The circle of confusion

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A large reason for image blur arises from simple geometry - the image point is not at the focal distance. Geometric blur is measured by the size of the **circle of confusion**, which is simply the diameter of a point image. The function **opticsCoC** calculates the circle of confusion.

For a description of the circle of confusion see this Wikipedia page. That page links to the original wonderful article describing the geometry.

See also: opticsCoC, opticsSet, opticsget

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```
ieInit
```

Calculate the circle of confusion diameter for different points
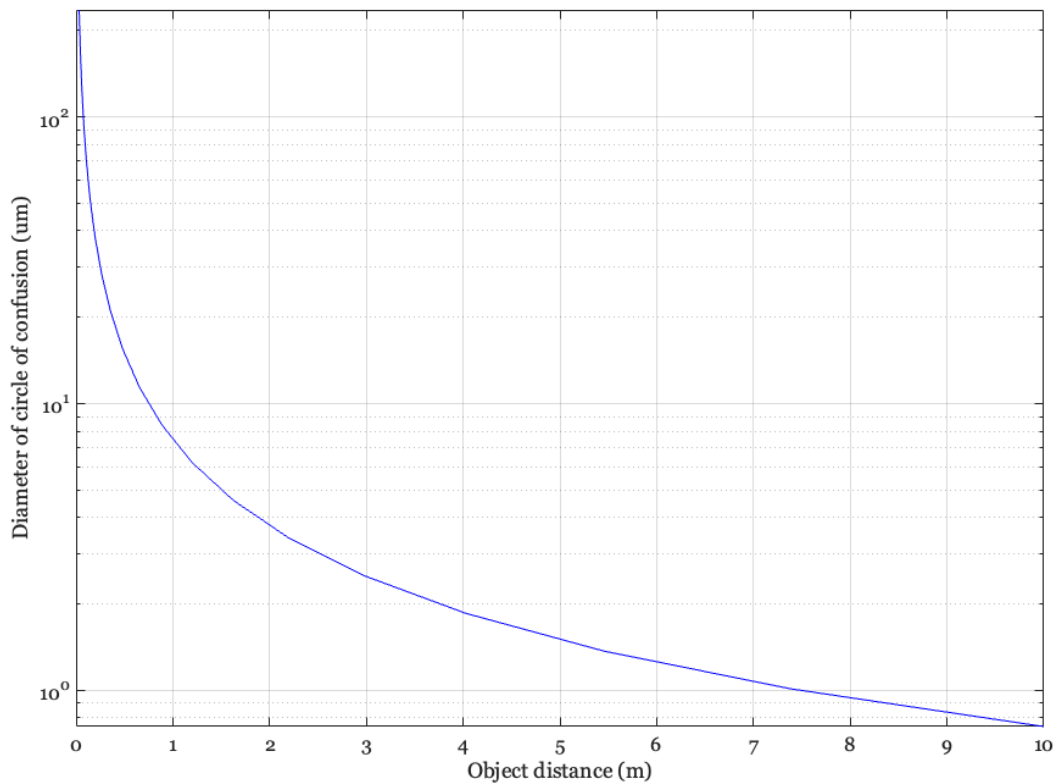
```
% Points distances
oDist = logspace(-1.5,1,20);

optics = opticsCreate;
optics = opticsSet(optics,'fnumber',2);
c = zeros(size(oDist));
for ii=1:length(oDist)
    c(ii) = opticsCoC(optics,oDist(ii),'um');
end
```

Plot the circle diameter as a function of distance

```
vcNewGraphWin([],'big');
semilogy(oDist,c,'b-'); grid on
% xlabel('Object distance (m)');
% ylabel('Diameter of circle of confusion (um)')

l = xlabel('Object distance (m)');                    %set(l,'Position',[0.5
 0.6,-1]);
```

```
l = ylabel('Diameter of circle of confusion (um)'); % set(l,'Position',[-0.07
 31.6,-1])
```


Change f-number, but not focal length, and re-calculate

```
optics = opticsSet(optics,'fnumber',4);
c = zeros(size(oDist));
for ii=1:length(oDist)
    c(ii) = opticsCoC(optics,oDist(ii),'um');
end
hold on
semilogy(oDist,c,'g-'); grid on
% xlabel('Object distance (m)');
% ylabel('Diameter of circle of confusion (um)')

l = xlabel('Object distance (m)');                  % set(l,'Position',[0.5
 0.7,-1]);
l = ylabel('Diameter of circle of confusion (um)'); % set(l,'Position',[-0.06
 31.6,-1])
```
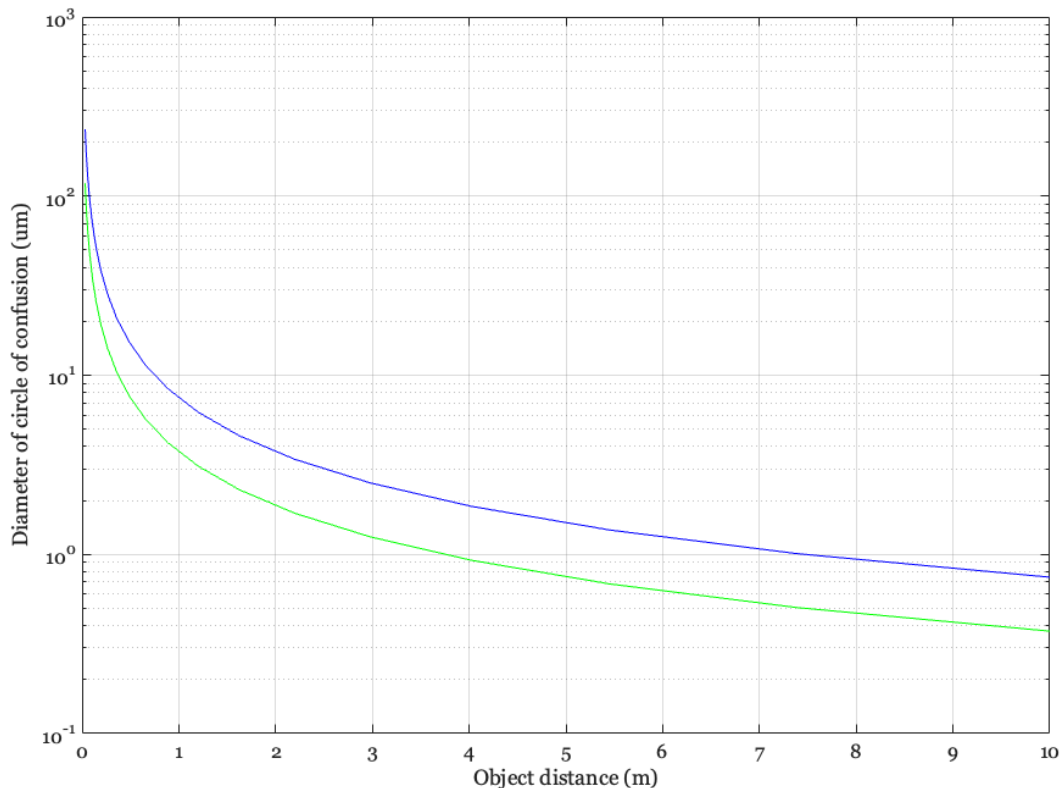
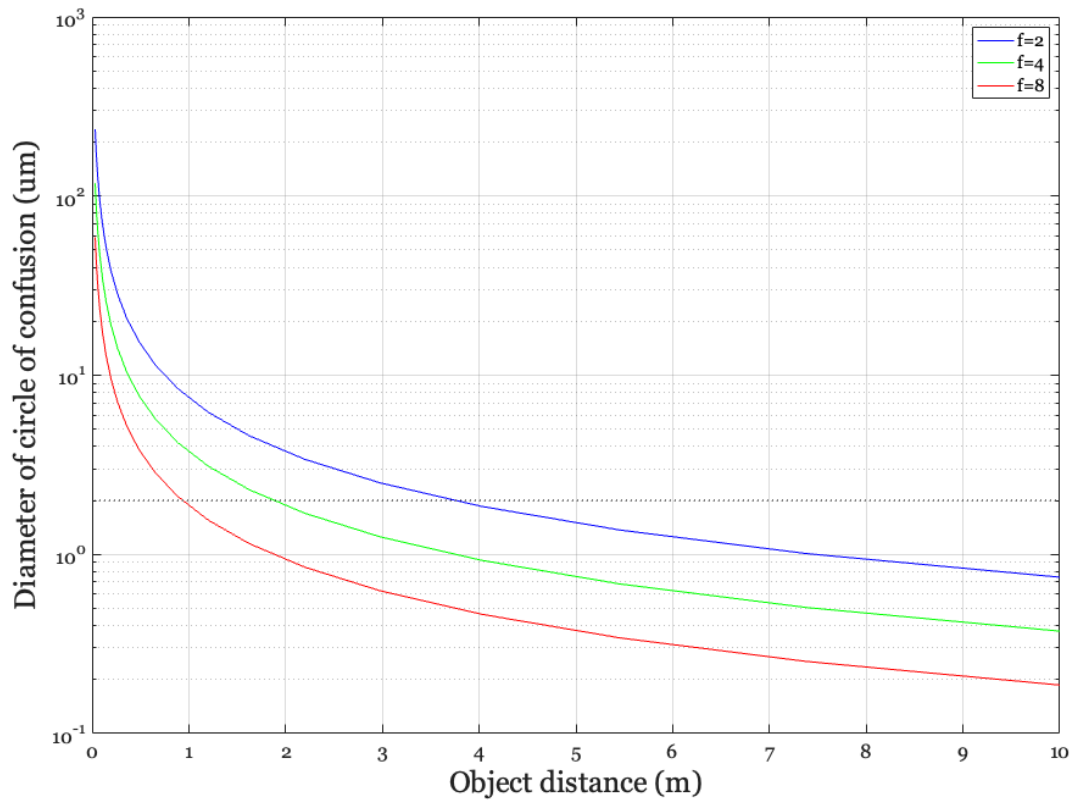# Change the f-number once more, keeping focal length fixed

```
optics = opticsSet(optics,'fnumber',8);
c = zeros(size(oDist));
for ii=1:length(oDist)
    c(ii) = opticsCoC(optics,oDist(ii),'um');
end

% Why aren't the axes default positions OK?
hold on
semilogy(oDist,c,'r-'); grid on
xlabel('Object distance (m)','fontsize',24);                %
 set(l,'Position',[0.5 0.7,-1]);
ylabel('Diameter of circle of confusion (um)','fontsize',24); %
 set(l,'Position',[-0.06 31.6,-1])

% diffractionLine
line([min(oDist),max(oDist)],[2 2],'linestyle',':','color','k');
% In all cases
% flength = opticsGet(optics,'focal length','mm');
% title(sprintf('Focal length %.2f mm',flength));
```

```
legend({'f=2','f=4','f=8'})
```


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