BEAM PHYSICS FOR MUON COLLIDERS

R. B. Palmer & R. Fernow

Brookhaven Nat. Lab
SUNY, Stonybrook
LBNL

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Lectures by Bob Palmer, except those marked (F) by Rick Fernow.

1 Introduction to Muon Colliders

1.1 Collaboration

1.2 Comparison of Colliders

1.3 History

1.4 Luminosity

1.5 Parameters

1.6 Pion Production

1.7 Proton Source

1.8 Target & Capture

1.9 Ionization Cooling

1.10 Acceleration

1.11 Collider Ring

1.12 Radiation & Backgrounds

1.13 Acceleration

1.14 Conclusion

2 Target and Pion Production (F)

2.1 Production

2.2 Heating & Shock

2.3 Moving Metal Target

2.4 Liquid Jet in Solenoid

2.5 Targetry R & D

3 Basic Dynamics & p Driver

3.1 Intro. to Emittance

3.2 Intro. to Courant Snyder β

3.3 Focus Channel

3.4 Bunch Compression

3.5 Space Charge Tune Shift

3.6 Intro. to Resonances

3.7 Proton Driver

3.8 Linac Energy Choice

3.9 Target Energy Choice

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4 Capture & Phase Rotation

4.1 Li Lens Capture

4.2 Quadrupole Capture

4.3 Solenoid Capture

4.4 Intro. to Solenoid Focus

4.5 Adiabatic Matching

4.6 Phase Rotation

4.7 Intro to rf

5 Polarization (F)

5.1 Decay Kinematics

5.2 Loss in Material

5.3 Precession

5.4 Loss with sextupoles

5.5 Energy Determination by g-2

6 Introduction to Ionization Cooling

6.1 Definitions

6.2 Transverse Cooling

6.3 Focus Systems

6.4 Longitudinal and 6D Cooling

6.5 Minimum emitance vs. Energy

6.6 Conclusion

Wednesday

7 Solenoid Transverse Cooling

7.1 Angular Momentum Problem

7.2 Intro. to Solenoid Dynamics

7.3 Linear Dynamics II

7.4 Achromatic Matching

7.5 Synchrotron Motion

7.6 Momentum Amplitude Correlation

7.7 Additional Heating Terms

7.8 Simulations

8 Ionization Cooling Simulation (F)

8.1 Scattering

8.2 Straggling

8.3 Lithium lens design

8.4 Simulation codes

8.5 Transverse cooling examples

8.6 Work to be done

12 Backgrounds & Radiation

12.1 Neutrino Radiation

12.2 Detector Background

12.3 Beam Halo Scraping

13 Advanced Ideas

13.1 Luminosity Scaling

13.2 Optical Stochastic Coolng

13.3 Friction Cooling

13.4 Muonium Cooling

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14 Exam