09-10 November 2026

RT-02 “Physics understanding of alternatives to Type-I ELM regime” Perspectives for 2027 experimental campaign

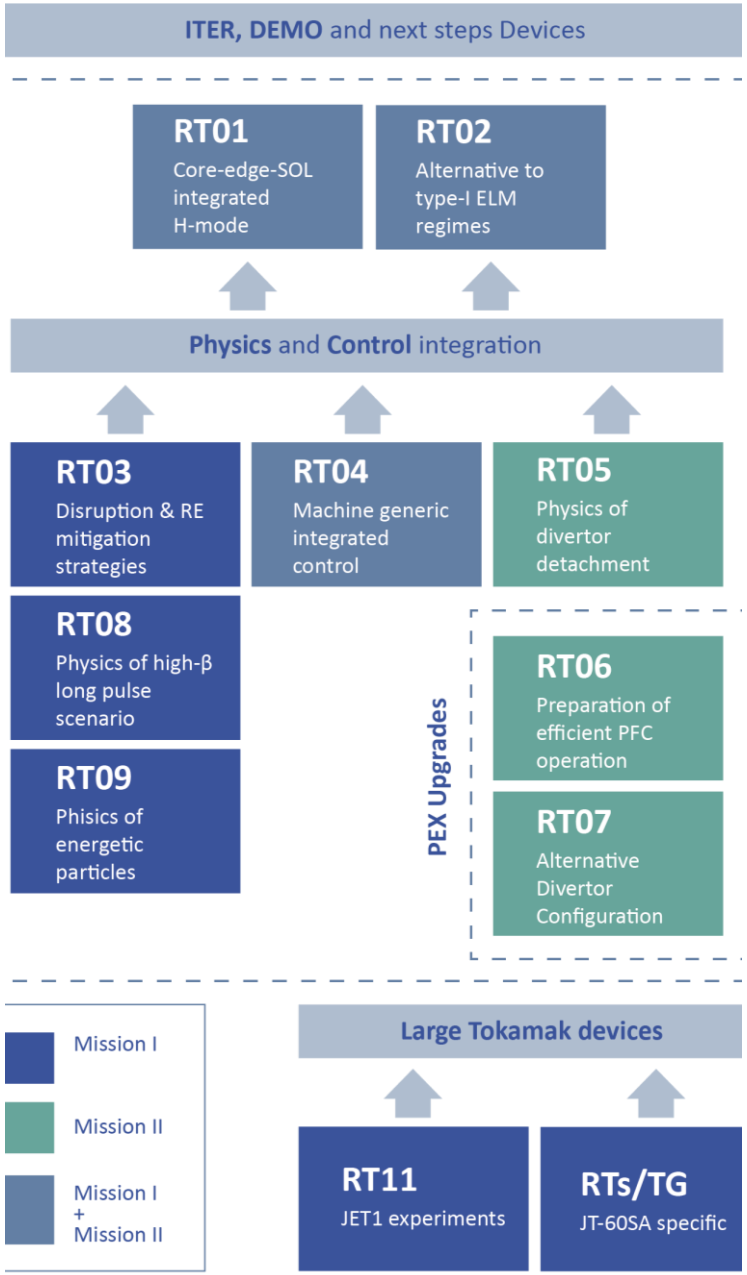
B. Labit and V. K. Zotta

On behalf of WPTE TFLs
E. Tsitrone, N. Vianello, V. Igochine, Y. Kazakov, D. Keeling, A. Hakola, B. Labit, V. K. Zotta

Research Topic Coordinators
E. Viezzer, M. Faitsch, Oleg Krutin, Alberto Mariani

This work has been carried out within the framework of the EUROfusion Consortium, funded by the European Union via the Euratom Research and Training Programme (Grant Agreement No 101052200 — EUROfusion). Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

Introduction



Proposal Evaluated according to the criteria:

Adherence to the Scientific Objectives

Team effort

Size and feasibility

All these aspects were considered by the TFLs when setting the priorities – according to the following scheme

+ needs to contribute to IO-EU MoU

novelty for 2027

Scientific objectives and status of SSRL

Scientific objectives	Status based on 2022 level 3 reports	Status based on 2023 level 3 reports	Status based on 2024 level 3 reports	Status based on 2025 level 3 reports
D1: Quantify turbulent and MHD driven transport in the vicinity of the separatrix and implications for predictions for ITER and DEMO	Exploratory	Exploratory	Exploratory	Exploratory
D2: Quantify first wall load in no-ELM scenarios and provide model for SOL transport extrapolation	Judgemental	Judgemental	Judgemental	Judgemental
D3: Extend the parameters space of no-ELM scenarios to large Psep/R and/or pedestal top collisionallities relevant for ITER and DEMO	Exploratory	Judgemental	Mature - needs underpinning	Mature - needs underpinning
D4: Determine the key physics mechanisms regulating edge transport in order to access no-ELM regimes	Exploratory	Exploratory	Judgemental	Mature - needs underpinning
D5: Determine access window and physics understanding for RMP ELM suppression and its compatibility with ITER FPO scenarios	Judgemental	Judgemental	Judgemental	Judgemental
D6: Quantify the overall performance of negative triangularity plasmas in view of DEMO	Exploratory	Judgemental	Mature - needs underpinning	Mature – needs support

Grant Deliverables and Milestones

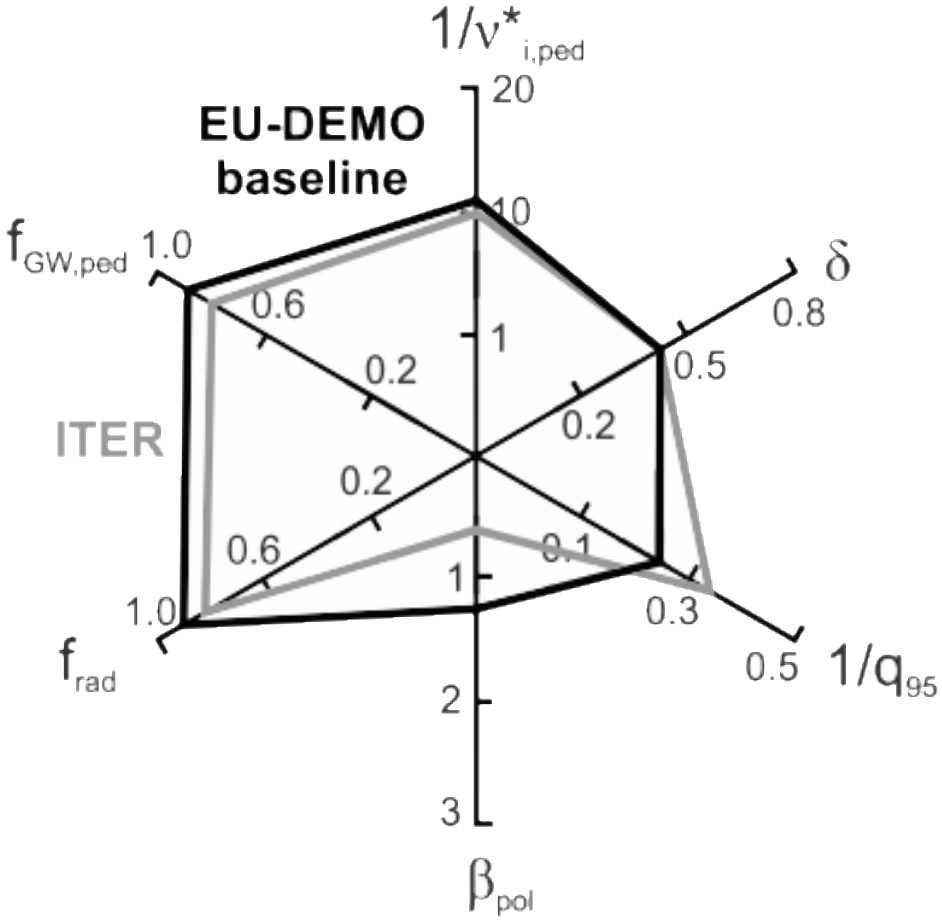
EUROFusion Grant Deliverable

TE.D.19	**Report on qualification with experiment/modelling of the most promising no-ELM scenario in terms of confinement, exhaust capabilities and plasma wall interaction**	**Dec 2027**

EUROFusion Milestone

TE.M.08	**Proper figure of merit for cross-scenario comparison among no-ELM / ADC defined**	**July 2027**

A working group is under construction to tackle this task



Summary of proposals

NT (10)	QCE (4)	EDA (4)	QH (1)	RMP (2)	I-mode (4)	Others (0)

No	RT	Proposal name	Proposer	Priority
11	RT02	NT in AUG: low q95 operation	Branka Vanovac	P1-2026-AUG
12	RT02	Improved confinement in NT AUG through stronger shaping?	Branka Vanovac	P1-2026-AUG
13	RT02	Comparative Study of Negative Triangularity performance in TCV, DIII-D, ASDEX Upgrade (AUG)	Branka Vanovac	P1-2026-AUG / P1-2026-TCV
14	RT02	Characterization of edge fluctuations for NT plasmas with ballooning modes	Margherita Ugoletti	PB/P2
15	RT02	Turbulent Edge/SOL Transport in EDA Regimes	Miriam La Matina	P2-AUG / P1-2027-TCV
16	RT02	ELM control by RMPs in low aspect ratio	David Ryan	P1-2026-MAST-U
17	RT02	QCE exploitation: high current / low safety factor	Mike Dunne	P1-2026-AUG / P1-2026-TCV / P1-2026-MAST-U / P1-2027-TCV
18	RT02	QCE exploitation: seeding and detachment	Michael Faitsch	P1-2026-AUG / P1-2026-TCV / P1-2027-TCV / P2-MAST-U
19	RT02	Power threshold density minimum in I-mode and edge ion heat flux scaling	Michael Komm	P2-AUG
20	RT02	I-mode detachment: access and operational window with Ar and Kr	Daniel Fajardo	P1-2027-AUG
21	RT02	Bt scaling of I-modes on WEST and AUG	John Rice	P2-AUG / P2-WEST
22	RT02	QCE exploitation: shaping scans	Andrés Miller	P1-2026-AUG / P1-2026-TCV / P1-2027-TCV
23	RT02	Edge turbulence characterization in Type I ELMy H-mode, QCE and mixed regimes	Alysée Khan	P1-2026-TCV / P1-2027-TCV
24	RT02	EDA H-mode QCM reflectometry measurement	Mário Vaz	PB/P2-AUG
25	RT02	Negative triangularity in conventional vs spherical tokamaks	Diego Jose Cruz Zabala	P1-2026-MAST-U / P1-2027-TCV
26	RT02	Detached high-power L-Mode negative-triangularity reactor relevant scenarios	G. Durr-Legoupil-Nicoud	P1-2026-TCV / P2-WEST
27	RT02	Fast-ion transport in real- and velocity-space in negative triangularity	Jesper Rasmussen	PB/P2-AUG / PB/P2-TCV
28	RT02	Development of Quiescente H-mode (QH mode)	Eli Viezzer	P1-2027-AUG / P1-2026-MAST-U
29	RT02	Impact of triangularity in I-mode and L-I-H transitions	Mário Vaz	P2-AUG
30	RT02	Towards long-pulse operation in negative triangularity plasmas	Jorge Morales	P2-WEST / P2-TCV
31	RT02	Neon transport in EDA H-mode pedestals	Tabea Gleiter	P1-2026-AUG
32	RT02	Impurity transport dependence on negative and positive triangularity	Jorge Morales	P2-WEST
33	RT02	EDA H-mode development in AUG and TCV	Luís Gil	P1-2027-AUG / P1-2026-TCV / P1-2027-TCV
34	RT02	Impact of resonant field amplification (RFA) on edge magnetic structure and ELM control in high-beta plasmas	Yunfeng Liang	P2-AUG / P2-MAST-U
35	RT02	High performance negative triangularity plasma in WEST	Olivier Sauter	P2-WEST/ P2-TCV

Summary of P1 proposals (as of 2025 GPM)

	AUG		TCV		MAST-U	WEST	
	2026	2027	2026	2027	2026	2026	2027
QH		#28			#28		
QCE	#17, #18, #22		#17, #18, #22, #23	#17, #18, #22, #23	#17		
NT	#11, #12, #13		#13, #26	#13, #25	#25		
EDA	#31	#33	#33	#15, #33			
I-mode		#20					
RMP					#16		
Scientific pulses requested	63	53	80	98	48		
Provisional shot allocation	30	22	80	110	32		15?

One shot-day proposed for NT-AUG

This session could be kept following I-mode experiements next week

Work Awarneness Table for 2026 developed by RTCs

https://wiki.euro-fusion.org/wiki/WPTE_wikipages:_Experimental_campaign_2026:_RT02

	AUG	TCV	MAST-U
QCE	QCE-AUG-02: high Ip	QCE-TCV-02: high Ip	
	QCE-AUG-03: shaping*	QCE-TCV-03: shaping**	QCE-MAST-U-03: shaping
		QCE-TCV-04: turbulence	
	QCE-AUG-05: seeding and detachment	QCE-TCV-05: seeding and detachment	
EDA	EDA-AUG-01: impurity transport	EDA-TCV-01: scenario dev.***	
RMP			MP-MAST-U-01: scenario dev.
NT	NT-AUG-01: scenario dev.*	NT-TCV-01: similarity experiments	NT-MAST-U-01: scenario dev.
		NT-TCV-02: high perf. and detachment	
		NT-TCV-03: Er in fav and unfav	
		NT-TCV-04: non-inductive scenarios***	
QH-mode			QH-MAST-U-01: scenario dev.
I-mode			

No machine time

Machine but no real progress

Machine time and progress

* Issues with EZ4: power, shaping, plasma current
** Issues with internal coils
*** Lack of additional power

More details in the slides of the Review Meeting – 25/09/2026

IO-EF MoU

Annex 2: Technical Specifications for activities to address gaps in the physics basis of ITER
https://wiki.euro-fusion.org/images/9/9a/Topics_collaboration_IO_EF_2028089.pdf

TE identifier	Description of the Work	Expected Deliverable Deadline	Relevant Research Topics
TE-IOS-1.1.3	ELM control and no-ELM scenarios with W wall: (a) 3-D field ELM control H-mode for SRO (ECH + ICH) (b) Development of no-ELM scenarios for high-Q operation (XPR and QCE) Accompained as well to modelling. Input to be provided by D4	D4 = Dec. 2027	RT02, RT05
TE-VPM-3.2	Validation of SOLPS-ITER wide grid and ensuing W source/transport	D4 = Dec. 2027	RT02, RT05

IO-EF MoU: possible contribution of AUG

Message from Alberto Loarte (03.11.2026)

3-D field ELM control H-modes for SRO (ECH+ICH)

The idea is to identify if it is possible to supress ELMs with pure RF heating which, so far, it has not been possible according to AUG experiments. The idea would be to see what the physics mechanisms is since they may not extrapolate to ITER. From what I know there are four possible reasons : **low rotation, low beta, high Te/Ti at the pedestal and maybe no core fuelling** but I am not sure if there is a clear picture which is the dominant one. Note that this may require NBI experiments besides RF ones.

Assessent of W transport with 3D fields

The assessment of W transport with 3-D fields and suppression is more of a physics understanding than specific for heating-mix. This is a 3-D problem and not an easy one since we expect to have convective cells at the second X-point that bring W into the plasma. Maybe if there are capabilities for local impurity injection one could **try assessing impurity penetration (Ar) into an ELM suppressed plasma** when injected at the midplane versus injection on the upper null region (when the active X-point is the lower X-point).

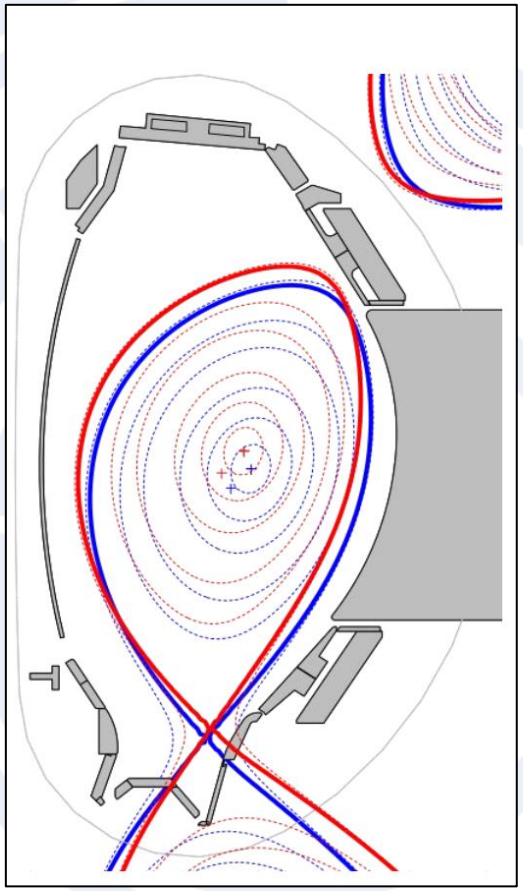
Uncertainty on NT-AUG

Message from T. Putterich (30.10.2026)

The restart is going quite well except for one issue which we will not be able to resolve easily.

We know about one tile in the lower divertor (thermocouple measurement), that the thermal contact to the water cooling is insufficient.
The tile is a tile on which usually no strike points are located and thus, we think it will mostly not pose problems. However, for the NT scenarios the SPs are on that tile. **So, I'd expect that this is an issue for the NT week.**

There is a slim chance that the problem will improve by itself. We will have a close look at the temperature measurements....If possible I'd suggest to not cancel NT yet and gather more information in the following 1-2 weeks.



Assessment of tolerable heat loads was foreseen during the restart phase last week but did not happened following the incident with the XPM ➔ Chances of NT experiments before 2027 summer break are low

Experimental proposal for 2027

	AUG	TCV	WEST
	35	120	0
QCE	High Ip + leftover from 2026	Seeding, high Ip, turbulence	Internal effort made to develop an PT H-mode and NT L-mode is acknowledged. I-mode session in internal programme in Dec. 2026. RT02 remains at low priority compared to other RTs on this device
NT	High shaping, high power, high density	non-inductive scenario, Te/Ti ratio, effect of rotation	
EDA	Missing bits under assessment	Operational space pending min. 2 gyro available	
I-mode	Detachment access and operational window with Ar and Kr	-	
(WP)QH-mode	Milestone: USN low density, low ELM frequency H-mode demonstrated	Operational space for wide pedestal H-mode (PhD topic)	
RMP	Possible contribution to support IO-EU MoU under assessment	-	

AUG: after QCE and NT, priority is given to RMP experiments (MoU) over the rest

Summary of proposals (revised)

	AUG		TCV		MAST-U	WEST	
	2026	2027	2026	2027	2026	2026	2027
QH		#28			#28		
QCE	#17, #18, #22	#17, #18, #22	#17, #18, #22, #23	#17, #18, #22, #23	#17		
NT	#11, #12, #13	#11, #12, #13	#13, #26	#13, #25	#25		
EDA	#31	#33	#33	#15, #33			
I-mode		#20					
RMP		TBC			#16		
Scientific pulses requested	63	-	80	-	48		
Provisional shot allocation	30	35	80	120	32		0

3 shot-days proposed for NT-AUG (shared with internal programme)

AUG: after QCE and NT, priority is given to RMP experiments (MoU) over the rest

Analysis and Modelling needs

- SOLPS-ITER wide grid for AUG-QCE (linked with RT06)
- SOLPS-ITER for JET-QCE – ongoing
- GRILLIX for JET-QCE
- JINTRAC for JET-QCE including DT
- JINTRAC for JET-NT – ongoing
- SOLPS-ITER for NT-TCV
- GBS for TCV-QCE – ongoing
- …

Please, contact refTFLs and RTCs if you want to propose something for the Call for Participation

Experiments in 2027

No	RT	Proposal name	Proposer	Priority
11	RT02	NT in AUG: low q95 operation	Branka Vanovac	P1-2026-AUG
12	RT02	Improved confinement in NT AUG through stronger shaping?	Branka Vanovac	P1-2026-AUG
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15	RT02	Turbulent Edge/SOL Transport in EDA Regimes	Miriam La Matina	P1-2027-TCV
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33	RT02	EDA H-mode development in AUG and TCV	Luís Gil	P1-2027-AUG / P1-2027-TCV

AUG: Low q_{95} operation in NT

Addressing Sci. Obj. 6

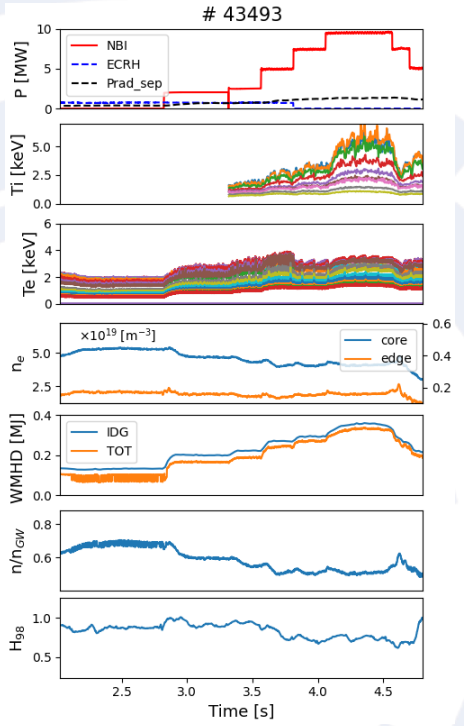
Continuation of 2025 effort

ECRH scheme at 1.5 T should be assessed

- **Proponents and contact person:**
- B Vanovac, J Hobirk, T Pütterich, M Dunne, M Faitsch, O Nelson, Sauter
- **Scientific Background & Objectives**
  - Establish low q 95 scenario
  - Important for comparison of performance/confinement between similar size machines AUG & DIII-D
  - Bt = -1.8 T and ~ -1.5 T to access low q_{95} ~ 3 at 600 kA. Therefore low B_t is needed.

- **Experimental Strategy/Machine Constraints and essential diagnostic**
- Start with established 1.8 T scenario on AUG
- Establish if the ECRH is possible to use at B_t ~ -1.5 T
- Use ICRH if needed
- Profile and turbulence diagnostics
- This development would contribute to the proposal comparing AUG/DIII-D/TCV tokamaks

III-D like pulse on AUG but at different q95



Proposed pulses

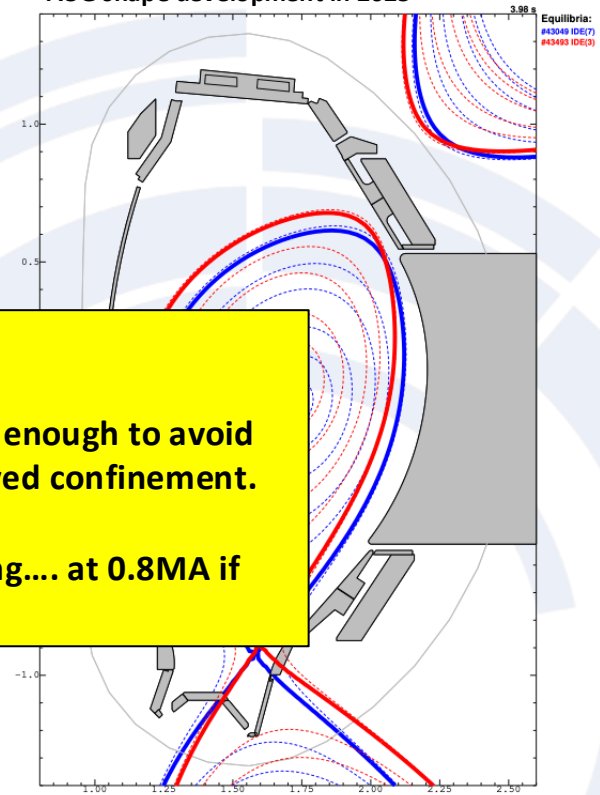
Device	# Pulses/Session	# Development
AUG	7	included
MAST-U		
TCV		
WEST		

AUG: Confinement studies in NT with stronger shaping

- **Proponents and contact person:**
- B Vanovac, O Nelson, O Sauter, J Hobirk, T Pütterich, M Dunne, M Faitsch, P Mantica, A Mariani
- **Scientific Background & Objectives**
- Establish stronger shaping compared to the 2025 NT campaign.
- Possible approach is through shaping ramps
- If achieved, does this stronger shaping has a significant impact c confinement?

- **Experimental Strategy/Machine Constraints and essential diagnostic**
- Start from a 2025 reference
- Perform shaping ramp of the X-point triangularity at fixed upper triangularity
- Apply 'feedback' control on shaping at NBI power steps to prevent hitting the upper PSL due to Shafranov shift

AUG shape development in 2025



Addressing Sci. Obj. 6

Current NT shapes in AUG are enough to avoid H-mode but not to see improved confinement.

So more shaping is worth doing…. at 0.8MA if possible…

Proposed pulses

Device	# Pulses/Session	# Development
AUG	10	included
MAST-U		
TCV		
WEST		

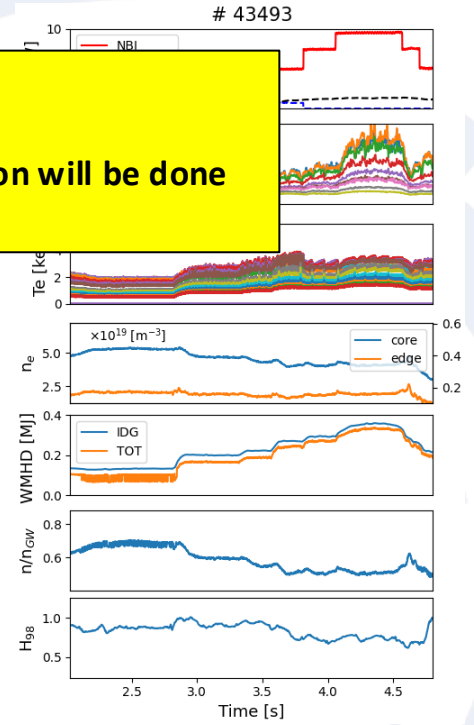
Comparative study of NT performance in TCV, DIII-D and AUG

- **Proponents and contact person:**
- B Vanovac, O Nelson, O Sauter, J Hobirk, T Pütterich, K Thome, M Dunne, M Faitsch, P Mantica, A Mariani
- **Scientific Background & Objectives**
  - Establish the role that wall materials play in ELM-free access and performance in NT scenarios
  - Evaluate an impact that Er formation plays in determining whether NT plasmas enter H-mode
  - Establish the degree of similarity in confinement levels at similar target plasma conditions - if they differ find the reasons
  - Find which triangularity plays a crucial role and if it is machine specific; top, bottom or both
  - Understand if the the dominant turbulence (ITG, TEM, MTM) differ between NT plasmas in DIII-D and AUG
- **Experimental Strategy/Machine Constraints and essential diagnostic**
  - Perform 'identity' experiments in AUG/DIII-D-TCV
  - Systematically vary upper and lower triangularity while fixing elongation and X-point position in TCV and DIII-D (in AUG this is likely not possible)
  - Conduct power scans and vary heating composition (ECRH vs. NBI)
  - Profile and turbulence diagnostics on all machines

Addressing Sci. Obj. 6

It is assumed that the comparison will be done for shapes developed in #012

DIII-D like pulse on AUG but at different q95



Proposed pulses

Device	# Pulses/Session	# Development
AUG	15	included
MAST-U		
TCV	15	included
WEST		

Turbulent Edge/SOL Transport in EDA Regimes

- **Proponents and contact person:**
  - Miriam La Matina (miriam.lamatina@igi.cnr.it)
  - Matteo Agostini
  - Margherita Ugoletti
  - Benoît Labit
  - Michael Griener
  - Mack Van Rossem
  - Pascale Hennequin
  - Sascha Rienäcker

- **Scientific Background & Objectives**

Investigate turbulence activity and transport to identify their key characteristics and unders
shape and stability properties of the pedestal in the EDA regime, specifically detecting and
the edge region, like the QCM using as primary diagnostic the Thermal Helium Beam (THB) diagnostic, together with SPR
diagnostic and DBS diagnostic that will be used to:

  - Characterize the fluctuation activity across the pedestal and the separatrix to better identify/discriminate instability regimes, reconstructing the electron temperature and density fluctuations;
  - Characterize of edge instabilities, including QCM modes;
  - Characterize the SOL filaments;

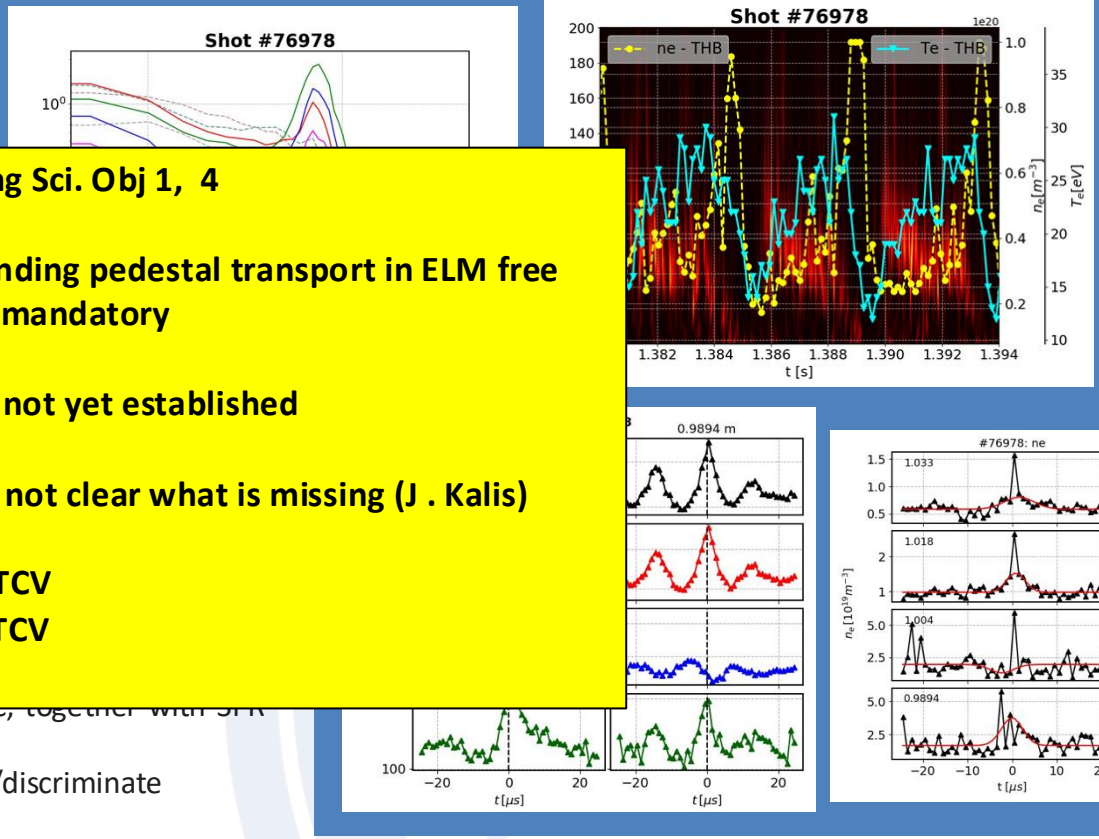
Addressing Sci. Obj 1, 4

Understanding pedestal transport in ELM free regime is mandatory

TCV: EDA not yet established

AUG: It is not clear what is missing (J . Kalis)

PB-2026-TCV
P1-2027-TCV
P2-AUG



- **Experimental Strategy/Machine Constraints and essential diagnostic**

  - Perform parameter scans: heating power, plasma density) (around 4 pulses for each scan)
  - Vary the plasma shape and study its influence on the regime and ELM avoidance (4 pulses)
  - Execute stationary discharges with optimized diagnostic settings for detailed characterization of plasma (4 pulses)

Required non-standard diagnostics: THB, SPR and DBS

Proposed pulses

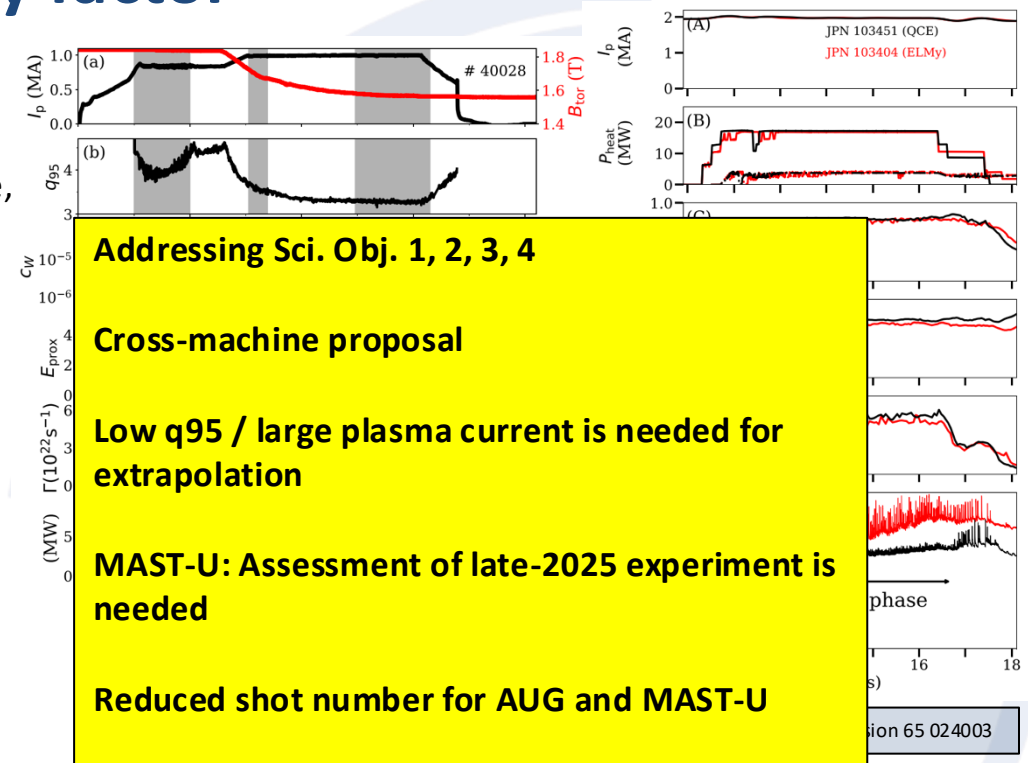
Device	# Pulses/Session	# Development
AUG	15	0
MAST-U		
TCV	20	0
WEST		

QCE exploitation: high current / low safety factor

- **Proponents and contact person:**
  - Michael.Faitsch@ipp.mpg.de, Mike.Dunne@ipp.mpg.de, Andres.Miller@ipp.mpg.de, Benoit.Labit@epfl.ch, samuli.saarelma@ukaea.uk, et al.

- **Scientific Background & Objectives**
  - QCE is well established scenario in AUG, TCV and now JET as of 2022 – has proven difficult to establish at highest currents
  - Evaluating access to regime at high current needed for extrapolation to next-step devices
  - Develop regime in three different devices would allow validation of theoretical and numerical models for global and local stability as well as estimates for increases in particle transport associated with absence of ELMs
  - Test ability to simultaneously achieve high shaping to avoid ELMs and operate in high current

- **Experimental Strategy/Machine Constraints and essential diagnostic**
  - Develop QCE regime by using high shaping while pushing I_P to greater than 1 MA on AUG and MAST-U and to greater than 210 kA on TCV
  - On AUG, develop the QCE in USN to exploit new divertor and new shaping capabilities
  - Main diagnostics are all available edge and divertor diagnostics, e.g. edge/core/divertor TS, lithium beam, thermal helium beam, CXRS, LPs, IR, manometer, bolometer, in-situ Penning gauges; on MAST-U, HSV camera



Addressing Sci. Obj. 1, 2, 3, 4

Cross-machine proposal

Low q95 / large plasma current is needed for extrapolation

MAST-U: Assessment of late-2025 experiment is needed

Reduced shot number for AUG and MAST-U

P1-2026-AUG
P1-2026-MAST-U
P1-2026-TCV
P1-2027-TCV

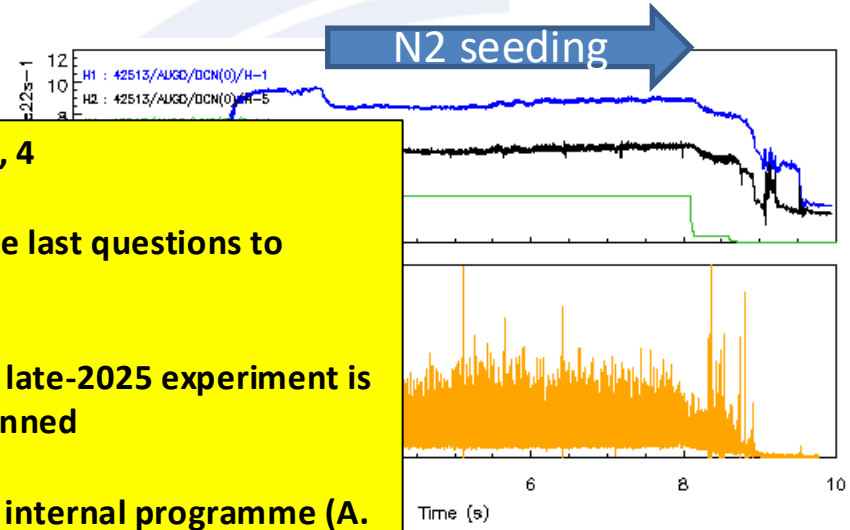
		pment
MAST-U	12	-
TCV	20	-
WEST	-	-

QCE exploitation: seeding and detachment

- **Proponents and contact person:**
  - Michael.Faitsch@ipp.mpg.de, Mike.Dunne@ipp.mpg.de, Benoit.Lab samuli.saarelma@ukaea.uk, et al.

- **Scientific Background & Objectives**
  - Despite the high separatrix density and broad powe length, the divertor is not naturally detached in QCE
  - Dedicated seeding and detachment studies:
  - Nitrogen seeding to
    - characterize QCE access under seeded conditions (Zeff dependence of coll. vs ideal ball
    - document filament behavior under seeding and buffering fractions

- **Experimental Strategy/Machine Constrai essential diagnostic**
  - Use a robust QCE scenario and add seeding (N2 (AUG, TCV & MAST-U); Ar an (AUG)
  - Main diagnostics are ELM/filament monitors, LPs to characterize divertor impact, all edge fluctuation measurements, bolometers



Addressing Sci. Obj. 1, 2, 4

Detachment is one of the last questions to answer for QCE

MAST-U: Assessment of late-2025 experiment is needed, if seeding is planned

TCV: Similar proposal in internal programme (A. Stagni) in late 2025 – Coordination

TCV: Extension to Ar?

P1-2026-AUG
P1-2026-MAST-U
P1-2026-TCV
P1-2027-TCV

	ession	# Development
AUG	12	-
MAST-U	8	-
TCV	20	-
WEST	-	-

I-mode detachment: access and operational window with Ar and Kr

- **Proponents and contact person*:**
  - Daniel Fajardo*
  - Davide Silvagni
  - Clemente Angioni
  - Luis Gil
  - Ondrej Grover
  - *et al…*

Addressing Sci. Obj. 3

Detachment was an issue of I-mode in the past

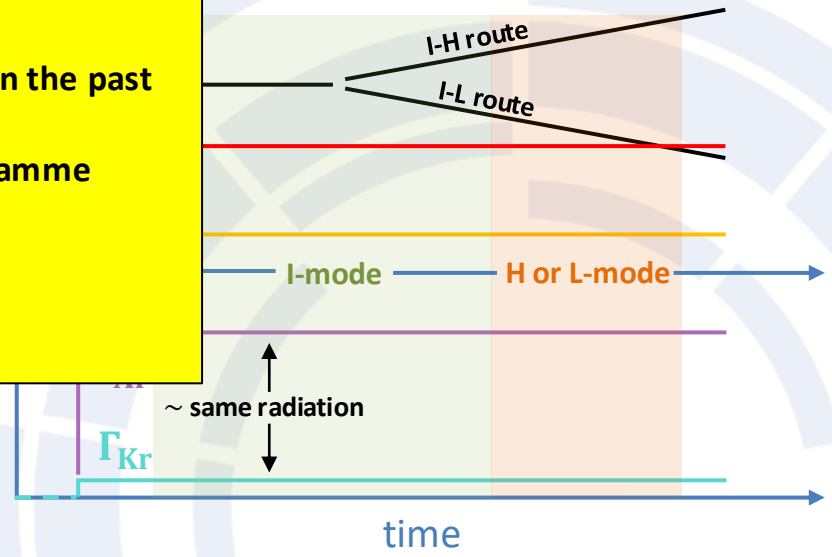
Nice progress made in internal programme

Clear proposal

P1-2027-AUG

- **Scientific Background & Objectives**
  - Background: experiments during the 2025 AUG
    detached scenario at high heating power and l
    suspected to be in the I-mode regime
  - Objectives:
    - Map the operational window of the detached Ar-seeded I-mode
    - Establish a detached Kr-seeded I-mode (same radiation at lower Zeff/dilution)
    - Map the operational window of the detached Kr-seeded I-mode

- **Experimental Strategy/Machine Constraints and essential diagnostic**
  - Starting from reference AUG #42734, perform NBI power ramps until I-mode is lost (ramp up until I-H transition, down until I-L transition)
  - Change Ar to Kr, adjusting the seeding rate for a similar radiated power. Once Kr scenario is established, perform similar power ramps as with Ar
  - Diagnostics:
    - Detachment: Langmuir probes, infrared cameras
    - Weakly coherent mode: reflectometer, CECE, thermal He beam
    - Confinement regime: edge Er (Doppler reflectometer), edge CXRS



Proposed pulses

Device	# Pulses/Session	# Development
AUG	10	2
MAST-U	-	-
TCV	-	-
WEST	-	-

QCE exploitation: disentangle role of shaping parameters on regime access

Contact person: Andrés Miller (andres.mill

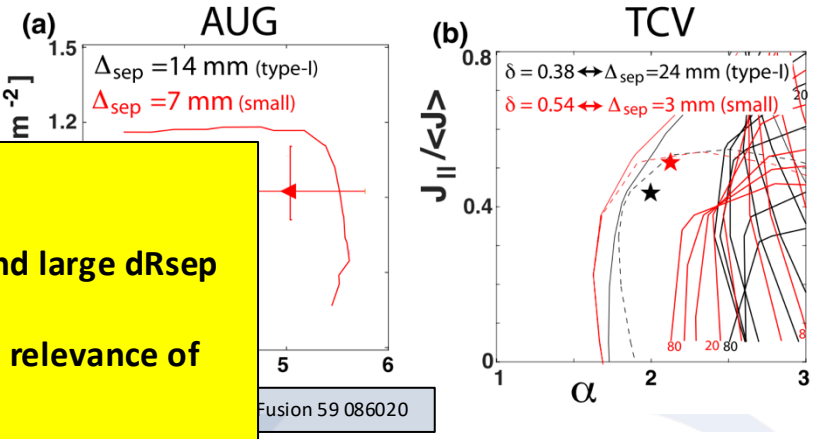
Co-proponents: Michael Dunne (mike.dunne@ipp.mpg.de), Ber
Michael Faitsch (michael.faitsch@ipp.mpg.de), Jörg Hobirk (jorg
Giannone (louis.giannone@ipp.mpg.de)

Addressing Sci. Obj. 1,3, 4

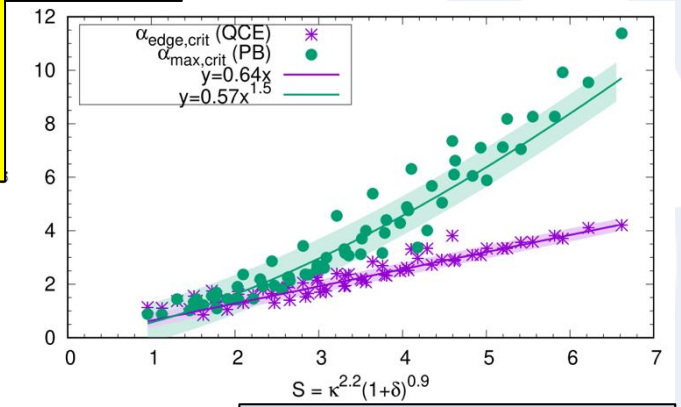
ITER will operate at high kappa and large dRsep

Will be a nice confirmation of the relevance of the shaping parameter Sd

P1-2026-AUG
P1-2026-TCV
P1-2027-TCV



Fusion 59 086020



M. Dunne et al 2024 Nucl. Fusion 64 124003

• Scientific Background & Objectives

- Attractive alternative to the Type-I ELMy H-mode – high performance
- The regime has now been robustly established on AUG, shaping and high n_{sep} – impact of different shaping par

Goal: Disentangle impact of δ and κ from dR_{sep} in access to QCE

- On both AUG and TCV, scan shaping parameters at different values of dR_{sep} to identify QCE regime access condition
- Study impact of different shaping parameters on stability to PBMs and KBMs and compare this with IPED modeling (MISHKA/HELENA)
- Evaluate impact of shaping parameters on pedestal structure and performance

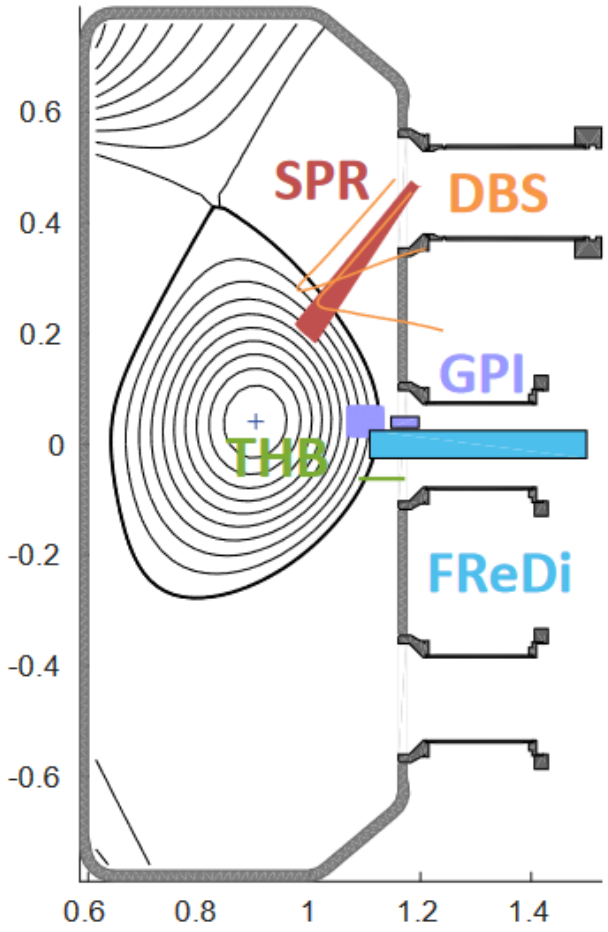
• Experimental Strategy/Machine Constraints and essential diagnostic

- Low I_P scenarios and new machine capabilities to allow for flexibility in varying shaping parameters independently (not possible until recently)
- Dedicated scans in δ and κ at different values of dR_{sep} on both AUG and TCV
- Main diagnostics are magnetics, ELM/filament monitors, Thomson scattering, and edge fluctuation measurements are desired

Proposed pulses

Device	# Pulses/Session	# Development
AUG	10	-
MAST-U	-	-
TCV	10	5
WEST	-	-

Edge turbulence characterization in Type I ELMy H-mode, QCE and mixed regimes



Proposed pulses

Device	# Pulses/Session	# Development
TCV	18	5

Proponents and contact perso

- Alysée Khan (alysee.khan@epfl.ch)
- Olivier Février (olivier.fevrier@epfl.ch
- Christian Theiler (christian.theiler@ep

Addressing Sci. Obj. 1, 4

Continuation of ongoing effort to understand turbulent transport in pedestal and SOL for QCE

The new probe will allow Ti measurements (among others)

P1-2026-TCV
P1-2027-TCV

Scientific Background & Objec

- **Type-I ELMy H-mode** and **quasi-continuou** different pedestal turbulence, with transiti instabilities

- **Fuelling** and **triangularity** strongly affect the nature of the turbulence, yet this dependence remains poorly understood despite its close link to heat and particle loads on plasma-facing components

➢ **The objective is to characterize the pedestal turbulence in Type-I ELMy H-mode, QCE, and mixed regimes.**

Experimental Strategy and essential diagnostics

- **Parameter scan** at two fueling levels and three triangularities in Upper Single Null configuration (18 shots, 5 for development)
- **Multi-diagnostic approach** for pedestal turbulence characterization: GPI, SPR, DBS, THB, FReDi
- **Stability analysis** of peeling and peeling–ballooning modes

Detached high-power L-Mode negative-triangularity reactor relevant scenarios

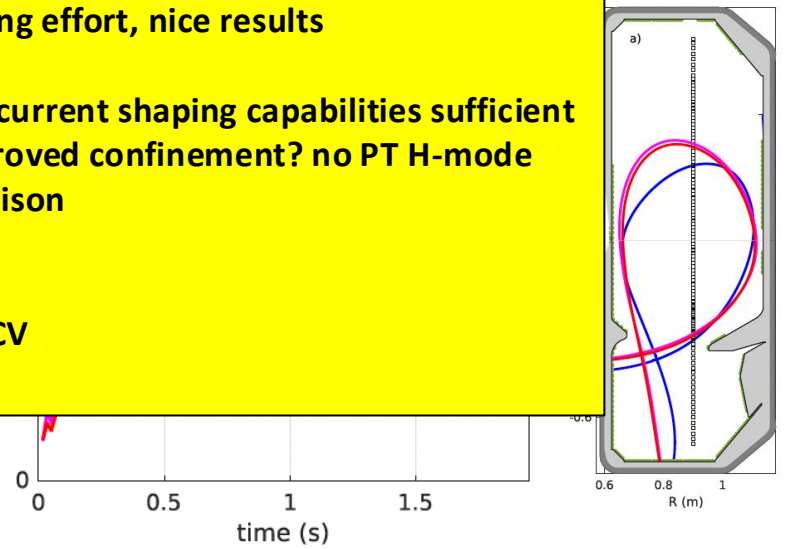
- **Proponents and contact person:**
  - Garance Durr-Legoupil-Nicoud garance.durr-legoupil-nicoud@epfl.ch
  - O. Février, J. Morales, S. Coda, O. Sauter, H. Reimerdes, C. Theiler

Addressing Sci. Obj. 6

TCV: ongoing effort, nice results

WEST: are current shaping capabilities sufficient to see improved confinement? no PT H-mode for comparison

P1-2026-TCV
P2-WEST



Scientific Background & Objectives

Negative triangularity (NT) may bring H-mode grade confinement in L-Mode operation, n it an attractive solution for a reactor.

This proposal aims to pursue the investigation and characterization of NBH-heated NT scenario, i particular from the point of view of core-edge integration (operation with a detached divertor)

→ Continue, in TCV, developing a high-power NT L-mode scenario which power-exhaust compatible an reactor relevant
  - ➢ Extend heating scheme to ECRH, pushing triangularity to stronger values (avoid H-Mode)
  - ➢ Use rt-beta control to maintain high β_N

→ Perform detachment studies in these scenarios using N_2 injection at various levels of power. Assess the achievement of X-Point Radiator Regime. Investigate the nitrogen penetration in the core and thus core-edge compatibility (effect of detachment on confinement). In a second phase, other impurities could be attempted.

Can a fully detached NT L-mode matching H-mode PT performances be obtained on TCV *[Durr-Legoupil-Nicoud'EPS25, Février'IAEA25]*? On WEST ?

Experimental Strategy/Machine Constraints and essential diagnostic

- TCV
  - → N_2 seeding ramps with NBI and ECRH (X3) in NT plasma: multiple input power levels, N_2 seeding at different rates
  - → Essential diagnostics: edge diagnostics (IR,LP,etc) and CXRS
- WEST
  - → NT scenario, ECRH/LHCD/ICRH

Proposed pulses

Device	# Pulses/Session	# Development
AUG		
MAST-U		
TCV	20	20
WEST	15	5

Development of stationary QH-mode with co-current beams

- **Proponents and contact person:**
  E. Viezzer eviezzer@us.es, S. Saarelma, E. R. Solano, J. Hobirk
  R. Ernst, L. Gil, P. Cano Megias, A. Pau, A Cathey

- **Scientific Background & Objectives**
  - Future fusion devices need to avoid high confinement c
    no-ELM regimes are considered as alternative
  - **Demonstrate compatibility of stationary QH-mode**
  - **Establish stationary QH-mode, low ν_{ped}***
    - Characterize parameter dependencies of QH-mode
    - Analyze pedestal structure and stability and compar
    - Quantify effect of rotation on EHO
    - Study role of q_{95} for accessing sustained QH-mode
    - Study impact of edge ECCD on EHO and ELMs
    - Test and further develop models for EHO

- **Experimental Strategy/Machine Constraints &**

  AUG: co-Ip NBI
  - Low collisionality USN scenario, high δ with cryo-pump
    boronization essential. Develop USN, DN, LSN flips.
  - Subset of pulses with edge ECRH at 105 GHz to drive edge ECCD (#41229, #41231). Scan in edge rotation (tangential vs. radial beams, MPs, NBI vs wave heating)
  - Explore changes between LSN and USN to decrease density, RMP during L-mode?

  MAST-U:
  - High temperature pedestal reference scenario (#49360), use new cryopump. Fresh boronization essential.
  - Change plasma rotation using RMP coils.
  - At best I_p value, B_t scan. Gas scan.

  Common to both:
  - Scan in heating power, q95 via I_p scan, outer gap.
  - Profile and fluctuation diagnostics essential to characterize QH-mode pedestal and EHO

Addressing Sci. Obj. 1, 3, 4

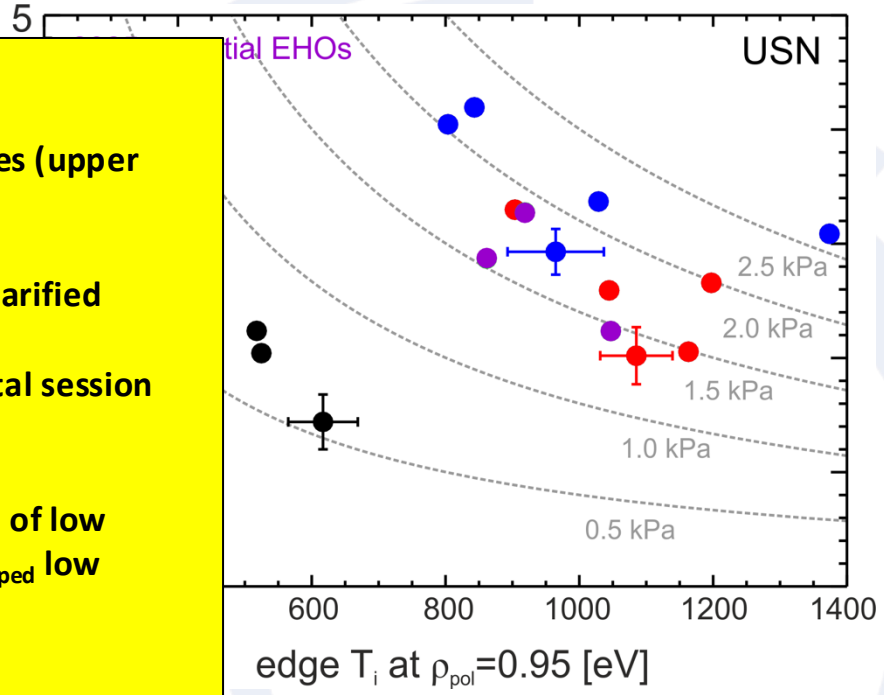
AUG:Issues with machine capabilities (upper cryo) in 2025 are acknowledged.

AUG: Experimental strategy to be clarified

MAST-U: Assessment of experimental session later this year to be done

Will help understanding the physics of low collisionality pedestals even if at $f_{G,ped}$ low compared to ITER

P1-2027-AUG
P1-2026-MAST-U



d pulses

Device	# Pulses/Session	# Development
AUG	30 pulses	15
MAST-U	8 pulses/1 session	8 pulses 2025
TCV		
WEST		

EDA H-mode development in AUG and TCV

- **Proponents and contact person:**

L. Gil (luis.gil@tecnico.ulisboa.pt), B. Labit, M. Vaz, M. Faitsch, O. Sauter,

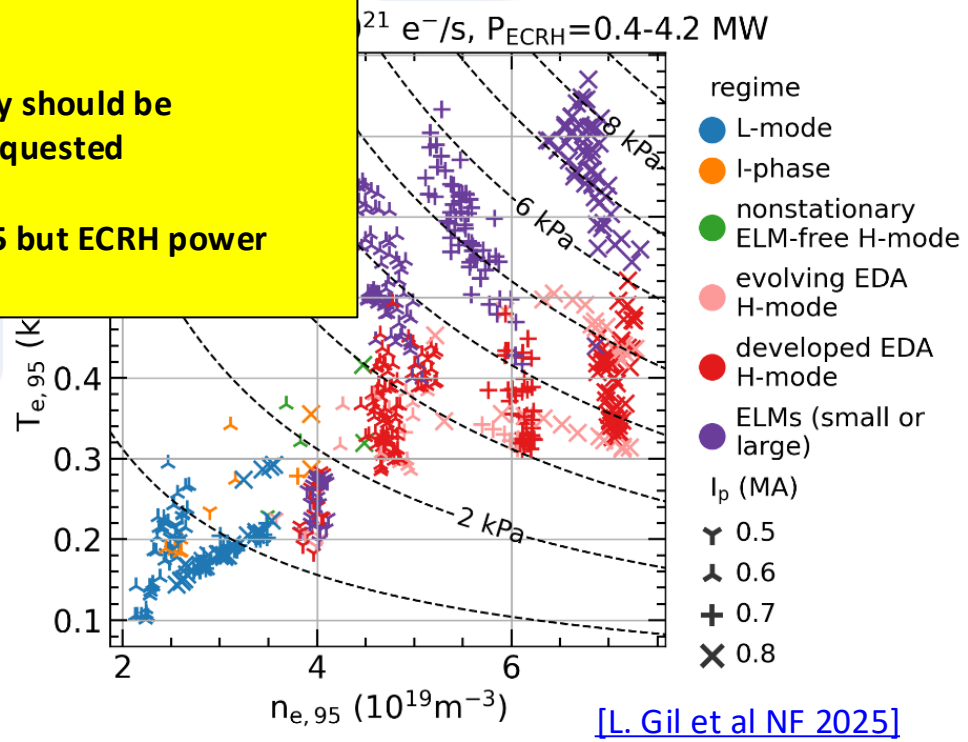
- **Scientific Background & Objectives**
  - EDA H-mode: promising no-ELM regime in several devices, but cr
  - Main AUG objectives:
    - Develop similar EDA scenarios at different magnetic field
    - Understand effect of B_t/ρ^* on EDA access, dynamics, and performance
  - Main TCV objectives:
    - Achieve and explore unequivocal EDA H-modes in TCV for the first time
    - Understand effect of shaping on EDA access, dynamics, and performance
  - Cross-machine objectives:
    - Bridge EDA experiments between devices of different size (incl. JET)
    - Build a unified understanding of EDA H-mode physics

- **Experimental Strategy/Machine Constraints and essential diagnostic**
  - AUG:
    - High δ, ICRH+NBI power ramps at different B_t
    - Vary I_p, fueling, … to match (non-)normalized parameters (e.g. q_{95}, $n_{e,sep}$, …)
    - Stationary discharges for detailed characterization
  - TCV:
    - High δ discharges predominantly heated by ECRH (X3)
    - If regime is found - parameter scans (incl. shape)
    - Stationary discharges for detailed characterization

Addressing Sci. Obj. 3

AUG: experimental strategy should be prioritized with 10 shots requested

TCV: was accepted for 2025 but ECRH power was missing



[L. Gil et al NF 2025]

Proposed pulses

Device	# Pulses/Session	# Development
AUG	10	
TCV	10 pulses + 40 if regime is found	