

# **TSVV 10 update and needs**

### **Alexey Mishchenko for TSVV10**

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# Mitigation of ICRH AE losses using NBI in ASDEX

- WPTE RT10 ; M12 proposal: AE Control NBI
- Counter ECCD with TAEs unstable for the whole discharge flattop
- <4 MW ICRF and <5 MW NBI; FILD, ICE, MSE
- Monitor EP distribution function (FILD, ICE, NPA, FIDA)
  - MODELING

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EXPERIMENT

- ICRH distribution function modeling (EPFL)
- NBI distribution function modeling (Rabbit)
- LIGKA/ORB5/MEGA simulations of AEs using numerical EP distribution functions

24<sup>th</sup> September 2021

# Studies of energetic 3He ions in 3-ion ICRF

#### EXPERIMENT

- WPTE RT10 ; M12 proposal: energetic 3He
- CX measurements of energetic 3He

#### MODELING

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- 3He distribution function modeling (EPFL Scenic)
- 3-ion ORB5 simulations

24<sup>th</sup> September 2021

Thrust'3 meeting (A. Mishchenko for TSVV10)

EUROfusion

### Impact of 3He EP and AEs on plasma transport

#### EXPERIMENT

- WPTE RT10 ; M12 proposal: AUG 3-ion on-axis
- Study discharges with strong electron heating (by 3He EP)

#### MODELING

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- ETS-LIGKA/critical-gradient modeling using NAT AUG-benchmark parameters
- ETS-LIGKA/critical-gradient modeling using ASDEX-U 3He (?)

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# Effect of neoclassical tearing modes on NBI fast ions

• WPTE RT11 ; M12 proposal: NTM FI

#### EXPERIMENT

- Create low density plasmas with large (3,2) or (2,1) NTMs, at the same time optimised for fast-ion measurements in the plasma core
- Observe and document the NTM-induced transport of fast-ions in real- and velocity-space: ASDEX-Upgrade (NBI, ICRH, ECRH); 6 pulses

#### MODELING

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- ORB5: gyrokinetic Alfven Eigenmodes in presence of static island
- ORB5: tearing mode evolution (simplified geometry); in presence of fast ions
- Similar problems in W7-X (MHD modes in presence of islands)

# EP confinement in tokamaks with external 3D fields

• WPTE RT11 ; M12 proposal: EP RMP control

EXPERIMENT

- Measure EP losses in presence of RMP (single-particle motion): FILD, FIDA
- Evaluate scaling of the losses with RMP amplitude

MODELING

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- Effect on self-consistent (AE) fields?
- ORB5: use antenna to model RMP
- ORB5: AEs and EP transport with antenna-RMP

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# AE control in tokamak by shaping

- WPTE RT11 ; M12 proposal: AE control shaping
  EXPERIMENT
- Measure AEs in TSVV varying upper and lower triangularity
- Measure EP confinement in TCV varying upper and lower triangularity

#### MODELING

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• ORB5: TCV AE-EP simulations for varying shaping





# EP physics in stellarators

#### EXPERIMENT

- W7-X: ICRH/NBI (power not enough for strong EP); AEs driven by bulk plasma
- TJ-II: more NBI power, interesting results (chirping in heavy-ion probe)
- HELIAS: several versions of conceptual design, issues with equilibrium quality

#### MODELING

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- For W7-X: better ICHR or ICRH+NBI distribution functions required (SCENIC)
- TJ-II: CKA-EUTERPE simulations of chirping events running
- HELIAS: CKA-EUTERPE simulations of AEs and EPs planned

24<sup>th</sup> September 2021

### EP physics in JET, JT60-SA, ITER

#### **EXPERIMENT**

- JET: DT campaign ongoing
- JT60-SA: assembly
- ITER: assembly

MODELING

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- JET: calculations for after-glow experiments possible
- JT60-SA: LIGKA calculations; ORB5?
- ITER: work within EP ITPA (LIGKA, ORB5)

24<sup>th</sup> September 2021