Beam-beam tracking studies 2007

DK and WH

June 6, 2008

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Failing seeds

- Observation: As always, 60 imperfect machines are tracked, but with Measured Errors some cases are not returned (failing)

  case = (tune, error seed, angle, amplitude)

  may be the whole seed missing, or just a case

- main cause identified: the a1 error

- solution:
  make comparisons only based on common non-failing seeds (machines)

  nominal-tune plots:

  at 450 GeV, up to 5 seeds of 60 may be failing

  at 7 TeV – more

  tune-scans plots at 450 GeV and $\Delta Q \sim .04$ around 3/4 of the seeds are non-failing, common to all tunes.

- seeds excluded "by hand" if min DA is small for ALL angles.
  Here only one such plot, 7TeV.
  This is SHOWN everywhere, e.g "excluded:{ }" (none)

1 Collisions for beta*=11m; 450 GeV

$0.4 \times 10^{11} p/b$

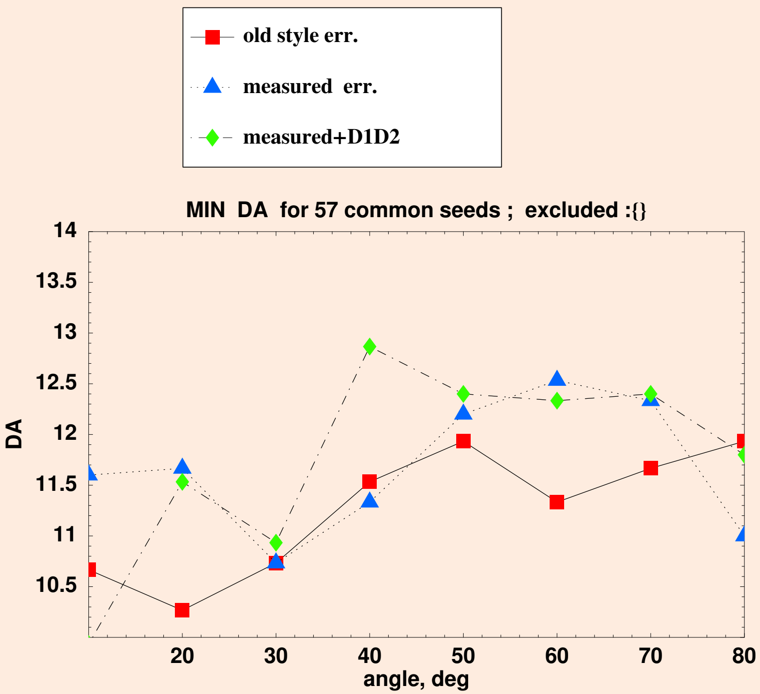
Beam-Beam $=$ ON

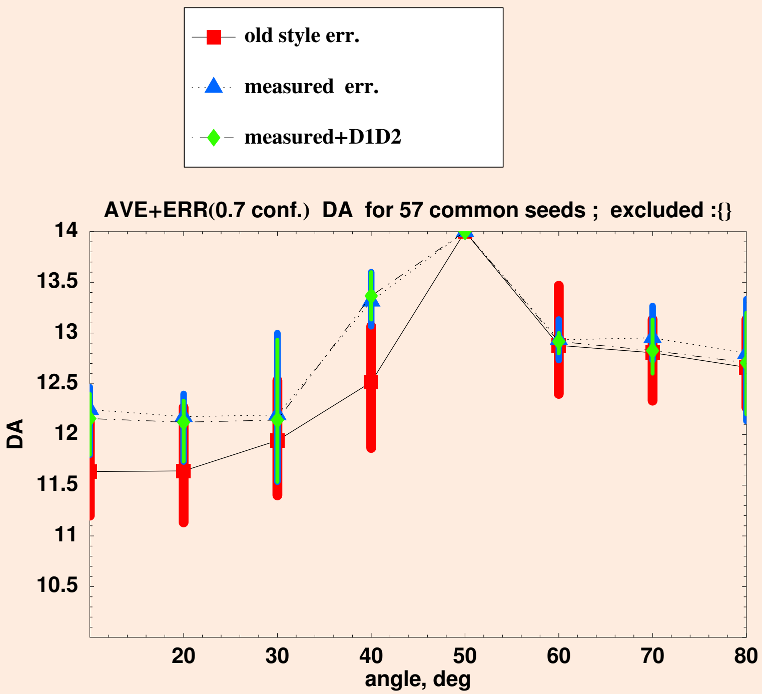
cross-ang$=$OFF

coupl corr $=$ ON

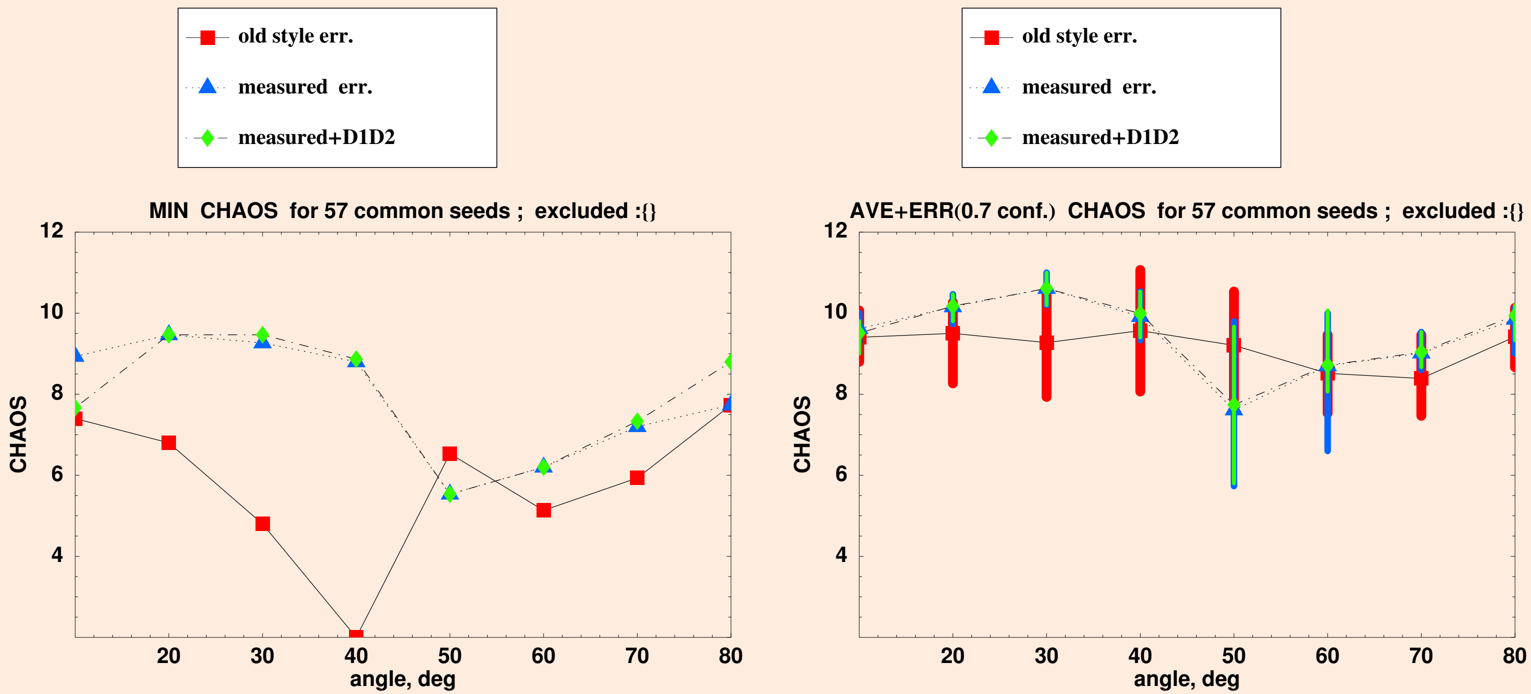
10^5 turns

- Here: compare old err. tables (July 07) with measured err. tables
- Conditions: beta=11m; 450 Gev; NO b1, a1 and NO Orbit Corr
- average shown with error bars at 70 % confidence level (1σ if it was Gaussian)

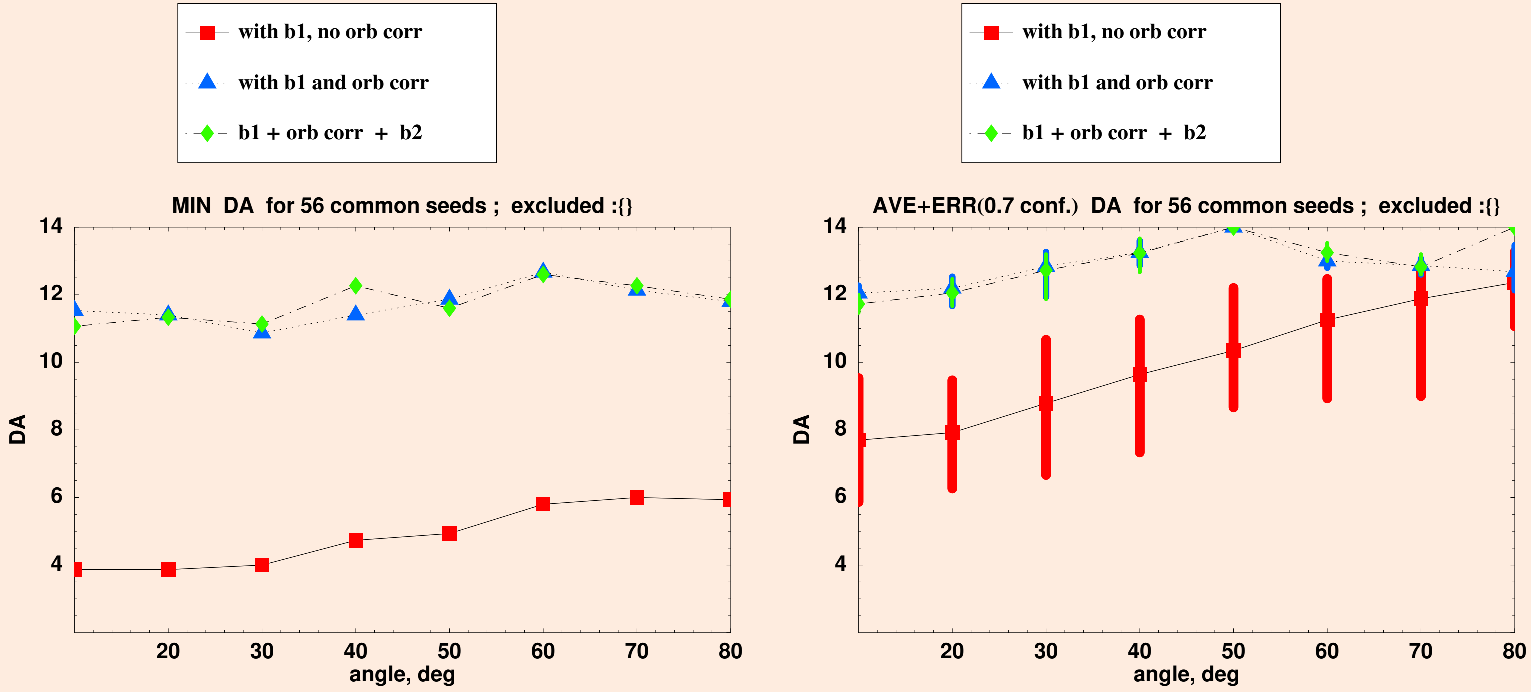




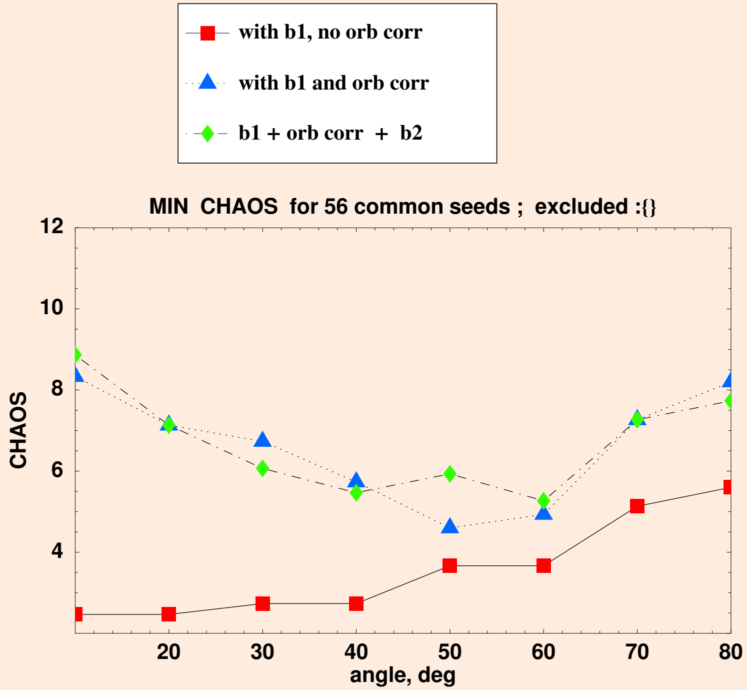
1 Collisions for beta*=11m; 450 GeV

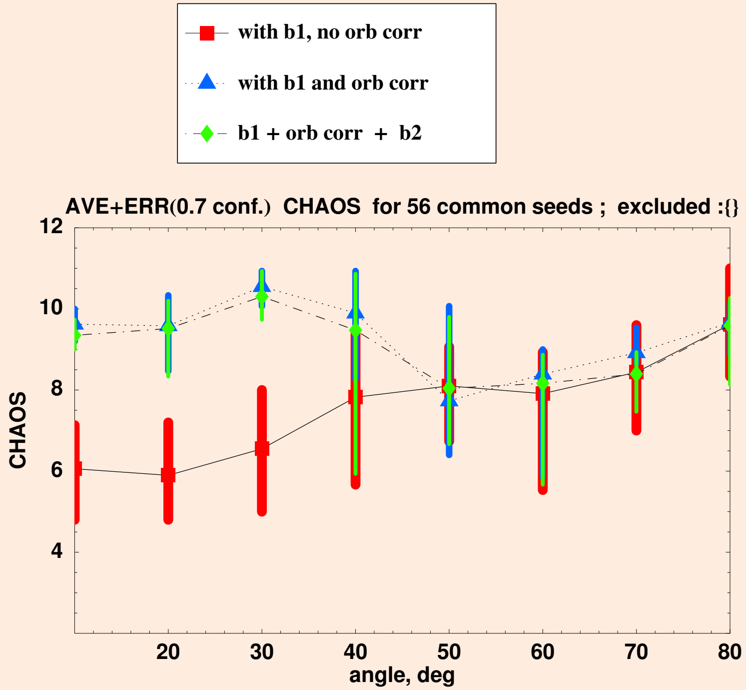


- Use Mesured errors (from this slide on) and test effect of b1-err and Orb Corr
- Same conditions, but added b1, Orb Corr and b2 (NO a1)
- There are 3 cases with numb. of seeds returned 56, 57 and 58. We use the 56 common seeds and exclude none.

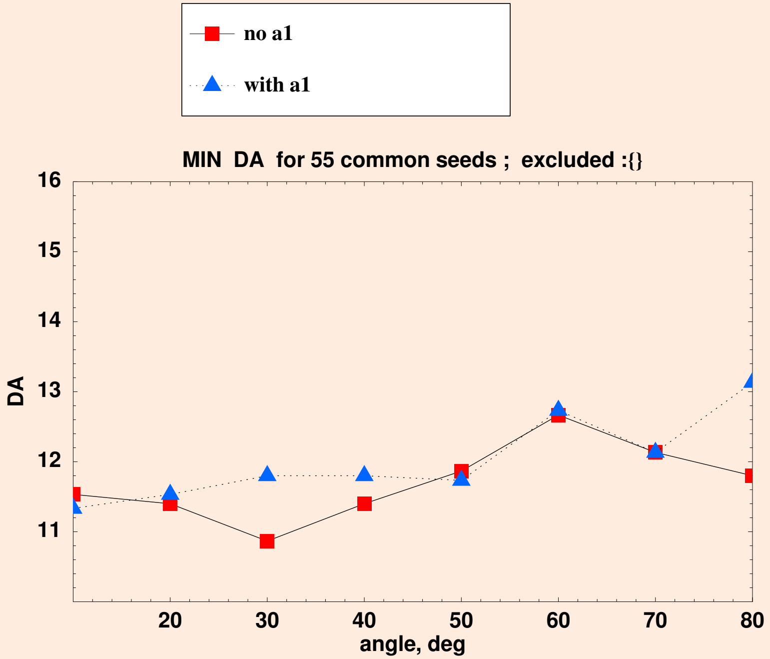


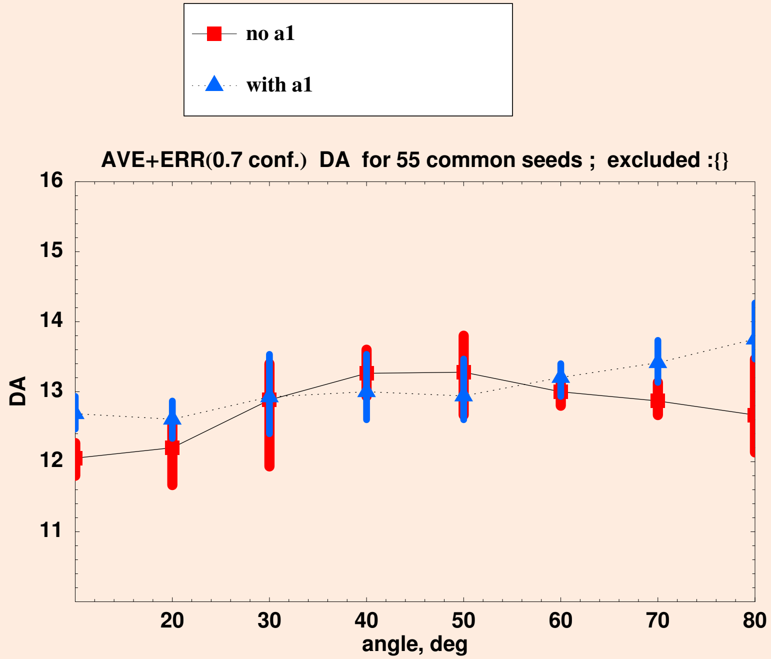
1 Collisions for beta*=11m; 450 GeV



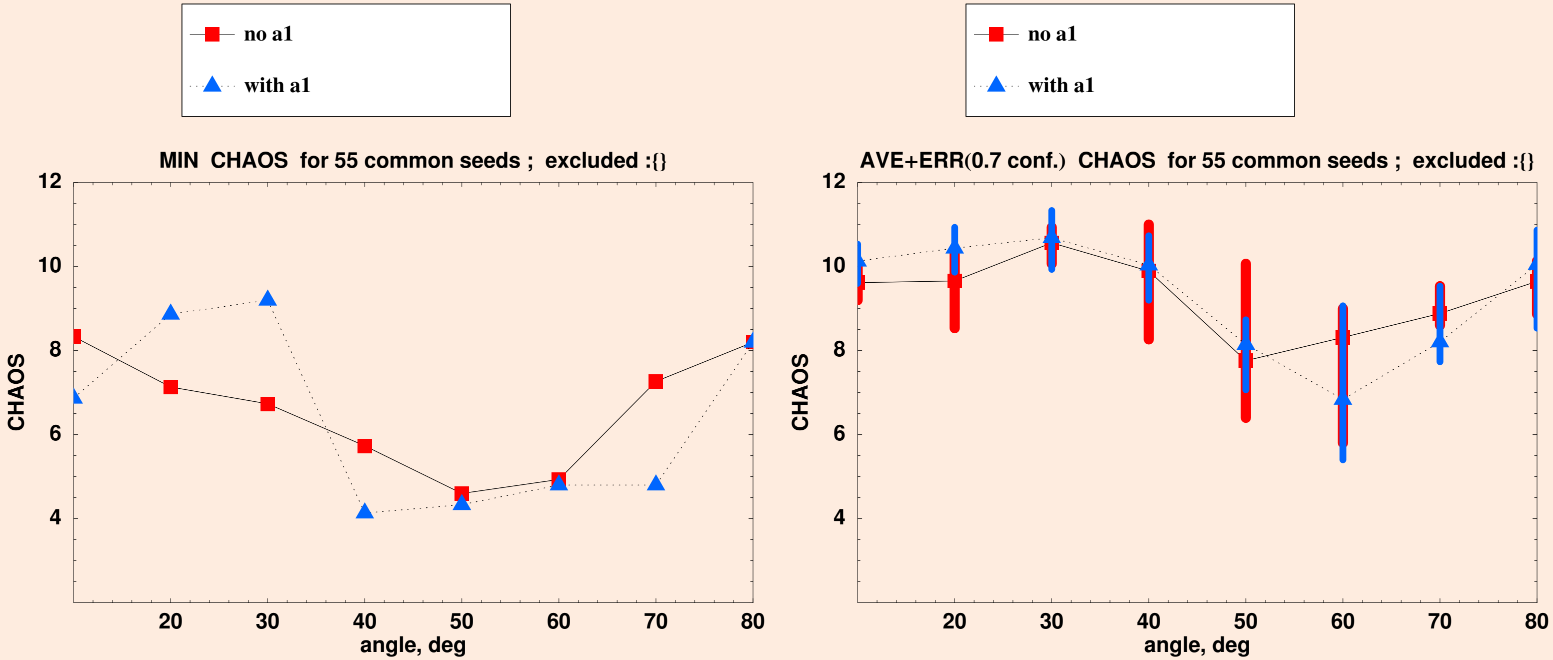


- Next check effect of a1-err, since it causes many cases to fail in tune scans
- Same conditions as previous slide, but added a1 err (NO b2 err)
- conclusion: nearly no effect for nominal tune

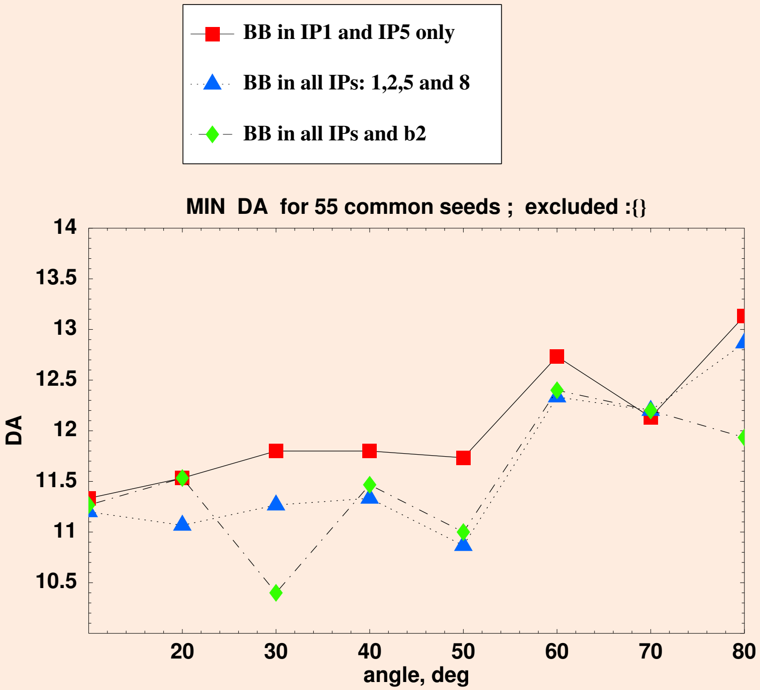


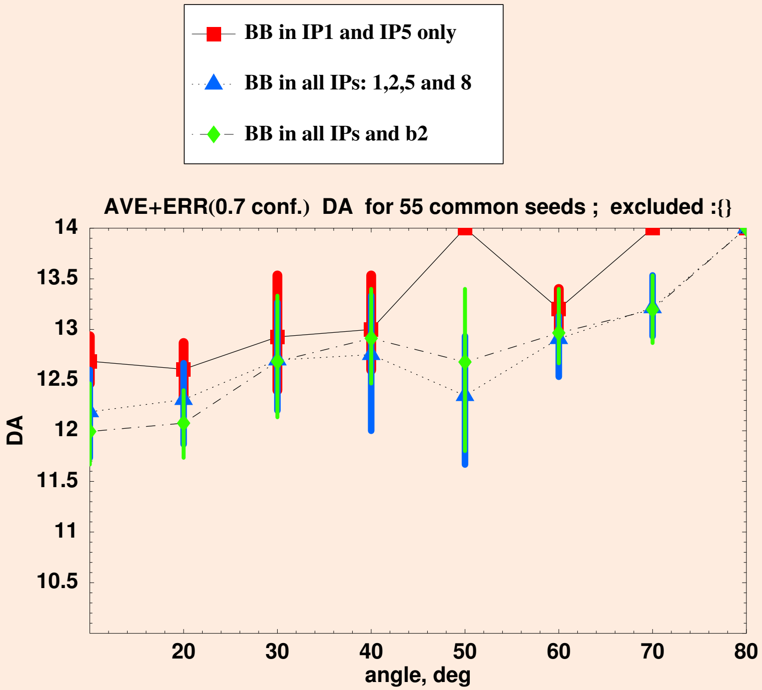


1 Collisions for beta*=11m; 450 GeV

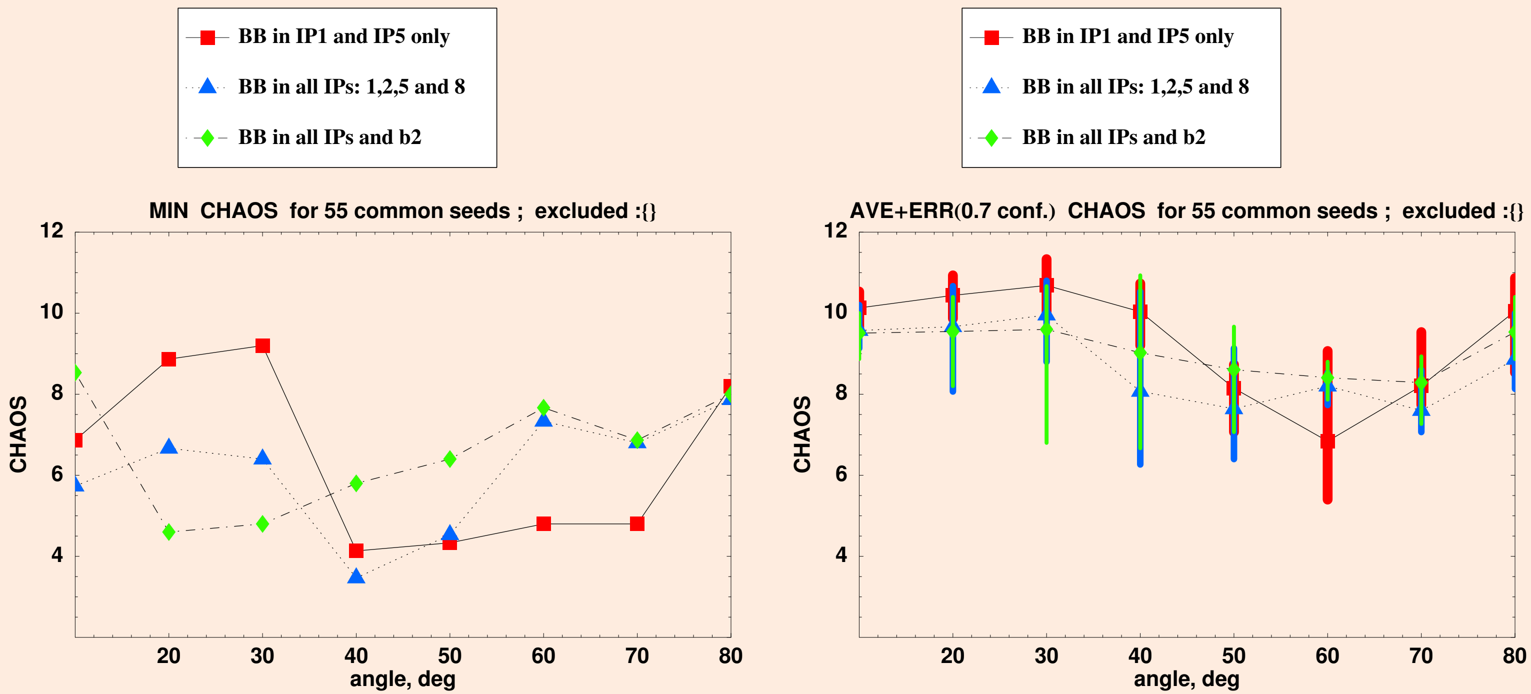


- switching off beam-beam in ip2 and 8, or adding b2-err

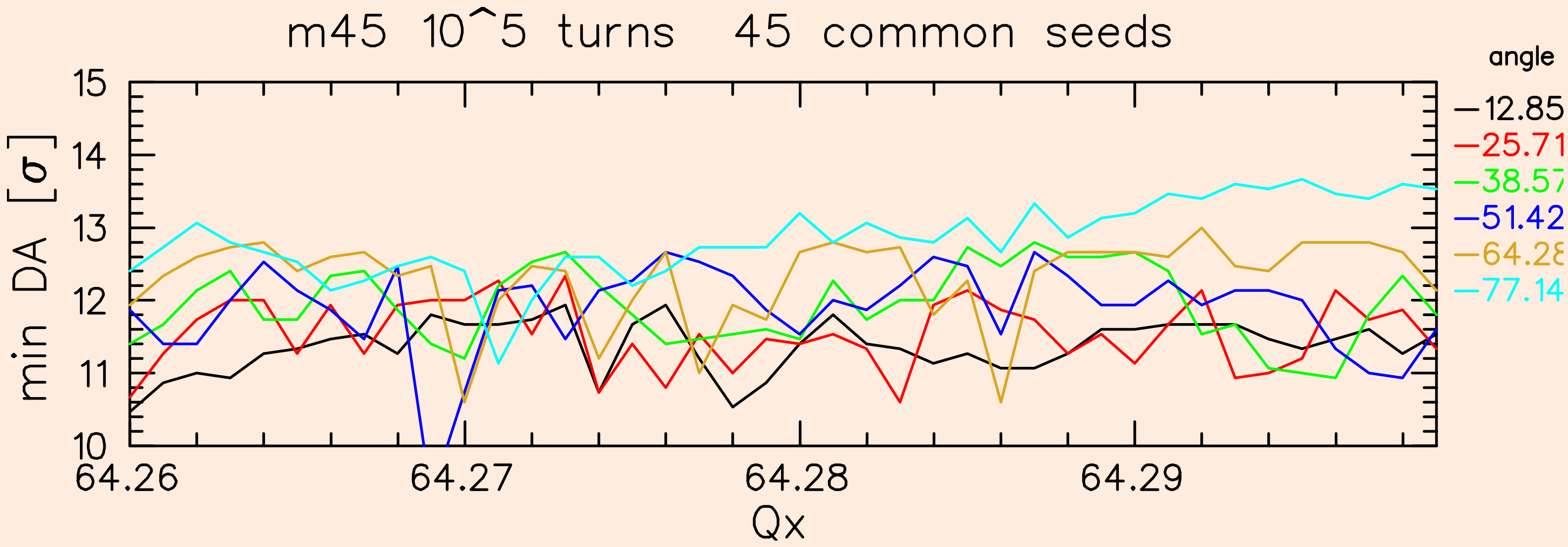




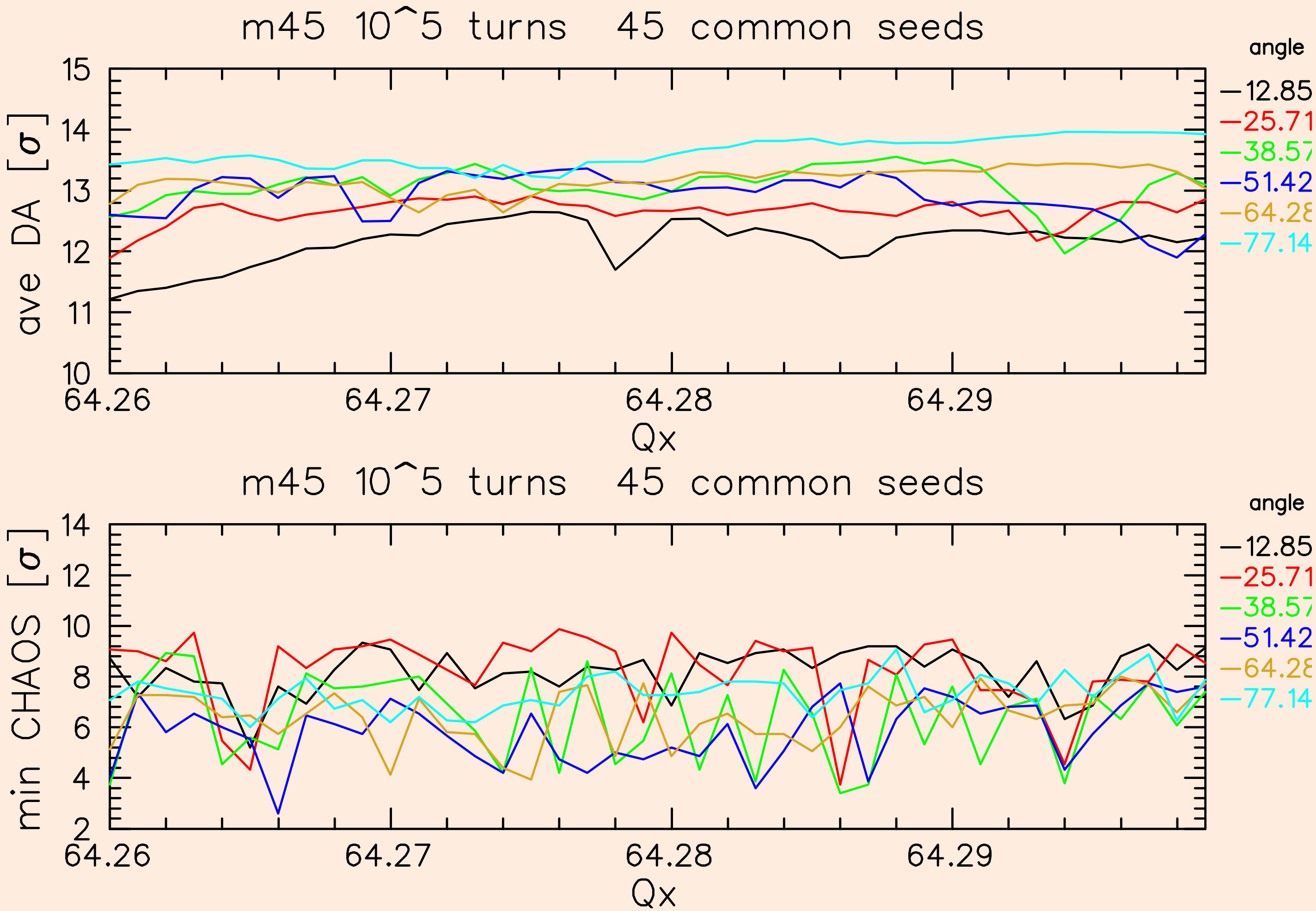
1 Collisions for beta*=11m; 450 GeV



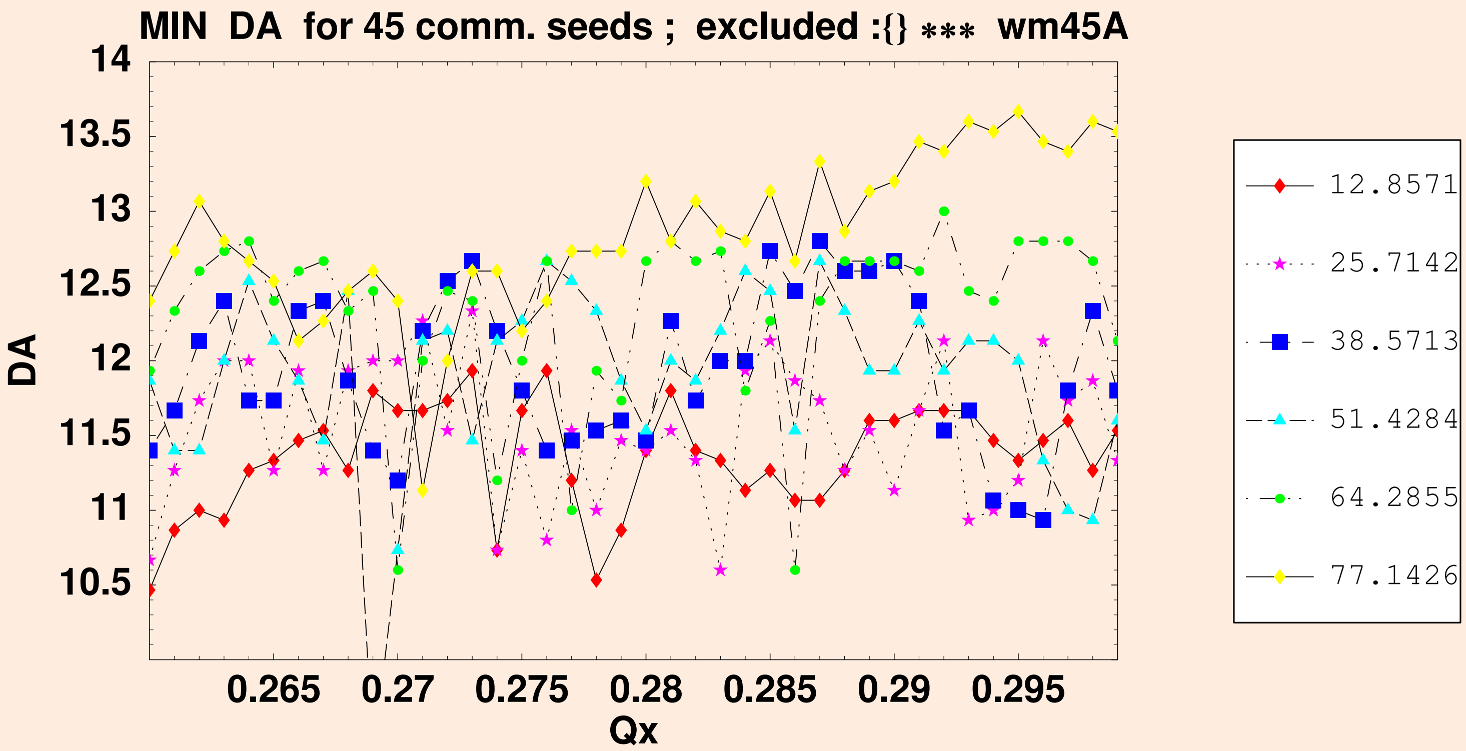
- **Take only the common seeds.**
- **TUNESCAN Qx=(0.26 – 0.30) step=0.001.**
- **All errors ON**

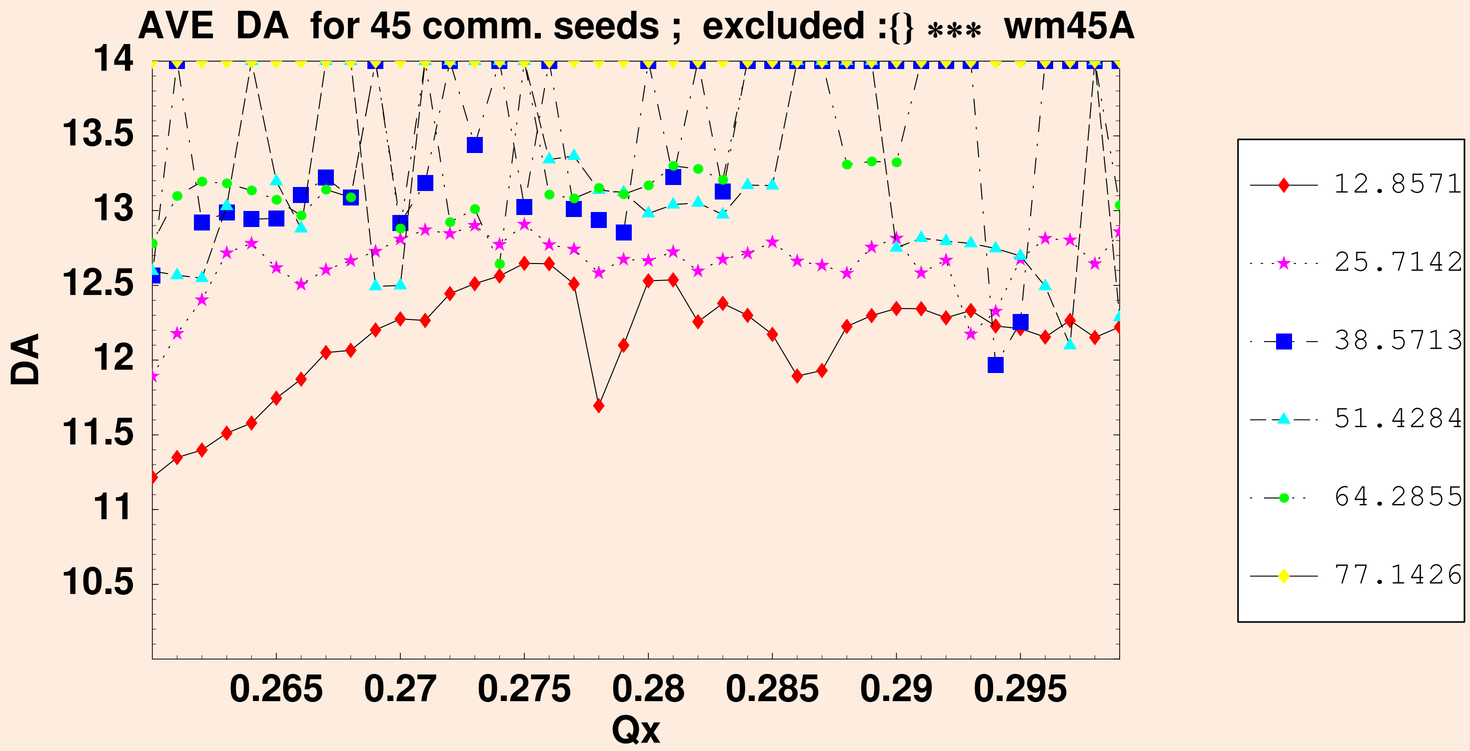


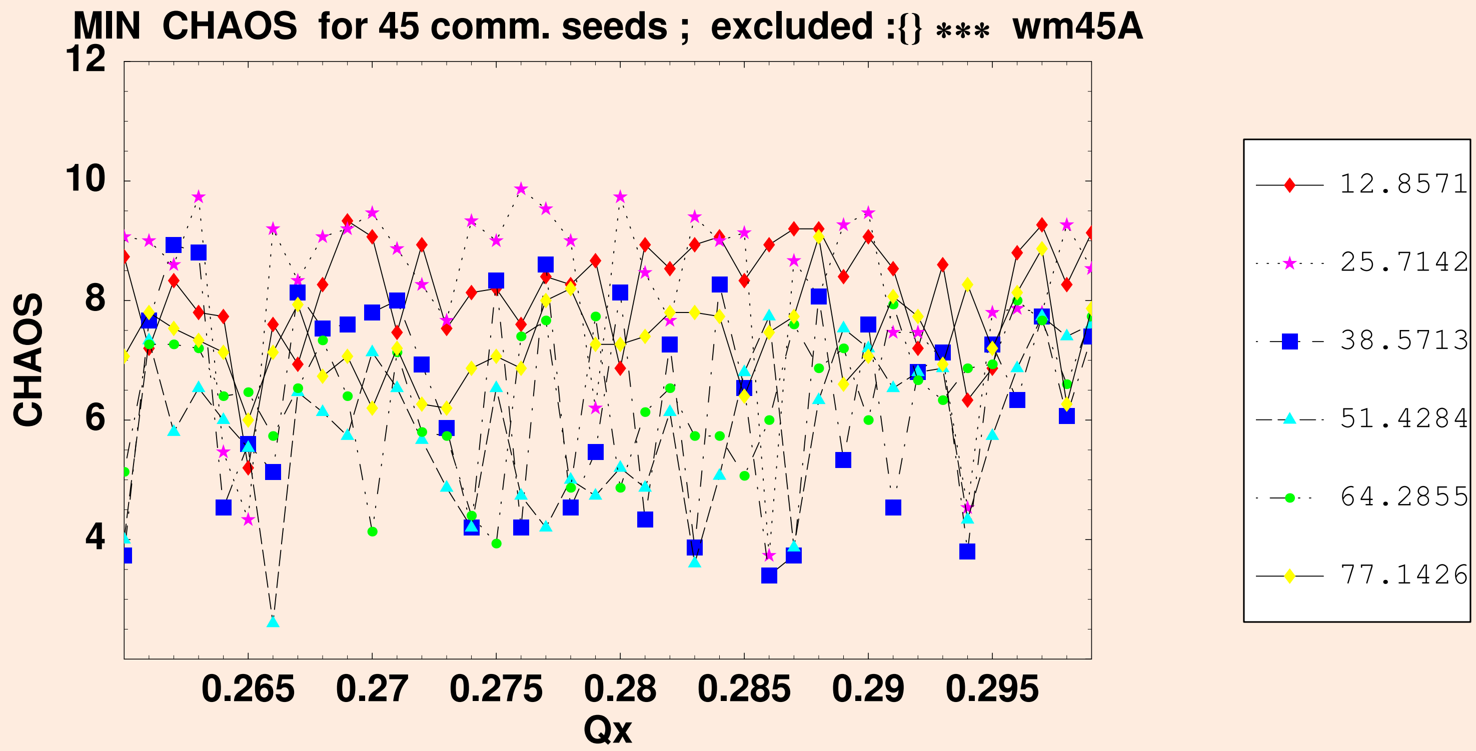
- **average DA and border of chaos**



- repeat the same plots (different tool)
- resonance dip best seen on the AVE-DA plot




AVE DA for 45 comm. seeds ; excluded :{} *** wm45A
DA
Qx
14
13.5
13
12.5
12
11.5
11
10.5
0.265
0.27
0.275
0.28
0.285
0.29
0.295
12.8571
25.7142
38.5713
51.4284
64.2855
77.1426


MIN CHAOS for 45 comm. seeds ; excluded :{} *** wm45A
CHAOS
Qx
12
10
8
6
4
0.265
0.27
0.275
0.28
0.285
0.29
0.295
12.8571
25.7142
38.5713
51.4284
64.2855
77.1426

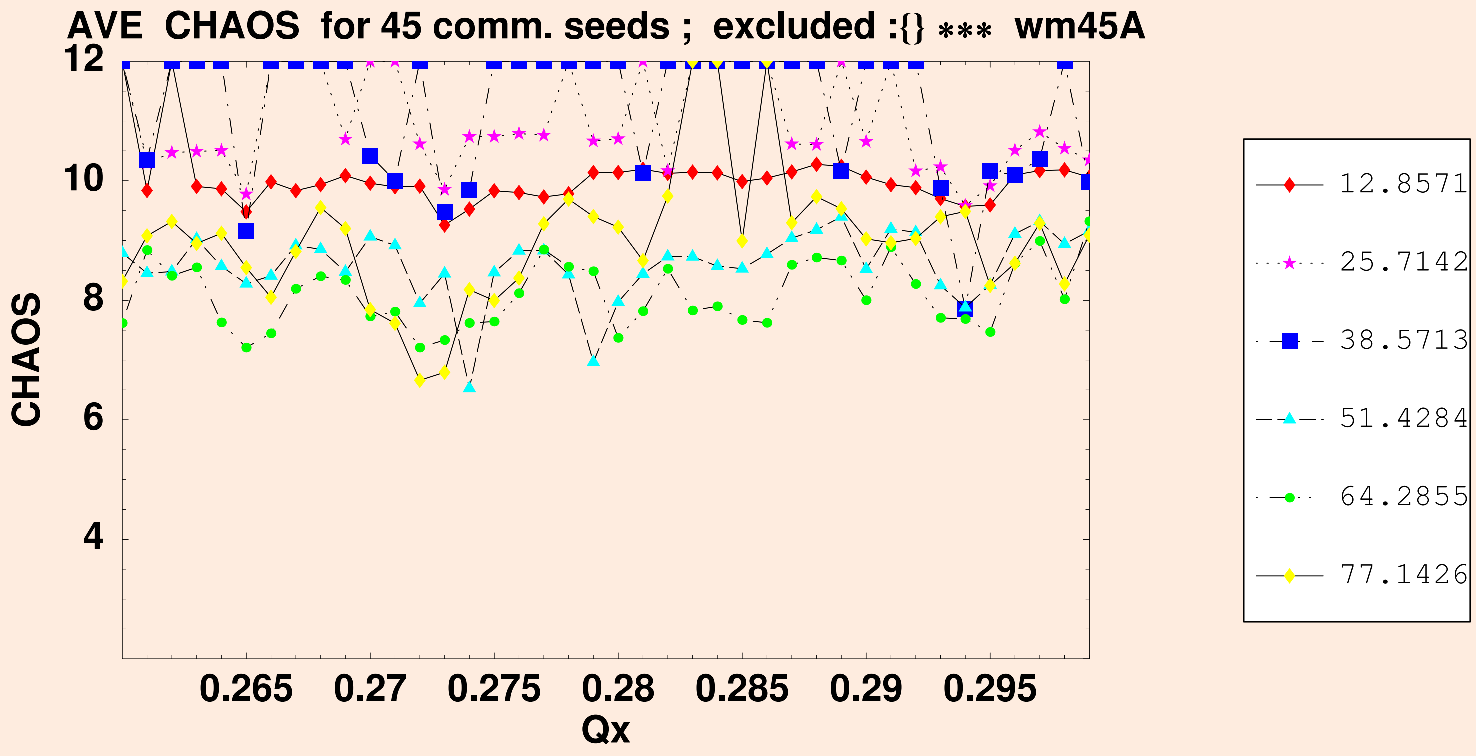
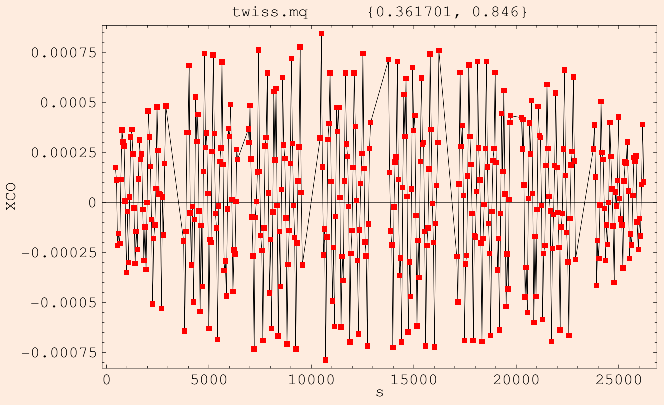

AVE CHAOS for 45 comm. seeds ; excluded :{} *** wm45A
CHAOS
Qx
12
10
8
6
4
0.265
0.27
0.275
0.28
0.285
0.29
0.295
12.8571
25.7142
38.5713
51.4284
64.2855
77.1426

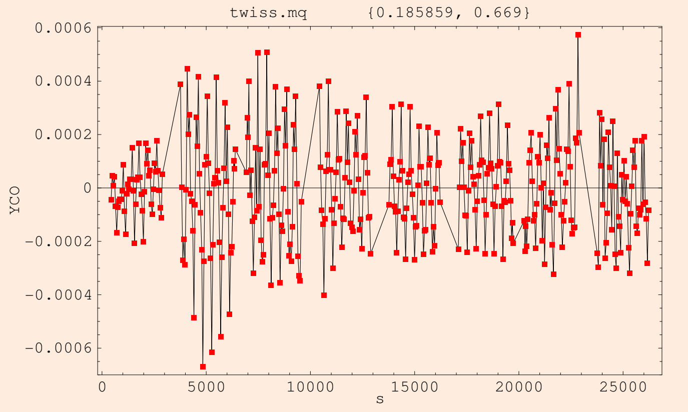
Table:

partially corrected orbit (poc) data for seed 1

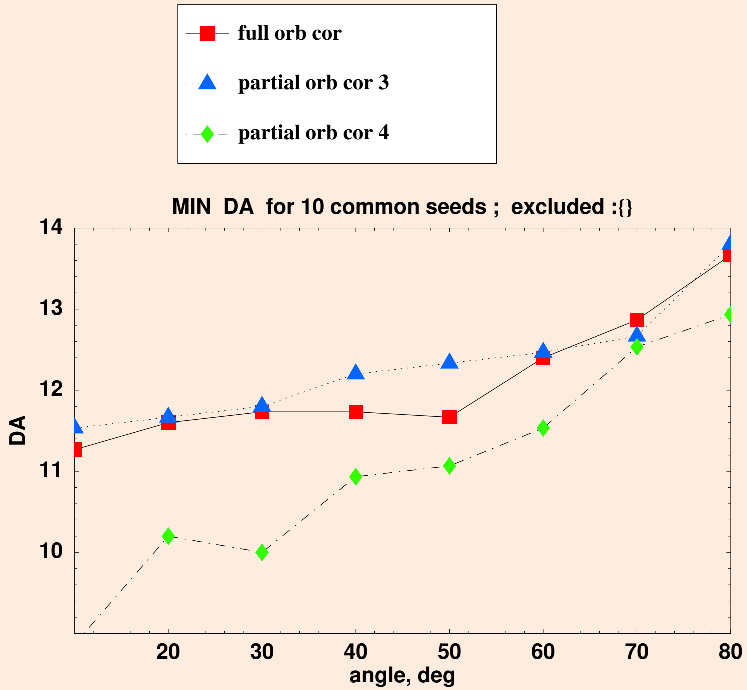
over main quads and bends

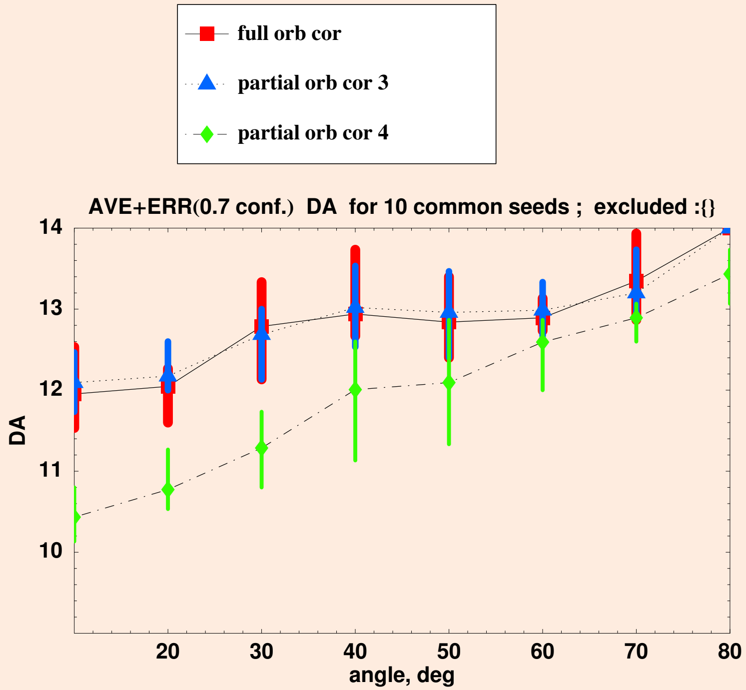
		full	poc1	poc2	poc3	poc4
		rms/max, mm				
MQ	X	.05 / .19	.07 / .22	0.08 /0.216	0.36 / 0.846	1.5 / 6.5
	Y	.05 / .25	.057/ .286	0.06 / 0.282	0.18 / 0.669	1.3 / 8
MB	X	0.05 /0.4	0.07 /0.36	0.08 / 0.314	0.32 / 0.75	1.3 / 5.5
	Y	0.05 /0.4	0.06 /0.42	0.06 / 0.414	0.16 / 0.66	1.2 / 6.9



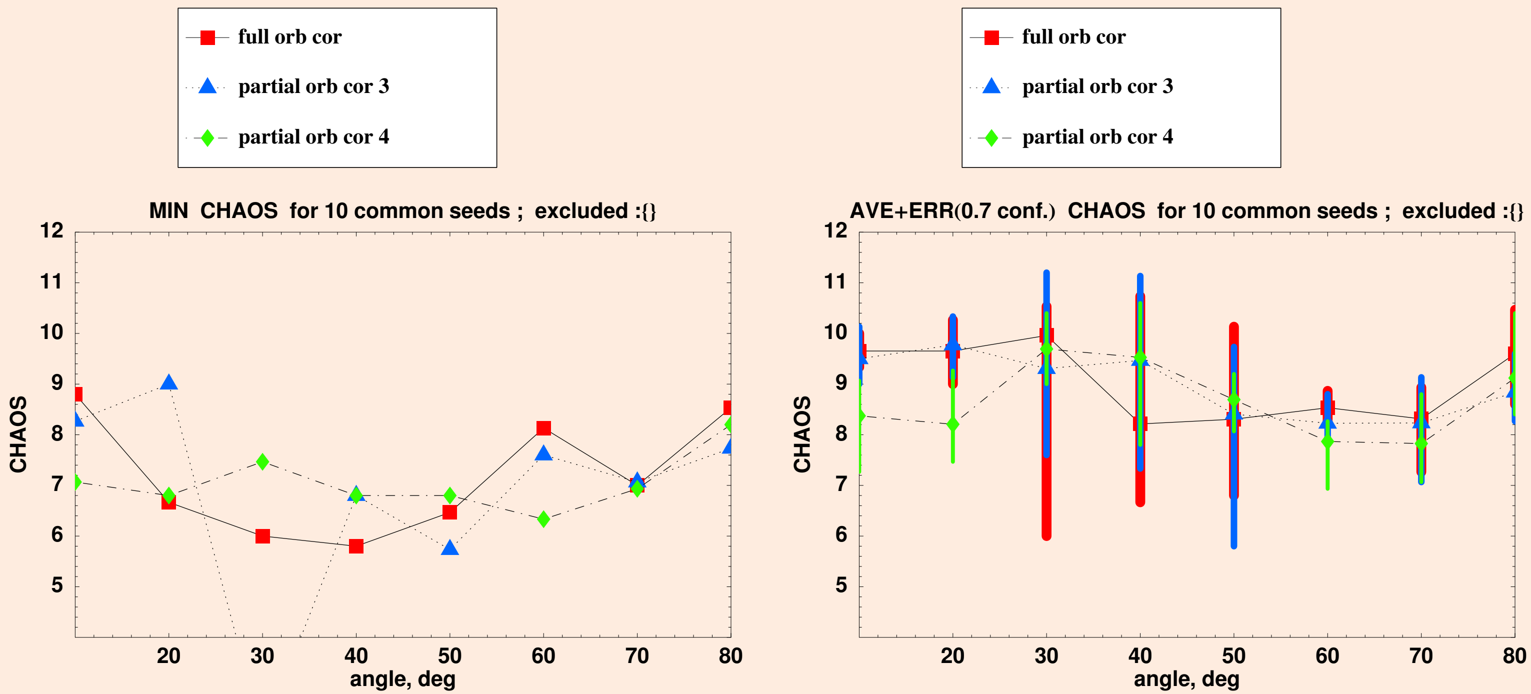


- only partial orb corr 4 has an effect (see Table for seed 1)
- 10 seeds

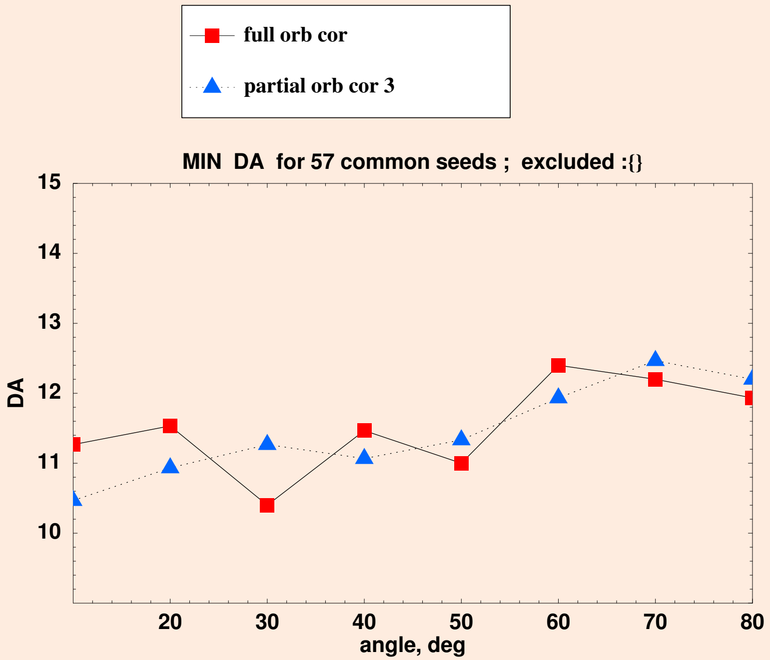


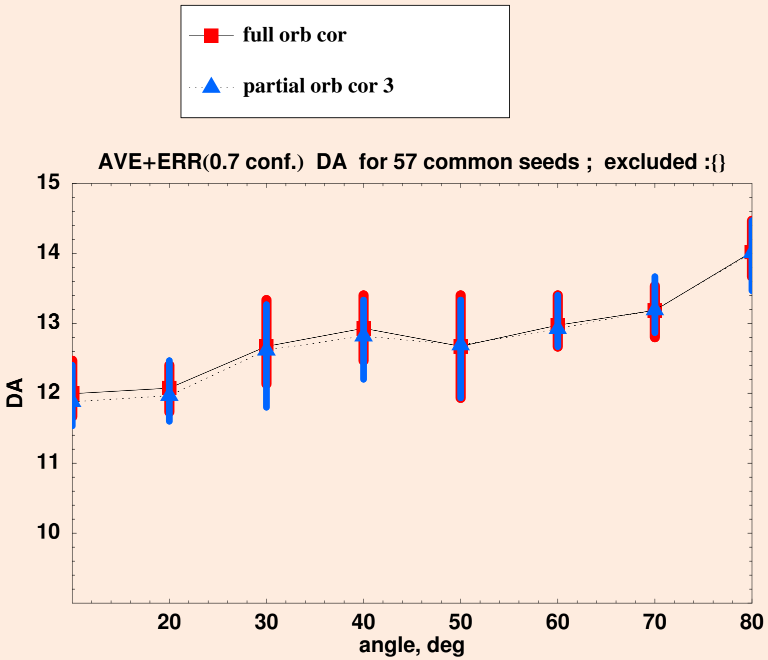


1 Collisions for beta*=11m; 450 GeV

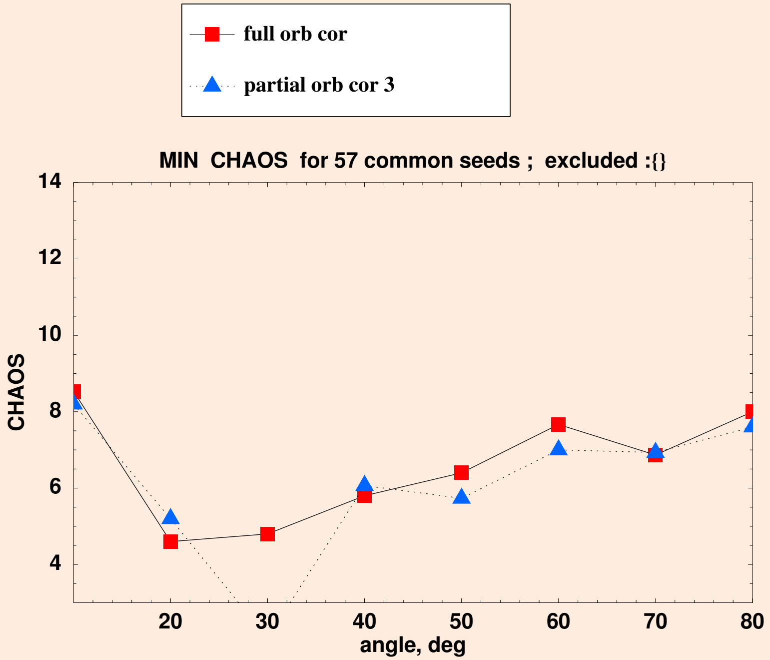


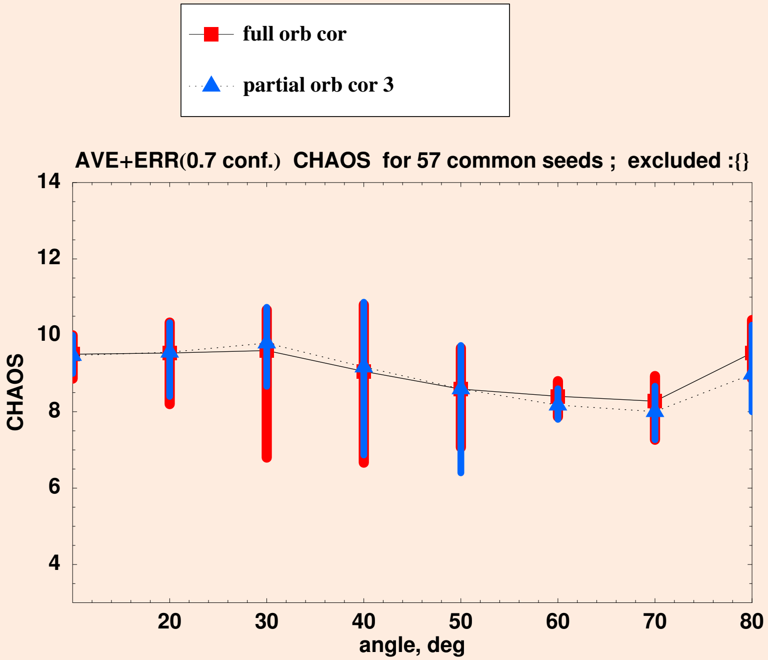
- partial orb corr 3 has no effect even for 60 seeds
- 60 seeds



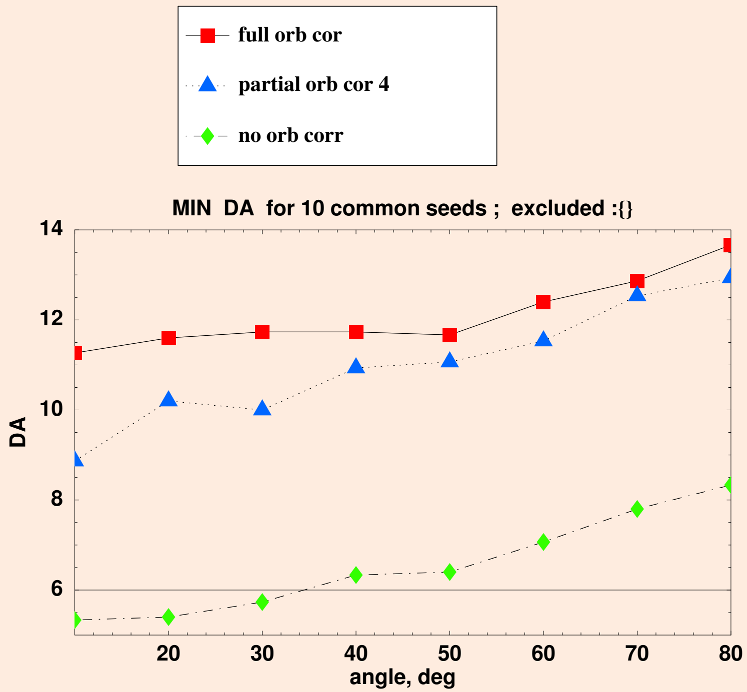


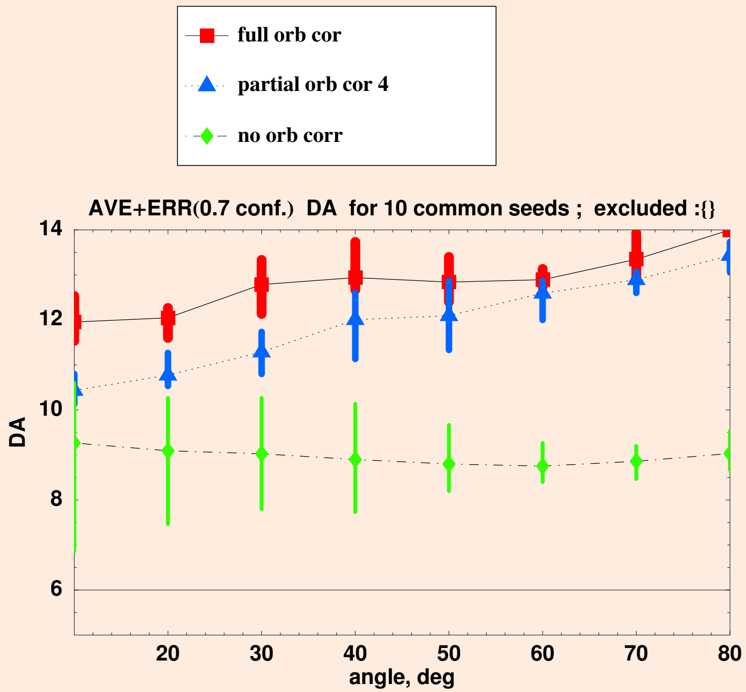
1 Collisions for beta*=11m; 450 GeV



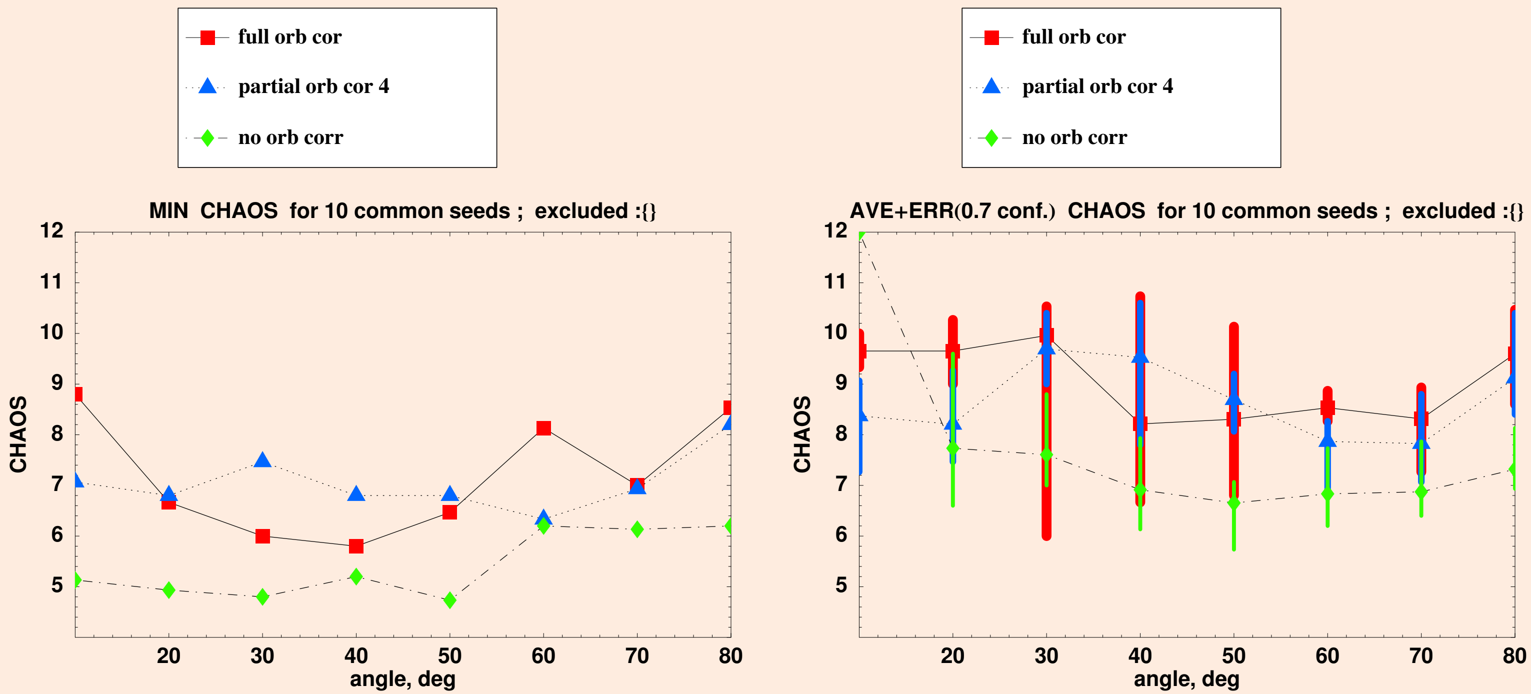


- without orbit correction

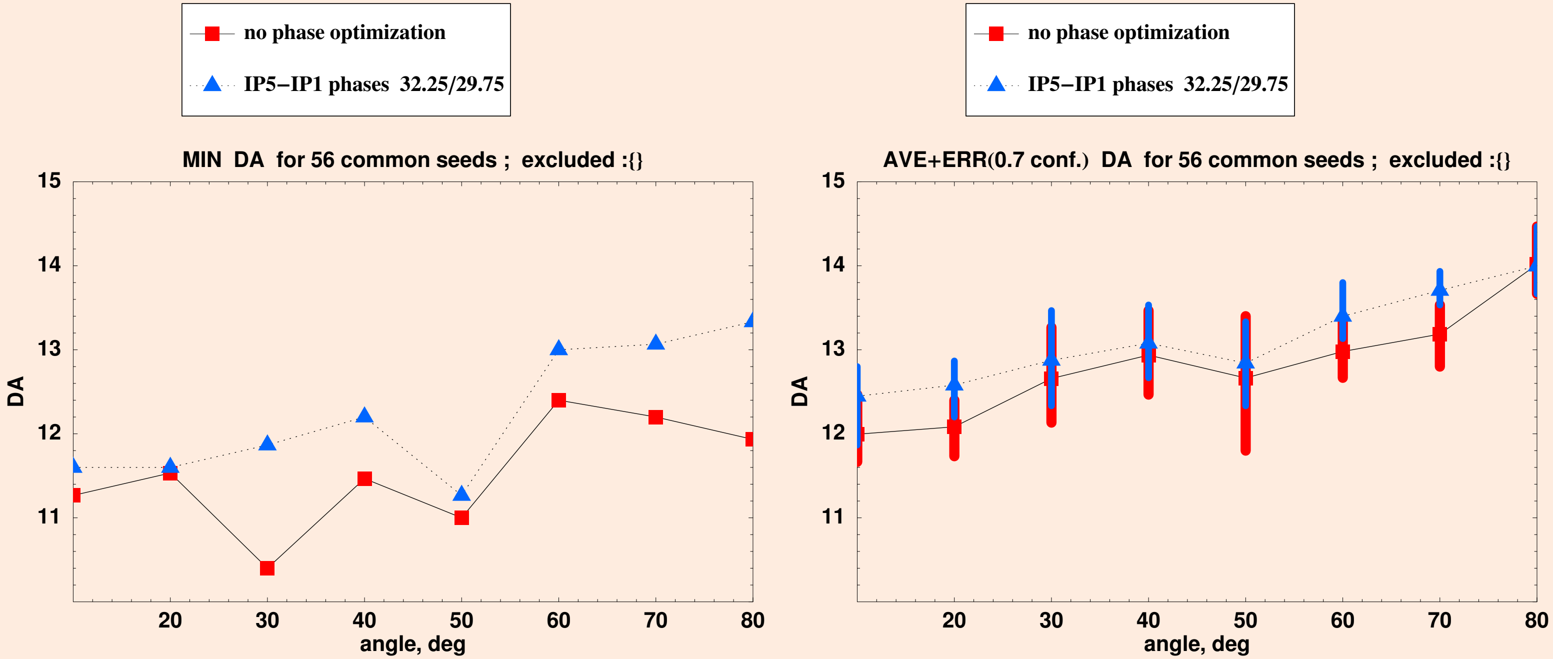


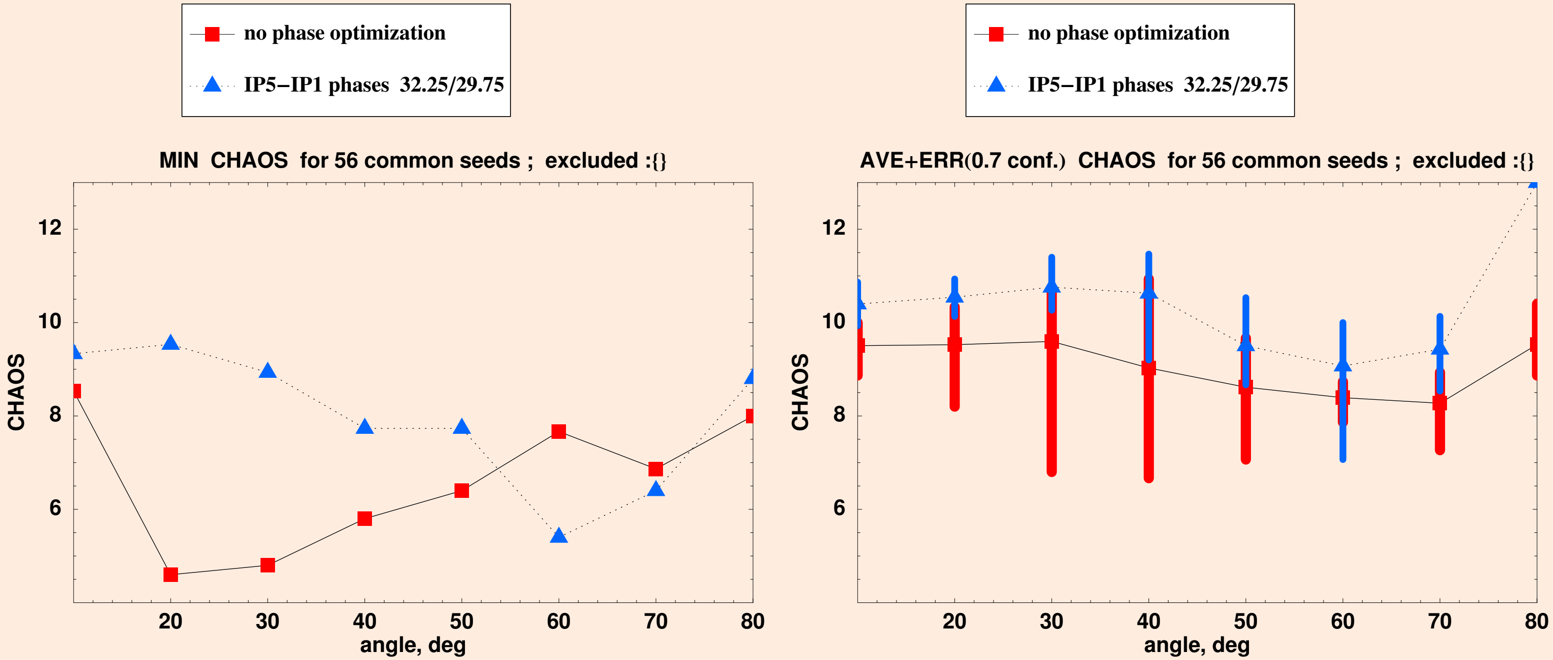


1 Collisions for beta*=11m; 450 GeV



- Effect of setting phase adv. IP5-IP1 to $\Delta\nu_x = \frac{1}{2}\pi$, $\Delta\nu_y = \frac{3}{2}\pi$
- by rematching IR7 and IR3; aperture- and strength- limits kept; spoiled collim. conditions in IR7 only)
- small effect, positive for all angles ; 56 seeds; MIN CHAOS much improved!,




no phase optimization
IP5−IP1 phases 32.25/29.75
MIN CHAOS for 56 common seeds ; excluded :{}
CHAOS
angle, deg
12
10
8
6
20
30
40
50
60
70
80
no phase optimization
IP5−IP1 phases 32.25/29.75
AVE+ERR(0.7 conf.) CHAOS for 56 common seeds ; excluded :{}
CHAOS
angle, deg

2 Squeeze at 7 TeV

$0.4 \times 10^{11} p/b$

Beam-Beam $=$ ON

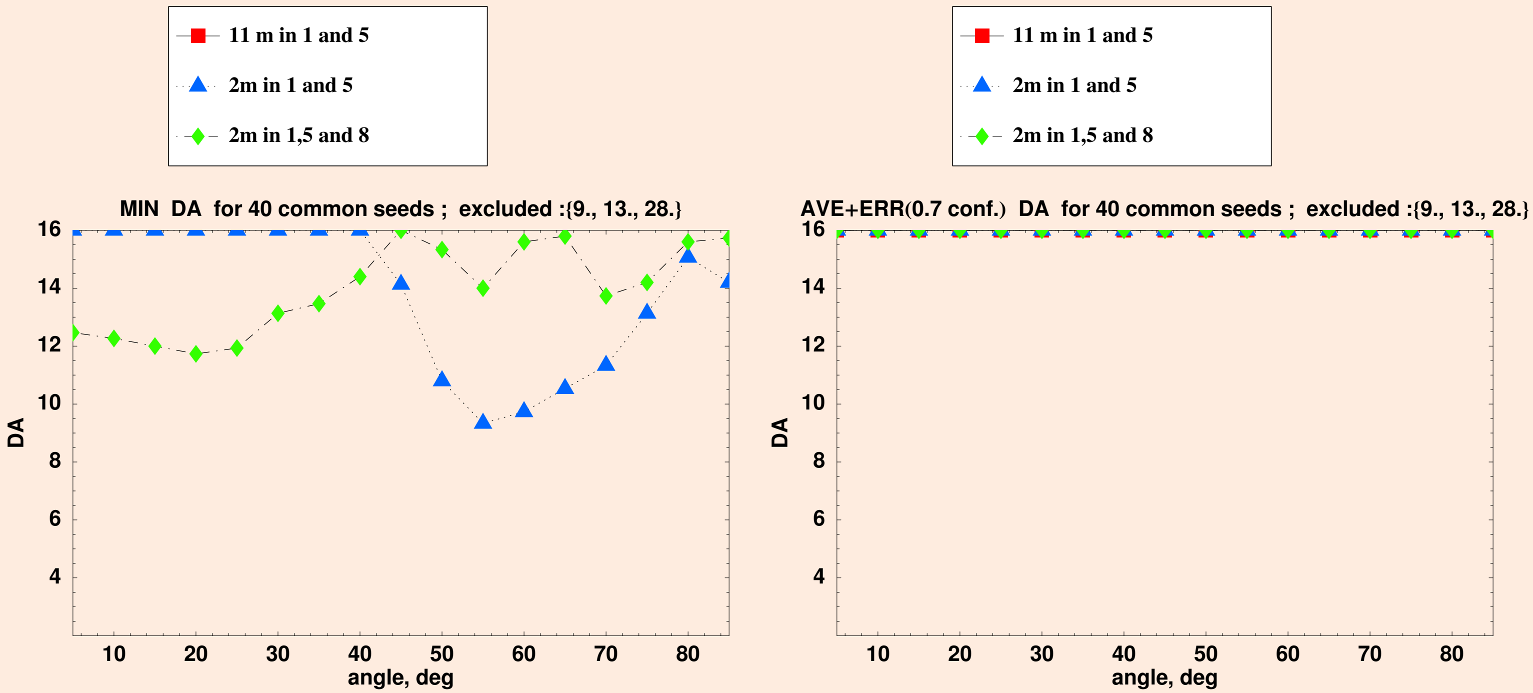
cross-ang=OFF

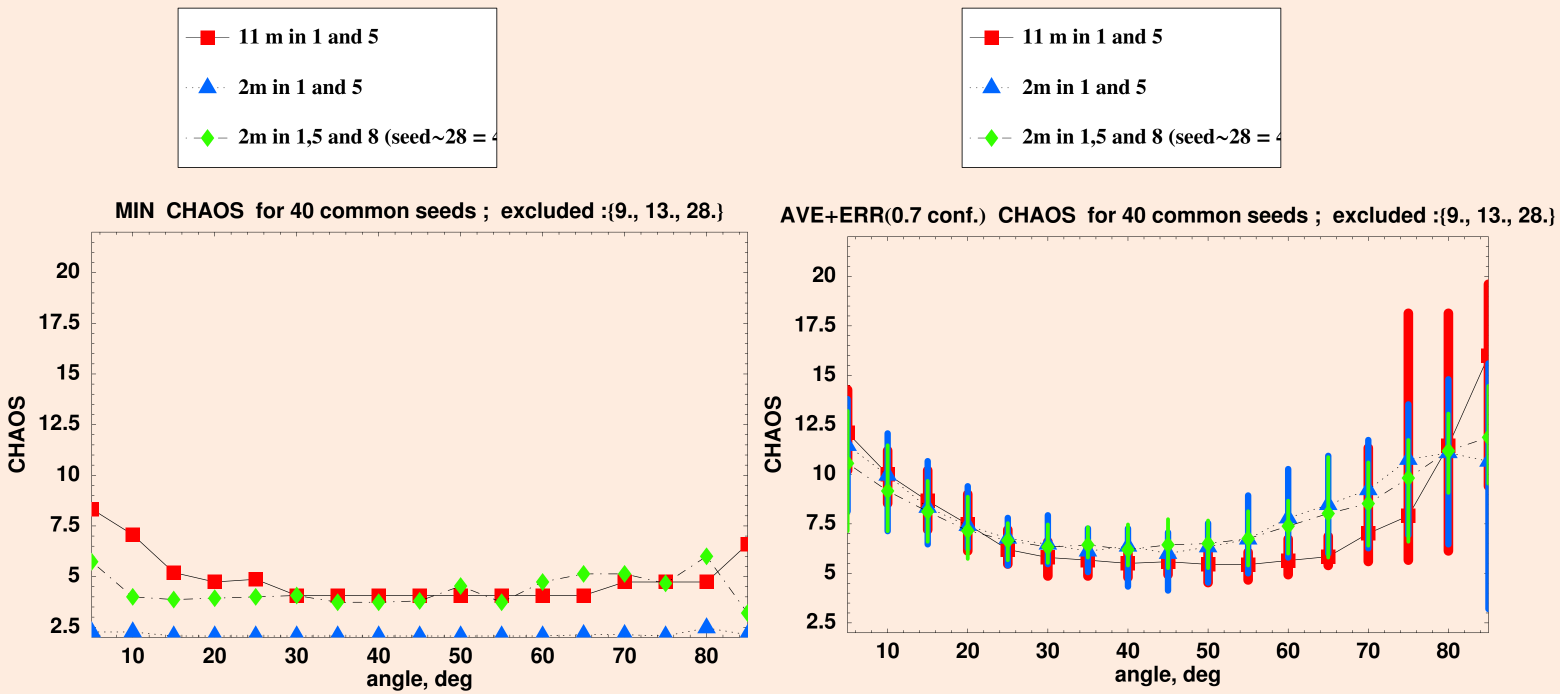
coupl corr $=$ ON

10^6 turns

full orbit correction

- effect of squeeze from 11m to 2m and then squeeze IP8 to 2m
- 7 TeV; 10^6 turns; what's above 16σ is not studied
- 43 seeds returned; seeds 9, 13, 28 excluded




11 m in 1 and 5
2m in 1 and 5
2m in 1,5 and 8 (seed~28 =
MIN CHAOS for 40 common seeds ; excluded :{9., 13., 28.}
CHAOS
angle, deg
11 m in 1 and 5
2m in 1 and 5
2m in 1,5 and 8 (seed~28 =
AVE+ERR(0.7 conf.) CHAOS for 40 common seeds ; excluded :{9., 13., 28.}
CHAOS
angle, deg