

LA-UR-12-22265

Approved for public release; distribution is unlimited.

Title: BPPM Position Coefficients

Author(s): Watkins, Heath A.

Intended for: Report



Disclaimer:

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By approving this article, the publisher recognizes that the U.S. Government retains nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

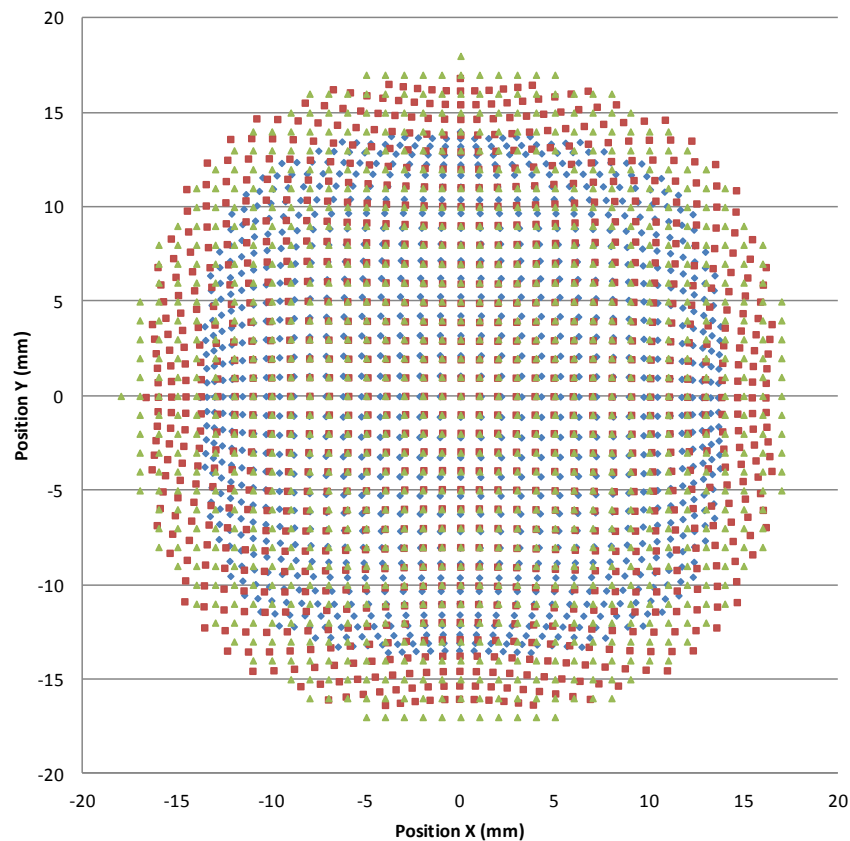
BPPM Position Coefficients

**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



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

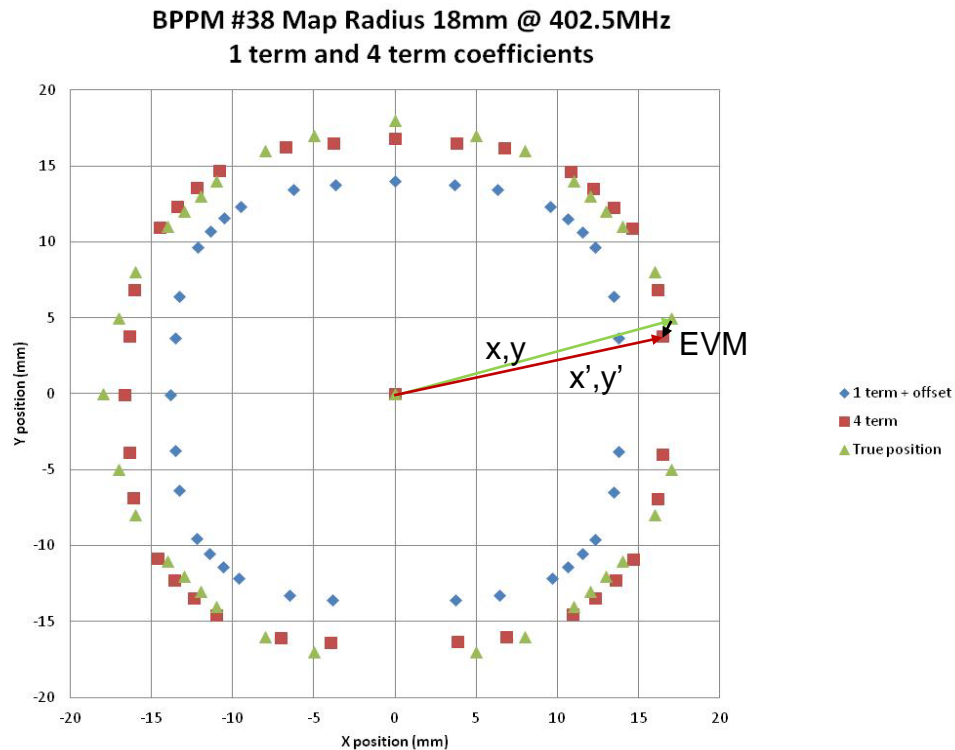
$$1TERM_X = offset + a_1 \times DS_X$$

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

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)

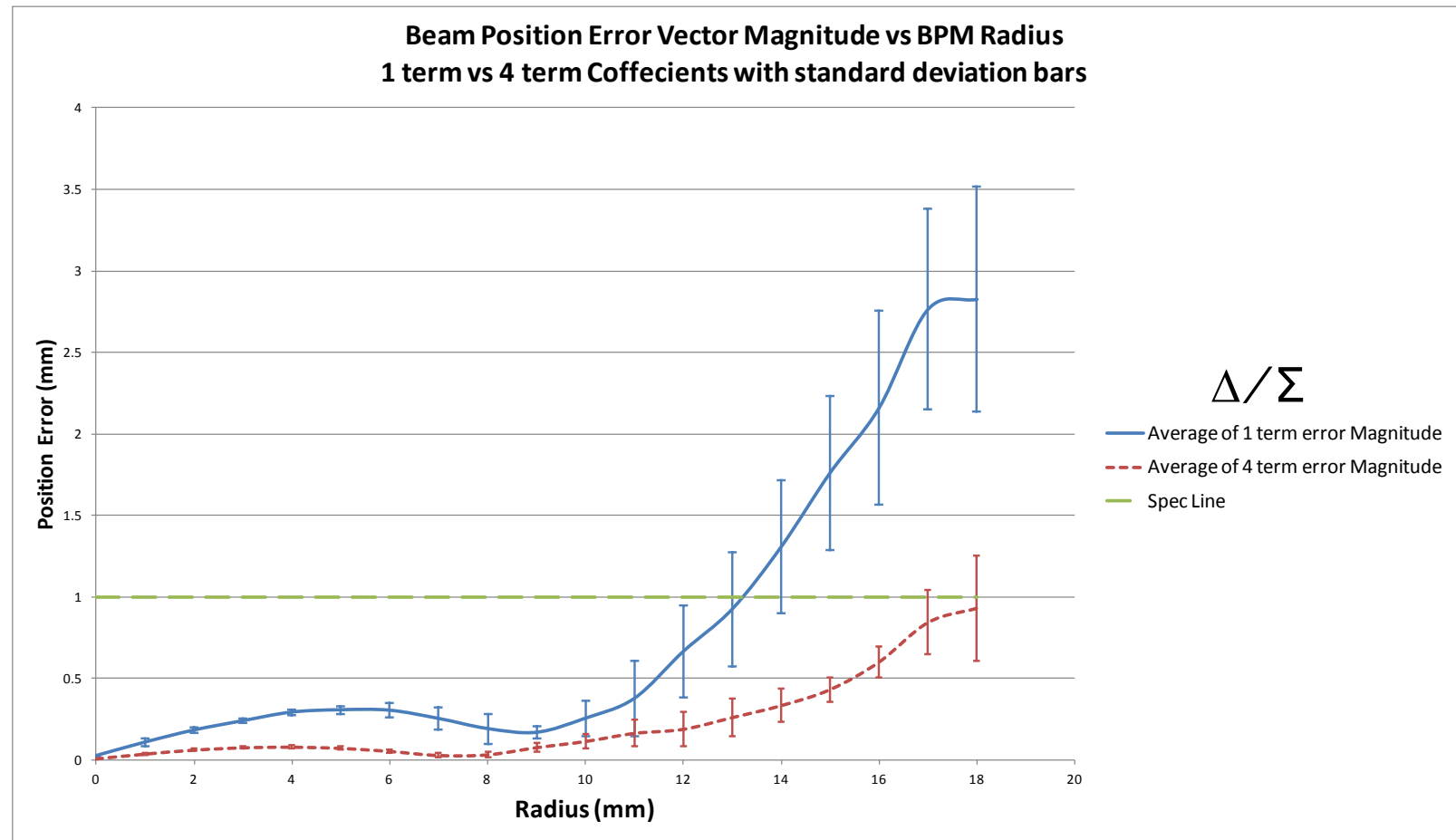


- Define EVM as the magnitude of the error vector between the true position vector and the calculated position vector using either linear term or 4 term coefficients.

- 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?