

Table 1: **Straw-man muon collider parameters. (Parameter set 30 TeV B was added on 23 February, 2001.)** See overview write-up for details.

| center of mass energy, E_{CoM} description | 400 GeV top threshold | 4 TeV frontier | 30 TeV A many-TeV | 30 TeV B many-TeV |
|--|--------------------------|----------------------|----------------------|----------------------|
| collider physics parameters: | | | | |
| luminosity, $\mathcal{L} [\text{cm}^{-2} \cdot \text{s}^{-1}]$ | 3.0×10^{33} | 5.0×10^{33} | 3.0×10^{35} | 2.0×10^{35} |
| $\int \mathcal{L} dt [\text{fb}^{-1}/\text{year}]$ | 30 | 50 | 3000 | 2000 |
| No. of $\mu\mu \rightarrow ee$ events/det/year | 16 000 | 270 | 290 | 190 |
| No. of (115 GeV) SM Higgs/year | 14 000 | 55 000 | 5.1×10^6 | 3.4×10^6 |
| CoM energy spread, $\sigma_E/E [10^{-3}]$ | 1.4 | 1.0 | 0.14 | 0.07 |
| collider ring parameters: | | | | |
| circumference, C [km] | 1.0 | 8.7 | 45 | 45 |
| ave. bending B field [T] | 4.2 | 4.8 | 7.0 | 7.0 |
| beam parameters: | | | | |
| $(\mu^- \text{ or } \mu^+)/\text{bunch}, N_0 [10^{12}]$ | 4.0 | 3.5 | 2.3 | 2.2 |
| $(\mu^- \text{ or } \mu^+)$ bunch rep. rate, $f_b [\text{Hz}]$ | 15 | 1.0 | 7.5 | 10 |
| 6-dim. norm. emit., $\epsilon_{6N} [10^{-12} \text{m}^3]$ | 170 | 170 | 100 | 82 |
| $\epsilon_{6N} [10^{-4} \text{m}^3 \cdot \text{MeV}/c^3]$ | 2.0 | 2.0 | 1.2 | 1.0 |
| P.S. density, $N_0/\epsilon_{6N} [10^{22} \text{m}^{-3}]$ | 2.4 | 2.2 | 2.3 | 2.7 |
| x,y emit. (unnorm.) [$\pi \cdot \mu\text{m.mrad}$] | 41 | 2.4 | 0.19 | 0.17 |
| x,y normalized emit. [$\pi \cdot \text{mm.mrad}$] | 77 | 46 | 27 | 24 |
| long. emittance [10^{-3}eV.s] | 10 | 28 | 48 | 50 |
| fract. mom. spread, $\delta [10^{-3}]$ | 2.0 | 1.4 | 0.20 | 0.10 |
| relativistic γ factor, E_μ/m_μ | 1890 | 18 900 | 142 000 | 142 000 |
| time to beam dump, $t_D [\gamma \tau_\mu]$ | no dump | 0.5 | no dump | no dump |
| effective turns/bunch | 620 | 450 | 1040 | 1040 |
| ave. current [mA] | 24 | 0.63 | 12 | 15 |
| beam power [MW] | 3.8 | 2.2 | 83 | 106 |
| synch. rad. critical E [MeV] | 1.1×10^{-5} | 0.0013 | 0.11 | 0.11 |
| synch. rad. E loss/turn | 0.6 keV | 700 keV | 450 MeV | 450 MeV |
| synch. rad. power | 15 W | 470 W | 5.2 MW | 6.6 MW |
| beam + synch. power [MW] | 3.8 | 2.2 | 88 | 113 |
| decay power into beam pipe [kW/m] | 2.1 | 0.06 | 0.8 | 1.0 |
| interaction point parameters: | | | | |
| rms spot size, $\sigma_{x,y} [\mu\text{m}]$ | 18 | 2.7 | 1.0 | 1.3 |
| rms bunch length, $\sigma_z [\text{mm}]$ | 7.5 | 3.0 | 4.8 | 10 |
| $\beta_{x,y}^* [\text{mm}]$ | 7.5 | 3.0 | 4.8 | 10 |
| rms ang. divergence, $\sigma_\theta [\text{mrad}]$ | 2.3 | 0.90 | 0.20 | 0.13 |
| beam-beam tune disruption, $\Delta\nu$ | 0.056 | 0.083 | 0.092 | 0.100 |
| pinch enhancement factor, H_B | 1.02 | 1.08 | 1.09 | 1.11 |
| beamstrahlung frac. E loss/collision | negligible | 6×10^{-9} | 9×10^{-8} | 2×10^{-7} |
| final focus lattice parameters: | | | | |
| max. poletip field of quads., $B_{5\sigma} [\text{T}]$ | 10 | 12 | 15 | 15 |
| max. full aper. of quad., $A_{\pm 5\sigma} [\text{cm}]$ | 18 | 18 | 18 | 12 |
| quad. gradient, $2B_{5\sigma}/A_{\pm 5\sigma} [\text{T}/\text{m}]$ | 110 | 130 | 160 | 250 |
| approx. $\beta_{\text{max}} [\text{km}]$ | 8 | 140 | 1800 | 800 |
| ff demag., $M \equiv \sqrt{\beta_{\text{max}}/\beta^*}$ ¹ | 100 | 7000 | 19 000 | 9000 |
| chrom. quality factor, $Q \equiv M \cdot \delta$ | 0.003 | 10 | 4 | 1 |
| neutrino radiation parameters: | | | | |
| collider reference depth, D[m] | 20 | 300 | 100 | 100 |
| ave. rad. dose in plane [mSv/yr] | 7×10^{-4} | 9×10^{-4} | 6 | 7 |
| str. sec. len. for 10x ave. rad. [m] | 1.6 | 1.1 | 1.9 | 1.9 |
| ν beam distance to surface [km] | 16 | 62 | 36 | 36 |

Table 2: Straw-man acceleration parameter sets corresponding to the 400 GeV muon collider ring scenario in table 1. The parameter N_f is the number of muons per bunch at the exit of each FFAG See overview write-up for details.

| i | type | E_i [GeV] | E_f [GeV] | $\frac{E_f}{E_i}$ | # turns | E_{rf} [GeV] | rf grad. [MV/m] | L_{linacs} [km] | B_{ave} [T] | L_{arcs} [km] | circum. [km] | $f_{survive}$ |
|-----|---------|----------------|----------------|-------------------|---------|-------------------|--------------------|----------------------|------------------|--------------------|-----------------|---------------|
| 0 | cooling | | 0.19 | | | | | | | | | |
| 1 | linacs | 0.19 | 3 | 16.1 | — | 2.81 | 5.0 | 0.56 | — | — | 0.56 | 0.915 |
| 2 | recirc. | 3 | 12 | 4.00 | 4 | 2.25 | 9.0 | 0.25 | 1.3 | 0.200 | 0.45 | 0.957 |
| 3 | recirc. | 12 | 50 | 4.17 | 5 | 7.6 | 15.2 | 0.50 | 2.1 | 0.500 | 1.00 | 0.970 |
| 4 | FFAG | 50 | 125 | 2.50 | 30 | 2.5 | 20 | 0.125 | 3.0 | 0.875 | 1.00 | 0.943 |
| 5 | FFAG | 125 | 200 | 1.60 | 30 | 2.5 | 20 | 0.125 | 4.8 | 0.875 | 1.00 | 0.970 |

Table 3: Straw-man acceleration parameter sets for high energy muon colliders. The parameter sets N_f^4 and N_f^{30} are the numbers of muons per bunch at the exit of each FFAG corresponding to the 4 TeV and 30 TeV muon collider ring scenarios in table 1, respectively. See overview write-up for details.

| i | type | E_i [GeV] | E_f [GeV] | $\frac{E_f}{E_i}$ | # turns | E_{rf} [GeV] | rf grad. [MV/m] | L_{linacs} [km] | B_{ave} [T] | L_{arcs} [km] | circum. [km] | $f_{survive}$ |
|-----|---------|----------------|----------------|-------------------|---------|-------------------|--------------------|----------------------|------------------|--------------------|-----------------|---------------|
| 0 | cooling | | 0.19 | | | | | | | | | |
| 1 | linacs | 0.19 | 3 | 16.1 | — | 2.81 | 5.0 | 0.56 | — | — | 0.56 | 0.9 |
| 2 | recirc. | 3 | 12 | 4.00 | 4 | 2.25 | 9.0 | 0.25 | 1.26 | 0.200 | 0.45 | 0.9 |
| 3 | recirc. | 12 | 50 | 4.17 | 5 | 7.6 | 15.2 | 0.50 | 2.09 | 0.500 | 1.0 | 0.9 |
| 4 | FFAG | 50 | 125 | 2.50 | 3 | 25 | 20 | 1.25 | .351 | 7.45 | 8.7 | 0.9 |
| 5 | FFAG | 125 | 250 | 2.00 | 5 | 25 | 20 | 1.25 | .703 | 7.45 | 8.7 | 0.9 |
| 6 | FFAG | 250 | 500 | 2.00 | 10 | 25 | 20 | 1.25 | 1.41 | 7.45 | 8.7 | 0.9 |
| 7 | FFAG | 500 | 1000 | 2.00 | 20 | 25 | 20 | 1.25 | 2.81 | 7.45 | 8.7 | 0.9 |
| 8 | FFAG | 1000 | 1500 | 1.50 | 20 | 25 | 20 | 1.25 | 4.22 | 7.45 | 8.7 | 0.9 |
| 9 | FFAG | 1500 | 2000 | 1.33 | 20 | 25 | 20 | 1.25 | 5.62 | 7.45 | 8.7 | 0.9 |
| 10 | FFAG | 2000 | 5000 | 2.50 | 30 | 100 | 25 | 4.00 | 2.55 | 41 | 45 | 0.9 |
| 11 | FFAG | 5000 | 10 000 | 2.00 | 50 | 100 | 25 | 4.00 | 5.11 | 41 | 45 | 0.9 |
| 12 | FFAG | 10 000 | 15 000 | 1.50 | 50 | 100 | 25 | 4.00 | 7.66 | 41 | 45 | 0.9 |