NLC $e^+$ source
based on helical undulator.

Proposal 1979
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$e^- \xrightarrow{\text{Undulator}} e^-$
$\delta \text{ target}$

$E_e > 10\text{MeV}$
$E_{e^-} > 100\text{GeV}$

NLC 500GeV
$6.3 \times 10^{11} \text{e/pulse}$
$1.13 \times 10^{14} \text{e/sec}$

NLC 1TeV
$9.4 \times 10^{11} \text{e/pulse}$
$1.13 \times 10^{14} \text{e/sec}$
\[
(\frac{e^+}{e^-} \approx 2)
\]

<table>
<thead>
<tr>
<th></th>
<th>SLC</th>
<th>NLC conv.</th>
<th>NLC UND.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power in, kW</td>
<td>20</td>
<td>150</td>
<td>32(\rightarrow)64</td>
</tr>
<tr>
<td>P target, kW</td>
<td>4</td>
<td>(~35)</td>
<td>0.6</td>
</tr>
<tr>
<td>Rad. level, arb. un.</td>
<td>1</td>
<td>(~7)</td>
<td>(~0.2) (incoming beam)</td>
</tr>
<tr>
<td>Coac. (e^-) beam power, kW</td>
<td>0.3</td>
<td>15</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>(120 MeV)</td>
<td>(400 MeV)</td>
<td>(300 MeV)</td>
</tr>
</tbody>
</table>

\(e^+\) accelerator:
- S band: \(r_0 = 9\) mm
- L band: \(r_0 = 18\) mm
- S band: \(r_0 = 12\) mm

\(e^+\) beam polariz.:
- -
- \(~50\%\)

Transv. acc. \(\gamma E\) \(e^+\) (rad. m):
- \(1.0 \times 10^{-2}\)
- \(6 \times 10^{-2}\)
- \(3 \times 10^{-2}\)

Long. acc. \(e^+\):
- \(\pm 15\) psec
- \(\pm 30\) psec
- \(\pm 15\) psec
- \(\pm 10\) MeV
- \(\pm 10\) MeV
- \(\pm 10\) MeV
The calculated curve and experimental results with the super conducting undulator. On x axis - total current, on left y axis - field on the axis of the undulator, on right y axis - the $P_1$ factor.

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$N_{81} = 56.4$

$N_{82} = 12.1$

$N_{43} = 3.1$
\[ E_{e} = 165 \text{GeV} \]

\[ \text{Lund} = 120 \text{m} \rightarrow 280 \text{m} \]

\[ \\text{e}^+ = 1 \quad \text{e}^- = 2 \]

\[ L/L_{\text{max}} \]

\[ E_{\text{lim}} = 20 \text{MeV} \quad E_{\text{IP}} = 80 \text{GeV} \]

\[ \sim 0.1 \]

\[ E_{\text{IP}} = 45 \text{GeV} \]

\[ E_{\text{max}} = 11.5 \text{MeV} \]

\[ NLC_{555} \text{GeV} \]

\[ NLC_{500} \text{GeV} \]
TARGET

\[ W_{75} \text{ Re:25} \quad 0.2 \text{ RL} \quad P_{max} = 0.6 \text{ kW} \quad (2^e\% -) \]

Not a stationary target

2 reasons:  
1. Steady state temperature
2. Radiation damage

\[ \bar{\sigma}_x \approx 5 \times 10^{-25} \text{ cm}^2 \quad 10 \text{ MeV} < E_Y < 20 \text{ MeV} \]

\[ \frac{1}{\bar{\tau}} = \frac{N_0 \bar{\sigma}_x}{2\pi \bar{\sigma}_x^2} = 4 \times 10^{-7} \text{ /sec} \]

i.e. 1% désintegration level \( \bar{\tau}_{1%} \approx 7 \text{ h-s} \)

Target with \( 2\pi r = 1 \text{ m} \) \( \Rightarrow \bar{\tau}_{1%} \approx 2300 \text{ h-s} \)

Radiation cooling

\[ T_1 = 300 \text{ °K} \quad T_2 = 500 \text{ °K} \quad \varepsilon = 0.5 \]

\[ S = 0.24 \text{ m}^2 \quad \Rightarrow \text{cylinder} \ \phi 25 \text{ cm}, L = 30 \text{ cm} \]

Rotation speed \( \approx 40 \text{ rpm} \)

\[ \rightarrow 1 \quad \leftarrow 3 \text{ h} \at 180 \text{ pps} \]
\( \frac{N_{e^+}}{N_{e^-}} = 1.0 \)

Limit

\[ n = \frac{L_{\text{und}}}{\lambda_0} \]

(NLC 1 TeV)

NLC 500 GeV

\[ \sigma_{\parallel} (\text{mm}) \]

0.6 0.8 1.0 1.2

Undulator \( K = 0.5 \) \( E_{\text{kin max}} = 20 \text{ MeV} \)

Target \( W_{15 \text{Re25} \ X_t = 0.2 \text{rL}} \)

Flux Concentrator \( B_m = 5.8T \) \( \Gamma_0 = 4.0 \text{mm} \)

Solenoid \( B_{\text{max}} = 1.2T \) \( B_0 = 0.5T \)

Accelerator \( S \)-band \( \Gamma_0 = 12 \text{mm} \) \( 30 \text{ MeV/m} + 17 \text{ MeV/m} \)

\( N_{\text{norm acceptance} \Theta 250 \text{ MeV} \times E = 3.0 \times 10^2 \text{ rad.m} \}

\( \Delta E = 20 \text{ MeV} \) (\( \pm 10 \text{ MeV} \))

\( \Delta t = 30 \text{ psec} \) (\( \pm 15 \text{ psec} \))

\( NLC 500 \text{ GeV} \) \( N_{e^+} = N_{e^-} \text{ at IP} \) \( 6.3 \times 10^7 \) per pulse, 180 pp:

\( NLC 1 \text{ TeV} \)

\( 9.4 \times 10^7 \) 120