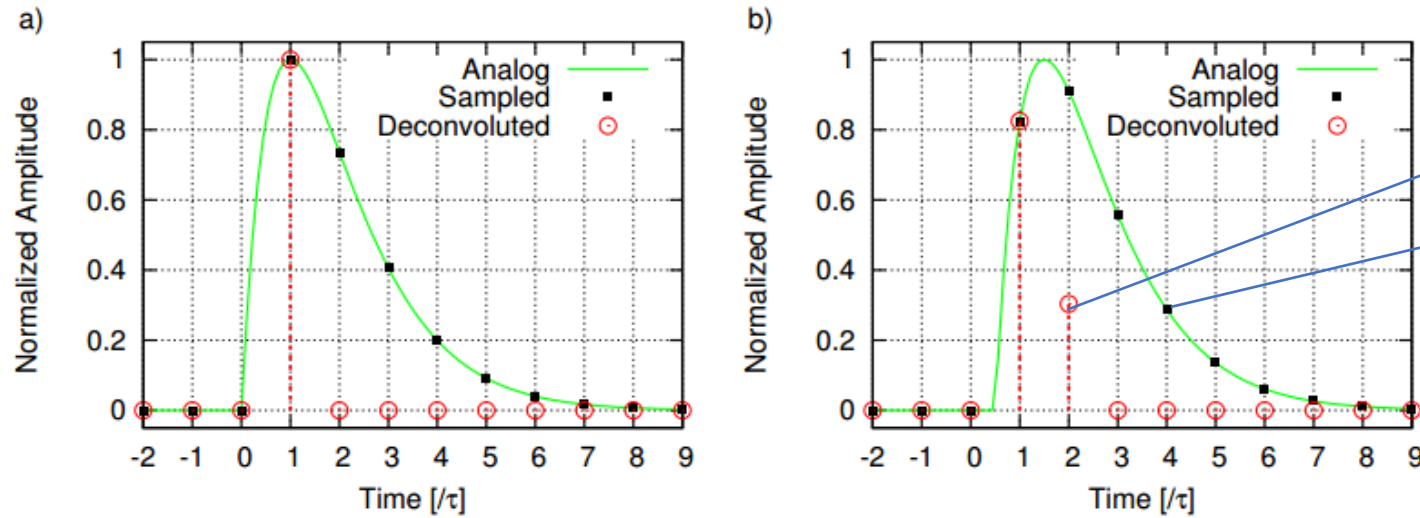


Deconvolution method

Evgenii Lutsenko

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Theory



s_i - deconvoluted points
 w_i - weights factors
 v_i - sampled points

Figure 2.23: Deconvolution filter response ($T_{smp} = T_{peak} = 1, amp = 1$). a) Pulse synchronous and b) Pulse asynchronous with sampling clock.

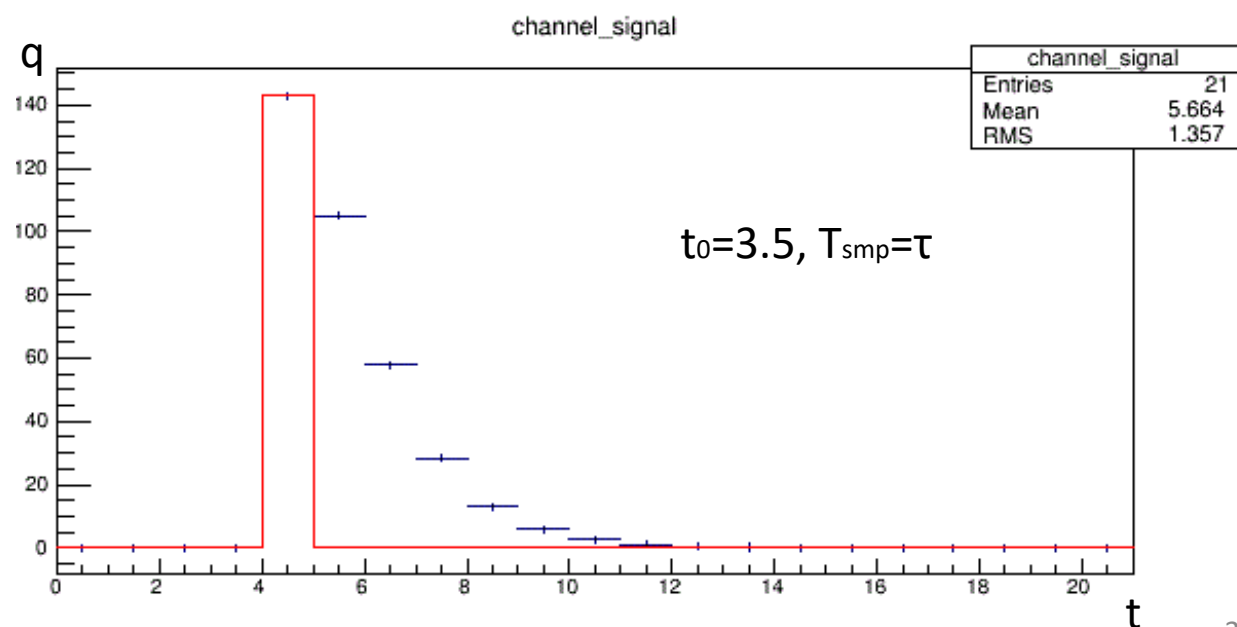
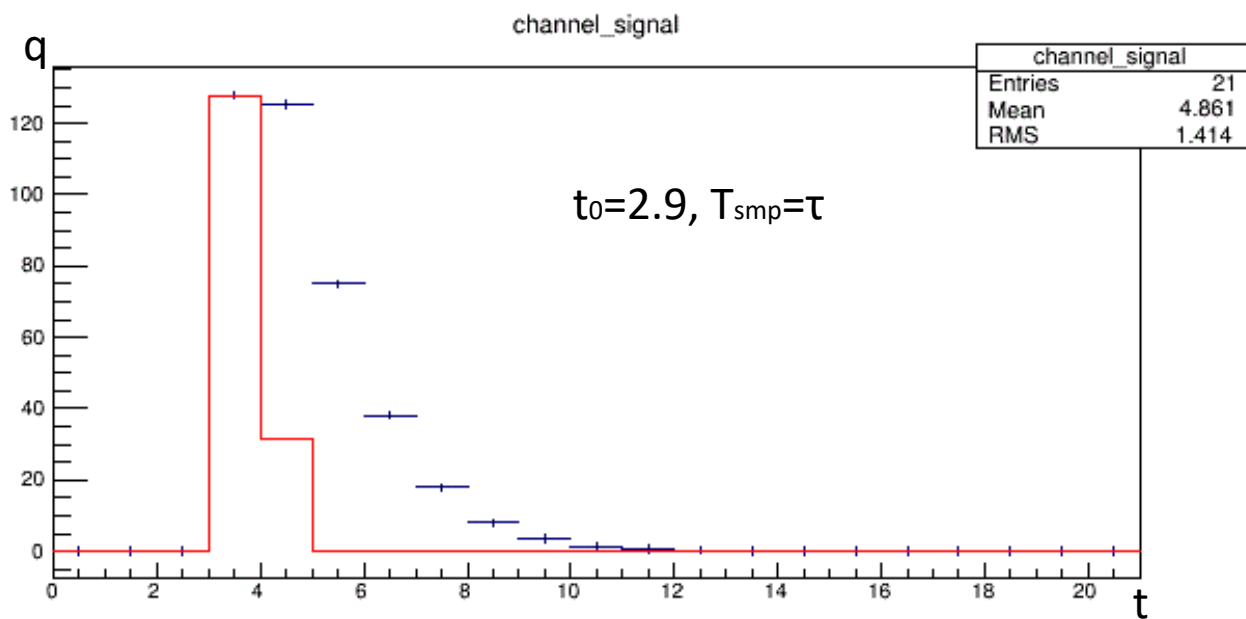
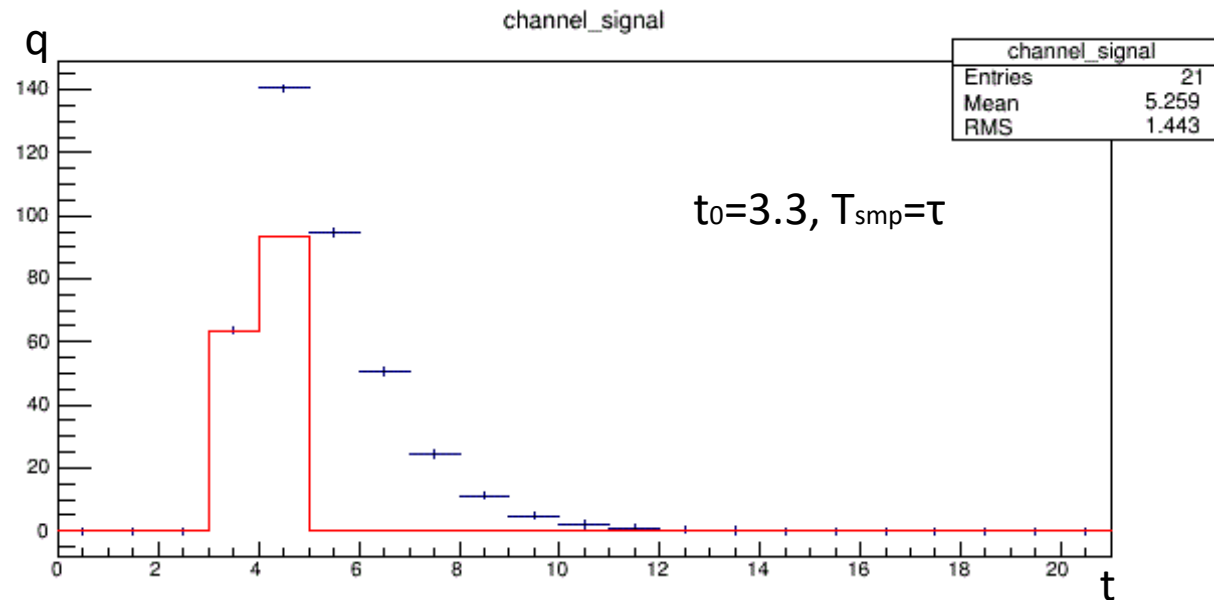
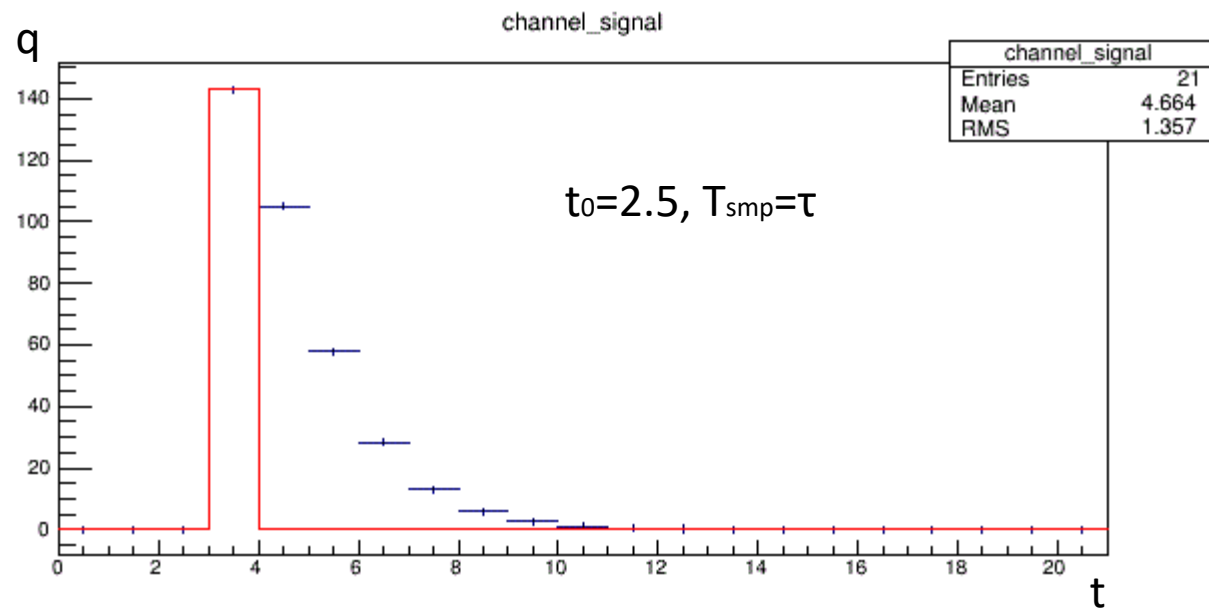
And corresponding samples after deconvolution filter as:

$$\begin{aligned}
 s_0 &= w_0 v_0 + w_1 v_{-1} + w_2 v_{-2} = 0, \\
 s_1 &= w_0 v_1 + w_1 v_0 + w_2 v_{-1} = \frac{Ae}{\tau} (T_{smp} - t_0) e^{-(T_{smp} - t_0)/\tau}, \\
 s_2 &= w_0 v_2 + w_1 v_1 + w_2 v_0 = \frac{Ae}{\tau} (2T_{smp} - t_0) e^{-(2T_{smp} - t_0)/\tau} - \frac{Ae}{\tau} 2e^{-T_{smp}/\tau} (T_{smp} - t_0) e^{-(T_{smp} - t_0)/\tau}, \\
 s_3 &= w_0 v_3 + w_1 v_2 + w_2 v_1 = \dots = 0, \\
 s_N &= w_0 v_N + w_1 v_{N-1} + w_2 v_{N-2} = \dots = 0.
 \end{aligned}$$

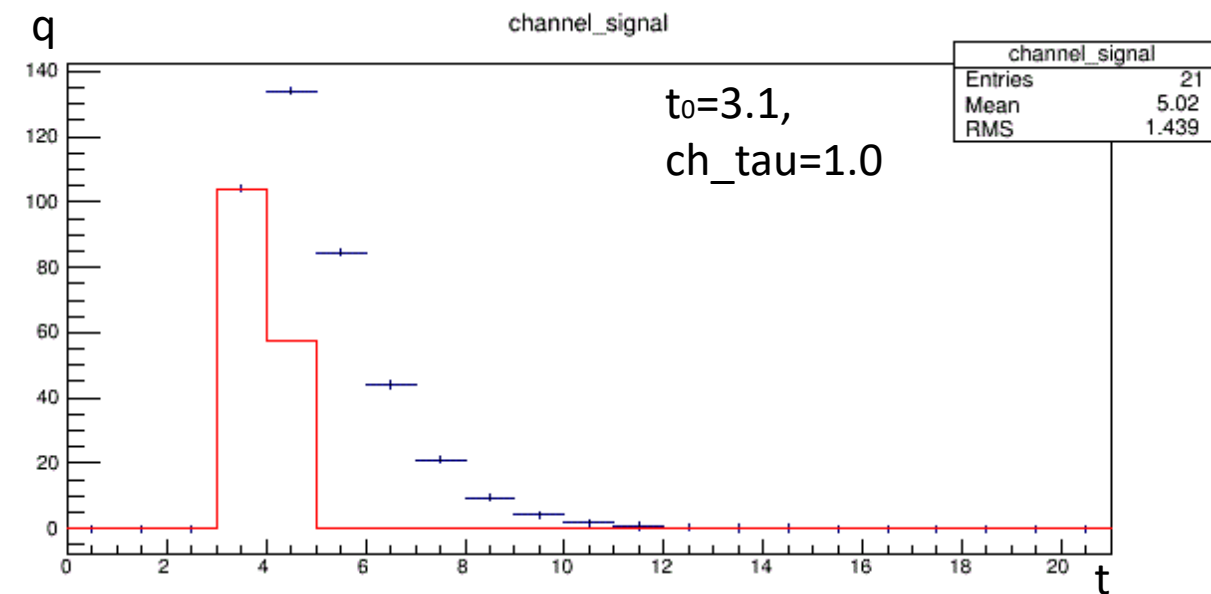
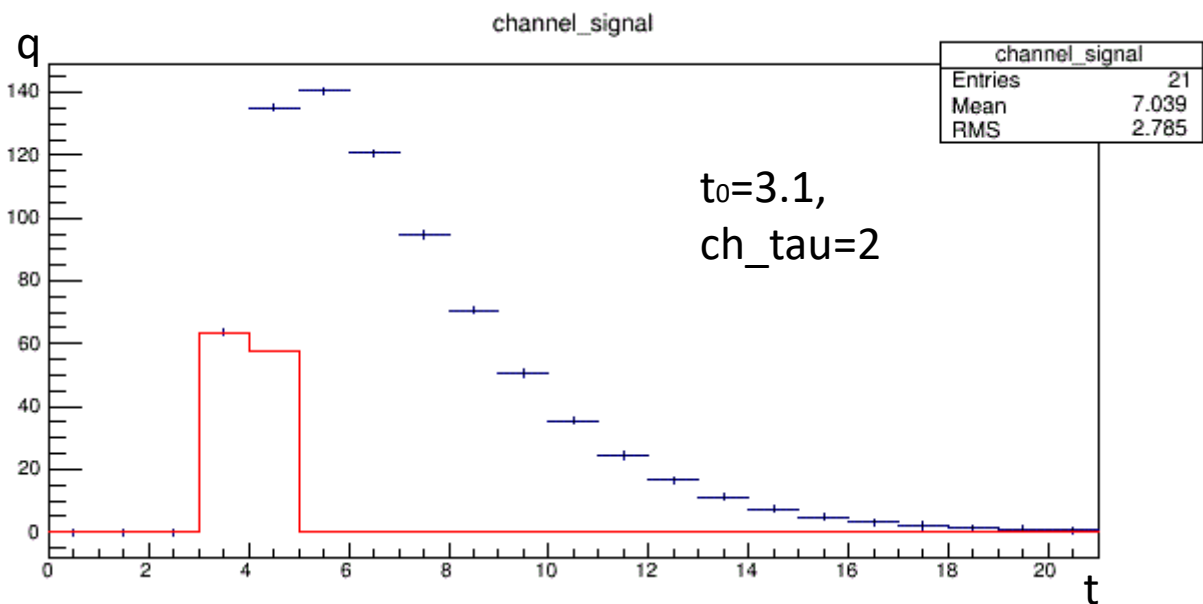
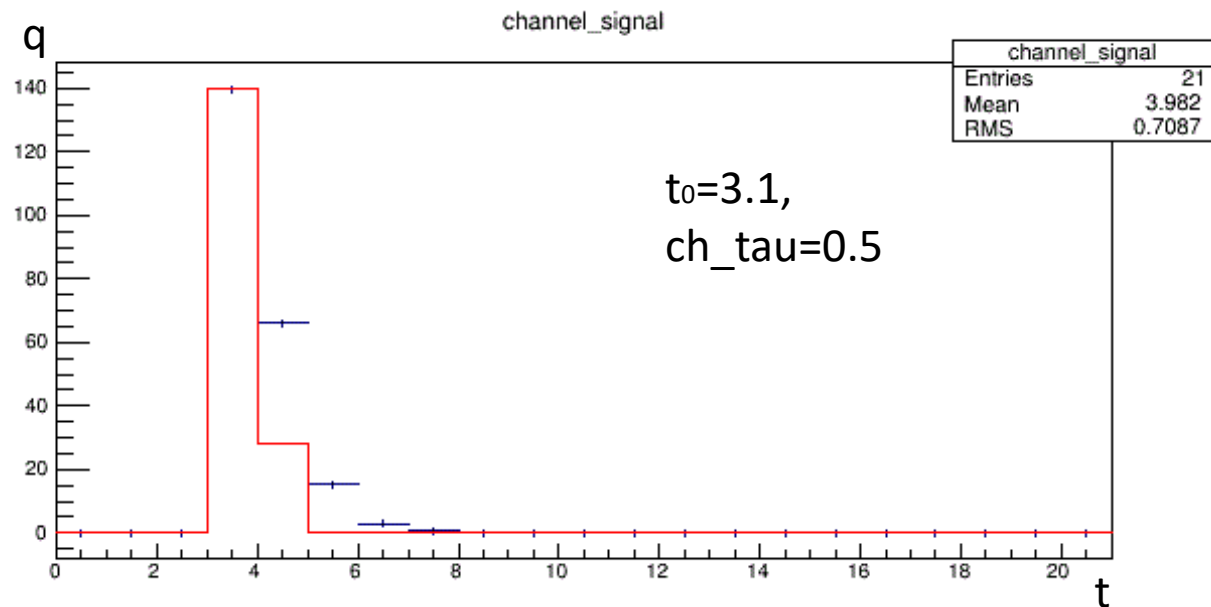
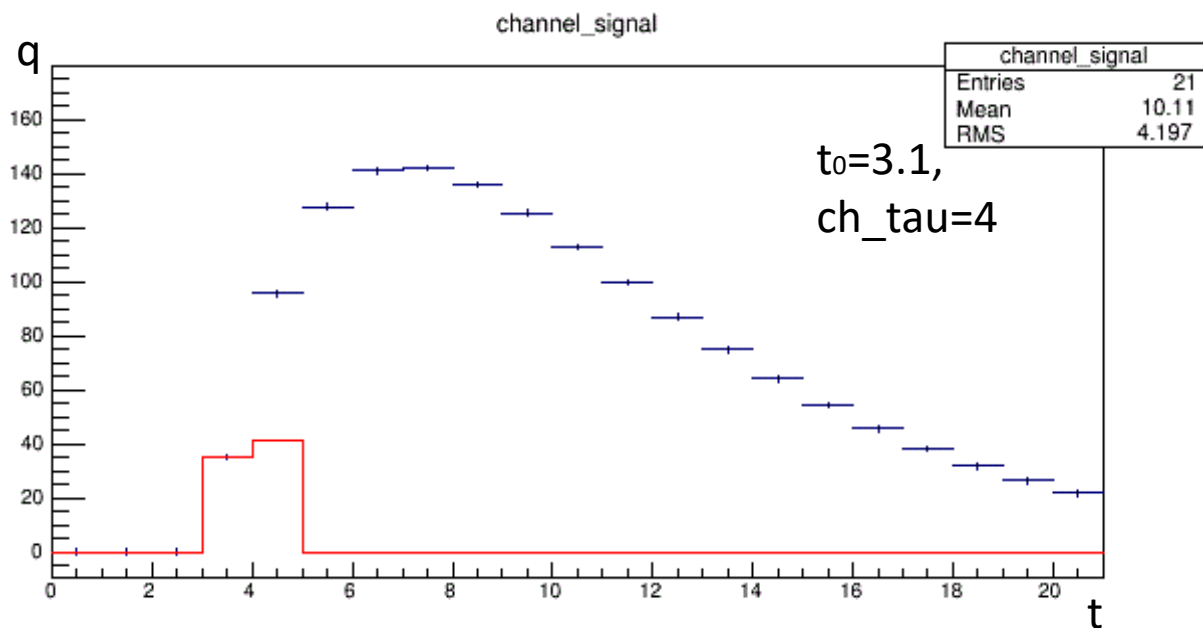
$$t_0 = \frac{s_2/s_1 T_{smp}}{s_2/s_1 + e^{-\frac{T_{smp}}{\tau}}}$$

$$A = (s_1 + s_2) \frac{\tau e^{\frac{T_{smp} - t_0 - \tau^2}{\tau}}}{\left(T_{smp} - t_0 \left(1 - e^{-\frac{T_{smp}}{\tau}}\right)\right)}$$

Tests for different pulse occurrence time (t_0)



Tests for different shaping time (τ)



Amplitudes

For tests w/o noise:

```

A = 328.565
q[j] 0 0 0 239.473 308.341 194.455 101.343 48.2472 21.7831 9.49753 4.03987 1.68702 0.694504 0.282674 0.113989 0.0456126 0.0181332 0.007168
s[i] 65 0.00282034 0.00110492 0.000431261
0 239.473 132.146 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
s1=239.473 s2=132.146 t0=0.6 A_Dec=328.565
1
A = 223.024
0 0 0 162.55 209.296 131.993 68.7896 32.7493 14.7859 6.44675 2.74219 1.14512 0.471417 0.191874 0.0773736 0.030961 0.0123085 0.0048659
5 0.00191439 0.000749997 0.000292732
0 162.55 89.6983 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
s1=162.55 s2=89.6983 t0=0.6 A_Dec=223.024

```

For 741 run:

```

q[j] 325 790 801 678 516 336 193 92 4 -65
s[i] 325 395.755 -37.7576 -3.03736 -11.7841 -40.5174

```

→ i=0	s1=325	s2=395.755	t0=0.667516	<u>A_Dec=849.27</u>
i=2	s1=-37.7576	s2=-3.03736	t0=0.117098	A_Dec=-48.9269
i=3	s1=-3.03736	s2=-11.7841	t0=0.864803	A_Dec=-17.6857
i=4	s1=-11.7841	s2=-40.5174	t0=0.850048	A_Dec=-62.3222
i=5	s1=-40.5174	s2=-24.7628	t0=0.501903	A_Dec=-76.7756
i=6	s1=-24.7628	s2=-18.5133	t0=0.552097	A_Dec=-50.8877
i=7	s1=-18.5133	s2=-36.6009	t0=0.765232	A_Dec=-65.247
i=8	s1=-36.6009	s2=-36.0073	t0=0.618609	A_Dec=-85.4428
i=9	s1=-36.0073	s2=-34.6795	t0=0.61359	A_Dec=-83.1736

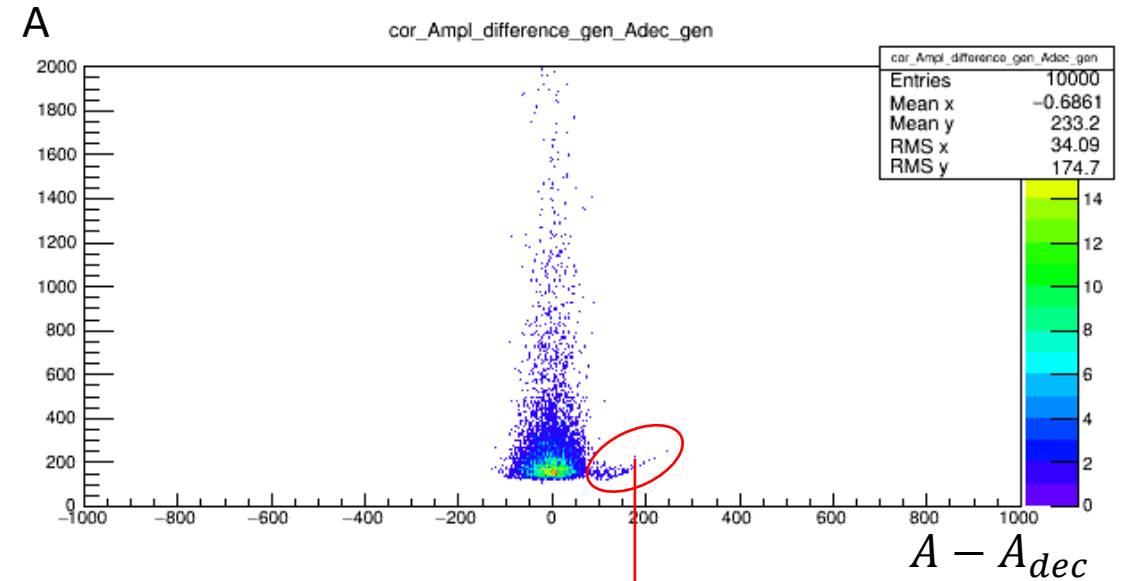
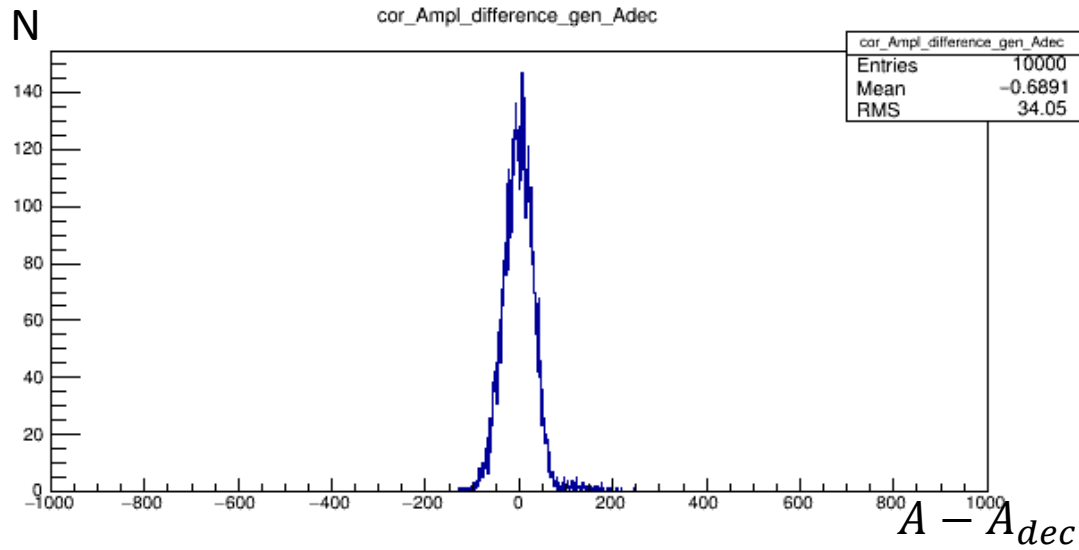
```

q[j] 4 140 214 199 177 120 55 35 48 37
s[i] 4 135.148 45.6429 -9.092 14.327 -21.5038 -25.4527

```

→ i=0	s1=4	s2=135.148	t0=0.982365	A_Dec=168.364
→ i=1	s1=135.148	s2=45.6429	t0=0.357663	<u>A_Dec=213.434</u>
i=5	s1=-21.5038	s2=-25.4527	t0=0.661187	A_Dec=-55.3177
i=7	s1=12.4272	s2=25.7762	t0=0.773743	A_Dec=45.2519
i=9	s1=-8.35116	s2=-8.22506	t0=0.618877	A_Dec=-19.5064

Tests with noise

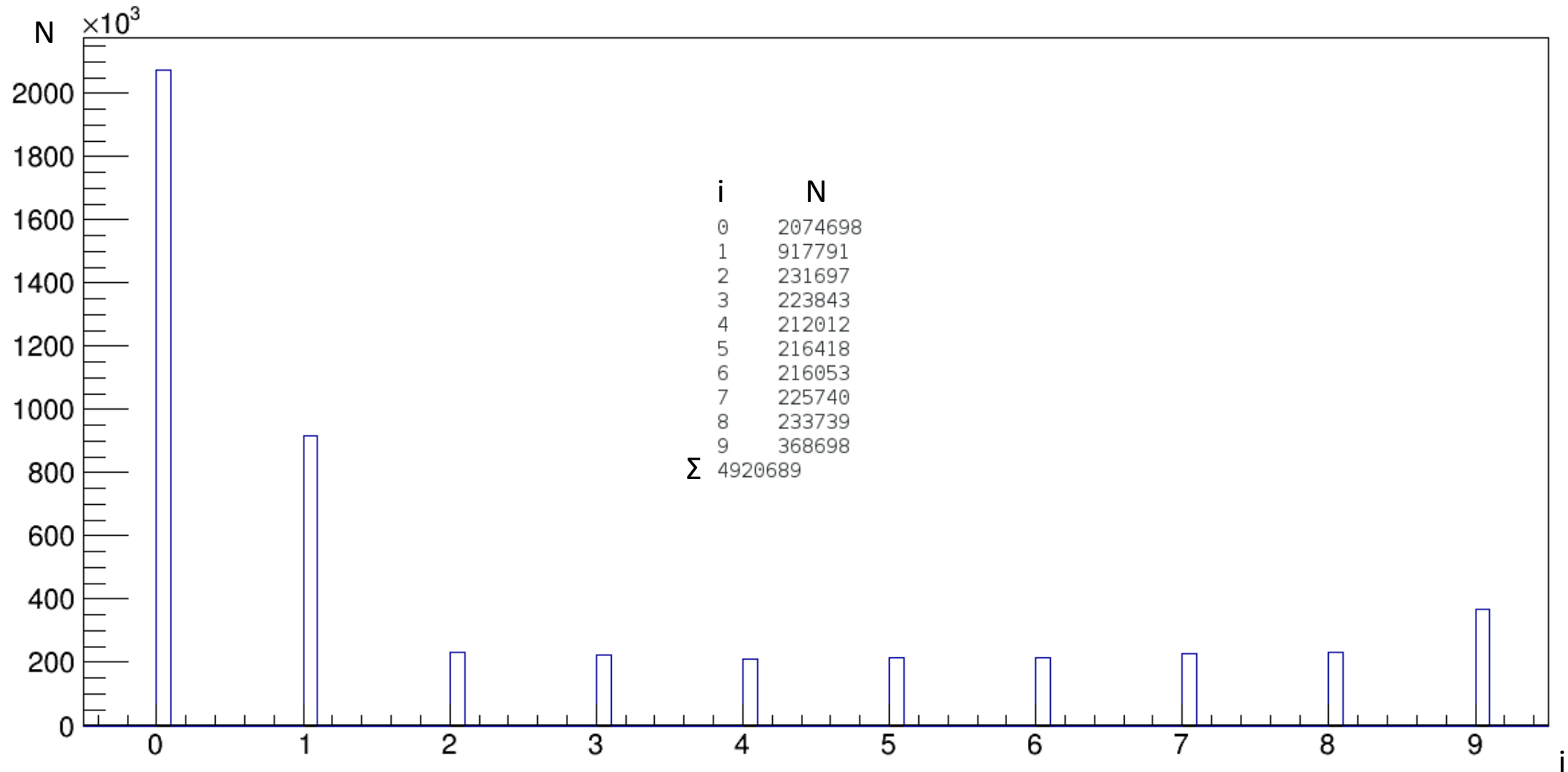


- Noise \rightarrow Gaus(0.0, 20.0)

???

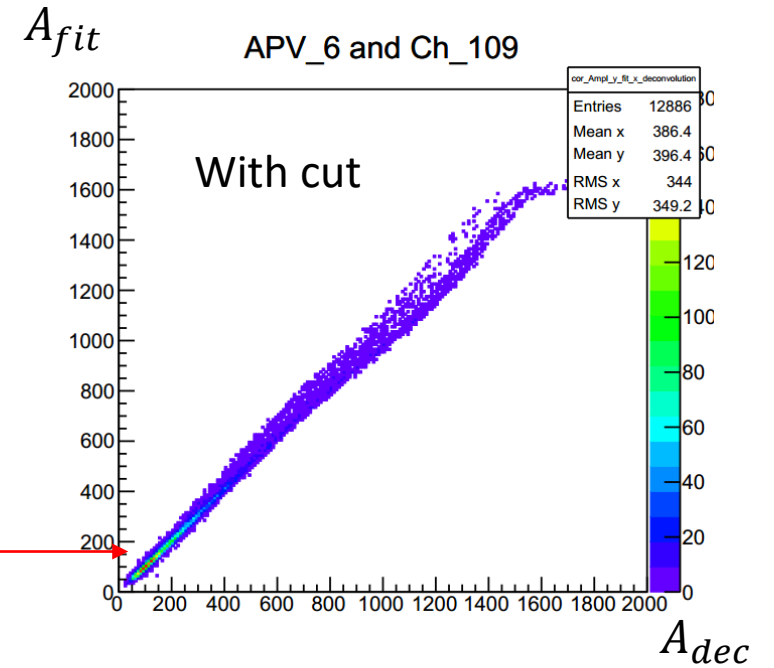
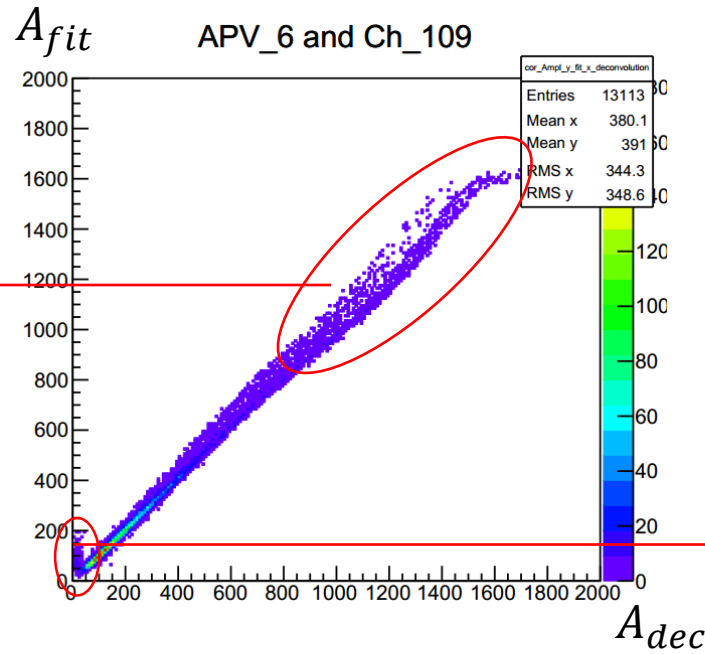
It will be later

The number of amplitudes as a function of i



Correlations

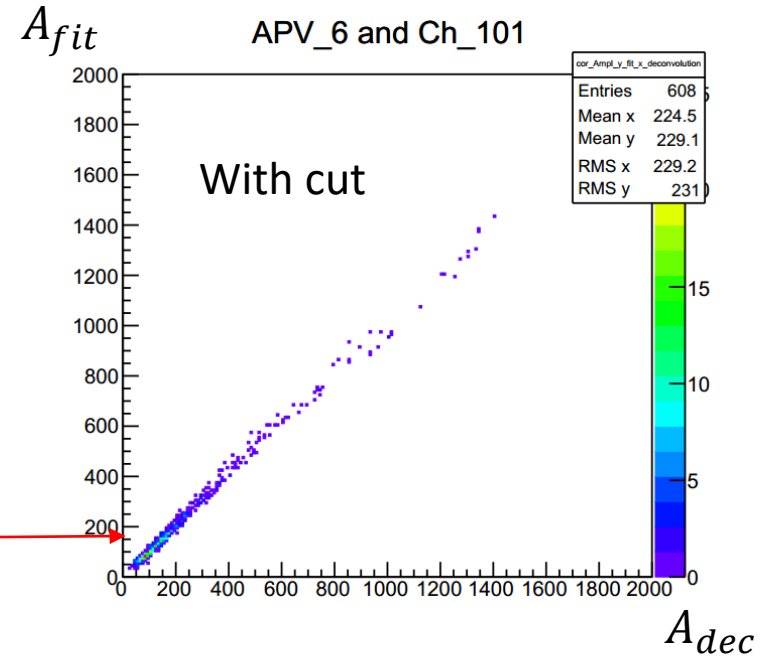
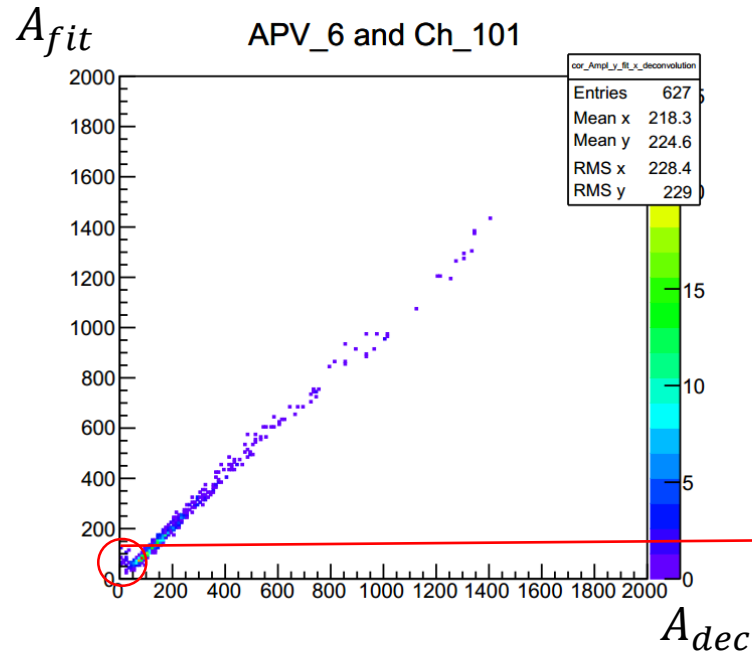
- Wave
- Supersaturation



Cut:

- $A_{dec} > 0$
- $s[i] < 2$

- $(1 < apv_fit_tau < 3)$
- $(apv_bint1 - 2.5) < apv_fit_t0$
- $(apv_bint1 - 0.5) > apv_fit_t0$
- $apv_nn_output > 0.5$

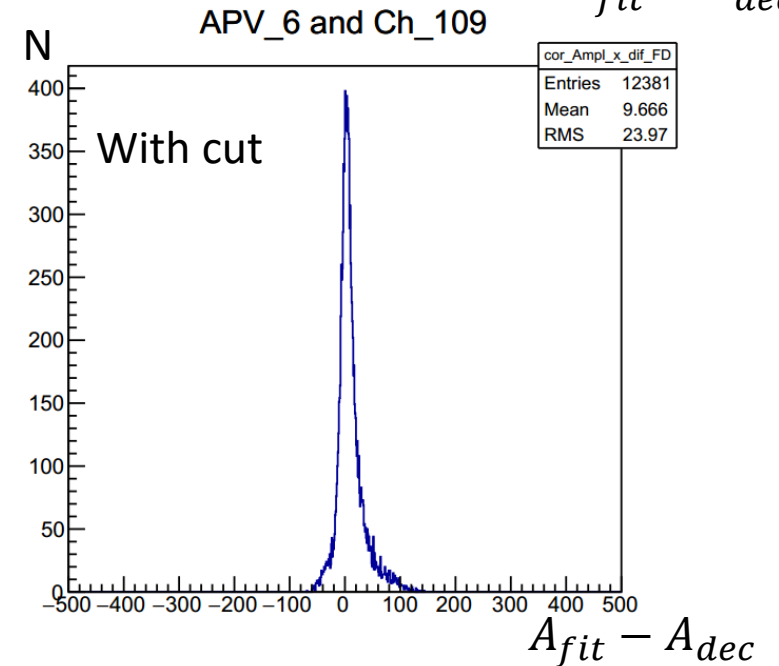
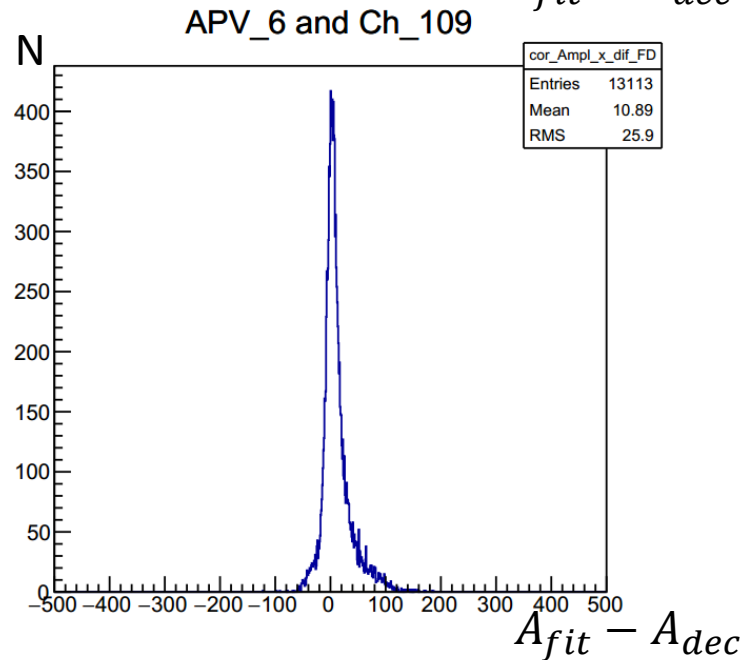
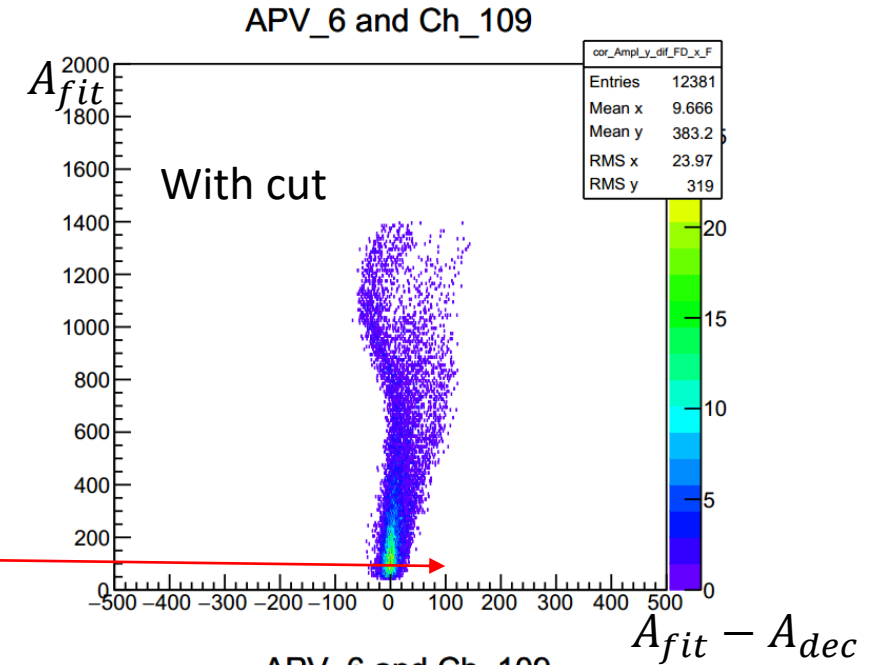
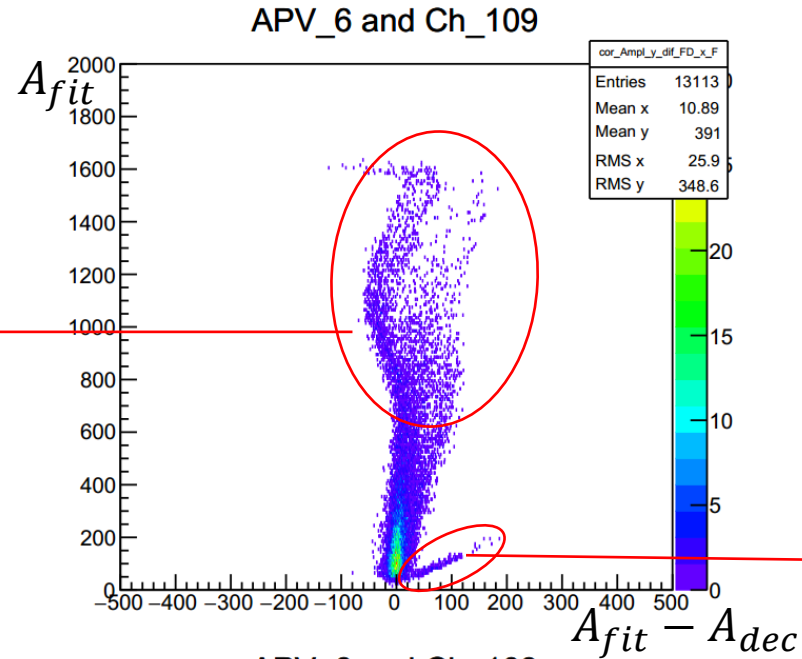


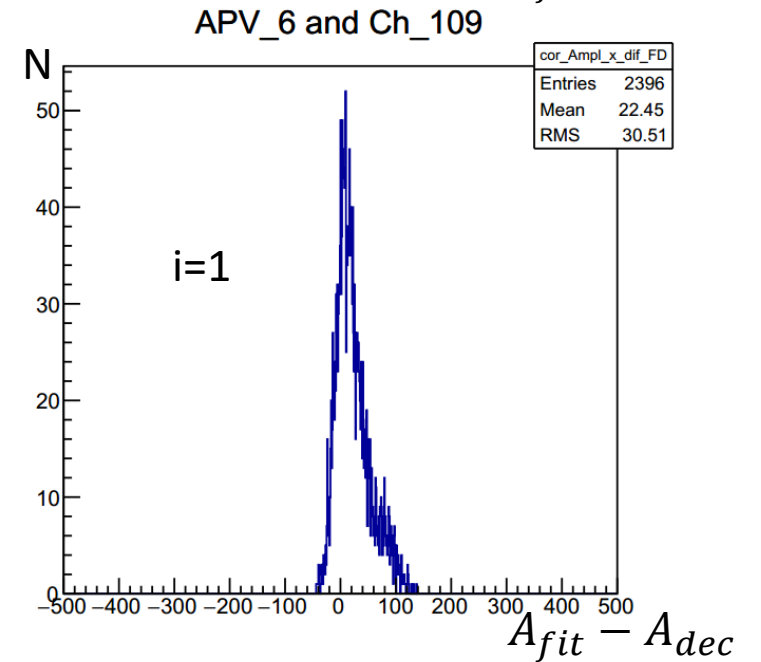
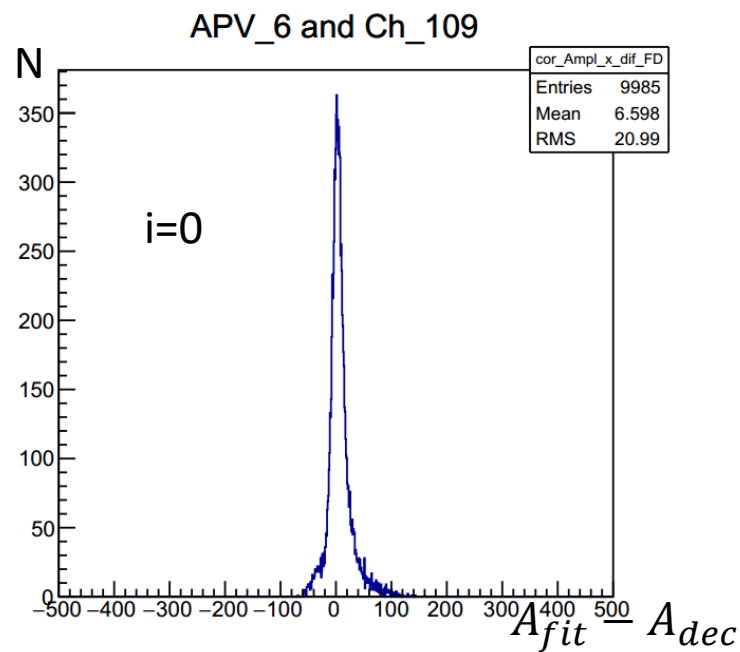
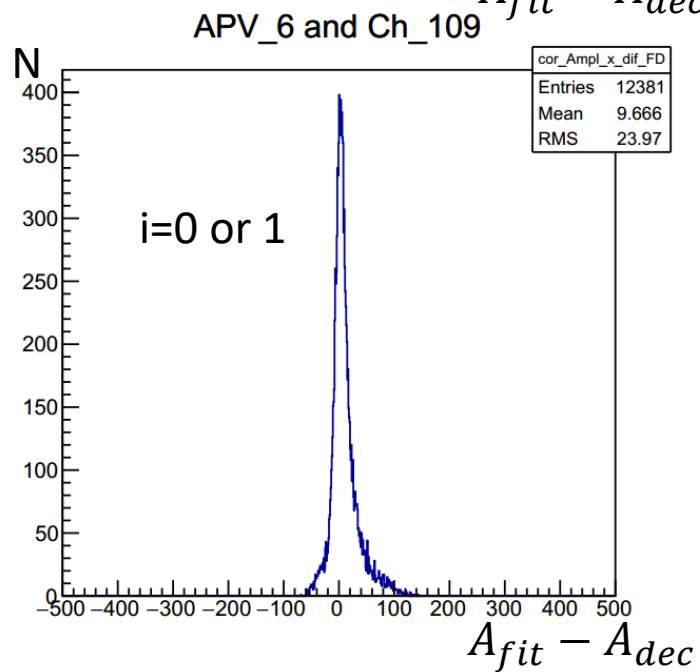
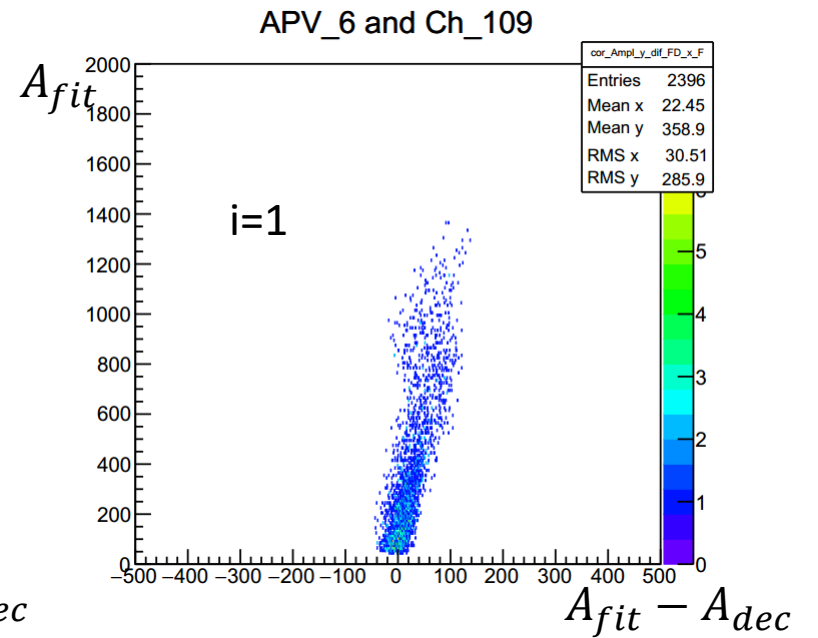
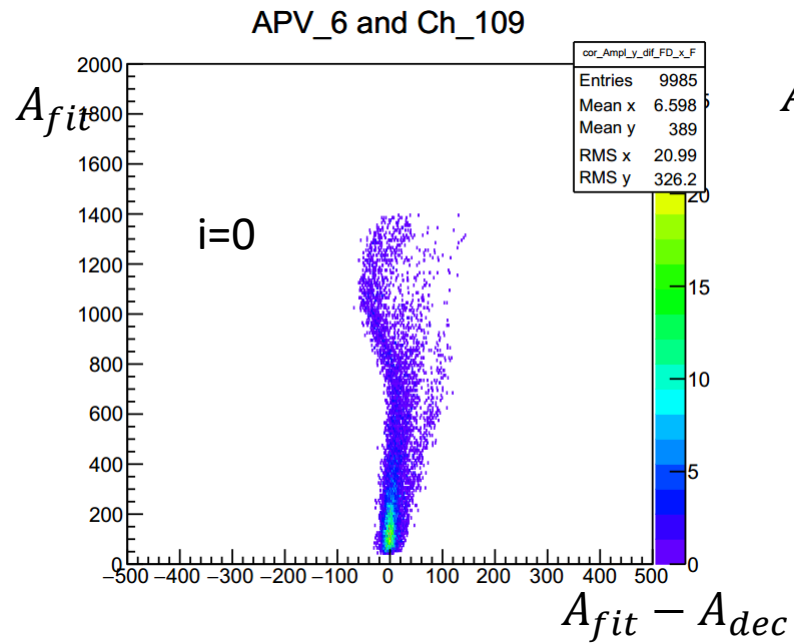
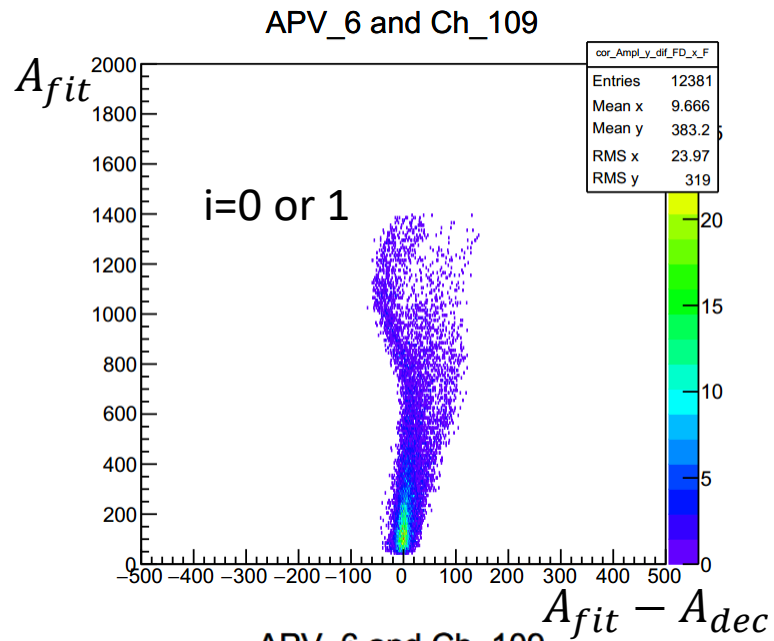
Difference

- Wave
- Supersaturation

Cut:

- $A_{dec} > 0$
- $s[i] < 2$
- $40 < A_{fit} < 1400$
- $(1 < apv_fit_tau < 3)$
- $(apv_bint1 - 2.5) < apv_fit_t0$
- $(apv_bint1 - 0.5) > apv_fit_t0$
- $apv_nn_output > 0.5$





Summery

- Deconvolution function are worked;
- Adec better correlates with Afit for small values;
- The wave should be investigated;
- Average Afit > Adec;
- $1.01 < \text{Mean}(A^{fit}/A_{dec}) < 1.035 \Rightarrow 1-4\%$

Thank you for your attention!

Ration

- $A_{fit} > A_{dec}$
- Wave
- Supersaturation

Cut:

- $A_{dec} > 0$
- $s[i] < 2$
- $40 < A_{fit} < 1400$
- $(1 < apv_fit_tau < 3)$
- $(apv_bint1 - 2.5) < apv_fit_t0$
- $(apv_bint1 - 0.5) > apv_fit_t0$
- $apv_nn_output > 0.5$

