EZ_hit-finder_tutorial

April 25, 2019

1   *EZ_hit-finder* Tutorial

Created on April 24th, 2019.
 Authors: Chufeng Li, Nadia Zatsepin
 Contact: chufengl@asu.edu; chufengl@icloud.com
 Generated from the ASU Research Computing Agave facility.

1.1   Installation and Environment

Setting up the environment: 1. install Anaconda3 2. conda env create -f ALBA_SX.yml 3. conda activate EZ_hit-finder (source activate EZ_hit-finder)

```
In [39]: !/bioxfel/local/anaconda3/bin/conda env list

# conda environments:
#
base                      /bioxfel/local/anaconda3
EZ_hit-finder        *    /bioxfel/local/anaconda3/envs/EZ_hit-finder
                          /home/chufengl/xxli/software/anaconda3
                          /home/chufengl/xxli/software/anaconda3/envs/py27
```

 In the terminal environment, instead of this ipython Jupyter notebook enviroment, the "!" is not needed.
 In addition, you can directly type "conda" instead of the absolute path name, if that's already set as your default conda and python.Using

```
export PATH=/bioxfel/local/anaconda3/bin:$PATH

In [40]: !source /bioxfel/local/anaconda3/bin/activate EZ_hit-finder
```

 Check that this is working in the correct environment, as below:

```
In [42]: !/bioxfel/local/anaconda3/bin/conda env list
```

```
# conda environments:
#
base                     /bioxfel/local/anaconda3
EZ_hit-finder         *  /bioxfel/local/anaconda3/envs/EZ_hit-finder
                         /home/chufengl/xxli/software/anaconda3
                         /home/chufengl/xxli/software/anaconda3/envs/py27
```

In [43]: `!pwd`

`/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/scripts`

1.2 Import all modules needed for the hit-finding processes.

In [44]:
```python
import sys,os
import numpy as np
import fabio
import matplotlib.pyplot as plt
import ALBA_SX_uitils_mpi as AL
```

1.3 Read in a sample .cbf image file for hit-finding parameter tweaking

In [46]:
```python
cbf_file_name='/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images
img_array_s=fabio.open(cbf_file_name)
print('The image dimension is:',img_array_s.data.shape)
center_x=np.round(img_array_s.data.shape[0]/2).astype(np.int16)
center_y=np.round(img_array_s.data.shape[1]/2).astype(np.int16)
print('The beam center is preliminarily: (%.2f,%.2f)'%(center_x,center_y))
```
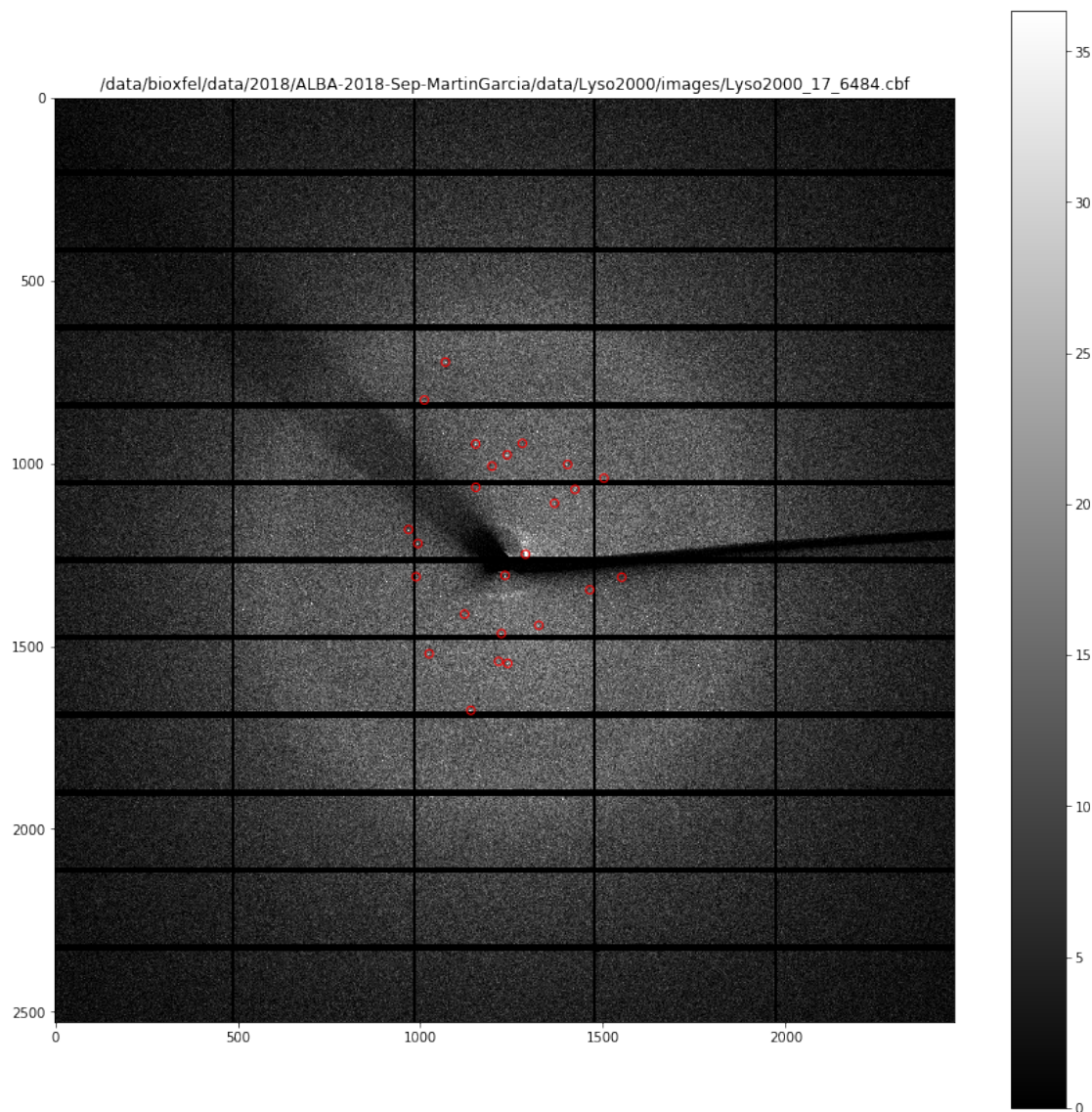
```
The image dimension is: (2527, 2463)
The beam center is preliminarily: (1264.00,1232.00)
```

Parameter_tweaking mode:

```
label_filtered_sorted,weighted_centroid_filtered,props= \
single_peak_finder(CBF_file_name,thld,min_pix,max_pix,mask_file,interact='True')
```

- thld: pixel value threshold
- min_pix: minimal number of pixels for a peak
- max_pix: maximal number of pixels for a peak
- mask_file: name of the mask file
- min_peak: minimal number of peaks for a hit

In [47]: `label_filtered_sorted,weighted_centroid_filtered,props=AL.single_peak_finder(cbf_file`

/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_17_6484.cbf

1.4 Run hit-finding with tuned parameters

After satisfied with the parmameter tuning above in the interactive mode, we can run the hit fiding in batch mode using the optimized parameters as follows:
   Usage:

```
ALBA_SX_uitils.py <cbf_file_list_file> <thld> <min_pix> <max_pix> <mask_file> <min_peak> <Regio
```

- thld: pixel value threshold
- min_pix: minimal number of pixels for a peak
- max_pix: maximal number of pixels for a peak
- mask_file: name of the mask file

- min_peak: minimal number of peaks for a hit
- Region: 'ALL'(full image), 'C'(central portion), 'Q'(quarter)

```
In [48]: !python ../../chufengl/scripts/ALBA_SX_uitils_mpi.py ../test_split.lst00000 50 3 20 N
```

```
Started on 4-20-2019
Authors: Chufeng Li, Nadia Zatsepin
E-mail: chufengl@asu.edu
Usage:
    ALBA_SX_uitils.py <cbf_file_list_file> <thld> <min_pix> <max_pix> <mask_file> <min_peak> <
    thld: pixel value threshold
    min_pix: minimal number of pixels for a peak
    max_pix: maximal number of pixels for a peak
    mask_file: name of the mask file
    min_peak: minimal number of peaks for a hit
    Region: 'ALL', 'C', 'Q'

Parameter_tweaking mode:

label_filtered_sorted,weighted_centroid_filtered,props= single_peak_finder(CBF_file_name,thld,
```

```
HIT!!!!  Event 0: 25 peaks found
BLANK!   Event 1: 4 peaks found
BLANK!   Event 2: 3 peaks found
BLANK!   Event 3: 4 peaks found
BLANK!   Event 4: 1 peaks found
BLANK!   Event 5: 1 peaks found
HIT!!!!  Event 6: 62 peaks found
BLANK!   Event 7: 1 peaks found
HIT!!!!  Event 8: 18 peaks found
HIT!!!!  Event 9: 10 peaks found
BLANK!   Event 10: 1 peaks found
BLANK!   Event 11: 1 peaks found
BLANK!   Event 12: 4 peaks found
HIT!!!!  Event 13: 40 peaks found
BLANK!   Event 14: 1 peaks found
BLANK!   Event 15: 1 peaks found
BLANK!   Event 16: 5 peaks found
BLANK!   Event 17: 1 peaks found
BLANK!   Event 18: 7 peaks found
BLANK!   Event 19: 1 peaks found
BLANK!   Event 20: 4 peaks found
BLANK!   Event 21: 1 peaks found
BLANK!   Event 22: 2 peaks found
BLANK!   Event 23: 2010 peaks found
HIT!!!!  Event 24: 33 peaks found
```

```
HIT!!!!   Event 25: 18 peaks found
BLANK!    Event 26: 7 peaks found
BLANK!    Event 27: 3 peaks found
BLANK!    Event 28: 4 peaks found
BLANK!    Event 29: 3 peaks found
BLANK!    Event 30: 6 peaks found
HIT!!!!   Event 31: 40 peaks found
BLANK!    Event 32: 9 peaks found
BLANK!    Event 33: 2 peaks found
BLANK!    Event 34: 1 peaks found
BLANK!    Event 35: 1 peaks found
HIT!!!!   Event 36: 35 peaks found
BLANK!    Event 37: 4 peaks found
BLANK!    Event 38: 3 peaks found
BLANK!    Event 39: 1 peaks found
BLANK!    Event 40: 1 peaks found
HIT!!!!   Event 41: 25 peaks found
HIT!!!!   Event 42: 18 peaks found
BLANK!    Event 43: 9 peaks found
HIT!!!!   Event 44: 35 peaks found
BLANK!    Event 45: 2 peaks found
BLANK!    Event 46: 2 peaks found
BLANK!    Event 47: 2 peaks found
BLANK!    Event 48: 1 peaks found
HIT!!!!   Event 49: 64 peaks found
BLANK!    Event 50: 1 peaks found
BLANK!    Event 51: 1 peaks found
BLANK!    Event 52: 1 peaks found
BLANK!    Event 53: 5 peaks found
BLANK!    Event 54: 6 peaks found
HIT!!!!   Event 55: 67 peaks found
BLANK!    Event 56: 4 peaks found
BLANK!    Event 57: 4 peaks found
BLANK!    Event 58: 1 peaks found
BLANK!    Event 59: 1 peaks found
BLANK!    Event 60: 1 peaks found
BLANK!    Event 61: 1 peaks found
BLANK!    Event 62: 1 peaks found
HIT!!!!   Event 63: 56 peaks found
HIT!!!!   Event 64: 66 peaks found
BLANK!    Event 65: 4 peaks found
BLANK!    Event 66: 4 peaks found
BLANK!    Event 67: 1 peaks found
BLANK!    Event 68: 1 peaks found
BLANK!    Event 69: 1 peaks found
BLANK!    Event 70: 1 peaks found
BLANK!    Event 71: 2 peaks found
BLANK!    Event 72: 1 peaks found
```

```
BLANK!    Event 73: 1 peaks found
BLANK!    Event 74: 3 peaks found
BLANK!    Event 75: 1 peaks found
BLANK!    Event 76: 1 peaks found
HIT!!!!   Event 77: 23 peaks found
HIT!!!!   Event 78: 28 peaks found
HIT!!!!   Event 79: 31 peaks found
BLANK!    Event 80: 1 peaks found
BLANK!    Event 81: 6 peaks found
BLANK!    Event 82: 1 peaks found
BLANK!    Event 83: 1 peaks found
BLANK!    Event 84: 1 peaks found
HIT!!!!   Event 85: 77 peaks found
BLANK!    Event 86: 1 peaks found
BLANK!    Event 87: 1 peaks found
BLANK!    Event 88: 5 peaks found
BLANK!    Event 89: 1 peaks found
BLANK!    Event 90: 1 peaks found
BLANK!    Event 91: 2 peaks found
HIT!!!!   Event 92: 10 peaks found
HIT!!!!   Event 93: 14 peaks found
BLANK!    Event 94: 2 peaks found
HIT!!!!   Event 95: 10 peaks found
HIT!!!!   Event 96: 26 peaks found
BLANK!    Event 97: 1 peaks found
BLANK!    Event 98: 2 peaks found
BLANK!    Event 99: 1 peaks found
BLANK!    Event 100: 1 peaks found
BLANK!    Event 101: 1 peaks found
BLANK!    Event 102: 1 peaks found
BLANK!    Event 103: 3 peaks found
BLANK!    Event 104: 1 peaks found
HIT!!!!   Event 105: 38 peaks found
BLANK!    Event 106: 8 peaks found
BLANK!    Event 107: 1 peaks found
BLANK!    Event 108: 7 peaks found
HIT!!!!   Event 109: 35 peaks found
HIT!!!!   Event 110: 10 peaks found
BLANK!    Event 111: 7 peaks found
BLANK!    Event 112: 8 peaks found
HIT!!!!   Event 113: 76 peaks found
HIT!!!!   Event 114: 21 peaks found
BLANK!    Event 115: 1 peaks found
BLANK!    Event 116: 2 peaks found
BLANK!    Event 117: 1 peaks found
BLANK!    Event 118: 4 peaks found
BLANK!    Event 119: 2 peaks found
BLANK!    Event 120: 1 peaks found
```

```
BLANK!   Event 121: 2 peaks found
BLANK!   Event 122: 1 peaks found
BLANK!   Event 123: 9 peaks found
BLANK!   Event 124: 1 peaks found
BLANK!   Event 125: 1 peaks found
BLANK!   Event 126: 1 peaks found
BLANK!   Event 127: 2 peaks found
HIT!!!!  Event 128: 59 peaks found
BLANK!   Event 129: 1 peaks found
BLANK!   Event 130: 1 peaks found
BLANK!   Event 131: 2 peaks found
BLANK!   Event 132: 3 peaks found
BLANK!   Event 133: 3 peaks found
BLANK!   Event 134: 1 peaks found
HIT!!!!  Event 135: 43 peaks found
BLANK!   Event 136: 6 peaks found
HIT!!!!  Event 137: 27 peaks found
BLANK!   Event 138: 4 peaks found
BLANK!   Event 139: 5 peaks found
BLANK!   Event 140: 1 peaks found
BLANK!   Event 141: 1 peaks found
HIT!!!!  Event 142: 45 peaks found
BLANK!   Event 143: 6 peaks found
BLANK!   Event 144: 1 peaks found
HIT!!!!  Event 145: 12 peaks found
BLANK!   Event 146: 4 peaks found
BLANK!   Event 147: 1 peaks found
BLANK!   Event 148: 1 peaks found
BLANK!   Event 149: 1 peaks found
BLANK!   Event 150: 3 peaks found
BLANK!   Event 151: 1 peaks found
BLANK!   Event 152: 4 peaks found
BLANK!   Event 153: 3 peaks found
BLANK!   Event 154: 4 peaks found
BLANK!   Event 155: 3 peaks found
HIT!!!!  Event 156: 32 peaks found
BLANK!   Event 157: 6 peaks found
BLANK!   Event 158: 5 peaks found
HIT!!!!  Event 159: 41 peaks found
BLANK!   Event 160: 4 peaks found
BLANK!   Event 161: 5 peaks found
HIT!!!!  Event 162: 22 peaks found
BLANK!   Event 163: 1 peaks found
BLANK!   Event 164: 2 peaks found
HIT!!!!  Event 165: 44 peaks found
BLANK!   Event 166: 1 peaks found
BLANK!   Event 167: 1 peaks found
HIT!!!!  Event 168: 34 peaks found
```

```
BLANK!    Event 169: 1 peaks found
HIT!!!!   Event 170: 30 peaks found
BLANK!    Event 171: 1 peaks found
BLANK!    Event 172: 3 peaks found
BLANK!    Event 173: 2 peaks found
BLANK!    Event 174: 1 peaks found
BLANK!    Event 175: 1 peaks found
BLANK!    Event 176: 1 peaks found
BLANK!    Event 177: 1 peaks found
BLANK!    Event 178: 5 peaks found
BLANK!    Event 179: 3 peaks found
BLANK!    Event 180: 1 peaks found
BLANK!    Event 181: 6 peaks found
BLANK!    Event 182: 1 peaks found
BLANK!    Event 183: 2 peaks found
HIT!!!!   Event 184: 17 peaks found
HIT!!!!   Event 185: 17 peaks found
BLANK!    Event 186: 6 peaks found
BLANK!    Event 187: 1 peaks found
BLANK!    Event 188: 3 peaks found
BLANK!    Event 189: 4 peaks found
BLANK!    Event 190: 2 peaks found
BLANK!    Event 191: 1 peaks found
HIT!!!!   Event 192: 16 peaks found
BLANK!    Event 193: 1 peaks found
BLANK!    Event 194: 1 peaks found
BLANK!    Event 195: 2 peaks found
BLANK!    Event 196: 1 peaks found
BLANK!    Event 197: 4 peaks found
BLANK!    Event 198: 2 peaks found
BLANK!    Event 199: 7 peaks found
BLANK!    Event 200: 2 peaks found
BLANK!    Event 201: 7 peaks found
BLANK!    Event 202: 1 peaks found
BLANK!    Event 203: 1 peaks found
BLANK!    Event 204: 3 peaks found
BLANK!    Event 205: 1 peaks found
BLANK!    Event 206: 7 peaks found
BLANK!    Event 207: 3 peaks found
HIT!!!!   Event 208: 20 peaks found
BLANK!    Event 209: 1 peaks found
BLANK!    Event 210: 2 peaks found
HIT!!!!   Event 211: 85 peaks found
BLANK!    Event 212: 1 peaks found
HIT!!!!   Event 213: 22 peaks found
BLANK!    Event 214: 1 peaks found
BLANK!    Event 215: 1 peaks found
BLANK!    Event 216: 2 peaks found
```

```
BLANK!    Event 217: 1 peaks found
BLANK!    Event 218: 1 peaks found
HIT!!!!   Event 219: 49 peaks found
BLANK!    Event 220: 6 peaks found
BLANK!    Event 221: 1 peaks found
BLANK!    Event 222: 9 peaks found
BLANK!    Event 223: 3 peaks found
BLANK!    Event 224: 3 peaks found
BLANK!    Event 225: 2 peaks found
BLANK!    Event 226: 1 peaks found
BLANK!    Event 227: 1 peaks found
BLANK!    Event 228: 1 peaks found
BLANK!    Event 229: 1 peaks found
BLANK!    Event 230: 1 peaks found
BLANK!    Event 231: 1 peaks found
BLANK!    Event 232: 1 peaks found
HIT!!!!   Event 233: 54 peaks found
BLANK!    Event 234: 3 peaks found
BLANK!    Event 235: 3 peaks found
BLANK!    Event 236: 8 peaks found
HIT!!!!   Event 237: 69 peaks found
HIT!!!!   Event 238: 58 peaks found
HIT!!!!   Event 239: 11 peaks found
HIT!!!!   Event 240: 32 peaks found
HIT!!!!   Event 241: 28 peaks found
BLANK!    Event 242: 6 peaks found
BLANK!    Event 243: 3 peaks found
BLANK!    Event 244: 1 peaks found
BLANK!    Event 245: 5 peaks found
HIT!!!!   Event 246: 13 peaks found
BLANK!    Event 247: 4 peaks found
BLANK!    Event 248: 3 peaks found
BLANK!    Event 249: 4 peaks found
BLANK!    Event 250: 4 peaks found
HIT!!!!   Event 251: 44 peaks found
BLANK!    Event 252: 3 peaks found
BLANK!    Event 253: 1930 peaks found
BLANK!    Event 254: 4 peaks found
BLANK!    Event 255: 1 peaks found
BLANK!    Event 256: 1 peaks found
BLANK!    Event 257: 1 peaks found
BLANK!    Event 258: 1 peaks found
HIT!!!!   Event 259: 81 peaks found
BLANK!    Event 260: 1 peaks found
BLANK!    Event 261: 1 peaks found
BLANK!    Event 262: 1 peaks found
BLANK!    Event 263: 2 peaks found
BLANK!    Event 264: 1 peaks found
```

```
BLANK!   Event 265: 3 peaks found
BLANK!   Event 266: 4 peaks found
HIT!!!!  Event 267: 24 peaks found
BLANK!   Event 268: 4 peaks found
BLANK!   Event 269: 1 peaks found
BLANK!   Event 270: 1 peaks found
BLANK!   Event 271: 1 peaks found
BLANK!   Event 272: 1 peaks found
BLANK!   Event 273: 1 peaks found
BLANK!   Event 274: 1 peaks found
BLANK!   Event 275: 4 peaks found
BLANK!   Event 276: 1 peaks found
BLANK!   Event 277: 1 peaks found
BLANK!   Event 278: 1 peaks found
BLANK!   Event 279: 2 peaks found
BLANK!   Event 280: 1 peaks found
BLANK!   Event 281: 1 peaks found
BLANK!   Event 282: 8 peaks found
BLANK!   Event 283: 2 peaks found
BLANK!   Event 284: 1 peaks found
BLANK!   Event 285: 1 peaks found
BLANK!   Event 286: 3 peaks found
BLANK!   Event 287: 1 peaks found
BLANK!   Event 288: 1 peaks found
BLANK!   Event 289: 7 peaks found
BLANK!   Event 290: 4 peaks found
BLANK!   Event 291: 1 peaks found
BLANK!   Event 292: 1 peaks found
BLANK!   Event 293: 9 peaks found
BLANK!   Event 294: 1 peaks found
BLANK!   Event 295: 2 peaks found
BLANK!   Event 296: 2 peaks found
BLANK!   Event 297: 1 peaks found
BLANK!   Event 298: 2 peaks found
BLANK!   Event 299: 4 peaks found
BLANK!   Event 300: 5 peaks found
BLANK!   Event 301: 1 peaks found
BLANK!   Event 302: 5 peaks found
BLANK!   Event 303: 2 peaks found
HIT!!!!  Event 304: 32 peaks found
HIT!!!!  Event 305: 15 peaks found
HIT!!!!  Event 306: 18 peaks found
BLANK!   Event 307: 1 peaks found
BLANK!   Event 308: 2 peaks found
HIT!!!!  Event 309: 27 peaks found
BLANK!   Event 310: 1 peaks found
HIT!!!!  Event 311: 26 peaks found
BLANK!   Event 312: 1 peaks found
```

```
BLANK!    Event 313: 1 peaks found
BLANK!    Event 314: 2 peaks found
BLANK!    Event 315: 5 peaks found
BLANK!    Event 316: 3 peaks found
BLANK!    Event 317: 2096 peaks found
BLANK!    Event 318: 5 peaks found
BLANK!    Event 319: 3 peaks found
HIT!!!!   Event 320: 15 peaks found
BLANK!    Event 321: 1 peaks found
BLANK!    Event 322: 5 peaks found
BLANK!    Event 323: 2 peaks found
HIT!!!!   Event 324: 13 peaks found
BLANK!    Event 325: 4 peaks found
BLANK!    Event 326: 3 peaks found
BLANK!    Event 327: 2 peaks found
BLANK!    Event 328: 1 peaks found
BLANK!    Event 329: 2 peaks found
BLANK!    Event 330: 1 peaks found
BLANK!    Event 331: 6 peaks found
BLANK!    Event 332: 1 peaks found
HIT!!!!   Event 333: 31 peaks found
BLANK!    Event 334: 1 peaks found
BLANK!    Event 335: 1 peaks found
BLANK!    Event 336: 1 peaks found
HIT!!!!   Event 337: 16 peaks found
BLANK!    Event 338: 1 peaks found
BLANK!    Event 339: 1 peaks found
BLANK!    Event 340: 3 peaks found
BLANK!    Event 341: 1 peaks found
BLANK!    Event 342: 1 peaks found
BLANK!    Event 343: 1 peaks found
BLANK!    Event 344: 4 peaks found
HIT!!!!   Event 345: 24 peaks found
BLANK!    Event 346: 3 peaks found
BLANK!    Event 347: 7 peaks found
HIT!!!!   Event 348: 48 peaks found
BLANK!    Event 349: 5 peaks found
HIT!!!!   Event 350: 13 peaks found
BLANK!    Event 351: 3 peaks found
BLANK!    Event 352: 1 peaks found
BLANK!    Event 353: 1 peaks found
BLANK!    Event 354: 1 peaks found
BLANK!    Event 355: 1 peaks found
BLANK!    Event 356: 1 peaks found
BLANK!    Event 357: 2 peaks found
BLANK!    Event 358: 1 peaks found
BLANK!    Event 359: 1 peaks found
BLANK!    Event 360: 1 peaks found
```

```
BLANK!    Event 361: 2 peaks found
HIT!!!!   Event 362: 76 peaks found
BLANK!    Event 363: 9 peaks found
BLANK!    Event 364: 1 peaks found
BLANK!    Event 365: 1 peaks found
HIT!!!!   Event 366: 11 peaks found
BLANK!    Event 367: 6 peaks found
BLANK!    Event 368: 2 peaks found
BLANK!    Event 369: 1 peaks found
BLANK!    Event 370: 1 peaks found
BLANK!    Event 371: 6 peaks found
BLANK!    Event 372: 4 peaks found
HIT!!!!   Event 373: 10 peaks found
BLANK!    Event 374: 2 peaks found
BLANK!    Event 375: 4 peaks found
HIT!!!!   Event 376: 13 peaks found
BLANK!    Event 377: 5 peaks found
BLANK!    Event 378: 1 peaks found
BLANK!    Event 379: 1 peaks found
BLANK!    Event 380: 1 peaks found
BLANK!    Event 381: 1 peaks found
BLANK!    Event 382: 3 peaks found
HIT!!!!   Event 383: 15 peaks found
HIT!!!!   Event 384: 18 peaks found
BLANK!    Event 385: 7 peaks found
BLANK!    Event 386: 9 peaks found
BLANK!    Event 387: 8 peaks found
HIT!!!!   Event 388: 33 peaks found
BLANK!    Event 389: 6 peaks found
HIT!!!!   Event 390: 24 peaks found
HIT!!!!   Event 391: 35 peaks found
HIT!!!!   Event 392: 55 peaks found
BLANK!    Event 393: 1616 peaks found
HIT!!!!   Event 394: 13 peaks found
BLANK!    Event 395: 1 peaks found
BLANK!    Event 396: 1 peaks found
BLANK!    Event 397: 5 peaks found
BLANK!    Event 398: 2 peaks found
BLANK!    Event 399: 5 peaks found
BLANK!    Event 400: 4 peaks found
BLANK!    Event 401: 3 peaks found
HIT!!!!   Event 402: 36 peaks found
BLANK!    Event 403: 5 peaks found
HIT!!!!   Event 404: 21 peaks found
BLANK!    Event 405: 3 peaks found
HIT!!!!   Event 406: 15 peaks found
BLANK!    Event 407: 1 peaks found
BLANK!    Event 408: 4 peaks found
```

```
BLANK!   Event 409: 2 peaks found
BLANK!   Event 410: 6 peaks found
BLANK!   Event 411: 1 peaks found
BLANK!   Event 412: 2 peaks found
BLANK!   Event 413: 4 peaks found
HIT!!!!  Event 414: 11 peaks found
HIT!!!!  Event 415: 21 peaks found
BLANK!   Event 416: 4 peaks found
BLANK!   Event 417: 1 peaks found
BLANK!   Event 418: 1 peaks found
HIT!!!!  Event 419: 22 peaks found
HIT!!!!  Event 420: 104 peaks found
BLANK!   Event 421: 1 peaks found
BLANK!   Event 422: 1 peaks found
BLANK!   Event 423: 1 peaks found
BLANK!   Event 424: 1 peaks found
BLANK!   Event 425: 2 peaks found
BLANK!   Event 426: 4 peaks found
BLANK!   Event 427: 1 peaks found
BLANK!   Event 428: 1 peaks found
BLANK!   Event 429: 1 peaks found
BLANK!   Event 430: 2525 peaks found
BLANK!   Event 431: 4 peaks found
BLANK!   Event 432: 1 peaks found
BLANK!   Event 433: 1 peaks found
BLANK!   Event 434: 5 peaks found
BLANK!   Event 435: 4 peaks found
HIT!!!!  Event 436: 21 peaks found
BLANK!   Event 437: 1 peaks found
BLANK!   Event 438: 1 peaks found
BLANK!   Event 439: 3 peaks found
BLANK!   Event 440: 4 peaks found
HIT!!!!  Event 441: 16 peaks found
HIT!!!!  Event 442: 19 peaks found
BLANK!   Event 443: 1 peaks found
BLANK!   Event 444: 1 peaks found
HIT!!!!  Event 445: 26 peaks found
BLANK!   Event 446: 7 peaks found
BLANK!   Event 447: 2 peaks found
BLANK!   Event 448: 2 peaks found
BLANK!   Event 449: 3 peaks found
BLANK!   Event 450: 1 peaks found
BLANK!   Event 451: 1 peaks found
BLANK!   Event 452: 1 peaks found
BLANK!   Event 453: 1 peaks found
BLANK!   Event 454: 2 peaks found
BLANK!   Event 455: 1 peaks found
HIT!!!!  Event 456: 21 peaks found
```

```
BLANK!    Event 457: 1 peaks found
BLANK!    Event 458: 2 peaks found
BLANK!    Event 459: 2 peaks found
BLANK!    Event 460: 1 peaks found
HIT!!!!   Event 461: 34 peaks found
BLANK!    Event 462: 6 peaks found
HIT!!!!   Event 463: 52 peaks found
BLANK!    Event 464: 3 peaks found
BLANK!    Event 465: 2 peaks found
BLANK!    Event 466: 1 peaks found
BLANK!    Event 467: 2 peaks found
HIT!!!!   Event 468: 14 peaks found
BLANK!    Event 469: 1 peaks found
HIT!!!!   Event 470: 11 peaks found
BLANK!    Event 471: 4 peaks found
BLANK!    Event 472: 1 peaks found
BLANK!    Event 473: 1 peaks found
BLANK!    Event 474: 3 peaks found
BLANK!    Event 475: 1 peaks found
BLANK!    Event 476: 3881 peaks found
HIT!!!!   Event 477: 45 peaks found
BLANK!    Event 478: 4 peaks found
BLANK!    Event 479: 1 peaks found
BLANK!    Event 480: 1 peaks found
BLANK!    Event 481: 1 peaks found
BLANK!    Event 482: 1 peaks found
BLANK!    Event 483: 4 peaks found
BLANK!    Event 484: 2 peaks found
BLANK!    Event 485: 1 peaks found
BLANK!    Event 486: 4 peaks found
BLANK!    Event 487: 4 peaks found
BLANK!    Event 488: 5 peaks found
HIT!!!!   Event 489: 17 peaks found
HIT!!!!   Event 490: 44 peaks found
BLANK!    Event 491: 2 peaks found
HIT!!!!   Event 492: 23 peaks found
BLANK!    Event 493: 3 peaks found
BLANK!    Event 494: 1 peaks found
BLANK!    Event 495: 6 peaks found
BLANK!    Event 496: 4 peaks found
BLANK!    Event 497: 5 peaks found
BLANK!    Event 498: 5 peaks found
BLANK!    Event 499: 1 peaks found
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/test_split.lst00000
100   out of   500   hits found!
HIT rate: 20.00 %
HIT events:
[0, 6, 8, 9, 13, 24, 25, 31, 36, 41, 42, 44, 49, 55, 63, 64, 77, 78, 79, 85, 92, 93, 95, 96, 10
```

```
Peak information saved in test_split.lst00000_peak_info.pkl
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/test_split.lst00000
 took  42.956661 seconds.
```

In [49]: !ls -lrth

```
total 13M
drwxrwsr-x 2 chufengl bioxfel 595K Apr 21 05:19 lists
-rw-rw-r-- 1 chufengl bioxfel 8.0K Apr 21 06:14 ALBA_SX.yml
-rw-r--r-- 1 chufengl bioxfel 9.5K Apr 22 01:37 ALBA_SX_uitils_mpi.py
drwxrwsr-x 2 chufengl bioxfel  512 Apr 24 17:12 __pycache__
-rw-rw-r-- 1 chufengl bioxfel  12M Apr 25 00:00 test_split.lst00000_peak_info.pkl
-rw-rw-r-- 1 chufengl bioxfel  18K Apr 25 00:00 test_split.lst00000HIT.log
-rw-rw-r-- 1 chufengl bioxfel 9.1K Apr 25 00:00 test_split.lst00000eve.lst
-rw-rw-r-- 1 chufengl bioxfel 851K Apr 25 00:01 EZ_hit-finder_tutorial.ipynb
```

1.5 Check the output files

.log, eve.lst , and .pkl files are generated for each hit-fingding batch. * .log: log file of the hit-
finding * eve.lst: hit event list, used for data transfer * .pkl: binary file consisting of the peak
information, adopting Cheetah and CrystFEL convention.

In [50]: !cat test_split.lst00000HIT.log

```
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/test_split.lst00000
-----------
thld: 50
min_pix: 3
max_pix: 20
min_peak: 10
mask_file: None
Region: C
-----------
HIT!!!!  Event 0: 25 peaks found
BLANK!   Event 1: 4 peaks found
BLANK!   Event 2: 3 peaks found
BLANK!   Event 3: 4 peaks found
BLANK!   Event 4: 1 peaks found
BLANK!   Event 5: 1 peaks found
HIT!!!!  Event 6: 62 peaks found
BLANK!   Event 7: 1 peaks found
HIT!!!!  Event 8: 18 peaks found
HIT!!!!  Event 9: 10 peaks found
BLANK!   Event 10: 1 peaks found
BLANK!   Event 11: 1 peaks found
BLANK!   Event 12: 4 peaks found
HIT!!!!  Event 13: 40 peaks found
```

```
BLANK!    Event 14: 1 peaks found
BLANK!    Event 15: 1 peaks found
BLANK!    Event 16: 5 peaks found
BLANK!    Event 17: 1 peaks found
BLANK!    Event 18: 7 peaks found
BLANK!    Event 19: 1 peaks found
BLANK!    Event 20: 4 peaks found
BLANK!    Event 21: 1 peaks found
BLANK!    Event 22: 2 peaks found
BLANK!    Event 23: 2010 peaks found
HIT!!!!   Event 24: 33 peaks found
HIT!!!!   Event 25: 18 peaks found
BLANK!    Event 26: 7 peaks found
BLANK!    Event 27: 3 peaks found
BLANK!    Event 28: 4 peaks found
BLANK!    Event 29: 3 peaks found
BLANK!    Event 30: 6 peaks found
HIT!!!!   Event 31: 40 peaks found
BLANK!    Event 32: 9 peaks found
BLANK!    Event 33: 2 peaks found
BLANK!    Event 34: 1 peaks found
BLANK!    Event 35: 1 peaks found
HIT!!!!   Event 36: 35 peaks found
BLANK!    Event 37: 4 peaks found
BLANK!    Event 38: 3 peaks found
BLANK!    Event 39: 1 peaks found
BLANK!    Event 40: 1 peaks found
HIT!!!!   Event 41: 25 peaks found
HIT!!!!   Event 42: 18 peaks found
BLANK!    Event 43: 9 peaks found
HIT!!!!   Event 44: 35 peaks found
BLANK!    Event 45: 2 peaks found
BLANK!    Event 46: 2 peaks found
BLANK!    Event 47: 2 peaks found
BLANK!    Event 48: 1 peaks found
HIT!!!!   Event 49: 64 peaks found
BLANK!    Event 50: 1 peaks found
BLANK!    Event 51: 1 peaks found
BLANK!    Event 52: 1 peaks found
BLANK!    Event 53: 5 peaks found
BLANK!    Event 54: 6 peaks found
HIT!!!!   Event 55: 67 peaks found
BLANK!    Event 56: 4 peaks found
BLANK!    Event 57: 4 peaks found
BLANK!    Event 58: 1 peaks found
BLANK!    Event 59: 1 peaks found
BLANK!    Event 60: 1 peaks found
BLANK!    Event 61: 1 peaks found
```

```
BLANK!    Event 62: 1 peaks found
HIT!!!!   Event 63: 56 peaks found
HIT!!!!   Event 64: 66 peaks found
BLANK!    Event 65: 4 peaks found
BLANK!    Event 66: 4 peaks found
BLANK!    Event 67: 1 peaks found
BLANK!    Event 68: 1 peaks found
BLANK!    Event 69: 1 peaks found
BLANK!    Event 70: 1 peaks found
BLANK!    Event 71: 2 peaks found
BLANK!    Event 72: 1 peaks found
BLANK!    Event 73: 1 peaks found
BLANK!    Event 74: 3 peaks found
BLANK!    Event 75: 1 peaks found
BLANK!    Event 76: 1 peaks found
HIT!!!!   Event 77: 23 peaks found
HIT!!!!   Event 78: 28 peaks found
HIT!!!!   Event 79: 31 peaks found
BLANK!    Event 80: 1 peaks found
BLANK!    Event 81: 6 peaks found
BLANK!    Event 82: 1 peaks found
BLANK!    Event 83: 1 peaks found
BLANK!    Event 84: 1 peaks found
HIT!!!!   Event 85: 77 peaks found
BLANK!    Event 86: 1 peaks found
BLANK!    Event 87: 1 peaks found
BLANK!    Event 88: 5 peaks found
BLANK!    Event 89: 1 peaks found
BLANK!    Event 90: 1 peaks found
BLANK!    Event 91: 2 peaks found
HIT!!!!   Event 92: 10 peaks found
HIT!!!!   Event 93: 14 peaks found
BLANK!    Event 94: 2 peaks found
HIT!!!!   Event 95: 10 peaks found
HIT!!!!   Event 96: 26 peaks found
BLANK!    Event 97: 1 peaks found
BLANK!    Event 98: 2 peaks found
BLANK!    Event 99: 1 peaks found
BLANK!    Event 100: 1 peaks found
BLANK!    Event 101: 1 peaks found
BLANK!    Event 102: 1 peaks found
BLANK!    Event 103: 3 peaks found
BLANK!    Event 104: 1 peaks found
HIT!!!!   Event 105: 38 peaks found
BLANK!    Event 106: 8 peaks found
BLANK!    Event 107: 1 peaks found
BLANK!    Event 108: 7 peaks found
HIT!!!!   Event 109: 35 peaks found
```

```
HIT!!!!   Event 110: 10 peaks found
BLANK!    Event 111: 7 peaks found
BLANK!    Event 112: 8 peaks found
HIT!!!!   Event 113: 76 peaks found
HIT!!!!   Event 114: 21 peaks found
BLANK!    Event 115: 1 peaks found
BLANK!    Event 116: 2 peaks found
BLANK!    Event 117: 1 peaks found
BLANK!    Event 118: 4 peaks found
BLANK!    Event 119: 2 peaks found
BLANK!    Event 120: 1 peaks found
BLANK!    Event 121: 2 peaks found
BLANK!    Event 122: 1 peaks found
BLANK!    Event 123: 9 peaks found
BLANK!    Event 124: 1 peaks found
BLANK!    Event 125: 1 peaks found
BLANK!    Event 126: 1 peaks found
BLANK!    Event 127: 2 peaks found
HIT!!!!   Event 128: 59 peaks found
BLANK!    Event 129: 1 peaks found
BLANK!    Event 130: 1 peaks found
BLANK!    Event 131: 2 peaks found
BLANK!    Event 132: 3 peaks found
BLANK!    Event 133: 3 peaks found
BLANK!    Event 134: 1 peaks found
HIT!!!!   Event 135: 43 peaks found
BLANK!    Event 136: 6 peaks found
HIT!!!!   Event 137: 27 peaks found
BLANK!    Event 138: 4 peaks found
BLANK!    Event 139: 5 peaks found
BLANK!    Event 140: 1 peaks found
BLANK!    Event 141: 1 peaks found
HIT!!!!   Event 142: 45 peaks found
BLANK!    Event 143: 6 peaks found
BLANK!    Event 144: 1 peaks found
HIT!!!!   Event 145: 12 peaks found
BLANK!    Event 146: 4 peaks found
BLANK!    Event 147: 1 peaks found
BLANK!    Event 148: 1 peaks found
BLANK!    Event 149: 1 peaks found
BLANK!    Event 150: 3 peaks found
BLANK!    Event 151: 1 peaks found
BLANK!    Event 152: 4 peaks found
BLANK!    Event 153: 3 peaks found
BLANK!    Event 154: 4 peaks found
BLANK!    Event 155: 3 peaks found
HIT!!!!   Event 156: 32 peaks found
BLANK!    Event 157: 6 peaks found
```

```
BLANK!    Event 158: 5 peaks found
HIT!!!!   Event 159: 41 peaks found
BLANK!    Event 160: 4 peaks found
BLANK!    Event 161: 5 peaks found
HIT!!!!   Event 162: 22 peaks found
BLANK!    Event 163: 1 peaks found
BLANK!    Event 164: 2 peaks found
HIT!!!!   Event 165: 44 peaks found
BLANK!    Event 166: 1 peaks found
BLANK!    Event 167: 1 peaks found
HIT!!!!   Event 168: 34 peaks found
BLANK!    Event 169: 1 peaks found
HIT!!!!   Event 170: 30 peaks found
BLANK!    Event 171: 1 peaks found
BLANK!    Event 172: 3 peaks found
BLANK!    Event 173: 2 peaks found
BLANK!    Event 174: 1 peaks found
BLANK!    Event 175: 1 peaks found
BLANK!    Event 176: 1 peaks found
BLANK!    Event 177: 1 peaks found
BLANK!    Event 178: 5 peaks found
BLANK!    Event 179: 3 peaks found
BLANK!    Event 180: 1 peaks found
BLANK!    Event 181: 6 peaks found
BLANK!    Event 182: 1 peaks found
BLANK!    Event 183: 2 peaks found
HIT!!!!   Event 184: 17 peaks found
HIT!!!!   Event 185: 17 peaks found
BLANK!    Event 186: 6 peaks found
BLANK!    Event 187: 1 peaks found
BLANK!    Event 188: 3 peaks found
BLANK!    Event 189: 4 peaks found
BLANK!    Event 190: 2 peaks found
BLANK!    Event 191: 1 peaks found
HIT!!!!   Event 192: 16 peaks found
BLANK!    Event 193: 1 peaks found
BLANK!    Event 194: 1 peaks found
BLANK!    Event 195: 2 peaks found
BLANK!    Event 196: 1 peaks found
BLANK!    Event 197: 4 peaks found
BLANK!    Event 198: 2 peaks found
BLANK!    Event 199: 7 peaks found
BLANK!    Event 200: 2 peaks found
BLANK!    Event 201: 7 peaks found
BLANK!    Event 202: 1 peaks found
BLANK!    Event 203: 1 peaks found
BLANK!    Event 204: 3 peaks found
BLANK!    Event 205: 1 peaks found
```

```
BLANK!    Event 206: 7 peaks found
BLANK!    Event 207: 3 peaks found
HIT!!!!   Event 208: 20 peaks found
BLANK!    Event 209: 1 peaks found
BLANK!    Event 210: 2 peaks found
HIT!!!!   Event 211: 85 peaks found
BLANK!    Event 212: 1 peaks found
HIT!!!!   Event 213: 22 peaks found
BLANK!    Event 214: 1 peaks found
BLANK!    Event 215: 1 peaks found
BLANK!    Event 216: 2 peaks found
BLANK!    Event 217: 1 peaks found
BLANK!    Event 218: 1 peaks found
HIT!!!!   Event 219: 49 peaks found
BLANK!    Event 220: 6 peaks found
BLANK!    Event 221: 1 peaks found
BLANK!    Event 222: 9 peaks found
BLANK!    Event 223: 3 peaks found
BLANK!    Event 224: 3 peaks found
BLANK!    Event 225: 2 peaks found
BLANK!    Event 226: 1 peaks found
BLANK!    Event 227: 1 peaks found
BLANK!    Event 228: 1 peaks found
BLANK!    Event 229: 1 peaks found
BLANK!    Event 230: 1 peaks found
BLANK!    Event 231: 1 peaks found
BLANK!    Event 232: 1 peaks found
HIT!!!!   Event 233: 54 peaks found
BLANK!    Event 234: 3 peaks found
BLANK!    Event 235: 3 peaks found
BLANK!    Event 236: 8 peaks found
HIT!!!!   Event 237: 69 peaks found
HIT!!!!   Event 238: 58 peaks found
HIT!!!!   Event 239: 11 peaks found
HIT!!!!   Event 240: 32 peaks found
HIT!!!!   Event 241: 28 peaks found
BLANK!    Event 242: 6 peaks found
BLANK!    Event 243: 3 peaks found
BLANK!    Event 244: 1 peaks found
BLANK!    Event 245: 5 peaks found
HIT!!!!   Event 246: 13 peaks found
BLANK!    Event 247: 4 peaks found
BLANK!    Event 248: 3 peaks found
BLANK!    Event 249: 4 peaks found
BLANK!    Event 250: 4 peaks found
HIT!!!!   Event 251: 44 peaks found
BLANK!    Event 252: 3 peaks found
BLANK!    Event 253: 1930 peaks found
```

```
BLANK!    Event 254: 4 peaks found
BLANK!    Event 255: 1 peaks found
BLANK!    Event 256: 1 peaks found
BLANK!    Event 257: 1 peaks found
BLANK!    Event 258: 1 peaks found
HIT!!!!   Event 259: 81 peaks found
BLANK!    Event 260: 1 peaks found
BLANK!    Event 261: 1 peaks found
BLANK!    Event 262: 1 peaks found
BLANK!    Event 263: 2 peaks found
BLANK!    Event 264: 1 peaks found
BLANK!    Event 265: 3 peaks found
BLANK!    Event 266: 4 peaks found
HIT!!!!   Event 267: 24 peaks found
BLANK!    Event 268: 4 peaks found
BLANK!    Event 269: 1 peaks found
BLANK!    Event 270: 1 peaks found
BLANK!    Event 271: 1 peaks found
BLANK!    Event 272: 1 peaks found
BLANK!    Event 273: 1 peaks found
BLANK!    Event 274: 1 peaks found
BLANK!    Event 275: 4 peaks found
BLANK!    Event 276: 1 peaks found
BLANK!    Event 277: 1 peaks found
BLANK!    Event 278: 1 peaks found
BLANK!    Event 279: 2 peaks found
BLANK!    Event 280: 1 peaks found
BLANK!    Event 281: 1 peaks found
BLANK!    Event 282: 8 peaks found
BLANK!    Event 283: 2 peaks found
BLANK!    Event 284: 1 peaks found
BLANK!    Event 285: 1 peaks found
BLANK!    Event 286: 3 peaks found
BLANK!    Event 287: 1 peaks found
BLANK!    Event 288: 1 peaks found
BLANK!    Event 289: 7 peaks found
BLANK!    Event 290: 4 peaks found
BLANK!    Event 291: 1 peaks found
BLANK!    Event 292: 1 peaks found
BLANK!    Event 293: 9 peaks found
BLANK!    Event 294: 1 peaks found
BLANK!    Event 295: 2 peaks found
BLANK!    Event 296: 2 peaks found
BLANK!    Event 297: 1 peaks found
BLANK!    Event 298: 2 peaks found
BLANK!    Event 299: 4 peaks found
BLANK!    Event 300: 5 peaks found
BLANK!    Event 301: 1 peaks found
```

```
BLANK!    Event 302: 5 peaks found
BLANK!    Event 303: 2 peaks found
HIT!!!!   Event 304: 32 peaks found
HIT!!!!   Event 305: 15 peaks found
HIT!!!!   Event 306: 18 peaks found
BLANK!    Event 307: 1 peaks found
BLANK!    Event 308: 2 peaks found
HIT!!!!   Event 309: 27 peaks found
BLANK!    Event 310: 1 peaks found
HIT!!!!   Event 311: 26 peaks found
BLANK!    Event 312: 1 peaks found
BLANK!    Event 313: 1 peaks found
BLANK!    Event 314: 2 peaks found
BLANK!    Event 315: 5 peaks found
BLANK!    Event 316: 3 peaks found
BLANK!    Event 317: 2096 peaks found
BLANK!    Event 318: 5 peaks found
BLANK!    Event 319: 3 peaks found
HIT!!!!   Event 320: 15 peaks found
BLANK!    Event 321: 1 peaks found
BLANK!    Event 322: 5 peaks found
BLANK!    Event 323: 2 peaks found
HIT!!!!   Event 324: 13 peaks found
BLANK!    Event 325: 4 peaks found
BLANK!    Event 326: 3 peaks found
BLANK!    Event 327: 2 peaks found
BLANK!    Event 328: 1 peaks found
BLANK!    Event 329: 2 peaks found
BLANK!    Event 330: 1 peaks found
BLANK!    Event 331: 6 peaks found
BLANK!    Event 332: 1 peaks found
HIT!!!!   Event 333: 31 peaks found
BLANK!    Event 334: 1 peaks found
BLANK!    Event 335: 1 peaks found
BLANK!    Event 336: 1 peaks found
HIT!!!!   Event 337: 16 peaks found
BLANK!    Event 338: 1 peaks found
BLANK!    Event 339: 1 peaks found
BLANK!    Event 340: 3 peaks found
BLANK!    Event 341: 1 peaks found
BLANK!    Event 342: 1 peaks found
BLANK!    Event 343: 1 peaks found
BLANK!    Event 344: 4 peaks found
HIT!!!!   Event 345: 24 peaks found
BLANK!    Event 346: 3 peaks found
BLANK!    Event 347: 7 peaks found
HIT!!!!   Event 348: 48 peaks found
BLANK!    Event 349: 5 peaks found
```

```
HIT!!!!   Event 350: 13 peaks found
BLANK!    Event 351: 3 peaks found
BLANK!    Event 352: 1 peaks found
BLANK!    Event 353: 1 peaks found
BLANK!    Event 354: 1 peaks found
BLANK!    Event 355: 1 peaks found
BLANK!    Event 356: 1 peaks found
BLANK!    Event 357: 2 peaks found
BLANK!    Event 358: 1 peaks found
BLANK!    Event 359: 1 peaks found
BLANK!    Event 360: 1 peaks found
BLANK!    Event 361: 2 peaks found
HIT!!!!   Event 362: 76 peaks found
BLANK!    Event 363: 9 peaks found
BLANK!    Event 364: 1 peaks found
BLANK!    Event 365: 1 peaks found
HIT!!!!   Event 366: 11 peaks found
BLANK!    Event 367: 6 peaks found
BLANK!    Event 368: 2 peaks found
BLANK!    Event 369: 1 peaks found
BLANK!    Event 370: 1 peaks found
BLANK!    Event 371: 6 peaks found
BLANK!    Event 372: 4 peaks found
HIT!!!!   Event 373: 10 peaks found
BLANK!    Event 374: 2 peaks found
BLANK!    Event 375: 4 peaks found
HIT!!!!   Event 376: 13 peaks found
BLANK!    Event 377: 5 peaks found
BLANK!    Event 378: 1 peaks found
BLANK!    Event 379: 1 peaks found
BLANK!    Event 380: 1 peaks found
BLANK!    Event 381: 1 peaks found
BLANK!    Event 382: 3 peaks found
HIT!!!!   Event 383: 15 peaks found
HIT!!!!   Event 384: 18 peaks found
BLANK!    Event 385: 7 peaks found
BLANK!    Event 386: 9 peaks found
BLANK!    Event 387: 8 peaks found
HIT!!!!   Event 388: 33 peaks found
BLANK!    Event 389: 6 peaks found
HIT!!!!   Event 390: 24 peaks found
HIT!!!!   Event 391: 35 peaks found
HIT!!!!   Event 392: 55 peaks found
BLANK!    Event 393: 1616 peaks found
HIT!!!!   Event 394: 13 peaks found
BLANK!    Event 395: 1 peaks found
BLANK!    Event 396: 1 peaks found
BLANK!    Event 397: 5 peaks found
```

```
BLANK!    Event 398: 2 peaks found
BLANK!    Event 399: 5 peaks found
BLANK!    Event 400: 4 peaks found
BLANK!    Event 401: 3 peaks found
HIT!!!!   Event 402: 36 peaks found
BLANK!    Event 403: 5 peaks found
HIT!!!!   Event 404: 21 peaks found
BLANK!    Event 405: 3 peaks found
HIT!!!!   Event 406: 15 peaks found
BLANK!    Event 407: 1 peaks found
BLANK!    Event 408: 4 peaks found
BLANK!    Event 409: 2 peaks found
BLANK!    Event 410: 6 peaks found
BLANK!    Event 411: 1 peaks found
BLANK!    Event 412: 2 peaks found
BLANK!    Event 413: 4 peaks found
HIT!!!!   Event 414: 11 peaks found
HIT!!!!   Event 415: 21 peaks found
BLANK!    Event 416: 4 peaks found
BLANK!    Event 417: 1 peaks found
BLANK!    Event 418: 1 peaks found
HIT!!!!   Event 419: 22 peaks found
HIT!!!!   Event 420: 104 peaks found
BLANK!    Event 421: 1 peaks found
BLANK!    Event 422: 1 peaks found
BLANK!    Event 423: 1 peaks found
BLANK!    Event 424: 1 peaks found
BLANK!    Event 425: 2 peaks found
BLANK!    Event 426: 4 peaks found
BLANK!    Event 427: 1 peaks found
BLANK!    Event 428: 1 peaks found
BLANK!    Event 429: 1 peaks found
BLANK!    Event 430: 2525 peaks found
BLANK!    Event 431: 4 peaks found
BLANK!    Event 432: 1 peaks found
BLANK!    Event 433: 1 peaks found
BLANK!    Event 434: 5 peaks found
BLANK!    Event 435: 4 peaks found
HIT!!!!   Event 436: 21 peaks found
BLANK!    Event 437: 1 peaks found
BLANK!    Event 438: 1 peaks found
BLANK!    Event 439: 3 peaks found
BLANK!    Event 440: 4 peaks found
HIT!!!!   Event 441: 16 peaks found
HIT!!!!   Event 442: 19 peaks found
BLANK!    Event 443: 1 peaks found
BLANK!    Event 444: 1 peaks found
HIT!!!!   Event 445: 26 peaks found
```

```
BLANK!    Event 446: 7 peaks found
BLANK!    Event 447: 2 peaks found
BLANK!    Event 448: 2 peaks found
BLANK!    Event 449: 3 peaks found
BLANK!    Event 450: 1 peaks found
BLANK!    Event 451: 1 peaks found
BLANK!    Event 452: 1 peaks found
BLANK!    Event 453: 1 peaks found
BLANK!    Event 454: 2 peaks found
BLANK!    Event 455: 1 peaks found
HIT!!!!   Event 456: 21 peaks found
BLANK!    Event 457: 1 peaks found
BLANK!    Event 458: 2 peaks found
BLANK!    Event 459: 2 peaks found
BLANK!    Event 460: 1 peaks found
HIT!!!!   Event 461: 34 peaks found
BLANK!    Event 462: 6 peaks found
HIT!!!!   Event 463: 52 peaks found
BLANK!    Event 464: 3 peaks found
BLANK!    Event 465: 2 peaks found
BLANK!    Event 466: 1 peaks found
BLANK!    Event 467: 2 peaks found
HIT!!!!   Event 468: 14 peaks found
BLANK!    Event 469: 1 peaks found
HIT!!!!   Event 470: 11 peaks found
BLANK!    Event 471: 4 peaks found
BLANK!    Event 472: 1 peaks found
BLANK!    Event 473: 1 peaks found
BLANK!    Event 474: 3 peaks found
BLANK!    Event 475: 1 peaks found
BLANK!    Event 476: 3881 peaks found
HIT!!!!   Event 477: 45 peaks found
BLANK!    Event 478: 4 peaks found
BLANK!    Event 479: 1 peaks found
BLANK!    Event 480: 1 peaks found
BLANK!    Event 481: 1 peaks found
BLANK!    Event 482: 1 peaks found
BLANK!    Event 483: 4 peaks found
BLANK!    Event 484: 2 peaks found
BLANK!    Event 485: 1 peaks found
BLANK!    Event 486: 4 peaks found
BLANK!    Event 487: 4 peaks found
BLANK!    Event 488: 5 peaks found
HIT!!!!   Event 489: 17 peaks found
HIT!!!!   Event 490: 44 peaks found
BLANK!    Event 491: 2 peaks found
HIT!!!!   Event 492: 23 peaks found
BLANK!    Event 493: 3 peaks found
```

```
BLANK!   Event 494: 1 peaks found
BLANK!   Event 495: 6 peaks found
BLANK!   Event 496: 4 peaks found
BLANK!   Event 497: 5 peaks found
BLANK!   Event 498: 5 peaks found
BLANK!   Event 499: 1 peaks found
------------------------------------------------------------------
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/test_split.lst00000
 100   out of  500  hits found!
 HIT rate: 20.00 %
------------------------------------------------------------------
```

In [51]: !cat test_split.lst00000eve.lst

```
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_17_6484.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_41_6172.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_7339.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_1_2989.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_11_1523.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_59_6964.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_2497.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_6172.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_3_8850.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_9864.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_8064.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_45_9660.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_4_3704.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_3729.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_40_5741.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_39_7097.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_6661.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_40_7882.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_43_6082.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_59_4532.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_18_7299.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_40_9424.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_41_1256.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_0661.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_3744.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_45_1833.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_0764.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_40_0110.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_41_1910.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_59_3288.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_1334.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_18_3772.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_60_1713.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_43_3462.cbf
```

```
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_8319.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_59_1303.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_8328.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_5714.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_45_0676.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_39_6980.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_41_9940.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_59_0801.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_60_0122.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_2247.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_5184.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_6984.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_5521.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_16_9496.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_60_0821.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_0773.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_7719.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_8_3445.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_39_4722.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_39_7685.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_1_6168.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_6081.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_7881.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_38_3172.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_41_4366.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_60_4752.cbf
```

```
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_12_3126.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_6247.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_1321.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_11_8390.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_47_8522.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_39_0710.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_40_7703.cbf
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/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_3540.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_12_1704.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_43_7631.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_42_3646.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_10_9271.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_18_4655.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_44_6683.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_46_2593.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_18_7457.cbf
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/data/Lyso2000/images/Lyso2000_1_2376.cbf
```

1.6 Check the distribution of peaks as a first diagnosis using .pkl file

```python
In [52]: import pickle as pk
         f=open('test_split.lst00000_peak_info.pkl','rb')
         peak_dict=pk.load(f)
         f.close()
         peak_dict.keys()

Out[52]: dict_keys(['cbf_file_list_file', 'nPeaks', 'peakTotalIntensity', 'peakXPosRaw', 'peak'

In [55]: cbf_file_list_file=peak_dict['cbf_file_list_file']
         nPeaks=peak_dict['nPeaks']
         peakXPosRaw=peak_dict['peakXPosRaw']
         peakYPosRaw=peak_dict['peakYPosRaw']
         #print(peakXPosRaw.shape)
         #print(nPeaks.shape)
         Npeaks=nPeaks.sum()
         print('There are %d peaks for the files in the list "%s"'%(Npeaks,cbf_file_list_file)
         peakX=peakXPosRaw.reshape(-1,)
         #print(peakX.shape)
         peakX=peakX[peakX!=0]
         #print(peakX.shape)
         peakY=peakYPosRaw.reshape(-1,)
         #print(peakY.shape)
         peakY=peakY[peakY!=0]
         #print(peakY.shape)
         RD=np.sqrt((peakX-center_x)**2+(peakY-center_y)**2);
         #print(RD.shape)
```
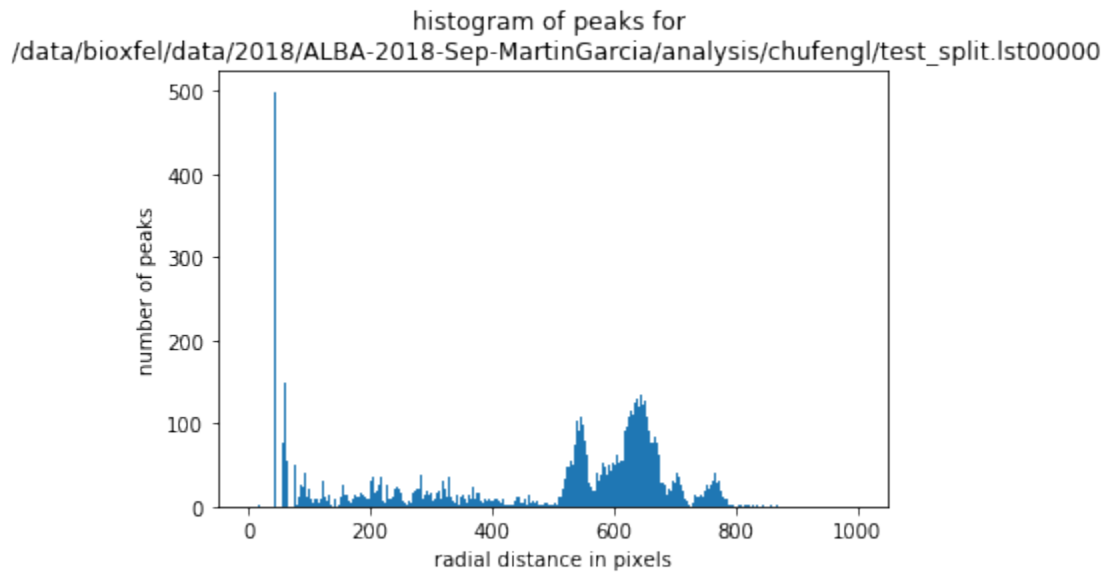
```
plt.figure()
plt.hist(RD,bins=np.linspace(0,1000,500));
plt.xlabel('radial distance in pixels')
plt.ylabel('number of peaks')
plt.title('histogram of peaks for \n %s'%(cbf_file_list_file));
```

There are 10328 peaks for the files in the list "/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGa

histogram of peaks for
/data/bioxfel/data/2018/ALBA-2018-Sep-MartinGarcia/analysis/chufengl/test_split.lst00000

1.7 Tips:

1. split the .cbf file list into batches of smaller ones using "split -d", so that multiples processes of hit-finding can be launched simultaneously.
2. Copy only the "hits" to your hard drive, by using "rsync –files-from=*.eve.lst "
3. Check the configuration of the computation system always, before launching multiples processes.