Conventional antennas

Let's now have a look to conventional antennas for helicons excitation. At first we consider the Nagoya III type which is represented on Figure 2. This design is historically the first one that has been popularized.

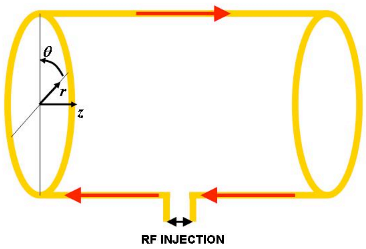

Figure 2: Representation of a Nagoya III antenna

If we have a look at the azimuthal current distribution of this antenna, it is obvious that it is a very rough approximation of the ideal sinusoidal distribution (Fig. 3). Hence the coupling with helicons is quite poor and not concentrated on a specific mode $\boldsymbol{m}$.

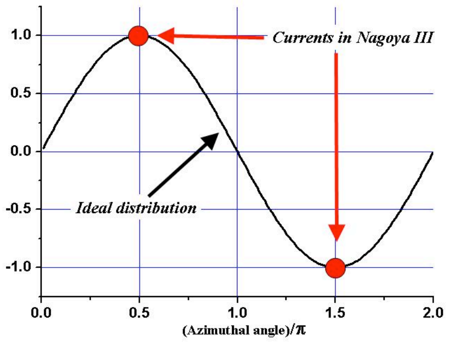

Figure 3: Azimuthal current distribution of a Nagoya III antenna

The $\boldsymbol{k_z}$ matching will be roughly defined by the choice of the antenna's length. Furthermore, as no helicity is given to the RF field, both negative and positive values of $\boldsymbol{m}$ can be excited. Finely there is of course no rotation of the field with time.

An improvement was made by Boswell who proposed the design shown in Figure 4. Here the sinusoidal distribution is approximated by four points (Fig. 5). As for Nagoya III, the $\boldsymbol{k_z}$ matching will be given by the choice of the antenna's length, no specific sign of $\boldsymbol{m}$ is selected, and the RF field generated remains linearly polarized.

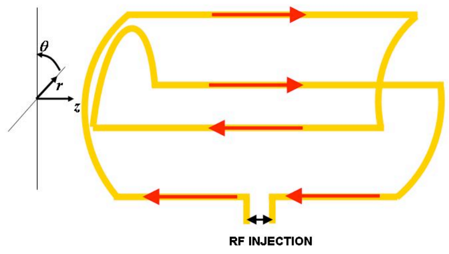

Figure 4: Representation of a saddle antenna

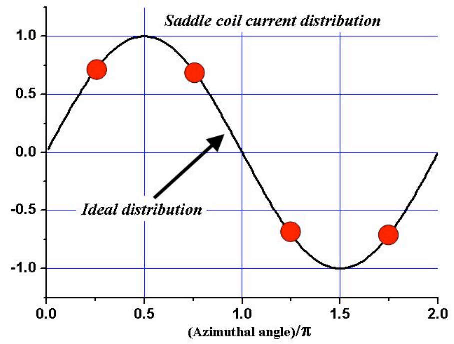

Figure 5: Azimuthal current distrubution of a saddle antenna

Another improving direction was chosen by Chen who proposed a twisted version of Nagoya III (Fig. 6). In this case the azimuthal current distribution remains the same as the one shown on figure 3, but the helicity provides a better k_z matching, and the possibility to select the sign of excited mode numbers m. As for the other designs the generated RF field doesn't rotate around z with time.

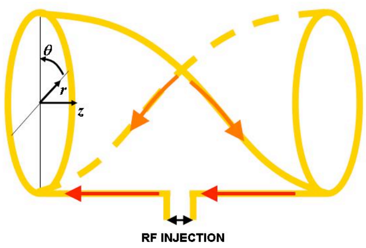

Figure 6: Representation of a helical antenna

Hence it appears clearly that all these conventional antennas generate RF fields that poorly match the helicons field structures.