Purpose:
The objective of this study was to find out if a spectroscopic semiconductor detector from the Medipix2 family is capable to simultaneously resolve the K-edges of iodine and gadolinium contrast agents present in a phantom at various concentrations. Employing a pixel pitch comparable to the range of X-ray fluorescences generated in the CdTe sensor, the energy response function (ERF) of the detector system employed is heavily biased. Therefore, its detection limits prior to any corrections were determined in this work.

Methods:
The detector used delivers spectroscopic information by means of an adjustable energy window. The sensor of the detector is made of 1mm thick cadmium telluride (CdTe) that has an active area of 4.2cm x 2.8cm and features a pixel pitch of 165um. The X-ray source employed was operated at 70kVp that corresponds to a mean photon energy of roughly 40keV. A phantom containing six different concentrations (11.8umol/ml, 23.6umol/ml, 47.3ummol/ml, 118.2umol/ml, 236.4umol/ml and 472.8umol/ml) of iodine (Imeron300) and gadolinium (Multihance 0.5M) contrast agents was employed, containing capillary tubes with diameters of 1.6mm and 0.8mmin order to mimic blood vessels.

Results:
The K-edges of iodine (33.2keV) and of gadolinium (50.2keV) could easily be detected for the 3 highest concentrations: 118.2umol/ml, 236.4umol/ml and 472.8umol/ml. With these concentrations the reconstructed absorption coefficients increased significantly between the energy windows 25-30keV and 35-40keV for iodine and between 42-47keV and 52-57keV for gadolinium.

Conclusions:
A pixel pitch of 165um is large enough to detect the absorption edges of iodine and gadolinium using a single tube voltage. However, quantitative measurements require the reconstruction of the acquired spectra by a precise knowledge of the ERFs of all photon energies involved.