

CONTENTS

<i>Preface</i>	vii
<i>Author's Biographies</i>	ix
Chapter 1. Introduction	1
Chapter 2. Historical Background	7
2.1. The Early History of Accelerators	7
2.2. Accelerator Physics in the Midwest	10
2.3. The Coming of Strong Focusing	11
2.4. The Desire for a New Accelerator Laboratory in the Midwest	12
Chapter 3. The Early MURA Years, 1953–1956	15
3.1. The Beginnings of MURA	15
3.2. The Invention of FFAG	20
3.3. MURA Studies	26
3.4. Theory of Radio Frequency Acceleration	34
3.5. Nonlinear Dynamics	41
3.6. The Radial Sector Model	46
3.7. The Spiral Sector Model	52
3.8. MURA Computing	59
3.9. Colliding Beams	63
3.10. Collective Instabilities	68
3.11. Conferences	72
Chapter 4. The Madison Years, 1956–1963	83
4.1. Formation of the MURA Organization	83
4.2. The Move to Madison	84
4.3. Space Charge	87

4.4.	Injection and Extraction	88
4.5.	The 50 MeV Two-Way Model	90
4.6.	MURA Proposals	95
4.7.	The 1959 Workshop; Synchrotrons Catch Up	99
4.8.	The Directorship of Bernard Waldman	101
4.9.	The Panel and Their Recommendations	106
4.10.	MURA Responds	117
Chapter 5.	The Last Years of MURA, 1963–1967	119
5.1.	The End of MURA	119
5.2.	The ZGS Tuneup and Improvement Program	121
5.3.	Linacs	126
5.4.	Magnet Development	129
5.5.	Cosmic Rays	130
5.6.	Bubble Chambers	132
5.7.	The Electron Storage Ring	133
5.8.	The Physical Sciences Laboratory; the Synchrotron Radiation Center	134
5.9.	Fermilab	137
5.10.	Cyclotrons and Nonscaling FFAGs Today and Tomorrow	139
5.11.	MURA's Last Gasp	142
Chapter 6.	Consequences and Reflections	145
6.1.	Innovations	146
6.2.	Innovation Was Not Enough	152
6.3.	Personal Note	156
	Bibliography	157
	Appendices	
A.	Glossary	171
B.	MURA Reports	183
C.	MURA Archives	225
D.	MURA Personnel	231
E.	List of Illustrations with Acknowledgments	239
F.	The Ramsey Panel, Lyndon Johnson, and the End of MURA, as Seen in Washington (Written by David Z. Robinson)	243
	Name Index	249
	Subject Index	253