

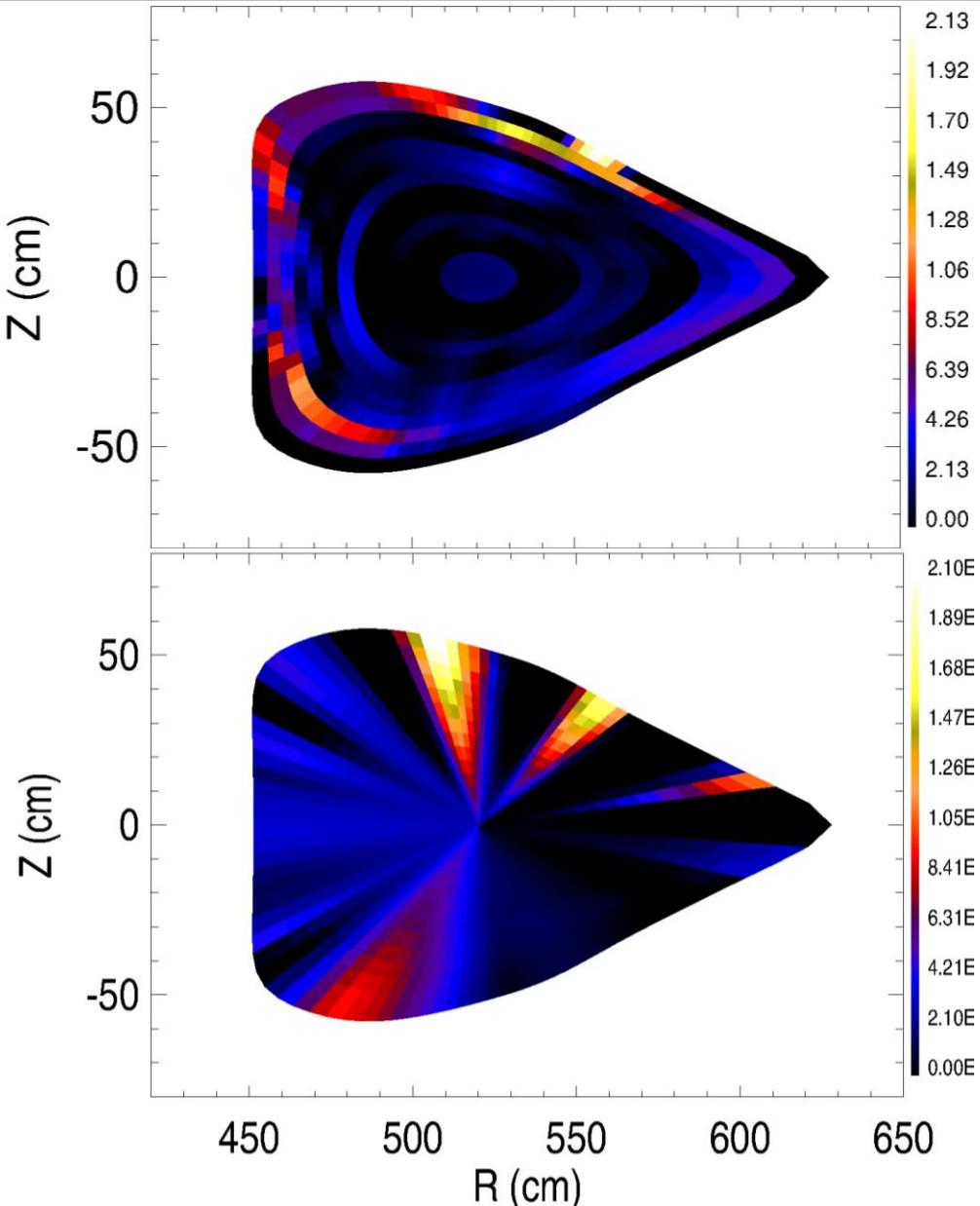
Report 05/14/2020

P. Hacker



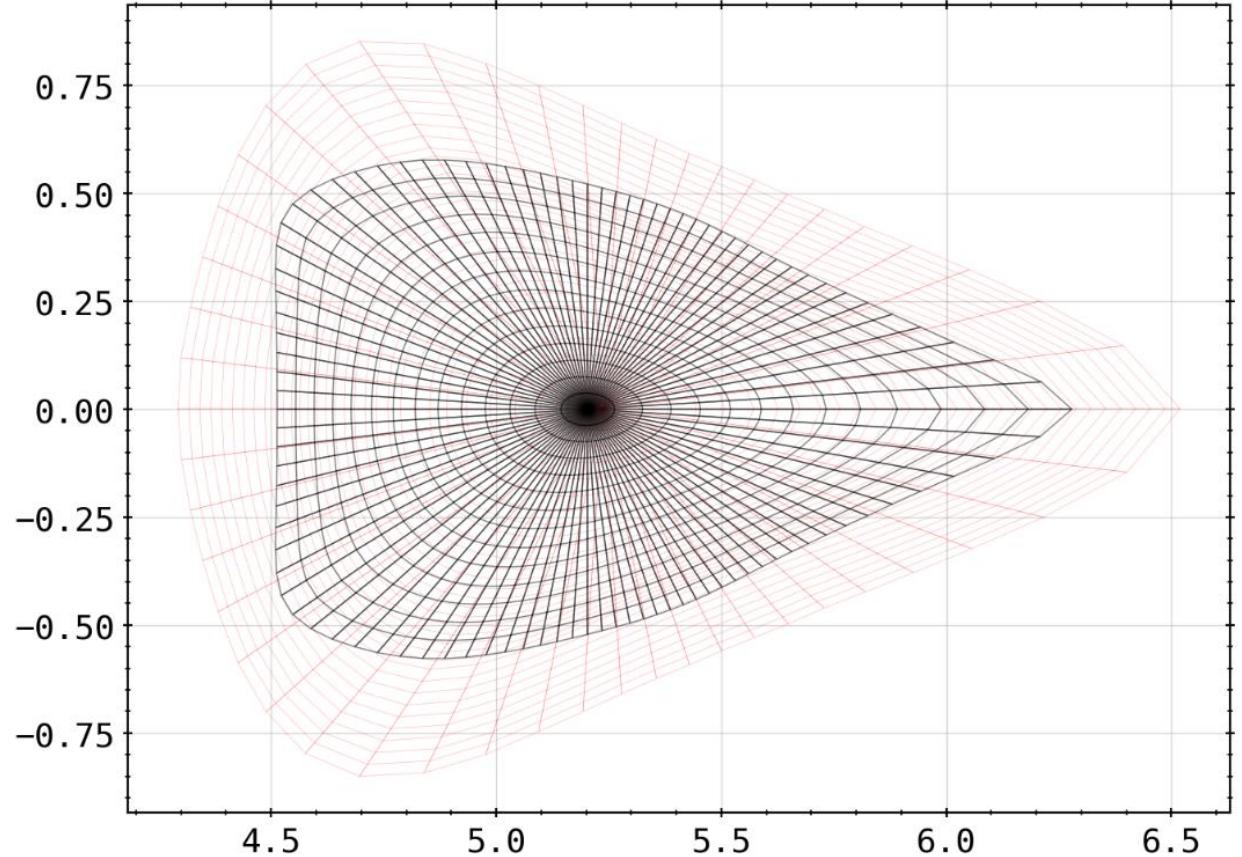
Previously: 2D Tomography - First Results

- $t = 3.421\text{s} \leftrightarrow \text{frad}=100\%$
- anisotropy factors – poloidal smoothing, i.e. gradient restrictions, set to 1.5 inside the LCFS and 1.2 at the edge
- anisotropy factors set to 1.0 and 1.0



Previously: 2D Tomography - First Results

- next step: set up forward calculation of chordal brightness profile from the 2D results of tomography as shown before
- change geometry of mesh to represent more vessel (plasma) volume

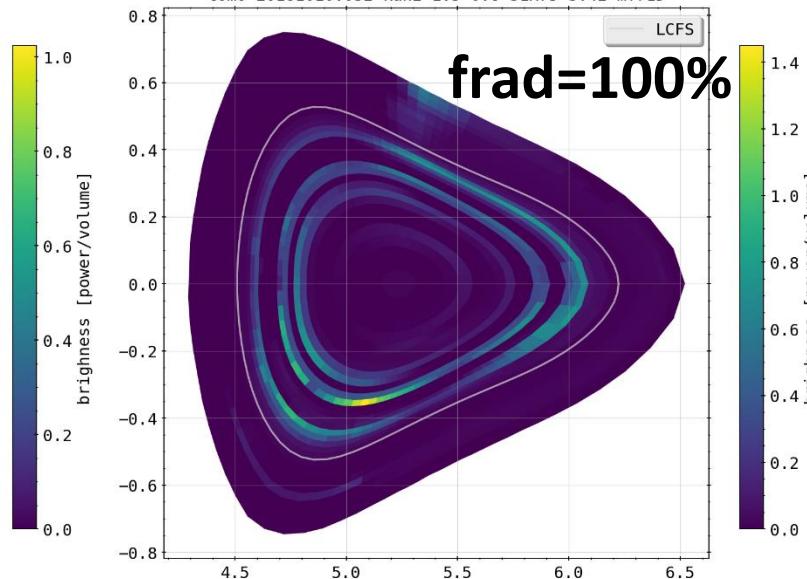
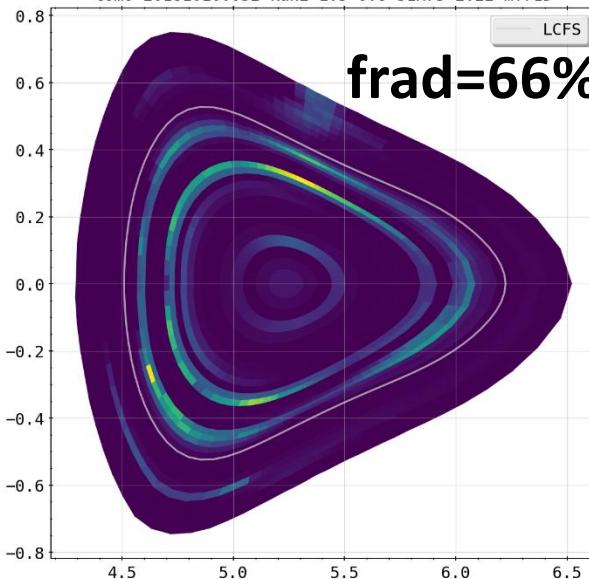
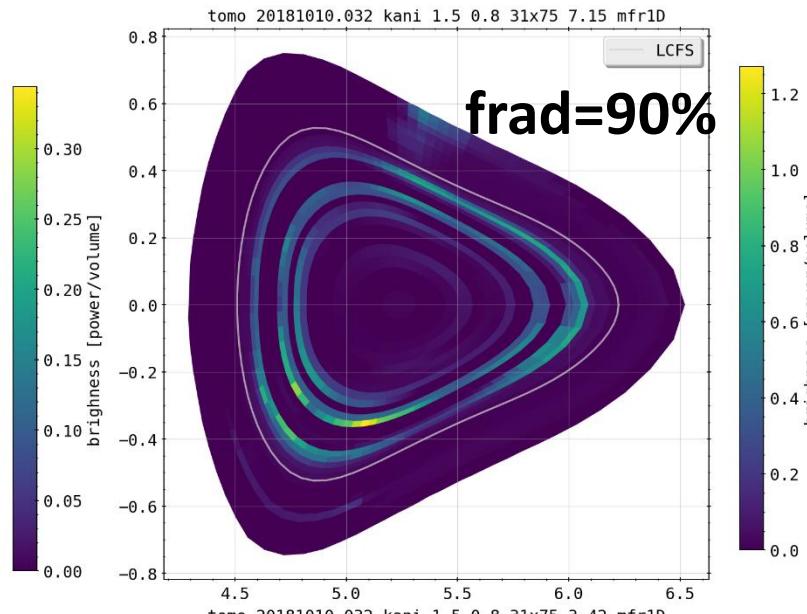
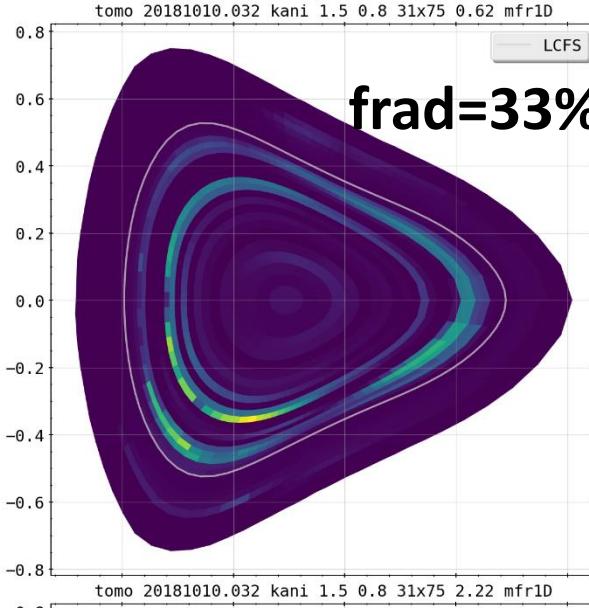


Not in order:

- 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

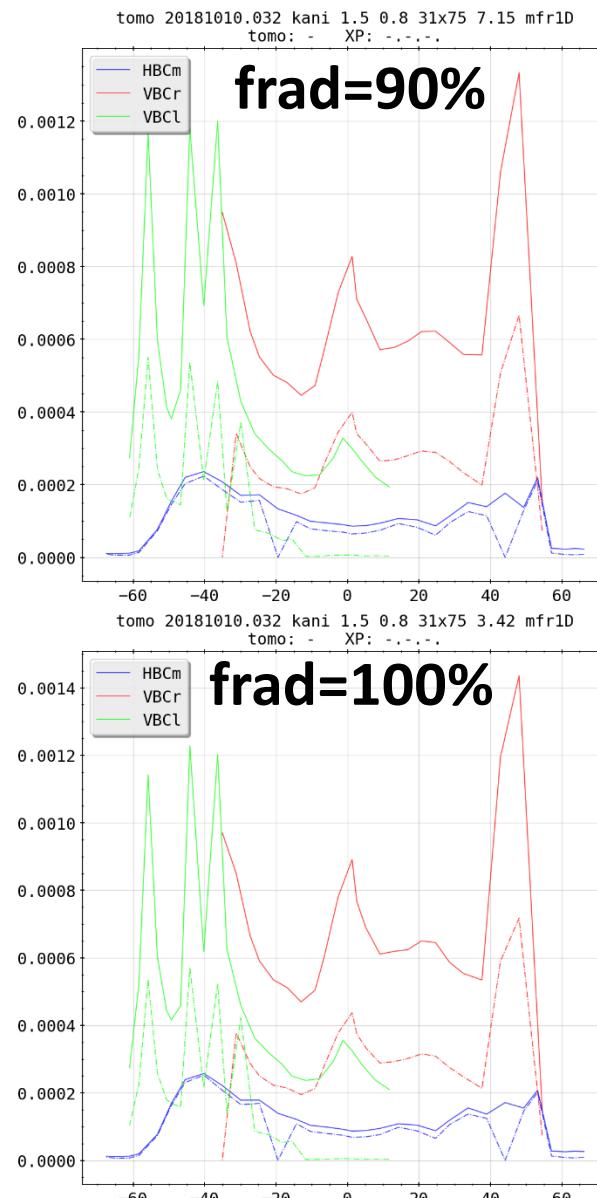
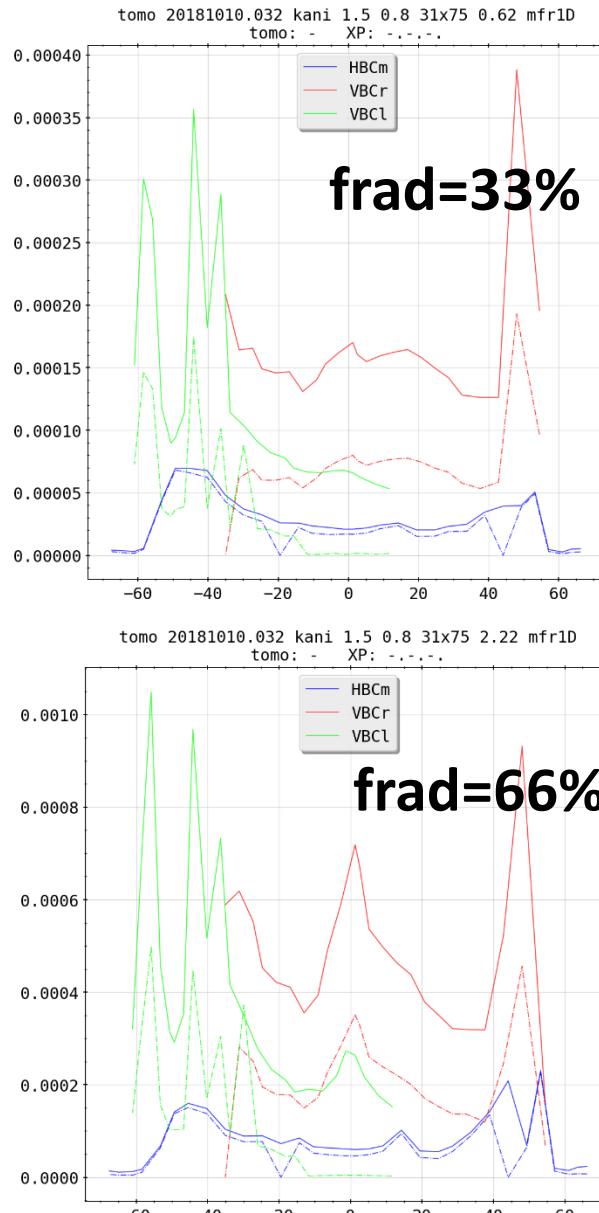
- calculating chordal profiles based off of geometry data used also for reconstruction
- iterating through $\text{frad} = 33\%, 66\%, 90\% \text{ and } 100\%$ for comparison
- set up forward calculation of chordal/radial brightness profile from the results of tomography
- change mesh geometry to check for intrinsic geometry of approach

Selfconsistent Tomography for 20181010.032



- prime feedback controlled discharge as test to see whether radiation moving from beyond the LCFS to inside is resolvable by algorithm
- same configuration and anisotropy factors for all calculations
- increasing brightness level, artifacts on last cell sheath for compensation?

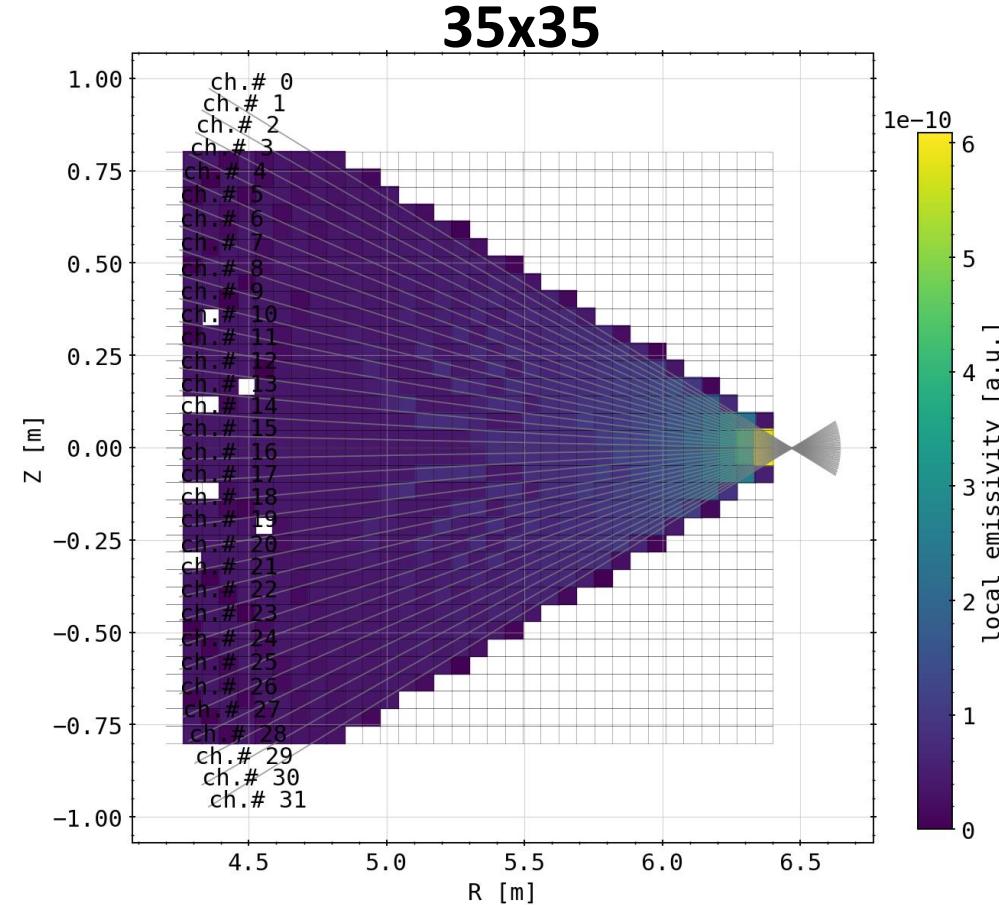
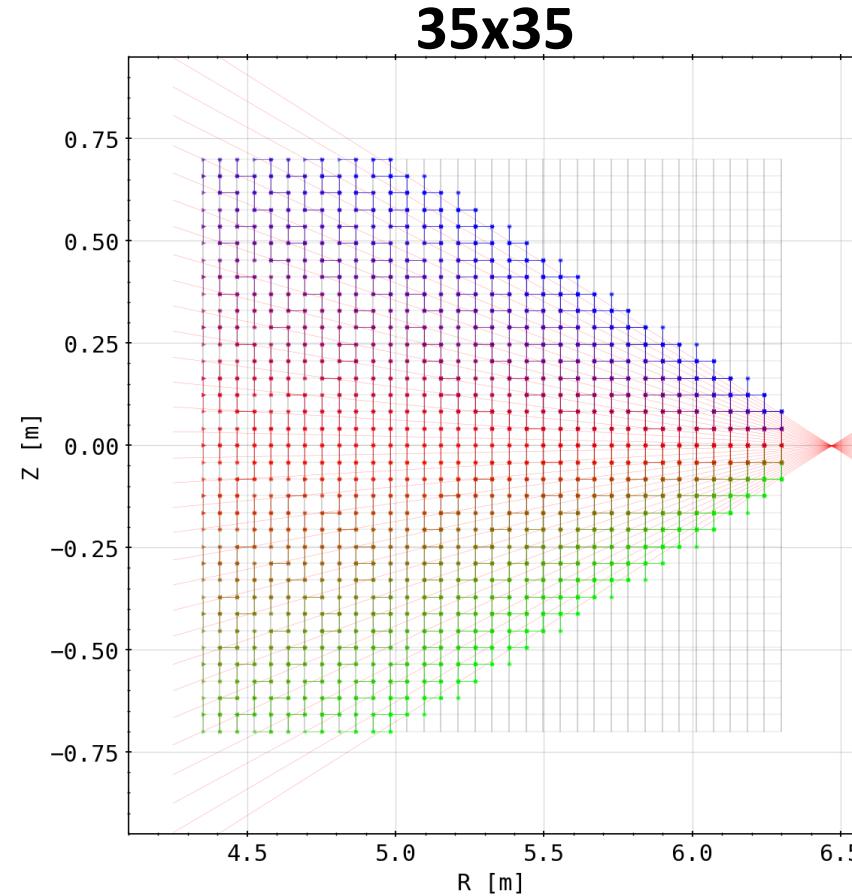
Selfconsistent Tomography for 20181010.032



- same discharge, but forward and backwards calculated chordal profiles for camera arrays
- in general $X^2 \sim 1.0$, fit for HBCm pretty good, less so for vertical cameras (see D.Zhang et al.)
- ‘eratic’ chordal profiles almost impossible to represent with poloidal smoothness and constraints

Cartesian Mesh and Test

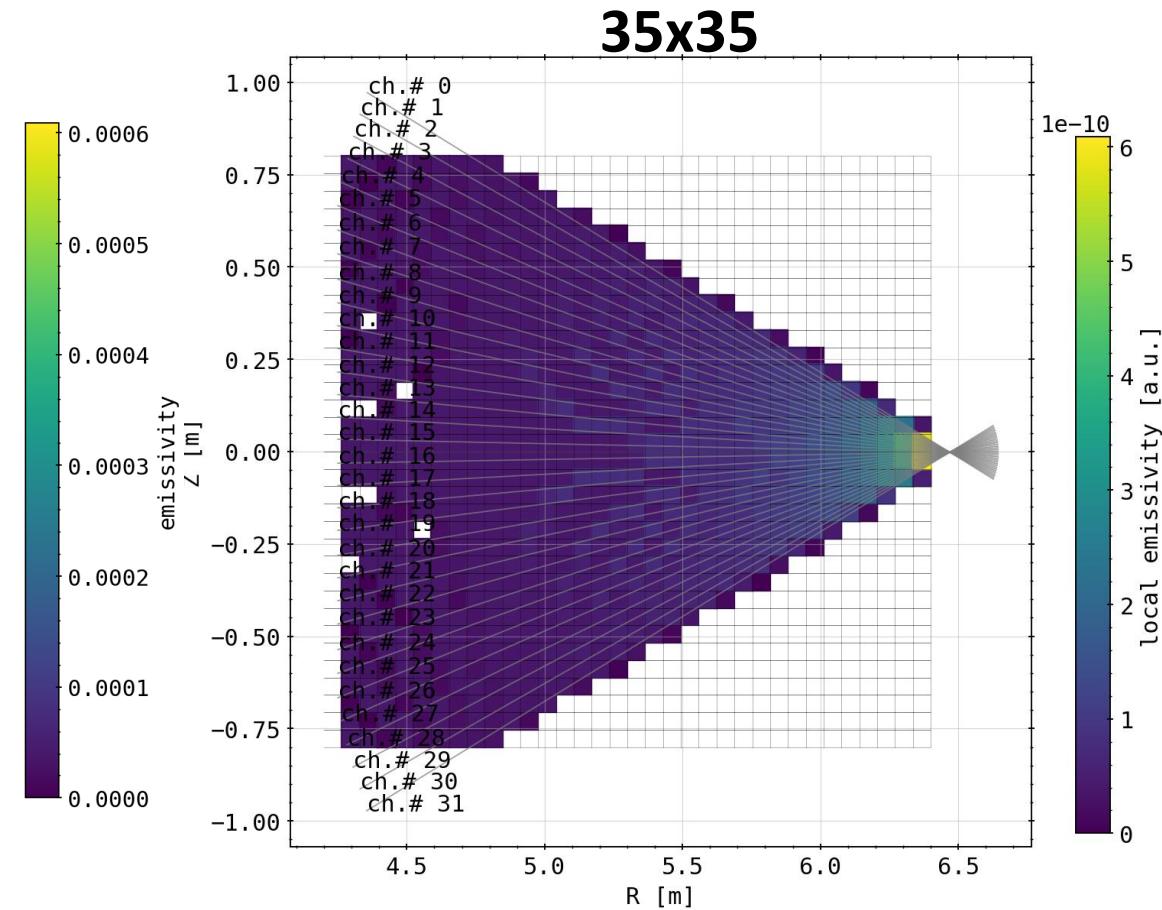
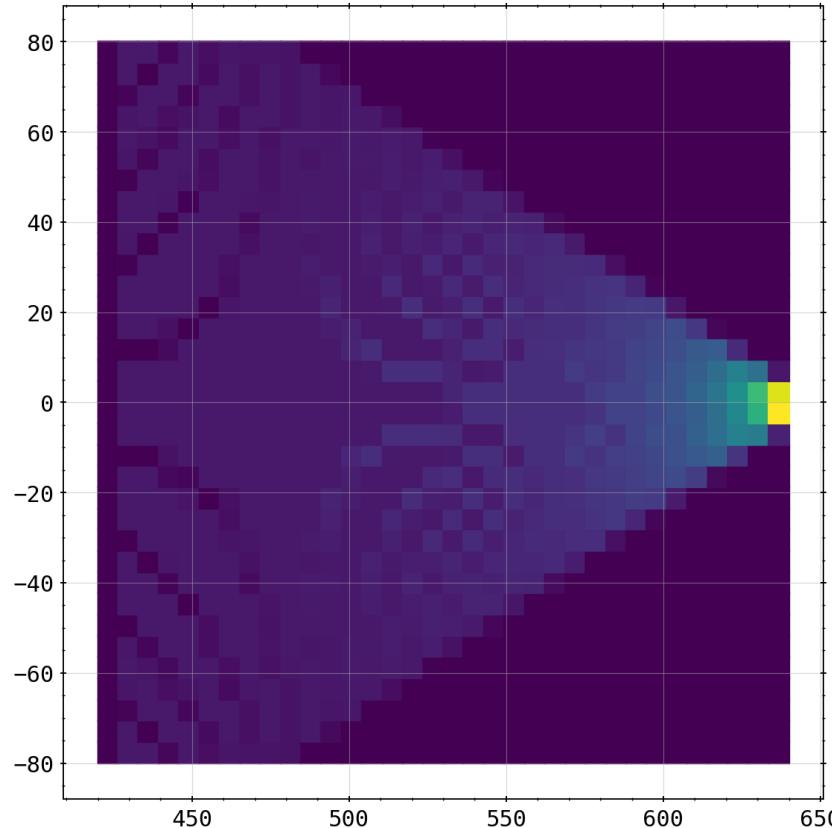
➤ using simple cartesian, i.e. rectangular mesh instead of fluxsurfaces and poloidal lines to calculate the geometry and tomogram



Cartesian Mesh and Test

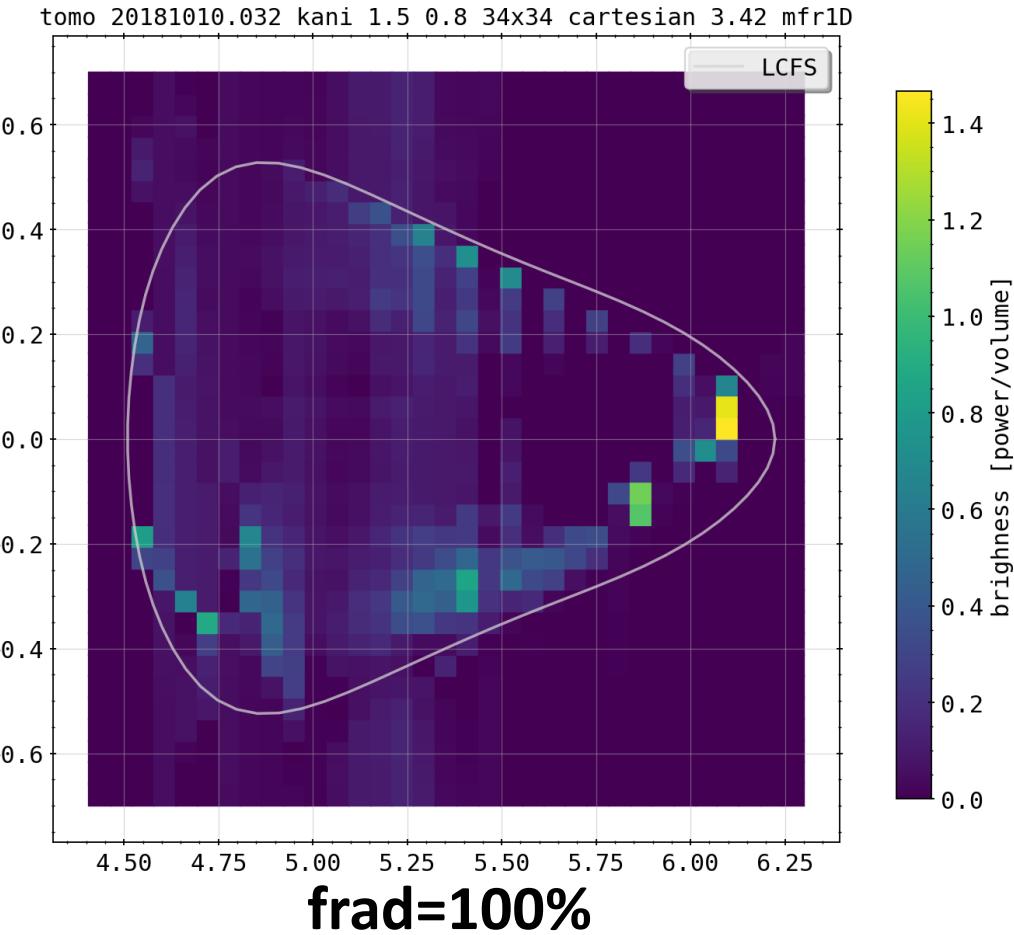
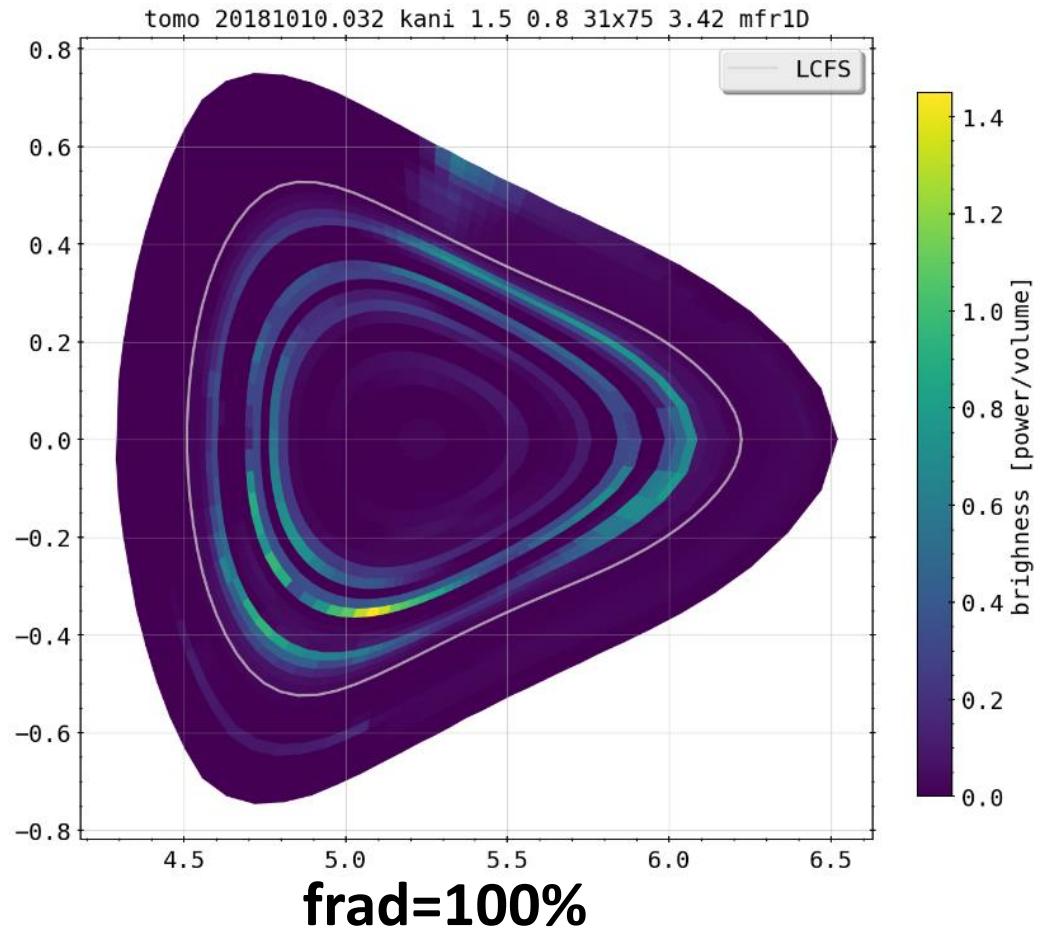
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35x35



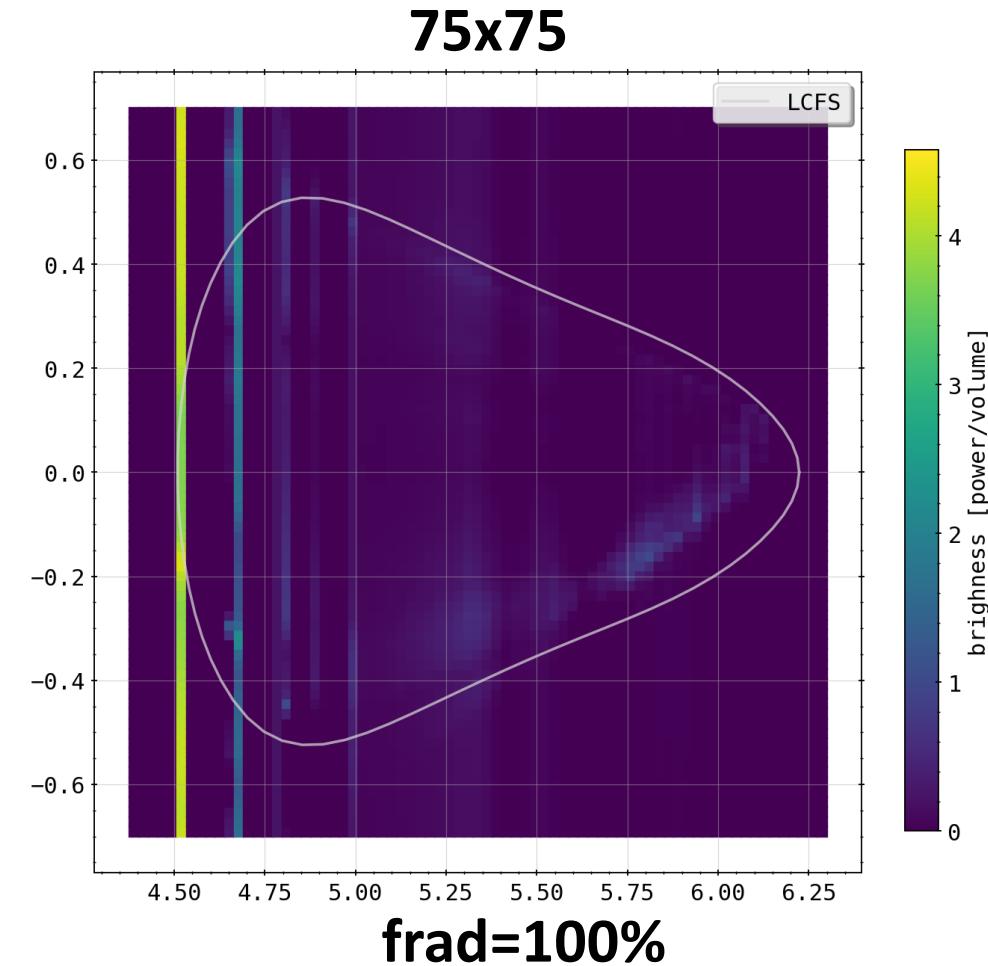
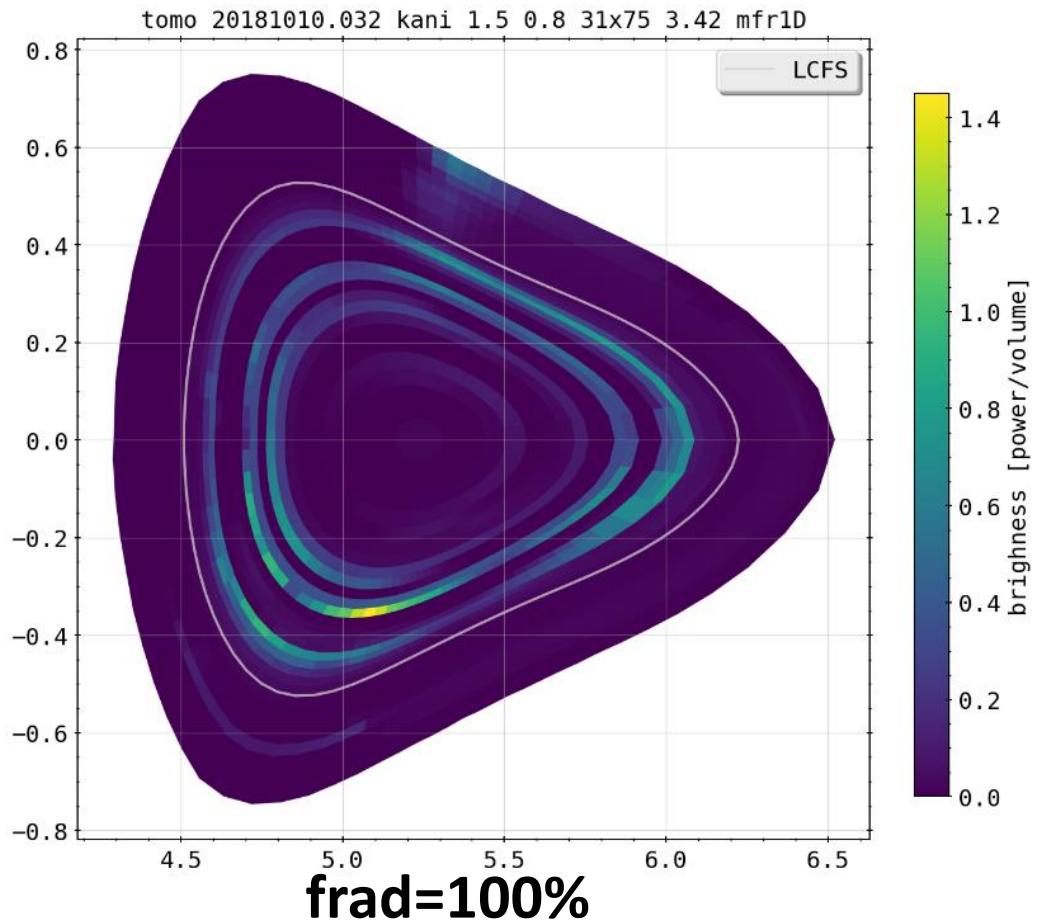
Cartesian Mesh and Test

- using simple cartesian, i.e. rectangular mesh instead of fluxsurfaces and poloidal lines to calculate the geometry and tomogram



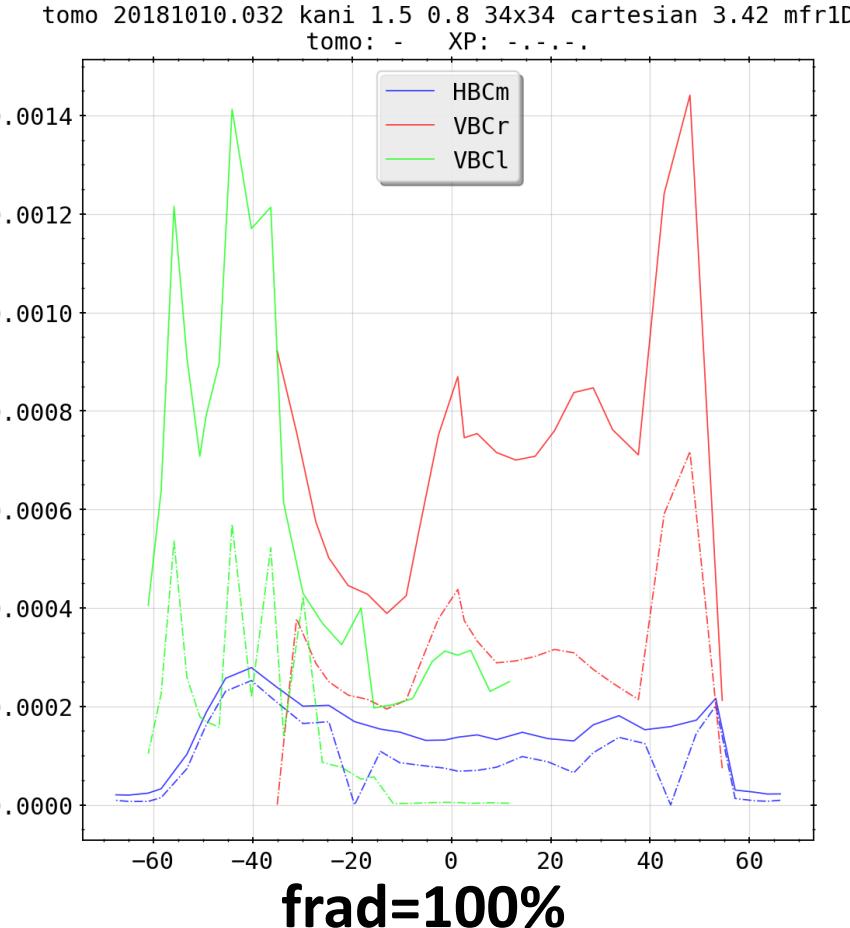
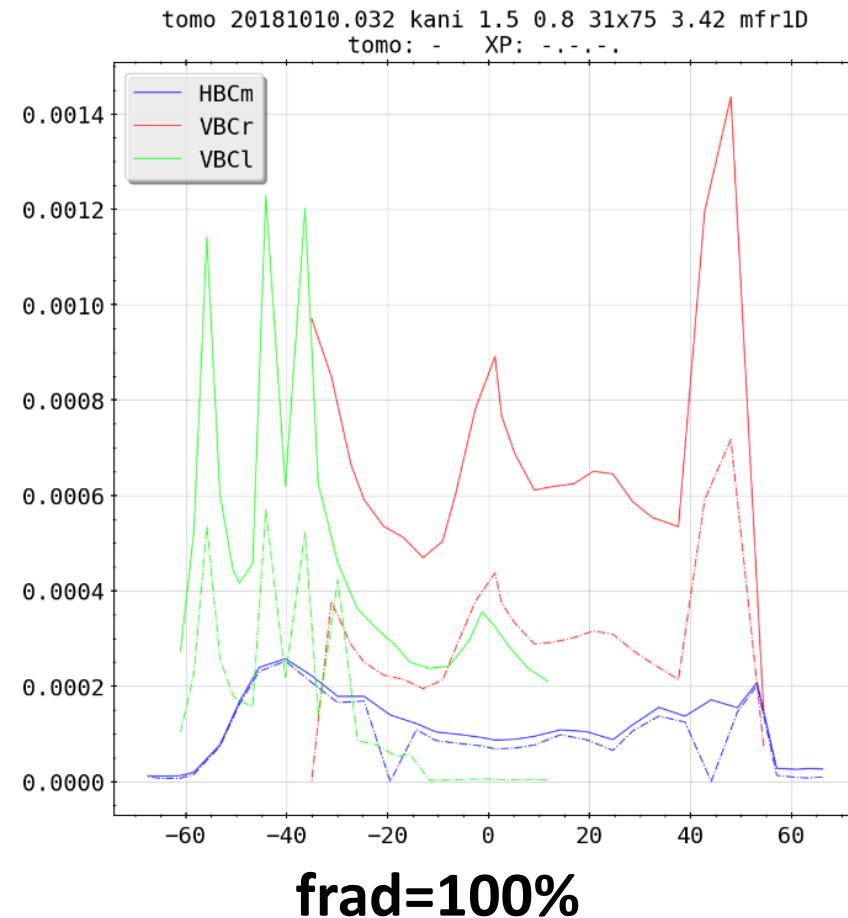
Cartesian Mesh and Test

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Cartesian Mesh and Test

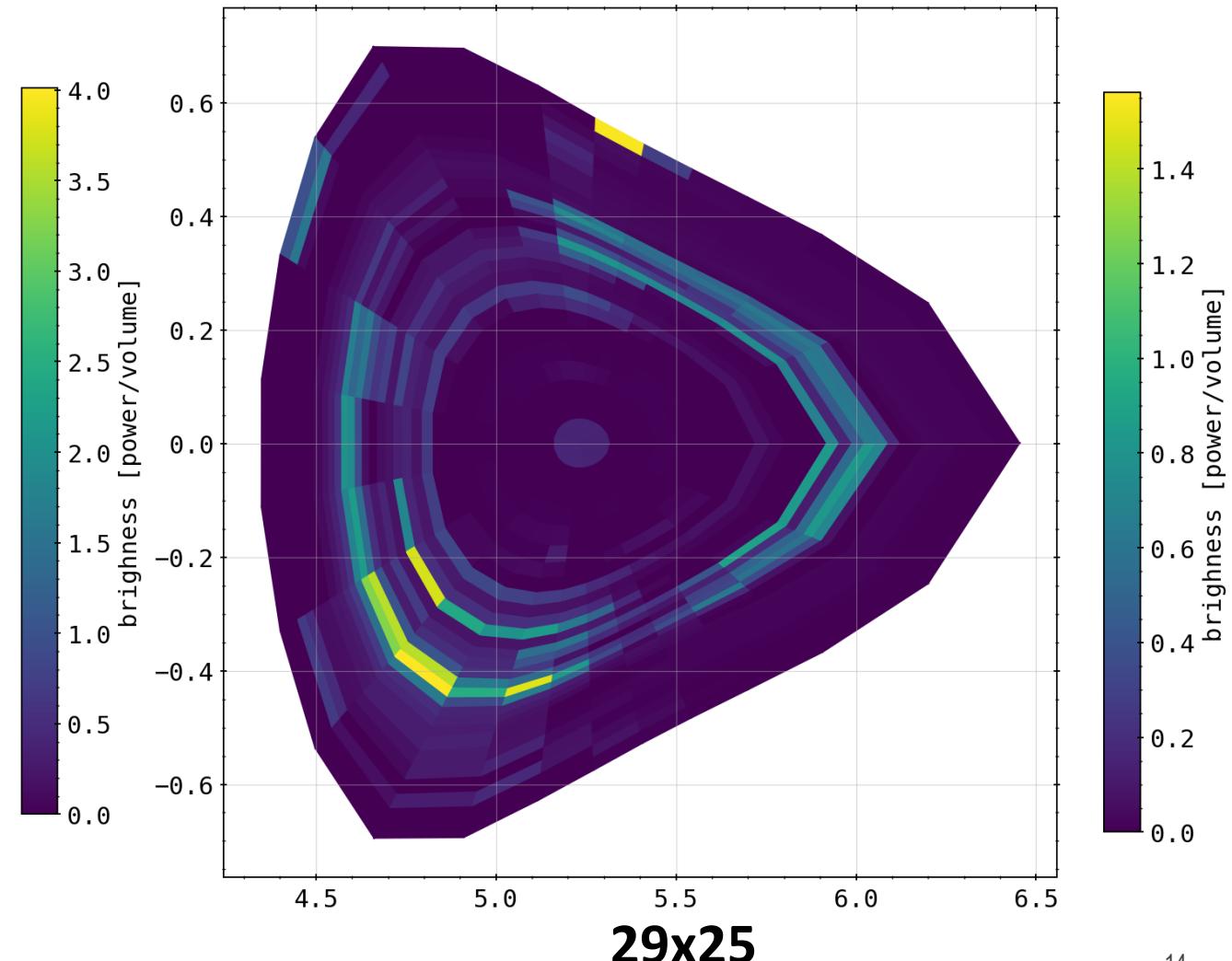
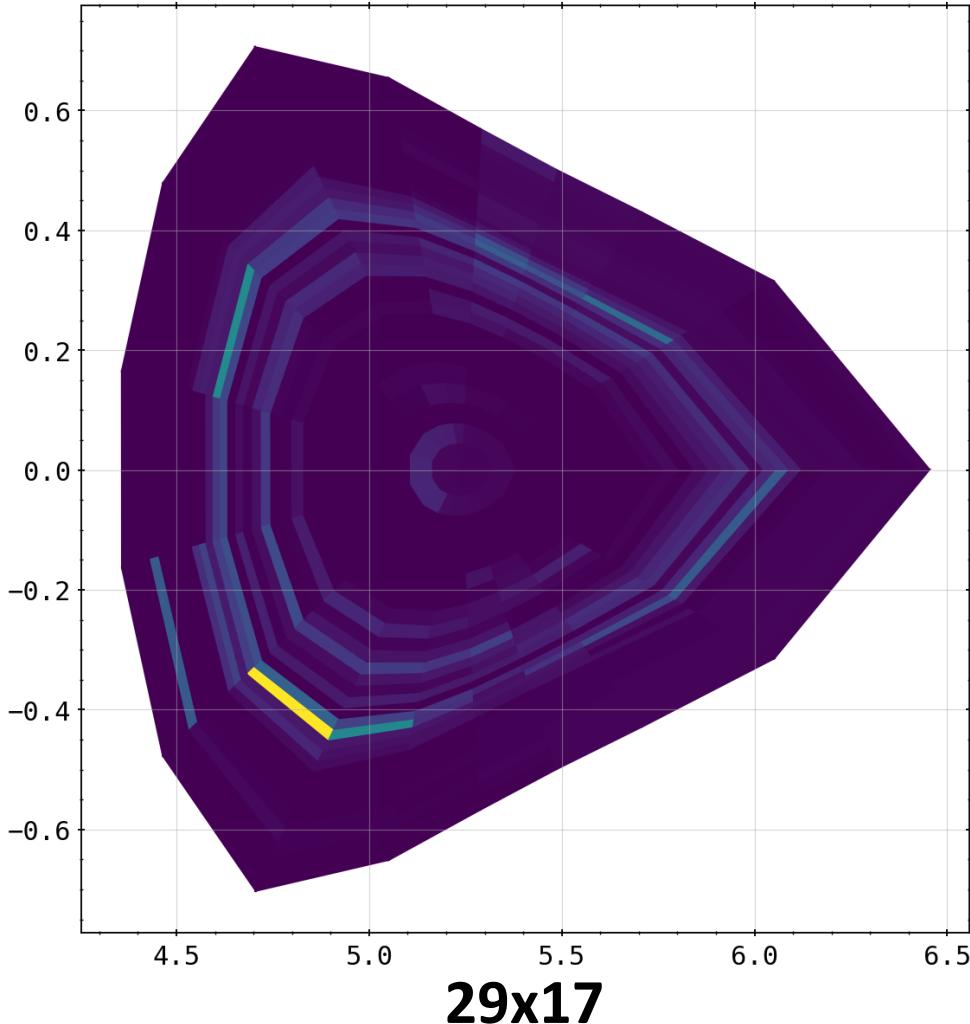
➤ using simple cartesian, i.e. rectangular mesh instead of fluxsurfaces and poloidal lines to calculate the geometry and tomogram



- using simple cartesian, i.e. rectangular mesh instead of fluxsurfaces and poloidal lines to calculate the geometry and tomogram
- seems that cartesian grids work, but not as ‘good’ as those motivated by magnetic geometry and fluxsurfaces, though $X^2 \sim 1.0$ for both
- likely poloidal constraints suppress artifacts created due to lack of information, where only one camera/single channels yield radiation information

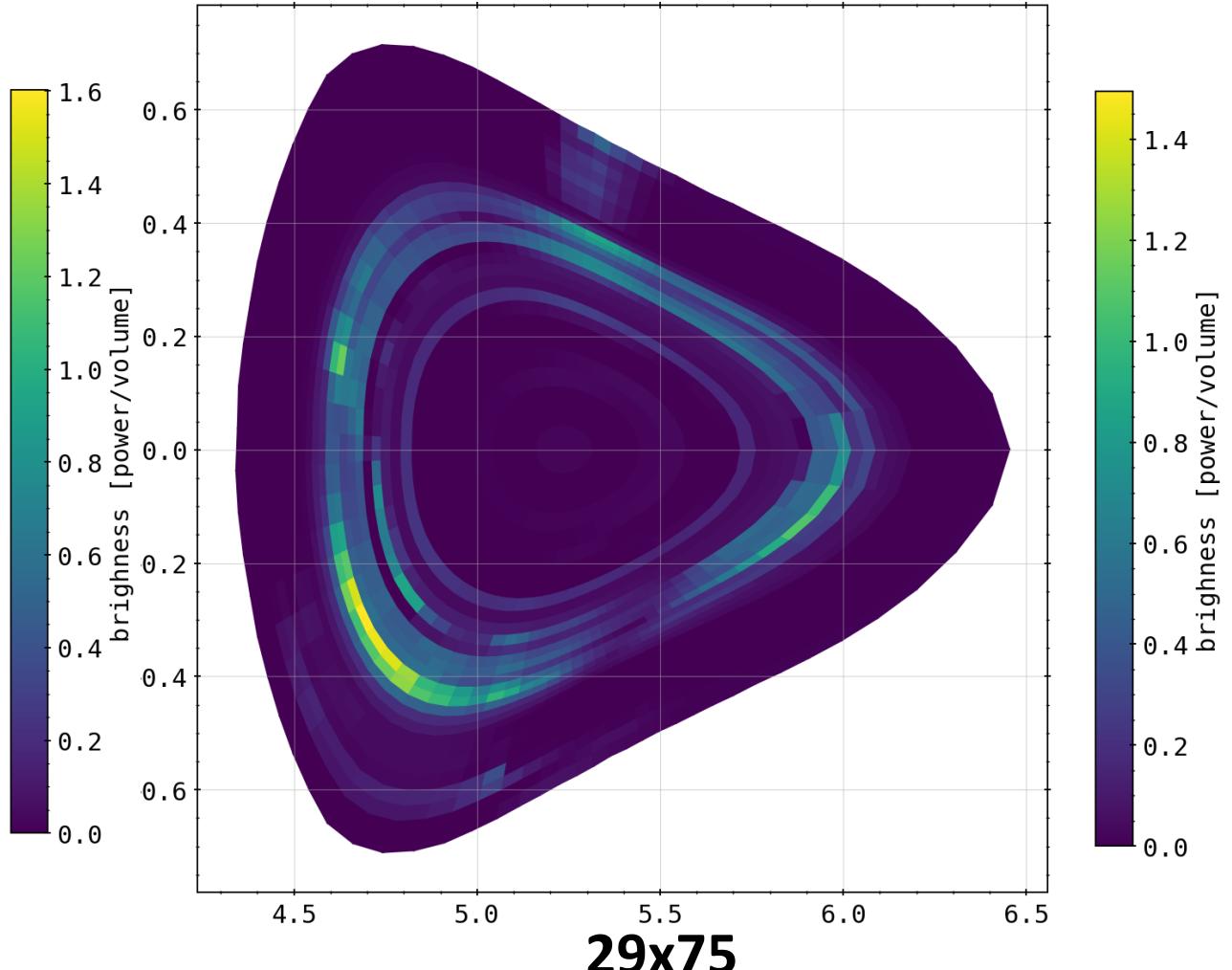
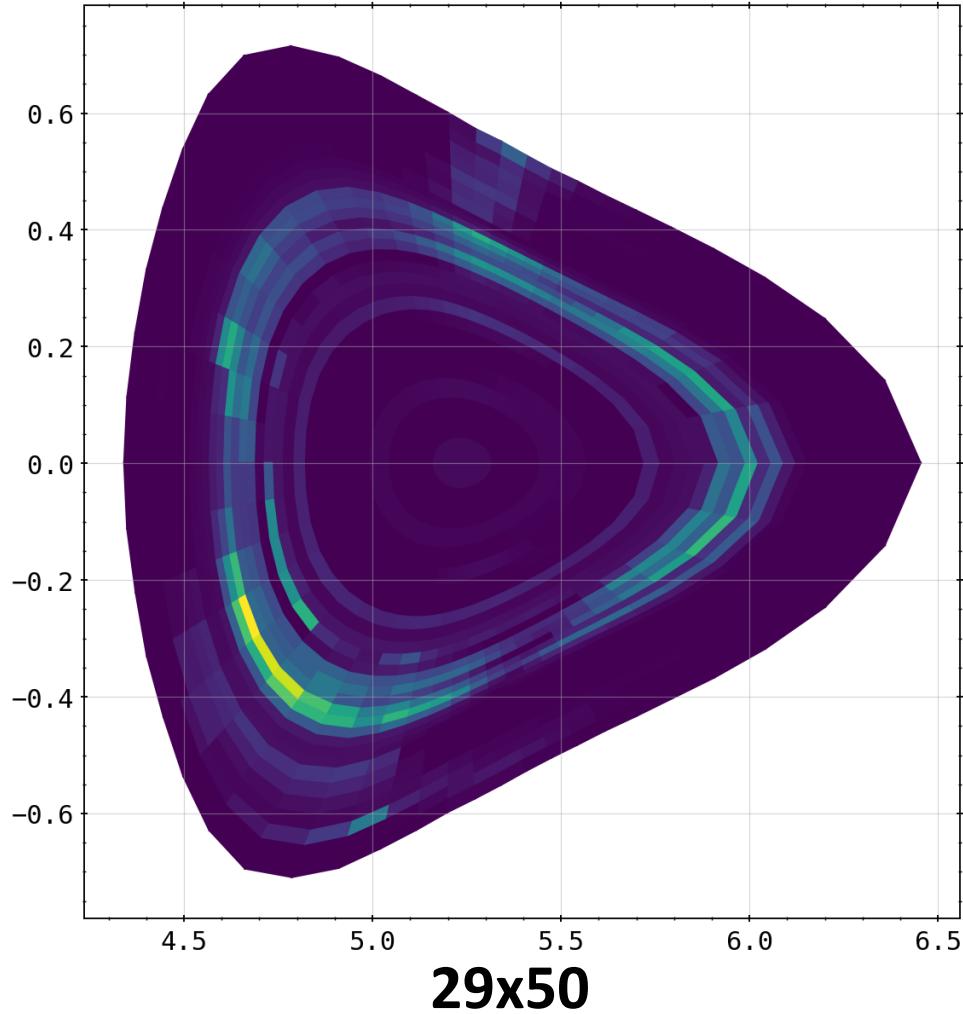
Mesh Test (kani_core = 1.5, k_diff = 0.8)

➤ changing the mesh setup or geometry on same tomogram (frad=100%)



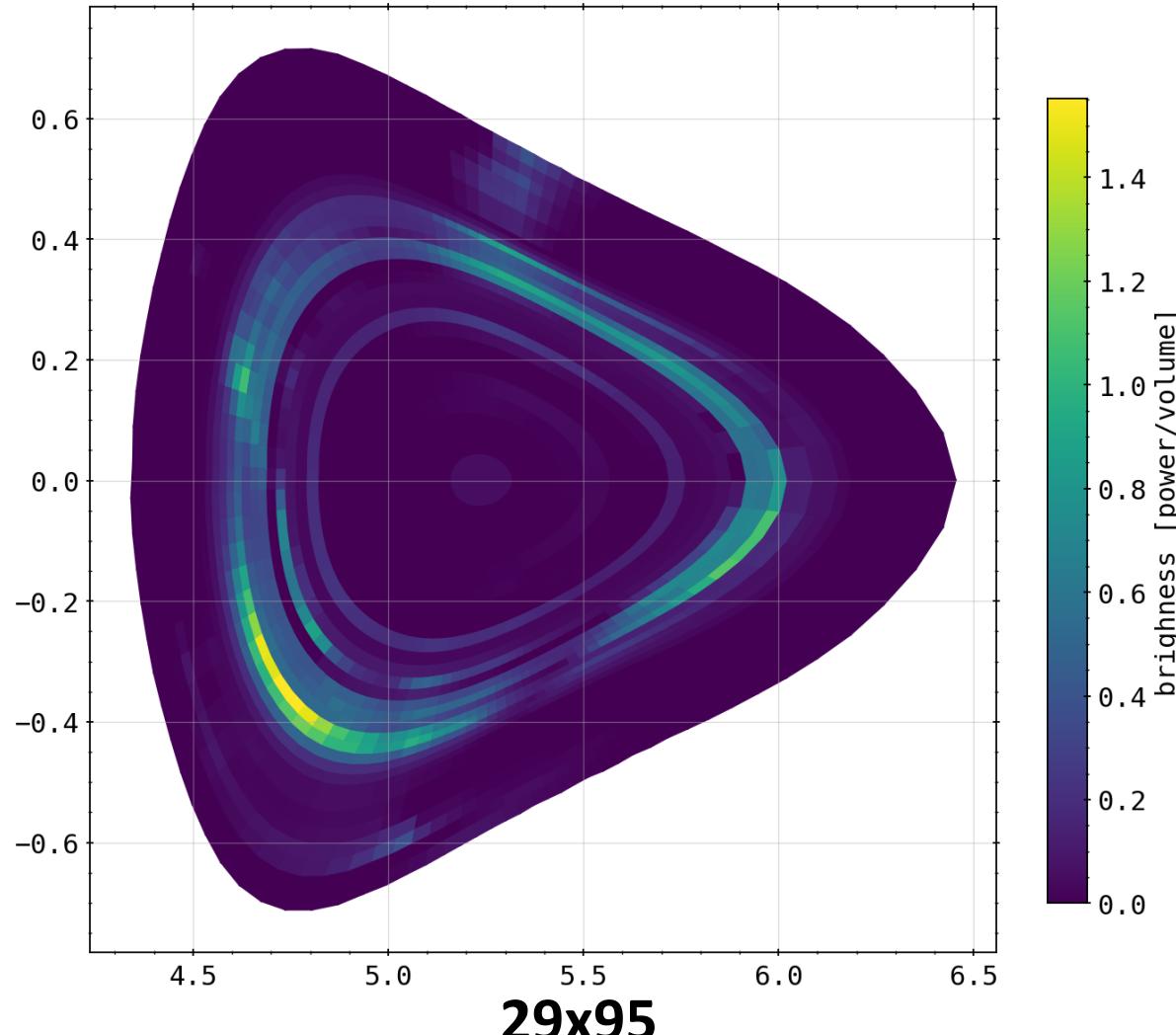
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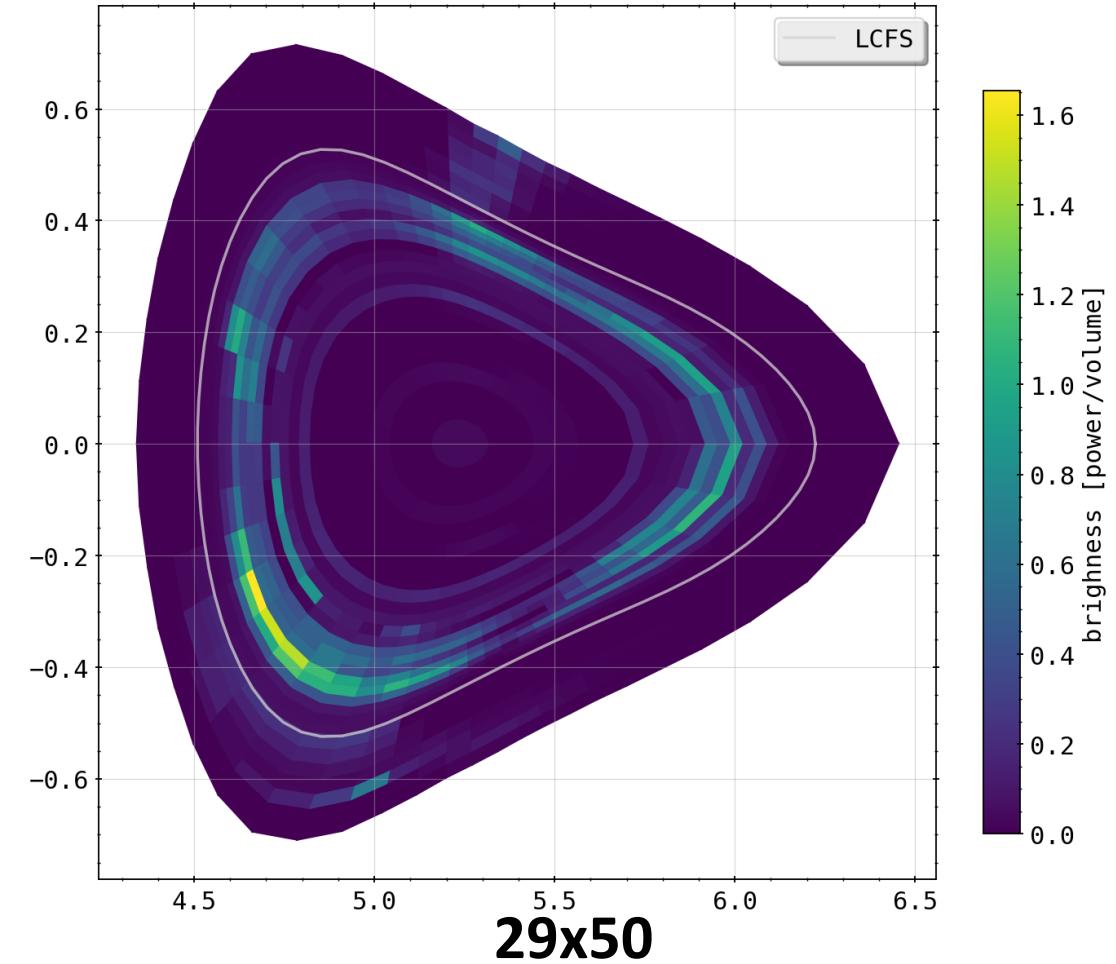
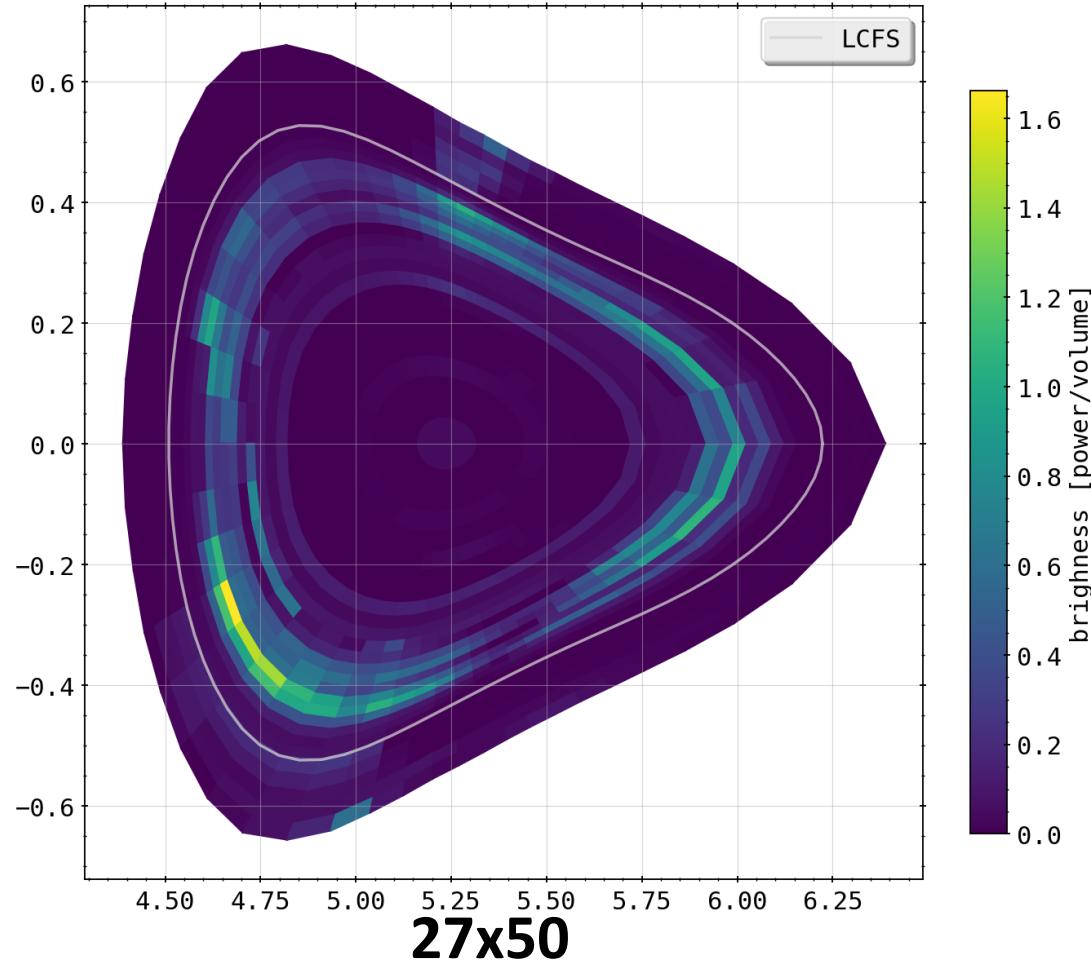
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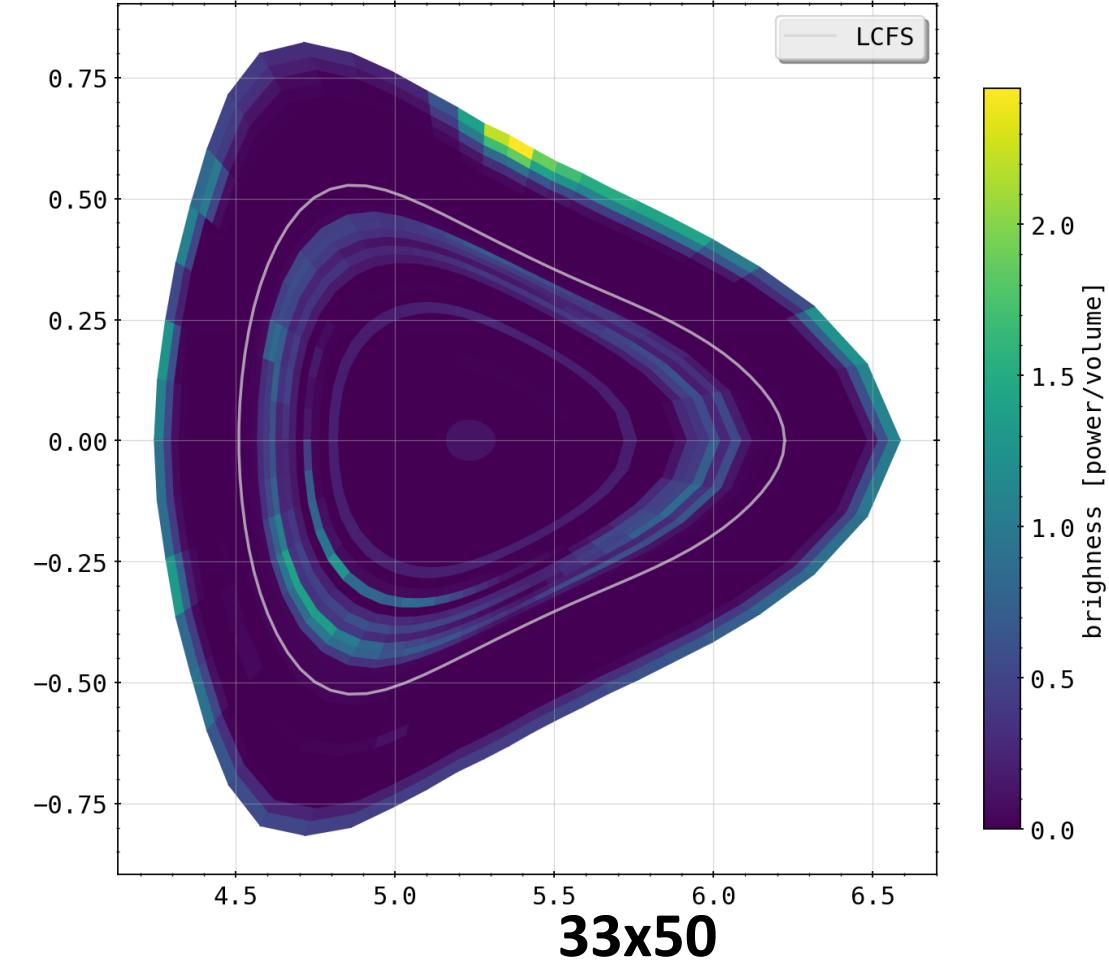
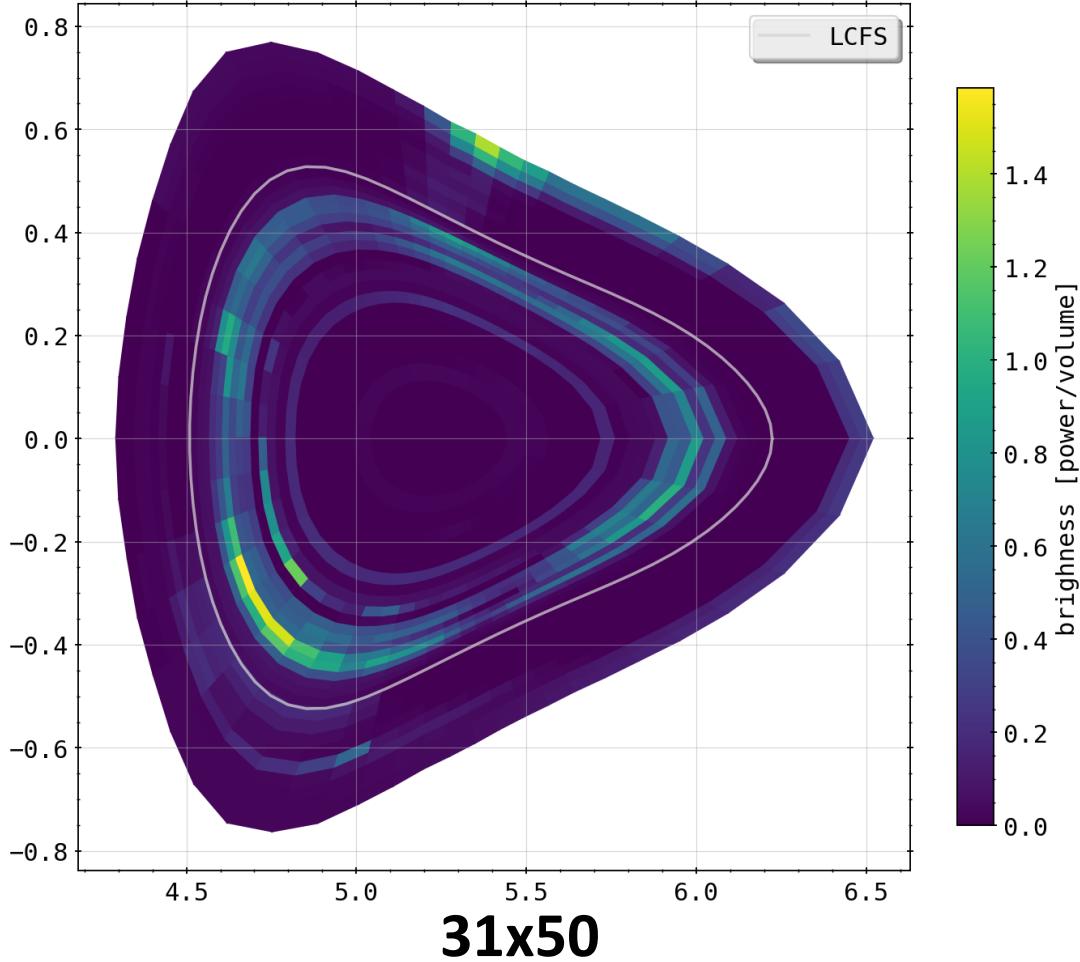
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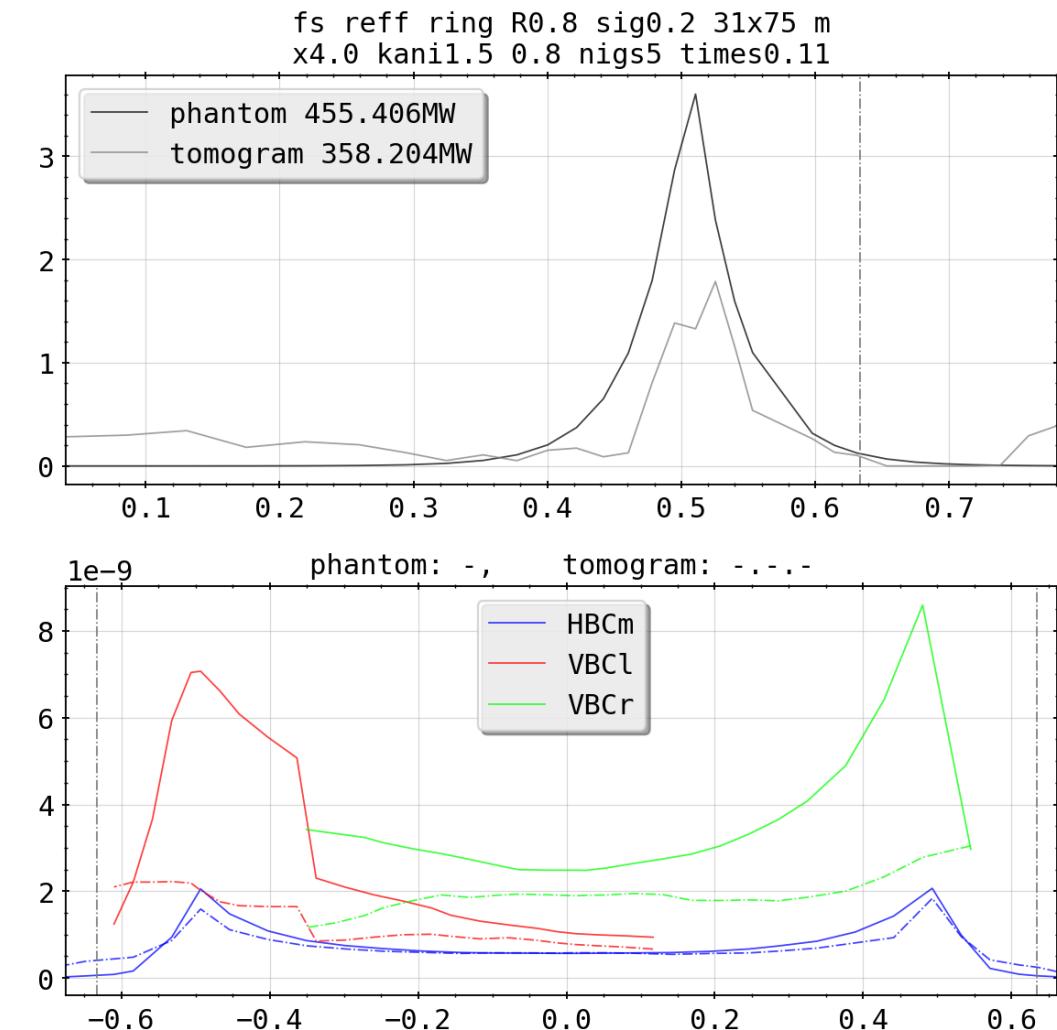
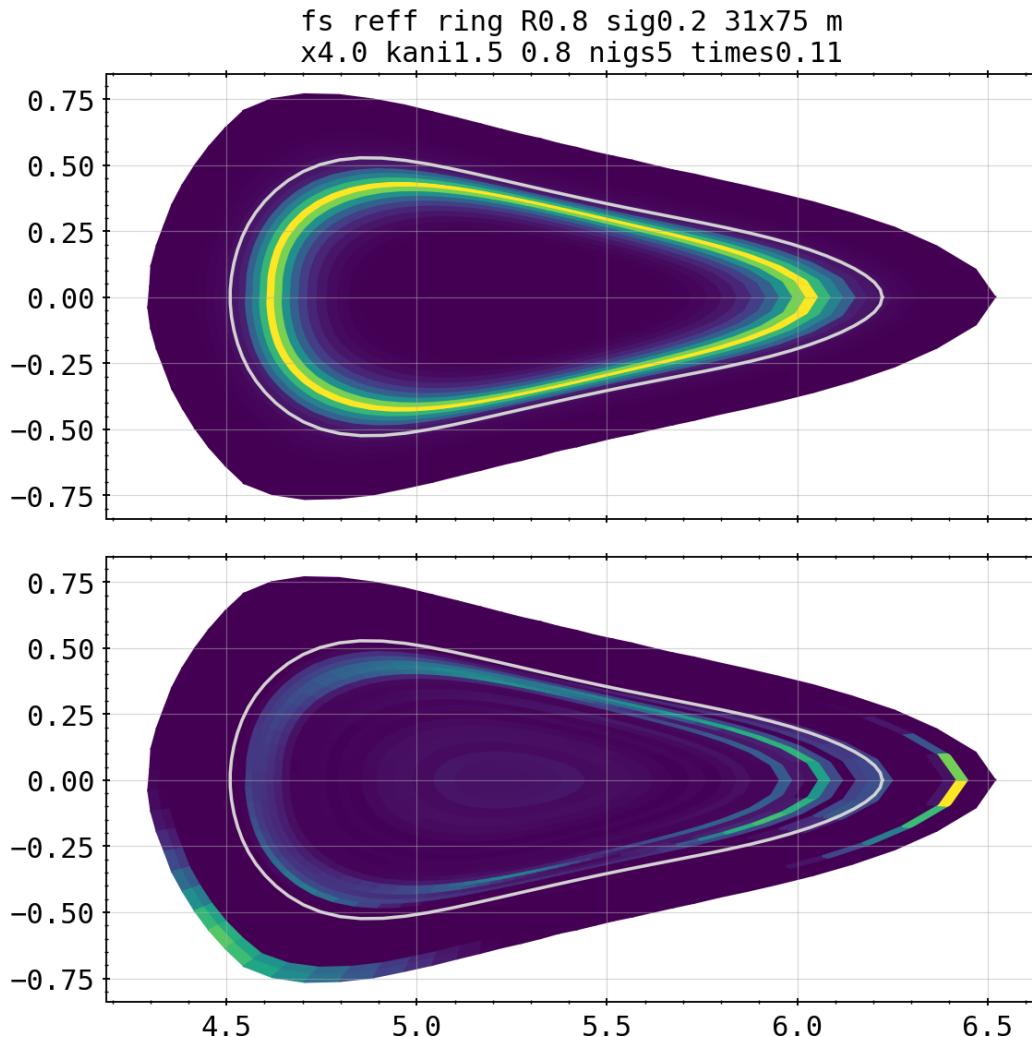


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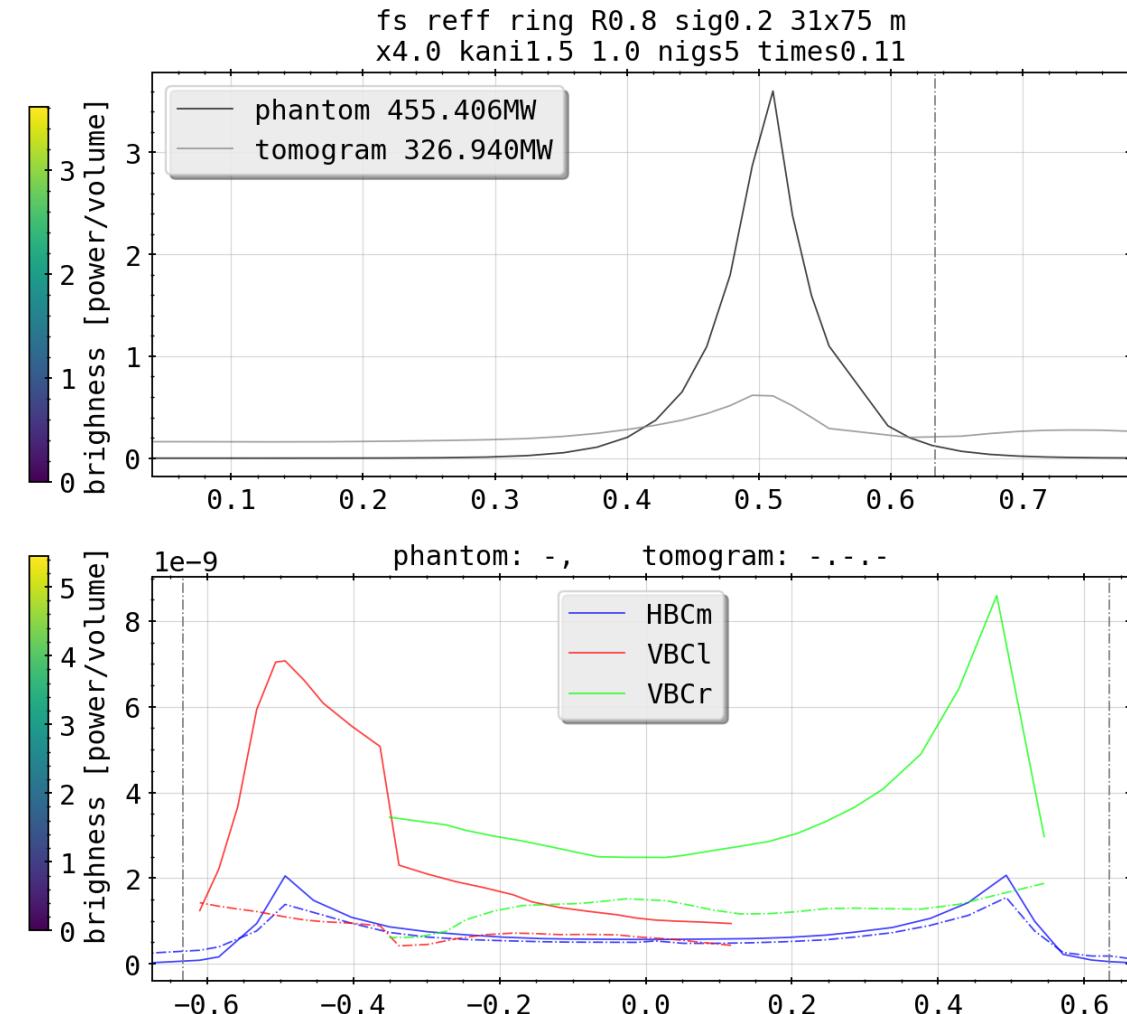
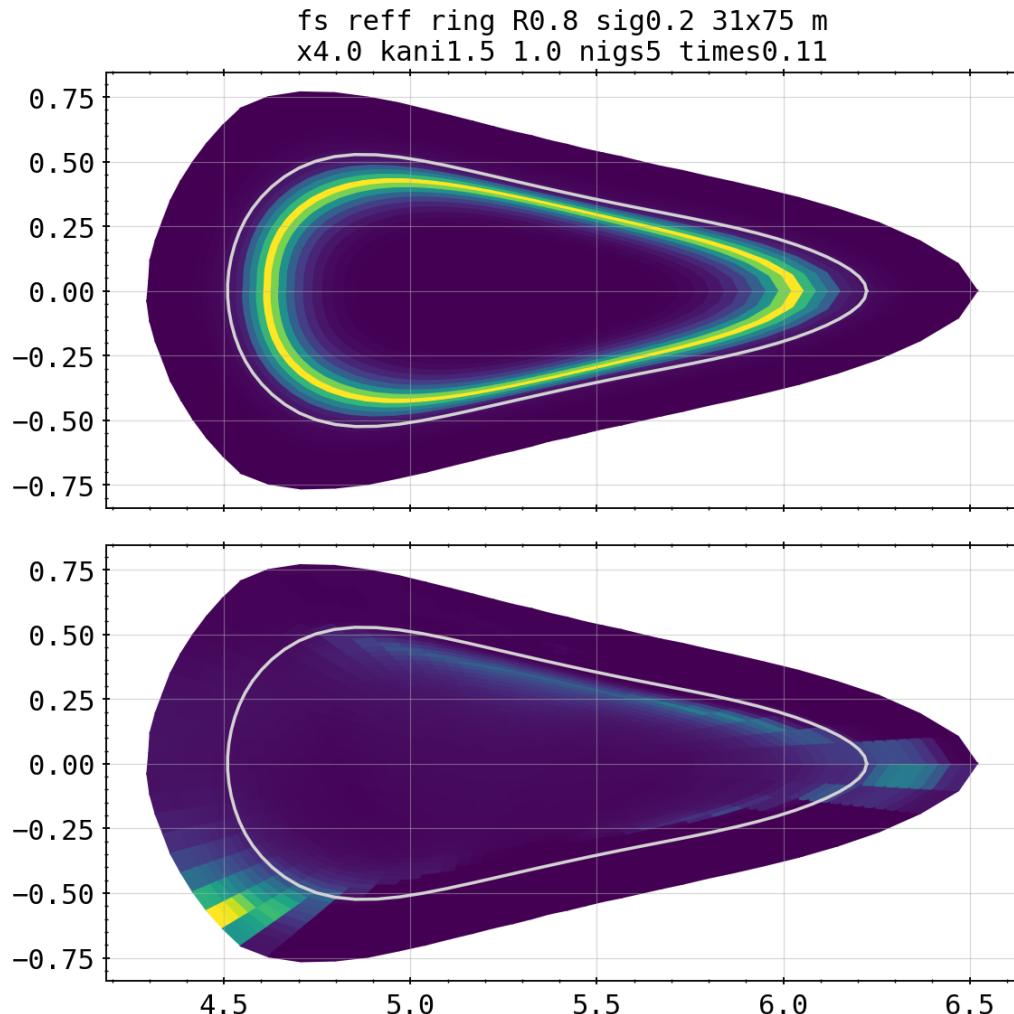


- changing the mesh setup or geometry on same tomogram (frad=100%)
- for same configuration, higher poloidal resolution might yield more information due to definition of gradient and smoothness constraint
- infinitely more ‘lines’ however do not yield infinitely more quality, fall off at ~75 angular sections
- increasing radial range can be detrimental to results of tomography, offering more degrees of freedom to regularization (as seen in results above)
- artifacting is seen commonly for higher radial indices, compensating for the input profiles

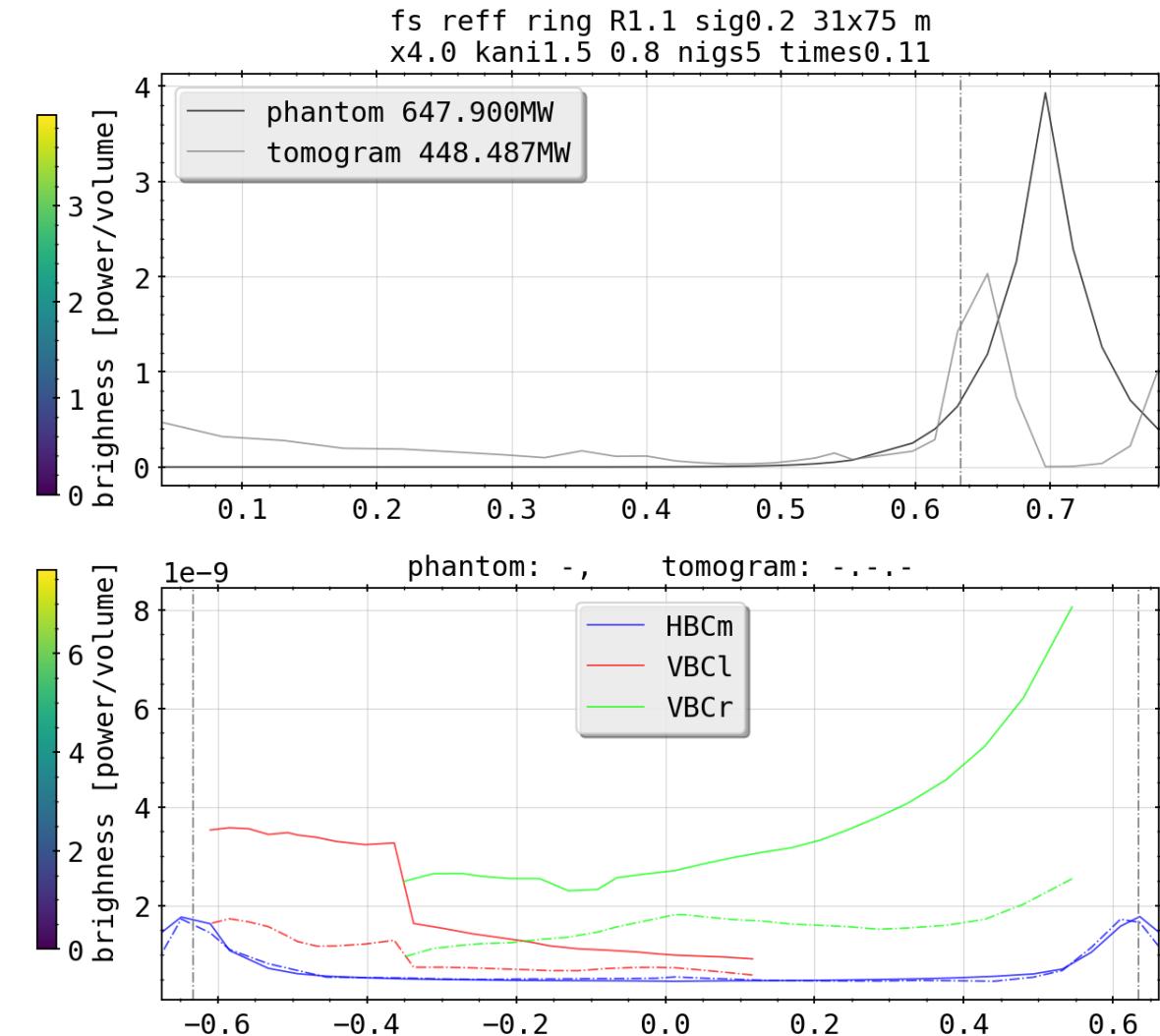
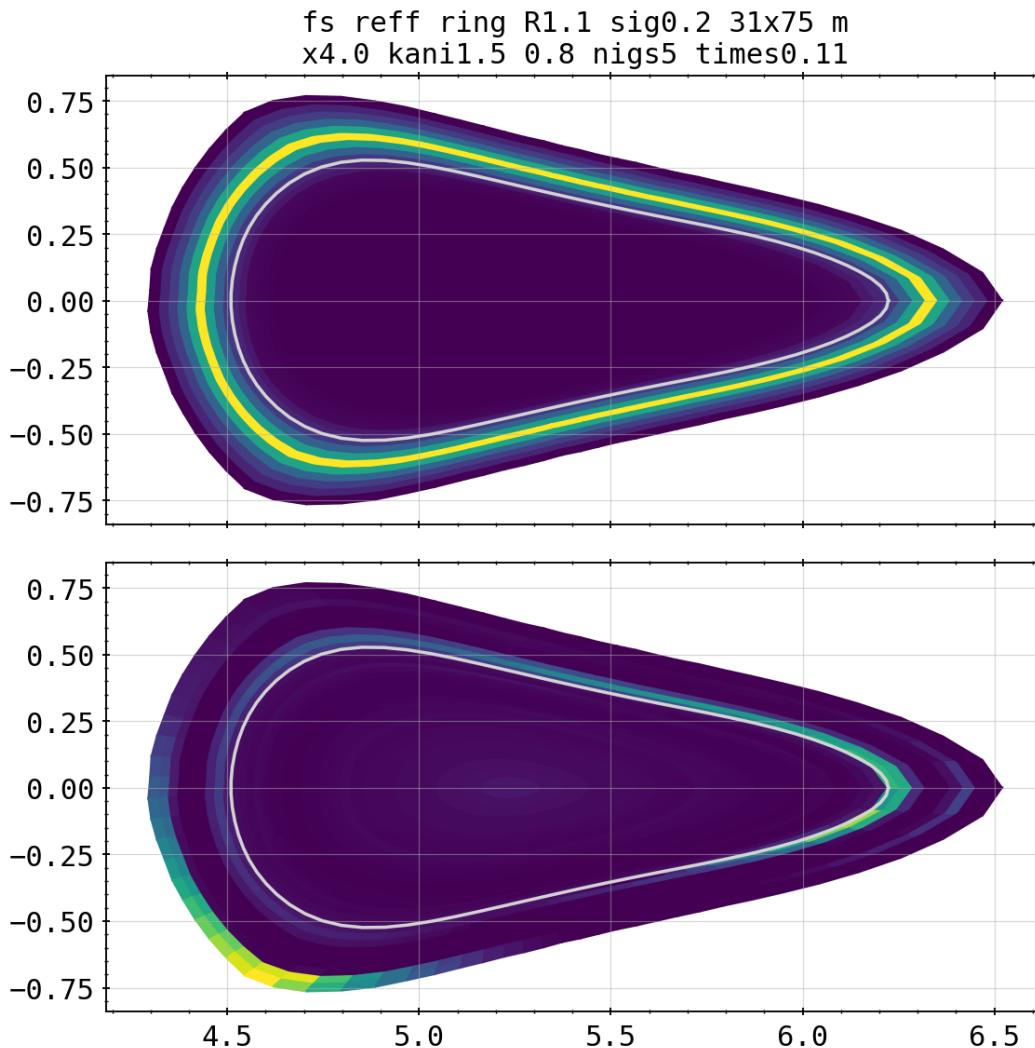
Phantom Tests: One Bright Ring (To Rule Them All)



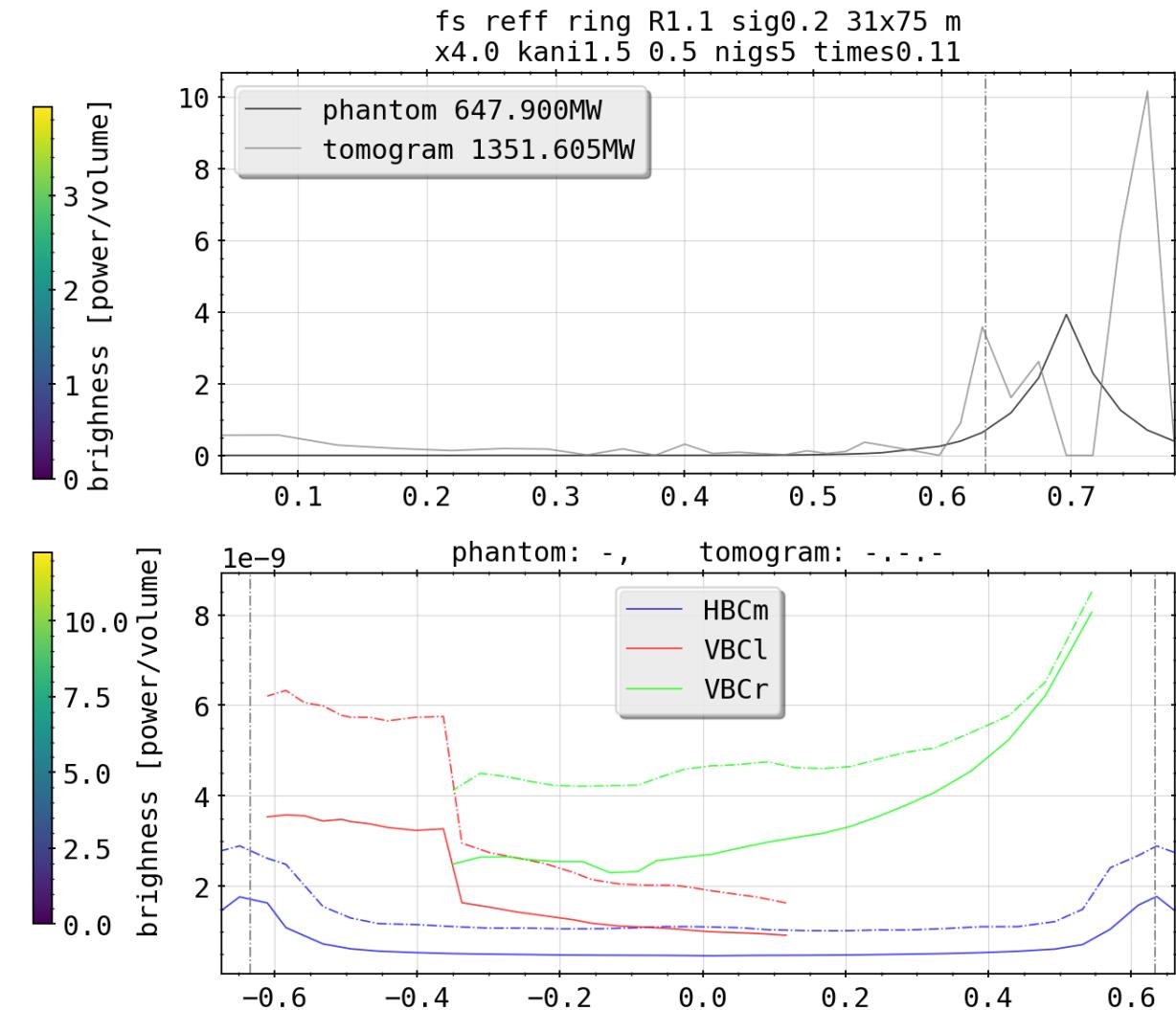
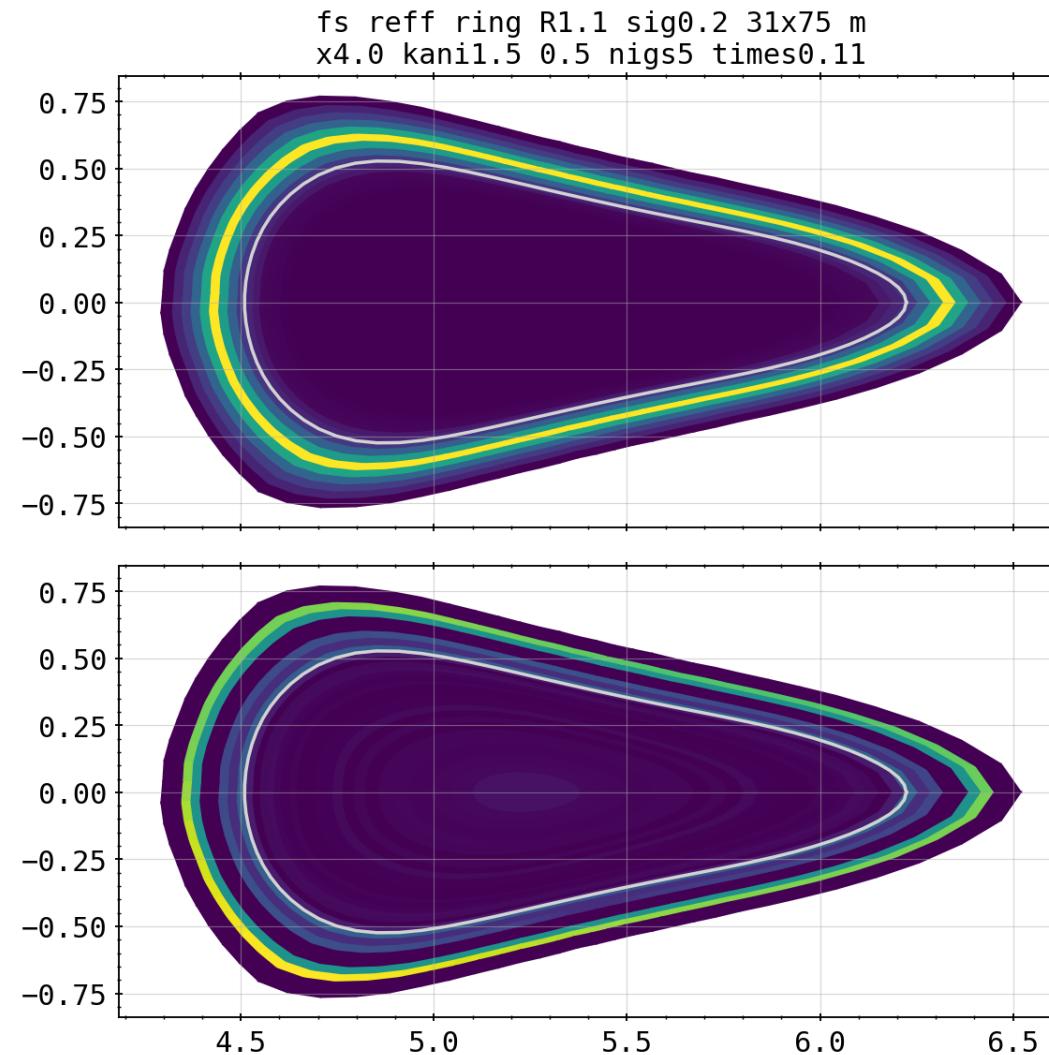
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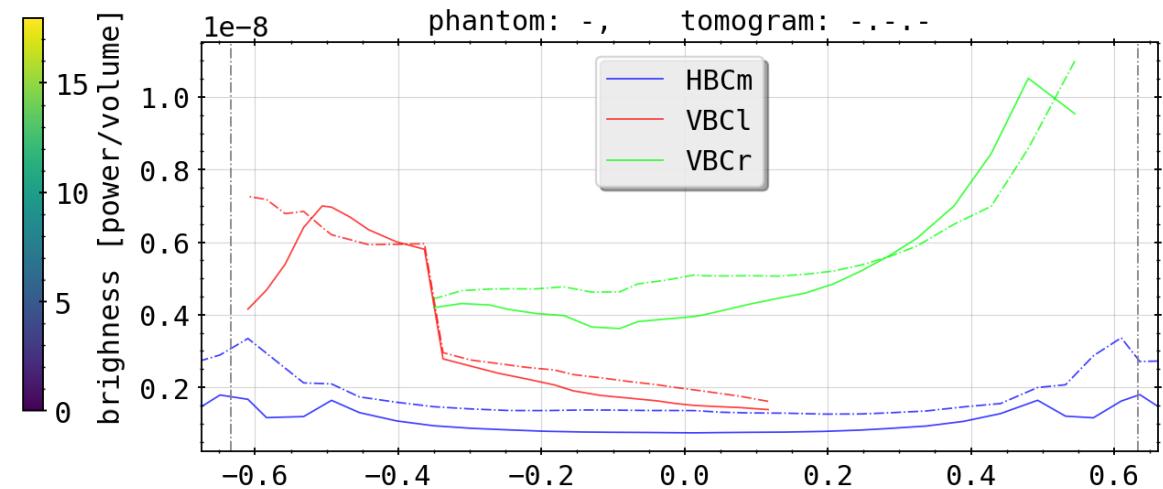
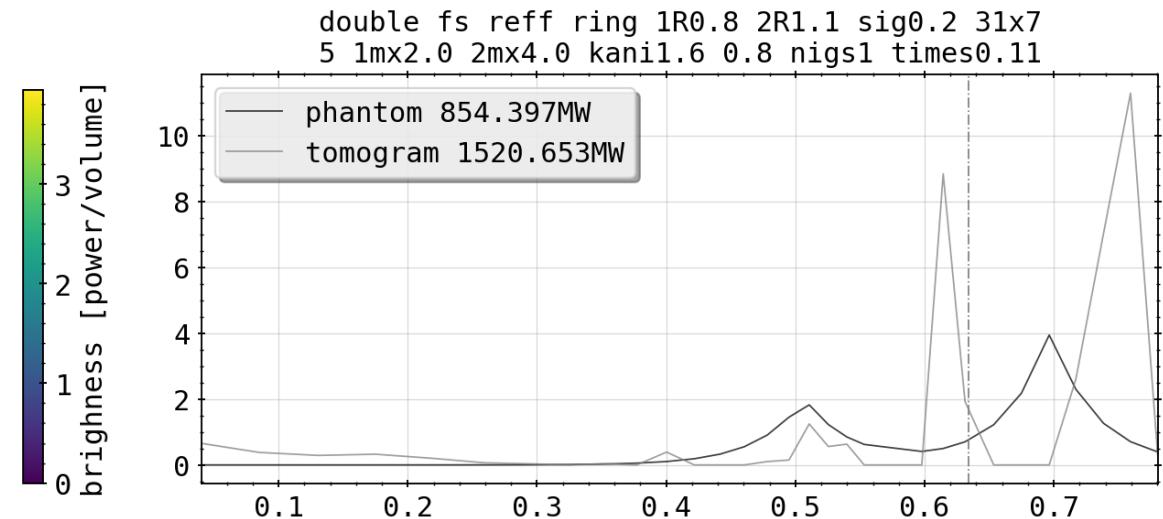
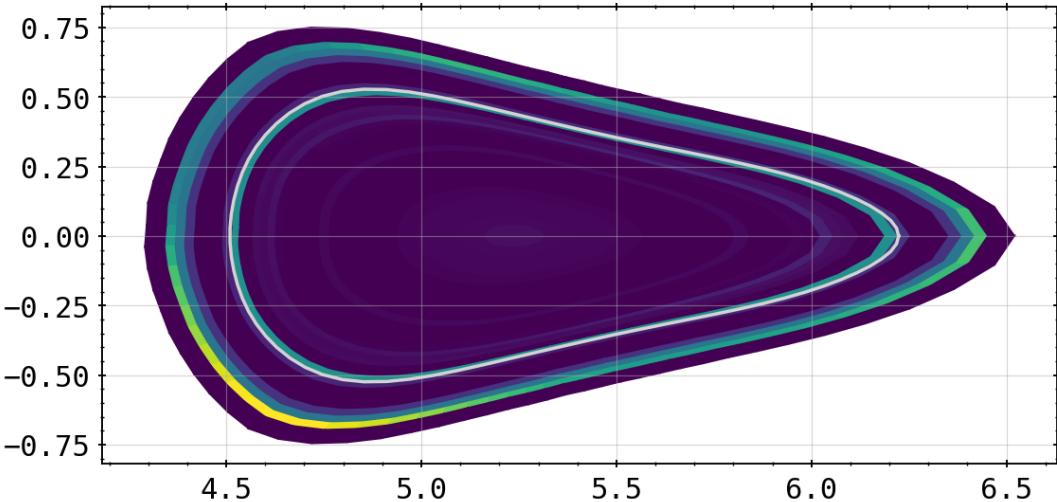
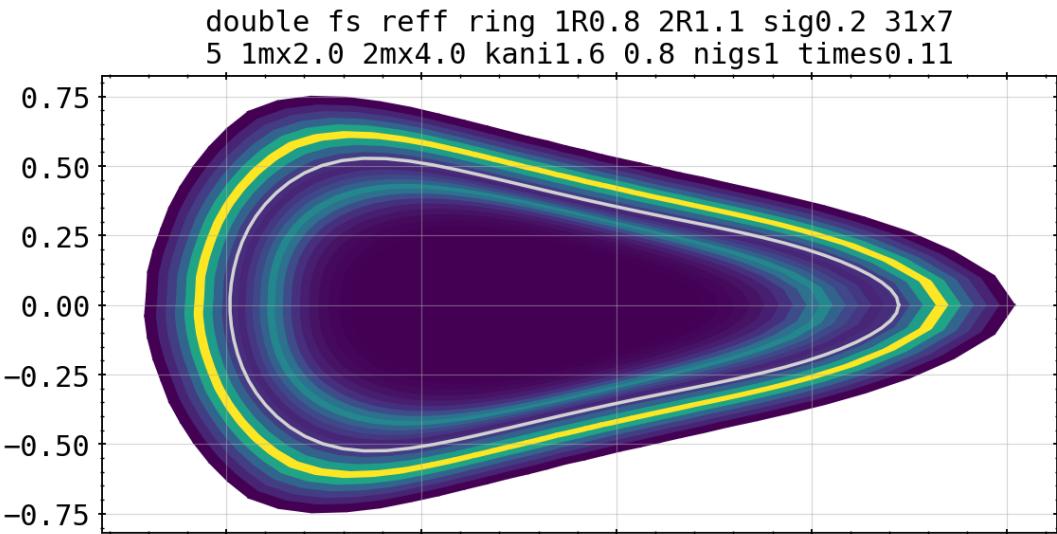
Phantom Tests: One Bright Ring (To Bind Them)



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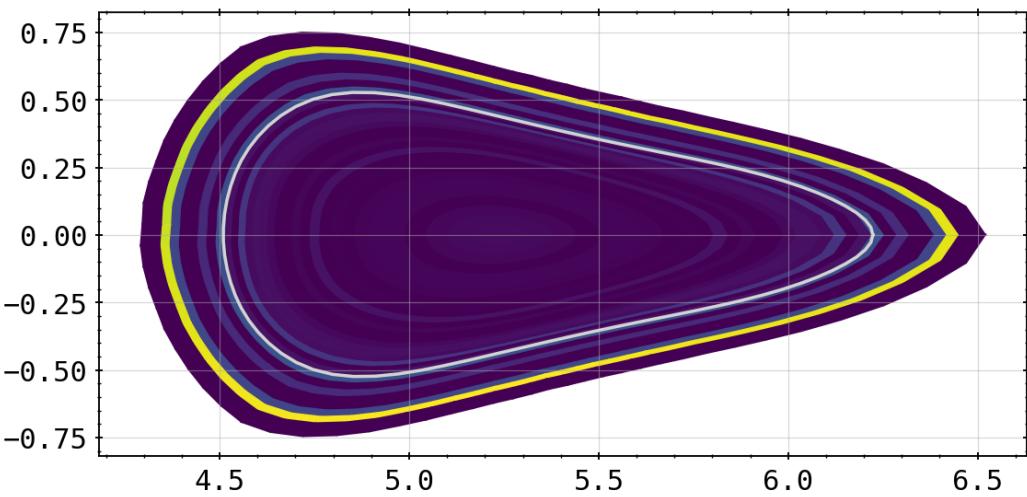
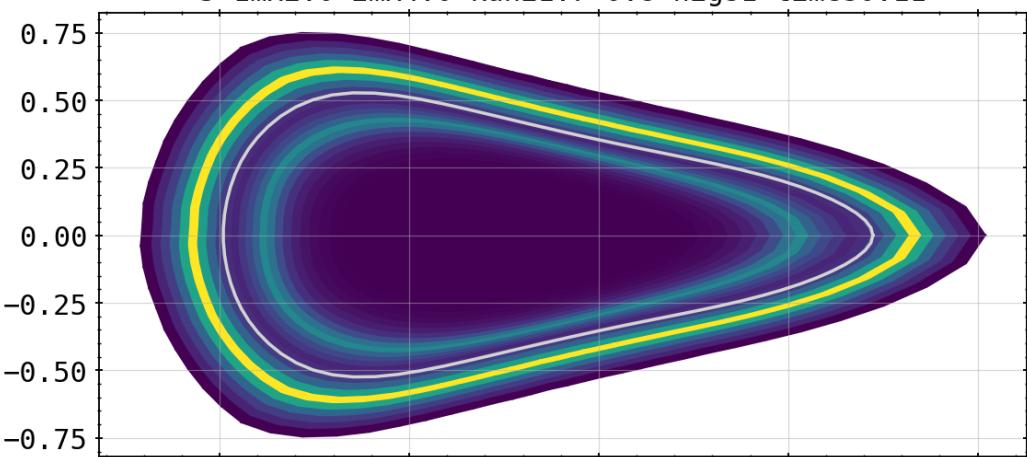


Phantom Tests: Two Bright Rings

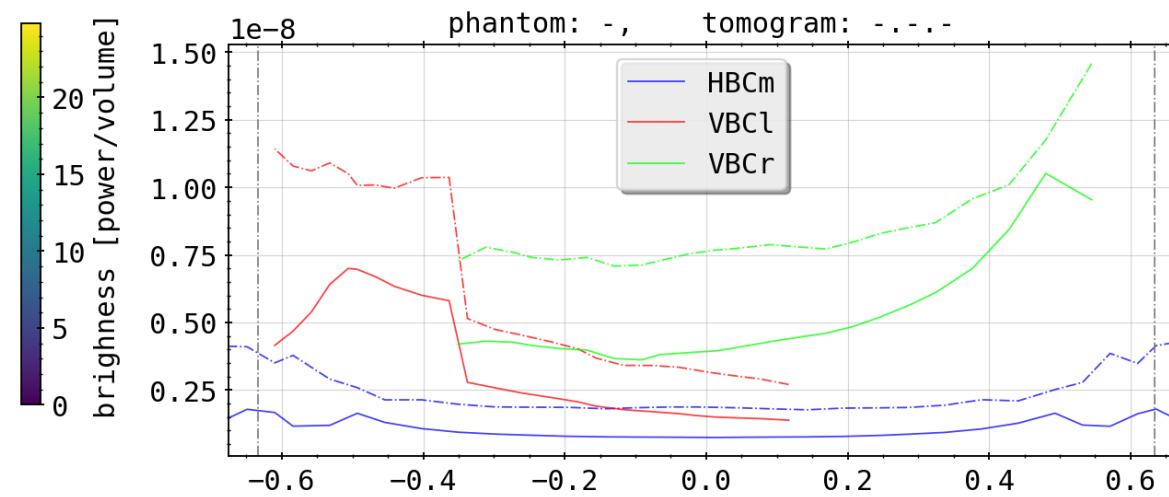
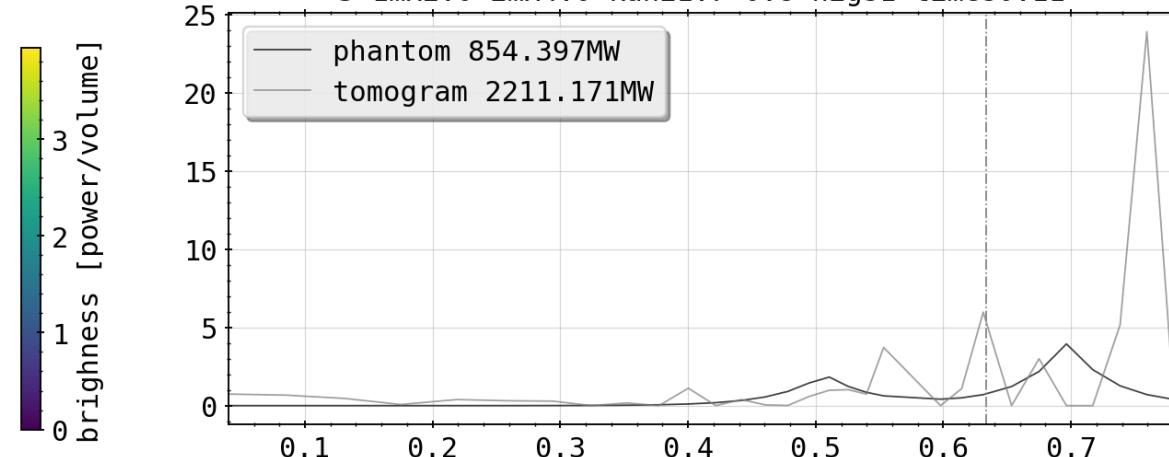


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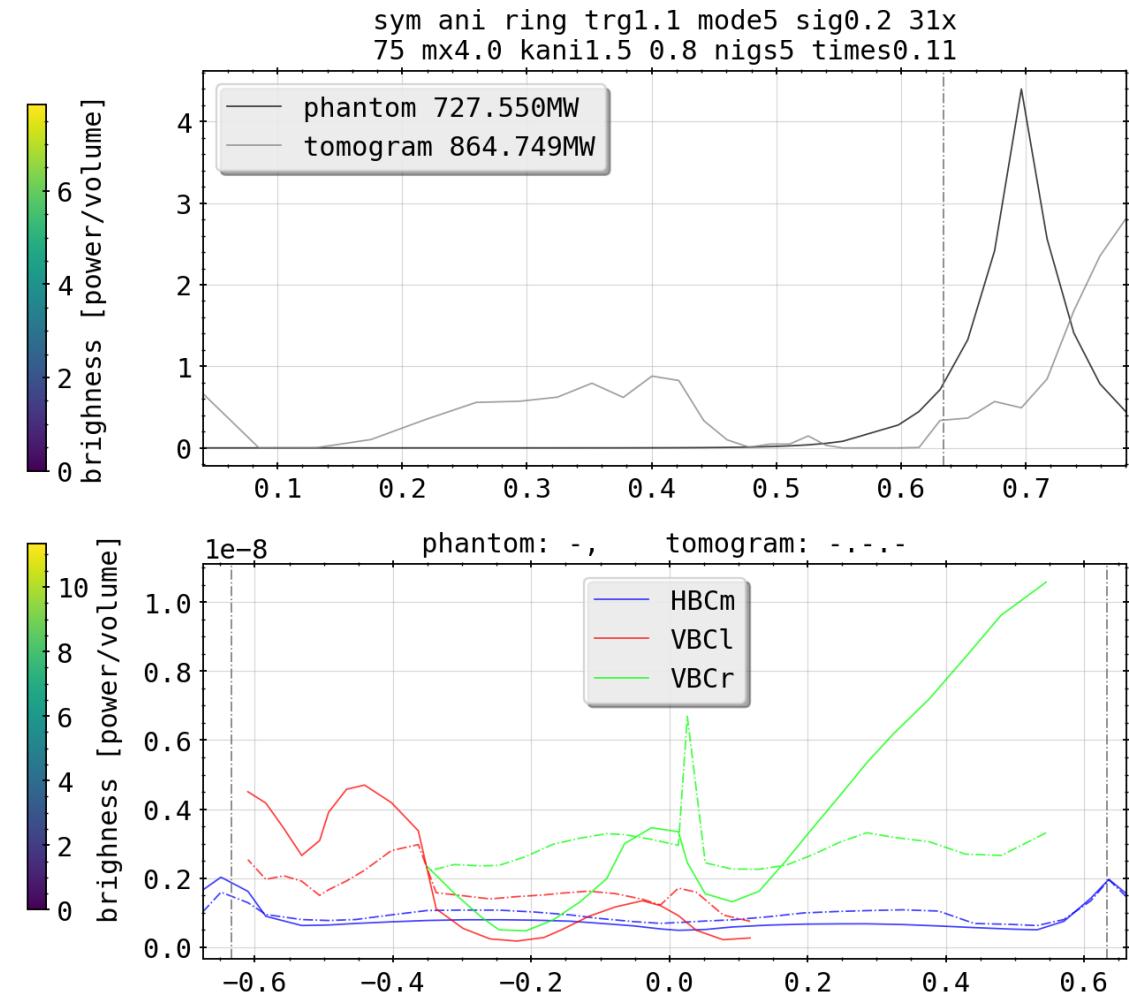
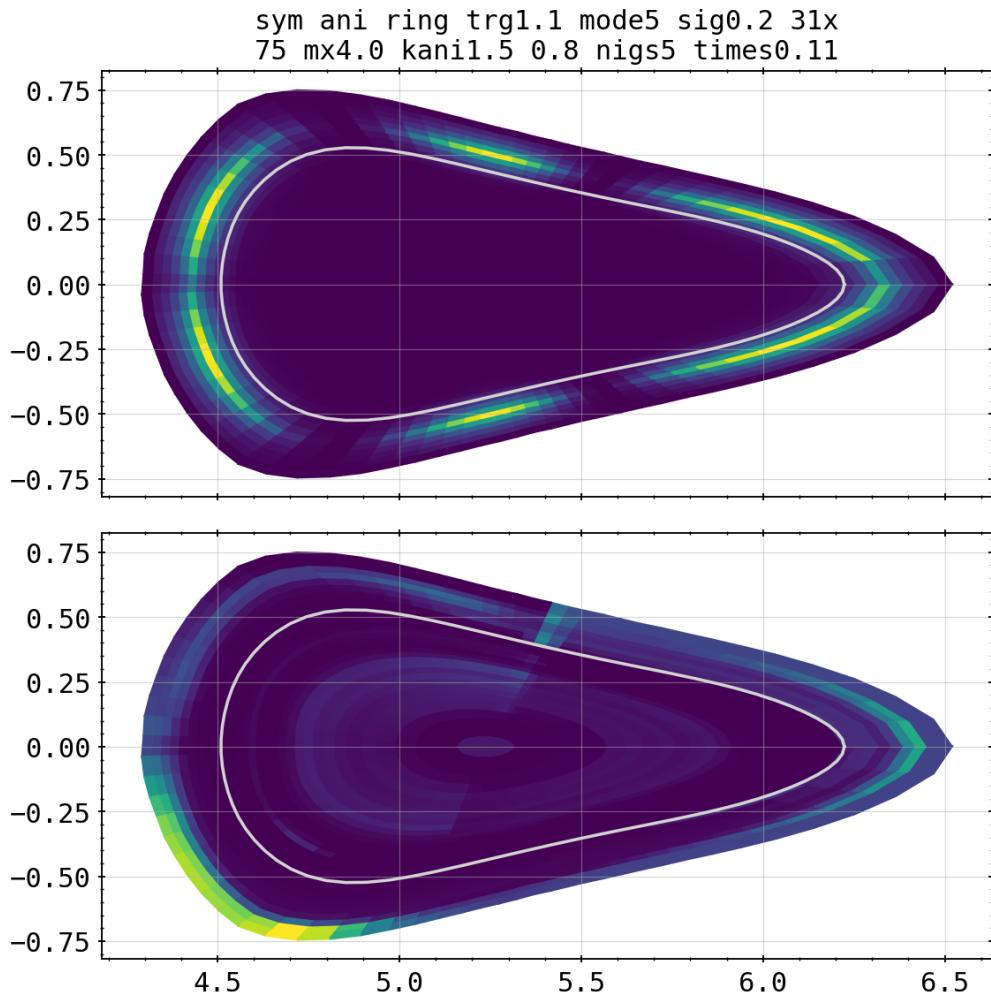
double fs reff ring 1R0.8 2R1.1 sig0.2 31x7
5 1mx2.0 2mx4.0 kani1.7 0.8 nigs1 times0.11



double fs reff ring 1R0.8 2R1.1 sig0.2 31x7
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Phantom Tests: Anisotropic Island Mimics



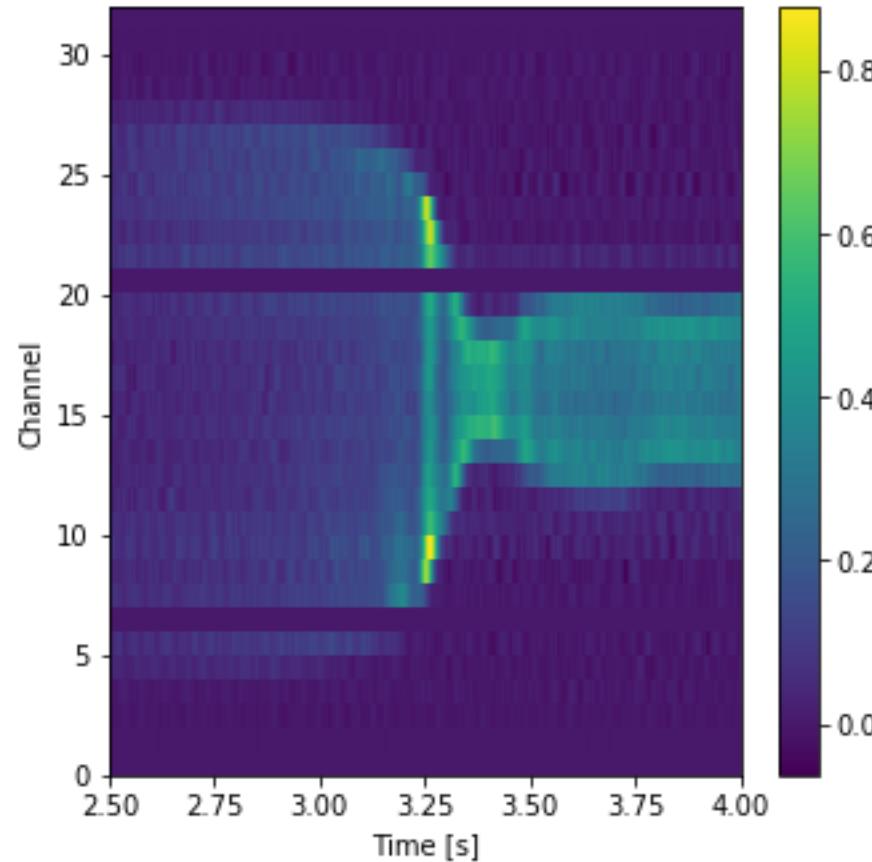
Phantom Tests: Anisotropic Island Mimics

- phantom tests yet incomplete, improving quality becomes multi-parameter optimization of input
- tailoring of anisotropy factors to grid and/or phantom type likely necessary
- consequently there might be a certain ‘best’ set of parameters from which a tomogram is calculated given a chordal profile of one/two/all cameras

Requested Test of 20180725.044

➤ reference KJM magnetic configuration used instead of standard EIM/EJM

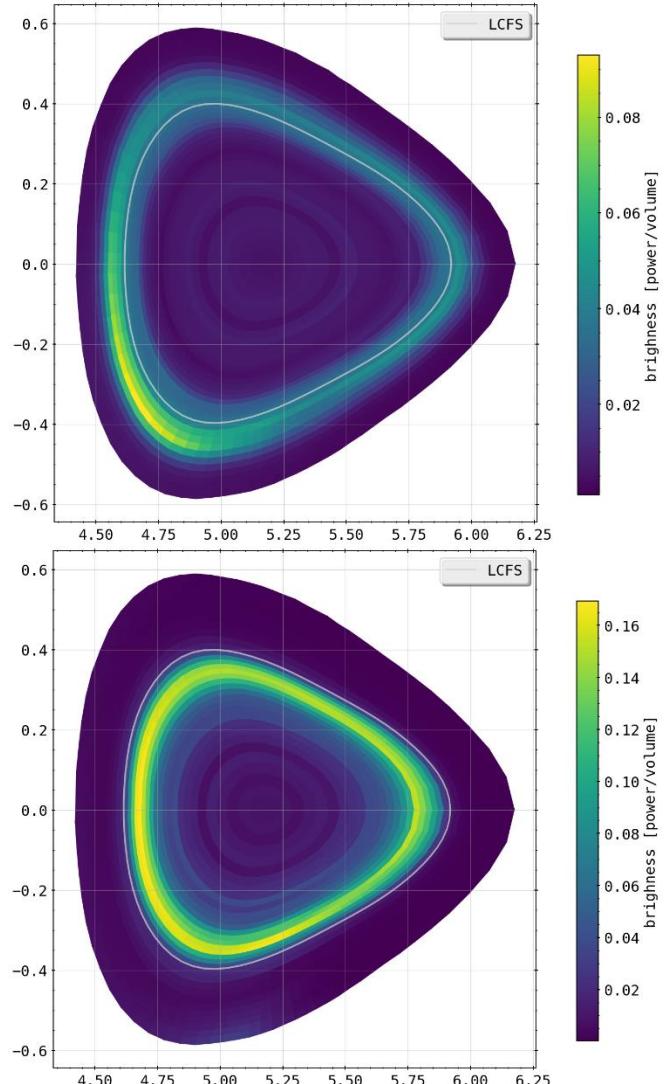
20180725.044, chordal profile HBCm



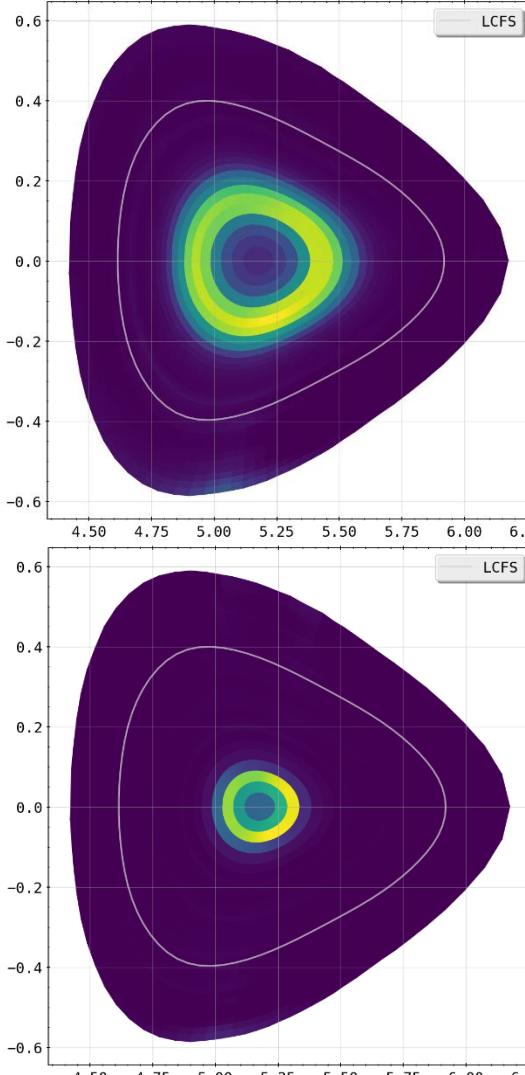
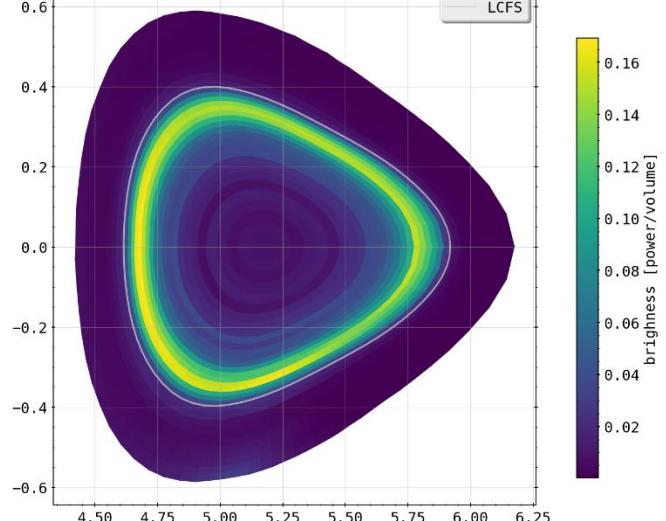
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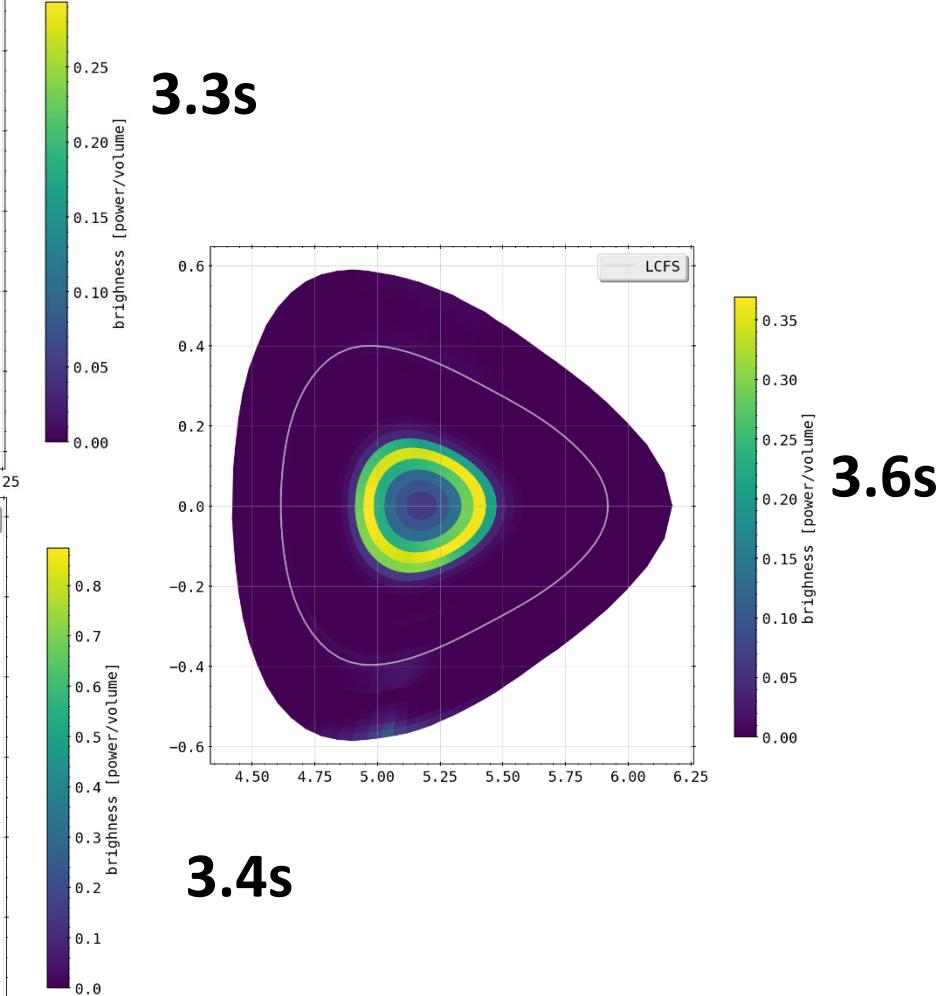
2.75s



3.2s



3.3s



3.4s