VOD Zone and Coefficient Training

TI Automotive Apps, Dallas

Overview

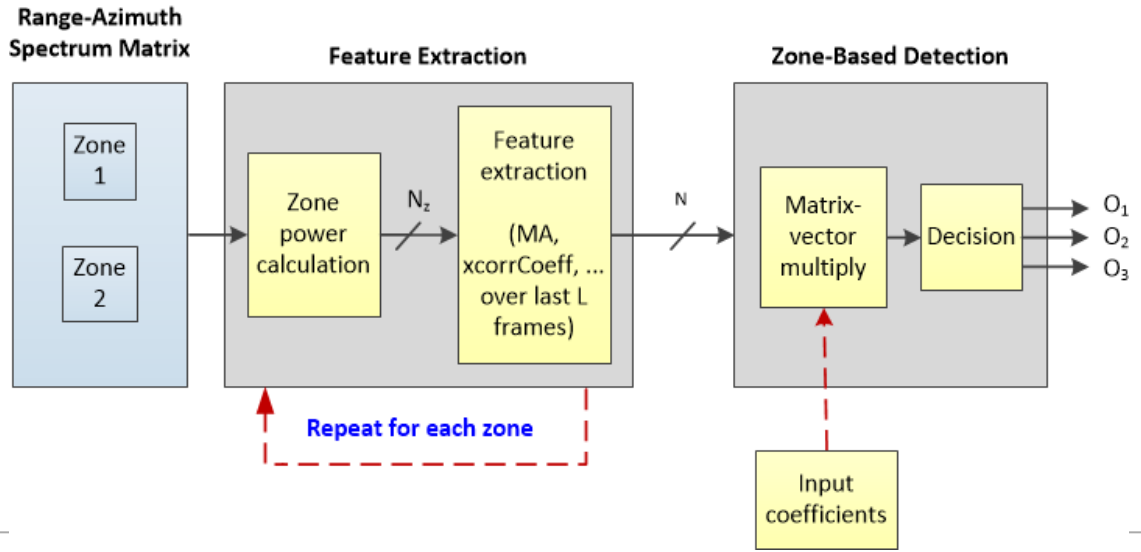
- This presentation provides additional information on the training process for the Vehicle Occupancy Demo. Please refer also to the demo's user guide.

- At a high level the process falls into 4 steps:
  1. Adjusting zone positions if needed.
  2. Collecting data sets.
  3. Processing the data sets through the provided tools.
  4. Copy paste the new coefficients into your chirp configuration file.

- This process only applies to VOD demo version 3.0 and newer, since the GUI has been updated to make the process easier and more accurate.
- The following slides step through each of these topics.

Why Is Coefficient Training Needed?

- Coefficients are used in the very last step of our processing to compare the averaged zone power of a pair of zones. In effect, we are teaching the code what the zones “look like” when they are empty or occupied.
- Coefficents are not used in heatmap generation nor in zone power analysis (Feature Extract).
- Training needs to be done in the final environment (the vehicle) so that it will include reflections off of interior surfaces.



Zone Adjustment

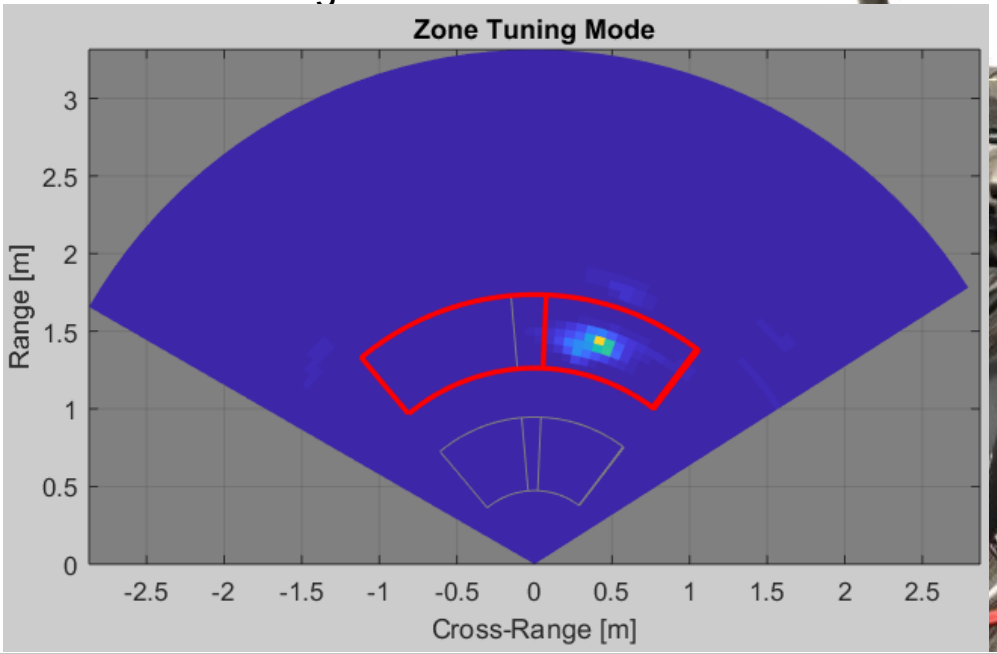
- Defining appropriate zone boundaries is the first step to tuning the demo.
- Steps:
  1. Setup the “scene” as it will be used – either in the vehicle under test, or in a lab.
  2. Open the VOD UG (docs/ODdemo_usersguide.html), find the “Zone and Coefficient Training” section at the end and follow the instructions under “Expand for details under tuning zone definitions”.
  3. For this walkthrough of the process, we will use these zone definitions from the chirp config file:

```
%OD Demo commands:
zoneDef 6   9 10 8 15   9 10 25 15   24 10 8 15   24 10 25 15   9 10 8 32   24 10 8 32
secZoneDef 5 2 1 2
secZoneDef 6 2 3 4
```

  - This definition creates 4 primary and 2 secondary zones, shown on the next slide:

Zone Adjustment

- The primary zone definitions 9 10 8 15 9 10 25 15 24 10 8 15 24 10 25 15 correspond to these zone positions (in order):
- You can change this as needed.



Data Collection

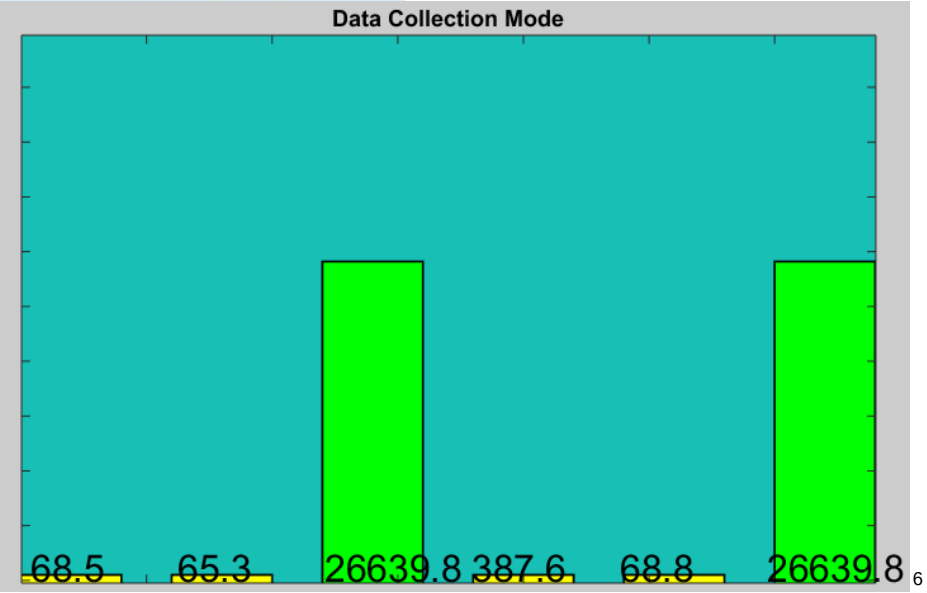
- The next step is to put the demo into data collection mode and collect several data sets. More on this in a minute...
- To put the demo in data collection mode, set the first parameter of oddemoParms to 3:

NOTE: Data Collection mode is selected via the first parameter of oddemoParms:

```
oddemoParms  3  8  0.001  0.50  18
```

- and restart the demo.

- You will need 1 or 2 subjects and a test operator.
- Have the subject(s) sit in the zones with the demo running and let them observe their power levels.
- Observe power spikes with big moves.
- Try to balance the amount of movement between the zone subjects.



Data Collection

- Next, we want to collect the following sets of data:

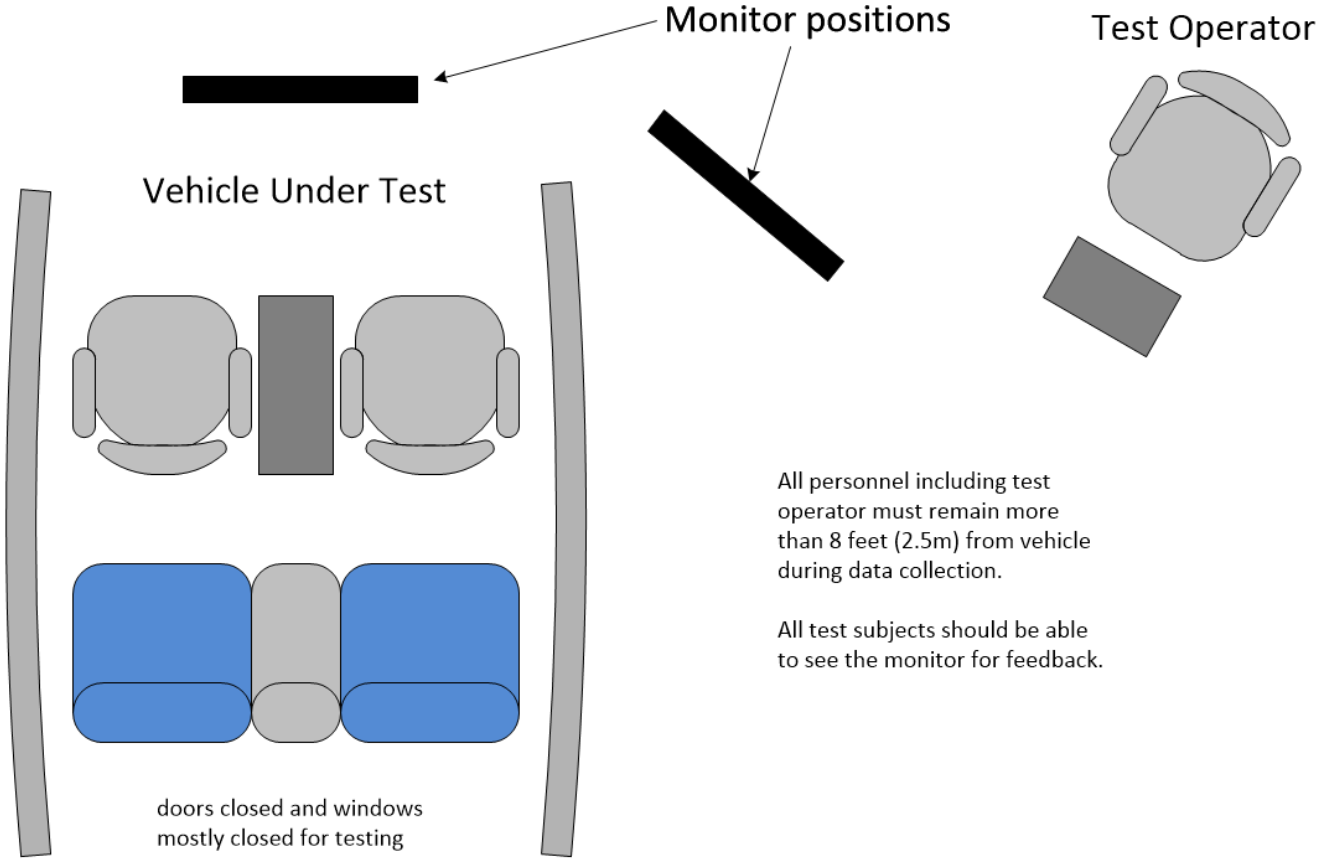
- For 2 zone operation:
  - Both zones empty: log_001.mat
  - Zone 1 (L) occupied: log_002.mat
  - Zone 2 (R) occupied: log_003.mat
  - Both occupied: log_004.mat (optional)

- For 4/5 zone operation:
  - All zones empty: log_001.mat
  - All zones empty: log_002.mat
  - Zone 1 (FL) occupied: log_003.mat
  - Zone 2 (FR) occupied: log_004.mat
  - Both Front occupied: log_005.mat
  - Zone 3 (BL) occupied: log_006.mat
  - Zone 4 (BR) occupied: log_007.mat
  - Both Back occupied: log_008.mat
  - FL + BR occupied: log_009.mat
  - FR + BL occupied: log_010.mat

- For 4/5 zone operation: (1 person)
  - All zones empty: log_001.mat
  - Zone 1 (FL) occupied: log_002.mat
  - Zone 2 (FR) occupied: log_003.mat
  - Zone 3 (BL) occupied: log_004.mat
  - Zone 4 (BR) occupied: log_005.mat

- Note: Filenames are generated by the gui, based on the current value in lognum.dat. Delete lognum.dat before starting so that the first filename will be log_001.mat.
- If you have to restart a collection – these filename numbers will be different!

Data Collection – Recommended Test Setup

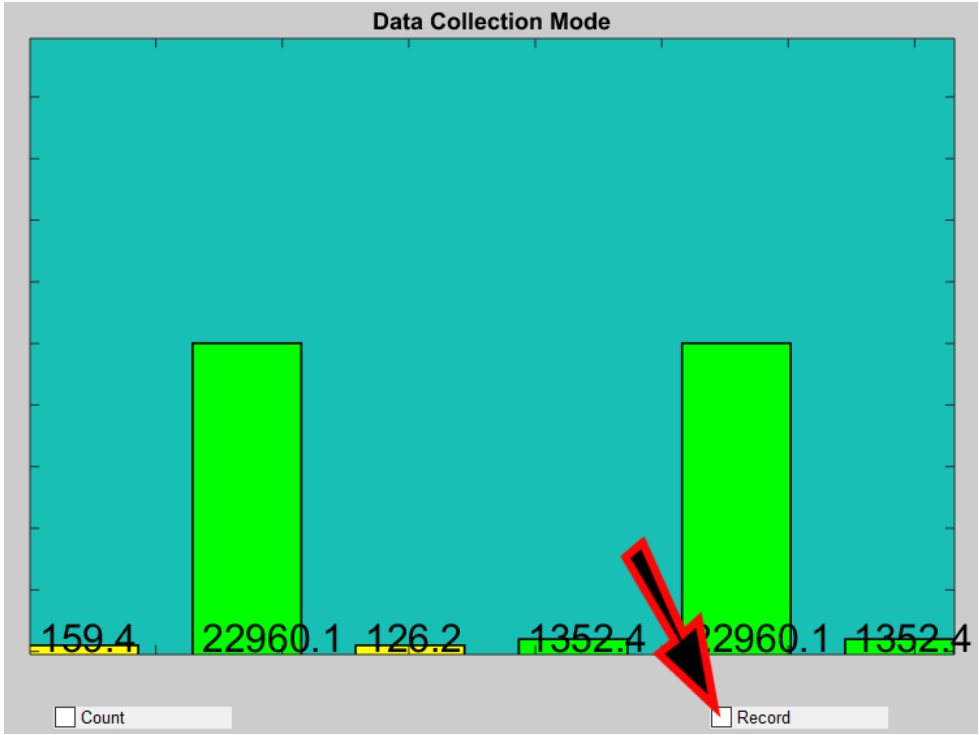


All personnel including test operator must remain more than 8 feet (2.5m) from vehicle during data collection.

All test subjects should be able to see the monitor for feedback.

Data Collection

- Here are the steps to collect each set of data:
  - Have the required subjects sit in the correct zones.
  - WAIT for the power levels to normalize.
  - Click the “Record” button on the GUI. It is best to have a test operator well outside the FOV doing this, but use a monitor so the subjects can see their levels.
  - WAIT for 192 frames (~31sec) to collect.
  - Click the “Record” button again to save the .mat file (it is saved where the GUI runs).
  - Rename the file if necessary to indicate which data case it is.
  - Repeat for each data set.



Data Collection

If there are anomalies during the data collection the data recording should be stopped and a new data collection should be started.

- Reasons to stop a data recording:
  - Someone moved a lot for an extended amount of time. This will be obvious by a sustained power spike in one or more zones. A brief spike is okay and will be averaged out.
  - Someone held their breath or did something to let their power level fall to the empty zone level for an extended amount of the recording.
  - Someone entered or exited a zone.
  - Someone walked nearby, elevating the power levels.
  - The test operator sees the GUI command window display a “dropped or skipped frame” message. This can happen from time to time and if it does, the data file will be incomplete and the coefficients generated from them will be invalid. If you see complex numbers in the generated coefficients you will know this happened, and that one of your files is corrupt. Swap out each file one at a time when running build_data() to discover which one is bad. If this happens frequently, try a better PC or a different USB cable, or stop other programs from running while collecting.
- If you do restart, note the new filenames and rename them so the batch files will work!

Data Collection – Final Notes

- Before collecting the data files, take note of the zone power levels when:
  - The zones are empty,
  - Occupied, but remaining still (not holding their breath),
  - Occupied, but moving slightly,
  - Occupied, but moving moderately.
- Capturing occupied power levels that approach the empty zone level does two things:
  - It increases the likelihood of detecting an occupant that is barely breathing,
  - It also increases the likelihood of false detections since the occupied level is similar to the unoccupied level.
- Capturing occupied power with significant movement makes it harder to detect very still occupants since the zone is trained to detect with higher power levels.
- A large imbalance of occupant power, such as a small child next to a large adult will sometimes cause difficulties with the child's zone. Test with real children as available.
- This requires experimentation. Generally, a smaller amount of movement is best.

Coefficient Generation – Two Zones

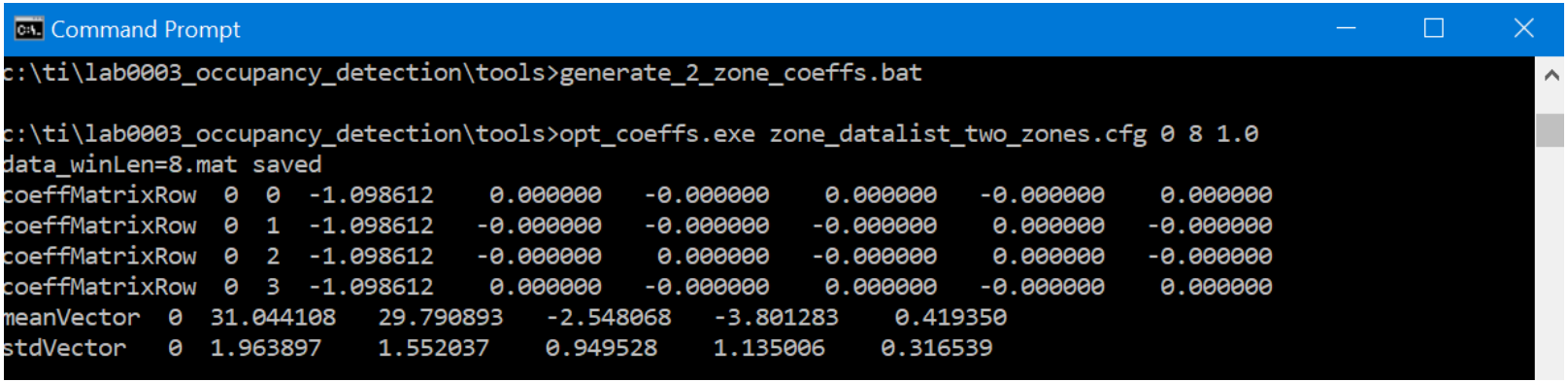
- First, please make sure your collected filenames match the names on Slide 7, or the batch file will fail. Or, modify the filenames and also the files listed in zone_datalist_2_zone_xxx.cfg to match.
- The batch files provided to run the tools for the two zone case are:
  - \tools\generate_2_zone_1ppl.bat (one test subject used for data collection)
  - \tools\generate_2_zone_1ppl.bat (two test subjects used for data collection)

- The arguments to opt_coeffs.exe are (see user guide for more details)
  - filename of data files – the list of collected .mat files to be processed, with occupancy indicators and zone def.
  - zone “pair” number. Always zero for the two zone case.
  - window length value used in the chirp configuration, usually 8 or 12.
  - lambda value, usually 1.0 (see user guide)

- Run the batch file in the \tools directory. It expects the .mat files are in ..\gui.

Coefficient Generation – Two Zones

- When you run the batch file, it will dump the coefficient commands to the window:



- Copy paste the six lines with the new coefficients into your chirp config file.
- Then, restart the demo in operational mode to test them.

Coefficient Generation – Four Zones + Secondary

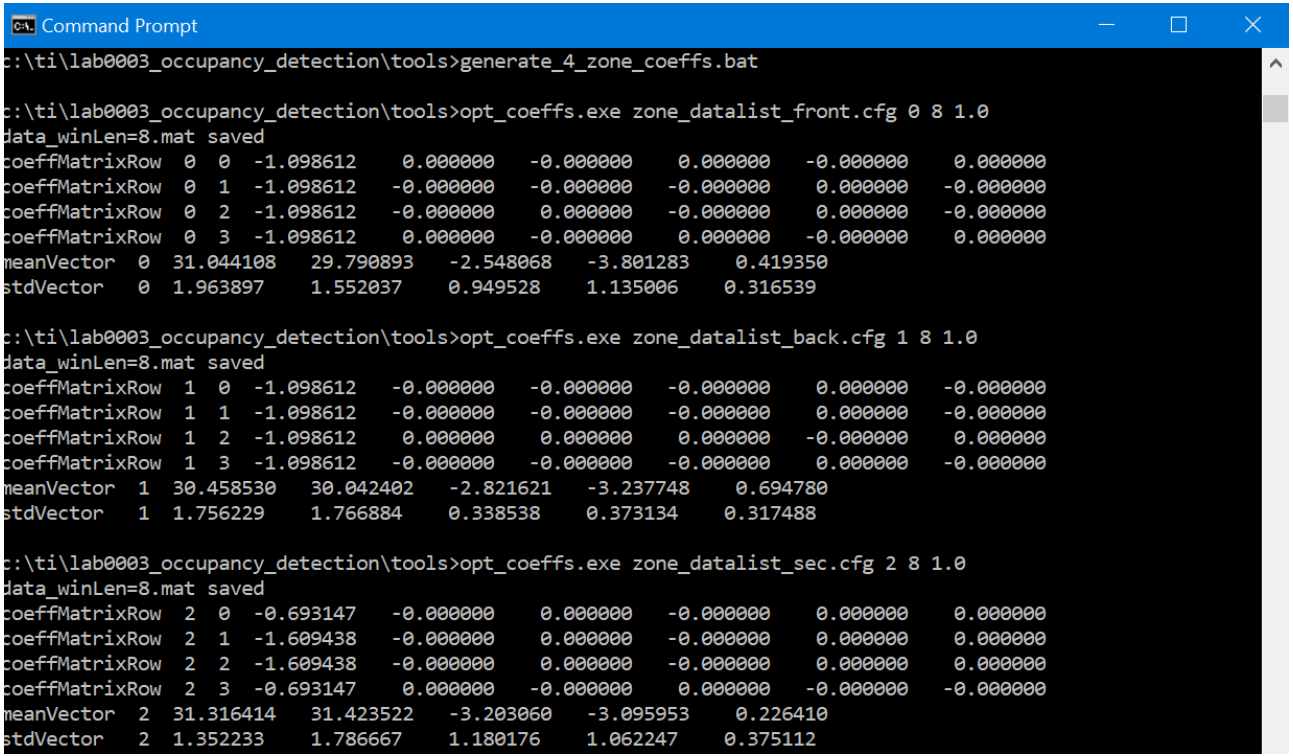
- First, please make sure your collected filenames match the names on Slide 7, or the batch file will fail. Or, modify the filenames and also the files listed in the zone_datalist_*.cfg files to match.
- The batch files provided to run the tools for the four+two zone case are:
  - \tools\generate_4_zone_1ppl.bat (one test subject used for data collection)
  - \tools\generate_4_zone_1ppl.bat (two test subjects used for data collection)

- The arguments to opt_coeffs.exe are (see user guide for more details)
  - filename of data files – the list of collected .mat files to be processed, with occupancy indicators and zone def.
  - zone “pair” number. 0 for front, 1 for back, 2 for secondary zones.
  - window length value used in the chirp configuration, usually 8 or 12.
  - lambda value, usually 1.0 (see user guide)

- Run the batch file in the \tools directory. It expects the .mat files are in ..\gui.

Coefficient Generation – Four Zones + Secondary

- When you run the batch file, it will dump 3 sets of coefficient commands to the window:
  - Copy paste these 3 sets of coefficients to your chirp config file.
  - Restart the demo to test.



All Done!

- With the new set(s) of coefficients added to your chirp config file, you're ready to run:
  - Stop the demo (press q in the GUI window).
  - Edit your chirp config file once again, and set the demo to run mode:

NOTE: Operational mode is selected via the first parameter of oddemoParms:

```
oddemoParms  1  8  0.001  0.50  18
```

  - Save the file, and restart the demo.
  - Test your new coefficient tuning.

End