Cochlear implant surgery planning requires careful segmentation of middle and inner ear anatomical structures. This process is complex and challenging on CT images because small structures are partially visible. High resolution µCT images are accurate enough for providing the missing information. Atlases based on manually segmented micro CT images are registered to CT, generating a probability map (work in progress). Segmentation of partially visible anatomy can be performed using shape prior.

**NEED FOR A PRIORI KNOWLEDGE**

A cochlear implant (CI) is a prosthetic device restoring hearing by direct electrical stimulation of the auditory nerve. In CI surgery an electrode array is inserted in one of the internal cavities of the cochlea. The operating field contains highly sensitive structures such as the facial nerve and the chorda tympani. The intra-operative visibility is limited and surgeons access the cochlea blind to the intracochlear cavities. Pre-operative CT scans are used to localize high-risk structures and adjust the drilling trajectory. For planning CI surgery, an accurate segmentation of the risk structures in the middle and inner ear is essential.

Anatomical structures are very small with complex shapes (shell-like spiral of cochlear anatomy) and different topology types (nerves, canals, membranes). Structures of interest have low contrast and vary in appearance. Therefore, a priori knowledge is needed which is why we apply multi-atlas segmentation based on both CT and µCT.

**EXPECTED RESULTS**

Multi-atlas segmentation may produce topology preservation violations. We plan to integrate prior knowledge [4].

**REFERENCES**