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Title: BPPM Position Coefficients

Author(s): Watkins, Heath A.

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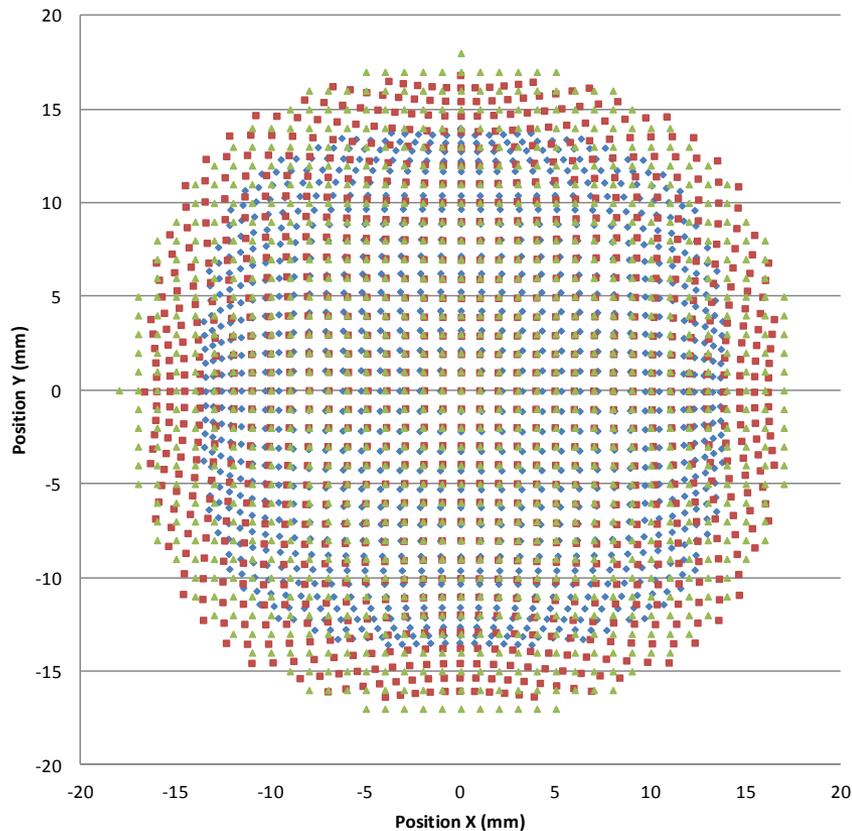
BPPM Position Coefficients

**Analysis of linear and non-linear
coefficients for BPPM position
calculations.**

Heath Watkins

Approximation Error of 1 term and 4 term polynomials

BPPM #38 Map Radius 1000pts @ 402.5MHz
1 term and 4 term coefficients



$$DS_X = [V_R - V_L] / [V_R + V_L]$$

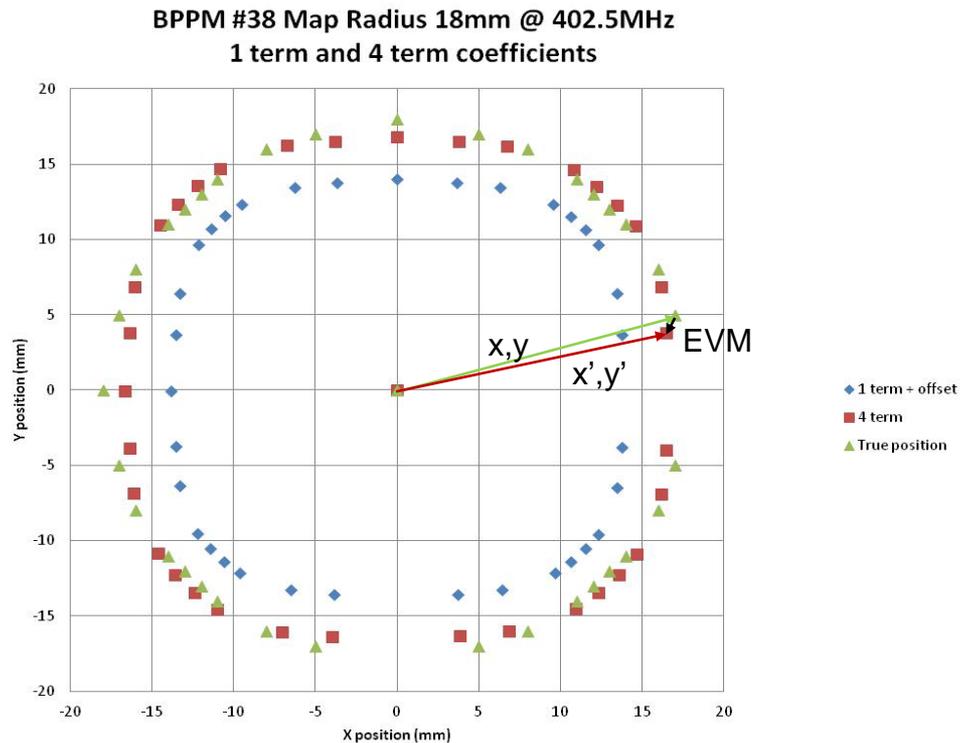
$$1TERM_X = offset + a_1 \times DS_X$$

$$4TERM_X = b_0 + b_1 \times DS_X + b_2 \times DS_X^3 + b_3 \times DS_X \times DS_Y^2$$

1 term	X and Y	4 term	X	Y
a1	15.7	b0	0.14	0.10
		b1	13.95	13.96
		b2	6.31	6.30
		b3	2.55	2.53

- offset + 1 term D/S
- 4 term D/S
- True Position

Beam Position Error Vector Magnitude (EVM)

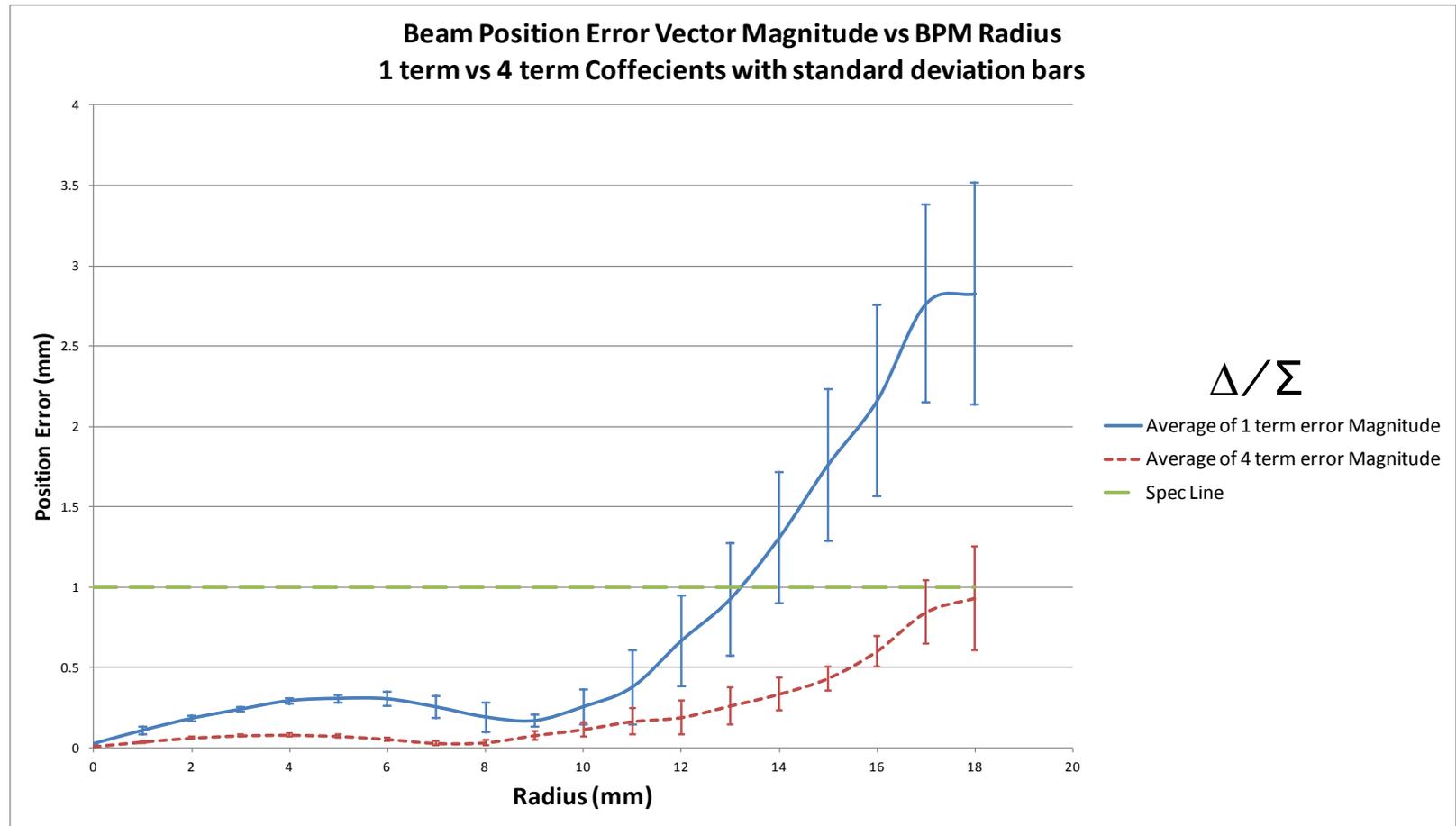


- Define EVM as the magnitude of the error vector between the true position vector and the calculated position vector using either linear term or 4 term coefficients.

- Goal: $EVM < 1 \text{ mm}$

$$EVM = \sqrt{(x - x')^2 + (y - y')^2}$$

Position Error – Delta Over Sum EVM for given radius



Conclusion

- To meet a position accuracy of $< 1\text{mm}$ within 60% of the clear aperture (13mm) with LANSCE-RM BPPM's the non-linear 3rd order terms need to be taken into account.
- The terms that reduce the error to within specification are the cubic term and a cross term for both x and y calculations.
- Instrumentation Technologies mentioned a customer requesting higher order terms other than LANL.
- Can this capability be added to the Libera Single Pass H system?