The dual purpose CAPTAIN (Cardiac Adult / Pediatric Torso Assembly for In-vivo imaging)

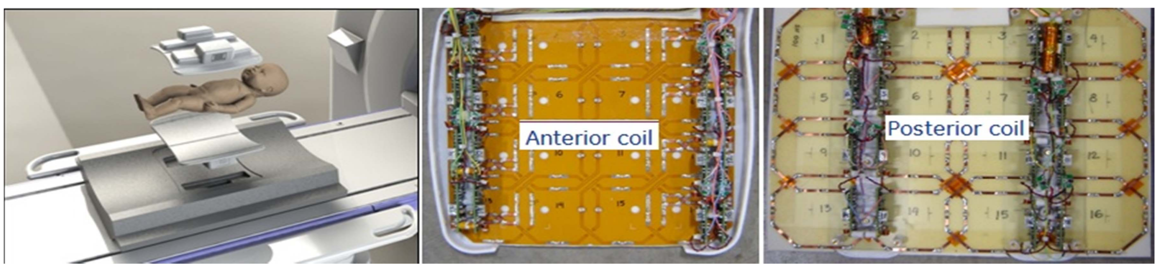
Modhurin Banerjee[1], Clyve Konrad Follante[1], Aleksey Zemskov[1], Rodney Bills[1], Kolman Juhasz[1], Steven G. Lee[1], Victor Taracila[1], and Fraser Robb[1]

[1]*MRI, GE Healthcare, Aurora, Ohio, United States*

Purpose: Currently, adult coils are used for pediatric imaging, which is suboptimal for a variety of reasons. For the pediatric population, a premium is placed on the ability to quickly obtain images and reduce or eliminate the need for sedation. The sensitivity pattern and g factor patterns for most adult coils simply do not lend themselves to the requisite high acceleration ability needed to quickly scan pediatric patients. Furthermore, adult coil systems are not optimized for the workflow and other considerations for the pediatric population. Therefore, a significant need exists for a dedicated thoracic pediatric coil.

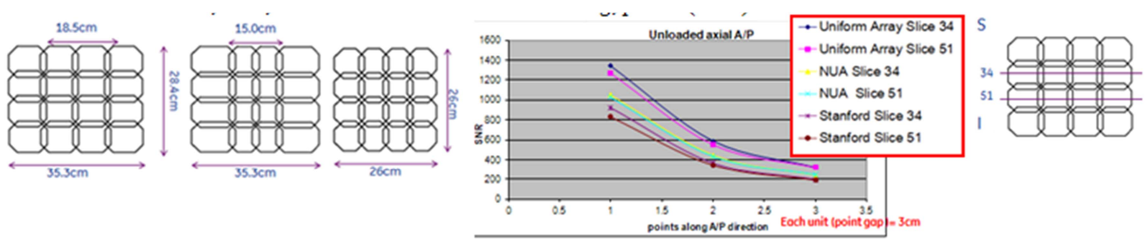
It is desired that a pediatric thoracic coil offer minimum patient handling, light weight, ease of access/emergency egress, and repeatability of exams. In addition, most coils (and indeed, MR systems in general) can be visually intimidating to pediatric patients making scanning all the more difficult; as such aesthetics are an important attribute for any coil design.

Methods: This work represents the evolution of a 32 channel pediatric coil design originally developed at Stanford by Shreyas Vasanawala et al. Said coil is able to serve both as an adult cardiac coil as well as a thoracic coil for the 0-7 y.o. pediatric population. Both a Uniform Array (UA) and Nonuniform Array (NUA) design variants were tested. As in all cases the coil spatial packing density was high, feedboards were mounted vertically (to reduce cross-coupling), and placed at the R-L ends of anterior arrays to increase the mechanical flexibility of the assembly.

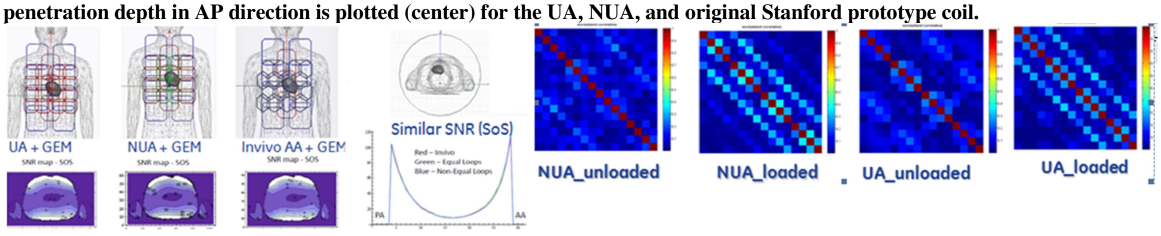


<u>Figure 1:</u> An illustration of the prototype coil concept, and as-built anterior (center) and posterior (right) arrays.

<u>Results:</u> Via both simulation and experiment it was observed that both designs (UA and NUA) have similar g-factors, and that the g-factor is greatest in the region of the heart. The UA design gave the best overall SNR performance.



<u>Figure 2:</u> An illustration of the UA (left), NUA (adjacent), and original prototype geometry (next). The SNR versus penetration depth in AP direction is plotted (center) for the UA, NUA, and original Stanford prototype coil.



<u>Figure 3:</u> Simulated g –factor and SNR for UA, NUA, and Invivo Cardiac coils (left). Measured noise correlation magnitude for NUA and UA coils in unloaded and loaded conditions.

<u>Conclusions:</u> It was determined that the 26 cm x 26 cm (anterior) 28 cm X 35 cm (posterior) UA demonstrated the best overall performance as a dedicated pediatric cardiac/thoracic imaging coil. The results suggest that a further improvement in performance can be had with a 64 channel version of the same system.

<u>Reference: 1.</u> Millimeter Isotropic Resolution Volumetric Pediatric Abdominal MRI with a Dedicated 32 Channel Phased Array Coil, Shreyas S Vasanawala, et.al., ISMRM 2012.