Attendees: Joe, John, Wuzheng, Yousef, Phil, Peter, Mei, Thomas, Tom

Wuzheng first presented his exploration on the RHIC ac dipole design based on the physics requirement from Mei. The goal is to achieve a field quality of 10e-3 within an radius of 3cm. Yousef questioned whether it is necessary to remain this requirement at 3cm. Thomas commented that the good field quality at large radius is driven by the fact that the orbit in the ac dipoles are off center because of the spin rotators in the flipper.

Wuzheng first directly scaled from the existing RHIC ac dipole and found that he needs to increase the number of turns from 7 to 9 to keep the field quality.

In his calculation , the Cu skin depth is 0.33mm @ 39 kHz. He explore the following cases with Litz wire from New England company with the same field quality constraint

- -- 7 turns one-two layers with and without ferrite.
- -- 5 turns one layer, aircore and ferrite.
- -- 4 turns: one layer, aircore and ferrite
- -- 3 turns: one layer, aircore and ferrite
- -- 2 turns: one layer, aircore and ferrite

Here, number of turns are the number of turns in half of the magnet. So the total number of turns for the magnet is a fact of 2 of the number quoted in the list. According to Wuzheng, 2 turns is the minimum number of turns needed to maintain a reasonable field quality. He also pointed out that it is always the top coil position impacts the sextupole component, and always prefer to control the error around 0.1mm.

Even though, the Litz wire has very small ac losses at these frequencies according to their specs, there still could be additional losses due to the deformation during the process of Litz wire stranding/bundling, according to Wuzheng and Peter.

Peter claims the existing RHIC ac dipole shows more losses in the Litz wire than expected and he suspected that this could be due to the proximity effect. According to his measurement of the existing RHIC ac dipole, the effective resistance of the RHIC Litz wire is about 7mohms per turn.

Wuzheng also explored the window frame magnet with a one-turn copper sheet proposed by Peter. The power loss in the copper is about 400w at 39kHz and 480w at 64kHz. Peter also commented that one can replace the copper sheet with flat Litz wire to cut the eddy current loss.

Peter also presented his thoughts on the ac dipole design. He prefers the design with ferrite which basically saves a power by a factor of 3.6 compared to an aircore magnet. This is mainly because either CMD5005 or 8C11 has very little losses at a frequency below 100kHz. For manufacturing point of view, a window frame magnet is easy to be built and provide similar field quality as the aircore magnet. With his estimate, we should be able to achieve the 100Gaussm field strength with a driving power within 1kW.

The number of turns of the magnet has to be able to accommodate the MOSFET requirement. So, Peter estimated that a 2 turn window frame magnet should work(one at the top half magnet and one at the bottom half of the magnet).

Work list

- -- define the magnet coil turn number by Peter.
- -- AC dipole magnet mechanical design, Joe will find a designer for this work and we tentatively plan to review the magnet design in a month
- -- Test the MOSEFT Tuning scheme at high power. Mei suggested we test this with the existing 0.5m model magnet built with Litz wire. Peter commented that he needs to work on a setup to accommodate the high voltage for this magnet. This is because this magnet has higher inductance than our current design of the RHIC ac dipole.
- -- Joe will start to look for a vendor who can provide us the two ceramic tubes for the ac dipoles. His current estimate is about $20k each.