Materials and Methods: The heterogeneous phantom was developed in the frame of IAEA Coordinated Research Project. The phantom consists of frame made with polystyrene and bone or lung equivalent inhomogeneity slabs. Special inserts allow to position TLD capsules within the polystyrene below the bone or lung material and also within the lung equivalent material. Additionally, there are inserts that allow for positioning the ionization chamber and films in the phantom. This enables comparisons of the doses calculated by TPSs for specific treatment fields in specified points with the measurements performed with various detectors. The comparisons were performed for a number of TPS (Eclipse from Varian, XiO, from CMS, Oncentra MasterPlan from Nucletron, Panther from Prowess, PrecisePlan fromElecta, Pinacle from Philips) and for a number of linear accelerators (Varian, Siemens, Elekta) in several radiotherapy departments in Poland in the framework of the Quality Assurance Audit programme in Poland.
Results: Seven Polish radiotherapy centers (of 28 in total) were audited. Six different TPSs and eleven calculation algorithms were examined. Generally, most of the results obtained with TLD and ionizing chamber were within 5% tolerance. Differences between doses calculated by TPSs and measured with TLD did not exceed 4% for bone equivalent and polystyrene materials. Under the lung equivalent material, on the beam axis the differences were lower than 5% whereas inside the lung material, off the beam axis – in some cases were about 7%.
Differences of doses measured with ionizing chamber under polystyrene and bone or lung equivalent materials were lower than 5%, whereas inside the lung material the difference was 5,2%.
Conclusions: The comparison of results for calculations and the measurements allow for the detection of limitations of TPS calculation algorithms. The audits performed with the use of heterogeneous phantom seem to be an effective tool for detecting the errors in basic data configuration and the TPS performance at the audited radiotherapy departments.

PO-0766
Small beam dosimetry using diamond devices
F. Marsolat[1], N. Tranchant[1], D. Tromson[1], M. Le Roy[2], F. Moignau[2], C. Bassinet[3], C. Huet[3], S. Derreumaux[3], G. Boisserie[4], A. Lisbona[5]
[1]*CEA LIST, LCD, Gif sur Yvette, France*
[2]*CEA LIST, lnhb, Gif sur Yvette, France*
[3]*IRSN, PRP-HOM/SDE/LDRI, Fontenay-aux-Roses, France*
[4]*Pitié Salpêtrière Hospital, Radiotherapy Department, Paris, France*
[5]*René Gauducheau Cancer Treatment Center, Radiotherapy Department, Nantes, France*

Purpose/Objective: Recent developments of new therapy techniques using small beams, such as stereotactic radiotherapy, require new detectors to precisely determine the delivered dose. The dosimeter has to be as close as possible to tissue equivalence and exhibit a small detection volume compared to the size of the irradiation field, because of the lack of lateral electronic equilibrium. Characteristics of single crystal diamond (tissue equivalent material Z=6, high density) make it an ideal candidate to fulfill most of the small beam dosimetry requirements.
Materials and Methods: We developed single crystal diamond dosimeters (SCDDo) with a small detection volume (<0.4 mm^3). The Monte-Carlo code PENELOPE (parallelized version) was used to optimize the encapsulating material and electrodes of our diamond detectors, in order to obtain a tissue equivalent detector. Response time, stability and repeatability of the detector were tested under Co^{60} source irradiation. SCDDo dose profile, depth dose and output factor measurements, were performed for small beams using two stereotactic systems: Varian Clinac 2100 C linear accelerator with micro MLC m3 and a Novalis TX linear accelerator. These measurements were compared to different detectors, both active and passive: diode, micro-LiF (TLD), EBT2 radiochromic film, PinPoint ionization chamber.
Results: SCDDo presents an excellent spatial resolution for dose profile measurements, due its small detection volume. OFs obtained with SCDDo are very satisfactory from 0.6 x 0.6 cm^2 to 10 x 10 cm^2 field sizes, compared to PinPoint ionization chamber which underestimates OF values in small beam.
Conclusions: SCDDo respects the small beam dosimetry requirements (tissue-equivalence, small detection volume). The absorbed dose measurements obtained with this device are very satisfying compared to the results obtained with the existing devices and to the literature.

PO-0767
Characterization of a radiochromic dosimeter: The chemical structures
P.S. Skyt[1], G.V. Jensen[2], I. Wahlstedt[3], J.B.B. Petersen[1], L.P. Muren[1], J.S. Pedersen[2], P. Balling[4]
[1]*Aarhus University Hospital, Dept. of Medical Physics, Aarhus C, Denmark*
[2]*Aarhus University, Interdisciplinary Nanoscience Centre (iNANO) and Dept. of Chemistry, Aarhus C, Denmark*
[3]*Aarhus University, Dept. of Physics and Astronomy, Aarhus C, Denmark*
[4]*Aarhus University, Dept. of Physics and Astronomy and Interdisciplinary Nanoscience Centre (iNANO), Aarhus C, Denmark*

Purpose/Objective: Radiochromic dosimeters are promising within radiotherapy due to the ability to measure dose distributions in 3D with high resolution. However, the response to irradiation is low compared to clinical relevant dose levels. Improvements of the dose response may be found through knowledge of the chemical structure of the dosimeter. In this study we therefore examined the nanoscale structures in a radiochromic dosimeter that was based on a leuco malachite green dye and the surfactant sodium dodecylsulfate (SDS) suspended in a gelatin matrix.
Materials and Methods: The original dosimeter formulation investigated consisted of 6 % (w/w) gelatin that formed the volume of the 3D dosimeter, 50 mM sodium dodecyl sulfate (SDS) was added as surfactant, 5 mM trichloroacetic acid as initiator, 0.37 mM leuco malachite green (LMG) as active component and 80 mM trichloromethane was added to dissolve the LMG. Small-angle x-ray scattering was then used to investigate the structures of a range of compositions of the dosimeter by omitting different components of the dosimeter formulation.
Results: When omitting gelatin ellipsoidal micelles of SDS were formed with a core radius near 15 Å and shell thickness near 7 Å (figure 1).Gelatin significantly changed the micelles to a cylindrical shape with around three times lower core radius and four times larger shell thickness, which indicates that the gelatin is present in the shell and the outer part of the core.

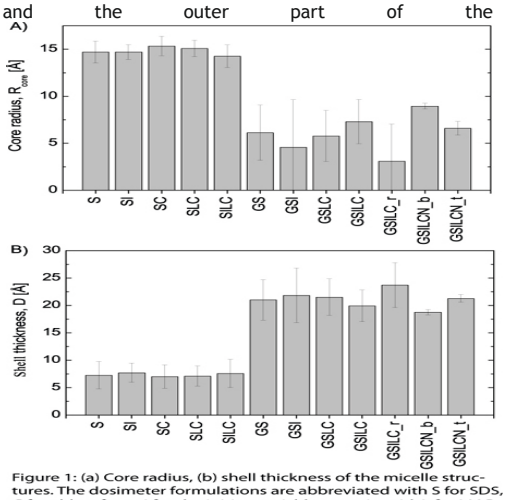

Figure 1: (a) Core radius, (b) shell thickness of the micelle structures. The dosimeter formulations are abbreviated with S for SDS, C for chloroform, I for the initiator trichloroacetic acid, L for LMG and G for gelatin. The extension, _r, is the irradiated dosimeter while _b and _t is the bottom and top phase of the dosimeter added salt, respectively.

Conclusions: It was possible to measure the individual dosimeter components effect on the chemical structures of the dosimeter. Using knowledge of the chemical structure, it might be possible to construct an improved dosimeter with a clinical relevant dose response by modifying the chemical composition and thereby the micelle structures.

PO-0768
Localization methodology for water-equivalent plastic scintillation detectors using surrogate fiducials in CT
R.J. Kudchadker[1], L.S. Wootton[1], A.K. Lee[2], A.S. Beddar[1]
[1]*The University of Texas MD Anderson Cancer Center, Department of Radiation Physics, Houston TX, USA*
[2]*The University of Texas MD Anderson Cancer Center, Department of Radiation Oncology, Houston TX, USA*

Purpose/Objective: To quantify the accuracy of a method to localize the sensitive volume of water equivalent *in-vivo* plastic scintillation detectors (PSDs) on Computerized Tomography (CT) images. PSDs when inserted in patients cannot be directly visualized on CT images