Ex 1.1.7/2.2.1/2.2.2 /Modeling Needs

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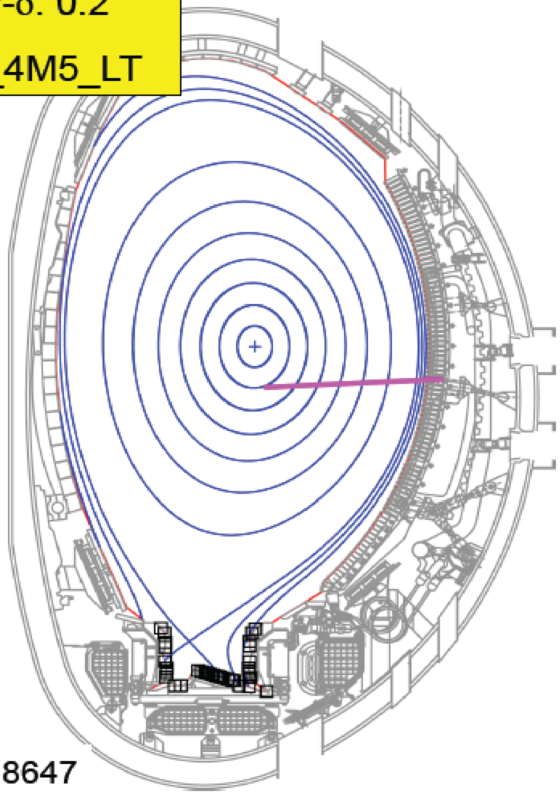
Introduction

- Experiments Ex 1.1.7, 2.2.1,2.2.2 -...... Ex 3.1.2 ....
  - Tungsten Transport
  - Divertor Erosion
  - Impuritiy Composition and Control
  - Detachment
- Understand
  - Tungsten transport
  - Tungsten sources
  - Impurities
  - Plasma Parameters

Main plasma shapes

Low-δ: 0.2

VHi5_4M5_LT

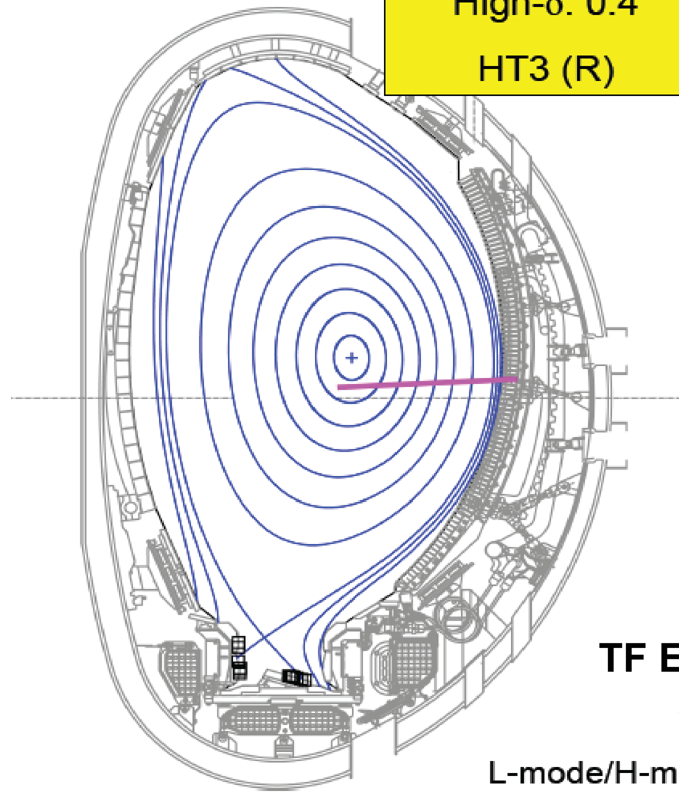


L-mode: 78647

H-mode:73569

High-δ: 0.4

HT3 (R)



M. Groth,
TF E1/E2 meeting
31.3.2011

L-mode/H-mode:

76666

- **Strike point sweeps (± 2cm) are needed in all discharges to get good profiles from Langmuir probe and W influx measurements**

R.Dux

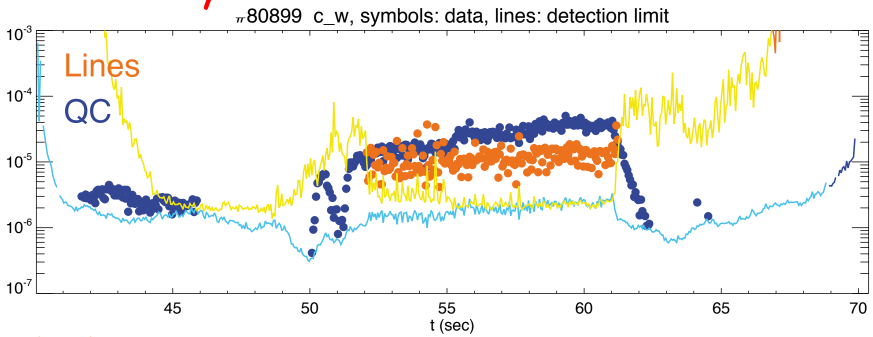
Ex 1.1.7

Tungsten

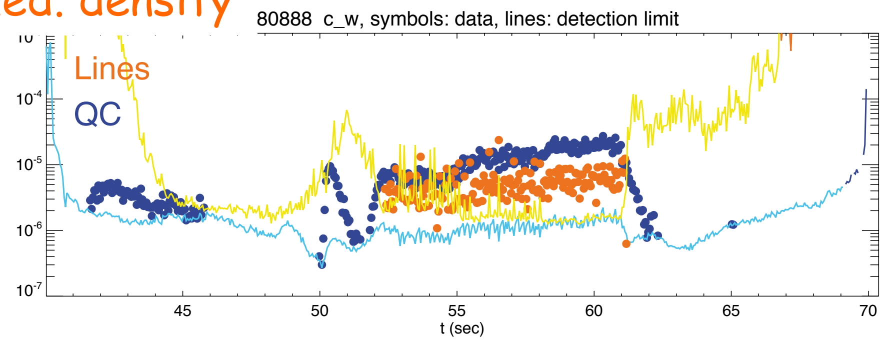
VUV emissions

80895,80889,80895

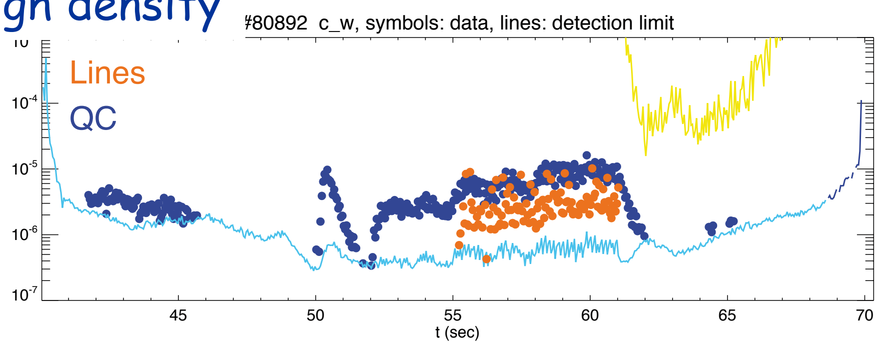
Low density

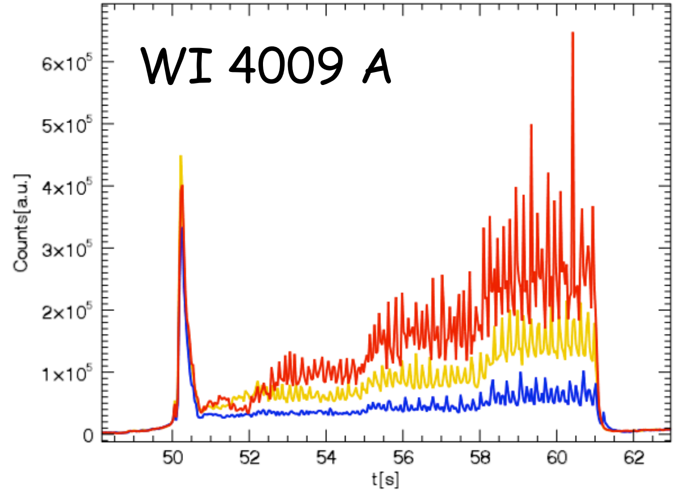


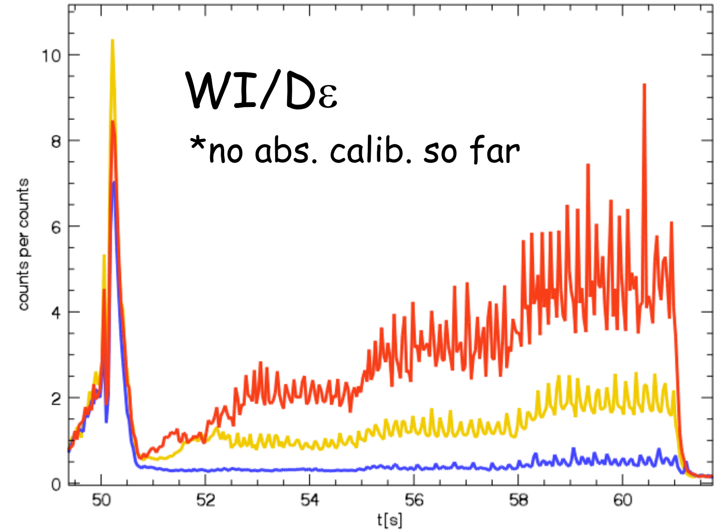
Med. density



High density



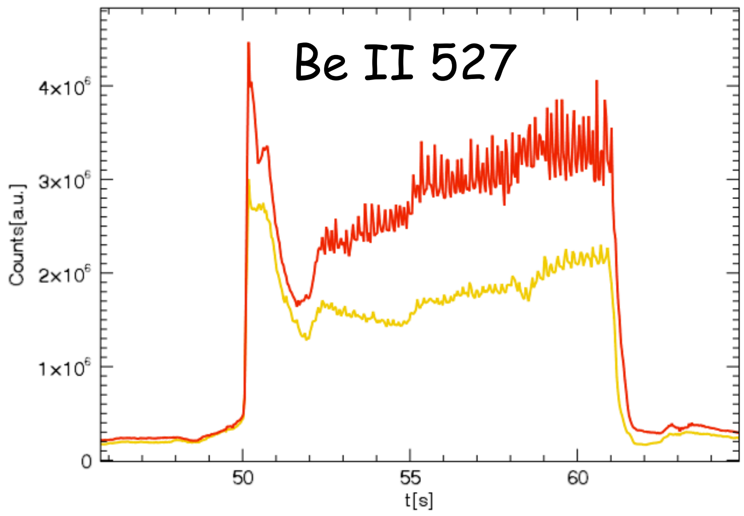


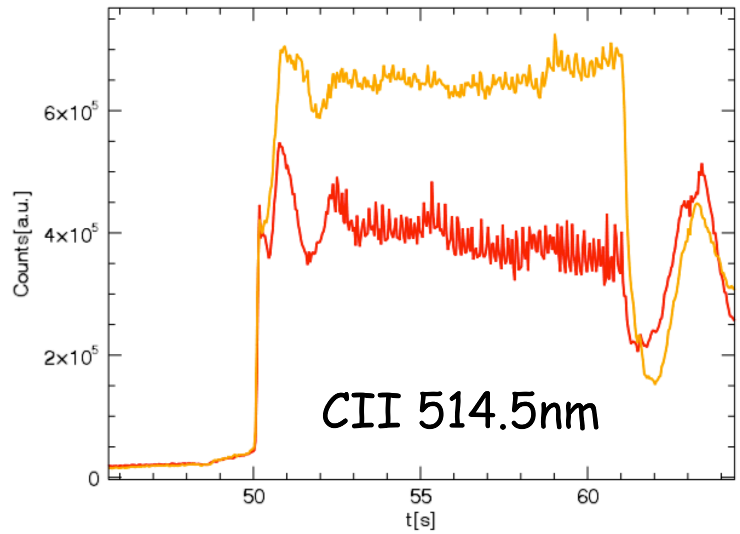


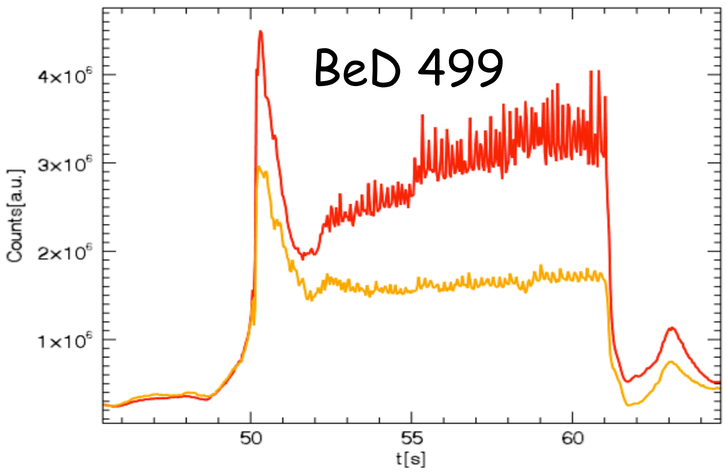
V_Hi5_Ref1: 2.5 MA / 2.5 T

Impurities

80845,80843







Beryllium,(Carbon) are the main intrinsic impurities

Oxygen almost invisible ...
Argon visible mainly in the inner Div.

Modelling for Experiment 2.2.2

- Experiment 2.2.2 is on W screening, peaking and control
- Modelling of the W screening is my main interest.
- W screening: What is the W density at the edge of the confined plasma (inside the pedestal) for a certain rate of sputtered W atoms in the divertor?
- Depends on / Modelling has to capture
  - prompt re-deposition of W
  - parallel transport in the SOL (friction force, temperature gradient forces)
  - perpendicular transport in SOL
  - perpendicular transport in the edge transport barrier up to the pedestal top (ELMs flush out W, neoclassical impurity transport inbetween ELMs causes strong peaking of W across the pedestal region, ELM frequency can be taken from experiment)
  - W production in divertor (strong variation in time; most W production during ELMs). Modelled W erosion does not have to fit experiment in absolute numbers
    but time behaviour has to fit.
  - Screening can only be understood by modelling the whole ELM cycle

R.Dux

Additional Needs for Ex 2.2.1 / 1.1.7

- Experiment 1.1.7 is on W erosion / Experiment 2.2.1 is on Impurity composition & control
- Modelling of the W erosion – deposition mechanisms are main focus
- Depends on / Modelling has to capture
  - prompt re-deposition of W
  - Divertor impurity composition and transport
  - Erosion mechanisms (extrinsic , intrinsic Imp., ELMs,)
  - Combining Background Plasma Solution and Divertor Simulations
    - Ex 3.1.2 uses similar plasmas to study Detachment

Combining efforts towards modling

Available Measurements

W, ne, Te:

- total W divertor source rate from complete emissivity profiles of WI lines
- W density inside pedestal top from quasi-continuum around 5nm (T_e ~ 1.5 keV)
- Measurement of a WII line for estimate of prompt re-deposition
- Divertor parameters from Langmuir probes
- Te, ne profiles in the edge transport barrier

for different discharge conditions in order to separate SOL transport from transport across ETB

Strategy for W Transport (Ex 2.2.2):

- W density profile in ETB can not be measured and we can only indirectly separate SOL transport from transport across ETB
- in 0th order impurity transport in ETB is governed by ELM frequency
- differences of low and high δ shape wrt ETB transport and ELM stability shall be investigated to get same ELM frequency at different heating/fuelling levels
- comparison to L-mode plasmas at same shape

R.Dux

Tools / Issues

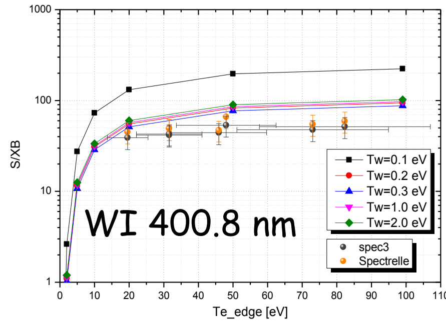
- Main Plasma
  - Edge2D/EIRENE ?
- Divertor
  - DIVIMP ?

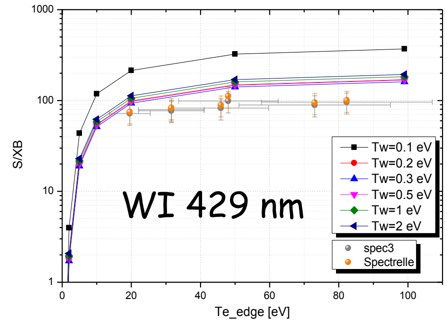
Adapt solutions for HT3R
Calibrated c_W for W-Transport studies

Check all impurties are incorporated appropriately (Be, O, C, Ar, N,..)

Spectral/Atomic Data

Erosion Yields , S/XB Values , Abs. Calibrations...





Main Issue:

Manpower ??

Summary

- Modeling needs include Plasma solutions for V_Hi5_... and HT3(R)
- Main Plama and Divertor Modeling

- Measurements include
  - W source and core / pedestal emissions
  - Plasma Parameters
    - *Pedestal / Core*
    - *Langmuir Probes*

- Modeling needs to be coordinated with all Experiments utilizing similar plasmas

Ex 2.2.2 Ex 3.1.2 Ex 1.1.7 ......