

The optimisation of a 16 channel neurovascular coil

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With the advent of many-channel acquisition systems in MRI, RF receive coils are no longer limited by the number of singly received elements and the coil geometry can be fully optimised for Signal to Noise Ratio (SNR) and Sense performance. A feasibility model RF coil was optimised for the neurovascular application without restriction of number of elements in three consecutive steps:

1. The neurovascular applicational Volume Of Interest (VOI) with the most important Sense directions was determined with the help of a database of people sizes and clinical and applicational input. Parameterised simulations were performed to find the optimal SNR over a whole range of Sense reduction factors 1.5 – 4 for the specified VOI. From this optimisation, purely for SNR and Sense, a coil geometry was conceived with 20 elements: two rings of 8 elements radially placed around the patient at the head and at the neck plus 2 sets of 2 elements posterior and anterior of the chest.
2. As a next step the patient comfort of the neurovascular coil was improved. Two anterior elements were merged to provide free breathing and free sight, two posterior elements were merged to allow a larger cushion for resting the head and finally also two sets of two elements at the ears were merged to integrate the headset inside the coil. Hence, the number of elements was reduced to 16 for the sake of patient comfort. It cannot be denied that 16 is also a convenient number.
3. As a final step all elements were allowed to deform slightly in a simulation program that minimised the mutual inductance between the coil elements to reduce coupling effects. A genetic algorithm was used for the deformations by mixing and mutation of the 20 best solutions during 50 generations.

These three steps have lead to a 16 element, patient friendly coil, with the best result for the neurovascular applicational VOI where the coupling between any element is at most 1.5%.

The feasibility coil geometry is constructed and tested, in Fig. 1 a picture of the coil is shown with a volunteer, Fig. 2 shows an image of the coil in the neck of a 3D inflow with a Sense reduction factor 6 and Fig. 3 shows a whole volume image of a T₁ weighted spine.

Fig. 1. Feasibility model of the Sense neurovascular coil ->

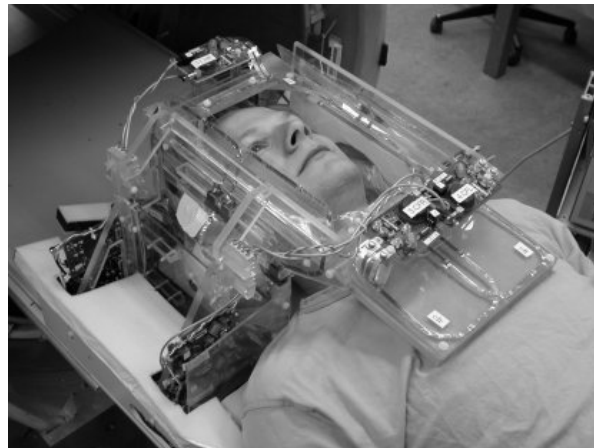


Fig. 2. 3D inflow image with Sense reduction factor 6



Fig. 3. T1W spine image with Sense reduction factor 2 ->