

PI_ICR_simulated_data Documentation

Sam Porter (wporter@triumf.ca)
University of British Columbia
TRIUMF, on behalf of the TITAN Collaboration

Overview

- **Language:** MATLAB
- PI_ICR_simulated_data.m creates simulated data files based on user-input cyclotron frequencies and accumulation times
- **Input:** Various User Inputs (detailed later)
- **Output:**
 - .csv files containing simulated position, time-of-flight and (fake) TDC trigger information
 - One .csv file containing an address list of files, their accumulations times (Taccs) and reference files assignments

User Inputs

```
tacc_list = [.6000002,.6000141,.600030,.6000479,.6000658,.6001155,.6001513,.6001702,.600203]; % List of Accumulation Times
new_filename = '/Users/wspporter/Documents/Physics_Research/TITAN/PIICR_Analysis/Simulated_Data/56V_small_forplot/56V_sim';

spot_freq_list = [1005878.022,1005860.729,1005856.879,1005842.204,1005750.655]; % Expected w_c of spots in the trap
R = 4; % Average radius of spots
pos_deviation = 0.5; % Sigma of Gaussian distribution for X/Y positions
TOF = 0.000006; % Mean of Gaussian distribution for time-of-flight
tof_deviation = 0.000003 % Sigma of Gaussian distribution for time-of-flight

counts_per_spot = 100;
w_minus = 6150;
amp = 0.01; % Amplitude of Sine Dependency
phase_const = 10; % Phase Constant of Sine Dependency
ref_phase = 150; % Phase of Reference Spot
```

User Inputs

- **tacc_list:** A list of accumulation times you want data simulated for. One file will be made for each Tacc
- **new_filename:** Directory (and filename) to be used
- **spot_freq_list:** A list of cyclotron frequencies of spots you want in the simulated files
 - These can be taken from TITAN_spreadsheet.xlsx
- **R:** Average distance from trap center of the spots
- **pos_deviation:** Simulated Gaussian spread of X/Y positions
- **TOF:** Simulated ToF between ejection and detector of counts

User Inputs

- **tof_deviation:** Simulated Gaussian spread of ToFs
- **counts_per_spot:** Counts to be simulated for each spot (where spots are determined by cyclotron frequency list)
- **w_minus:** Magnetron frequency in trap
- **amp:** Amplitude of the sinusoid dependence (see Automatic Fitting for more explanation)
- **phase_const:** Phase constant of the sinusoid dependence
- **ref_phase:** Phase of the reference (i.e. $T_{acc} = 0$) spot

new_filename

- new_filename should be of the form: ~/path/to/directory/filename
 - ~/path/to/directory is the directory where files will be saved
 - filename will be the name of the FileList.csv
 - filenameTacc.csv will be the name of each simulated data file (where Tacc will be the respective Tacc number)
- NOTE: When using simulated data with PhIAT.m, make sure **Sim Ion Rate is checked** and the **trap center is set as (0,0)**
- Once user inputs are done, press the MATLAB run button to create your files!

- For more on **PhIAT**, please reference the Automatic Fitting documentation
- Please contact Sam Porter (wporter@triumf.ca) if you have any questions