Classical Simulation

We must also rule out the possibility of this system acting classically. A classical beam splitter that doesn't work perfectly may possibly produce results that look quantum so we will want to rule this out as a possibility. We will consider beam splitters at each end with unique biases towards the northern spheres:

Parameters:

- $?$ = L - mode occupancy.
- $?$ - phase of interferometer.
- T_{max} - maximum number of generated particle
- cycles = C - number of simulated tests used to perform correlation.
- QE = R - retention rate / quantum efficiency.
- dark_rate = D - fraction of tests which return a non-experimental count.
- $?$ = B - decay width of gaussian blur in detection uncertainty.
- phys - Quantum ('Q') or Classical ('C') physics to be used.
- Y_{bias} - with a classical beam splitter, the R.H.S. bias towards Y (up)
- X_{bias} - " " , the L.H.S. bias towards X (up)

```
lambda = 0.1;
phi = 0;
Tmax = 8;
cycles = 5E4;
QE = 100;
dark_rate = 0;
sigma = 0.01;
phys = 'C';
```

Arrays:

```
Ybias = 0:0.05:1;
Xbias = 0:0.05:1;

g_YX = zeros(length(Ybias),length(Xbias));
g_WZ = g_YX; g_YZ = g_YX; g_XW = g_YX;
Elist = zeros(length(Ybias),length(Xbias));
```

```
for y = 1:length(Ybias)
    for x = 1:length(Xbias)
        [g_YX(y,x), g_WZ(y,x),g_YZ(y,x),g_XW(y,x)] = correlators3(lambda,phi,Tmax,cycles,QE,dark_rate,sigma,0.3,phys,Ybias(y),Xbias(x
        %Elist(y,x) = (g_YX+g_WZ - g_YZ - g_XW)/(g_YX+g_WZ + g_YZ + g_XW);
    end
    Y = 100*y/length(Ybias)
end
```

```
figure(1);
surf(Xbias,Ybias,g_YX(:,:))
ylabel("Right Side Bias")
xlabel("Left Side Bias")
title("Top Halo Correlator ($g^{(2)}_{YX}$)",'interpreter','latex',"FontSize",20)

figure(2);
surf(Xbias,Ybias,g_WZ(:,:))
ylabel("Right Side Bias")
xlabel("Left Side Bias")
title("Bottom Halo Correlator ($g^{(2)}_{WZ}$)",'interpreter','latex',"FontSize",20)

figure(3);
surf(Xbias,Ybias,g_YZ(:,:))
ylabel("Right Side Bias")
xlabel("Left Side Bias")
title("Between Halo Correlator($g^{(2)}_{YZ}$)",'interpreter','latex',"FontSize",20)

figure(4);
surf(Xbias,Ybias,g_XW(:,:))
ylabel("Right Side Bias")
xlabel("Left Side Bias")
title("Between Halo Correlator ($g^{(2)}_{XW}$)",'interpreter','latex',"FontSize",20)
```