

# The CERN Accelerator School holds courses in all of the member states of CERN

## The Twenty Member States of CERN

### Member States (Dates of Accession)

-  AUSTRIA (1959)
-  BELGIUM (1953)
-  BULGARIA (1999)
-  CZECH FR (1993)
-  DENMARK (1953)
-  FINLAND (1991)
-  FRANCE (1953)
-  GERMANY (1953)
-  GREECE (1953)
-  HUNGARY (1992)
-  ITALY (1953)
-  NETHERLANDS (1953)
-  NORWAY (1953)
-  POLAND (1991)
-  PORTUGAL (1986)
-  SLOVAK FR (1993)
-  SPAIN (1/1961-12/1968-1/1983)
-  SWEDEN (1953)
-  SWITZERLAND (1953)
-  UNITED KINGDOM (1953)

2013, Trondheim  
Norway



The CERN Accelerator School (CAS) and Norwegian University of Science and Technology (NTNU) are organizing a course on

# Advanced Accelerator Physics

18 - 29 August, 2013

Trondheim, Norway

The course will be of interest to physicists and engineers who wish to extend their knowledge of Accelerator Physics. The program offers core lectures on accelerator physics in the mornings and course

work on dedicated specialized topics in the afternoons. Participants will select one afternoon course from the three available. Seminars and tutorials will complete the program.



Contact: CERN Accelerator School  
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[www.cern.ch/schools/CAS](http://www.cern.ch/schools/CAS)



ADVANCED ACCELERATOR PHYSICS COURSE – TRONDHEIM, NORWAY, 18 – 29 August, 2013

Time	Sunday 18 August	Monday 19 August	Tuesday 20 August	Wednesday 21 August	Thursday 22 August	Friday 23 August	Saturday 24 August	Sunday 25 August	Monday 26 August	Tuesday 27 August	Wednesday 28 August	Thursday 29 August	
08:30	A R R I V A L  D A Y	Opening Talks	Transverse Dynamics II	New Tools for Non Linear Dynamics I	New Tools for Non Linear Dynamics II	Non Linear Dynamics II	Low Emittance Machines III	E X C U R S I O N	Landau Damping I	Landau Damping II	Timing and Synchronisation	D E P A R T U R E  A F T E R  B R E A K F A S T	
09:30		Transverse Dynamics I	Longitudinal Dynamics II	Beam Instabilities I	Beam Instabilities II	Low Emittance Machines I	Space Charge		RF Cavity Design	High Field Magnets	Feedback Systems I		
10:30		B. Holzer	F. Tecker	G. Rumolo	G. Rumolo	A. Wolski	M. Ferrario		E. Jensen	G. de Rijk	H. Schmickler		
11:00		COFFEE	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	COFFEE		
11:00		Longitudinal Dynamics I	Introduction to Beam Diagnostics	Machine Protection	T1  Longitudinal Dynamics	Linear Accelerators I	T2  Transverse Dynamics		T3  Low Emittance Machines	Medical Applications	T4  Non-Linear Dynamics		
12:00		F. Tecker	H. Schmickler	R. Schmidt	Private Study	Private Study	Private Study		Instabilities in Linacs	Beam-beam	Private Study		Feedback Systems II
12:00		Introduction to Beam Instrumentation	Insertions	Private Study	Non Linear Dynamics I	Private Study	Private Study		Instabilities in Linacs	Beam-beam	Private Study		Feedback Systems II
13:00		R. Jones	B. Holzer		O. Bruning		M. Ferrario			T. Pieloni			H. Schmickler
		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH			LUNCH	LUNCH		LUNCH
15:00		Lattice Cells	C1	C1		F R E E	Low Emittance Machines II		C1	C1	C1		C1
16:00	B. Holzer	C2	C2		A F T E R	A. Wolski	C2	C2	C2	C2			
16:00	RF Measurement Concepts	C3	C3		N O N	Linear Accelerators II	C3	C3	C3	C3			
17:00	F. Caspers					M. Vretenar							
	TEA	TEA	TEA			TEA	TEA		TEA	TEA	TEA		
17:30	Discussion Session	C1	C1			Seminar Linear Colliders	Poster Session		Seminar Northern Lights	Seminar Norwegian Petroleum Research	Closing Talk		
18:30		C2	C2										
20:00		C3	C3			E. Adli			A. Egeland	M. Landrø	F. Gianotti		
20:00	Dinner	Dinner	Dinner		Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Special Dinner		
21:30			Discussion Session	Discussion Session					Discussion Session	Discussion Session			

Course 1 = RF Measurements Techniques (F. Caspers and P. Kowina) Course 2 = Beam Instrumentation and Diagnostics (R. Jones, H. Schmickler, K. Wittenburg, M. Gasior, T. Lefevre)  
 Course 3 = Optics Design and Corrections (W. Herr, O. Bruning, B. Holzer, V. Kain, Y. Papaphilippou)

# Generalities

ADVANCED ACCELERATOR PHYSICS COURSE – TRONDHEIM, NORWAY, 18 – 29 August, 2013

- 80 selected out of 93 applicants
  - 10 unable to come, so 70

- All lectures in Britannia Hall
  - Except last day, Meeting room 5

- All afternoon courses at NTNU

- Coffee breaks in the Britannia
  - outside Britannia Hall

- Tea breaks in the University
  - cafeteria near to course room

- Secretariat, Barbara Strasser
  - Britannia, Meeting room 7
  - University, R30

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08:30		Opening Talks	Transverse Dynamics II	New Tools for Non-Linear Dynamics I	New Tools for Non-Linear Dynamics II	Non-Linear Dynamics II	Low Emittance Machines III		Landau Damping I	Landau Damping II	Timing and Synchronisation	
09:30		Transverse Dynamics I	B. Holzer	W. Herr	W. Herr	O. Bruning	A. Wolski		W. Herr	W. Herr	H. Schlarb	
10:30	A	B. Holzer	F. Tecker	G. Rumolo	G. Rumolo	A. Wolski	M. Ferrario		E. Jensen	G. de Rijk	H. Schmickler	
11:00	R	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	COFFEE	
12:00	R	Longitudinal Dynamics I	Introduction to Beam Diagnostics	Machine Protection	Longitudinal Dynamics	Linear Accelerators I	Transverse Dynamics		T3	Medical Applications	T4	
13:00	I	F. Tecker	H. Schmickler	R. Schmidt		M. Vretenar			Low Emittance Machines	C. Biscari	Non-Linear Dynamics	
13:00	V	Introduction to Beam Instrumentation	Insertions	Private Study	Non-Linear Dynamics I	Private Study	Instabilities in Linacs		Beam-beam	Private Study	Feedback Systems II	
13:00	L	R. Jones	B. Holzer		O. Bruning		M. Ferrario		T. Pieloni		H. Schmickler	
15:00		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH			LUNCH	LUNCH	LUNCH	
16:00	D	Lattice Cells	C1	C1	F	Low Emittance Machines II	C1		C1	C1	C1	
16:00	A	B. Holzer	C2	C2	R	A. Wolski	C2		C2	C2	C2	
16:00	Y	RF Measurement Concepts	C3	C3	E	Linear Accelerators II	C3		C3	C3	C3	
17:00		F. Caspers	TEA	TEA	R	M. Vretenar	TEA		TEA	TEA	TEA	
17:30		Discussion Session	C1	C1	N	Seminar Linear Colliders	Poster Session		Seminar Northern Lights	Seminar Norwegian Petroleum Research	Closing Talk	
18:30			C2	C2	O	E. Adli			A. Egeland	M. Landro	F. Gianotti	
20:00		Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Special Dinner	
21:30			Discussion Session	Discussion Session					Discussion Session	Discussion Session		

Course 1 = RF Measurements Techniques (F. Caspers and P. Kowina) Course 2 = Beam Instrumentation and Diagnostics (R. Jones, H. Schmickler, K. Wittenburg, M. Gasior, T. Lefevre)  
 Course 3 = Optics Design and Corrections (W. Herr, O. Bruning, B. Holzer, V. Kain, Y. Papaphilippou)

- Breakfast Lunch and Dinner all at the Britannia Hotel
  - Lunch in Palmehaven
  - Dinner in Speilshalen (except Saturday, in Britannia hall)

- Handouts provided each morning

# Afternoon Courses

Time	18 August	19 August	20 August	21 August	22 August	23 August	24 August	25 August	26 August	27 August	28 August	Thursday 29 August	
08:30	A R R I V A L  D A Y	Opening Talks	Transverse Dynamics II	New Tools for Non Linear Dynamics I	New Tools for Non Linear Dynamics II	Non Linear Dynamics II	Low Emittance Machines III	E X C U R S I O N	Landau Damping I	Landau Damping II	Timing and Synchronisation	D E P A R T U R E  A F T E R  B R E A K F A S T	
09:30		Transverse Dynamics I	Longitudinal Dynamics II	Beam Instabilities I	Beam Instabilities II	Low Emittance Machines I	Space Charge		RF Cavity Design	High Field Magnets	Feedback Systems I		
10:30		B. Holzer	F. Tecker	G. Rumolo	G. Rumolo	A. Wolski	M. Ferrario		COFFEE	COFFEE	COFFEE		COFFEE
11:00		Longitudinal Dynamics I	Introduction to Beam Diagnostics	Machine Protection	T1 Longitudinal Dynamics	Linear Accelerators I	T2 Transverse Dynamics		T3	Medical Applications	T4		Non-Linear Dynamics
12:00		F. Tecker	H. Schmickler	R. Schmidt	Private Study	Private Study	Private Study		Instabilities in Linacs	Beam-beam	Private Study		Feedback Systems II
12:00		Introduction to Beam Instrumentation	Insertions	Private Study	Non Linear Dynamics I	Private Study	Private Study		Instabilities in Linacs	Beam-beam	Private Study		Feedback Systems II
13:00		R. Jones	B. Holzer	O. Bruning	O. Bruning	M. Ferrario	M. Ferrario		M. Ferrario	T. Pieloni	H. Schmickler		H. Schmickler
		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH		LUNCH	LUNCH	LUNCH		LUNCH
15:00		Lattice Cells	C1	C1	F R E E	Low Emittance Machines II	C1		C1	C1	C1		C1
16:00		B. Holzer	C2	C2	A F T E R	Linear Accelerators II	C2		C2	C2	C2		C2
16:00	RF Measurement Concepts	C3	C3	A F T E R	Linear Accelerators II	C3	C3	C3	C3	C3			
17:00	F. Caspers	C3	C3	R E C E I V E	M. Vretenar	C3	C3	C3	C3	C3			
	TEA	TEA	TEA	N O N	TEA	TEA	TEA	TEA	TEA	TEA			
17:30	Discussion Session	C1	C1	N O N	Seminar Linear Colliders	Poster Session	Poster Session	Seminar Northern Lights	Seminar Norwegian Petroleum Research	Closing Talk			
18:30		C2	C2		E. Adli			A. Egeland	M. Landrø	F. Gianotti			
20:00	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Special Dinner			
21:30		Discussion Session	Discussion Session					Discussion Session	Discussion Session				

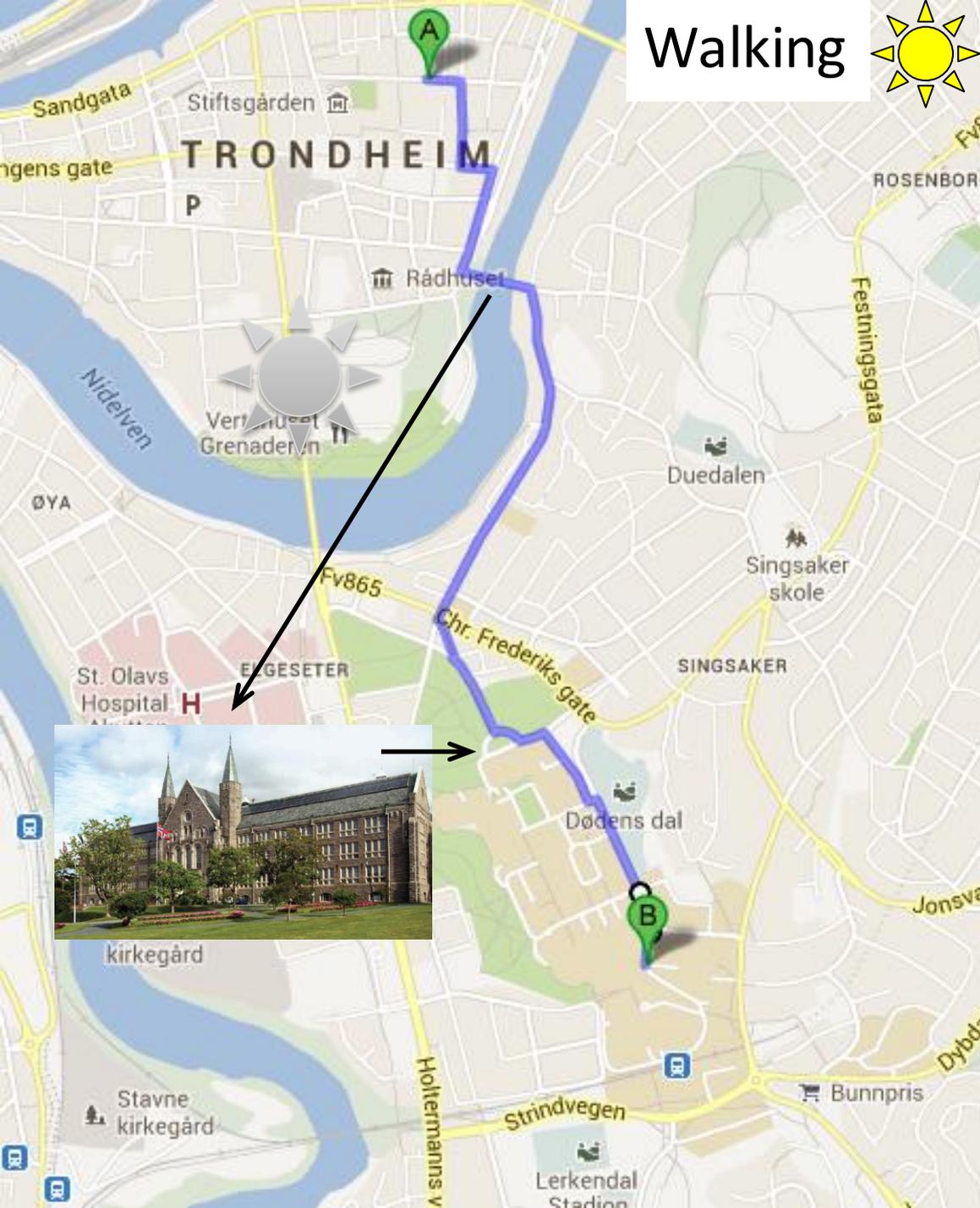
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# Afternoon Courses

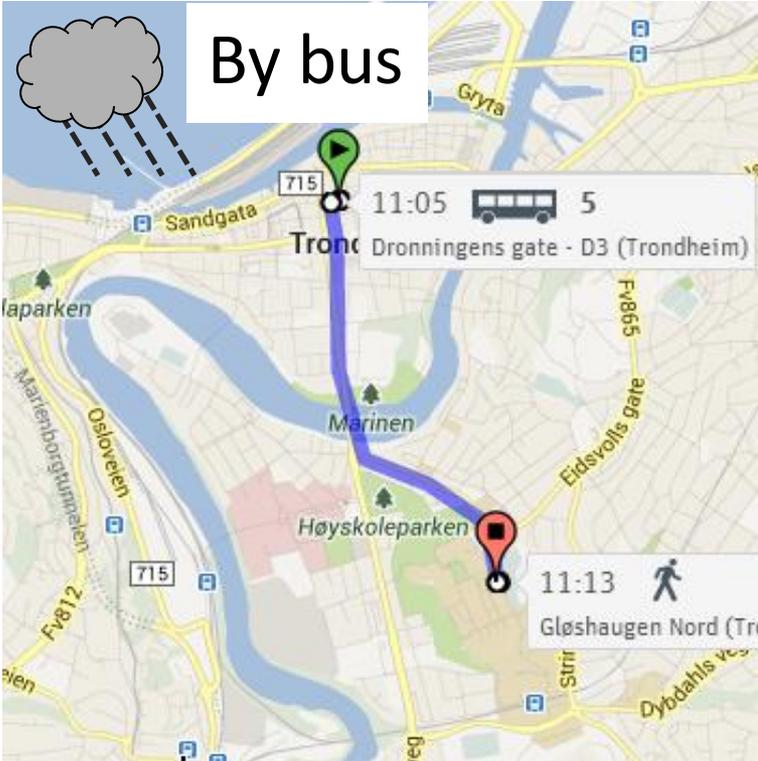
- Chance to try something new!
- 14 hours ++ of practical training
- Sign up for the course of preference (~equal numbers)
  - At the secretariat absolute latest by coffee on Tuesday AM

Course	Location	Coordinator	Tutors week 1	Tutors week 2
C1 RF	Høgskoleringen	F.Caspers	P.Kowina	P.Kowina
C2 BI	Natural Science D1 - 102	H.Schmickler	K.Wittenberg, R.Jones, M.Gasior	K.Wittenberg, T.Lefevre
C3 Optics	Natural Science D1 - 185	W.Herr	B.Holzer, V.Kain, O.Bruning	B.Holzer, V.Kain, Y.Papaphilippou

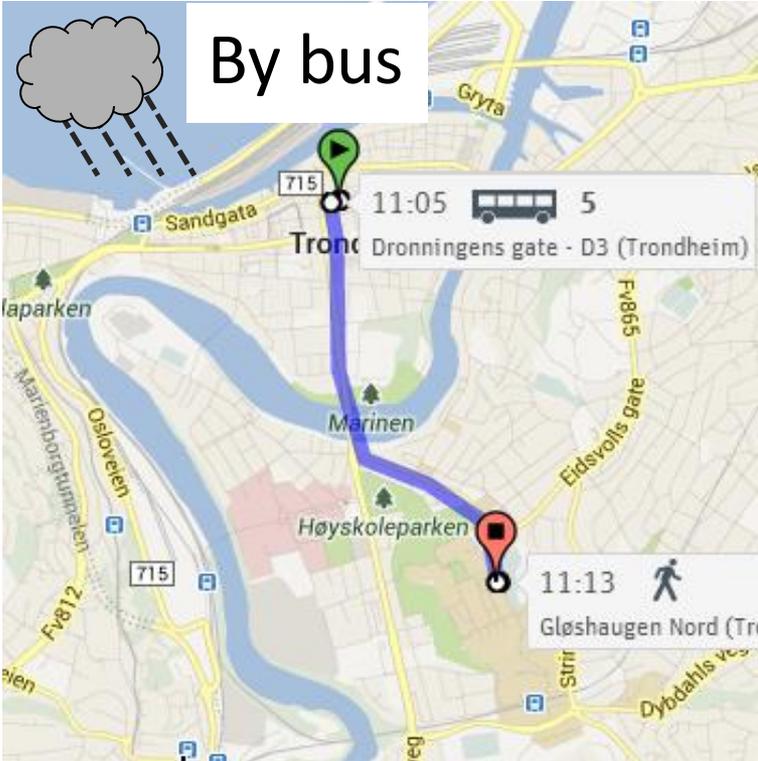
# Walking

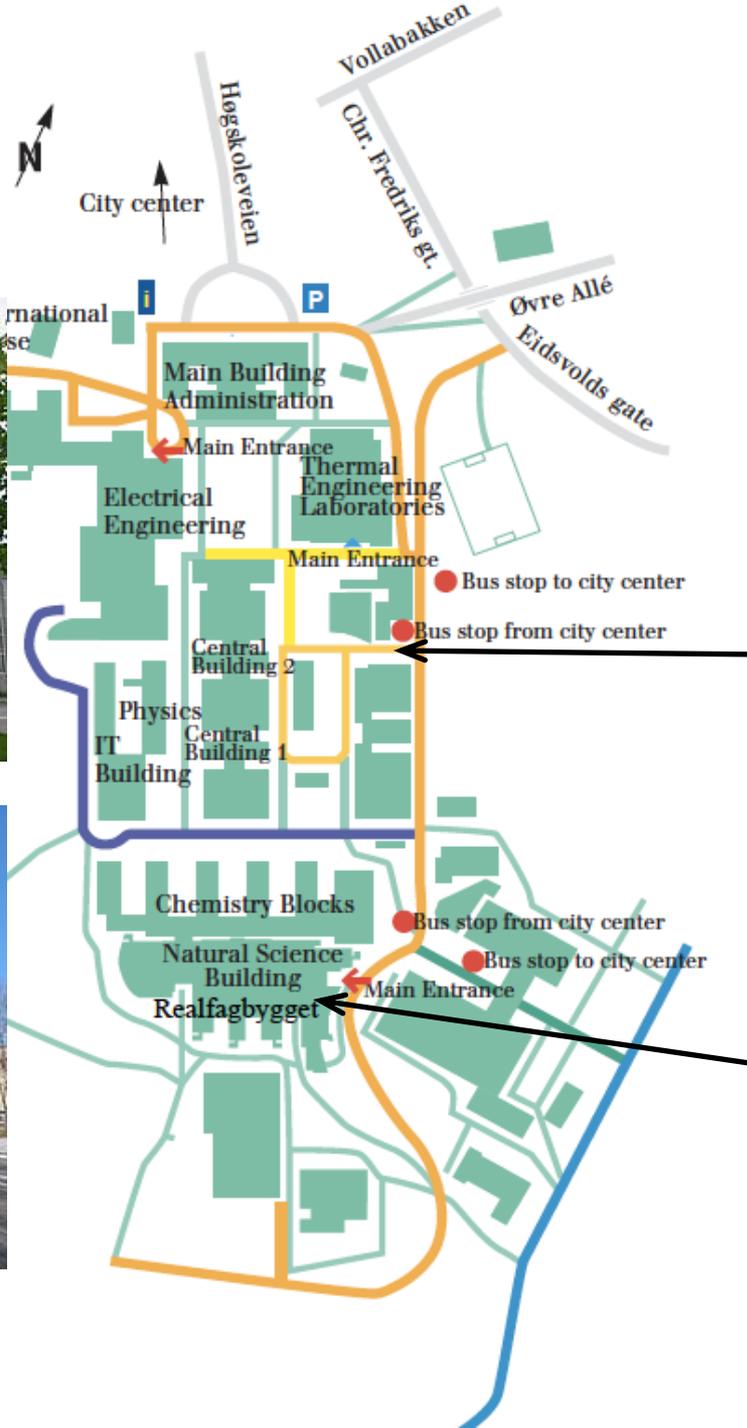


How to get from Britannia Hotel to the afternoon courses at NTNU come rain or shine



# By bus

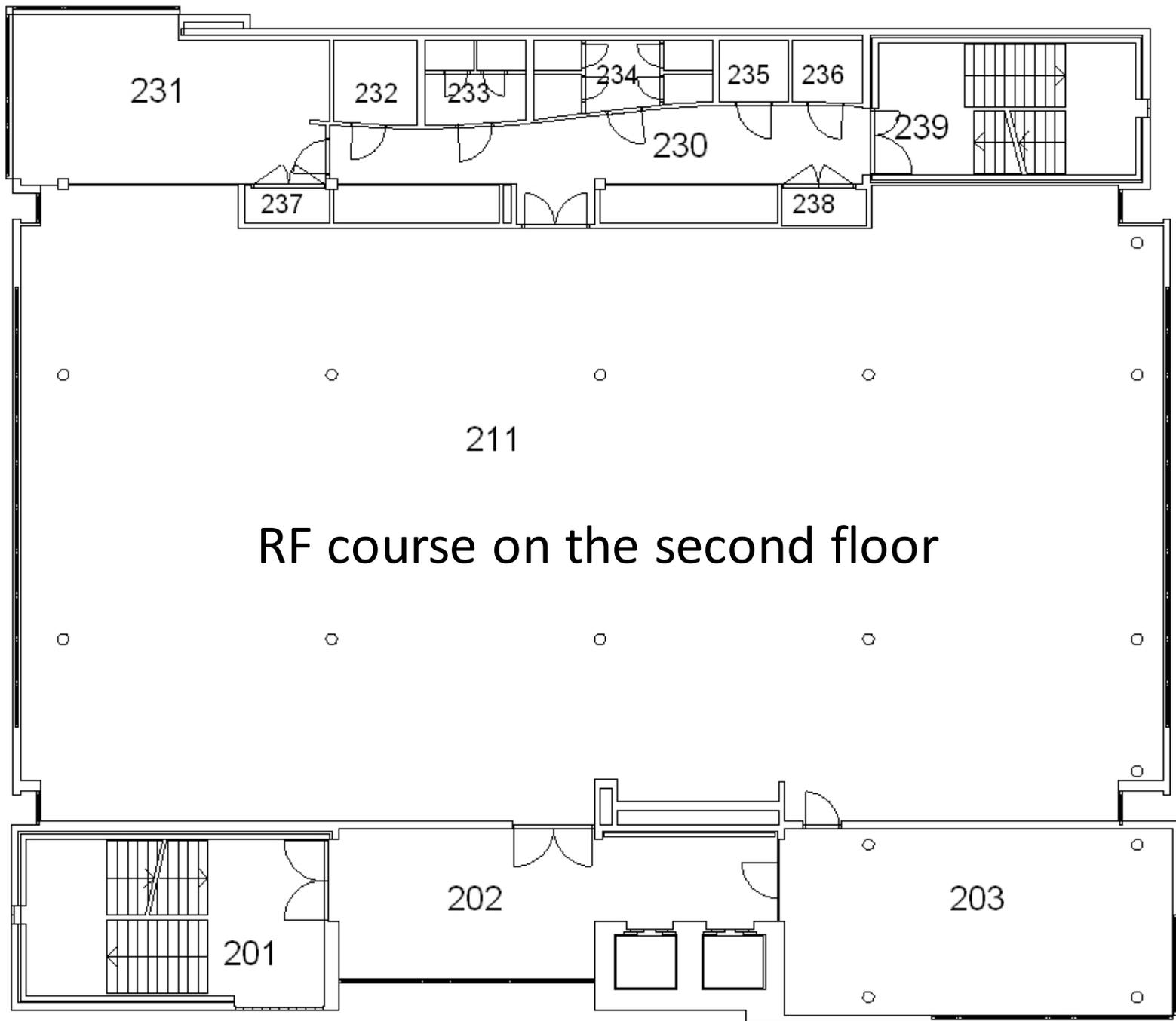




RF course

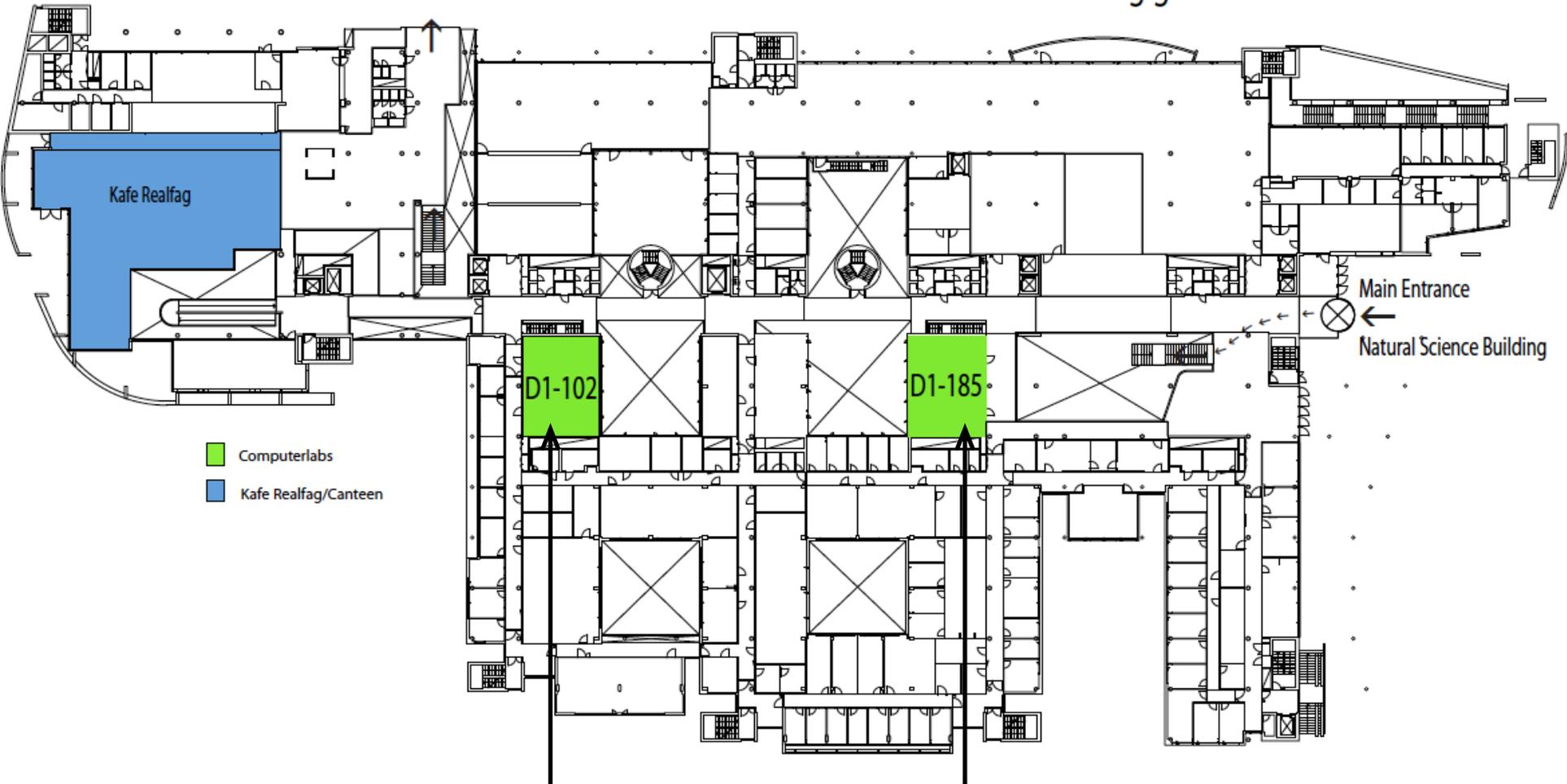
BI course

Optics course



RF course on the second floor

# Natural Science Building ground floor



- Computerlabs
- Kafe Realfag/Canteen

BI course

Optics course

# Tutorials

Time	18 August	19 August	20 August	21 August	22 August	23 August	24 August	25 August	26 August	27 August	28 August	Thursday 29 August	
08:30	A R I V L  D A Y	Opening Talks	Transverse Dynamics II B. Holzer	New Tools for Non Linear Dynamics I W. Herr	New Tools for Non Linear Dynamics II W. Herr	Non Linear Dynamics II O. Bruning	Low Emittance Machines III A. Wolski	E X C U R S I O N	Landau Damping I W. Herr	Landau Damping II W. Herr	Timing and Synchronisation H. Schlarb	D E P A R T U R E  A F T E R  B R E A K F A S T	
09:30		Transverse Dynamics I B. Holzer	Longitudinal Dynamics II F. Tecker	Beam Instabilities I G. Rumolo	Beam Instabilities II G. Rumolo	Low Emittance Machines I A. Wolski	Space Charge M. Ferrario		RF Cavity Design E. Jensen	High Field Magnets G. de Rijk	Feedback Systems I H. Schmickler		
10:30		COFFEE	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	COFFEE		COFFEE
11:00		Longitudinal Dynamics I F. Tecker	Introduction to Beam Diagnostics H. Schmickler	Machine Protection R. Schmidt	T1 Longitudinal Dynamics	Linear Accelerators I M. Vretenar	T2 Transverse Dynamics		T3 Low Emittance Machines	Medical Applications C. Biscari	T4 Non-Linear Dynamics		
12:00		Introduction to Beam Instrumentation R. Jones	Insertions B. Holzer	Private Study	Non Linear Dynamics I O. Bruning	Private Study	Instabilities in Linacs M. Ferrario		Beam-beam T. Pieloni	Private Study	Feedback Systems II H. Schmickler		
13:00		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH		LUNCH	LUNCH	LUNCH		LUNCH
15:00		Lattice Cells B. Holzer	C1	C1	F R E E	Low Emittance Machines II A. Wolski	C1		C1	C1	C1		C1
16:00		RF Measurement Concepts F. Caspers	C2	C2	A F T E R	Linear Accelerators II M. Vretenar	C2		C2	C2	C2		C2
16:00		TEA	TEA	TEA	N O N	TEA	TEA		TEA	TEA	TEA		TEA
17:00		Discussion Session	C1	C1	Seminar Linear Colliders E. Adli	Poster Session	C3		C3	C3	C3		C3
17:30		C2	C2						Seminar Northern Lights A. Egeland	Seminar Norwegian Petroleum Research M. Landrø	Closing Talk F. Gianotti		
18:30		C3	C3										
20:00	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Special Dinner		
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# Tutorials

- Exercises set by the 4 lecturers mentioned
  - Tutorials for each in 3 roughly equal groups
    - TG1 Surnames A to H Britannia Hall
    - TG2 Surnames I to P Meeting room 10, Britannia
    - TG3 Surnames Q to Z Meeting room 11, Britannia

<b>Tutorial</b>	<b>TG1 (A to G)</b>	<b>TG2 (H to O)</b>	<b>TG3 (P to Z)</b>
	Meeting room 10	Meeting room 11	Britannia Hall
<b>T1</b> Longitudinal Dynamics	W.Herr	B.Holzer	O.Bruning
<b>T2</b> Transverse Dynamics	B.Holzer	V.Kain	W.Herr
<b>T3</b> Low Emittance Machines	A.Wolski	W.Herr	Y.Papaphilippou
<b>T4</b> Non-Linear Dynamics	W.Herr	Y.Papaphilippou	T.Pieloni

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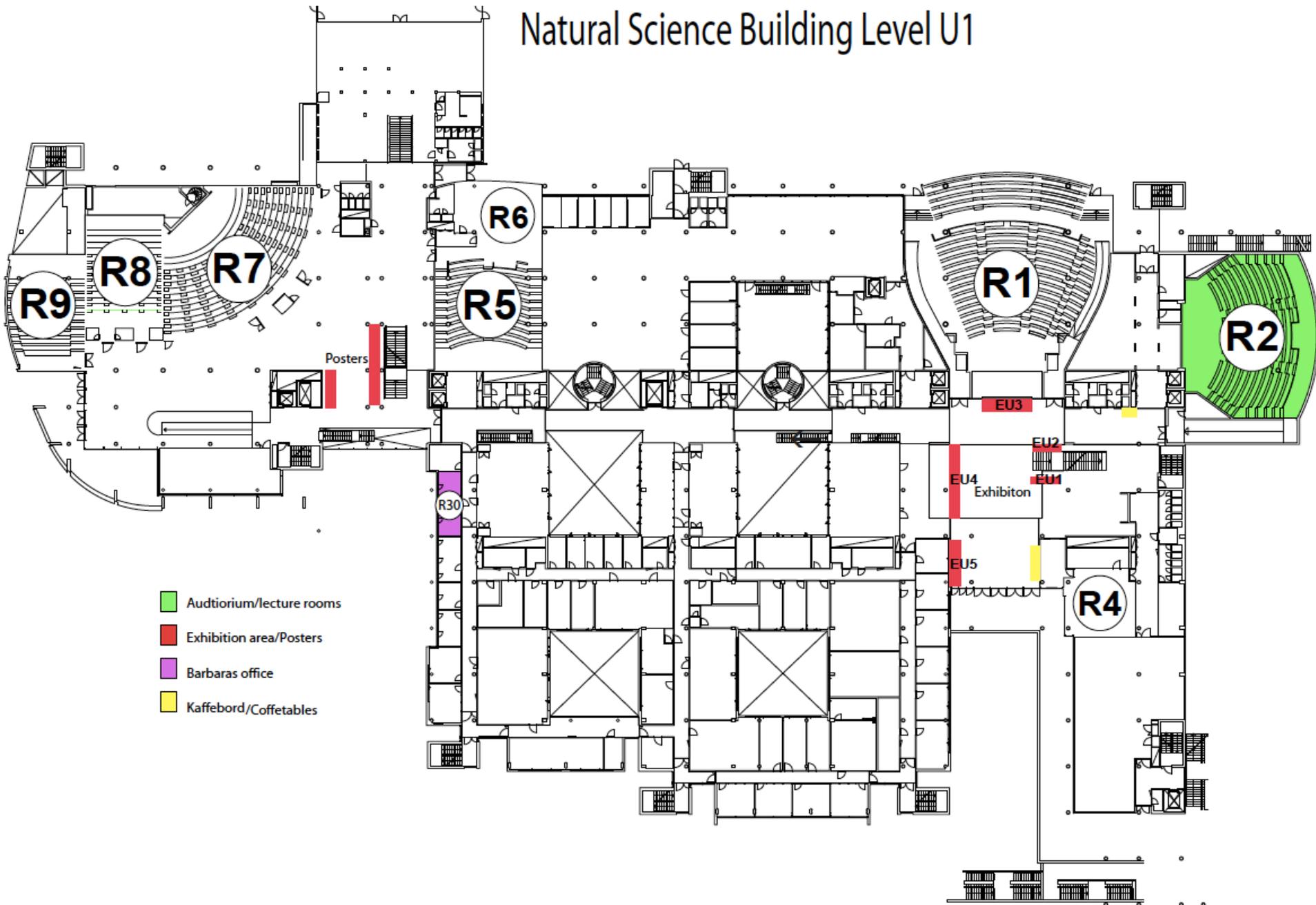
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	R	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE	COFFEE		COFFEE	COFFEE	COFFEE	
11:00	R	Longitudinal Dynamics I	Introduction to Beam Diagnostics	Machine Protection	T1 Longitudinal Dynamics	Linear Accelerators I	T2 Transverse Dynamics		T3 Low Emittance Machines	Medical Applications	T4 Non-Linear Dynamics	
12:00	I	F. Tecker	H. Schmickler	R. Schmidt		M. Vretenar				C. Biscari		
12:00	V	Introduction to Beam Instrumentation	Insertions	Private Study	Non Linear Dynamics I	Private Study	Instabilities in Linacs		Beam-beam	Private Study	Feedback Systems II	
13:00	L	R. Jones	B. Holzer		O. Bruning		M. Ferrario		T. Pieloni		H. Schmickler	
		LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH		LUNCH	LUNCH	LUNCH	
15:00	D	Lattice Cells	C1	C1		Low Emittance Machines II	C1		C1	C1	C1	
16:00	A	B. Holzer	C2	C2		A. Wolski	C2		C2	C2	C2	
16:00	Y	RF Measurement Concepts	C3	C3		Linear Accelerators II	C3		C3	C3	C3	
17:00		F. Caspers				M. Vretenar						
		TEA	TEA	TEA		TEA	TEA		TEA	TEA	TEA	
17:30		Discussion Session	C1	C1		Seminar Linear Colliders	Poster Session		Seminar Northern Lights	Seminar Norwegian Petroleum Research	Closing Talk	
			C2	C2								
18:30			C3	C3		E. Adli			A. Egeland	M. Landrø	F. Gianotti	
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# No-lecture periods

- Private Study
  - To work on exercises, wherever you like
- Discussion sessions
  - First one is here
  - Others are in the hotel bar
  - Discuss with lecturers outside the amphitheater
  - Go into detail which is maybe not of interest to all
- Poster session
  - At the university in AU 1-6
  - Mount from Thursday, take down Tuesday
- Seminars in the second week
  - At the university in Auditorium R2
- Free Afternoon
  - Is exactly that
  - If you decide **not to take dinner at the hotel** (after the free afternoon or otherwise) **please let Barbara know** the day before so that we can inform the hotel
- School photo
  - Afternoon tea break on Wednesday 21<sup>st</sup>

# Natural Science Building Level U1



# Exhibition and HR stand

- CERN exhibition
  - Already installed in the University
  - Will remain throughout and beyond the school
- CERN HR stand
  - Will be installed tomorrow
  - Will be manned Tuesday and Wednesday

# Excursion

- Sunday August 25, all day
  - Løkken verk <http://en.oi.no/>
  - Depart by bus at 09.00
  - Trip on old train to the mine
  - Guided tour of mine
  - Lunch at the mine
  - Return to Trondheim by bus
  
  - We have reserved for everyone !
  - We need to know if you will come or not
  - Please **tell Barbara YES or NO by coffee Wednesday AM**

# WiFi

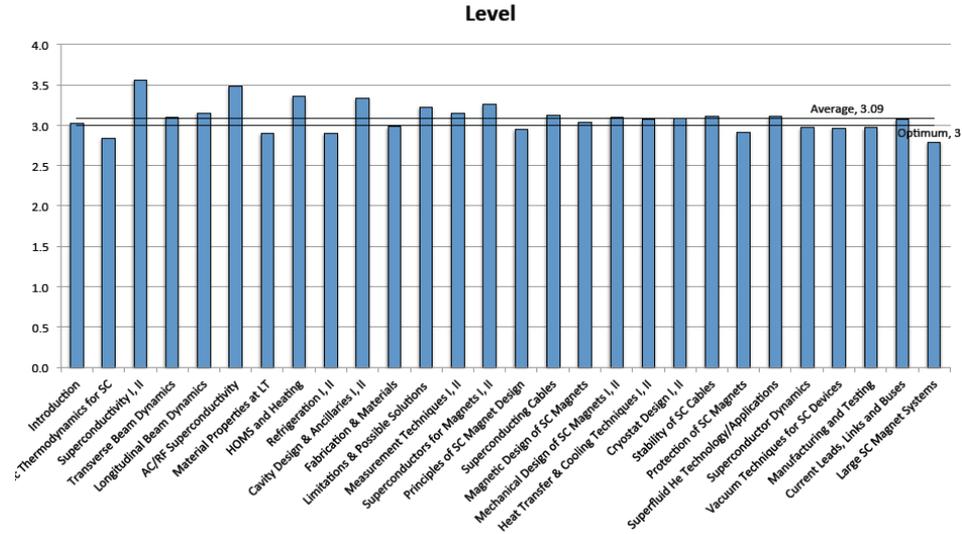
- WiFi in the hotel
  - Username and password provided by the front desk
  - You will need one for each device
- WiFi in the university
  - Eduroam if you have it
  - NTNU guest
    - The NTNU guest network is for visitors who cannot use Eduroam
    - Note that NTNU guest only gives you limited access to the Internet
    - To connect to NTNU guest
      - Click on the wireless icon on your taskbar
      - Select ntnuguest and click connect (koble til)

# Feedback

- Please, please, please, please
- Give us your feedback on the lectures
- For each lecture (series)
  - Level 1 to 5, 3 is ideal, 4,5 too high, 1,2 too low
  - Content 1 to 5, higher is better
  - Presentation 1 to 5, higher is better

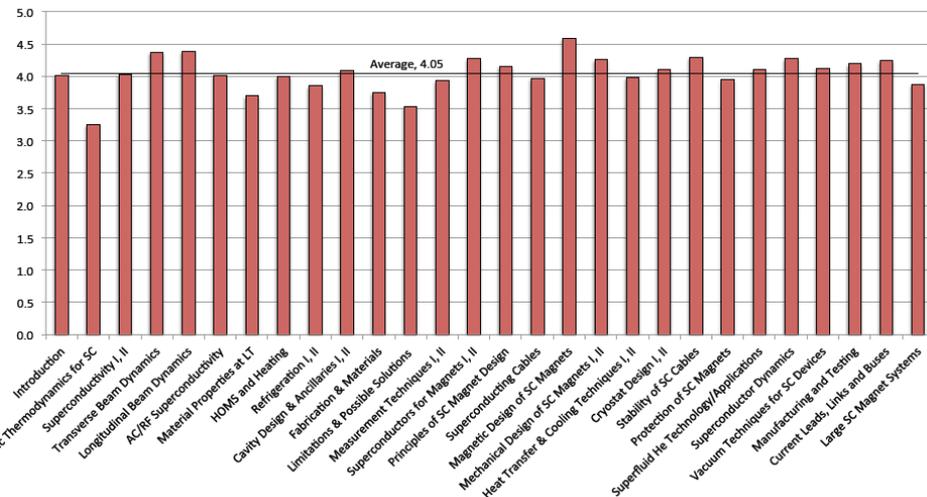
# Feedback from last school

CERN Accelerator School, Superconductivity for Accelerators, Erice, Apr/May 2013 - Replies from 60/94 students



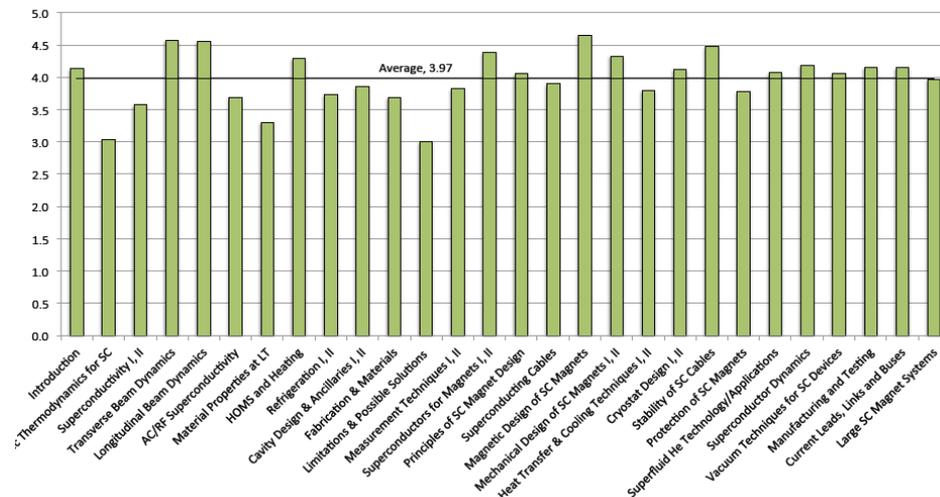
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**Content**



CERN Accelerator School, Superconductivity for Accelerators, Erice, Apr/May 2013 - Replies from 60/94 students

**Presentation**



# LCP combined (Level is 5, 3 or 1)

CERN Accelerator School, Superconductivity for Accelerators, Erice, Apr/May 2013 - Replies from 60/94 students

