

Other resplitting algorithms: Methods 1,3,5

RECUT_KIND7_ONE(FIBRE,LMAX0,DRIFT)

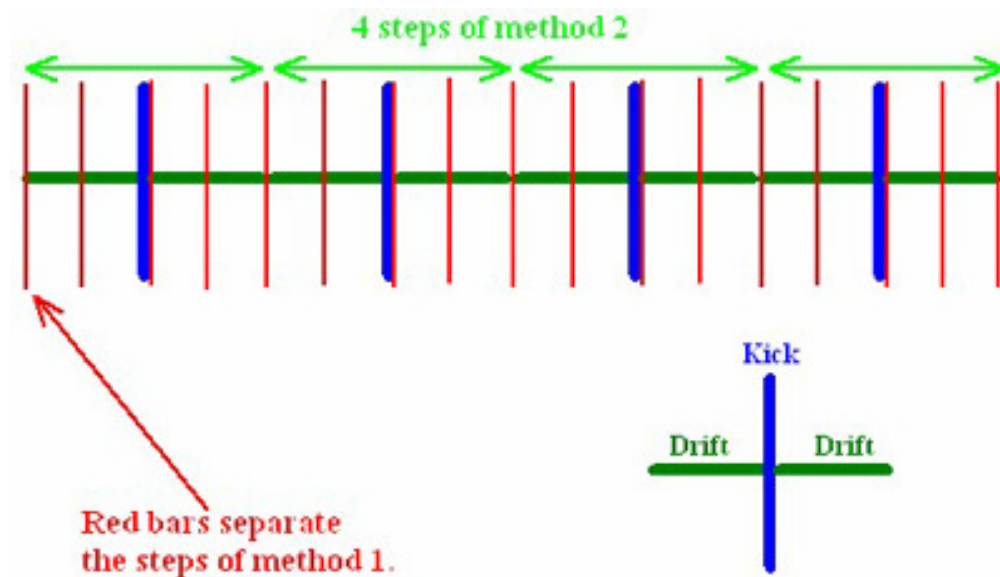
In the presence of space charge or for other reasons, it may be more important to observe the beam at many locations “approximately” than to use a high order integration method.

PTC provides a so-called method 1 for certain magnets.

Drift-kick-drift: strict Talman interpretation

For this type of algorithm, the `exact_model = true` and the `exact_model = false` can be switched into method 1 *if and only if* the original method was method 2, i.e., second order integrator. Basically negative propagators (drifts) are not acceptable: this is the strict Talman interpretation to which PTC does not adhere except in the case of switching to method 1.

Let us look pictorially at an example:



The original drift-kick-drift appeared as green-blue-green crosses. The are 4 steps. The new method 1 split is simply a resplitting of the drifts. Obviously the results should be the same to machine precision.

Example with the 36 degrees bend of the PSR (Los Alamos) :

```
BE = SBEND("B", 2.54948D0, TWOPI*36.D0/360.D0);
X=0.001D0
CALL TRACK(BE,X,DEFAULT)
WRITE(6,*) BE%MAG%P%METHOD,BE%MAG%P%NST
WRITE(6,*) X
CALL RECUT_KIND7_ONE(BE,2.54948D0/16,.FALSE.)
X=0.001D0
CALL TRACK(BE,X,DEFAULT)
WRITE(6,*) BE%MAG%P%METHOD,BE%MAG%P%NST
WRITE(6,*) X
X=0.001D0
CALL ALLOC(Y)
Y=X
CALL TRACK(BE,Y,DEFAULT)
X=Y
WRITE(6,*) BE%MAG%P%METHOD,BE%MAG%P%NST
WRITE(6,*) X
PAUSE 888
```

Integration results are:

2	4	←----- ! ORIGINAL METHOD AND # OF STEPS
3.962104445927857E-003	1.253543855340728E-003	3.546933066933068E-003
1.000000000000000E-003	1.000000000000000E-003	2.523695791724136E-003
1	16	
3.962104445927856E-003	1.253543855340728E-003	3.546933066933066E-003
1.000000000000000E-003	1.000000000000000E-003	2.523695791724136E-003
1	16	
3.962104445927856E-003	1.253543855340728E-003	3.546933066933066E-003
1.000000000000000E-003	1.000000000000000E-003	2.523695791724136E-003

A larger of steps for method 1 does not change the accuracy!

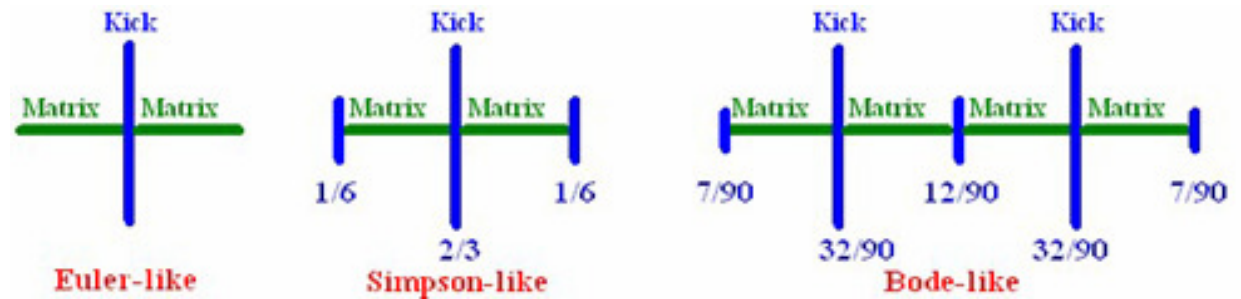
Matrix-Kick-Matrix

Methods 2,4, 6 switching to methods 1,3 and 5 **Exact_model=.FALSE.**

PTC also has a matrix-kick-matrix method where the matrix is energy independent. The delta dependence is buried in the kick.

Our comments here will apply to `exact_model=false`.

The method of integration 2, 4 and 6 always split the integration step using matrices of equal length.



The various methods (2,4,6) are depicted above. These methods are the so-called biased methods. Although they exist in accelerators since the days of SSC, they have been discussed recently at length by McLachlan and also by Laskar and Robutel.

In accelerators, they have the advantage of producing the “exact” tune for a typical ideal machine. The effect of the matrix on the kicks is of order 2,4 or 6 although all three methods are truly 2nd order integrators strictly speaking--- the word biased refers to this uneven way of ordering the perturbation due to the kicks Hamiltonian that produced the matrices.

Let us retry the above example with the Bode-like integrator:

```

6          4 ←----- ! ORIGINAL METHOD AND # OF STEPS
3.966179536791447E-003  1.252157150179758E-003  3.546933066933068E-003
1.000000000000000E-003  1.000000000000000E-003  2.529326133576445E-003

5          16
3.966179536791447E-003  1.252157150179758E-003  3.546933066933068E-003
1.000000000000000E-003  1.000000000000000E-003  2.529326133576445E-003

5          16

```

```
3.966179536791447E-003  1.252157150179758E-003  3.546933066933068E-003  
1.000000000000000E-003  1.000000000000000E-003  2.529326133576445E-003
```

N.B. Exact_model=true only works with straight element if the matrix-kick-matrix method (kind7) is selected. Please be aware. Bends should be of the drift-kick-drift (method 2) is exact_model is true.

Drifts

Drifts can also be cut using:

```
CALL RECUT_KIND7_ONE(D1,0.45D0/16.D0,.TRUE.)
```

Recutting the entire attices

```
RECUT_KIND7(LAYOUT,LMAX0,DRIFT)
```

This routine simply applies RECUT_KIND7_ONE over the entire layout.