Image_reconstruction

June 15, 2021

1 Imaging

Run the following hidden cells for preparing the code environment

[1]:
```
%pylab inline
from tqdm.notebook import tqdm as tqdm
from ipyfilechooser import FileChooser
from pathlib import Path
import h5py
import os
import ttp
```

```
Populating the interactive namespace from numpy and matplotlib
```

[2]:
```
#%% Plot Config

SMALL_SIZE = 14
MEDIUM_SIZE = 18
BIG_SIZE = 22
BIGGER_SIZE = 28

plt.rc('font', size=SMALL_SIZE)          # controls default text sizes
plt.rc('axes', titlesize=BIG_SIZE)       # fontsize of the axes title
plt.rc('axes', labelsize=BIG_SIZE)       # fontsize of the x and y labels
plt.rc('xtick', labelsize=MEDIUM_SIZE)   # fontsize of the tick labels
plt.rc('ytick', labelsize=MEDIUM_SIZE)   # fontsize of the tick labels
plt.rc('legend', fontsize=MEDIUM_SIZE)   # legend fontsize
plt.rc('figure', titlesize=BIGGER_SIZE)  # fontsize of the figure title
plt.rc('figure', titlesize=BIGGER_SIZE)  # fontsize of the figure title
matplotlib.rcParams['figure.figsize'] = (13.0, 10.0)
```

2 Select Data

[3]:
```
fc = FileChooser()
fc.default_path='/home/labuser/myDev/timetaggingplatform/dataReceiver/data'
fc.use_dir_icons = True
display(fc)
```

```
FileChooser(path='/home/labuser/myDev/timetaggingplatform/dataReceiver/data',␣
↪filename='', title='HTML(value='…
```

[4]:
```
filename = fc.selected
```

3 Specify parameters

[5]:
```
sysclk_MHz=240.  # FPGA system clock (MHz)
laser_MHz=40.    # Laser repetition rate (MHz)
laser_factor=1   # Adimensional number to account for laser actual repetiton␣
↪frequency
npixel = 512     # Image size (pixels)
dwell_time = 50  # Pixel dwell time (us)
nchannel = 21    # Number of active channels
kC4=43           # Time width of TCSPC histogram bin (picoseconds)
```

[6]:
```
laser_MHz=laser_MHz*laser_factor
laser_Hz=laser_MHz*10**6
max_counter=2**16-1
sysclk_ps=1000000./sysclk_MHz #ps
print("SysClk ps:", sysclk_ps)
laser_ps=1000000./laser_MHz #ps
print("LaserClk ps:", laser_ps)
ratio=sysclk_MHz/laser_MHz
sysclk_ps=1e6/sysclk_MHz
laser_ps=1e6/laser_MHz
nbins=int(round(laser_ps/kC4))
```

```
SysClk ps: 4166.666666666667
LaserClk ps: 25000.0
```

4 Data conversion to H5 format

[7]:
```
myReturn=ttp.convertDataRAW( filenameToRead=filename,
                    sysclk_MHz = sysclk_MHz,
                    laser_MHz=laser_MHz,
                    dwell_time_us=100.,
                    list_of_channels=np.arange(0,nchannel),
                    autoCalibration=True,
                    kC4=45.,
                    textInPlot=None,
                    compressionLevel=1,
                    makePlots=True,
                    ignorePixelLineFrame = False)
```

```
/mnt/Disk1T/dataSlowDisk/data-2021-02-02-BCD_cooled_Vimentin/FLIM_512x512pixels_
```

```
dwelltime250us_Dataset_40MHz
*************************
* Size table:  69142351
*************************
Convert to DataFrame
Converted

Calculate rates
Calculate cumulative step
Add cumulativeStep
Acquisition lasted:  68.28652335416666 s
Scan_enable 47648.0 ratio 0.0006891290115373717 rate 697.7657912510001
line_enable 143370.0 ratio 0.0020735482367384354 rate 2099.535793562288
pixel_enable 262168.0 ratio 0.0037917137066976504 rate 3839.2348463879325
Laser 31209759.0 ratio 0.4513841162271153 rate 457041.26476217306
Calculate totalphotons
kC4<=== 45.0
sysclk_ps<=== 4166.666666666667
kC4<=== 44.80286738351255
Start process

Current frame: 0        :   2%|          | 1382846/69142351 [00:00<00:07,
8794643.99it/s]

Start analysisForImg
Arrays copied into analysisForImg

Current frame: 2        : : 69833723it [00:15, 4387122.29it/s]

('Total Frame:', 2)

  0%|          | 0/21 [00:00<?, ?it/s]

New HDF5 written
total_photon        uint8
cumulative_step     int64
arr_px             uint16
arr_px_corr        uint16
arr_py             uint16
arr_frame          uint16
dtype: object
Start conversion of 0 channel
t_0 valid_tdc_0
..


  0%|          | 0/32344843 [00:00<?, ?it/s]
 16%|         | 5175168/32344843 [00:00<00:00, 50947008.82it/s]
 31%|         | 10026888/32344843 [00:00<00:00, 49956839.65it/s]
 46%|        | 14878608/32344843 [00:00<00:00, 49298385.78it/s]
 61%|       | 19730328/32344843 [00:00<00:00, 48960067.05it/s]
```

```
 77%|       | 24905496/32344843 [00:00<00:00, 48943856.95it/s]
 93%|      | 30080664/32344843 [00:00<00:00, 49330624.08it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_0"

  5%|          | 1/21 [00:09<03:11,  9.57s/it]

t_0      int16
t_L      int16
dS_0    uint16
dtype: object
Start conversion of 1 channel
t_1 valid_tdc_1
..


  0%|           | 0/32392311 [00:00<?, ?it/s]

 15%|          | 4858845/32392311 [00:00<00:00, 47181149.78it/s]

 29%|         | 9393767/32392311 [00:00<00:00, 46228652.14it/s]

 43%|        | 13928689/32392311 [00:00<00:00, 45824216.03it/s]

 57%|        | 18463611/32392311 [00:00<00:00, 45317808.51it/s]

 72%|       | 23322456/32392311 [00:00<00:00, 45447395.49it/s]

 87%|      | 28181301/32392311 [00:00<00:00, 46254313.78it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_1"

 10%|          | 2/21 [00:18<03:00,  9.51s/it]

t_1      int16
t_L      int16
dS_1    uint16
dtype: object
Start conversion of 2 channel
t_2 valid_tdc_2
..


32668248it [00:17, 49330624.08it/s]


  0%|           | 0/31969524 [00:00<?, ?it/s]
```

```
 16%|          | 5115120/31969524 [00:00<00:00, 50911034.83it/s]

 33%|         | 10549935/31969524 [00:00<00:00, 51568037.10it/s]

 49%|        | 15665055/31969524 [00:00<00:00, 51257859.85it/s]

 63%|       | 20140785/31969524 [00:00<00:00, 48768294.81it/s]

 76%|       | 24296820/31969524 [00:00<00:00, 46081982.60it/s]

 91%|      | 29092245/31969524 [00:00<00:00, 45830433.01it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_2"

32668248it [00:19, 1641782.99it/s]
32716223it [00:10, 3138364.89it/s]
32289195it [00:00, 35910489.07it/s]
 14%|          | 3/21 [00:28<02:51,  9.51s/it]

t_2      int16
t_L      int16
dS_2    uint16
dtype: object
Start conversion of 3 channel
t_3 valid_tdc_3
..

  0%|           | 0/32597503 [00:00<?, ?it/s]
 16%|          | 5215600/32597503 [00:00<00:00, 49608052.97it/s]
 25%|         | 8149375/32597503 [00:00<00:00, 40335554.67it/s]
 38%|         | 12387050/32597503 [00:00<00:00, 40160646.33it/s]
 51%|        | 16624725/32597503 [00:00<00:00, 40462403.00it/s]
 65%|       | 21188375/32597503 [00:00<00:00, 41105403.12it/s]
 76%|       | 24774100/32597503 [00:00<00:00, 38213924.50it/s]
 89%|      | 29011775/32597503 [00:00<00:00, 39299264.29it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_3"

 19%|          | 4/21 [00:38<02:46,  9.80s/it]

t_3      int16
t_L      int16
dS_3    uint16
```

```
dtype: object
Start conversion of 4 channel
t_4 valid_tdc_4
..


  0%|          | 0/33963037 [00:00<?, ?it/s]

 11%|          | 3735930/33963037 [00:00<00:00, 35760297.92it/s]

 20%|          | 6792600/33963037 [00:00<00:00, 33600534.67it/s]

 30%|          | 10188900/33963037 [00:00<00:00, 33317549.06it/s]

 41%|         | 13924830/33963037 [00:00<00:00, 33670305.23it/s]

 51%|         | 17321130/33963037 [00:00<00:00, 33625967.36it/s]

 61%|        | 20717430/33963037 [00:00<00:00, 33609933.61it/s]

 71%|       | 24113730/33963037 [00:00<00:00, 33554107.21it/s]

 82%|      | 27849660/33963037 [00:00<00:00, 33770677.64it/s]

 93%|     | 31585590/33963037 [00:00<00:00, 33886181.21it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_4"
 24%|         | 5/21 [00:50<02:45, 10.35s/it]
t_4      int16
t_L      int16
dS_4    uint16
dtype: object
Start conversion of 5 channel
t_5 valid_tdc_5
..

32923475it [00:18, 39299264.29it/s]


  0%|          | 0/33459586 [00:00<?, ?it/s]


 12%|         | 4015140/33459586 [00:00<00:00, 38328105.01it/s]
```

```
 20%|          | 6691900/33459586 [00:00<00:00, 33466872.71it/s]

 31%|         | 10372445/33459586 [00:00<00:00, 33960895.91it/s]

 42%|        | 14052990/33459586 [00:00<00:00, 34622047.41it/s]

 53%|        | 17733535/33459586 [00:00<00:00, 34946058.48it/s]

 64%|       | 21414080/33459586 [00:00<00:00, 35112003.55it/s]

 75%|       | 25094625/33459586 [00:00<00:00, 34955261.92it/s]

 86%|      | 28775170/33459586 [00:00<00:00, 35068725.22it/s]

 97%|     | 32455715/33459586 [00:00<00:00, 35186322.60it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_5"
 29%|         | 6/21 [01:01<02:37, 10.47s/it]
t_5      int16
t_L      int16
dS_5    uint16
dtype: object
Start conversion of 6 channel
t_6 valid_tdc_6
..


34302630it [00:17, 33886181.21it/s]


  0%|          | 0/32980242 [00:00<?, ?it/s]

 14%|         | 4617228/32980242 [00:00<00:00, 45635809.77it/s]
```

```
 27%|          | 8904654/32980242 [00:00<00:00, 44684939.58it/s]

 40%|         | 13192080/32980242 [00:00<00:00, 43679337.12it/s]

 53%|        | 17479506/32980242 [00:00<00:00, 43079281.72it/s]

 66%|       | 21766932/32980242 [00:00<00:00, 42335896.16it/s]

 79%|       | 26054358/32980242 [00:00<00:00, 42161135.41it/s]

 92%|      | 30341784/32980242 [00:00<00:00, 42035118.88it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_6"
32923475it [00:33, 984080.54it/s]
34302630it [00:23, 1489997.89it/s]
33794095it [00:11, 2843782.72it/s]
33310002it [00:01, 29443105.22it/s]
 33%|         | 7/21 [01:11<02:24, 10.35s/it]
t_6      int16
t_L      int16
dS_6    uint16
dtype: object
Start conversion of 7 channel
t_7 valid_tdc_7
..

  0%|           | 0/31958328 [00:00<?, ?it/s]
 19%|          | 6072077/31958328 [00:00<00:00, 60444853.62it/s]
 37%|         | 11824571/31958328 [00:00<00:00, 59375474.11it/s]
 55%|        | 17577065/31958328 [00:00<00:00, 58348363.79it/s]
 74%|       | 23649142/31958328 [00:00<00:00, 58138146.41it/s]
 92%|      | 29401636/31958328 [00:00<00:00, 57530652.98it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_7"
 38%|         | 8/21 [01:20<02:08,  9.90s/it]
```

```
t_7      int16
t_L      int16
dS_7    uint16
dtype: object
Start conversion of 8 channel
t_8 valid_tdc_8
..


  0%|          | 0/33100471 [00:00<?, ?it/s]

 14%|         | 4634056/33100471 [00:00<00:00, 44120734.69it/s]

 27%|         | 8937108/33100471 [00:00<00:00, 42854826.92it/s]

 40%|         | 13240160/33100471 [00:00<00:00, 42086063.89it/s]

 53%|        | 17543212/33100471 [00:00<00:00, 41456073.78it/s]

 66%|       | 21846264/33100471 [00:00<00:00, 40982029.79it/s]

 79%|       | 26149316/33100471 [00:00<00:00, 40806423.23it/s]

 92%|     | 30452368/33100471 [00:00<00:00, 40808440.11it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_8"
 43%|        | 9/21 [01:31<02:02, 10.20s/it]
t_8      int16
t_L      int16
dS_8    uint16
dtype: object
Start conversion of 9 channel
t_9 valid_tdc_9
..

32277883it [00:16, 57530652.98it/s]


  0%|          | 0/34264628 [00:00<?, ?it/s]


 10%|          | 3426460/34264628 [00:00<00:00, 33678788.93it/s]


 19%|         | 6510274/34264628 [00:00<00:00, 31963496.65it/s]
```

```
 29%|         | 9936734/34264628 [00:00<00:00, 31803980.85it/s]

 39%|         | 13363194/34264628 [00:00<00:00, 32339810.99it/s]

 49%|         | 16789654/34264628 [00:00<00:00, 32860970.01it/s]

 59%|         | 20216114/34264628 [00:00<00:00, 33041634.25it/s]

 69%|         | 23642574/34264628 [00:00<00:00, 33215926.59it/s]

 79%|         | 27069034/34264628 [00:00<00:00, 32737709.29it/s]

 89%|         | 30495494/34264628 [00:00<00:00, 32197111.90it/s]

 99%|         | 33921954/34264628 [00:01<00:00, 31731055.43it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_9"
 48%|         | 10/21 [01:42<01:57, 10.68s/it]
t_9      int16
t_L      int16
dS_9    uint16
dtype: object
Start conversion of 10 channel
t_10 valid_tdc_10
..


33431404it [00:16, 40808440.11it/s]


  0%|          | 0/35106671 [00:00<?, ?it/s]

 10%|          | 3510660/35106671 [00:00<00:00, 31774558.56it/s]
```

```
 19%|          | 6670254/35106671 [00:00<00:00, 30802425.97it/s]

 28%|         | 9829848/35106671 [00:00<00:00, 30168879.63it/s]

 37%|         | 12989442/35106671 [00:00<00:00, 30005320.80it/s]

 46%|        | 16149036/35106671 [00:00<00:00, 29904993.82it/s]

 55%|        | 19308630/35106671 [00:00<00:00, 29547553.02it/s]

 63%|       | 22117158/35106671 [00:00<00:00, 27617488.91it/s]

 72%|       | 25276752/35106671 [00:00<00:00, 28102685.14it/s]

 81%|       | 28436346/35106671 [00:00<00:00, 28404384.67it/s]

 90%|      | 31595940/35106671 [00:01<00:00, 28462018.48it/s]

 99%|     | 34755534/35106671 [00:01<00:00, 28464061.88it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_10"

32277883it [00:34, 942588.86it/s]
33431404it [00:24, 1347139.43it/s]
34607246it [00:13, 2560352.52it/s]
35457666it [00:01, 17970819.50it/s]
 52%|       | 11/21 [01:55<01:51, 11.13s/it]
```

```
t_10      int16
t_L       int16
dS_10    uint16
dtype: object
Start conversion of 11 channel
t_11 valid_tdc_11
..


  0%|          | 0/33346030 [00:00<?, ?it/s]
 12%|         | 4001520/33346030 [00:00<00:00, 39306202.73it/s]
 24%|         | 8003040/33346030 [00:00<00:00, 38731993.29it/s]
 35%|         | 11671100/33346030 [00:00<00:00, 37924406.64it/s]
 46%|        | 15339160/33346030 [00:00<00:00, 37128334.93it/s]
 58%|        | 19340680/33346030 [00:00<00:00, 37570023.50it/s]
 70%|       | 23342200/33346030 [00:00<00:00, 37782859.30it/s]
 81%|       | 27010260/33346030 [00:00<00:00, 37057795.67it/s]
 92%|      | 30678320/33346030 [00:00<00:00, 36355913.70it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_11"

 57%|       | 12/21 [02:05<01:38, 10.94s/it]

t_11      int16
t_L       int16
dS_11    uint16
dtype: object
Start conversion of 12 channel
t_12 valid_tdc_12
..



  0%|          | 0/32056628 [00:00<?, ?it/s]

 17%|         | 5449622/32056628 [00:00<00:00, 54153992.61it/s]

 34%|         | 10899244/32056628 [00:00<00:00, 53423234.66it/s]

 50%|        | 16028300/32056628 [00:00<00:00, 52473196.64it/s]

 66%|       | 21157356/32056628 [00:00<00:00, 52050622.94it/s]

 83%|      | 26606978/32056628 [00:00<00:00, 52302034.60it/s]

100%|      | 32056600/32056628 [00:00<00:00, 52764112.62it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_12"
```

```
 62%|       | 13/21 [02:14<01:23, 10.44s/it]
t_12      int16
t_L       int16
dS_12    uint16
dtype: object
Start conversion of 13 channel
t_13 valid_tdc_13
..

33679460it [00:12, 36355913.70it/s]


  0%|          | 0/32618326 [00:00<?, ?it/s]


 15%|         | 4892745/32618326 [00:00<00:00, 47401687.39it/s]


 29%|         | 9459307/32618326 [00:00<00:00, 45896656.55it/s]


 43%|        | 14025869/32618326 [00:00<00:00, 45717477.64it/s]


 57%|        | 18592431/32618326 [00:00<00:00, 45448714.43it/s]


 71%|       | 23158993/32618326 [00:00<00:00, 45266752.94it/s]


 85%|      | 27725555/32618326 [00:00<00:00, 44908490.15it/s]


 99%|     | 32292117/32618326 [00:00<00:00, 44407826.23it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_13"
 67%|       | 14/21 [02:24<01:11, 10.18s/it]
t_13      int16
t_L       int16
dS_13    uint16
dtype: object
Start conversion of 14 channel
t_14 valid_tdc_14
..
```

```
32377166it [00:11, 52764112.62it/s]


  0%|          | 0/33652199 [00:00<?, ?it/s]

 13%|         | 4374773/33652199 [00:00<00:00, 40165590.56it/s]

 24%|         | 8076504/33652199 [00:00<00:00, 38925557.05it/s]

 35%|         | 11778235/33652199 [00:00<00:00, 38245954.91it/s]

 46%|        | 15479966/33652199 [00:00<00:00, 37867064.43it/s]

 57%|        | 19181697/33652199 [00:00<00:00, 37201875.09it/s]

 67%|       | 22546907/33652199 [00:00<00:00, 36059239.53it/s]

 78%|       | 26248638/33652199 [00:00<00:00, 35878363.63it/s]

 89%|      | 29950369/33652199 [00:00<00:00, 35378208.77it/s]

 99%|     | 33315579/33652199 [00:00<00:00, 34830107.36it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_14"
33679460it [00:31, 1083998.58it/s]
32377166it [00:20, 1554802.66it/s]
32944483it [00:11, 2847310.47it/s]
```

```
33988621it [00:01, 23525792.40it/s]
 71%|       | 15/21 [02:35<01:02, 10.44s/it]

t_14      int16
t_L       int16
dS_14    uint16
dtype: object
Start conversion of 15 channel
t_15 valid_tdc_15
..


  0%|          | 0/34085740 [00:00<?, ?it/s]
 11%|          | 3749427/34085740 [00:00<00:00, 37197210.52it/s]
 20%|         | 6817140/34085740 [00:00<00:00, 34872328.16it/s]
 29%|         | 9884853/34085740 [00:00<00:00, 33238318.55it/s]
 40%|        | 13634280/34085740 [00:00<00:00, 33717679.45it/s]
 51%|        | 17383707/34085740 [00:00<00:00, 34083490.00it/s]
 62%|       | 21133134/34085740 [00:00<00:00, 34189845.78it/s]
 72%|       | 24541704/34085740 [00:00<00:00, 34088711.98it/s]
 82%|      | 27950274/34085740 [00:00<00:00, 33713810.87it/s]
 92%|      | 31358844/34085740 [00:00<00:00, 33591330.81it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_15"

 76%|       | 16/21 [02:46<00:53, 10.75s/it]

t_15      int16
t_L       int16
dS_15    uint16
dtype: object
Start conversion of 16 channel
t_16 valid_tdc_16
..


  0%|          | 0/32893931 [00:00<?, ?it/s]

 15%|         | 4934085/32893931 [00:00<00:00, 47928290.59it/s]

 29%|         | 9539231/32893931 [00:00<00:00, 46665521.44it/s]

 43%|        | 14144377/32893931 [00:00<00:00, 45895679.35it/s]

 57%|       | 18749523/32893931 [00:00<00:00, 45457356.63it/s]
34426557it [00:11, 33591330.81it/s]

 71%|       | 23354669/32893931 [00:00<00:00, 44851830.86it/s]
```

```
 84%|      | 27630876/32893931 [00:00<00:00, 43713414.04it/s]

 97%|      | 31907083/32893931 [00:00<00:00, 42457431.68it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_16"

 81%|      | 17/21 [02:56<00:41, 10.48s/it]

t_16      int16
t_L       int16
dS_16    uint16
dtype: object
Start conversion of 17 channel
t_17 valid_tdc_17
..



  0%|          | 0/31972199 [00:00<?, ?it/s]


 18%|         | 5754978/31972199 [00:00<00:00, 56868920.97it/s]


 36%|        | 11509956/31972199 [00:00<00:00, 56676519.48it/s]


 53%|       | 16945213/31972199 [00:00<00:00, 55538642.12it/s]


 70%|       | 22380470/31972199 [00:00<00:00, 55132200.34it/s]


 87%|      | 27815727/31972199 [00:00<00:00, 54867331.52it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_17"

 86%|      | 18/21 [03:05<00:30, 10.04s/it]

t_17      int16
t_L       int16
dS_17    uint16
dtype: object
Start conversion of 18 channel
t_18 valid_tdc_18
..
```

```
  0%|          | 0/32317244 [00:00<?, ?it/s]

 17%|         | 5493924/32317244 [00:00<00:00, 54490949.96it/s]

 34%|        | 10987848/32317244 [00:00<00:00, 53657127.18it/s]

 50%|        | 16158600/32317244 [00:00<00:00, 52472937.36it/s]

 66%|       | 21329352/32317244 [00:00<00:00, 51501241.63it/s]

 82%|      | 26500104/32317244 [00:00<00:00, 51152729.49it/s]

 98%|     | 31670856/32317244 [00:00<00:00, 50707620.95it/s]
Data ready, conversion to array
Adding keys to HDF5…  "ch_18"
34426557it [00:30, 1115176.00it/s]
33222839it [00:19, 1675520.84it/s]
32291821it [00:10, 3157201.17it/s]
32640372it [00:00, 37724998.65it/s]
 90%|      | 19/21 [03:15<00:19,  9.84s/it]
t_18      int16
t_L       int16
dS_18    uint16
dtype: object
Start conversion of 19 channel
t_19 valid_tdc_19
..

  0%|          | 0/32419694 [00:00<?, ?it/s]
 17%|         | 5511332/32419694 [00:00<00:00, 54995365.20it/s]
 33%|        | 10698468/32419694 [00:00<00:00, 53498100.43it/s]
 49%|        | 15885604/32419694 [00:00<00:00, 51984739.51it/s]
```

```
 64%|       | 20748544/32419694 [00:00<00:00, 50589075.24it/s]
 80%|       | 25935680/32419694 [00:00<00:00, 50093248.81it/s]
 96%|      | 31122816/32419694 [00:00<00:00, 49662004.03it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_19"

 95%|      | 20/21 [03:24<00:09,  9.62s/it]

t_19      int16
t_L       int16
dS_19    uint16
dtype: object
Start conversion of 20 channel
t_20 valid_tdc_20
..


  0%|          | 0/31431161 [00:00<?, ?it/s]

 24%|         | 7543464/31431161 [00:00<00:00, 75400196.44it/s]

 47%|        | 14772617/31431161 [00:00<00:00, 74222879.40it/s]

 69%|       | 21687459/31431161 [00:00<00:00, 72169783.45it/s]

 91%|      | 28602301/31431161 [00:00<00:00, 71025486.84it/s]

Data ready, conversion to array
Adding keys to HDF5…  "ch_20"

100%|      | 21/21 [03:32<00:00, 10.13s/it]

t_20      int16
t_L       int16
dS_20    uint16
dtype: object
Data saved:  /mnt/Disk1T/dataSlowDisk/data-2021-02-02-BCD_cooled_Vimentin/output
/FLIM_512x512pixels_dwelltime250us_Dataset_40MHz-raw.h5
```

5 Timing calibration of data

[8]:
```
calibDict=ttp.calculateCalibFromH5(filenameH5=myReturn['filenameH5'],    #the␣
↪HDF5 file input
                                   listChannel=range(0,nchannel) #list of␣
↪channel [0,nchannel]
                                   )
```

```
32743796it [00:19, 1705388.40it/s] /s]
31745411it [00:10, 3160697.43it/s]
100%|      | 21/21 [03:00<00:00,  8.60s/it]
```

[9]:
```
table_channels={}
for i in tqdm(range(nchannel)):
    table_channels[i] = ttp.applyCalibDict(myReturn['filenameH5'],
                         channel=i,
                         calibDict=calibDict)
```

```
HBox(children=(HTML(value=''), FloatProgress(value=0.0, max=21.0),␣
↪HTML(value='')))
```

6 Creating 4D data matrix x-y-t-ch

[10]:
```
image_4d=ttp.image_4d_fast(npixel,nbins,nchannel,table_channels, laser_ps)
```

```
100%|      | 21/21 [00:41<00:00,  1.98s/it]
```

[11]:
```
channel=10
ch=channel-1
# 3D dataset
data_3d_channel_10=image_4d[:,:,:,ch]
# x-y image
image_channel_10=data_3d_channel_10.sum(axis=2)

fig= plt.figure(figsize=(12,12))
plt.imshow(image_channel_10, cmap='hot')

cbar = plt.colorbar()
cbar.set_label('\n Photon Counts/'+str(dwell_time)+'us')
title('Image from Channel '+str(ch+1)+' \n')
xlabel('Pixels')
ylabel('Pixels')
```

[11]:
```
Text(0, 0.5, 'Pixels')
```

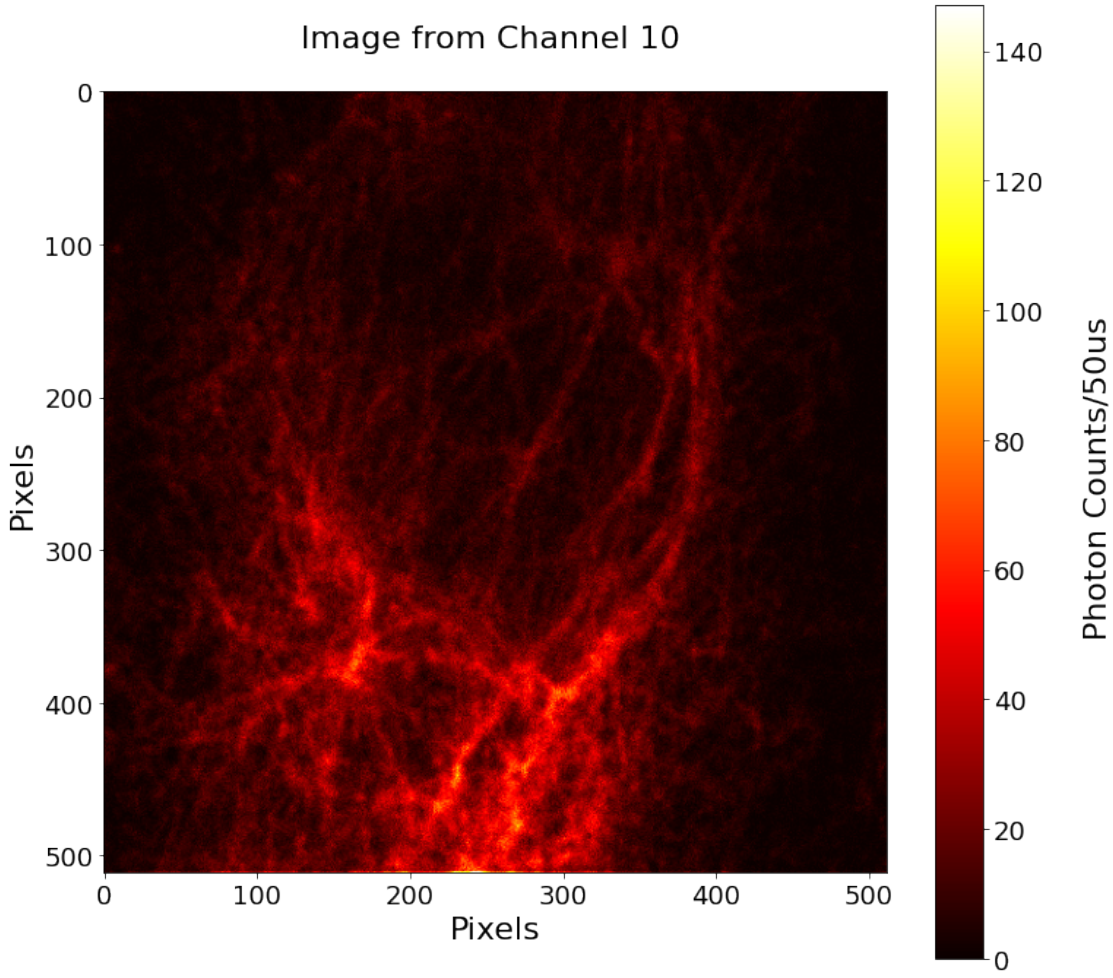
Image from Channel 10
Pixels
Pixels
Photon Counts/50us
0
100
200
300
400
500
0
20
40
60
80
100
120
140

[ ]:

[ ]: