```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i0 R=3 i=0
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,0) =   0.785398

.....................................
* A: the leaf optimal path  R=3 i=0
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=118097

path type : leafmin
dp= 0 th=  0.785398 +7.8539816340e-01 br= 0  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=0
.....................................
level min node : depth=  0 theta= +7.853982e-01 id=0
level min node : depth=  1 theta= +0.000000e+00 id=1
level min node : depth=  2 theta= +0.000000e+00 id=5
level min node : depth=  3 theta= +0.000000e+00 id=17
level min node : depth=  4 theta= +0.000000e+00 id=53
level min node : depth=  5 theta= +0.000000e+00 id=161
level min node : depth=  6 theta= +0.000000e+00 id=485
level min node : depth=  7 theta= +0.000000e+00 id=1457
level min node : depth=  8 theta= +0.000000e+00 id=4373
level min node : depth=  9 theta= +0.000000e+00 id=13121
level min node : depth= 10 theta= +0.000000e+00 id=39365
level min node : depth= 11 theta= +0.000000e+00 id=118097

* global min node : depth=  1 theta= +0.000000e+00 id=1

path type : globalmin
dp= 0 th=  0.785398 +7.8539816340e-01 br= 0  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=0
.....................................
* cordic min node : depth= 11 theta= +0.000000e+00 id=118096

path type : cordic
dp= 0 th=  0.785398 +7.8539816340e-01 br= 0  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i1 R=3 i=1
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
ternary angle tree search (N=12)
theta= atan(pow(2,-1) =   0.463648

.....................................
* A: the leaf optimal path  R=3 i=1
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=157463

path type : leafmin
dp= 0 th=  0.463648 +4.6364760900e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.463648 +4.6364760900e-01 br= 0  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=1
.....................................
level min node : depth=  0 theta= +4.636476e-01 id=0
level min node : depth=  1 theta= -3.217506e-01 id=1
level min node : depth=  2 theta= +0.000000e+00 id=7
level min node : depth=  3 theta= +0.000000e+00 id=23
level min node : depth=  4 theta= +0.000000e+00 id=71
level min node : depth=  5 theta= +0.000000e+00 id=215
level min node : depth=  6 theta= +0.000000e+00 id=647
level min node : depth=  7 theta= +0.000000e+00 id=1943
level min node : depth=  8 theta= +0.000000e+00 id=5831
level min node : depth=  9 theta= +0.000000e+00 id=17495
level min node : depth= 10 theta= +0.000000e+00 id=52487
level min node : depth= 11 theta= +0.000000e+00 id=157463

* global min node : depth=  2 theta= +0.000000e+00 id=7

path type : globalmin
dp= 0 th=  0.463648 +4.6364760900e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.463648 +4.6364760900e-01 br= 0  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=1
.....................................
* cordic min node : depth= 11 theta= -2.019522e-04 id=133222

path type : cordic
dp= 0 th=  0.463648 +4.6364760900e-01 br= 0  :  -0.785398 +0.0  +0.785398
dp= 1 th= -0.321751 -3.2175055440e-01 br= 2  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.141897 +1.4189705460e-01 br= 0  :  -0.244979 +0.0  +0.244979
dp= 3 th= -0.103082 -1.0308160852e-01 br= 2  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.021273 +2.1273386024e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.021273 +2.1273386024e-02 br= 0  :  -0.031240 +0.0  +0.031240
dp= 6 th= -0.009966 -9.9664474062e-03 br= 2  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.005657 +5.6572812143e-03 br= 0  :  -0.007812 +0.0  +0.007812
dp= 8 th= -0.002155 -2.1550598458e-03 br= 2  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.001751 +1.7511702861e-03 br= 0  :  -0.001953 +0.0  +0.001953
dp=10 th= -0.000202 -2.0195223034e-04 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th= -0.000202 -2.0195223034e-04
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i2 R=3 i=2
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-2) =   0.244979
```

```
.....................................
* A: the leaf optimal path  R=3 i=2
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=170585

path type : leafmin
dp= 0 th=  0.244979 +2.4497866313e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.244979 +2.4497866313e-01 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.244979 +2.4497866313e-01 br= 0  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=2
.....................................
level min node : depth=  0 theta= +2.449787e-01 id=0
level min node : depth=  1 theta= +2.449787e-01 id=2
level min node : depth=  2 theta= -7.677189e-02 id=6
level min node : depth=  3 theta= +0.000000e+00 id=25
level min node : depth=  4 theta= +0.000000e+00 id=77
level min node : depth=  5 theta= +0.000000e+00 id=233
level min node : depth=  6 theta= +0.000000e+00 id=701
level min node : depth=  7 theta= +0.000000e+00 id=2105
level min node : depth=  8 theta= +0.000000e+00 id=6317
level min node : depth=  9 theta= +0.000000e+00 id=18953
level min node : depth= 10 theta= +0.000000e+00 id=56861
level min node : depth= 11 theta= +0.000000e+00 id=170585

* global min node : depth=  3 theta= +0.000000e+00 id=25

path type : globalmin
dp= 0 th=  0.244979 +2.4497866313e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.244979 +2.4497866313e-01 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.244979 +2.4497866313e-01 br= 0  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=2
.....................................
* cordic min node : depth= 11 theta= -4.744492e-05 id=163801

path type : cordic
dp= 0 th=  0.244979 +2.4497866313e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.244979 +2.4497866313e-01 br= 0  :  -0.463648 +0.0  +0.463648
dp= 2 th= -0.218669 -2.1866894587e-01 br= 2  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.026310 +2.6309717253e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.026310 +2.6309717253e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.026310 +2.6309717253e-02 br= 0  :  -0.031240 +0.0  +0.031240
dp= 6 th= -0.004930 -4.9301161773e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th= -0.004930 -4.9301161773e-03 br= 2  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.002882 +2.8822248828e-03 br= 0  :  -0.003906 +0.0  +0.003906
dp= 9 th= -0.001024 -1.0240052492e-03 br= 2  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000929 +9.2911726727e-04 br= 0  :  -0.000977 +0.0  +0.000977
dp=11 th= -0.000047 -4.7444922292e-05
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i3 R=3 i=3
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-3) =   0.124355
```

```
.....................................
* A: the leaf optimal path  R=3 i=3
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=174959

path type : leafmin
dp= 0 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.124355 +1.2435499455e-01 br= 0  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=3
.....................................
level min node : depth=  0 theta= +1.243550e-01 id=0
level min node : depth=  1 theta= +1.243550e-01 id=2
level min node : depth=  2 theta= +1.243550e-01 id=8
level min node : depth=  3 theta= +4.758310e-02 id=21
level min node : depth=  4 theta= +0.000000e+00 id=79
level min node : depth=  5 theta= +0.000000e+00 id=239
level min node : depth=  6 theta= +0.000000e+00 id=719
level min node : depth=  7 theta= +0.000000e+00 id=2159
level min node : depth=  8 theta= +0.000000e+00 id=6479
level min node : depth=  9 theta= +0.000000e+00 id=19439
level min node : depth= 10 theta= +0.000000e+00 id=58319
level min node : depth= 11 theta= +0.000000e+00 id=174959

* global min node : depth=  4 theta= +0.000000e+00 id=79

path type : globalmin
dp= 0 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.124355 +1.2435499455e-01 br= 0  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=3
.....................................
* cordic min node : depth= 11 theta= -1.749042e-04 id=172762

path type : cordic
dp= 0 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.124355 +1.2435499455e-01 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.124355 +1.2435499455e-01 br= 0  :  -0.244979 +0.0  +0.244979
dp= 3 th= -0.120624 -1.2062366858e-01 br= 2  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.003731 +3.7313259667e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.003731 +3.7313259667e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.003731 +3.7313259667e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.003731 +3.7313259667e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.003731 +3.7313259667e-03 br= 0  :  -0.003906 +0.0  +0.003906
dp= 9 th= -0.000175 -1.7490416531e-04 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th= -0.000175 -1.7490416531e-04 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th= -0.000175 -1.7490416531e-04
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i4 R=3 i=4
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-4) =  0.0624188
```

```
.....................................
* A: the leaf optimal path  R=3 i=4
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=176417

path type : leafmin
dp= 0 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.062419 +6.2418809996e-02 br= 0  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=4
.....................................
level min node : depth=  0 theta= +6.241881e-02 id=0
level min node : depth=  1 theta= +6.241881e-02 id=2
level min node : depth=  2 theta= +6.241881e-02 id=8
level min node : depth=  3 theta= -1.435308e-02 id=21
level min node : depth=  4 theta= -1.435308e-02 id=65
level min node : depth=  5 theta= +0.000000e+00 id=241
level min node : depth=  6 theta= +0.000000e+00 id=725
level min node : depth=  7 theta= +0.000000e+00 id=2177
level min node : depth=  8 theta= +0.000000e+00 id=6533
level min node : depth=  9 theta= +0.000000e+00 id=19601
level min node : depth= 10 theta= +0.000000e+00 id=58805
level min node : depth= 11 theta= +0.000000e+00 id=176417

* global min node : depth=  5 theta= +0.000000e+00 id=241

path type : globalmin
dp= 0 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.062419 +6.2418809996e-02 br= 0  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=4
.....................................
* cordic min node : depth= 11 theta= +4.826254e-04 id=175687

path type : cordic
dp= 0 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.062419 +6.2418809996e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.062419 +6.2418809996e-02 br= 0  :  -0.124355 +0.0  +0.124355
dp= 4 th= -0.061936 -6.1936184551e-02 br= 2  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000483 +4.8262544515e-04 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000483 +4.8262544515e-04
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i5 R=3 i=5
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-5) =  0.0312398
```

```
.....................................
* A: the leaf optimal path  R=3 i=5
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=176903

path type : leafmin
dp= 0 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.031240 +3.1239833430e-02 br= 0  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=5
.....................................
level min node : depth=  0 theta= +3.123983e-02 id=0
level min node : depth=  1 theta= +3.123983e-02 id=2
level min node : depth=  2 theta= +3.123983e-02 id=8
level min node : depth=  3 theta= +3.123983e-02 id=26
level min node : depth=  4 theta= -1.634327e-02 id=94
level min node : depth=  5 theta= -6.553079e-04 id=228
level min node : depth=  6 theta= +0.000000e+00 id=727
level min node : depth=  7 theta= +0.000000e+00 id=2183
level min node : depth=  8 theta= +0.000000e+00 id=6551
level min node : depth=  9 theta= +0.000000e+00 id=19655
level min node : depth= 10 theta= +0.000000e+00 id=58967
level min node : depth= 11 theta= +0.000000e+00 id=176903

* global min node : depth=  6 theta= +0.000000e+00 id=727

path type : globalmin
dp= 0 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.031240 +3.1239833430e-02 br= 0  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=5
.....................................
* cordic min node : depth= 11 theta= +6.085686e-05 id=176659

path type : cordic
dp= 0 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.031240 +3.1239833430e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.031240 +3.1239833430e-02 br= 0  :  -0.062419 +0.0  +0.062419
dp= 5 th= -0.031179 -3.1178976566e-02 br= 2  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.000061 +6.0856864579e-05 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000061 +6.0856864579e-05 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000061 +6.0856864579e-05 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000061 +6.0856864579e-05 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000061 +6.0856864579e-05 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000061 +6.0856864579e-05
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i6 R=3 i=6
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
ternary angle tree search (N=12)
theta= atan(pow(2,-6) =  0.0156237

.....................................
* A: the leaf optimal path  R=3 i=6
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=177065

path type : leafmin
dp= 0 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.015624 +1.5623728620e-02 br= 0  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=6
.....................................
level min node : depth=  0 theta= +1.562373e-02 id=0
level min node : depth=  1 theta= +1.562373e-02 id=2
level min node : depth=  2 theta= +1.562373e-02 id=8
level min node : depth=  3 theta= +1.562373e-02 id=26
level min node : depth=  4 theta= +1.562373e-02 id=80
level min node : depth=  5 theta= +7.880219e-04 id=199
level min node : depth=  6 theta= -7.195412e-04 id=855
level min node : depth=  7 theta= +0.000000e+00 id=2185
level min node : depth=  8 theta= +0.000000e+00 id=6557
level min node : depth=  9 theta= +0.000000e+00 id=19673
level min node : depth= 10 theta= +0.000000e+00 id=59021
level min node : depth= 11 theta= +0.000000e+00 id=177065

* global min node : depth=  7 theta= +0.000000e+00 id=2185

path type : globalmin
dp= 0 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.015624 +1.5623728620e-02 br= 0  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=6
.....................................
* cordic min node : depth= 11 theta= +7.623811e-06 id=176983

path type : cordic
dp= 0 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.015624 +1.5623728620e-02 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.015624 +1.5623728620e-02 br= 0  :  -0.031240 +0.0  +0.031240
dp= 6 th= -0.015616 -1.5616104810e-02 br= 2  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.000008 +7.6238106854e-06 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000008 +7.6238106854e-06 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000008 +7.6238106854e-06 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000008 +7.6238106854e-06 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000008 +7.6238106854e-06
```

```
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i7 R=3 i=7
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-7) = 0.00781234

.....................................
* A: the leaf optimal path  R=3 i=7
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=177119

path type : leafmin
dp= 0 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.007812 +7.8123410601e-03 br= 0  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=7
.....................................
level min node : depth=  0 theta= +7.812341e-03 id=0
level min node : depth=  1 theta= +7.812341e-03 id=2
level min node : depth=  2 theta= +7.812341e-03 id=8
level min node : depth=  3 theta= +7.812341e-03 id=26
level min node : depth=  4 theta= +7.812341e-03 id=80
level min node : depth=  5 theta= -6.540740e-03 id=198
level min node : depth=  6 theta= -6.540740e-03 id=596
level min node : depth=  7 theta= -3.528955e-03 id=2145
level min node : depth=  8 theta= +0.000000e+00 id=6559
level min node : depth=  9 theta= +0.000000e+00 id=19679
level min node : depth= 10 theta= +0.000000e+00 id=59039
level min node : depth= 11 theta= +0.000000e+00 id=177119

* global min node : depth=  8 theta= +0.000000e+00 id=6559

path type : globalmin
dp= 0 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.007812 +7.8123410601e-03 br= 0  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=7
.....................................
* cordic min node : depth= 11 theta= +9.534997e-07 id=177091

path type : cordic
dp= 0 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.007812 +7.8123410601e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.007812 +7.8123410601e-03 br= 0  :  -0.015624 +0.0  +0.015624
dp= 7 th= -0.007811 -7.8113875604e-03 br= 2  :  -0.007812 +0.0  +0.007812
```

```
dp= 8 th=  0.000001 +9.5349972539e-07 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000001 +9.5349972539e-07 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000001 +9.5349972539e-07 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000001 +9.5349972539e-07
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i8 R=3 i=8
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-8) = 0.00390623

.....................................
* A: the leaf optimal path  R=3 i=8
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=177137

path type : leafmin
dp= 0 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.003906 +3.9062301320e-03 br= 0  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=8
.....................................
level min node : depth=  0 theta= +3.906230e-03 id=0
level min node : depth=  1 theta= +3.906230e-03 id=2
level min node : depth=  2 theta= +3.906230e-03 id=8
level min node : depth=  3 theta= +3.906230e-03 id=26
level min node : depth=  4 theta= +3.906230e-03 id=80
level min node : depth=  5 theta= +3.906230e-03 id=242
level min node : depth=  6 theta= +3.250922e-03 id=687
level min node : depth=  7 theta= +2.635583e-03 id=2581
level min node : depth=  8 theta= +3.772747e-04 id=6438
level min node : depth=  9 theta= +0.000000e+00 id=19681
level min node : depth= 10 theta= +0.000000e+00 id=59045
level min node : depth= 11 theta= +0.000000e+00 id=177137

* global min node : depth=  9 theta= +0.000000e+00 id=19681

path type : globalmin
dp= 0 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.003906 +3.9062301320e-03 br= 0  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=8
.....................................
* cordic min node : depth= 11 theta= +1.192038e-07 id=177127

path type : cordic
dp= 0 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.244979 +0.0  +0.244979
```

```
dp= 3 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.003906 +3.9062301320e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.003906 +3.9062301320e-03 br= 0  :  -0.007812 +0.0  +0.007812
dp= 8 th= -0.003906 -3.9061109281e-03 br= 2  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.000000 +1.1920383283e-07 br= 1  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +1.1920383283e-07 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +1.1920383283e-07
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
tc1_power2_3ary_i9 R=3 i=9
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
ternary angle tree search (N=12)
theta= atan(pow(2,-9) = 0.00195312

.....................................
* A: the leaf optimal path  R=3 i=9
.....................................
* leaf min node : depth= 11 theta= +0.000000e+00 id=177143

path type : leafmin
dp= 0 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.001953 +1.9531225165e-03 br= 0  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +0.0000000000e+00

.....................................
* B: the global optimal path  R=3 i=9
.....................................
level min node : depth=  0 theta= +1.953123e-03 id=0
level min node : depth=  1 theta= +1.953123e-03 id=2
level min node : depth=  2 theta= +1.953123e-03 id=8
level min node : depth=  3 theta= +1.953123e-03 id=26
level min node : depth=  4 theta= +1.953123e-03 id=80
level min node : depth=  5 theta= +1.953123e-03 id=242
level min node : depth=  6 theta= +1.297815e-03 id=687
level min node : depth=  7 theta= +6.824752e-04 id=2581
level min node : depth=  8 theta= +6.824752e-04 id=7745
level min node : depth=  9 theta= -6.813876e-04 id=16122
level min node : depth= 10 theta= +0.000000e+00 id=59047
level min node : depth= 11 theta= +0.000000e+00 id=177143

* global min node : depth= 10 theta= +0.000000e+00 id=59047

path type : globalmin
dp= 0 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.003906 +0.0  +0.003906
dp= 9 th=  0.001953 +1.9531225165e-03 br= 0  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +0.0000000000e+00

.....................................
* C: the cordic path R=3 i=9
.....................................
```

```
* cordic min node : depth= 11 theta= +1.490099e-08 id=177139

path type : cordic
dp= 0 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.785398 +0.0  +0.785398
dp= 1 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.463648 +0.0  +0.463648
dp= 2 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.244979 +0.0  +0.244979
dp= 3 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.124355 +0.0  +0.124355
dp= 4 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.062419 +0.0  +0.062419
dp= 5 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.031240 +0.0  +0.031240
dp= 6 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.015624 +0.0  +0.015624
dp= 7 th=  0.001953 +1.9531225165e-03 br= 1  :  -0.007812 +0.0  +0.007812
dp= 8 th=  0.001953 +1.9531225165e-03 br= 0  :  -0.003906 +0.0  +0.003906
dp= 9 th= -0.001953 -1.9531076155e-03 br= 2  :  -0.001953 +0.0  +0.001953
dp=10 th=  0.000000 +1.4900990666e-08 br= 1  :  -0.000977 +0.0  +0.000977
dp=11 th=  0.000000 +1.4900990666e-08
```