



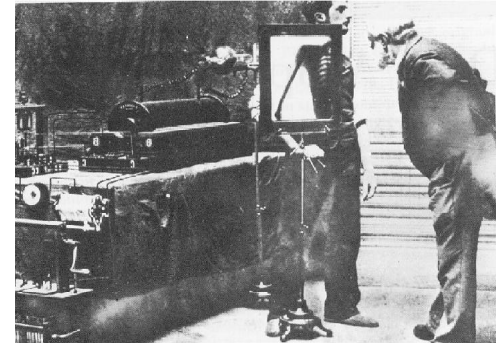
QA and optimization in diagnostic radiology - a multi-disciplinary task: How to build a regional service to implement ALARA

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**Section for Diagnostic Physics
The Intervention Centre**

Challenges in radiology

- **Advanced technology**
 - MR, CT, PET-CT, C-arms
- **Increase in performed CT scans**
 - from 13 million scans in 1990 to 62 million scans in 2006 in the US (McCollough et al, 2009).
 - In 2008, 80% of the total population dose from medical exposure in Norway was related to CT (NRPA report 2010:12)



Regional Physicist Service

- In January 2006, it became mandatory that all hospitals should have physicists
- One + One is more than two (.....in collaboration)
- Started regional physicist service from January 2006 in 15 hospitals
- Today, we are serving 35 hospitals and radiological institutes in the Health Region South-East



Organisation

- **Collaboration agreements between OUH and other hospitals**
- **Non profit service**
 - The salary for physicists and travelling costs related to the work done in a hospital are paid from the actual hospital
- **One contact physicist for each hospital**
 - Working together with the radiologists and radiographers in the radiology department and in the nuclear medicine department
 - Multidisciplinary work is one important factor of success for this work!
- **All physicists in the section is meeting in OUH one day pr week**
- **IMPORTANT to be familiar and feel included in the physicist-environment in OUH while travelling to other hospitals several days a week...**

The Diagnostic Physics Section



8,5 X-ray/CT physicists

**4,5 nuclear medicine
physicists**

6 MR physicists

**1 Radiation protection
supervisor**

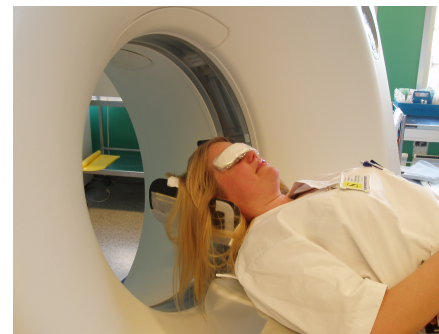
**1 Head of section/CT-
physicist**

6 PhD-students

2 Post doc positions

Services we offer

- System acceptance tests
 - Image quality and dose
- Quality assurance tests annually
- Multidisciplinary Dose- and image quality optimising projects
 - CT
 - Trauma
 - Paediatrics
 - Angio/intervention

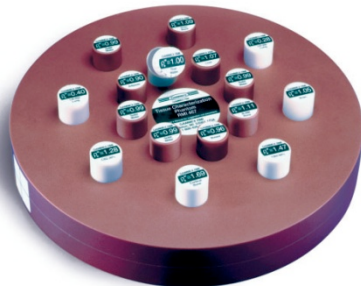
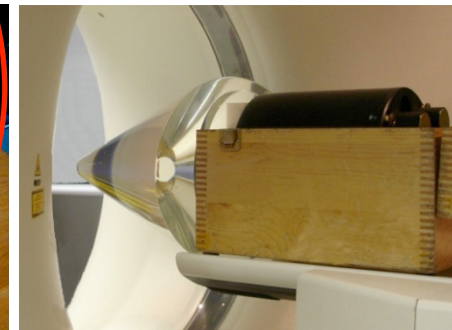
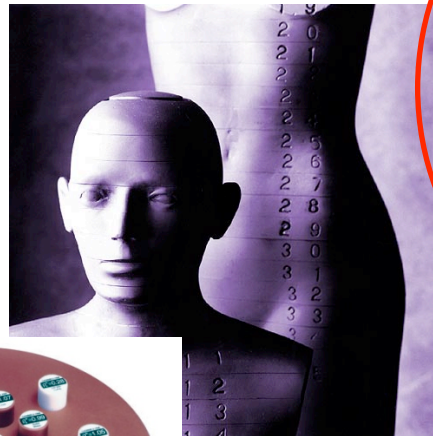
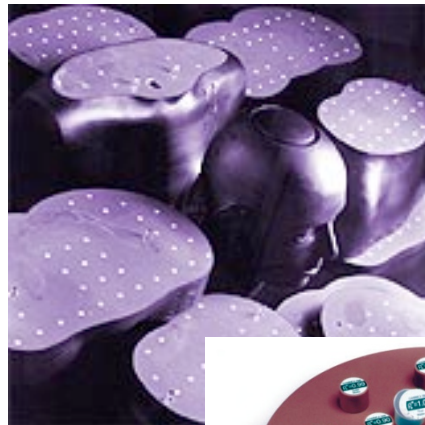
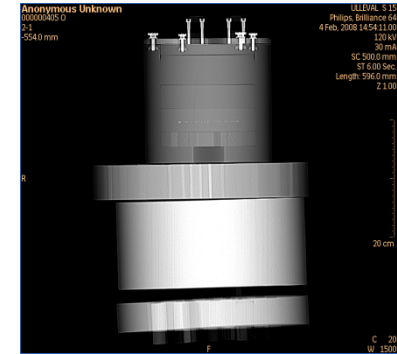
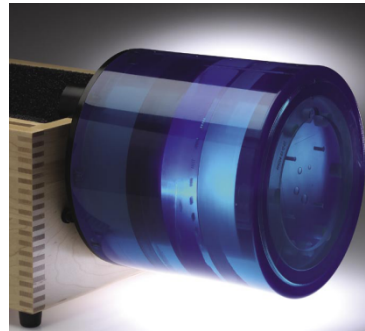


Services we offer II

- Lectures for surgical personnel using X-ray equipment
- Lectures at the radiological and nuclear medicine departments
- Dose measurements and dose estimates
- Consultancy in purchases of new radiology modalities

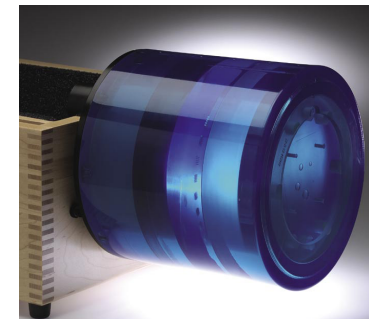


Phantoms and test equipment

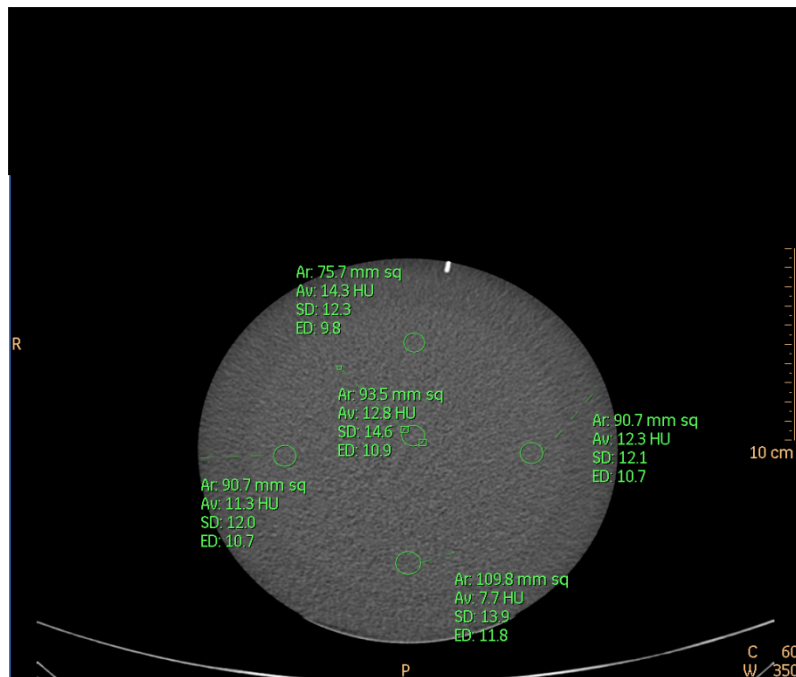
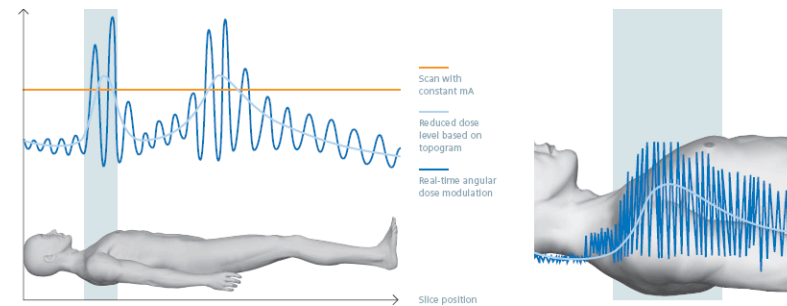


Technical competence

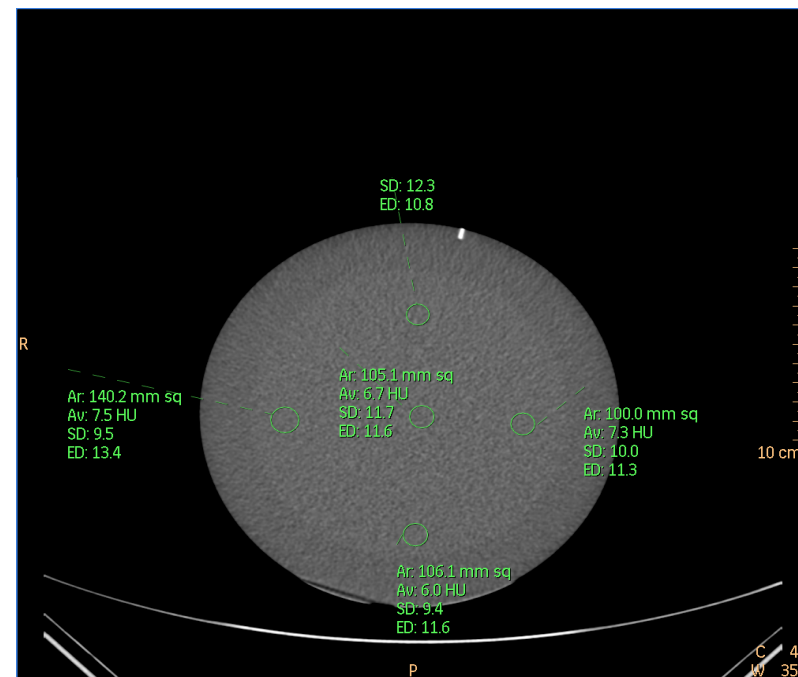
- 450 laboratories are tested annually;
 - approximately 50 CT scanners
- Base-lines and references for different types of equipment for all vendors in the Norwegian market
- Know the quality for different kinds of radiology equipment
- Database under development
 - QA
 - Science



Dose modulation out of order....

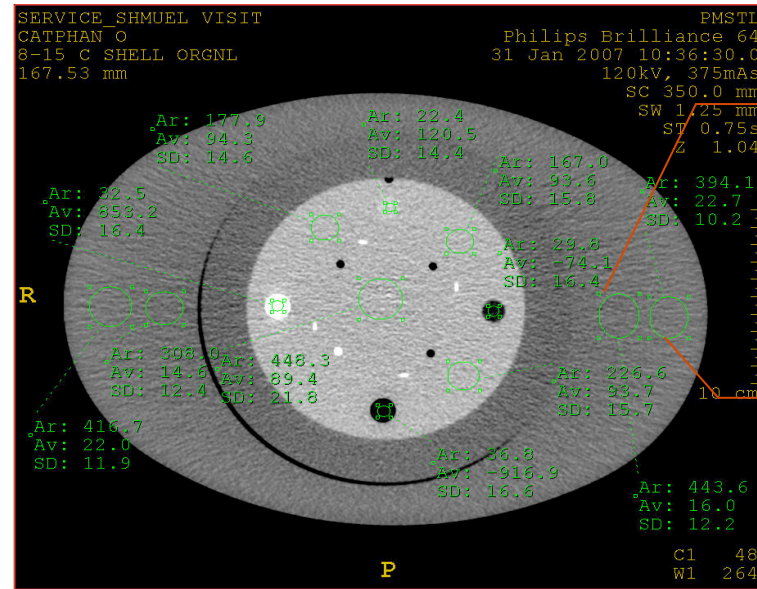
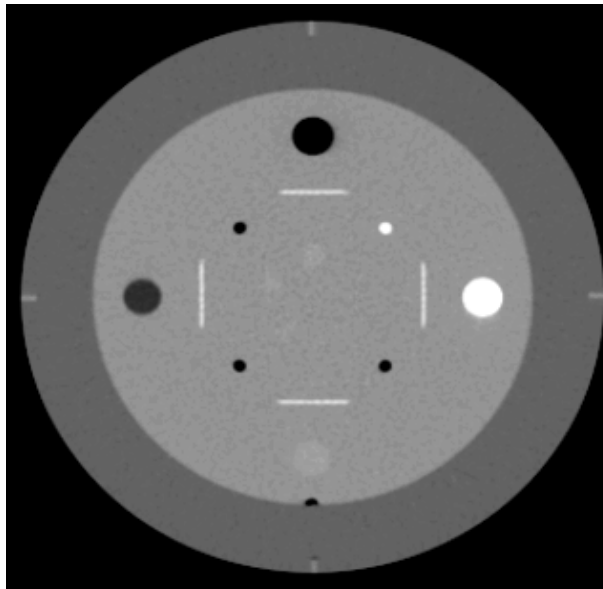


102 mAs/SD 15



81 mAs/SD 12

Deviations in HU measurements



16 HU

22,7 HU

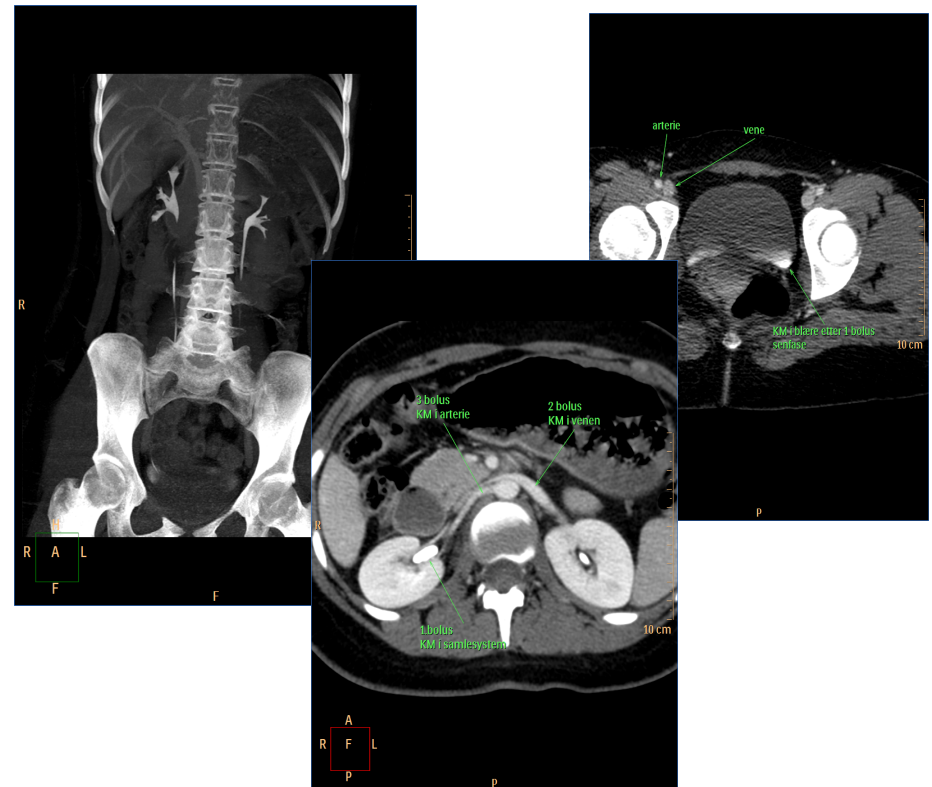
Maufacturer/slice width	Air/	LDPE/	Acryl/	Teflon/
Nominal HU	-1000	-100	120	990
Philips Brilliance 64 /5mm	-921	-79	126	910
Toshiba Aquillion 64 2/ 4 mm	-1001,2	-100,3	117,1	960,2
GE Lightspeed /5m	-933	-93	116	927
Simens Somatom 64/5 mm	-997	-101	123	981

Optimizing radiological examinations

- **NRPA demand from 01.01.2006**
- **Radiologist, radiographer and medical physicist**
- **Cost-benefit (ALARA)**
 - Which exams are performed most often
 - Which exams give the highest patient doses?
 - Which exams are dedicated to children?
 - What about dedicated exams for pregnant patients?

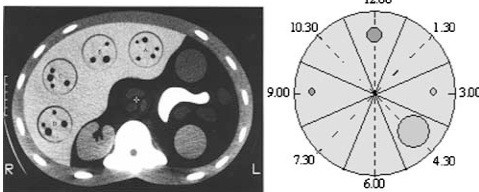
Multi disciplinary modality meetings

- Radiographer, Radiologist and Physicist
- Review of "this weeks' problem-examinations"
 - Diagnostic image quality
 - Radiation dose
 - Iodine contrast
- Monitoring of particularly exposed patients
- Evaluation of "perfect" exams

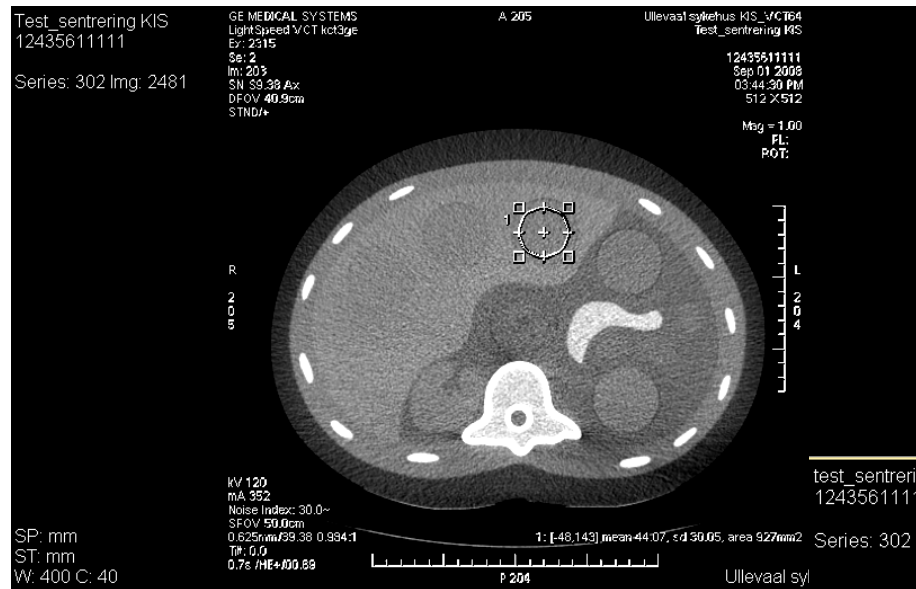


“Standardisation” of CT protocols

- Experience from optimization in several hospitals
 - From single detector to 256 multi detector CT
- Test equipment, image quality and dosimetry phantoms and advanced image analysis
 - Neutral, more objective assessment
- Organ specific, multi disciplinary task groups in the Health Region
- Consensus on adequate image quality for different examinations and clinical indications in the Health Region.

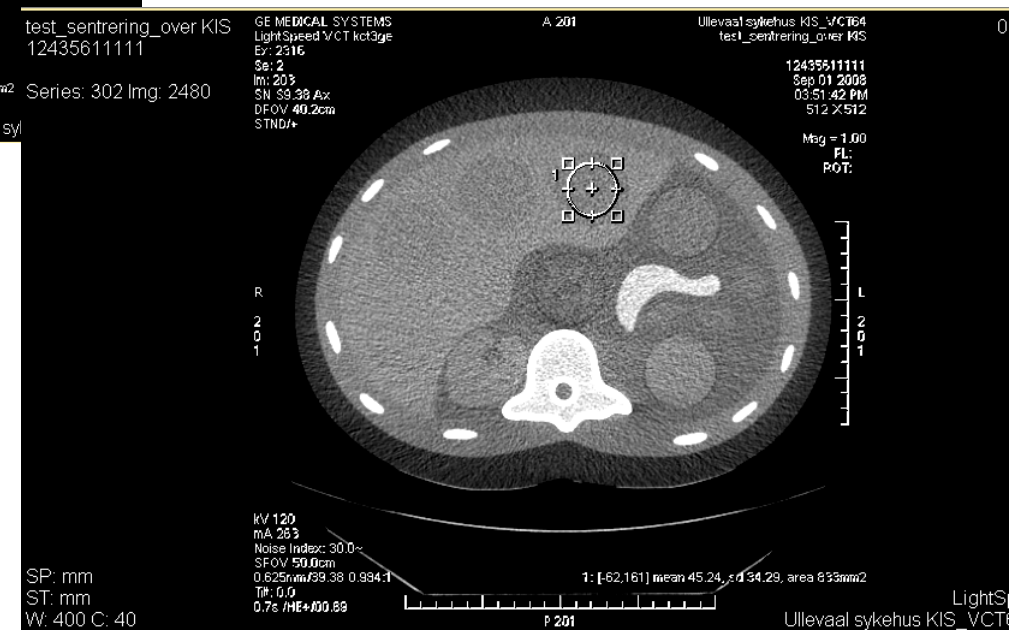


Positioning affects the dose modulation



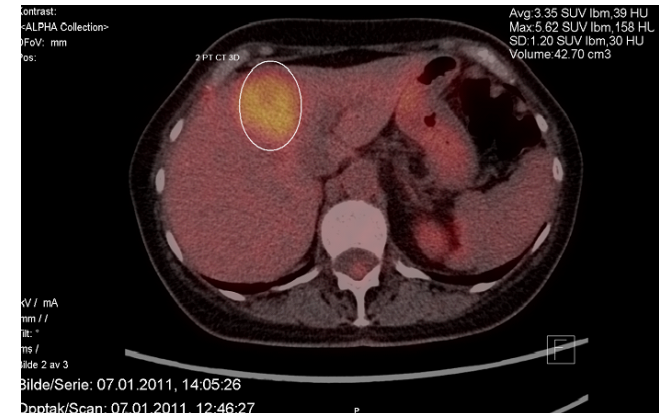
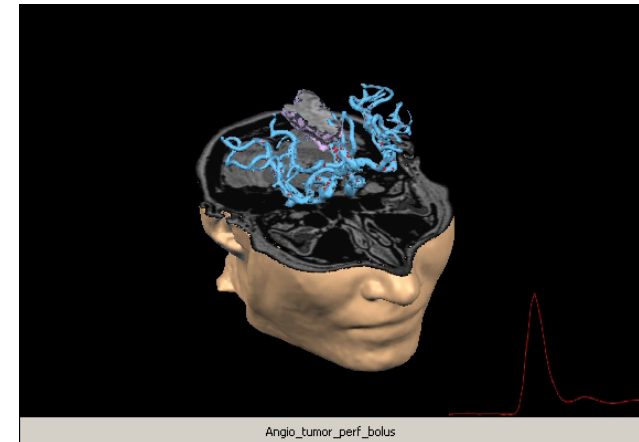
2 cm below
isocentre
352 mA

2 cm above
isocentre
263 mA

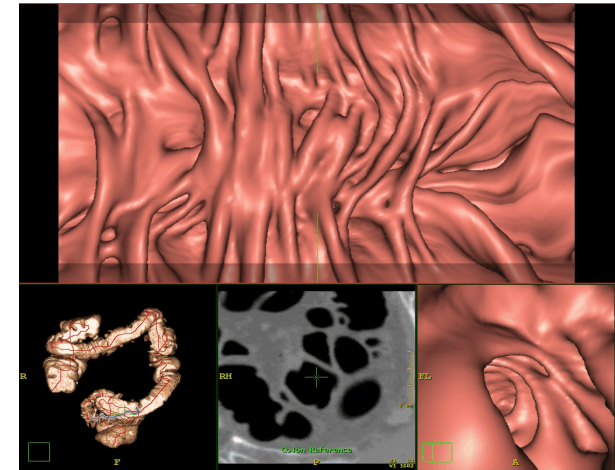


Science

- MR: supervising 6 phds and 2 postdocs
- PET-CT: supervising 2 phd, core facility
- CT: one phd in progress
- Internal dosimetry
- Radiation protection (angio/intervention, paediatrics and CT)
- More than 20 peer reviewed scientific publications in 2010
- 4 presentations on ECR 2011 and 10 presentations and posters at ISMRM in 2011
- 1 professorship (UiO)
- Responsible for post graduation courses for radiographers at HiO
- Co-responsible for a MSc course in physics (UiO)



CT-courses



- CT-courses for radiologists, radiographers and physicists
- Course in CT colonography
 - radiologists, radiographers, gastro surgeons and gastrologists
- Nordic CT colonography school
 - Radiologists and radiographers
- NACP (Nordic association of clinical physicists) CT course for physicists
- National Phd-course in medical imaging in collaboration with MedIm (University of Science and Technology)

Positive effects related to the regional physics organisation

- Large, multidisciplinary network of contacts in radiology and nuclear medicine in the south eastern part of Norway
 - Collaborating with all departments in OUH where X-ray equipment are installed
 - Multi disciplinary projects
- Collaboration with physicists in Norway and internationally
- Collaboration with academic institutions in Norway
 - University of Science and Technology,
 - University of Oslo,
 - University Colleges in Oslo and Bergen

Benefits of a Regional Physicist centre in the Norwegian Health Region South-East

- Achieving high competence in CT, X-ray, MR, and Nuclear medicine
- Exchange of experience increases knowledge
 - Technologic problems are solved by experience from previous corresponding problems on other sites
 - Development of QA methods and procedures
 - Methods are exchanged and discussed in our scientific groups
 - "Clever" solutions are transferred from one hospital to another
 - Individual specialisation and mutual exploitation
- Economically benefits for the region
 - Less personal is needed because of recirculation of methods, lectures, reports and knowledge
 - No problems because of turnover
 - Knowledge is transferred between the hospitals
 - Less measuring equipments, phantoms and so on is needed in the region

**Multidisciplinary collaboration is
exciting and the most important
factor to succeed in the ALARA
work!!**

