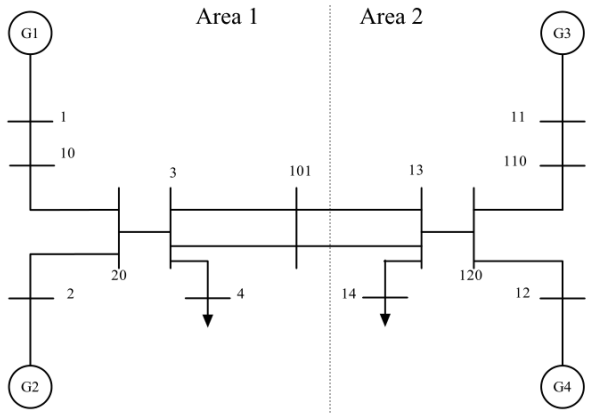
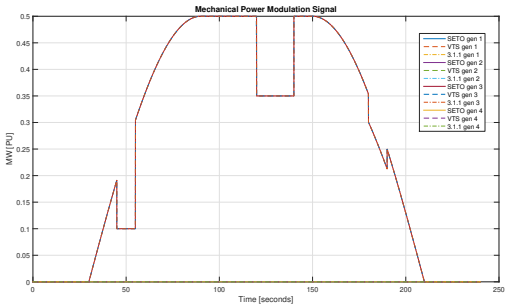
Scenario





- Kundur 4 machine system packaged with PST
- Constant Z load model
- System has governors, exciters, and PSS.
- Governor of generator being perturbed by pm_sig removed
- Perturbance was meant to mimic a solar ramp with various situations of cloud cover:
  (larger plot of pm_sig on Page 6)

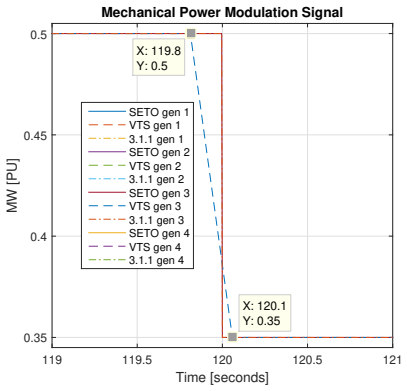
```
% time [seconds]
% 0-30      - no action
% 30-90     - ramp up 0.5 PU (50 MW)
% 90-150    - hold peak
% 150-210   - ramp down 0.5 PU (50 MW)
% 210-240   - no action

% cloud cover events
% 45-55 - 20% max gen (generation of 0.1 PU)
% 120-140 - 30% cover (generation reduction to 70%)
% 180-190 - 15% cover (generation reduction to 85%)
```

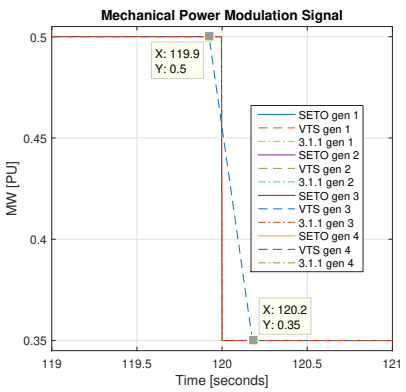
Summary

1. Delay in executing pm_sig caused by VTS created a noticeable delay in VTS dynamics.
2. Increasing ODE solver tolerances did not resolve the issue.
3. Creating a new time block near the event in question did resolve the issue.

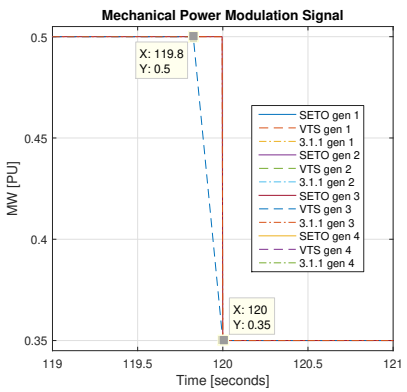
As shown below, VTS may result with event start times ending up between computed time steps without additional user action/foresight.



Original Simulation



Increased Tolerance



Additional 'time block'

sw_con Changes

The original switching array is shown below.

```
ts = 0.004;
sw_con = [...
.1      0          0          0    0    0    ts;   % sets intitial time step
0.2     101        3          0    0    6    ts;   % Do Nothing
30.0    0          0          0    0    0    ts;   % Do Nothing
240.0   0          0          0    0    0    0];   % end simulation
```

The altered switching array adds a null event at t = 120 to ensure the pm_sig step is processed at the designed starting time.

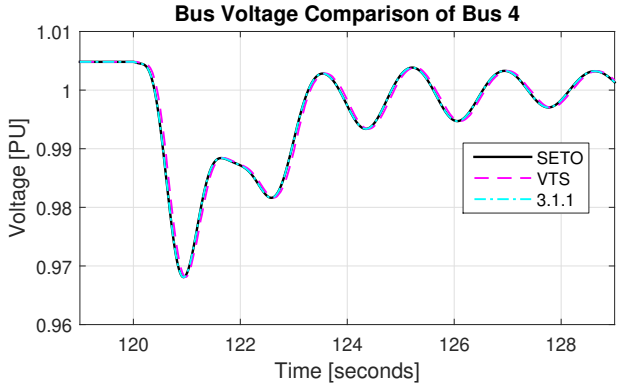
```
ts = 0.004;
sw_con = [...
.1      0          0          0    0    0    ts;   % sets intitial time step
0.2     101        3          0    0    6    ts;   % Do Nothing
30.0    0          0          0    0    0    ts;   % Do Nothing
120.0   0          0          0    0    0    ts;   % Do Nothing
240.0   0          0          0    0    0    0];   % end simulation
```

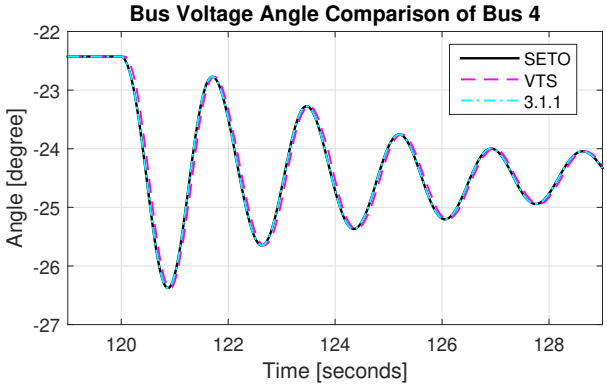
Performance Effects

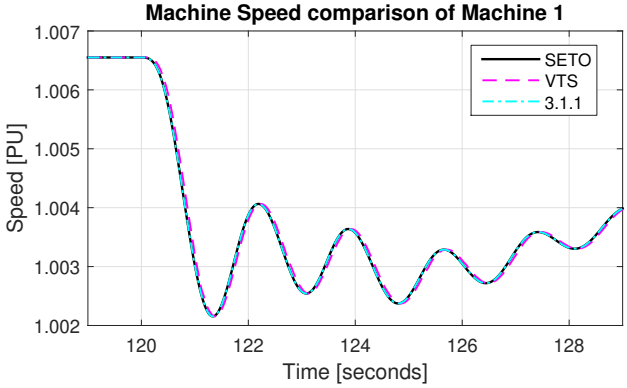
The increased tolerance case (VTS 1) took more time to simulate as it took many more steps. VTS 2, with altered sw_con, performed slightly slower than the original (VTS 0) case.

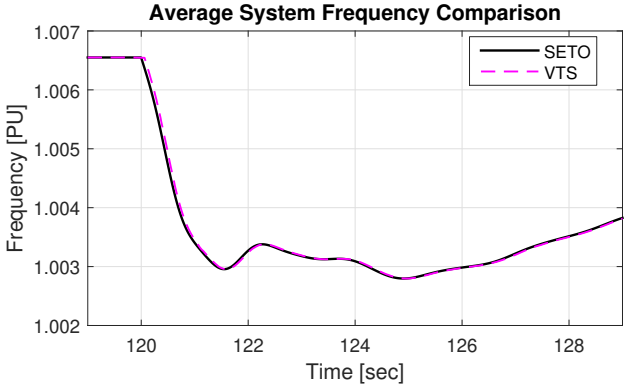
	Step Size [seconds]				Solutions Per Step				
Version	Max.	Min.	Ave.	Total Steps	Ave.	Max.	Total Slns.	Sim. Time	Speed Up
VTS 0	2.32E+01	2.68E-04	2.58E-02	9,315	2	97	17,006	61.73	1.00
VTS 1	2.32E+01	1.36E-04	1.38E-02	17,353	2	96	27,243	106.09	0.58
VTS 2	2.00E+01	2.19E-05	2.58E-02	9,504	2	100	17,927	66.59	0.93

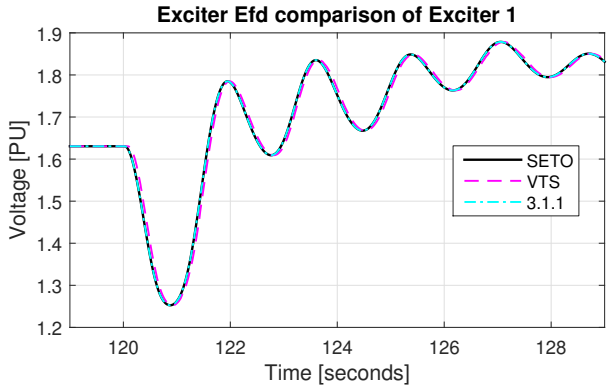
Original Results (VTS 0)

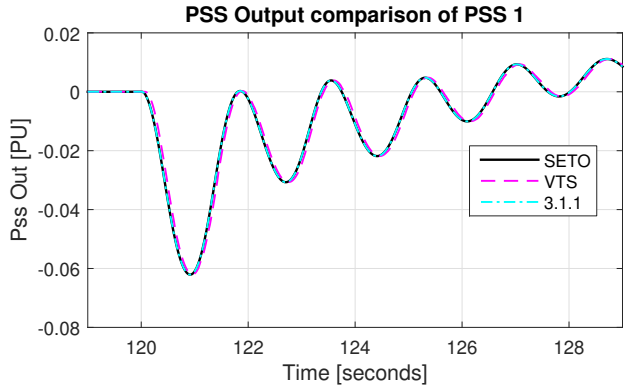












Altered sw_con Results (VTS 2)