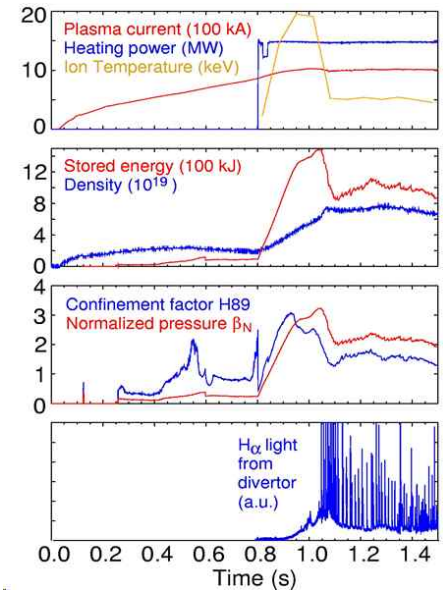
# Fusion Reactor Engineering 1 (459.760)

**Midterm Examination**

**23 April, 2014**

1. (1) (20 points) Discuss details of the discharge shown below in terms of confinement and stability.




(2) (10 points) Calculate the energy confinement time at 1.05 s of this discharge by neglecting the Ohmic heating and the radiation power.

(3) (10 points) What is the maximum Greenwald density fraction in this discharge? Note that the plasma minor radius is 0.5 m

(4) (20 points) Design your own tokamak operation scenario. Show time evolution of main tokamak variables in the designed scenario and discuss them.

2. (10 points) Discuss how to increase plasma beta in a tokamak.

3. Answer the following questions.

(1) (10 points) What are the limitations of H-modes if considering them as a reference operation mode in fusion reactors?

(2) (10 points) Discuss characteristics of hybrid modes in view of overcoming the limitations of H-modes.

(3) (10 points) Why is the Kadomtsev model not proper to explain sawtooth activity observed in experiments?

"Though the mountains be shaken and the hills be removed, yet my unfailing love for you will not be shaken nor my covenant of peace be removed," says the LORD, who has compassion on you." (Isaiah 54:10)