

# Summary

## 1. Artifacts and data acquisition techniques

### CT artifacts: causes and reduction techniques

The types of artifacts:

1. Ring artifact  
This artifact is caused by the malfunction or mis-calibration of detector elements. The ring artifacts lower the image quality and affect image-based diagnoses. Recalibrating the detector is sufficient to fix this artifact.
2. Noise  
Poisson noise is due to the statistical error of low photon counts and in random, thin, bright and dark streaks that appear preferentially in the direction of greatest attenuation.
3. Beam hardening & scatter  
Beam hardening can produce dark streaks along the long axis of a single high-attenuation object.
4. Pseudoenhancement  
Pseudoenhancement decreases with the distance from enhancing renal tissue.
5. Motion artifact  
Motion (patient, cardiac, respiratory or bowel) causes blurring and double images, as well as long-range streaks.
6. Cone-beam (multidetector row) & windmill (helical) artifacts
7. If there is a high contrast edge between the two detector lines, the interpolation may be inaccurate. This produces smooth periodic dark stripes and bright stripes that originate from high contrast edges, called windmill artifacts.
8. Metal artifact  
Metal stripe artifacts are caused by a variety of mechanisms, some of which are related to the metal itself, some of which are related to metal edges.
9. Out of field 'artifact'  
Out of field 'artifacts' are due to a suboptimal reconstruction algorithm and can be fixed using a better algorithm.

Reference: <https://www.openaccessjournals.com/articles/ct-artifacts-causes-and-reduction-techniques.html>

## 2. Quality control and preprocessing

1. Quality control and preprocessing procedures are key steps to detect and correct artifacts in DWI and to exclude those that could not be corrected, providing consistency to reliable tensor estimation.

2. The first step consists in, when importing the data, checking if all images have been imported and sorted correctly and if the different subjects, under the same study, have the same parameters.
3. In preprocessing, it is common to start by converting raw data into specific and adequate image formats.
4. In DWI images, distortions caused by eddy currents and head motion are the most common artifacts; therefore, a common and recommended preprocessing step is to correct for such artifacts.
5. one optional step is to perform skull stripping, removing non-brain areas from analysis, improving co-registration/normalization results and reducing data size.