Conventional Positron Source Issues for the ILC

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Bharadwaj, Stein, Batygin, Gronberg, and Wang Talks

also

Conventional Positron Source

LCC-0133

SLAC TN-03-072

A Conventional e+ Source

Multi-GeV Electrons onto a thick, hi-Z target to produce unpolarized e+

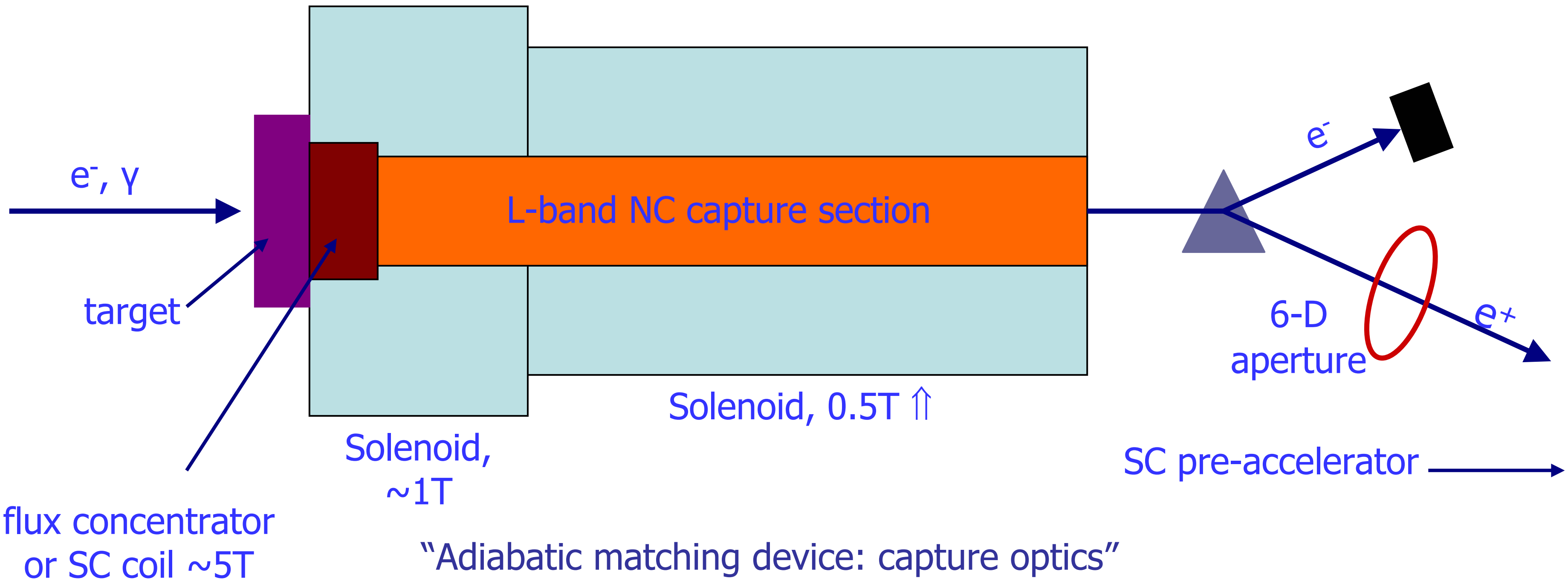
Why a Conventional Source?

- Why Not?
- Responsibility to understand ILS Design Options
- Separation of e+ production from colliding e-
  - Availability
  - Fewer constraints
- Direct comparison with existing designs

Generic Positron Source, polarized, photon or conventional

From last ½ radiation length of target and downstream, the issues are the same with a few differences related to beam spray and corresponding power levels (details are important)

---Will always run design to Damage Threshold of the Target---



Parameters/Specifications

ILC Non-Polarized e+ Source

Bunch trains at 5hz

2820 bunches per train (upgrade to 5640)

308-271 ns bunch spacing in(?) and out of the DR’s (850 μs)

2×10^{10} e^+ per bunch out of the DR’s
(upgrade to 1×10^{10})

Good Ideas are good; Much More Important to Meet Required ILC Specifications

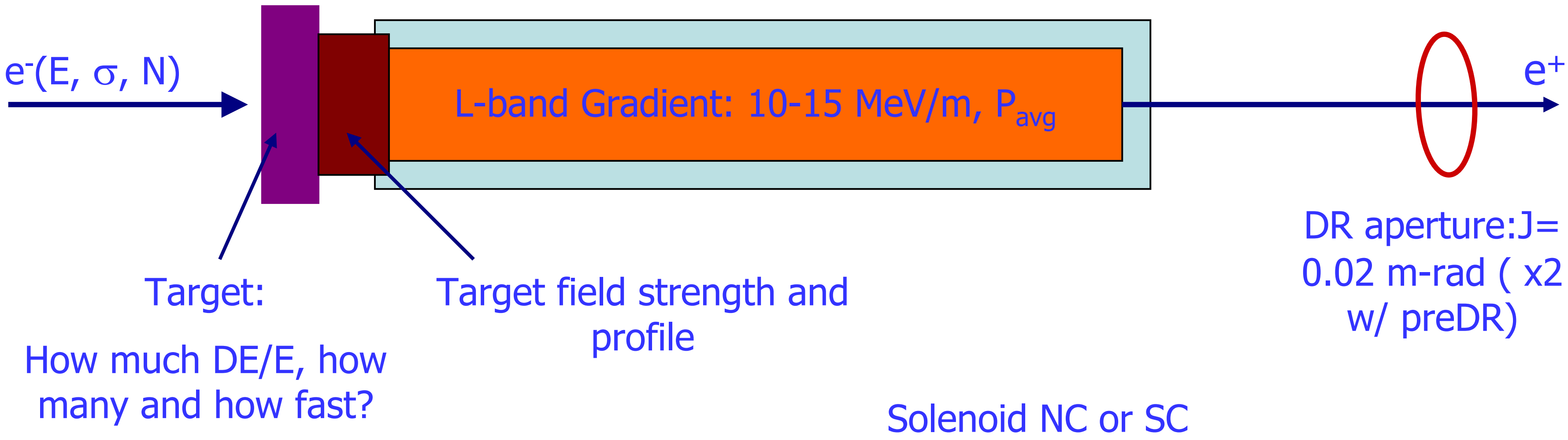
Positron Source Design Issues

Yield(A,E,σ,Z,T,G,Optics)→Inst. $\Delta E/E < \Delta E$ threshold (shock and fatigue)

---Use Multiple Targets as needed---

Target Power Removal (hi rotation speed)

Engineering Required:
- Hi Radiation Environment ~300 kW drive
- Heat load in Accelerator
- Damage to components
- Repair Scenarios (sched. Vs. on demand)



Basic Layout
(see W. Stein talk)

6 GeV Electron Drive Beam at $2x10^{10}$ e-/bunch

~2 mm rms incident spot

4.5 rl W23Re77 Target Material (hi Z, thick)

~280 kW Drive Beam (Yield = 1.5)

~19% Target Absorption

~14% of energy in all e+ (~200 kW of spray)

360 m/s target rotation

Topics for Study

Basic Capture Yield Calculations (AMD, rf gradient, focusing optics, capture aperture(6-D))

Energy Deposition and Stress

Material Damage Threshold (mechanical and radiological fatigue)

Candidate Target Material Selection and Testing

Average Power Removal

Target Station Layout

Removal and Replacement Scenarios

Infrastructure (remote handling, equipment shielding)

Civil Facility Specifications

Commissioning, Operations, Availability

Activities for a CDR

Specification of Beam Parameters

Specification of Damping Ring 6-D Acceptance (need to understand if addition of a predamping ring for increased acceptance and relaxation of e+ production systems is required (J: 0.02 ---> 0.04 m-rad))

Decision on Baseline Design Option: Conventional Undulator, other (is the Compton Backscattered Photon System Adaptable to the SC Design Parameters?)

Design Parameter Choice Optimization

Resolution of Availability Issues

Fall Back Scenarios

Upgrade Options

Activities for a TDR, Conventional System

AMD Prototype Demonstration: *Brechna design, SC coils*

Capture rf Section Prototype (incl. rf power source if required): *DESY development(?)*

Material Damage: *BNL and KEK*

Shielding Tests: *(? To level of 0.001-0.0001 ??)*

Target Station Prototype: *Hi speed rotation and power removal*

???-- WHAT ELSE – *Are these the correct tasks???*

Summary

Draft Design Description for Snowmass

Selection of ILC Baseline Design

Baseline Technical Description by End of 2005

CDR Text and Cost in late 2006

TDR Work Started in 2006

Need Help, Open to Any and All Good Ideas which will meet ILC Specifications