

Skjemainformasjon

Skjema	SFU
Referanse	1006665
Innsendt	12.05.2013 20:33:49

Host

Information about host institution and center

Name of centre	Centre of Interaction-based Physics and Technology Education
Host institution	Department of Physics and Technology, University of Bergen.
PO Box address	P.O. Box 7803
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Contact person

Contact person

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About the centre

About the centre

Is the centre already established at the time of application

No

Describe briefly the plans for establishing the centre (maximum 1500 characters)

CIPTED will be hosted by the Department of Physics and Technology, University of Bergen, and will be established and operative from April 2014. The centre leader will be professor Bjørn Tore Hjertaker. The centre will be organized in four work groups, each of which will have a leader and a co-leader, who will constitute the leader group, headed by the centre leader. The key additional personnel of CIPTED will be professor Anna Lipniacka, associate professor Kjartan Olafsson and professor Stein Dankert Kolstø. There will also be a CIPTED centre board, consisting of representatives from UiB, and an advisory board consisting of three persons representing academia, industry and the Norwegian public school system with at least one female and one foreign member. The advisory board members shall monitor CIPTEDs educational progress with regards to the aims and activities laid out in this proposal, and advise/challenge the center leader (leadership team) on the overall educational direction.

Describe briefly the aims and current as well as planned activities of the centre (maximum 1500 characters)

The objective of CIPTED is to enhance interaction and relevance in physics- and technology-based education at bachelor level. A flying start program will be established to optimize the student recruitment process by better integrating new students at the department. Interaction in the learning environment will be stimulated through increased human interaction (student-student and lecturer-student) and stronger interaction between abstract theory and practical experiments/observations. Teaching activities will stimulate peer-support, interactivity, personal response systems, flipped classrooms, and increased use of technical/teaching assistants. The relevance of the education will be improved through stronger interaction with external partners (research institutes, industry, public sector), and stronger coordination with other departments at the university. Research activities in science education (physics didactics) will continuously evaluate and document findings in order to provide new scholarly knowledge. Results will be disseminated broadly to collectively engage science lecturers in active learning. Discussions based on own practices and student feedbacks will be stimulated, e.g. at local and national lecturer workshops. Ideas will be promoted to teachers in public schools through a teacher educational program and events like "Faglig-Pedagogisk Dag". Results will also be presented at international conferences and published in peer-review journals in science education.

Application Document

Application Document

Upload application document

[profile_SFUCIPTED
Application.pdf](#)

Timeline and budget

Timeline and budget

Upload planned timeline and the activities to be conducted

[timeline_SFUCIPTEDPlanned
timeline.pdf](#)

Upload plan for financial resource acquisition

[financial_SFUCIPTEDFinancial
resource_acq.pdf](#)

Upload budget

[budget_SFUCIPTEDBudget.pdf](#)

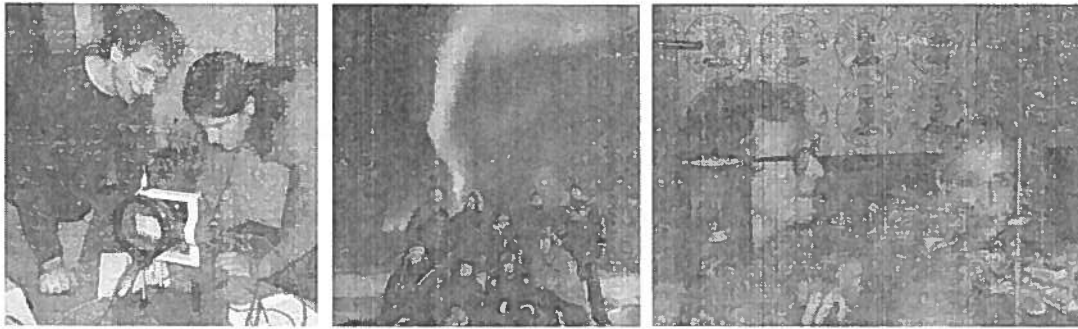
Attachments

Attachments

- Letter_UNIS.pdf
- Letter_Birkeland_Centre.pdf
- Letter_CERN.pdf
- Letter_Roxar_Flow_Measurement.pdf
- Letter_Haukeland_University_Hospital.pdf
- Letter_Christian_Michelsen_Research.pdf
- Letter_Dept_of_Physics_and_Technology.pdf
- Letter_Faculty_of_Mathematics_and_Natural_Sciences.pdf
- Letter_University_of_Bergen.pdf
- CV_Olafsson.pdf
- CV_Lipniacka.pdf
- CV_Kolstoe.pdf
- CV_Hjertaker.pdf
- References.pdf
- budget_SFU CIPTED Budget.pdf
- financial_SFU CIPTED Financial resource acq.pdf
- timeline_SFU CIPTED Planned timeline.pdf
- profile_SFU CIPTED Application.pdf
- Letter_Norwegian_Physical_Society.pdf

Comments

Comments to the application form (maximum 1500 characters)



Centre of Interaction-based Physics and Technology Education (CIPTED)

A proposal for a Centre of Excellence in Education

Principal investigator: *Professor Bjorn Tore Hjertaker*, University of Bergen.

1. Profile and Vision

Background. Department of Physics and Technology (IFT), University of Bergen (<http://www.uib.no/ift/>) gives research-based education in physics and technology by integrating scientific results, pedagogical methodologies and teaching concepts. IFT is committed to *excellence in education and research*, and continuously seeks to improve the balance between education, research and societal impact. IFT offers programs in physics and petroleum- and process technology, and is also a major contributor to cross-disciplinary programs in nano science, science teacher education, and energy resources. Our **vision** is *through high-quality education to (1) maximize students' practical understanding of abstract physics theory; (2) maximize societal relevance of students' competences in research, industry and education, and (3) continuously monitor results and adjust our study programs to achieve (1) and (2).*

Interaction. Interaction between *theory and experiment* (model building, model testing, development of equipment and analysis methods) includes development of problems and learning situations similar to real-life. Students get experience in modelling, solving technological problems and using apparatus of relevance for their professional life, which agrees with research on the issue of knowledge transfer (Anderson, 1996) and how our thinking, knowledge and competence is tied to learning situations (Säljö, 2001). Our focus on interaction is founded on knowledge of how practical project work requires both cooperation and independent work. Our study programs include elements to foster problem solving, experimentation, cooperation and autonomy. *Human interaction* is fundamental for development of conceptual understanding. New ideas must be processed and tied to prior knowledge and relevant observations/situations, which is important in lectures (Deslauriers *et al.*, 2011). Since short term memory is restricted, stimulation of processing and clarification of new ideas is paramount. We therefore seek to enhance dialogical ways of teaching, and challenge lecturers to transform their teaching. IFT already offers highly successful master degree education, as described in section 2, and our candidates are in demand in industry, education and research (NFR, 2010).

Relevance. Physics addresses needs and challenges in society related to *e.g.* energy, environment, medicine and further understanding of nature. Our courses are modified according to new discoveries in physics, and cross-disciplinary programs are introduced to meet the requirements of industry and research. Research in applied physics is closely related to existing technological challenges. Research within fundamental physics intends to understand nature and discover new phenomena by development of mathematical models and experimental and/or computational methods. In our education we combine present knowledge of nature with development of technological applications, new experimental methods and data analysis.

The innovative aspect in our vision is the combined focus on *human interactions* and *theory-experiment interaction*. This ensures focus on human interaction in the important but challenging situations where theory is to be understood in light of the situations in which it applies, and vice versa. Moreover, this combined focus will at the same time increase the *relevance* of the developed competence.

Challenges. Our bachelor programs have challenges not present at the master level, and CIPTED will therefore focus on:

- Stronger interaction between bachelor students and the academic staff, master and PhD students, and within the bachelor student group.
- Stronger integration of abstract theory with experiments and observations.
- Closer connection to industry/society through project work outside the department.
- Better adaption of introductory courses in physics for students in chemistry, biology etc.
- Research on university level science education (physics didactics) and more systematic insights in effects of different teaching methods and measures.

Benefit. A Centre of Excellence in Education (CEE) will benefit the other university departments within science and mathematics through mutual course adaptation. CIPTED will allow us to immediately improve the bachelor education, especially related to peer-support, interactivity, e-learning (*e.g.* voting system and flipped classroom) and evaluation in learning contexts involving observation or experiences. For dissemination, internally and externally, we will provide videos with best practice examples and workshops with experience-based training in successful teaching methods and models for professional development of lecturers. Documentation of effectiveness will be disseminated through research articles. Together with partners at other departments, national and international industry and research centers, we have an excellent opportunity to establish a successful CCE to the common profit of ours and other departments at the University of Bergen, other Norwegian universities as well as our partners abroad.

2. Outputs and Quality in the Established Activities

2.1 Result factors

In 2010-2012 IFT had a steady increase in the number of bachelor students, see Figure 1. A small reduction was seen for master students, mainly due to the high demand for skilled industry labour. Overall, recruitment is stable, which we consider as an indicator of high educational quality. Figure 1 also shows degrees awarded at the Department (on average 52 bachelor and 56 master degrees per year). For master students admitted in 2008-2010, 88% finished within 2 years. IFT produces ~25% of the master degrees at the Faculty of Mathematics and Natural Sciences with only 15% of the total staff, and it also has the widest range of master degree projects at our university; including theoretical and experimental physics, instrumentation, modeling, energy, environment, science didactics, and technology in industry and research. The website <http://www.studiekvalitet.no> provides statistics on students' satisfaction with higher education in Norway. The students were asked to rank institutions, their professional content, their teaching quality and relevant job opportunities. The diagram in Figure 2 shows the results for physics at the three largest universities in Norway (Trondheim, Oslo and Bergen). Bergen (in green) scores high in every category, and is best on relevant jobs. The same statistics reports that the Bergen students are likely to receive 7-11% higher salary than students from Trondheim or

Oslo, which may indicate that society and industry has a particular positive attitude towards the knowledge, skills and expertise of our candidates.

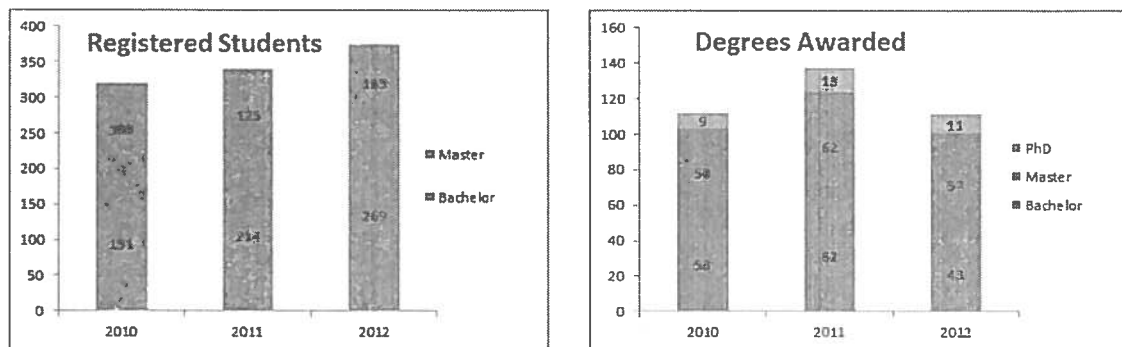


Figure 1 – Registered bachelor and master students at IFT and degrees awarded for the period 2010-2012.

Teaching quality is the area where this proposal seeks to make major improvements, and by initiating a closer link between our teaching and our external partners, we expect to further improve the relevance for the job market. Students graduated from IFT are of high standing in the industry, exemplified by the following statement by Vice President Eivind Olav Dahl (CMR Instrumentation): *“It is my opinion that the graduates from IFT have a strong professional foundation with a good balance between theoretical and experimental knowledge, which makes them very attractive for a wide variety of positions in industry”*.

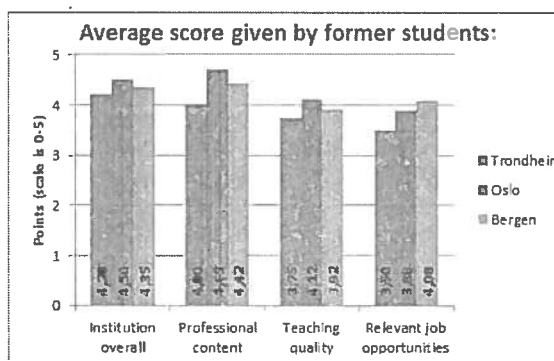


Figure 2 – Average score given by former physics students at the three largest universities in Norway (Trondheim, Oslo, Bergen) related to overall institution rating, professional content, teaching quality and relevant job opportunities.

2.2 Process factors

Ensure relevance. Several process factors contribute to enhance relevance and quality at master and bachelor level at IFT. Courses are led by academic staff in close contact with industry, research institutions, management, and schools. Lecturers of master courses have freedom to adjust the curriculum to maximise relevance of competence, content and activities. Course descriptions have been renewed to match the national qualification framework and standards for learning outcomes initiated by the Bologna-process. One IFT professor participated in this process at the faculty level. IFT took the opportunity to increase awareness of the importance of identifying and communicating competences, not just the content to be learned for each course. Student evaluations and internal discussions have revealed overlaps, gaps and relevant issues. A reform process was initiated two years ago. Work groups identified challenges and possibilities, and restructuring of the bachelor courses will begin later this year to increase relevance both towards the job market and towards other programs (biology/chemistry). Student feedback has also identified the necessity to increase relevance of assignments and examples in several courses at several departments.

Linking educational and R&D activities. IFT promotes the interplay between research and high-quality education, and has close connections to industrial partners (process/petroleum) and nuclear- and

particle physics (CERN). IFT is the host institution for The Birkeland Centre for Space Science (Norwegian Centre of Excellence - SFF). IFT also participates in a Centre for Research-based Innovation (The Michelsen Centre for Industrial Measurement Science and Technology). Many international scientists visit IFT each year, and the visiting scientists also give lectures and supervise students. Master and PhD projects are significant for the research groups and provide an efficient way to transfer knowledge and responsibility. The interplay between research and education, and the different topics offered for the master students in mono- and multi-disciplinary programs, is communicated through IFT's organizational matrix, see Figure 3.

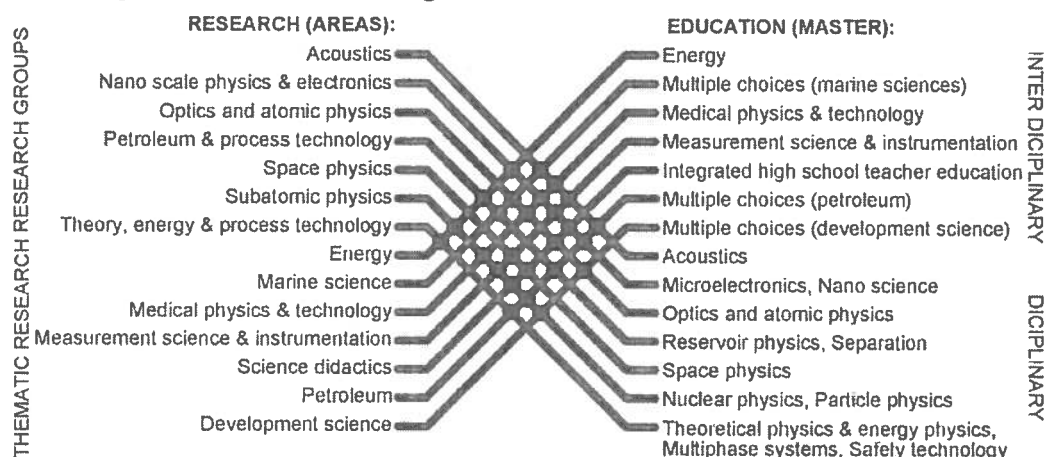


Figure 3. IFT's organizational matrix: The seven research groups are listed in the upper left (red), and research topics are listed in the lower left (green). All master programs are listed on the right; the cross-disciplinary programs in the upper right (green), and disciplinary physics programs in the lower right (red).

Master programs with relevance and interaction. When developing the quality of our bachelor education, we take inspiration from our successful master programs, in which IFT seeks to expose students to research and industrial environments in order to develop their application-oriented insights and research capabilities. IFT has extensive collaboration with external partners, e.g. Haukeland university hospital, Bergen University College, The Institute of Marine Research (Havforskningsinstituttet), Christian Michelsen Research (CMR), CERN and Roxar Flow Measurement. Master projects conducted in such stimulating learning environments link abstract concepts to concrete practices, measurements and equipment. IFT gains updated information on professional requirements, securing high societal relevance for our master programs. The master students are included in research groups, and are supervised by active researchers in an environment of student presentations, discussions and human interaction with researchers, PhD students and fellow students. Master courses with few students are also characterized by widespread interaction.

Facilitating student learning at Bachelor level – toward increased human interaction. Bachelor students have less contact with on-going research and application, and IFT aims to improve this area by building on experiences from the master program, although new strategies must be tested. IFT believes in student-lecturer and student-student interaction, active interplay between abstract models, practical measurement skills and applications, developing students' problem-solving skills, the ability to communicate and collaborate, critical thinking and creative thinking (Meld. St. 18, 2012-2013). Every researcher must participate in teaching, and the teaching methods at IFT are varied, although mainly traditional. According to student evaluations, lecturers' communication skills vary from excellent to ordinary. At the positive end we have statements like: *“Both the calculation tutorial and the lectures*

have been exceptionally inspirational and instructive. Participation in the tutorials has made it possible for me to follow the progress of the course, and the teaching assistant has been very helpful, without necessarily giving us answers to the exercise problems directly". On the negative end, in addition to average communication skills, evaluations by students state the need for "Fewer proofs and more understanding. More time for questions and discussions". IFT is stimulating the use of demonstrations, interaction and student activities, hoping to receive more evaluations like the following: "The lecturer gave excellent, systematic and well-arranged lectures, and I enjoyed very much the simple experiments he conducted in the lecture room to demonstrate the topic at hand. It is easier to understand physics when it is demonstrated in practice". Voting equipment is used in two courses to engage the students' thinking and discussions in the classroom, e.g. during practical demonstrations, but its use is still under-developed. Demonstrations are used by most lecturers. Some courses are based on laboratory exercises combined with brief lectures at the laboratory. The teacher education courses make frequent use of seminars and discussions based on experiences with learning situations and equipment. IFT offers one course using a web-based learning environment. In the course PHYS117 (5th semester), the bachelor students in pair of two interact with research groups and work autonomously through literature study, problem-solving, measurements, and oral/written communication of results. In addition to lectures, many courses include workshops in small groups where problem-solving exercises are discussed under supervision of Teaching Assistants (TA). The TAs are usually majoring in the subject, and these workshops receive both positive and challenging words from students. Some students comment on TAs' cleverness in explaining and stimulating them to discuss, think and "try again". Other students complain that there is not enough time for personal supervision, too much presentation of solutions without really explaining things, and too little stimuli and time for discussions. The study program boards regularly discuss evaluations made by students and lecturers, offer recommendations, and encourage lecturers to make improvements when needed.

Assessment methods – insufficient monitoring of relevance. In most bachelor courses the assessment includes evaluation of conceptual understanding, problem solving abilities and experimental competences. From laboratory exercises, project work and thesis, the students get comments on their written reports. To provide more feedback, and to enhance students' learning effort, many courses include a midterm test. Revised learning objectives have enabled students to identify core themes in courses, help students assess their own study progress, and help lecturers harmonize with other courses. Consistency between course descriptions and tested competences was increased in 2012 when learning outcomes for all courses and programs were reformulated. However, the learning activities were not modified, although the relevance relating to future workplace challenges was part of the reform.

2.3 Input factors

IFT is committed to its educational obligations. High quality education is rewarding and essential for the future of our research groups. The professors and associate professors are responsible for all teaching. In 2010 there were 24.2 professor and 8.8 associate professor positions at IFT, along with 10.2 researcher/Post.Doc. positions. The professor to associate professor ratio has increased steadily since 2010, and indicates quality in both research and education. Most staff has completed a course in university science education (pedagogics). All of IFT is considered as the learning environment, and the students are considered to be an integral part of the community. The office doors are usually open, to create a friendly atmosphere and increase interaction between students/staff. One room at IFT has been converted into an open working space for bachelor students. It is located at the heart of the Department,

next to the cafeteria, in order to increase the natural interaction of students and staff. IFT has mechanical and electronics workshops and well-equipped laboratories, where students get supervision, and can design/build experimental apparatus. IFT has also modernized both equipment and methods (1.2 MNOK to upgrade the multiphase flow laboratory, in addition to 800 kNOK per year for teaching equipment). Furthermore, IFT is currently upgrading its lecture rooms, and a new technology building is planned, which will become an excellent experimental learning facility. In addition, IFT has extensive competence in physics- and science didactics, which is valuable in the process of further developing our courses/study programs, professional development initiatives and CIPTED.

The CIPTED leader **Bjørn Tore Hjertaker** has a M.Sc. degree from University of California and a PhD degree from University of Bergen within process tomography. Prof. Hjertaker has professional experience from ABB Corporate Research (oil and gas instrumentation), Christian Michelsen Research (oil and gas instrumentation) and Haukeland University Hospital (cancer research). Since 2003 he has been working at IFT on different research projects within measurement science and instrumentation. Prof. Hjertaker lectures several technology and laboratory related courses, with focus on developing their educational aspects. He has completed a 10 ECTS course in university educational science.

Anna Lipniacka has a PhD in experimental high energy physics from University of Warsaw and a Docent in Physics degree from Stockholm's University. Prof Lipniacka has been a CERN associate since 1984. She has experience in large international research collaborations, including student education programs organized within them. **Kjartan Olafsson** has a dr.scient. degree in space physics from University of Bergen. He is the leader of the board of the Science Education Centre at Faculty of Mathematics and Natural Sciences and deputy head of department at IFT. **Stein Dankert Kolstø** is professor in physics education and responsible for the physics teacher education at IFT. His main interest is use of dialogue in inquiry-based science teaching.

3. Potential for Innovation and Dissemination

IFT considers its educational development as a closed loop control system, with the national qualification framework as a main reference and the educational relevance and quality as the output, as shown below in Figure 4. The quality and relevance of the educational process is evaluated (monitored) by the study program evaluator, the students and the lecturers. However, it needs to be strengthened with organized feedback from additional partners, including industry, the public sector and teaching assistants, with increased focus on how to follow up the evaluations with specific measures.

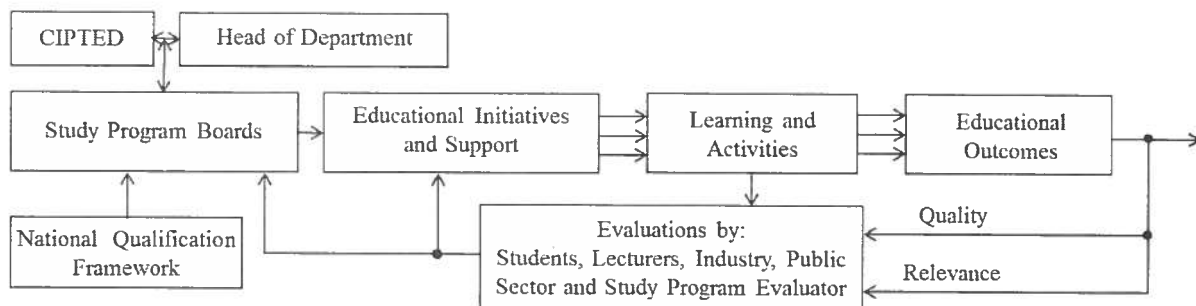


Figure 4 – The IFT educational development system.

CIPTED will focus on the bachelor education and the following work packages (initiatives):

3.1 Recruitment and the Flying Start Program

To optimize the student recruitment process, and to better integrate new bachelor students at IFT, we propose a new program called “Recruitment and Flying Start”. Physics education starts early, so for several years we have maintained close contacts and co-operation with public schools, including visits by our students. We present popular demonstrations at the University Science Fair, and we organize lectures for visiting school groups. A challenge in physics is the traditional weak gender balance. We have therefore worked with schools to improve recruitment of female students. In this process we will focus on:

- Strengthening contacts with science teachers and students, especially at upper secondary school.
- Support initiatives like “Fysikk Show Bergen”, and collaborate with important institutions like *VilVite*, the Bergen science centre, and the Centre of Science Education in Bergen.
- Contribute in TeknoVest to promote master degree studies at IFT as a natural next step forward for bachelor students at regional institutions and colleges.

Some students struggle and feel “lost” in the beginning of the bachelor degree study, and there is a certain dropout in the first semester. CIPTED will therefore initiate a “Flying Start” program, similar to that developed at the Centre of Excellence in Finnish Education at the Department of Physics, University of Jyväskylä (Hiltunen, 2009). The Flying Start program will be a two-week crash course to integrate the new students into IFT. Students will be divided into small groups and guided by enthusiastic third-year students with good social skills. The groups will collaborate and solve problems. Teachers, researchers, and PhD students will inform on their daily work and present scientific “nuggets” from their latest research. Time will also be devoted to discuss applications of physics in industry, in addition to the job market for physicists. The program will end with an informal dinner.

3.2 Interaction Learning Program

When students have overcome the initial phase as new bachelor students in physics, it is time to focus on interaction in the learning environment. Under this program we will enhance the students’ conceptual understanding by stimulating:

Enhanced Human Interaction: We will work to improve interaction between lecturer and student, interaction between students, and related activities outside the lecture room. New lecturing techniques and learning technology will be tested and evaluated, including peer instruction (Mazur, 1997), the “flipped classroom” lecturing technique, web casting, problem-based learning and development of voting technology (*e.g.* smartphone apps) facilitating use of questions for deliberate practice (Deslauriers *et al.*, 2011) and feedback in the auditorium (Reay, *et al.* 2008). Alternative assessment methods will be tested and evaluated, including the possibility for, and learning effect of, extracurricular courses in study techniques, academic writing, presentation techniques and literature search techniques.

Enhanced Theory/Experiment Interaction: Deep understanding in physics requires a balance between theory and practical experience from demonstrations and laboratory experiments. In their evaluation of courses, many students request more laboratory assignments and better integration across bachelor courses, including a larger focus on conceptual understanding rather than extensive assignments. We will therefore introduce Technology Assistants (TechAssist), who are interested master or PhD students that are hired to prepare experimental equipment for demonstrations in lectures, and to provide additional supervision for bachelor students during laboratory assignments. The TechAssists will also support lecturers in developing questions for the voter system. Different ways to increase the expertise of the TechAssists and ways they can support students’ learning, will be explored.

Evaluation: In evaluation of effects of changes and measures, we will use pre- and post-testing and monitor drop-out rates and presence at learning activities. To ensure high quality assessments, CIPTED will focus on research and development in science education, with publications in high level journals and conference proceedings. Building on our in-house expertise in science education, one PostDoc and one PhD position in science education will be promoted for further research, development and assessment in the centre. The main objective of the science educational research will be to identify examples of best practice and document quantitatively the effect of these, in addition to qualitatively determine the probable didactic mechanisms responsible for these effects. This will enable identification of examples and ideas to be communicated through CIPTED outreach activities. However, this research will also explore the use of different kinds of questions and ways to carry out learning dialogues as this, although important for practical teaching, is an underdeveloped topic in the current research literature.

3.3 Relevance of Learning Program

Students are most motivated to learn when they feel that the curriculum is relevant. Under this work program we will therefore enhance the students' understanding of relevance by introducing:

Enhanced Interaction with External Partners: The Department is fortunate to have many external partners from industry and research establishments, which has been greatly beneficial for the learning experience of our master and PhD students. This is however not yet the case at the bachelor level. In the fifth semester we have a course which with additional funding easily can be modified to exploit already existing and available national and international laboratory resources for education. The course is called PHYS117 "Experimental Physics with Project Work". In this course we will establish mandatory excursions for bachelor students to Conseil Européen pour la Recherche Nucléaire (CERN), the University Centre in Svalbard (UNIS), or industrial partners like Roxar Flow Measurement, the public sector including Haukeland University Hospital, and research institutes like Christian Michelsen Research. We will develop and evaluate models for making such excursions relevant and fruitful for students' learning. Such excursions will also be beneficial to the external partners, who may expect higher future recruitment to master projects, PhD projects, and vacant positions.

Interaction at University Faculty Level for Enhanced Mutual Course Adaptation: Students at diverse study programs needs physics as part of their education, and students in physics and technology needs courses e.g. in mathematics and informatics. Cooperation with other departments at Faculty of Mathematics and Natural Sciences is therefore necessary. In the past this inter-disciplinary cooperation has been insufficient. We will therefore devote resources to enhance inter-departmental mutual course adaptation, especially since mathematics turns out to be a significant challenge for many physics students early in their bachelor program. Subsequently, CIPTED will seek ways to adapt courses in obligatory mathematics and informatics at bachelor level to e.g. also include exercises related to physics and technology, in order to strengthen relevance and students learning. Likewise, we will negotiate with other departments to find ways to tailor introductory courses in physics for non-physics students, e.g. to offer more topical focus to make the courses more relevant and inspiring for these students.

3.4 Outreach / Dissemination Program

Results from CIPTED will be communicated within IFT and to other interested parties. IFT has excellent competence in physics and science education (physics didactics) with strong connections to public schools. Through research activities by PostDocs/PhD-students, CIPTED will contribute to scholarly knowledge concerning effective and interactive university science teaching and models for

professional development. CIPTED will aim to disseminate examples and ideas to three identified groups of colleagues: within IFT, within our faculty, and to colleagues at other science departments nationally. To include and motivate teaching staff at IFT and provide specific means of pedagogical development, CIPTED will host department lecturer workshops twice per year (for each lecturer) for the bachelor level teaching staff. The workshops will discuss collected course evaluations, and possibilities and facilities for further development of teaching by sharing ideas and ensure collegial support for lecturers testing new ideas. Pedagogical training/motivation will also be addressed by invited talks. In the planning of outreach activities aiming at supporting colleagues at other departments interested in developing their teaching practice, we will take into account research findings on teacher professional development. According to Wilson (2013), effective professional development is characterized by focusing on specific content, engaging teachers collectively, and over time in active learning supported by local policy and leadership. Moreover, activities for professional development needs to be close to lecturers' own practice and include inquiry into own teaching and peer evaluation of teaching. In line with these findings, CIPTED will emphasize use of workshops in our attempts to share ideas and experiences. The workshops will be supported by short videos produced by CIPTED exemplifying both technical possibilities and pedagogical strategies. Through workshops teachers can share examples from their own teaching, and new ideas can be exemplified and trained. CIPTED will also offer follow-up contextualized supervision (whether in auditorium, laboratory or group work) when invited, and a web-site will offer videos and information on projects, evaluations and upcoming workshops. Furthermore, CIPTED will arrange workshops for colleagues at the other departments at our faculty and for science colleagues nationally (e.g. at the biannual meeting of the Norwegian Physics Society). In addition, we will present results and ideas through more traditional lectures at science departments nationally. Finally, we will promote ideas to teachers in public schools in connection with events like "Faglig-Pedagogisk Dag", and for future school teachers through our teacher education program.

4. Organization

CIPTED will be located and hosted at IFT, and Prof. Bjørn Tore Hjertaker will be the centre leader. The centre will be organized in four work groups focusing on recruitment and flying start for new students, interaction in learning, relevance in learning, and outreach/dissemination, as shown in

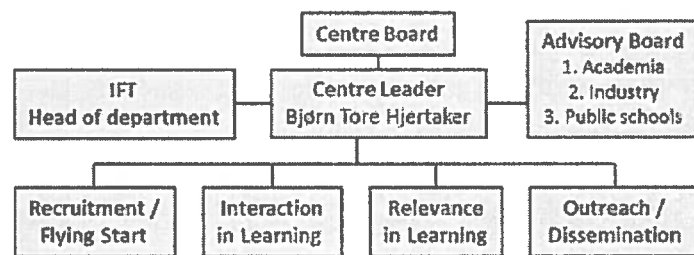


Figure 5 -- The CIPTED organizational chart

Figure 5. Each work group will have a leader and a co-leader, who will constitute the leader group, headed by the centre leader. There will also be a Centre Board consisting of representatives from UiB. The Advisory Board will consist of three persons representing academia, industry and the Norwegian public school system with at least one female and one foreign member. The advisory board members shall monitor CIPTEDs educational progress with regards to the aims and activities laid out in this proposal, and advise/challenge the center leader (leadership team) on the overall educational direction. The added value of this organization is a streamlined approach that connects the admission of new students, a targeted focus on the learning environment for existing students, continuous collaboration with other departments, and active communication of key findings to other parties.

5. Collaborative Partners

The Department has a large network of national and international collaborators. The most important partners in this project are:

- CERN: (The European Organization for Nuclear Research) operates the European Laboratory for Nuclear- and Particle Physics.
- UNIS: The world's northernmost institution for research and higher education.
- NAROM: A national centre for space physic education located at Andøya Rocket Range.
- Haukeland University Hospital: The second largest medical research center in Norway.
- Christian Michelsen Research: A leading institute in technology research.
- Roxar Flow Measurement: A leading provider of technology to the oil & gas industry.
- Birkeland Centre for Space Science: An established centre of excellence hosted by IFT.

All CIPTED partners are world-leading in their respective research areas. The state-of-the-art research facilities of these institutions will give our students valuable practical experience and true research-based education during project work in the PHYS117 course. Personnel at these institutions will contribute with supervision, in close collaboration with IFT staff.

6. Gender Aspects

To improve gender equality at Norwegian universities, we will have special focus on including young female members in CIPTED activities, and thereby giving them opportunities to advance towards excellence in education. It is also our experience that brilliant female staff members serve as excellent role models for female students.

7. Added Value by Establishing the Centre and Exit Strategy

By establishing CIPTED we will:

- Utilize new educational possibilities and methods in physics and technology education
- Create an attractive educational environment for future researchers and teachers in science
- Stimulate team work, interaction, personal development and common responsibility for professional and social learning
- Offer our bachelor students true research-based education by establishing project work using the state-of-the-art research infrastructure with our collaboration partners
- Educate highly qualified candidates that with confidence and professional abilities are capable of communicating and utilizing their knowledge for the greater benefit of society

After 10 years CIPTED will have established an international reputation of excellence to:

- Support science colleagues nationally to improve their use of interaction in science teaching
- Attract funding from domestic and foreign sources (e.g. industry and government) to sustain a program of excellent education in physics and technology based in Bergen
- Attract excellent national and international students to IFT for the benefit of both students and the wider Norwegian community
- Continue education of the next generation of physics and technology experts

The first 10 years of CIPTED is intended to be the beginning of a long term commitment to excellent education in physics and technology for the benefit of students, staff, and the general public.

References

References to publications:

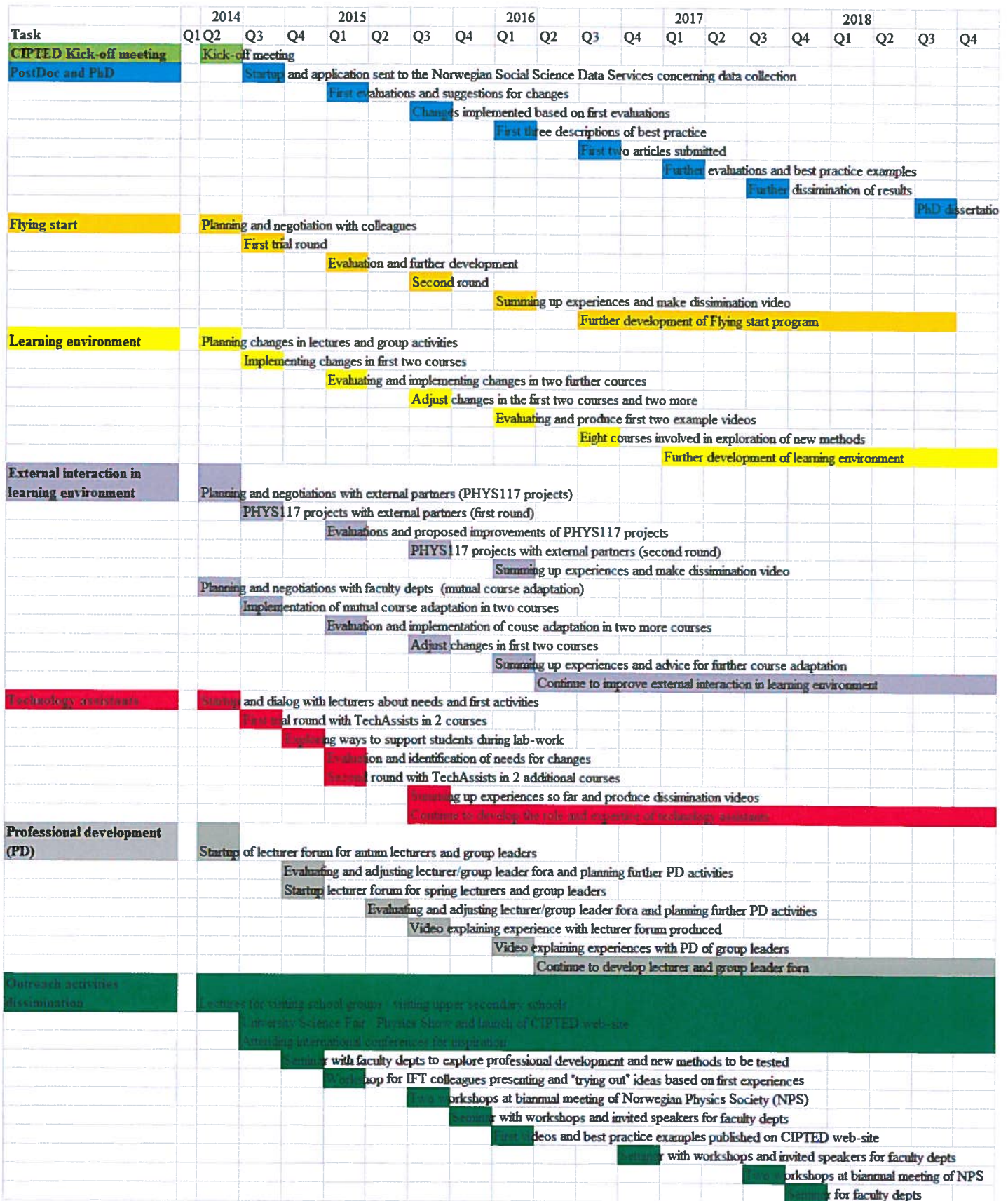
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References to photos used in the application document:

- Photo 1: Front page (left) - Laboratory work by students in the teacher education program at IFT.
Copyright: Stein-Dankert Kolstø
- Photo 2: Front page (middle) - Students following the course AGF345 “Polar Magnetospheric Substorms” on field work at Svalbard. Copyright: Njål Gulbrandsen.
- Photo 3: Front page (right) - Students participating in the IFT hosted “Fysikk Show”.
Copyright: Kjartan Olafsson.

Planned timeline and activities to be conducted

The planned timeline and activities to be conducted in CIPTED is shown in the chart below:



Budget

The CIPTED budget (all numbers in kNOK):

Cost	2014	2015	2016	2017	2018
Post.Doc. position (CIPTED)	468	967	999	1032	1066
Ph.D. position (UiB)	389	801	825	850	438
Student excursions CERN/Svalbard/Industry	600	600	600	600	600
Technology Assistants	200	200	200	200	200
Conferences/travels	200	150	150	150	250
CIPTED administration (Including CIPTED board and advisory board meetings)	332	200	200	200	217
Lecture Forum (Invited lecturers and moderators)	350	200	200	200	300
Workshops/video production	350	283	251	318	500
Personnel cost	500	400	400	300	400
CIPTED centre leader	1100	1133	1167	1202	1238
Upgrade of IFT laboratory facilities	800	800	800	800	800
Lecturing and supervision of lower degree courses at IFT, includes: - contribution by professors/associate professors - supervision by external partners, - contribution by IFT technical staff - contribution by IFT teaching assistants and - compulsory work by UiB funded PhDs)	7434	7657	7886	8122	8365
Total	12723	13391	113678	13974	13841

Plan for financial resource acquisition
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The CIPTED financing plan is as follows (all numbers in kNOK):

Financing	2014	2015	2016	2017	2018
Allocation from the <i>Norwegian Agency for Quality Assurance in Education (NOKUT)</i>	3000	3000	3000	3000	3000
University of Bergen (In-kind contribution specified below)	9588	10252	10535	10827	10689
External partners (In-kind contribution specified below)	135	139	143	147	152
Total	12723	13391	13678	13974	13841

If awarded a CEE, we will work to secure further funding to strengthen the financial foundation of CIPTED by investigating possibilities via our many external partners participating in M.Sc. and Ph.D. projects, in addition to other funding sources, e.g. Bergen Teknologioverføring AS and Norgesuniversitetet.no.

List of internal (University of Bergen) in-kind financial contributions to CIPTED:

Internal (UiB) in-kind contribution
1 Ph.D. position (4 years) contributed by the Faculty of Mathematics and Natural Sciences (UiB). In-kind contribution: 778 kNOK per year (2014) + 3% for each additional year.
CIPTED centre leader funded by IFT In-kind contribution: 1100 kNOK per year (2014) + 3% for each additional year.
Annual department upgrade/ further development of lower degree laboratory facilities (PHYS117/PHYS114) by IFT In-kind contribution: 800 kNOK per year
Man-year workload for lecturing of lower degree courses at IFT: 4.5 man-year at 1100 kNOK per year (2014) + 3% for each additional year.
Man-year participation of IFT technical staff into lower degree education (PHYS114/PHYS117): 0.6 man-years at 458 kNOK (ltr 55) per year (2014) + 3% for each additional year.
Man-year workload by teaching assistants at IFT: 1.0 man-year at 362 kNOK (ltr 40) per year (2014) + 3% for each additional year.
Man-year compulsory duty of university PhDs (25% workload): 2.2 man-year at 778 kNOK per year (2014) + 3% for each additional year.

The man-year estimate for professor/associate professor lecturing and the compulsory work done by university PhDs in the CIPTED associated lower degree courses at IFT are listed in the following table:

Course	% of man-labour years Perm. staff	% of man-labour years Temporary staff	Students per year	Planned CIPTED-activities
PHYS101 Basic course in mechanics and thermodynamics	22.5	20	120	Better adaption to biology, chemistry, geology
PHYS102 Basic course in electromagnetism, optics and modern physics	22.5	12.5	50	Better adaption to biology, chemistry, geology
PHYS109 Introduction to astrophysics	22.5	12.5	50	More outdoor observations
PHYS110 Perspectives in physics	22.5	12.5	55	Simple experiments
PHYS111 Mechanics I	40	25	120	
PHYS112 Electromagnetism and optics	22.5	12.5	60	Experiments
PHYS113 Mechanics II and thermodynamics	22.5	12.5	45	Experiments/demonstrations
PHYS114 Experimental physics and measurement science	100	90	60	New experiments
PHYS115 Quantum physics and statistical mechanics	22.5	12.5	25	Experiments and/or new exercises
PHYS116 Signal- and system analysis	40		15	
PHYS117 Experimental physics with project work	80		25	Excursions, cooperation on project exercises with external partners (regional, national and international)
PTEK100 Introduction to petroleum- and process technology	35	12,5	150	Excursions, more group work
Total	452	223		

In second column the contribution of permanent academic staff, measured in percentage of man-labour years, is specified and in third column the contribution from temporary academic staff and student assistants. The man-labour year of a permanent faculty member is nominally divided on research (45%), teaching/supervision (45%) and administration (10%). The work contribution of the permanent academic staff on these courses corresponds to 10 full-time positions.

List of external in-kind financial contributions to CIPTED:

External in-kind contribution
Man-year contribution by Haukeland University Hospital ¹ 60 hrs at 564 NOK per hour (2014) + 3% for each additional year.
Man-year contribution by Christian Michelsen Research ¹ 60 hrs at 564 NOK per hour (2014) + 3% for each additional year.
Man-year contribution by Roxar Flow Measurement ¹ 60 hrs at 564 NOK per hour (2014) + 3% for each additional year.
Man-year contribution by the Birkeland Centre for Space Science ¹ 60 hrs at 564 NOK per hour (2014) + 3% for each additional year.

¹ Based on 60 supervision hours per semester, and a cost of 1100 kNOK per year assuming 1950 working hours per year. 1100 kNOK per year is the cost for a university professor/associate professor.

Curriculum Vitae for Bjørn Tore Hjertaker

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P.B. 7803, NO-5020 Bergen, Norway.
Phone: Office: (+47) 5558 2782, Mobile: (+47) 928 09 028
Email: bjorn.hjertaker@ift.uib.no

Education:

1992-1994: Dr.Scient (Ph.D.), Department of Physics, University of Bergen, Norway.
1987-1989: M.Sc. Electrical Engineering, University of California, Santa Barbara, USA.
1984-1987: B.Sc. Electronics, Bergen University College, Norway.

Professional Background:

2011- present: Professor, Department of Physics and Technology, University of Bergen, Norway.
2010: Visiting professor, Victoria University, Melbourne, Australia.
2003-2009: Associate professor, Department of Physics and Technology, University of Bergen, Norway.
1999-2003: Medical physicist, Department of Oncology and Medical Physics, Haukeland university hospital, Bergen, Norway.
1999: Christian Michelsen Research, Bergen, Norway.
1995-1999: Senior scientist, ABB Corporate Research, Norway.
1989-1991: Research Engineer, Department of Physics, University of Bergen, Norway.

Overview:

My scientific work is multi-disciplinary and focused on applied physics and technology. After finishing my PhD degree in industrial process tomography in 1994, I worked as a scientist at ABB Corporate Research Norway with projects related to oil and gas instrumentation, most notably level and oil-in-water monitoring for the innovative SUBSIS Troll Pilot subsea separator application. In 1999 I was employed by Christian Michelsen Research as lead scientist in the EU project "Flow measurement for control of oilfield pipelines", before accepting a position as medical physicist at Department of Oncology and Medical Physics, Haukeland University Hospital. The work at Haukeland University Hospital was mainly related to trial hyperthermia cancer treatments conducted at the hospital, in which I was responsible for the technology used in the treatment sessions, and the development of quality assurance instrumentation for hyperthermia treatment, i.e. monitoring of RF radiation and high accuracy temperature control. In 2003 I accepted a position as associate professor at Department of Physics and Technology, where my research work has been focused at process tomography for imaging of hydrocarbon flow, new subsea and downhole instrumentation and subsea electromagnetic sensor systems. I have also been involved in projects within medical physics (multiparametric imaging and development of novel intraluminal sensor and stimulation devices) and biology (instrumentation of swim tunnels and measurements and simulations of electrical conductivity in live fish), in addition to research in fundamental physics (quantum control of Rydberg atoms, molecules and matter). Currently I am mainly working on a project concerning monitoring of CO₂ in water using photoacoustics, which relates to environmental and fish farming applications. This technology was also the research focus during my sabbatical stay at The Optical Technology Research Laboratory, Victoria University, Melbourne (Australia) in 2010. Since 2006 I have been an academic partner of The Michelsen Centre for Industrial Measurement Science and Technology (Centre for Research-based Innovation). At the Department of Physics and Technology I have successfully supervised one Ph.D. candidate, and two Ph.D. candidates are in the process of concluding their work. I have also successfully supervised 21 M.Sc. students. Three M.Sc. students are ongoing, i.e. with master research project submissions in June 2013. I am currently lecturing PHYS114 "Basic measurement science and experimental physics" (partial course responsibility), PHYS225 "Instrumentation" (full course responsibility) and PHYS327 "Laboratory course in instrumentation and process control" (full course responsibility). I have previously been associated with courses as: PHYS117 "Experimental physics with research project", PTEK100 "Introduction to petroleum and process technology", PHYS326 "Feedback control systems theory and design" and PHYS328 "Selected topics in measurement science". I have completed a 10 ECTS course in university educational science, and have been focusing on further developing the educational aspects of the courses I am lecturing. I have published one educational paper in Uniped (Tidsskrift for universitets- og høyskolepedagogikk), and two educational papers in BORA (Bergen Open Research Archive). I am also the co-author of a book in educational science relating to supervision of master and PhD level students.

Posts:

1994: Board member at Department of Physics, University of Bergen.
1994: Council member at Department of Physics, University of Bergen.
2000-2002: Safety representative (verneombud) at Department of Oncology and Medical Physics, Section of Medical Physics, Haukeland University Hospital, Bergen.

- 2004-2007: Chairman of the library (journal collection) committee at Department of Physics and Technology, University of Bergen.
- 2004-2007: Member of the University of Bergen, Faculty of Mathematics and Natural Sciences library committee.
- 2005-2009: Council member at Department of Physics and Technology, University of Bergen.
- 2003- Member of the physics program committee at Department of Physics and Technology, University of Bergen.
- 2010-2012: Member of the M.Sc. examination committee at Department of Physics and Technology, University of Bergen.
- 2011- Member of the research, development and innovation committee (FUNS) at the Faculty of Engineering, Bergen University College (Høgskolen i Bergen).

Scientific committee work

- 2002: Member of the organizing committee of “20th Annual Meeting of the European Society for Hyperthermic Oncology (ESHO 2002)”, held in Bergen, May 23-25, 2002 with ~ 100 delegates.
- 2004-2005: Member of the organizing committee of “Fysikermotet 2005”, held in Ulvik, August 11-14, 2005 with ~ 170 delegates.
- 2005: Member of cross-faculty work group at University of Bergen developing a new cross-faculty project course for occupational preparation. (Utvikling av yrkesrettet studietilbud for studenter fra flere fakultet).
- 2006: Member of international scientific committee of “5th International Symposium on Measurement Techniques for Multiphase Flows / 2nd International Workshop on Process Tomography”, Macau / Zhuhai, China, December 10–13, 2006.
- 2006-2007: Member of congress technical committee of “5th World Congress on Industrial Process Tomography”, Bergen, Norway, September 3-6, 2007 (~150 delegates).
- 2007-2009: Member of international scientific committee of “3rd International Workshop on Process Tomography”, Tokyo, Japan, April 17-18, 2009 (~100 delegates).
- 2007: Member of work group at the Faculty of Mathematics and Natural Sciences, University of Bergen developing a new faculty interdisciplinary project course: “Applied research comprising science studies” (“Anvendt forskning med vitenskapsteori”).
- 2009-2010: Member of scientific committee of “6th World Congress on Industrial Process Tomography”, Beijing, China, September 6-9, 2010 (~150 delegates).
- 2012-2013: Member of scientific committee of “7th World Congress on Industrial Process Tomography”, Krakow, Polen, September 2-5, 2013 (~150 delegates).
- 2005- Leader of miscellaneous PhD evaluation committees
- 2008- Leader of miscellaneous PhD seminar evaluation committees
- 2000- Leader of miscellaneous scientific employment evaluation committees.

Research experience:

- 1989-1991: **University of Bergen, Department of Physics**
Experience: Hydrocarbon flow sensors and instrumentation, space (aurora) satellite instrumentation, analog and digital electronics design, including simulation and PCB layout software tools, data acquisition and control software. Project cooperation (AURIO space physics project): University of Sheffield, (UK), Norwegian Space Centre / European Space Agency
- 1992-1995 **University of Bergen, Department of Physics**
Experience: Gamma-ray tomography, electrical capacitance tomography, dual mode tomography, transputer microprocessor programming and hardware design. Project cooperation: University of Manchester Institute of Science and Technology (UMIST)(UK), University of Liverpool (UK), Norsk Hydro ASA
- 1995-1999 **ABB Corporate Research Norway, Department of Oil and Gas**
Experience: Hydrocarbon choke multiphase monitoring, monitoring of hydrocarbon scale deposition, subsea separation instrumentation (oil-in-water and level monitoring), pipeline condition monitoring, downhole instrumentation. Project initialization, cooperation and management:
1996: Project manager of “Investigation into acoustic/electromagnetic techniques for non-invasive monitoring of pipeline scaling”, project cooperation with Heriot-Watt University, Edinburgh, Scotland (Professor R. Dunbar)
1996: Project manager of “Detection of scaling in offshore pipes”
1996: Project manager of “Flow Measurement of Multiphase Hydrocarbon Flow”, project cooperation with NTNU (Professor J.S. Gudmundsson) and AEA Technology Petroleum Services, UK.
1996: Project initiator and manager of “Oil in water monitoring – feasibility study”, project cooperation with ABB Corporate Research in Germany and Switzerland and ABB AmData (USA).

1996: Initiator and responsible (scientific and administrative) for ABB Corporate Research Workshop "Sensors and instrumentation for oil and gas field developments" held in Asker, Norway, February 19.-21 (1996). Approximately 50 delegates from Saga Petroleum AS, Norsk Hydro AS, ABB Lummus Global, ABB Vetco Gray, ABB Seatec, in addition to delegates from the ABB Corporate Research Centers in Norway, Sweden, Germany, Switzerland and USA.

1997: Project initiator and manager of "Gamma-ray level monitoring systems for the SUBSIS Troll Pilot Application", project cooperation with ABB Offshore Technology.

1997: Project initiator and manager of "Characterization of a dual mode process tomograph".

1997: Project initiator of "Interface Level Monitoring System by Inductive Measurements", project cooperation with ABB Corporate Research Sweden and ABB Offshore Technology.

1998: Project initiator and manager of "Evaluation and Recommendation of Subsea Oil Content in Water Measuring Instrument for Troll Pilot Station", project cooperation with ABB Corporate Research in Germany, Switzerland and Sweden, in addition to ABB AmData (USA).

1998: Project manager of "Interface Level Monitoring System for Troll Pilot", project cooperation with ABB Corporate Research Sweden, ABB Offshore Technology, ABB Seatec and Norsk Hydro ASA. Sub-project of commissioned development work for Norsk Hydro ASA (Troll Pilot subsea separator station).

1999: Project manager of "DIFCOM98 – Point Thickness Wax Sensor", project cooperation with ABB AmData (USA) and Christian Michelsen Research AS.

1999: Project manager of "Downhole WaterCut Metering", project cooperation with ABB Corporate Research Switzerland and Germany in addition to ABB Seatec (UK) and Norsk Hydro ASA.

1999

Christian Michelsen Research AS, Dept. of Industrial Instrumentation

Experience: Wetgas metering, monitoring of hydrocarbon scale deposition. Project initialization, cooperation and management:

1999: CMR project manager of EU Craft project: Flow measurement for control of oilfield pipelines.

1999-2003

Haukeland University Hospital, Department of Oncology and Medical Physics

Experience: Regional and whole body hyperthermia cancer treatment, including quality assurance procedures, RF instrumentation, monitoring of non-ionizing radiation (RadHaz monitoring), high accuracy and reliability temperature monitoring, data acquisition of treatment data using LabVIEW and LabWindows. Project initialization, cooperation and management:

1999: Project manager of "RF quality assurance instrumentation system"

2001: Project initiator and manager of "Monitoring of non-ionizing radiation"

2001: Project initiator and manager of "Temperature monitoring for whole body hyperthermia".

Project cooperation: Department of Radiotherapy, Erasmus MC-Daniel den Hoed Cancer Centre Rotterdam, The Netherlands (Regional hyperthermia), Medical University of Lübeck, Germany (Whole body hyperthermia), University Medical Center Hamburg-Eppendorf, Germany (Whole body hyperthermia)

2003-2010

University of Bergen, Department of Physics and Technology

Experience: Dual modality tomography, gamma-ray tomography, high frequency magnetic field sensing, electrical conductivity measurements in live fish, multiparametric imaging and instrumentation of intraluminal sensors and stimulation devices, synchronization of multiparametric data, electromagnetic monitoring: Project initialization, cooperation and management:

2003: Project initiator of "Draw-in of cancer radiation therapy fields using Virtual Reality / CAVE technology as developed for hydrocarbon reservoir studies". Project cooperation with Haukeland University Hospital and Christian Michelsen Research AS.

2004: Initiator of part-time post as Associate Professor II to initiate course "Medical Physics and Technology" at Department of Physics and Technology. Project cooperation with Haukeland University Hospital and Christian Michelsen Research AS.

2004: Project co-initiator of "Multiparametric imaging and development of novel intraluminal sensor and stimulation devices". Project cooperation with Haukeland University Hospital and Christian Michelsen Research AS.

2005-09: Project participant in Petromaks-KMB project "New Subsea and Downhole Instrumentation". Project cooperation with Christian Michelsen Research AS and Statoil-Hydro AS. Project task "Subsea on-line multiphase fluid sampling and analysis".

2005-08: Participant in project "Instrumentation of swim tunnels and measurements and simulations of electrical conductivity in live fish". Project cooperation with Department of Biology, University of Bergen.

2006: Project initiator and manager of “High frequency magnetic field sensor for hydrocarbon watercut monitoring”. Project funded by The Research Council of Norway.

2005-06: Co-initiator of the “Michelsen Centre for Industrial Measurement Science and Technology” - Centre for Research-based Innovation. Application granted June 2006.

2006-15: Academic partner in the “Michelsen Centre for Industrial Measurement Science and Technology” Centre for Research-based Innovation.

2006-08: Project participant in Petromaks-KMB project “Subsea Electromagnetic Sensor System”. Project funded by The Norwegian Research Council and Statoil ASA – Project cooperation with Naxys AS.

2007: Project leader for application “iMeasure – Industrial Measurement Science and Technology” to the EU 7th Framework Programme (Marie Curie Training Network) with the following project partners: University of Bergen, University of Manchester (UK), Technical University of Lodz (Poland) and Tsinghua University (China).

2008-09: Participant in project “Quantum control of Rydberg atoms”. Funded by Bergen Research Foundation (Norway), the Carlsberg Foundation (Denmark), The Norwegian Research Council and the EU 7th Framework Programme. Project cooperation with Aarhus University (Denmark), Centro Atómico Bariloche and Consejo Nacional de Investigaciones Científicas y Técnicas (Argentina) and Université Pierre et Marie Curie (France).

2008-10: Project co-initiator of “Condition monitoring of subsea electrical equipment using motor current signature analysis”. Project cooperation with Bergen University College.

2009-10: Project initiator and manager of “Instrumentation and data acquisition system upgrade of flow loop research laboratory at Dept. of Physics and Technology, University of Bergen”. Project funded by The Michelsen Centre for Measurement Science and Technology (Norway).

2010 **Victoria University (Melbourne, Australia)**

Optical Technology Research Laboratory,

Experience: Optical measurement principles; fiber Bragg grating sensors and laser induced pulsed near-infrared photoacoustic sensing.

2010: Project participant of “European Micro Nano Broker Platform - RUP project”. Project funded by Hordaland County Council. Manager of project task: “Industrial applications and implementations of fiber Bragg grating sensor systems”.

2011 - **University of Bergen, Department of Physics and Technology**

2011-13: Project participant in project “Quantum control of Rydberg atoms, molecules and matter (QRAM)” funded by The Research Council of Norway.

2011-13: Project initiator and manager of “Monitoring of CO₂ in water using photoacoustics”. Project funded by The Michelsen Centre for Measurement Science and Technology.

Students

Master finished (21): Arild Bård Ellingsen, Vidar Spord, Stian Stavland, Tore Sørflakne, Logeswaran Ratnam, Ole Andreas Almås, Endre Grimsbø, Erik Johan Stangborli, André Vasdal, Erik Schuster, Yngve Boe, Pål Steffensen, Karl Kristian Olsen, Sigrid Katharina Meyer, Eivind Soldal, Stian Stjernberg, Tom Erik Kjenner, Kjetil Haukalid, Kristian Haarr, Åsmund Gjermundrød, Mahsa Karimi.

Master ongoing (3): Vårin Renate Andvik Holm, Zahra Bayati, Sindre Fotland

PhD finished (1): Rachid Maad

PhD ongoing (2): Erik Magnus Bruvik, Frank Tore Sæther

University lecturing experience:

PHYS 114 “Basic measurement science and experimental physics”

Workload: 10 credits -- Number of students: ~ 60, Partial responsibility for course

Lecturing on data acquisition using LabVIEW software tool

Lectured: spring 2004, spring 2006, spring 2007, spring 2008, spring 2009, spring 2011, spring 2012, spring 2013.

PHYS 117 “Experimental physics with research project”

Work load: 10 credits -- Number of students: ~ 30, Full responsibility for course

Lectured: fall 2004, fall 2005, fall 2006, fall 2007, fall 2008, fall 2009

PHYS 225 “Instrumentation”

Work load: 10 credits -- Number of students: ~ 15, The course includes laboratory work, Full responsibility for course

- Lectured: spring 2004, spring 2005, spring 2006, spring 2007, fall 2007, fall 2008, fall 2009, fall 2011, fall 2012
- PHYS 326 “Feedback Control Systems Theory and Design”
Work load: 10 credits -- Number of students: ~ 15, The course includes laboratory work, Full responsibility for course
Lectured: fall 2003, fall 2004 and fall 2005
- PHYS 327 “Laboratory course in instrumentation and process control”
Work load: 10 credits -- Number of students: ~ 15, Full responsibility for course
Lectured: fall 2003, spring 2004, fall 2005, fall 2006, spring 2007, spring 2008, spring 2009, fall 2009, spring 2011, spring 2012, spring 2013
- PHYS 328 “Selected topics in measurement science”
Work load: 10 credits -- Number of students: ~ 10, Partial responsibility for course, Lecturing on separator instrumentation (level and oil-in-water monitoring)
Lectured: spring 2003, spring 2004, spring 2005 and fall 2007
- PTEK 100 “Introduction to petroleum and process technology”
Work load: 10 credits -- Number of students: ~ 60, Partial responsibility for course, Lecturing on introduction to instrumentation and process control
Lectured: fall 2005

Selected publications

Refereed journals

1. *The development of a dual mode tomograph for three-component flow imaging*, The Chemical Engineering Journal, 56 (1995) pp. 175-182, Co-author.
2. *A dual sensor flow imaging tomographic system*, Measurement Science and Technology, Volume 7, No 3 (1996), Co-author.
3. *Static characterization of a dual sensor Flow Imaging system*, Flow Measurement and Instrumentation, Volume 9, No 3 (1998), Author.
4. *Level measurement and control strategies for subsea separators*, Journal of Electronic Imaging, Volume 10, No 3 (2001), Principal-author
5. *Multiphase flow regime identification by multibeam gamma-ray densitometry*, Measurement Science and Technology, Volume 13, No 8 (2002), Co-author.
6. *Thermometry instrumentation system for quality assurance and documentation of whole body hyperthermia procedures*, International Journal of Hyperthermia, Volume 21, No 1 (2005), Principal-author.
7. *Multimodality tomography for multiphase hydrocarbon flow measurements*, IEEE Sensors Journal, Volume 5, No 2 (2005), Principal-author.
8. *Midveiseksamen basert på flervalgsoppgaver ved Institutt for fysikk og teknologi. Universitetet i Bergen, Uniped – Tidsskrift for universitets- og høyskolepedagogikk, Årgang 29, 3/2006, pp. 4-12, Author.*
9. *A dual modality tomography system for imaging gas/solids flows*, Particle & Particle Systems Characterization, Volume 23 (3-4): 260-265 (2006), Co-author.
10. *Evaluation of power and phase accuracy of the BSD Dodek amplifier for regional hyperthermia using an external vector voltmeter measurement system*, International Journal of Hyperthermia, Volume 22, No 8 (2006) pp. 657-671, Co-author.
11. *Semi-empirical scatter correction model for high speed gamma-ray tomography*, Measurement Science and Technology, Volume 19, 094016 (2008) 6 pp, Co-author.
12. *A data acquisition and control system for high-speed gamma-ray tomography*, Measurement Science and Technology, Volume 19, 094012 (2008) 6 pp, Principal-author.
13. *Patients with functional chest pain have an increased oesophageal wall tone during bag distension*, Scandinavian Journal of Gastroenterology, Volume 45, No. S247 (2010), Co-author.
14. *Flow imaging by high speed transmission tomography*, Applied Radiation and Isotopes, Volume 68, No 4-5 (2010) pp. 518-524, Co-author.
15. *Gamma-ray tomography applied to hydro-carbon multi-phase sampling and slip measurements*, Flow Measurement Instrumentation, Volume 21, No 3 (2010) pp. 240-248, Co-author.
16. *Sensation evoked by esophageal distension in functional chest pain patients depends on mechanical stress rather than on ischemia*, Neurogastroenterology and Motility, Volume 22, pp. 1170-e311 (2010), Co-author.
17. *Dynamic characterization of a high speed gamma-ray tomograph*, Flow Measurement Instrumentation, Volume 21, No 4 (2010), pp. 538-545, Co-author.
18. *Suppression of multiphoton intrashell resonances in Li Rydberg atoms*, Physical Review A, Volume 83, No 6, 063421 (2011) [9 pages], Co-author.
19. *Dual-mode capacitance and gamma-ray tomography using the Landweber reconstruction algorithm*, Measurement Science and Technology, Volume 22, 104002 (2011) 7 pp, Principal-author.
20. *Unidentified transitions in one-photon intrashell dynamics in Rydberg atoms*, Physical Review A, Volume 85, No 4, 043416 (2012) [4 pages], Co-author.

21. *Condition monitoring of subsea electrical equipment using motor current signature analysis*, EPE Journal, Volume 22, No 1 (2012), pp, 28-36, Co-author.
22. *Monitoring oil-water mixture separation by time domain reflectometry*, Measurement Science and Technology, Volume 23, 125303 (2012) 12 pp, Co-author.
23. *Excitation of Rydberg wave packets with chirped laser pulses*, Physical Review A, Volume 86, 063418 (2012) [8 pages], Co-author.
24. *Three-phase flow measurement in the petroleum industry*, Measurement Science and Technology, Volume 24, 012003 (2013) 17 pp, Co-author

Conference proceedings

1. Feasibility and Acute Toxicity of Combined Radiotherapy and Hyperthermia for Patients with Pelvic Malignancies Treated with BSD 2000, Proceedings of 8th ICHO (International Congress of Hyperthermic Oncology), Kyong-Ju, Korea, April 26-29 (2000), Co-author.
2. Recent developments in hydrocarbon separator interface imaging, Proceedings of SPIE Vol. 4188, International Symposium on Intelligent Systems for Advanced Manufacturing - Process Imaging for Automatic Control (2000), Principal-author.
3. Regional hyperthermia as part of trimodality treatment of locally advanced / locally recurrent cervical carcinoma, and primarily inoperable / locally recurrent rectal carcinoma, Proceedings of ESHO 2001 (European Society of Hyperthermic Oncology), Verona, Italy (2001), Co-author.
4. An accurate thermometry system for control and documentation of whole body hyperthermia procedures, Proceedings of ESHO 2002 (European Society of Hyperthermic Oncology), Bergen, Norway (2002), Principal-author.
5. Trimodality treatment with weekly cisplatin, hyperthermia and radiotherapy for locally advanced/locally recurrent cervical carcinoma, Proceedings of ESHO 2002 (European Society of Hyperthermic Oncology), Bergen, Norway (2002), Co-author.
6. Trimodality treatment with regional hyperthermia, radiotherapy and chemotherapy in primary inoperable or recurrent rectal carcinoma, Proceedings of ESHO 2003 (European Society of Hyperthermic Oncology), München, Germany (2003), Co-author.
7. Regional hyperthermia in addition to chemoradiotherapy in cervical carcinoma: Results of a phase II study, Proceedings of 14th BSD Users Conference, Erlangen, Germany (2003), Co-author.
8. Trimodality treatment of inoperable/locally recurrent cancer with hyperthermia, radiotherapy and chemotherapy - pilot studies, Proceedings of 14th BSD Users Conference, Erlangen, Germany (2003), Co-author.
9. Advances in multi modality tomography for multiphase hydrocarbon flow, Proceedings of 3rd International Symposium on Process Tomography in Lodz, Poland (2004), Co-author.
10. Trimodality treatment with regional hyperthermia, radiotherapy and chemotherapy in primary, inoperable and recurrent rectal carcinoma, Proceedings of 9th ICHO (International Congress of Hyperthermic Oncology), St. Louis, Miss, USA (2004), Co-author.
11. First experimental results of multiphase hydrocarbon flow monitoring using dual modality gamma-ray tomography and high frequency magnetic field sensors, Proceedings of 4th World Congress on Industrial Process Tomography, Aizu, Japan (2005), Principal-author.
12. A dual modality tomography system for imaging gas/solids flows, Proceedings of 4th World Congress on Industrial Process Tomography, Aizu, Japan (2005), Co-author.
13. Semi-empirical scatter correction models for high speed gamma-ray tomography, Proceedings of 5th World Congress on Industrial Process Tomography, Bergen, Norway (2007), Co-author.
14. A novel subsea on-line multiphase fluid sampling and analysis system, Proceedings of 5th World Congress on Industrial Process Tomography, Bergen, Norway (2007), Co-author.
15. USB-based data acquisition and control system for high speed gamma-ray tomography, Proceedings of 5th World Congress on Industrial Process Tomography, Bergen, Norway (2007), Principal-author.
16. High Speed Gamma-Ray Tomography for Hydrocarbon Flow Applications, AIP published proceedings of CT2008: Tomography Confluence: An International Conference on the Applications of Computerized Tomography, Indian Institute of Technology, Kanpur, India (2008), ISBN: 978-0-7354-0578-3, Principal-author.
17. A novel subsea on-line multiphase fluid sampling and analysis system, Proceedings of Underwater Technology Conference (UTC) 2008, Bergen, Norway (2008), Co-author.
18. Flow imaging by high speed transmission tomography, Proceedings of 7th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Application, Prague, Czech Republic (2008), Co-author.
19. Characterization of on-line fluid sampling using gamma-ray tomography, Proceedings of 3rd International Workshop on Process Tomography, Tokyo, Japan (2009), ISBN: 5-906497-83-5, Co-author.
20. Fluid characterisation in a subsea on-line multiphase fluid sampling and analysis system, Proceedings of 27th International North Sea Flow Measurement Workshop, Tønsberg, Norway (2009), Co-author.
21. Intra-shell RF-resonances in Li Rydberg atoms, Proceedings of 10th European Conference on Atoms Molecules and Photons (ecamp10), Salamanca, Spain (2010), Co-author.

22. Static characterization of dual mode capacitance and gamma-ray tomography using the Landweber reconstruction algorithm, Proceedings of 6th World Congress on Industrial Process Tomography, Beijing, China (2010), Principal-author.
23. Dynamic characterization of a high speed gamma-ray tomograph, Proceedings of 6th World Congress on Industrial Process Tomography, Beijing, China (2010), Co-author.
24. Tilstandsovervåkning av frekvensdriftede motorer med lange forsyningskabler ved bruk av motorstrøm signaturanalyse, Proceedings of Norsk Elektroteknisk Forening (NEF) Teknisk Møte 2011, Trondheim 24.-25. mars 2011, ISBN: 978-82-594-3505-7, Co-author.
25. Suppression of multiphoton intrashell resonances in Li Rydberg atoms, Poster presented at "XXVII International Conference on Photonic, Electronic and Atomic Collision (ICPEAC)", Belfast, Northern Ireland, UK (2011), Co-author.
26. Inherent dual mode single energy gamma-ray tomography, Proceedings of 6th International Symposium on Process Tomography, Cape Town, South Africa (March 2012), Principal-author.
27. Industrial applications of tomographic gamma-ray methods, Proceedings of 6th International Symposium on Process Tomography, Cape Town, South Africa (March 2012), Co-author.
28. The particle system iterative reconstruction technique in a high speed gamma-ray tomograph, Proceedings of 6th International Symposium on Process Tomography, Cape Town, South Africa (March 2012), Co-author.
29. Creation of Rydberg wavepackets with femtosecond laser pulses, Proceedings of "10th Nordic Femtochemistry Conference 2012 (NFC'12)", Hovs Hallar, Skåne Sweden (2012), Co-author.
30. Quantum coherent interactions of Rydberg atoms with controlled sequences of femtosecond laser pulses, Proceedings of "11th European Conference on Atoms, Molecules and Photons (ECAMP11)", Aarhus, Denmark (2013), Co-author.

Miscellaneous publications

1. Multiphase Flow Imaging by Dual Mode Tomography, Dr. Scient. (Ph.D) dissertation (March 1998), ISBN 82-992715-3-3, Author.
2. Sammenligning av eksisterende mastergradsveiledning ved Institutt for administrasjons- og organisasjonsvitenskap og Institutt for fysikk og teknologi, UPED-skrift nr. 1/2005 – BORA (Bergen Open Research Archive) – URI: <http://hdl.handle.net/1956/1049> , Co-author.
3. En refleksiv modell for mastergradsveiledning, UPED-skrift nr. 1/2005 – BORA (Bergen Open Research Archive) – URI: <http://hdl.handle.net/1956/1067> , Co-author.
4. Sammenlignende studie av mastergradsveiledningen ved to institutt. Book contribution to "Forskningsveiledning på master- og doktorgradsnivå", Abstrakt forlag AS (2006), ISBN: 978-82-7935-207-5, Co-author.

Patents

1. Fremgangsmåte og apparat ved måling av nivå (in Norwegian)
(Method and apparatus for indicating level of material)
Patentnr. 321678 notified 19. juni 2006 based on patent application nr. 97.6148. The patent is commercial property of Vetco Aibel AS, Postboks 81, 1375 Billingstad, Author.
2. Anordning ved måling av nivå (in Norwegian)
(Arrangement for indicating level of material)
Patentnr. 319584 notified 29. august 2005 based på patent application nr. 98.0070. The patent is commercial property of Vetco Aibel AS, Postboks 81, 1375 Billingstad, Co-author.

Patent First Filing

1. Fremgangsmåte og apparatur ved detektering av avsetning (in Norwegian)
Patent application nr. 96.3553 - commercial property of ABB Corporate Research Norway, Author.

Patent Invention Disclosure

1. Acoustic-electromagnetic monitoring of scale deposits (1996) – commercial property of ABB Corporate Research Norway, Principal-author.

Curriculum Vitae for Stein Dankert Kolstø

Address: Department of Physics and Technology, University of Bergen,
P.B. 7803, NO-5020 Bergen, Norway.
Phone: Office: (+47) 5558 4839, Mobile: (+47) 9264 2136
Email: kolsto@ift.uib.no

Professional Background:

2008 – present: Professor, University of Bergen, Norway
2001 – 2008: Associate professor. University of Bergen, Norway
1996 – 2001: Doctor scient. degree (Ph.D.) from the University of Oslo
1992 – 1995: Lecturer in general science, physics and mathematics in upper secondary school
1991 – 1992: Teacher education seminar at the University of Bergen

Overview:

My research interest covers two main areas. The first area is teaching for democratic participation in socio-scientific issues. I use qualitative methods to get insights into how students analyse and evaluate the science dimension of socio-scientific issues, and how they use science in their own argumentation and decision-making. The second area is inquiry-based science education. In specific, I am interested in the development of models for inquiry-based teaching and learning in science and the role of inquiry in science curricula for sustainable development. This includes an interest in the use of hands-on activities, students' use of language in the learning process and students' reading and writing of multimodal science texts. I have teaching experience from upper secondary school and Univ. of Bergen, and have been the main supervisor for 5 PhD-students, and currently supervisor for 3 students. I have published 29 academic papers and book chapters, and given more than 100 courses and presentations for science teachers at lower and upper secondary schools, including many articles in science teacher journals. Two of my publications are registered with 94 and 52 citations in Web of Knowledge, respectively, and is on the reading lists of many courses in science education and sustainable development, worldwide. I have been member of three curriculum committees established by the Norwegian Directorate for Education and Training, and is co-editor of the journal SPISS, published by the Centre for Science Education at UiB, which publishes peer-reviewed experimental reports made by science students. I was also leader of the committee for learning outcomes ("Arbeidsgruppe for kvalifikasjonsrammeverk og læringsutbytte") at the Faculty of Mathematics and Natural Sciences, UiB, which delivered their report November 3, 2010.

Current research projects

2013 – 2016 Senior researcher in RERISE (Submitted to FP7-SCIENCE-IN-SOCIETY-2012-1)
2012 – 2015 "Science learning through participation" (In co-operation with UMB)
2007-2011 "Students in school science as researchers" (Funded by NRC)

Students

PhD: Idar Mestad, Nils Petter Hauan, Anders Sivle
Finished: Elaosi Vhurumuku, Emmanuel Dzama, Peter Kwaira, Neo Paul Liphoto, Guðrún Jónsdóttir

Selected publications

1. Kolstø, S.D. Naturfag som forbereder til demokratisk deltakelse (Science education as preparation for democratic participation). In: Demokratisk medborgerskap i skolen. Fagbokforlaget 2012 ISBN 978-82-450-1272-9. s. 102-138
2. Knain, E.. & Kolstø, S. D. (Red.). (2011). Elever som forskere i naturfag (Students in school science as researchers). Oslo: Universitetsforlaget.
3. Angell, C., Bungum, B., Henriksen, E. K., Kolstø, S. D., Persson, J., & Renstrøm, R. (2011). Fysikkdidaktikk (Physics Education). Oslo: Høyskoleforlaget.
4. Kolstø, S. D. (2009): Vektlegging av lesing i naturfaget. Del 1: Vil den nye norske læreplanen i naturfag øke elevenes lesekompetanse? (Reading in science. Part 1: Will the new national science curriculum increase students' reading comprehension?) Del 2: Hvordan fremme elevens kompetanse i å lese naturfaglige tekster? (Reading in science. Part 2: How to develop students' ability to read scientific texts?) *NorDiNa* 5 (1) 61-88
5. Kolstø, S. D. (2008). Science education for democratic citizenship through the use of the history of science. *Science & Education*, 17 (8-9) 977-997.
6. Kolstø, S. D., Bungum, B., Arnesen, E., Isnes, A., Kristensen, T., Mathiassen, K., et al. (2006). Science students' critical examination of scientific information related to socio-scientific issues. *Science Education*, 90(4), 632-655.
7. Helmut J. Vollmer (ed.). Ta'ána Holasová. Stein Dankert Kolstø, Jenny Lewis (2007) : Language and communication in the learning and teaching of science in secondary schools. Council of Europe, Language Policy Division. Intergovernmental Conference Prague 8-10 November 2007 Organised by the Language Policy Division, Council of Europe, Strasbourg. Available : http://www.coe.int/t/dg4/linguistic/Publications_EN.asp

Curriculum Vitae for Anna Lipniacka

Address: Department of Physics and Technology, University of Bergen,
P.B. 7803, NO-5020 Bergen, Norway.
Phone: Office: (+47) 5558 2803 Mobile: (+47) 95786756
Email: anna.lipniacka@ift.uib.no

Research/teaching positions:

2003 – present: Professor, University of Bergen, Norway
1984 – present: Unpaid Associate, CERN (Corresponding Associate in 1999, 2004, 2013)
2001 – 2003: Lecturer (docent, associate professor), Stockholms University, Sweden
1995 – 2001 : Assistant Professor, Stockholms University, Sweden
1993 – 1995: Researcher, Laboratory of Linear Accelerator, Universite Paris Sud, France
1992 – 1993: Postdoc, University of California, Irvine, USA.
1990 – 1994: Junior Faculty member (permanent position) University of Warsaw, Poland
1984 – 1990: Research (50%) and teaching (50%) assistant, University of Warsaw/CERN

International Collaborations, present membership:

2001 – present: ATLAS Collaboration (Large Hadron Collider at CERN)
2010 – present: Individual Member of Cherenkov Telescope Array (CTA) Laboratory
1990 – present: DELPHI Collaboration (LEP accelerator at CERN)

Overview of research/teaching scope and responsibilities:

My research is in the area of high energy particle physics and it has covered wide range of subjects starting from neutrino physics and study of matter structure with neutrino microscopes to the precise measurements of parameters of theories governing the microscopic behavior of particles (Quantum Chromodynamics and Electro-Weak Theory). My major interest now is the highest energy frontier accelerators with capabilities to produce heavy, yet unknown particles in order to elucidate the present composition of the Universe. Expert in precision detection techniques for extreme energy radiation and in high statistics, large volume data mining and analysis; held several research coordination positions withing large international collaborations and in Norway; An active master and PhD student supervisor since 1992, supervised many international students in the framework of CERN Summer Student programme; Organized many research schools and conferences; An active outreach profile (popular science talks, articles, media); Elected member of Royal Norwegian Society of Sciences and Letters (DKNVS); Teaching/supervision experience from Univ. Bergen, Stockholm's University, University of California, Irvine and University of Warsaw. The main supervisor for 4 PhD students, co-supervisor of 8 PhD students ; Supervised 8 CERN Summer Student research projects ; Co-authored 600 publications in refereed journals, <http://inspirehep.net/search?p=find+author+lipniacka> ; **Publication H-index (hep) of 74 according to <http://inspirehep.net/author/A.Lipniacka.1> .**

Current/recent research responsibilities

2006 – 2018: Deputy PI of project "Norwegian High Energy Particle Physics" (10MNOK/year)
2006 – 2018: ATLAS-Bergen group leader.
2009 – 2012: Norwegian Delegate to the Global Science Forum of OECD, Astroparticle Physics
2009 - present Member of several RCN review panels.

Students

PhD: Therese Sjursen, Alex Kastanas, Mahdi Purmohammadi, Orjan Dale
Master: Agnethe Seim Olsen
Finished PhD: Arshak Tonoyan, Niels Erik Bomark, Peter Rosendahl, Per Johanssen, Are Raklev, Ola Kristopher Oye, Greg Griffin, Jamal Tarazzi.
Finished masters: Marzieh Vahabi, Orjan Dale, Kent Olav Skjei, Therese Sjursen, Alex Kastanas, Oyvind Satre, Jonas Strandberg, Per Andersson, Joergen Dalmau.

Five selected publications;

1. Basso, Lorenzo; Lipniacka, Anna; Mahmoudi, Farvah, Moretti, Stefano; Osland, Per and others,"Charged Higgs boson benchmarks in the CP-violating type-II 2HDM",CERN-PH-TH-2013-011, FR-PHENO-2013-001, SHEP-13-01
2. Basso, L.; Lipniacka, A. ; Mahmoudi, F. ;Moretti, S.; Osland, P. and others,"Probing the charged Higgs boson at the LHC in the CP-violating type-II 2HDM., 10.1007/JHEP11(2012)011
3. T. Burgess, J. O. Lindroos, A. Lipniacka and H. Sandaker;"Finding viable Models in SUSY Parameter Spaces with Signal Specific Discovery Potential".arXiv:1210.7020
4. Aad,G, Lipniacka A, and others;"Observation of a new particle in the search for the Standard Model Higgs boson with the ATLAS detector at the LHC," Phys. Lett. B 716,1(2012)
5. J. Abdallah, A. Lipniacka and others,"Searches for supersymmetric particles in e+ e- collisions up to 208-GeV and interpretation of the results within the MSSM, Eur.Phys.J.C 31,421(2003).

Curriculum Vitae for Kjartan Olafsson

Address: Department of Physics and Technology, University of Bergen,
P.B. 7803, NO-5020 Bergen, Norway.
Phone: Office: (+47) 5558 2752, Mobile: (+47) 9526 5140
Email: Kjartan.Olafsson@ift.uib.no

Professional Background:

2004 – present: Associate professor, University of Bergen, Norway
1991 – 2004: Coordinator for teaching/education, Dept. of Physics and Technology, Univ. of Bergen.
1991: Associate professor (temp.) Dept. of Physics, Univ. of Bergen.
1990: Fellow at Dept. of Physics, Univ. of Bergen.
1989: Assistant professor (temp.), Dept. of Physics, Univ. of Bergen.
1985 – 1988: Fellow at Dept. of Physics, Univ. of Bergen.

Overview:

My research has been within space physics with focus on education, public outreach and administration of study programs. I am the deputy leader of Department of Physics and Technology, leader of (a) the board of Centre for Science Education (UoB), (b) Physics education board at IFT (2003-2010), (c) PhD-committee at IFT, member of (a) the board of Norwegian Physical Society (2005-2011), (b) the board of science teachers education board at the Faculty of M&N, (c) the board of PhD-education at the Faculty of M&N, (d) the bachelor- and master education committee at the Faculty of M&N.

Students

Finished: Marit Sandanger (PhD), Laura Degener, Erwin Thorne.

Selected activities related to outreach

2000 – present: National Science Week (Forskingsdagene): Hands-on experiments, school projects and lectures.
Special award of the National Science Week in 2010
2010 – present: “Physics Show Bergen”, PI of project
2007 – present: “The Space Science Suitcase”, PI of project

Selected outreach publication

Kjartan Olafsson, Nikolai Ostgaard and Eija Tanskanen (2008): *The Space Science Suitcase—Instruments for Exploring Near-Earth Space from the Classroom*, Earth Moon Planet, DOI 10.1007/s11038-008-9261-z

Popular science

About 70 presentations on popular science, about 150 presentations in connection with school class visits at Department of Physics and Technology.

Teaching experience:

PHYS 102 Basic Course in Electricity, Optics and Modern Physics
PHYS109 Introduction to Astrophysics
PHYS112 Electromagnetism and Optics
PHYS117 Experimental Physics with Project Work
PHYS 252 Experimental Methods in Space Physics
MNF115 Natural Science Perspective on Sustainable Development
MNF140 Mathematics and Sciences
F 251 Space Physics
F 351 Magnetospheric Physics
FYS 132 General Physics II
FYS 011 Basic Course in Physics
AGF345 Polar Magnetospheric Substorms
NAROM, Andøya Rocketrange: Basic Course in Space Technology.
Various courses for science teachers at UoB's Centre for Science Education and the Centre for Continuing Education (SEVU) at UoB.



UNIVERSITY OF BERGEN

Nasjonalt organ for kvalitet i utdanningen (NOKUT)
Postboks 1708 Vik
0121 Oslo

Your ref

Our ref
2011/6578-BJUB

Date
03.05.2013

Letter of commitment (SFU - CIPTED)

The University of Bergen hereby confirms its support for and its intention to host the proposed *Centre of Interaction-based Physics and Technology Education (CIPTED)*.

The objective of creating the CIPTED Centre of Excellence in Higher Education is to enhance the interaction in physics- and technology-based education by focusing on recruitment and a flying start program, stronger human educational interaction, stronger interaction of abstract theory with experiments and observations, improved relevance in the learning program and research on university level physics/science didactics.

CIPTED will allow for immediate improvement of the bachelor education at the Department of Physics and Technology, especially related to peer-support, interactivity, e-learning (e.g. personal response system and flipped classroom) and evaluation. By dissemination, internally and externally, CIPTED will collectively engage lecturers in active learning and discussions based on own practices and student feedbacks through workshops, meetings, and conferences, which will also enable colleagues at other departments at the University of Bergen, and colleagues at other universities in Norway and abroad, to benefit from the centre.

We hereby express our firm intent to host and to support the proposed SFU. The University of Bergen regards the centre as an important part of our work with education, and we shall continue to provide support and contribute to the ongoing progress and development of the centre.

Yours sincerely,

Sigmund Grønmo
Rector

Kari Tove Elvbakken
University Director



UNIVERSITETET I BERGEN

Det matematisk-naturvitenskapelige fakultet

Referanse

2013/5143-ELIHØ

Dato

08.05.2013


Letter of intent from the Faculty of Mathematics and Natural Sciences

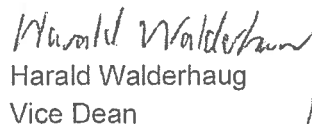
The Faculty of Mathematics and Natural Sciences supports the application for status as a Centre of Excellence in Higher Education: CIPTED - Centre of Interaction-based Physics and Technology Education, coordinated by Professor Bjørn Tore Hjertaker and hosted by the Department of Physics and Technology, Faculty of Mathematics and Natural Sciences, University of Bergen.

The Centre of Interaction-based Physics and Technology Education will cooperate with several external partners, in addition to other science departments at the University of Bergen, including CERN, UNIS/Department of Arctic Geophysics, NAROM/Andøya Rocket Range, Haukeland University Hospital, Christian Michelsen Research, Emerson Roxar, and Birkeland Centre for Space Science .

We hereby express our firm support to the proposed centre. The faculty regards the centre application as an important part of our continuing commitment to improve our education programs, and we shall continue to provide support and contribute to the ongoing progress and development of the centre.

If the application is successful, the faculty commits to supporting the centre with one 4-year ph.d-position.


Dag Rune Olsen
Dean


Harald Walderhaug
Vice Dean

Dette er et UiB-internt notat som godkjennes elektronisk i ePhorte

Det matematisk-naturvitenskapelige
fakultet
Telefon 55582062
Telefaks 55589666
post@mfna.uib.no

Postadresse
Postboks 7803
5020 Bergen

Besøksadresse
Realfagbygget, Allégaten 41
Bergen

Saksbehandler
Eli Neshavn Høie
55583227



UNIVERSITY OF BERGEN

Department of Physics and Technology

Nasjonalt organ for kvalitet i utdanning
Postboks 1708 Vika
0121 Oslo

Bergen, May 8th 2013

Letter of commitment

This to confirm that The Department of Physics and Technology fully supports the proposed *Centre of Interaction-based Physics and Technology Education (CIPTED)*. We will proudly host CIPTED and contribute with resources as outlined in the proposal, which has been developed in close collaboration with the department leadership.

We also confirm that we have a collaboration agreement with NAROM and extensive project collaboration with CERN through the Norwegian CERN membership and related research program.

Yours sincerely

Professor Geir Anton Johansen
Head of Department

Address:	Telephone:	Telefax:	E-mail
Allégaten 55	+47 5558 2806	+47 5558 9440	firstname.surname@ift.uib.no
N-5007 Bergen			



To whom it might concern

Your ref.

Our ref.

Date
May 8th, 2013

CONFIRMATION OF COLLABORATION

On behalf Christian Michelsen Research AS, Bergen, I hereby confirm our willingness to participate with relevant student projects in PHYS117 "Experimental physics with project work" for the Centre of Interaction-based Physics and Technology Education (CIPTED). The topics will need to be relevant for ongoing research activities within our department, and as such we hope it will be extra motivating for the students.

We have previously supervised master students and Ph.D. candidates in cooperation with the Department of Physics and Technology, University of Bergen, in similar projects.

Establishment of a centre will strengthen our ongoing collaborations within the interdisciplinary fields of applied physics, measurement science and instrumentation.

Yours sincerely
for CMR Instrumentation

Kari Marvik
Vice President

tel. +47 951 28 917
e-mail: kari.marvik@cmr.no

CMR
Christian Michelsen Research AS
P.Box 6031
NO-5892 Bergen, Norway

Visiting address:
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Fantoft

Telephone: +47 55 57 40 40
Telefax: +47 55 57 40 41
www.cmr.no

Bank: 5201 05 11755
NO 965 243 798 VAT

Bergen, May 6, 2013

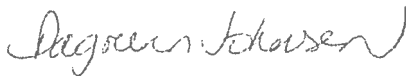
To whom it might concern

CONFIRMATION OF COLLABORATION

On behalf the Department of Radiology, Haukeland University Hospital, Bergen, I hereby confirm our willingness to participate with relevant student projects for the Centre of Interaction-based Physics and Technology Education (CIPTED). The topics will need to be relevant for ongoing clinical or research projects within our department, and as such we hope it will be extra motivating for the students that the outcome of their projects holds the potential of being important in patient handling.

We have previously supervised Bachelor students from the Department of Physics and Technology in similar projects (PHYS117), and also have successfully collaborated in supervising students on Master and PhD level. Establishment of a centre will strengthen our ongoing collaborations within the interdisciplinary fields of physics and medical imaging.

Sincerely yours,



for Aslak Aslaksen, MD, PhD
Head, Dept of Radiology

To whom it might concern

CONFIRMATION OF COLLABORATION

On behalf of Roxar Flow Measurement, Bergen, I hereby confirm our willingness to participate with relevant student projects in PHYS117 "Experimental physics with project work" for the Centre of Interaction-based Physics and Technology Education (CIPTED). The topics will need to be relevant for ongoing research and development activities within our company, and as such we hope it will be extra motivating for the students.

We have previously supervised master students and Ph.D. candidates in cooperation with the Department of Physics and Technology, University of Bergen, in similar projects.

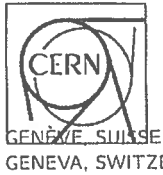
Establishment of a centre will strengthen our ongoing collaborations within the interdisciplinary fields of applied physics, measurement science and instrumentation.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Eirik Thorsen", written over a horizontal line.

Eirik Thorsen

E&D Manager MPFM, Bergen



ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Laboratoire Européen pour la Physique des Particules
European Laboratory for Particle Physics

Adresse postale / Postal address :

CERN
CH - 1211 GENÈVE 23

To whom it may concern

Téléphone / Telephone :

Direct +41 22 7672410

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Télex / Telex : 419000 CER CH

Télécopieur / Telefax :

Direct +41 22 7678350

General +41 22 767 6555

Electronic mail : jens.vigen@Cern.CH

Votre référence / Your reference

Notre référence / Our reference

8 May 2013

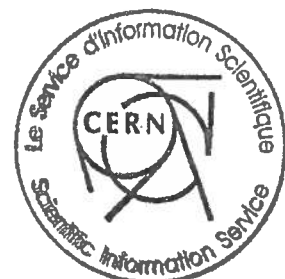
CERN, the European Organization for Nuclear Research, located near Geneva, Switzerland, operates the European Laboratory for Particle Physics. Norway is a founding member state of CERN.

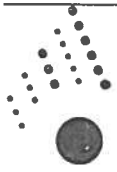
CERN welcomes the general public and organizes guided tours. CERN offers courses for physics teachers in English or in their mother tongue, lasting between 3 days and 3 weeks. CERN also organizes programmes for university students and young post-graduates in the fields of particle physics, accelerator physics, and computing (See <http://education.web.cern.ch/education/> for more information). For years Norwegian researchers at CERN have been supplementing CERN educational and organizing schools and visits targeting students affiliated to Norwegian Universities. Participations of students in such programmes is limited by financing of travels and stay at CERN available to students.

The typical costs of lodging and subsistence for short term visit amount to 70-150 CHF/day/person (around 450-950 NOK/day/person). More information can be found at <https://espace.cern.ch/hostel-service/default.aspx>.

Yours sincerely

Jens Vigen
Head of Scientific Information Office
CERN





Bergen, May 5, 2013

Supporting a Centre of Excellence in Education in Physics and Technology

Dear Bjørn Tore, I want to express my fully support of your proposal to NOKUT for a Centre of Excellence in Education called the Centre of Interaction-based Physics and Technology Education (CIPTED). As you know, I am leading the newly opened Norwegian Centre of Excellence in research (SFF); the Birkeland Centre for Space Science (BCSS). Both BCSS and CIPTED are hosted in the same building.

Excellent research builds on excellent education, and I am convinced there will a lot of synergy between CIPTED and BCSS. Our staff will supervise PHYS117 bachelor students in project work, and in the next 10 years we plan to recruit more than 80 master students. Excellent education at the bachelor level is important for us in order to reach that goal.

Sincerely,

Nikolai Østgaard

Leader of
Birkeland Centre for Space Science
Prof. at Dept. of Physics and Technology
University of Bergen
Alleggt 55, 5007 Bergen, Norway
phone: +47 5558 2794
cell: +47 4727 0653
URL: www.ift.uib.no/~nikost
email: Nikolai.Ostgaard@ift.uib.no



UNIS

The University Centre in Svalbard

Prof. Bjørn Tore Hjertaker
Department of Physics and Technology
University of Bergen
Postbox 7803
NO-5020 Bergen
Norway

Date: 06.05.2013

Supporting your proposal to NOKUT for a Centre of Excellence in Education

Dear Bjørn Tore, let me write in support of your proposal to NOKUT for a Centre of Excellence in Education called Centre of Interaction-based Physics and Technology Education (CIPTED). I am in charge of The Kjell Henriksen Observatory (KHO), which is an optical observatory at UNIS that opened in February 2008. At the observatory there are more than 25 instruments, from 15 institutions in 7 countries.

We already have an excellent collaboration with the University of Bergen via the Birkeland Centre for Space Science (Norwegian Centre of Excellence in research). Your plan of extending this collaboration to excellent education is greatly appreciated. We look forward to have your staff and bachelor students to visit KHO for project work. At KHO we have excellent facilities for studies of the aurora. The current rent at KHO is 20 000 NOK per year, and it covers electricity, data network, and minor technical support.

I am therefore very pleased to support your proposal, and I look forward to collaborate with you.

Kind regards,

Prof. Fred Sigernes
Chief of The Kjell Henriksen Observatory, UNIS



UNIVERSITETET I BERGEN

Institutt for fysikk og teknologi
Department of Physics and Technology

May 6, 2013

Prof. Bjørn Tore Hjertaker
Department of Physics and Technology
University of Bergen
Postbox 7803
NO-5020 Bergen
Norway

In support of a Centre of Excellence in Education in Physics and Technology

Dear Bjørn Tore, let me write in support of your proposal to NOKUT for a Centre of Excellence in Education called the Centre of Interaction-based Physics and Technology Education (CIPTED).

As President of the Norwegian Physical Society I applaud your idea of including the bi-annual Norwegian Physics Meeting as a key arena in your dissemination plan. The Norwegian Physics Meeting is attended by scientists, students and teachers from all universities (and many secondary schools) in Norway. In particular, the Norwegian Physics Teacher's Society is much involved in its organization, so presentations, discussions and workshops about education are always welcome and much appreciated at these meetings.

Personally, as the President of the Norwegian Physical Society, I must say that it is both inspiring and exciting to see initiatives that focus on and promote excellent physics education.

Kind regards

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President, Norwegian Physical Society

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