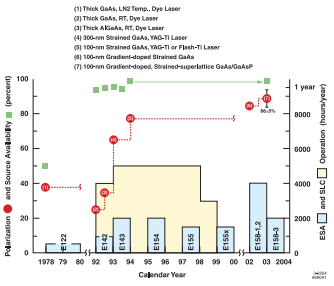
Polarized Electron Source

The SLC polarized electron source is the prototype for the GLC/NLC source

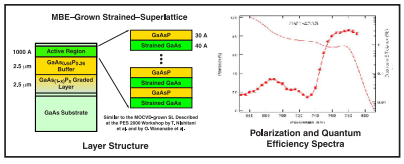
>40,000 h of user operation at SLAC since 1992 with availability approaching 100%

88±5% polarization achieved at E158

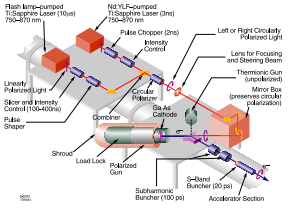
Currents in excess of GLC/NLC requirements have been demonstrated at SLAC



Improvements in Polarization at SLAC e– beams since 1978 using semiconductor photocathodes.



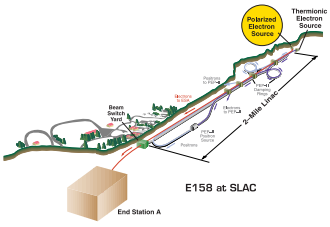
Strained GaAs/GaAsP Superlattice Photocathode for E158.



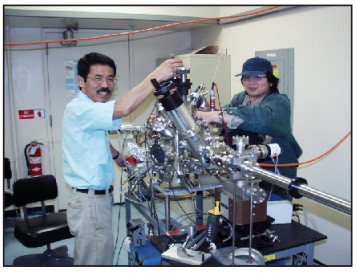
SLC Polarized Electron Source Configured for E158

	E-158	X-Band LC
Charge/Train (10^{10})	50	144
Repetition Rate (Hz)	120	120
Energy (GeV)	45	250
e^- Polarization (%)	88±5	80
Train Length (ns)	270	267
Microbunch Spacing (ns)	0.3	1.4
Beam Loading (%)	10	22
Energy Spread (%)	0.15	0.16
e^- Intensity Stability (%)	<0.5	<1.0

E158 Beam and Comparison with X-band LC Design



E158 at SLAC



Atomic hydrogen cleaning system at SLAC Cathode Test Lab for precision cleaning of cathodes.

Positron Source

Conventional source based on the SLC

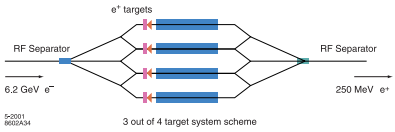
Studies with LANL and LLNL show WRe target material meets NLC requirements

3x4 target geometry provides a factor of 2 overhead on energy deposition

>50% overhead in yield and transverse emittance designed into system

Dedicated 6 GeV drive beam allows faster commissioning and greater availability

Polarized positron source development in E166 experiment and ongoing target material studies

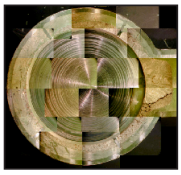


3x4 NLC Positron Target System Layout

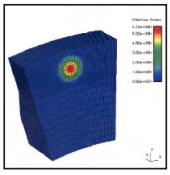
	SLC	Warm US LC	Cold US LC
Electron Beam Energy (GEV)	32	6.2	6.2
N e^-/bunch (10^{10})	4	0.75	2.0
Energy/Pulse (J)	205	477	28,000
Target Material	WRe	WRe	WRe
Target Thickness (rad. length)	6	4	4
Incident e^- Spot Size, rms (mm)	0.7	1.6	2.5
Target Radius (m)	0.032	0.125	0.8
Target Rotation Speed, rpm	120	46	1500
ΔT/Pulse (°C)	220	189	256
Capture Yield e^+/e^-	1.0	1.5	1.5

Conventional Source Parameters

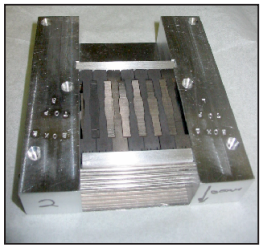
Positron Target Material Studies



SLC Target Damage Analyses, LANL

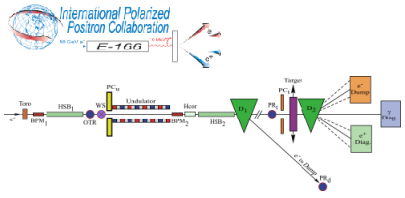


Structural Modeling of the NLC Positron Target, LLNL



Radiation Damage Tests of Candidate Target Materials, BNL

Polarized Positron Studies, E166



E166: Demonstration of Undulator Based Production of Polarized Positrons for Linear Colliders