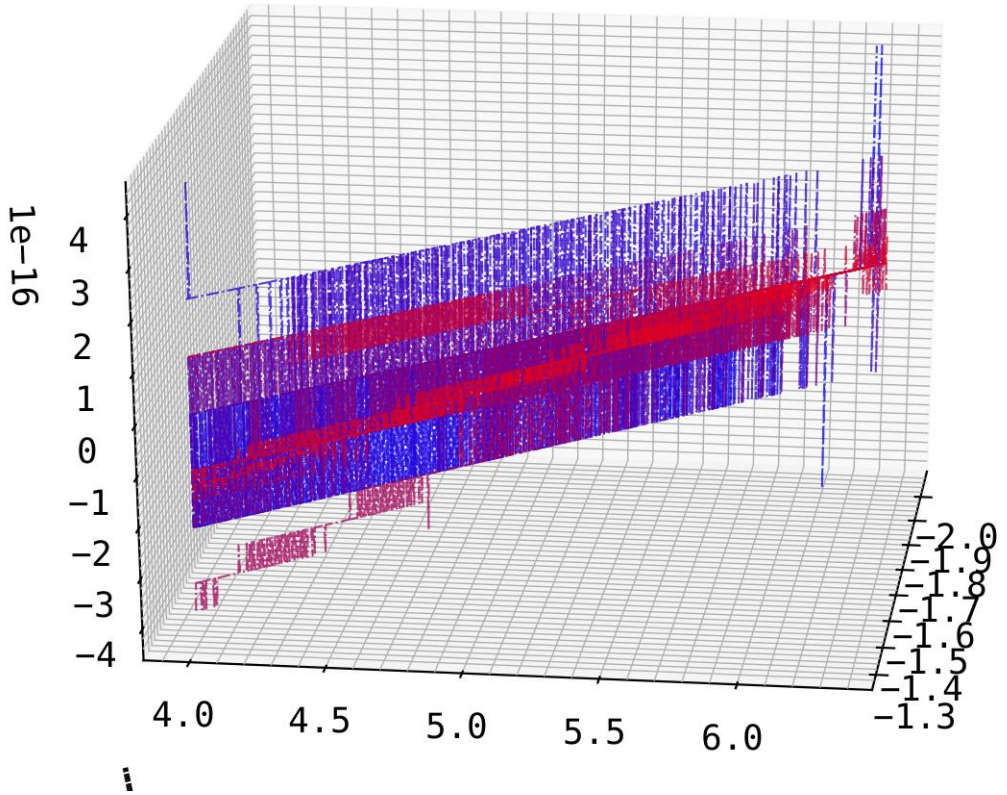


Setup

- **Lines of sight from this configuration are symmetric (top-bottom) down to the numerical accuracy of a 53 bit encoded double precision float**

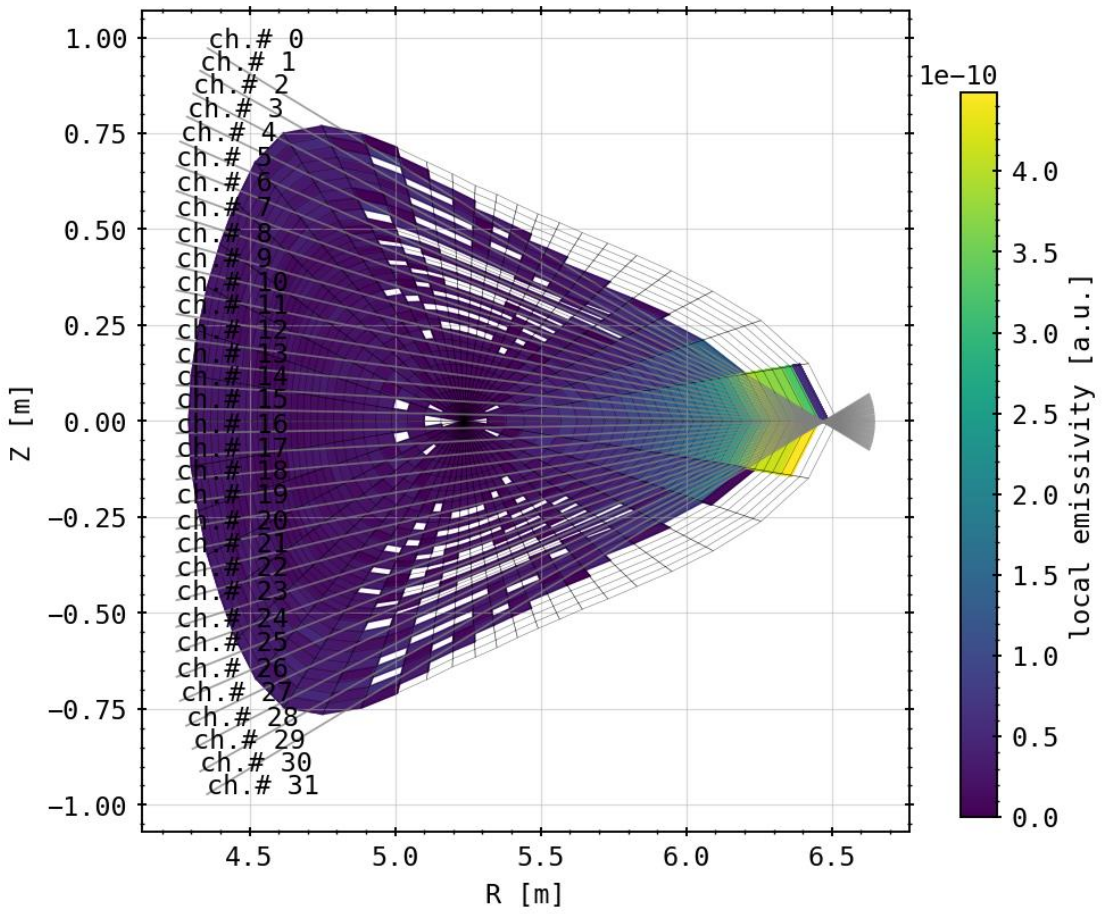


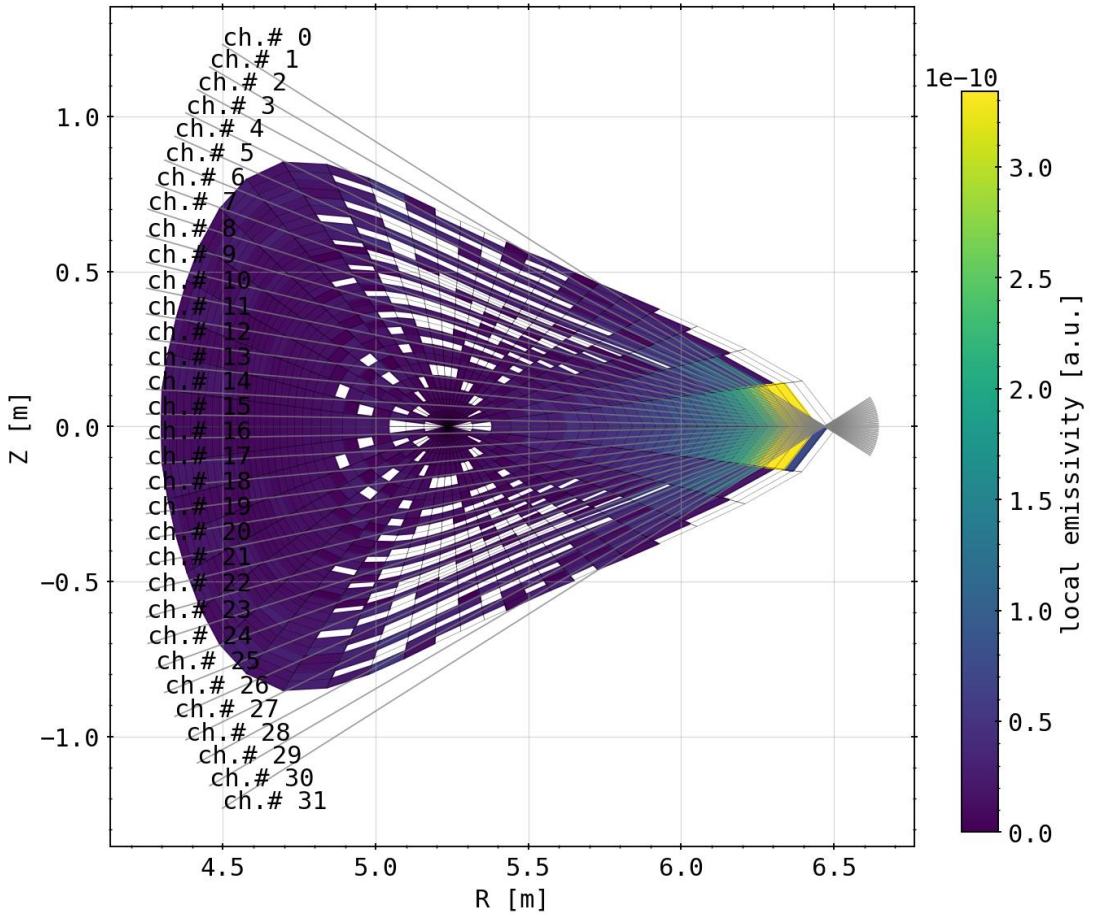
sum of channels (0-31, 1-30 ,…) in (r,z)-space



sum of opposing channels (0-31, 1-30 ,…) in (x,y,z)-space

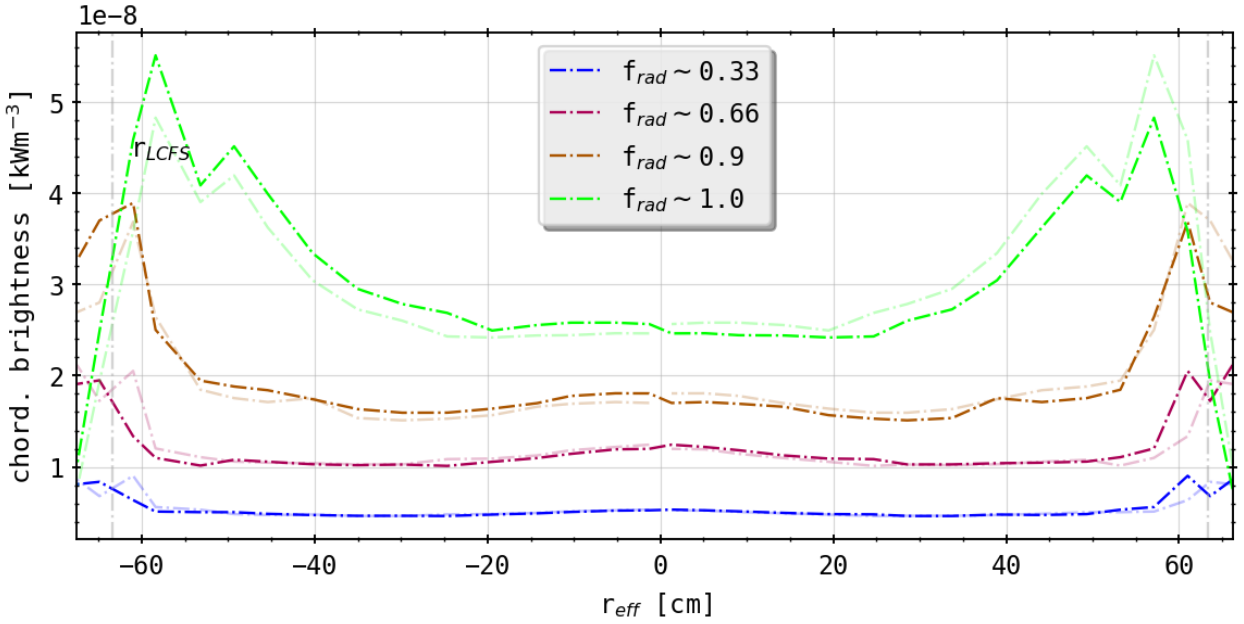
Emissivity on Fluxsurface Cells



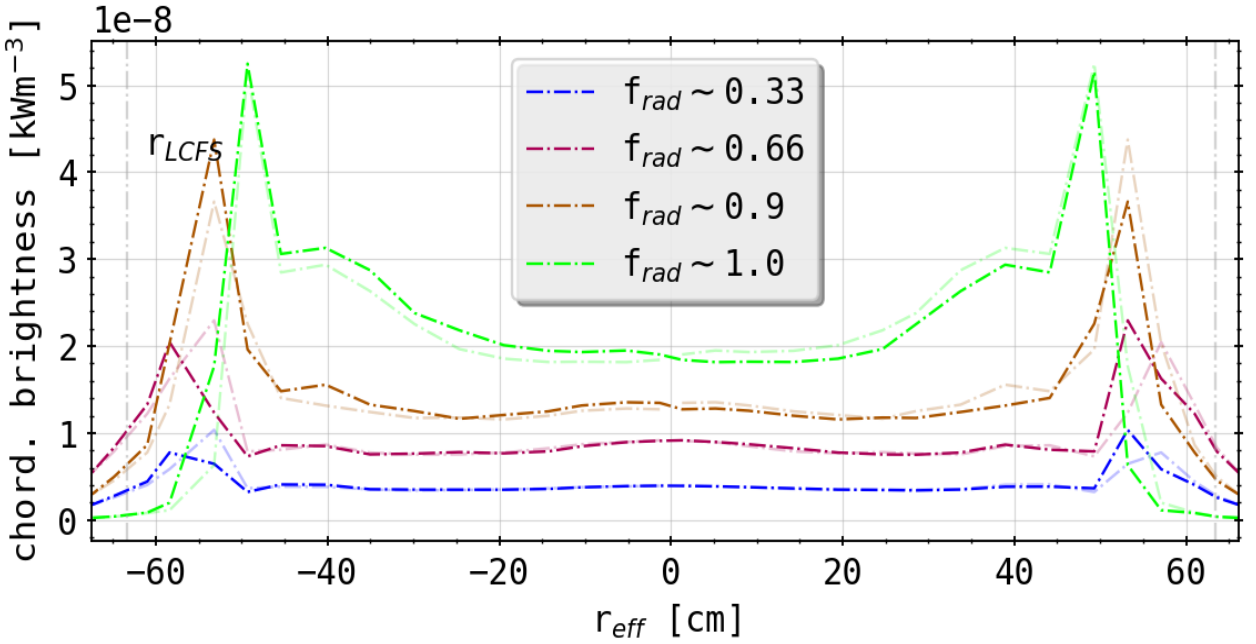


- almost entirely symmetric emissivity distribution on fluxsurfaces, except artifact in front of aperture
- slightly wider opening angle on line of sight-fan

Forward Integral: Standard Case vs. Artificial Array



(forward integration of STRAHL simulations)

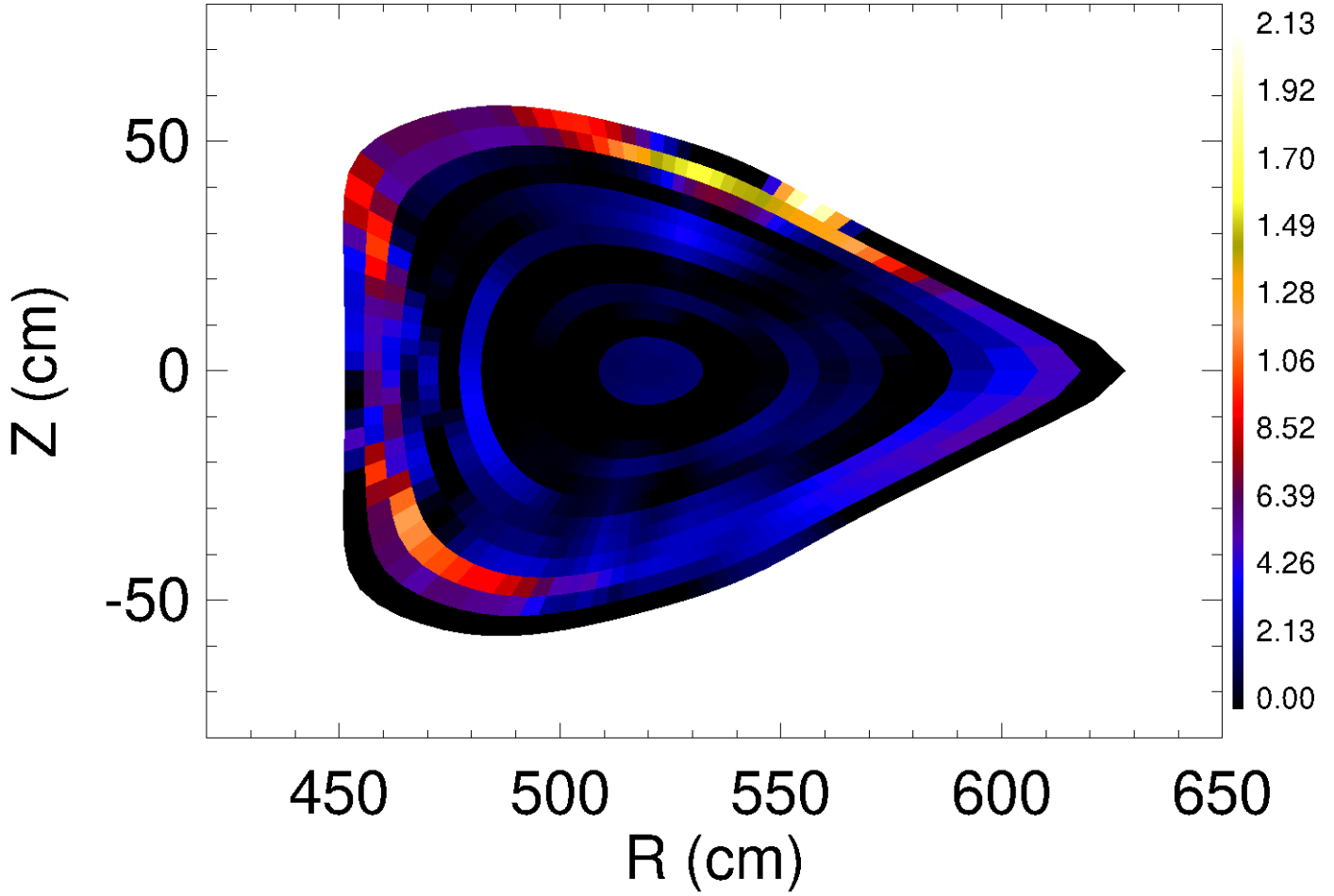


(forward integration of STRAHL simulations of artificial, fully symmetric horizontal camera array)

- still not entirely symmetric, deviance in fluxsurface geometry? (pinhole is located not exactly at 108 degrees, but rather 107.9)
- geometrically very different to ‘standard’ case
- more peaked towards edge
- far inside the LCFS even for low radiation fraction cases

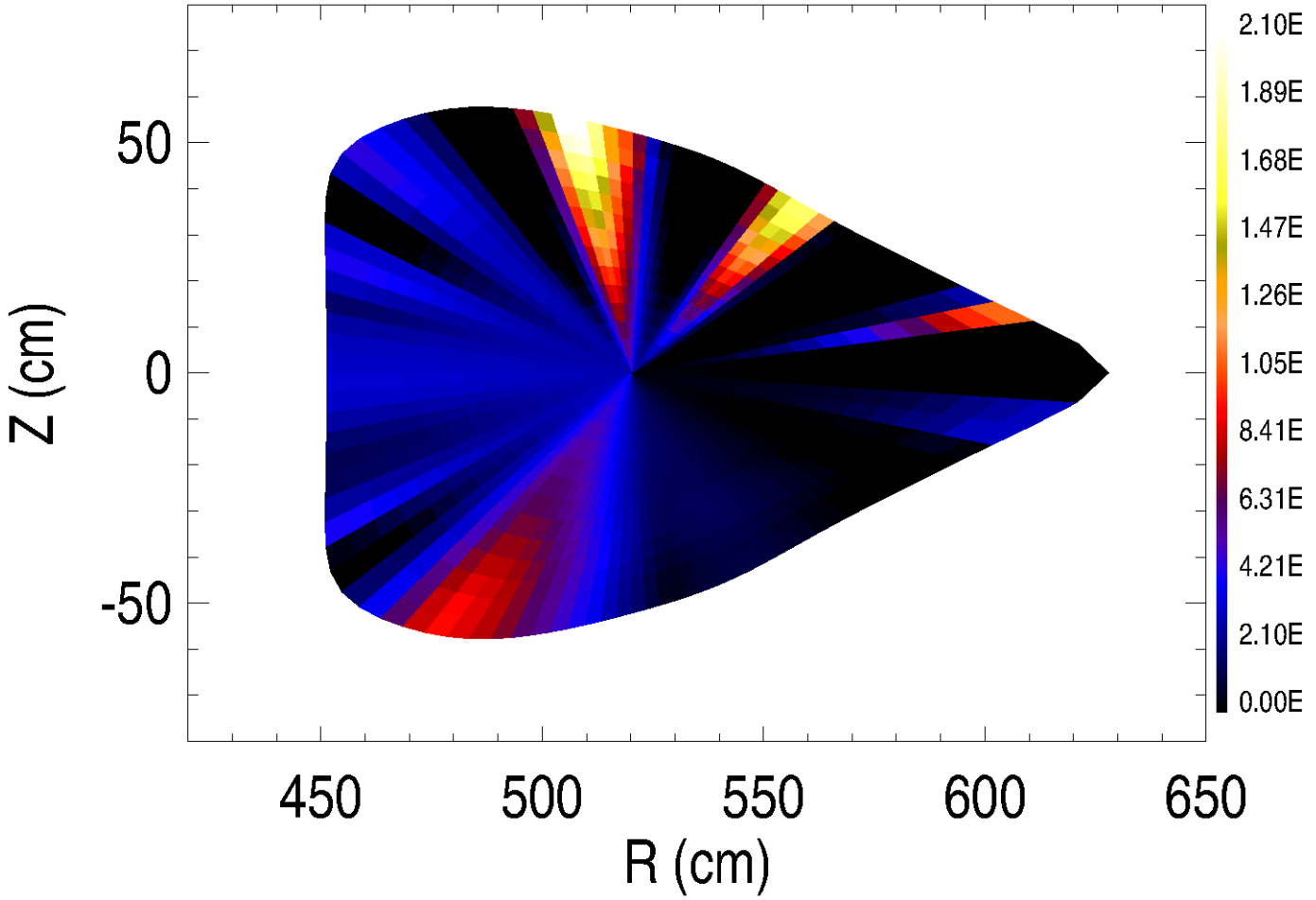
2D Tomography: First Results

- geometry files are now being read correctly
- anisotropy factors set to 1.5 for divertor (?) or island and 0.8 for core-like regions
- t = 3.421s <-> frad=100%



2D Tomography: First Results

- anisotropy factors set to 1.0 and 1.0
- again: t = 3.421s (frad=100%)



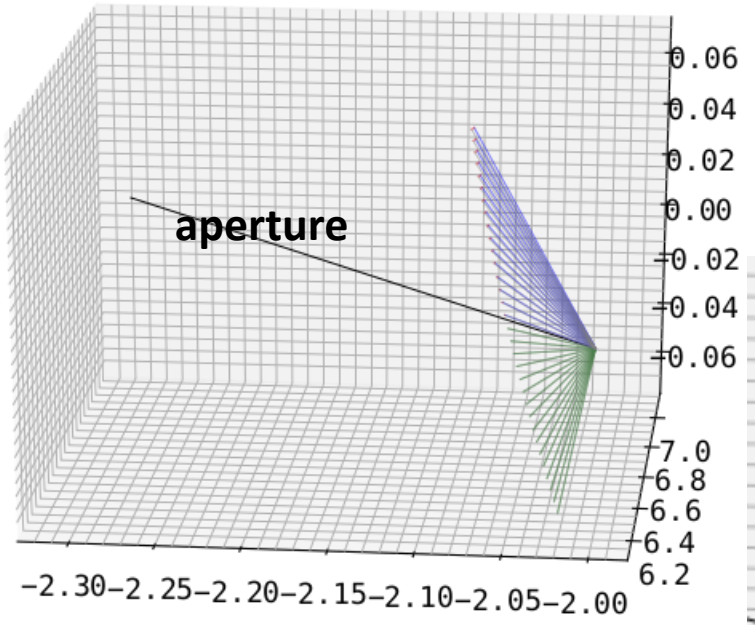
Agenda

Not in order:

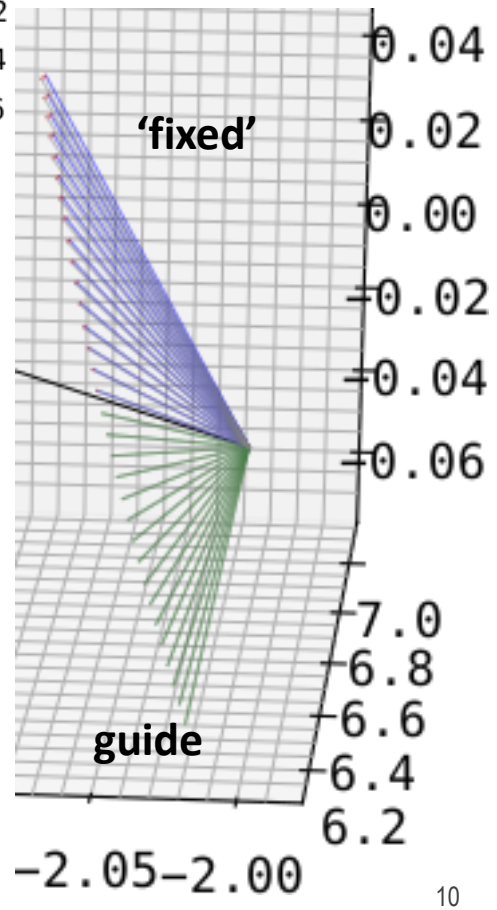
- **start to finish RSI paper (for internal reviewing)**
- **understand anisotropy factor, hence structure of tomogram**
- **create and feed phantom radiation profiles to inversion method using that knowledge**

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

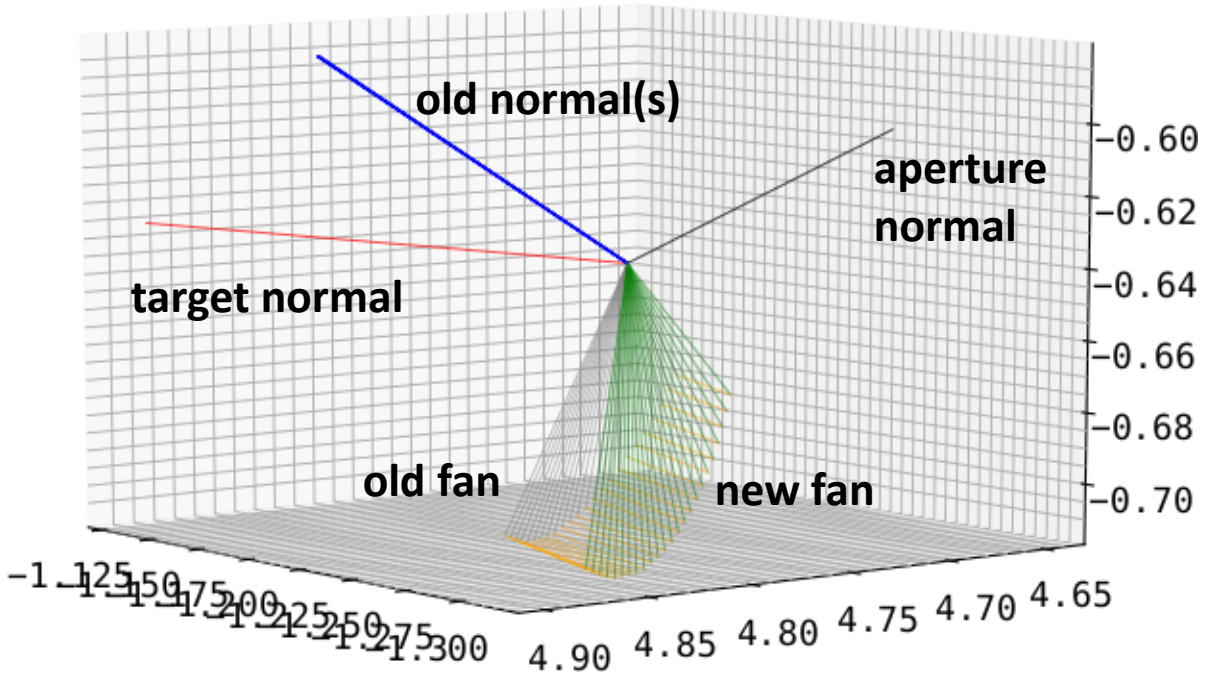


HBCm



2.: Toroidal Transformation to Axis Plane

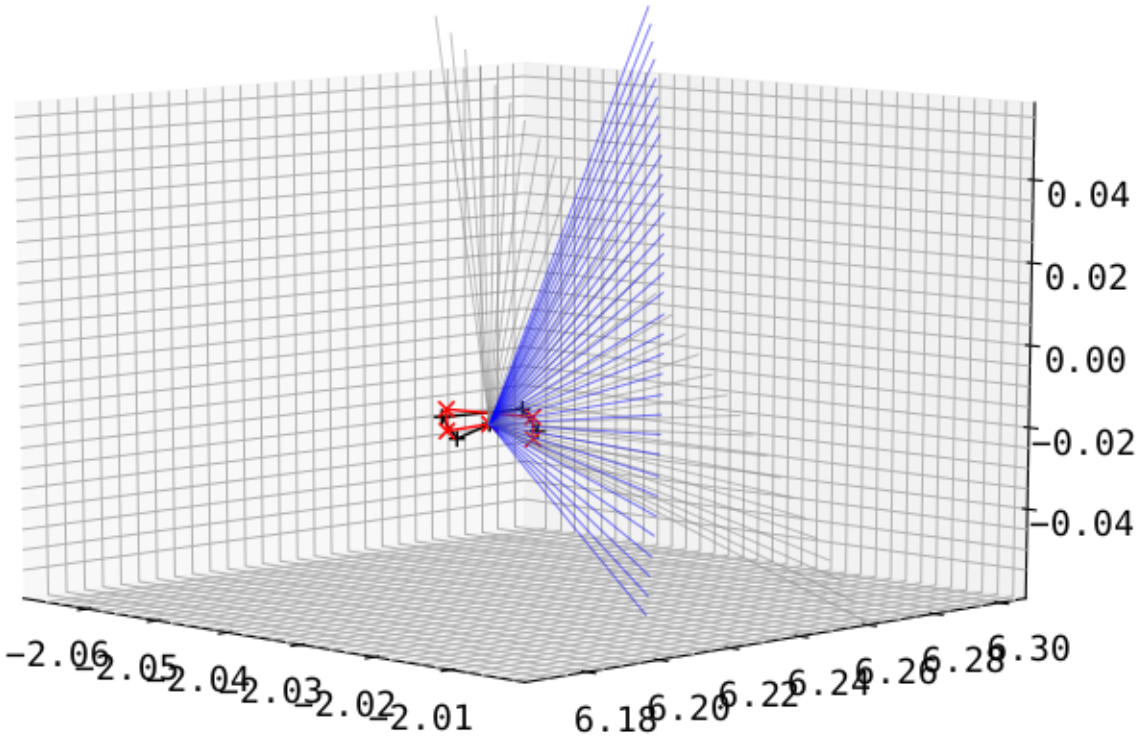
- guide is normal of plane constructed by detector fan (blue)
- transforming all channels so that normal points in/at toroidal direction (red)
- transformation for each channel individual (see previous argument (1.)) (orange)
- done for all cameras individually



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)

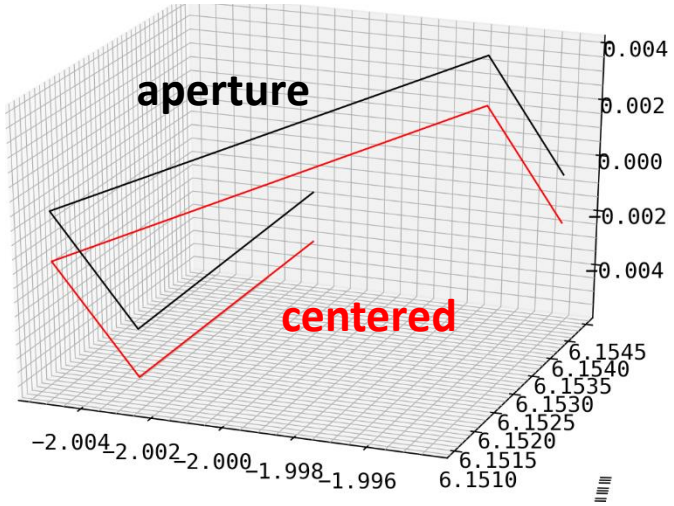


(results for (2.) with aperture change included)

HBCm

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