

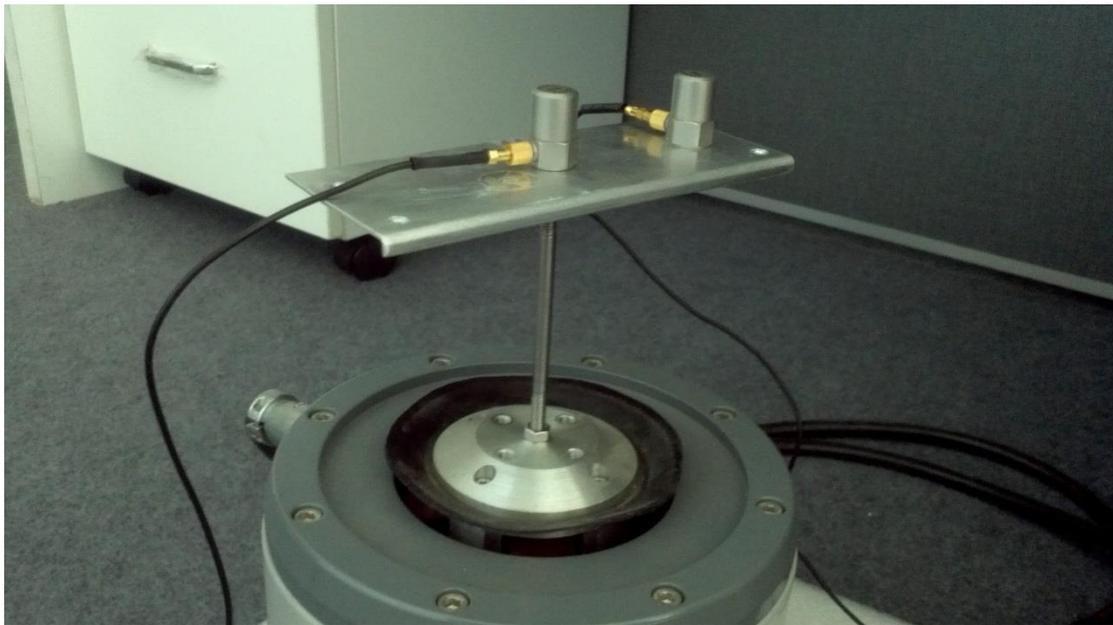
## Phase Tracking in RSTD

The purpose of Resonance Search, track and dwell test is usually for fatigue and durability test, it always can find and test the weakest frequency of test unit, the dwell methods include locked frequency, locked phase, peak amplitude tracking and phase tracking. The latter three methods frequency will be varied during the tracking and dwelling phase, since as we know the resonant frequency is true decreasing during dwelling period, while phase is not, so these three methods maybe better in catching with the resonance point. This paper will analyze results between fixed frequency dwell and phase tracking dwell, emphasizing on phase tracking and introduce how to do this test with VENZO controller VibExpert software.

### Phase Tracking Experiment

1. 150 N small shaker
2. Two IEPE sensors
3. A thin metal beam was installed on the small shaker, two sensors adhere to it, one in the central and the other in the end of the metal beam

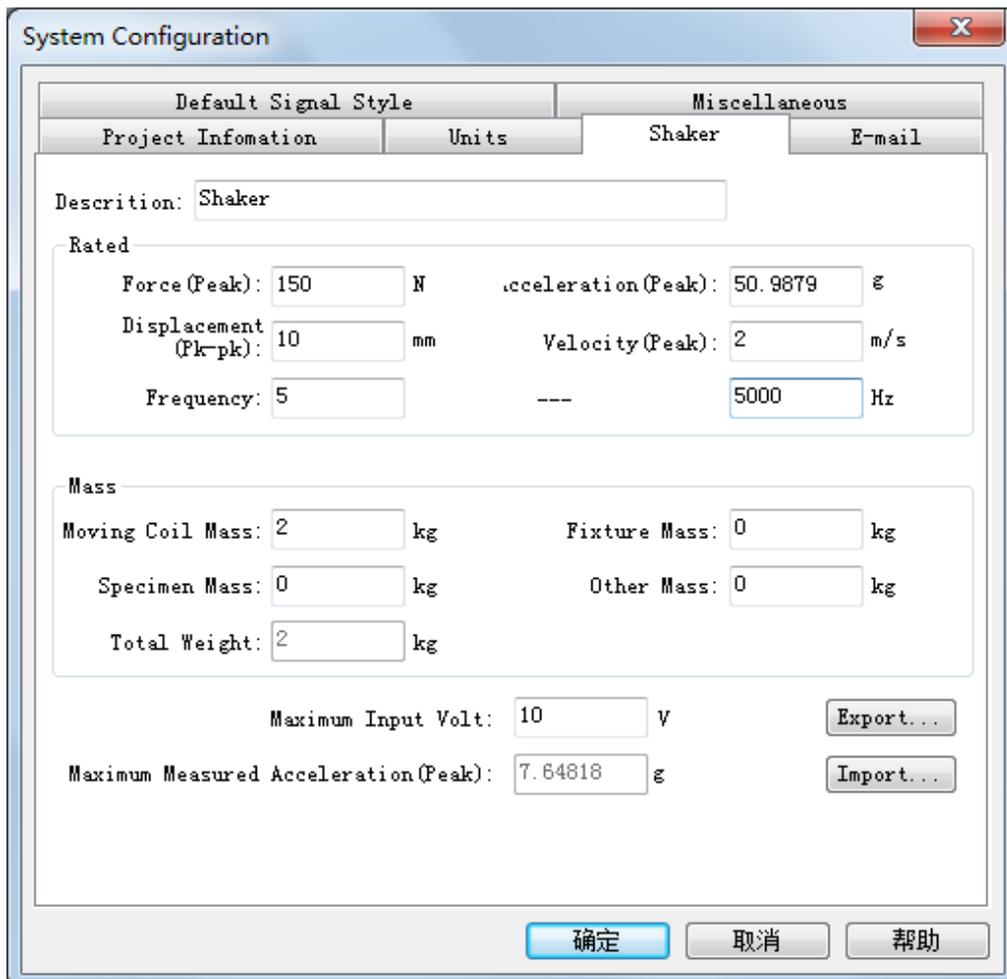
See picture below:



Step 1, open VENZO control software VibExpert and click "RSTD" function module



Step 2, click icon  to set shaker parameters according to specifics of shaker.



Step 3, setup input channel parameters corresponding to two sensors

The 'Edit Channel' dialog box shows the configuration for two sensors. The 'Input Channel' tab is selected, and the 'Digital Input' sub-tab is active. The main table lists 8 channels, with the first two being 'Control' and 'Measure'.

Channel	Type	Range		Weighted	Input Mode	Transducer					Es
		V	EU			Quantity	Polarity	Sensitivity		TEDS	
1	Control	10 V	197.628 g	1	ICP	Acceleration	Pos	50.6	mV/(g)	<input type="checkbox"/>	
2	Measure	10 V	100.402 g	1	ICP	Acceleration	Pos	99.6	mV/(g)	<input type="checkbox"/>	
3	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	
4	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	
5	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	
6	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	
7	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	
8	Disable	10 V	100 g	1	DC Gnd	Acceleration	Pos	100	mV/(g)	<input type="checkbox"/>	

Buttons at the bottom: Export..., Import..., Read TEDS,  Multiple Variable Control, Multiple Variable Weighting, Fill Down, 确定, 取消, 帮助.

Step 4, edit the test spectrum and schedule

The 'Edit Test' dialog box shows the configuration for a test spectrum and schedule. It includes three graphs for Acceleration, Velocity, and Displacement, and a table for the Sweep Spectrum 1 schedule.

**Acceleration Graph:** g vs Hz. Y-axis: 0.9354 to 4.3652. X-axis: 30 to 2000 Hz.

**Velocity Graph:** m/s vs Hz. Y-axis: 0.0013 to 0.1318. X-axis: 30 to 2000 Hz.

**Displacement Graph:** mm vs Hz. Y-axis: 0.00016 to 1.6982. X-axis: 30 to 2000 Hz.

**Sweep Spectrum 1 Schedule:**

Limit	Frequency	Left Slope	Level		Right Slope	Alarm Minus	Alarm Plus	Abort Minus	Abort Plus
	Hz	dB/Oct	Type	Value	dB/Oct	dB	dB	dB	dB
1	30		Acce (g)	1		-3	3	-6	
2	2000		Acce (g)	1		-3	3	-6	

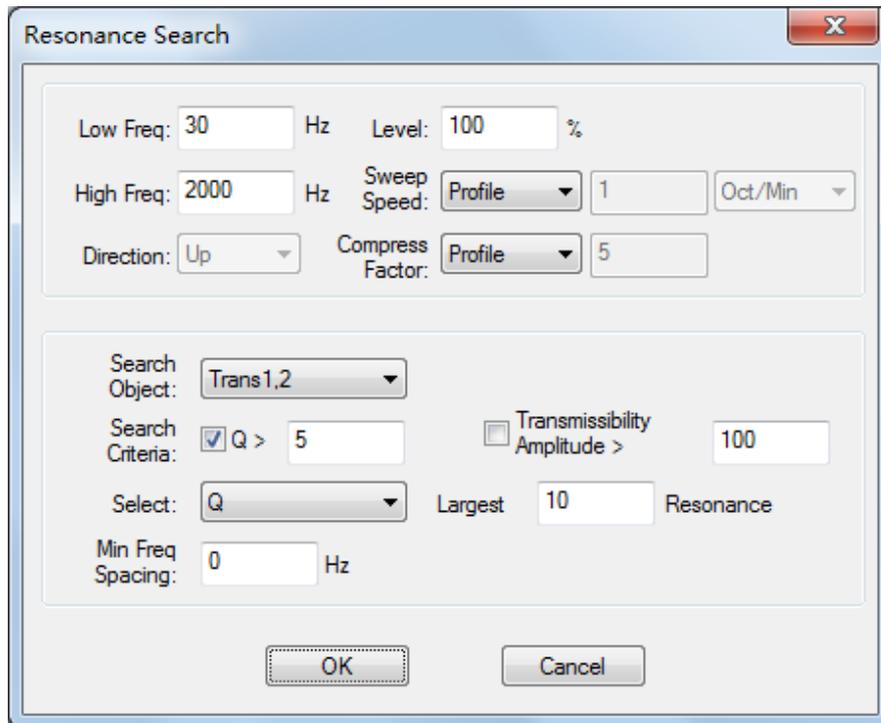
Buttons: Insert, Delete, Append, Refresh,  Calculate Break Points, Const Profile...

Multiple Profiles: Freq Range: 25600 Hz, Analysis Lines: 2048, Current: 1, Insert, Append, Delete.

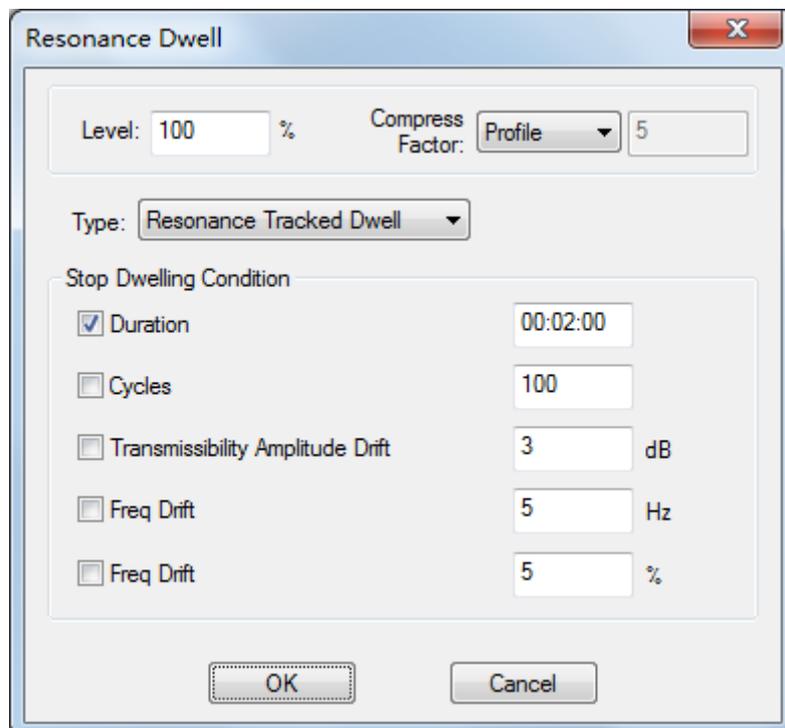
Profile Description: [Text Field], Export..., Import...

Buttons: OK, Cancel, Help.

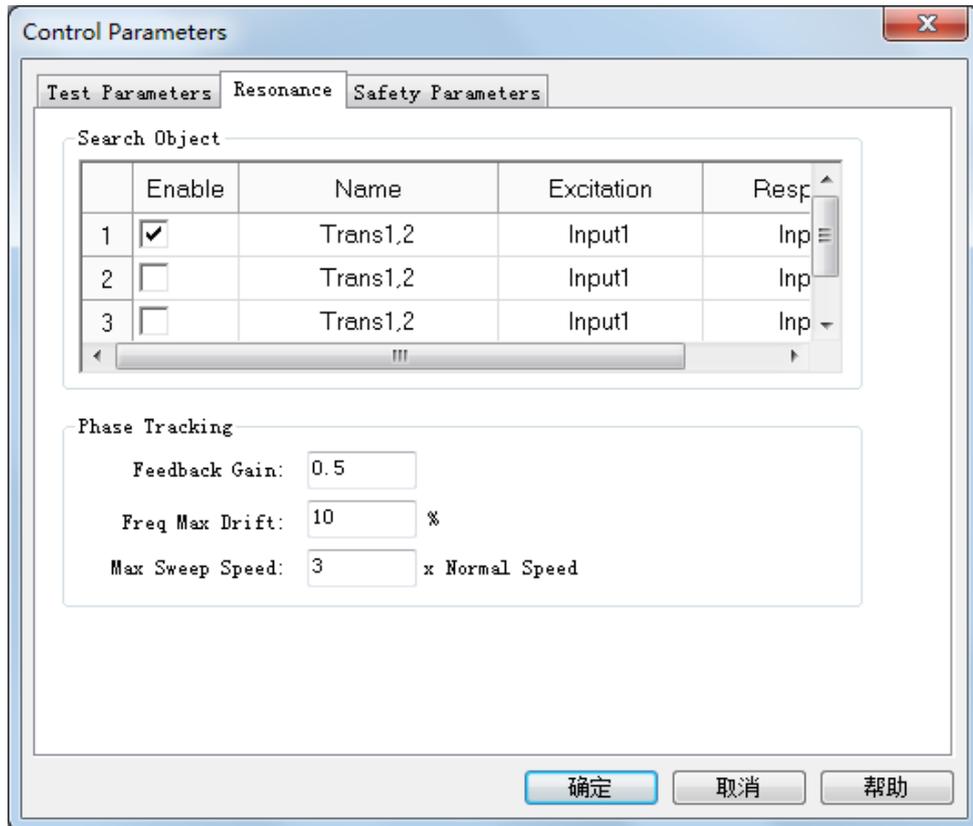
Step 5, in the schedule tab setup the resonance search parameters, search object, criteria and largest resonance number. Here we choose Q value as search criteria and set max.10 resonances.



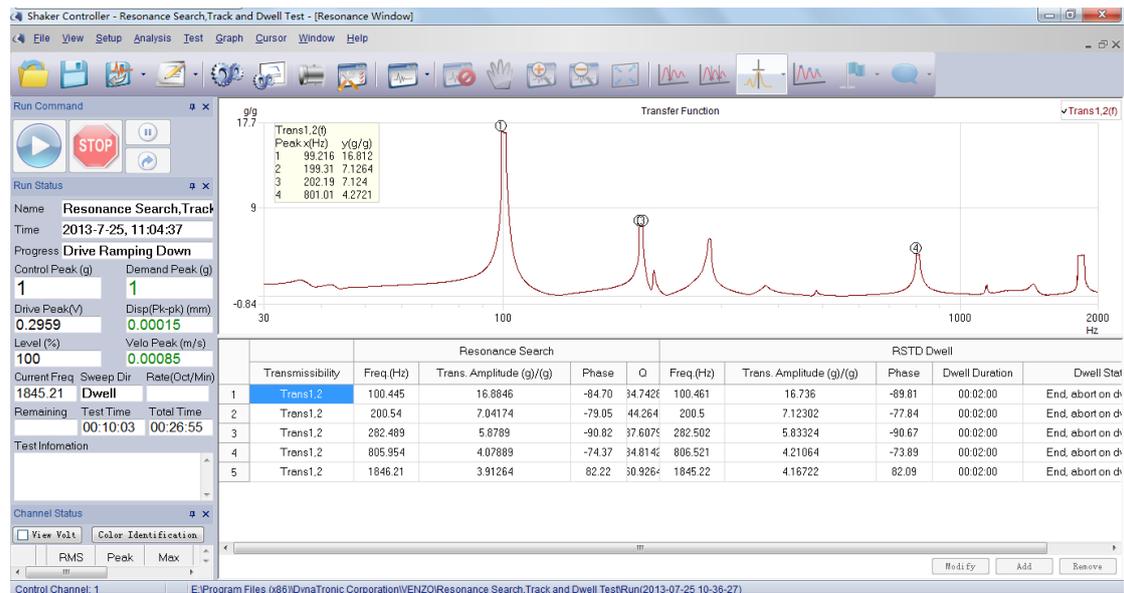
Step 6, in the schedule tab, add RSTD Dwell event and setup parameters as below, here we choose Resonance Tracked Dwell (Phase Tracking).



Step 7, finally, we need to setup control parameter especially phase tracking column, parameters as below will get precise result.

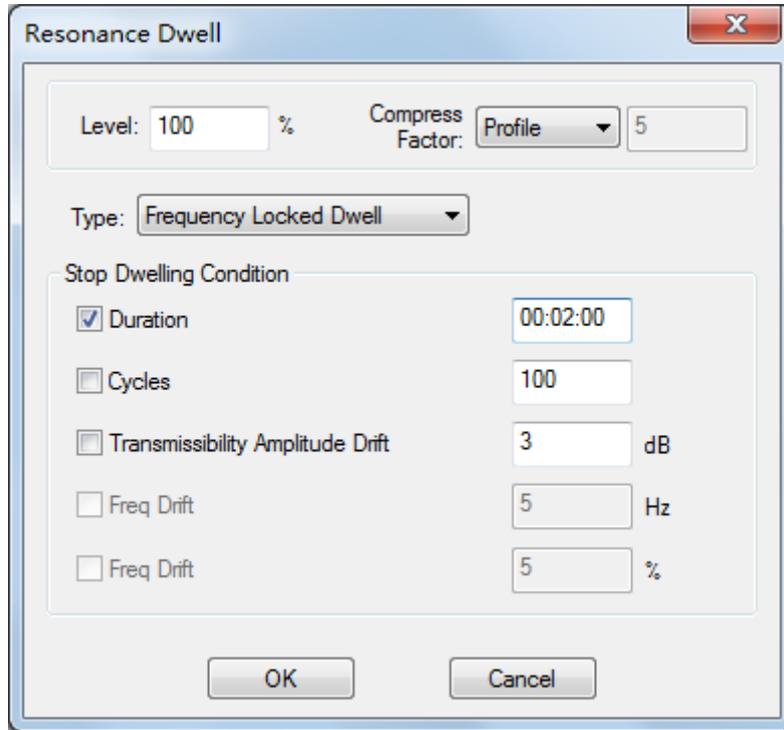


Results of Phase tracking: we can find phase is drifting little in the mean while resonant frequency varies. After phase tracking, the 3 points' amplitude transmissibility has been enhanced, while the others have negligible decreasing.

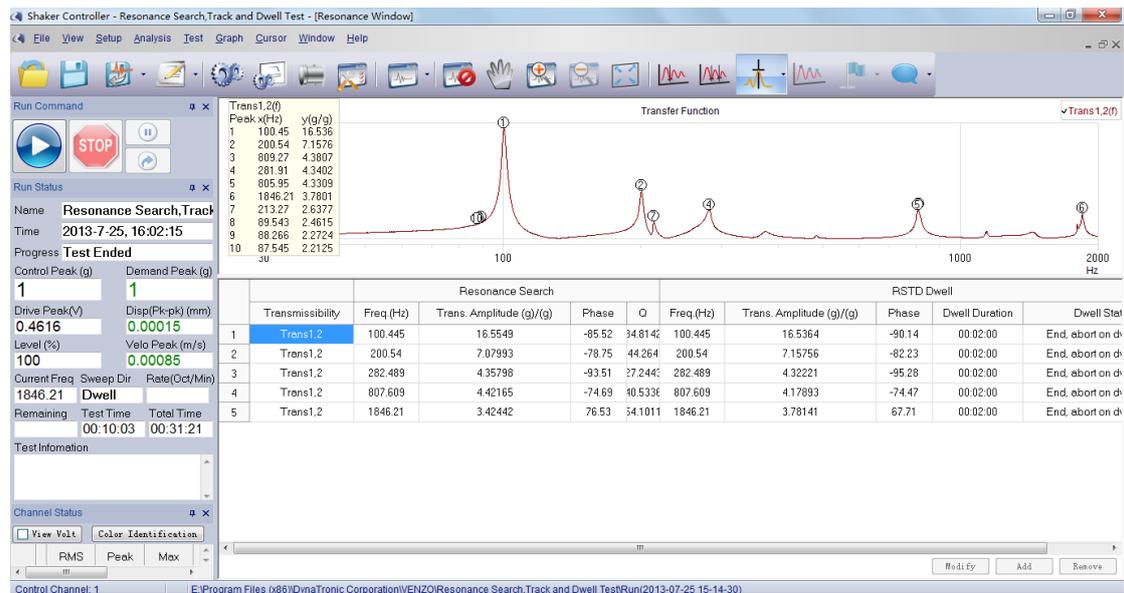


Let us see the result of locked frequency:

Same steps with above, only one step is different, step 6, in the schedule tab, add RSTD Dwell event and setup parameters as below, here we choose Frequency Locked Dwell.



Results of Locked frequency dwell: we can see that it the same frequency point amplitude transmissibility is changed, most of them getting lower value, the significant change is the phase value, the max. gap is about 9 degree, this means this frequency point maybe not the true resonant frequency.



**Conclusion:**

In the long time dwelling period for fatigue and durability testing, resonant frequency will be decreasing and locked frequency is not the only method for dwell anymore, test engineer need to pay more attention to the phase value. If the test system is the linear system, the phase value is usually  $-90^\circ$  or near to this value, so sometimes phase is also a criteria for a resonance.