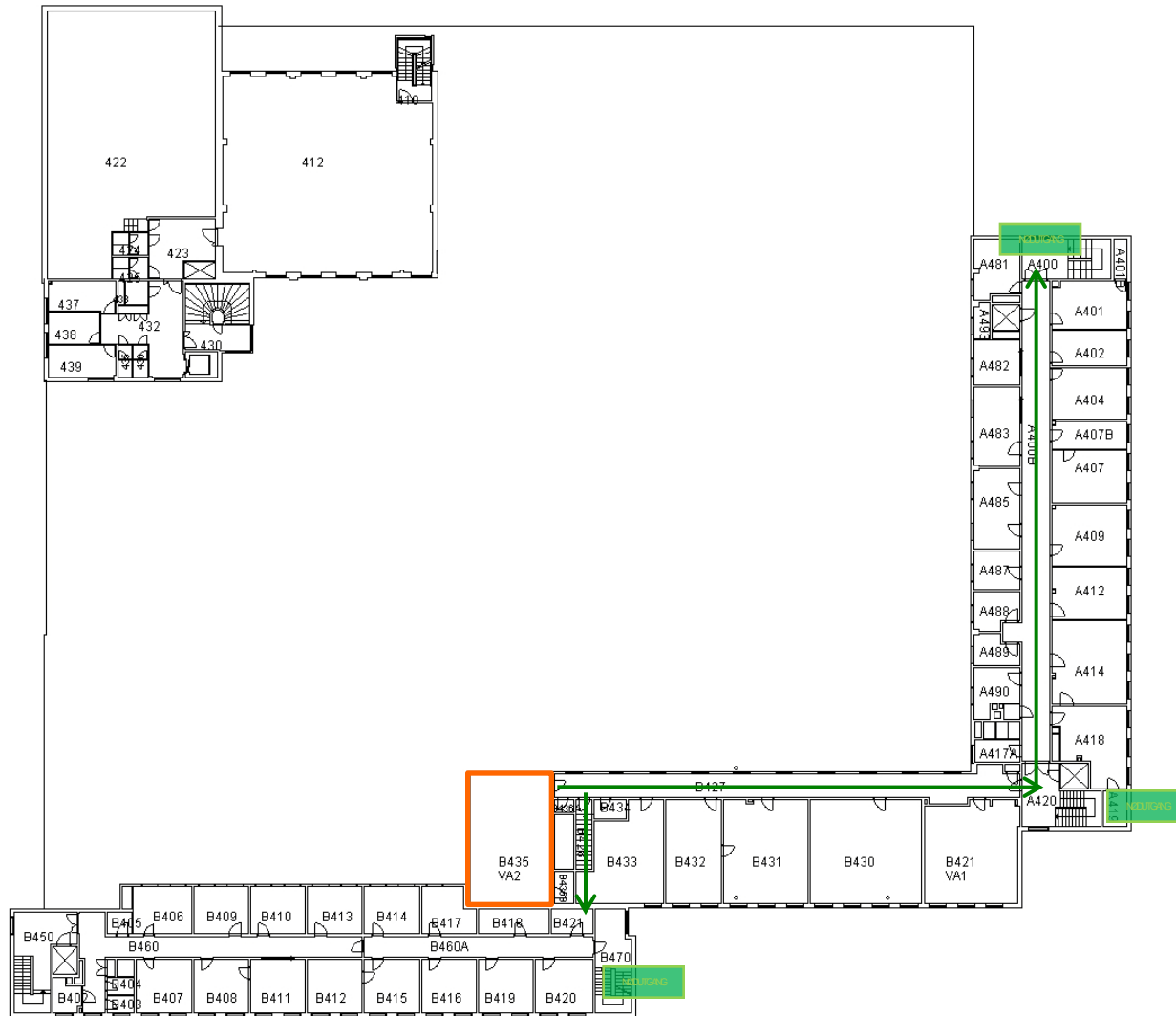




**Nordic PhD course**  
**Analytical Techniques in Combustion**  
**May 4-7, 2009**  
**NTNU, Trondheim, Norway**

# Emergency Exit

NØDUTGANG



# Lecturers and lab responsible

## **Lecturers**

<b>Lecturers</b>	<b>Institution</b>
Gabor Varhegyi	Hungarian Academy of Sciences
Johan E. Hustad	NTNU
Morten Grønli	NTNU
Øyvind Skreiberg	SINTEF Energy Research
Roger Khalil	SINTEF Energy Research

## **Lab responsible**

## **Institution**

### ***Fuel characterization***

Liang Wang	NTNU
Erik Langørgen	NTNU
Christer Heen Skotland	NTNU

### ***Wood stove testing facility***

Halvor Flatberg	NTNU
Franziska Goile	SINTEF Energy Research

### ***Multifuel Reactor***

Mario Ortega	SINTEF Energy Research
Willy Horrigmo	SINTEF Energy Research
Judit Sandquist	SINTEF Energy Research

# Monday May 4

Time	Subject	Responsible
09:00-09:50	Welcome and introduction lecture	Hustad
10:00-10:50	NTNU & SINTEF - who are we and what are we doing	Grønli
	Short HSE-in-laboratory lecture	
11:00-11:50	Laboratory tour	Grønli
<b>12:00-12:50</b>	<b>Lunch</b>	
13:00-13:50	Solid Fuel Characterisation - methods, equipment and characteristics	Grønli
	Solid Fuel Characterisation - methods, equipment and characteristics	Grønli
14:00-14:50	Introduction to gas analysis, with focus on FTIR and GC	Khalil
15:00-15:50	Introduction to gas analysis, with focus on FTIR and GC	Khalil
<b>19:00</b>	<b>Dinner at Bari café and bar</b>	

# Dinner at Bari Café & bar

## Monday at 19.00

Bari [ba'ri] Mer enn et spisested. Mer enn et utested. Bari er et møtested. Hvor venner møter venner, i møte med god mat, god drikke, den gode stemningen. Et sted å nyte dagen, et sted å starte kvelden, et sted å være seg selv.

Foto: Camilla Suul



Mattilsynet Tilsynsrapport

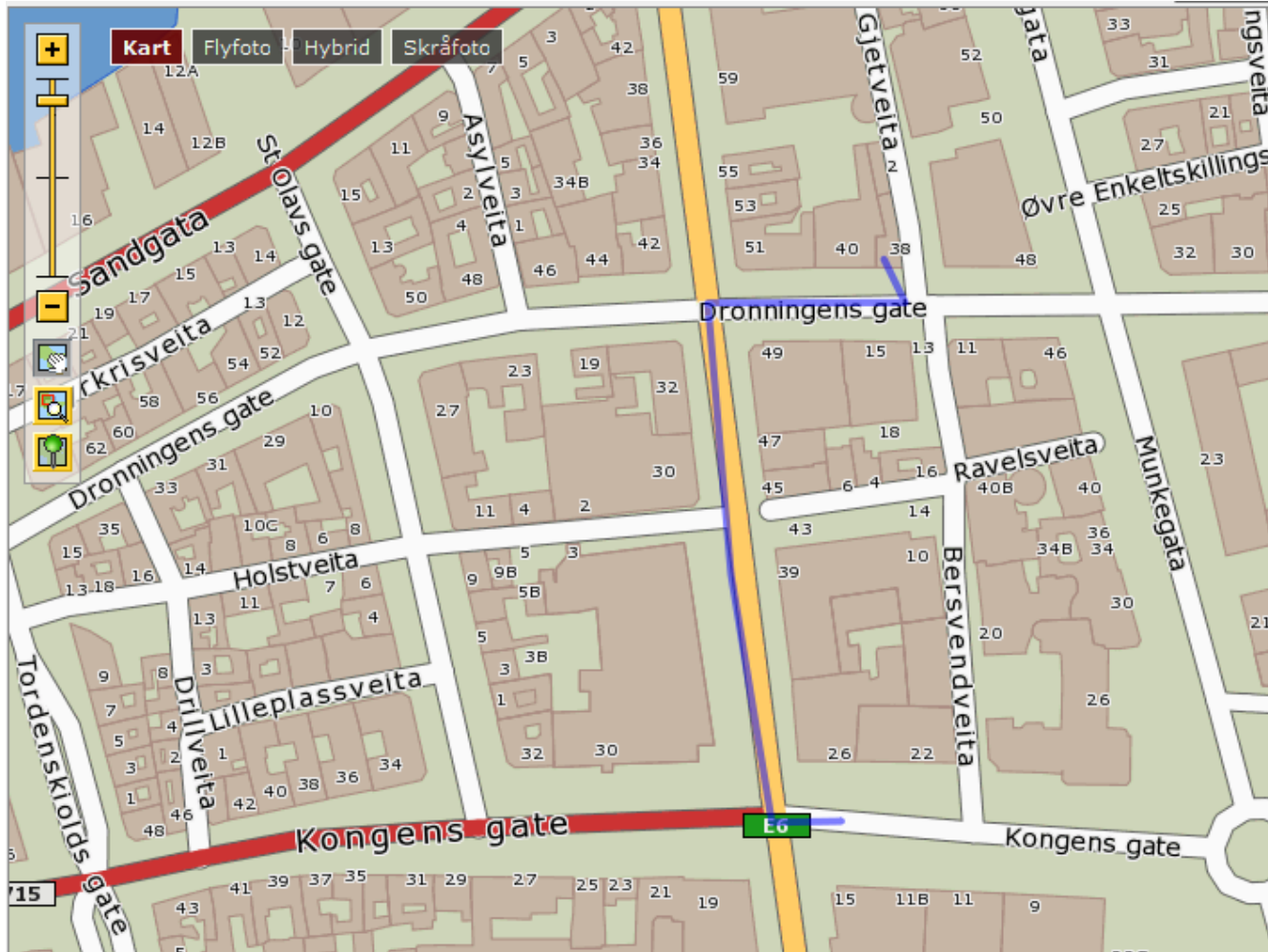
Dato: 18.09.2007  
Tilsynsresultat: +++ 

**BARI**  
cafe & bar

Munke gt. 25  
7011 Trondheim  
Tel.: 73 60 60 24  
Fax: 73 01 06 19  
E-post: post@bari.no

[DAGMENY](#) ▲ [KVELDSMENY](#) ▲ [KAFFEMENY](#) ▲ [ÅPNINGSTIDER](#) ▲ [PRINT MENY](#) ▲ [KONTAKT OSS](#)

# Dinner at Bari Café & bar Monday at 19.00



# Tuesday May 5

Time	Subject	Responsible
08:00-08:50	Multifuel Reactor - Introduction	Skreiberg
09:00-09:50	Wood Stove Testing Facility - Introduction	Skreiberg
10:00-10:50	Introduction to kinetic models for biomass pyrolysis	Varhegyi
11:00-11:50	Introduction to kinetic models for biomass pyrolysis	Varhegyi
<b>12:00-12:50</b>	<b>Lunch</b>	
13:00-16:00	<b>Lab exercise</b>	
	<b>Evening on your own</b>	

# Wednesday May 6

Time	Subject	Responsible
08:00-08:50	Data analysis & exercises – Pyrolysis kinetics by TGA	Varhegyi
09:00-09:50	Data analysis & exercises – Pyrolysis kinetics by TGA	Varhegyi
10:00-10:50	Data analysis & exercises – Pyrolysis kinetics by TGA	Varhegyi
11:00-11:50	Data analysis & exercises – Pyrolysis kinetics by TGA	Varhegyi
<b>12:00-12:50</b>	<b>Lunch</b>	
13:00-16:00	<b>Lab exercise</b>	
<b>19:00</b>	<b>Guided tour and dinner and at Ringve Museum</b>	



# Guided tour and dinner at Ringve Museum Wednesday at 19.00

Ringve

MUSEENE I SØR-TRØNDELAG AS



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[Botanical Garden](#)

[Tordenskiold Café](#)

[About Ringve](#)

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## Welcome to Ringve!

Ringve houses Norway's National museum of music and musical instruments with collections from the whole world. The interiors from the 1880s in the Great House provides a backdrop for guided tours with musical demonstrations during the summer season, while the exhibition "The Museum in the Barn" is available throughout the year.

Ringve is situated only five minutes from Trondheim by car, and is one of the old country seats on the historical Lade peninsula with buildings from the 1700s, 1800s and the 1900s.

The Ringve Estate was the childhood home of "Tordenskiold", a famous Norwegian naval hero. Today the Ringve Botanical Gardens, NTNU surrounds the Estate and the old English garden from the 1800s is included here.

The café "Tordenskiold Kro" and the popular Museumshop at Ringve are only two of the many attractions which make Ringve one of Trondheim's most important recreation areas.

Visitor- and box address:

Lade Allé 60, 7041

Trondheim

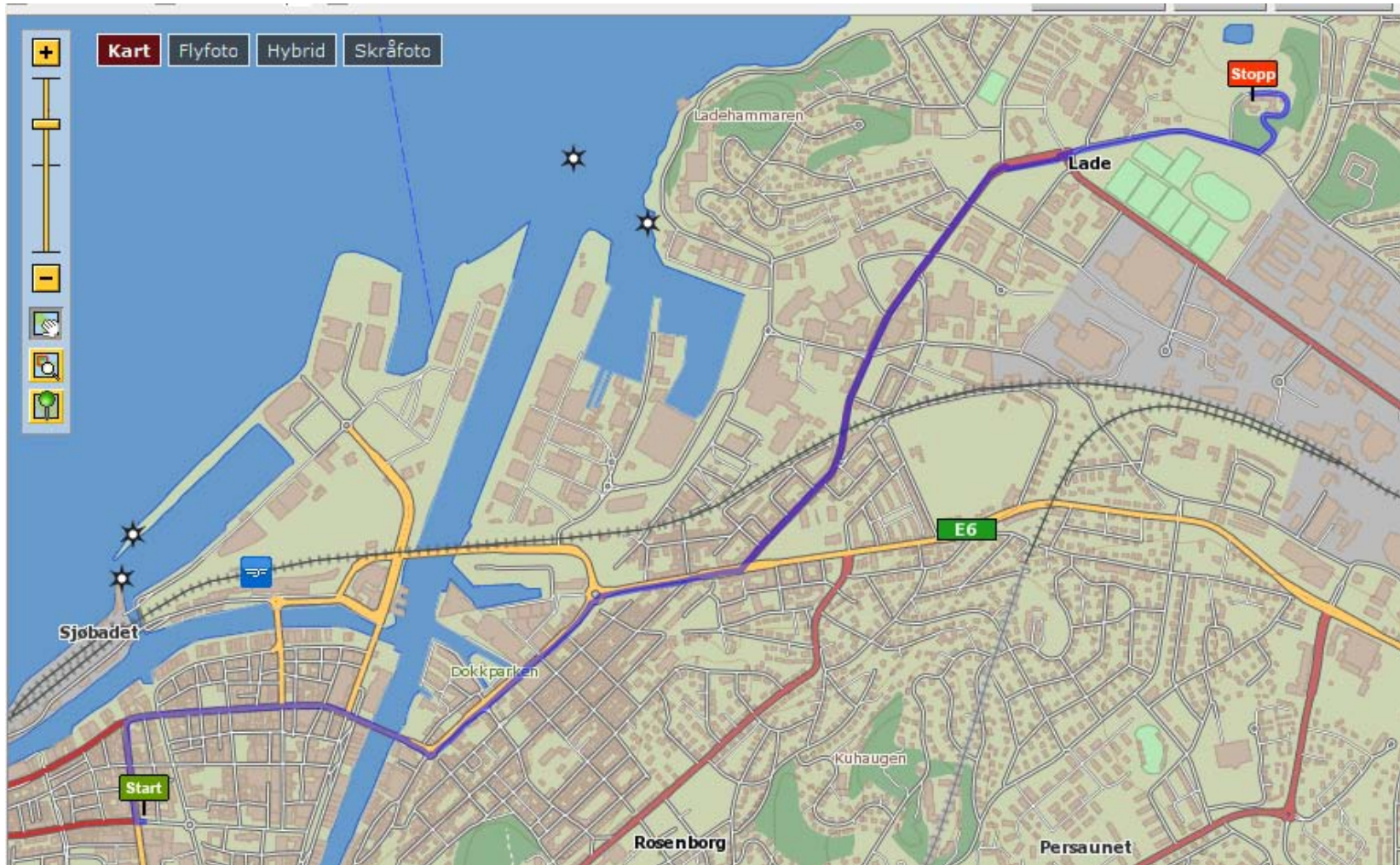
Phone: 73 87 02 80

Fax: 73 87 02 81

E-mail:

[firmapost@ringve.no](mailto:firmapost@ringve.no)

# Guided tour and dinner at Ringve Museum Wednesday at 19.00

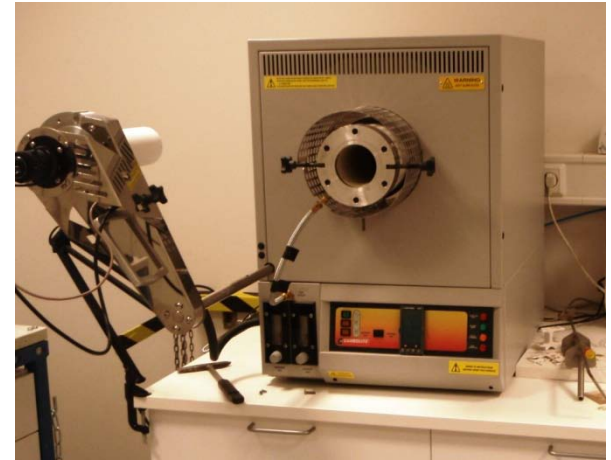


# Thursday May 7

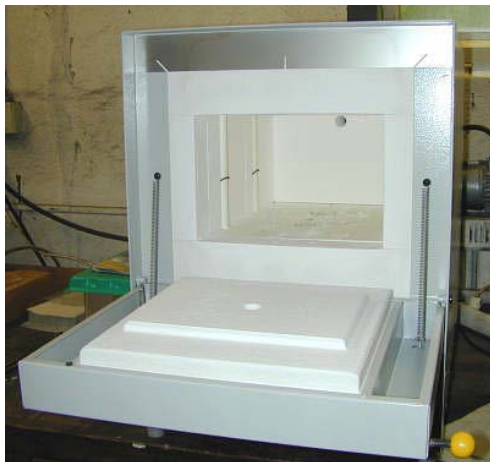
Time	Subject	Responsible
09:00-09:50	Data analysis and exercises – Multifuel reactor/Wood Stove Testing facility	Skreiberg
10:00-10:50	Data analysis and exercises – Multifuel reactor/Wood Stove Testing facility	Skreiberg
11:00-11:50	Data analysis and exercises – Multifuel reactor/Wood Stove Testing facility	Skreiberg
<b>12:00-12:50</b>	<b>Lunch</b>	
13:00-13:50	Data analysis and exercises – Multifuel reactor/Wood Stove Testing facility	Skreiberg
14:00-14:50	Summary and concluding remarks	Grønli

# Fuel Characterization 1

- Proximate analysis (VM, fixC, ash)
- Ash fusion (Ash melting microscope)



**Muffle furnace**

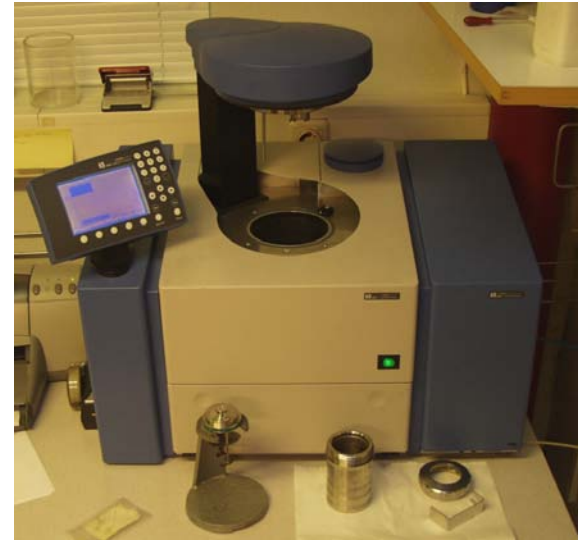


**Crucible**



# Fuel Characterization 2

- TGA (pyrolysis)
- Bomb calorimeter (Heating value)



# Multifuel reactor

- Combustion experiments
- NO<sub>x</sub> release
- FTIR-measurements
- Data handling



# Wood Stove testing facility

- Standardization test
- Particle emissions
- Data handling



# Laboratory group 1 & 2

## Group 1

Oskar Karlström	Åbo Akademi	okarlstr@abo.fi
Dusan Todorovic	University of Belgrade	dusanodzice@yahoo.com
Samira Telschow	DTU	ste@kt.dtu.dk
Johanna Olsson	Chalmers	johanna.olsson@chalmers.se
Daniel Kühnemuth	Chalmers	kuehnemu@chalmers.se

## Group 2

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Norazana Binti Ibrahim	DTU	nbi@kt.dtu.dk
Pontus Markström	Chalmers	f99poma@chalmers.se
Daniel Fleig	Chalmers	Daniel.fleig@chalmers.se



# Laboratory group 3 & 4

## Group 3

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Fredrik Lind

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## Group 4

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NTNU

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Muhammad Shafique Bashir

DTU

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Stefan Hjærtstam

Chalmers

stefan.hjartstam@chalmers.se

# Lab exercise – time plan

Day	Tuesday	Tuesday	Wednesday	Wednesday
Time	13.00-14.30	14.30-16.00	13.00-14.30	14.30-16.00
Fuel Characterization 1	Group 1	Group 2	Group 3	Group 4
Fuel Characterization 2	Group 2	Group 1	Group 4	Group 3
Multifuel reactor	Group 3	Group 4	Group 1	Group 2
Wood Stove testing facility	Group 4	Group 3	Group 2	Group 1

# HSE in LABORATORY

It is YOUR and OUR  
security that matters

What your research supposedly looks like:

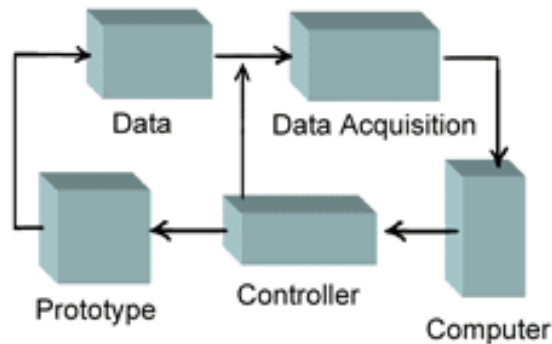


Figure 1. Experimental Diagram

What your research *actually* looks like:

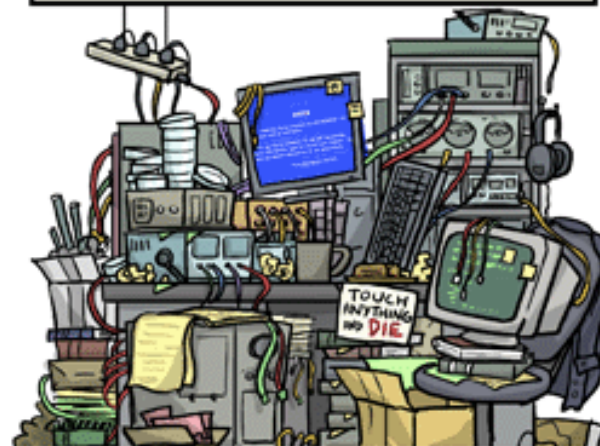


Figure 2. Experimental Mess

WWW.PHIDCOMICS.COM JORGE CHAM © 2008

# Fire Instructions

From your location in laboratory,  
please note:

- Nearest emergency exit and alternatives
- Nearest, and the most suitable extinguisher equipment
- The evacuation alarm is a high bell sound. Always evacuate.
- Local gas alarms in Refrigeration and Thermal laboratories can give light and sound. Always evacuate
- **ELEVATORS shall not be used in an evacuation situation**

 **SINTEF** **NTNU**

## BRANNINSTRUKS

**Gjør deg kjent med:**

- Rømningsveiene
- Nærmeste brannmelder
- Slukkeutstyrets plassering og virkemåte

**Hvis brann oppstår:**

- Prøv å slokke branntilløp
- Utløs manuell brannmelder
- Ring brannvesenet på telefon **110**

**Ved alarm:**

- Lukk dører og vinduer
- Steng gasskraner og flaskeventiler
- Forlat bygningen
- Gå til møteplass

**Heis skal ikke benyttes ved brannalarm**

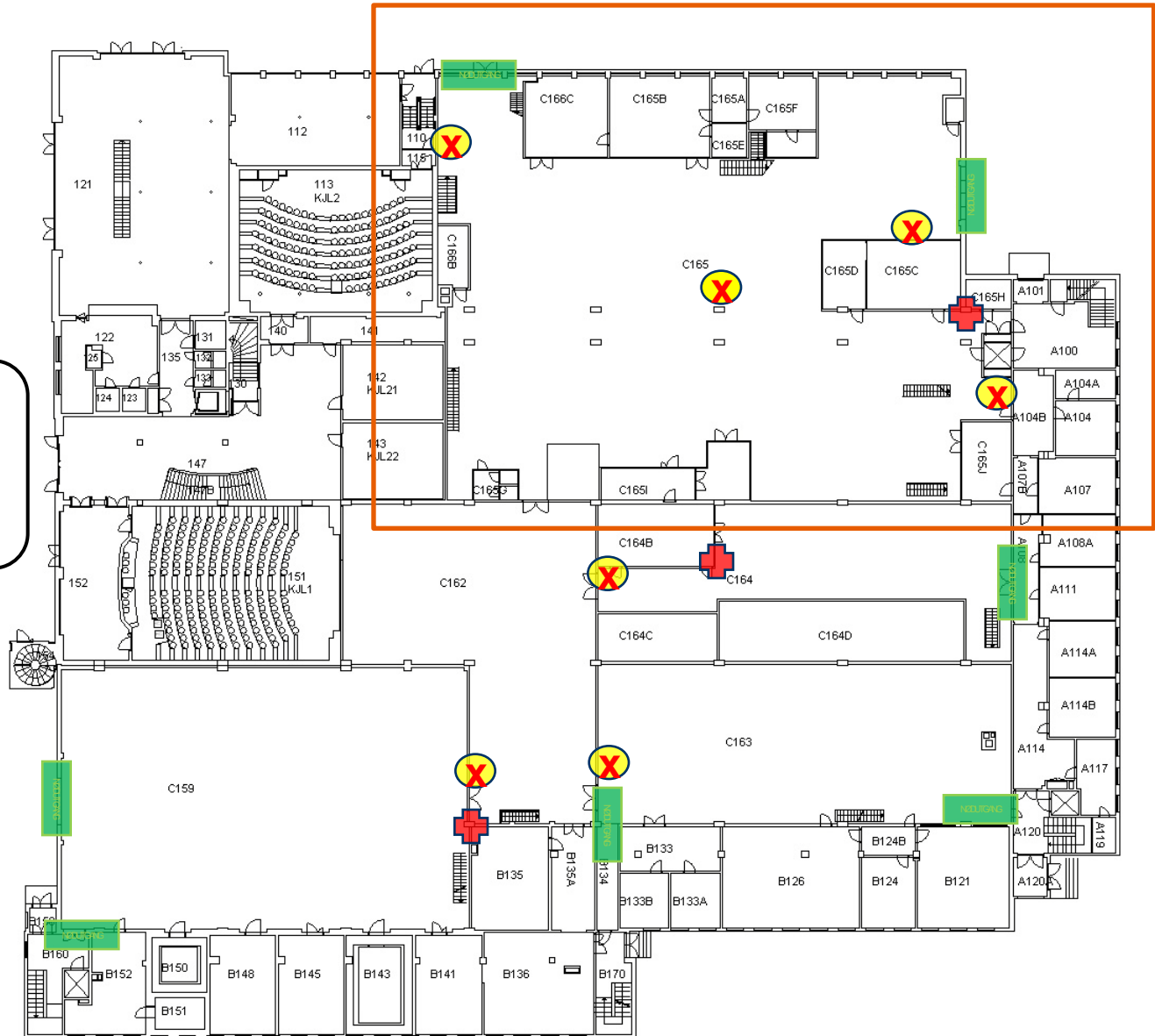
**Brann/Fire**  
  
**110**

Juni 2008

# Emergency exit, fire extinguisher, first aid equipment

1<sup>st</sup> floor

- Emergency exit
- Fire extinguisher
- First aid equipment



# Personal protective equipment

- Mandatory use of protective glasses during laboratory exercises and experiments
- Always use the necessary personal protective equipment
- If necessary, use ear protection, respiratory protective devices, gloves and special clothing during your work in the lab.
- Mandatory personal protective equipment are listed on the "Experiment in progress" sign.