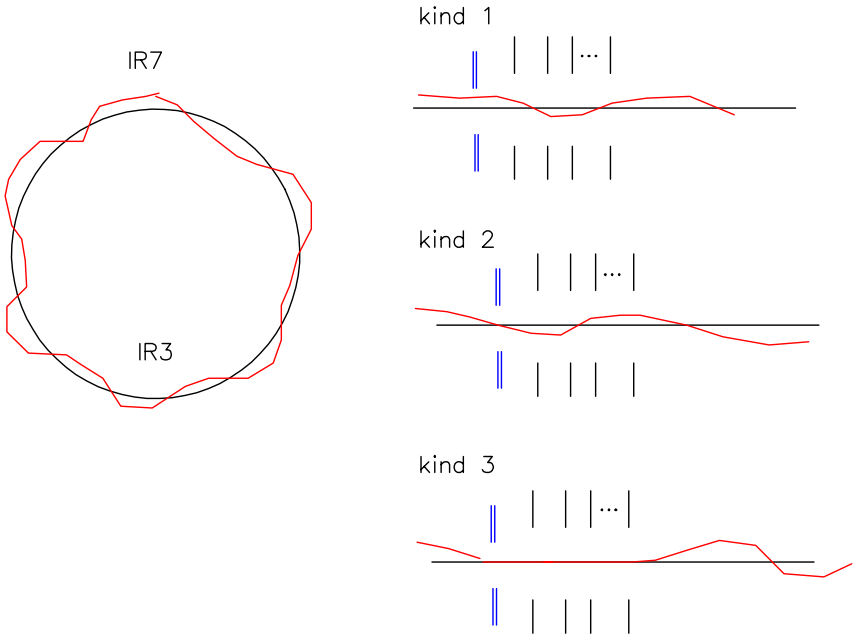
200-300 turn tracking of the halo created by the IR7 primary coll-r in presence of IR3 plus sample uncorrected closed orbit (kind 1)



- fast: **use counter of events:** event = a halo particle crosses QF (or QD) quad at dist.

$$x, x + \Delta x$$

  w.r.t. chamber axis (also y and $r = \sqrt{x^2 + y^2}$)

- exact: **set ap. limit** in all QF, QD and compute inefficiency $N_{lost\ at\ apert\ lim.}/N_{total\ at\ start}$

two sample misaligned closed orbits with nearly equal rms and max. values in both planes (horizontal is computed at QFs, and vertical at QDs)

– **"moderate" uncorrected closed orbit (CO1)**

– **"large" uncorrected closed orbit (CO2)**

Excursions $[mm]$**:**

	CO1	CO2
RMS at the arc quadrupoles	0.7	1.8
MAX at the arc quadrupoles	1.2	2.5
MAX at the IR7 collimators	1	3

procedure

- Two initial on-momentum zero-size beams (10^4 part. each) are generated at IR7 entrance normalized centroid coordinates $(x, y) = (6.0002, 0)$ and $(0, 6.0002)$.
- these 2 beams tracked until all part. lost
- Normalise the bin populations. The ratio of number of QF (QD) crossings occurring in the intervals $(x, x + \Delta x)$, $(y, y + \Delta y)$, $(r, r + \Delta r)$ vs total of particles $\times$ life-turns $\times$ QF-quads.

$$P = \frac{N^{quad-crossings}(x, x + \Delta x)}{N^{last\ lost} N_{QF}}$$

- it seems such P only weakly depends on initial halo and length of primaries (here we take Al and $L_{prim} = 0.05\ m$)

P IN UNITS $[10^{-2}]$ $\quad L_{prim} = 5\ cm$

coord. $[mm]$ $\rightarrow$		8-11	11-14	14-17	17-20	>20
Ideal system ($N^{last\ lost}$ >300)						
QFs	r	0.022	0.002	0.001	0.001	**0.004**
	x	0.002	0.000	0.000	0.000	0.002
	y	0.001	0.000	0.000	0.000	0.000
QDs	r	0.028	0.002	0.001	0.001	0.003
	x	0.000	0.000	0.000	0.000	0.001
	y	0.012	0.001	0.001	0.000	0.001
CO1 ($N^{last\ lost}$=143)						
QFs	r	21.518	0.092	0.047	0.032	**0.172**
	x	10.495	0.021	0.012	0.009	0.060
	y	0.023	0.008	0.004	0.003	0.015
QDs	r	7.614	0.134	0.064	0.036	0.144
	x	0.016	0.009	0.006	0.005	0.026
	y	3.754	0.059	0.027	0.015	0.047
CO2 ($N^{last\ lost}$ =57)						
QFs	r	18.590	4.796	0.505	0.329	**1.089**
	x	9.452	2.200	0.137	0.074	0.212
	y	0.191	0.122	0.077	0.055	0.215
QDs	r	18.833	3.609	0.291	0.226	1.300
	x	0.095	0.041	0.021	0.015	0.054
	y	9.643	1.492	0.129	0.095	0.581
CO2 with artificial limit $\delta < 0.0005$ ($N^{last\ lost}$=76)						
QFs	r	19.421	4.509	0.018	0.011	**0.038**
	x	9.852	2.060	0.004	0.004	0.009
	y	0.007	0.005	0.003	0.002	0.010
QDs	r	19.301	3.365	0.017	0.012	0.048
	x	0.004	0.001	0.001	0.001	0.002
	y	9.965	1.385	0.008	0.005	0.023
CO2, but IR3 secondary are black ($N^{last\ lost}$= 80)						
QFs	r	19.2	4.5	0.1	0	**0.22**
	x	9.6	2.0	0	0	0.09
	y	0.2	0.	0	0	0
QDs	r	19.3	3.4	0.1	0.1	0.18
	x	0.1	0.	0	0	0.04
	y	9.9	1.4	0	0	0.05

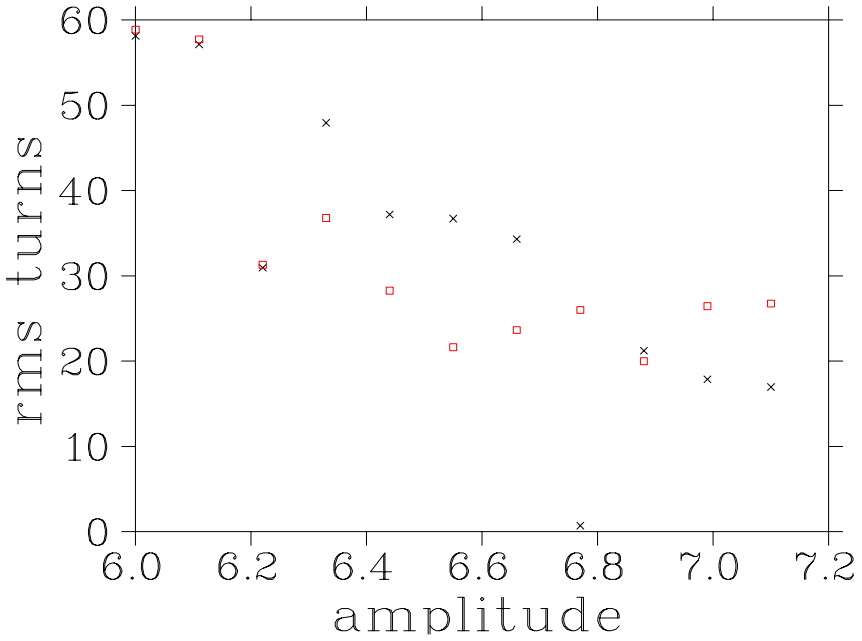
$P[\%] \quad L_{prim} = 2.5\ cm$

coord. $[mm]$ $\rightarrow$		8-11	11-14	14-17	17-20	>20
CO1 ($N^{last\ lost}$=137)						
QFs	r	18.358	0.088	0.046	0.028	0.153
	x	8.925	0.021	0.013	0.008	0.057
	y	0.021	0.007	0.005	0.003	0.011
QDs	r	8.778	0.125	0.066	0.041	0.128
	x	0.014	0.010	0.007	0.005	0.023
	y	4.334	0.056	0.029	0.019	0.038
CO2 ($N^{last\ lost}$=39)						
QFs	r	15.911	4.104	0.408	0.271	0.876
	x	8.149	1.888	0.114	0.058	0.164
	y	0.142	0.094	0.069	0.051	0.174
QDs	r	23.100	3.525	0.240	0.182	1.021
	x	0.076	0.035	0.017	0.011	0.036
	y	11.839	1.435	0.102	0.079	0.461
CO2 with artificial limit $\delta < 0.0005$ ($N^{last\ lost}$=120)						
QFs	r	16.021	3.761	0.020	0.007	0.034
	x	8.183	1.714	0.004	0.003	0.009
	y	0.008	0.004	0.002	0.002	0.008
QDs	r	23.493	3.367	0.020	0.012	0.047
	x	0.003	0.002	0.001	0.002	0.002
	y	12.108	1.369	0.009	0.005	0.022

DIMAD + TDRIVE (I.Baichev)

- DIMAD now includes the basic module of LDRIVE (LDRIVE source, help and test routines prov. by Igor Baichev)
- LHC V6.3 Beam 1 lattice (line fmt) into DIMAD – larger size of common blocks
- new COLLIMATOR element; new `SET COLLIMATOR` operation. Some features include 3 kinds coll-r material; adiabatic plunge of collimator (slow halo drift); flags for retraction of individ. coll. or groups (like all in IR3, or IR7)
- MOVEMENT oper of DIMAD to find c.o. (by tracking of 10 test particles in the 2-order DIMAD=TRANSPORT map + kicks, if any; + field errors, if any)
- BEAM + GENERATE operations to gen. arbitrary 6D beam
- TRACK to track
- the multiturn "DJ" window (black collimators) now autom. computed with DIMAD

rms number of turns needed to reach some amplitude with and without collimators



- collimators are at n1=6 n2=7
- look at RMS: above n2 diffusion is larger with collimatrs than without
- look at MAX: above n2 max number turns less different

horizontal zero-size beam only (better seen the difference)

```
total lost in coll-s   100
total surv      0
total halo    100 trop.gt.0 =>       0lost w/win dpplim QFs QDs =>     21    79     0     0
turn1 turn2      1     6     5
 tot part x trns ipjaw (for darb 5)   302
 tot part x trns QF quads 39592
 tot part x trns QD quads 39592
 tot  part x trns ipjaw (for darb 6)  0


 Ampl:   coll. name      p x t            8.0      11.0      14.0      17.0      20.0
     1    TCPA             302       205        97         0         0         0         0
     1    TCPA               0       297         5         0         0         0         0
     1    TCPA               0       302         0         0         0         0         0

Coord:   coll. name   q x p x t         0.0080    0.0110    0.0140    0.0170    0.0200
     2    QF quads       39592     27875     11717         0         0         0         0
     2    QF quads           0     33828      5764         0         0         0         0
     2    QF quads           0     39592         0         0         0         0         0
     3    QD quads       39592     39592         0         0         0         0         0
     3    QD quads           0     39592         0         0         0         0         0
     3    QD quads           0     39592         0         0         0         0         0

total lost in coll-s   100
total surv      0
total halo    100 trop.gt.0 =>       0lost w/win dpplim QFs QDs =>     29    71     0     0
turn1 turn2      1    10     9
 tot part x trns ipjaw (for darb 5)   217
 tot part x trns QF quads 23324
 tot part x trns QD quads 23324
 tot  part x trns ipjaw (for darb 6)  0

 Ampl:   coll. name      p x t            8.0      11.0      14.0      17.0      20.0
     1    TCPA             217       133        82         2         0         0         0
     1    TCPA               0       183        34         0         0         0         0
     1    TCPA               0       217         0         0         0         0         0

Coord:   coll. name   q x p x t         0.0080    0.0110    0.0140    0.0170    0.0200
     2    QF quads       23324     16495      6395       156        47        36       195
     2    QF quads           0     20296      2890        20        21        10        87
```

2	QF quads	0	23289	6	4	11	12	2
3	QD quads	23324	22931	158	65	38	29	103
3	QD quads	0	23238	23	14	15	5	29
3	QD quads	0	23189	70	12	17	2	34