



## Proposals for the TCV experimental campaigns 2006-2007

Fast ions on TCV  
(theme 7, physics of ECH and ECCD dominated plasmas)

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# Fast ion detection (4 sessions)

## Specific goals

- Further discrimination experiments to ensure that the measurements of the CNPA are due to ions (and not light or X-rays).
- Optimization of the suppression of the parasitic signals with improved shielding.

## Background and motivation

- To date the CNPA can only be operated in regimes without strong X-ray emission, the latter is strongly affecting the CNPA channeltrons.

## Experimental strategy

- Low density discharges to generate strong hard X-ray radiation (due to runaways).
- Injection of deuterons with the DNBI in deuterium and hydrogen plasmas.
- Comparison to measurements with neutron detector.

## Experimental requirements

- Completion of the CNPA shielding (planned at the beginning of 2006).
- CXRS/DNBI,  $Z_0=0$  for CNPA, 5-ch.NPA, TS, ECE, MPX, XTOMO, Hard-X, NEUT.
- Hydrogen and deuterium plasmas.
- The part involving ECCD/ECH discharges can be carried out parasitically with the mission "Assessment of the anomalous energy transfer from electrons to ions".



# Relaxation of DNBI deposited fast particles revisited

## Specific goals

- Complete the study of the relaxation of DNBI deposited particles (AK EPS 2002).

## Background and motivation

- Extend the experiments carried out with vertical NPA before the upgrade of DNBI.
- Operate in hydrogen and deuterium plasmas (observation of the relaxation process of both species separately).
- Achieve active (CNPA) and passive (NPA) measurements.

## Experimental strategy

- Cross check NPA and CNPA with suppression of one species in the vertical NPA (needs some recabling and work of the electronics department).
- The beam energy must be stable (after maintenance) and pulse duration long enough.
- Can be probably carried out parasitically

## Experimental requirements

- CXRS/DNBI, CNPA, 5-ch.NPA, TS
- Hydrogen and deuterium plasmas



# Assessment of the anomalous energy transfer from electrons to ions

## Specific goals

- Study of anomalous ion heating in regimes with ECH and ECCD.
- Identification of the mechanism of the momentum and energy transfer from electrons to ions.
- Study mass effect of the process by operating in hydrogen and deuterium plasmas.
- This mission is divided into three parts, depending on the availability of new diagnostics.

## Background and motivation

- Continuation of "Study of non-Maxwellian effects in ion energy distribution (with ECH, ECCD)".
- Completion of experimental database (HXR, NPA, TS, X2-ang, ECE, MPX)
- Explain experimental results with theory (based on Coppi, completed for TCV scenarios, evidence in correlations of  $E_{\parallel}$ ,  $W_s/W_t$ , tails,  $n_e$ ,  $J_{\parallel}$ ).

## Experimental strategy

- short term
  - ▷ Continuation of eITB scenarios, with/without inductive current, similar  $n_e$  and  $T_e$ , pos./neg.  $V_{\text{loop}}$ , changing barrier without perturbation of distribution function.
  - ▷ Achieve various  $V_{\text{loop}}$  in order to span  $E_{\parallel}/E_D$  (distortion of  $f_{e\parallel}$ ).

- middle term
  - ▷ Monitoring of the r.f. spectrum of e.m. radiation to verify the onset of toroidal modes close to  $\omega_{pi}$  with the antenna to be installed by AP and LC.
  - ▷ Electron distribution functions could be obtained from modeling (CQL3D, new post-doc in spring).
  - ▷ Study the mass dependence of the anomalous energy transfer from electrons to ions (operation in hydrogen and deuterium plasmas)
- long term
  - ▷ Experimental evidence of electron distribution functions measured with the new hard X-ray cameras
  - ▷ Exploring the regimes from slide-away to run-away, characterize the dependence of  $T_i/T_e$  on the regime, etc.

#### Experimental requirements

- $Z_0=0$  for CNPA, 5-ch.NPA, TS, ECE, MPX, MHD, XTOMO, HXR, 2-X2 (up to 1MW) from central ports for on-axis ECH-ECCD, up to 3MW of the total X2 power, probably  $B_T > 1.47$  T, neutron monitor

#### Other remarks

- Linked to "Physics of suprathermal electrons" and "Suprathermal transport in eITBs"
- Further dedicated series of experiments could be proposed during the campaign, depending on the progress and obtained results.