A PET training demonstrator

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PiPET main specs

- Hamamatsu H12700 MA-PMT photo-detectors
- 26 x 27 pixels
- 1.7 mm pitch
- LYSO matrix
- 3D printed mechanics ± 0.15 mm precision
Accessible FPGA-based electronics

- 4x peak detectors
- Test points
- Altera FPGA
- Xilinx FPGA
- Breakout board
- Anger encoder and CFD
- Test points
Python-based high level development framework

- Connect remotely with an own laptop
- Follow example calibration techniques
- Measure key characteristics of the PET system
- Customize firmware and software to improve system performances

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In [11]: pet.init('files/firmware.bit')
EVENTS_PER_ACQ = 30000
N_ACQUISITIONS = 5
with open('files/coincidences.evt.dat', 'w') as f:
    for i in range(N_ACQUISITIONS):
        a = pet.acquire('coinc', events=EVENTS_PER_ACQ)
        a.tofile(f)

pds = json.loads(open('files/pedestal.json').read())
raw_data = memmap('files/coinc.evt.dat', dtype=uint16, mode='r')
e = parser.raw2evt(raw_data);

# Correcting pedestals
for j in ['a', 'b']:
    e[j] = {n: e[j][n] - pds[j][n] for n in ['xa', 'xb', 'ya', 'yb']}  

# Calculating energy histograms
en = e['xa'] + e['xb'] + e['ya'] + e['yb']
en, _ = histogram(en)

# Calculating flood maps
x = (e['xa'] - e['xb']) / (e['xa'] + e['xb'])
y = (e['ya'] - e['yb']) / (e['ya'] + e['yb'])
```
Calibration exercises

Timing and S/N

Expected FWHM = 15.62 ns
Measured FWHM = 16.98 ns
Offset = 1.12 ns

Coincidence window

Pixel identification