EO sampling for A0

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What we did and what we planed

• Scanning delay method using EO effect
  – Done by Fitch et. al very difficult to understand with the presence of huge weak field background

• EO sampling simulation
  – Done using the algorithm developed by DESY

• EO experiment (single shot)
  – Ti:sapphire laser (800nm) is in order
  – One of the Fiber laser (1560nm) is ready
Single shot scheme

Spectral Decoding

Spatial Decoding

Temporal Decoding
## Comparision

<table>
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<th>Pros</th>
<th>SD sampling</th>
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|      | • Simple laser system  
• Arbitrary time windows  
• High resolution | • Simple laser system  
• Single shot measurement  
• High repetition rate | • Large time window  
• High resolution (110 fs)  
• Single shot measurement | • Simple laser system  
• Single shot measurement  
• High resolution (160 fs)  
• High repetition rate |
| Cons | • No single shot measurement  
• Very high requirement on Jitter between e-bunch and laser | • Limited resolution (400 fs)  
• Distorted signal for e-bunches < 200 fs | • Complex laser system (mJ laser pulse energy)  
• Low repetition rate | • More complex imaging optics  
• Good for clocking but tough to get the e-bunch information |
Different wavelength

Simulated EO signal using 3 different laser wavelengths. Electron beam bunch length is 1 ps rms with a bunch charge of 1 nC. The EO sampling crystal is 1 mm thick ZnTe and 5 mm away from the beam center. Gaussian fits of these curves give rms values of 1.025 ps, 1.032 ps and 1.06 ps for 800 nm, 1030 nm and 1500nm respectively.
Plan for A0

• We will use spectral decoding approach considering the pulse length we will work on.
• We will try to use fiber laser instead of Ti:sapphire laser
• However Temporal decoding effect may still needed for fs bunch study as planed