

HITACHI



Internship Experience

Kilian Stenning

About me...

- Final year M.Eng Nuclear Engineering student at the University of Birmingham.
- Aim for a career in research, either the nuclear sector or condensed matter physics.
- Research projects:
 - Study of irradiation damage of RPV steels using typical testing methods as well as small-angle neutron scattering and thermodynamic simulations.
 - Study of the nature of the magnetic phase transition in europium hexaboride using small-angle neutron scattering and magneto-transport measurements.

Initial stages

- Finding out about the internship
 - Nominated for the internship as a result of my 2nd year performance.
 - After speaking to students who previously attended the internship, it sounded like a fantastic opportunity.
- Application process
 - Topic choice – Accident Analysis
 - Numerous security checks
 - No Interview required

Arrival

- Flew out to Tokyo at the beginning of June and made my way to Hitachi City.
- I was given a very warm welcome at work and moved into my apartment.
- The language barrier was not an issue at work, however food shopping was quite difficult.



My work...

- Main
 - Using MAAP 5.04 (Modular accident analysis program)
 - Industry standard code for accident analysis
 - Firstly I investigated some new features of this update
 - Hydrolysis model – radiation present inside the reactor causes the ionization of water molecules thus releasing hydrogen gas.
 - Combustion model – improved model used conditions inside the reactor (e.g. geometry and gas concentrations) to predict whether to deflagration to detonation transition (DDT) can occur.

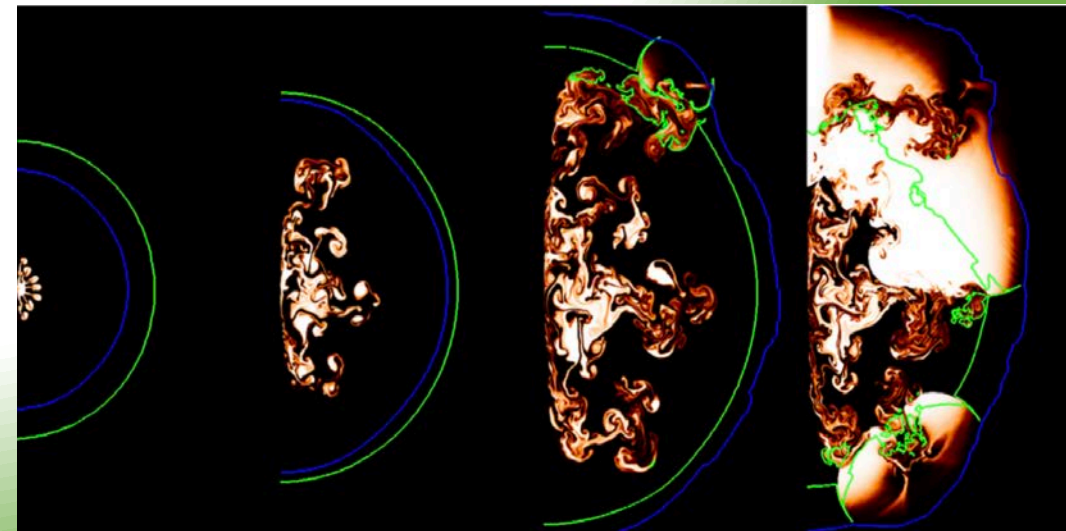
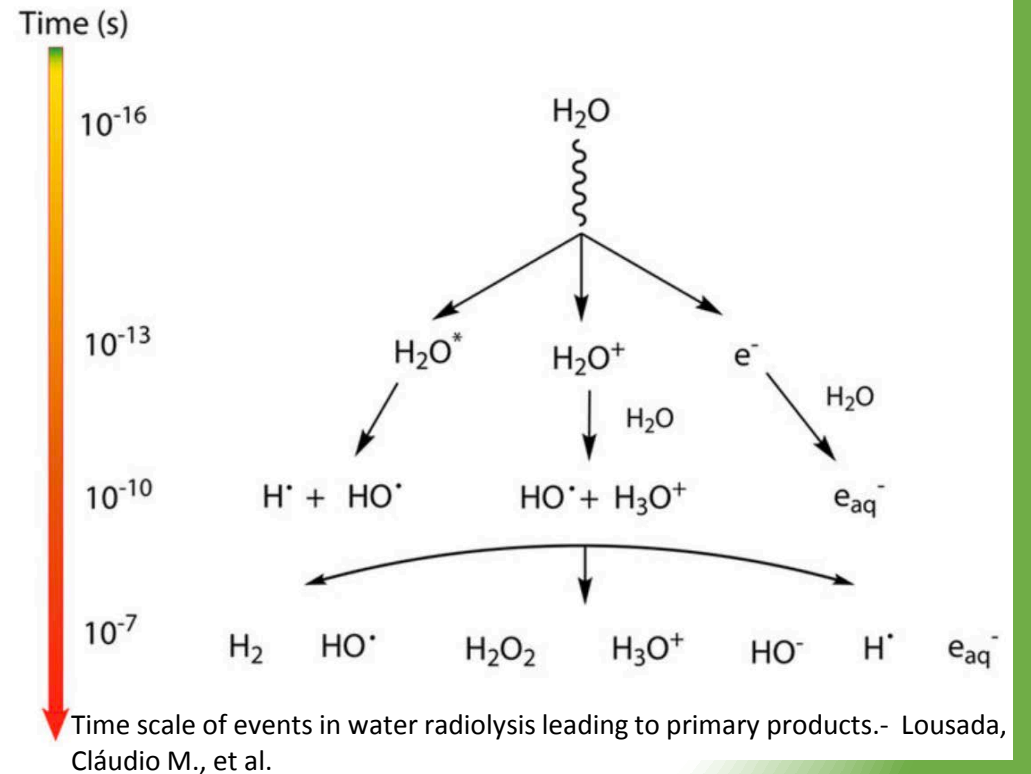
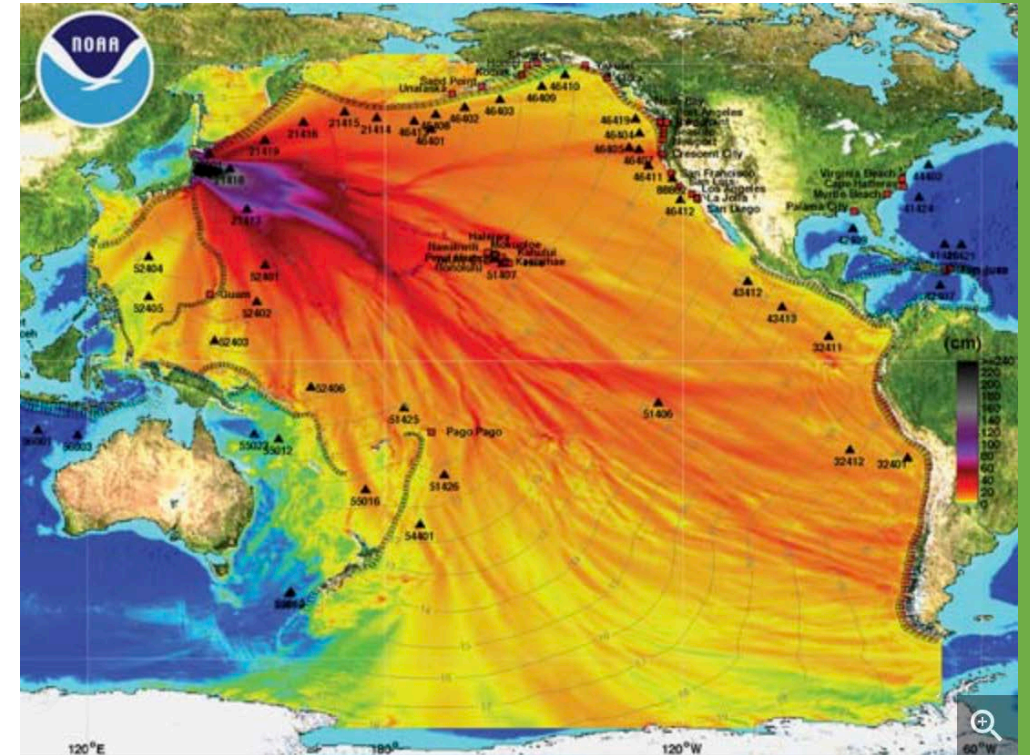


Image of DDT transition from simulation - <http://www.astro.sunysb.edu>

My work...

- Application of these models to the Unit 1 Fukushima disaster
 - Loss of power in due to flooding caused by the tsunami in 2011 meant that all safety systems went down.
 - Despite the incredible effort by staff, the core melted and damaged the RPV
 - Soon after, there was an explosion in the containment building.
 - There is limited measured data.
 - As the site is still highly radioactive, simulations are required to assess the current situation of the building in order to plan appropriate clean up measures.

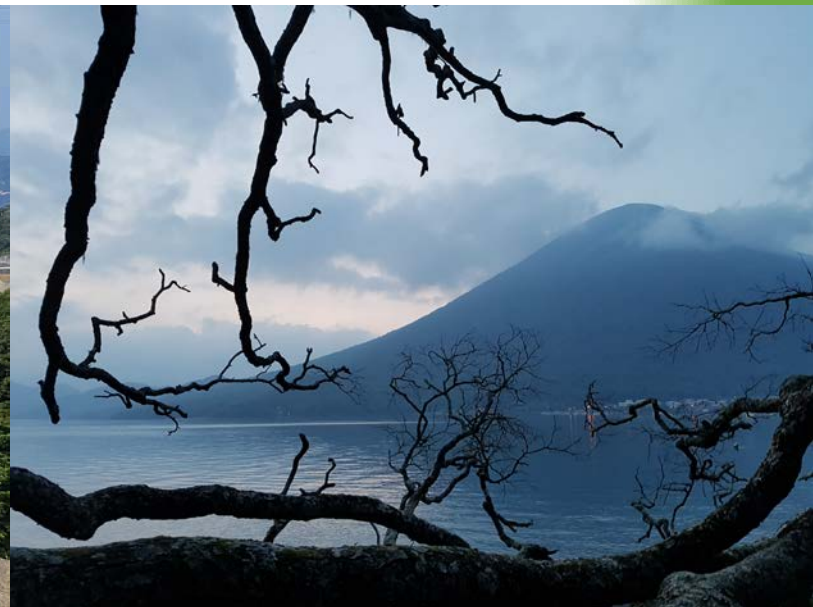


Map showing the extent of the 2011 tsunami produced by the NOAA Centre for Tsunami Research

Key findings

- Data recorded in Unit 1 after the loss of power reveals that the flow of water into the core was approximately 1kg/s.
- MAAP simulation results reveal that if this flow rate of water did enter the core, the pressure would be higher than that recorded during the time.
- Furthermore, if this amount of water did enter the core, the steam concentration would be high enough to prevent a DDT from occurring, which did happen as seen by the explosion event that occurred.
- This suggests that there may have been a leakage between the flow monitor and the RPV meaning the core could potentially be in a worse state than previously thought.

Outside of work



Overall

- I had an excellent time both at work and travelling around Japan.
- I learnt a lot about what I want from a job and met some amazing people.
- I'm extremely grateful for Hitachi for giving me this opportunity.

