Explore the parameters for the gas/star fractions from TNG100 / TNG300

```
% we generted fits for double gaussian based on histograms of the fgs
% value. The bin number/size of the histogram affects the result
% We want to see how the fit changes with histogram bin number/size
```

loading the data

```
global DEFAULT_MATFILE_DIR


load([DEFAULT_MATFILE_DIR '/fgs_stellarMass_gaussianFit_byBin_snp_99_TNG300.mat'])



binEdge=[9 9.2500 9.5000 9.7500 10 10.2500 10.5000 10.7500 11 11.2500 11.5000];
be=9:0.25:11.5;


fgs=-5:0.001:1.5;
```

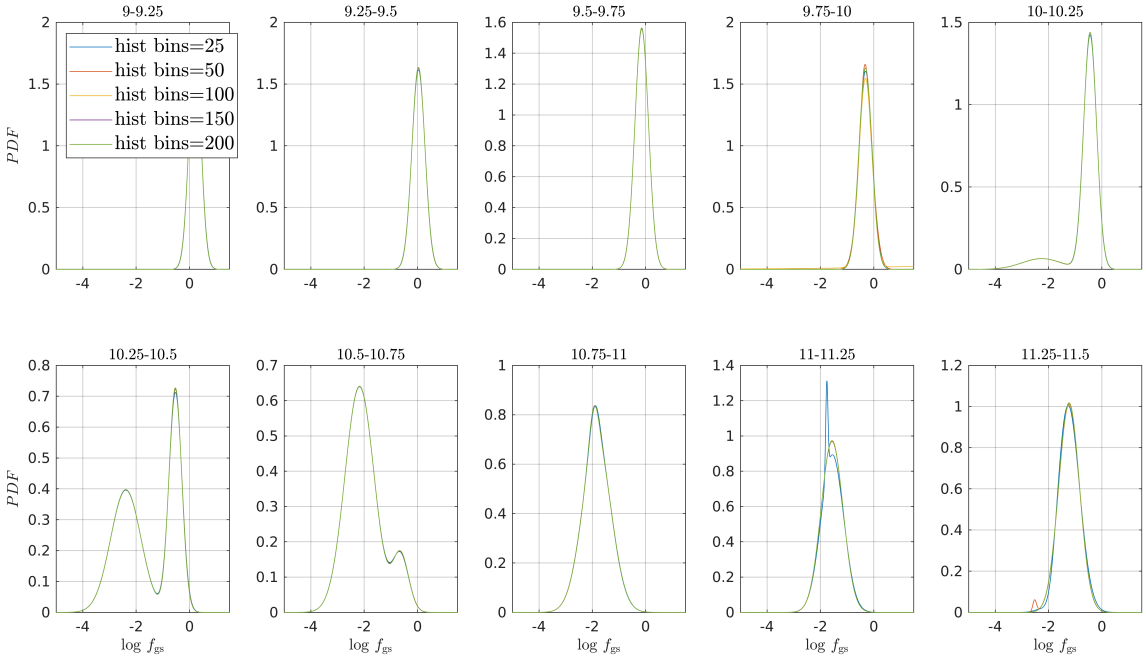
plot pdf's for different histogram bins

```
% we plot the resultign PDFs for different stellar mass bins from the
% different fits. Changes appear to be very small.
```

```
plotting PDFs for different mass bins - different colors show PDFs derived from histograms of different bi
```

```
hf=figure('color','w','position',[83 433 1710 883]);




for i=1:length(ft(1).mu1)
    h=[];

    pdf1=zeros(length(ft),length(fgs));
    for k=1:length(ft)
        pdf=ft(k).a1(i).*exp(-0.5.*((fgs-ft(k).mu1(i))./ft(k).sig1(i)).^2) + ...
            ft(k).a2(i).*exp(-0.5.*((fgs-ft(k).mu2(i))./ft(k).sig2(i)).^2);
        pdf1(k,:)=pdf./trapz(fgs,pdf);

    end
```

```
    %figure(hf)
    subplot(2,5,i)
    ax=gca;


    for k=1:length(ft)
        tag=['hist bins=' num2str(ft(k).histBinNum)];
        h(k)=plot(fgs,pdf1(k,:),'Displayname',tag);
        hold on
    end

    if i==1
        hl=legend(h);
        set(hl,'Interpreter','latex','fontsize',14,'Location','NorthWest');
    end

    %ax.Legend.Visible='off';

    grid
    xlim([-5 1.5])
    if i>5
        xlabelmine( '$\log\,f_\mathrm{gs}$');
    else
        ax.XLabel.Visible='off';

    end
    if i==1 || i==6
        ylabelmine( '$PDF$');
    else
        ax.YLabel.Visible='off';

    end
    titlemine([ num2str(be(i)) '-' num2str(be(i+1)) ]);

end
```



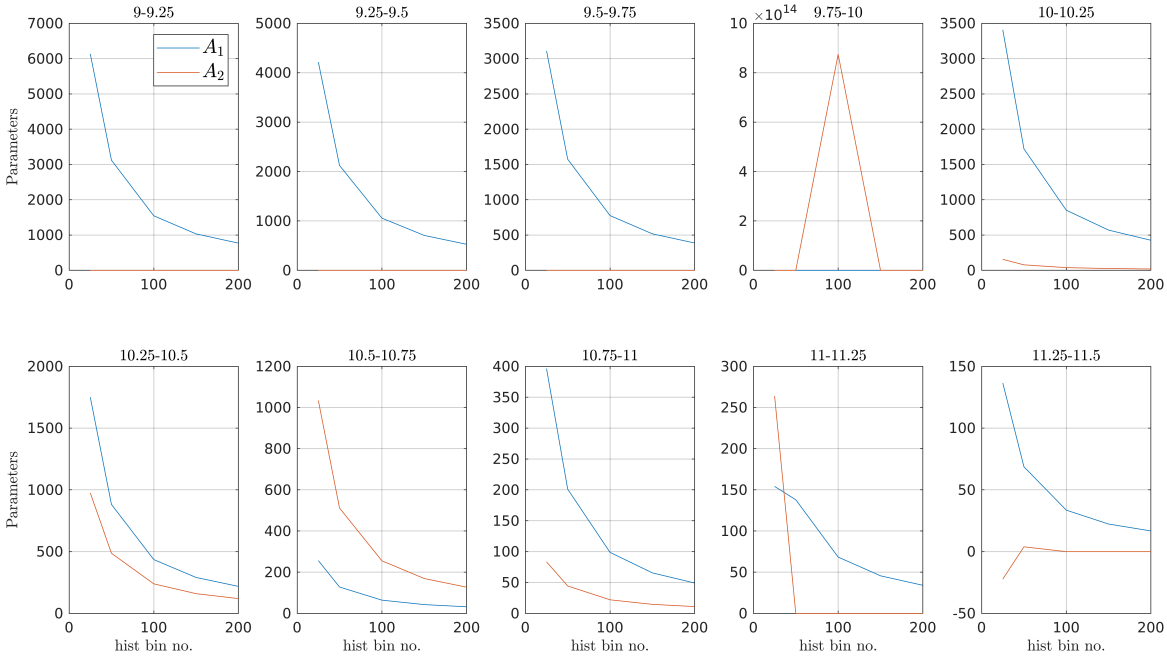
plot fit parameters for different histogram bins

```
%Here we examine the results more closely - follow the parameters
%themselves as bin number/size is changed. In the mass bins where
%the fit produced a single gaussian we ignore the other fit results.

hf=figure('color','w','position',[83 433 1710 883]);
tag={'$\mu_1$','$\mu_2$','$\sigma_1$','$\sigma_2$','$A_1$','$A_2$'};


for i=1:length(ft(1).mu1)
    h=[];

    pars=zeros(length(ft),6);
    for k=1:length(ft)
        pars(k,1)=ft(k).mu1(i);
        pars(k,3)=ft(k).sig1(i);
        pars(k,5)=ft(k).a1(i);

        if ft(k).a2(i)~=0
            pars(k,2)=ft(k).mu2(i);
            pars(k,4)=ft(k).sig2(i);
            pars(k,6)=ft(k).a2(i);
        end
        xx(k)=ft(k).histBinNum;

    end
```

```
    subplot(2,5,i)
    ax=gca;

    for k=1:4
        h(k)=plot(xx,pars(:,k),'Displayname',tag{k});
        hold on
    end

    if i==1
        hl=legend(h);
        set(hl,'Interpreter','latex','fontsize',14,'Location','northeast');
    end

    %ax.Legend.Visible='off';

    grid
    %xlim([-5 1.5])
    if i>5
        xlabelmine( 'hist bin no.');
    else
        ax.XLabel.Visible='off';

    end
    if i==1 || i==6
        ylabelmine( 'Parameters');
    else
        ax.YLabel.Visible='off';

    end
    titlemine([ num2str(be(i)) '-' num2str(be(i+1)) ]);

end
```

```
% Plot the amplitude values - these go down since the bin size is
% decreasing

hf=figure('color','w','position',[83 433 1710 883]);
tag={'$\mu_1$','$\mu_2$','$\sigma_1$','$\sigma_2$','$A_1$','$A_2$'};


for i=1:length(ft(1).mu1)
    h=[];

    pars=zeros(length(ft),6);
    for k=1:length(ft)
```

```
        pars(k,1)=ft(k).mu1(i);
        pars(k,3)=ft(k).sig1(i);
        pars(k,5)=ft(k).a1(i);

        if ft(k).a2(i)~=0
            pars(k,2)=ft(k).mu2(i);
            pars(k,4)=ft(k).sig2(i);
            pars(k,6)=ft(k).a2(i);
        end
        xx(k)=ft(k).histBinNum;

    end


    subplot(2,5,i)
    ax=gca;

    for k=5:6
        h(k-4)=plot(xx,pars(:,k),'Displayname',tag{k});
        hold on
    end

    if i==1
        hl=legend(h);
        set(hl,'Interpreter','latex','fontsize',14,'Location','northeast');
    end

    %ax.Legend.Visible='off';

    grid
    %xlim([-5 1.5])
    if i>5
        xlabelmine( 'hist bin no.');
    else
        ax.XLabel.Visible='off';

    end
    if i==1 || i==6
        ylabelmine( 'Parameters');
    else
        ax.YLabel.Visible='off';

    end
    titlemine([ num2str(be(i)) '-' num2str(be(i+1)) ]);

end
```




```
%% Now plot the fractional values for the fit parameters
hf=figure('color','w','position',[83 433 1710 883]);
tag={'$\mu_1$','$\mu_2$','$\sigma_1$','$\sigma_2$','$A_1$','$A_2$'};


for i=1:length(ft(1).mu1)
    h=[];

    pars=zeros(length(ft),6);
    for k=1:length(ft)
        pars(k,1)=ft(k).mu1(i);
        pars(k,3)=ft(k).sig1(i);
        pars(k,5)=ft(k).a1(i);

        if ft(k).a2(i)~=0
            pars(k,2)=ft(k).mu2(i);
            pars(k,4)=ft(k).sig2(i);
            pars(k,6)=ft(k).a2(i);
        end
        xx(k)=ft(k).histBinNum;

    end



    subplot(2,5,i)
    ax=gca;
```

```
    for k=1:4
        h(k)=plot(xx,pars(:,k)./pars(end,k)-1,'Displayname',tag{k});
        hold on
    end

    if i==1
        hl=legend(h);
        set(hl,'Interpreter','latex','fontsize',14,'Location','northeast');
    end

    %ax.Legend.Visible='off';

    grid
    %xlim([-5 1.5])
    if i>5
        xlabelmine( 'hist bin no.');
    else
        ax.XLabel.Visible='off';

    end
    if i==1 || i==6
        ylabelmine( 'Parameters');
    else
        ax.YLabel.Visible='off';

    end
    titlemine([ num2str(be(i)) '-' num2str(be(i+1)) ]);

end
```

```
```

conclusion - the fits are by and large consistent even for low bin number histograms, but there are some weird flukes we should be carful of, using the 200 bin fit is probably best.

```
```