Octupole result from Chromaticity Study

04/28/2012

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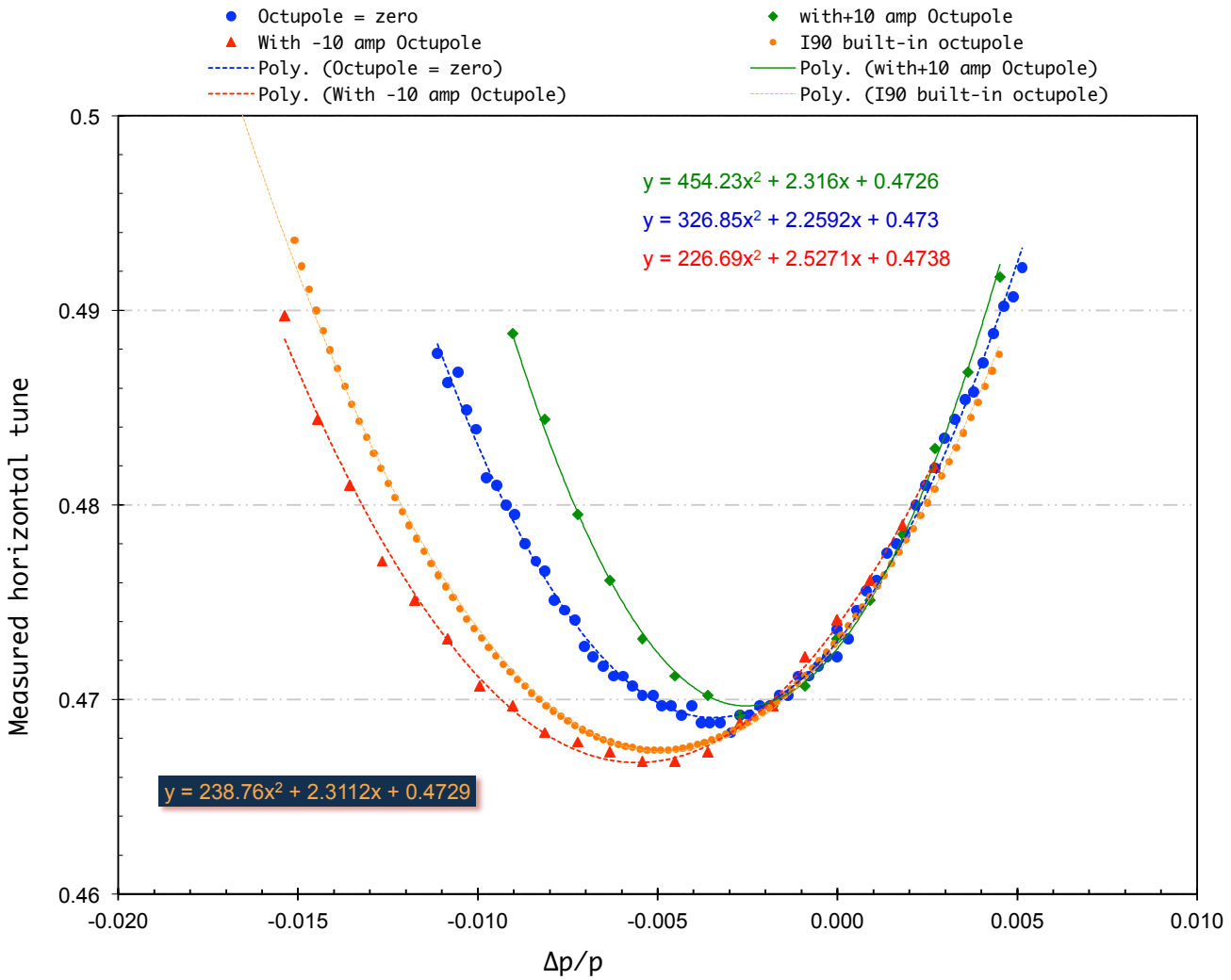
Tune vs Δp/p

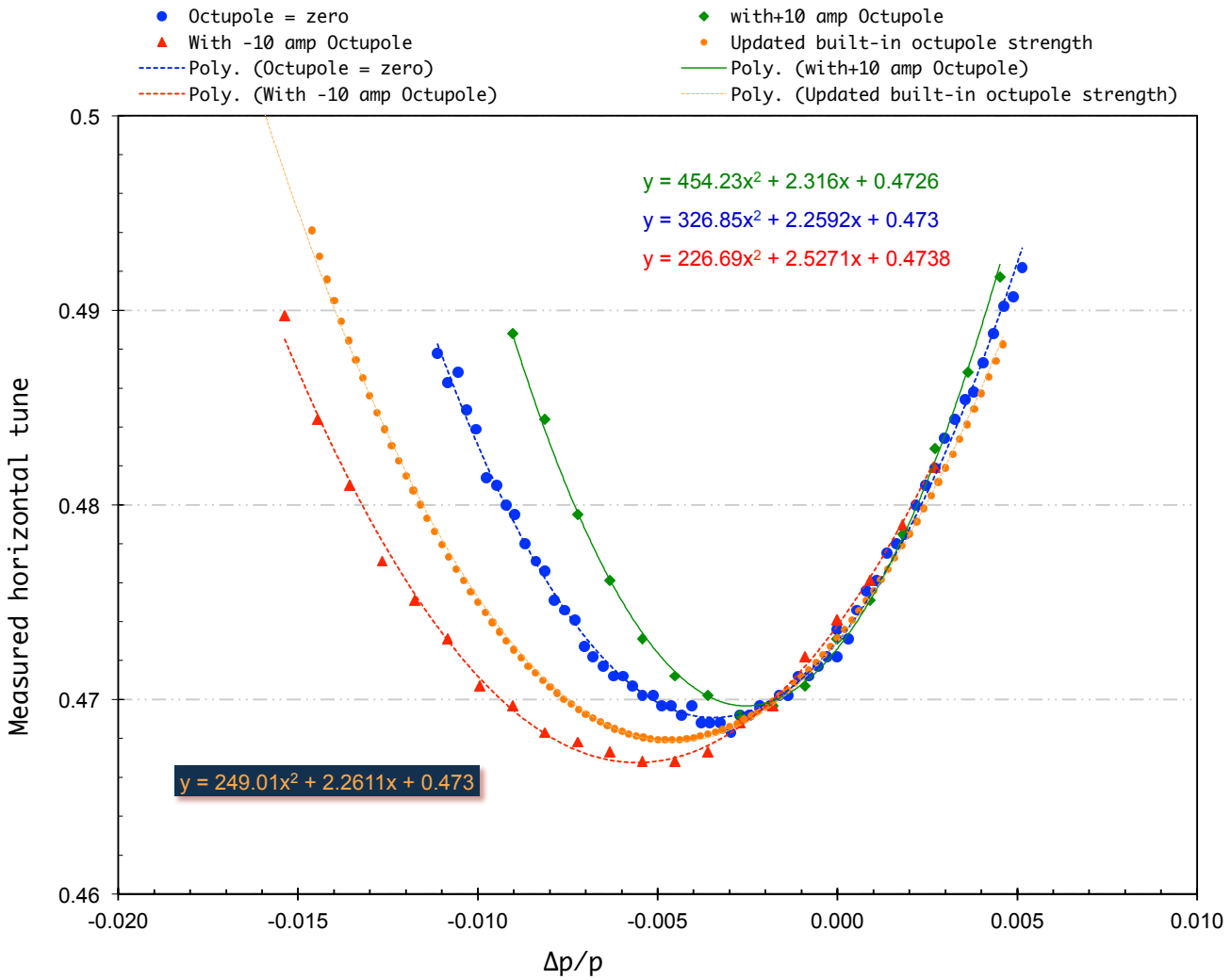


May 02, 2012

MTF data: Octupole field in MI quadrupoles

Categories	IQB	IQC	IQD	Unit
QF at 8 GeV	71.03	68.56	61.71	KG/m^3
QD at 8 GeV	-56.47	-46.98	-56.51	KG/m^3
QF at 120 GeV	957.44	832.45	712.39	KG/m^3
QD at 120 GeV	-737.92	-596.31	-634.07	KG/m^3

Tune vs Δp/p, use updated MTF numbers



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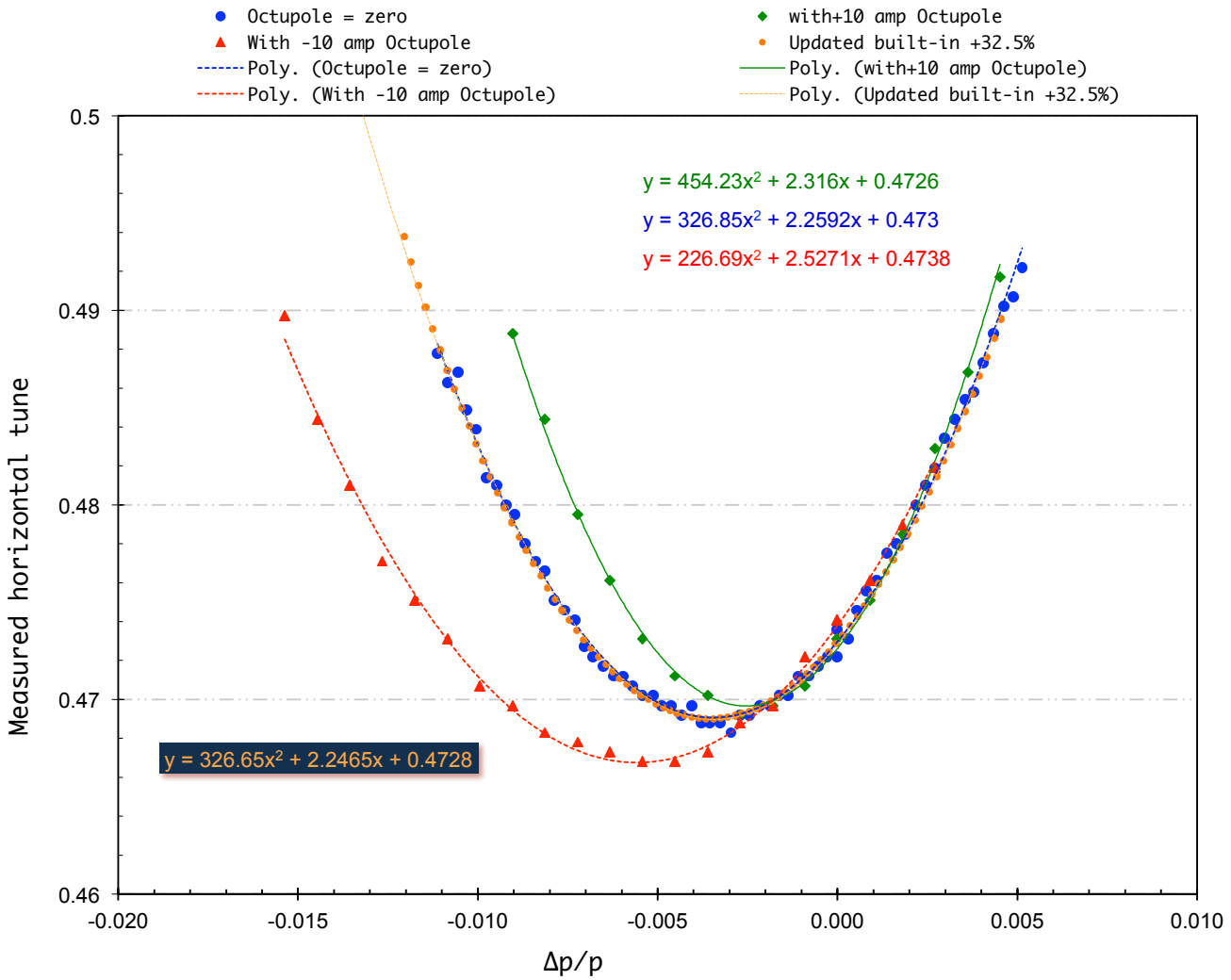
Tune vs Δp/p, built-in octupole at +32.5%



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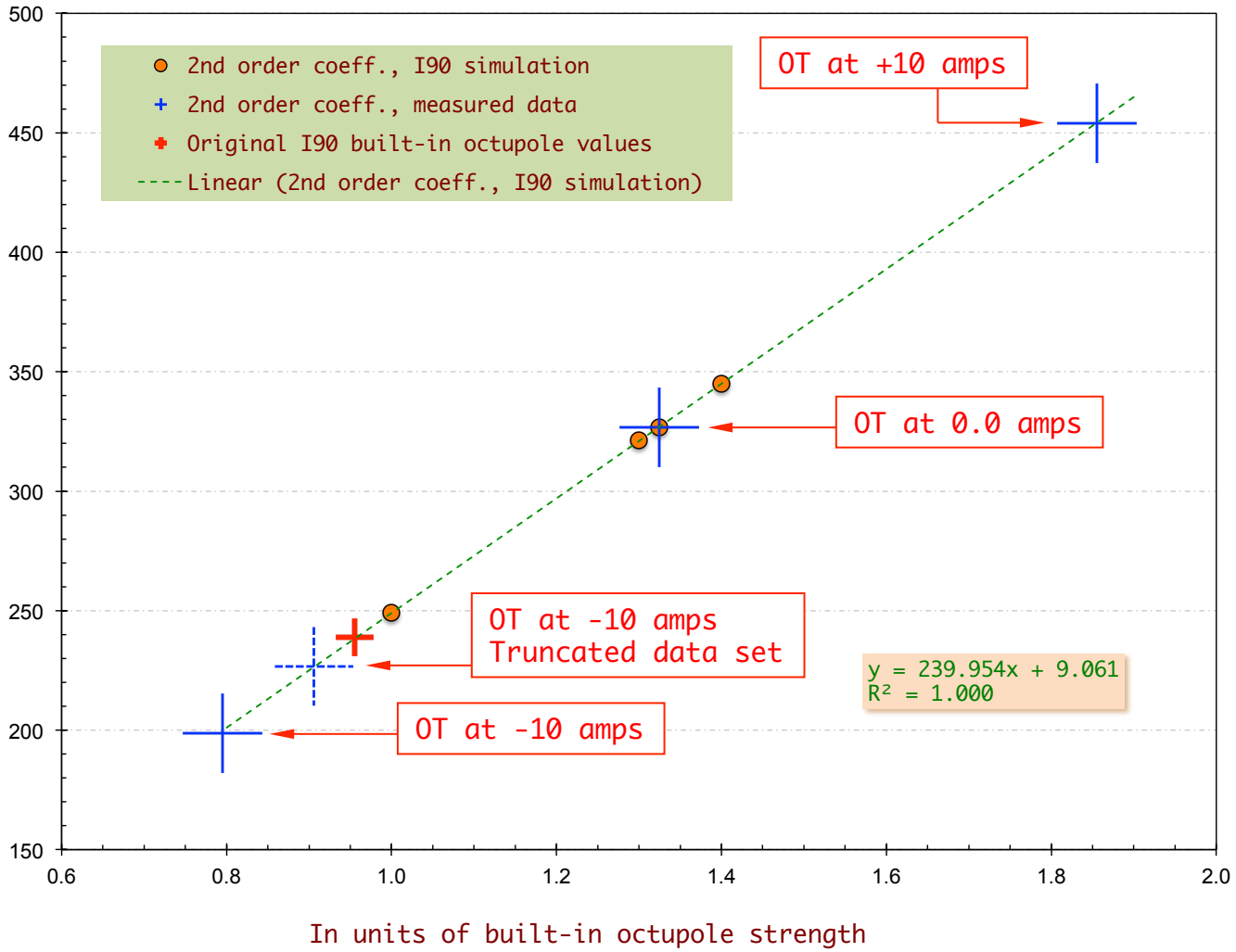
Matching the built-in octupole field



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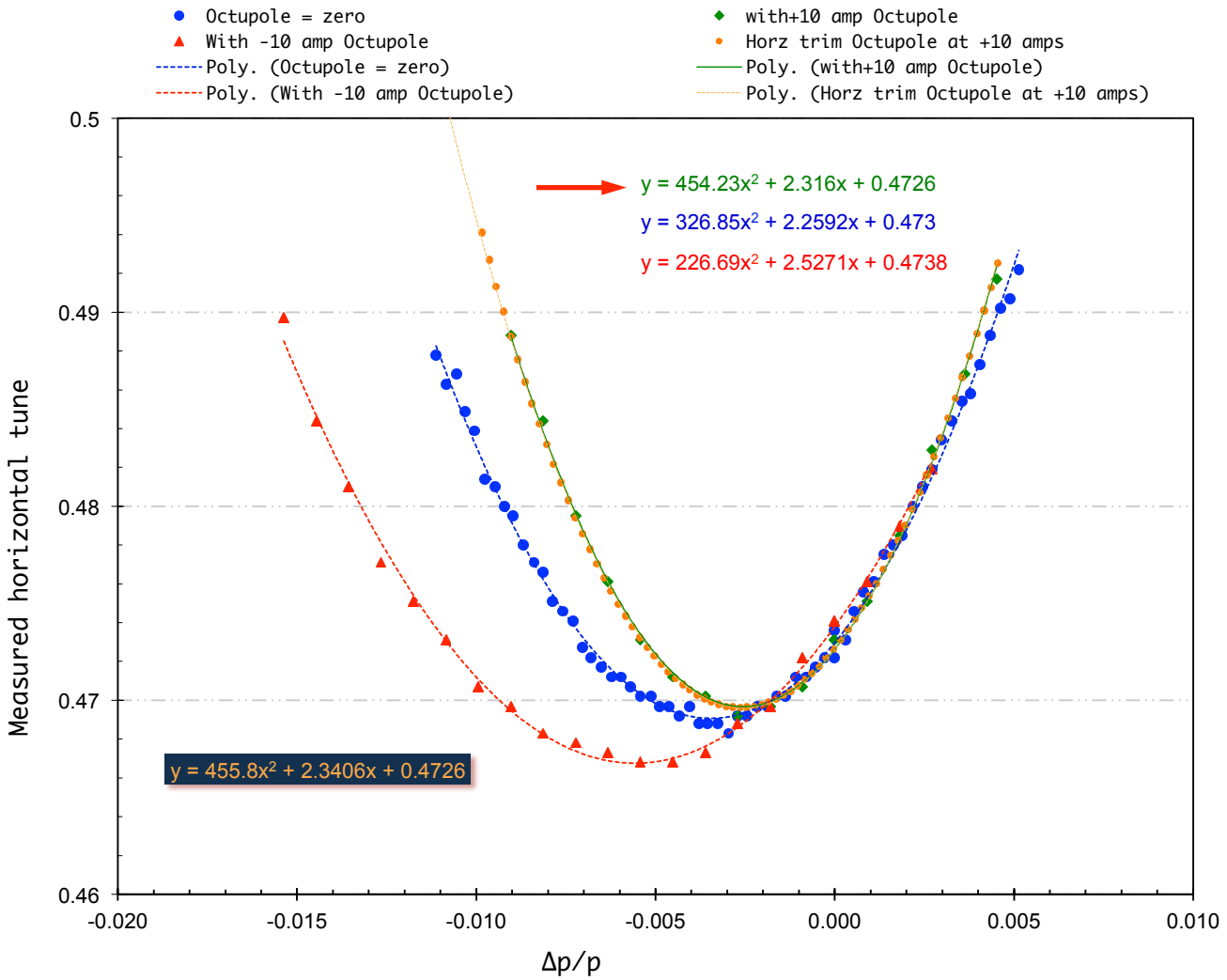
Tune vs Δp/p, trim octupoles at +10 amps



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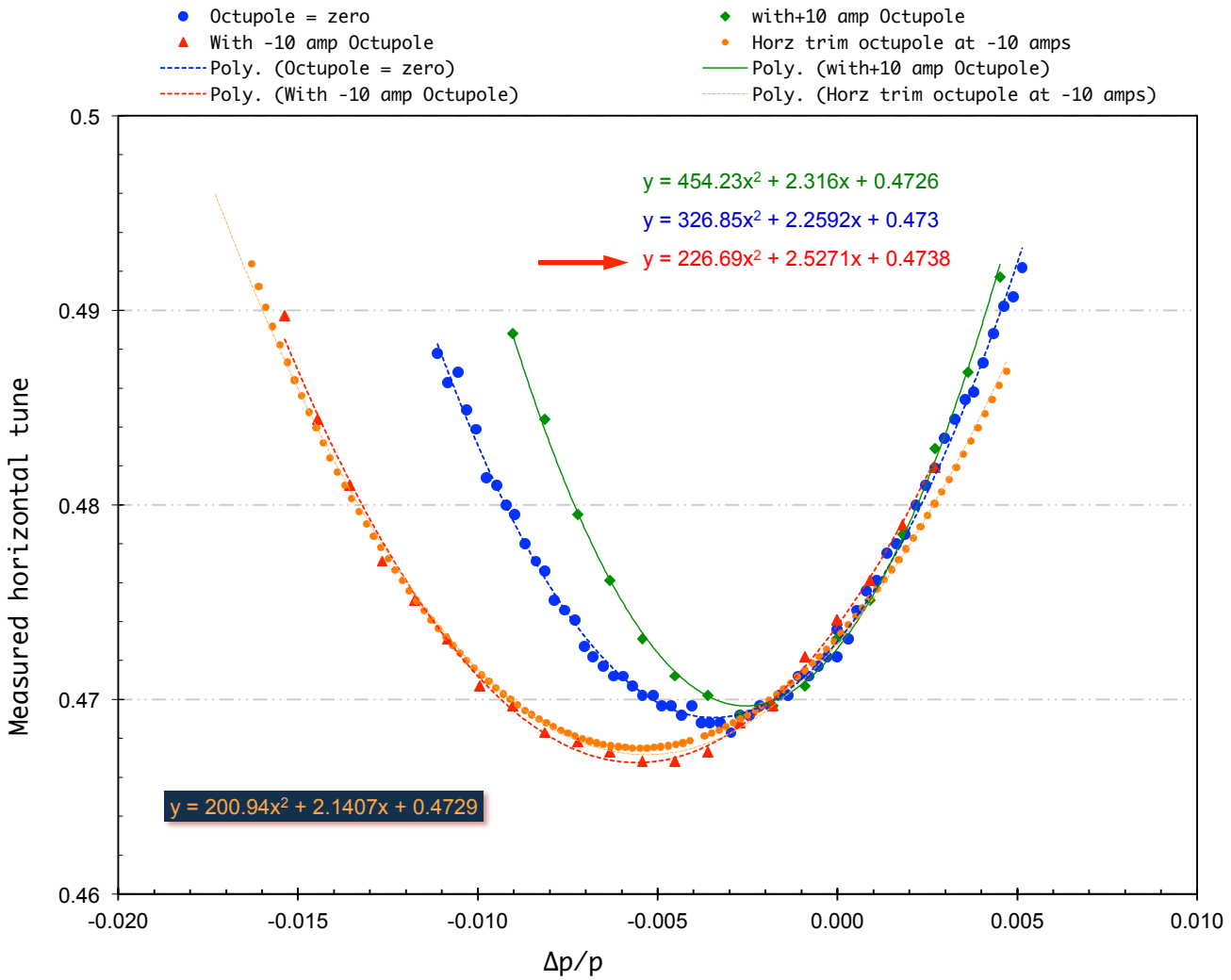
Tune vs Δp/p, trim octupoles at -10 amps



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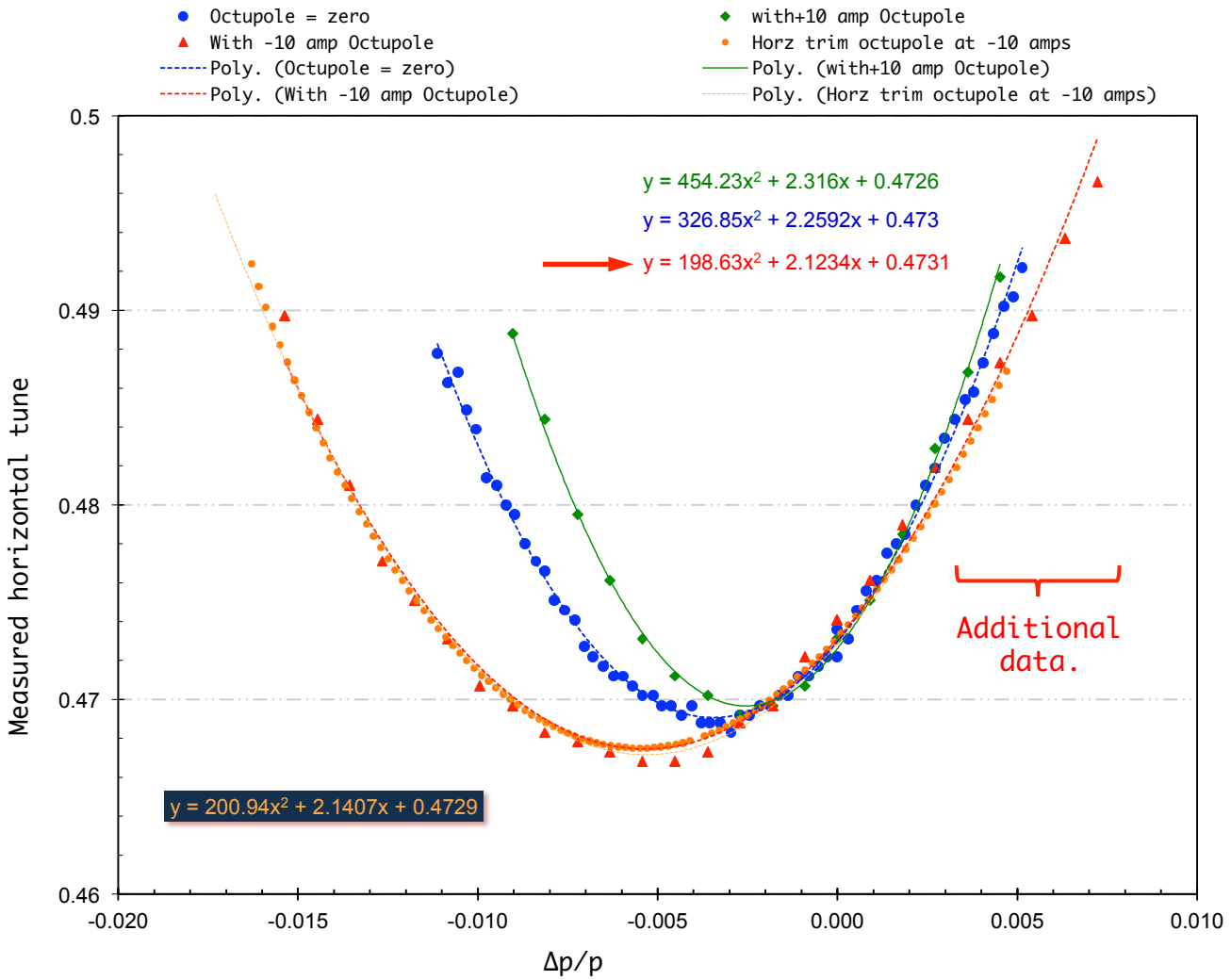
Tune vs Δp/p, trim octupoles at -10 amps



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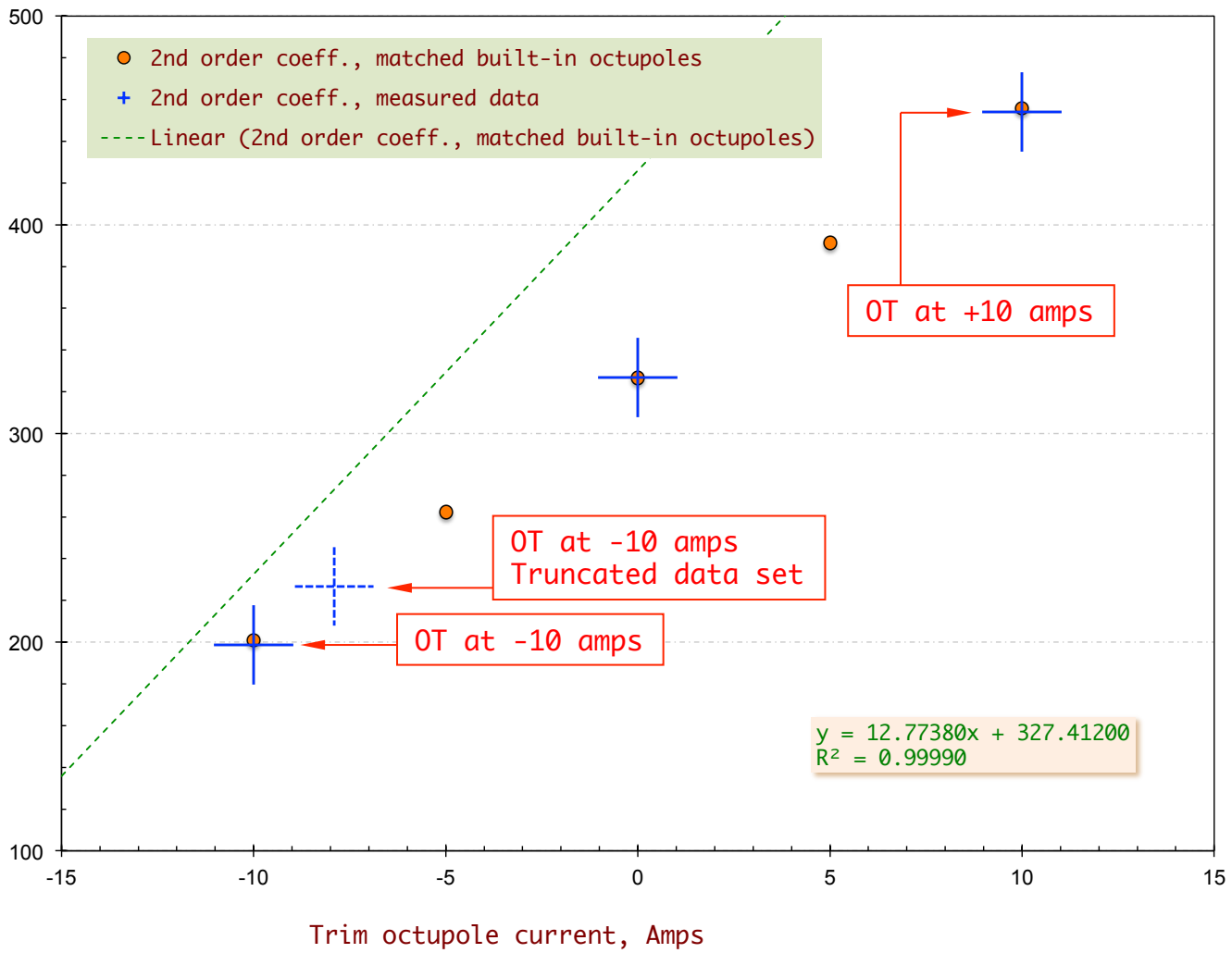
Comparing trim octupole strength



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Trim octupole strength

- From TM-1412
  - $h_3 * L_{eff} / I = 27.921$ KG-m/m^3/A
  - $b_3 = 3! * h_3$
- Magnet length
  - L_{eff} = 6 inches, or 0.1524 meter.
  - h_3 = 183.21 KG/m^3
  - b_3 = 1099.25 KG/m^3
- At 10 amp
  - 10992.5 KG/m^3
  - About what is needed to match observed data.

Conclusions

- Tune measurement
  - A manifestation of octupole
    - ✓ Independent of I90 program
- Built-in octupole component
  - About 30% more than the expected
    - ✓ Checked MTF magnet database.
    - ✓ Phase-slip factor at 120 GeV/C.
  - I90 tracking calculation
    - ✓ MTF octupole strength used as baseline.
- Trim octupole
  - Strength
    - ✓ Consistent with TM-1412 value.
    - ✓ Clearly not in-effective.
  - The cause of asymmetric effect
    - ✓ Magnetic hysteresis.
    - ✓ Higher order field in the machine.