

Gasifier Training Problem Part 4: Post-Processing

February 2018

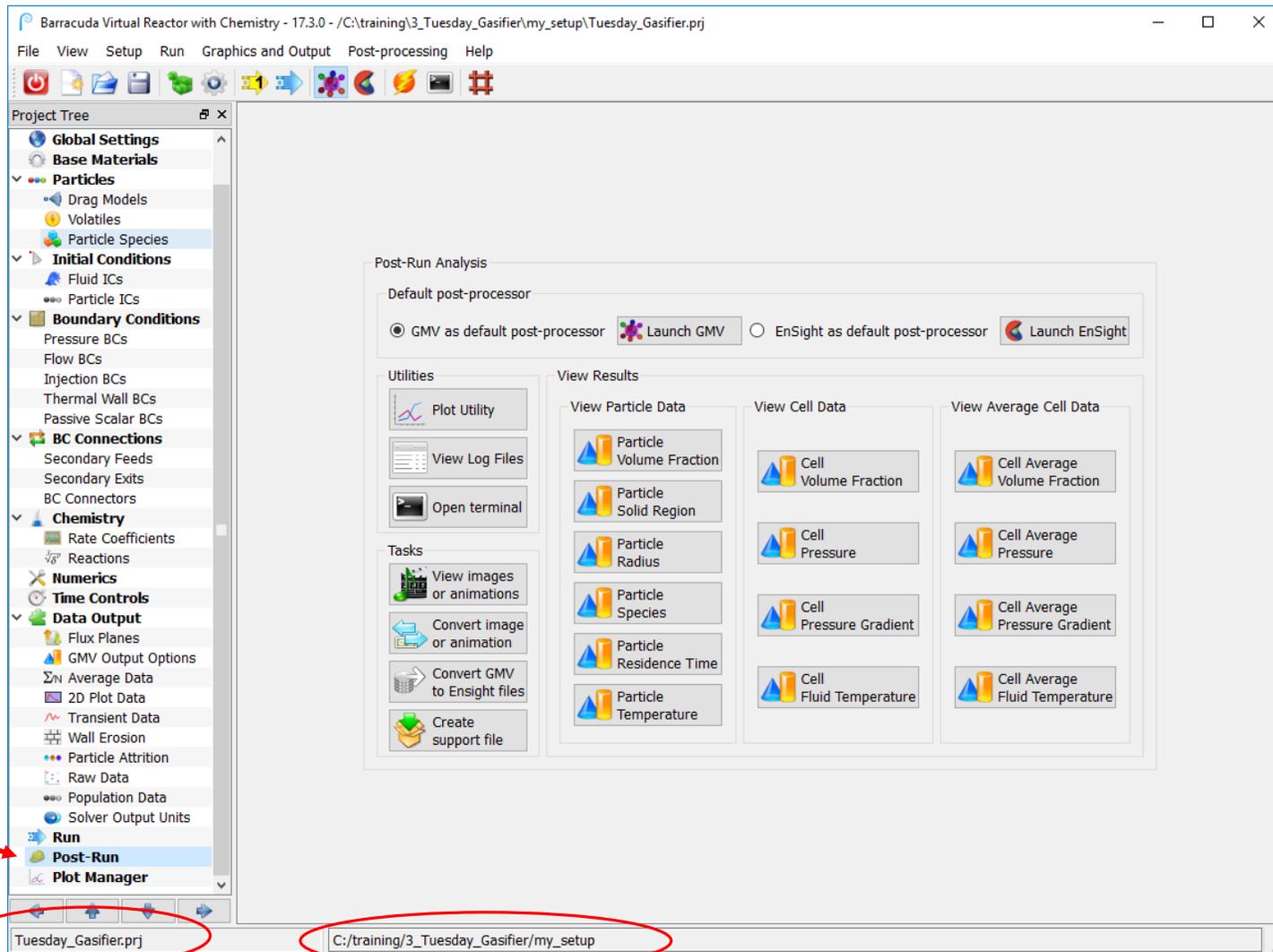
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Training Objectives

- Revisit basic GMV functionality and study common post processing techniques
 - Displaying tracers
 - Using subset to display sections of the domain
 - Making animations
- Use GMV's **Select** feature to filter particles based on properties
- Revisit basic plotting of data with **Plot Manager**
- Apply running averages to Barracuda time-varying output data

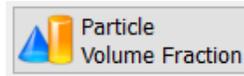
Post-Run

- When the Barracuda solver completes the run, examine your results by clicking on the **Post-Run** tab
- Check that the **project file** and **working directory** are correct

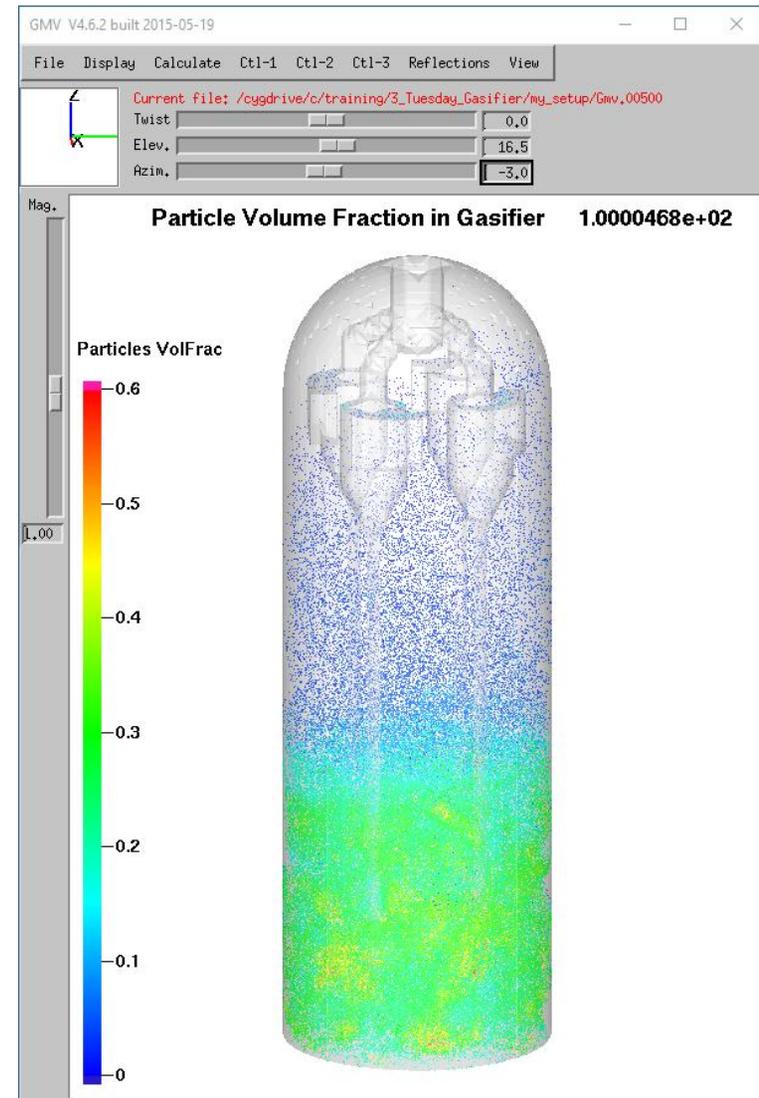


Particle Volume Fraction

- First look at the particles colored by volume fraction in the full gasifier



- Add an appropriate title
- Adjust the view angle and the Data Limits as desired

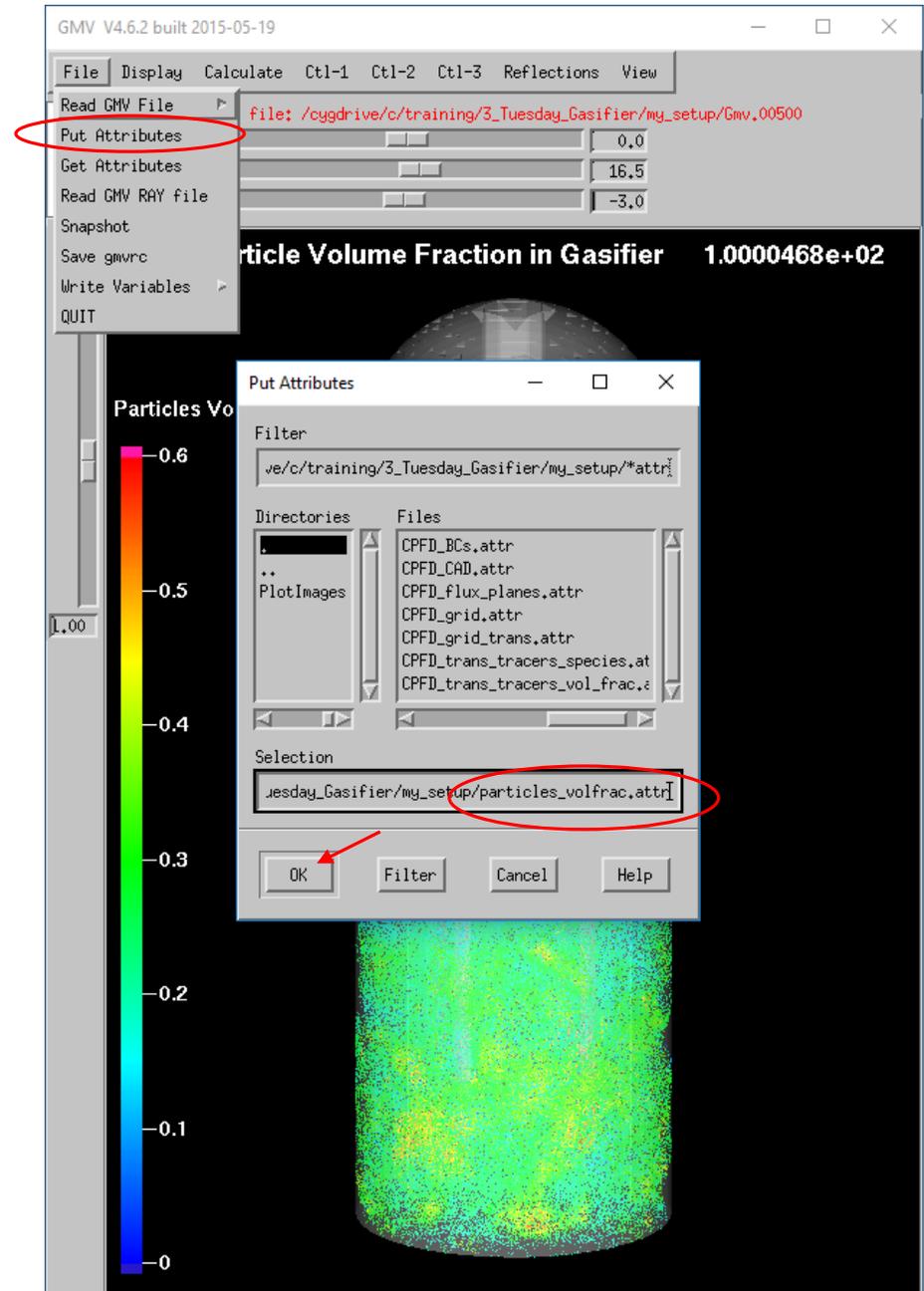


Animation of Gasifier Fluidization

- Create an animation showing the gasifier fluidization

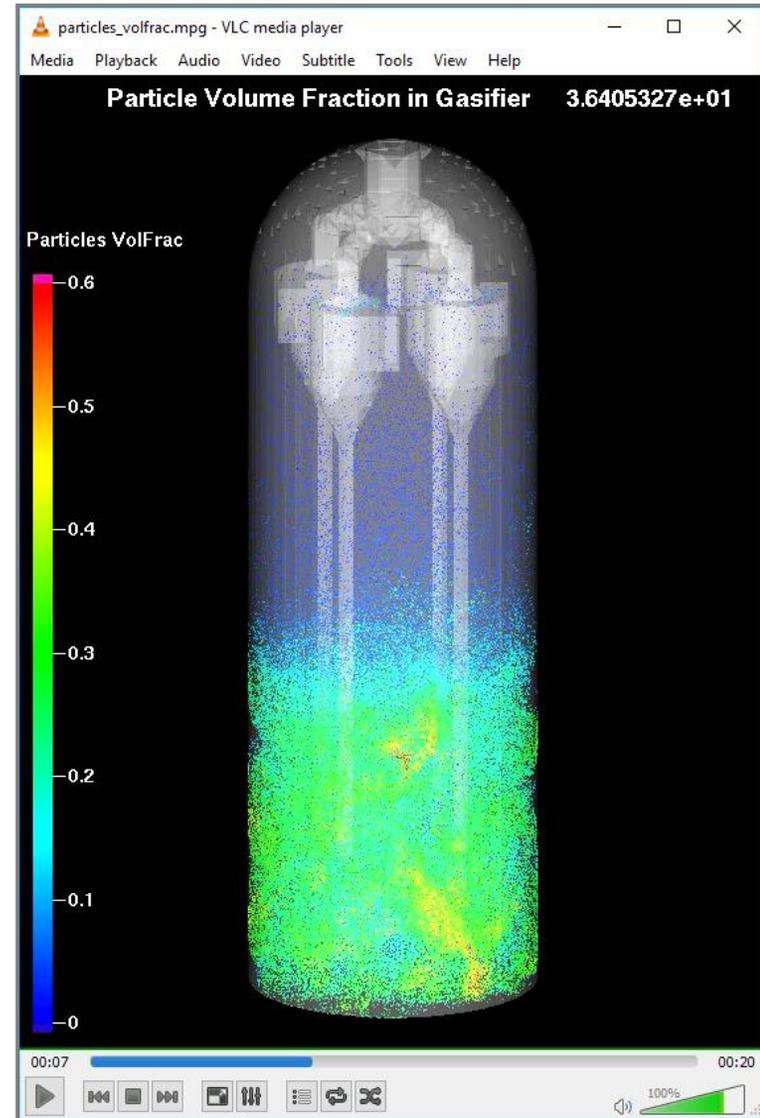
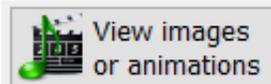
Tips:

- Start by creating an attribute file
 - File → Put Attributes
- Use **BATCHMOVIE.sh** to create the animation
- Refer to the Kuiper's post-processing slides for help
- A black background often looks good on animations (white backgrounds are better for printing)



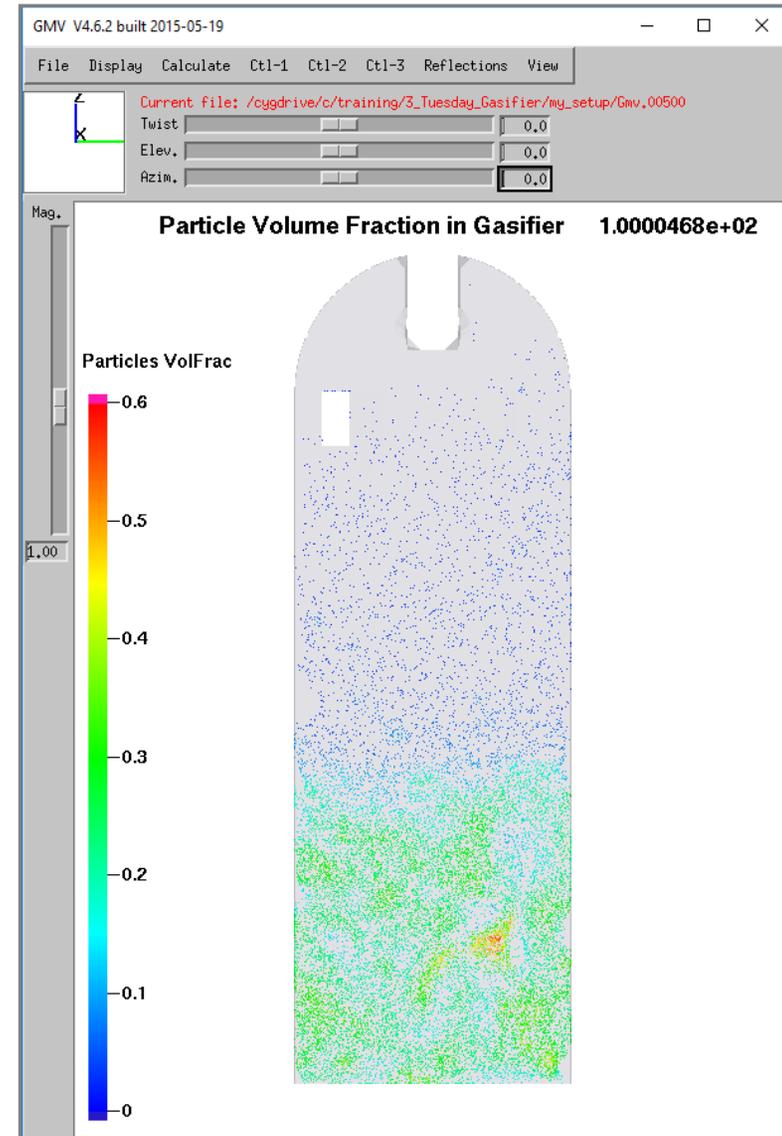
View Animation of Gasifier Fluidization

- BATCHMOVIE.sh will create a snapshot for each Gmv* file, and assemble a .mpg file as the final step.
- To view the animation, click on View images or animations and select the appropriate file, i.e. "gasifier_fluidization.mpg"



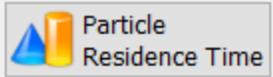
Displaying Thin Slices of the Model

- Look at a thin slice of the particles at the center of the gasifier by taking a subset in the x-direction between -6 inches and +6 inches
- Hint: Ctl-3 → Subset

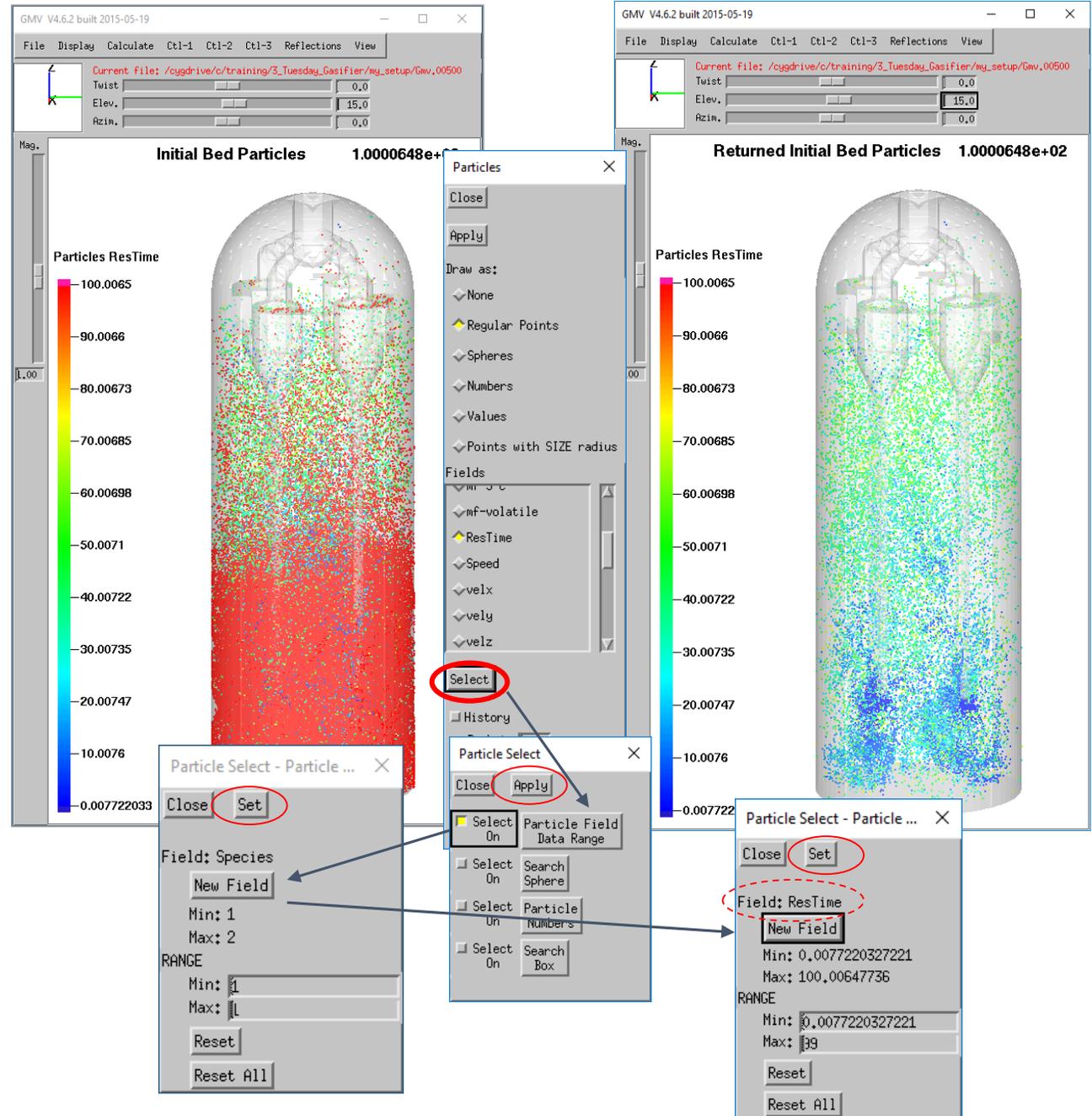


Residence Time of Particles

- Plot particles by residence time

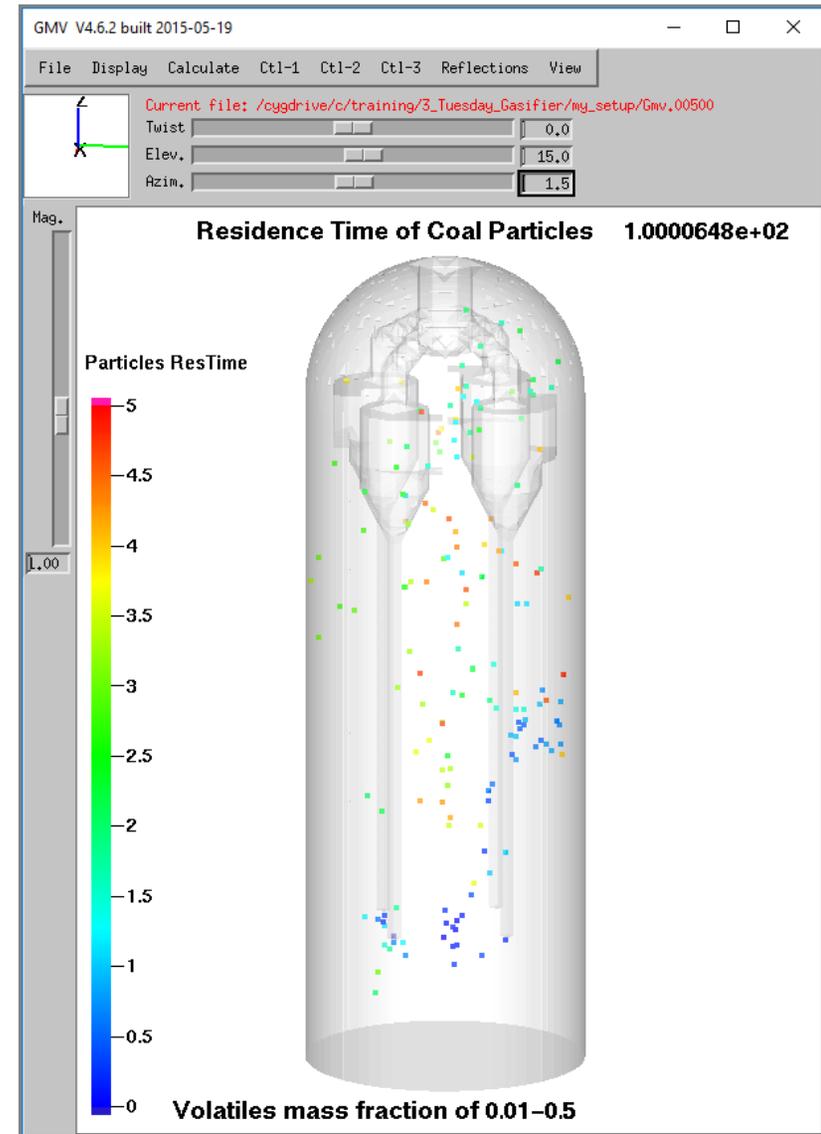


- Look at the initial bed particles (species 1) only by using the particle **Select** feature
- There are a lot of red particles (particles that have been in the system during the whole simulation). Change the field in Particle Select to **ResTime** and give a Max of 99. This will show the particles that have been entrained and then returned via the BC Connectors.
- What does this tell us about mixing in the bed?



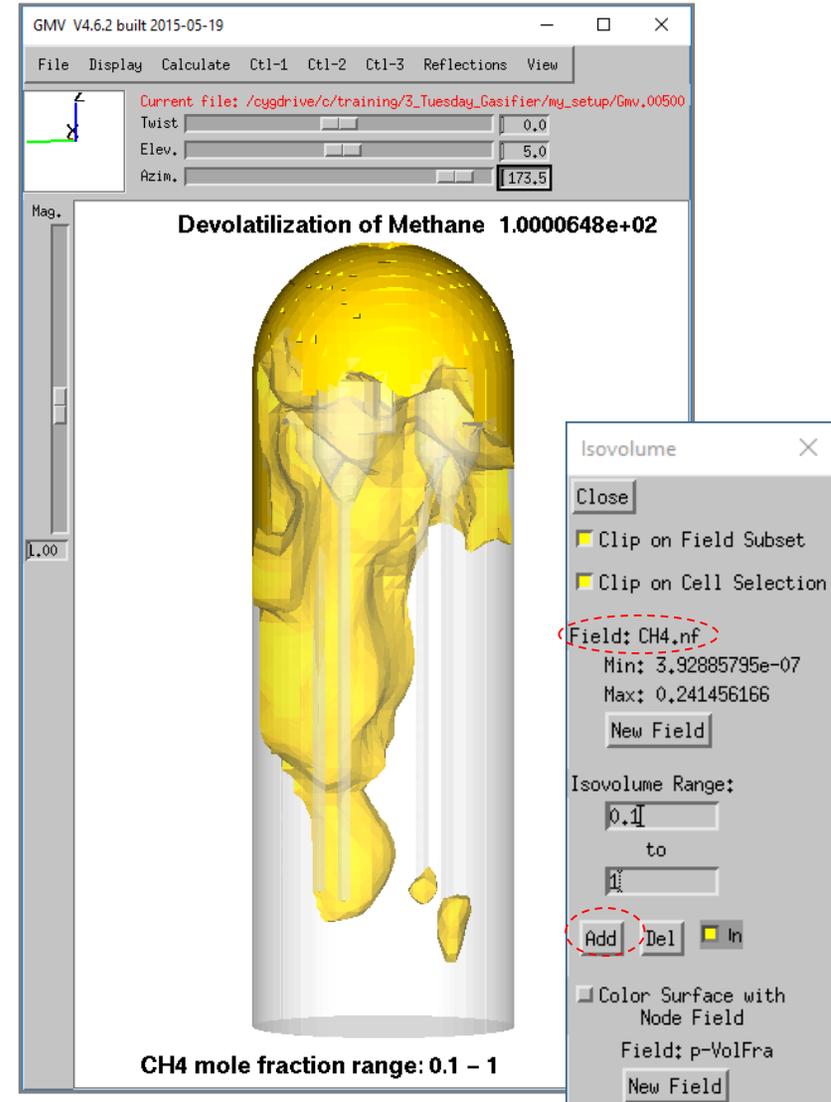
Residence Time of Particles

- Look at the residence time of particles with a volatiles mass fraction of at least 0.01
- Use the Particle **Select** feature to display only the particles with a volatile mass fraction between 0.01 and 0.5
- Adjust the **Data Limits** to show residence times between 0.005 and 5 seconds
- What does this tell us about devolatilization?
- How can Barracuda be used to optimize the coal feed location?



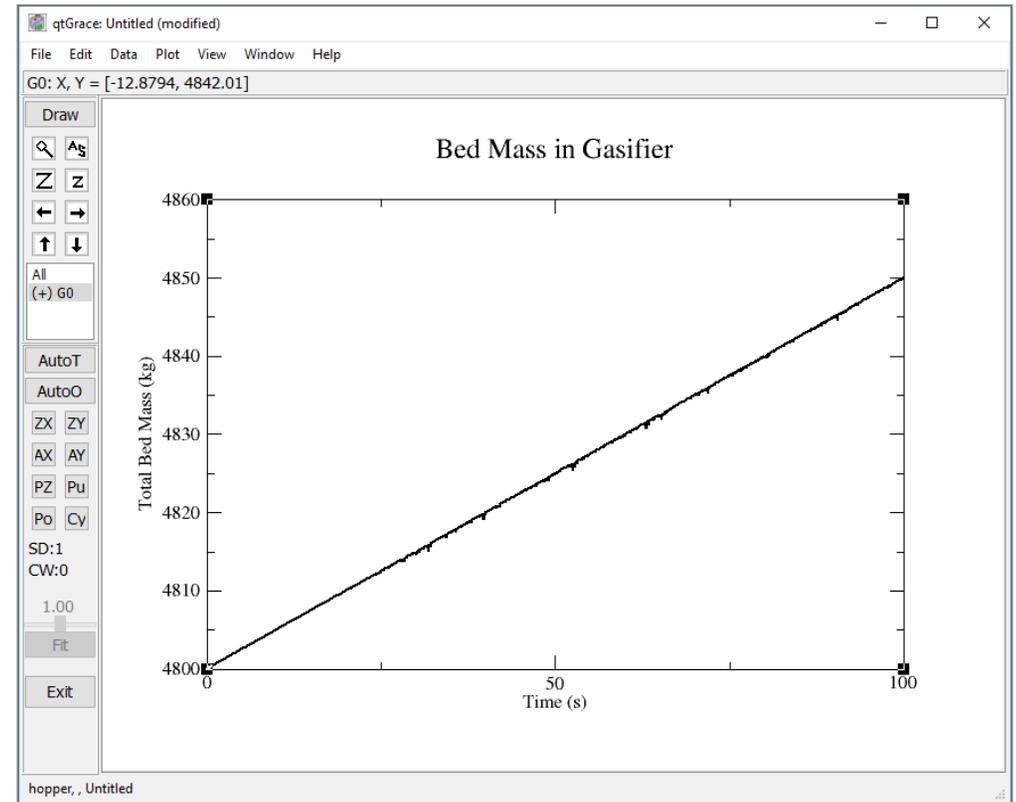
Devolatilization of Methane

- Use an isovolume to show where the mole fraction of methane ranges from 0.1-1.0
- **Start with Post-Run → Particle Solid Region**
- Click on **Calculate → Isovolume**
- Select **CH4.nf**.
- Enter the desired **Isovolume Range** and click **Add**
- De-select **Color Surface with Node Field**
- To add the color, click on **Ctl-1 → Coloredit → Materials, Isosurfaces, Isovolumes**
 - Notice **Get Color** is selected
 - Click on **16** (or whatever color you wish to use for the isovolume)
 - Select **Set Color**
 - Click on **Volume**
- What does this tell us about the mixing of gases within the bed?



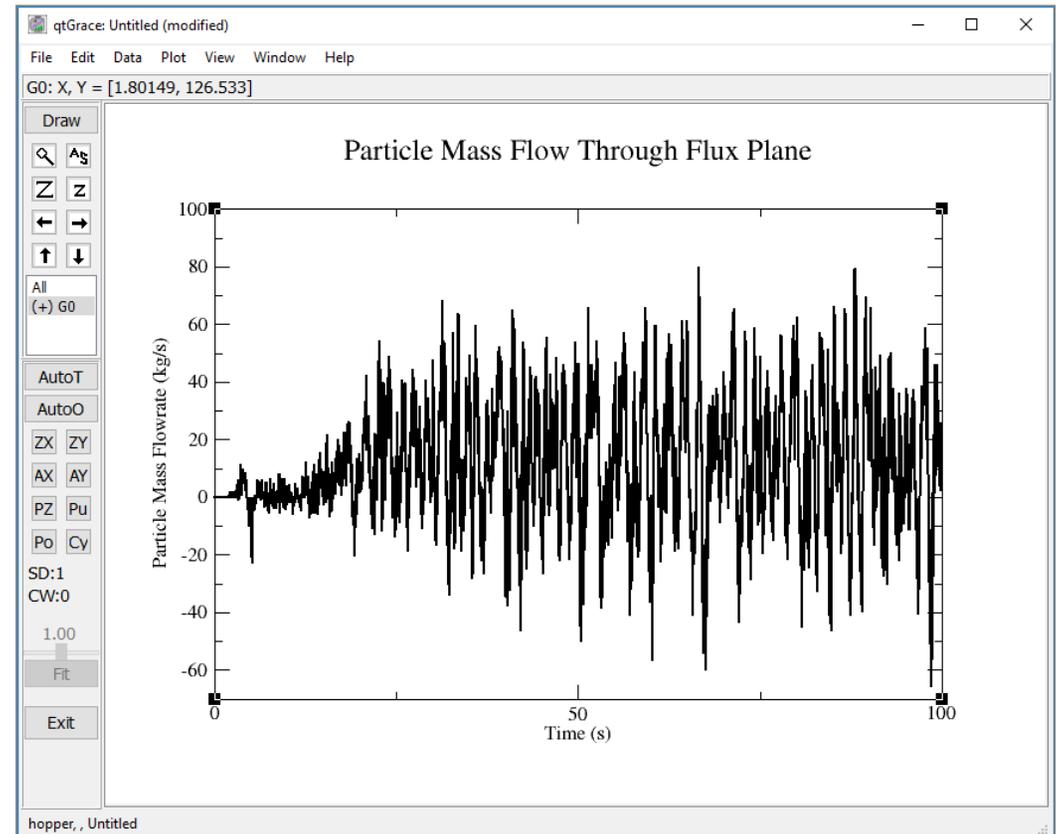
Plotting Total Bed Mass

- Use **Plot Manager** to plot the total bed mass from the “history.log” file
- Remember to add axis labels and a title for clarity
- Are the BC Connectors working?
- Is this the most effective way to model the particle flow through the cyclones?



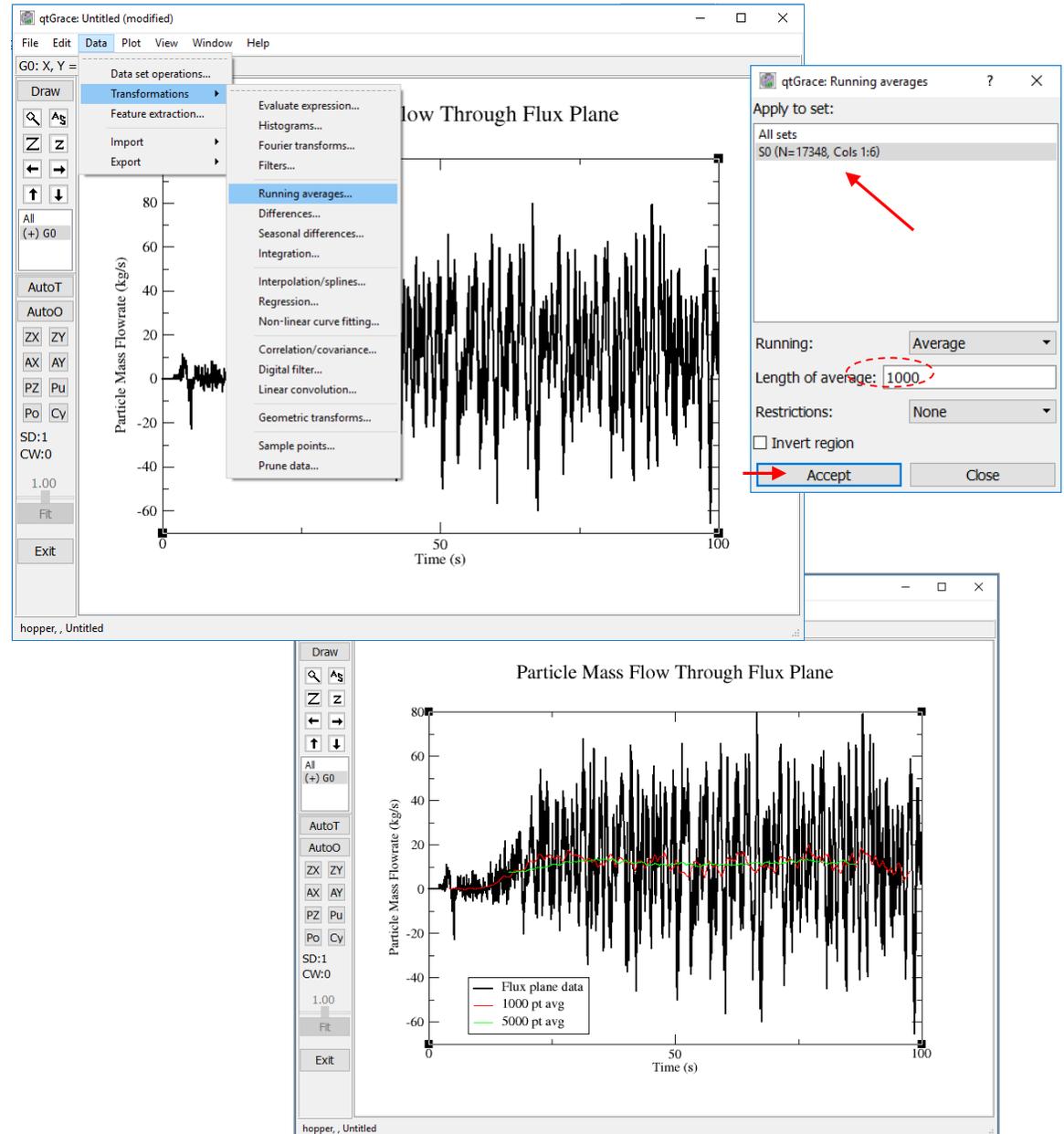
Early Entrainment

- Plot the particle mass flow through the early entrainment flux plane from the “FLUX_early_entrainment” file
- Particle mass flow rate averaged over 5 time steps is available in column 6
- Add axis labels and a title



Early Entrainment - Averaged

- To reduce the noise, 1000 and 5000 point running averages are added
- Click on **Data** → **Transformations** → **Running averages**
- Select data set “S0”
- Set the **Length of average** to “1000”
- Click **Accept**
- To add the 5000 pt running average, re-select data set “S0”, set the **Length of average** to “5000”, and click **Accept**



Early Entrainment - Averaged

- The averages can be isolated by removing the original data
- Using **Linux**:
 - Click on **Data** → **Status**
 - Click on Kill and then click on data set# 0
 - **Close** the Status window
- Using **Windows**:
 - Click on **Plot** → **Set appearance**
 - Select the **S0** set
 - Under **Line properties**, change the **Style** to “None”
 - Click **Apply** and then **Accept**
- Adjust the y-axis limits to better display the data
- Hint: **Plot** → **World Scaling**
- In what ways do the averages provide more information? In what ways do they provide less?



Conclusion of Gasifier Example

- A basic coal gasifier was set up including
 - Multi material particles
 - Volatile components
- A coarse grid was used and boundary condition assumptions were made to obtain a fast running model
- Basic post processing was performed to study the fluidization and entrainment in the model
- This work serves as the basis for a more complex model