

**Main Injector Extra-Wide
Aperture BPMs
Sensitivity of Sum Signal to
Position**

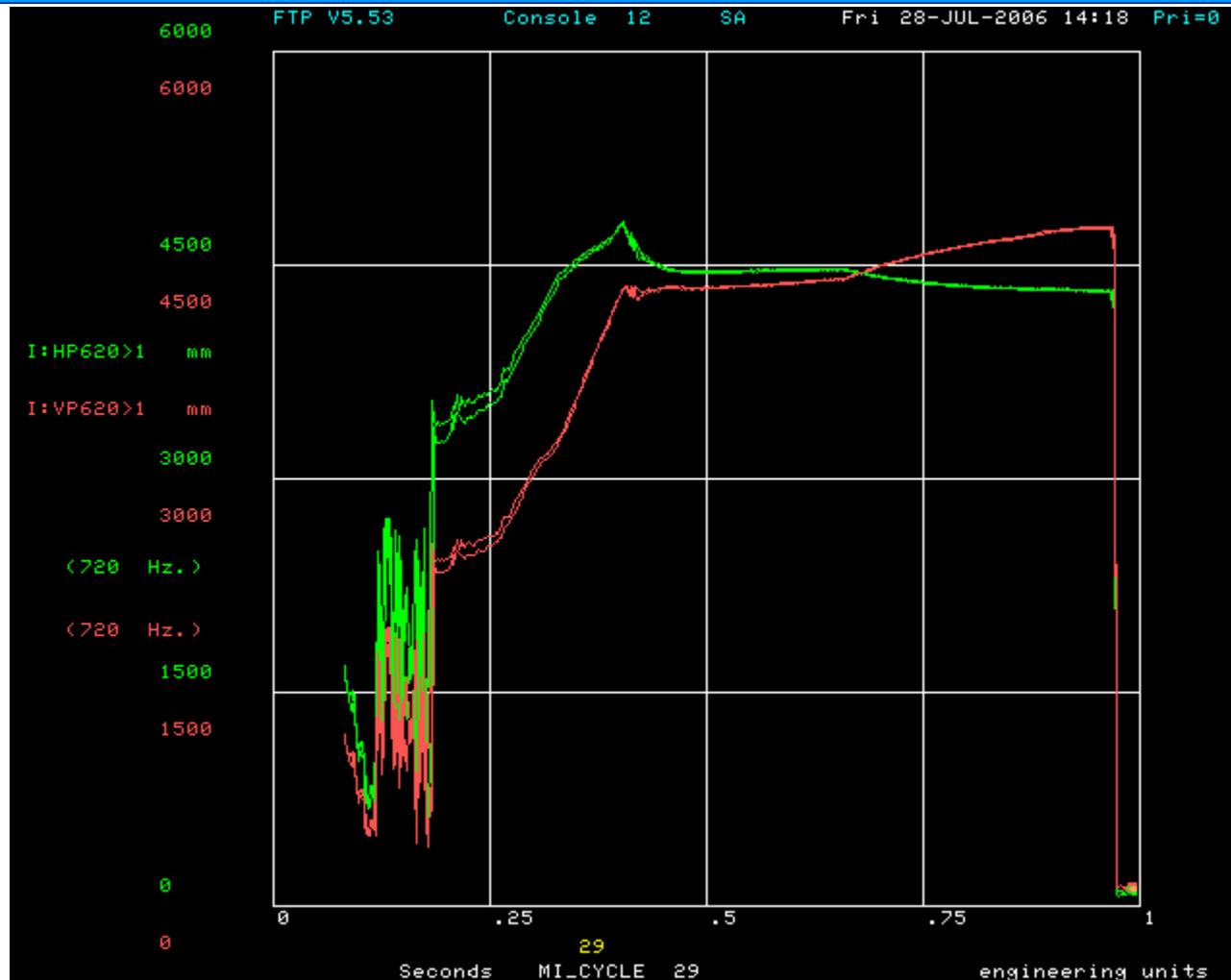
**Bob Webber
MI-BPM Meeting
8/1/06**

EWABPM Sensitivity of Sum to Position

- **Observe “unexpected” behavior when comparing horizontal and vertical sum signals from EWA BPM at one location**
- **Use test stand data from scan of one EWA BPM observing signals from one electrode pair, arbitrarily choose BPM SN04**
- **Define coordinates as:**
 - “on-axis” – position along the axis connecting the centers of the observed electrodes
 - “off-axis” – position along the axis defining the separation plane between the observed electrodes

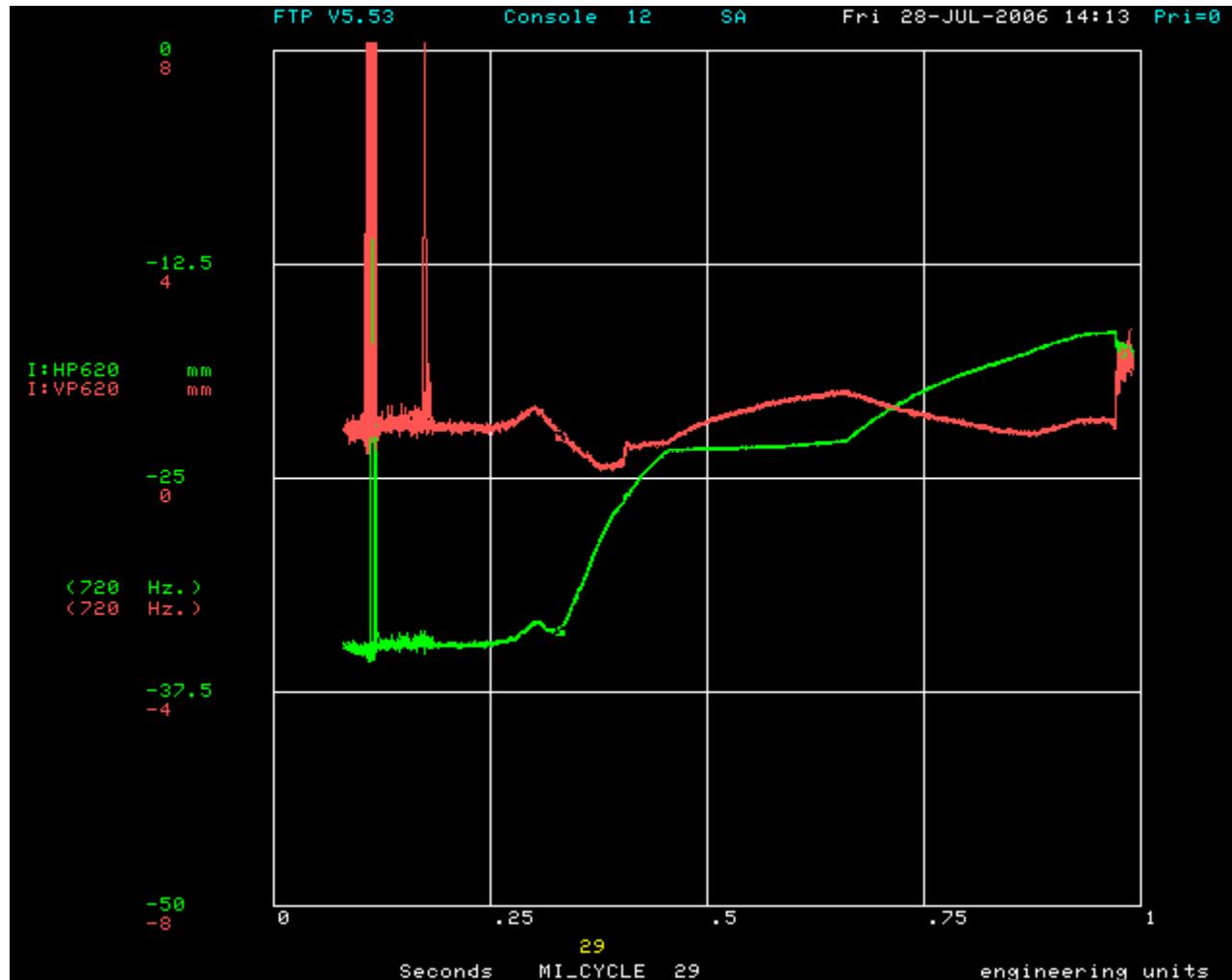


Observations - H and V Sums at 620



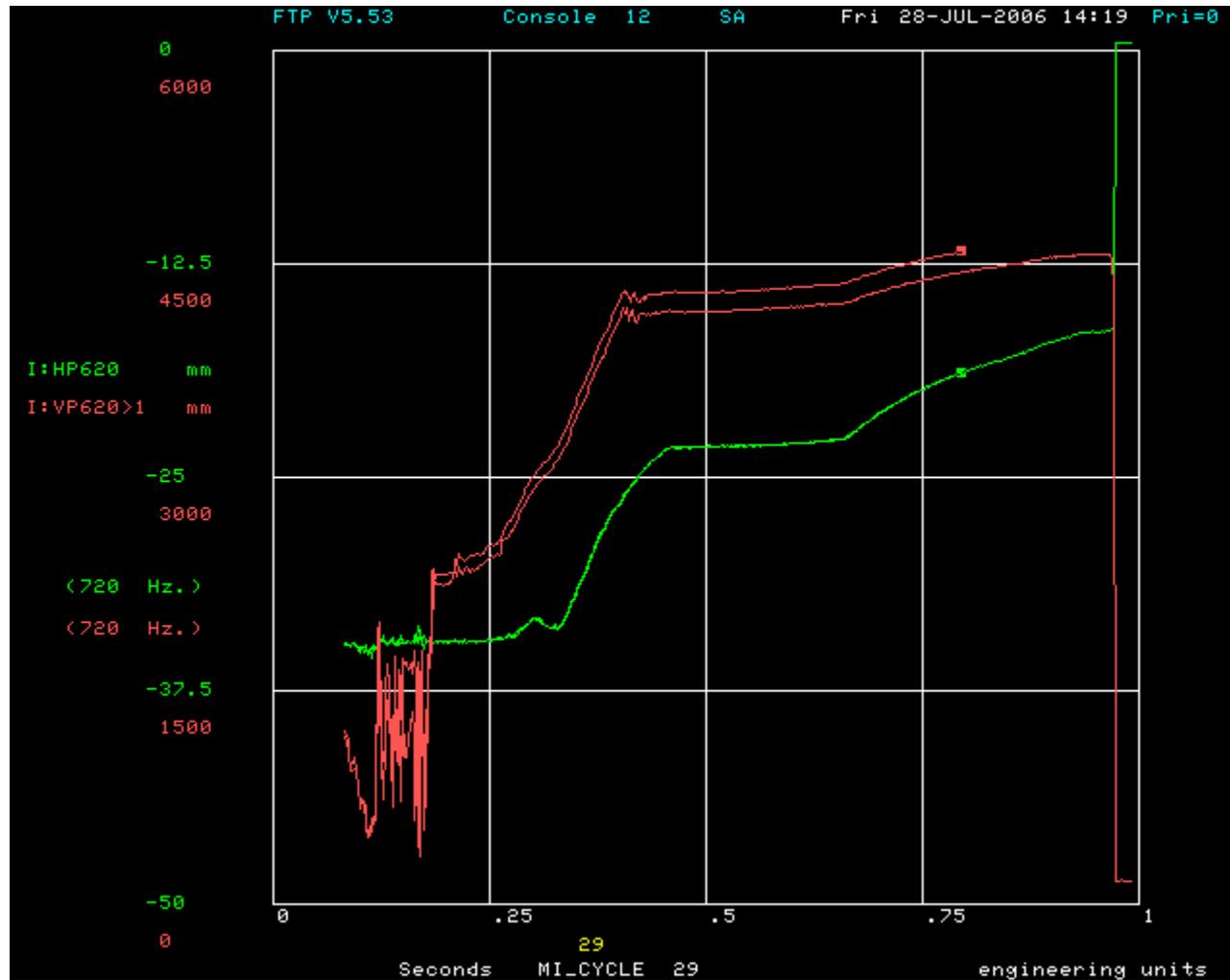
H and V sum signals from same location have different “character”

Observations - H and V Position at 620



H position moves from ~ -35 to -16 mm and V position remains ~ 1 mm

Observations - H Position and V Sum at 620

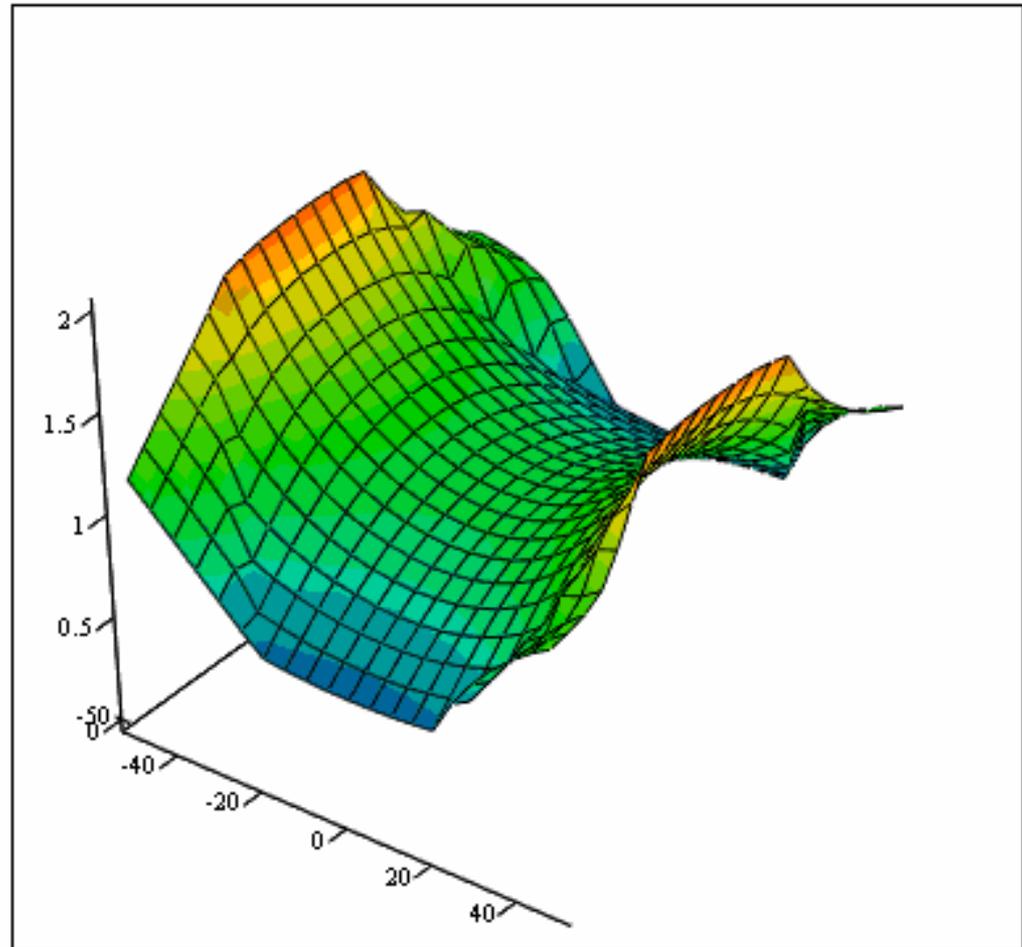


V sum signal “looks like” H position



What Test Stand Data Shows

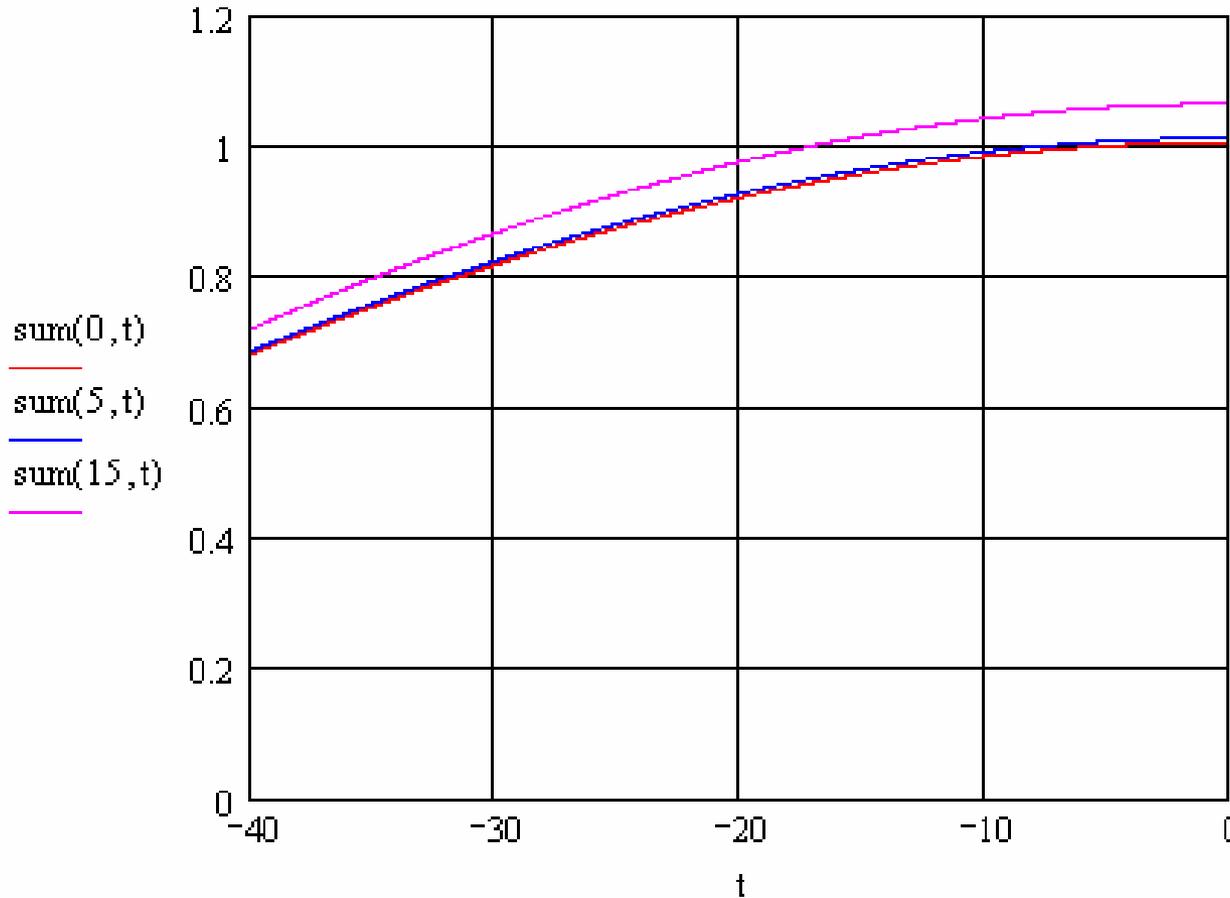
Sum signal of “on-axis” electrodes normalized to that at BPM center as a function of “on-axis” position (axis pointing to 4 o’clock) and “off-axis” position (axis pointing to 2 o’clock)



(xwire, ywire, sum)



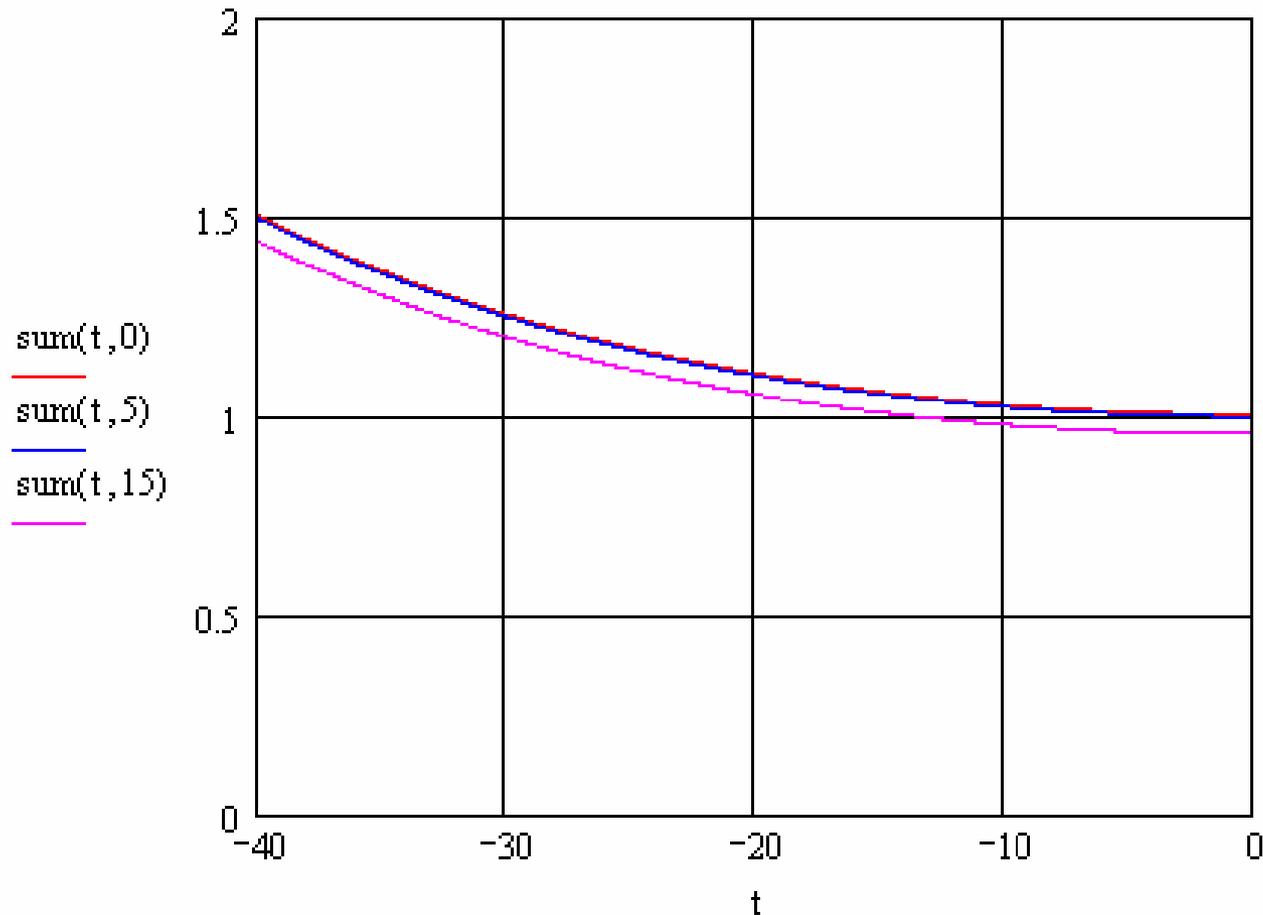
Sensitivity to Off-Axis Position



For example, sensitivity of vertical sum signal to horizontal position (t) (mm) for three vertical positions (0, 5, 15 mm)



Sensitivity to On-Axis Position



For example, sensitivity of horizontal sum signal to horizontal position (t) (mm) for three vertical positions (0, 5, 15 mm)



The Function

- The polynomial in x (“on-axis”) and y (“off-axis”) describing the sum of the “on-axis” electrode signals is:

$$\text{electrodesum}(x, y) := \sum_{i=0}^{\text{last}(\text{coeffs})} \left(\text{coeffs}_i \cdot x^{\text{term}_{i,0}} \cdot y^{\text{term}_{i,1}} \right)$$

Where:

	0	1
0	1	3
1	0	4
2	0	3
3	0	2
4	1	2
5	2	2
6	0	1
7	1	1
8	2	1
9	3	1
10	0	0
11	1	0
12	2	0
13	3	0
14	4	0

term =

	0
0	1.745·10 ⁻⁹
1	7.683·10 ⁻⁹
2	-3.892·10 ⁻⁹
3	-2.159·10 ⁻⁴
4	-4.303·10 ⁻⁸
5	-5.772·10 ⁻⁸
6	-4.211·10 ⁻⁵
7	-5.636·10 ⁻⁶
8	-9.564·10 ⁻⁹
9	-1.822·10 ⁻⁹
10	1.005
11	1.209·10 ⁻⁴
12	2.426·10 ⁻⁴
13	7.238·10 ⁻⁹
14	4.423·10 ⁻⁸

coeffs =

