

Comparison of measured survey data with MAD calculations.

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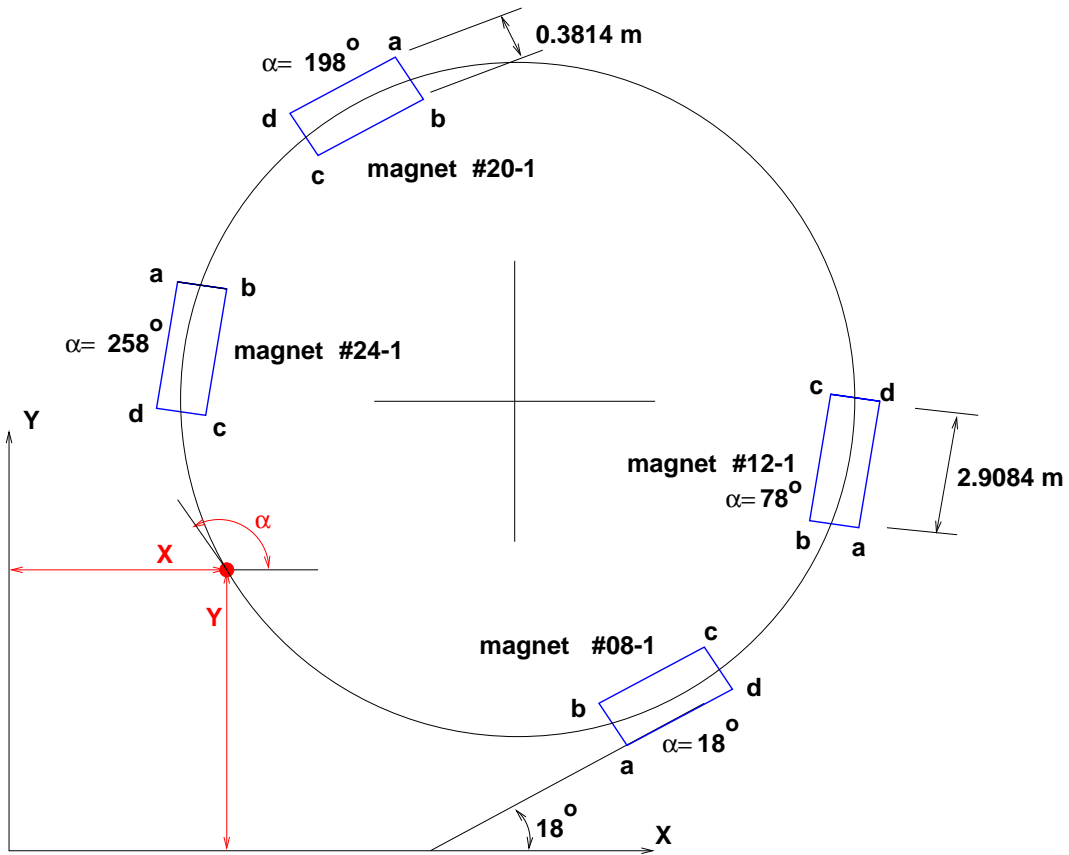


Figure 1: **Booster magnet survey. Position of the Booster ring with respect to the system of coordinates.**

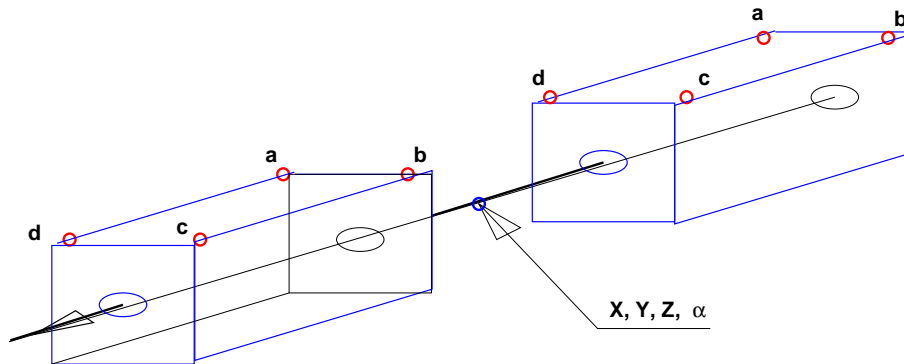


Figure 2: **Booster magnet survey. Definition of initial point coordinates from measured data for the MAD calculations.**

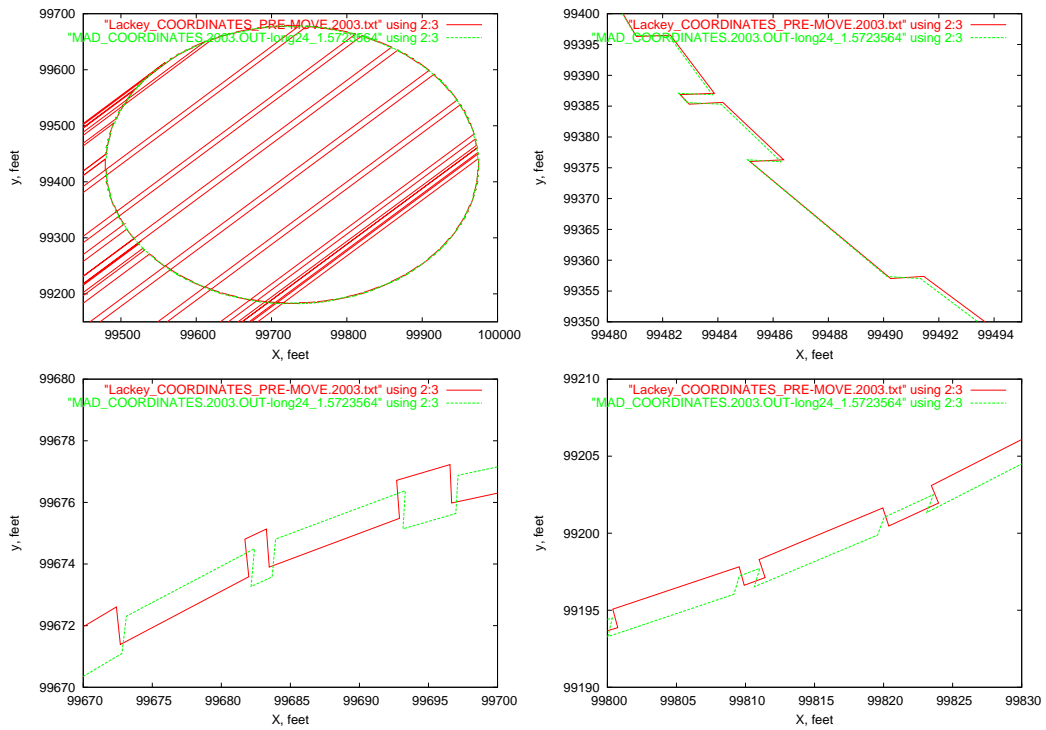


Figure 3: Comparison of measured survey data with MAD calculations. Example of survey marks displacement at different part of the ring.

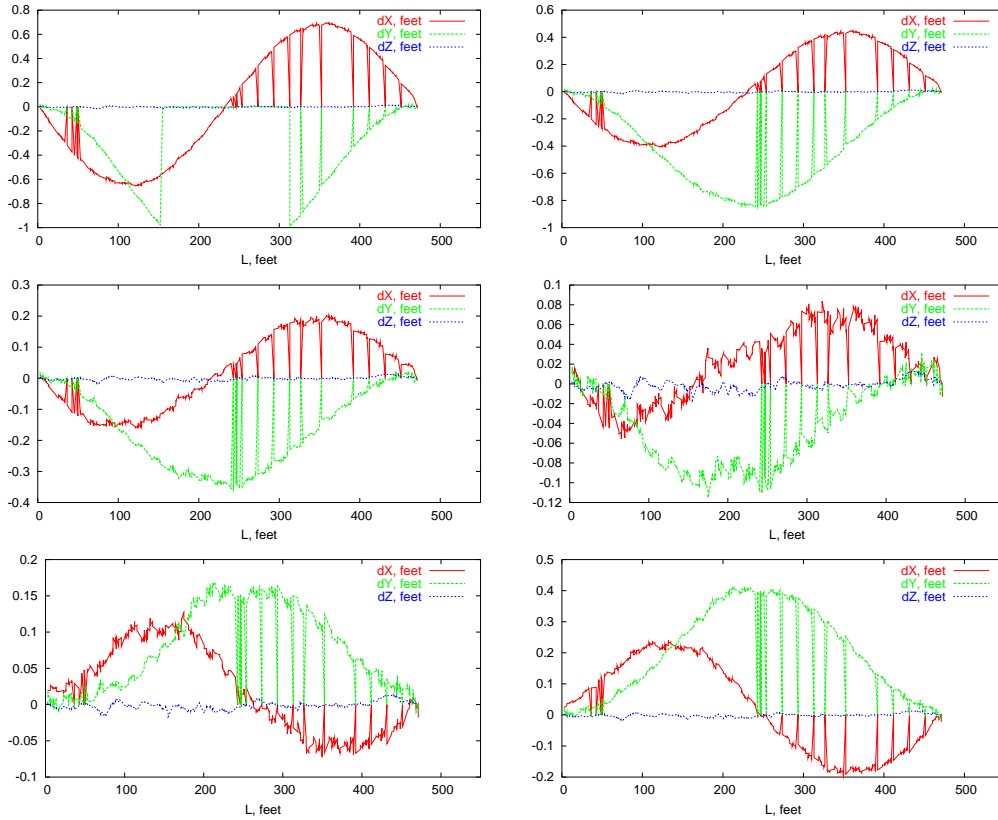


Figure 4: **Comparison of measured survey data with MAD calculations (initial θ -coordinate variation).** $X = 30306.46689\ m$, $Y = 30321.46745\ m$. **Top: left - $\theta = -1.5733564\ rad$, right - $\theta = -1.5723564\ rad$, middle: left - $\theta = -1.5713564\ rad$, right - $\theta = -1.5708564\ rad$, bottom: left - $\theta = -1.5703564\ rad$, right - $\theta = -1.5698564\ rad$.**

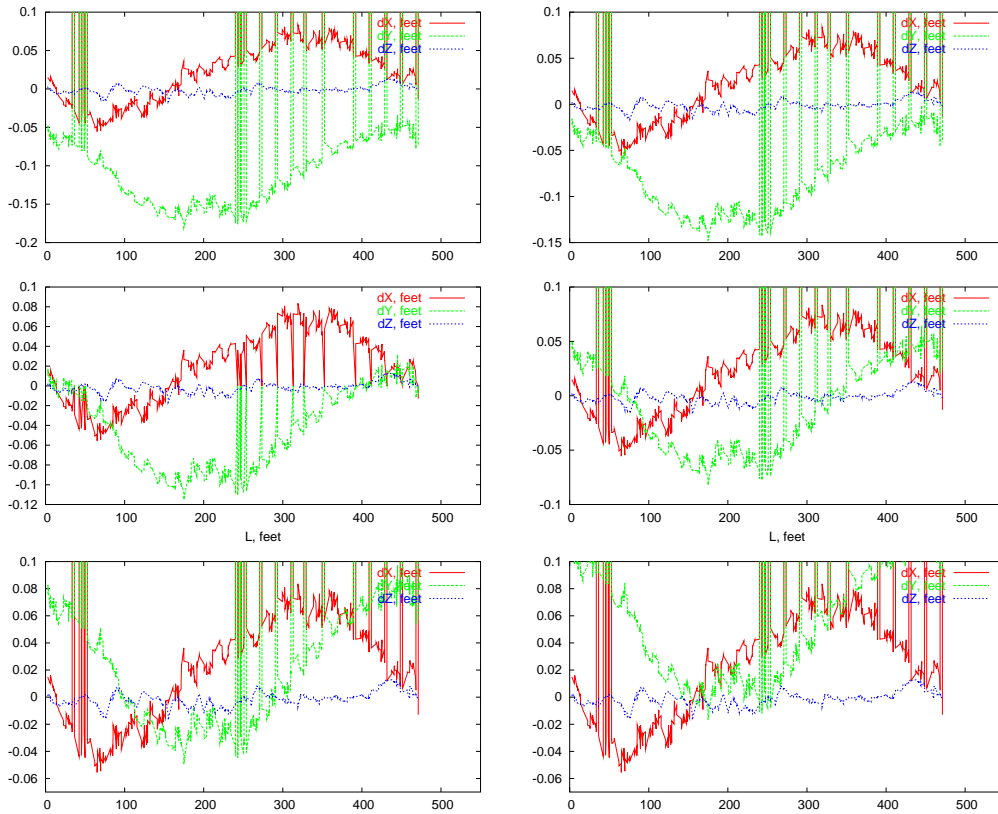


Figure 5: Comparison of measured survey data with MAD calculations (initial X-coordinate variation). $\theta = -1.5708564 \text{ rad}$, $Y = 30321.46745 \text{ m}$. Top: left - $X = 30306.44689 \text{ m}$, right - $X = 30306.45689 \text{ m}$, middle: left - $X = 30306.46689 \text{ m}$, right - $X = 30306.47689 \text{ m}$, bottom: left - $X = 30306.48689 \text{ m}$, right - $X = 30306.49689 \text{ m}$.

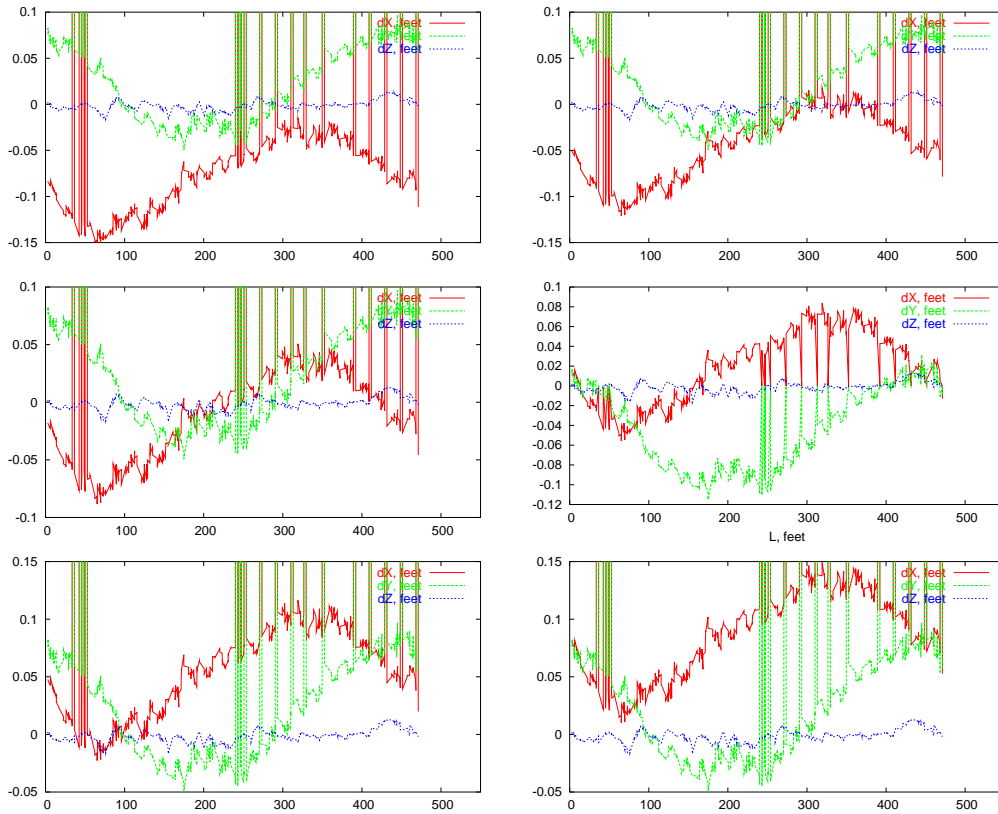


Figure 6: **Comparison of measured survey data with MAD calculations (initial Y-coordinate variation).** $\theta = -1.5708564 \text{ rad}$, $X = 30306.48689 \text{ m}$. **Top: left - $Y = 30321.43745 \text{ m}$, right - $Y = 30321.44745 \text{ m}$, middle: left - $Y = 30321.45745 \text{ m}$, right - $Y = 30321.46745 \text{ m}$, bottom: left - $Y = 30321.47745 \text{ m}$, right - $Y = 30321.48745 \text{ m}$.**

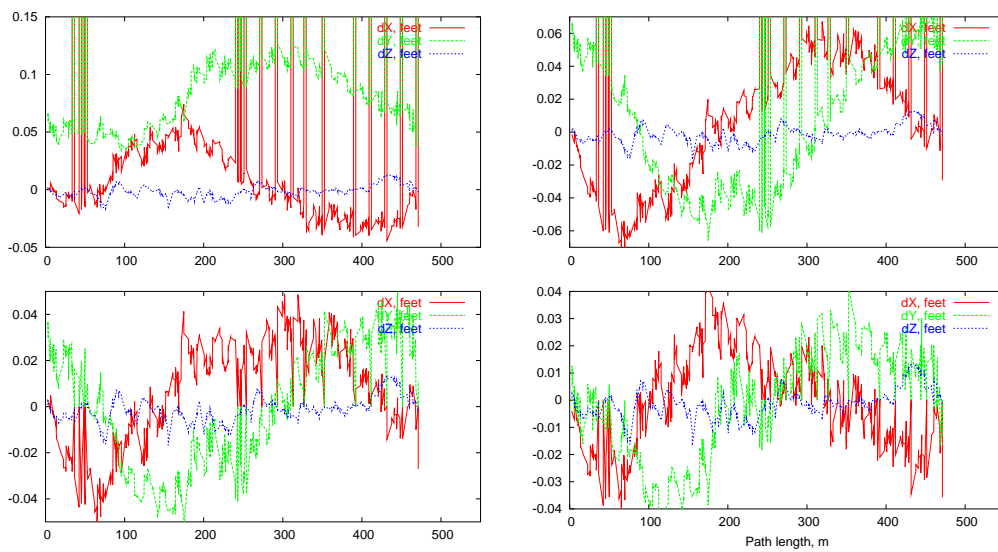


Figure 7: **Comparison of measured survey data with MAD calculations (final fitting).** **Top: left** - $\theta = -1.5705564 \text{ rad}$, $X = 30306.48189 \text{ m}$, $Y = 30321.46245 \text{ m}$, **right** - $\theta = -1.5708564 \text{ rad}$, $X = 30306.48189 \text{ m}$, $Y = 30321.46245 \text{ m}$, **bottom: left** - $\theta = -1.5707564 \text{ rad}$, $X = 30306.47289 \text{ m}$, $Y = 30321.46345 \text{ m}$, **right** - fitting calculated from position of Booster center: $\theta = -1.5706612 \text{ rad}$, $X = 30306.465475 \text{ m}$, $Y = 30321.461094 \text{ m}$.

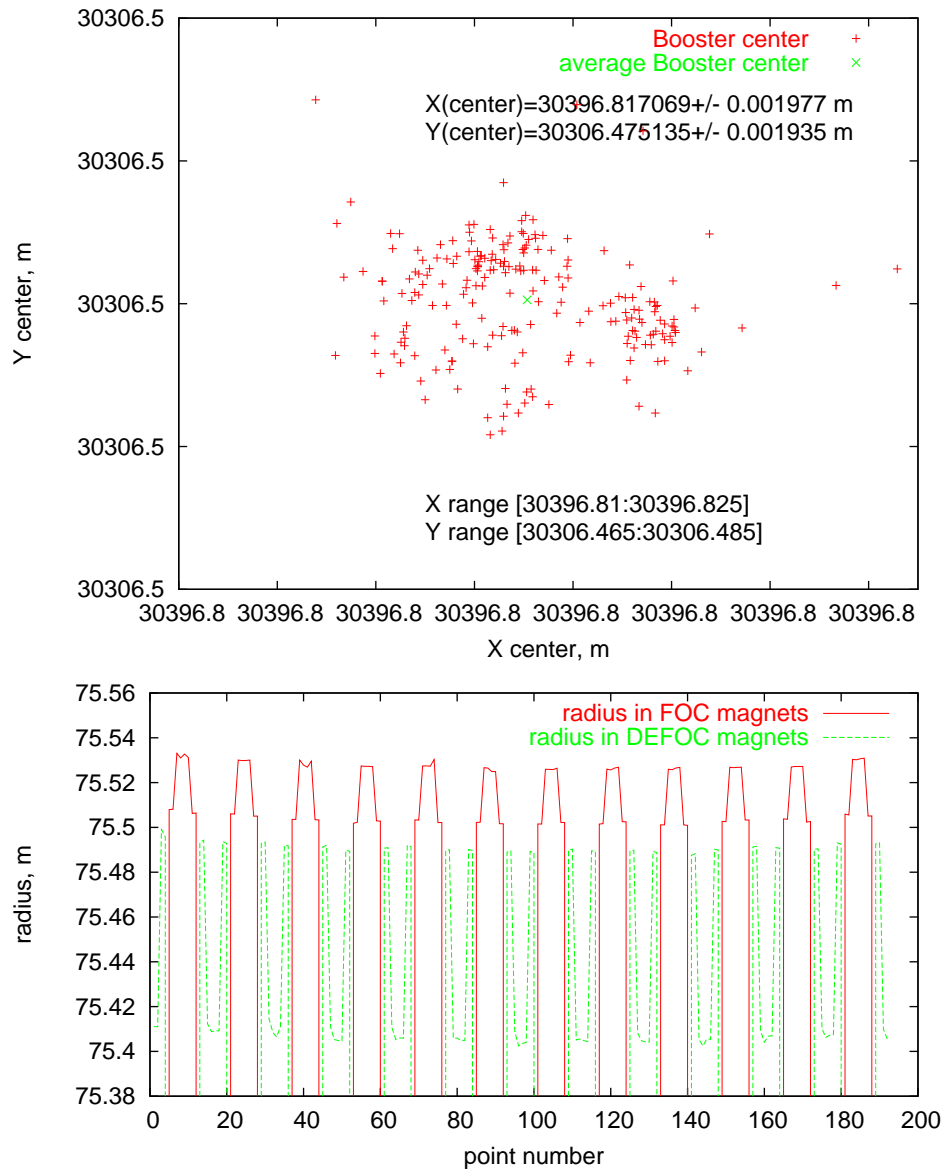


Figure 8: **Booster center position calculated from survey data (top) and distance from the Booster center to ideal trajectory at the entrance and exit of FOCusing and DEFOCusin magnets (bottom).**

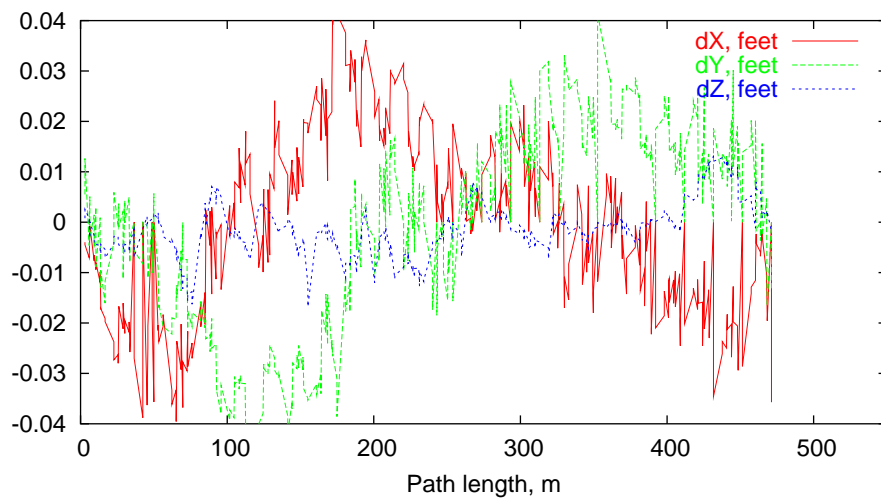


Figure 9: **Comparison of measured survey data with MAD calculations (the best solution):** $\theta = -1.5706612 \text{ rad}$, $X = 30306.465475 \text{ m}$, $Y = 30321.461094 \text{ m}$.