

Pile-up pulse analysis with fast sampling ADC techniques

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I have developed a method, and it works.

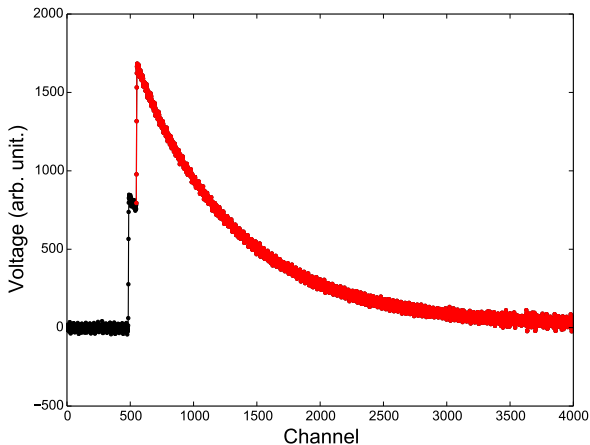
Outline

- 1 Why has the method been developed?
- 2 How does the method work?
- 3 How do we know it works?
- 4 What is next?

Why has the method been developed?

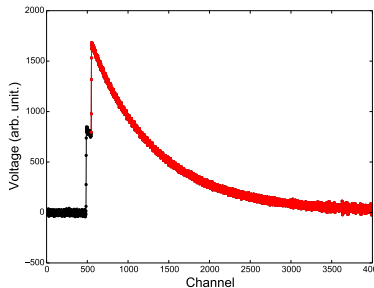
Pile-ups

A digitised preamplifier pile-up signal with a fast sampling ADC.

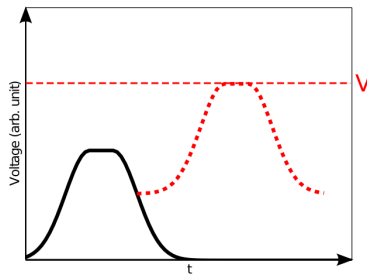


Pile-ups

Digital



Analogue



Why has the method been developed?

Possibilities with a digital electronics system:

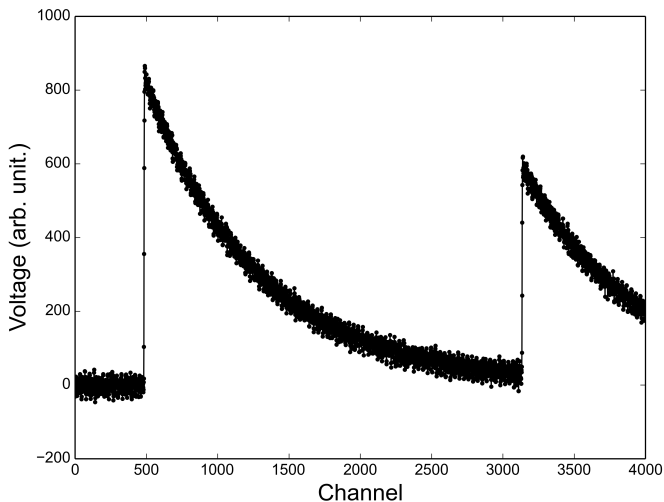
- The amplitudes in pile-ups can be resolved
- Short-lived nuclei can be studied

And:

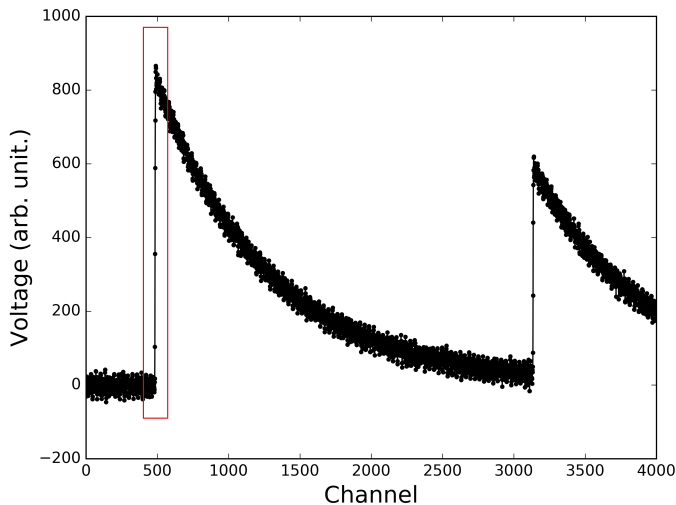
- Experimental data is available

How does the method work?

Filter and Time Extraction

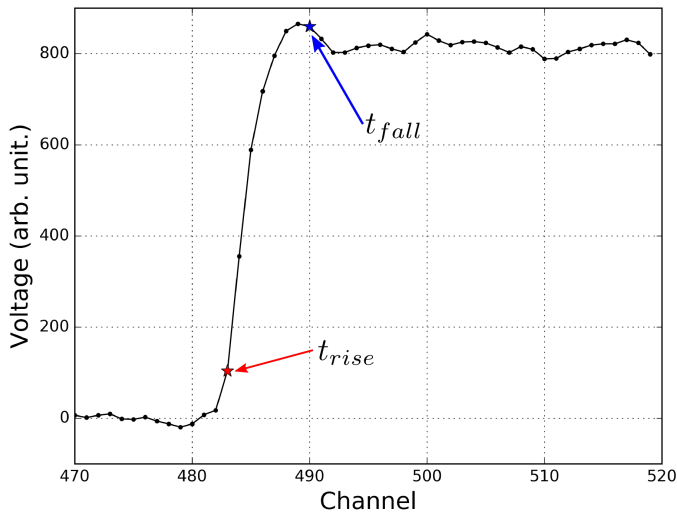


Filter and Time Extraction



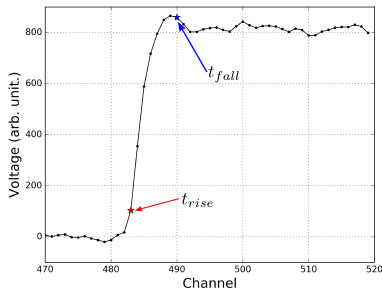
Filter and Time Extraction

Zoomed in

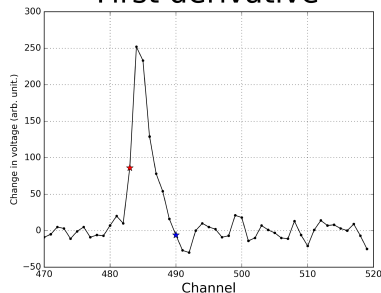


Filter and Time Extraction

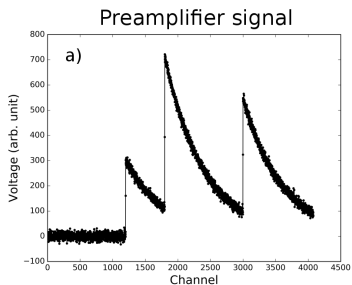
Zoomed in



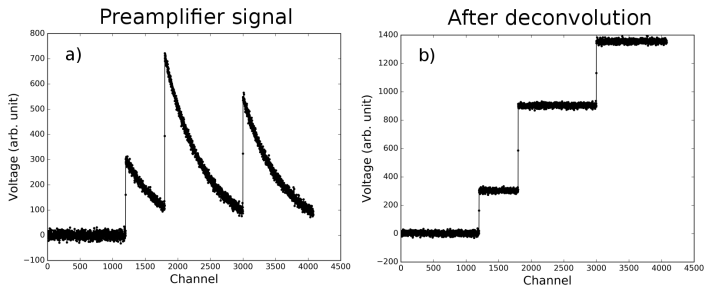
First derivative



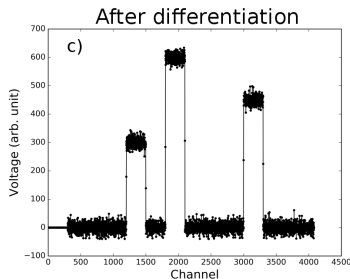
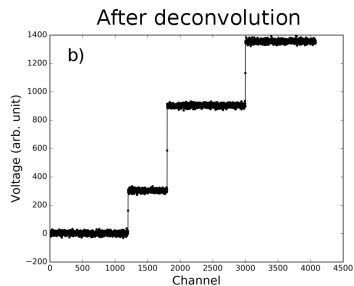
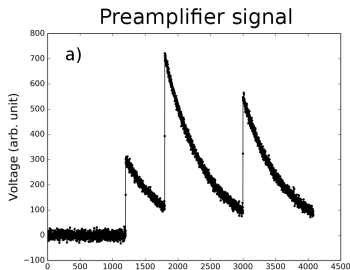
Moving Window Deconvolution



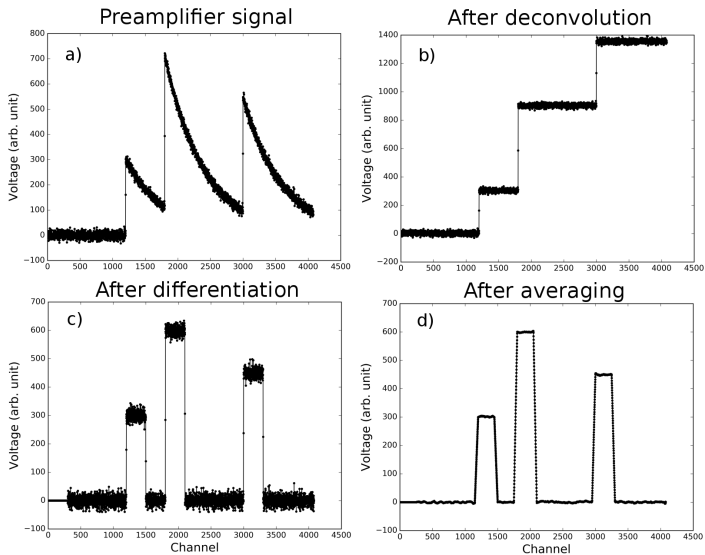
Moving Window Deconvolution



Moving Window Deconvolution



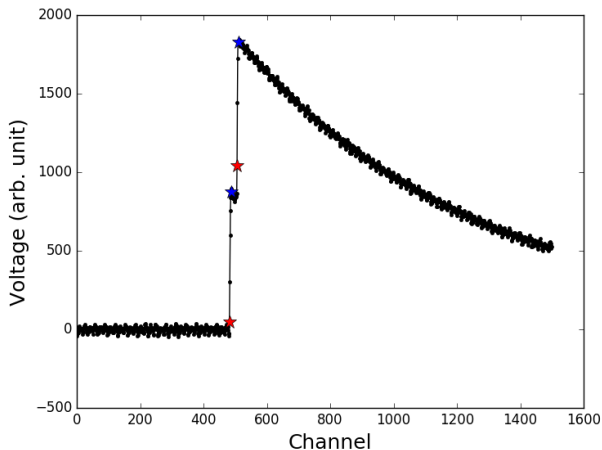
Moving Window Deconvolution



Amplitude Extraction

An example

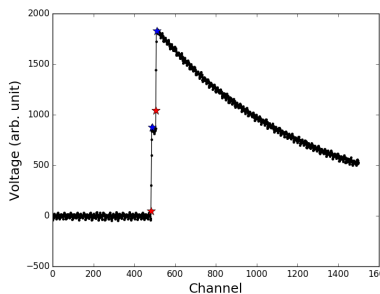
Digitised signal



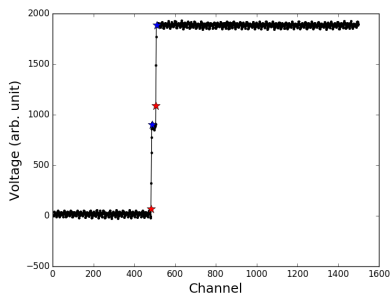
Amplitude Extraction

An example

Digitised signal



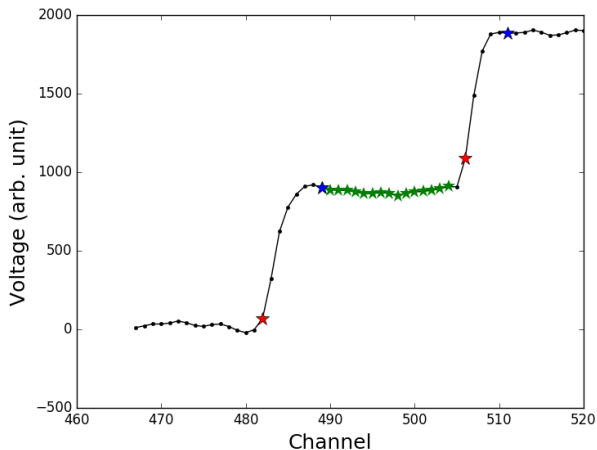
Deconvolved signal



Amplitude Extraction

An example

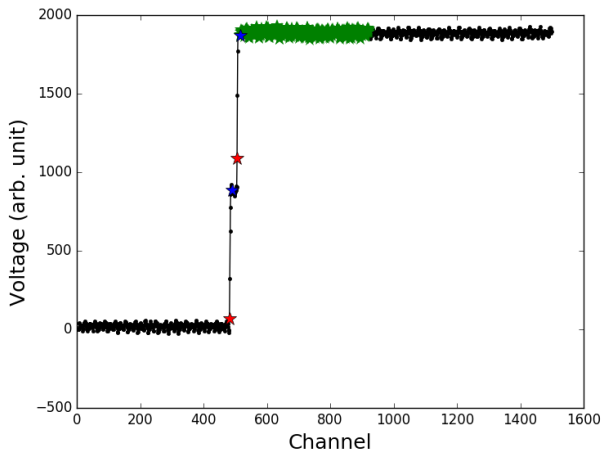
Pulse 1



Amplitude Extraction

An example

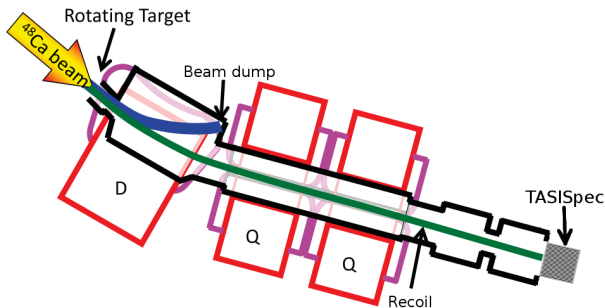
Pulse 2



How do we know it works?

The 2012 E115-experiment

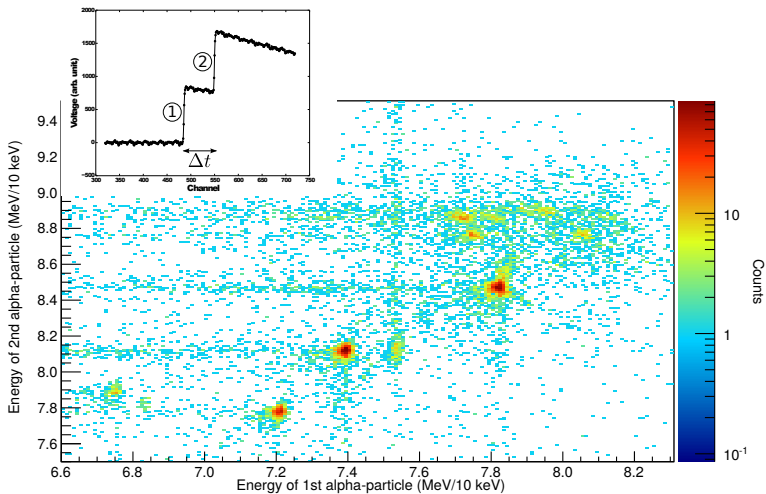
The reaction: $^{48}\text{Ca} + ^{243}\text{Am} = ^{291}115^*$



TASCA-separator. Source: Phys. Rev. C, **83**:054618.

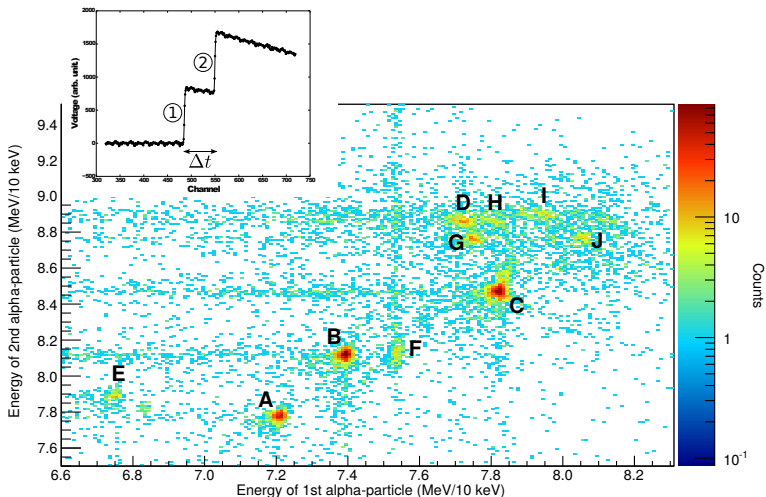
Results

α_1 - α_2 -correlation spectra



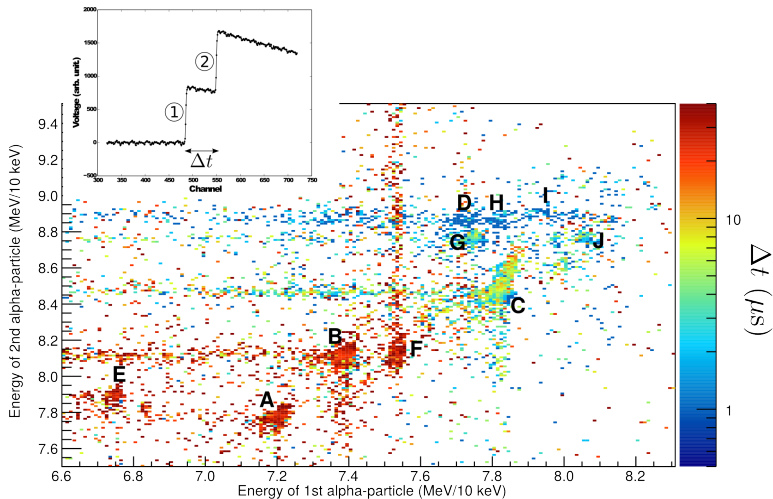
Results

α_1 - α_2 -correlation spectra



Results

α_1 - α_2 -correlation spectra



Results

Compiled results

Region	E_{α_1} (MeV)	E_{α_2} (MeV)	$T_{1/2}$ (μ s)	E_{α_3} (MeV)
A	7.15(1)	7.72(1)	85(22)	-
B	7.33(2)	8.06(2)	32(2)	6.62(1)
C	7.76(2)	8.41(3)	3.6(1)	-
D	7.67(3)	8.80(2)	0.90(5)	-
E	6.69(2)	7.84(1)	44(12)	-
F	7.48(1)	8.07(3)	62(26)	-
G	7.68(5)	8.70(3)	2.1(1)	7.45(2)
H	7.75(3)	8.80(3)	0.7(1)	-
I	7.88(4)	8.83(3)	0.72(7)	-
J	8.00(3)	8.69(3)	1.9(2)	7.45(1)

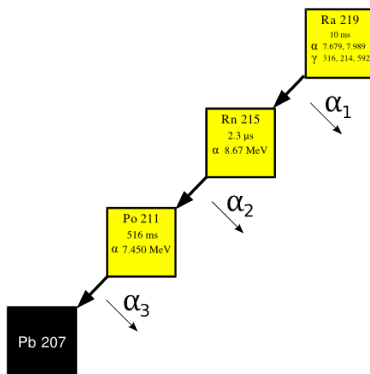
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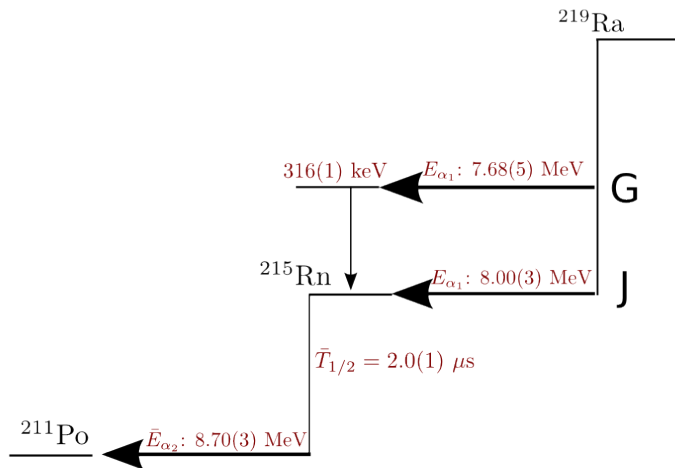
Connection to decay paths



Source: Karlsruhe Nuclide Chart.

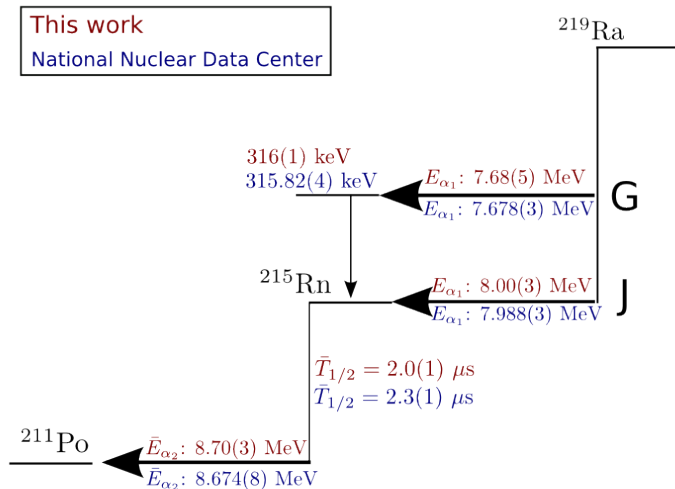
Results

Decay Level Scheme



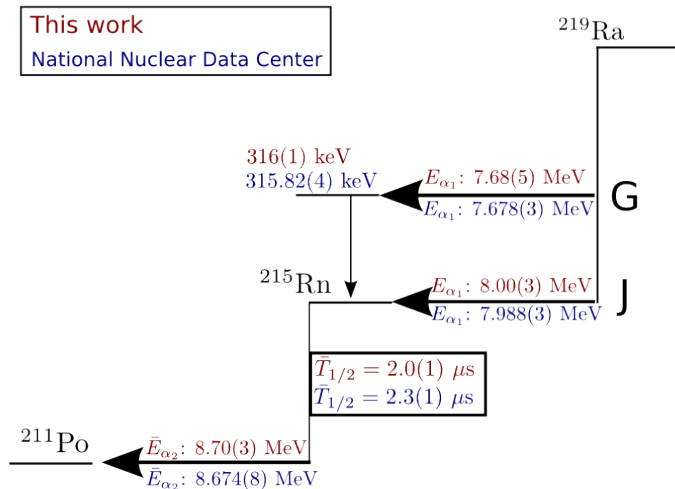
Results

Decay Level Scheme



Results

Decay Level Scheme

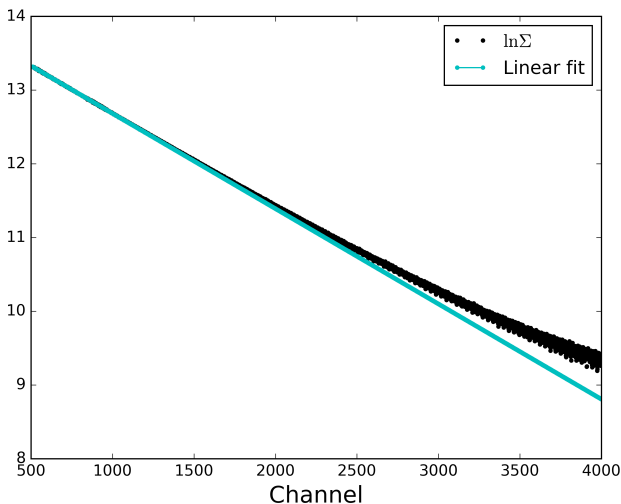


Outlook

- Study the remaining eight (and possibly more) blobs for:
 - Better half-life measurements
 - New decay modes
 - Improved branching ratios

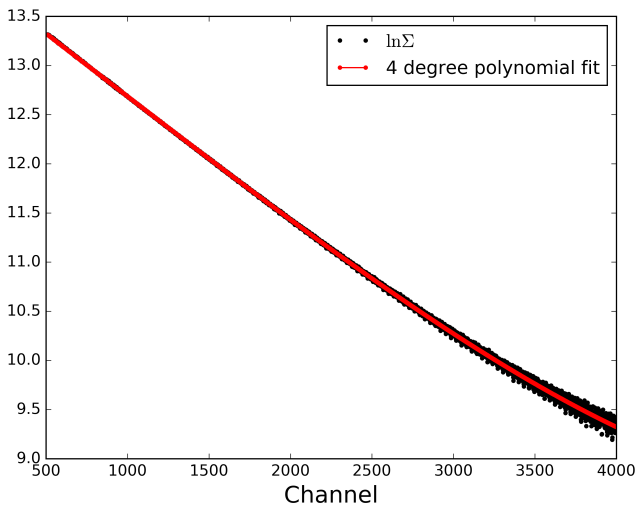
Amplitude Extraction

Deconvolution



Amplitude Extraction

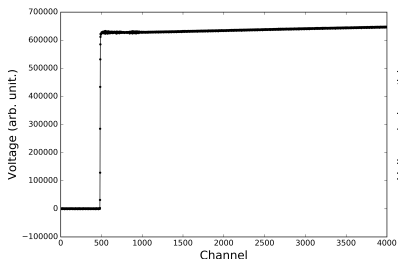
Deconvolution



Amplitude Extraction

Deconvolution

Deconvolution - before



Deconvolution - new

