MRI Correction
In 5-7 Minutes

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Situation

- Functional Neurosurgery
  - Parkinson’s Disease, Trigeminal Neuralgia
  - Error < 1mm

- MRI target localization
  - Distinguish tissue types
  - More than 250k pixels/study
  - Gradient Nonlinearity Distortion ~2mm error
Basic Process

1. Select Slices
2. Find Edges
3. Ideal Image
4. Fit Spherical Harmonics
5. Transform
6. Apply
Spherical Harmonics

- Cylinder’s Magnetic field
  - \((x^2+y^2), z^2\)
  - Combinations & multiples
- Pixel locations \(\rightarrow b\)
- Basis functions & Ideal \(\rightarrow A\)
- Unknown Coefficients \(\rightarrow x\)
- Solve \(Ax=b\) for \(x\)
Corrected Images

Axial

Coronal

Sagital
Conclusions

- Error reduction
  - Was 2mm or more
    - 5 to 8 pixels
    - $\sigma \approx .15\text{mm to .25mm}$
    - Less than 1 pixel
  - $3\sigma < .8\text{mm}$
    - About 2 pixels
- Meets medical needs