

Contents

1. Introduction	1
1.1 The Observatory	1
1.2 Observing Proposals	2
1.2.1 Proposal Preparation	2
1.2.2 Proposal Submission and Refereeing	3
1.2.3 Proposal and Observing Propriety	4
1.3 Observatory Policy	4
1.3.1 Staff Responsibilities	4
1.3.2 Observer's Responsibilities	4
1.3.3 Maintenance and Repairs	5
1.3.4 Sharing Telescope Facilities with Other Observing Teams	5
1.3.5 Observations under Poor Weather Conditions	5
1.3.5.1 High Winds	5
1.3.5.2 Moisture Accumulation In or On the Dome	6
1.3.5.3 Sun on the Dish	6
1.3.5.4 Observations Using Emergency Power Generators	6
1.3.5.5 Safety Rules	6
2. Getting Started	9
2.1 What to Bring to the Telescope	9
2.2 Startup Checklist	10
2.3 Basic Data Reduction with UniPOPS	11
2.4 Alternate Data Analysis Packages	13
2.4.1 CLASS	13
2.5 Data Archiving and Export	17
3. Instrumentation	19
3.1 Telescope Site Layout	19
3.2 Telescope Optics	19
3.3 Receivers	20
3.3.1 1mm Array Receiver	23
3.3.1.1 1mm Array Rotator and Positioning Conventions	24
3.3.1.2 Pointing and Mapping O sets with the 1mm Array Rotator	25
3.4 The Local Oscillator System	26
3.5 The IF Section	27
3.6 Spectrometers	28
3.6.1 Filter Banks	28
3.6.2 Millimeter Autocorrelator (MAC)	28
3.6.3 Continuum Backend	29
3.7 Computer Equipment	29
4. Tracking, Pointing, and Focus	31
4.1 Tracking Capabilities	31
4.1.1 Ephemeris Objects	32
4.2 Tracking Limits	33
4.2.1 Elevation Limits	33
4.2.2 Azimuth Limits	34
4.3 Tracking Error Tolerance	34
4.4 Sequence of Position Computation Operations	34

Contents

4.5 Sub reflector Beam Throw	36
4.6 Pointing	38
4.6.1 Continuum and Spectral Line Five-Point Measurements	38
4.6.1.1 Continuum Five-Point Analysis	45
4.6.1.2 Spectral Line Five-Point Analysis	45
4.6.2 Pointing Model Equations	48
4.6.3 Pointing Data Analysis Program	48
4.7 Focus	48
4.7.1 Axial Focus	48
4.7.2 Determining the Axial Focus	51
4.7.3 Lateral Focus	51
5. Spectral Line Observing	55
5.1 Startup Checklist	55
5.2 Sideband Choice	56
5.3 Spectrometers	57
5.3.1 Filter Banks	57
5.3.1.1 The Parallel/Series Option	57
5.3.1.2 Bad Channel Elimination	57
5.3.1.3 Frequency O sets	60
5.3.2 Millimeter Autocorrelator	60
5.3.2.1 The 4IF Observing Mode	60
5.4 Observing Modes	63
5.4.1 Total Power ONs and OFFs	63
5.4.2 Position Switching	64
5.4.3 Absolute Position Switching	66
5.4.4 Frequency Switching	66
5.4.5 Beam Switching	70
5.4.6 Mapping	71
5.4.6.1 Manual O sets	71
5.4.6.2 Grid Mapping	71
5.4.6.3 When Should I OTF Instead of Grid Map?	74
5.4.6.4 An Important Note about Spatial Sampling	74
5.5 Spectral Line Sensitivities	75
5.6 Calibration.	77
5.6.1 Vane Calibration	77
5.6.2 Direct Calibration	78
5.7 Signal Processing	79
5.7.1 Position and Frequency Switched Data	79
5.7.1.1 Vane/Chopper Calibrates	79
5.7.1.2 No-Cal Signal Processing	80
5.7.2 Beam Switched Data	80
5.8 Changing the Intermediate Frequency	81
5.9 Spectral Line Status Monitor	82
6. Continuum Observing	87
6.1 Startup Checklist	87
6.2 Selecting an Observing Frequency	88

Contents

6.3 Observing Basics	88
6.3.1 Switching Modes	90
6.3.2 Checking the Sub reflector Throw	90
6.3.3 Continuum Sensitivity	92
6.3.4 The Digital Backend	93
6.3.5 Software Signal Processing of Digital Backend Data	94
6.4 Observing Procedures	96
6.4.1 Point Source ON/OFF Observing Procedures	96
6.4.1.1 The ON/OFF Sequence	96
6.4.2 Mapping Extended Sources	98
6.4.2.1 Grid Mapping	98
6.4.2.2 Continuum On-The-Fly Mapping	99
6.5 Utility Observing Routines	99
6.5.1 Sky Tip Procedures	99
6.5.1.1 The SPTIP Analysis Procedure	100
6.5.1.2 The STIP Reduction Procedure	101
6.6 Calibration.	103
6.6.1 Vane Calibration	103
6.6.2 Hot/Cold-Load Calibration	105
6.6.3 Calibration of the Flux Density Scale	108
6.7 Continuum Status Monitor	109

Contents

A. Pointing Equations for the 12m Telescope	113
A.1 Primary Pointing Equations	113
A.1.1 Secondary Pointing Corrections	115
B. The Relationship between Flux and Brightness Temperature	117
B.1 Uniform Disk Source	117
B.2 Elliptical Gaussian Source	118
C. Temperature Scales and Telescope Efficiencies	119
C.1 Definitions	119
C.2 Relations Between Temperature Scales	121
C.3 Telescope Efficiency Measurements	122
C.3.1 Corrected Main Beam Efficiency	122
C.3.2 Main Beam Efficiency	122
D. Spectral Resolution and Sensitivity Bandwidth in Spectrometers	125
D.1 Function Integrals	126
D.1.1 Sinc	126
D.1.2 Gaussian	126
D.1.3 Hanning	127
D.1.4 Hamming	127
E. Walsh Function Modulation	129
F. The Radiometer Equation for Position Switched Measurements	133
G. The 12m Telescope Primary Focus Plate Scale	137