8th thematic workshop: International Symposium On Advanced Intraoperative Imaging of Radioisotopes and Presymposium workshop TOF PET

Report of Contributions

Contribution ID: **0** Type: **not specified**

Welcome

Saturday 5 September 2009 08:15 (25 minutes)

Author: Prof. GARIBALDI, Franco (istituto di sanita, dipertimento TESA &INFN-Roma1, Rome, Italy)

Presenters: Prof. GARIBALDI, Franco (istituto di sanita, dipertimento TESA &INFN-Roma1, Rome, Italy); CUTTONE, Giacomo (INFN-LNS); DUVAL, Marie Alix (Laboratoire Imagerie et Modélisation en Neurobiologie et Cancérologie, Centre National de la Recherche Scientifique, Universités Paris VII and Paris XI); LECOQ, Paul (CERN); MACELLARI, Velio (TESA, ISS)

Session Classification: Symposium Opening Session

Contribution ID: **1** Type: **not specified**

Anyone can find a ”hot” node

Saturday 5 September 2009 09:00 (30 minutes)

Development of technologies, techniques, and protocols that make a surgical procedure incorporating radioisotope imaging possible and successful requires significant understanding of the technologies, techniques, and protocols relevant to the surgical task, and of the patient management goals of the surgical procedure. With emphasis on the imaging component of integration of imaging into surgery, with primary reference to an investigation of a specific breast cancer SLN biopsy task, parameters of system design, of development of surgical procedures incorporating radioisotope imaging, and of development of application-specific protocols are presented. At the core is specification of the task—anyone can find a “hot”node—what is the true objective?

Author: Dr AARSVOLD, John N. (Department of Radiology, Emory University & Nuclear Medicine Service, Atlanta Veterans Affairs Medical Center)

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Presenter: Dr AARSVOLD, John N. (Department of Radiology, Emory University & Nuclear Medicine Service, Atlanta Veterans Affairs Medical Center)

Session Classification: Symposium Session 1

Contribution ID: **2** Type: **not specified**

SPECT/CT and a portable gamma camera to optimize sentinel node visualization in urological malignancies and head and neck cancer

Saturday 5 September 2009 09:30 (30 minutes)

Exact localization of radioactive sentinel nodes is requisite to provide accurate staging with lymphatic mapping. SPECT/CT can exactly localize sentinel nodes and is able to depict more sentinel nodes than conventional (planar) images. It especially adds relevant information in areas with a complex anatomy, like the head and neck region and in pelvic and retroperitoneal areas. A portable gamma camera can be used to improve intra-operative search for sentinel nodes. Such a camera provides real-time imaging of the sentinel node and can detect and localize those nodes, even if located near the injection area. The use of a gamma camera also increases certainty about the accuracy and completeness of the excision of the radioactive nodes, because it facilitates post-excision monitoring.

Author: Dr VERMEEREN, Lenka (Department of Nuclear Medicine, Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital)

Co-authors: Dr BEX, Axel (Department of Head and Neck Surgery, Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital); Dr BALM, Hans (Department of Head and Neck Surgery, Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital); Dr KLOP, Martin (Department of Urology); Dr VAN DEN BREKEL, Michiel (Department of Head and Neck Surgery, Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital); Dr VALDES OLMOS, Renato (Department of Nuclear Medicine); Dr HORENBLAS, Simon (Department of Urology); Dr MEINHARDT, Wim (Department of Urology)

Presenter: Dr VERMEEREN, Lenka (Department of Nuclear Medicine, Netherlands Cancer Institute - Antoni van Leeuwenhoek Hospital)

Session Classification: Symposium Session 1

Contribution ID: **3** Type: **not specified**

Breast cancer (surgery)

Saturday 5 September 2009 10:00 (30 minutes)

Author: Dr AMANTI, Claudio (Operative Unit Chirurgia Senologica, University of Rome Sapienza II)

Presenter: Dr AMANTI, Claudio (Operative Unit Chirurgia Senologica, University of Rome Sapienza II)

Session Classification: Symposium Session 1

Contribution ID: **5** Type: **not specified**

Freehand SPECT and the "tracked approach" for 3D intraoperative nuclear imaging

Saturday 5 September 2009 11:30 (30 minutes)

The combination of tracking systems and intraoperative nuclear probes has been proposed recently as a promising way of enabling 3D intraoperative nuclear imaging. The particular experience of freehand SPECT, where a low energy gamma probe served as nuclear probe, has shown the feasibility of this approach in initial pilot studies. In the process several issues have emerged to be considered due to the fundamentally different nature of this imaging modality. Concepts, problems and solutions arising from this new technology will be dealt with in detail based on different experiences of the Munich research group.

Author: WENDLER, Thomas (Nuklearmedizinische Klinik und Poliklinik, Klinikum rechts der Isar & Computer Aided Medical Procedures (CAMP) Faculty of Computer Science)

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Presenter: WENDLER, Thomas (Nuklearmedizinische Klinik und Poliklinik, Klinikum rechts der Isar & Computer Aided Medical Procedures (CAMP) Faculty of Computer Science)

Session Classification: Symposium Session 2

Contribution ID: **6** Type: **not specified**

Molecular imaging in the operating room: Novel tools for guiding surgery

Saturday 5 September 2009 11:00 (30 minutes)

This presentation will give an overview of molecular imaging tools (nuclear, optical imaging) and their possible use in the operating room in guiding oncologic abdominal surgery. For instance, the role of surgery in metastatic/recurrent cancer is currently being redefined, as new diagnostic tools and treatments are available: metastasectomy and cytoreductive can be considered viable management in selected cases. Probes sensitive to β+ radiation (positrons) used in combination with specific radiopharmaceuticals offer superior sensitivity for real-time localization of tumoral lesions and the ability to link tumor biological characteristics to preoperative positron emission tomography. Moreover, these probes are exquisitely sensitive and have been reported to detect micro-metastases in lymph nodes missed by conventional histopathological examination or pre-operative imaging and only detected when ultrathin histopathological analysis of resected lymph nodes was requested.

Author: Dr PRIOR, John (Nuclear Medicine Department, CHUV University Hospital)

Co-authors: Dr DEMARTINES, Nicolas (Visceral Surgery Department, CHUV University Hospital); Dr DUNET, Vincent (Nuclear Medicine Department, CHUV University Hospital)

Presenter: Dr PRIOR, John (Nuclear Medicine Department, CHUV University Hospital)

Session Classification: Symposium Session 2

Contribution ID: **7** Type: **not specified**

Technologies for intraoperative PET and SPECT imaging probes

Saturday 5 September 2009 12:00 (30 minutes)

There are a variety of strategies that can be used to detect the emission of positron-emitting (PET) and single photon-emitting (SPECT) radionuclides. The ones used in conventional PET and SPECT cameras cannot be directly applied to intraoperative imaging probes, mostly because of their physical size. Many designs require shielding, which exacerbates the size limitations. This presentation will discuss the requirements and the various technologies that are appropriate for meeting these requirements, and will also explore various potential intraoperative imager configurations.

Author: Dr MOSES, Williams (Lawrence Berkeley National Laboratory)

Presenter: Dr MOSES, Williams (Lawrence Berkeley National Laboratory)

Session Classification: Symposium Session 2

Contribution ID: **8** Type: **not specified**

Counting probes and mini gamma cameras: From the bench to clinical trials

Saturday 5 September 2009 16:00 (30 minutes)

The sentinel lymph node procedure is now widely used in the staging of breast cancer patients. The "classic"procedure uses preoperative lymphoscintigraphy combined with blue-dye injection and peroperative dedicated instrumentation. These devices have already been implemented by several research groups using different detector materials such as semiconductors and inorganic scintillating crystals. From our experiences in nuclear and particle physics, the "Institut Pluridisciplinaire Hubert Curien"(IPHC) has developed a gamma probe and small field of view (FOV) gamma cameras with YAP and GSO crystals respectively. The impact of figure of merits such as spatial resolution, detection efficiency and system FOV on the surgical procedure will be discussed based on clinical trials.

Author: Dr BRASSE, David (IPHC, Université de Strasbourg, CNRS/IN2P3)

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Presenter: Dr BRASSE, David (IPHC, Université de Strasbourg, CNRS/IN2P3)

Session Classification: Symposium Session 3

Contribution ID: **9** Type: **not specified**

Mobile gamma camera imaging in sentinel lymph node biopsy of melanoma patients

Saturday 5 September 2009 15:30 (30 minutes)

Background: Lymph node metastasis is a strong predictor of melanoma-associated mortality. However, the false negative rate for sentinel lymph node biopsy (SLNBx) has been reported as high as 24%. Intra-operative mobile gamma camera (MGC) imaging may improve the accuracy of SLNBx. Methods: From 4/08-9/08, 20 patients undergoing SLNBx for melanoma were imaged with MGC. Participants underwent standard lymphoscintigraphy followed by intra-operative MGC imaging. Hot spots detected by fixed gamma camera (FGC), MGC and hand-held gamma probe were recorded. Intra-operative logistical challenges were scored. Situations in which MGC was useful in adjunct to standard practice were recorded. Results: Among 20 participants, 30 lymph node basins containing SLNs were identified with a total of 46 SLNs. The sensitivities for detection of basins were 97% (29/30) for the FGC and 90% (20/30) for the MGC. 70% of the SLNs (32/46) were detected as individual hot spots by the FGC compared to 93% (43/46) for intraoperative MGC imaging. Among the 12 subjects who receiving 99mTc-SC injection on the day of surgery (as opposed to the previous day) the basin and SLN detection sensitivities for the MGC were both 100%. Investigator opinion of MGC (scale of 1-9; 1=outstanding, 9=inability to complete study) resulted in a mean score of 2.3 for MGC identification of hot spots preoperatively and 2.0 for identification of residual nodes. Conclusions: Real-time, intra-operative imaging in SLNBx for melanoma is sensitive and provides additional information when FGC imaging fails or is ambiguous. Use of the MGC warrants further investigation for its potential to reduce false negative SLNBx.

Author: Dr WILLIAMS, Mark B (Department of Radiology, Department of Biomedical Engineering, Department of Physics University of Virginia)

Co-authors: Dr SLINGLUFF, Craig (Department of Surgery, University of Virginia); Dr DENGEL, Lynn (Department of Surgery, University of Virginia); MORE, Mitali (Department of Biomedical Engineering); JUDY, Patricia (Department of Biomedical Engineering); Dr MAJEWSKI, Stan (Department of Radiology, University of West Virginia)

Presenter: Dr WILLIAMS, Mark B (Department of Radiology, Department of Biomedical Engineering, Department of Physics University of Virginia)

Session Classification: Symposium Session 3

Contribution ID: **10** Type: **not specified**

TBD

Contribution ID: **11** Type: **not specified**

New tools for sentinel node localization and radioguided laparoscopic gastrointestinal surgery

Saturday 5 September 2009 17:45 (30 minutes)

Pre-operative planar scintigraphy and intra-operative probe detection have been performed in a variety of solid tumors in the last decade.
Actually the new nuclear medicine tool is to better localize sentinel node and discover deeply located ones in mediastinum , abdomen and pelvis .
Moreover, to improve anatomical information, hybrid imaging devices such as SPECT-CT and PET-CT , that combine nuclear functional information with CT morphological data , have been introduced.
Portable mini-gamma-camera can help the surgeon especially in the colon-surgery, in which investigators have a high false negative rate because of the lack of imaging.
Portable devices are particularly useful in laparoscopic surgery because combine real time findings and pre-operative imaging and are able to depict the signals of two radionuclide simultaneously.
New generation probe are able to better identify radioactive signals both from tumor both from lymphonodes and to guide the surgeon to a selective lymphadenectomy.
This new investigation area can help the crucial point in decision making in gastrointestinal tumor management, about a less or more extensive surgery , to recognize sentinel node and to excide it for histopathology such as in early gastric cancer, where a simply mucosectomia can be performed, if negative pathological node has been found.

Author: MUTO, Pietro (Department of Nuclear Medicine - A.O.Monaldi)

Co-author: Dr CATALANO, Mara (Department of Nuclear Medicine, A. O. Monaldi)

Presenter: MUTO, Pietro (Department of Nuclear Medicine - A.O.Monaldi)

Session Classification: Symposium Session 4

Contribution ID: **12** Type: **not specified**

SiPMs: New photodetectors for intraoperative imagers?

Saturday 5 September 2009 18:45 (20 minutes)

The Silicon PhotoMultiplier (SiPM) has recently come out as a very promising photodetector for many forthcoming applications. Its capability to detect and resolve single photons, along with its wonderful timing figure, small size, insensitivity to magnetic fields, low voltage operations, intrinsic protection from accidental exposure to ambient light, make it a strong candidate for many future implementations in several fields, including medical diagnostics. The basic features of this new sensor will be illustrated, as well as a few possible applications.

Author: FINOCCHIARO PHD, Paolo (Nazionale di Fisica Nucleare –Laboratori Nazionali del Sud,)

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Presenter: FINOCCHIARO PHD, Paolo (Nazionale di Fisica Nucleare –Laboratori Nazionali del Sud,)

Session Classification: Symposium Session 4

Contribution ID: **13** Type: **not specified**

Colorectal Cancer: Surgical Challenges

Saturday 5 September 2009 18:15 (30 minutes)

Author: ZIPARO, V

Presenter: ZIPARO, V

Session Classification: Symposium Session 4

Contribution ID: **14** Type: **not specified**

Intra-operative near-infrared fluorescence imaging: From bench to bedside

Saturday 5 September 2009 19:30 (30 minutes)

We have developed an advanced multi-spectral fluorescence real-time imaging platform for assessing in positive surgical margins, loco-regional metastases and overall physiological and molecular biomarkers intra-operatively. The approach utilizes fluorochromes with targeting specificity, advanced optical imaging instrumentation and algorithms that yield quantitative and sensitive fluorescence imaging in tissues. This technique ties well with surgical practices and offers high potential for practical dissemination. In this talk, we will present the system and overall strategy, results from animal experiments by using targeted probes in an animal breast cancer model, the first results in patients with a sentinel-lymph-node detection in breast conserving surgery together with future targeted fluorescent probes.

Author: Dr HARLAAR, Niels (Institute for Medical and Biological Imaging, Technical University Munich and Helmholtz Center and Department of Surgery and BioOptical Imaging Center Groningen, University Medical Center Groningen)

Co-authors: Dr VAN DAM, Gooitzen (Department of Surgery and BioOptical Imaging Center Groningen, University Medical Center Groningen); Dr NTZIACHRISTOS, Vasilis (Institute for Medical and Biological Imaging, Technical University Munich and Helmholtz Center)

Presenter: Dr HARLAAR, Niels (Institute for Medical and Biological Imaging, Technical University Munich and Helmholtz Center and Department of Surgery and BioOptical Imaging Center Groningen, University Medical Center Groningen)

Session Classification: Symposium Session 4

Contribution ID: **15** Type: **not specified**

Radiopharmaceuticals for intraoperative nuclear medicine

Sunday 6 September 2009 08:30 (30 minutes)

Author: Dr HOFMANN, Michael (Institut für Nuklearmedizin und PET-Zentrum, Klinikum Hildesheim GmbH)

Presenter: Dr HOFMANN, Michael (Institut für Nuklearmedizin und PET-Zentrum, Klinikum Hildesheim GmbH)

Session Classification: Symposium Session 5

Contribution ID: **16** Type: **not specified**

Intra-operative positron probe to address surgical challenges in brain surgery

Sunday 6 September 2009 09:30 (30 minutes)

The survival outcome of a patient suffering from a glioma is directly linked to the complete surgical resection of the tumor. To help surgeons delineate precisely the boundaries of a tumor, we developed an intra-operative positron probe with gamma background rejection capability. The probe was designed to be directly coupled to the excision tool such that detection and removal of the radiolabeled tumors could be simultaneous. The device consists of two interchangeable detection heads composed of clear plastic scintillating fibers. Each head is coupled to an optical fiber bundle that transmits the scintillation light to a photodetector and processing electronic module placed outside the surgical bed. The background rejection method is based on a real-time subtraction technique. In performed phantom tests, the measured probe sensitivity for 18F was 41cps/kBq for the small detection head and 121cps/kBq for the large head. The obtained mean spatial resolution was 1.6 mm FWHM on the detector surface. The γ-ray rejection efficiency measured by realistic brain phantom modeling of the surgical cavity was 99.6%. These phantom studies also demonstrated the ability of the probe to detect disc tumor lesions as small as 5 mm in diameter (20 mg) for tumor-to-background ratios higher than 3:1 and with an acquisition time around 4s at each scanning step. These results indicate that our detector could be a useful addition to existing techniques for the accurate excision of brain tumor tissue and more generally to improve the efficiency of radio-guided cancer surgery.

Author: Dr LESTON, Jose (Service de Neurochirurgie, Hôpital Henri Mondor)

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Presenter: Dr LESTON, Jose (Service de Neurochirurgie, Hôpital Henri Mondor)

Session Classification: Symposium Session 5

Contribution ID: **17** Type: **not specified**

Lung Cancer, Mediastinal Nodes, Pulmonary Nodules: Imaging Challenges

Sunday 6 September 2009 11:30 (30 minutes)

In the last ten years, the widespread use of minimally invasive thoracic surgical procedures has prompted the development of nuclear medicine techniques for the pre-operative imaging and intra-operative probe detection of pulmonary lesions and mediastinal sentinel and metastastic nodes. Moreover, the introduction in clinical practice of hybrid imaging devices like SPET/CT and PET/CT has pushed thoracic surgeons and nuclear medicine physicians to use intra-operatively gamma and/or beta emitters for the detection and excision of minimal residual disease. We present results of the 15 years of clinical experience in this field and future trends and applications in radioguided thoracic surgery.

Author: Dr BONI, Giuseppe (Nuclear Medicìne Unit, Department of Oncology and Radiology, A.O.U. Pisa)

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Presenter: Dr BONI, Giuseppe (Nuclear Medicìne Unit, Department of Oncology and Radiology, A.O.U. Pisa)

Session Classification: Symposium Session 6

Contribution ID: **18** Type: **not specified**

Urologic Cancers: Surgical Challenges

Sunday 6 September 2009 10:00 (30 minutes)

Author: Dr MUTO, Giovanni

Presenter: Dr MUTO, Giovanni

Session Classification: Symposium Session 5

Contribution ID: **19** Type: **not specified**

High-resolution PET imaging probe for the prostate

Sunday 6 September 2009 10:30 (30 minutes)

PET tracers such as C11-choline potentially provide the ability to distinguish aggressive lesions from those in which "watchful waiting"is a more appropriate course of action. Nevertheless, there remains much controversy regarding the role of PET in detecting and managing prostate cancer with mixed results in the literature depending on the clinical study. Surprisingly, few of these studies even note the confounding influence of the PET scanner itself. Differences in spatial resolution among scanners can result in very different conclusions. To both reduce variations among scanners having different spatial resolutions and improve resolution, we are developing a transrectal prostate imaging probe that can be used as an add-on device to conventional PET rings. Design studies are ongoing, but the technology for the imaging probe is low-risk and a demonstration device has been developed that will be tested in conjunction with a PET ring over the next few months. In addition to describing the prostate imaging probe, investigation of other technologies for intra-operative molecular imaging will be briefly noted.

Author: Dr CLINTHORNE, Neals (Department of Radiology, University of Michigan)

Co-author: Dr MAJEWSKI, Stan (Department of Radiology, University of West Virginia)

Presenter: Dr CLINTHORNE, Neals (Department of Radiology, University of Michigan)

Session Classification: Symposium Session 5

Contribution ID: **20** Type: **not specified**

Intra-operative Compact Gamma Imagers for Radio-guided Cancer Surgery

Saturday 5 September 2009 16:30 (30 minutes)

In addition to intra-operative probes, compact gamma cameras are very attractive to provide more efficient radio-labelled tumors localization. We have developed a high resolution intra-operative imager, POCI (Per-Operative Compact Imager), who has following imaging performances at 140 keV Tc99m gamma energy: a) spatial resolution of 2.3 mm FWHM and b) corresponding detection efficiency of 10.7 cps/µCi. This camera was evaluated in the sentinel node detection protocol in a clinical trial including 162 breast cancer patients. The results demonstrate that POCI can be used for lymphoscintigraphy and that it plays a decisive role in operating room.
Due to a substantial interest raised by POCI, a new pixellated detector called TReCam (Tumor Resection Camera) is under development. This device will offer better detection performances, easier handling, and moreover a design suiting a future industrialisation. The camera is based on a 256 pixel multi-anode photomultiplier coupled with a LaBr3 scintillator.
TReCam will be evaluated in the radioguided occult lesion localisation (ROLL) protocol. It will be used to localise the tumor and to check for residual radioactivity.
Overall imaging performances and clinical evaluations of both cameras will be extensively presented and discussed.

Author: DUVAL, Marie Alix (Laboratoire Imagerie et Modélisation en Neurobiologie et Cancérologie, Centre National de la Recherche Scientifique, Universités Paris VII and Paris XI)

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Presenter: DUVAL, Marie Alix (Laboratoire Imagerie et Modélisation en Neurobiologie et Cancérologie, Centre National de la Recherche Scientifique, Universités Paris VII and Paris XI)

Session Classification: Symposium Session 3

Contribution ID: **21** Type: **not specified**

Parathyroid Surgeries

Sunday 6 September 2009 09:00 (30 minutes)

Author: Dr MARINI, Pierluigi

Presenter: Dr MARINI, Pierluigi

Session Classification: Symposium Session 5

Contribution ID: **22** Type: **not specified**

LaBr3 as scintillator for intraoperative imagers

Sunday 6 September 2009 15:40 (20 minutes)

Over the last five years, INFN has been studying the potential of LaBr3:Ce scintillation crystals for nuclear medicine application. The continuous improvement of each generation of crystals has resulted in the fabrication of detectors with excellent imaging characteristics at 140 keV with detection efficiencies between 70 and 90%, with energy resolution of 7%, with intrinsic spatial resolutions ranging between 1.5 mm and 0.8 mm, and with very good position linearity over the full FoVs of the detectors. Detector FoVs from 25 cm2 to 150 cm2 have been investigated. LaBr3:Ce is very promising as a candidate for use in small FoV imagers, in particular, for use in devices in the field of intra-operative single-photon emission imaging. Although the potential is good for LaBr3:Ce to improve visual quality and quantitative accuracy of radionuclide imaging in small FoV gamma cameras, it remains that radionuclide imaging intrinsically lacks anatomic cues that are needed to localize or stage disease and typically has poorer statistical and spatial characteristics than anatomic imaging methods. Functional and anatomic information need to be considered together if one wants to give meaning to a small photon emission image and obtain a more reliable diagnosis. Toward this end, the INFN ECORAD collaboration plans to develop a dual-modality compact camera that will acquire ultrasound and scintigraphic images. Among the technologies that can provide anatomical information, ultrasound is a cost-effective and reliable technology. Further, ultrasound probes are among the most common portable devices. All of these factors provide motivation for the development of a new imaging approach that combines functional data from compact gamma cameras with structural data from ultrasound technology.

Author: Dr PANI, Roberto (representing the INFN ECORAD collaboration, INFN Roma1, 2nd Faculty of Medicine, Department of Experimental Medicine, Sapienza University of Rome)

Presenter: Dr PANI, Roberto (representing the INFN ECORAD collaboration, INFN Roma1, 2nd Faculty of Medicine, Department of Experimental Medicine, Sapienza University of Rome)

Session Classification: Symposium Session 7

Contribution ID: **23** Type: **not specified**

High-resolution devices for sentinel-node detection in breast cancer

Sunday 6 September 2009 16:00 (30 minutes)

We worked with two models—1in2 and 4 in2 FOV—of high-resolution hand-held cameras (HRCs), to verify if a HRC shows advantages over an Anger camera (AC) plus common gamma probe (GP). Methods: 280 patients with T1 breast cancer were divided in two groups of 140—one studied with AC-GP, the other with HRC. Patients were age, body mass index, and tumour size matched. Results: HRC detected more nodes than with GP+ AC: 247 vs 192 ($p< 0.01$). 45 nodes showed invasion in the HRC group, 32 in the AC+GP group ($p =0.05$). Conclusions: HRC shows clinically interesting advantages over AC-GP.

Author: Dr SCOPINARO, Francesco (University "Sapienza)

Co-authors: PARISELLA, Maria-Gemma (University "Sapienza); PIZZICHINI, Patrizia (University Hospital S.Andrea); MASSARI, Roberto (Institute of Bio-Medical Technologies (ITBM) CNR)

Presenter: Dr SCOPINARO, Francesco (University "Sapienza)

Session Classification: Symposium Session 7

Contribution ID: **24** Type: **not specified**

Performance characteristics of a newly developed intra-operative gamma camera: Evaluation of sentinel lymph node detection in an experimental animal model and preliminary clinical experience

Sunday 6 September 2009 16:30 (30 minutes)

Hypothesis: The ability to obtain detailed visual assessments of radio-labeled tissues intra-operatively is expected to improve localization and removal of such targets. We have tested the capacity of a newly developed portable gamma camera to precisely locate sentinel lymph nodes using an injected radiotracer contrast agent both in an animal model and a preliminary clinical study. Design: Animal study: Two sets of experiments were performed on 8 pigs under general anesthesia. 99mTc-nanocolloid and dye complex was injected into the sub muscular layer of the small bowel in the first set, and subcutaneously in the knee region in the second set of experiments. Images were acquired at various distances from the injection sites following the lymphatic expansion towards the inguinal sentinel nodes. Image acquisition of the sentinel nodes was performed with the camera placed at various angles also. The nodes were then excised and scanned in vitro. The node sites were scanned again after node removal to prove the completeness of the excision. Clinical study: Four patients with breast cancer underwent axillary lymph node dissection and were evaluated with the portable gamma camera during the routine procedure. Results: Animal study: In each experiment, a mosaic of images was obtained encompassing the injection sites, lymphatic pathways and sentinel lymph nodes. By acquiring images of the sentinel nodes with various angular perspectives, three dimensional visualizations were obtained allowing the precise location and complete excision of these nodes. Clinical study: More hot nodes were detected by the camera. Excellent views were obtained. Easy localization of hot nodes was possible. Conclusions: The use of the portable gamma camera allowed the rapid visualization of the lymphatic pathways leading from the injection sites to the sentinel nodes and precise location of these nodes, even if they were located deep below the surface. The camera was also useful to verify the complete removal of the labeled target tissues, even in the presence of a general background activity from the surgical field. The camera served as an excellent guidance device to the surgeon. Acknowledgement: These studies were performed with the financial assistance of the MAGNET Program, Office of the Chief Scientist, Ministry of Industry and Trade, State of Israel.

Author: Dr KOPELMAN, Doron (Department of Surgery BHaEmek Medical Center & Faculty of Medicine Technion, Israel Institute of Technology)

Co-authors: Dr IOSILEVSKY, Galina (Department of Nuclear Medicine, Rambam Medical Center); BLEVIS, Ira (GE Healthcare); Dr HASHMONAI, Moshe (Department of Surgery B, HaEmek Medical Center); Dr ISRAEL, Ora (Department of Surgery B, HaEmek Medical Center , Department of Nuclear Medicine, Rambam Medical Center)

Presenter: Dr KOPELMAN, Doron (Department of Surgery BHaEmek Medical Center & Faculty of Medicine Technion, Israel Institute of Technology)

Session Classification: Symposium Session 7

Contribution ID: **25** Type: **not specified**

Corporate Presentations : SENSL Ltd, St Gobain Crystals, Metaltronica

Saturday 5 September 2009 17:30 (15 minutes)

Presenters: Dr JACKSON, Carl (SensL technologies Ltd); KNIEST, Frans (Saint-Gobain Crystals); GIOIA, Stefano (Metaltronica)

Session Classification: Symposium Session 4

Contribution ID: **26** Type: **not specified**

Corporate Presentation : Dilon Technologies

Sunday 6 September 2009 15:30 (10 minutes)

Author: Dr WELCH, Benjamin (Dilon Technologies)

Presenter: Dr WELCH, Benjamin (Dilon Technologies)

Session Classification: Symposium Session 7

Contribution ID: **27** Type: **not specified**

Biomedical imaging research in the EU's 7th Framework Programme (FP7)

Saturday 5 September 2009 08:40 (20 minutes)

FP7: structure and budget; short description of 4 Specific Programmes (aspects that could be of particular interest to this audience).
•where in FP7 are their topic(s) of interest to this audience considered: medical imaging (mainly HEALTH programme, including image-guided therapy; slightly in nano and ICT)
•what in imaging has been funded up to now in the FP7 Health programme (with short summary and comparison with FP6)
•when is the next Health call: on-going, deadline
• how to apply: what is important, rules and proposal selection criteria

Author: Dr JEHENSON, Philippe (DG- Research Health Directorate, European Commission)

Presenter: Dr JEHENSON, Philippe (DG- Research Health Directorate, European Commission)

Session Classification: Symposium Opening Session

Contribution ID: **29** Type: **not specified**

Welcome Pre Symposium TOF PET

Friday 4 September 2009 08:20 (10 minutes)

Author: GARIBALDI, Franco (Sezione Sanita(ISS))

Presenter: GARIBALDI, Franco (Sezione Sanita(ISS))

Session Classification: Pre Symposium Opening session

Contribution ID: **31** Type: **not specified**

TOF PET: Preliminary results and prospectives

Friday 4 September 2009 08:30 (30 minutes)

Author: SURTI, S (University of Pensilvania)

Presenter: SURTI, S (University of Pensilvania)

Session Classification: Pre Symposium Session 1 : TOF PET : Challenges and Prospectives

Contribution ID: **32** Type: **not specified**

State of the art and challenges of TOF PET

Friday 4 September 2009 09:00 (30 minutes)

Author: CONTI, M (Siemens)

Presenter: CONTI, M (Siemens)

Session Classification: Pre Symposium Session 1 : TOF PET : Challenges and Prospectives

Contribution ID: **33** Type: **not specified**

(TBC) The Gemini TOF PET scanner

Author: SCHULZ, V (Philips)

Presenter: SCHULZ, V (Philips)

Contribution ID: **34** Type: **not specified**

TBD

Friday 4 September 2009 10:00 (30 minutes)

Session Classification: Pre Symposium Session 1 : TOF PET : Challenges and Prospectives

Contribution ID: **35** Type: **not specified**

A proposal for a TOF PET and SPECT MRI probe for diagnosis and follow up of prostate cancer

Friday 4 September 2009 09:30 (30 minutes)

Prostate cancer (PCa) is the sixth most common cancer in the world, the third most common cancer in men, and the most common cancer in men in Europe, North America, and some parts of Africa. The incidence is increasing steadily in almost all countries, yet we know little about its causes. PCa is a biologically heterogeneous disease for which a variety of treatment options are available but a precise disease characterization is needed: evaluation of cancer location, size, and extent and an indication of tumor aggressiveness. Pre-treatment knowledge of these prognostic variables is essential for achieving minimally invasive, patient-specific therapy. The current standard for diagnosing PCa is transrectal ultrasound (TRUS) guided sextant biopsy with or without additional biopsies. PCa is the only malignancy where the diagnosis is made from tissue obtained on a blind biopsy, and that is inadequate in assessing the grade of the disease. A novel multidisciplinary approach is required. Imaging may play a key role provided dedicated prostate imagers and procedures are available. In fact considerable improvements have been implemented in diagnosis with the Magnetic Resonance Imaging (MRI) technique, and with nuclear medicine techniques (PET and SPECT). However, those modalities do not adequately address the problem of distinguishing lethal from non-lethal disease, a prediction of disease prognosis or of treatment response. Due to sub-optimal prostate imaging geometries with these generic large instruments and their associated poor spatial resolutions preventing separation of the signal from surrounding organs, the sensitivity, spatial resolution and lesion contrast attained are inferior to what can be potentially achievable with optimized dedicated prostate imagers and procedures. Traditional morphologically based prostate imaging needs to be complemented by functional and molecular imaging techniques. Recently a new research project was initiated by a large INFN collaboration with the goal of designing, building and testing in phantom tests an endorectal PET-TOF probe compatible with MRI. The concept has been developed based on different concepts discussed during the Prostate Workshop (Rome 2005) from Moses, Levin and Clinthorne, further developed by Majewski and Clinthorne and from a proposal presented to EU FP7 on PET-TOF-MRI chaired by INFN and ISS Rome. We think that multimodality and TOF capability, while challenging, are a necessity to achieve proper operation. This probe would allow diagnosis, biopsy guidance and follow-up of prostate cancer. Fully exploiting the TOF capability would allow not only to increase the SNR/NECR but also to get rid of the huge background coming from the bladder. A timing resolution of ˜300 ps would allow this, but we believe that even better timing resolution seems to be potentially possible. Extensive simulation of the entire system is needed for selecting the scintillator (LSO (doped with Ca) or LaBr(Ce)), its degree of segmentation and the light collection geometry. Silicon Photo Multipliers (SiPMs) are mandatory as photodetectors. Fast readout based on the advanced compact ASIC already under study in the framework of the INFN research in the field as well as on the expertise present in the collaboration from developing ASIC for HE physics experiment. Using SiPM will allow not only the advantages of fusing morphological and functional techniques, but also the MR spectroscopy adding fundamental complementary information. The research team is establishing several collaborations, with the Marek Moszynski's group on electronics development, with Johns Hopkins (Martin Pomper) on development of new prostate biomarkers, with the Michael Hofmann group on selection and possibly testing different prostate radiotracers, as well as with ISS Oncology Department on mouse models, and with other clinical

departments (Rome, Torino, Naples). The SPECT-MRI option will be also evaluated.

Author: GARIBALDI, Franco (Sezione Sanita(ISS))

Presenter: GARIBALDI, Franco (Sezione Sanita(ISS))

Session Classification: Pre Symposium Session 1 : TOF PET : Challenges and Prospectives

Contribution ID: **36** Type: **not specified**

The Role of Scintillators on TOF PET

Friday 4 September 2009 11:00 (30 minutes)

Author: MOSES, William (Lawrence Berkeley National Laboratory)

Presenter: MOSES, William (Lawrence Berkeley National Laboratory)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors

Contribution ID: **38** Type: **not specified**

Scintillators for TOF-PET. What to do?

Friday 4 September 2009 11:30 (30 minutes)

The renewal of interest for Time of Flight Positron Emission Tomography (TOF PET), as well as the necessity to precisely tag events in High Energy Physics (HEP) experiments at future colliders, where high luminosity is achieved through high density trains of bunches are pushing for an optimization of all factors affecting the time resolution of the whole acquisition chain: crystal, photodetector, electronics.
The time resolution of a scintillator-based detection system is determined by the rate of photoelectrons at the detection threshold, which depends on the time distribution of photons being converted in the photo-detector.
The possibility to achieve time resolution of about 100ps requires an optimization of the light production in the scintillator, the light transport and its transfer from the scintillator to the photodetector. In order to maximize the light yield, and in particular the density of photons in the first nanosecond, while minimizing the rise time and decay time a particular attention must be given to the energy transfer mechanisms to the activator as well as to the energy transition type at the activator ion.
A particular emphasis will be put on the light transport within the crystal and the transfer to the photo-detector. Light being produced isotropically in the scintillator the detector geometry must be optimized to decrease the optical path-length to the photodetector. Moreover light bouncing within the scintillator must be reduced as much as possible. It concerns typically about 70% of the photons generated in currently used scintillators. It will be shown how photonics crystals specifically designed to couple light propagation modes inside and outside the crystal at the limit of the total reflection angle can significantly improve this situation and impact on the time resolution. Examples of production and deposition of photonics crystals on LYSO and LuYAP crystals will be shown as well as first results on light extraction improvement.

Author: LECOQ, Paul (CERN)

Presenter: LECOQ, Paul (CERN)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors

Contribution ID: **39** Type: **not specified**

Recent developments on silicon photomultipliers

Friday 4 September 2009 12:00 (20 minutes)

Author: PIEMONT, C (IRS, FBK, Trento)

Presenter: PIEMONT, C (IRS, FBK, Trento)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors

Contribution ID: **40** Type: **not specified**

Recent results on silicon photomultipliers : Measurements and Comparisons

Friday 4 September 2009 15:30 (30 minutes)

Author: FINOCCIARO, P (INFN-LNS)

Presenter: FINOCCIARO, P (INFN-LNS)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors (Continued)

Contribution ID: **41** Type: **not specified**

TOF PET : Continous vs pixellated scintillators and PMTs vs SiPMs

Friday 4 September 2009 16:00 (30 minutes)

Author: SZCZESNIAK, T (Soltan Institute of Nuclear Studies)

Presenter: SZCZESNIAK, T (Soltan Institute of Nuclear Studies)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors (Continued)

Contribution ID: **42** Type: **not specified**

Microelectronics for fast timing. The high energy physics prospective

Friday 4 September 2009 16:30 (30 minutes)

Author: RIVETTI, A (INFN Torino)

Presenter: RIVETTI, A (INFN Torino)

Session Classification: Pre Symposium Session 2 : The Role of Scintillators and Photodetectors (Continued)

Contribution ID: **43** Type: **not specified**

System architecture for TOF PET readout

Friday 4 September 2009 17:30 (25 minutes)

INFN will fund a 3 years R&D program to develop a TOF-PET prostate probe.
A lot of experiences can be found and used in all involved fields: light sensors, scintillators, electronics.
A readout architecture will be presented, introducing the requirements and discussing the implementation.
An ASIC (Application Specific Integrated Circuit) will be designed to obtain the requested performances in term of precision of measurement, small size, low power.
The ASIC will equip the detection units which include also the sensor controls.
A control unit connected to several detection units will compute the coincidence trigger, collects the incoming data and transfer them to a PC for further processing and imaging.
A discussion will follow the presentation.

Author: MUSICO, P (Genova university & INFN Genoa)

Presenter: MUSICO, P (Genova university & INFN Genoa)

Session Classification: Pre Symposium Session 3 : Electronics for TOF PET

Contribution ID: **44** Type: **not specified**

ASIC for TOF PET with SiPMT 1

Friday 4 September 2009 17:55 (25 minutes)

Author: CORSI, F (Politecnico di Bari & INFN Bari)

Presenter: CORSI, F (Politecnico di Bari & INFN Bari)

Session Classification: Pre Symposium Session 3 : Electronics for TOF PET

Contribution ID: **45** Type: **not specified**

ASIC for TOF PET with SiPMT 2

Friday 4 September 2009 18:20 (25 minutes)

Author: RIVETTI, A (INFN Torino)

Presenter: RIVETTI, A (INFN Torino)

Session Classification: Pre Symposium Session 3 : Electronics for TOF PET

Contribution ID: **46** Type: **not specified**

(TBC) Electronics for Gemini scanner improvements

Author: SCHULZ, V (Philips)

Presenter: SCHULZ, V (Philips)

Contribution ID: **47** Type: **not specified**

Advanced electronics for intraoperative imagers

Saturday 5 September 2009 19:09 (21 minutes)

In this talk, we summarize the advances in electronics (for SiPms and other relevant technologies) in the context of intraoperative imagers. Those advances involve mainly ASIC designs. Emphasis will be given to intraoperative imagers designed for "SPECT"pharmaceuticals such as Tc99m-labeled colloids (low energy, single-photon detection). Different approaches for the electronics will be presented from several research groups in the World. Obviously, the architecture of the electronics depends heavily on the design of the detector. Two main detector designs will be considered when using scintillating crystals: monolithic and pixellated.

Author: Dr BENLLOCH, Jose (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna)

Co-authors: GONZALEZ, A (OncoVision, R&D division, Ciutat Politécnica de la Innovación); MARTINEZ- GARRIDO, A (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna); SEBASTIA, A (Departamento de Ingeniería Electrónica, Universidad Politécnica de Valencia Camí de Vera); SORIANO, A (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna); MOLINOS, C (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna); LERCHE, Ch. W (Departamento de Ingeniería Electrónica, Universidad Politécnica de Valencia Camí de Vera); ABELLAN, D (OncoVision, R&D division, Ciutat Politécnica de la Innovación); BENLLOCH, J. M (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna); PAVON, N (OncoVision, R&D division, Ciutat Politécnica de la Innovación); COLOM, R (Departamento de Ingeniería Electrónica, Universidad Politécnica de Valencia Camí de Vera); GADEA, R (Departamento de Ingeniería Electrónica, Universidad Politécnica de Valencia Camí de Vera); HERRERO, V (Departamento de Ingeniería Electrónica, Universidad Politécnica de Valencia Camí de Vera)

Presenter: Dr BENLLOCH, Jose (Instituto de Física Corpuscular (IFIC), Nuevos edificios de Investigación Paterna)

Session Classification: Symposium Session 4

Contribution ID: **48** Type: **not specified**

CZT in pre-clinical research, diagnostics, and image-guided therapeutics

Sunday 6 September 2009 17:00 (30 minutes)

Cadmium Zinc Telluride (CZT) for single-photon emission imaging applications has seen remarkable progress in recent years. CZT is a room-temperature semiconductor that is capable of excellent energy resolution and intrinsic spatial resolution (including depth-of-interaction) –making it versatile in spectroscopic and pinhole magnification configurations. CZT is used in cutting-edge multi-head, multi-pinhole pre-clinical microSPECT and dual-head, high-sensitivity breast imaging for early stage detection of small lesions. Advantages of CZT also include MRI compatibility and a limiting volumetric spatial resolution as small as 0.5 mm in the imaging plane as well as throughout depths of 5-10 mm. Dual isotopes and x-ray fluorescence can be imaged readily with CZT and new applications such as real-time image guided biopsy exploit this capability. Performance of current CZT products and prototypes will be reviewed.

Author: Dr WAGENAAR, Douglas J. (Director of Research, Gamma Medica-Ideas,)

Co-author: Dr PATT, Bradley (Gamma Medica-Ideas)

Presenter: Dr WAGENAAR, Douglas J. (Director of Research, Gamma Medica-Ideas,)

Session Classification: Symposium Session 7

Contribution ID: **49** Type: **not specified**

Need for novel intra-operative margin assessment in breast conserving surgery

Sunday 6 September 2009 18:00 (15 minutes)

Rapid advancements in the surgical resection of primary breast cancers have occurred in the last century. This evolution has maintained oncologic principles with significant aesthetic improvements. Breast conserving surgery implies the removal of the tumor with negative margins while preserving the breast. Positive margin rates after initial lumpectomy can be as high as 40% necessitating repeat intervention. Current intra-operative margin assessment with either frozen section analysis of the specimen margins or radiographic imaging is difficult and often inadequate and inaccurate. Using breast-specific intra-operative PET imaging devices, it may be possible to improve the accuracy of margin assessment while maximizing cosmetic and oncologic principles.

Author: Dr HAZARD, Hannah W. (Department of Surgery, West Virginia University)

Co-authors: Dr STOLIN, Alexander (Thomas Jefferson National Accelerator Facility); Dr MARANO, Gary (Department of Radiology, West Virginia University); Dr ABRAHAM, Jame (Department of Medicine, West Virginia University); Dr RAYLMAN, Raymond (Department of Radiology, West Virginia University); Dr REMICK, Scot (Mary Babb Randolph Cancer Center, School of Medicine, West Virginia University); Dr KURIAN, Sohba (Department of Medicine, West Virginia University); Dr MAJEWSKI, Stan (Department of Radiology, University of West Virginia)

Presenter: Dr HAZARD, Hannah W. (Department of Surgery, West Virginia University)

Session Classification: Symposium Session 7 (Continued)

Contribution ID: **50** Type: **not specified**

Dual-modality (digital mammography-breast scintigraphy) image-guided breast surgery using radiomarkers

Sunday 6 September 2009 18:15 (15 minutes)

Currently, the majority of lumpectomy and excisional biopsy procedures involving non-palpable breast lesions are performed using the wire localization (WL) technique. We are investigating dual-modality surgical guidance as a means of overcoming many of the problems associated with wire localization. The technique uses a dual-modality (digital mammography and breast scintigraphy) breast imaging system to place a marker composed of radiolabeled albumin into the lesion. In order to assist the surgeon in identifying a possible surgical path, a point will be marked on the surface of the breast that is geometrically closest to the lesion (the closest skin point, or CSP). A portable gamma camera, coupled with an optical digital mini-camera, will be used in the operating suite to assess the centricity of the radiomarker within the specimen, immediately after specimen removal. We present the results of pre-clinical validation measurements of the localization and needle positioning accuracy of our system. We also describe the results of phantom measurements designed to determine the impact of mild breast compression on identification of the CSP. The localization accuracy was found to be within 0.7 mm for x-ray imaging and within 1.2 mm for gamma imaging. On average, the errors in injection accuracy were 0.4, 0.7, and 0.6 mm for the x, y, and z dimensions, respectively. The result of the compressible phantom tests was that the path length from the lesion to the CSP determined under mild compression differed from that with the breast uncompressed by only ˜10%. These results provide encouragement that we can accurately locate a lesion, inject the radiomarker into it, and identify a potential incision point whose distance from the lesion is within 10% of the shortest possible distance. Clinical trials are expected to begin in September 2009. Subjects will be enrolled in two groups. In group 1, we will compare the radiomarker technique with the current practice of WL among women who are not having sentinel lymph node biopsy (SLNBx) during their surgery. In group 2, we will compare the new technique to known success rates of WL, but among women who are also having SLNBx during their surgery. A total of 75 participants will be recruited; 55 in group 1, 20 in group 2.

Author: JUDY, Patricia (Department of Biomedical Engineering, University of Virginia)

Co-authors: Dr STOLIN, Alexander (Thomas Jefferson National Accelerator Facility); Dr SCHROEN, Anneke (Department of Surgery, University of Virginia); Dr BRENIN, David (Department of Surgery, University of Virginia); Dr WILLIAMS, Mark B (Department of Radiology, Department of Biomedical Engineering, Department of Physics University of Virginia); Dr MAJEWSKI, Stan (Department of Radiology, University of West Virginia); Dr HARVEY, jennifer (Department of radiology, University of Virginia)

Presenter: JUDY, Patricia (Department of Biomedical Engineering, University of Virginia)

Session Classification: Symposium Session 7 (Continued)

Contribution ID: **51** Type: **not specified**

Symposium Round Table

Sunday 6 September 2009 18:45 (45 minutes)

Session Classification: Symposium Round Table

Contribution ID: **52** Type: **not specified**

Pre Symposium Summary/Conclusion/round table

Friday 4 September 2009 19:00 (45 minutes)

Presenters: Dr MAJEWSKI, Stan (Department of Radiology, University of West Virginia); MOSES, William (Lawrence Berkeley National Laboratory)

Session Classification: Pre Symposium Summary/Conclusion/Round Table

Contribution ID: **53** Type: **not specified**

Radioguided lung cancer surgery

Sunday 6 September 2009 12:00 (30 minutes)

Radioguided techniques to enhance the effectiveness of various thoracic procedures are being reported with increasing frequency in the literature. This includes the localization of pulmonary nodules for thoracoscopic resection, sentinel lymph node mapping, and attempts to identify all lymphatic micrometastatic disease in lung cancer patients.
The radiotracers that have been used clinically include In111-pentetreotide, F18-fluorodeoxyglucose (FDG), or Tc99m bound to sulfur colloid, tin colloid, human serum albumin or macroaggregated albumin. A clinical trial using an intra-operative hand held gamma probe following intravenous F18-FDG injection will be described. These techniques have great potential to improve the accuracy of lung cancer staging. This can result in improved outcomes, especially in the current era of adjuvant chemotherapy and targeted therapy.

Author: Dr NWOGU, Chumy (Roswell Park Cancer Institute)

Co-authors: Dr LAMONICA, Dominick (Roswell Park Cancer Institute); Dr BOGNER, Paul (Roswell Park Cancer Institute); Dr YENDAMURI, Sai (Roswell Park Cancer Institute); Dr DEMMY, Todd (Roswell Park Cancer Institute)

Presenter: Dr NWOGU, Chumy (Roswell Park Cancer Institute)

Session Classification: Symposium Session 6

Contribution ID: **54** Type: **not specified**

PET/CT and PEM based breast surgeries: The need for adequate evaluation of lesion and tissue margins

Sunday 6 September 2009 18:30 (15 minutes)

As PET/CT has become more common in clinical practice, we are seeing patients earlier for diagnosis and staging and more frequently for monitoring of therapy. Some of the PET positive recurrent lesions we identify are anatomically within normal limits on CT. High resolution positron emission mammography (PEM) is a more recent tool for evaluating breast cancer. The lesions we identify on PEM sometimes do not correlate with any obvious anatomic abnormality. Intra-operative PET probes have been developed to assist in localization of these lesions. However, once localized it is essential to determine if the intra-operative margins are adequate. Currently, surgeons often have to wait while pathologists evaluate frozen sections. While this is happening, the patient remains under anesthesia and the operating room is on hold. Small table-top high resolution PET scanners with optical image fusion may allow surgeons to quickly determine if the lesion is in the excision sample and whether there are adequate margins around the lesion.

Author: Dr FALEN, Steven (Northern California PET Imaging Center)

Presenter: Dr FALEN, Steven (Northern California PET Imaging Center)

Session Classification: Symposium Session 7 (Continued)