

# Coincidence LMFIT Example

September 8, 2022

## 1 Setup

```
[1]: import numpy as np
import matplotlib.pyplot as plt

[2]: # Put your path to coinc_lmfit.py here
import sys
sys.path.insert(1, '..\..\..\coinc_lmfit')
import coinc_lmfit as cl
```

## 2 Simple example

Creating the standard plot I originally wrote these functions for.

```
[3]: pairlist = ('1 & 3', '1 & 4', '2 & 3', '2 & 4')
# change this path if you want to run this notebook
arrlist = [cl.make_nice(np.load(
    '../freespace_datasets/06_19_22/' + \
    'Polarizer_2Lamps/pairs_{}_{}.npz'.format(
        p[0], p[-1]))) for p in pairlist]

# Takes about 3 minutes to run using the 06/19/22 Two-Lamp VV Polarizer data.
coinc_lists = []
for nums, arr in zip(pairlist, arrlist):
    coinc_lists.append(cl.coinc_sum(arr, maxiter=2000))

[4]: start1 = 0
end1 = 15
start2 = 19.5
end2 = 33.5
slice1, slice2 = cl.make_slices([(start1, end1), (start2, end2)],
                                coinc_lists[0][0])

[5]: res_list = []
for coinc_list in coinc_lists:
    firstrun = [x[slice1] for x in coinc_list]
    secondrun = [x[slice2] for x in coinc_list]
```

```

res1 = cl.fit_sin(*firststrun, ci_verbose=False)
res2 = cl.fit_sin(*secondrun, ci_verbose=False)

res_list.append((res1, res2))

```

```

[6]: fig, axs, extra = cl.plot_chpairs(coinc_lists, res_list,
                                     [[slice1, slice2]]*4, ylabel_binwidth=10,
                                     figure_kwargs=dict(dpi=200))

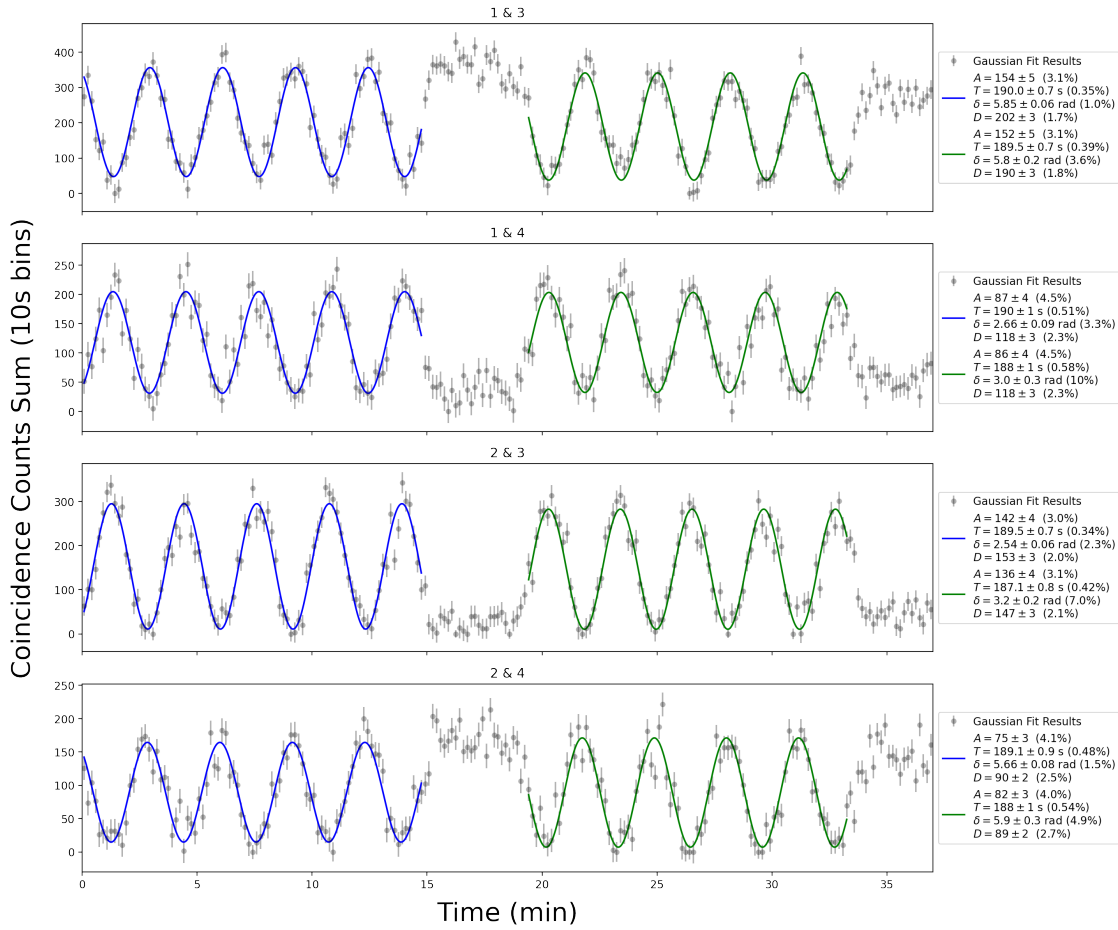
# Examples of the figure can be modified
for ax, pair in zip(axs, pairlist):
    ax.set_xlim((0,37))
    ax.set_title(pair)

fig.suptitle(r'Coincidence Pair Rate Cosine Fits for 6/19/22 VV '+'\
             r'$ F(x) = A \cos \left( \frac{2 \pi}{T} t - \delta \right) + D$',
             fontsize=24)

plt.tight_layout()
plt.show()

```

Coincidence Pair Rate Cosine Fits for 6/19/22 VV  $F(x) = A \cos(\frac{2\pi}{T}t - \delta) + D$



### 3 Demonstration of plotting function flexibility

This is only an example, ignore the infinite uncertainties.

```
[7]: slices1 = cl.make_slices([(0,15),(19.5, 33.5)], coinc_lists[0][0])
slices2 = cl.make_slices([(0,8), (9,14), (20, 30)], coinc_lists[0][0])

reslist1 = [cl.fit_sin(*[arr[s1] for arr in coinc_lists[0]],
                      suppress_warnings=True) for s1 in slices1]
reslist2 = [cl.fit_sin(*[arr[s1] for arr in coinc_lists[1]],
                      suppress_warnings=True) for s1 in slices2]
# Suppressing warnings because these are not good fitting widows, just examples.

[8]: reslists = [reslist1, reslist2, []]
sliceslists = [slices1, slices2, []]
```

```
[9]: fig, axs, extra = cl.plot_chpairs(coinc_lists[: -1],
                                     reslists, sliceslists, ylabel_binwidth=10,
                                     legend_kwargs=dict(fancybox=True, handlelength=4),
                                     figure_kwargs=dict(sharey=True, dpi=200),
                                     errorbar_kwargs=dict(markersize=10, alpha=0.2),
                                     sin_kwargs=dict(dashes=(2,1), alpha=0.7, lw=5),
                                     color_list=('g', 'r', 'xkcd:indigo'))
# Infinite uncertainty is from where lmfit.conf_interval failed

fig.suptitle(r'Coincidence Pair Rate Cosine Fits for 6/19/22 VV      '+\
            r'$ F(x) = A \cos \left( \frac{2 \pi}{T} t - \delta \right) + D$',
            fontsize=24)

plt.tight_layout()
plt.show()
```

