Experimental study of RMP induced fast-ion transport using FIDA spectroscopy at the ASDEX Upgrade tokamak

A. Jansen van Vuuren

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Max-Planck-Institut
für Plasmaphysik

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- RMPs break the axisymmetry of tokamak fields in order to mitigate the presence edge localised modes

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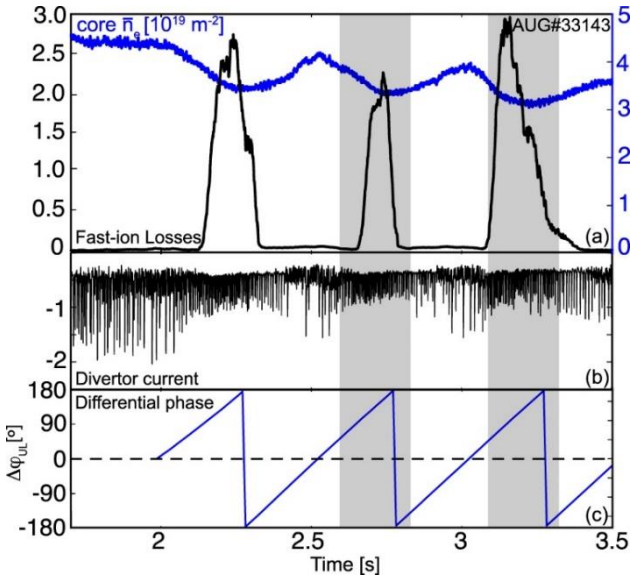

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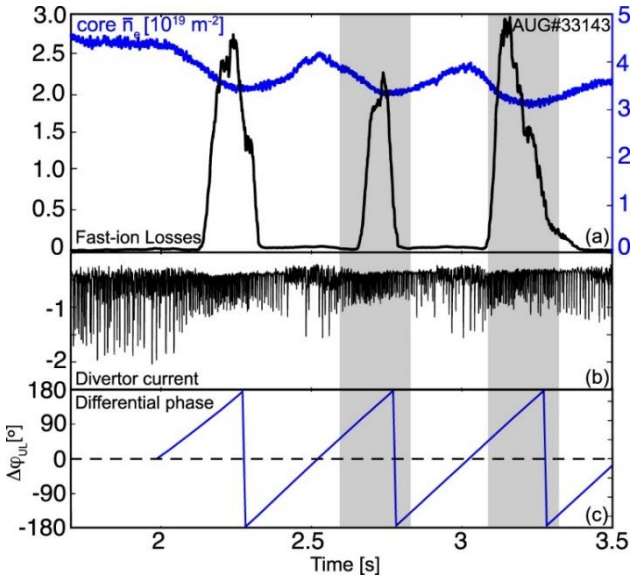

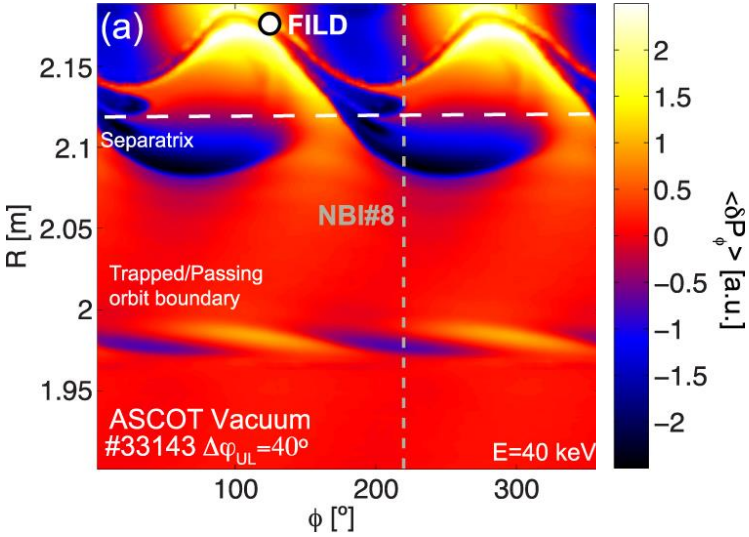

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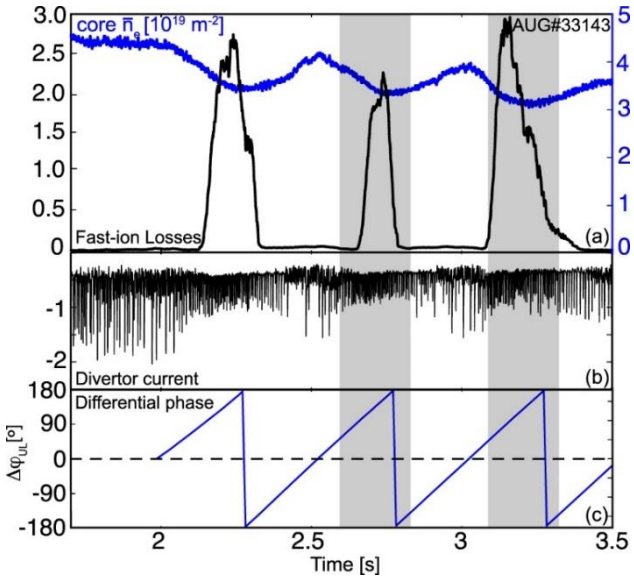

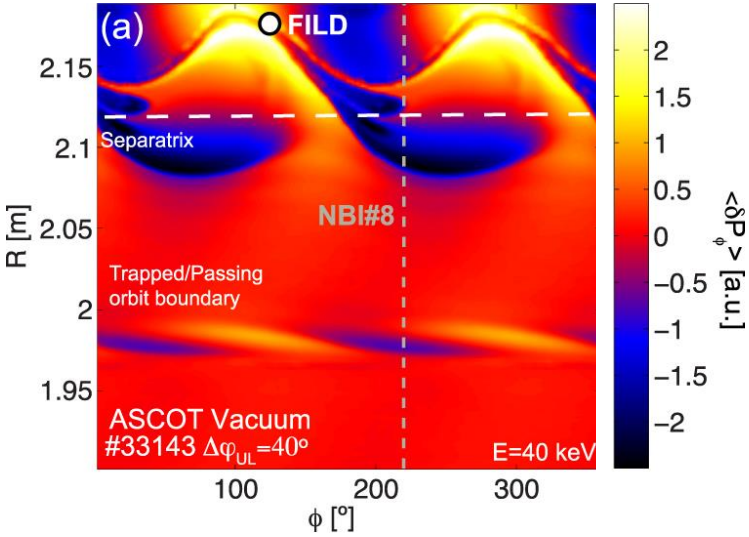

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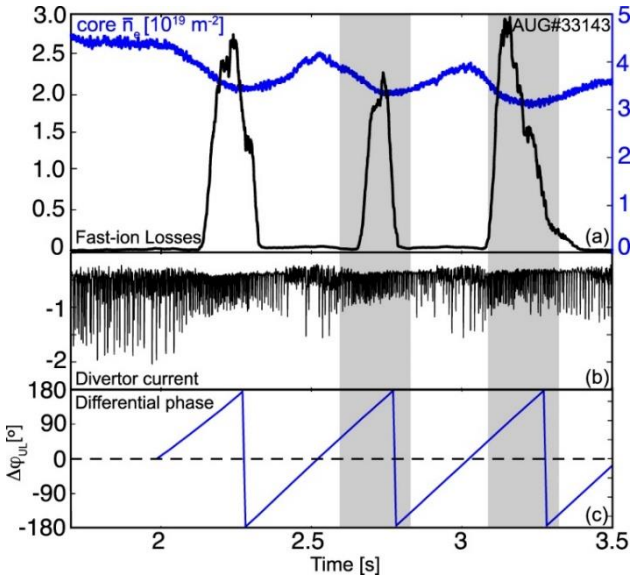

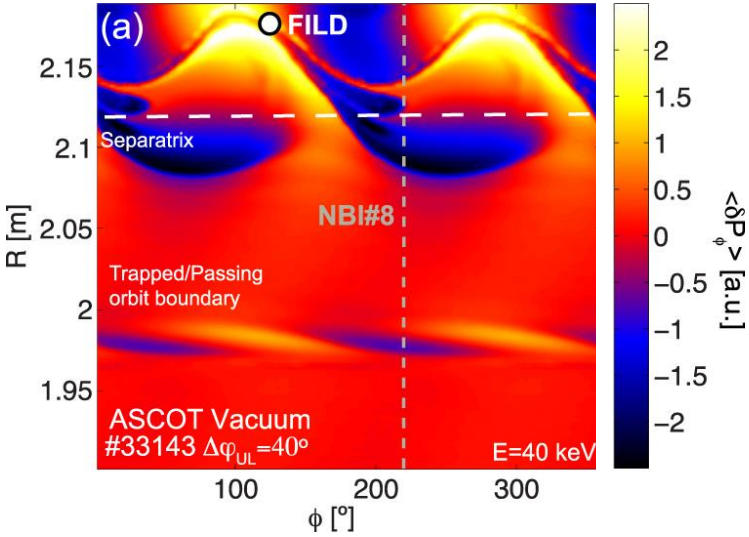

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1. Overview of experiments performed

2. Analyses and modelling of experimental results

3. Conclusion and outlook

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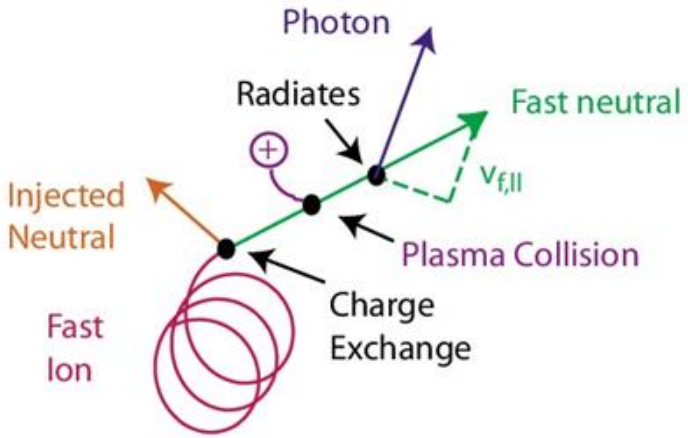

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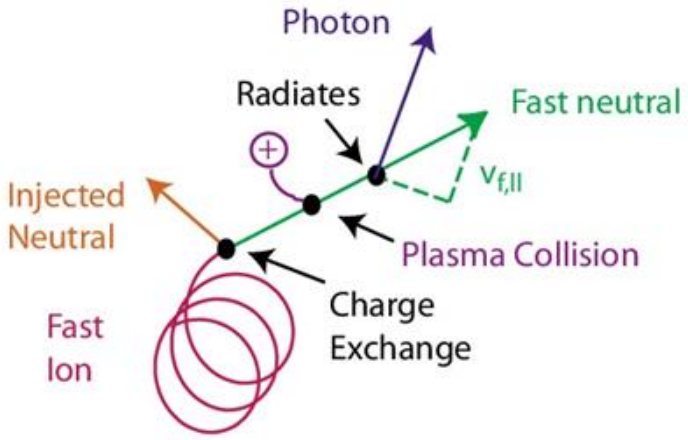

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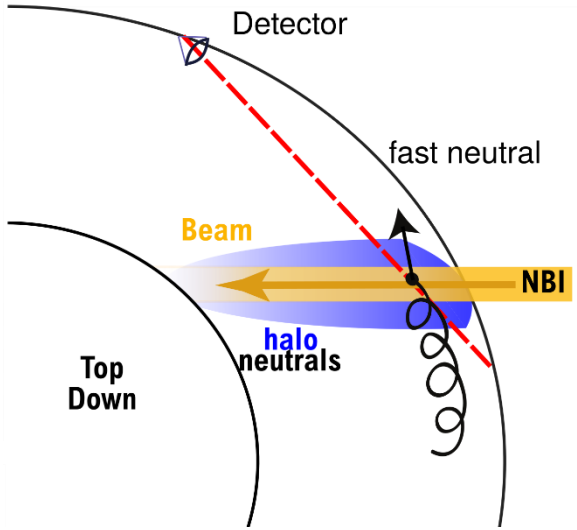

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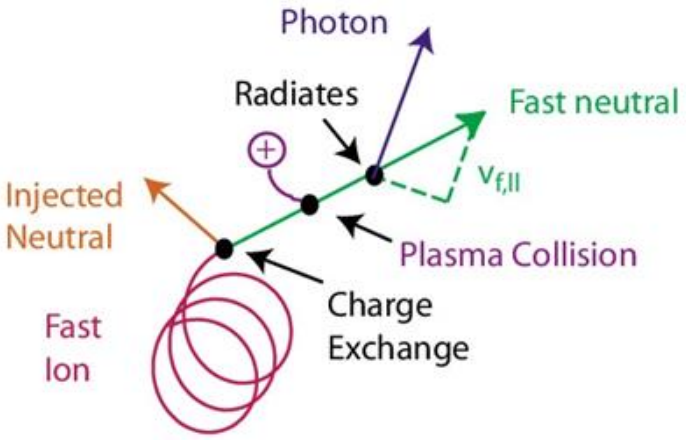

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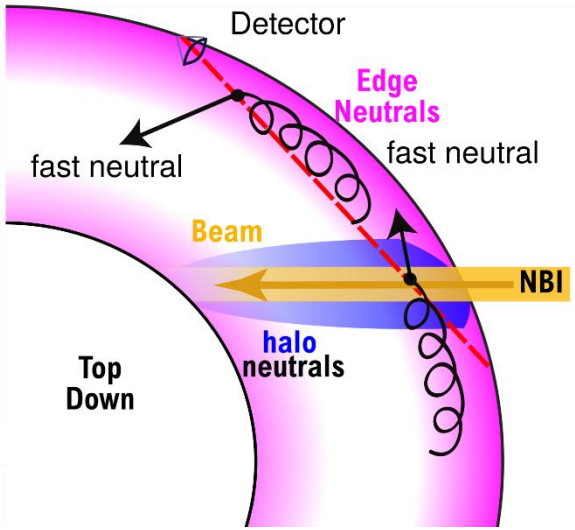
- Background neutrals lead to source of passive emission particularly along edge lines of sight



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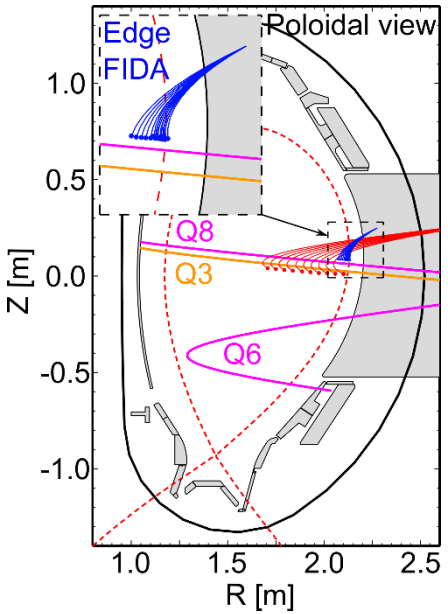
- ASDEX Upgrade (AUG) is equipped with a core and edge FIDA system [1, 2]

- Several views allow for radially localized fast-ion density information



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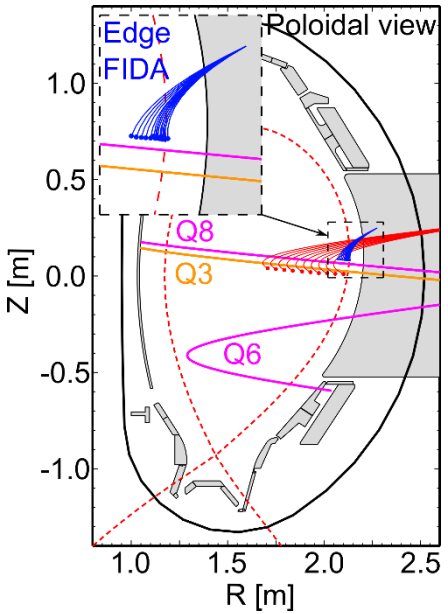

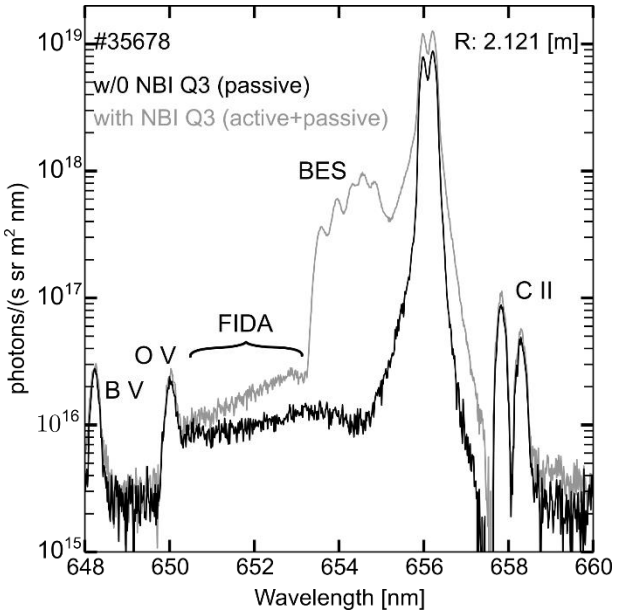

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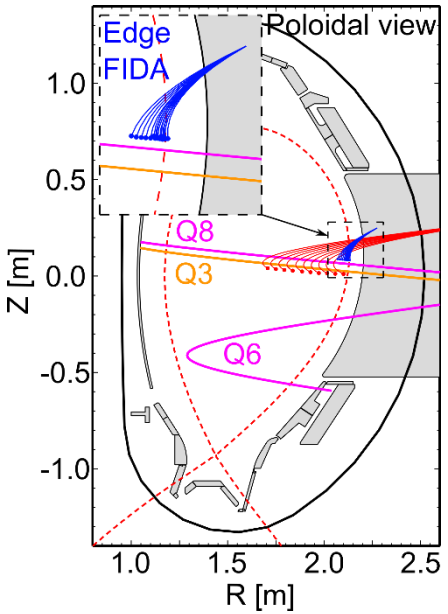
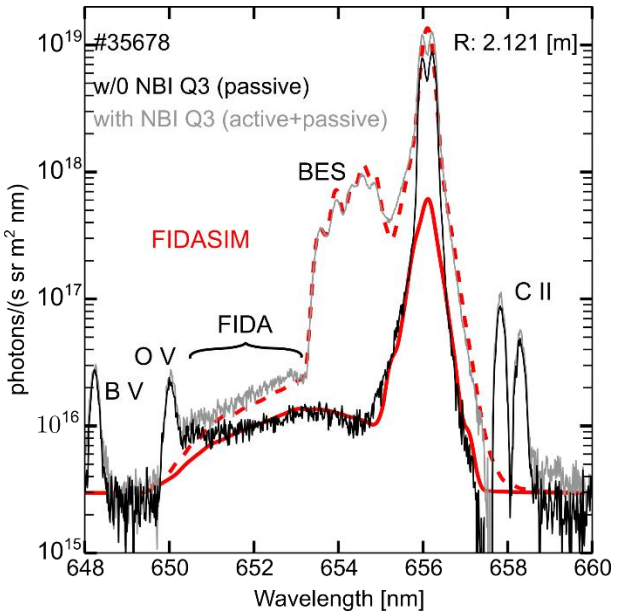
- FIDASIM [3] is used to calculate synthetic spectra from theoretical fast-ion distributions





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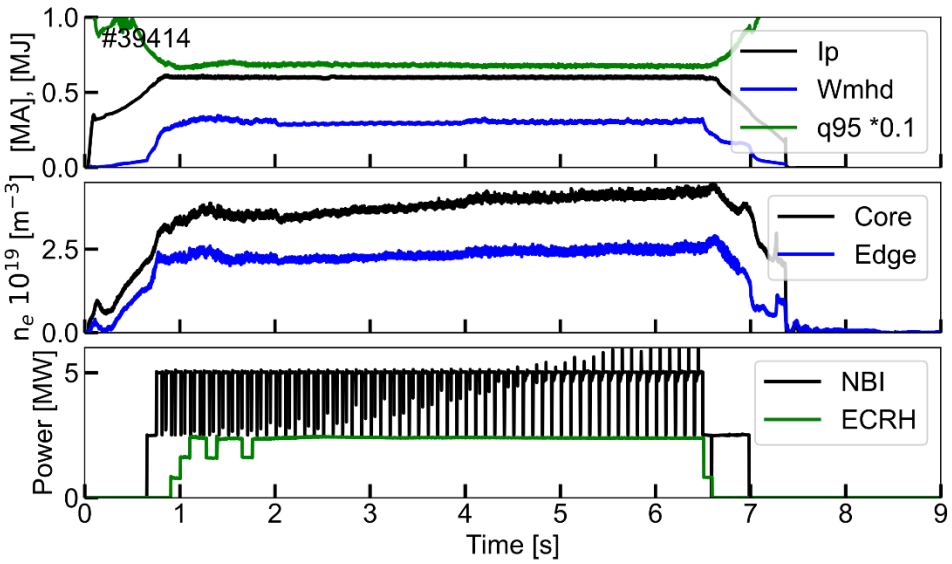

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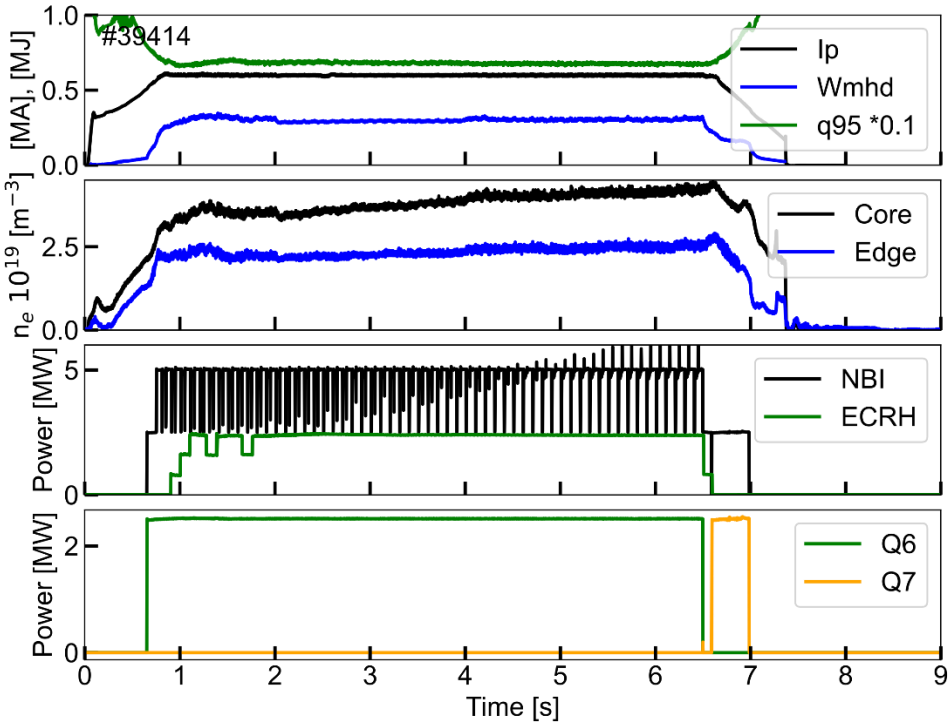

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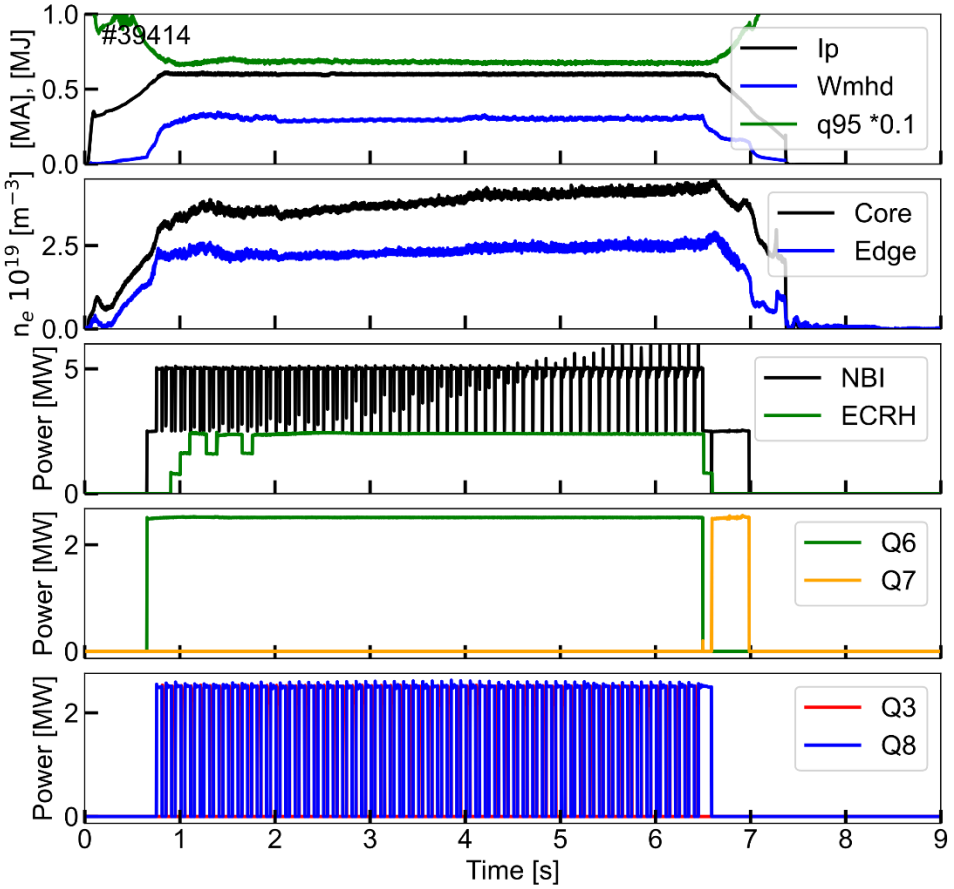

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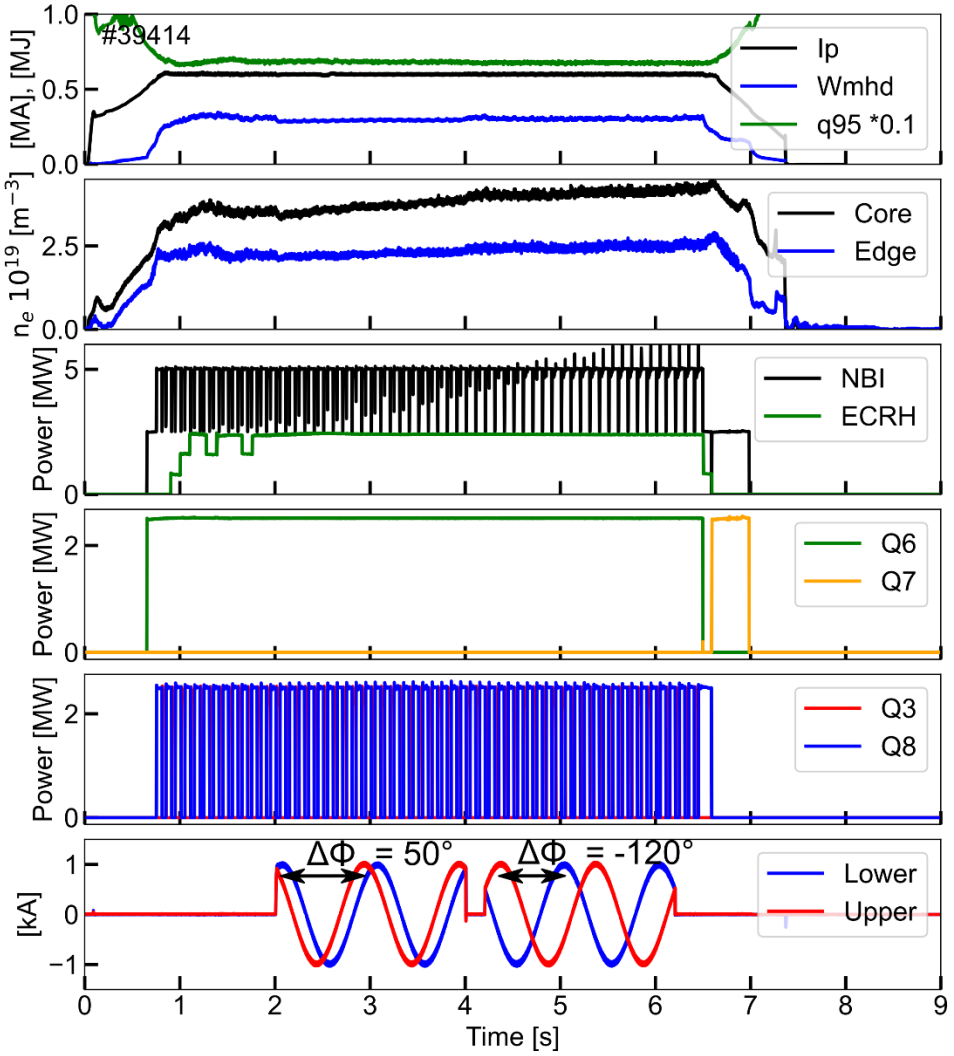
- Rotating RMP with n=2 periodicity were applied in two 2s phases with differing ΔΦ



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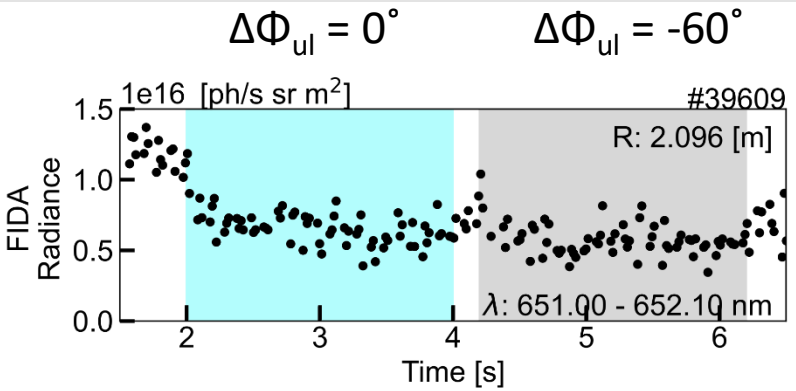

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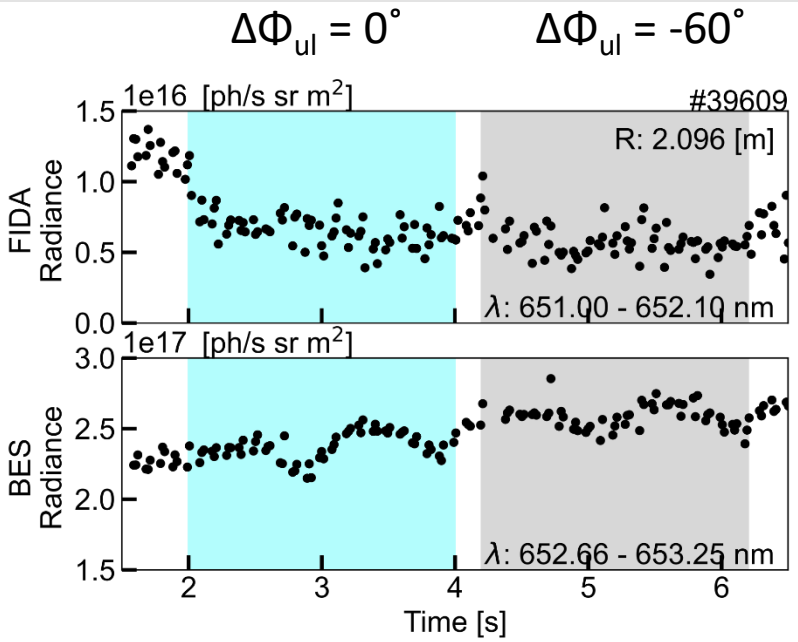

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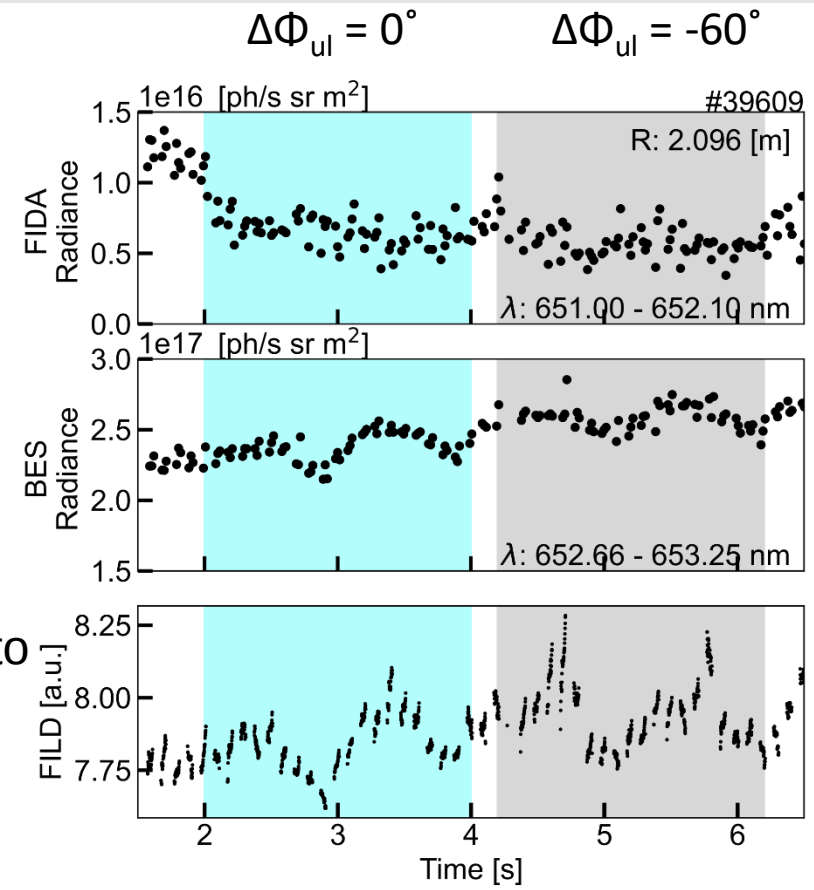

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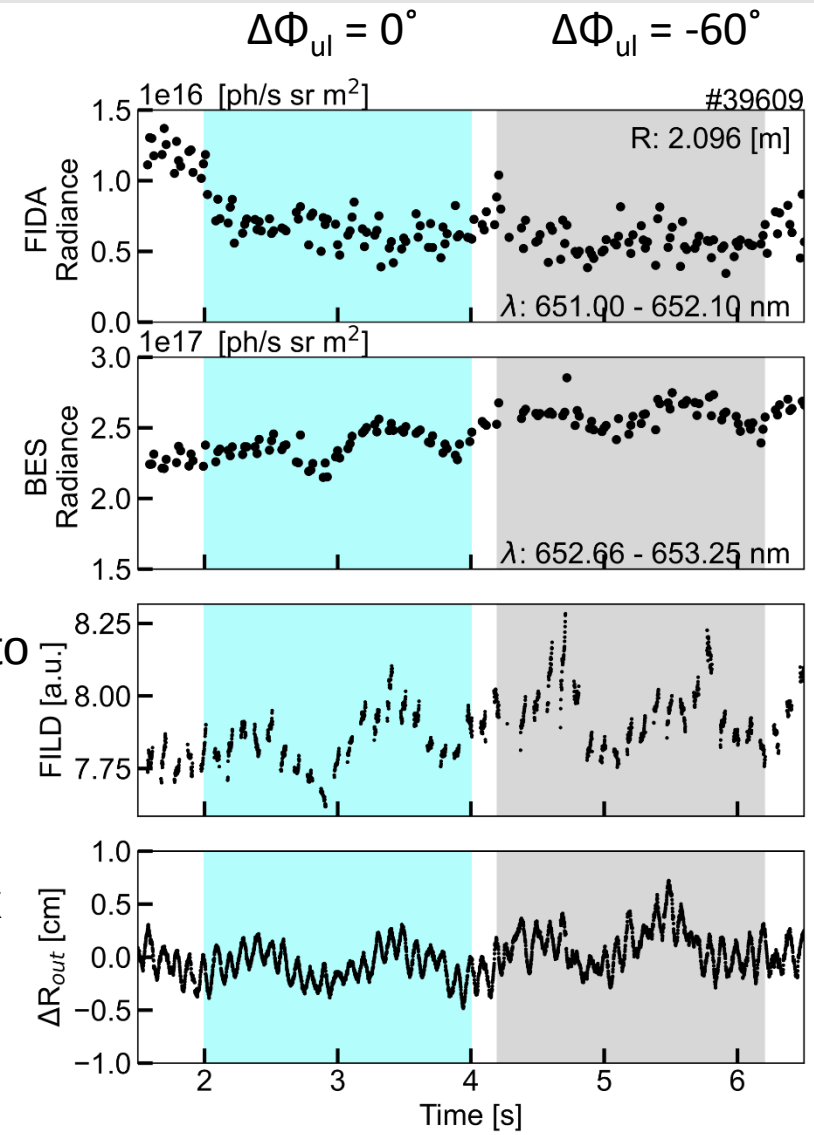

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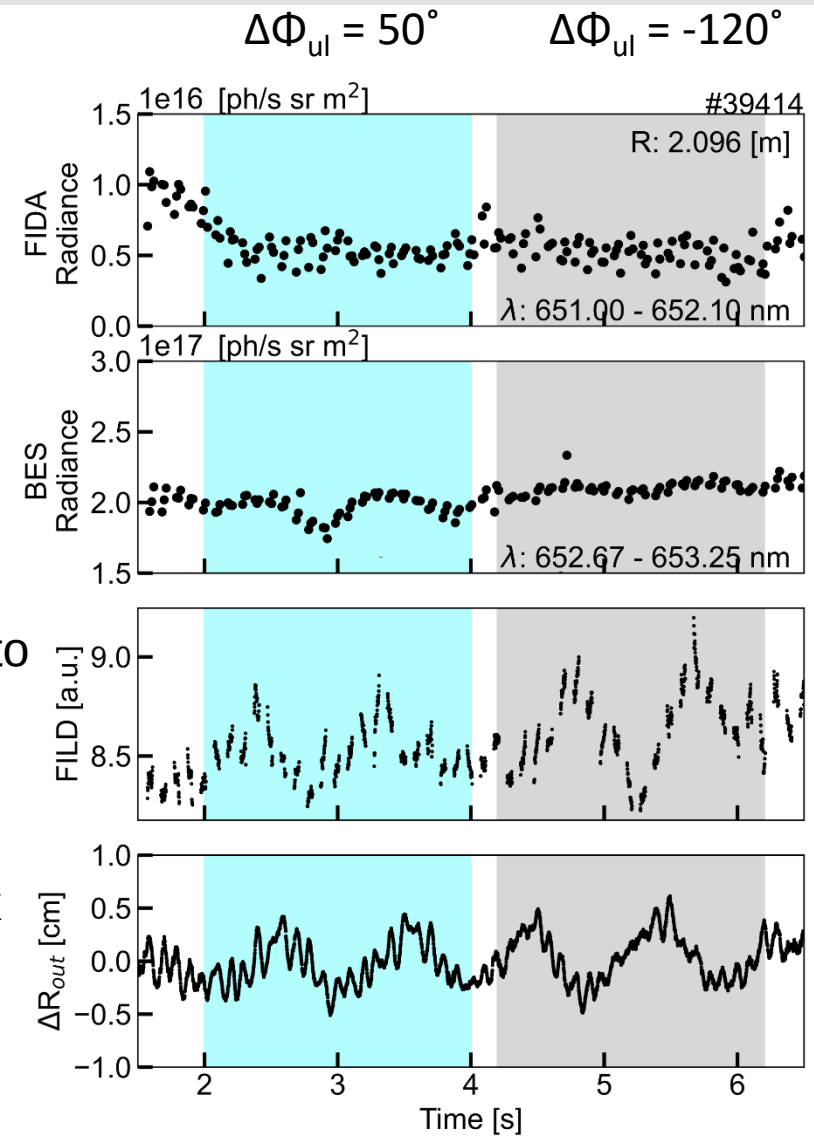

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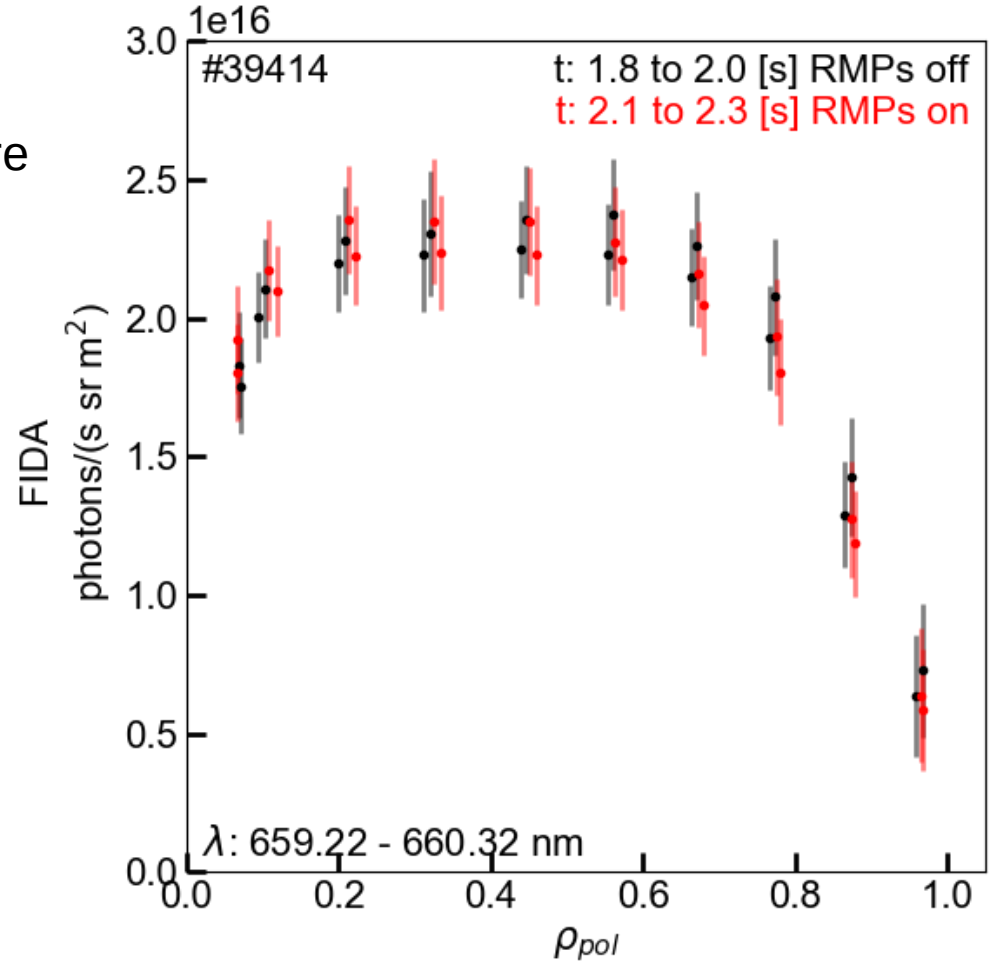

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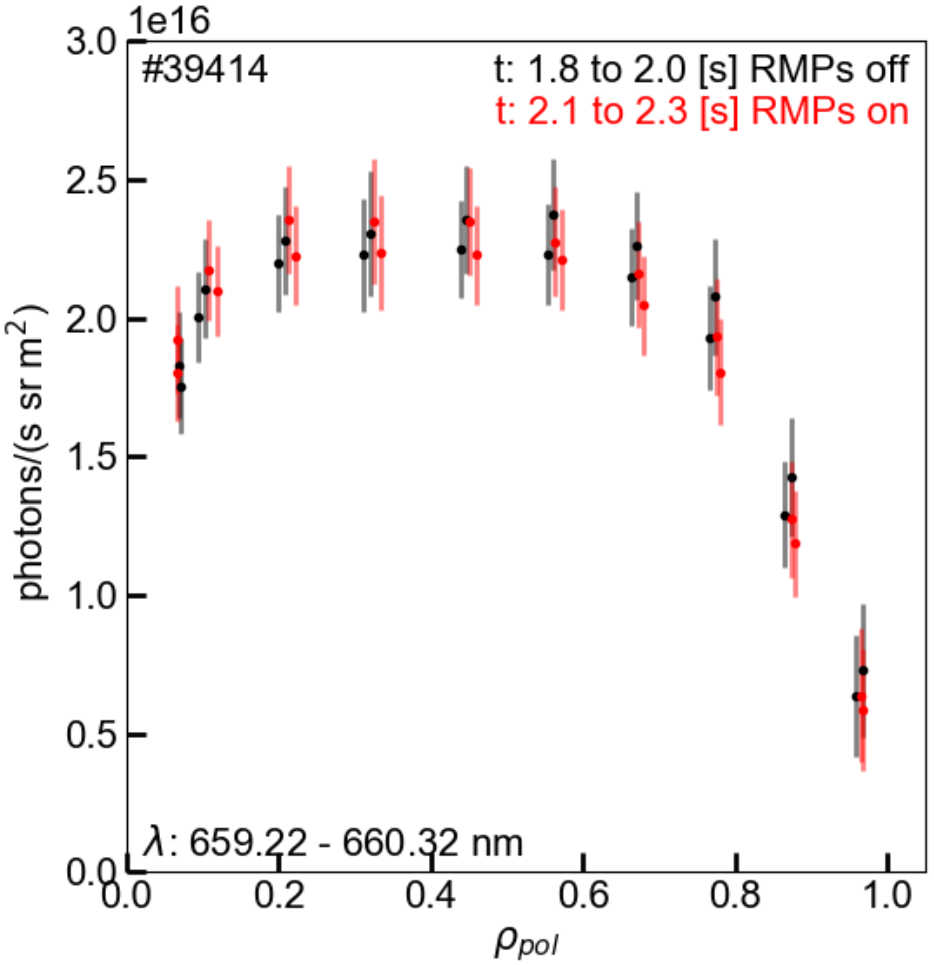

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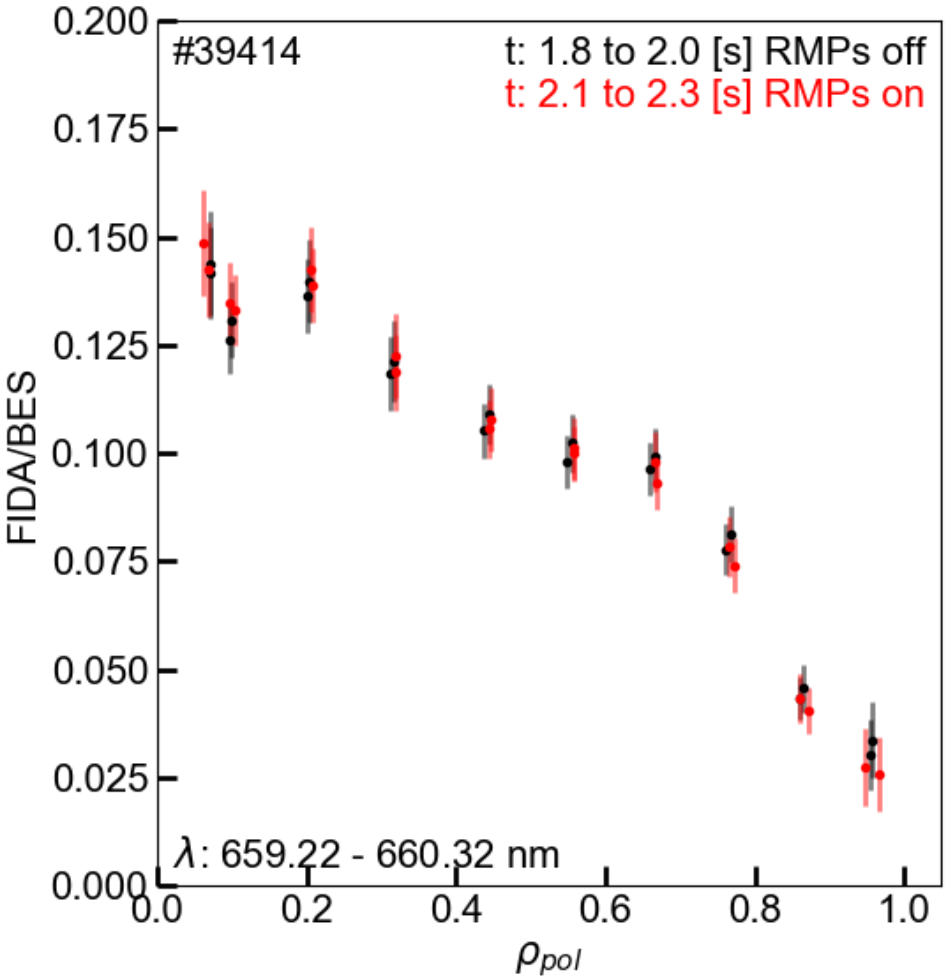

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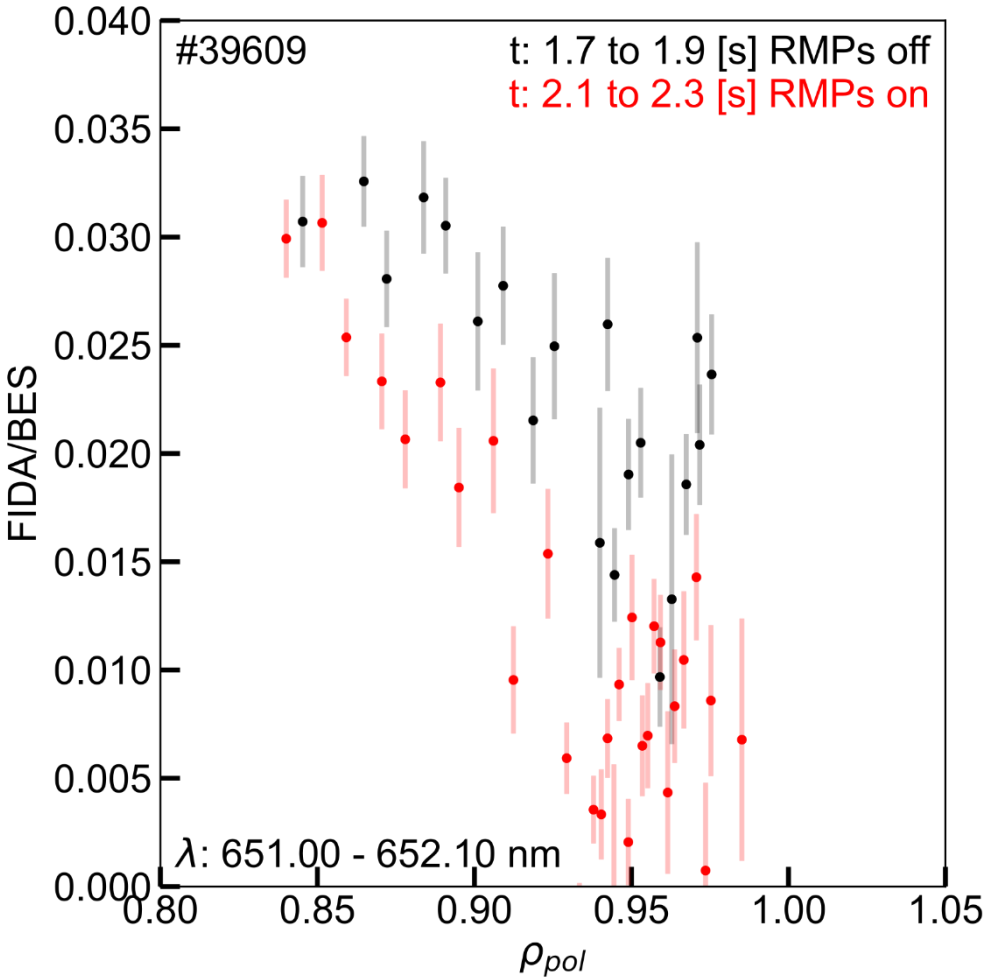

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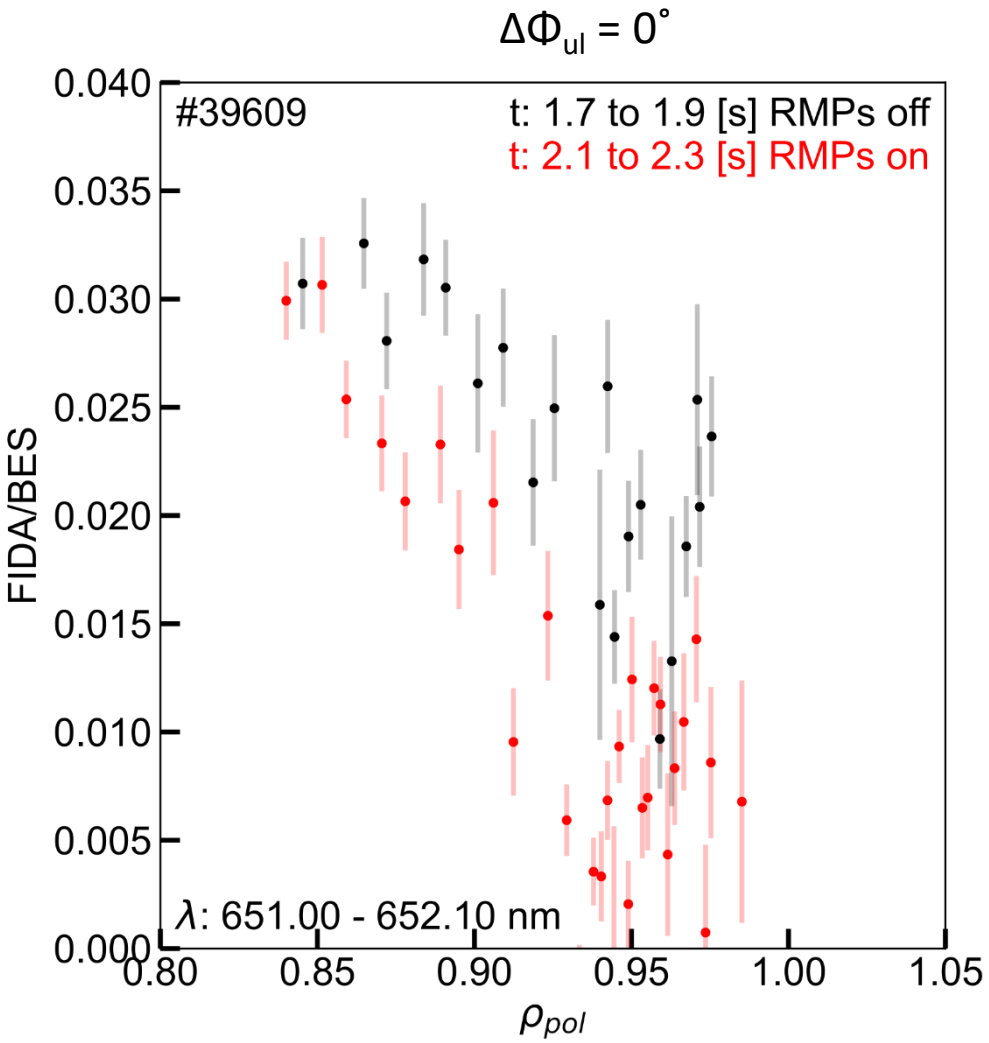

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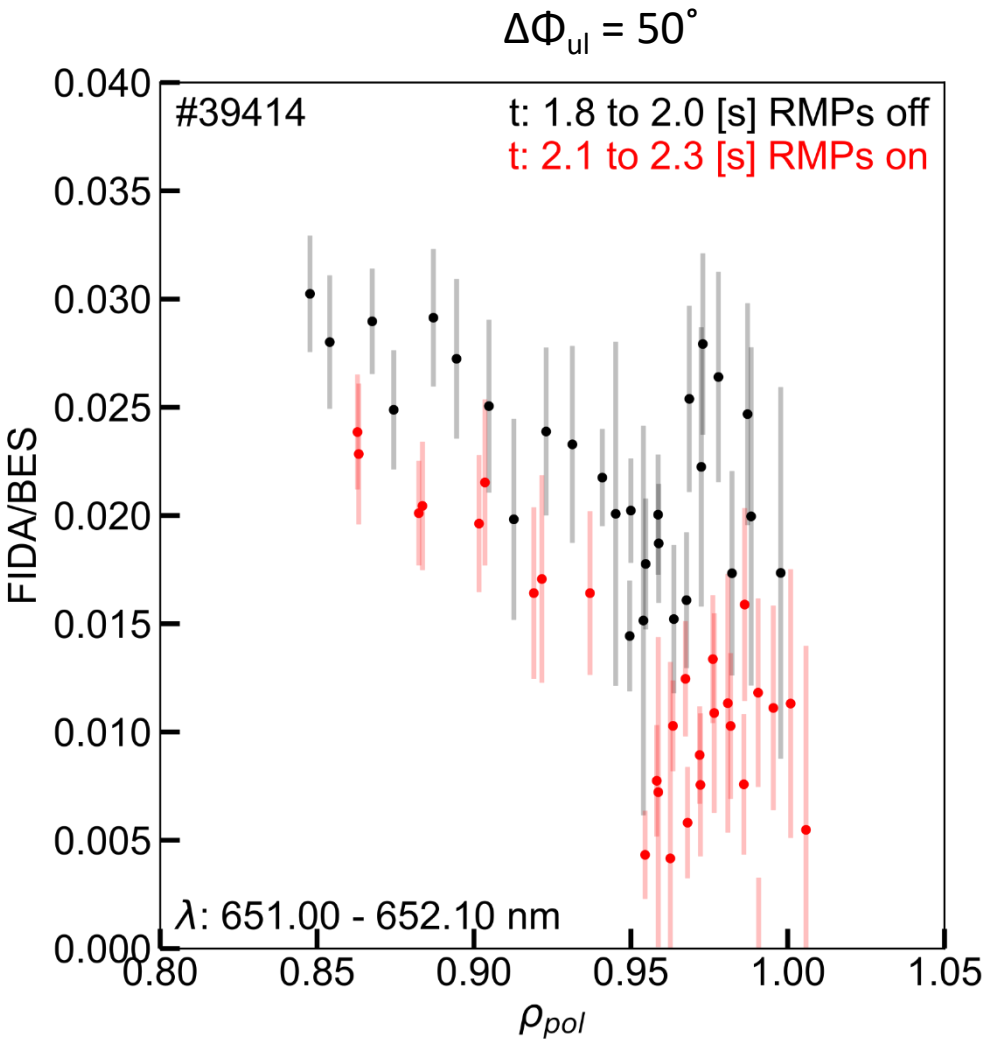

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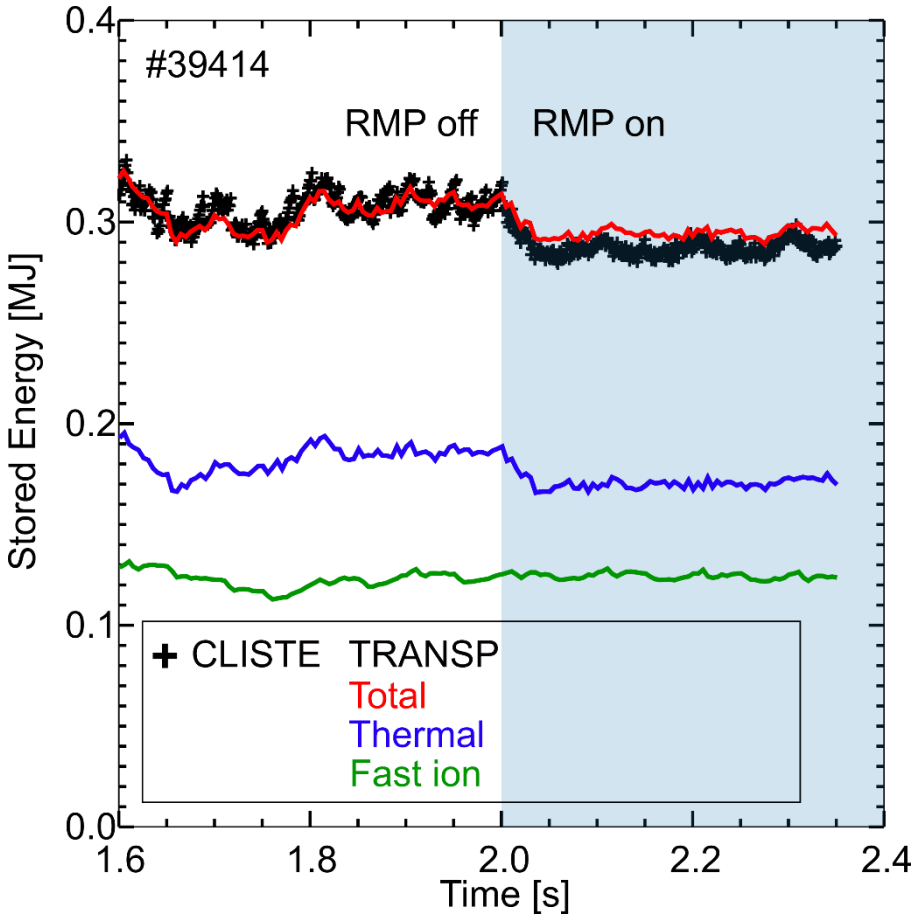

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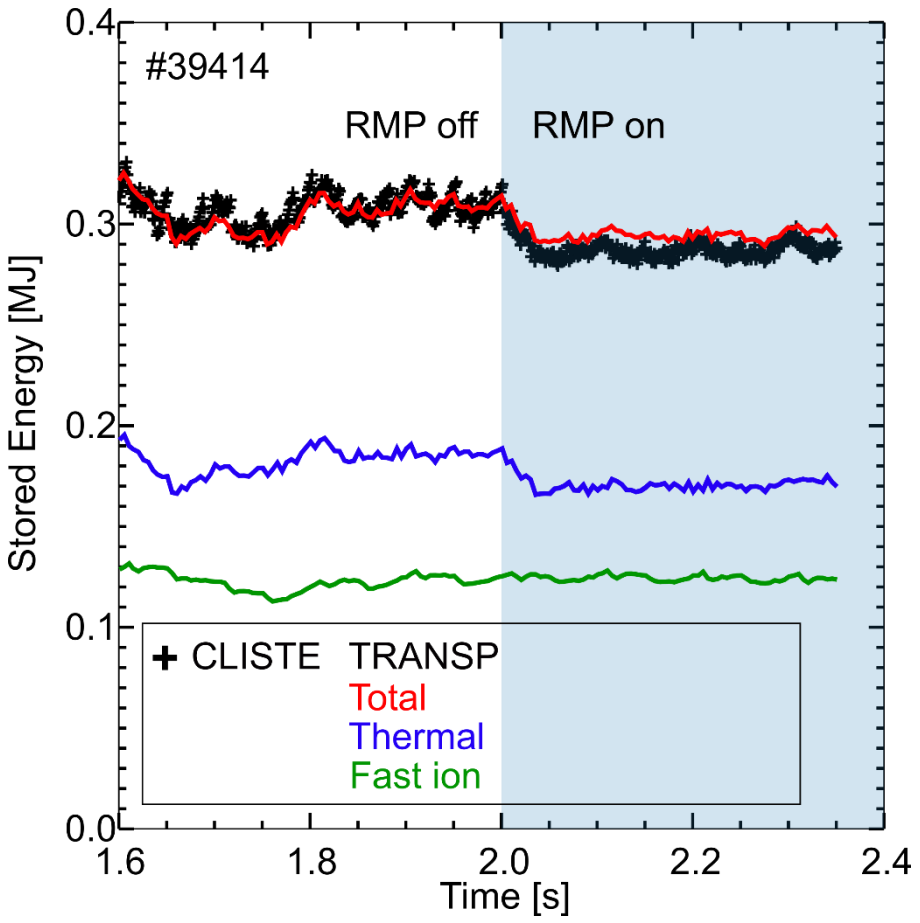

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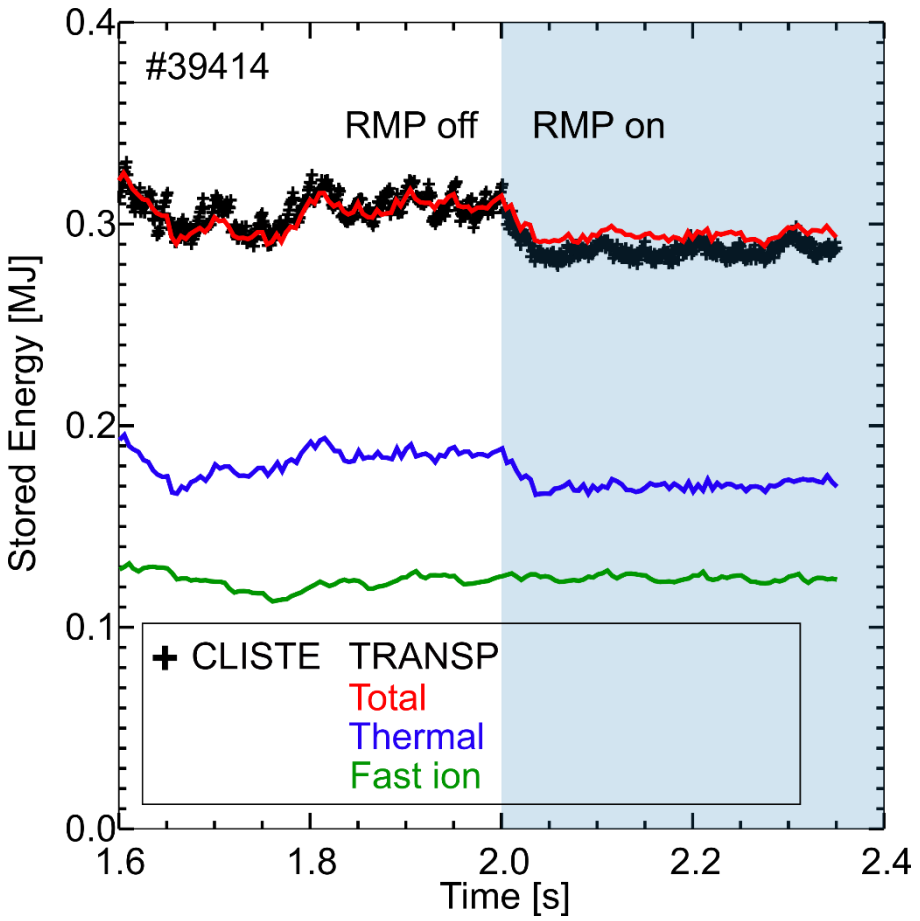

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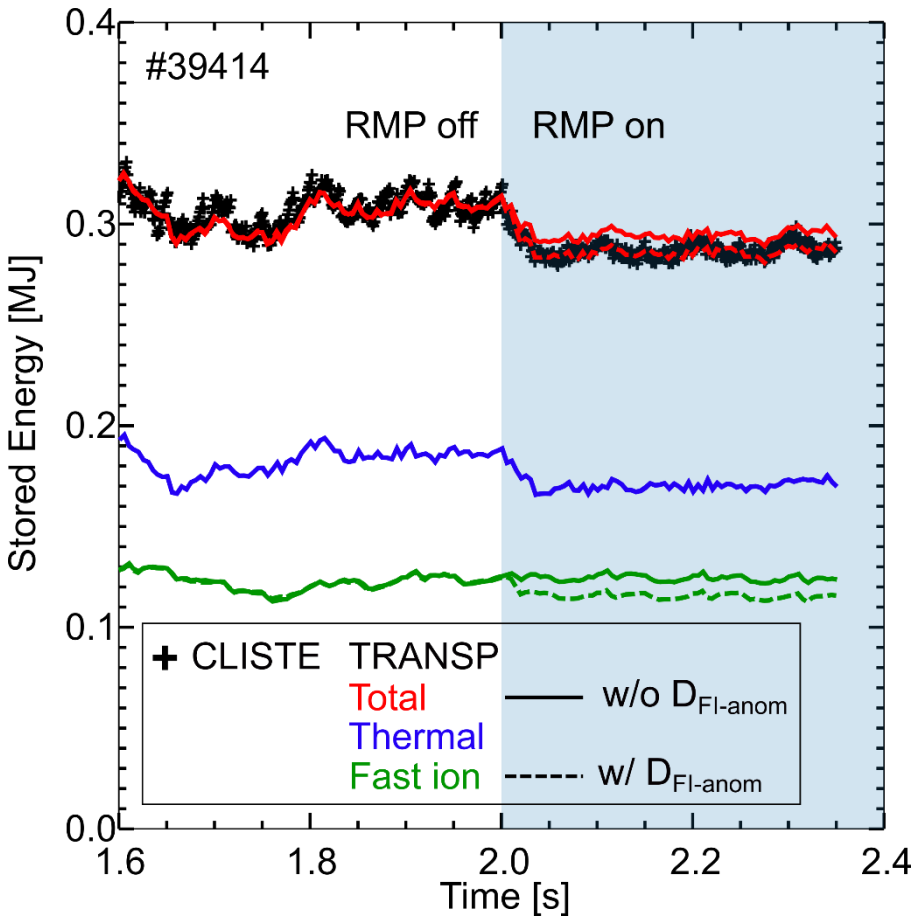

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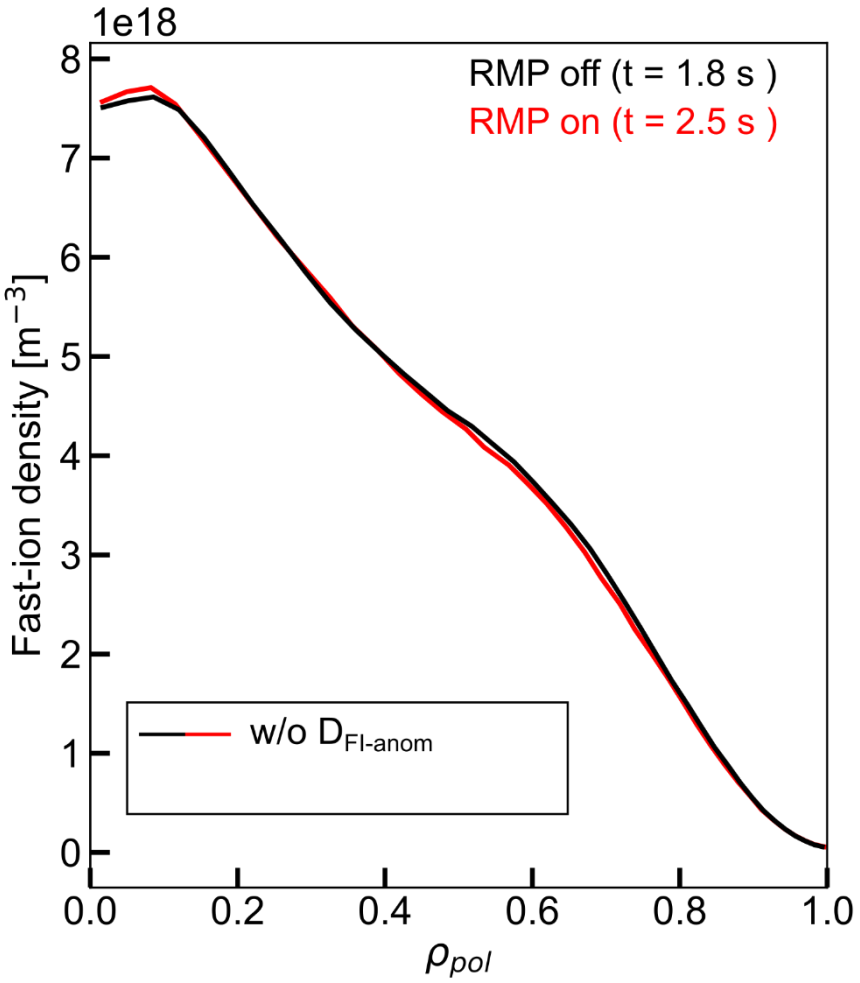

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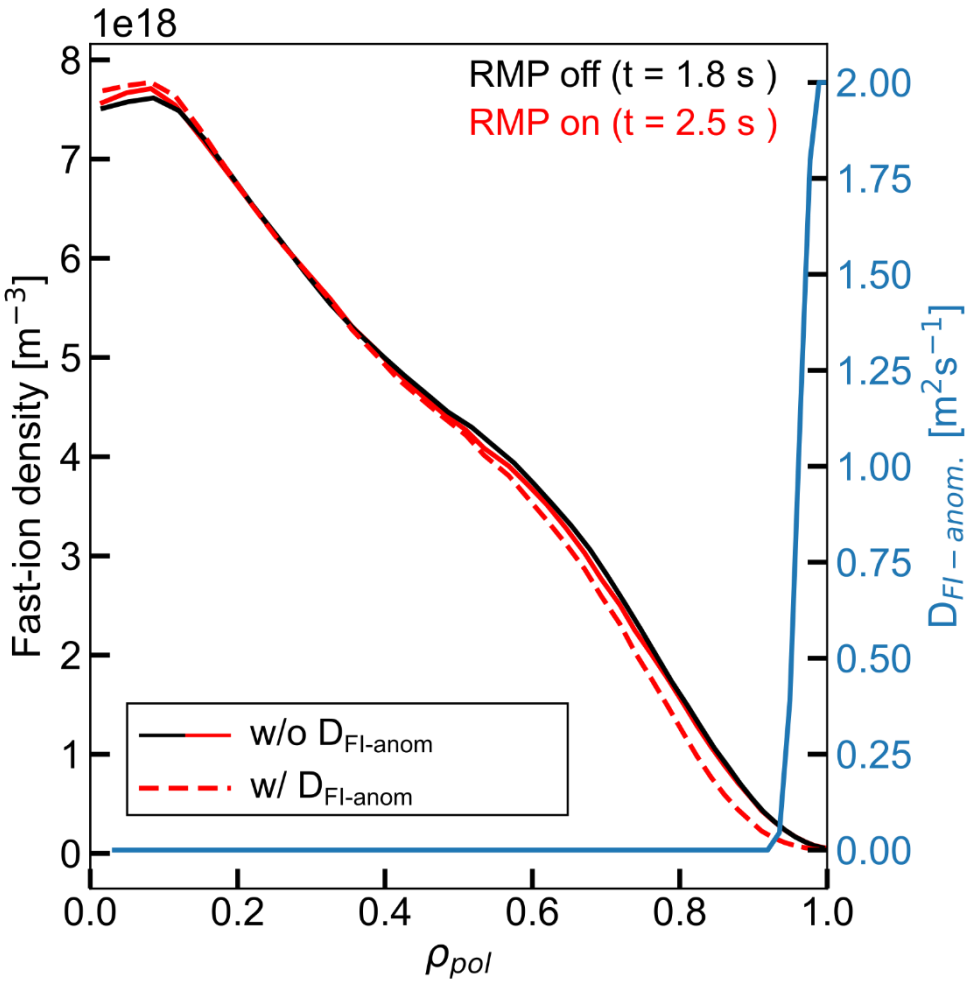

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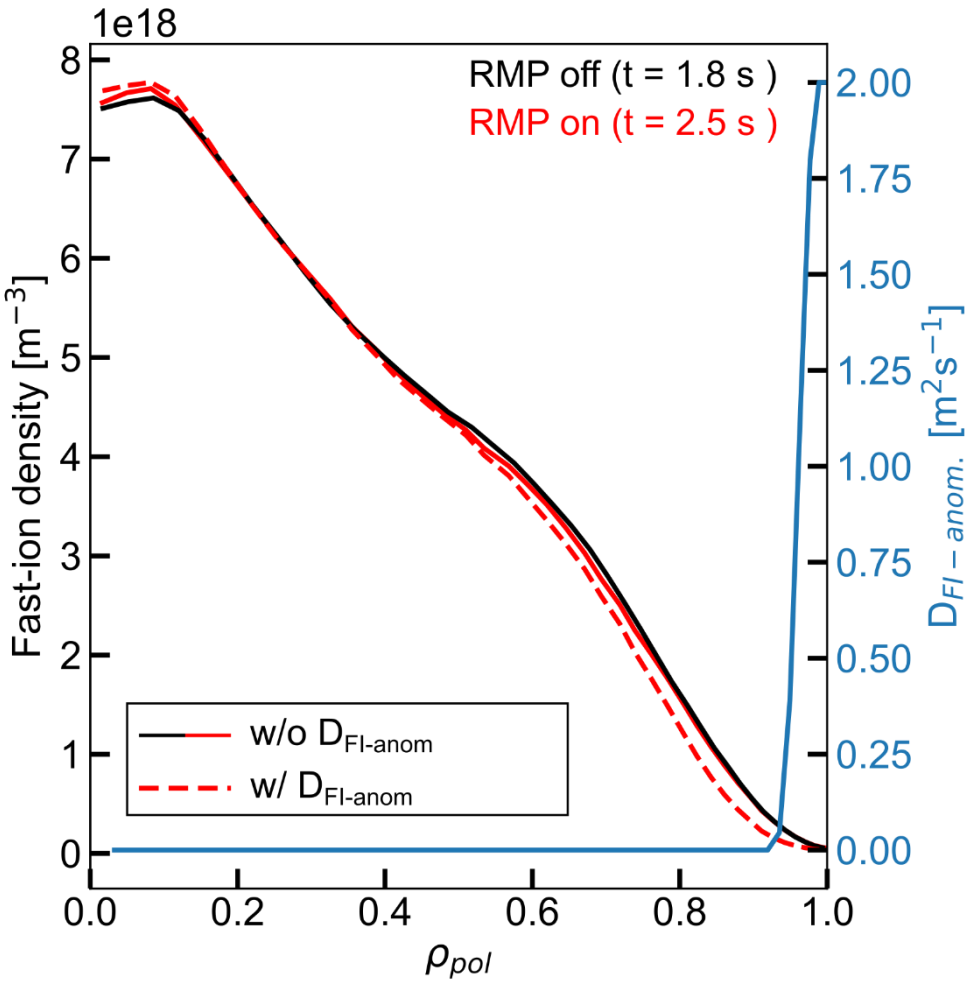

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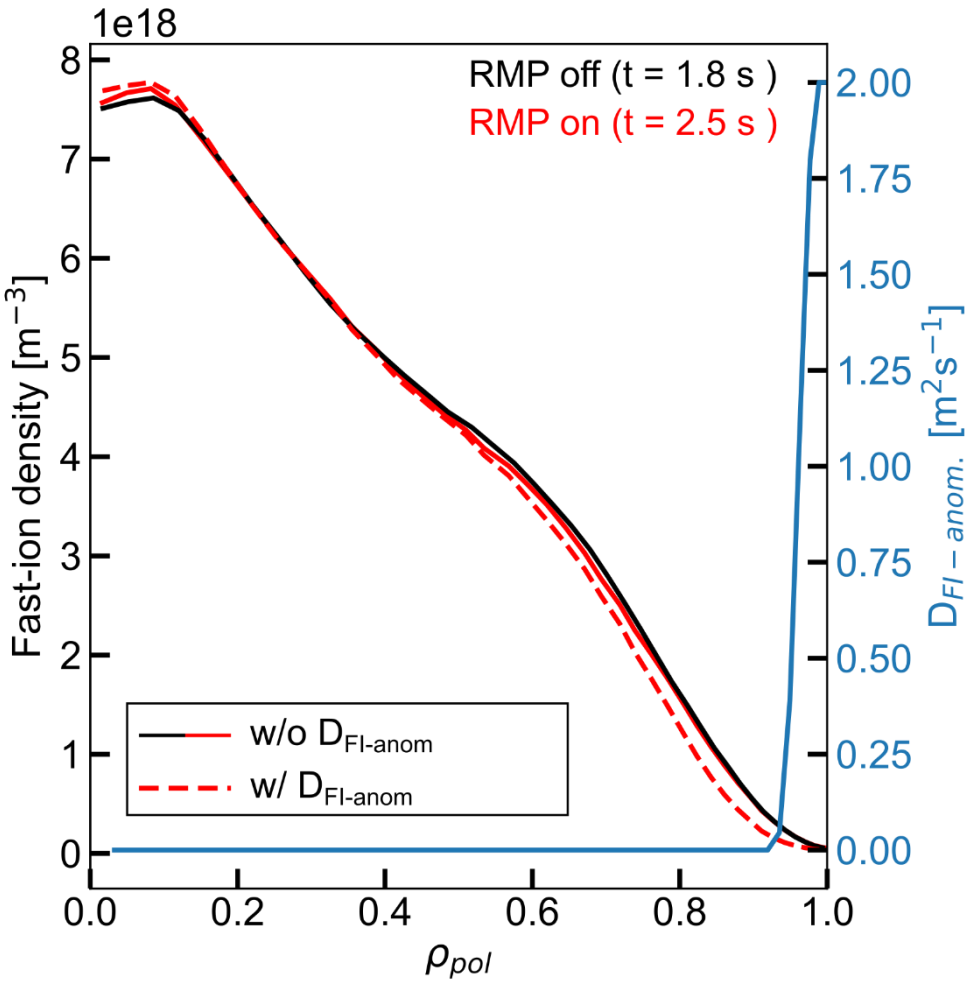

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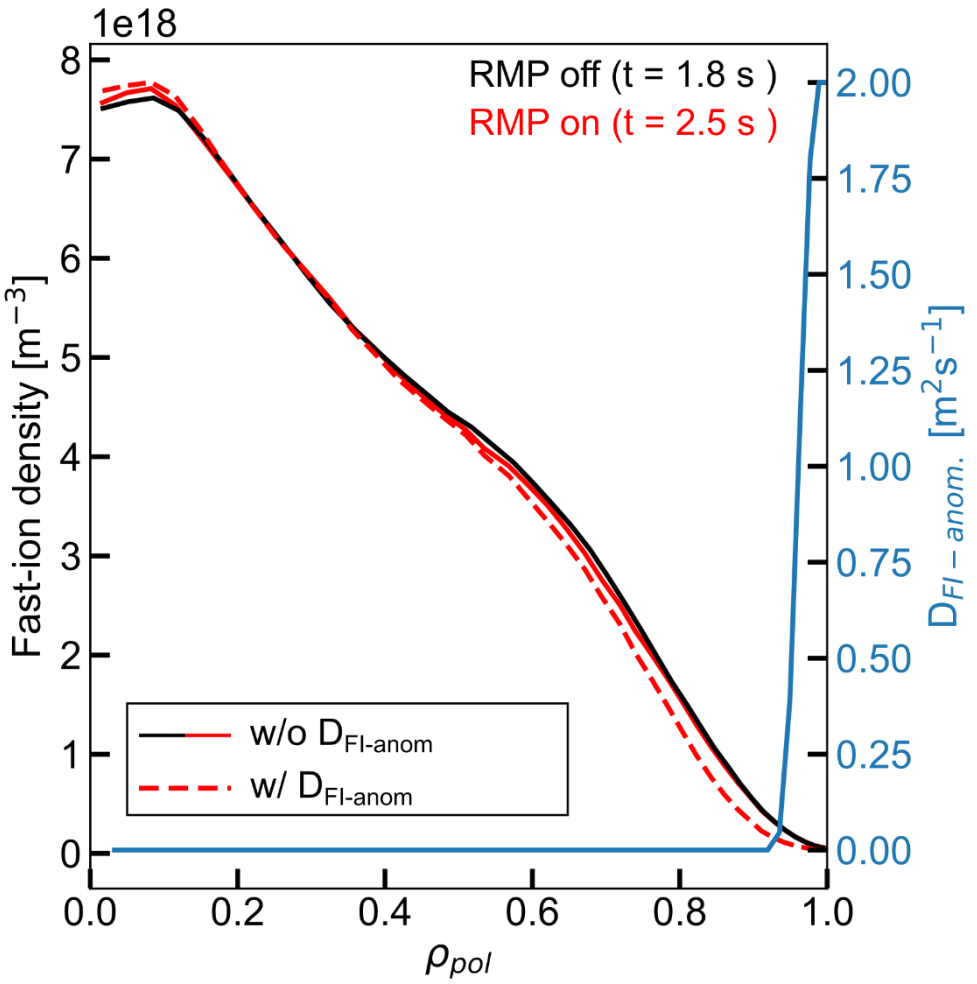

Anomalous diffusion also needed to match FIDA profiles

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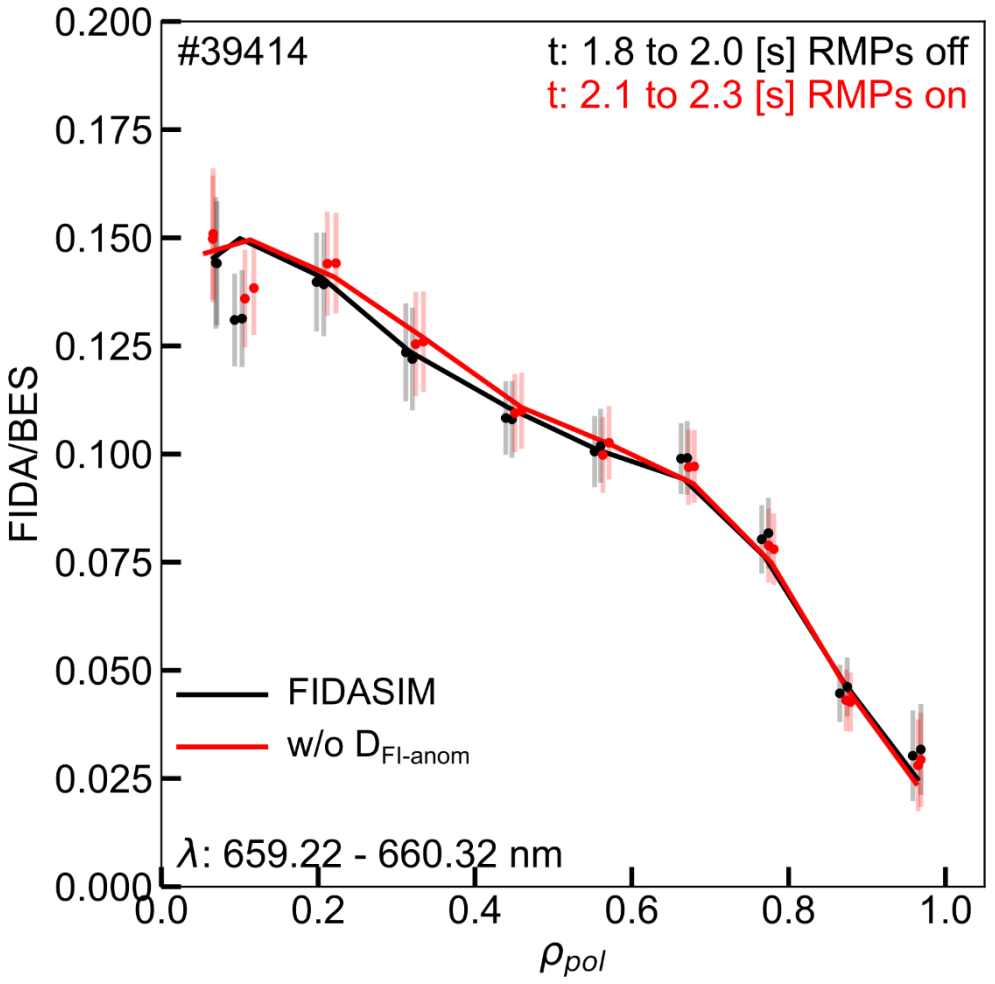

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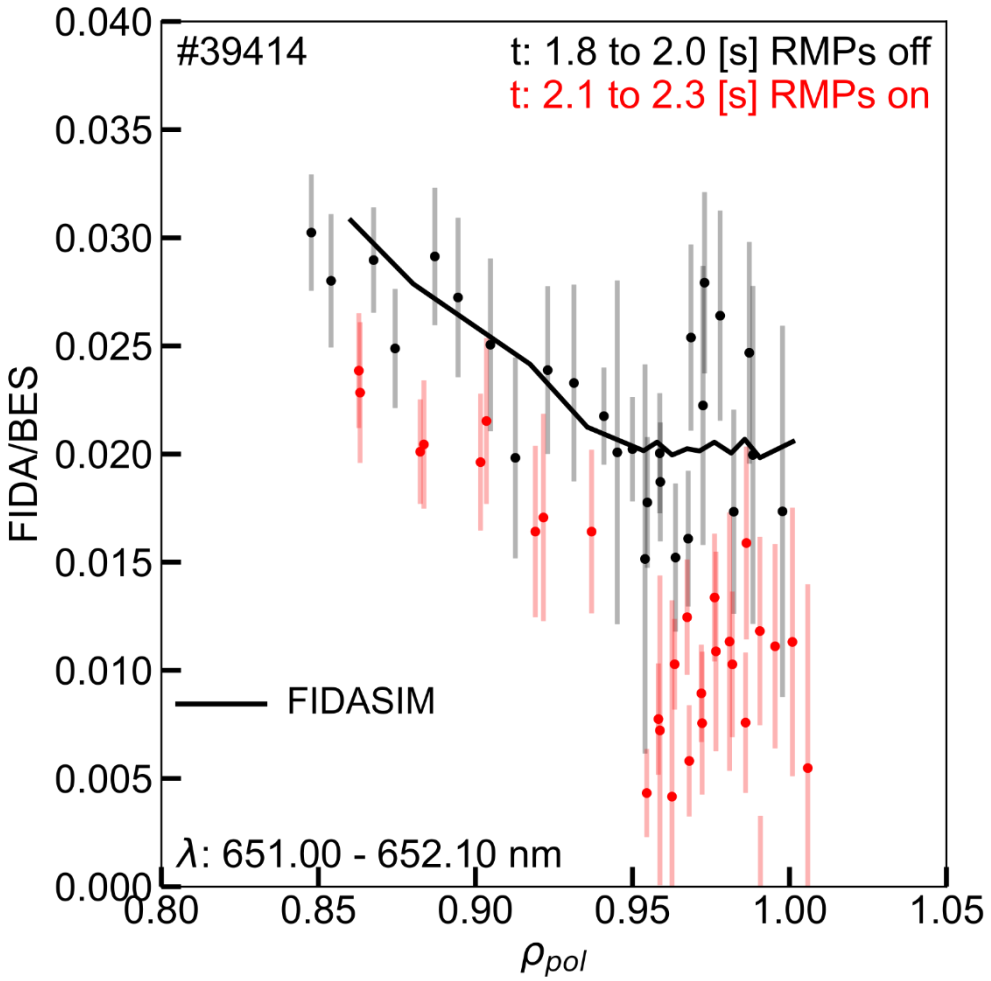

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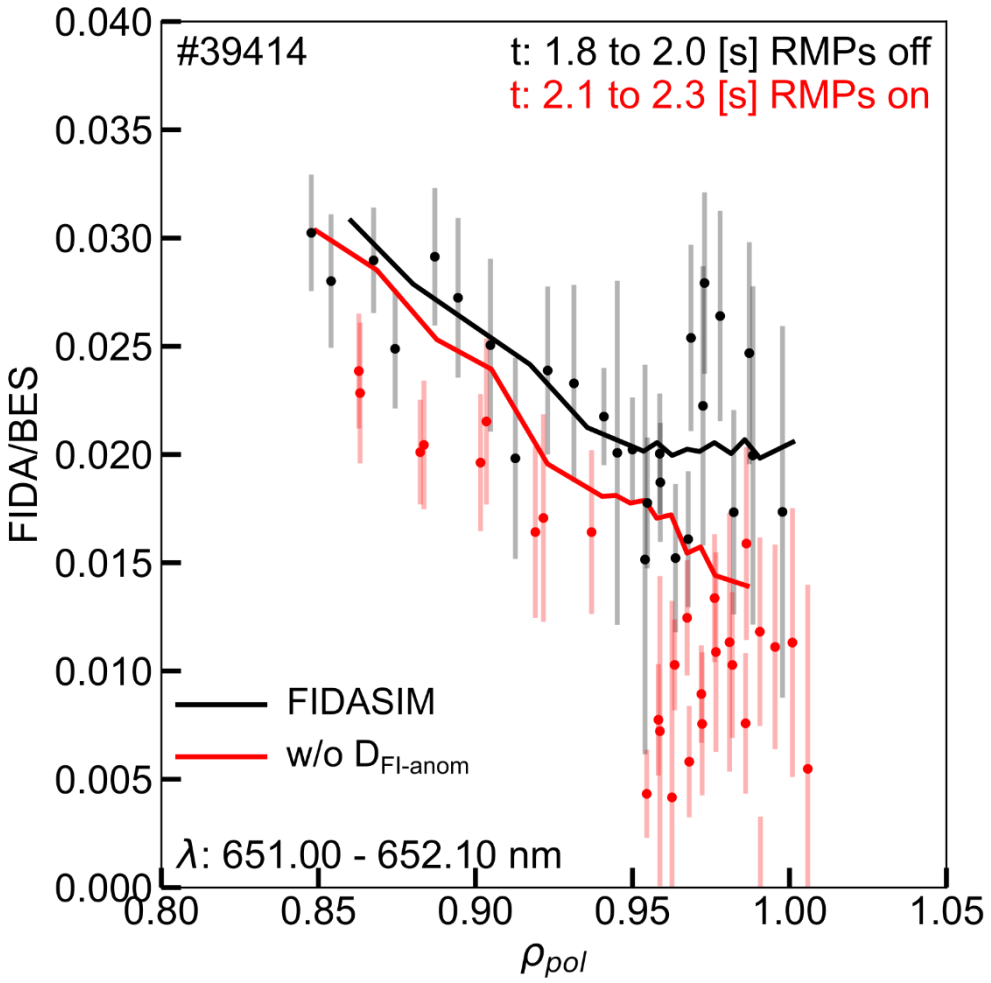

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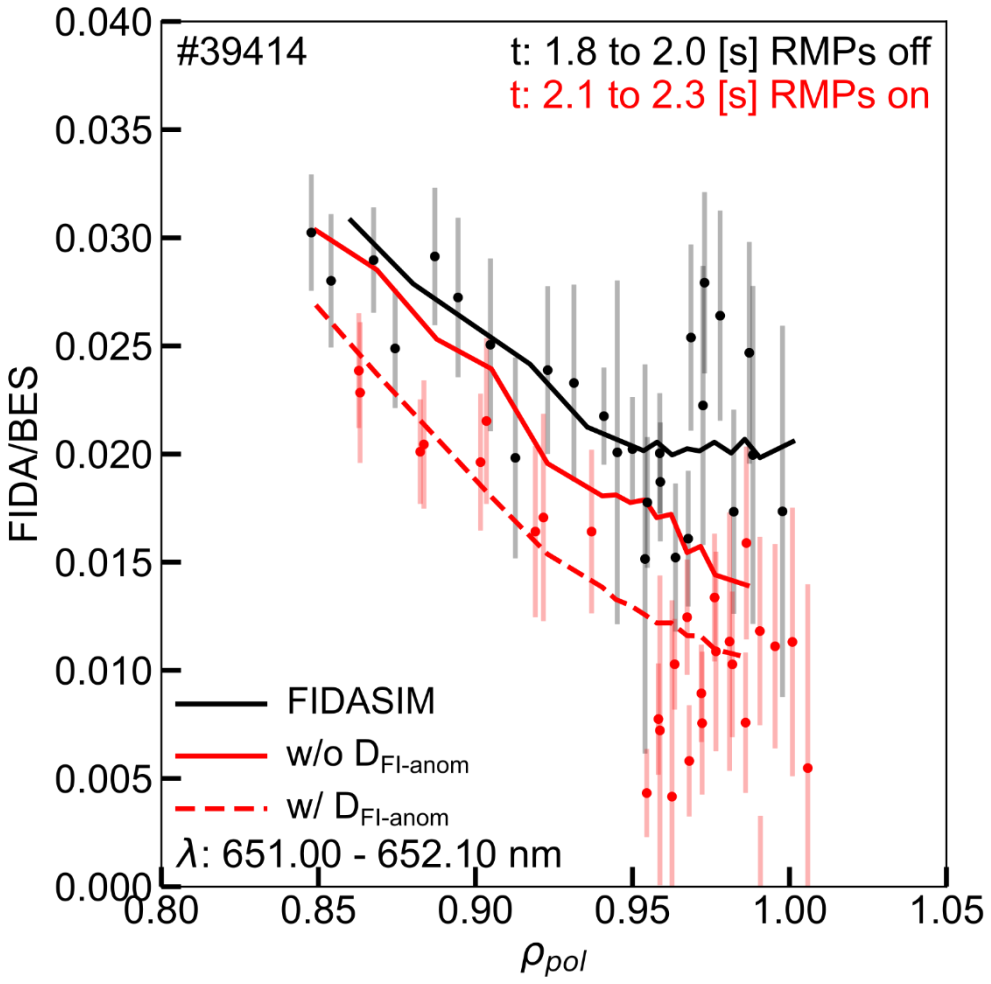

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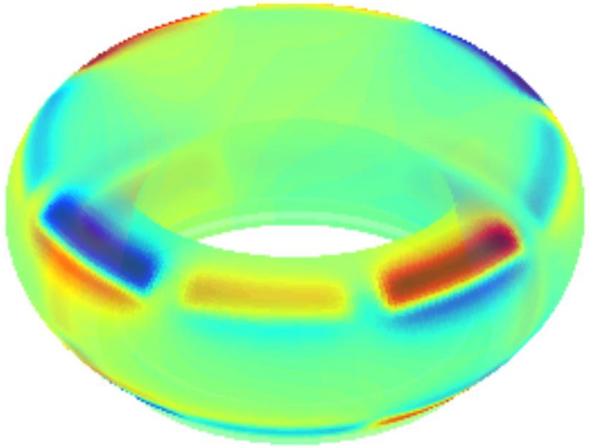

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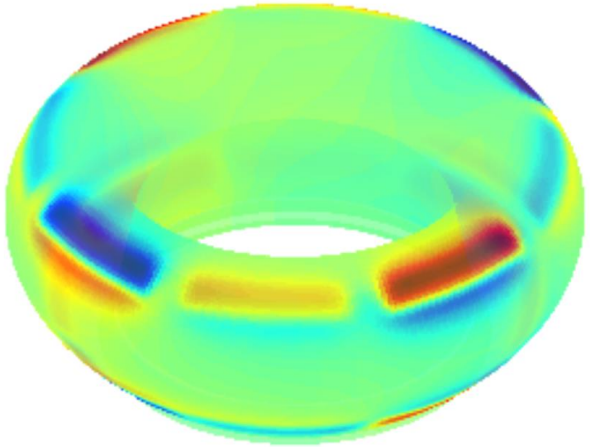

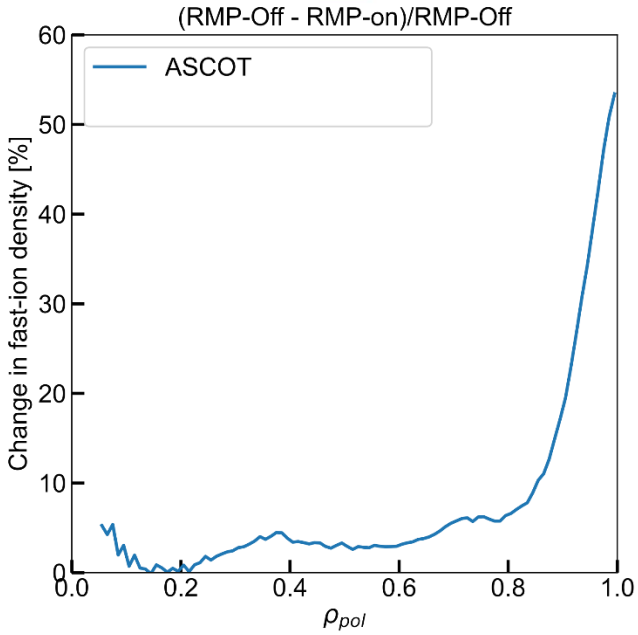

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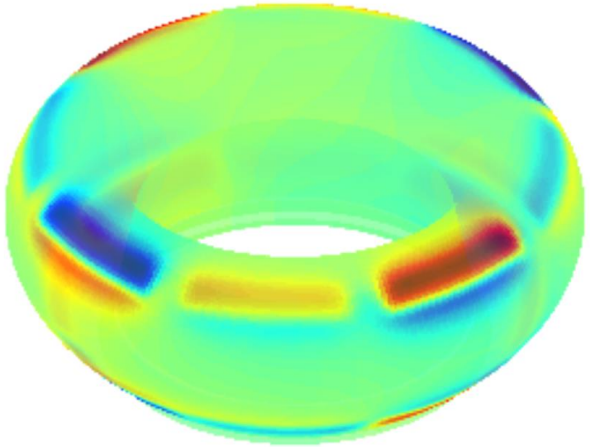

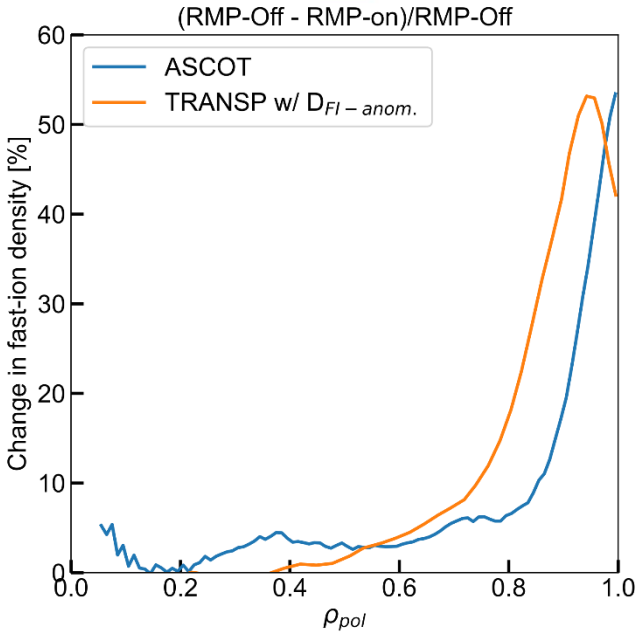

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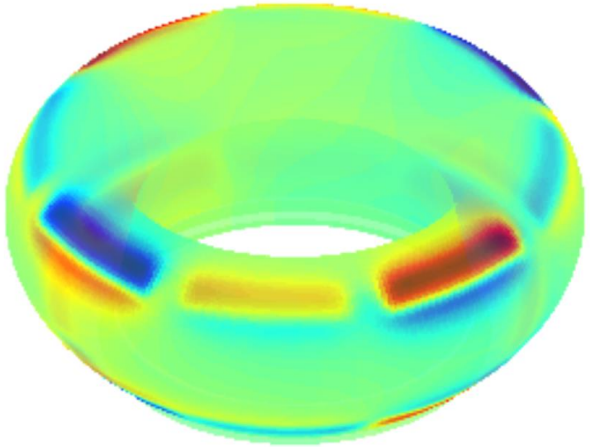

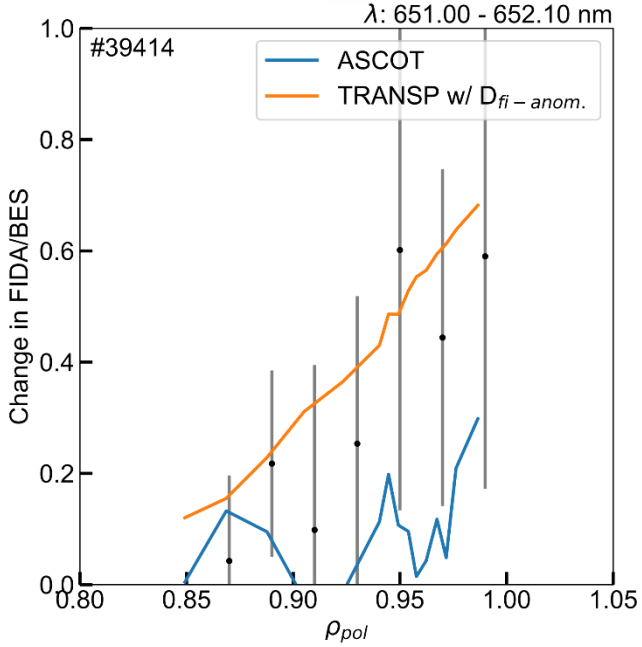

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- Need to consider plasma response [1]

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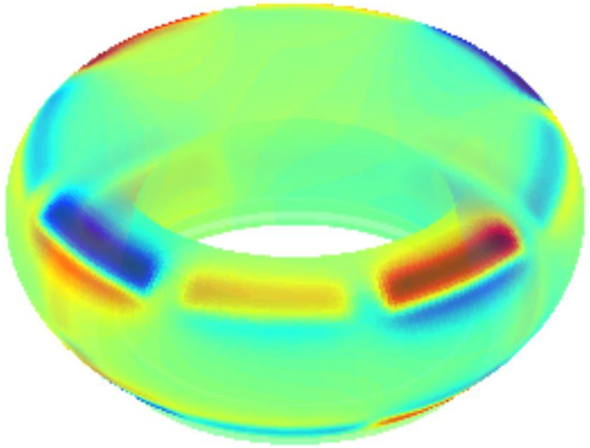
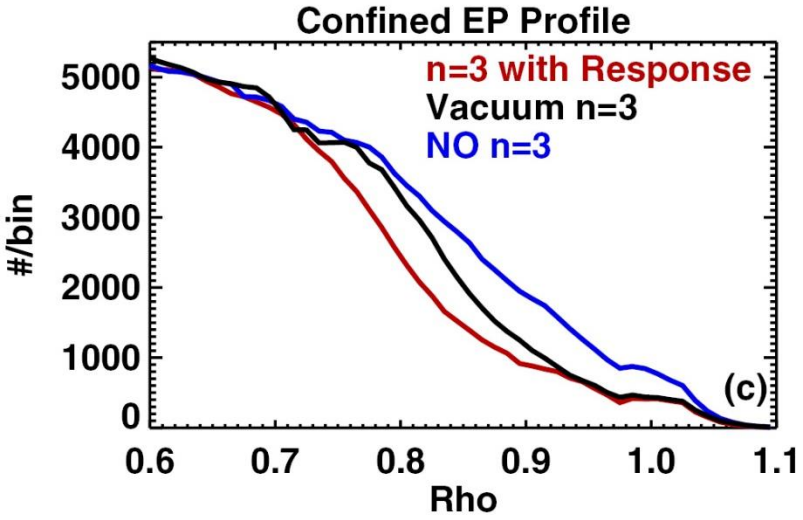




[1] M.A. Van Zeeland et al., Nucl. Fusion **55** (2015)

Outline

1. Overview of experiments performed

2. Analyses and modelling of experimental results

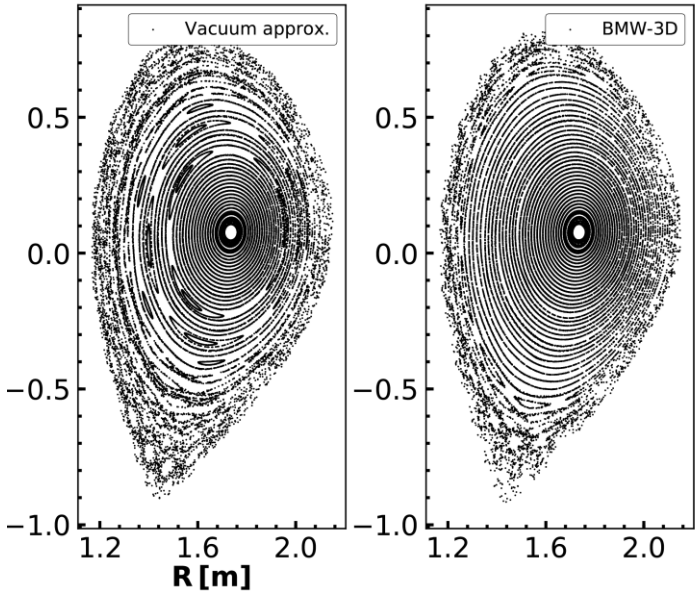
3. Conclusion and outlook

Conclusion

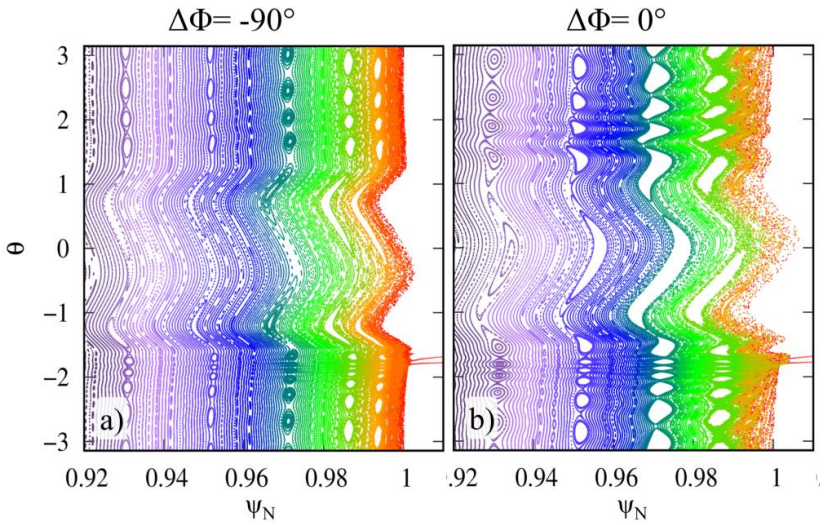
- RMP fields cause a reduction in edge FIDA emission on AUG
- Neoclassical modelling overestimates the experimental stored energy and FIDA emission during RMP on times
- Including anomalous fast-ion diffusion in neoclassical modelling shows a good match with experimental measurements can be achieved
- Indeed, 3D modelling of the vacuum perturbation fields show a reduction in the edge fast-ion density, but underestimates the absolute change in the FIDA profile

Outlook

- ASCOT modelling using V-MEC calculated equilibria with ideal MHD plasma response [1] included is being performed

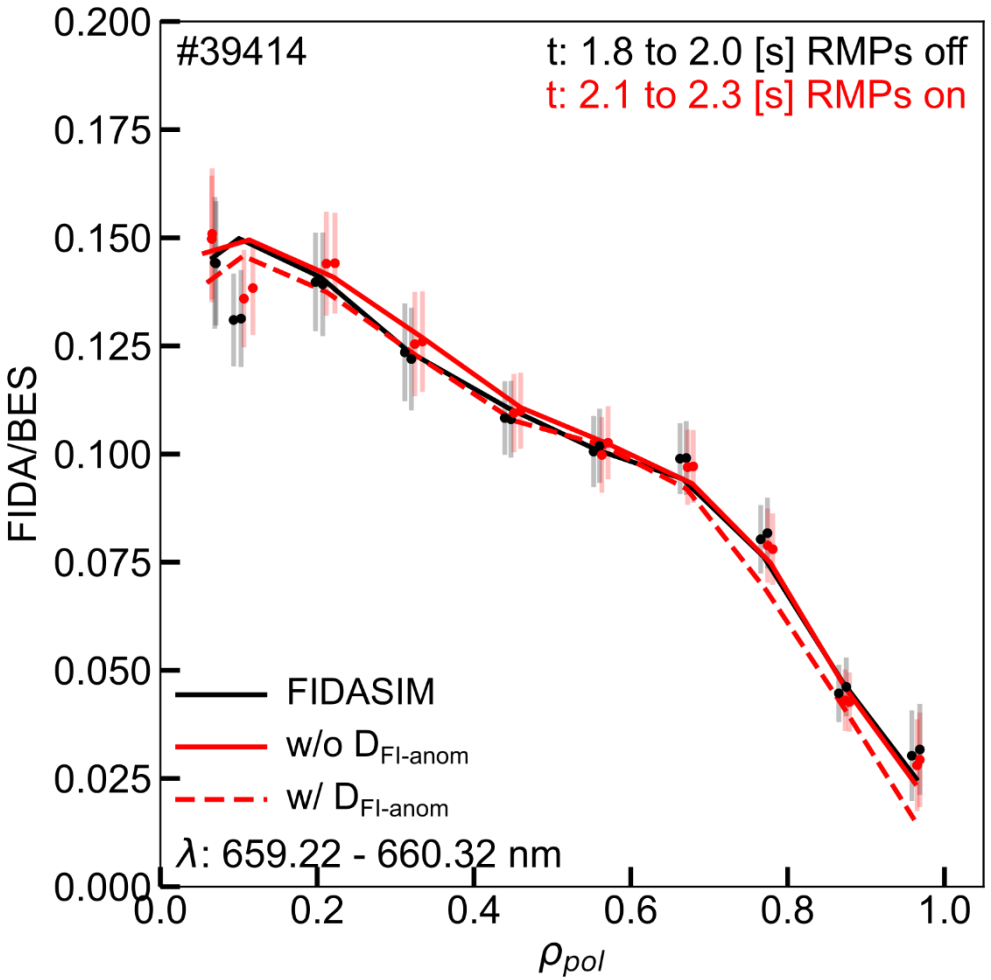


- Comparison with JOREK modelling of the RMP plasma response [2] is on the horizon



[1] G. Suárez López, PhD Thesis, LMU (2021)

[2] V. Mitterauer, Masters Thesis, TUM (2021)

Backup

Core FIDA profiles well matched