Using Kontakt's

AET Filter

For

Volume Dynamics Control

Part 1

The Basics

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Last Revised 8-22-12

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1.0 Introduction

Realistic emulation of wind instruments (as well as other instruments that can produce a steady, sustained tone) requires us to break away from the 'shop-worn' piano paradigm. Instead of simply controlling volume with the initial attack velocity, we must provide a means for varying volume continuously during the sustain of a note. However, the timbre of most instruments also changes with volume and therefore that property must also be continuously variable throughout a note's sustain. This of course doesn't fit too well with the current practice of sampling instruments at several discrete volume levels and then selecting the most appropriate sample to play based solely on key-down velocity.

This problem has generally been attacked from two directions. Since softer sounds usually contain fewer of the higher harmonics, soft sounds are 'darker' and loud sounds are 'brighter'. Therefore, one way to emulate continuous timbre control is to use some form of dynamic equalization. Variations on this general theme might be called the *modeling approach*. An alternate methodology is to use several volume-level samples and attempt to smoothly morph between them some way in an effort to simulate the needed continuous timbre control. Variations on this general theme might be called the *sampling approach*. Each of these approaches have their strengths and weaknesses.

While sampling inherently provides more realism, morphing smoothly between discrete static samples is problematic. Usually, sample morphing is accomplished by crossfading a number of discrete samples but this often produces a distinct phasing sound in the overlap regions. This more or less forces the performer to pass through these overlap regions quickly to 'avoid hearing it' (which then often warps the intended musical dynamics). There are some techniques for getting rid of (or at least subduing) these phasing problems but most of them require very arduous processing of the **volume-layer** samples.

Dynamic EQ on the other hand can more easily provide smooth continuous morphing but at the expense of less realism. However, with the right kind of equalization, a fairly convincing timbre variation can be obtained and in many cases the slight loss of realism may be less objectionable than the phasing artifacts of sample crossfading.

Probably the benchmark for phase-free morphing of samples is a proprietary process introduced by Sample Modeling which they refer to as 'Harmonic Alignment'. But most developers have neither the facility nor the know-how to accomplish something similar and as a result, phase-free morphing of volume layers remains somewhat of an elusive dream. So, not too surprisingly, when NI first announced their new AET filter, it created a fair amount of excitement in that it sounded like it might be the 'Poor Man's Harmonic Alignment'.☺

The AET filter appeared to be a rather sophisticated extension of the dynamic EQ approach but, after some initial hands on experience, a rather negative buzz began to develop on the forums. It is most unfortunate that NI didn't counteract some of this negativism with some nice tutorials and perhaps a little more positive press. I know from personal experience that when the AET was first introduced, I was very busy with other things and I allowed the negative comments of others to influence me in the wrong direction.

The AET filter has two fundamental modes of operation that NI refers to as **Articulation Morphing** and **Velocity Morphing**. NI made Velocity Morphing much easier to use by automating a lot of the setup steps so it's likely that most early experimenters tried Velocity Morphing first. But, Velocity Morphing in its basic configuration is not too well suited for continuous dynamics control (which is probably what most users were trying to do with it). On the other hand, Articulation Morphing, which ***is*** well suited for sustained-note dynamics control, requires a bigger initial investment of learning time to use. This, perhaps coupled with some disappointing results obtained with Velocity Morphing, may have resulted in a lot of Kontakt users setting aside the AET without even trying to use it properly.

In any case, I suspect that the full capability of the AET filter has yet to be realized by the majority of Kontakt developers. But there are always a few pioneers who prevail against fearful odds and, thanks to the efforts of **David Carpenter**, my interest in the AET filter was recently rekindled. In spite of all the negative comments floating around, David dug in his heels and developed some techniques for using Articulation Morphing to provide impressive sounding, phase-free dynamics control of his wind instruments and thereby demonstrated convincingly that the AET filter *can* provide excellent results when used properly.

The AET Filter isn't perfect and you may encounter situations that it won't handle as well as you would like. But for many (if not most) applications, you may find that the AET filter is just what you have been hoping for. **Part 1** of this guide only introduces the essential **basics** of using the AET filter. However, David is planning to author a **Part 2** for this guide in which he intends to cover some of the practical problems you may encounter in real-world application of the AET Filter.

Overall, Part 1 of the AET Guide takes a tutorial approach by presenting a series of hands-on Case Studies. The preferred Wind Instrument controller for dynamics is of course a breath or wind controller. However, it is realized that there will be interest in using the AET for other types of instruments as well. Moreover, many readers may not have a BC or WC but just about everyone will have a Mod Wheel so I decided to use it as the dynamics controller for all the Case Studies. This in no way should be implied as an endorsement of the Mod Wheel for this purpose. For wind instruments you will obtain far more convincing results if you use breath to control your dynamics. You may also encounter other issues when using a BC versus using the Mod Wheel but nevertheless, you should be able to adapt the general basics that are presented here to any kind of continuous controller.

The ordering of the case studies in this tutorial may seem *contrary* in that I'm going to start with **Articulation Morphing** instead of the easier-to-setup **Velocity Morphing** mode. However, there are good reasons for presenting it this way in that too many details of using the AET filter are hidden from you when using the automated Velocity Morphing mode. Exposure to these details is necessary in order to understand why the Velocity Morphing mode will sometimes provide less than expected performance. However, it turns out that it is rather easy to devise some simple scripting support that can elevate the performance of the Velocity Morphing mode to that obtained with Articulation Morphing — while still being easier to set up.

Even though the AET filter can sometimes be used to morph between unrelated sounds (with varying degrees of success), this guide will focus specifically on the morphing of volume layers. You may be able to use the AET filter to morph between some closely related sounds (such as a trumpet with and without a mute) but such things will be left for you to experiment with.

In any case, once you have mastered the basics of using the AET filter, you should be able to set up either a Velocity or an Articulation Morph with little difficulty. So you can then choose the method most appropriate for each situation you encounter.

It is my hope that this Basic Guide to using the AET Filter will encourage others to start exploring this very useful effect. And, who knows, if more developers start showing interest in the AET, it might just motivate NI to start improving it in the days ahead.

Rejoice in the Lord,

Bob

2.0 Before Starting These Tutorials

The tutorials in this guide are ‘hands-on’ case studies that you can perform in Kontakt. But, in order to do that, some preparation is required. The case studies use a pair of instruments obtained from the standard K4/K5 library but they must be edited first. Please do not try to follow the case studies without properly preparing yourself or the tutorial instruments.

2.1 Self Preparation

Before starting the tutorials, please read the Kontakt Reference Manual discussion of the AET Filter. The description of how the filter works and the basics of using it are presented quite well by NI so we will not intentionally repeat that discussion here. It will also generally be assumed that you are familiar with the basics of using Kontakt and with the Group and Mapping Editors and their basic operations of selecting, exporting/importing and moving samples and their zones around as necessary to prepare the Case Study instruments.

2.2 Instrument Preparation

The instruments used in the case studies are derived from the K4/K5 VSL Solo Trumpet as follows:

1. Create a folder named **AET Demo** some convenient place on your hard drive.

2. Open Kontakt and load the **VSL Solo Trumpet** instrument from the Kontakt 4 Library in Orchestral / 3-VSL Brass / **Trumpet.nki**

3. In the group editor, select the first **Sustain** group and **export** it (patch only) to your AET Demo folder.

4. Close the VSL instrument and open a **New** default Instrument (Files->New instrument)

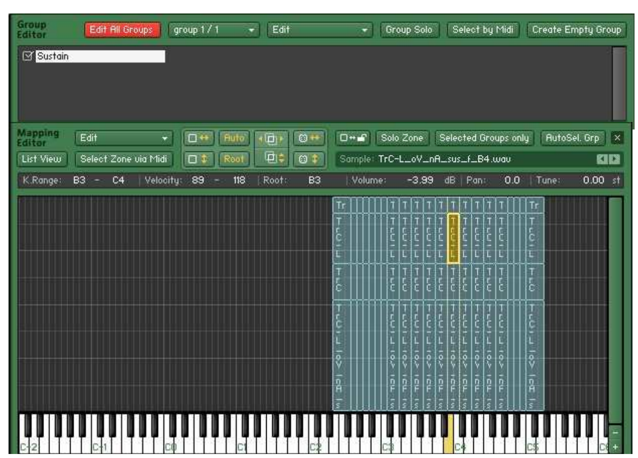
5. Open the group editor and **Import** the sustain group you exported from the VSL trumpet.

6. Delete the empty **Group 1** leaving just the imported **Sustain** group.

7. Under **Amp** modulators, delete **CC11** leaving just envelope and velocity.

8. Under **Group Start** options, delete the assigned keyswitch.

9. Save this instrument in your AET Demo folder with the name **Tpt#1.nki** (patch only).



Note that **Tpt#1** is a simple, one-group instrument with Sustain samples configured in the classic velocity layer format. This is the configuration that the Velocity Morph mode is intended to be used with and we will therefore use it for the Case Studies in section 4. However, we will now also derive the **Tpt#2** instrument (used in all the case studies of section 3) from this simple Tpt#1 instrument.

10. Continuing now with instrument preparation, save another copy of **Tpt#1** under the name **Tpt#2.nki** (patch only).

11. In Tpt#2, **Duplicate** the Sustain group 3 times (creating 4 identical Sustain groups). Then **rename** the four identical groups from left to right as FF, F, MF, and MP. Each group should now look like that depicted in the top picture to the right.

12. Select the **FF** group and in the mapping editor with **selected groups only** turned on, select and then **delete all but** the top FF zones.

13. **Stretch** the **FF zones** down over the full velocity range.

Now in a similar manner process the **F** group, the **MF** group and the **MP** group using the following steps.

14. Select the **F** group and in the mapping editor with **selected groups only** turned on, select and then **delete all but** the **F** zones.

15. **Stretch** the **F zones** down and up to cover the full velocity range.

16. Next, select the **MF** group and in the mapping editor with **selected groups only** turned on, select and then **delete all but** the **MF** zones.

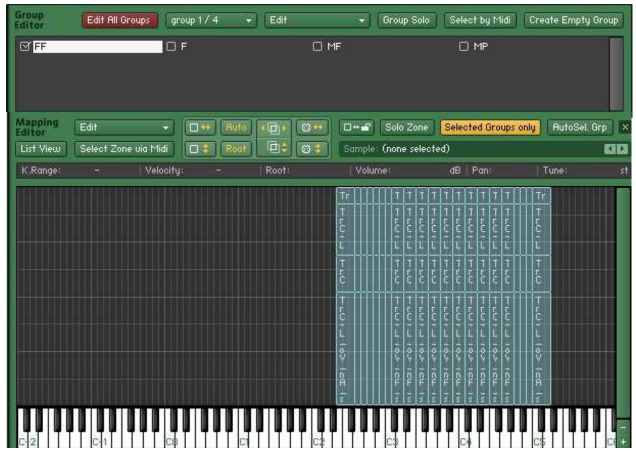
17. **Stretch** the **MF zones** down and up to cover the full velocity range.

18. Finally, select the **MP** group and in the mapping editor with **selected groups only** turned on, select and then **delete all but** the **MP** zones.

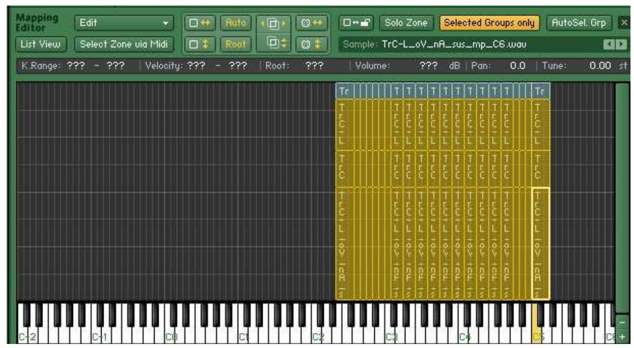
19. **Stretch** the **MP zones** down and up to cover the full velocity range.

20 As a final step, resave Tpt#2.

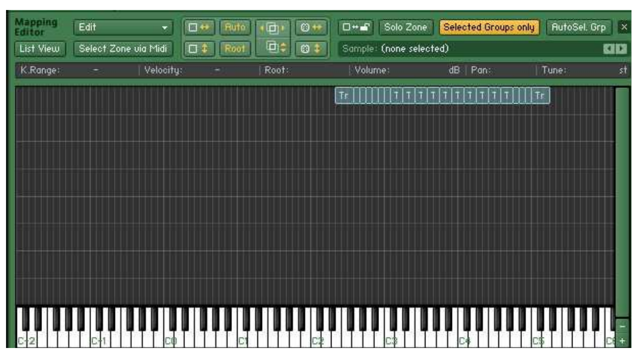
Note that the instrument named Tpt#2 is derived from Tpt#1 by moving the Volume Layers into four separate groups and spreading their zones vertically over the entire velocity range. Tpt#2 is thus organized in a typical ‘one velocity layer per group’ configuration with the FF samples in Group 1, the F samples in Group 2, the MF samples in Group 3 and the MP samples in Group 4.



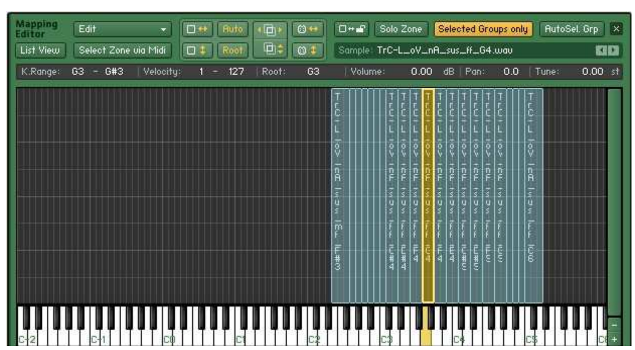
Step 11: all 4 groups look like the above FF group



Step 12: after selecting all but the FF zones



Step 12: after deleting all but the FF zones



Step 13: after stretching the FF zones

This configuration is typical of how the volume layers of most Mod-Wheel crossfade instruments are laid out and this instrument will be used as the basis for all the Case Studies of section 3. As you now begin the actual case studies, **never alter the original Tpt#1 and Tpt#2** instruments you just created. Rather, always make your edits to *copies* of these basic instruments, see the following **CAUTION**.

CAUTION: Never add an AET filter and its associated Morph layers and/or maps without first making a backup copy of your original instrument. If you should make a mistake and later want to remove the AET and start over, you may not be able to do so because there are some situations where you cannot fully remove the effects of the AET filter. The conditions under which this occurs are not yet fully characterized so the safest course of action is to always keep a copy of your original instrument as a fallback position.

3.0 Articulation Morphing

The case studies in section 3 are all derived from **Tpt#2** but always make your edits to a copy of Tpt#2 and not the original (see the above **CAUTION**).

3.1 Case Study #1

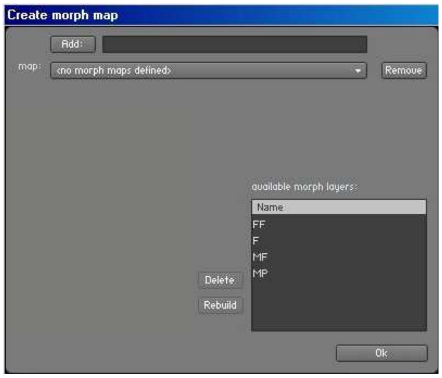
For this study, we're going to build a basic articulation morph using the four volume layers of Tpt#2. To do this, follow the steps outlined next.

1. Load Tpt#2 and resave it as **AET-CS1**. Set Tpt#2 aside without altering it.
2. Turn on Edit All Groups (EAG) and replace the Amp Velocity modulator with MIDI CC-1 (Mod-wheel) and set the modulation Intensity to about 55%.
3. Turn off EAG and select just the **FF** group.
4. Open the Mapping Editor and turn on **Selected Groups Only** (SGO).
5. Select all the zones and then click on **Create AET Morph Layer** in the Edit Menu.
6. In the dialog that opens, type the name **FF** and then accept the rest of the defaults by clicking **OK**. We will discuss these options briefly in section 3.6.
7. Steps 5 and 6 essentially cause Kontakt to scan all the zones in the **FF** group and build what NI calls a 'spectral fingerprint' for the **FF** group. See section 3.6.
8. In the Group Editor, select the **F** group and then repeat steps 5 and 6 in the Mapping Editor except this time name this Morph Layer **F** (instead of FF).
9. Repeat steps 5 and 6 for the **MF** and **MP** groups using Morph Layer names of **MF** and **MP**.
10. The above steps complete the 'analysis' phase of creating the the Articulation Morph Layers so resave the instrument **AET-CS1** up to this point.

11. Now open the **AET Morph Map Editor** and note that the names of the 4 Morph Layers you created in steps 1 to 10 appear in lower-right box near the bottom of the dialog.

12. In the **Add** box of the dialog, type the name **MP-MF-F-FF** and then click **Add.**

13. Select the **MP** layer in the right-hand box and then click on the left arrow button. This will move the **MP** layer to the left box where the **Morph Map** will be built.

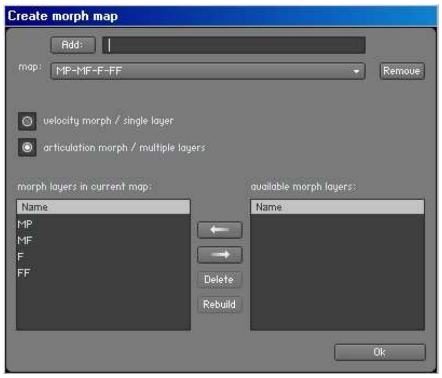


14. Next, select the **MF** layer in the right box and then click the left arrow to add **MF** to the Map.

15. Similarly, select the **F** layer and add it to the Map then select the **FF** layer and add it to the Map.

16. Finally, select the ‘articulation morph’ radio button and then click **OK**.

17. You have now defined your first **Morph Map** and named it **MP-MF-F-FF.**



18. Close the Mapping Editor and in the **Group Editor**, select only the **FF** group.

19. In the first **Group Insert Fx slot**, add the AET filter and then click on the button that says <no morph map> and select the **MP-MF-F-FF** map that you just created.

20. Click on the AET’s Modulator button and assign CC1 with intensity set to 100%.

21. In the Group Editor, with only the FF group selected, click on the **Group Solo** button.

22. This completes the first Case Study instrument, **AET-CS1,** so resave it now.

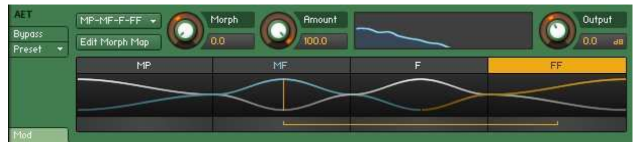
This instrument uses the Mod Wheel to modulate two things. The first is the Amp volume and the second is the AET filter’s Morph control. To try this instrument, move your Mod Wheel to min and then play and hold E4 on your keyboard. While the played note sustains, move your Mod Wheel from min to max slowly and listen. The volume will increase as you raise your Mod Wheel and at the same time the timbre will morph from the sound of the MP volume layer, through the MF and F layers and finally into the FF layer. If you want to hear a greater change in volume over the Mod Wheel’s range, adjust the Amp’s mod intensity slider until you get the volume range you desire. However, for now we wish to concentrate on the timbre morphing aspect.

Now, with the FF group still being soloed in the Group Editor, put your Mod Wheel at its minimum position. and note the appearance of the AET display. The AET filter display contains two graphical elements. The small window between the Amount and Output knobs displays the filter’s amplitude versus frequency response. The larger graphical window displays a number of things.

Note that this larger window is partitioned horizontally into four sections. These correspond with the four Morph Layers we assigned to the filter's Morph Map and are captioned with the names we originally assigned them, namely MP, MF, F, and FF. Note that the FF section is highlighted in orange to indicate that it is the group that the filter effect is actually associated with (inserted into).

Thus the horizontal axis of this graph represents something akin to a morphing gradient. You will also note an orange (vertical) cursor that indicates the current playing position along the morph gradient. Watch this cursor as you move the Mod Wheel (while a note is sounding).

When the wheel is at min, the cursor will be to the far left. When the wheel is around 37% the cursor will be about in the center of the MF zone. When the wheel is around 64%, the cursor will be about in the center of the F zone and when the wheel is at max, the cursor will be at the far right. Also note that when the wheel is at max, the filter response graph indicates a flat response (essentially no filtering). This is consistent with the fact that when the wheel is near max, we want the timbre of the FF group itself, and since that's the group that is actually sounding, we don't need to apply any filtering.



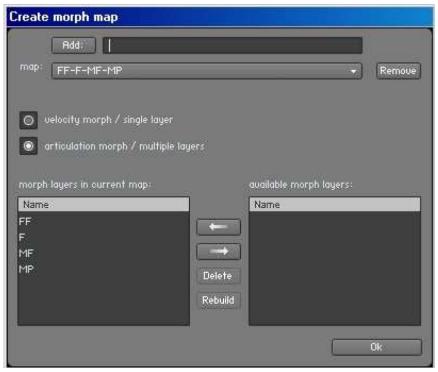
On the other hand, when the wheel is near min, we really want to hear the timbre of the MP group. Therefore, the AET filter applies the necessary filtering to modify the spectral characteristics of the FF layer (the layer actually playing) so that it 'takes on' a sound more like when the MP layer is sounding. So, when the wheel is near min, you will notice that the filter response graph shows that a lot of the higher frequencies are being attenuated. It is important to realize that when you morph from MP to FF, only the FF samples are actually being played. For example, when the cursor is in the MF section of the morph gradient, the FF samples are filtered in such a way so as to simulate the spectral characteristics of the MF layer. But, the MF layer itself **is not sounding**. In fact, it is important that only the group assigned to the AET filter (the FF group in this case study), is actually allowed to sound. This is the reason we have soloed the FF group, thereby muting the MP, MF, and F groups.

Note that the Morph Layers (which in our case are the Volume Layers of our instrument), are spread linearly across the range of the Morph knob (which is controlled by the Mod Wheel). In terms of the Mod Wheel position (with Mod Intensity set to 100%), the MP morph zone runs from about 0 to 31, the MF morph zone runs from about 32 to 63, the F zone runs from about 64 to 95, and the FF zone runs from about 96 to 127. Suppose however that we wanted a non-linear relationship for morphing the volume layers? For example, the original layout of the velocity zones for the VSL trumpet had the FF zone from 119 to 127, the F zone from 70 to 93, the MF zone from 53 to 69, and the MP zone from 1 to 66. If we wanted the same kind of relationship between Mod Wheel displacement and the position on the morph gradient, we could simply add a modulation shaping table with an appropriate shape. For example, the shaping table should be such that when the Mod Wheel is set to 119, the shaping table would convert that to 96. When the mod wheel is set to 66, the shaping table would convert that to 31, etc. Once the four key points are established, simply connect them with a smooth curve. Such a shaping table will essentially 'bend' the morphing gradient as desired.

Note that the order of the volume layers from min to max is the same as the order we positioned these volume layers in the Morph Map. When constructing a Morph Map, it is important how you order the Morph Layers. The *topmost* or first layer moved from the available Morph Layers to the left-side Map window will always be associated with the *leftmost* (or minimum) morph gradient position. Case Study #2 will illustrate what happens when we change the order of the Morph Layers.

3.2 Case Study #2

For this case study, load the **AET-CS1** instrument and resave it with the name **AET-CS2**. Then, edit **AET-CS2** using the following procedure to create a second Morph Map.

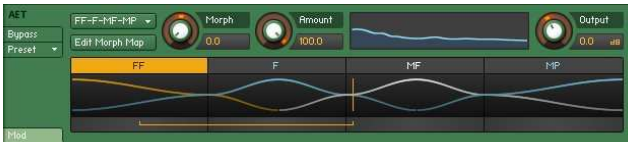


1. Open the Morph Map Editor and in the **Add** box, type the name **FF-F-MF-MP** and click on Add.

2. Select **FF** in the right-hand box and then click the left arrow button. This will make FF the first volume layer in the new map.

3. Similarly, select the remaining volume layers one by one in the order F, MF, and MP and transfer them to the Map window.

4. Check the articulation morph radio button and then click OK.



5. Now, on the AET filter panel, change the Morph Map from **MP-MF-F-FF** to **FF-F-MF-MP** and resave the **AET-CS2** instrument.

Now, play a note and move the Mod Wheel to assess the situation. Note that the morph gradient now runs from the FF volume layer to the MP volume layer with the FF layer leftmost (see Screen Shot 19). So, as you raise the Mod Wheel from min to max, the timbre runs from FF to MP (while the volume still runs from low to high, since we didn't change the Amp modulation settings). Normally you would not want it to work this way, at least when you are dealing with true volume layers as we are. However, the purpose of this Case Study is to illustrate that the order of morphing is determined by the order that the layers are positioned in the Morph Map. You can of course put the 4 layers in any order you might want for any given situation. But again, in the case of true volume layers, the order used in Case Study #1 would be the most logical.

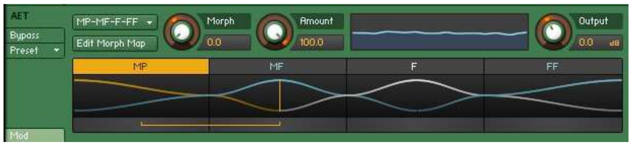
In addition to using the modulator shaping table to provide non-linear morphing, you can also use the Modulator **Invert** button to reverse the order of morphing. Try this by clicking the **Invert** button now and notice that the performance of the **FF-F-MF-MP** map then functions the same as that of **MP-MF-F-FF** map (i.e. the timbre changes from MP toward FF as the Mod Wheel moves from min to max).

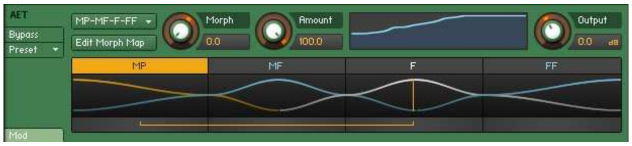
So far, our Case Studies have all used the **FF** group as the group that actually sounds. Or another way of saying this is that we have been assigning the AET filter to the FF group. Case Study #3 will explore what happens if we assign the filter to a different group.

3.3 Case Study #3

For this case study, prepare a new instrument as follows.

1. Reload the **AET-CS1** instrument and then save it as **AET-CS3**.
2. In the Group Editor, select the MP group (Group Solo should still be on).
3. Now insert an AET filter as the first insert effect for the MP group.
4. Add the Mod Wheel as a modulator for the MP AET filter (intensity at 100%).
5. As a last step, assign the **MP-MF-F-FF** morph map to this MP filter.
6. Resave this new instrument as **AET-CS3**.





Now, with the MP group soloed, play a key and move your Mod Wheel to assess the situation. You should see something like that depicted in the figures to the right for Mod Wheel at min, at 37%, at 64%, and at max. While the audible performance is similar to what you get when you solo the FF group, there are quite notable *visual* differences.

First, the AET morph gradient display now highlights the MP group in orange (instead of the FF group). Also, as you move your Mod Wheel from min to max, examine the filter response graph. Do you see something different from what you saw when you were soloing the FF group? Note that the filter is now flat in the MP zone and is boosting the highs in the FF zone.

Finally, repeat steps 2 through 5 to add an AET filter to the remaining two volume-layer groups MF and F. Once you have done this, resave the **AET-CS3** instrument.

Now, you should be able to solo any one of the four groups and when you play a note and move your Mod Wheel, you should experience a similar audio performance. However, each of the groups when soloed will result in a different set of AET graphics.

Note the following key points.

1. The group being soloed is of course the only one that actually sounds.
2. The Morph gradient zone display always highlights the active filter zone.
3. The frequency response is always flat when in the sounding zone and will display attenuated lows to the left and boosted highs to the right.

Now let's discuss the audible differences. Do you hear any? Which of the four do you think sounds the best overall? Generally, we can expect the best results if we filter the group whose samples are the richest in harmonic content. For this case study, this is the FF group.

As with all forms of equalization, it is generally better to attenuate unwanted frequencies rather than to boost those we want to emphasize. It is harder to recreate the higher harmonics than it is to attenuate them. Moreover, boosting the higher harmonics generally will also boost the ever-present noise whereas attenuating frequencies will reduce their noise contribution. Therefore, as a general rule when setting up an Articulation Morph, the AET filter itself should be inserted in the group with the richest harmonic content. Thus, for volume-layer groups the best choice will likely be the samples recorded at the highest volume level (the FF group for the VSL Trumpet). We will see later in section 4, that this mechanism is probably responsible for the early negative reports on the operation of the AET filter in the Velocity Morph mode.

3.4 Case Study #4

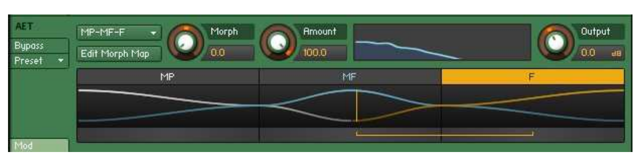
In this final case study of section 3, we will explore some of the less-typical configurations that are possible with the AET filter. The VSL Trumpet happens to have 4 sampled volume layers so all our case studies so far have been using the 4 Morph Layers made from those. However, the same process we have been using can be applied to more (or fewer) volume layers as needed for any given instrument/articulation.

We have also illustrated that we can insert an AET filter in more than one group if we want. Of course, in the end we would only enable one of those groups (or at least only one of them at a time). But, you should also know that you can create more than one Morph Map for any given filter. It is also important to realize that a Morph Map need not use all the available Morph Layers. A morph map can be made from any combination of two or more morph layers and in various orders. However, if a map doesn't include the AET insert group itself, the Morph control for that group will not function.

To illustrate some of the foregoing, let's put together another case study instrument as follows.

1. Load the AET-CS1 instrument and resave it as **AET-CS4**
2. Open the Morph Map Editor and type **MP-MF-F** in the Add box and then click Add.
3. Click on the MP layer and then use the left arrow to move it to the left Map box.
4. Click on the MF layer and then use the left arrow to move it to the left Map box.
5. Click on the F layer and then use the left arrow to move it to the left Map box.
6. Select the articulation morph radio button and then click OK.
7. In the Group Editor, select the F group and then insert an AET filter adding a CC1 modulator.
8. Assign the new **MP-MF-F** map to this F-group filter.
9. Resave the **AET-CS4** instrument.

With the **F** group soloed, play a key and move your Mod Wheel back and forth to assess the situation. You should see a 3-zone morph gradient as depicted in the figure to the right. This then is an example of making a map with only 3 of the 4 morph layers.



Now, let's create another Morph Map with only 2 of the 4 layers as follows.

1. Open the Morph Map Editor and type the name **MP-FF** into the Add box and then click Add.
2. Select the MP layer and then click the left-arrow button to transfer it to the left Map box.
3. Select the FF layer and then click the left-arrow button to add it to the Map.
4. Select the articulation morph radio button and then click OK.
5. Resave the **AET-CS4** instrument.

Now, solo the **FF** group again and note the behavior (as previously noted in Case Study #1). Then, open the map assignment drop down and notice that you now have a choice of 3 different maps. Select the **MP-FF** map you just created and then ply a key and move your Mod Wheel. You should now see a 2-zone morph gradient as depicted to the right.

Note that audibly, the performance of this 2-zone morph gradient is similar to that of the 4-zone gradient. However, the AET filter has to engage in more 'guesswork' to interpolate between the two extremes of MP and FF. Generally, the AET filter can do a better job when it has more 'in-between' information to work with. However, there could be situations where you might want to use only the 'outside groups for some reason. Obviously one such reason would be that you only have the MP and FF samples available for analysis in the first place. Whatever the reason for using this configuration might be, our purpose here is only to demonstrate that you can create multiple maps and/or that they can contain fewer than the entire set of morph layers.

Now, with the FF group still soloed, assign the 3 of 4 map named MP-MF-F and then play a key and move the Mod Wheel. What happens? While the volume still tracks the Mod Wheel, there is no AET filter action and therefore no simulated morphing. So, even though you can assign any of the Morph Maps to any AET filter, if the map doesn't contain the filter's group (i.e. the group the filter is inserted in), the filter will not function in the intended way. To work properly, **the assigned Morph Map must contain the group in which the filter is inserted.**

Now, we have already demonstrated that we can assign either the MP-FF map or the MP-MF-F_FF map to the FF filter and the AET will provide either a 2-zone or 4-zone morph respectively. But, what if we want to select between these during performance, let's say under script control for example? One way this could be accomplished is to insert a 2nd AET filter into the FF group (in the 2nd insert effect slot). Then, assign the MP-MF-F-FF map to the first filter and the MP-FF map to the 2nd filter. Then, under script control, you could bypass one or the other of these filters using the bypass engine parameter.

Another way to accomplish this would be to create a duplicate FF group and assign the MP-MF-F-FF map to one and the MP-FF map to the other. The script could then control which map would be used by simply enabling whichever FF group it wanted. This method however may not be doable after you have added AET filtering to an instrument. You may have to duplicate the FF group before adding AET features because there may be no way to duplicate a group afterward that will enable you to create separate Morph Layers for them.

3.5 Group Participation and Control

In the foregoing case studies, we have been simply soloing one group at a time. However, in most situations, we build instruments with collections of articulations that consist of one or more groups being activated by some means. For example, keyswitch instruments may enable groups via Kontakt's group start machinery. Scripts like WIPS convert keyswitches or program change messages into allow/disallow group commands, etc. Whatever the mechanism used, the important point regarding Articulation Morphing is that only one of the groups for each 'set' of Morph Layers should be audible when using the AET filter. That group is the one the AET filter is inserted into. The other Morph Layers do not directly participate with contributing to the sound.

For example, for Case Study #1, the AET filter is inserted in the FF group and thus the MP, MF, and F groups should be muted while the FF group is sounding. This muting can be performed by any convenient means such as merely turning down the AMP volume for the non-participating groups. However, such an approach will use unnecessary polyphony so it would generally be better to just disable the inactive groups some way. Also, it should be noted that while the MP, MF, and F groups are not sounding, they must nonetheless still be present in the instrument. Firstly, they need to be there when the analysis phase is performed. However, you might think that after performing the analysis you could discard these groups but such is not the case. Either NI stores these 'spectral fingerprints' with the group and its sample zones or, these fingerprints are not in a standalone format. Therefore, if you delete one of the inactive groups, your morphing gradient will have dead spots.

3.6 Creating Morph Layers

When performing the initial analysis phase (back in Case Study #1), there were a few details that we kind of glossed over that will now be discussed briefly. The procedure for analyzing a Morph Layer is to first open the Group Editor and select the group you want to analyze and then open the Mapping Editor and enable the **Selected Groups Only** button.

The actual analysis process consists of first selecting all the zones in the active group. It is important to realize that every 'playable' position in the pitch/velocity xy matrix must be covered by one and only one zone. If you have any overlapping zones they must be resolved first. If you have any holes, they need to be plugged by stretching the adjacent sample zones if necessary. Once this is done, you can then select all the zones and then click on the **Create AET morph layer** command in the Edit menu.

In Case Study #1, we merely entered a name and then clicked OK to accept all the default settings. For most situations this will work just fine but you should be aware of the available options and how to use them if necessary. These options are described in the Kontakt Reference Manual and will not be repeated here except to mention that if you are having a problem with your morph layer transitions, carefully choosing the analysis range may help even out the morph layers for smoother transitions.

It should also be mentioned that the 'Create morph layer' dialog can be accessed 'after the fact' from the **Morph Map Editor**. If at any time you determine that you would like to redo one or more of your Morph Layers, you can do so from the Morph Map Editor. In the editor, simply select the morph layer you want to redo and then click the **Rebuild** button. This will bring up the **Create morph layer** dialog (where you can optionally change any of the analysis parameters) and then click OK to re-analyze the layer — thus updating its 'spectral fingerprint'.

4.0 Velocity Morphing

In this section, we'll set up a **Velocity Morph** and examine its performance relative to that of using **Articulation Morphing**. For the next two case studies, we'll use the **Tpt#1** nki that we prepared in section 2.2. Since most existing instruments are configured with this same kind of velocity layer format, NI has provided a fairly automated method of building an AET morph to accommodate it. Since a Velocity Morph is easier to setup than an Articulation Morph (in most cases), it may be useful to know what we can expect from this mode performance wise. After we have identified the principal weakness of this mode, we will examine some simple scripting support which can overcome this weakness to a large degree.

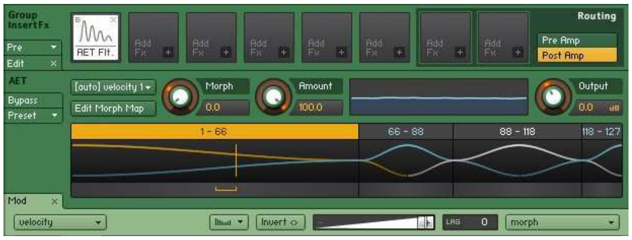
4.1 Case Study #5

Use the following procedure to create the first instrument for Case Study #5.

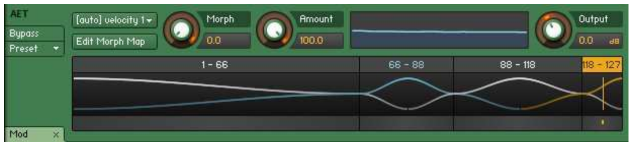
1. Load **Tpt#1** and resave it as **AET-CS5**. Set Tpt#1 aside without altering it. Please see the **CAUTION** on page 7.
2. Open the Mapping Editor and after selecting all the zones, open the Edit menu and click on **Auto add AET velocity morph**.
3. Click OK and then close the Mapping Editor and resave AET-CS5.

In the Group Insert Effects rack you will see that an AET filter has been installed. Click on the Edit button to open the AET display. Also click on its Mod button and you will see that Velocity has been assigned for control of the Morph knob.

Now, play a key with a low velocity (so as to trigger an MP sample) and observe the display which should appear similar to that shown in the top figure on the right.



Next, strike a key with a velocity that will trigger one of the MF sample zones and note the AET display which should appear something like the 2nd figure to the right. Now, strike a key with a velocity that will trigger one of the **F** sample zones followed by a hard key strike that will trigger one of the **FF** sample zones. What you will see should look something like what is depicted in 3rd and 4th figures to the right.



Notice that the way Kontakt sets up the Velocity Morph is all 'velocity-control' oriented. The morphing gradient zones are automatically named with the corresponding velocity ranges for each zone. The Morph knob is modulated by velocity so naturally the morph gradient cursor position is also velocity dependent.

But also please note that the active or 'sounding' zone (the one highlighted in orange) is also determined by the played velocity. When used just the way Kontakt sets it up, the Velocity Morph functions just like the traditional velocity-selected sample configuration in that the initial key velocity is what determines which sample is played and it remains the only sample sounding throughout the sustain of the note.

The primary advantage of using the AET filter, for this kind of sample configuration, relates to when a series of notes are played with differing velocities, and those velocities all hover around the ‘edge’ between two velocity zones. For example, suppose you play a series of notes with velocities of 117, 121, 118, 120, etc. These velocities alternate between being in the F group and the FF group. If these samples have any marked differences, this discontinuity at the transition may be quite audible. The AET filter gradient results in eliminating these abrupt ‘edge’ transitions (by morphing from center to center of each velocity zone) and therefore can provide a decided improvement.

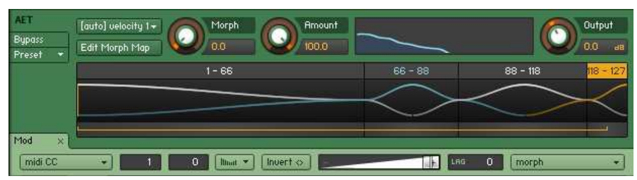
However, it remains to be seen what kind of performance Velocity Morphing can provide for the continuous dynamics controller mode we are interested in. Therefore, our next Case Study will modify the AET-CS5 instrument to incorporate Mod Wheel dynamics control (as for all the prior case studies).

4.2 Case Study #6

For this case study, create a new **AET-CS6** instrument as follows.

1. Load AET-CS5 and then resave it as AET-CS6.
2. Replace the Velocity modulator of the AET with CC1 (intensity at 100%).
3. Replace the Amp velocity modulator with CC1 (intensity at about 55%).
4. Resave the **AET-CS6** instrument.

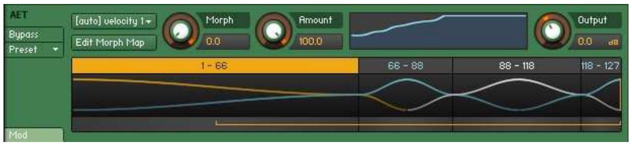
Play a key with **FF** velocity and while holding it, move your Mod Wheel up and down and assess the situation. Note the following. The active morphing zone (highlighted in orange) is the **FF** zone on the far right. As you move the Mod Wheel from min to max, the gradient cursor will move from the far left of the MP zone to the far right of the FF zone. This is depicted at the min and max Mod Wheel positions in the figures to the right.



As you move the Mod Wheel, note the filter response graph. Near the mod wheel min, you will notice that high frequency attenuation is occurring while at mod wheel max, the filter response is flat. Therefore, the behavior at this point is very much like that of Case Study #3 with the FF group soloed. The primary difference is the non-linearity of the morphing gradient.

You will notice that the gradient in the Velocity Morph mode is such that the morph zone sizes are proportional to the velocity zone sizes whereas in the Articulation Morph mode the morph zone sizes are equally divided into quarters. However, if we require a linear gradient (such as with Articulation Morphing), we can simply use a shaping table to linearize the Velocity Morph gradient (the inverse of what we discussed near the end of section 3.1). So, the linear versus non-linear gradient need not pose any special problems. But, there are a few other differences between the Velocity and Articulation Morph modes that we need to examine.

Now, play a key with a velocity in the **MP** zone and while holding it down, move your Mod Wheel up and down to again assess the situation. Note that everything behaves the same as for the FF velocity note except that the active (orange highlighted zone) is now the leftmost MP zone. This is depicted in the pair of figures to the right for wheel at min and max respectively.



Note that in this case, the frequency response graph indicates a flat response at min mod wheel and a large amount of high-frequency boost at max mod wheel. This is the counterpart of Case Study #3 with the MP group being soloed.

Similarly, if we play a key with velocity = MF we will have the counterpart of Case Study #3 with the MF group soloed and if we play a key with velocity = F we will have the counterpart of Case Study #3 with the F group being soloed.

Now, while all of these situations sound *similar*, we have already concluded that the effect sounds best when the FF group is the active group. This then is the biggest weakness of the Velocity Morph mode in that the active morph zone (the one that actually sounds) is determined by the key velocity. Even if we don't use velocity to control something else, it's not too convenient to have to 'bang hard' on the keys all the time (so we can insure that the velocity is always in the FF zone). Moreover, we may want to put velocity to use for some other musical purpose such as controlling attack strength. If we do that, we have to use a velocity that's appropriate for the musical situation we are trying to achieve and that will not always be maximum velocity. The result of all this is that the AET morphing quality may undesirably 'dance around' with the velocity variations.

Of course, we can always resolve this issue by simply using Articulation Morphing but, with a little scripting support, there is a fairly easy way to 'have our cake and eat it too'☺ This technique will be discussed in the next section.

4.3 Using Script Support

To get the best quality from the AET filter when using the Velocity Morph mode, we can use a simple script such as the following.

```
on note
  ignore_event($EVENT_ID)
  play_note($EVENT_NOTE,127,0,-1)
  set_controller(100,$EVENT_VELOCITY)
end on
```

What this script does is to intercept all input notes and change the velocity to 127 before sending it to the instrument. Therefore, the active AET filter zone will always be the FF zone. In addition, the original played velocity is sent out on CC100 acting as a proxy. Of course you can make this CC# any CC you wish. If your instrument formerly used velocity in some way, you simply edit your instrument to use CC100 in place of velocity wherever velocity was formerly used as a modulator. This will allow you to use the velocity (carried in CC100 as a proxy) in any way you wish but it will no longer affect how the AET filter operates.

To try this for yourself, load AET-CS6 and then type the above script into the script editor and hit Apply. Then resave AET-CS6. Now every time you play a key, no matter what the velocity, the AET filter will activate the FF zone for best AET performance. And, CC100 will act as a proxy for the played key velocity for whatever purpose you wish.

So, by including the above script or by modifying some existing script you may be using, you can avail yourself of the relative ease of setting up the Velocity Morph mode instead of being forced into always using the Articulation Morph mode. Of course the flip side of this is that when you use the simplicity of the Velocity Morph, you won’t have access to things like the Morph Layer analysis parameters and such. So, if you need to handle special situations for which it is beneficial to tweak the Morph Layer parameters, or if your instrument already has the velocity layers separated out into individual groups, then you will probably want to use the Articulation Morph mode. In summary, Velocity Morphs are easier to set up but Articulation Morphs are more flexible generally. So, choose the type that fits your situation the best.

4.4 WIPS Velocity Morph Option

The WIPS articulation script includes some built-in support for using the AET filter in the Velocity Morph mode. Included in the Art/Var Parameters dialog you will find a checkbox labeled **AET Velocity Morph**. Whenever you activate any articulation that has this box checked, any note played with this articulation will have its velocity changed to 127. On the other hand, articulations that do not have this box checked will pass incoming velocity through without modification.

In addition, WIPS also allows you to map incoming velocity to any CC proxy of your choice. This feature is independent of the AET option. So, if you want to configure an articulation to use the AET filter and that articulation is configured initially as a standard velocity-mapped set of volume layers, you can use Kontakt’s simple Velocity Morph mode to set up the AET filter. Then simply check the **Uses AET Velocity Morph** option box. If your instrument also uses velocity for some purpose (including volume control), you can simply choose an unused CC as a proxy for velocity and substitute it everywhere that velocity was formerly used. Finally, use WIPS **Special Controller Mapping** facility to map velocity to the same CC number you used as a proxy in your instrument. When you use the **AET Velocity Morph** checkbox, the incoming velocity will first be mapped to the selected CC proxy **before** being forced to 127. Therefore, you will not lose your former velocity control but you will still be able to force the AET filter to work with the optimum max velocity.

5.0 Advanced Issues

The foregoing sections of this guide have presented the essential basics of using the AET Filter. However, as you apply the AET to real-life situations, you may well encounter some difficulties. **David Carpenter** has used the AET quite extensively and has developed a number of special techniques for dealing with problem samples and such. So, to provide some help in this area, David planned to author a **Part 2** of this Guide. Orignally, it was thought that **Part 2** would be available shortly after I released **Part 1** but, when that didn’t pan out, we were hoping that it might be finished by the time that WIPS would be released. However, so far, all I have received from David is a preliminary outline together with a rough draft of a few key ideas. Hopefully, one day soon, David will find the time to flesh this out a bit more and add the tutorial case studies and such that he originally planned. However, since that hasn’t happened yet, I’m going to release the rough draft form of **Part 2** because it does contain some useful information.

David was also planning to write a series of advanced tutorials that deal with many of the other issues that surround Virtual Wind Instrument development. So, be sure to watch for his tutorials if and when they become available because I’m sure you will find them to be most helpful and informative.