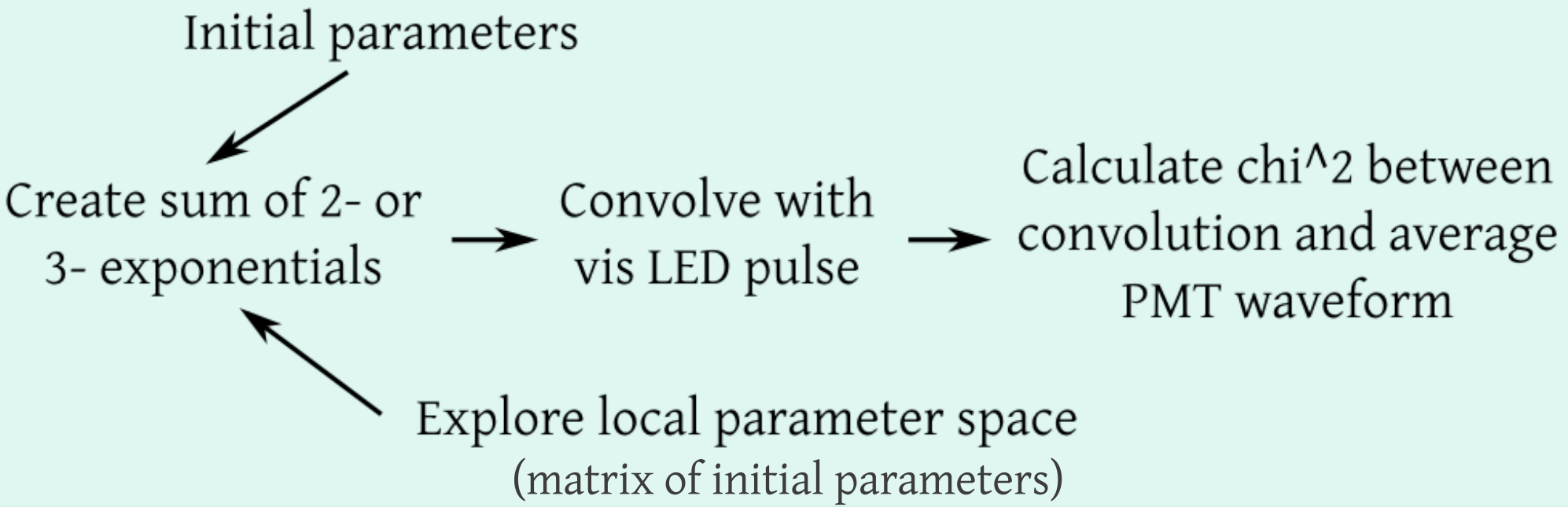
Template Fit Analysis:
Fitting to PMT Waveforms using Convolutions

Talk 4 of 6

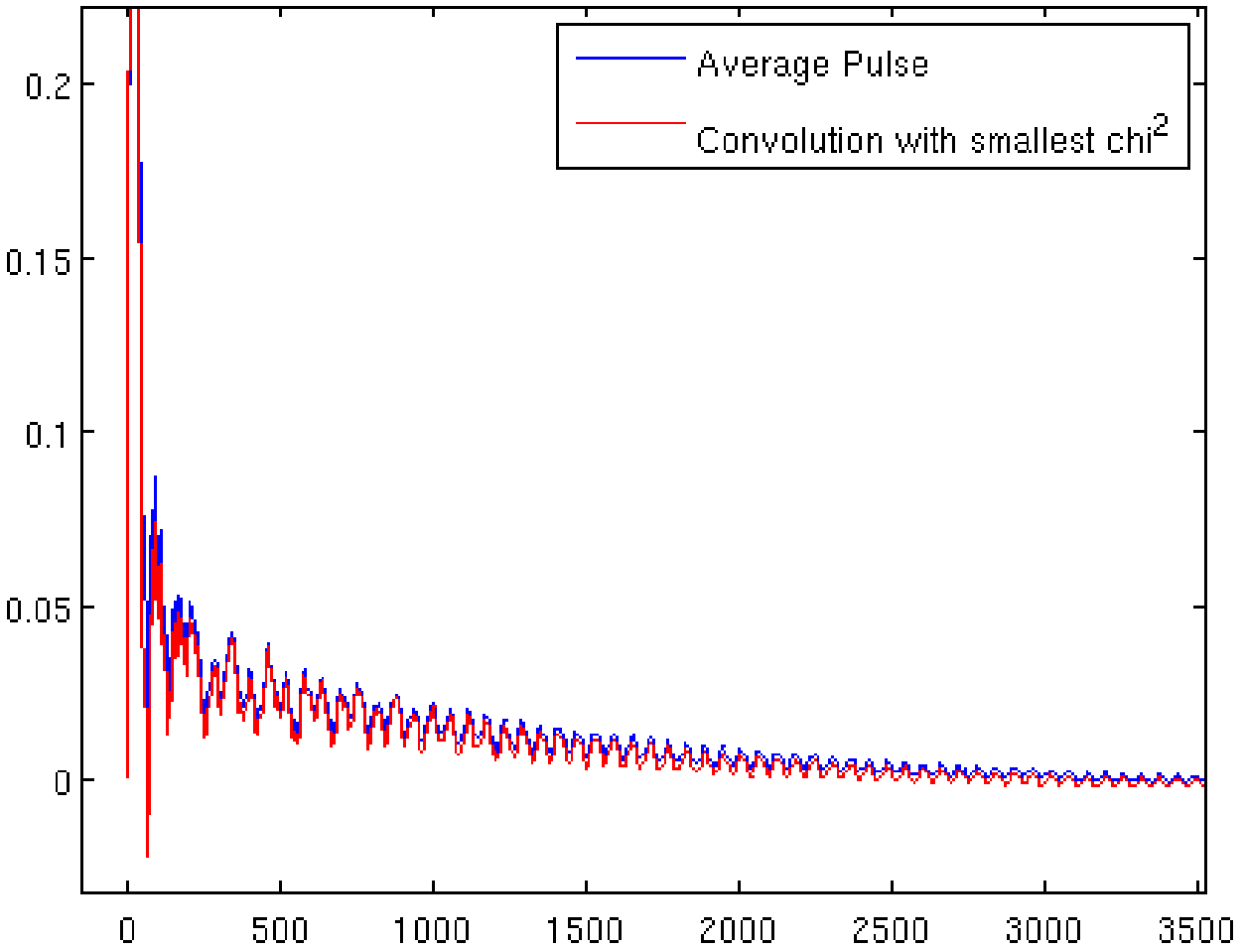
Christie Chiu
Bo VST: Feb 1 2013

Template Fit Method

MATLAB analysis:

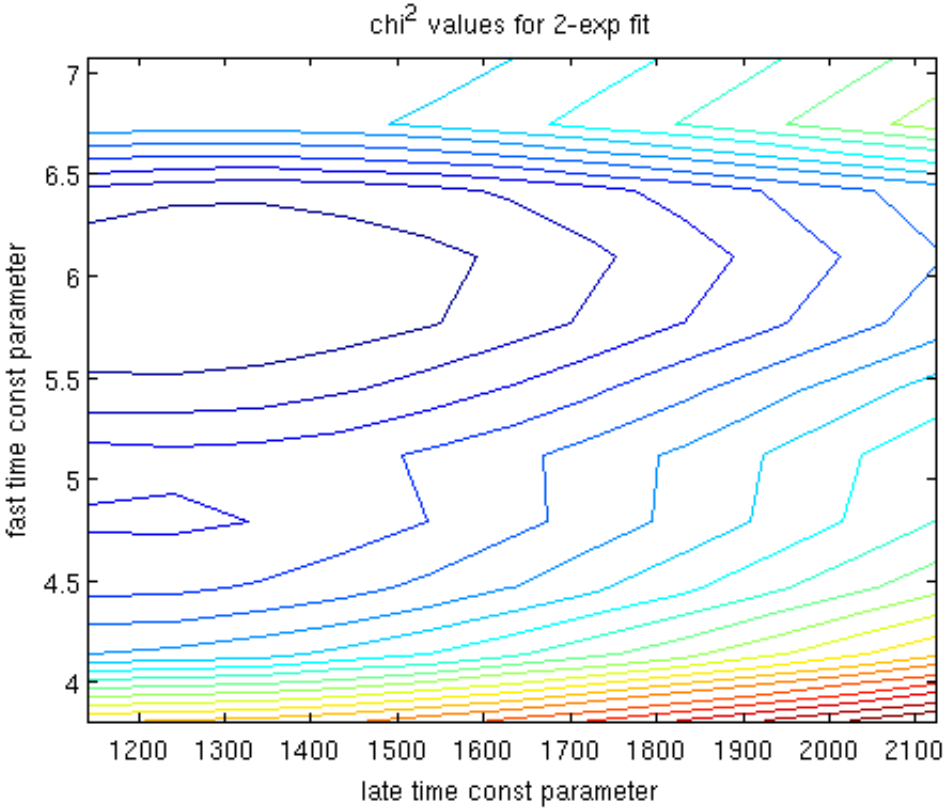


The convolution matches up quite well with the average pulse already, even with just the ROOT fit parameters

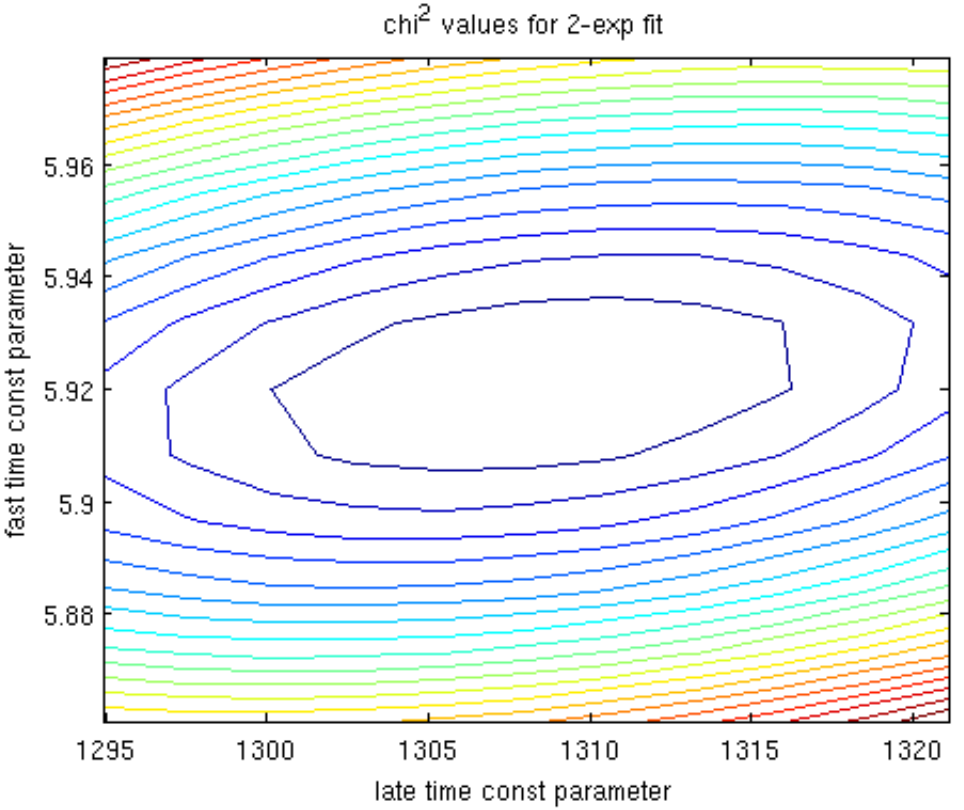


2 exponent fits

- We float the amplitude parameters, to reduce our 4D space to 2D
  - For each pair of time constants, take the smallest chi^2 value among the different amplitudes
- Look for a chi^2 local minimum

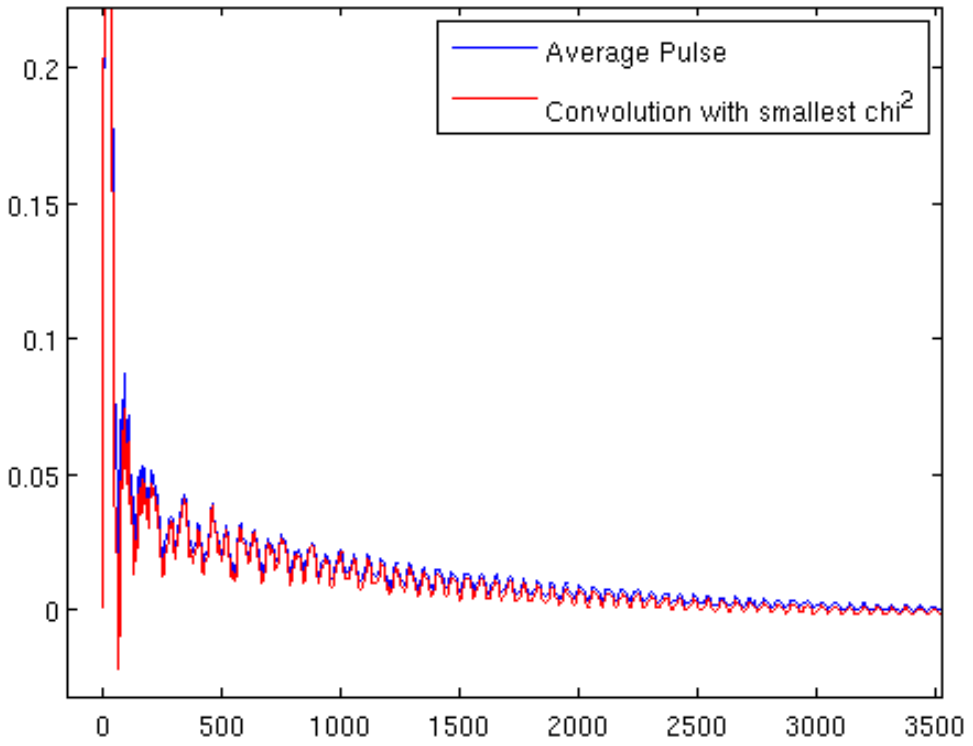


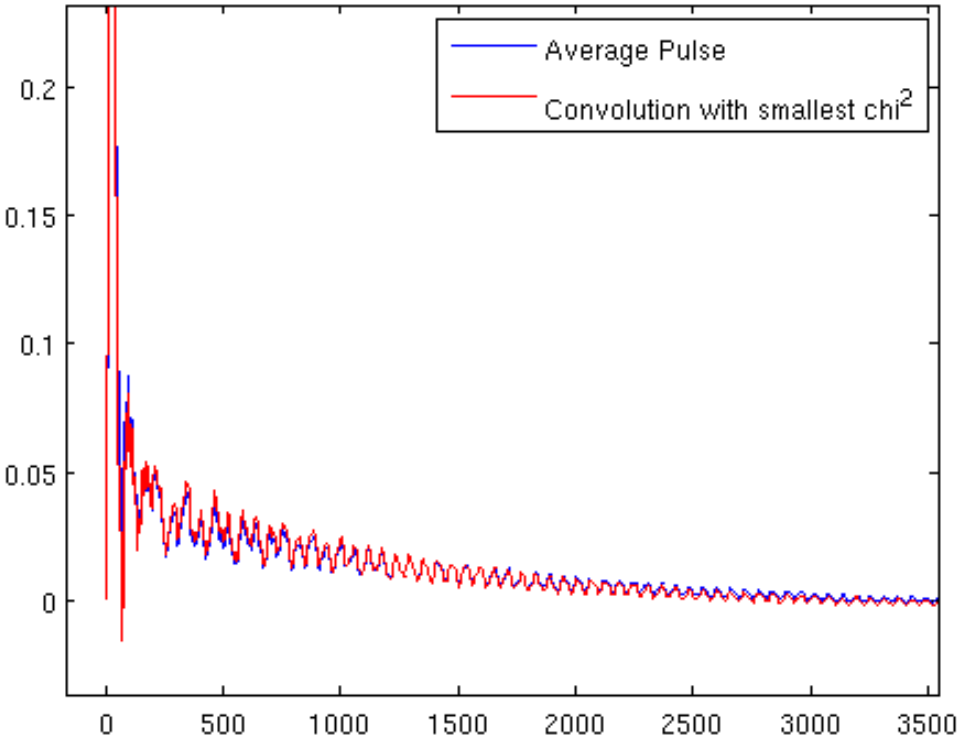
Start with a large parameter space

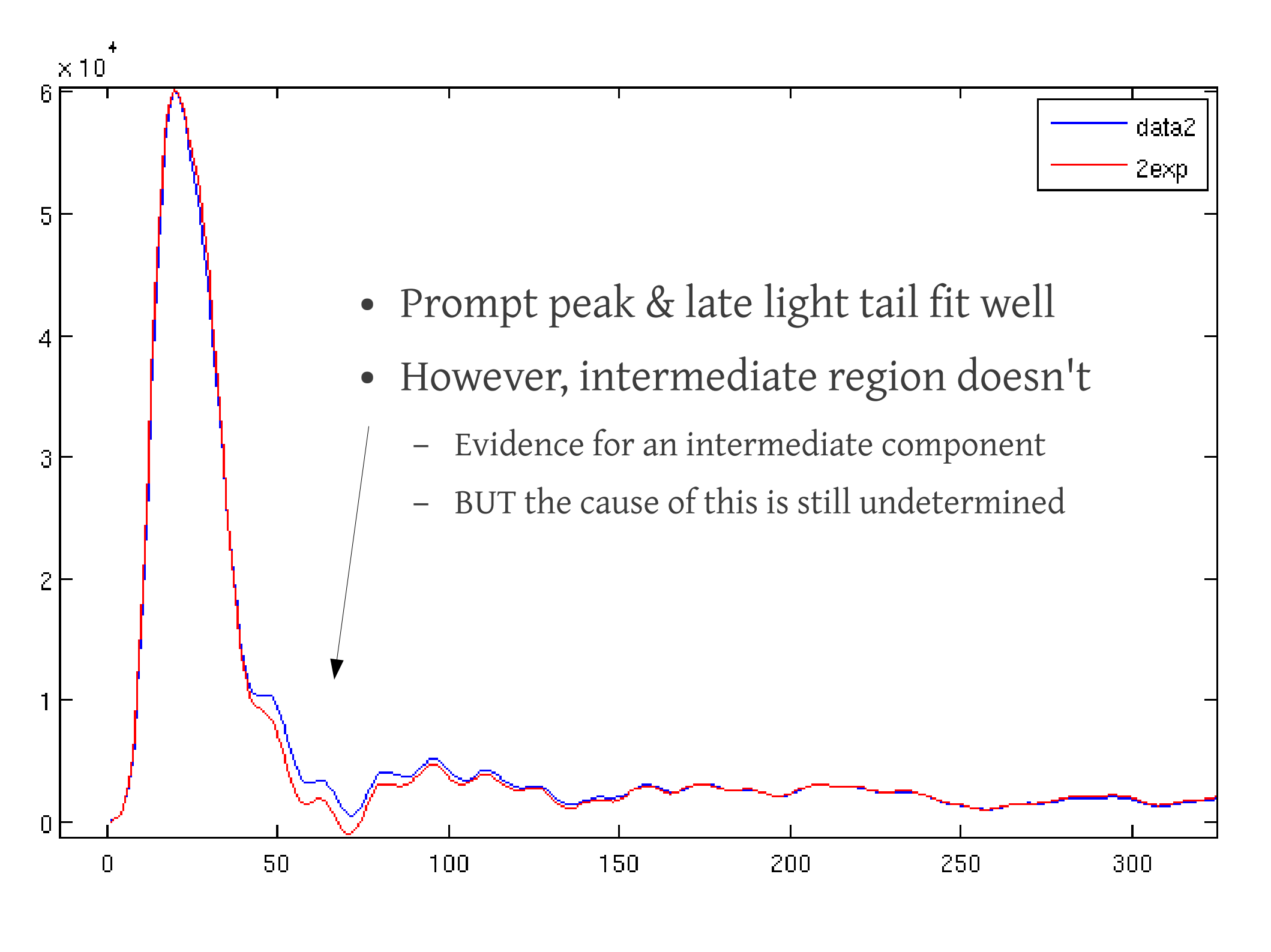


Center at maximum and increase parameter resolution to determine best fit parameters

Sanity check: can tell by eye that fits are getting better as well



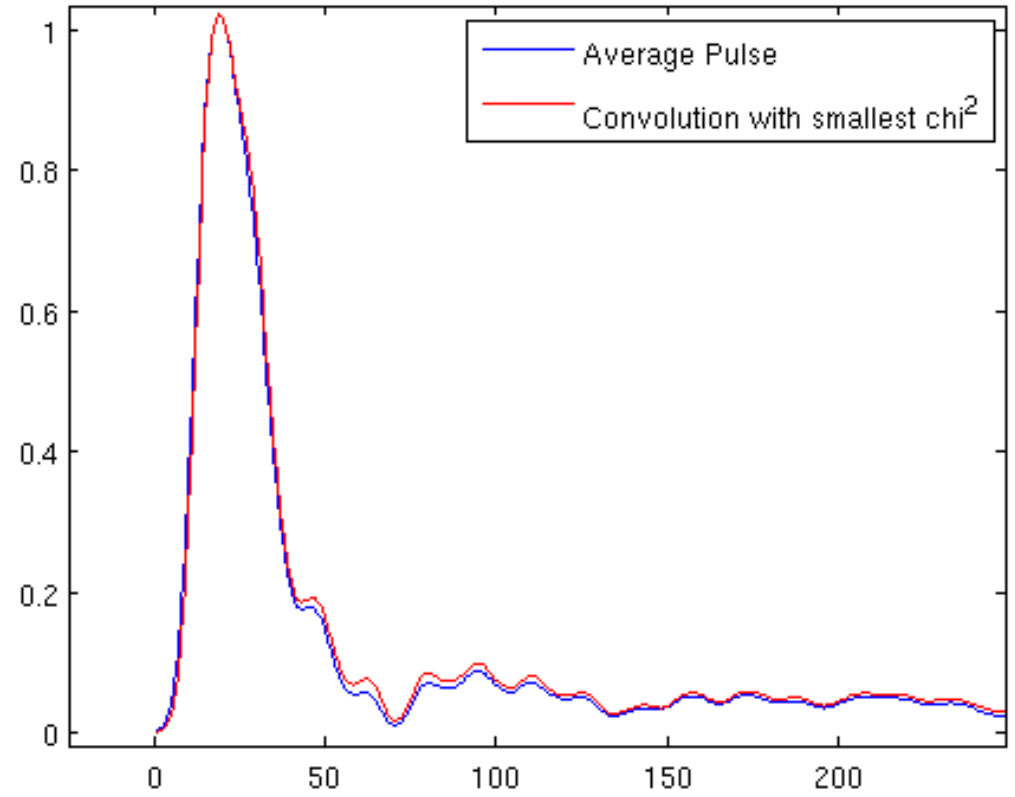


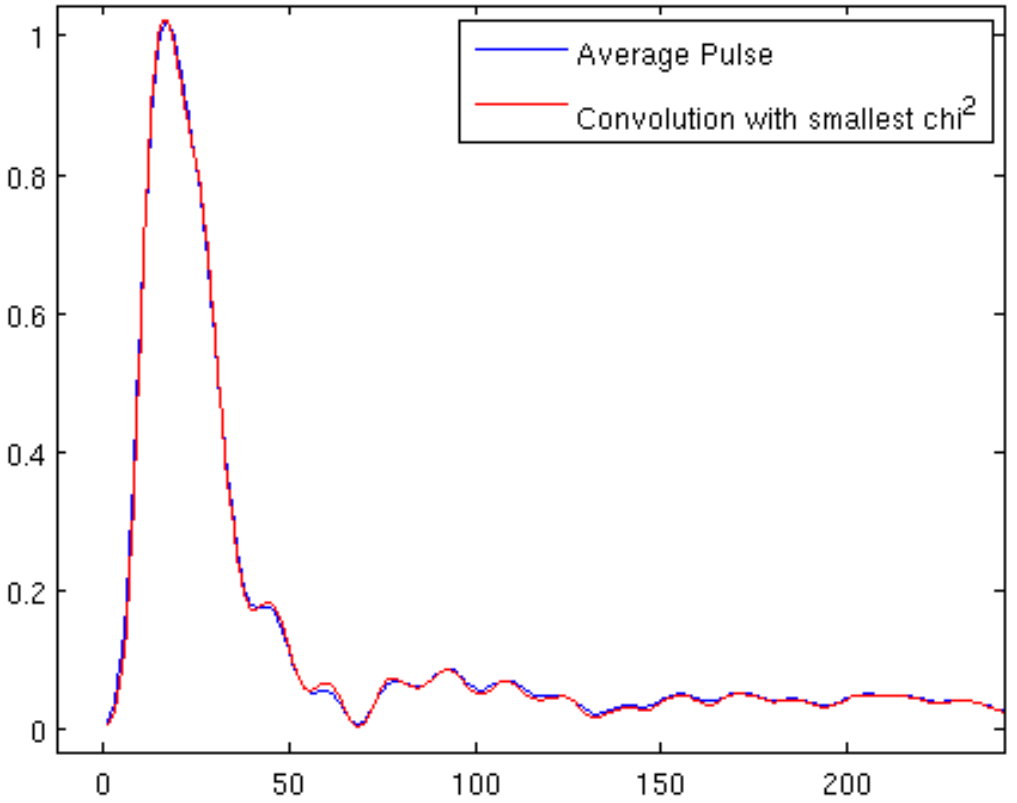

x 10^4
6
5
4
3
2
1
0
0
50
100
150
200
250
300
data2
2exp
• Prompt peak & late light tail fit well
• However, intermediate region doesn't
– Evidence for an intermediate component
– BUT the cause of this is still undetermined

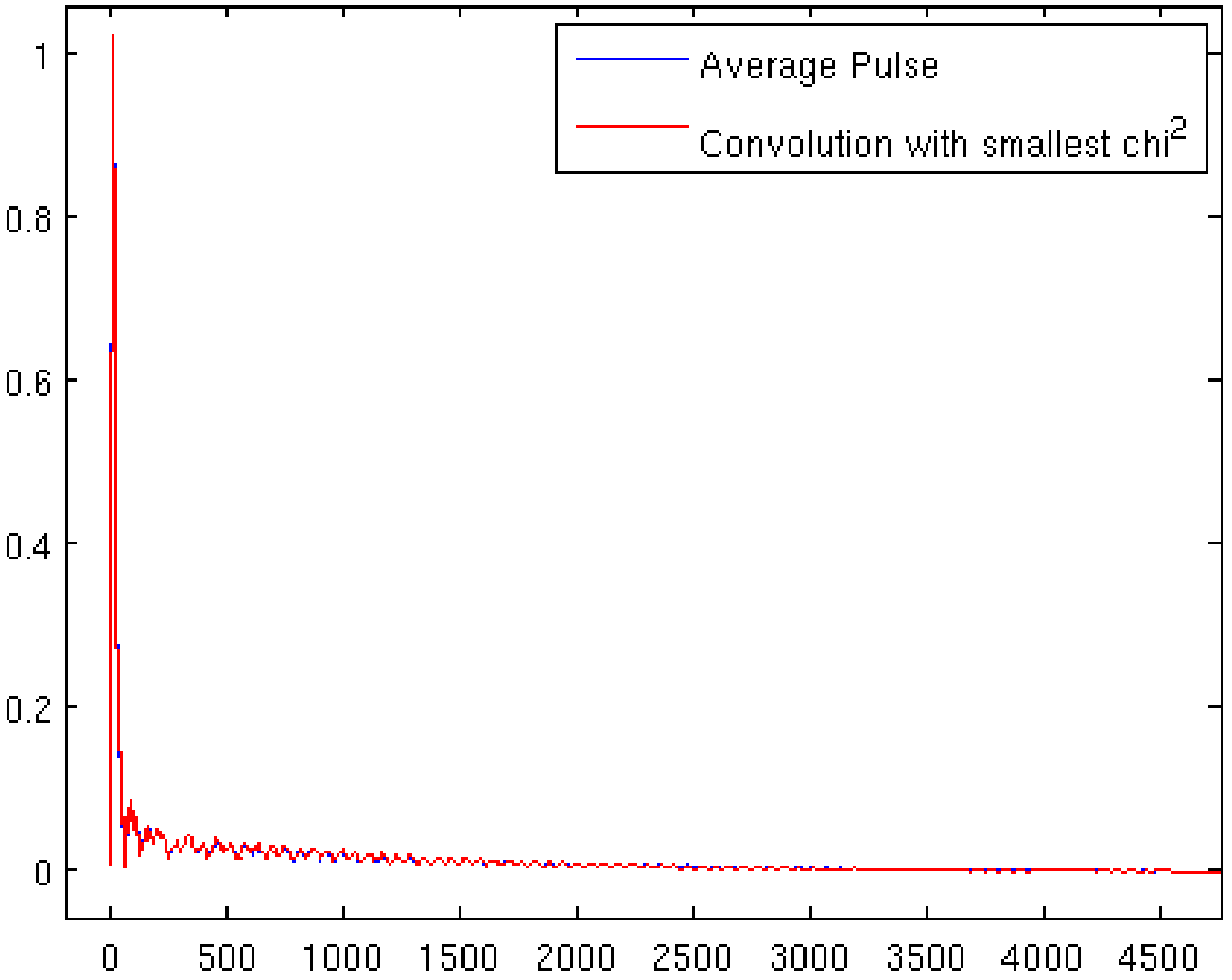
3 exponent fits

- Same as before, but with 6 parameters
  - Float amplitudes again to reduce this down to 3D
  - Output local minimum in this parameter space
- Repeat with new parameters & narrow down in parameter space

Here too, can tell by eye that fits are getting better







- Best 3-exp fit so far
- Time Constants:
  - Late: 1391 ns
  - Int: 23.09 ns
  - Prompt: 3.55 ns