9-6-00

Memorandum

To: K. Crady, G. Ediss, R. Groves, A. R. Kerr, D. Koller, G. Lauria, M. Lambeth, S. -K. Pan

cc: J. Webber

From: J. Effland

Date: 6 September 2000

Subject: Mixer Measurement System Hardware Tasks

Summary

This memo describes the major tasks and the resource assignments for mixer measurement system hardware. Detailed assignments are shown in the attached MS Project task listings.

The primary purpose for this memo is to ensure that everyone involved knows:

1. their responsibilities, and
2. the priorities assigned for the tasks.

Installation of 3-13 GHz IF Amplifier in Dewar

Most measurement effort has recently been directed towards measuring the mixer/preamp combinations. A high priority task is to install a single 3-13 GHz IF amplifier to increase the IF gain in the Dewar. This will allow accurate measurements of mixer/preamp gain, noise contribution, and frequency response. Figure 1 shows a block diagram of the overall measurement system including this new IF amplifier. Kirk is responsible for the mechanical and RF interfacing and Ralph is handling construction of the bias cable.

Construction of Mixer/Preamp Simulator

Ralph is building a box to simulate the interface characteristics of the mixer/preamp. This uses the same connector and pinouts as the real mixer/preamp and will provide confirmation that the bias supplies are operating properly prior to installing the real mixer/preamp.

A similar simulator was constructed for the sideband-separating balanced mixer that allowed us to confirm that the four bias supplies and associated wiring is ready for that mixer.

Upgrades to 5th Mixer Bias Supply for 600 GHz Measurements

The four newest bias supplies have been dedicated to measuring sideband separating, balanced mixers and are installed in the JT-2 rack. A 5th bias box is needed to support the 600 GHz mixer measurements, so Kirk has updated the old "Type II" bias supply with output shorting switches. He is also going to replace the existing independent power supplies in that chassis with regulators powered from the standard ±20V rack supplies.

Quieter Chopper Wheel

Dan Koller is working on several chopper wheel projects:

1. Quite the existing wheel.
2. Design and build a smaller wheel.
3. Repackage the chopper wheel triggering circuit and associated voltage regulator on PC boards.

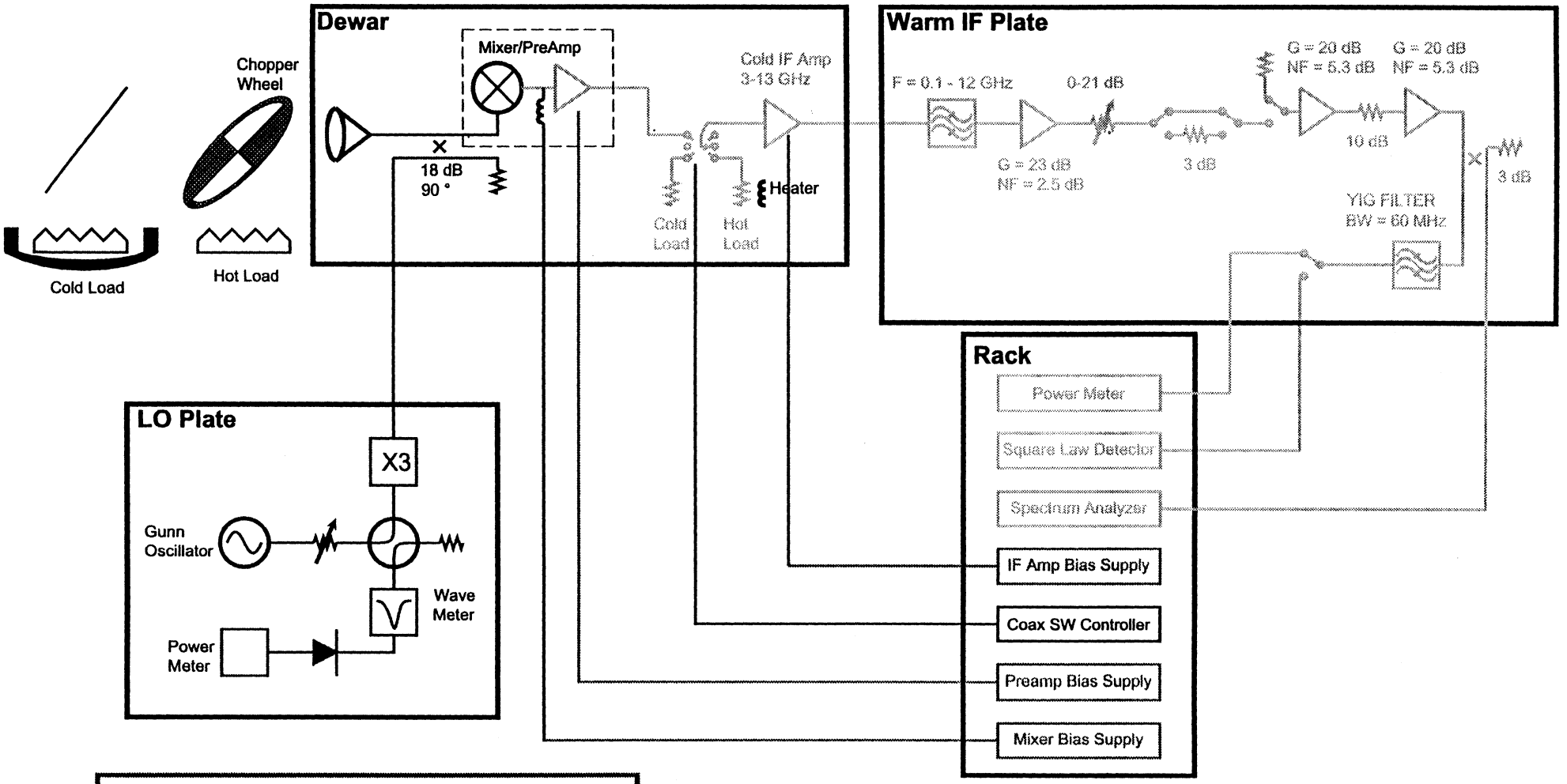
Mike Lambeth has stuffed components into the new triggering circuits on the PC boards, but is waiting on the optical interrupter to finish the task. The interrupters were omitted from the initial parts order and were ordered a few days ago.

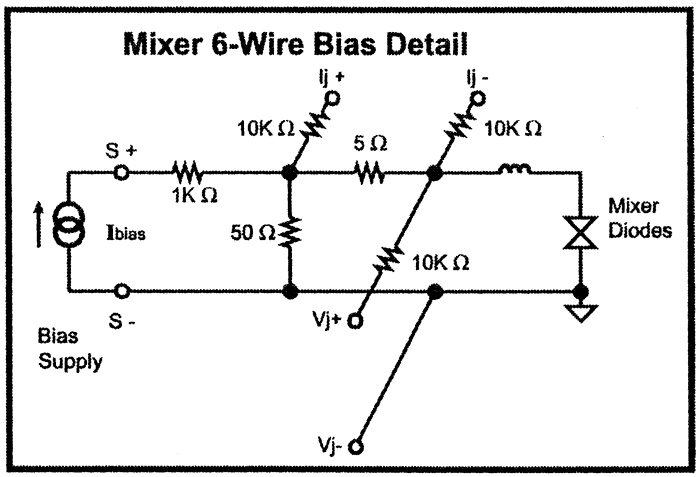
4-Channel Mixer Bias Supply

We have recently received the components required to test our concept of using reed relays to short the bias lines during mode switching of the new, 4-channel mixer bias supply. Kirk will install a suitable driver and one of these relays in the same bias supply that has the Lead-Lag compensation network. Afterwards, we will confirm using an oscilloscope that this relay does not introduce noise spikes on the bias lines.

Task Lists

Figure 2 lists the tasks assigned to Kirk roughly ordered from most to least importance. Figure 3 is the same type of list for tasks assigned to Ralph. The overall task list is given in Figure 4.





Color Key

RF

IF

Bias

REV	WHO	DATE	DESCRIPTION
02	JEE	2000-09-05	ADDED COLD IF AMP
01	JEE	2000-04-05	INITIAL

NATIONAL RADIO ASTRONOMY OBSERVATORY
CHARLOTTESVILLE, VA. 22903

TITLE: OVERALL DIAGRAM MIXER/PREAMP TESTS

PROJECT: SIS MIXER MEASUREMENT SYSTEM

DESIGN				
DRAWN	JEE	2000-04-05	MATERIAL	
SHEET			FINISH	

COMPUTER DRAWING: \\Eagle\cv-cdl-sis\docs\rack\MixerPreamp.dwg

SCALE: None | DWG. NO. | REVISION: 02

Fig 1

ID	Task Name	Resource Initials	Notes
1	**SIS Mixer Measurement System**		
1	**Hardware**		
221	**Mixer/Preamp Tests**		
222	**3-13 GHz Cold IF Amp**		Adds more gain to Dewar.
223	Mechanical Interfaces	WKC	
217	**600 GHz Mixer Tests**		
218	**Mixer Bias Supply**		2000-09-29 Get the 5th (oldest) bias supply (Type II) working, and add shorting switches to it....
219	Update Documentation	WKC	
220	Add Shorting Switches	WKC	
169	**4 CH Mixer Bias Supply**		
171	**Shorting Relay Tests**		
172	Test reed relay for static discharge	WKC	Initial tests were inconclusive. Additional testing required.
177	Mechanical Layout	WKC	
2	**SS-DB Mixer Measurements**		
3	**Test System**		
5	**IF Amps -Balanced Design**		
7	**Quadrature Hybrids**		
10	Install	WKC	
11	Design mounting fixture	WKC	
46	**Mixer Interfaces**		
50	**Pole Pieces**		
54	Receive from Shop	WKC	
55	Install	WKC	
56	**Mixer Mounting Brackets**		
60	Receive from Shop	WKC	
61	Install	WKC	
64	**Non-Essential Tasks**		
67	Fix 50K-stage heater wiring	WKC	Find open in heater wiring and repair.
68	Magnet Coil Fabrication - 2 more	WKC	
112	**Refrigerator Controller**		
113	**Software for MUX Controller**		
114	**Check**	**WKC**	
115	Using JT-1 Controller	WKC	
116	Using JT-2 Controller	WKC	
89	**Complete JT-1 Rack**		
98	**Dewar**		
99	**Wiring**		
100	Find Suitable Wire Type	WKC	
101	**Window**		
105	Install	WKC	
106	Mechanical Interfaces	WKC	
107	Lens Assy	WKC	
108	**Cold IF Plate**		
109	Order components	WKC	
92	Wire all 6 positions for coax switch	WKC	
93	**Warm IF Plate**		
94	Parts - Order	WKC	
117	**Heater Controller**		
118	System Design	WKC	
119	Procure Parts	WKC	

Fig. 2A

ID	Task Name	Resource Initials	Notes
122	Test	WKC	
192	**Preamp Bias Supply**		
210	**Software**		
211	Upgrade	WKC	

FIG. 28

ID	Task Name	Resource Initials	Notes
1	**SIS Mixer Measurement System**		
1	**Hardware**		
221	**Mixer/Preamp Tests**		
222	**3-13 GHz Cold IF Amp**		Adds more gain to Dewar.
224	**Cold IF Plate to Amp Wiring**	RG	
226	Fab Cable	RG	
227	**Mixer/Amp Test Fixture**		2000-09-05: Build fixture to test electrical interfaces.
229	Fabricate	RG	
169	**4 CH Mixer Bias Supply**		
178	Order Parts	RG	
179	**PC Boards**		
181	Fabricate	RG	
183	Chassis Wiring/Assembly	RG	
159	**Automated LO level control**		Use modulator to turn LO on and off
165	Operates with WR-10/12 Modulators?	RG	
2	**SS-DB Mixer Measurements**		
3	**Test System**		
5	**IF Amps -Balanced Design**		
12	Assembly	RG	
64	**Non-Essential Tasks**		
66	Install Diode Protection	RG	Install protection diodes for both mixer and amplifer in bias lines.
123	**Fix pod with excessive filtering**		2000-08-29 Problem only occurs with Gene's Mixer....
124	Order more filters	RG	
135	**Chopper Wheel**		
150	**Cold Load**		
152	Fabricate	RG	2000-09-05: Cut cold load to fit new container.
136	**Motor Control**		
137	Add DIO7 and CONVERT to other two Refrig controllers	RG	Only one I/O box modified now.
166	**Upgrade Mixer 1 Rack**		
167	Rebuild Dewar connectors	RG	
168	Permanent Hardware Installation	RG	Install IF switch on IF Plate...
187	**Cold 3-13 GHz IF Amp Bias Supply**		
188	Documentation Collection/Organization	RG	
89	**Complete JT-1 Rack**		
98	**Dewar**		
110	Temperature Cabling	RG	
111	Diode Protection	RG	Install protection diodes for both mixer and amplifer in bias lines.
90	General rack wiring	RG	
91	Check Coax SW Driver	RG	Confirm that it still works - it was plugged into JT-2 rack using the wrong cable, and an output transistor smoked. It was replaced, but oth
93	**Warm IF Plate**		
97	Fabricate	RG	
117	**Heater Controller**		
121	Fabricate	RG	
192	**Preamp Bias Supply**		
194	**Documentation Collection/Organization**		
195	Test Procedures	RG	
193	Build Two More	RG	Wait for final budget -- mixer bias supplies are more important.

Fig. 3

ID	Task Name	Resource Initials	Notes
1	**SIS Mixer Measurement System**		
1	**Hardware**		
2	**SS-DB Mixer Measurements**		
3	**Test System**		
5	**IF Amps -Balanced Design**		
6	Fabricate	MP	Schedule from John Webber given on 2000-04-13...
7	**Quadrature Hybrids**		
10	Install	WKC	
11	Design mounting fixture	WKC	
12	Assembly	RG	
13	Test	JEE	
46	**Mixer Interfaces**		
50	**Pole Pieces**		
53	Fabricate	Shop	
54	Receive from Shop	WKC	
55	Install	WKC	
56	**Mixer Mounting Brackets**		
59	Fabricate	Shop	
60	Receive from Shop	WKC	
61	Install	WKC	
62	Prepare software	JEE	
63	System Testing	JEE,RG,WKC	
64	**Non-Essential Tasks**		
66	Install Diode Protection	RG	Install protection diodes for both mixer and amplifer in bias lines.
67	Fix 50K-stage heater wiring	WKC	Find open in heater wiring and repair.
68	Magnet Coil Fabrication - 2 more	WKC	
69	Test System ready		
70	**Mixer Fabrication**		
71	**Body**		
73	Release to Shop		
75	Fabrication	Shop	
78	Integrate Wafer into body	NH	
79	Ready for Tests		
81	SS-BM testing begins		
85	Routine Mixer Testing		
89	**Complete JT-1 Rack**		
90	General rack wiring	RG	
91	Check Coax SW Driver	RG	Confirm that it still works - it was plugged into JT-2 rack using the wrong cable, and an output transistor smoked. It was replaced, but oth
92	Wire all 6 positions for coax switch	WKC	
93	**Warm IF Plate**		
94	Parts - Order	WKC	
95	Parts - Delivered		
96	Confirm amp config	JEE	Check that everything is properly balanced.
97	Fabricate	RG	
98	**Dewar**		
99	**Wiring**		
100	Find Suitable Wire Type	WKC	
101	**Window**		
105	Install	WKC	
106	Mechanical Interfaces	WKC	

Fig. 4A

ID	Task Name	Resource Initials	Notes
107	Lens Assy	WKC	
108	**Cold IF Plate**		
109	Order components	WKC	
110	Temperature Cabling	RG	
111	Diode Protection	RG	Install protection diodes for both mixer and amplifer in bias lines.
112	**Refrigerator Controller**		
113	**Software for MUX Controller**		
114	**Check**	**WKC**	
115	Using JT-1 Controller	WKC	
116	Using JT-2 Controller	WKC	
117	**Heater Controller**		
118	System Design	WKC	
119	Procure Parts	WKC	
120	Parts Delivered		
121	Fabricate	RG	
122	Test	WKC	
123	**Fix pod with excessive filtering**		2000-08-29 Problem only occurs with Gene's Mixer....
124	Order more filters	RG	
125	**Warm IF Plate (JT-2)**		
126	**Update Documentation**		
127	Integ with Main Schems	JEE	
132	**Readjust Square-Law Detector Linearity**		
134	Measure and Adjust	JEE	
135	**Chopper Wheel**		
136	**Motor Control**		
137	Add DIO7 and CONVERT to other two Refrig controllers	RG	Only one I/O box modified now.
138	**Make wheel quieter**	**DK**	
141	Fab Lighter Wheel	ShopGB	
142	Test Lighter Wheel/Motor	DK	
143	Procure more motors	DK	
144	**Repackage Motor Controller**		
147	Fab Boards	MRL	
148	Test Boards	DK	
150	**Cold Load**		
152	Fabricate	RG	2000-09-05: Cut cold load to fit new container.
158	Integrate Bradley's LO System		From August meeting, Pan recommends delaying this until Bradley's LO's are ready.
159	**Automated LO level control**		Use modulator to turn LO on and off
165	Operates with WR-10/12 Modulators?	RG	
166	**Upgrade Mixer 1 Rack**		
167	Rebuild Dewar connectors	RG	
168	Permanent Hardware Installation	RG	Install IF switch on IF Plate...
169	**4 CH Mixer Bias Supply**		
170	Analyze Root-Locus Plot	JEE	2000-04-14 Understand stability requirements of bias supply voltage feedback system.
171	**Shorting Relay Tests**		
172	Test reed relay for static discharge	WKC	Initial tests were inconclusive. Additional testing required.
174	Put Sequencer into PAL	JEE	
175	Rethink front panel	JEE	
176	Complete schematics	JEE	
177	Mechanical Layout	WKC	
178	Order Parts	RG	

FIG. 4B

ID	Task Name	Resource Initials	Notes
179	**PC Boards**		
180	Layout	JEE,WKC	
181	Fabricate	RG	
182	Test	JEE,WKC	
183	Chassis Wiring/Assembly	RG	
184	**System Tests**		
185	Hardware	JEE,WKC	
186	Software	JEE,WKC	
187	**Cold 3-13 GHz IF Amp Bias Supply**		
188	Documentation Collection/Organization	RG	
192	**Preamp Bias Supply**		
193	Build Two More	RG	Wait for final budget -- mixer bias supplies are more important.
194	**Documentation Collection/Organization**		
195	Test Procedures	RG	
210	**Software**		
211	Upgrade	WKC	
212	Construction complete		
214	**SSB Injection/Measurement**		
215	Package Components		
216	Software development		
217	**600 GHz Mixer Tests**		
218	**Mixer Bias Supply**		2000-09-29 Get the 5th (oldest) bias supply (Type II) working, and add shorting switches to it....
219	Update Documentation	WKC	
220	Add Shorting Switches	WKC	
221	**Mixer/Preamp Tests**		
222	**3-13 GHz Cold IF Amp**		Adds more gain to Dewar.
223	Mechanical Interfaces	WKC	
224	**Cold IF Plate to Amp Wiring**	**RG**	
226	Fab Cable	RG	
227	**Mixer/Amp Test Fixture**		2000-09-05: Build fixture to test electrical interfaces.
228	Drawing to Simulate FET's with resistors	JEE	
229	Fabricate	RG	
230	**Software, SIS Mixer Measurement System**		
1	Software for 600 GHz LO		2000-08-24 Test to confirm Mixer 1 SW will work at 600 GHz.
2	Protect data already measured	JEE	Provide suitable warnings prior to overwriting data already measured....
3	**Sweep Parameters Subsystem**		
4	Get "Add" Working		
5	**Move Up/ Move Down**		
6	Sweep Order		Make sure it's unique.
7	**DataBase**		
8	Measurement Version Field	JEE	Add field for measurement software version...
9	Rack ID Field	JEE	
10	Store all parameters	JEE	
11	AddNewParameter	JEE	2000-08-15 Update Sweep Order
12	Upgrade Code to ADO	JEE	
13	Change from Access to MSDE	JEE	
14	Add Anal and Meas S/W version to all outputs	JEE	
15	Update CdbStoreData	JEE	2000-08-02 Remove m_oFields.Add "Key4Depend", "Key4Depend" and replace with normal field names.
16	Error Handling	JEE	2000-08-03 Add boolean return value to OpenRecordset....
17	**Automatic Graph of Results**		

Fig 4c

ID	Task Name	Resource Initials	Notes
18	Plot Mixer Isolation	JEE	
19	Control during power outage	JEE	Add UPS to computer to provide notification of power outage. During and after outage, computer should close valve between vacuum pu
20	**Temperature/Pressure Strip Chart**		
21	Use SDEV for pressure data	JEE	Entered: 1999Feb10 10:17
23	Investigate resource sharing	JEE	Entered: 1999Feb10 15:11
24	Parameter subgraph	JEE	User can enter a number of selectable parameters in an autoscaling graph...
26	Fix Graphing Limits Dialog box	JEE	This works only for noise graph.
27	**I-V Measurement (Visual Basic)**		
28	**Fix DB interface Errors**		
29	Restructure db Components	JEE	Design using data controls is awkward at best.
30	Delete last measurement record	JEE	When the last measurement record is deleted, the dialog box should query the user about keeping the mixer record. If yes, then add a b
31	Initials get mangled	JEE	The initial field gets mangled....
32	Use Cgraph object for plotting data	JEE	
33	Set Plot Scales	JEE	Scales should be set for predefined values rather than allowed to autorange.
34	Make stepping direction user-selectable	JEE	That is, either min step to max step to min or min-max return to min
35	Test for Bias point data	JEE	When retruning for IV plotting form, enhance no data test to test for bias point data too.
36	Change Commanded Bias Range	JEE	The bias v range doesn't change when changed in the mixer bias dialog box.
37	Record SDEV for oscillation	JEE	
38	Get SDEV "Retry" working	JEE	
40	**Optimization**		
47	Show graph of IV-Plot and bias point if already exists in dB	JEE	
48	Get MeasType from Query	JEE	' 2000-02-29 jee TO DO: in CdbStoreData.bInit, replace the select case with a database query into table MeasTypeDefs. See the excel
49	Calculate bias offset	JEE	Correct bias plots so the offest is removed -- plot negative bias voltages, and look for inflection of symmetry point....

Fig. 4D

ID	Task Name	Resource Initials	Notes
50	**Noise Measurement (Excel)**		
51	Add IF Freq Adjust	JEE	23Jun2000 Removed spectrum analyzer frequency measurement module. This needs to be replaced with IF Set frequency.
52	Port to Database	JEE	
53	vs Stepped Bias Volts	JEE	
54	vs LO Power	JEE	
55	Indep control of each bias box	JEE	Independently control each bias box to simplify reverse bias setup and measurement.
56	Dewar IF Switch	JEE	To reduce problems with dewar IF switch, make at least three measurements, throwing switch each time. If all three are not within 0.05
58	Isolate frmDataCollection from RangeNames	JEE	Range names belong only in the CBalMixDataForm class.
59	Share modules with bias meas	JEE	
60	Share Modules between racks	JEE	
61	Errors with empty workbook	JEE	Menu functions "Existing" and "Graph" error if there are not sheets in the current workbook....
62	Rev Bias Algorithm Working?	JEE	Confirm this works
63	Faster chopper response	JEE	2000-02-08 Move CMotor resolution and slew settings to init function so they aren't...
64	**Mixer-1 Rack**		
65	Update for 600 GHz Operation	JEE	2000-07-27 jee Test both I-V curve software and noise measurement spreadsheet.
66	Circ Noise	JEE	Circulator noise doesn't turn on with restart...
67	Plot Tr without Radome	JEE	
68	Vague SB Error Message	JEE	If a sideband is entered that's not on the list, the error message is nebulous....
69	Plot L*Tif	JEE	On the noise temperature plot it might also be good to show the contribution...
70	**JT-2 Rack**		
71	Generate final plot of data	JEE	
72	Calculate output 2 data	JEE	Correct spreadsheet for output port 2 data: Lorej, Tlo, etc....
73	Read Tif	JEE	Put this into appropriate cell on spreadsheet....
74	Don't reset Imag	JEE	Stop resetting mag current after each measurement....
75	Only plot rows with data	JEE	Only plot those rows with data -- turn plotting of other rows off to clean-up graph.
76	**Intial System Checks**		
77	Noise source switch	JEE	Confirm that noise source switch is in auto mod by turning switch on and off and checking for noise power difference....
78	Pin Attn Test	JEE	Confirm that Pin attenuator is working by measuring noise power while stepping through several attenuation ranges. May want to set hig
79	**I-V Plotter (Excel)**		
80	Correct button text	JEE	Should be 'Graph selected data"
81	Use Multi-Select box for meas & plot	JEE	Make the measurement list box multi-select, which is useful for printing.
82	Better recovery from empty db records	JEE	when only a mixer record is entered, but no measurements, the program currently crashes
83	Error using Print Last with no sheets	JEE	When there are no sheets in the workbook and this command is run, the delete sheet errors because each workbook must contain at leas
84	Errors with Long Comments	JEE	Sometimes long comments don't show up on plots....
85	Move Comment	JEE	Std Dev Box - move comment to status box
86	Std Dev Too Low	JEE	Too low during Rev Bias Meas
87	Second time printing causes error	JEE	Second time printing from Meas IV caused error: "Object ~ in Class ~..". Also C drive was full.

Fig 4E