Fast simulation about PID for p, K ,pi with TOF

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2025.2.14

❖ **Effect of different radius (length)of TOF(only barrel) on the PID**

p 0-1GeV/c

L : 2900mm /1000 mm R: 1800mm/555mm

L : 1000/2000/2900mm R: 555mm

❖ **Performance of OTK with different position of endcap in z direction**

p 0-1GeV/c

L : 1500/2350/2900mm R : 1800mm

Endcap's geometry is const (inner radius 400mm,outer radius 1800mm)

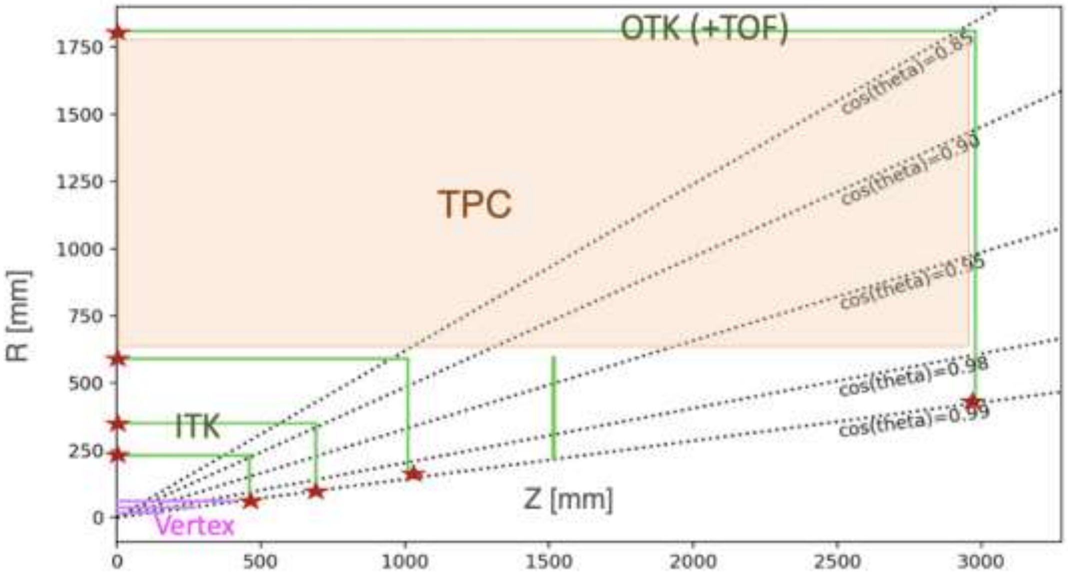
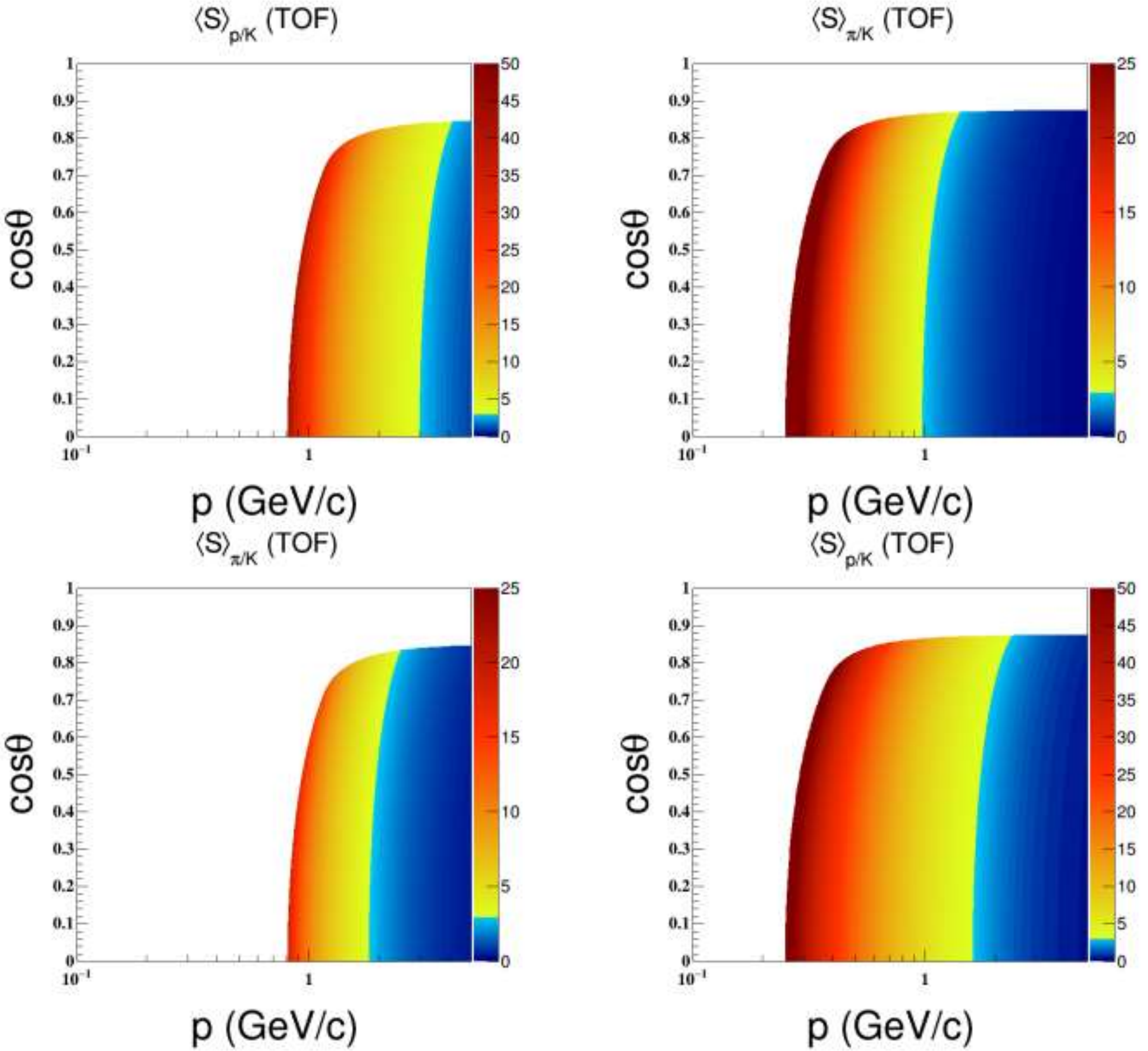


Figure 5.2: The layout of the CEPC tracker system.

Effect of different radius(length) of TOF(only barrel) on the PID



L=2900mm;R=1800mm

L=1000mm;R=555mm

Separation power:

$S_{AB} = \frac{|T_A - T_B|}{\sigma}$, T is TOF of particle, σ is the TOF resolution.

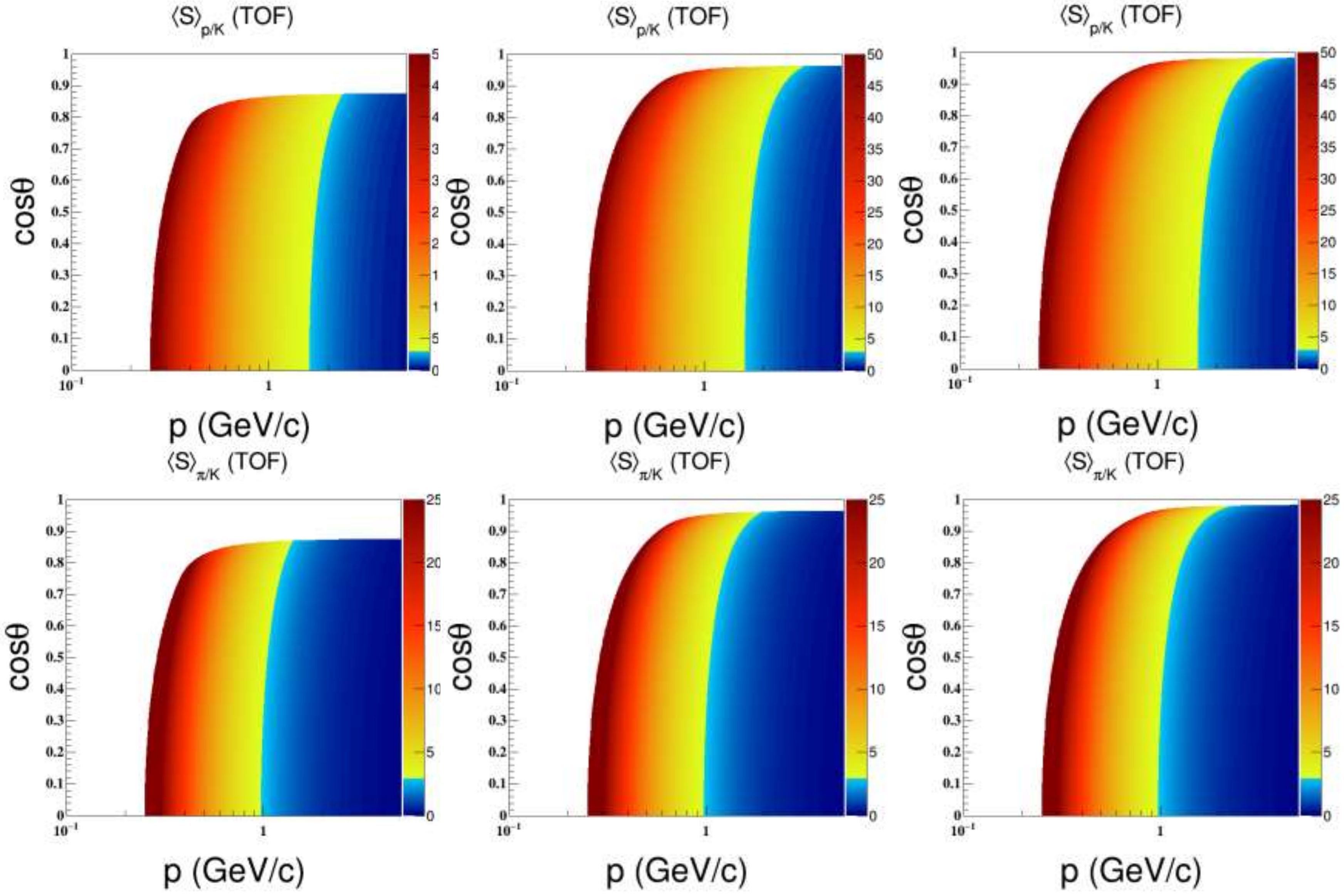
X axis is momentum of particle

Y axis is the angle from Z direction

L=2900mm , R=1800mm :
p>800MeV , cosθ<0.8;

L=1000mm , R=555mm :
p>250MeV , cosθ<0.8;

Radius 555mm with different length



L=1000mm;R=555mm L=2000mm;R=555mm L=2900mm;R=555mm

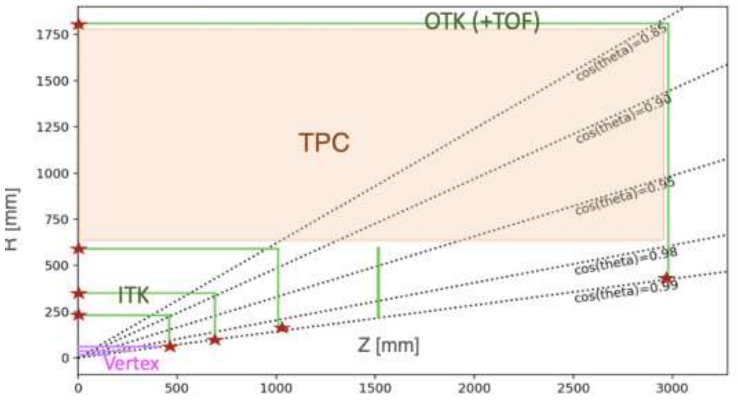
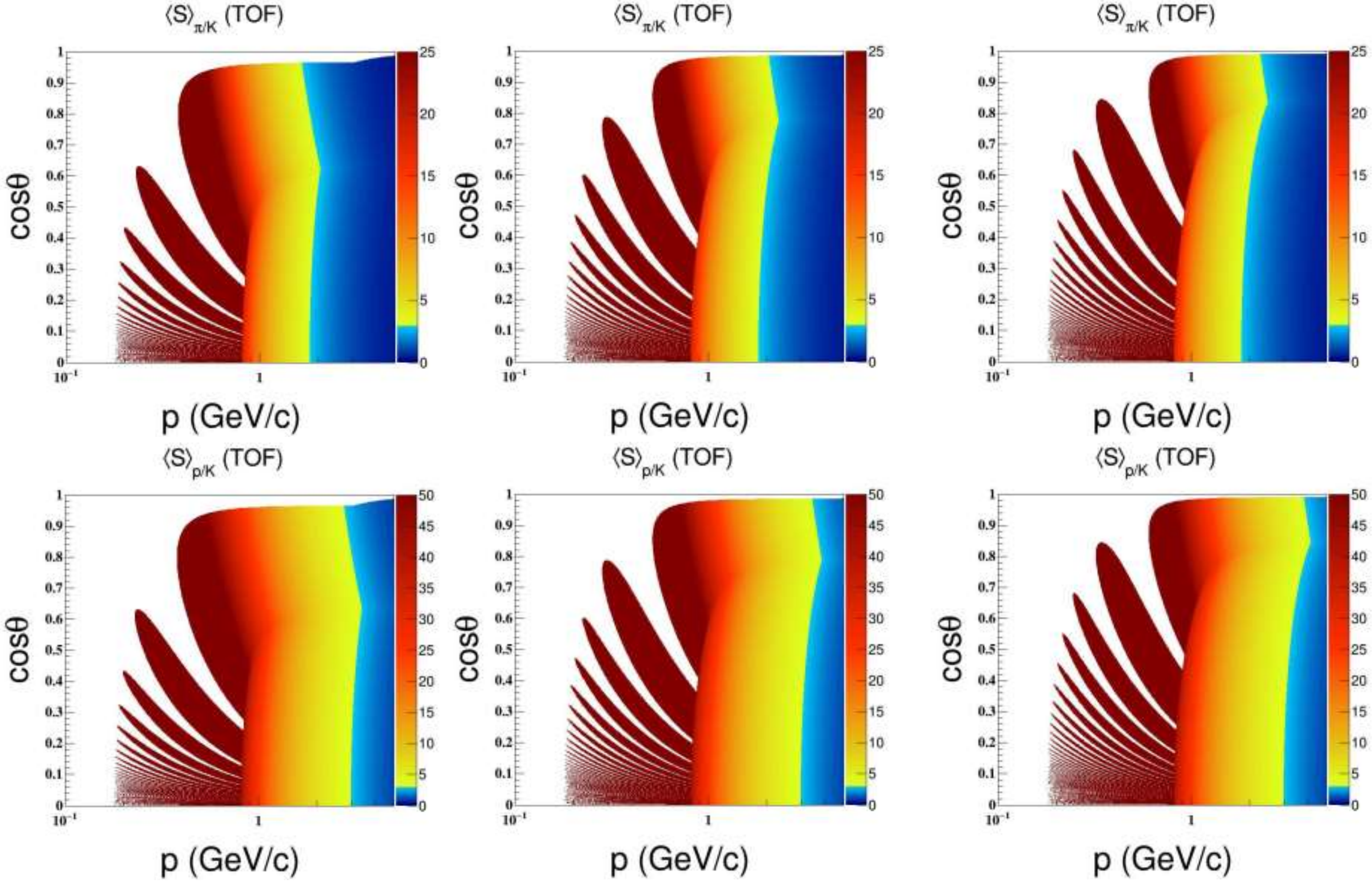


Figure 5.2: The layout of the CEPC tracker system.

Shorter barrel cut the area of cos>0.85

Performance of OTK with different position of endcap in z direction



L=1500mm;R=1800mm

L=2350mm;R=1800mm

L=2900mm;R=1800mm

Endcap can coverage the area invisible to the shorter barrel

Conclusion and plan

❖ **Conclusion :**

L=2900mm , R=1800mm : $p>800$MeV , $\cos\theta<0.8$;
L=1000mm , R=555mm : $p>250$MeV , $\cos\theta<0.8$;
ITK can improve the PID on 0~1GeV with ac-lgad.

❖ **Plan :**

Make fast simulation with TPC on 0~1GeV
and combine TOF and TPC

```cpp
double func_kp_tof_zhu_2D(double* x, double* par)
{   double R = 1800;
    double ir = 400;
    double L = 1500;
    double c = 300;
    double pathA = 0, pathB = 0;
    double betaA = x[0]/sqrt(x[0]*x[0]+mass[4]*mass[4]);
    double betaB = x[0]/sqrt(x[0]*x[0]+mass[3]*mass[3]);
    double vA = betaA * c;
    double vB = betaB * c;
    double gammaA = 1/(sqrt(1-betaA*betaA));
    double gammaB = 1/(sqrt(1-betaB*betaB));
    double CTheta = x[1];
    double STheta = sqrt(1 - CTheta*CTheta);
    double rA = x[0] * STheta * 1000 / (0.3 * 3);
    double rB = x[0] * STheta * 1000 / (0.3 * 3);
    double mean1 = 0, mean2 = 0;
    if(rA * 2 > R){pathA = rA * 2 * asin( R/(2*rA) );
        mean1 = pathA/(vA * STheta);
        if(L/(vA * CTheta) < pathA/(vA * STheta)){
            mean1 = L/(vA * CTheta);
        }
    }
    else if (rA * 2 < ir) {
        mean1 = 0;
    }
    else{
        pathA = rA * 2 * asin(ir / (2 * rA));
        mean1 = 0;
        for (int i = 0; i < 1000;i++)
        {
            if ((L / (vA * CTheta) > (i * rA * 2 * acos(-1.0) + pathA) / (vA * STheta)) && (L / (vA * CTheta) < (i * rA * 2 * acos(-1.0) + (rA * 2 * acos(-1.0) - pathA)) / (vA * STheta)))
            {
                mean1 = L / (vA * CTheta);
            }
        }
    }
    if(rB * 2 > R){pathB = rB * 2 * asin( R/(2*rB) );
        mean2 = pathB/(vB * STheta);
        if(L/(vB * CTheta) < pathB/(vB * STheta)){
            mean2 = L/(vB * CTheta);
        }
    }
    else if (rB * 2 < ir) {
        mean2 = 0;
    }
    else{
        pathB = rB * 2 * asin(ir/ (2 * rB));
        mean2 = 0;
        for (int i = 0; i < 1000;i++)
        {
            if ((L / (vB * CTheta) > (i * rB * 2 * acos(-1.0) + pathB) / (vB * STheta)) && (L / (vB * CTheta) < (i * rB * 2 * acos(-1.0) + (rB * 2 * acos(-1.0) - pathB)) / (vB * STheta)))
            {
                mean2 = L / (vB * CTheta);
            }
        }
    }
    double sigma = 50*sqrt(2.);
    double sep = fabs(mean1-mean2)/sigma*1000;
    return sep;
}
```

Date Caculated under root referred by YongFeng Zhu