Correction of one parasitic with one wire

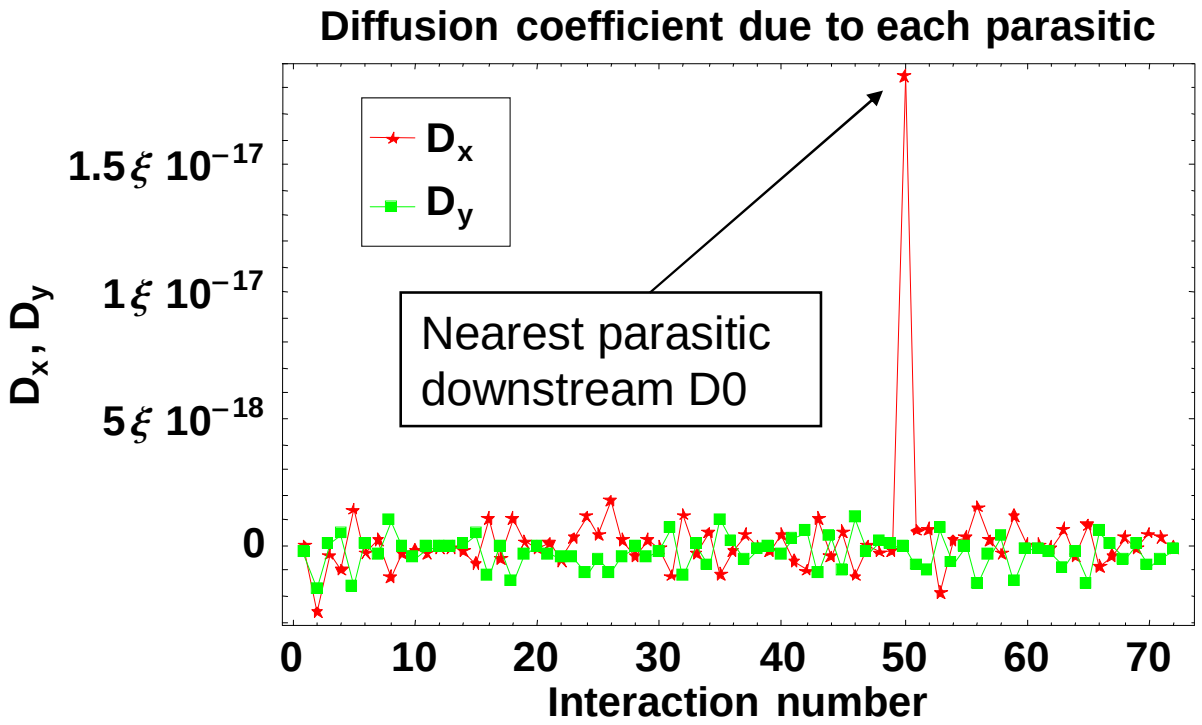
- Theory gives requirements for ideal correction of one round well separated long-range beam-beam interaction by one wire:
  - Phase difference multiples of π in both planes
  - Ratio of horizontal and vertical beta functions at location of beam-beam interaction and wire the same
  - Current*length of wire related to bunch intensity by $2ecN_b$
- Pick one parasitic with the largest diffusion coefficient and try to compensate by placing a wire in the appropriate location

Departure from the ideal conditions

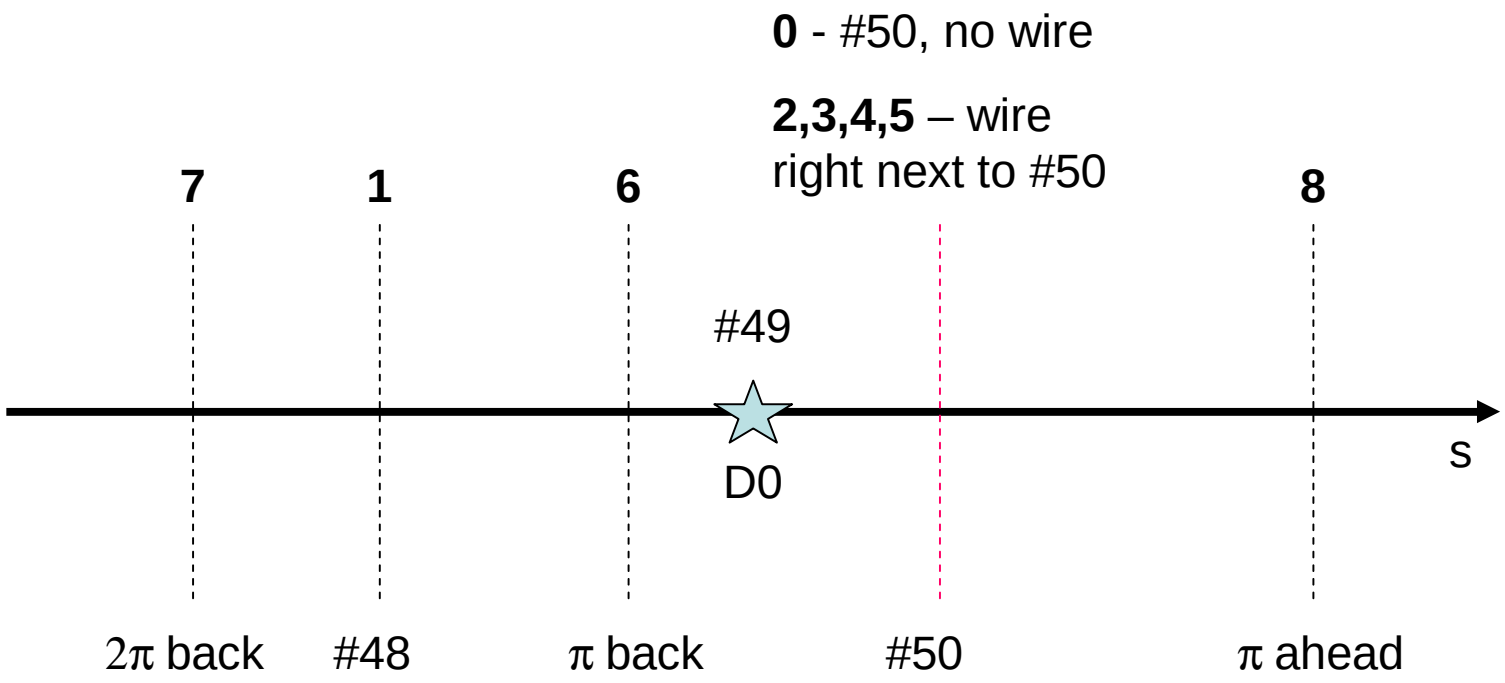
- In the Tevatron (even without lattice nonlinearities), the requirements cannot be satisfied exactly, because:
  - Beams are not round
  - Finite separation
  - The location of the π phase separation in the horizontal and vertical planes do not coincide longitudinally
  - At the longitudinal position where the phase differences come close to the required values, the ratio of the beta functions are not the same as at the beam-beam interaction's location
- Strategy for placement of wire under these circumstances:
  - Calculate longitudinal locations of multiples of π phase difference horizontally and vertically, and take average
  - Pick a few locations that are close to the location of the beam-beam interaction => maximum phase error is about 5 degrees
  - Set the transverse placement to the values required by the average kick correction
  - Current set to the value required by ideal correction (*this choice needs to be studied in more detail*)

Diffusion coefficient of each parasitic

Coefficient calculated using 200 randomly chosen particles with 5 σ initial amplitudes after 10^6 turns



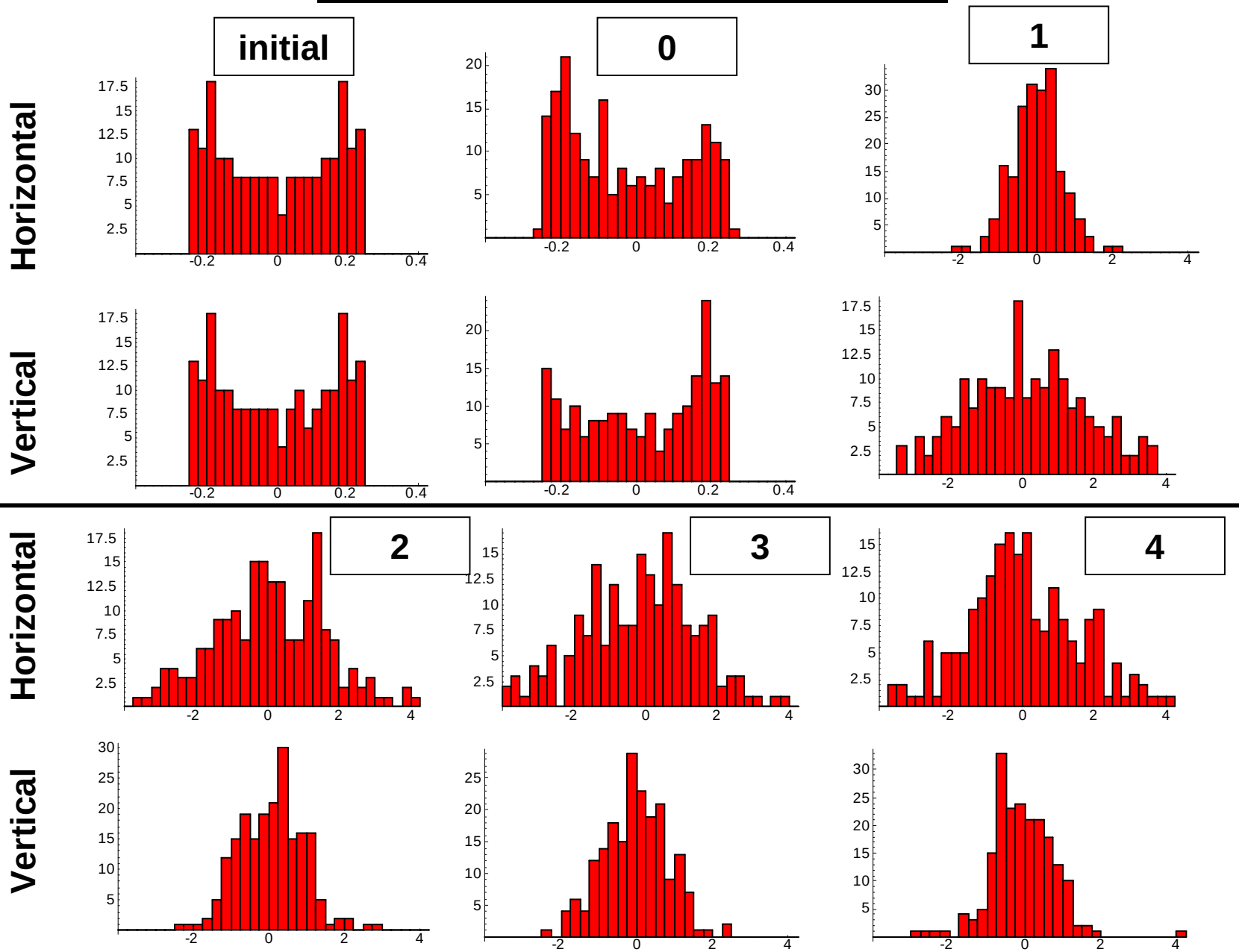
Schematic of wire placement



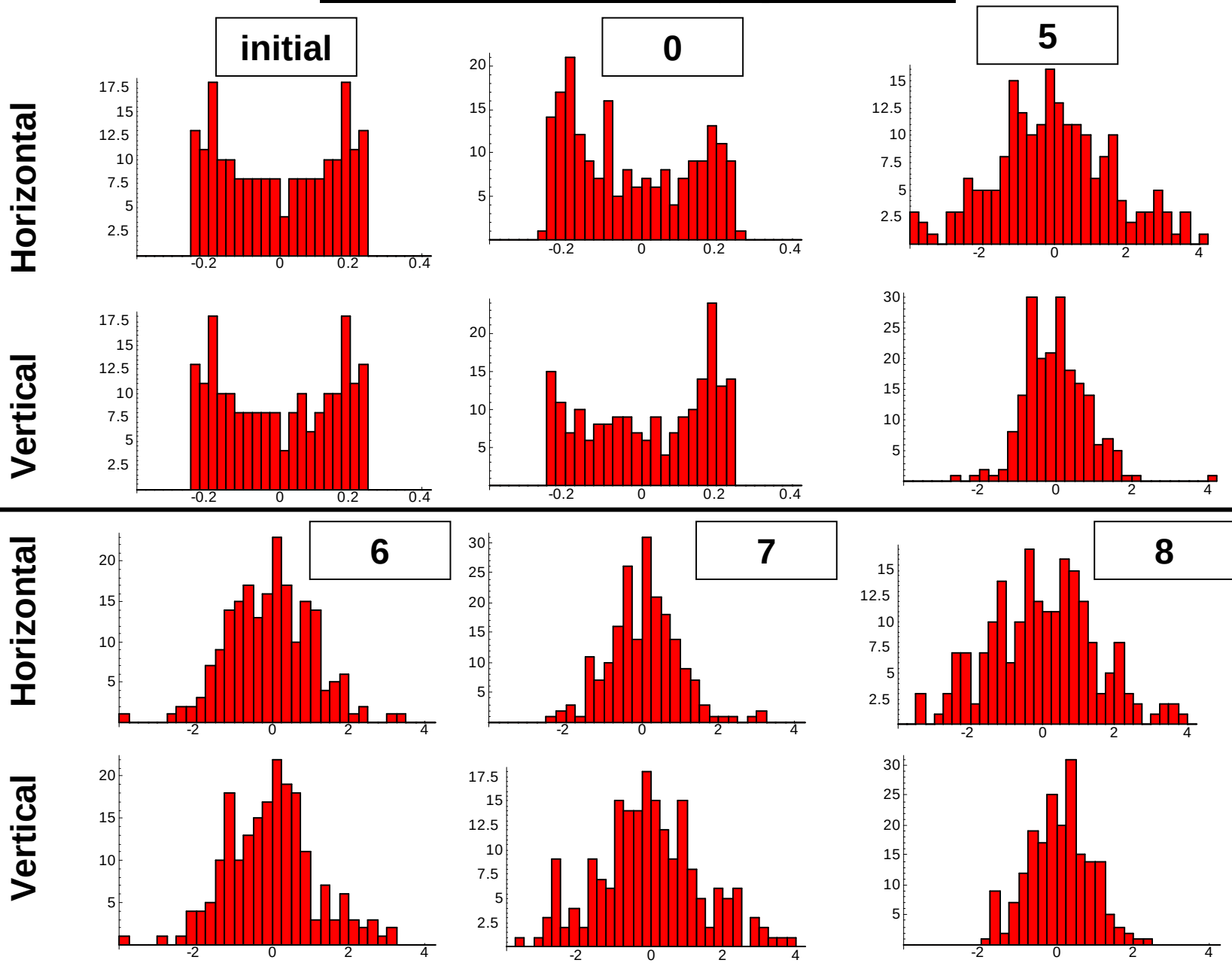
Pbar direction →

Difference among 2,3,4,5 are the signs of the current and/or transverse positioning

Results: density profiles



Results: density profiles



Diffusion coefficients

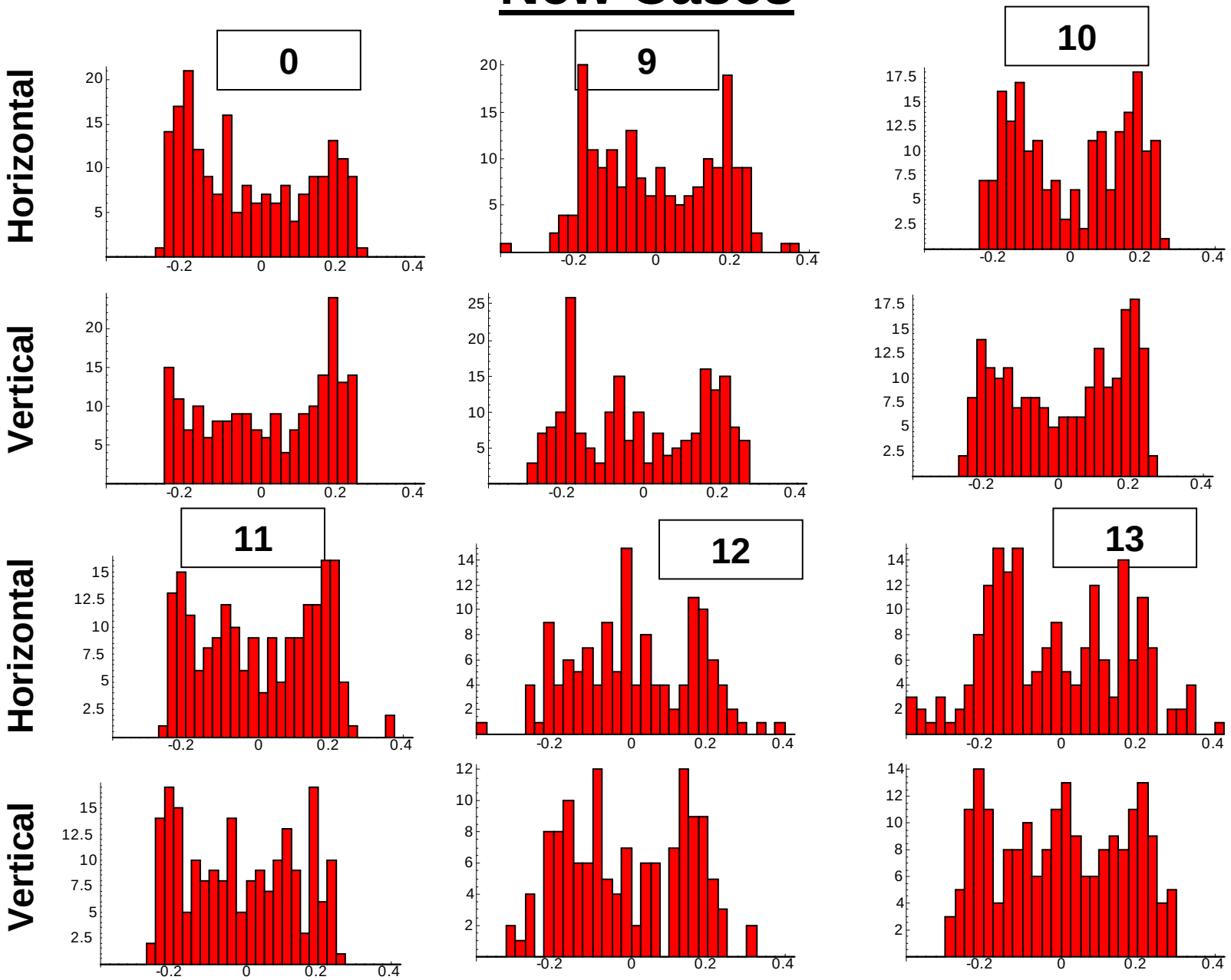
Case	Description	$<D_x>$	$<D_y>$
0	Only the parasitic (#50), no wire	0.4796862E-17	0
1	Wire @ location of parasitic #48 (nearest upstream)	0.5988409E-11	0.4914306E-09
2	Wire next to #50 (+,+)	0.1529652E-09	0.7762199E-11
3	Wire next to #50 (+,-)	0.2953537E-08	0.5097404E-10
4	Wire next to #50 (-,+)	0.1485387E-08	0.3200185E-10
5	Wire next to #50 (-,-)	0.1430018E-09	0.8529229E-10
6	π back	0.3587714E-10	0.1037292E-09
7	2π back	0.6461816E-10	0.1950050E-08
8	π ahead	0.1127217E-09	0.8579232E-10

To do list:

- Check whether the diffusion coefficient goes down when the single parasitic with largest coefficient is compensated ideally by a wire
  - *Understand recent results*
  - *Check if method of average kick compensation works*

- See what happens when two parasitics are compensated by a wire
- Decide which parasitics to be compensated on average, and check diffusion coefficient before and after
- Recompute total diffusion coefficient with all beam-beam and wires
- Estimate DA (with lattice nonlinearities included) if the previous points turn out to be successful
- Look at possible locations in the ring to make it practical
- Look at different bunches
- Look at different operating phases
- Look at multiple wires at the same longitudinal position

New Cases



Diffusion coefficients

Case	Description	$<D_x>$	$<D_y>$
0	Only the parasitic (#50), no wire	0.4796862E-17	0
9	Case **2**, but 10x current and distance	0.2010562E-16	0
10	Case **6**, but 10x current and distance	0.2817232E-16	0
11	Case **7**, but 10x current and distance	0.2046528E-14	0.1553452E-16
12	Case **8**, but 10x current and distance	0.1236592E-11	0.2426753E-10
13	Case **3**, but 10x current and distance	0.3766299E-13	0.1926693E-15