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H-MODE INTER-ELM POWER DECAY LENGTH IN COMPASS

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H-mode λ_q scaling models:

[T. Eich *et al,* 2013] – AUG, DIII-D, JET, NSTX, MAST

[D. Brunner *et al,* 2018] – C-Mod

[D. Silvagni *et al,* 2020] – AUG

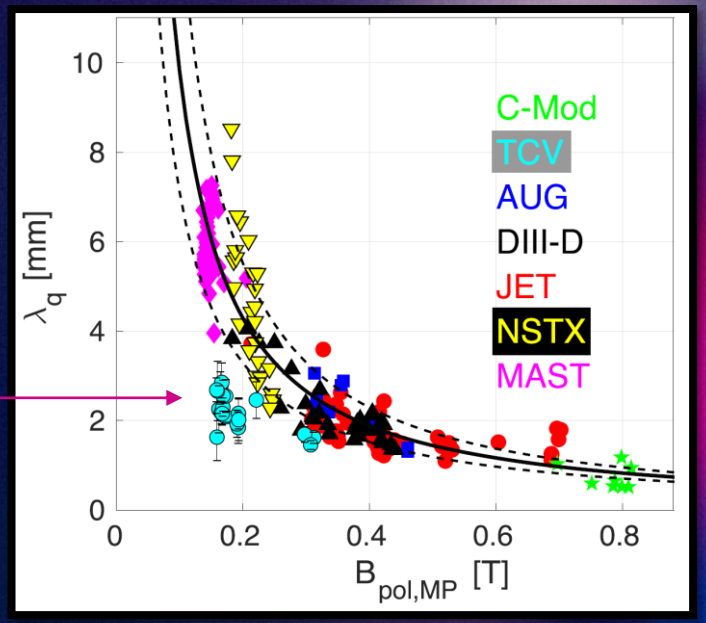
[R. Maurizio *et al,* 2021] – TCV

+ New COMPASS results ?

Anomalously short λ_q

Difference downstream vs. upstream

Drift effects? => Reversed field experiments



Outline

1. Edge plasma diagnostics at COMPASS
2. Experiments with standard B_ϕ configuration
   - The main research
3. Experiments with reversed direction of B_ϕ (and I_p)
   - Exploring the involvement of drift effects
4. Summary

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1. EDGE PLASMA DIAGNOSTICS (COMPASS)

Downstream λ_q

1. Divertor probes (Ball-pen + Langmuir)

- Available with forward B_ϕ
- Unreliable data in reversed B_ϕ experiments

2. Fast infrared (FIR) camera

- Available only in more recent experiments (with reversed B_ϕ)

Upstream λ_q

3. Thomson scattering (TS)

- Repetition rate 120Hz ~ 1/5th of the rate of ELMs
- Thus: only 0-3 inter-ELM profiles were observed per H-mode discharge

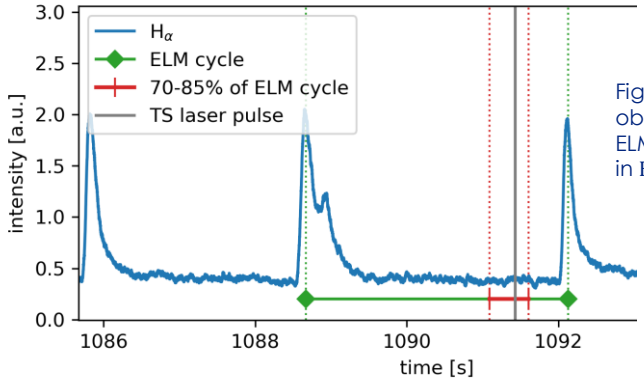
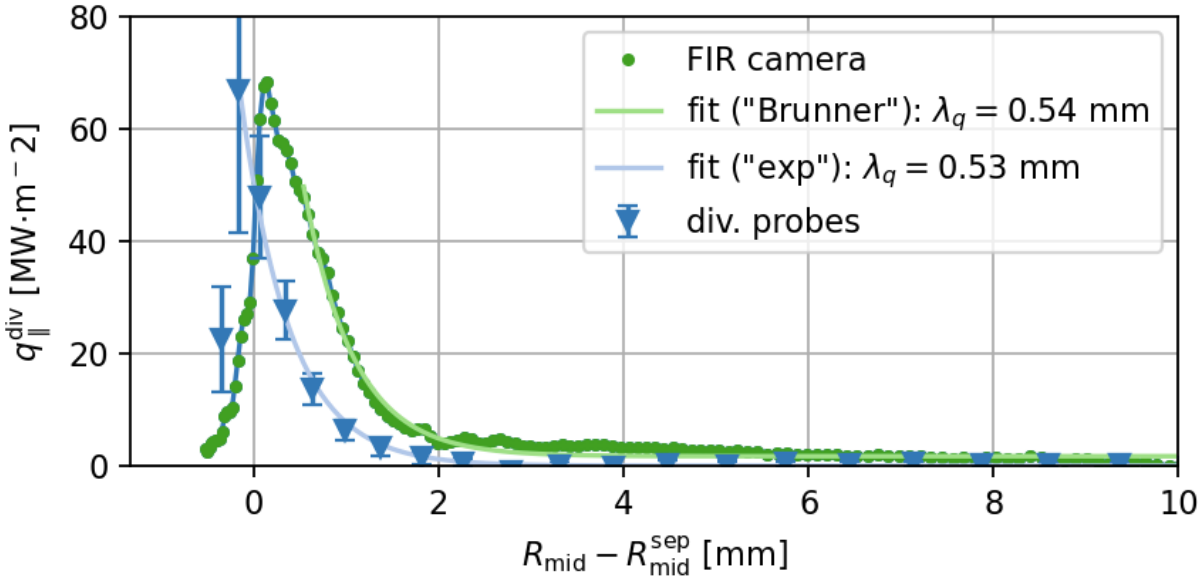


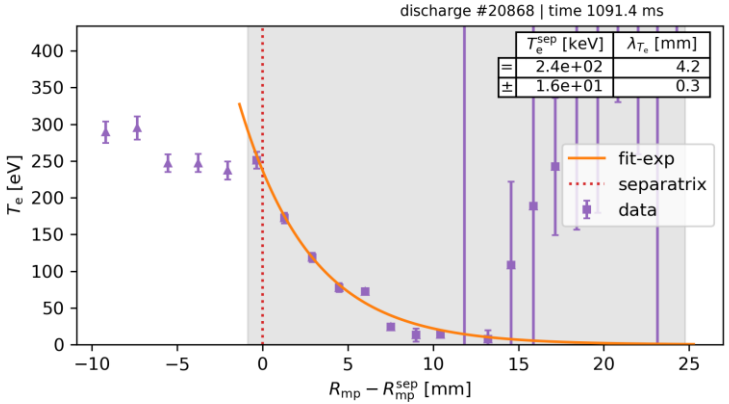
Fig. 1: View of the observed 70-85% ELM cycle interval in H_α signal.

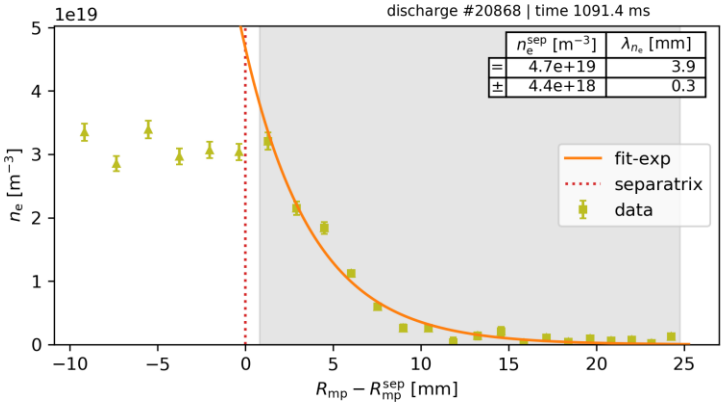
Downstream example (FIR camera, div. probes)



Comparison:
FIR vs. Div. probes
=> similar results

Upstream example (TS)





COMPASS plasma appears to be dominated by the flux (sheath) limited SOL transport.

[P.C. Stangeby *et al* 2010 *Nucl. Fusion* **50** 125003]:

$$\frac{1}{\lambda_q^{\text{flux-lim.}}} = \frac{3/2}{\lambda_{T_e}} + \frac{1}{\lambda_{n_e}}$$

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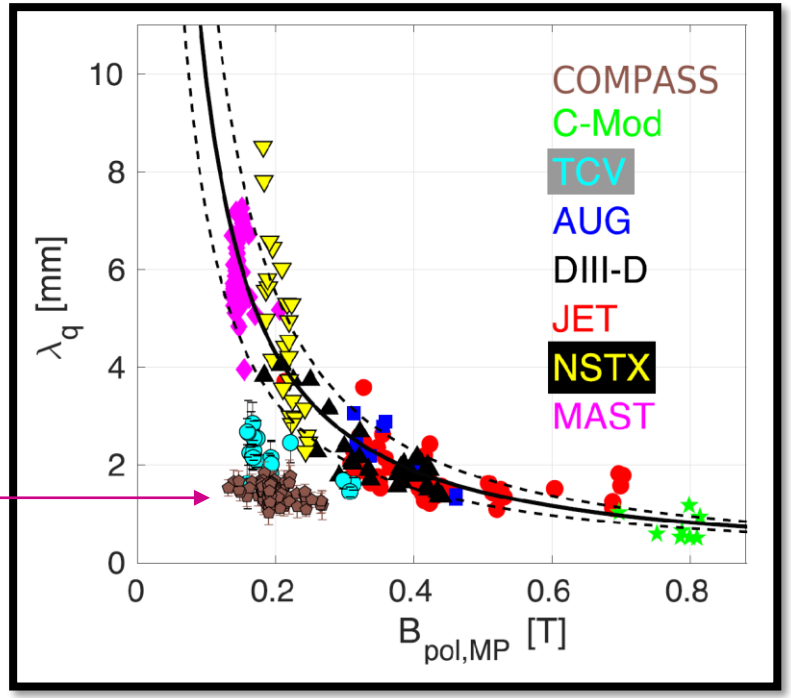
2. FORWARD FIELD CONFIGURATION

DIAGNOSTICS: THOMSON SCATTERING + DIVERTOR PROBES

Results: B_{pol} scaling

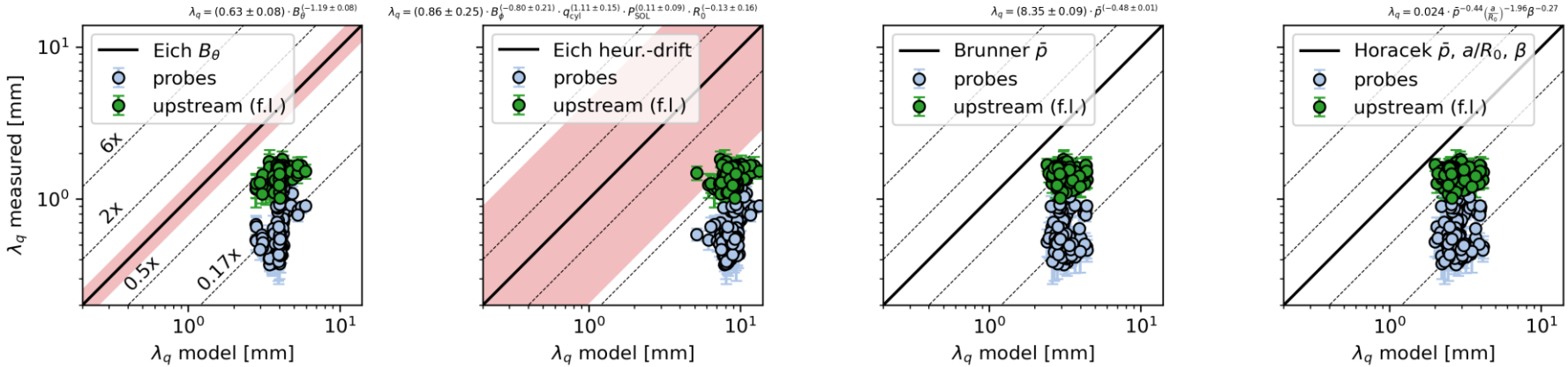
COMPASS has **anomalously short**
H-mode inter-ELM decay lengths λ_q

COMPASS, TCV
vs.
MAST, NSTX (spherical tokamaks)



[T. Eich et al, 2013], [R. Maurizio *et al*, 2021]

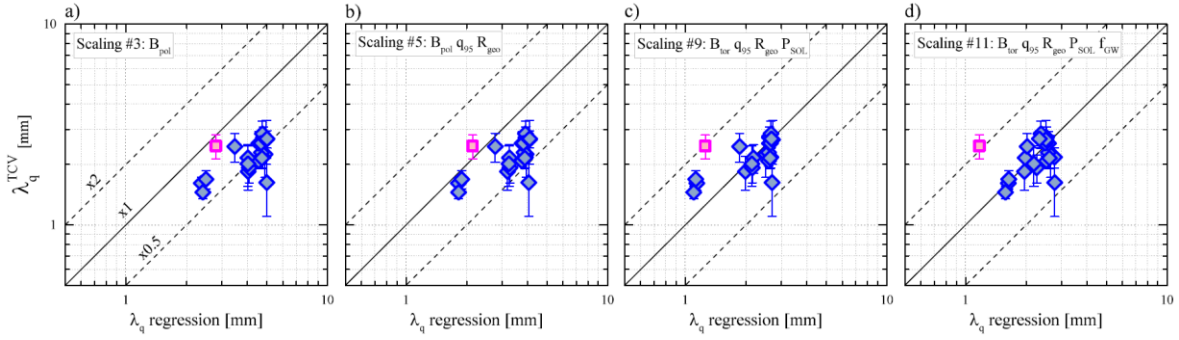
Results: Selected scaling models ($B_{\mathrm{pol}}, \bar{p}, \ldots$)



TCV

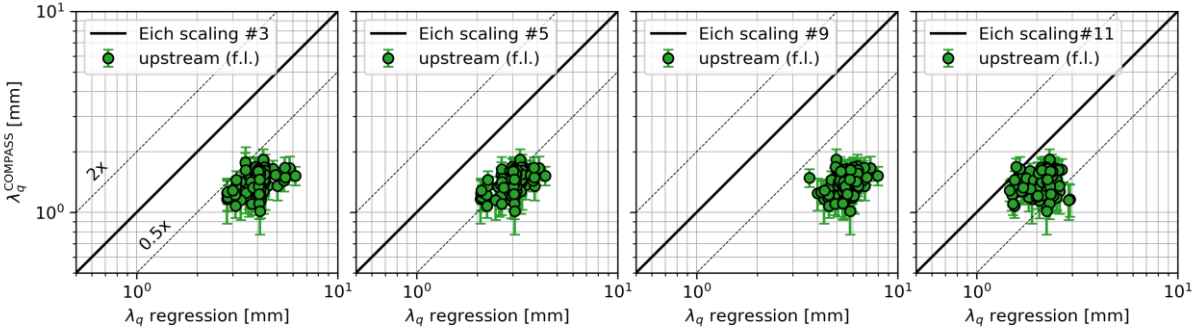
- Comparison with 4 scaling models published in Eich2013
- Strong deviation in a), b), d)

[R. Maurizio *et al* 2021 *Nucl. Fusion* **61** 024003]



COMPASS

- Similar machine (magnetic field, dimensions, etc.)
- Stronger deviation in a), b), d)
- Case c) is an exception



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3. REVERSED FIELD CONFIGURATION

DIAGNOSTICS: THOMSON SCATTERING + FIR CAMERA

Achieving H-mode with reversed B_ϕ direction

COMPASS
+
reversed B_ϕ and I_p
+
brand new NBI
+
a great deal of effort

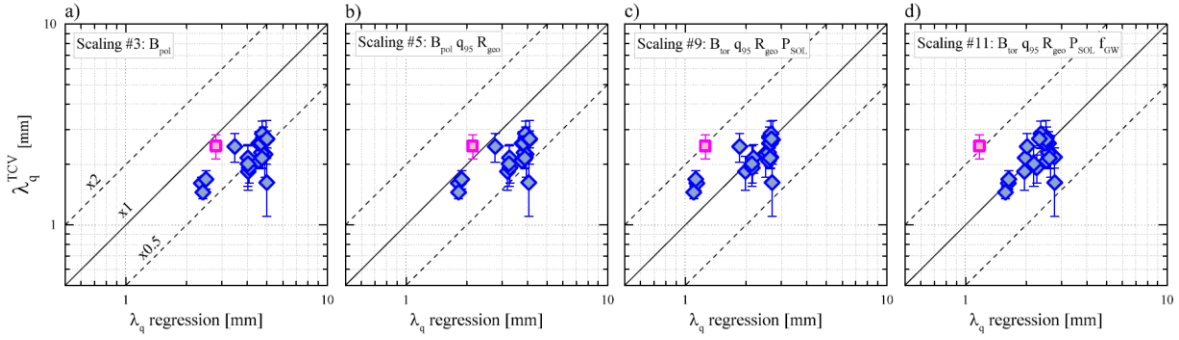
(from the NBI team, COMPASS team)

=

TCV

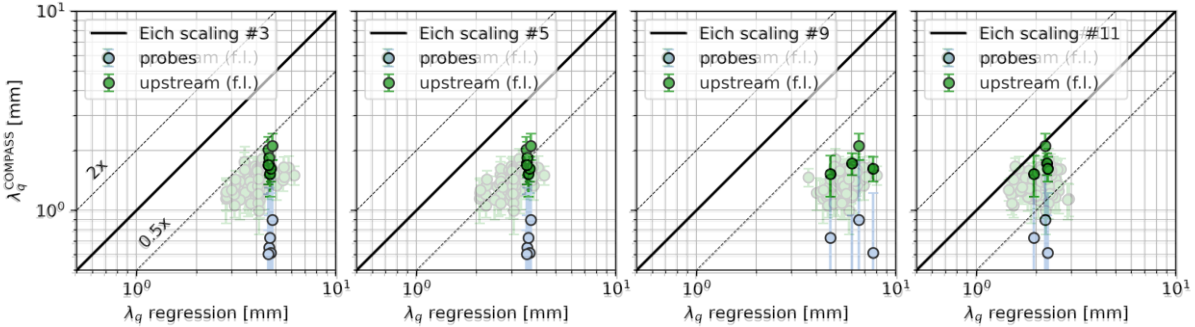
- Comparison with 4 scaling models published in Eich2013
- Strong deviation in a), b), d)

[R. Maurizio *et al* 2021 *Nucl. Fusion* **61** 024003]



COMPASS (reversed B_ϕ)

- No obvious (significant) influence of drifts is observed



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SUMMARY

SUMMARY

Observed H-mode inter-ELM power decay lengths in COMPASS

- Anomalously short decay lengths (in respect to the published scaling models)
- Similar results were observed in the TCV tokamak

- Difference between downstream and upstream observations

- Additional results from experiments with reversed B_ϕ
  - Drifts do not seem to have any significant influence

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THANK YOU FOR ATTENTION

JAN HECKO

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