

Chapter 13

SUMMARY OF PARAMETERS

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13.1 Introduction

This Chapter contains a summary of the muon collider parameters. It consolidates the tables scattered throughout this report. It is intended to give a self-consistent snapshot of the design parameters of the several components of the muon collider complex.

Table 13.1: Proton driver requirements; target and particle production parameters; capture and transfer solenoid system

Energy [GeV]	30
Rep. Rate [Hz]	15
Protons [/pulse]	10^{14}
Bunches [@ target]	4
Protons [/bunch]	2.5×10^{13}
σ_t [ns]	1
P_{beam} [MW]	7.2
ϵ_{Nrms} , 10^{-6} [m-rad]	40
β_{target} [m]	12
$\sigma(x)$ [mm]	4
$\sigma(x')$ [mrad]	0.3
B_{sol} [T]	20
a_{sol} [cm]	7.5
$p_{\perp max}$ [GeV/c]	0.225
A_N [m-rad]	0.12
L_{target} [cm]	22.5
r_{target} [cm]	1
$\pi^{\pm}/p$	1.2
P on target [kW]	600
Nominal Transport Magnetic Induction [T]	5.0
Stored Magnetic Energy to $x = 3$ meters [MJ]	37.9
Stored Energy S/C Magnet to $x = 3$ meters [MJ]	22.4
Stored Energy for $x > 3.0$ meters [MJ/m]	1.58

Table 13.2: Low-energy pion collection linac parameters

rf frequency [MHz]	90	50	30
Cavity Radius [cm]	90	206	126
Beam Pipe Aperture [cm]	30	30	30
Avg Gradient [MV/m]	4.2	3.3	2.1
rf Peak Power [MW]	1.8	1.1	4.8
Avg Power (15Hz) [KW]	17	26	43
Stored Energy [J]	165	261	423
Linac Length [m]	6	18	18
Total Power (15Hz) [KW]	85	390	640

Table 13.3: Cooling section summary

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
ϵ_{xN} (rms)	15000	39	mm mr
ϵ_{zN} (rms)	61.2	6.0	m %
σ_z	1.50	0.35	m
$\frac{\delta p}{p}$	11.0	31.7	%
μ intensity	7.5	3.0	10^{12} / bunch

Table 13.4: Parameters of a 4-RLA scenario

	RLA	RLA	RLA	RLA
	1	2	3	4
Energy in [GeV]	1	9.6	70	250
Energy out [GeV]	9.6	70	250	2000
Nturns	9	11	12	16
V _{rf} per linac [GV]	0.5	3	8	56
rf frequency [MHz]	100	350	800	1300
gradient [MV/m]	5	10	15	20
L(linac) [m]	100	300.0	533.3	2800
Arc length [m]	30	175	520	3500
B _{arc} [T]	3.4	4.2	5.2	6.0
Decay Losses[%]	9.0	5.2	2.4	3.6
<i>rms</i> Bunch Length [cm]	4.8	1.3	0.59	0.29
<i>rms</i> ΔE_{rms} [GeV]	0.09	0.34	0.80	1.5

Table 13.5: High energy-high luminosity $\mu^+ \mu^-$ collider

Maximum c-m Energy [TeV]	4
Luminosity $\mathcal{L}[10^{35}\text{cm}^{-2}\text{s}^{-1}]$	1.0
Circumference [km]	8.08
Time Between Collisions [μs]	12
Energy Spread $\sigma_E[\text{units } 10^{-3}]$	2
Pulse length $\sigma_z[\text{mm}]$	3
Free space at the IP [m]	± 6.25
Luminosity lifetime [No.turns]	900
Horizontal betatron tune, ν_x	55.79
Vertical betatron tune, ν_y	38.82
<i>rms</i> emittance, $\epsilon_{x,y} [10^{-6}\pi \text{ m-rad}]$	0.0026
<i>rms</i> normalized emittance, $\gamma\epsilon_{x,y} [10^{-6}\pi \text{ m-rad}]$	50.0
Beta-function values at IP, $\beta_{x,y}^* [\text{mm}]$	3
<i>rms</i> Beam size at IP [μm]	2.8
Quadrupole pole fields near IP [T]	6.0
Peak beta-function, $\beta_{x\text{max}} [\text{km}]$	284
Peak beta-function, $\beta_{y\text{max}} [\text{km}]$	373
Magnet Aperture closest to IP [cm]	12
Beam-Beam tune shift per crossing	0.05
Repetition Rate [Hz]	15
rf frequency [GHz]	1.3
rf voltage [MeV]	130
Particles per Bunch [units 10^{12}]	2
No. of Bunches of each sign	2
Peak current $\mathcal{I} = eNc/\sqrt{2\pi}\sigma_z [\text{kA}]$	12.8
Average current $\mathcal{I} = eNc/\text{Circum} [\text{A}]$	0.032
Bending Field [T]	8.5

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