Quantitative Electron Microscopy 2005

European School on advanced TEM measurement techniques for materials science

Email : QEM2005@cemes.fr
Tel : +33 (0) 562 25 78 91
Fax : +33 (0) 562 25 79 99

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Toulouse, 3rd November 2005

Dear Partner,

We would like to thank you for your kind help in the organization of the **QEM2005 School.**

Please find below our conclusions for the school:

QEM2005 « European School on Quantitative Electron Microscopy: advanced TEM measurement techniques for materials science » was held at "Les Issambres" St Aygulf (French riviera) from the 24th September to the 7th October 2005. The school was mainly funded by the **CNRS** (France) but also with contributions from the **French Microscopy Society**, the **CEA** the **European Microscopy Society** and **Gatan**. QEM2005 was also supported by **FEI**, **JEOL**, **Zeiss** and **Synergie4**.

Nearly 100 students attended QEM2005 originating from France (44), The United Kingdom (20) Germany (7), Sweden (5), Spain (5), Poland (4), Switzerland (3), Italy (2) but also Belgium, Croatia, Israel, Ireland, The Netherlands, Slovenia, Brasil, Korea, The Czech Republic, Norway and Canada.

Lecturers came from France, Germany, Great Britain, The Czech Republic, Ireland, Slovenia, Norway, Canada, and Belgium (see below).

Lectures and computer lab sessions on all the quantitative TEM techniques (Q-HREM, EELS, EFTEM, ADF, HAADF, Holography, Tomography, CBED, LACBED, Image simulation…) were given by 22 lecturers and practical class leaders over the two weeks. Practicals were also performed on two microscopes specially installed for the school: a **JEOL JEM-2100 STEM** fitted with an EDS system, an HAADF detector, a GIF Tridiem and a tomography set-up and a **FEI TECNAI STEM-FEG** 200kV fitted with a biprism and EDX, an HAADF detector and a tomography set-up.

A typical working day at QEM2005 was organized as follow:

- 9:00 / 10:30 : Lecture # 1
- 11:00 / 12:30 : Lecture #2
- 12:30 : Lunch
- 14:30 / 16:00 : Free time or demonstration on the Jeol & FEI microscopes
- 16:00 / 17:30 : 4 practicals on parallel sessions (computers or demonstration).
- 18:00 / 19:30 : 4 practicals on parallel sessions (computers or demonstration)
- 20:00 : Dinner
- 21:00 : Free time or demonstration on the Jeol & FEI microscopes

In addition, 2 round tables and a seminar were organized during the school.

Please find in attachment the detailed program of the school together with its final budget.

Given the success of the school, participants and organisers wish that QEM be repeated in 3 years time and become a regular feature of the European microscopy scene.

For the organizing committee

E. Snoeck, M.J. Hÿtch, V. Serin, M. Kociak, E. Leroy, P. Bayle-Guillemaud

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

GdRE : QTEM

FEI COMPANY™ TOOLS FOR NANOTECH

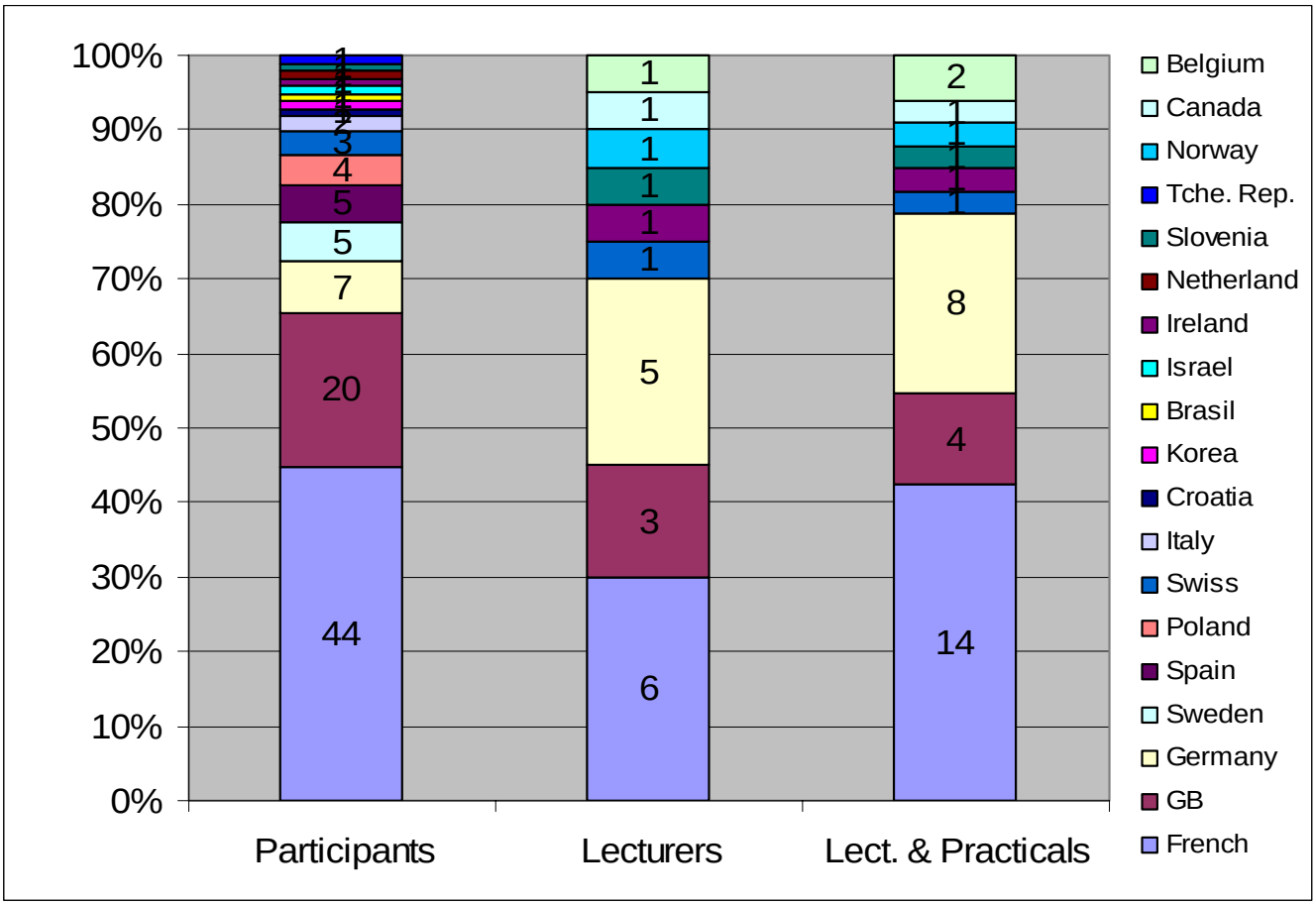
JEOL

ZEISS

gatan

SYNERGIE4

Origin of the participants & lecturers



LECTURES

Lectures are 1½ hours in duration

Short Title	Lectures	Lecturers
ray	Image Planes and Ray Optics	**J.-P. Morniroli**
wave	Introduction to Wave Optics	**P. Formanek**
HREM Q	Quantitative HREM (methods, matching) strain mapping (peak-finding, geometric phase)	**M. J. Hÿtch**
HREM Cs	Cs corrected HREM (theory, practise) exit wave function reconstruction (defocus, tilt series)	**A. Kirkland**
EELS 1	Quantitative elemental analysis (spectrum) ELNES and Low Loss (modelling, energy resolution)	**G. Botton**
EELS 2	Elemental mapping (STEM, EFTEM) electronic states mapping (STEM, EFTEM)	**Jo Verbeeck**
Holo MR	Magnetic fields & electric fields	**R. Dunin-Borkowski**
Holo HR	High-resolution holography (Cs correction)	**M. Lehmann**
QED	Crystallography (SAED, CBED) ordering and amorphous materials (SAED)	**R. Holmestad**
LACBED	bonding and defects (CBED, LACBED) strain analysis (CBED, LACBED)	**J.P. Morniroli**
ADF	Composition mapping (quantitative BF, ADF)	**Th. Walther**
HAADF	High-resolution imaging (HAADF)	**M. Ceh**
Tomo	Principal and methods (reconstruction, holders) signals (ADF/BF/ESI/Holography)	**P. Midgley**
in situ 1	In-situ TEM ; Some general aspects and selected examples	**F. Phillipp**
in situ 2	Environmental TEM for catalysis	**S. Giorgio**
in situ 3	Nanolab (AFM in TEM, applied fields) and in-situ experiments	**M. Kociak**
instr	Cs correctors (TEM, STEM) monochromators (TEM, STEM) imaging filters (In-column, post-column)	**P. Hartel**
CCD	Detectors (CCD, IP)	**A. Kirkland**
simulation	Simulation in EM: theory, uses	**P. Stadelmann**
modeling	Modeling methods for electron microscopy (MD, FE, ab initio)	**L. Calmels**
FIB+	FIB advanced specimen preparation	**R. Langford**

PRACTICALS *Practicals are 1½ hours in duration Each practical will be for a group of 25 students*

Short Title	Room	Practical Class	Organisers
wave/ray	Video1	Wave Optics/ Ray Tracing	**P. Formanek, E. Snoeck**
HREM GPA	Comp 2	strain mapping	**J.-L. Rouvière M. J. Hÿtch**
HREM Cs	Comp	Cs corrected HREM / reconstruction	**C. Hetherington M.J. Hytch**
EELS	Comp	Quantitative elemental analysis ELNES	**O. Stéphan J. Verbeeck V. Serin**
EFTEM	Comp	elemental mapping (STEM, EFTEM) electronic states mapping (STEM, EFTEM)	**P. Bayle-Guillemaud W. Sigle**
Holo MR	Comp	magnetic fields & electric fields	**R. Dunin-Borkowski P. Formanek, E. Snoeck**
Holo HR	Comp	high-resolution holography (Cs correction)	**M. Lehmann H. Lichte P. Formanek**
QED	Comp	crystallography (SAED, CBED) ordering and amorphous materials	**Ch. Koch D. Jacob**
CBED	Comp	CBED, LACBED	**D. Jacob R. Holmestad**
ADF HAADF	Video	ADF/HAADF	**Th. Walther**
Tomo	Video	Tomography	**P. Midgley S. Bals**
in situ	Video	nanolab (AFM in TEM, applied fields) environmental TEM	**M. Kociak F. Phillipp**
Cs 0	Video	Cs correctors, monochromators, imaging filters	**P. Hartel**
CCD	Video	detectors (CCD, IP)	**A. Kirkland**
JEMS	Video	JEMS	**P. Stadelmann**
Multi	Video	Processing/Analysis of multi-component images and spectrum images	**N. Bonnet**
FIB+	Video	Advanced specimen preparation	**R. Langford**
Optionnal practicals			
HREM 3	Video	Q-HREM image analysis	**M.J. Hÿtch**
EELS3	Video	Low loss energy spectroscopy	**V. Serin/ S. Schamm**