aberrations the reconstruction error appears to be only a function of the signal to ratio. For higher strength aberrations the performance starts to deteriorate due to the smaller and noisy segments in the overlap area. In Fig. 7, RMS wavefront reconstruction error is plotted against signal to noise ratio. A sample restoration result is given in Fig.8. The segmented regions are apparently more fragmented due to noise; but a satisfactory restoration can still be achieved.

## 4. Conclusions

In this paper we present a method to estimate aberrations, modeled with Zernike polynomials, in a multi-transmitter imaging system. We choose the transmitter locations to form overlap regions between effective apertures and avoid computationally costly iterative optimization techniques. In order to avoid 2D phase unwrapping, the difference wavefront is segmented into sub-regions. (The segmentation process discards edge pixels to avoid misplacement; it is possible to minimize the amount of pixels discarded by using sub-pixel accurate edge detection.) The phase offset in each sub-region is not known and is included in the set of linear equations along with the unknown Zernike polynomial coefficients. The estimation is simply a pseudo-inverse operation. We reported modeled results with fifth and seventh order aberrations.

The reconstruction method proposed here could be used with multi-transmitter, multi-receiver sparse aperture imaging systems. By forming overlaps between different apertures, it is possible to estimate piston/tip/tilt errors between apertures by including the corresponding Zernike polynomials.

We use an aperture configuration, which results in the coverage of entire pupil area so that the system of equations gives a solution for the aberration in all areas of the pupil that is represented by the Zernike coefficients found. If the configuration did not cover the entire pupil area (that is, when the distance between the transmitter locations were larger than the aperture radius), then the system would be under-determined due to some parts of the aberration not being accounted for in the overlap regions (typically in the center of the aperture). Similar to other shearing interferometry approaches, some higher spatial frequency aberrations cannot be reconstructed when those spatial frequencies are cyclical over transmitter separations. For the case shown the separations were maximized to achieve a larger effective aperture, for situations where aberration spatial frequencies are of concern smaller transmitter separations would be desirable.