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# AGS Stopbands

L. Ahrens

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Collider Accelerator Department
**Brookhaven National Laboratory**

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# DISCLAIMER

| AGS Complex Machine Studies<br>(AGS Studies Report No. 315)<br><br>AGS Stopbands |
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| **Study Period:** Various |
| **Participants:** L. Ahrens, M. Blaskiewicz, C. Gardner, W. van Asselt |
| **Reported by:** M. Blaskiewicz |
| **Machine:** AGS |
| **Beam:** Low Intensity, Front Porch |
| **Tools:** Digital Oscilloscope, Agast |
| **Aim:** Understand stopband behavior as a function of machine parameters. |

## Summary

Some properties of the normal quadrupole and sextupole imperfection resonances in the AGS are discussed. For the sextupole lines the correction settings are strong functions of the current in the horizontal sextupoles. The effect of the vertical sextupoles is unknown as is any dependence on orbital radius. The quadrupole corrections depend on orbital radius. Dependence of these corrections on the current in the sextupoles has not been measured.

## Sextupole Corrections

The resonance $3Q_x = 26$ has been studied. by varying the current in the horizontal sextupoles, with the vertical sextupoles turned off it was found that

$$SX26 = 870 - 230(I_{HS}/10A)^2 \tag{1}$$

where $SX26$ is the number of counts in the sine component of the $3Q_x = 26$ correction and $I_{HS}$ is the current in the horizontal sextupoles. The fit was very good with the curve passing through the error bars of the data points. The cosine component is less certain but the best guess is

$$CX26 = 600 + 700(I_{HS}/10A)^2. \tag{2}$$

Power supply constraints bound the counts by $\sim 3000$.

Dependence on the current in the vertical sextupoles or radius were not measured. The $2Q_y + Q_x = 26$ resonance has not been studied in detail.

## Quadrupole Corrections

For $I_{HS} = 15A$ and $I_{VS} = 0$ the $2Q_x = 17$ and $2Q_y = 17$ resonance corrections depend on main magnet field as

$$\frac{\partial CX17}{\partial B} = 65 \pm 7 \quad \text{counts/Gauss} \tag{3}$$

$$\frac{\partial SX17}{\partial B} = -60 \pm 10 \quad \text{counts/Gauss} \tag{4}$$

$$\frac{\partial CY17}{\partial B} = -15 \pm 6 \quad \text{counts/Gauss} \tag{5}$$

$$\frac{\partial SY17}{\partial B} = -20 \pm 8 \quad \text{counts/Gauss.} \tag{6}$$

The corrections are limited to $\sim 3000$ counts. The quantitative dependence of these corrections on sextupole current is not known but is thought to be fairly strong.

## Discussion

Given the strong dependence on horizontal sextupole current it appears best to have zero current in the sextupoles if one wishes to correct the stopbands. It is necessary to check whether simultaneous correction of all four lines is possible with existing power supplies. On the other hand it has been found that survival is insensitive to the setting of the stopband corrections for high intensity running conditions (35 Tp, with $Q_x = 8.85$ and $Q_y = 8.89$ on the injection porch). A quick study was done to try and determine how close the coherent tunes could get to the horizontal resonance lines for high intensity operations. For the sextupole line it was found that beam survival was affected by the stopband corrections for $Q_x \lesssim 8.78$. The incoherent tune shift, calculated using the IPM and wall current monitor was $\approx 0.3$. The half integer corrections had no noticeable affect for $Q_x = 8.78$. Buy doing a careful study with the present intensity it appears possible to extrapolate to higher intensity and make a good estimate of the intensity for which stopband corrections will be needed.