The CERN Accelerator School and
Max IV Laboratory are organizing a course on

Vacuum for Particle Accelerators

6 to 16 June, 2017

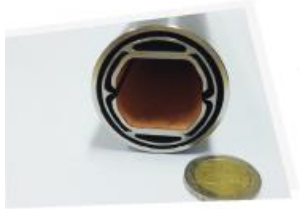
Hotel Örenäs Slott, Glumslöv, Sweden

This course will mainly be of interest to staff in accelerator laboratories, university departments and companies manufacturing vacuum equipment.

Following introductory lectures on accelerator parameters and vacuum fundamentals, the different processes contributing to vacuum quality will be discussed. The various components and techniques currently available for a modern vacuum system will then be treated in some detail, as will beam-vacuum phenomena.

Most afternoons will be devoted to a series of tutorials, where the participants will have the opportunity to work in small groups on a variety of practical techniques.

A full day visit incorporating both Max IV and ESS, both in Lund, will provide a current insight into the field.



Agilent Technologies · HIDEN ANALYTICAL · saes group · PFEIFFER VACUUM · VAT · Leybold

The CERN Accelerator School

Contact: CERN Accelerator School
CH – 1211 Geneva 23 Fax: +41 22 767 54 60
cern.ch/schools/CAS

CERN

Draft Program for the 2017 CAS - Vacuum for Particle Accelerators, June 6 to 16

	Tue 6	Wed 7	Thu 8	Fri 9	Sat 10	Sun 11	Mon 12	Tue 13	Wed 14	Thu 15	Fri 16
08:30	Arrival day and registration	Opening	Materials & properties IV: Outgassing Chiggiato (CERN)	Getter pumps Manini (SAES)	Industrial Vacuum Applications Chew (Edwards)	Excursion	Surface Characterisation Valizadeh (Darsbury)	Transport to MaxIV	Controlling Particles/Dust in Vacuum Systems Lilje (DESY)	Vacuum Acceptance Tests Bregliozzi (CERN)	Departure day
09:30		Introduction to machine parameters Tavares (MaxIV)	Vacuum Gauges I Jousten (PTB)	Ion pumps Maccarrone (Agilent)	Vacuum Gauges II Jousten (PTB)		Interactions between Beams and Vacuum System Walls Cimino (INFN)	Seminar on MaxIV Grabski	Beam Induced Radioactivity and Radiation Hardness Cerutti (CERN)	Manufacturing and Assembly for Vacuum Technology Mathot (CERN)	
10:30		Coffee					Coffee		Coffee		
11:00		Fundamentals of Vacuum Technology Al Dmour (MaxIV)	Mechanical Vacuum Pumps Barfuss (Pfeiffer)	Introduction to Cryogenics Claudet (CERN)	Beam Induced Desorption Malyshev (STFC)		Surface Cleaning and Finishing Taborelli (CERN)	Seminar on ESS Juni Ferreira	Radiation Damage and its Consequence Brugger (CERN)	The Real Life of Ooperation Baglin (CERN)	
12:00		Impedance & instabilities Wanzenberg (DESY)	Computation for Vacuum System of Accelerators Kersevan (CERN)	Cryopumping Baglin (CERN)	Beam-Gas Interaction Ferro Luzzi (CERN)		Thin-Film Coating Costa Pinto (CERN)		Control & Diagnostic Pigny, Rocha (CERN)	Challenges for Vacuum Technology of Future Accelerators Jimenez (CERN)	
13:00		Lunch					Lunch				
14:30		Materials & properties I: introduction Sgobba (CERN)	Tutorials in 5 groups See below	Tutorials in 5 groups See below	Tutorials in 5 groups See below		Tutorials in 5 groups See below	Visit to Max IV	Tutorials in 5 groups See below	Tutorial work closeout	
15:30		Materials & properties II: Thermal and Electrical Calatroni (CERN)						Visit to ESS			
16:30		Coffee					Coffee		Coffee		
17:00		Materials & properties III: Mechanical Behaviour Garion (CERN)	Tutorial work	Tutorial work	Tutorial work		Tutorial work	Transport to Hotel	Tutorial work	Closing	
18:00											
19:30		Dinner									

Tutorial 1 : MOLFLOW+ Monte-Carlo	Group 1	Group 5	Group 4		Group 3		Group 2	
Tutorial 2 : Impedance calculations	Group 2	Group 1	Group 5		Group 4		Group 3	
Tutorial 3 : Mechanical & Material Aspec	Group 3	Group 2	Group 1		Group 5		Group 4	
Tutorial 4 : Residual Gas Analysis	Group 4	Group 3	Group 2		Group 1		Group 5	
Tutorial 5 : Leak Detection and Pumping	Group 5	Group 4	Group 3		Group 2		Group 1	

What we tried to do in 56h

- Opening and closing talks (2h)
- Lectures (30h)
  - Material properties
  - Gauges and Pumps
  - Surface properties and treatments
  - Beam induced effects
  - Computational techniques and controls
  - Manufacturing and acceptance

  - All talks as-given (will be) on Indico
  - Proceedings will follow in about a year
- Tutorials (17h)
- Max IV and ESS visit (7h)

My impressions on the program

- Dedicated Program Committee Meeting in May 2016

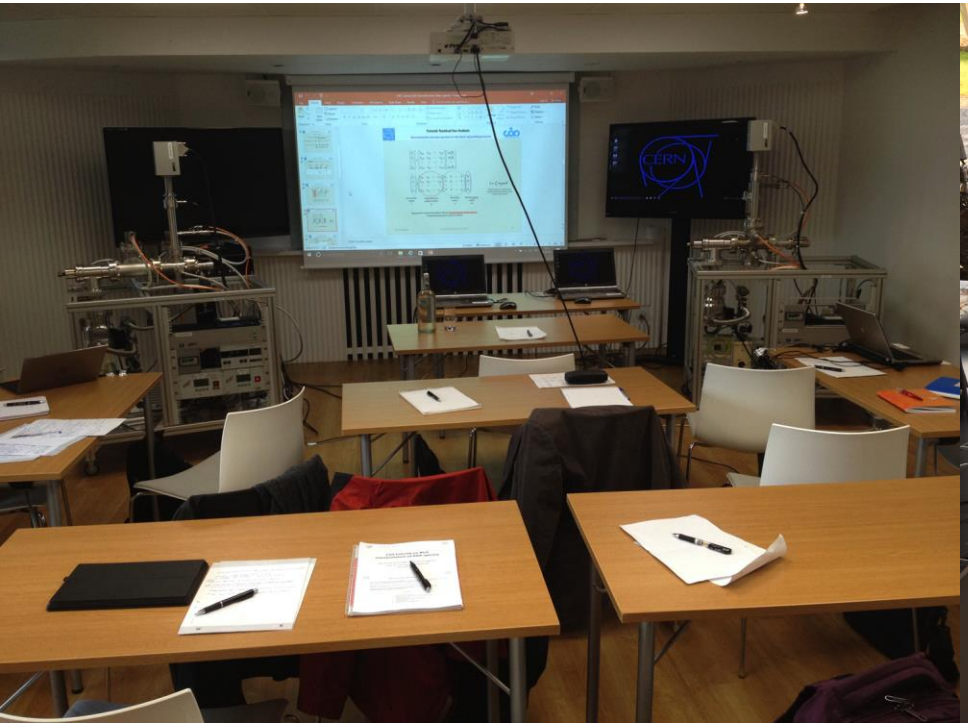
- 28 lecturers delivered 30 lectures
  - Very specific topics
  - Running order
    - About right
  - Quality
    - Generally very high, with a few exceptions
    - Some could have been more pedagogical
  - Level
    - Difficult to get right, maybe a little high
- Tutorials
  - Very well done and very well liked
- Projects
  - Good response, taken seriously
  - Would have been good to have time in the program

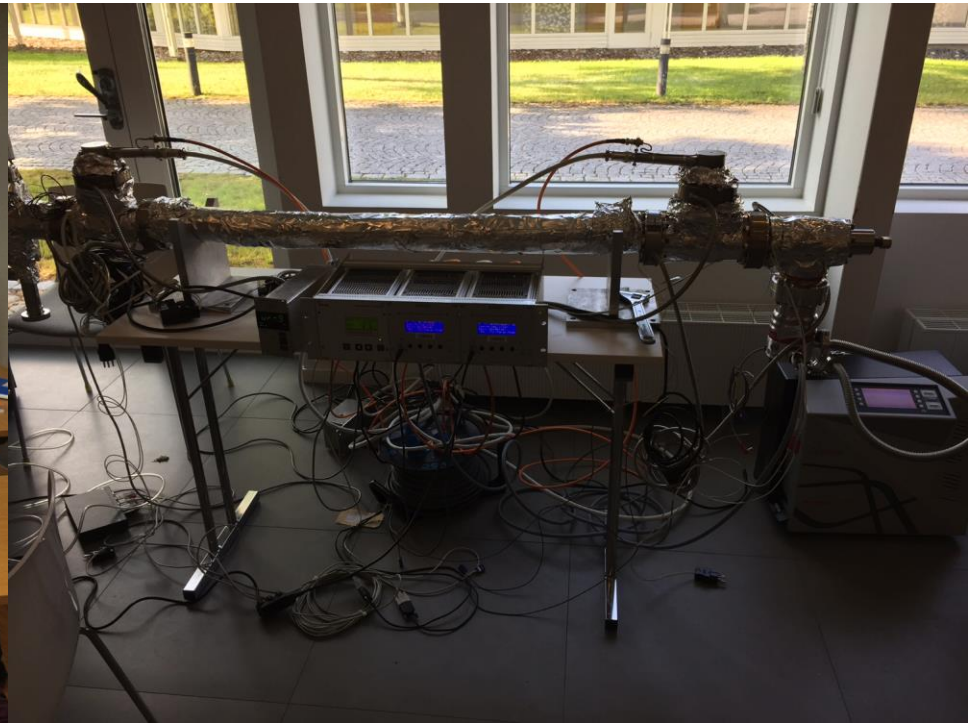
Tutorials

- Impressive logistics
- CERN vacuum group
- Special thanks to

	coordinator	tutor	needed	provider	room
Tutorial 1 : MOLFLOW+ Monte-Carlo	Kersevan	Ady	Computers	CERN	Knopen + Palsteken
Tutorial 2 : Impedance calculations	Calatroni	Salvant	Computers	CERN	Kolen + Durken
Tutorial 3 : Mechanical & Material Aspects	Garion	Sitko	Valves	VAT	Foren
Tutorial 4 : Residual Gas Analysis	Chiggiato	Jenninger	RGA	Hiden	EESTI (in the castle)
Tutorial 5 : Leak Detection and Pumping	Cruikshank	Bregliozzi	Leak detect	Leybold	Skrovet

- Thanks for the help from industry
- Thanks for the help from Max IV
- Thanks for the help from Orenas Slott (and the farmer)


CERN



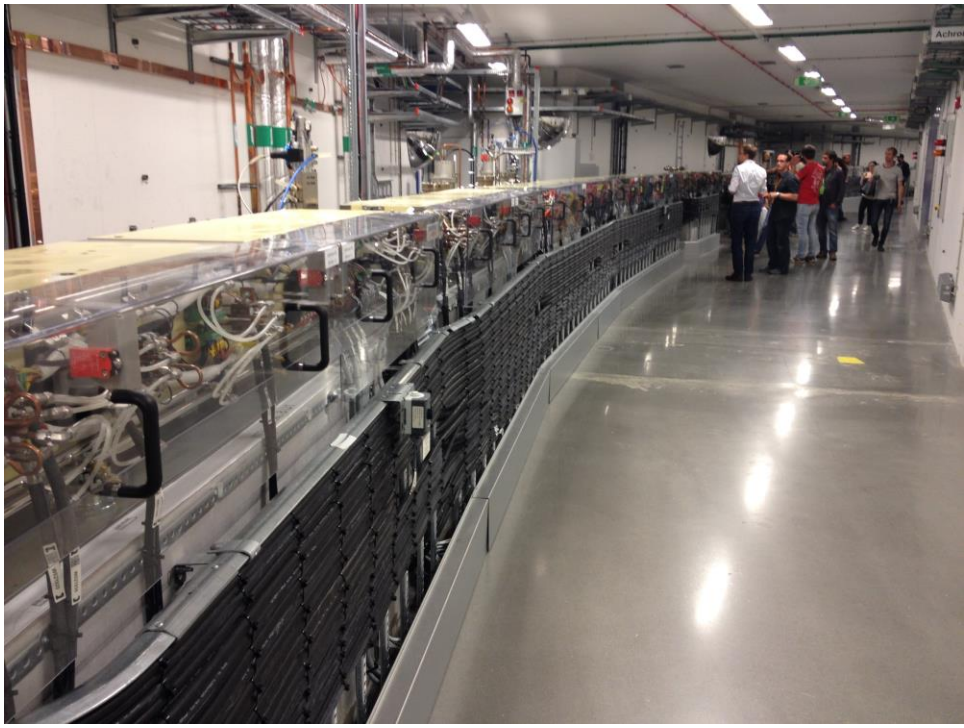
Industrial participation

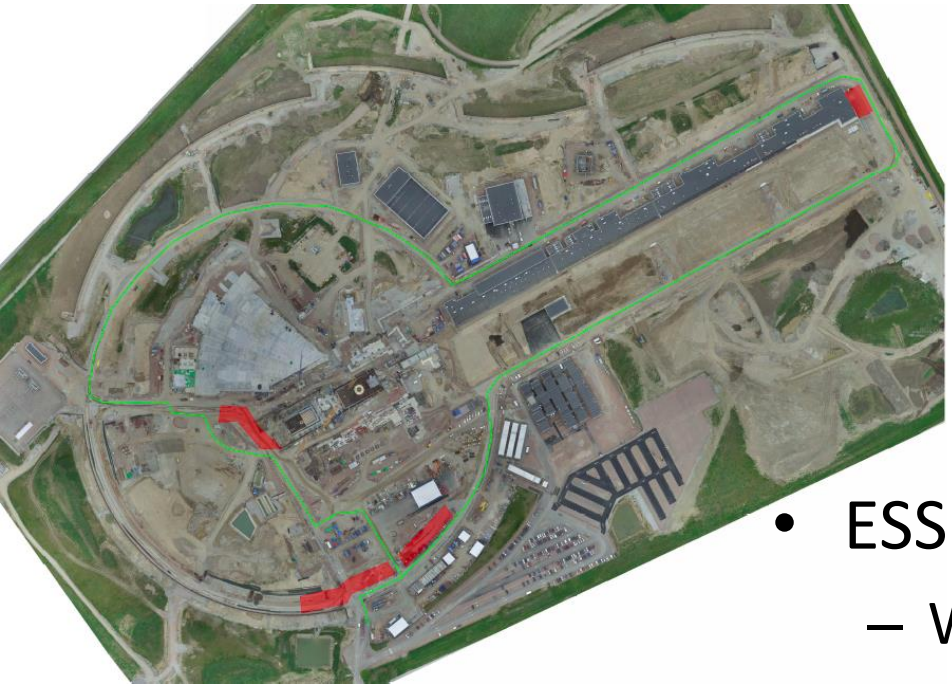
Company	Equipment	Lecturer	Sponsorship
VAT	Valves		Eliana La Francesca
Hiden	RGA		Saeid Pirani
Leybold	Leak detect		Bo Zhang
Pfeiffer		Barfuss	Mastafa Salahshoor
SAES		Manini	Tobias Eggert + Visit
Agilent		Maccarrone	Vahagn Vardanyan
Edwards		Chew	

Industrial exhibition

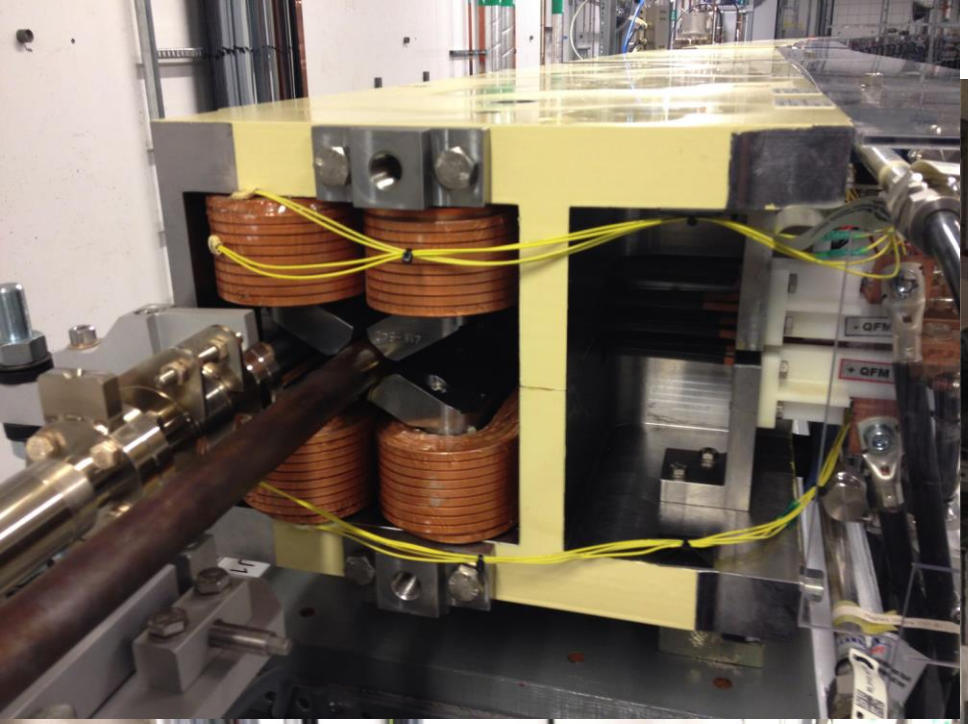
Visit to Max IV and ESS on the Tuesday

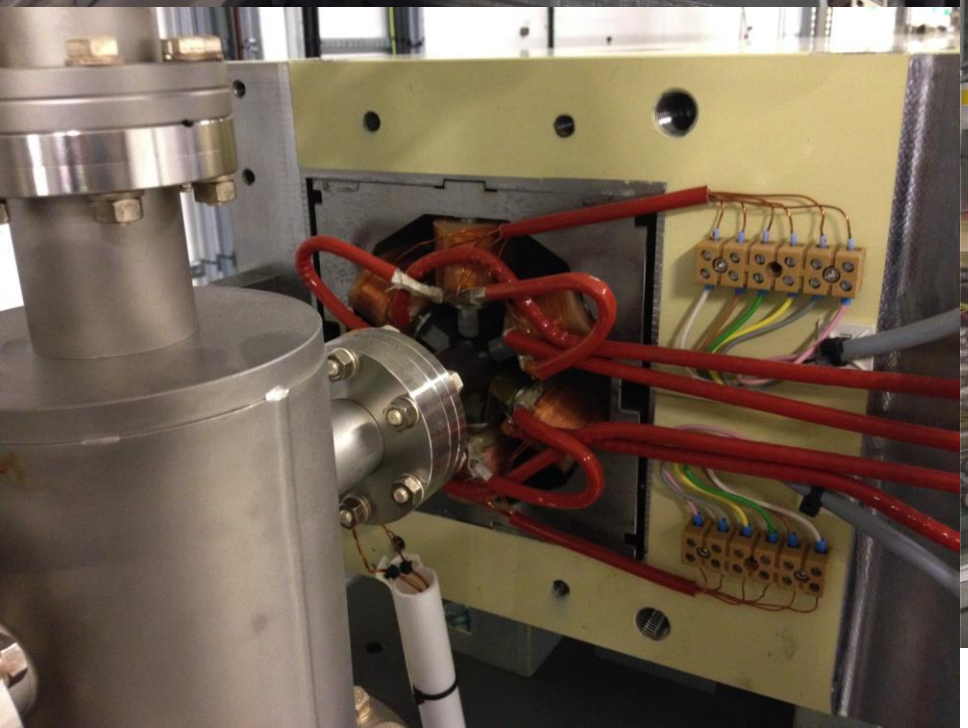
- Interesting seminars
  - Marek on Max IV
  - Marcello on ESS

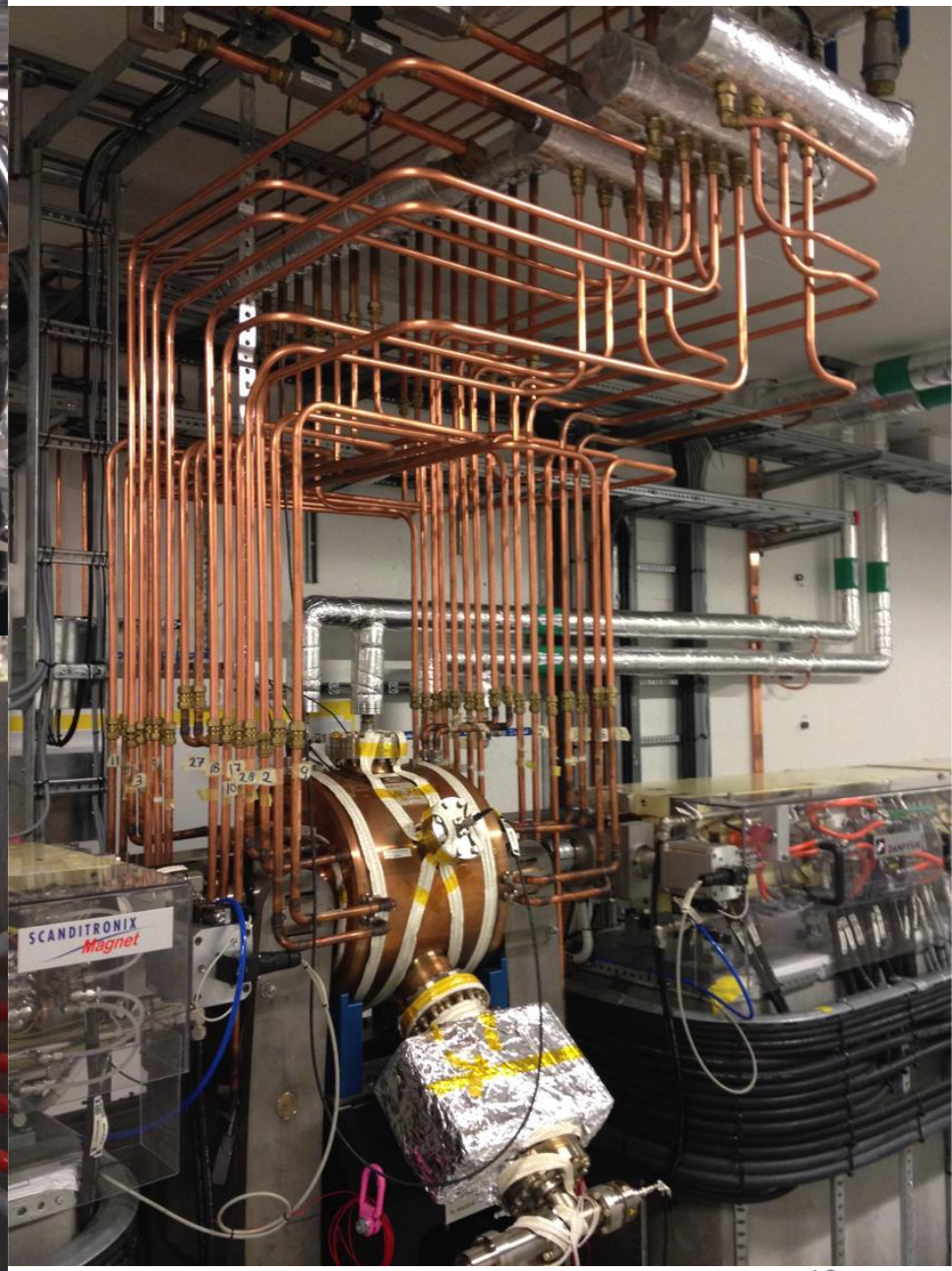


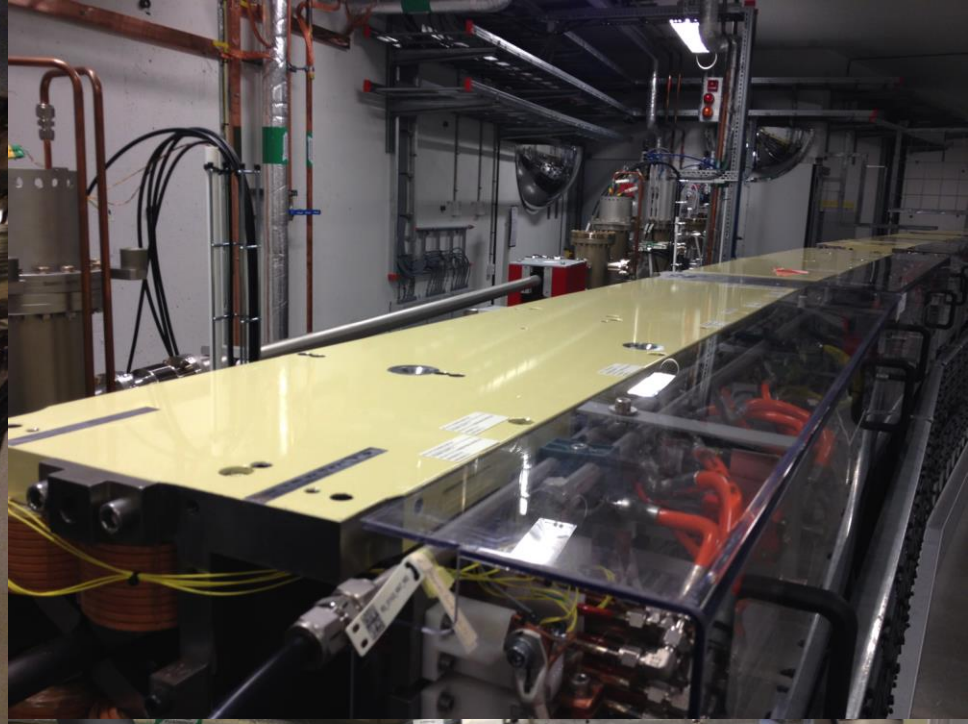


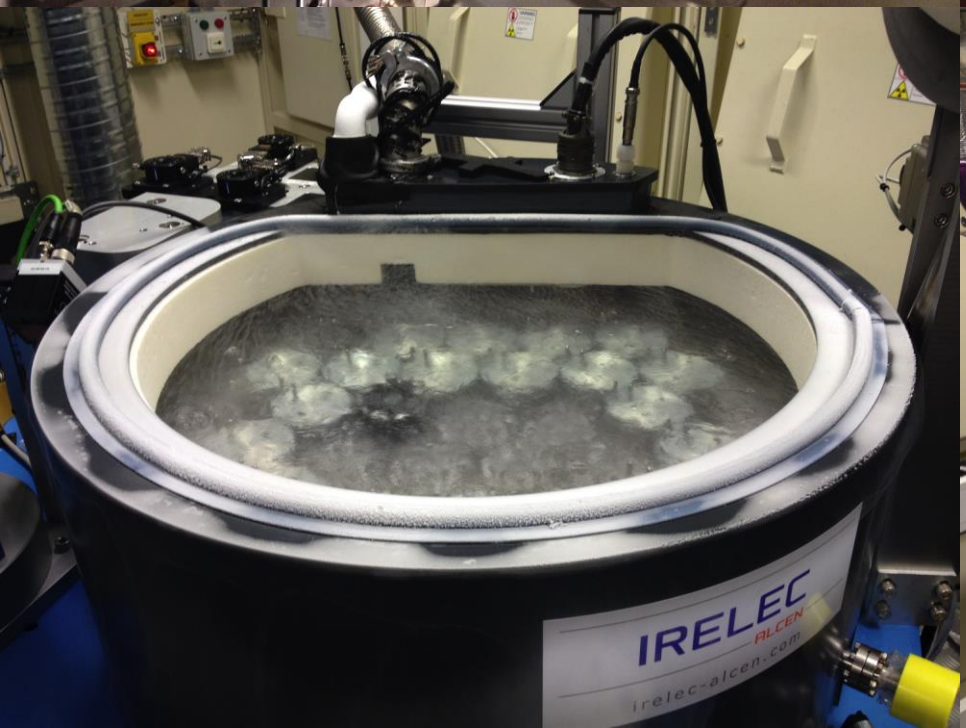
- Max IV
  - Access to the machine(s)
  - Access to BioMax
- ESS
  - We did what we could






SCANDITRONIX
Magnet

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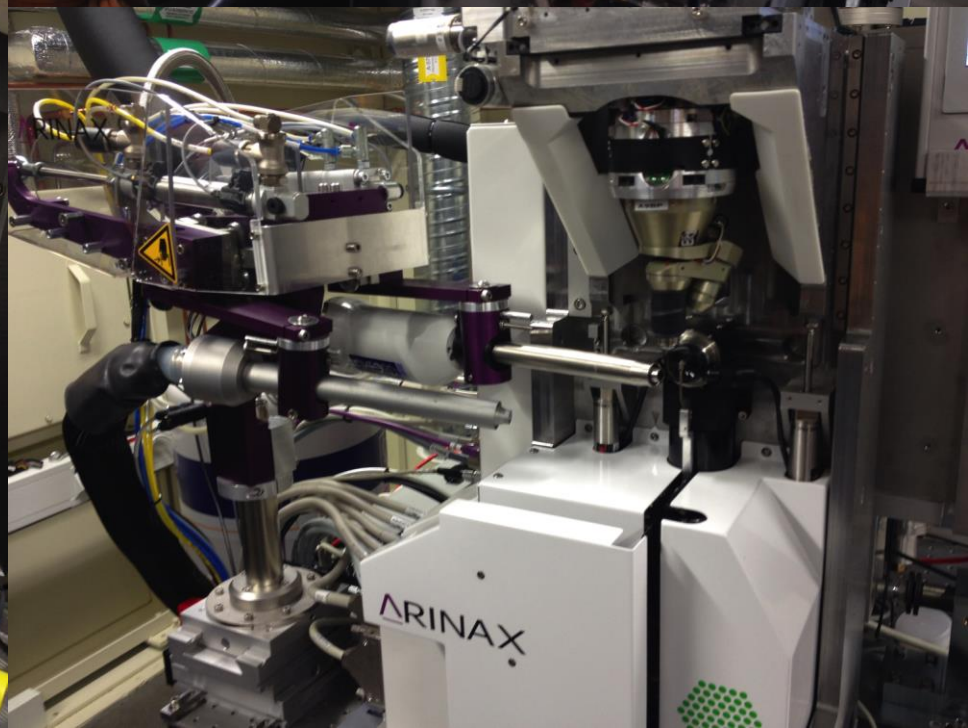

ARINAX

Excursion on Sunday

- Very enjoyable
  - Kronborg Castle
    - Hamlet in an hour
    - Bonus of a cannon salute
  - Louisiana Museum of Modern Art
    - Henry Moore
    - Jorn
    - Giacometti
    - TAL R
    - William Kentridge

(Some of) the social life

Feedback

- Please help us
- Very important
  - For CAS
  - For the speakers
- About
  - The lectures
  - The tutorials
  - The place
  - Anything else

VACUUM FOR PARTICLE ACCELERATORS
6-16 June, 2017
Glumslov, Sweden

YOUR IMPRESSIONS OF THE PROGRAMME

Please mark each lecture with a number 1 to 5 in each of the three columns labelled "Level, Content and Presentation". The meaning of the numbers is as shown below. Please return this sheet to Barbara Strasser or Roger Bailey as soon as possible when completed. Your answers are confidential.

LEVEL	CONTENT	PRESENTATION
1 – Much too low	1 – Completely uninteresting	1 – Very poor
2 – Low	2 – Uninteresting	2 – Poor
3 – Just right	3 – Of some interest	3 – Fair
4 – Too high	4 – Interesting	4 – Good
5 – Much too high	5 – Very interesting	5 – Very good

TITLE	LEVEL	CONTENT	PRESENTATION
Introduction to Machine parameters			
Fundamentals of Vacuum Technology			
Impedance & Instabilities			
Materials & Properties I: Introduction			
Materials & Properties II: Thermal & Electrical Characteristics			
Materials & Properties III: Mechanical Behaviour			
Materials & Properties IV: Outgassing			
Vacuum Gauges I, II			
Mechanical Vacuum Pumps			
Computation for Vacuum System of Accelerators			
Getter Pumps			
Ion Pump Techology for Particle Accelerators			
Introduction to Cryogenics			
Cryopumping			
Industrial Vacuum Applications			
Beam Induced Desorption			
Beam-Gas Interaction			
Surface Characterisation			
Interactions between Beams and Vacuum System Walls			
Surface Cleaning & Finishing			
Thin-Film Coating			
Controlling Particles/Dust in Vacuum Systems			
Beam Induced Radioactivity & Radiation Hardness			
Radiation Damage and its Consequence			
Control & Diagnostic			
Vacuum Design Aspects			
Manufacturing & Assembly for Vacuum Technology			
The Real Life of Operation			
Challenges for Vacuum Technology of Future Accelerators			

If you have any general comments about the course, please write them on the reverse side of this page.

Essentials for a good school

- Scientific program
  - Dedicated program committee, CERN, May 2016
  - 30h lectures, 17h for tutorials, 7h for Max IV & ESS visit
  - Lecturers
    - Prepare, travel, lecture, write proceedings
    - They do this for love not money!
  - Paolo and his team
    - Tutorials
    - Definition before the school
    - Guidance during the school
  - 80 participants
    - Apply, travel, listen, interact
    - Tutorials and projects
    - Provide feedback !

Essentials for a good school

- Location
  - Found in collaboration with Max IV
  - Hotel selected as most suitable venue
    - Beautiful location
    - Conference facilities excellent (not one problem with AV – a first)
    - Tutorials
    - Good lodging
    - Excellent food
    - Support excellent

  - Mikael Petersson
  - Caroline Lindholm
    - And all their staff

Essentials for a good school

- Local Organisation by Max IV
  - Location
  - Logistics
  - Tutorials
  - Visits
  - Excursion on Sunday

  - Eshraq Al Dmour
  - Marek Grabski
    - Carolina Ingvander
    - Karolin Lundberg

Essentials for a good school

- CAS Organisation
  - Starts about 15 months before
    - Selection of venue
    - Establish contract
    - Open and advertise the school
    - Process applications
    - Student invitations and fees
    - Lecturers invitations
    - Help run the school
  - Ends months afterwards
    - Process feedback
    - Lecturers travel claims

- Barbara (and Delphine)

The CERN Accelerator School holds courses in all of the Member States of CERN

2017

- Injection & Extraction
  - » Erice, Italy, March
- Vacuum for Accelerators
  - » MaxIV, Sweden, June
- Advanced AP
  - » RHUL, UK, September
- RF technologies (JAS)
  - » Japan, October

2018

- Future Colliders for HEP
  - » Zurich, Switzerland
- Beam Instrumentation
  - » Helsinki, Finland
- Introduction to AP
  - » Romania
- Computing and Simulation
  - » Netherlands

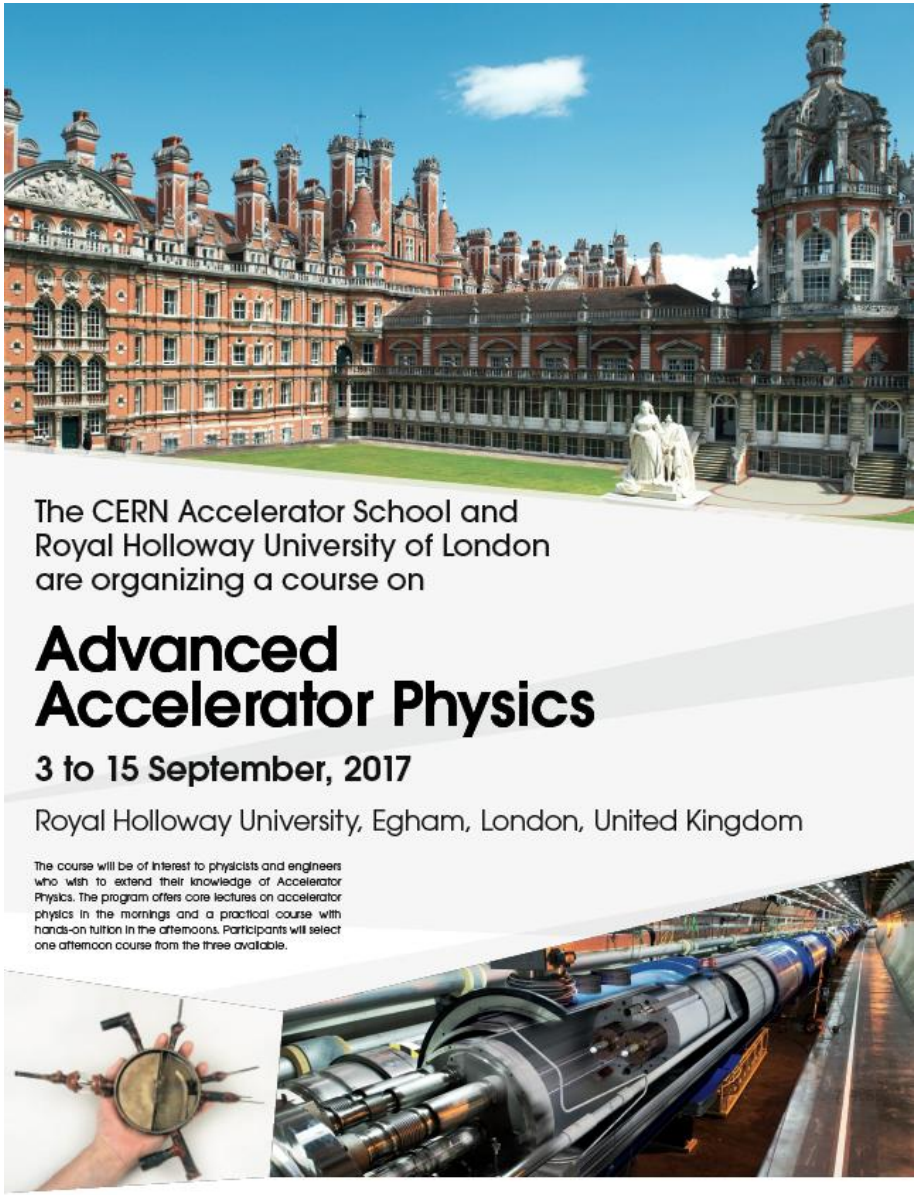
Have been to all except Israel (joined 2014) and Romania (joined 2016)

Advanced Accelerator Physics, London, UK

- In collaboration with RHUL
- Still a few places available
  - Registration is closed but …

- Beam Instabilities
- Non Linear Dynamics
- Low emittance machines
- Selected special topics

- Practical courses in the afternoons
  - Beam Instrumentation
  - RF Measurement techniques
  - Optics Design and Correction



Draft Program for the 2017 CAS - Advanced Accelerator Physics - RHUL - September 3 to 15

	3 Sun	4 Mon	5 Tue	6 Wed	7 Thu	8 Fri	9 Sat	10 Sun	11 Mon	12 Tue	13 Wed	14 Thu	15 Fri
08:30	Arrival day and registration	Opening	Introduction to Lattice Cells Holzer	Wakefields and Impedances Rumolo	Beam Instabilities - Longitudinal LI	Beam Instabilities - Transverse Rumolo	Electron Cloud and Instabilities LI	Excursion	Beam-Beam effects Pieloni	NLD Methods and Tools II Herr	NLD Methods and Tools III Herr	Low emittance machines I Wolski	Departure day
09:20		Discussion							Discussion				
09:30		Recap Transverse Beam Dynamics I Schmickler	Recap Longitudinal Beam Dynamics I Tecker	Space charge in linear machines Ferrario	Space charge in circular machines Ferrario	Instabilities in Linacs Ferrario	Feedback systems II Schmickler		Timing and synchronisation Gallo	NLD Phenomenology I Papaphilippou	NLD Phenomenology II Papaphilippou	Insertion Devices Clarke	
10:30		Coffee							Coffee				
11:00		Introduction to RF measurement techniques Wendt	Introduction Beam Instrumentation and Diagnostics II Jones	Recap Longitudinal Beam Dynamics II Tecker	Energy Recovery Linacs Jankowiak	Feedback systems I Schmickler	Discussion on Instabilities		NLD Methods and Tools I Herr	Study	High Brightness Beam Diagnistics Cianchi	Low emittance machines II Wolski	
11:50		Discussion							Discussion				
12:00		Introduction Beam Instrumentation and Diagnostics I Jones	Introduction to Insertions Holzer	Introduction to Non Linear Dynamics Papaphilippou	Landau Damping I Kornilov	Landau Damping II Kornilov	Advanced concepts for beam-driven acceleration Ferrario		Beam cooling Steck	Advanced magnet technologies Quettier (CEA)	Discussion on Non Linear Dynamics	Advanced concepts for laser-driven acceleration Hooker	
13:00		Lunch							Lunch				
14:30		Recap Transverse Beam Dynamics II Schmickler	C1 C2 C3	C1 C2 C3	Free	C1 C2 C3 Note Bene C1 in RF lab C2 in BI lab	C1 C2 C3		C1 C2 C3	C1 C2 C3	Free	C1 C2 C3 Presentations	
15:30		Introduction to Optics Design Holzer											
16:30		Coffee				Coffee			Coffee			Coffee	
17:00		151M	C1 C2 C3	C1 C2 C3		C1 C2 C3 Note Bene C1 in RF lab C2 in BI lab	C1 C2 C3		C1 C2 C3	C1 C2 C3		Closing	
18:00													
19:30	Dinner												

Coord		Theme
Massimo	Theme 1	Instabilities
Yannis	Theme 2	Non Linear Dynamics
Andy	Theme 3	Low emittance machines

Coord		Practical course in the afternoons	Tutors			
R.Jones	C1	Beam Instrumentation and Diagnostics	H.Schmickler	K.Wittenburg	R.Jones (week1)	M.Gasior (week1)
M.Wendt	C2	RF Measurement Techniques	M.Wendt	P.Kowina	C.Vollinger	
G.Sterbini	C3	Optics design and Correction	G.Sterbini	W.Herr	K.Li (week1)	B.Holzer (week1)

Tutors	
T.Lefevre (week2)	
Y.Papaphilippou (w2)	S.Boogert et al

Joint Accelerator School on RF Technologies

Draft program for Joint US-CERN-Japan-Russia Internarional Accelerator School 2017 -RF Technologies-

Oct. 16-26, Hayama, Japan

October	16	17	18	19	20	21	22	23	24	25	26
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu
8:40 10:10	Arrival Registration	Introduction K. Takayama	Basic concepts2 T. Higo	Cavity 1 NC electron linac H. Ego	Beam diagonostics T. Obina	Cavity 2 NC electron ring S. Sakanaka	Cavity 3 NC proton, ion, RFQ O. Kamigaito	Cavity 4 SRF 1GHz< E. Kako	Cavity 5 SRF low-beta E. Kako	Going to KEK, Tokai	Tsukuba Tour
		Coffee	Coffee	Coffee	Coffee	Coffee	Coffee	Coffee	Coffee		
10:30 12:00		RF theory T. Higo	Klystron S. Fukuda	RF measurements D. McGinnis	Manufacturing Techniques Y. Higashi	Electric discharge Y. Saito	LLRF 1 F. Qiu	LLRF 2 Z. Fang	Simulation tool Z. Li		
		Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch
13:30 14:30		Q&A	Q&A	Q&A	Open time	Q&A	Q&A	Q&A	Q&A	Tokai Tour	Departure
		Coffee	Coffee	Coffee		Coffee	Coffee	Coffee	Coffee		
14:50 16:20		Basic concepts1 T. Higo	Klystron power supply M. Akemoto	Waveguide system S. Kazakov		Window, Load Y. Saito	Deflecting cavity R. Calaga	Poster preparation	Poster		
		Coffee	Coffee	Coffee		Coffee	Coffee	Coffee			
16:40 17:40		Euro-XFEL, ILC,LCLS II M. Ross	LHC P. Lebrun	Pulse compression J. Wang		NC Linac M. Boland	Medical Applications A. Degiovanni	Poster preparation		Going to KEK, Tsukuba	
18:00	Buffet Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Dinner	Special Dinner	Dinner	

School on Future Colliders

	Wed, 21.2.2018	Thu, 22.2.2018	Fri 23.2.2018	Sat, 24.2.2018	Sun, 25.2.2018	Mon, 26.2.2018	Tue, 27.2.2018	Wed, 28.2.2018	Thu, 1.3.2018	Fri,2.3.2018	Sat, 3.3.2018	Sun, 4.3.2018	Mon, 5.3.2018	Thu,6.3.2018
08:30	Arrival day and registration	Opening Seminar L.Linssen	Detectors for HE colliders/MDI I L.Linssen	Recap of long. BD I F.Tecker	Collider Diagnostics / Measurement of critical beam parameters I J.Wenninger	Beam-Beam/Beamstrahlung I K. Buffat	Instabilities/Collective effects/transverse and long. Damping/RT feedbacks I O.Boine-Fr...	Excursion	LC Beam dynamics I D.Schulte	NC & pm magnets T. Zickler	NC high gradient Rf systems I W.Wuensch	Collimation Systems, Lossmaps, safe beam handling and dump, MP concepts, Interaction of particles with matter I N. Mokhov	LLRF challenges/timing T.Schlicher	Departure day
09:20					Discussion					Discussion				
09:30		HE physics at colliders M. Mangano	Recap of transverse BD I H.Schmickler	cryogenics P. Lebrun	Circular Hadron Collider beam dynamics I M.Syphers	Circular Lepton Collider beam dynamics/damping rings I K. Olde	Injection and extraction M.Alba		SC RF systems I E.Jensen	SC RF systems II E.Jensen	NC high gradient Rf systems II W.Wuensch	magnet vibration and feedbacks A.Seryi	Kickers & Septa M.Paraliev	
10:30					Coffee						Coffee			
11:00		Luminosity goals, critical parameters B. Muratori	Detectors for HE colliders/MDI II L.Linssen	Recap of long. BD II F.Tecker	Collider Diagnostics / Measurement of critical beam parameters II J.Wenninger	Beam-Beam/Beamstrahlung II K. Buffat	Instabilities/Collective effects/transverse and long. Damping/RT feedbacks II O.Boine-Fr...		LC Beam dynamics II D.Schulte	Single Shot high brillance beam transport W.Bartmann	RF power systems, CLIC drive beam S. Doebert	Collimation Systems, Lossmaps, safe beam handling and dump, MP concepts, Interaction of particles with matter II N. Mokhov	alignment/metrology D. Missiaen	
11:50					Discussion						Discussion			
12:00		Linear Collider studies overview S.Stapnes	Recap of transverse BD II H.Schmickler	Discussion Session I B.Holzer	Circular Hadron Collider beam dynamics II M.Syphers	Circular Lepton Collider beam dynamics/damping rings II K. Olde	Discussion Session II B.Holzer		SC RF systems II E.Jensen	beams production and transport to collider W.Bartmann	Discussion III B.Holzer	Final Focus/IR/Quadrupole stabilization A. Seryi	positron production M. Kuriki	
13:00					Lunch					Lunch				
14:30		Large circular colliders overview, he incl. M.Benedikt	Lessons learnt from LHC M.Lamont	Case Studies Introduction WH/BH/DS	Free	Case Studies II WH/BH/DS	Case Studies IV WH/BH/DS		sc material C. Senatore	Case Studies VI WH/BH/DS	Free	Case Studies VIII WH/BH/DS	Reliability Engineering/Availbilty of Complex A.Lundacke	
15:30		Other HE collider projects (uu, gg) W.Chou	Lessons learnt from LEP W.Herr	Case Studies I WH/BH/DS		Case Studies III WH/BH/DS	Case Studies V WH/BH/DS		Sc magnets /LTS L. Bottura	Case Studies VII WH/BH/DS		Case Studies IX WH/BH/DS	Case Studies Presentations I WH/BH/DS	
16:30		Coffee				Coffee				Coffee			Coffee	
17:00		The big picture Fabiola Gianotti	technology overview and siting P. Lebrun	polarized electron beams/energy calibration J.Wenninger		Seminar I local	Vacuum Challenges R.Kersevan		SC magnets /HTS L. Bottura	Advanced future Collider Concepts P. Muggli		collimators & Dumps & Masks M.Seidel	Case Studies Presentations II WH/BH/DS	
18:00		Extended Discussion											Closing	
19:30		Dinner							Dinner			Gala Dinner	Dinner	

Dinner tonight

- Upstairs in the castle from 19.30
- Exceptionally there will be wine
- Offered anonymously