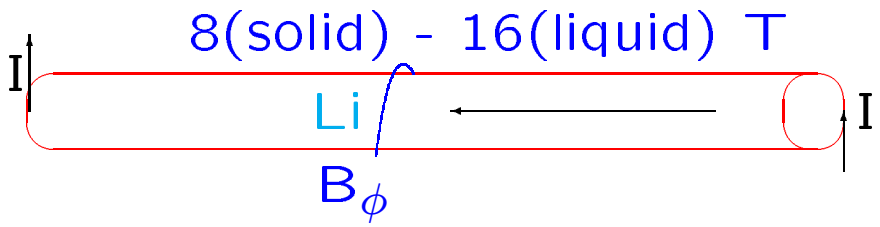
HOW TO GET LOW β^*? *

- Lithium Lens

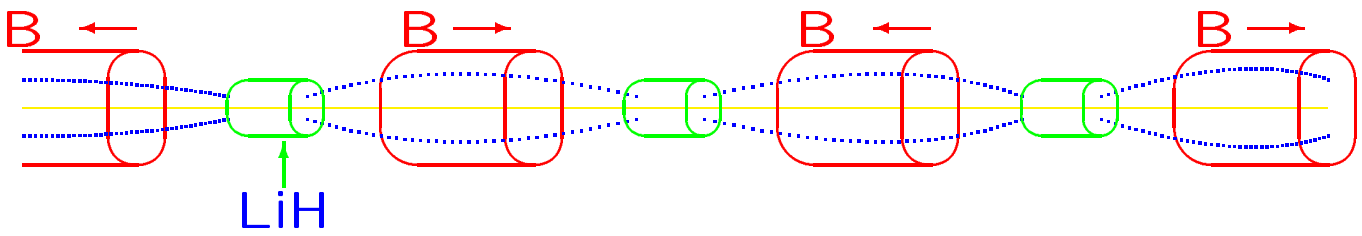
  Experience at CERN/FNAL/Novosibirsk

  $\beta^* \approx 1\,\text{cm}$ at $100\,\text{MeV}$



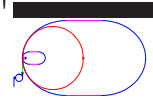
†

- Alternating Solenoids - FOFO
  $\beta^* \approx 6\,\mathrm{cm}$ at $100\,\mathrm{MeV}$
  $10 - 15\,T$



- Longitudinal cooling

†

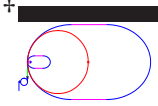


$\mu^+\mu^-$ COLLIDER

The natural logarithmic raise of $\frac{dE}{dz}$ is TOO WEAK

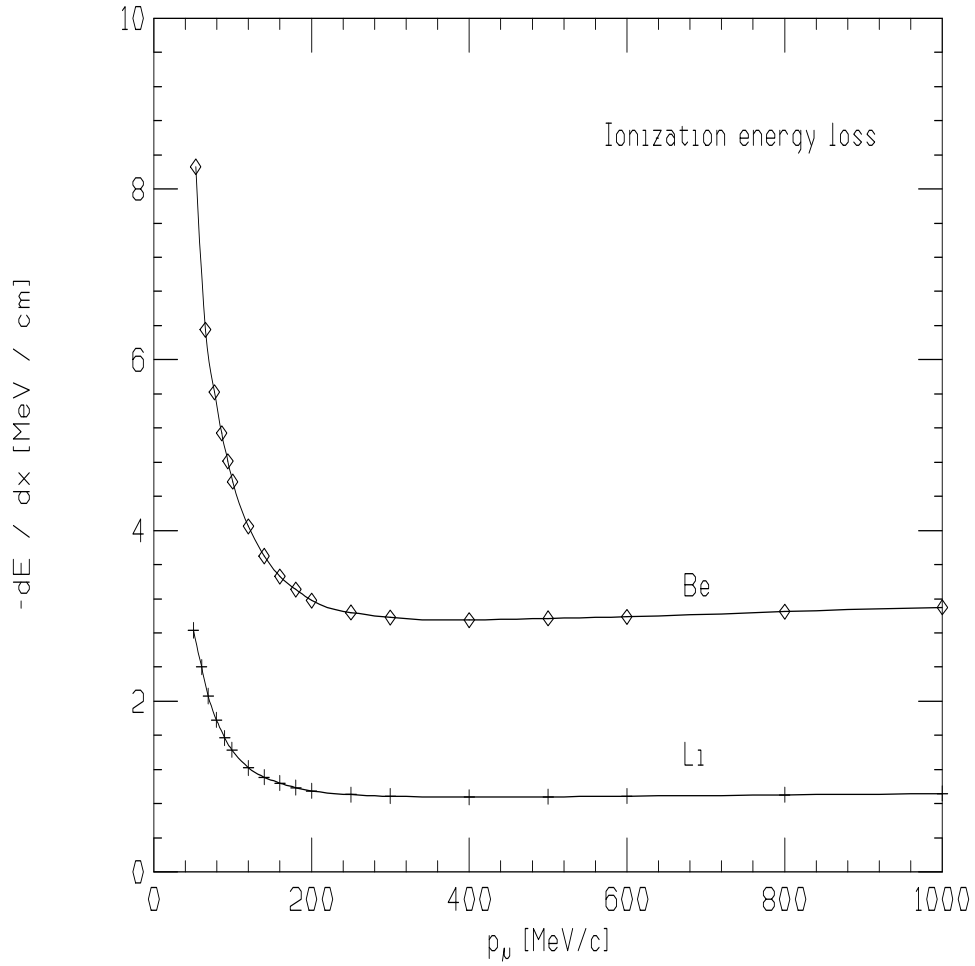
- Exchange
  Introduce dispersion and use Be or Li WEDGE to reduce longitudinal phase space. ‡

‡



$\mu^+\mu^-$ COLLIDER

§



$\frac{dE}{dz}$ as a function of muon momentum for Li and Be

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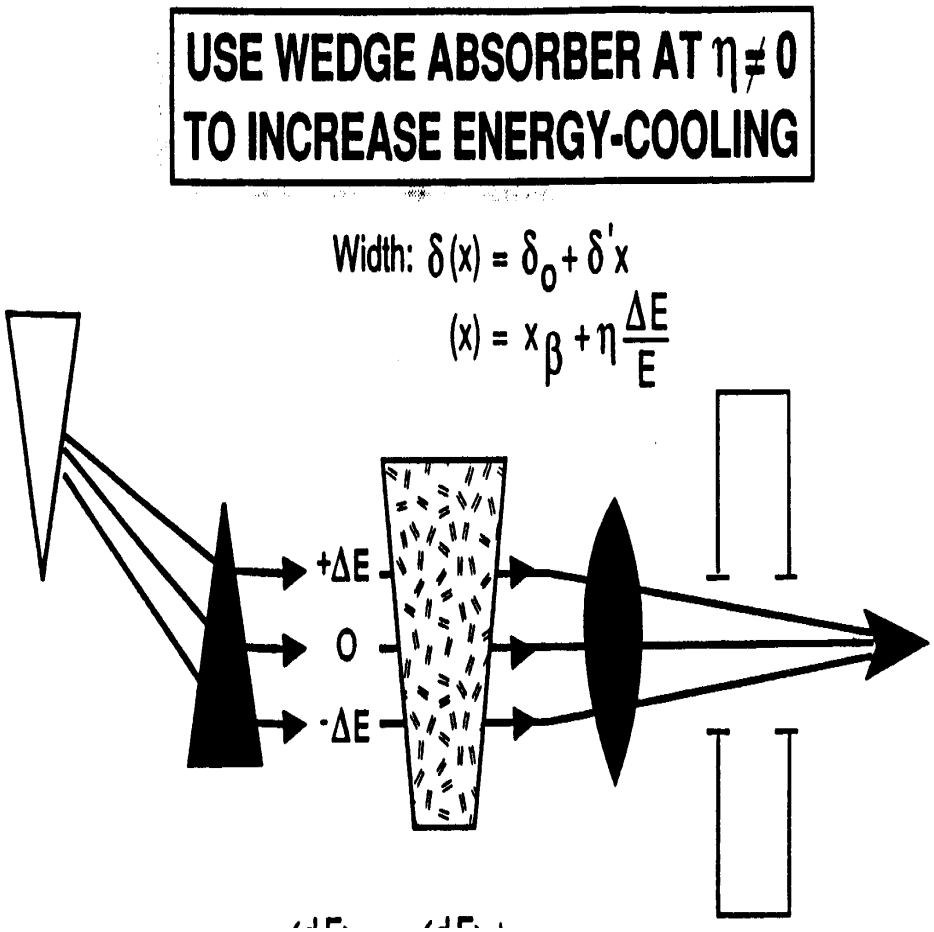

Basic principle of Ionization Cooling using a wedge absorber

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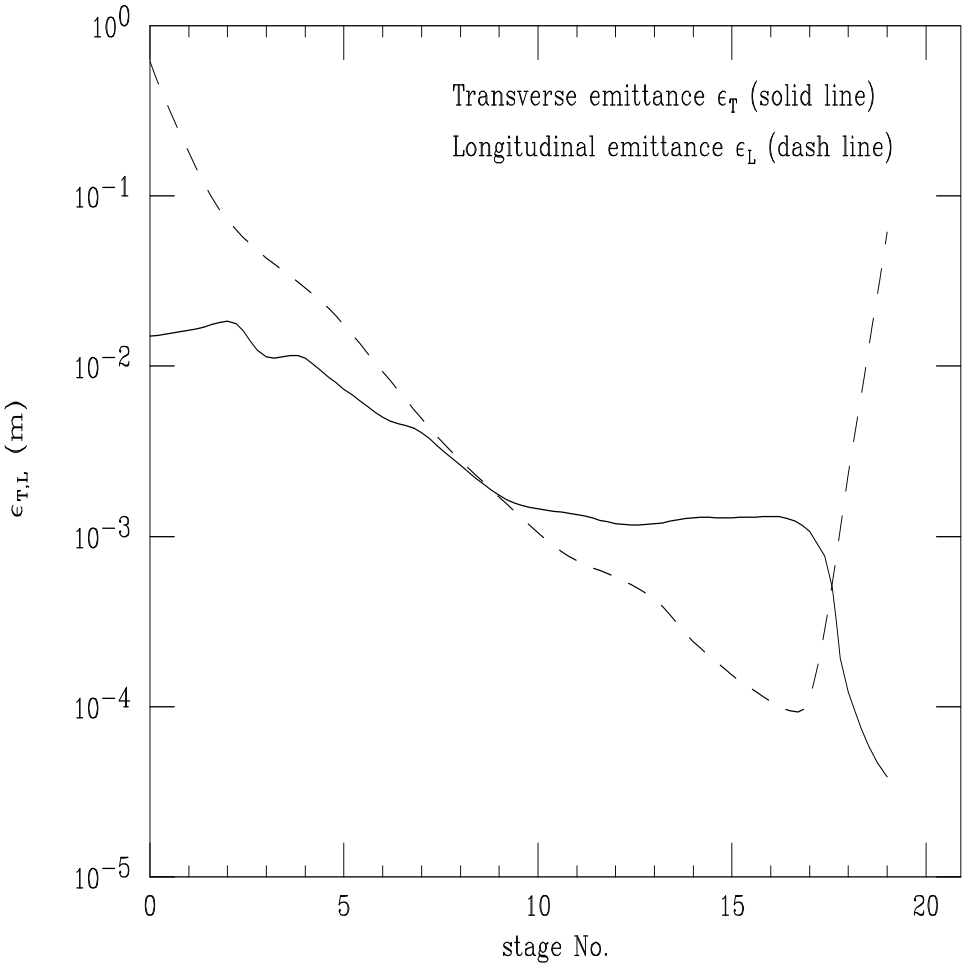
- Summary of the Cooling Section

total length		743	m
sections		19	
total acceleration		4.8	GeV
accelerator length		690	m
μ decay loss		45	%
contingency loss		20	%
	Entrance	Exit	
KE	300	15	MeV
p	392	58	MeV/c
β	0.966	0.481	
$\epsilon_{xN}(rms)$	15000	39	$mm\,mr$
$\epsilon_{zN}(rms)$	61.2	6.0	$m\,\%$
σ_z	1.50	0.35	m
$\frac{\delta p}{p}$	11.0	31.7	%
μintensity	7.5	3.0	10^{12}/bunch



Normalized transverse and longitudinal emittance as a function of section number in a model cooling system**