



# ILC Polarized e- source Special Instrumentation

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# Laser Diagnostics

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- Spectrum
  - Spectrometer
- Pulse length
  - Autocorrelator
  - FROG
- Timing stability
  - Fast Oscilloscope  
(Network analyzer, sampling scope, TIC)
- Intensity
  - Fast Photodiodes
- Beam profile
  - CCD

Integrated into laser system



# DC Gun Diagnostics

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- Dark current
  - QE monitor
  - QE profile
  - Vacuum conditions
- Nanoammeter
  - QE Lock Laser  
(low power CW diode laser)
  - 2D scanning  
using low power  
cw laser beam
  - RGA, Ion gages

Integrated into Gun design



# Polarimetry

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- Mott (low energy beam) polarimeter measures e- polarization
- Polarization of 5 GeV beam could be measured using a laser wire beam (Compton polarimeter)



# Bunch Length Monitor

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- Bunch lengths cm to mm
  - Pass-band microwave detectors
  - Gap monitors
  - Standard technique, inexpensive, little R&D required



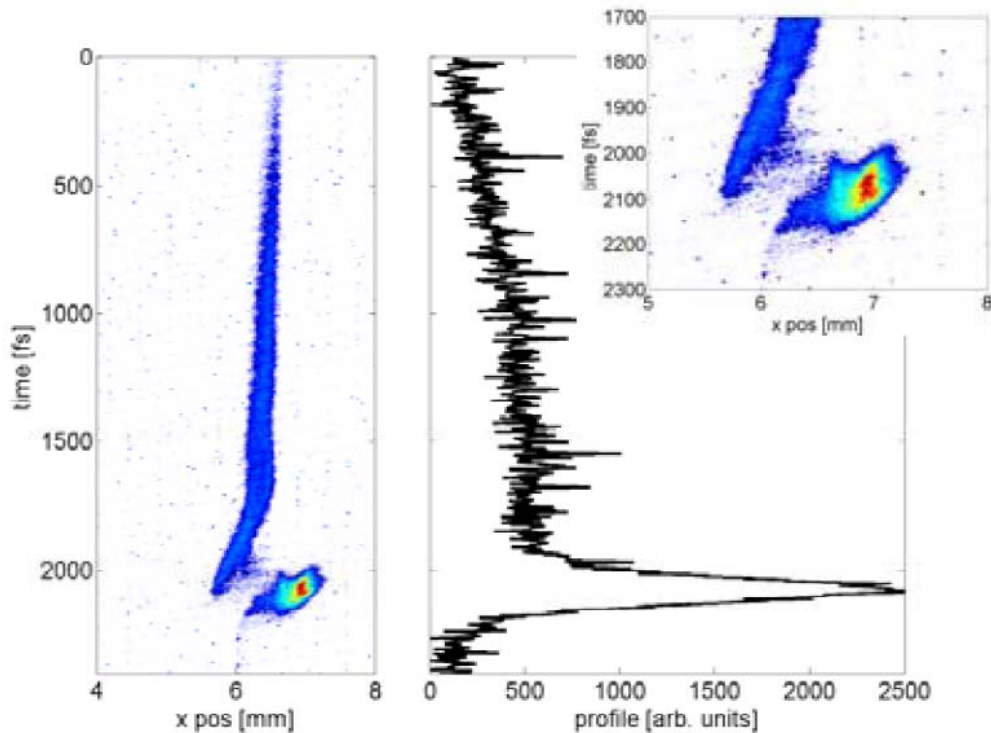
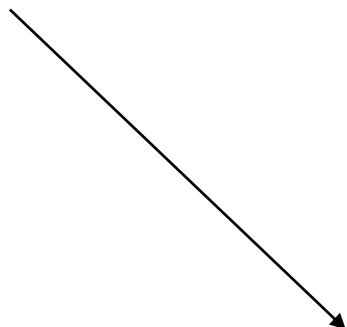
# Beam Phasing

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- Pair of deflecting cavities
  - Cavities are driven such that x and y kicks are out of phase
  - Result is a beam deflection pattern that resembles ‘Lissajou’ patterns
  - Images bunch phase and energy vs. charge distribution
  - Invasive technique
  - Tested at the 17 GHz MIT test accelerator  
(Jake Haimson)
  - Possible R&D topic using SLAC’s main injector (after conclusion of PEP-II beam)

# Beam Phasing Illustration

Streaked bunch



Hüning et al; OBSERVATION OF FEMTOSECOND BUNCH LENGTH USING A TRANSVERSE DEFLECTING STRUCTURE; FEL 2005



# Energy / Time Correlations

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- Similar to previous method but one dimensional
- Uses one dimensional RF deflector (LOLA)
- Monitors beam energy vs. time
- invasive technique





## Beam Size and Emittance – Wire scanners

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- Conventional wire scanners for low energy beams
- Located downstream of NC pre-accelerator < 100 MeV beam energy
- Integrated into optical design
- Slow method – sampling of bunch trains vs. individual bunches



# Beam Size and Emittance - Laser Wires

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- One laser wire station past the SC (5 GeV) linac (integrated into optical design)
- Measurement of beam size and emittance
- Sampling of bunchtrain (individual bunches) rather than 3 MHz rep rate or integration of bunchtrain
- 3 MHz design is in principal possible but expensive and R&D is necessary
- R&D topic – laser technology
- Clever design allows use as polarimetry station