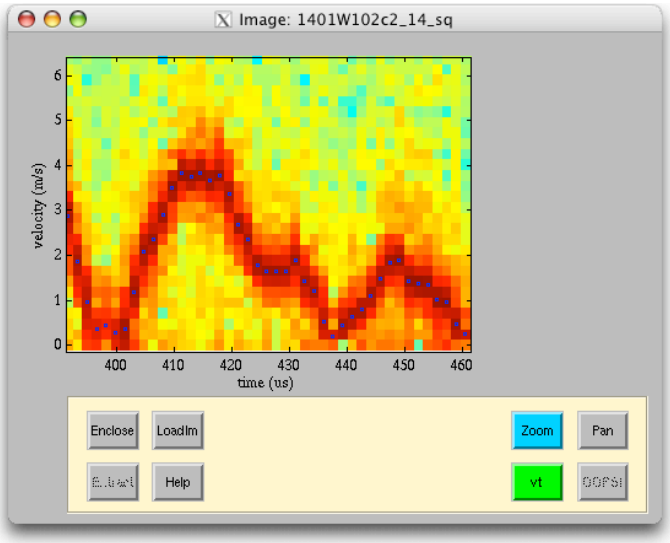
Data Analysis Using the FT Method

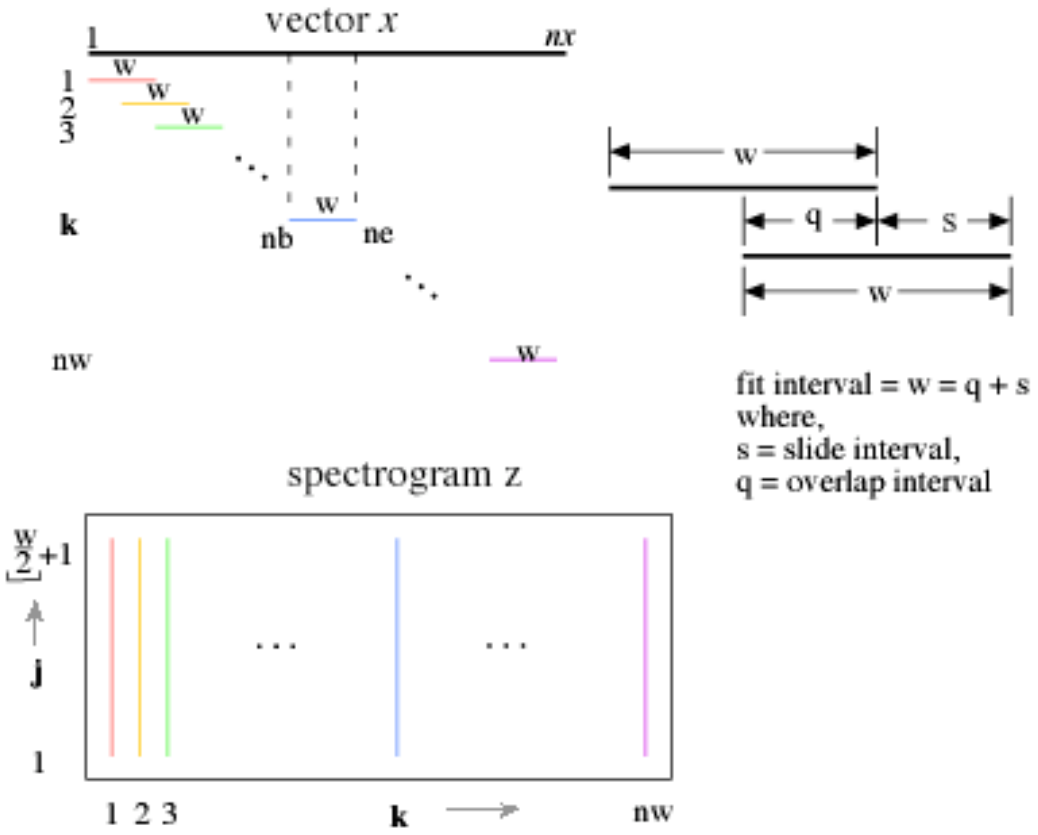
William Kuhlow

July 21, 2006



National Security Technologies LLC

The t-v equations are simply derived



$$t(k) = \frac{tb(k) + te(k)}{2} =$$

$$t(1) + \left\{ \frac{w-1}{2} + (k-1)s\Delta t \right\}$$

$$k = 1,2,3,\cdots,nw;$$

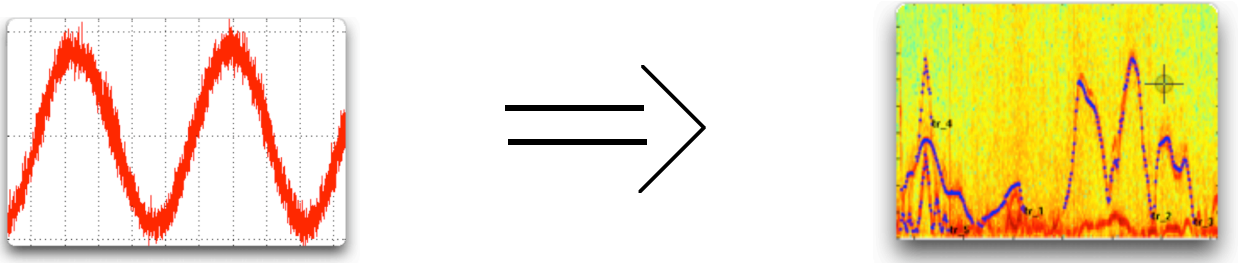
(usually $s = \frac{w}{2}$)

$$v(j) = \frac{\lambda}{2} \frac{j-1}{j_{\max} - 1} \frac{1}{2\Delta t},$$

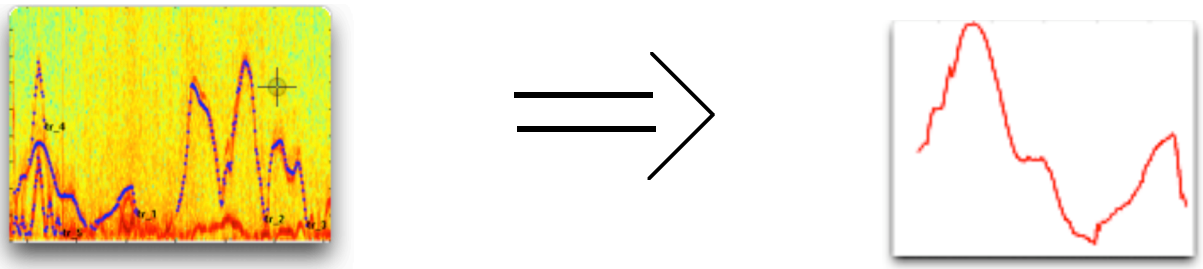
$$j = 1,2,3,\cdots, floor(\frac{w}{2}) + 1$$

PDV consists of two major codes

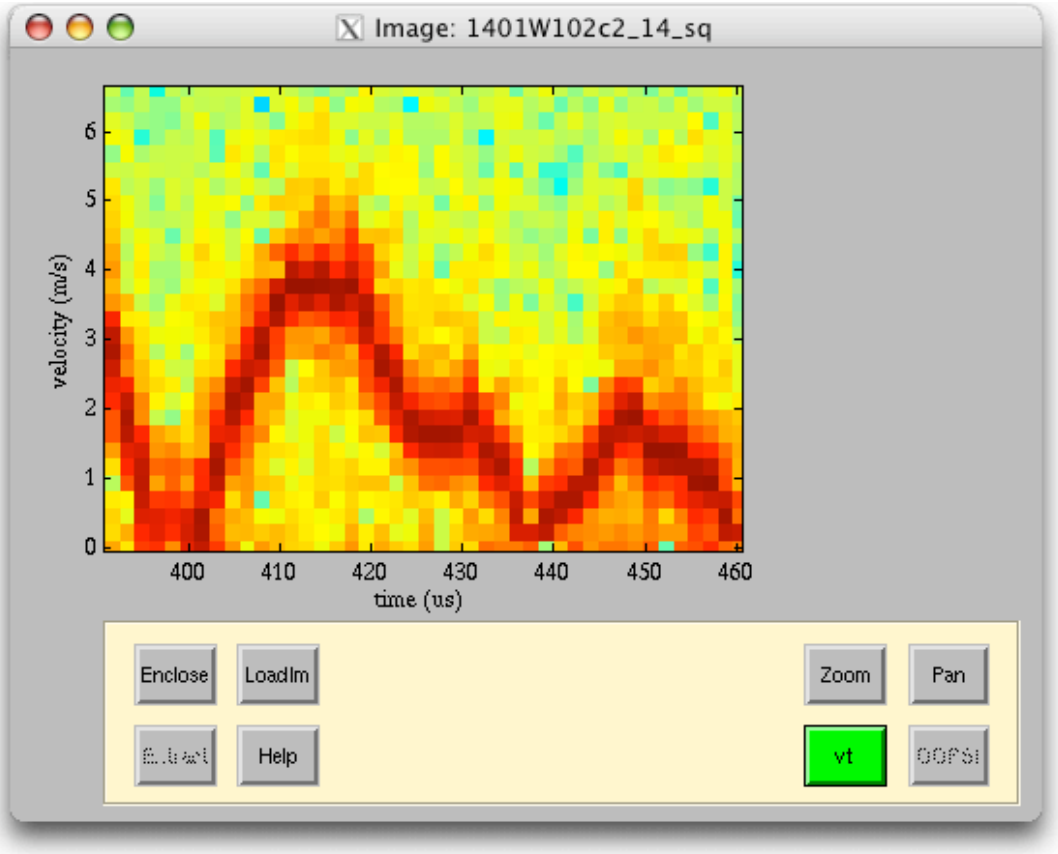
- Batch: raw data => spectrogram



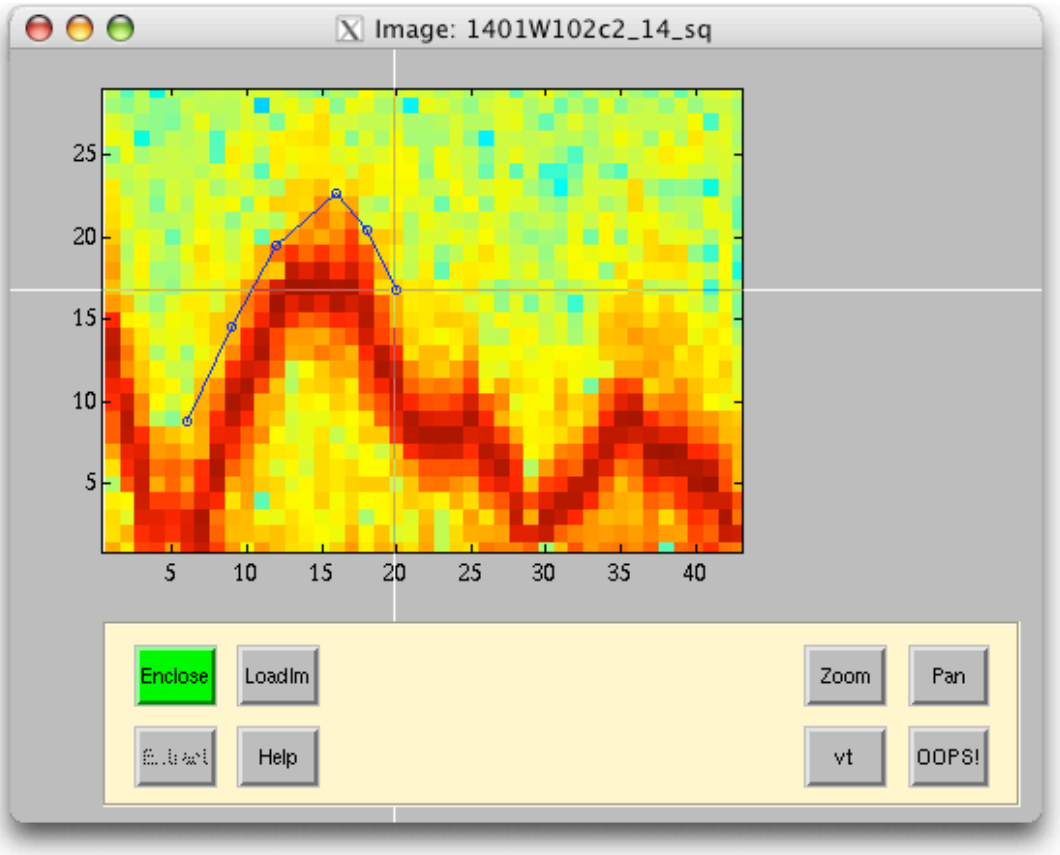
- Interactive: spectrogram => tv files



Most of the usefulness of PDV resides in the GUI

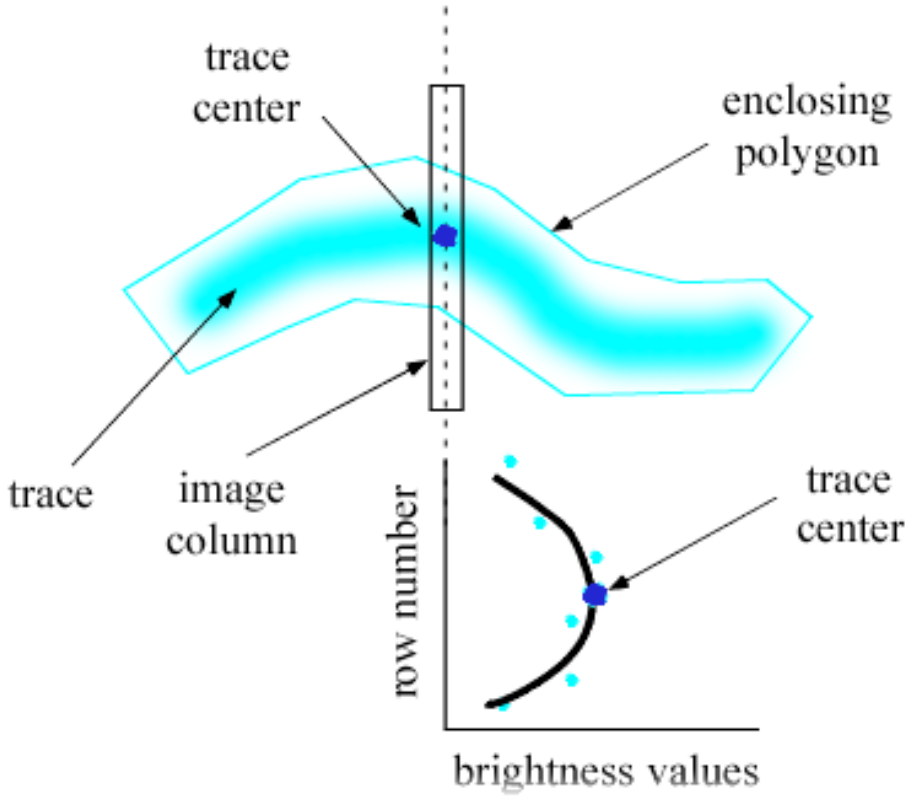


Trace extraction is highly interactive…

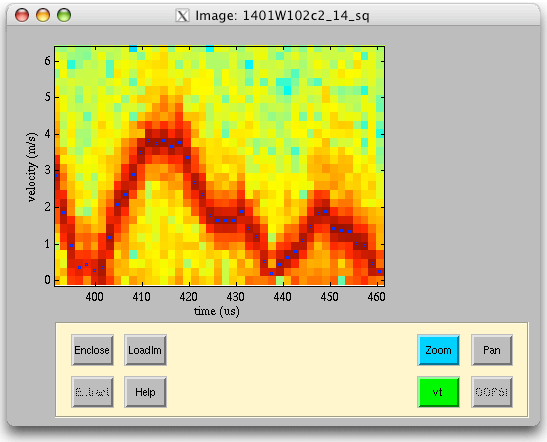


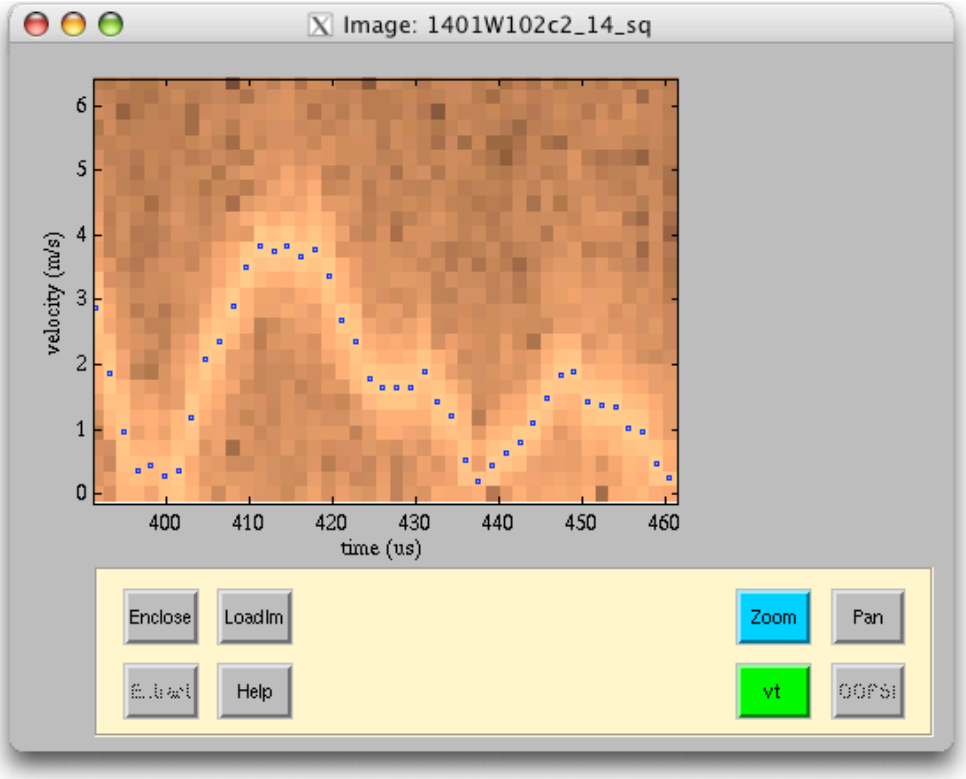
…and modestly computational

The maximum of
a least-squares-fit
parabola
for each polygon-
bounded
image column
determines
the trace center

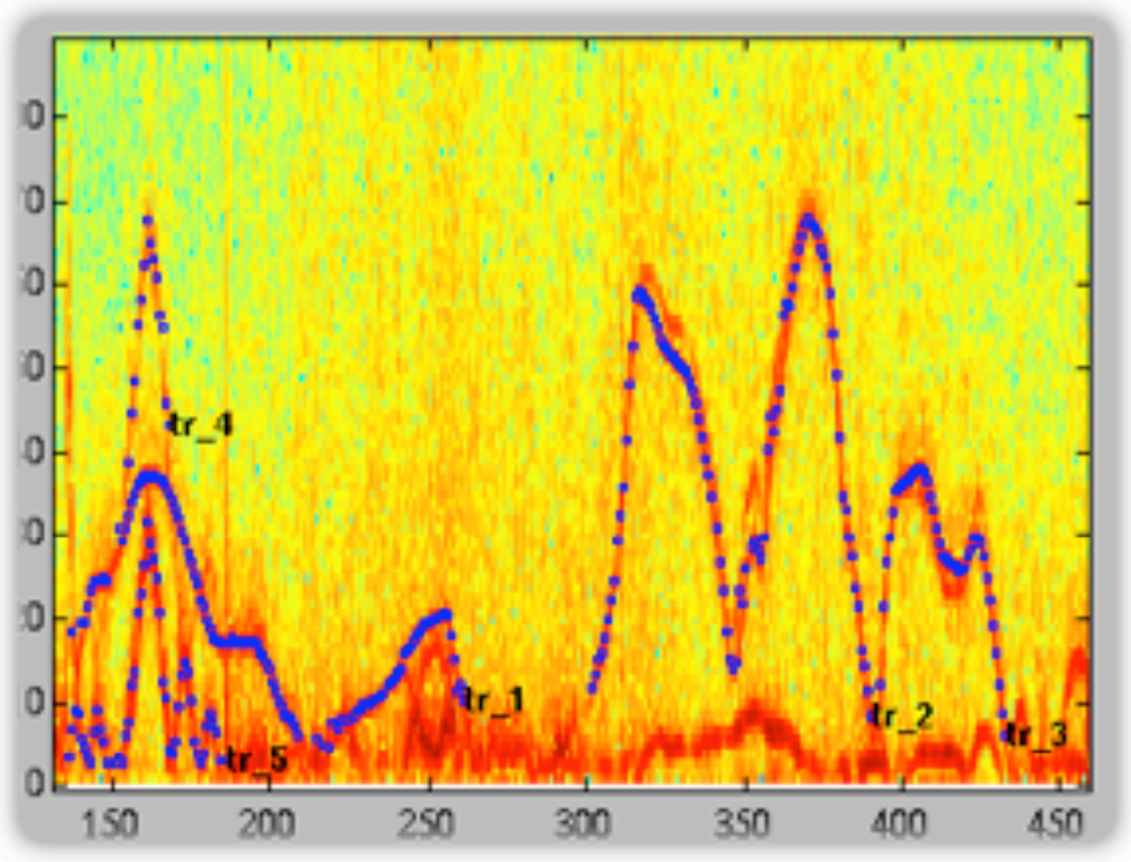


The extracted traces (points) are displayed on the image trace





The FT method works well for overlapping multiple traces



The end product are t-v files and a summary report

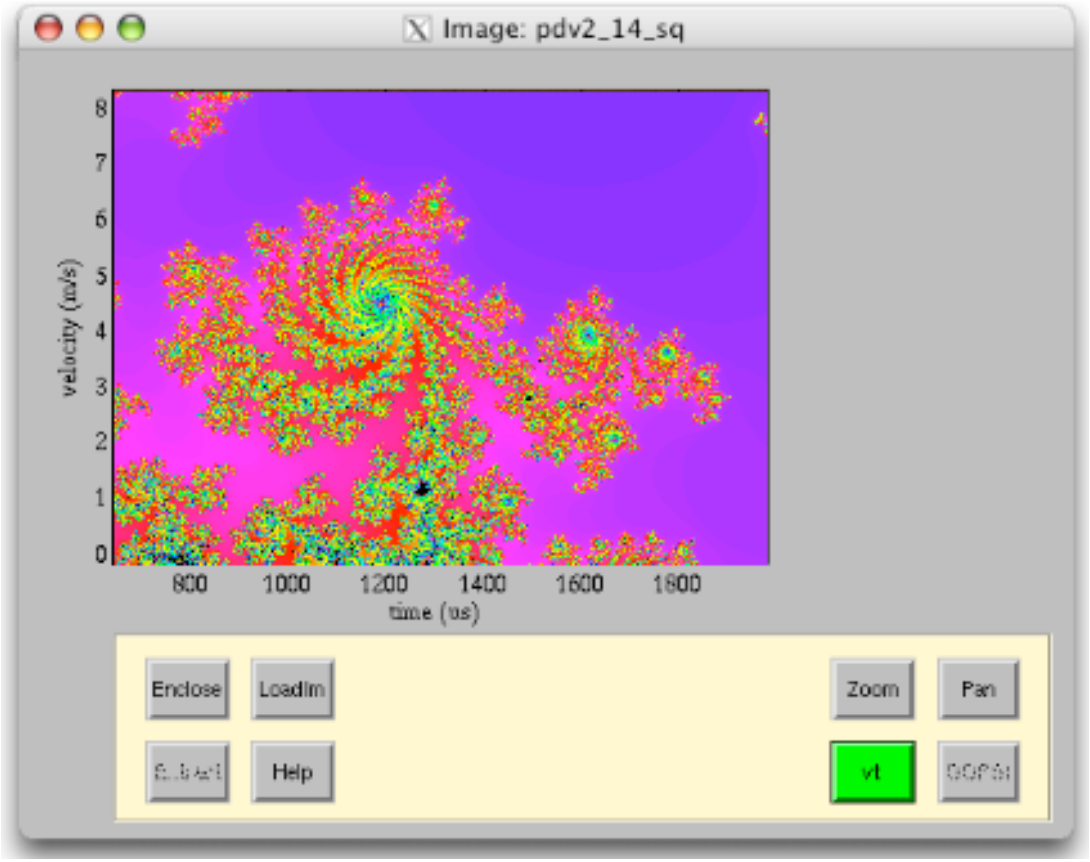
Summary Report
Shot Series Name: 1401_Wxx_Shots
Shot Name: W16
10-Feb-2005

filename	t1	dt	ptt	tt	np	2^np	date-time	
vt_1401w16c2_10_1	390	200	0	390	10	1024	10-Feb-2005	17:48:48
vt_1401w16c2_10_2	390	200	0	390	10	1024	10-Feb-2005	17:49:24
vt_1401w16c4_10_1	390	200	0	390	10	1024	10-Feb-2005	17:51:40
vt_pdv2_11_1	100	500	0	100	11	2048	10-Feb-2005	18:27:41
vt_pdv2_11_2	100	500	0	100	11	2048	10-Feb-2005	18:28:15

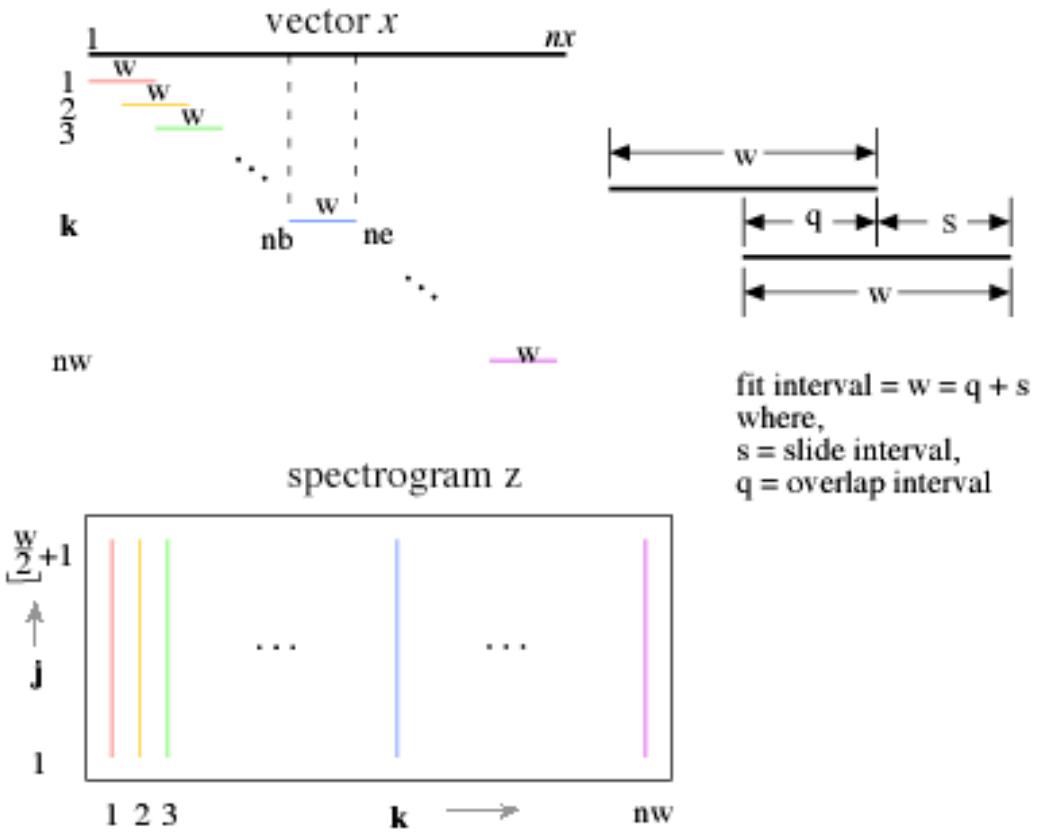
KEY:
- filename = file name of velocity-time data file
- t1 = start time of pdv data (us)
- dt = sample time (ps)
- ptt = pre-trigger time (us)
- tt = trigger time (us); t1 = tt + ptt
- np = power of 2 for fit interval length (no dimensions)
- 2^np = fit interval length (number of data points)
- date-time = date & time when vt file created

OTHER DATA:
- wavelength = 1549.5 (nm)

Some spectrograms are too complicated for normal FT methods



There are limits to t-v accuracy



$$t(k)=\frac{tb(k)+te(k)}{2}=$$

$$t(1)+\left\{\frac{w-1}{2}+(k-1)s\Delta t\right\}$$

$$k=1,2,3,\cdots,nw;$$

$$(\text{usually } s=\frac{w}{2})$$

$$\Delta t(k)=s\Delta t$$

$$v(j)=\frac{\lambda}{2}\frac{j-1}{j_{\max}-1}\frac{1}{2\Delta t},$$

$$j=1,2,3,\cdots,floor(\frac{w}{2})+1$$

$$\Delta v(j)=\frac{\lambda}{2}\frac{1}{2\Delta t}\frac{2}{w}=\frac{\lambda}{2}\frac{1}{w\Delta t}$$