Claudia Rischer Master's Thesis:

"The Development of a Thyroid Specialized Gamma Camera"

ABSTRACT

Nuclear medicine allows the diagnosis of structures inside the human body by detection of a tracer molecule which distributes through the body and accumulates, thanks to its physical structure, in the tissue to be observed. The ability to monitor the existence of photons, emitted by the radioactive tracer, offers a wide field of application in medical diagnostic. The system declipse®SPECT Imaging Probe, founded by SurgicEye GmbH, is used to localize e.g. sentinel lymph nodes in breast cancer and in head and neck malignancies and to visualize them in three dimensional images. Furthermore, the device involving a gamma camera can be used for thyroid imaging.

Within this thesis a thyroid specialized gamma camera was developed. A different design, adapted to the anatomy of the neck, shall result in better image quality than it can be achieved with present solutions. Concerning this, simulations with the medicine-oriented simulation tool GAMOS were done. With the outcome of these measurements, image reconstruction was performed to investigate the benefit regarding gained spatial information of the thyroid and potential inner nodes. Thereby images according to different gamma camera designs were elaborated and compared. The conclusion formed the input requirements for the hardware design of the gamma camera head.

It could be shown that the re-design of a gamma camera with multiple detector modules, which are aligned around the patient's neck, achieve a better visualization of the thyroid structure in three-dimensional imaging than it can be done with a single and plain gamma camera detector. The outcome of GAMOS simulative data was successfully fused with the ReconTool image reconstruction application. The specific design, determined by number and size of detectors and their angular arrangement, was used to create a conceptual and finally an embodiment design of a prototype for a thyroid specialized gamma camera head.