PEPICO_Elettra_VG – Data Analysis in Python

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Software Structure

Main program:

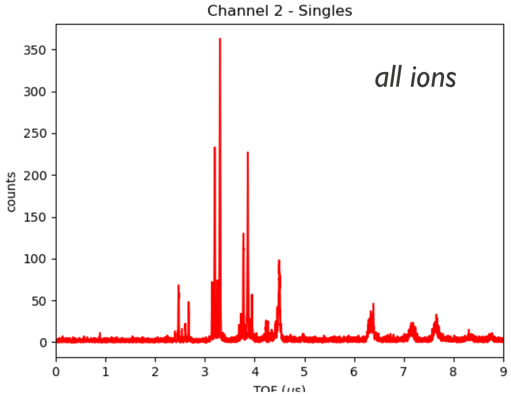
- main.py runs the code with the parameters provided in the input section

Classes:

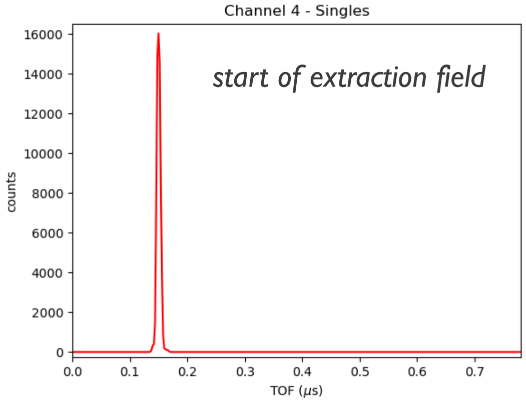
- VG_tof.py reads in the raw files and creates lists with electron coordinates, ion stop times, start times, and assigns corresponding events
- VG_tof_only.py ion TOF spectra started by anode or random trigger
- VG_figures.py plots histograms, images, spectra
- VG_Movie_Tof.py produces electron energy selected TOF spectra and subtracts weighted TOF spectrum of randoms

Output: channel histograms

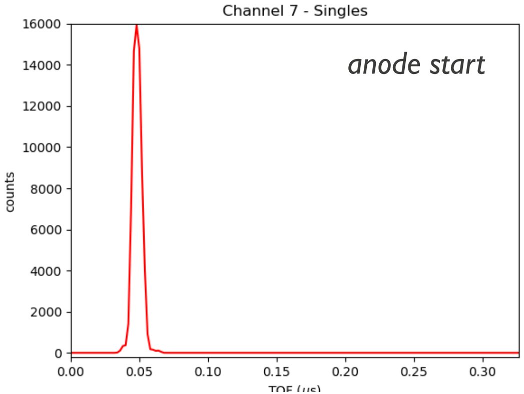
Channel stops in coincidence with a complete electron event


Channel 2 - Singles

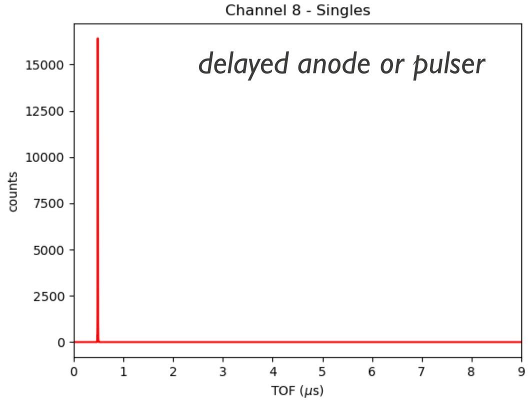
all ions


Channel 4 - Singles

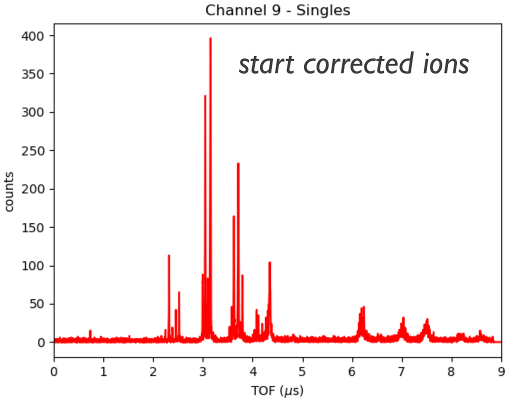
start of extraction field


Channel 7 - Singles

anode start

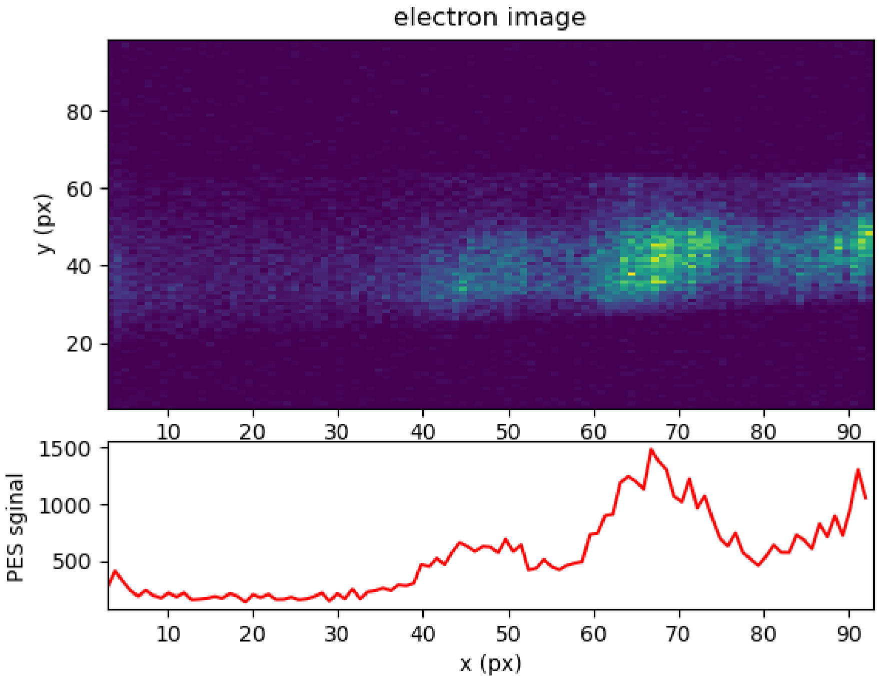

Channel 8 - Singles

delayed anode or pulser


Channel 9 - Singles

start corrected ions

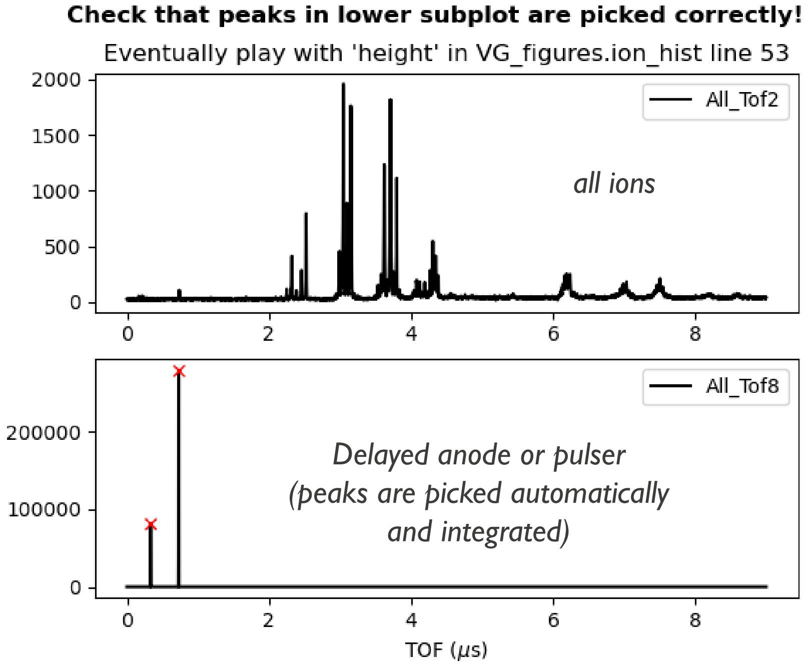
Output: electron image



electron image in px

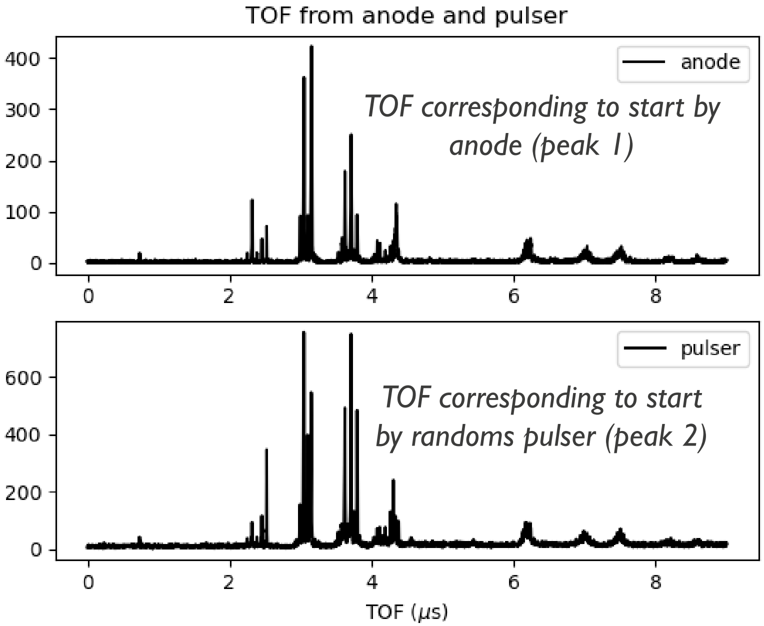
Projection on x-axis corresponding to electron energy

Output: TOF spectra (no coincidences)



all ions

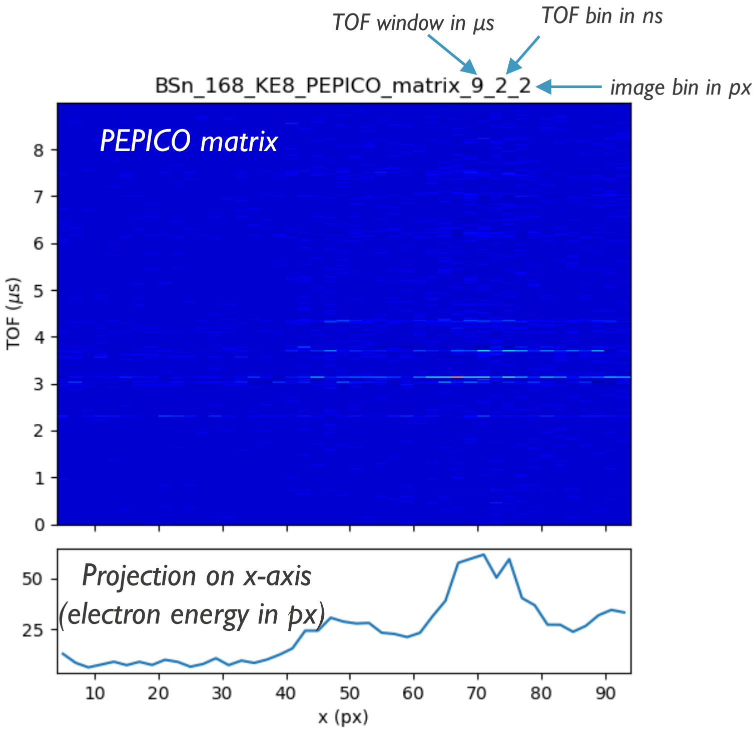
Delayed anode or pulser (peaks are picked automatically and integrated)



TOF corresponding to start by anode (peak 1)

TOF corresponding to start by randoms pulser (peak 2)

Output: PEPICO matrix (final result)



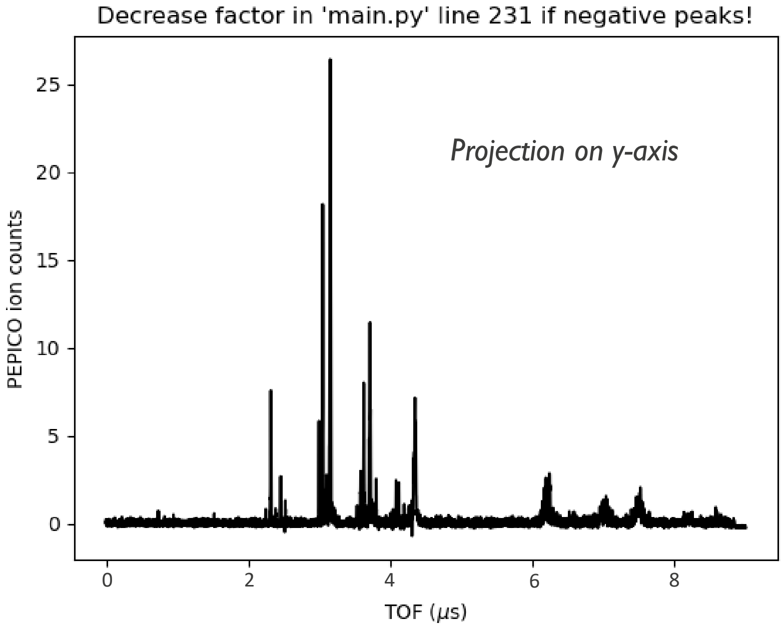
TOF window in μs

TOF bin in ns

image bin in px

PEPICO matrix

Projection on x-axis (electron energy in px)



Decrease factor in 'main.py' line 231 if negative peaks!

Projection on y-axis

Output: Files

_PEPICO_matrix.dat	text file containing the final PEPICO matrix (columns = TOF, rows = electron energy)
_PEPICO_matrix.png	.png image of the PEPICO matrix figure

The 3 numbers at the end of the file name give the TOF upper limit in µs, the binning of the TOF spectrum in ns, and the binning of the electron image energy axis in px.

_9_2_2.dat contains therefore a (45,4500) matrix, for which the energy axis runs from 0 to 90 px in steps of 2 px, and the TOF axis runs from 0 to 9 µs in steps of 2 ns.

Putting together the kinetic energy groups

PEPICO_complete_sp.py

Puts together the PEPICO matrices for the different energy regions to obtain the complete matrix (overlapping regions are averaged)

Input needed in the first section

path to folder containing the input matrices

identifier of the mesurement

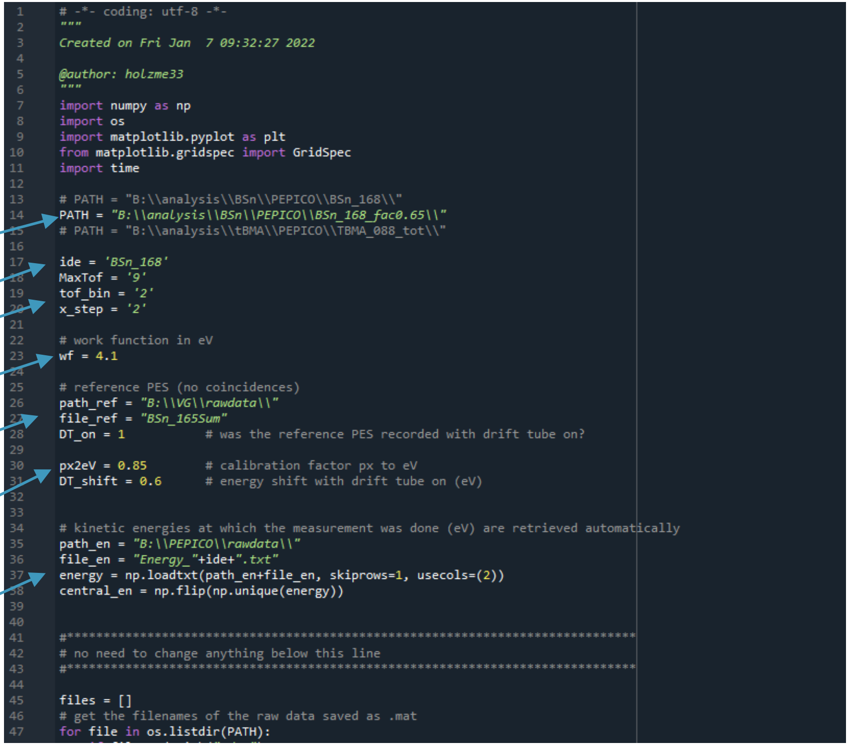
parameters used in the previous analysis

work function

path and file to a reference PES

energy calibration factor for PEPICO

central energies of the different regions are retrieved automatically from the Energy .txt file

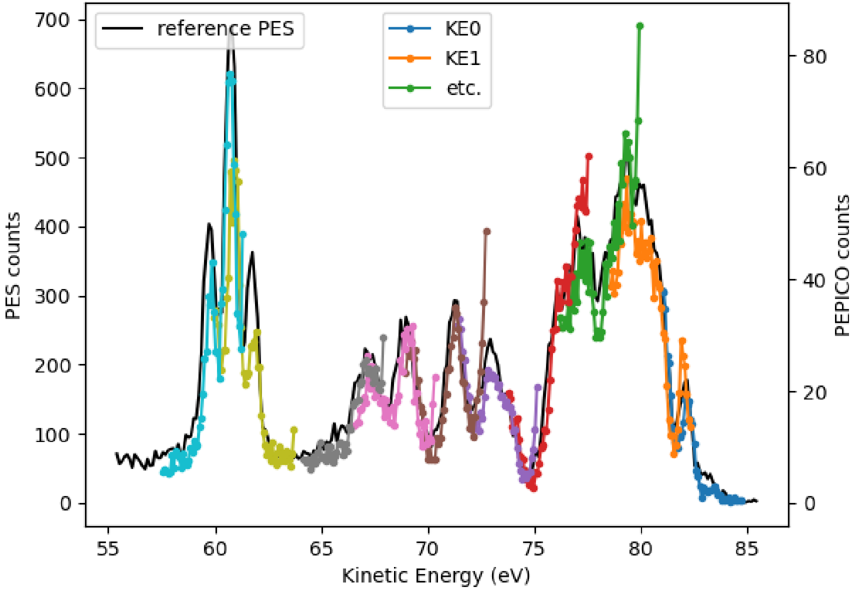


```python
# -*- coding: utf-8 -*-
"""
Created on Fri Jan  7 09:32:27 2022

@author: holzme33
"""
import numpy as np
import os
import matplotlib.pyplot as plt
from matplotlib.gridspec import GridSpec
import time

# PATH = "B:\\analysis\\BSn\\PEPICO\\BSn_168\\"
PATH = "B:\\analysis\\BSn\\PEPICO\\BSn_168_fac0.65\\"
# PATH = "B:\\analysis\\tBMA\\PEPICO\\TBMA_088_tot\\"

ide = 'BSn_168'
MaxTof = '9'
tof_bin = '2'
x_step = '2'

# work function in eV
wf = 4.1

# reference PES (no coincidences)
path_ref = "B:\\VG\\rawdata\\"
file_ref = "BSn_165Sum"
DT_on = 1           # was the reference PES recorded with drift tube on?

px2eV = 0.85        # calibration factor px to eV
DT_shift = 0.6      # energy shift with drift tube on (eV)


# kinetic energies at which the measurement was done (eV) are retrieved automatically
path_en = "B:\\PEPICO\\rawdata\\"
file_en = "Energy_"+ide+".txt"
energy = np.loadtxt(path_en+file_en, skiprows=1, usecols=(2))
central_en = np.flip(np.unique(energy))


#*******************************************************************************
# no need to change anything below this line
#*******************************************************************************

files = []
# get the filenames of the raw data saved as .mat
for file in os.listdir(PATH):
```

Check parameters, calibration, etc.

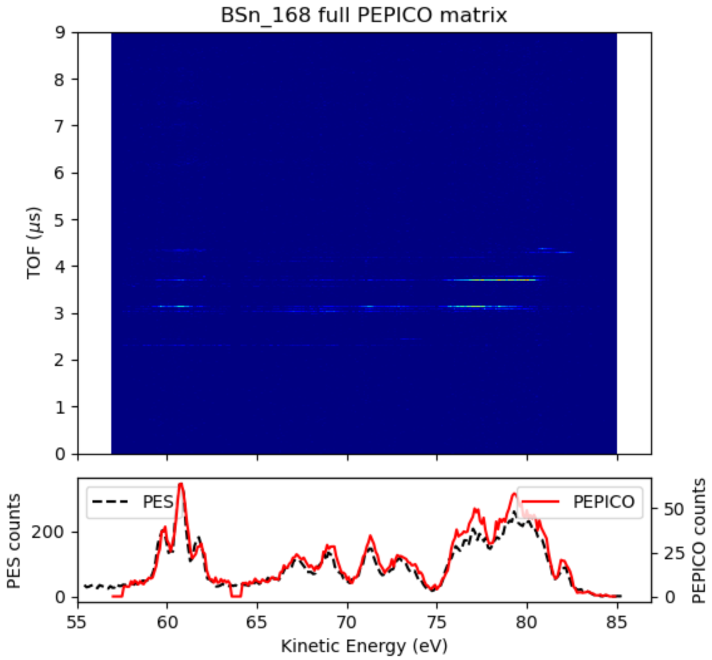
Compares the mass-integrated electron spectra for the individual energy regions to the pure photoelectron spectrum.

- Adjust drift tube shift if needed
- Adjust px2eV calibration parameter if needed



Combined PEPICO matrix

- Plots the combined PEPICO matrix and compares the mass-integrated electron spectrum to the reference PES
- Saves the figure as .png
- Saves the matrix and the kinetic energy axis, and the TOF axis in .txt files
- ‘cut’ (line 85) specifies how many points are dismissed for each energy region at the high energy side
- ‘z_max’ (line 88) defines the upper limit of the z axis (lower limit is by default 0)



Contact

Address questions, suggestions for extension, bug reports etc. to:

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