Physique et physicochimie des Plasmas excites par radio-frequence

Jean-Paul Booth

Laboratoire de Physique des Plasmas
CNRS/Ecole Polytechnique
Palaiseau
France

Journees Plasma-PV Perpignan 7-8 nov 2010

Competences et moyens

- Sources plasma au LPP
  - CCP (incl. VHF -> 200 MHz, jusqu'a 50cm diametre) – uniformite,
  - ICP
  - Helicon
  - Gaz reactifs: H_2, SiH_4, Cl_2, CF_4 SF_6 etc

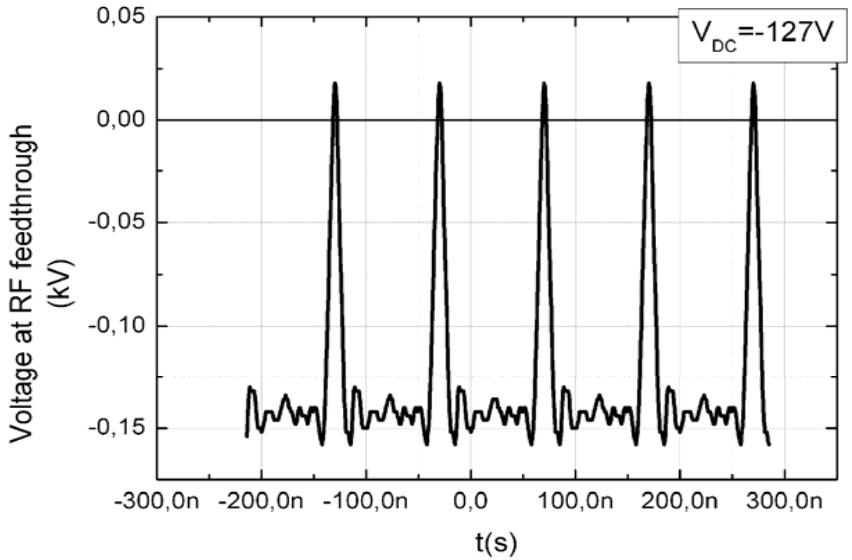
- Diagnostics plasma:
  - Sonde de Langmuir, de flux ionique
  - Micro-onde: resonateur "hairpin"$\rightarrow n_e$
  - Analyseur d'energie des ions, QMS

- Diagnostics plasmas reactifs
  - TALIF -atomes H, O, Cl etc
  - Absorption UV -radicaux SiHx, CFx etc
  - CRDS
  - Photodetachment -ions negatifs

- Modelisation et theorie
  - Fluide/Monte Carlo
  - PIC (avec LAPLACE)

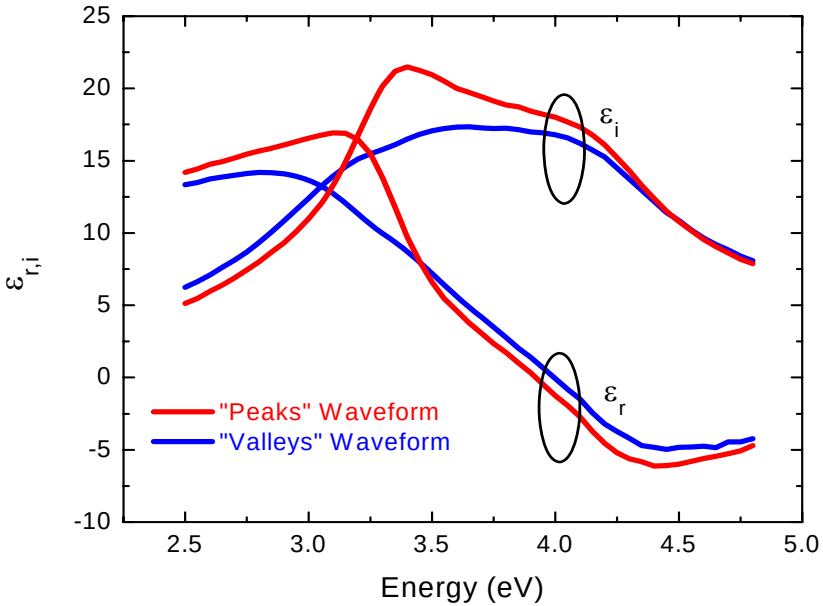
Trapezoidally-excited plasmas

- Break the symmetry of the sheaths in CCP
  - Use non-sinusoidal waveforms
  - Increase μ-c Si deposition rate without increasing ion energy at the substrate



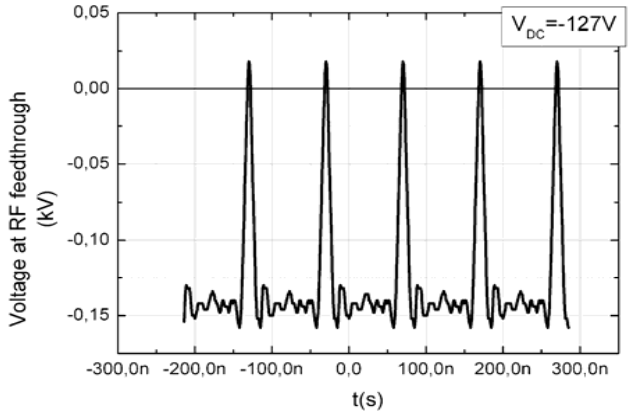
- Projets avec Erik Johnson (PICM):
  - STEP-UP (CNRS PIE)
  - CANASTA (ANR Habisol)

Control of Thin Film Characteristics through TVW

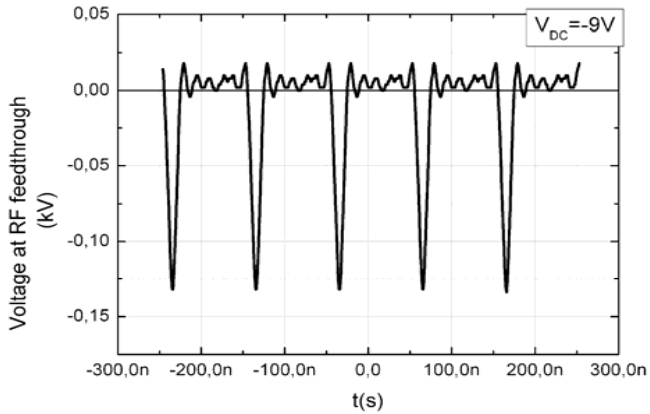


μ-crystalline film only possible with peaks waveform

Not possible with either Valleys X or sinusoidal X waveforms



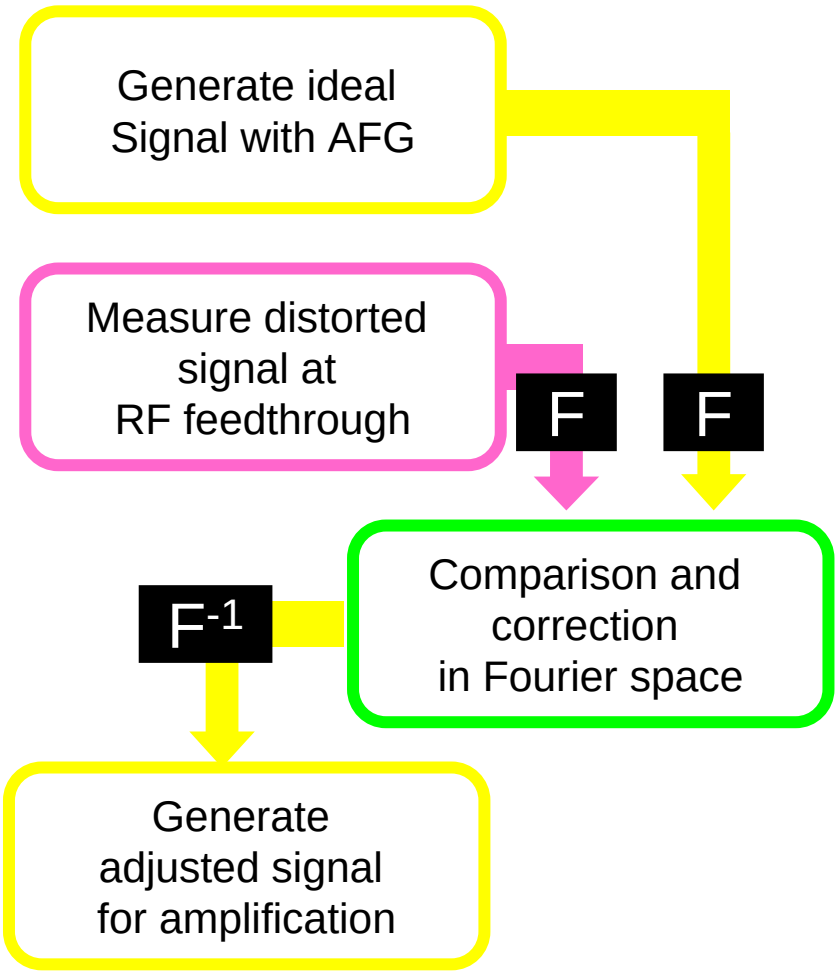
« Peaks »

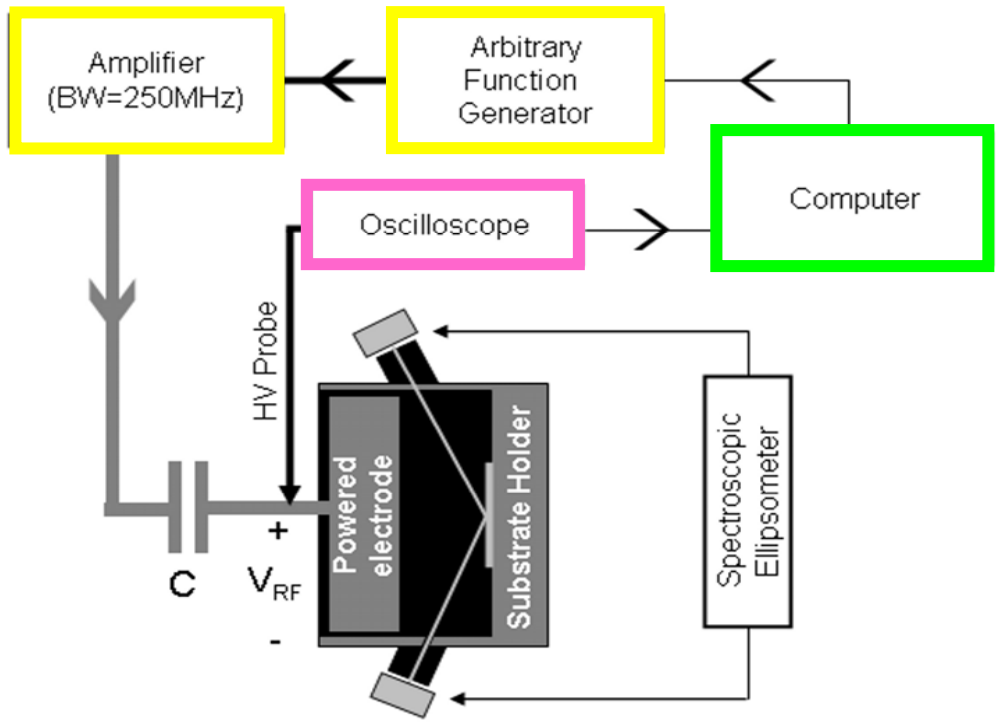


« Valleys »

Waveform generation

Correct for amplifier distorsion:
(Patterson et al, PSST 16 (2007) 257





N.B. Coupling C, but no matching network used