Multidimensional Datasets

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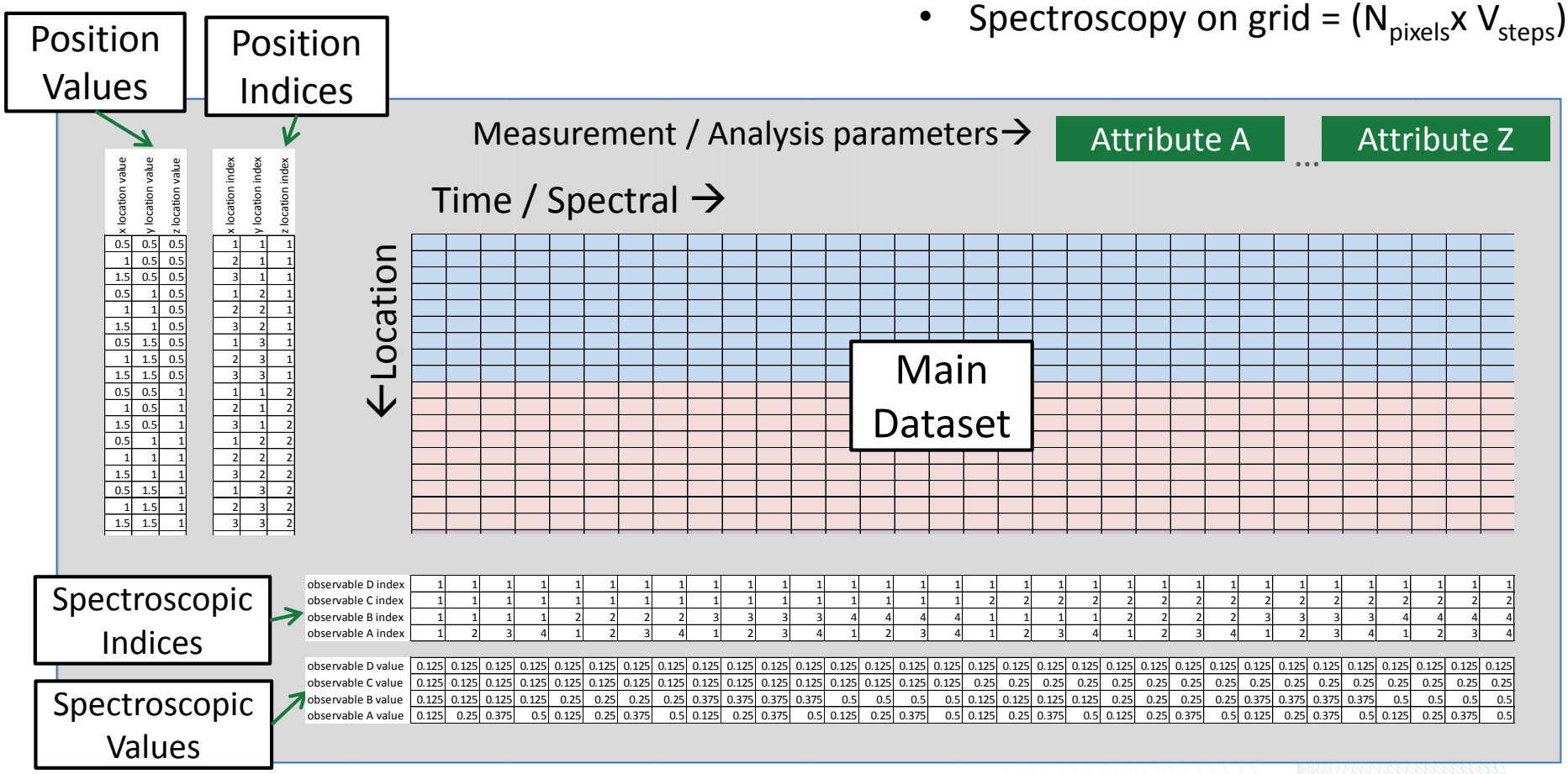
Universal Imaging and Spectroscopic Data (USID)

- Data stored as 2D matrix of (position x spectral values) regardless of dimensionality
- Ancillary datasets explain the data

Example data types:

- 2D images = (N_{pixels} x 1)
- Single spectra = (1 x Z_{steps})
- Spectroscopy on grid = (N_{pixels}x V_{steps})



x location value	y location value	z location value
0.5	0.5	0.5
1	0.5	0.5
1.5	0.5	0.5
0.5	1	0.5
1	1	0.5
1.5	1	0.5
0.5	1.5	0.5
1	1.5	0.5
1.5	1.5	0.5
0.5	0.5	1
1	0.5	1
1.5	0.5	1
0.5	1	1
1	1	1
1.5	1	1
0.5	1.5	1
1	1.5	1
1.5	1.5	1

x location index	y location index	z location index
1	1	1
2	1	1
3	1	1
1	2	1
2	2	1
3	2	1
1	3	1
2	3	1
3	3	1
1	1	2
2	1	2
3	1	2
1	2	2
2	2	2
3	2	2
1	3	2
2	3	2
3	3	2

observable D index	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
observable C index	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
observable B index	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	
observable A index	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	

observable D value	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
observable C value	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
observable B value	0.125	0.125	0.125	0.125	0.25	0.25	0.25	0.25	0.375	0.375	0.375	0.375	0.5	0.5	0.5	0.5	0.125	0.125	0.125	0.125	0.25	0.25	0.25	0.25	0.375	0.375	0.375	0.375	0.5	0.5	0.5	0.5	
observable A value	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	0.125	0.25	0.375	0.5	

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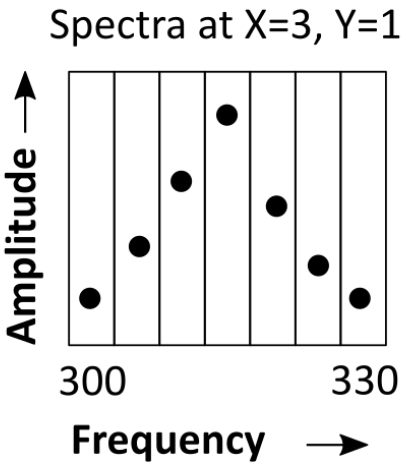
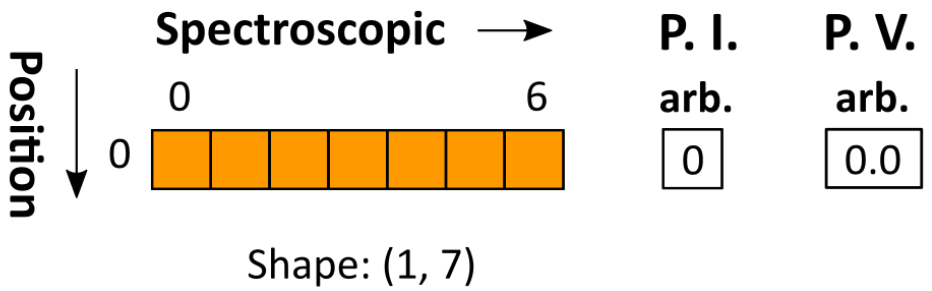
USID – 1D spectra

Original N-dimensional form



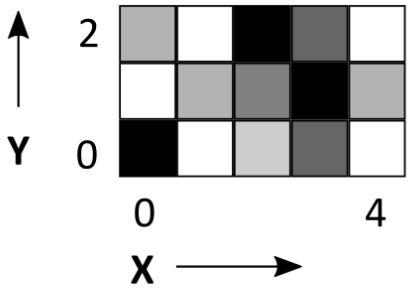
Shape: (7,)
Quantity: Amplitude
Units: V

USID 2-dimensional form



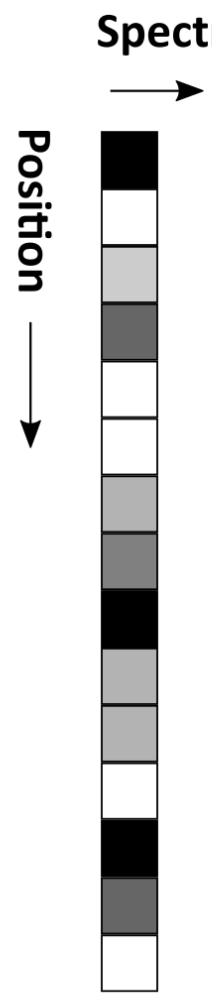
S. I.	Frequency	0	1	2	3	4	5	6
S. V.	Frequency	300	305	310	315	320	325	330

USID – 2D Image



Original N-D form

=



P. I. X	P. I. Y	P. V. X	P. V. Y
0	0	-250	0
1	0	-125	0
2	0	0	0
3	0	125	0
4	0	250	0
0	1	-250	3.5
1	1	-125	3.5
2	1	0	3.5
3	1	125	3.5
4	1	250	3.5
0	2	-250	7
1	2	-125	7
2	2	0	7
3	2	125	7
4	2	250	7

USID 2D form

Quantity: Intensity
Units: arb. units

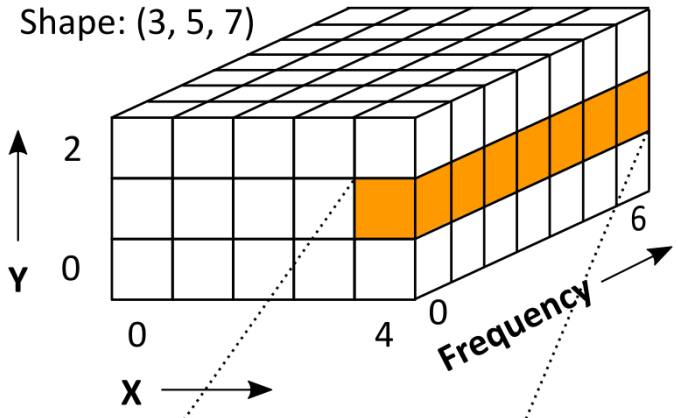
S. I. arb. 0

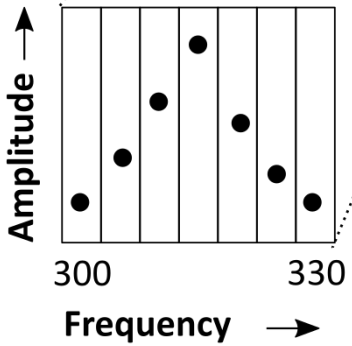
S. V. arb. 0.0

Shape: (15, 1)

USID – Spectra on Grid (3D)

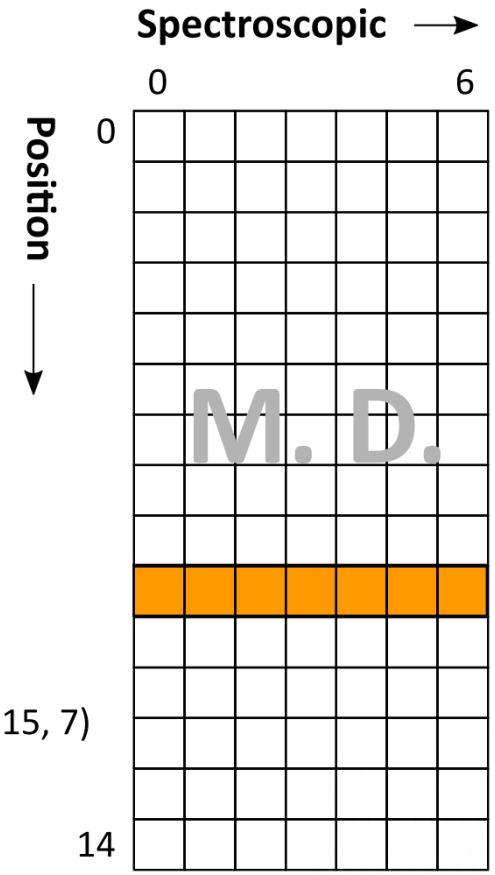
Original N-dimensional form





Quantity: Amplitude
Units: V

USID 2-dimensional Form



P. I.

X	Y
0	0
1	0
2	0
3	0
4	0
0	1
1	1
2	1
3	1
4	1
0	2
1	2
2	2
3	2
4	2

P. V.

X	Y
-250	0
-125	0
0	0
125	0
250	0
-250	3.5
-125	3.5
0	3.5
125	3.5
250	3.5
-250	7
-125	7
0	7
125	7
250	7

S. I. Frequency

0	1	2	3	4	5	6

S. V. Frequency

300	305	310	315	320	325	330

USID - Instrument Agnostic Code

- Instrument-agnostic data allows instrument-agnostic code
- Single version of analysis and processing routine
- Brings multiple scientific communities together