Dynamic Aperture at 2.5 GeV Tunes

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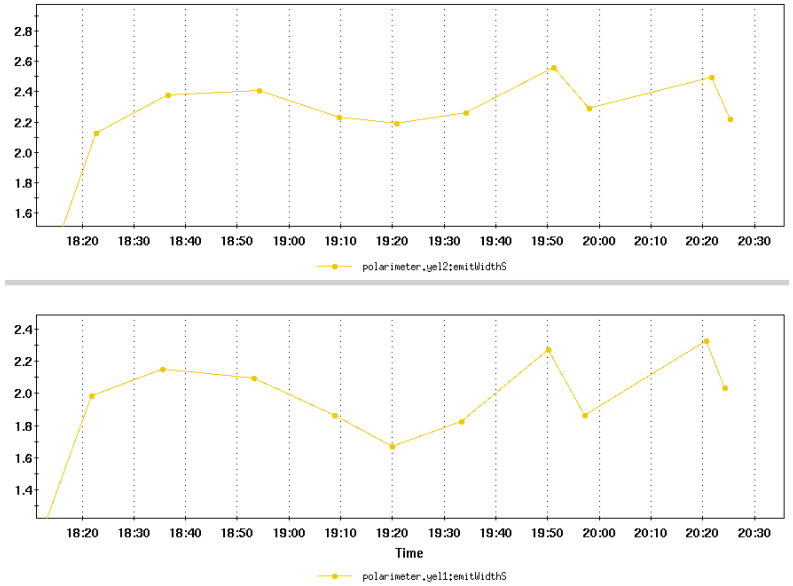
Experimenters' requests and ideas

- Pb instead of Au, because it's spherical instead of football-shaped
- p at 10-20 GeV beam energy, if sPHENIX is delayed
- One (Au) energy below 3.85 GeV

(Private communication with D. Cebra, nothing official yet)

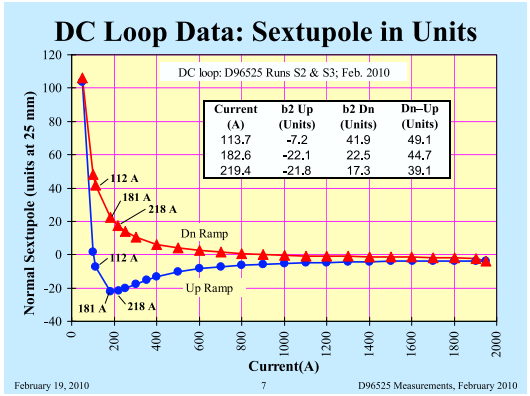
Dynamic aperture with 5.86 GeV protons

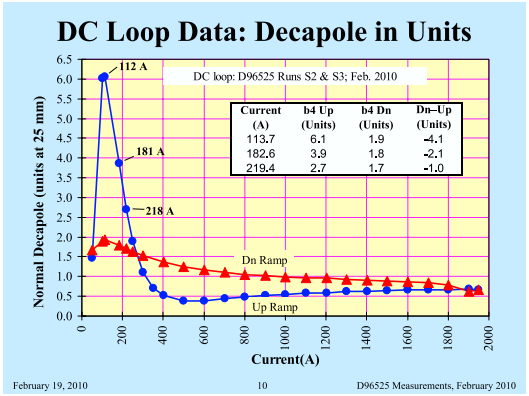


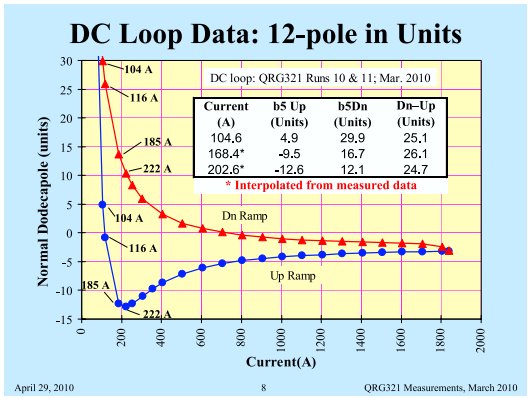
RMS beam size remains unchanged regardless of mis-steering and BBQ blow-up efforts

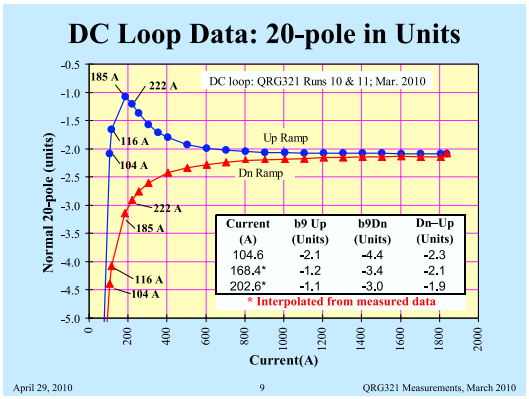
$\Rightarrow$ (Dynamic) aperture is already filled anyway, RMS emittance (=acceptance) $\epsilon = 0.16\,\mathrm{mm\,mrad}$ (or normalized $\epsilon_n = 1\,\mathrm{mm\,mrad}$ RMS) at $\gamma = 6.25$

Multipole measurements









Multipole errors at 2.5 GeV and 9.8 GeV are very similar

Multipoles at four different energies

	$\sqrt{s} = 5$ GeV	$\sqrt{s} = 7.7$ GeV	regular injection	100 GeV protons
sextupole	-7.2	-22.1	-10	-3
10-pole	6.1	3.9	0.4	0.7
12-pole	4.9	-9.5	-7	-3
20-pole	-2.1	-1.2	-1.9	-2.1

10-pole is 50 percent larger at 2.5 GeV than at 3.85 GeV

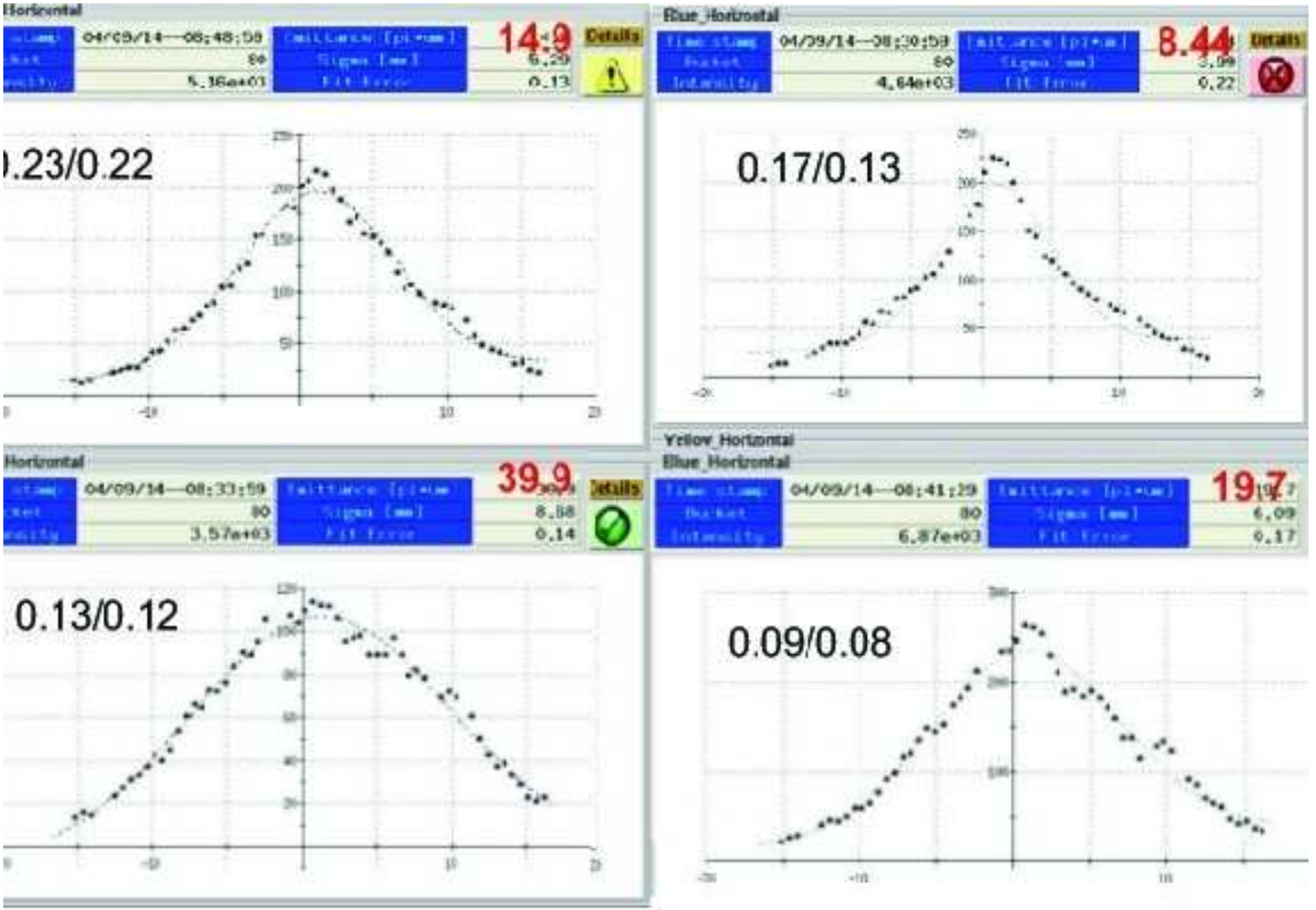
12-pole has opposite sign at 2.5 GeV, but is not larger than at the other energies

Sextupole and 20-pole are well within "normal range"

No obvious reason for small dynamic aperture at 2.5 GeV

Is it just the wrong working point?

Dynamic aperture measurements at injection



Experimental results

- Measured profile width at (.17,.13) is smallest of all the working points, indicating small dynamic aperture
- Beam profiles are non-Gaussian
- Injected beam was already blown up due to AtR quadrupole problem

Measurement should be repeated in FY2015 (2 hours)

Multipoles at 3.05 GeV

- $h = 378 = 42 \cdot 9$ allows collisions at both experiments

- Multipoles:

	$\sqrt{s} = 6.1$ GeV	$\sqrt{s} = 7.7$ GeV	regular injection	100 GeV protons
sextupole	-12	-22.1	-10	-3
10-pole	5	3.9	0.4	0.7
12-pole	-2	-9.5	-7	-3
20-pole	-1.5	-1.2	-1.9	-2.1

Multipole errors are not bigger than at 3.85 GeV

If all else fails at 2.5 GeV, 3.05 GeV may be an alternative

Summary

- Measured dynamic aperture in the 2.5 GeV lattice is surprisingly small
- There is experimental indication that this may be due to the working point far from the diagonal (.17,.13)
- Experiment was hampered by quadrupole failure in AtR, and should be repeated in Run-15 (2 hours)
- 3.05 GeV is a possible alternative for future physics run