ACCELERATION :*

The central difficulty in a $\mu^+\mu^-$ COLLIDER is: **MUON DECAY**. They must be collected, cooled, accelerated and collided within lifetime.

Acceleration system must accommodate fairly large phase space and compress it to match the requirements of the collider

- Lifetime Constraints
  Decay rate $\frac{dN}{ds} = -\frac{1}{L_\mu \gamma}$ $\qquad L_\mu c\tau_\mu \approx 660\,\mathrm{m}$
  Assume low losses $\rightarrow eV'_{\mathrm{rf}} >> 0.16\,\frac{\mathrm{MeV}}{\mathrm{m}}$

- Scenarios

  1. Sequence of linacs (VERY EXPENSIVE)

  2. Recirculating linacs with multiple arcs (similar to CEBAF) (RELATIVELY EXPENSIVE)

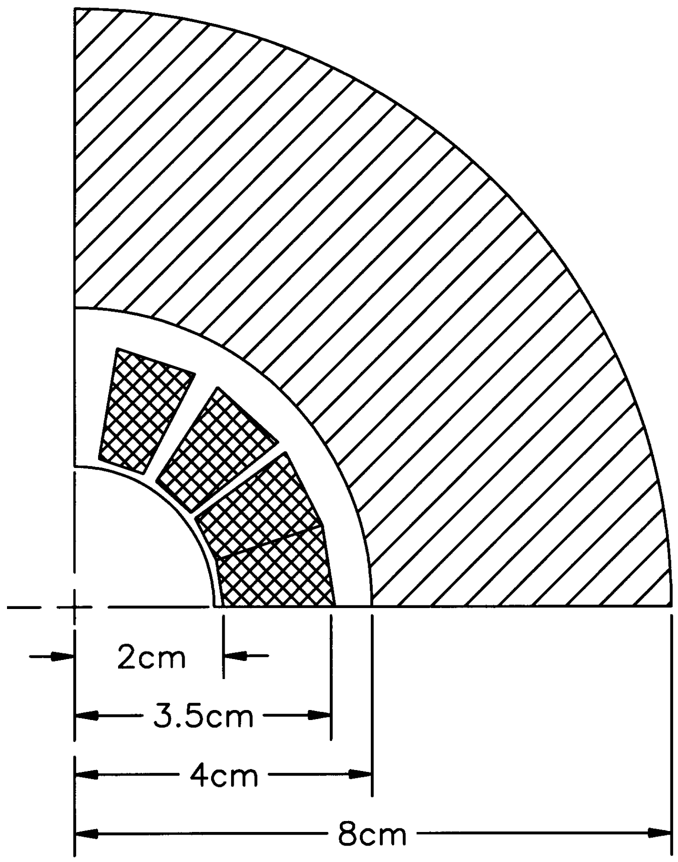
  3. Synchrotrons with fast pulsed magnets with long SC linacs (MORE ECONOMICAL)

  4. (250 GeV) 4 T pulsed magnets (t=1 msec)

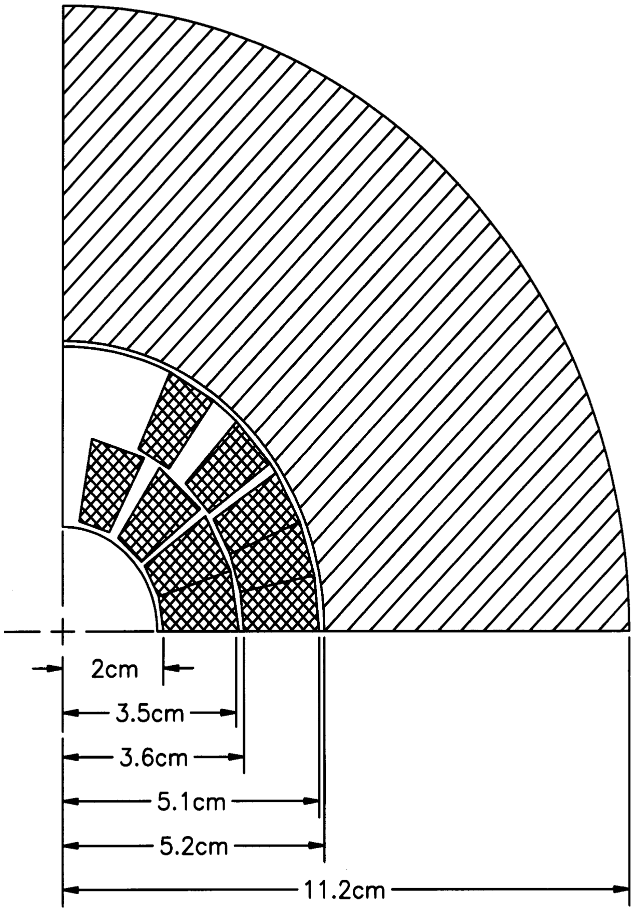
  5. (2 TeV) Interlace of fixed 8 T SC dipole magnets with ± 2 T pulsed magnets

†

‡

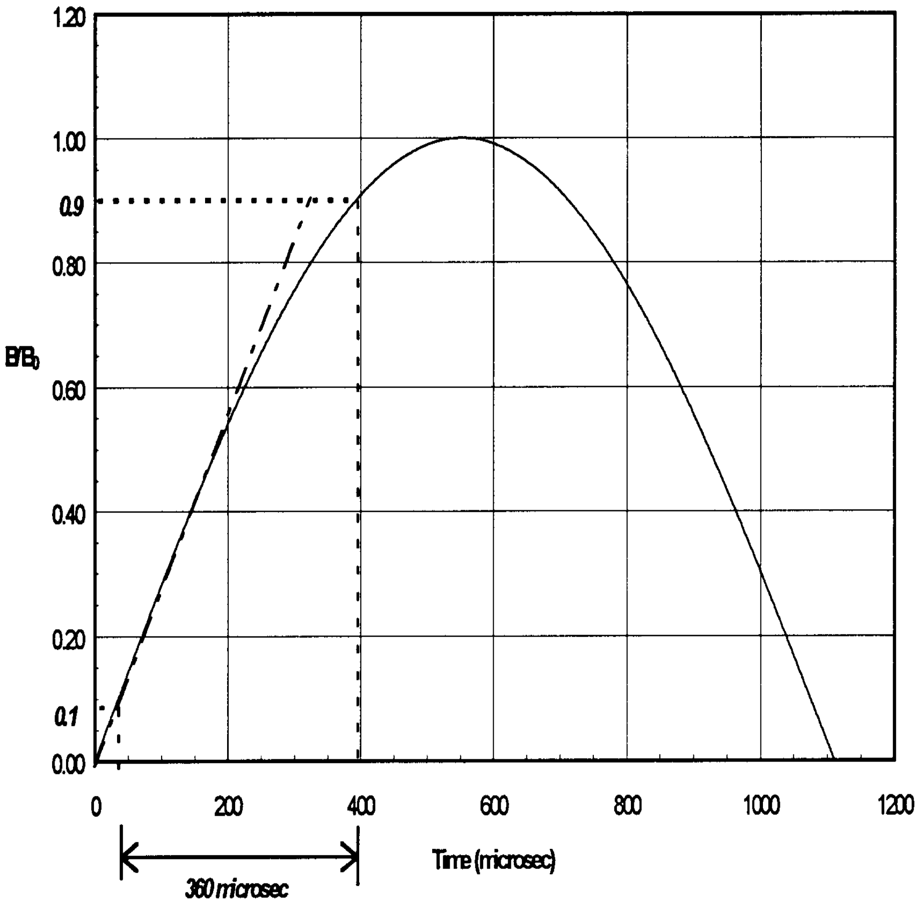


Cross sections of pulsed current dipoles for a μ rapid-cycling accelerator dipole (4 T)

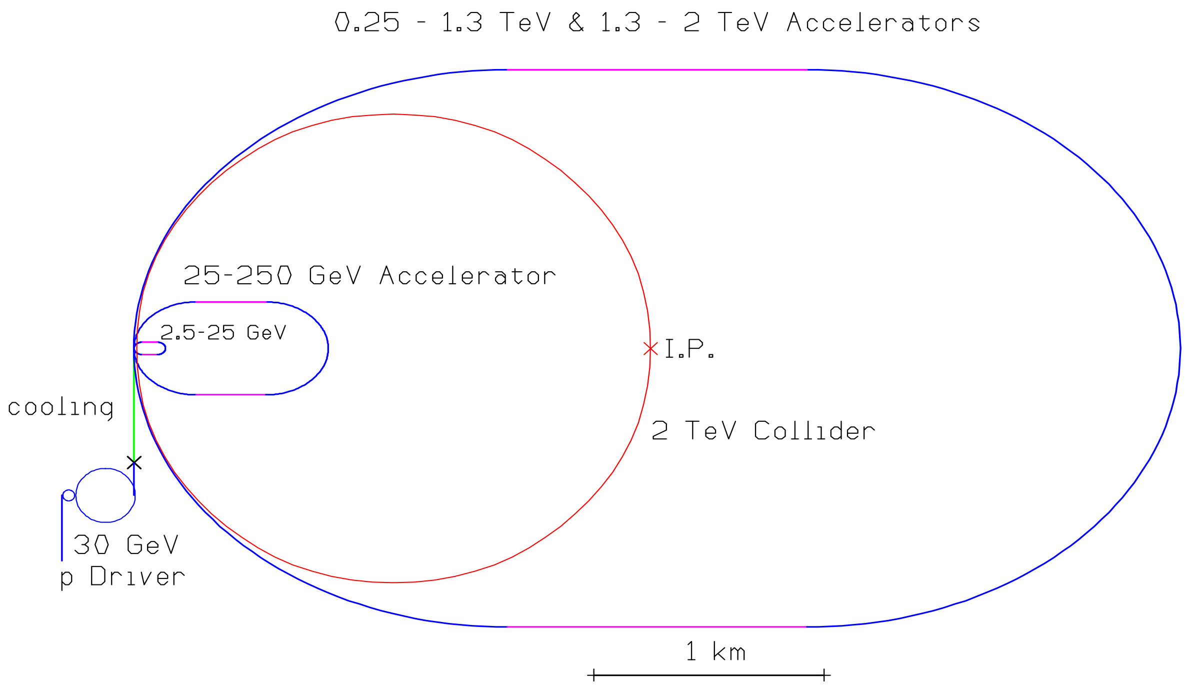


Cross sections of pulsed current dipoles for a collider dipole (6 T).

§



Ramp for rapid-cycling pulsed-dipoles for acceleration to 250 GeV ¶



A scale drawing of a possible 4 TeV muon collider machine ‖

‖

Parameters for pulsed conductor-dominated accelerator and storage ring dipoles

Parameter unit	Accelerator	Storage Ring
	Dipole	*Dipole*
Coil r_{inner} (cm)	2	2
Magnet length (m)	10	10
Field (T)	4	6
Current (kA)	29.5	24.9
Stored energy (kJ)	160	360
Inductance (mH)	0.37	1.2
Coil R (mW)	19	44
Ramp time (μs)	360	
Store Time (μs)		5000
Power supply V (kV)	31.2	1.1
P. into mag. *at* 2 Hz (kW)	19	452
Power into ring (MW)	2.7	39.4

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