

# Introduction to Aspect Signaling with JMRI/PanelPro

Dick Bronson - *RR-CirKits, Inc.*

Clinics in this series:

- **Introduction to Aspect Signaling with JMRI/PanelPro**

4:00 PM, Wednesday, July 6<sup>th</sup>

- **Aspect Based Signaling Internals with JMRI/PanelPro**

4:00 PM, Thursday, July 7<sup>th</sup>





## ■ Web Sites

<http://www.rrsignalpix.com/index.html> A site for Signals and rules.  
By Zachary Gillihan

<http://www.ctcparts.com/> An excellent site for CTC information.  
By Michael Burgett

<http://www.RR-CirKits.com/> Our web site for signal control hardware.  
By Dick Bronson



## ✓ **Signal System types**

There are two general methods of signaling in use for railroads. The first is 'Route' based, and the second is 'Speed' based.

### ✓ **Route based signals:**

Route based signals give a general indication of the route condition ahead of the train.

### ✓ **Speed based signals:**

Speed based signals primarily give the target speed for the track ahead of the train.



## ✓ **Route based signals:**

Route based signals in the USA give a general indication of the route condition ahead of the train. Some European route systems may give very specific information. Typically the western US railroads used route based signals. The long distances between signals leaves plenty of room for stopping in advance of signals with only one or two signals of advanced warning.

JMRI has supported Route Based signaling with SSL (Simple Signal Logic) for a number of years now. Some small amount of speed information may be combined with the route information by the use of flashing aspects.



# UP Route signal near Barstow, CA

Signal System Types



Photo by Chris Sanfino



## Speed based signals:

Speed based signals in the USA are usually found on the more congested eastern routes where the added cost of shorter blocks and more complex signal hardware is justified by the denser east coast traffic patterns.

Speed signaling requires many different aspects in order to indicate each combination of speeds that apply to the next section of track.

Support for speed signaling is just now being added into JMRI and is called "Aspect Signaling". This new capability is the topic of today's clinic.





# Speed signal in Sauget, IL

Signal System Types



ZACHARY C. GILLIHAN

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## ✓ Setting the PanelPro Preferences

Setup your hardware according to the information found in the JMRI Help pages. Select 'Help' - 'General Help...' then navigate down to 'DecoderPro' - 'DecoderPro Manual' - 'Getting Started' - 'Setting Preferences'. On the web go to:

[http://www.jmri.org/help/en/manual/Getting\\_Started.shtml#Start](http://www.jmri.org/help/en/manual/Getting_Started.shtml#Start)

## ✓ Note:

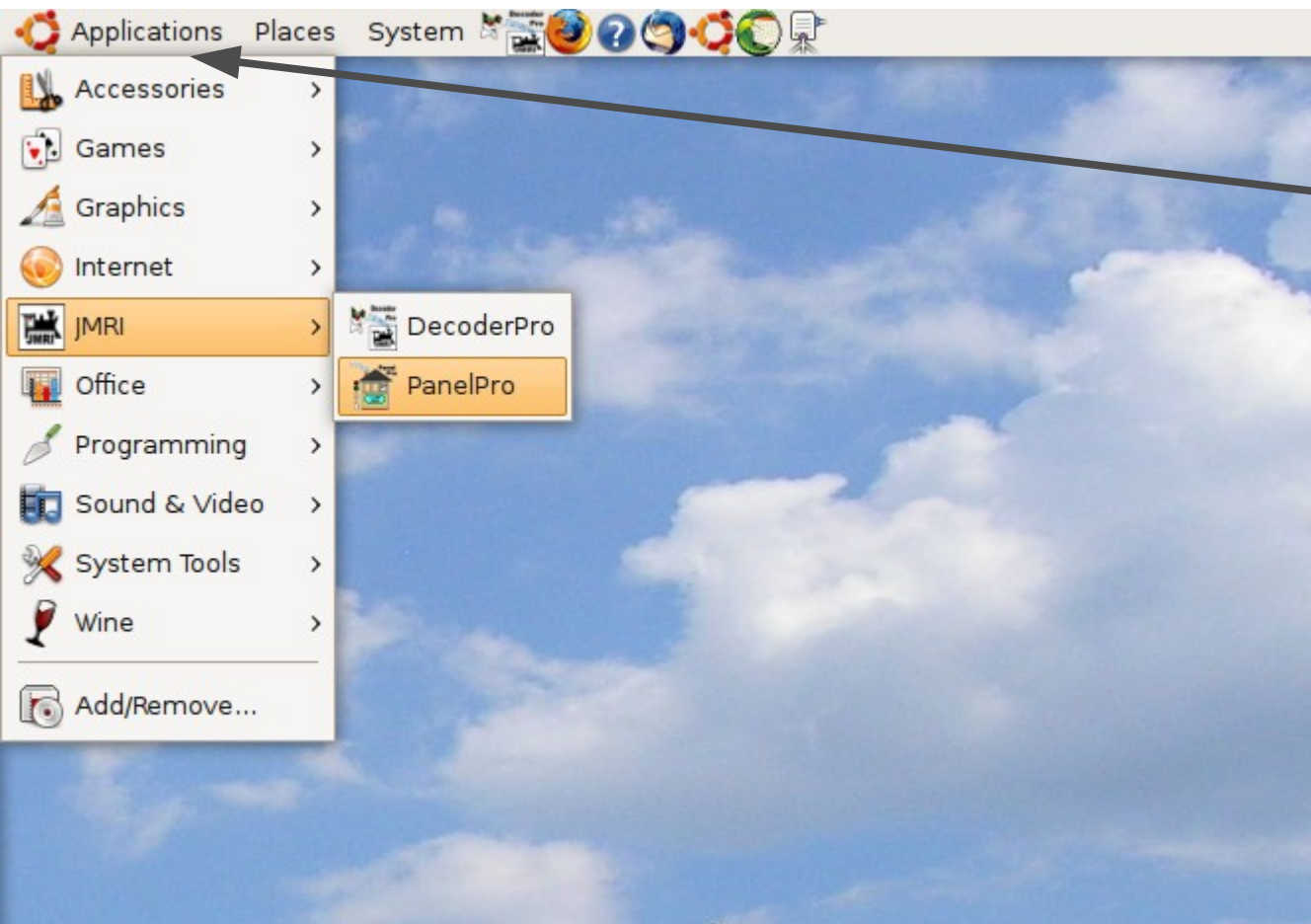
The setup options for PanelPro are saved in their own startup file, distinct from those in DecoderPro. Normally you will use the same settings for both DecoderPro and PanelPro.

Be sure to not try and run both PanelPro and DecoderPro at the same time. They are essentially the same program, so you have the full capabilities of each no matter how you initially start it running.



# Getting Started

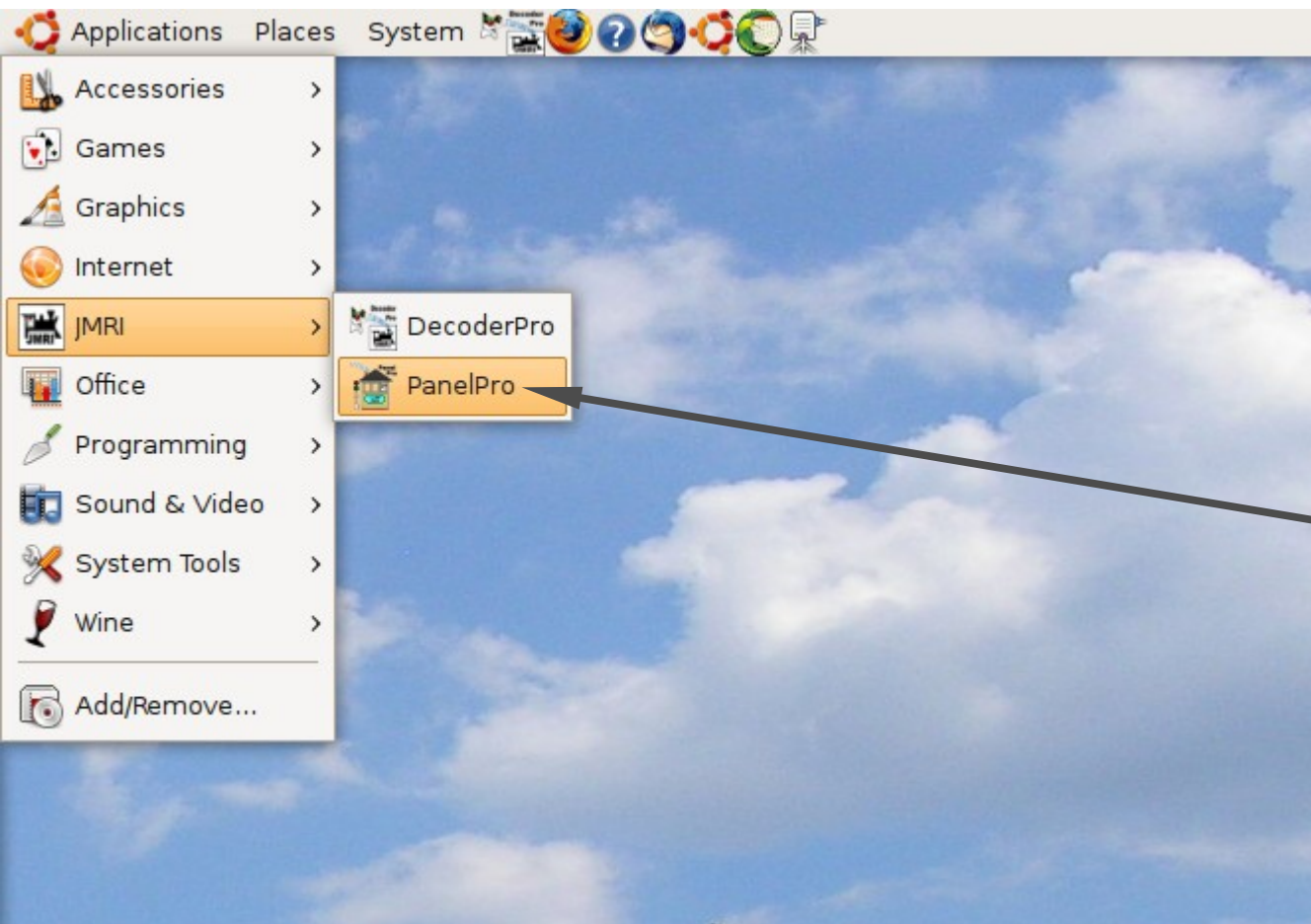
## Starting the Program



- Use your own operating systems method for starting the program. In this demo we are running with Ubuntu Linux.

# Getting Started

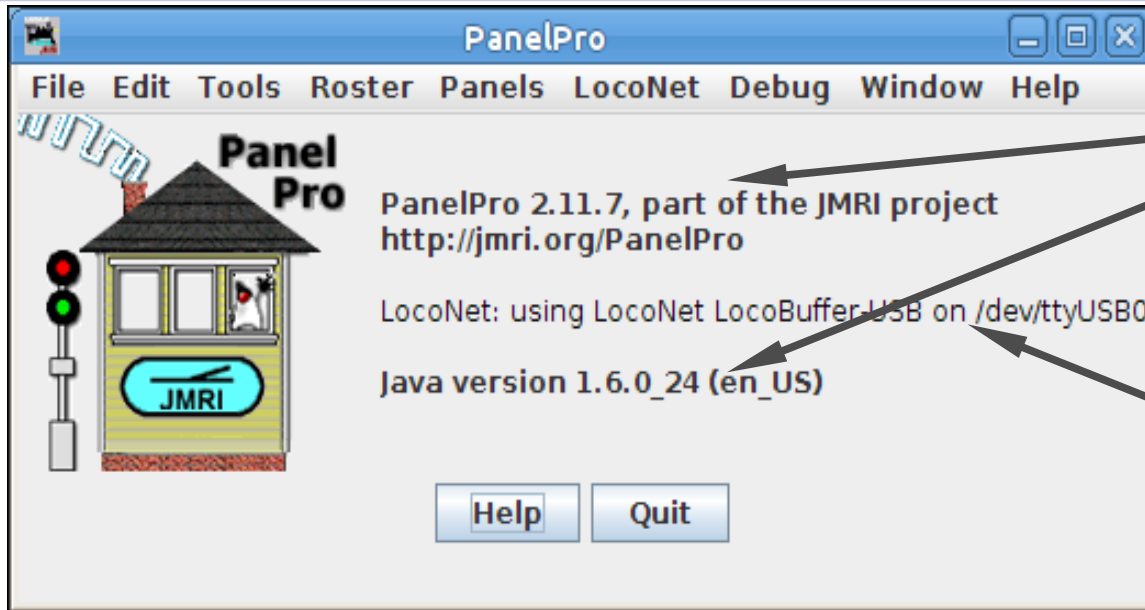
## Starting the Program



- Use your own operating systems method for starting the program. In this demo we are running with Ubuntu Linux.
- Select the desired startup icon and single click.

# Getting Started

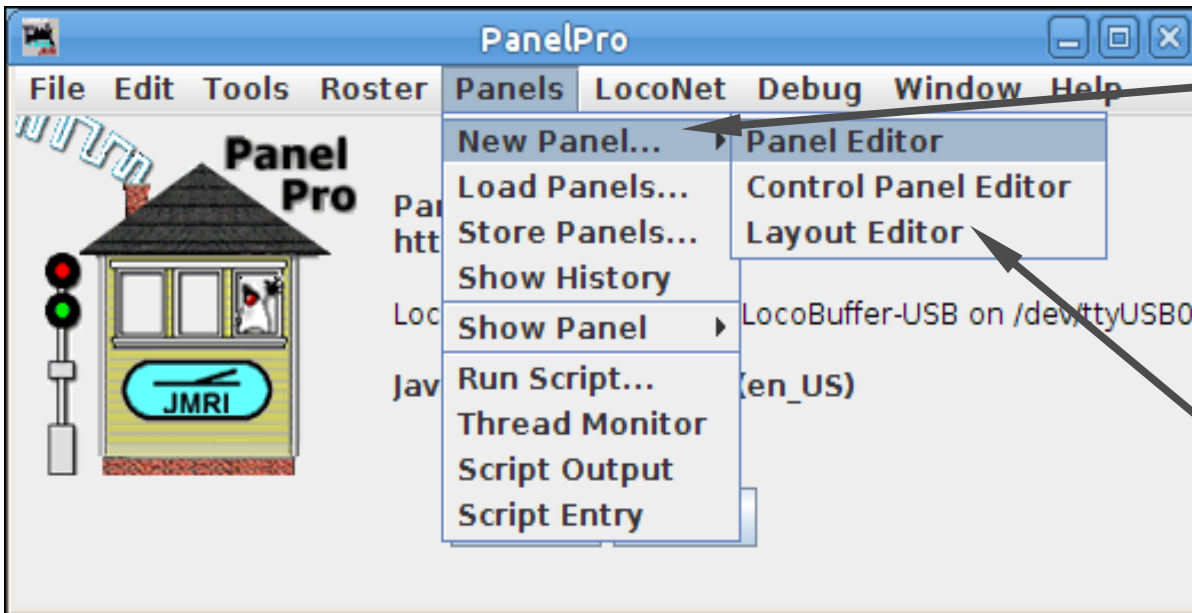
Useful Information



- The initial PanelPro window includes information about the version numbers of JMRI, Java, and also information about the computer interface. Include this information as well as your computer's operating system type in any support requests.

# Getting Started

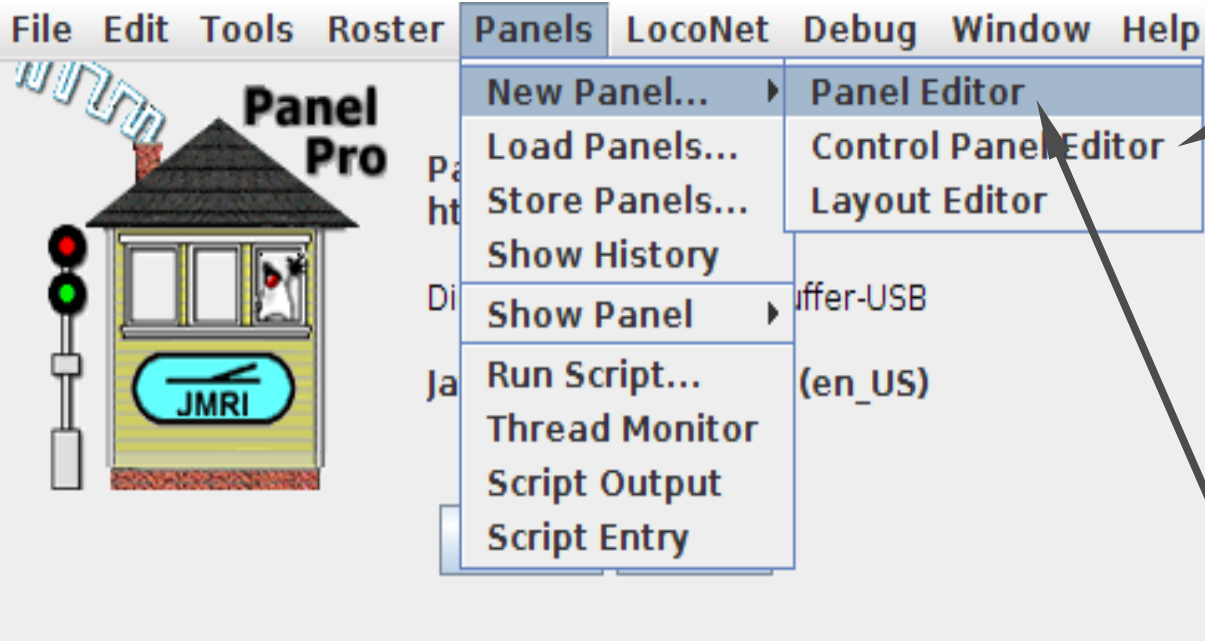
Opening a new panel



- To get started on building a panel open the 'Panels' drop down list and select 'New Panel'
- This will open a selection between the 'Layout Editor' and 'Panel Editor'
- The 'Layout Editor' is a vector based way to create a drawing that follows your layout plan and which auto captures much of the information required for Signaling.

# Getting Started

Opening a new panel

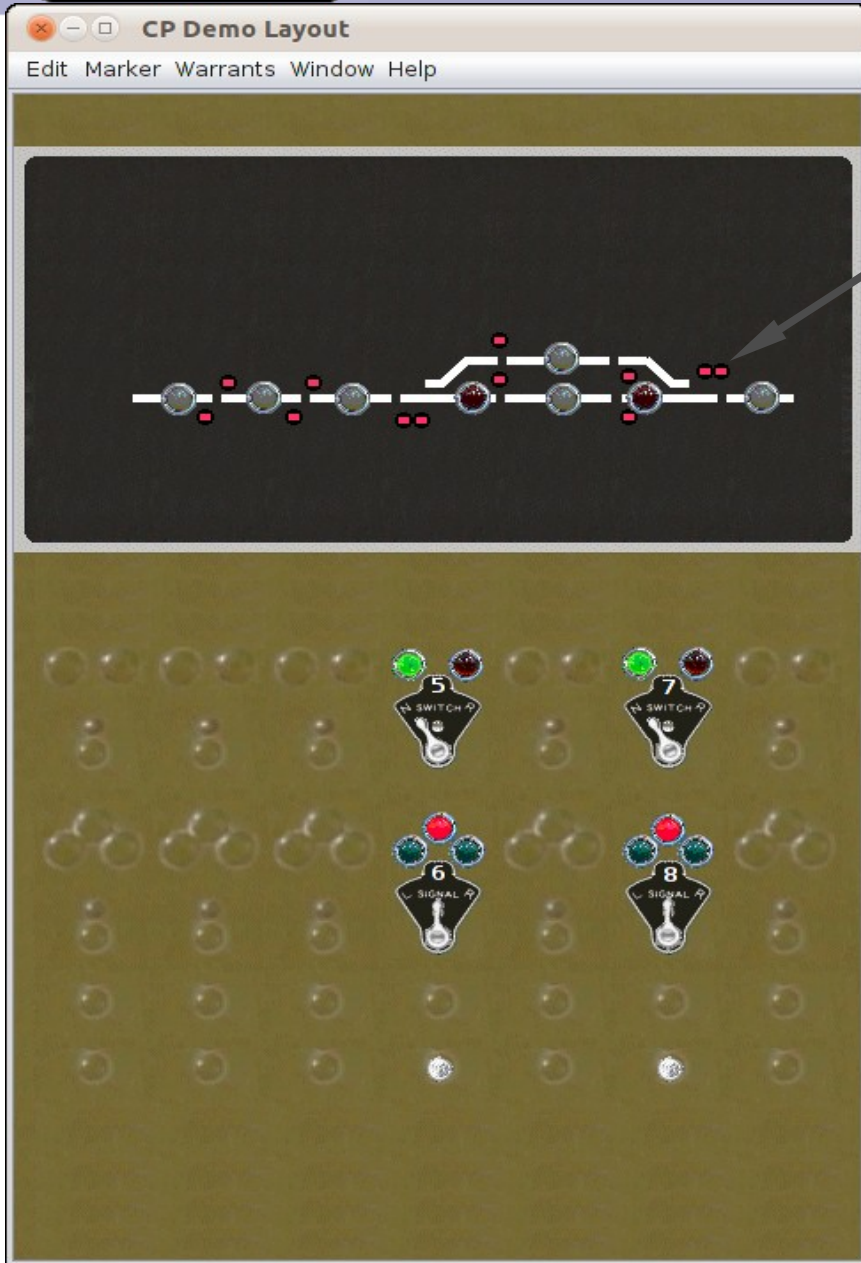


- The 'Control Panel Editor' is a graphic editor similar to 'Panel Editor', but with a more integrated interface. You may switch between these two graphic interfaces.
- The traditional 'Panel Editor' is a pure graphic based solution that is well suited to making classic CTC panels like we will create for this clinic. It uses a separate control window during editing.



# Simple Signal Logic

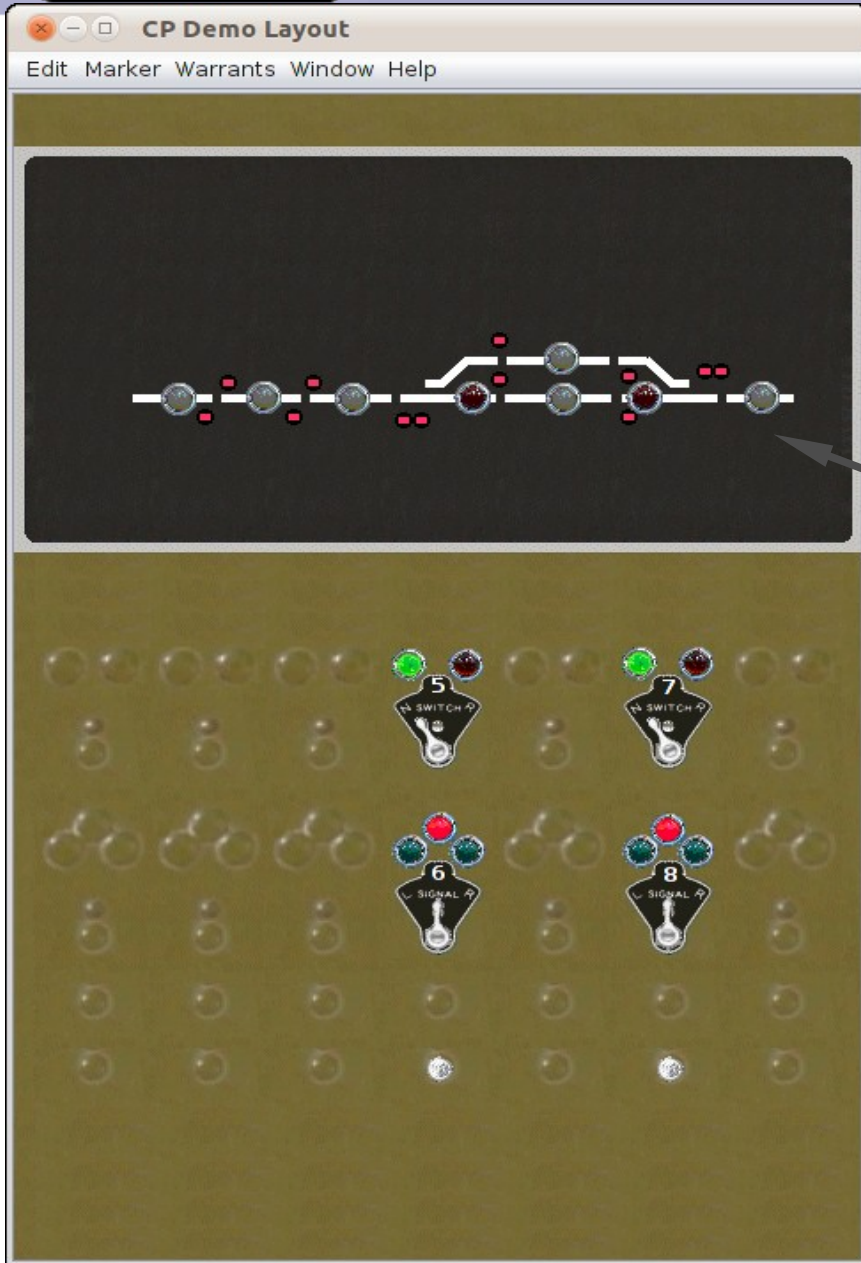
Opening a demo panel



- We will start out with a panel representing the demo layout, but with simple signals.

# Simple Signal Logic

ABS Relationships

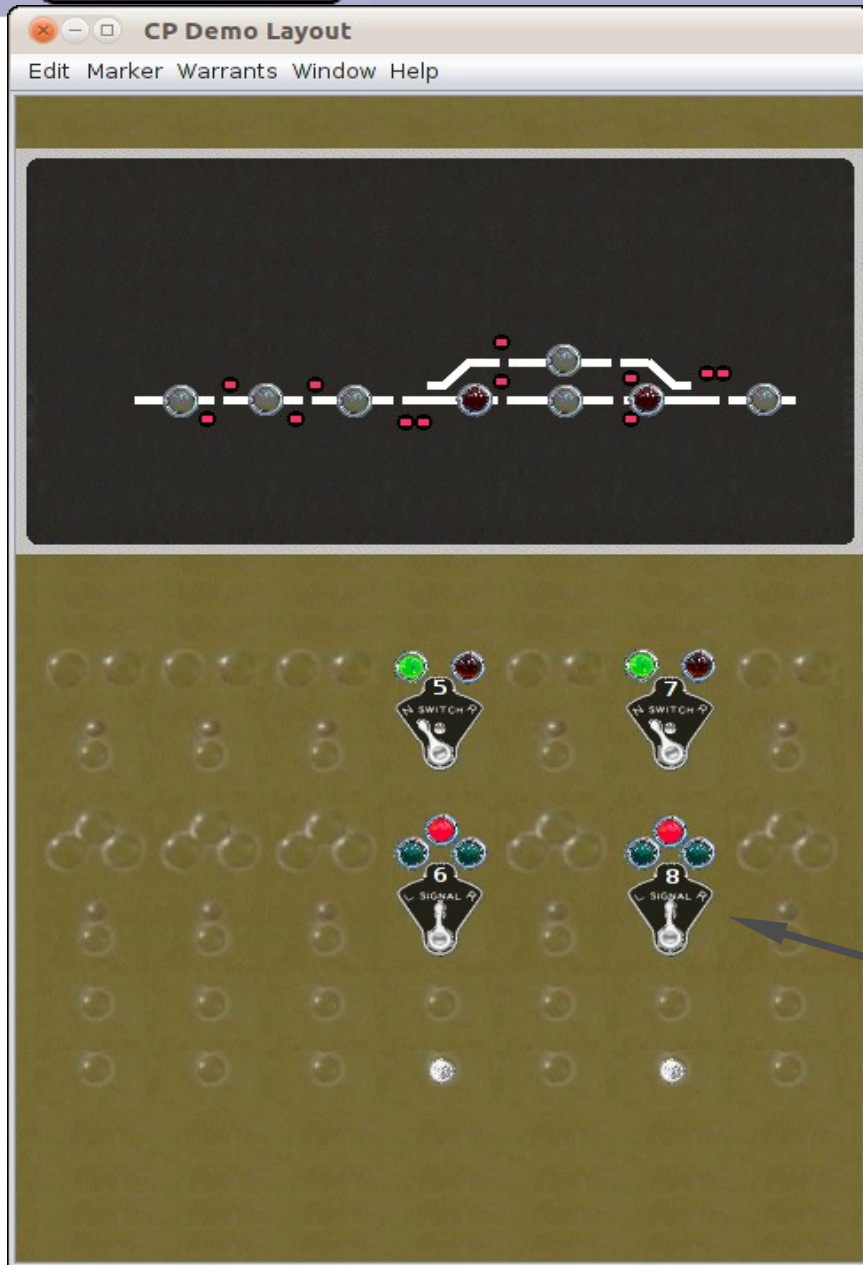


- We will start out with a panel representing the demo layout, but with simple signals.
- The relationships between the signals and the layout are simple. (Simple Signal Logic)
  - Block Occupied = Stop
  - Turnout not aligned = Stop
  - Next signal Stop = Approach
  - Next signal Approach = Flash
  - None of the above = Clear



# Simple Signal Logic

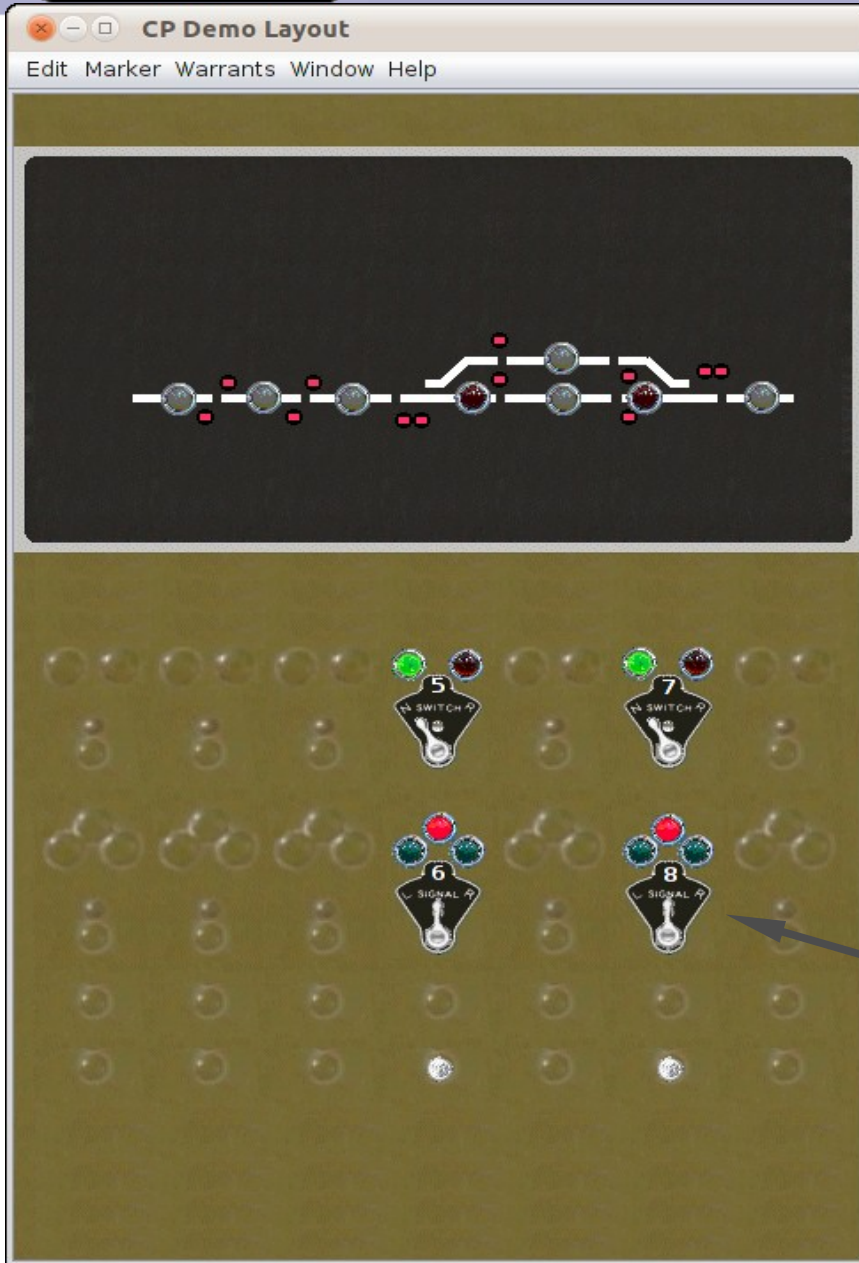
CTC Overlay



- We will start out with a panel representing the demo layout, but with simple signals.
- The relationships between the signals and the layout are simple. (Simple Signal Logic)
  - Block Occupied = Stop
  - Turnout not aligned = Stop
  - Next signal Stop = Approach
  - Next signal Approach = Flash
  - None of the above = Clear
- There are a few added options for linking in CTC panels but basically this is the extent of the complexity.

# Simple Signal Logic

ABS (Automatic Block Signals)



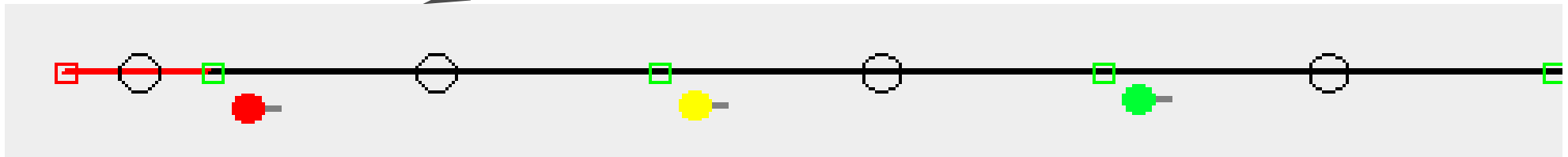
- We will start out with a panel representing the demo layout, but with simple signals.
- The relationships between the signals and the layout are simple. (Simple Signal Logic)
  - Block Occupied = Stop
  - Turnout not aligned = Stop
  - Next signal Stop = Approach
  - Next signal Approach = Flash
  - None of the above = Clear
- There are a few added options for linking in CTC panels but basically this is the extent of the complexity.
- This is ABS Route Signaling.



# Simple Signal Logic

ABS (Automatic Block Signals)

- This is ABS Route Signaling.

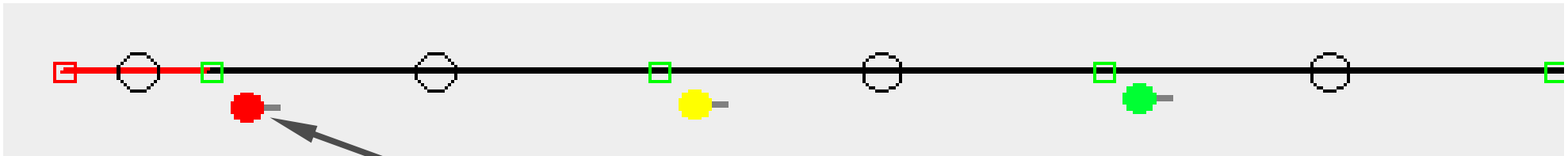




# Simple Signal Logic

ABS (Automatic Block Signaling)

- This is ABS Route Signaling.



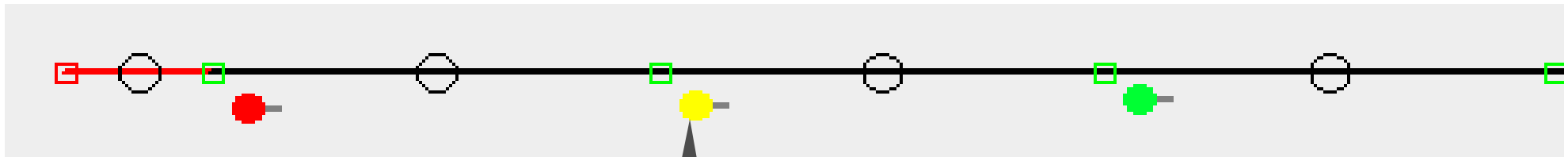
- The occupied block is protected by a red (stop) signal.



# Simple Signal Logic

ABS (Automatic Block Signals)

- This is ABS Route Signaling.



- The occupied block is protected by a red (stop) signal.
- The stop signal is protected by a yellow (approach) signal. I.e. You are "approaching" a stop signal.





- **Speed Based Signals**
- Speed Signaling gives the engineer information regarding how fast his train must travel in the upcoming segment of track. In general there are two speed zones in a signal block.
- The first zone is that portion of a block when any part of the train is in an interlocking section. For example, as defined in the CSX rules; "through turnouts, crossovers, sidings, and over power routed switches."
- The second speed zone is the speed allowed for the duration of the block.
- The "Name" of the signal aspect reflects these two different pieces of speed information. For example "Medium Clear" indicates; 'Medium speed through turnouts, crossovers, sidings, and over power routed switches; then proceed. "Medium Approach" indicates; 'Medium speed through turnouts, crossovers, sidings, and over power routed switches; then proceed, prepared to stop at next signal.



# Speed Based Signals

Speed Signal Rules

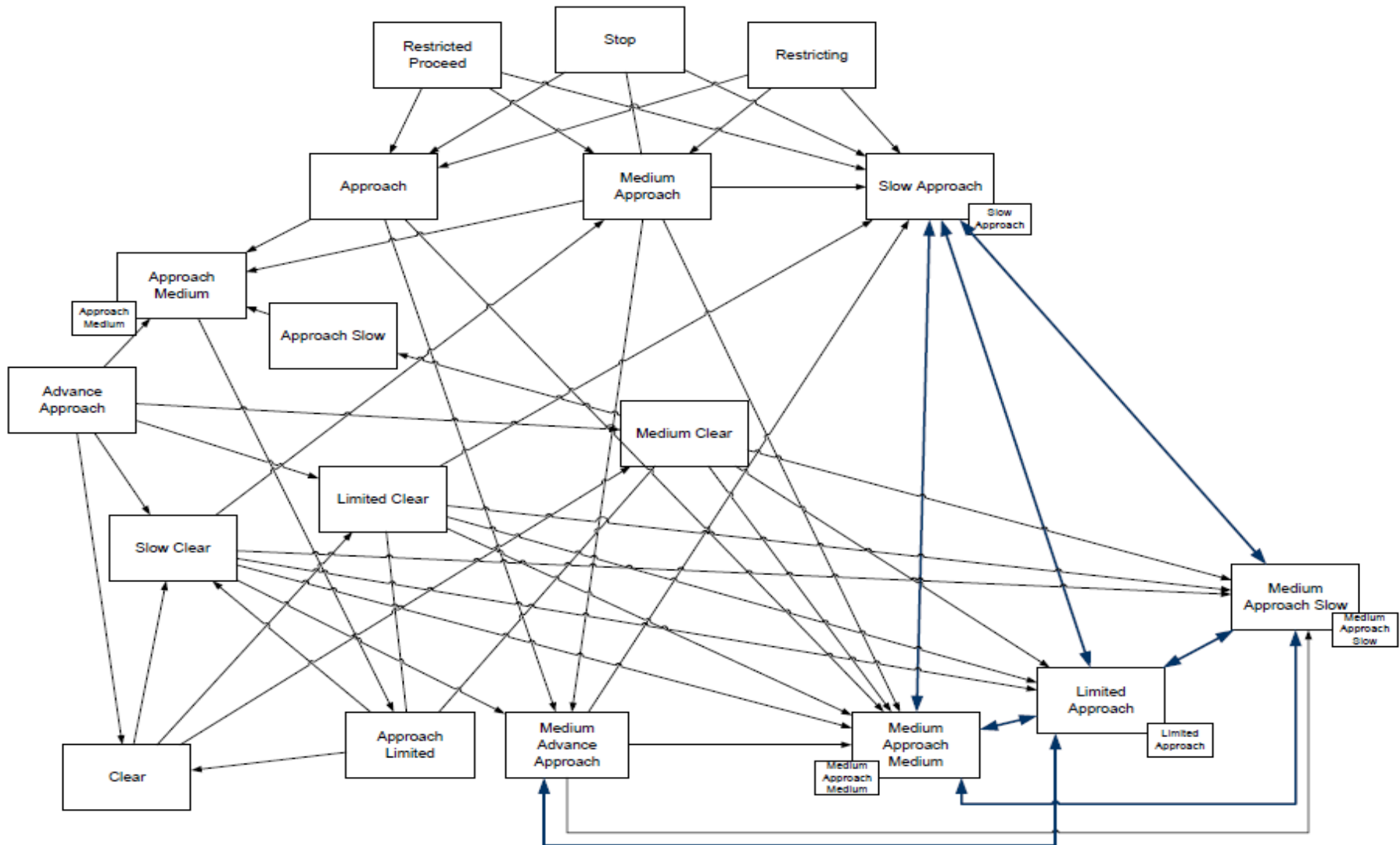
- The Speed based signal rules may sometimes be a bit more complex.



# Speed Based Signals



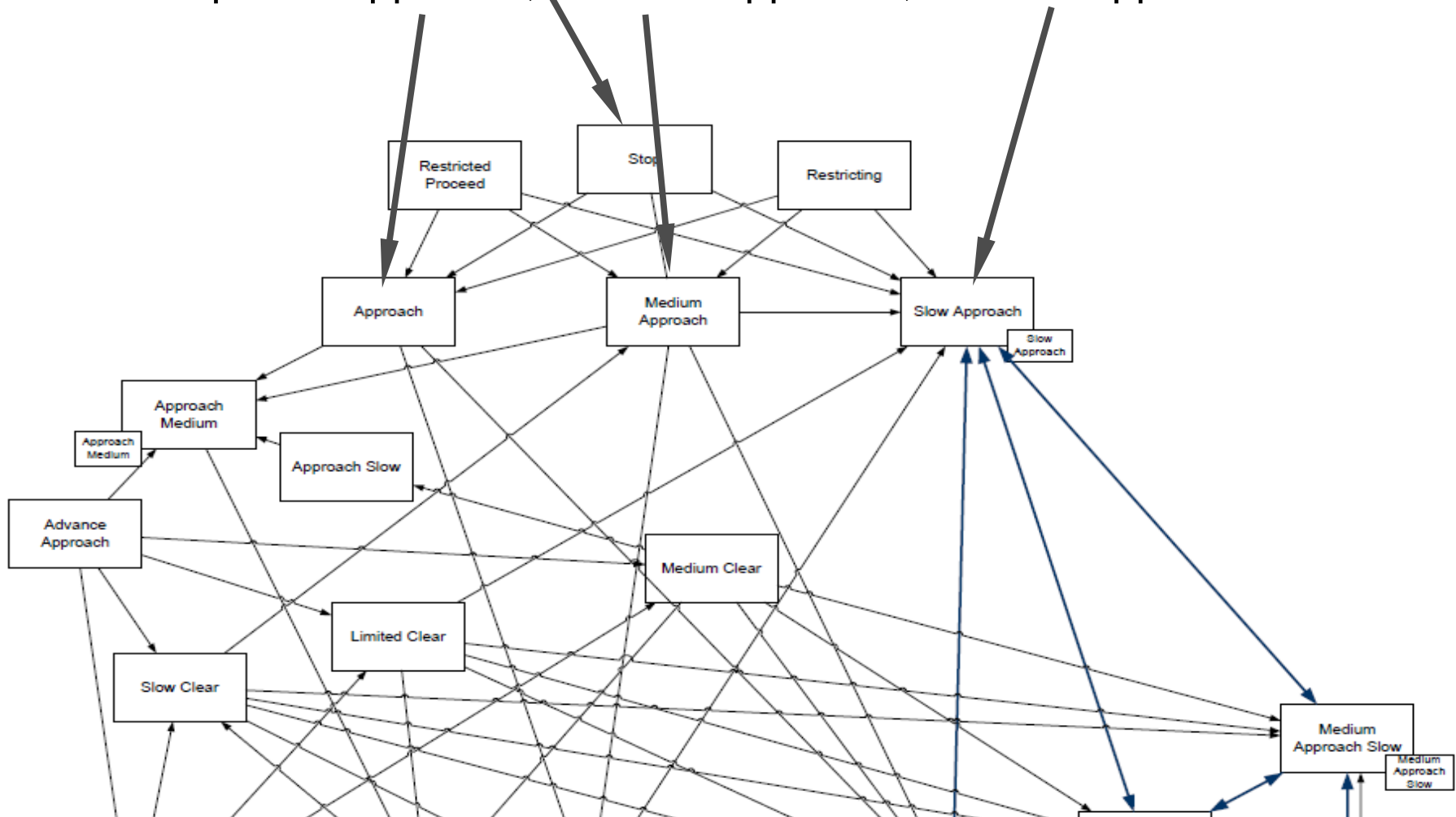
- The Speed based signal rules may sometimes be a bit more complex.



# Speed Based Signals

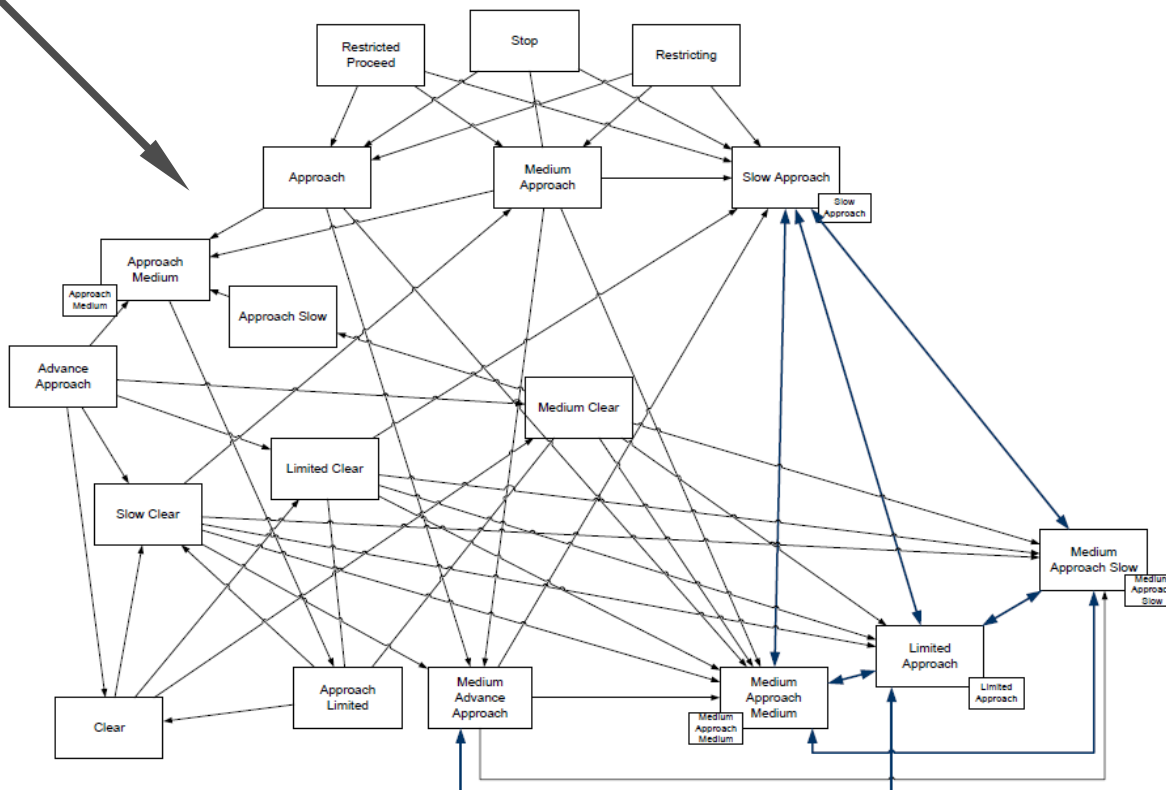


- The Speed based signal rules may sometimes be a bit more complex.
- In this CSX example, a "Stop" aspect may be 'protected' by any of three different aspects. Approach, Medium Approach, or Slow Approach.



# Speed Based Signals

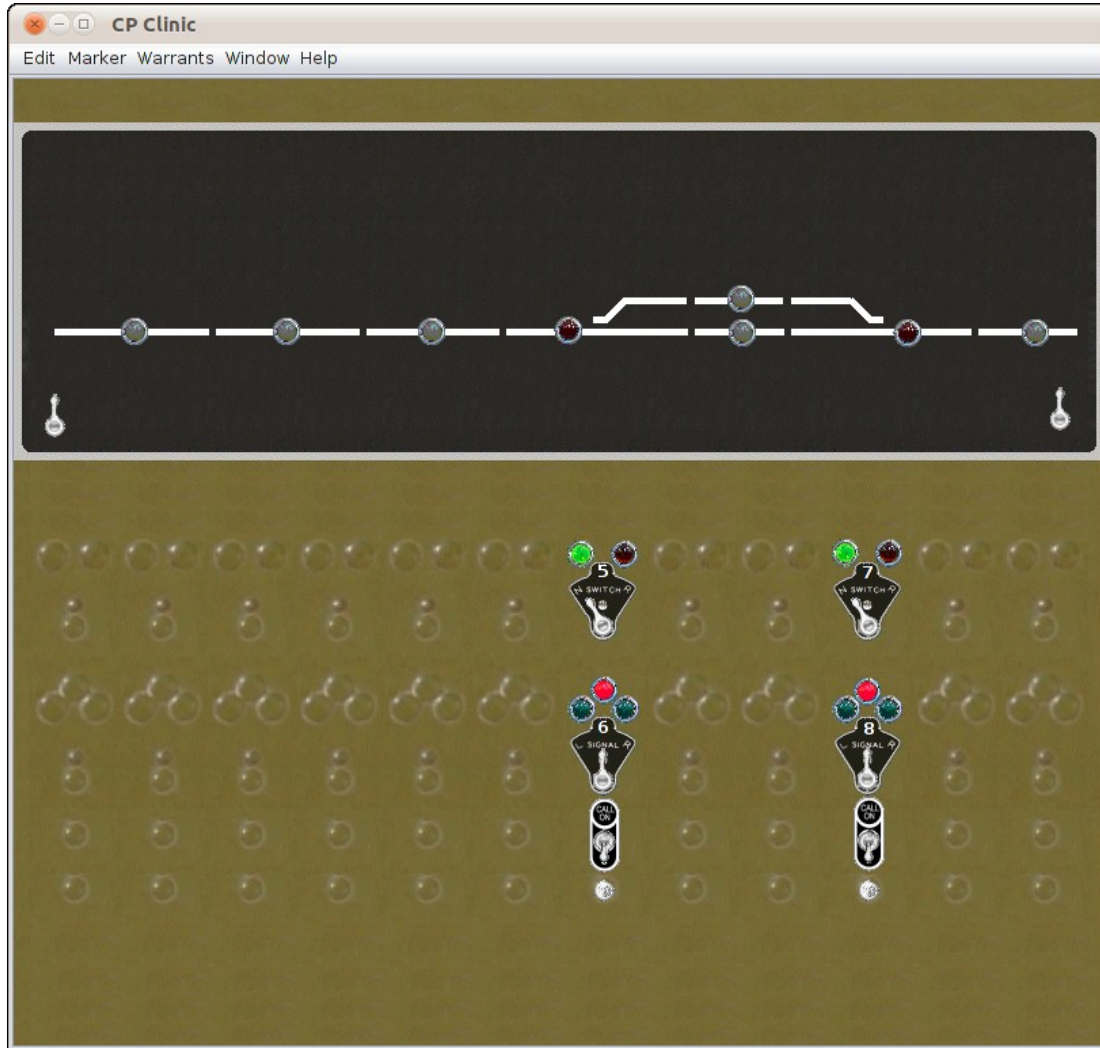
- The Speed based signal rules may sometimes be a bit more complex.
- In this CSX example, a "Stop" aspect may be 'protected' by any of three different aspects. Approach, Medium Approach, or Slow Approach.
- This is the reason that JMRI now supports aspect based signaling.





# Using Panel Editor

Opening a new panel

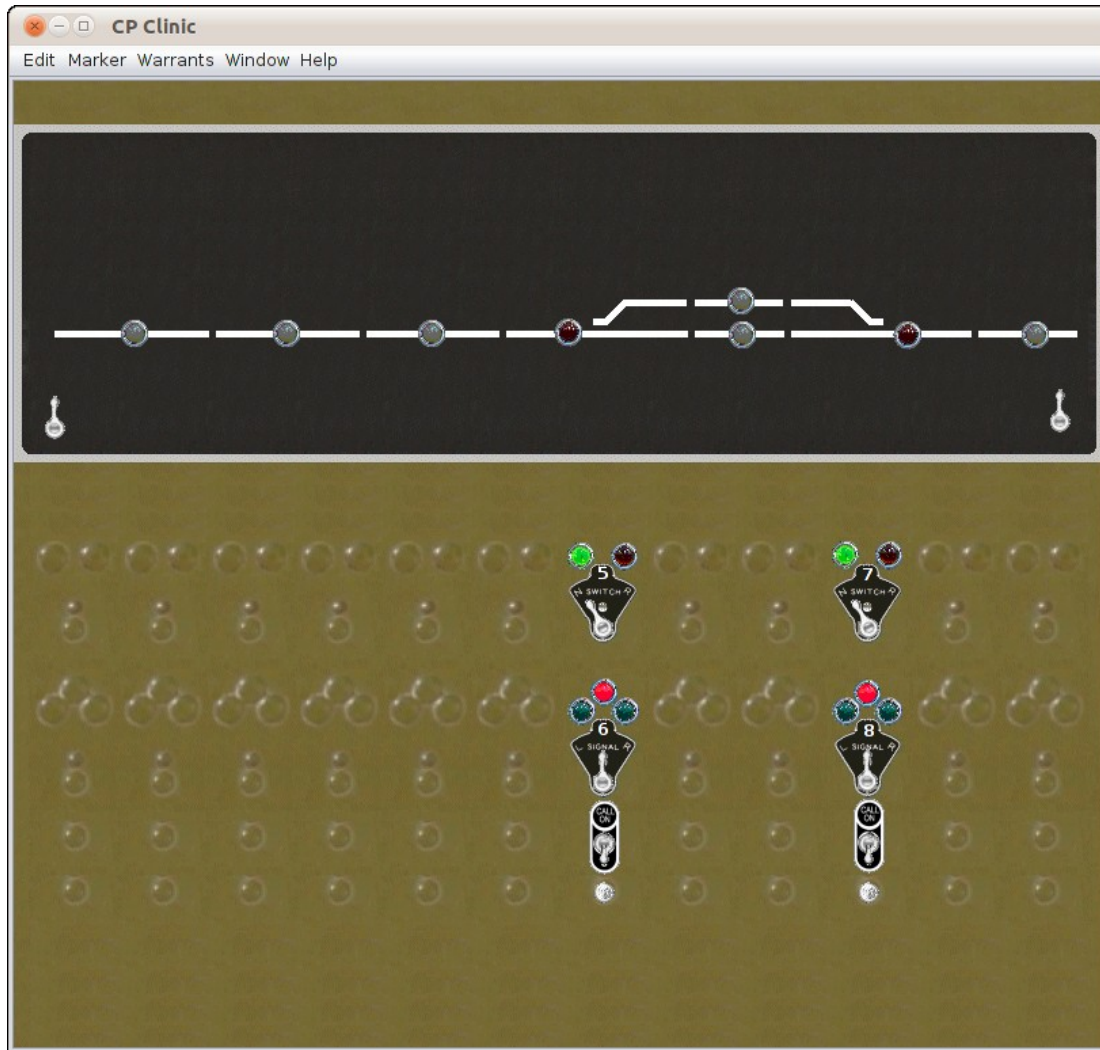


- We will start out with a panel representing the demo layout, but without any signals.



# Using Panel Editor

Opening a new panel



- We will start out with a panel representing the demo layout, but without any signals.
- **WARNING!** If you are reusing an existing panel, be sure to remove all traces of any SSL logic and/or Logix code that may have previously been used on this panel.





# Using Panel Editor

Manual Edit

Using your favorite text editor, NOT a word processor, search for "<signalelement " and remove each entry and all of its included data. (Example highlighted in red) Other instances to remove shown in green.

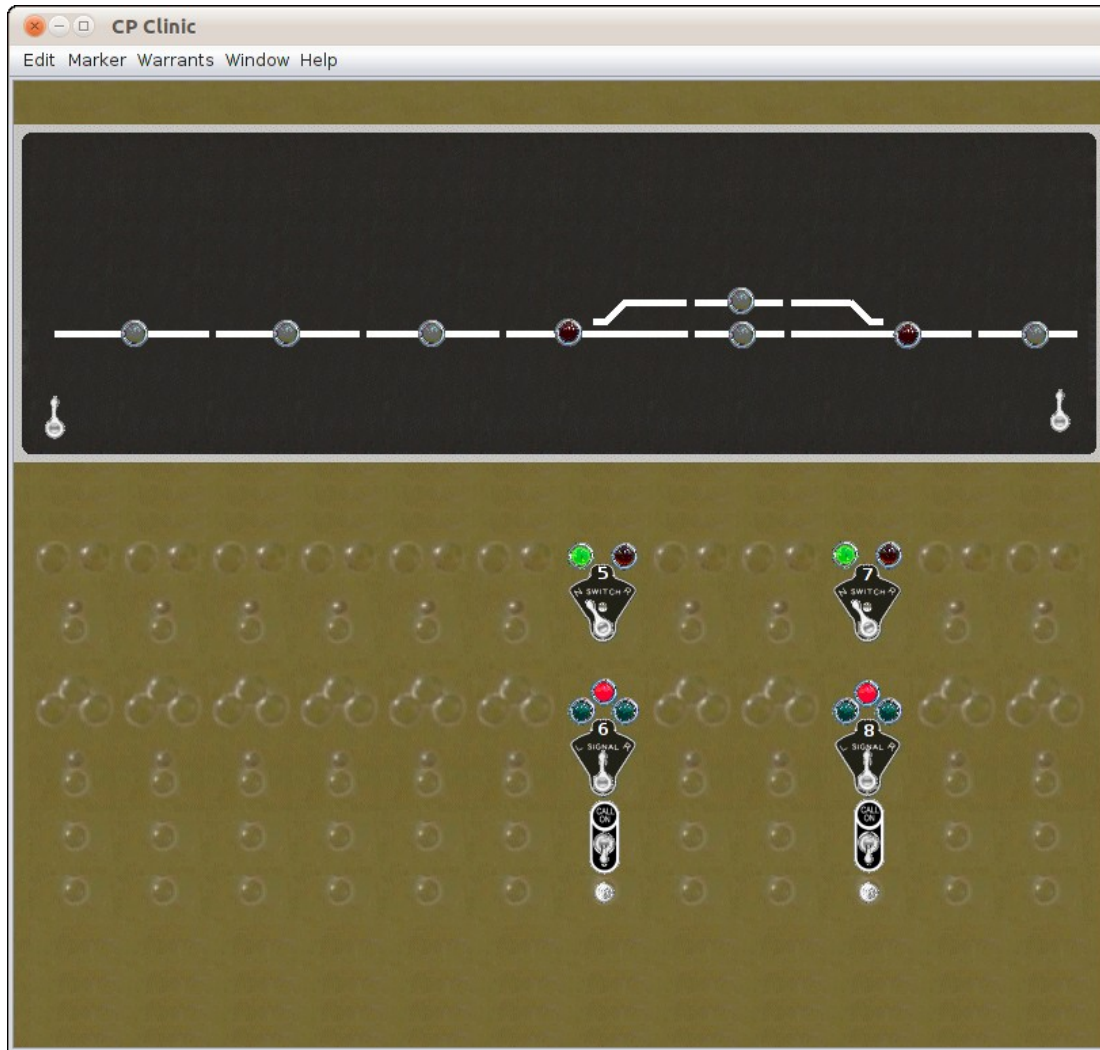
```
CP-Clinic.xml (file:///home/dick/.jmri/CP-Clinic.xml) - Bluefish 2.0.2
File Edit View Document Go Project Tools Tags Dialogs Help
Quick bar Standard bar Fonts Tables Frames Forms List CSS
C Apache DHTML DocBook HTML PHP+HTML PHP Replace SQL
file:///home/di
dick
  Desktop
  Documents
  Downloads
  Music
  Pictures
  Public
  Templates
  Videos
  eagle
  eagle-5.10.0
1830 <oblocks class="jmri.jmrit.logix.configurexml.OBlockManagerXml" />
1831 <warrants class="jmri.jmrit.logix.configurexml.WarrantManagerXml" />
1832 <signalelements class="jmri.jmrit.blockboss.configurexml.BlockBossLogicXml">
1833   <signalelement signal="LH19" mode="3" watchedturnout="LT5" watchedsignal1="LH11" limitspeed1="false" li
1834     <sensorname>IS3:TK</sensorname>
1835     <sensorname>IS1:TK</sensorname>
1836     <sensorname>IS6:NGK</sensorname>
1837     <sensorname>IS6:LDGK</sensorname>
1838     <comment />
1839   </signalelement>
1840   <signalelement signal="LH9" mode="2" watchedturnout="LT7" limitspeed1="true" limitspeed2="false" usefl
1847   <signalelement signal="LH13" mode="3" watchedturnout="LT7" watchedsignal1="LH21" limitspeed1="false" li
1855   <signalelement signal="LH21" mode="3" watchedturnout="LT5" watchedsignal1="LH29" limitspeed1="false" li
1862   <signalelement signal="LH23" mode="2" watchedturnout="LT5" watchedsignal1="LH29" limitspeed1="false" li
1869   <signalelement signal="LH11" mode="3" watchedturnout="LT7" limitspeed1="false" limitspeed2="true" usefl
1876 </signalelements>
1877 <panelEditor class="jmri.jmrit.display_panelEditor.configurexml.PanelEditorXml" name="CP_Clinic" x="2047"
```





# Using Panel Editor

Opening a new panel

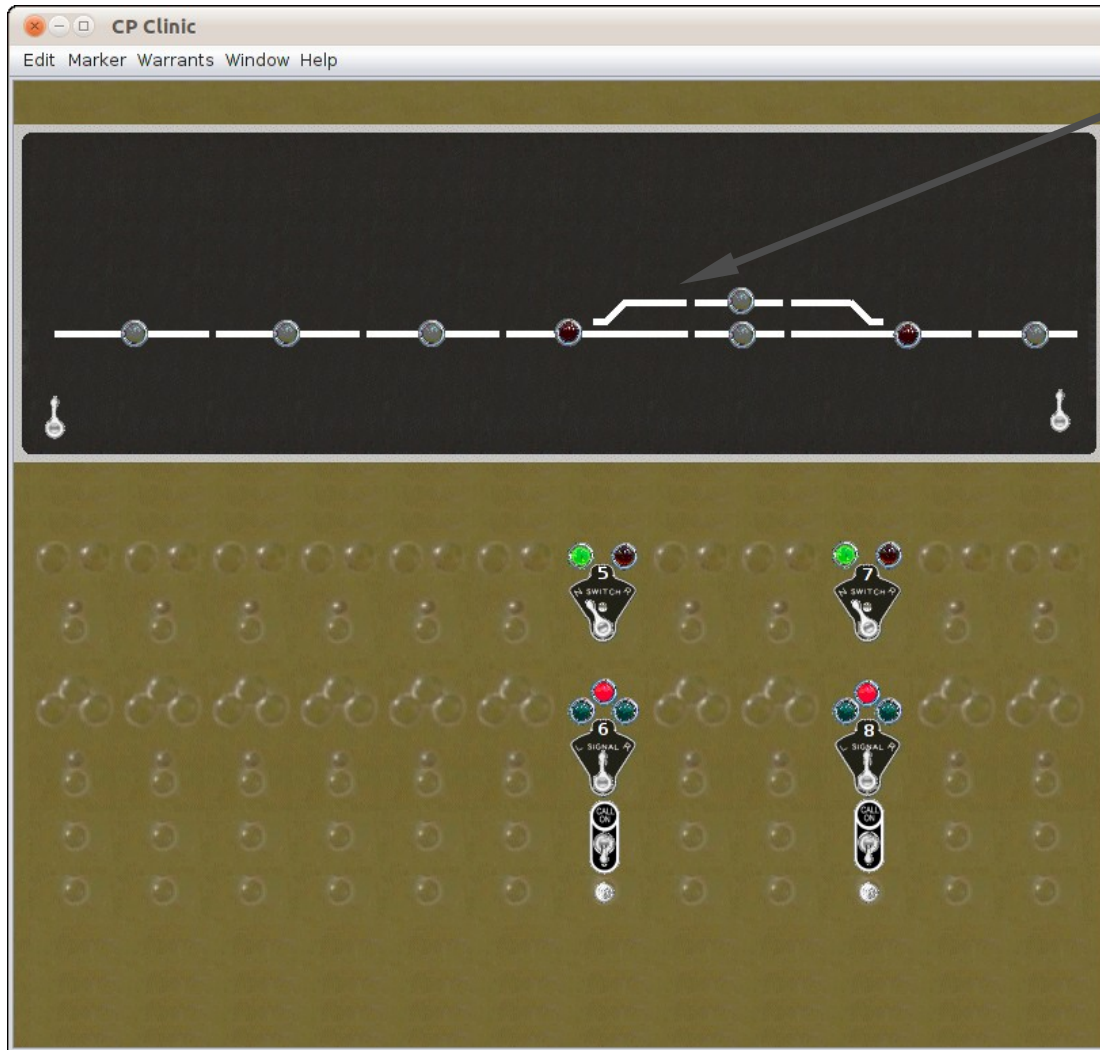


- We will start out with a panel representing the demo layout, but without any signals.
- **WARNING!** If you are reusing an existing panel, be sure to remove all traces of any SSL logic and/or Logix code that may have previously been used on this panel.
- Once you have a panel with your required detection and turnouts you can add your signal masts.



# Using Panel Editor

Opening a new panel

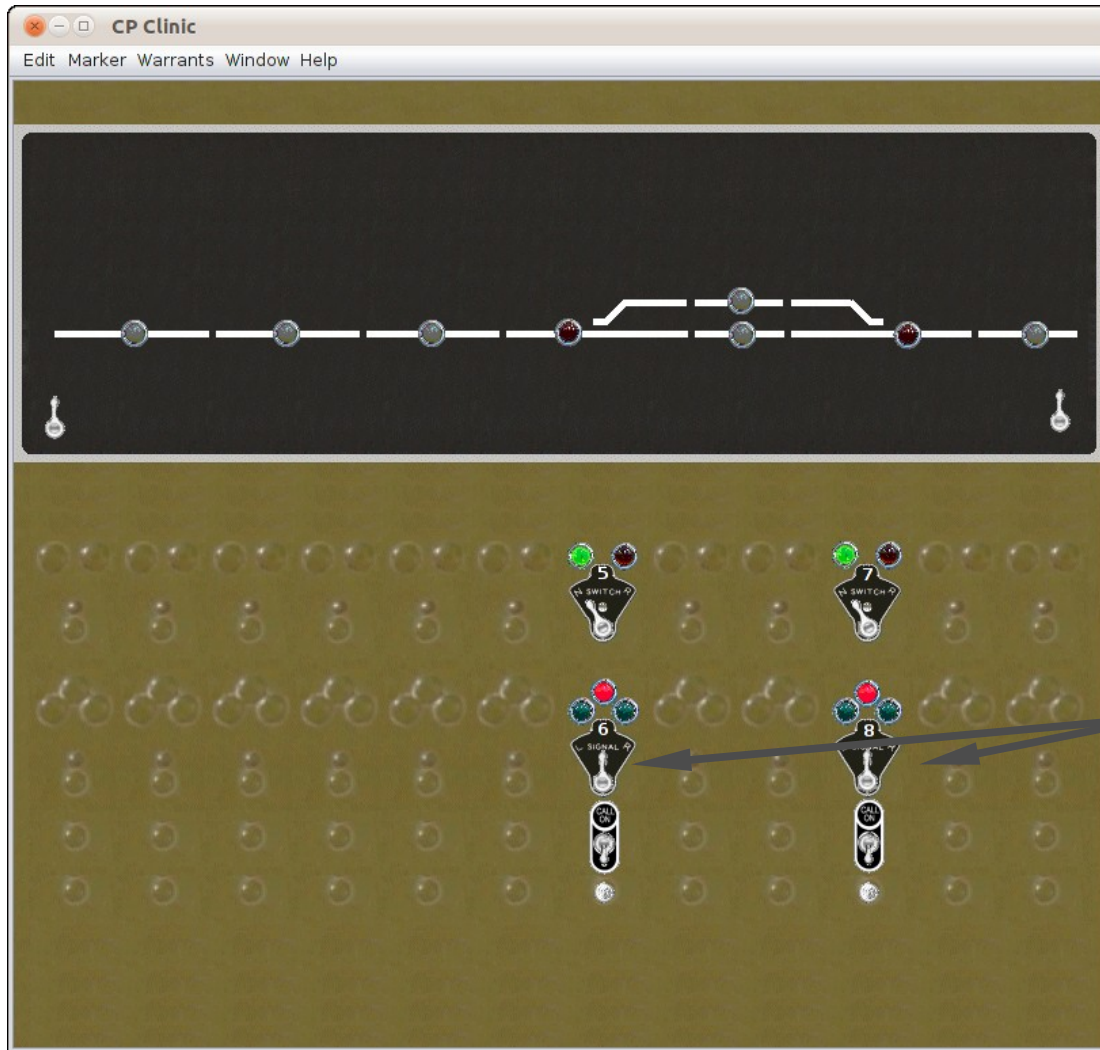


- I have spaced out the track images and lever spacing to allow the fitting of the signal masts onto this demo panel. Normally a CTC panel does not include any actual signal information, but for our purposes it makes things easier to understand.



# Using Panel Editor

Opening a new panel



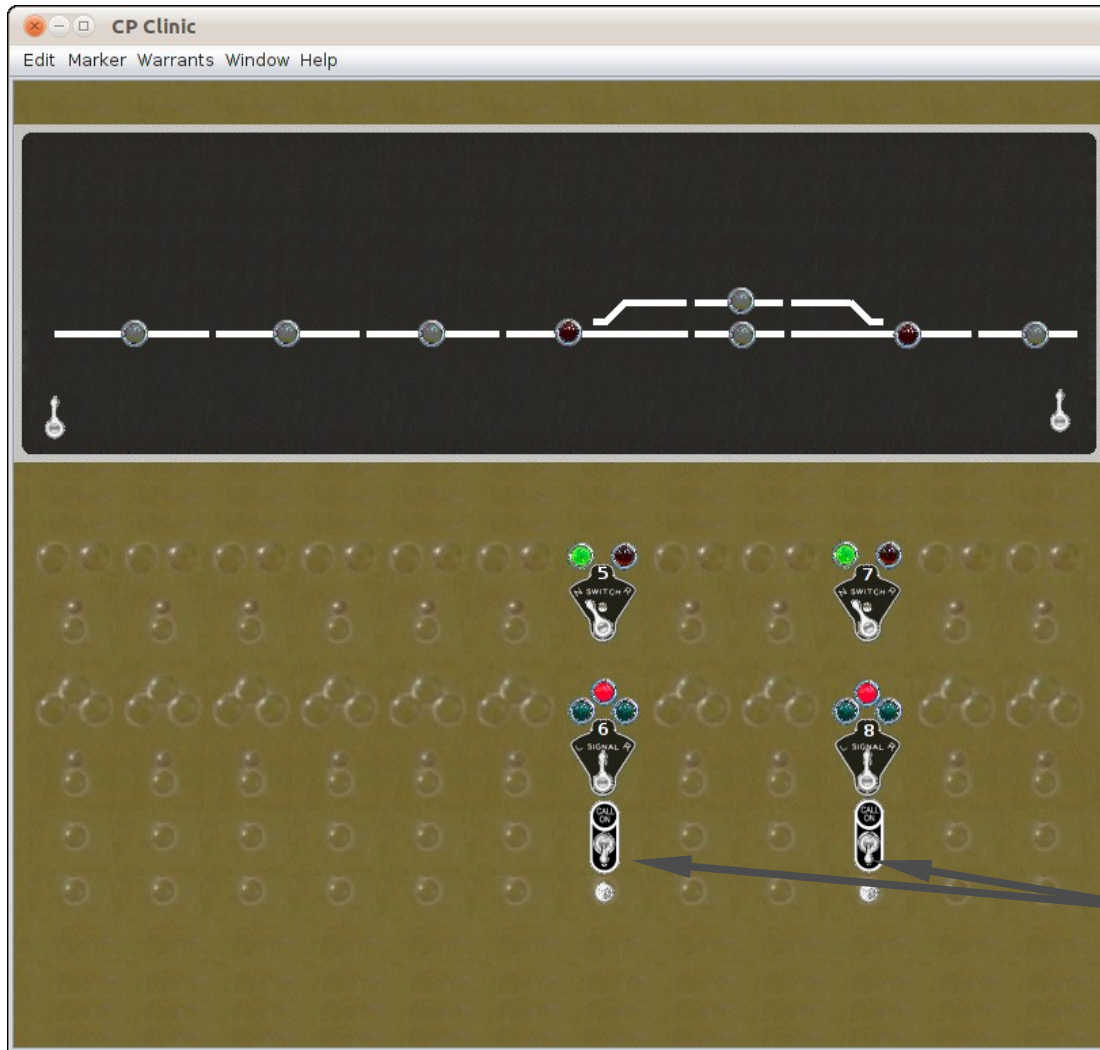
- I have spaced out the track images and lever spacing to allow the fitting of the signal masts onto this demo panel. Normally a CTC panel does not include any actual signal information, but for our purposes it makes things easier to understand.
- I have only included the turnout and signal direction levers for these two interlocking points.





# Using Panel Editor

Opening a new panel

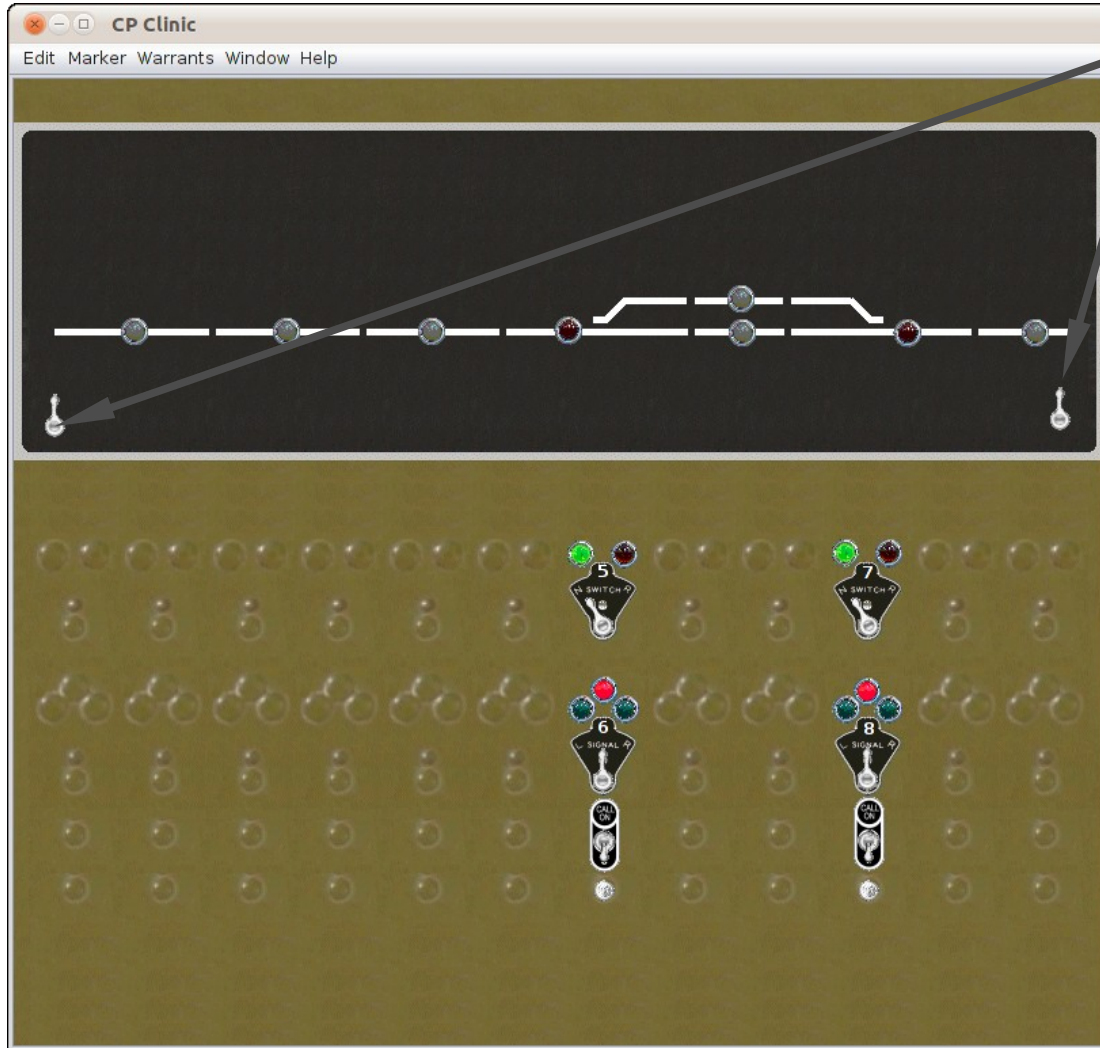


- I have spaced out the track images and lever spacing to allow the fitting of the signal masts onto this demo panel. Normally a CTC panel does not include any actual signal information, but for our purposes it makes things easier to understand.
- I have included the turnout and signal direction levers for two interlocking points.
- I have also included a pair of "Call On" switches and indicators to enable "restricting" moves using Logix.



# Using Panel Editor

Opening a new panel

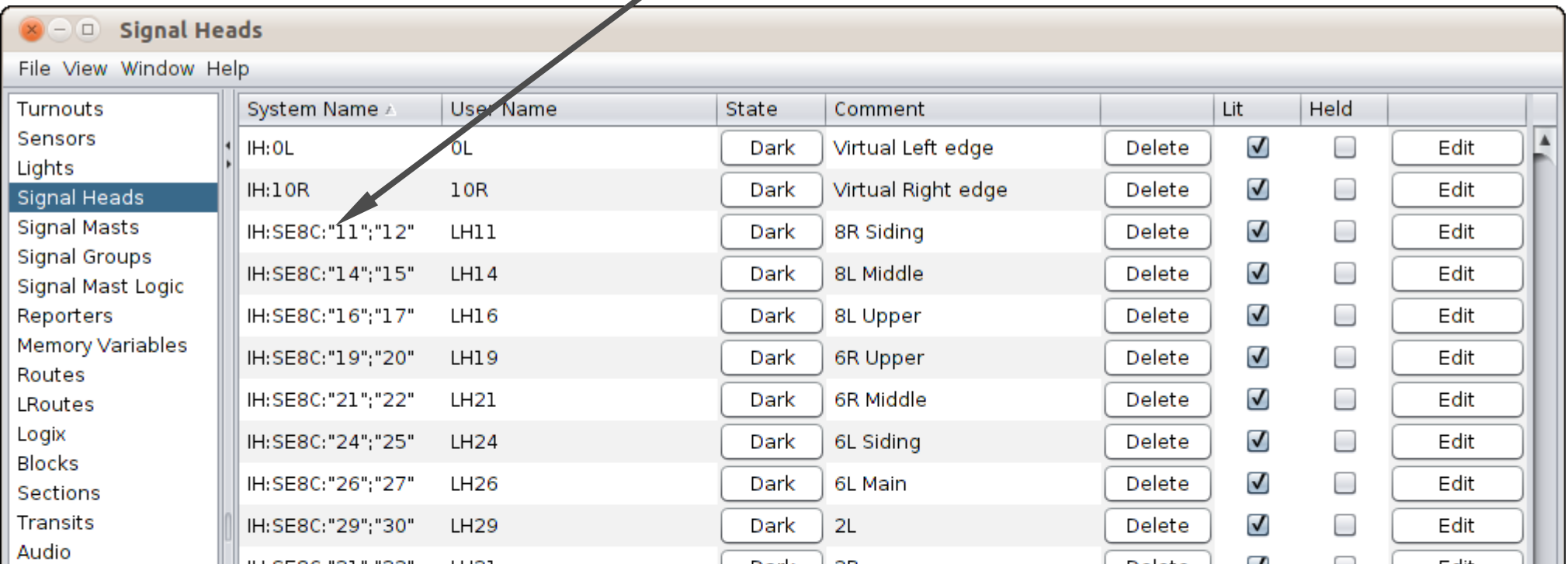


- These two levers are used to simulate off panel traffic information. 'Toward the center' is traffic "onto the panel", 'center' is "occupied" and 'away from center' is traffic "off of the panel".

# Adding Signal Heads

Signal Head table

- The current version of JMRI 2.12 only has the capability to create masts from individual signal heads. This may be because there are not any currently available products that understand "aspect" commands. We expect this to change in the near future.
- Due to these present limitations you must first build a signal head table using the hardware that you have available. The following table is for our demo hardware configured as if it were a Digitrax SE8c signal driver. In fact it is our prototype RR-CirKits LNCP unit that does understand aspects. (but see above limitations)



The screenshot shows the 'Signal Heads' window in JMRI. The window title is 'Signal Heads' and it has a menu bar with 'File', 'View', 'Window', and 'Help'. On the left is a sidebar with a tree view containing: Turnouts, Sensors, Lights, Signal Heads (selected), Signal Masts, Signal Groups, Signal Mast Logic, Reporters, Memory Variables, Routes, LRoutes, Logix, Blocks, Sections, Transits, and Audio. The main area contains a table with columns: System Name, User Name, State, Comment, Lit, and Held. Each row also has a 'Delete' button and an 'Edit' button. An arrow points from the text in the second bullet point to the 'IH:SE8C:"11";"12"' row in the table.

System Name	User Name	State	Comment	Lit	Held
IH:0L	0L	Dark	Virtual Left edge	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:10R	10R	Dark	Virtual Right edge	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"11";"12"	LH11	Dark	8R Siding	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"14";"15"	LH14	Dark	8L Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"16";"17"	LH16	Dark	8L Upper	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"19";"20"	LH19	Dark	6R Upper	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"21";"22"	LH21	Dark	6R Middle	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"24";"25"	LH24	Dark	6L Siding	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"26";"27"	LH26	Dark	6L Main	<input checked="" type="checkbox"/>	<input type="checkbox"/>
IH:SE8C:"29";"30"	LH29	Dark	2L	<input checked="" type="checkbox"/>	<input type="checkbox"/>

# Adding Signal Masts

Signal Mast basics



- The new signal mast (aspect based) signaling capability in JMRI uses the signal types themselves to determine the necessary rules of operation. This greatly simplifies the implementation of any signal system, but especially one that is more complex than the ABS signals currently supported by SSL. The intent is that, like Decoder definitions are currently added to DecoderPro, signal definitions will be added for each prototype RR rule book.



# Adding Signal Masts

Signal Mast basics CSX Rules



## CSX TRANSPORTATION

SIGNAL RULES - 281-298

JANUARY 1998

<p><b>CLEAR Rule 281</b></p>	<p><b>APPROACH LIMITED Rule 281-B</b></p>	<p><b>LIMITED CLEAR Rule 281-C</b></p>	<p><b>LIMITED APPROACH Rule 281-D</b></p>
<p><b>APPROACH MEDIUM Rule 282</b></p>	<p><b>ADVANCE APPROACH Rule 282-A</b></p>	<p><b>MEDIUM CLEAR Rule 283</b></p>	<p><b>MEDIUM APPROACH MEDIUM Rule 283-A</b></p>
<p><b>MEDIUM APPROACH SLOW Rule 283-B</b></p>	<p><b>MEDIUM ADVANCE APPROACH Rule 283-C</b></p>	<p><b>APPROACH SLOW Rule 284</b></p>	<p><b>APPROACH Rule 285</b></p>
<p><b>MEDIUM APPROACH Rule 286</b></p>	<p><b>SLOW CLEAR Rule 287</b></p>	<p><b>SLOW APPROACH Rule 288</b></p>	<p><b>RESTRICTING Rule 290</b></p>
<p><b>RESTRICTED PROCEED Rule 291</b></p>	<p><b>STOP Rule 292</b></p>	<p><b>STOP AND CHECK Rule 293</b></p>	<p><b>STOP AND OPEN SWITCH Rule 294</b></p>

- The rules that we are using are taken from the CSX-1998 Signal Rules – 281-298.

# Adding Signal Masts

Signal Mast basics CSX Rules



## CSX TRANSPORTATION

SIGNAL RULES - 281-298

JANUARY 1998

<p><b>CLEAR Rule 281</b></p>	<p><b>APPROACH LIMITED Rule 281-B</b></p>	<p><b>LIMITED CLEAR Rule 281-C</b></p>	<p><b>LIMITED APPROACH Rule 281-D</b></p>
<p><b>APPROACH MEDIUM Rule 282</b></p>	<p><b>ADVANCE APPROACH Rule 282-A</b></p>	<p><b>MEDIUM CLEAR Rule 283</b></p>	<p><b>MEDIUM APPROACH MEDIUM Rule 283-A</b></p>
<p><b>MEDIUM APPROACH SLOW Rule 283-B</b></p>	<p><b>MEDIUM ADVANCE APPROACH Rule 283-C</b></p>	<p><b>APPROACH SLOW Rule 284</b></p>	<p><b>APPROACH Rule 285</b></p>
<p><b>MEDIUM APPROACH Rule 286</b></p>	<p><b>SLOW CLEAR Rule 287</b></p>	<p><b>SLOW APPROACH Rule 288</b></p>	<p><b>RESTRICTING Rule 290</b></p>
<p><b>RESTRICTED PROCEED Rule 291</b></p>	<p><b>STOP Rule 292</b></p>	<p><b>STOP AND CHECK Rule 293</b></p>	<p><b>STOP AND OPEN SWITCH Rule 294</b></p>

- The rules that we are using are taken from the CSX-1998 Signal Rules – 281-298.
- Especially note that each mast configuration can only indicate some, but not all of the possible rules.



# Adding Signal Masts

Signal Mast basics CSX Rules



CSX TRANSPORTATION			
SIGNAL RULES - 281-298		JANUARY 1998	
<p>CLEAR Rule 281</p>	<p>APPROACH LIMITED Rule 281-B</p>	<p>LIMITED CLEAR Rule 281-C</p>	<p>LIMITED APPROACH Rule 281-D</p>
<p>APPROACH MEDIUM Rule 282</p>	<p>ADVANCE APPROACH Rule 282-A</p>	<p>MEDIUM CLEAR Rule 283</p>	<p>MEDIUM APPROACH MEDIUM Rule 283-A</p>
<p>MEDIUM APPROACH SLOW Rule 283-B</p>	<p>MEDIUM ADVANCE APPROACH Rule 283-C</p>	<p>APPROACH SLOW Rule 284</p>	<p>APPROACH Rule 285</p>
<p>MEDIUM APPROACH Rule 286</p>	<p>SLOW CLEAR Rule 287</p>	<p>SLOW APPROACH Rule 288</p>	<p>RESTRICTING Rule 289</p>
<p>RESTRICTED PROCEED Rule 291</p>	<p>STOP Rule 292</p>	<p>STOP AND CHECK Rule 293</p>	<p>STOP AND OPEN SWITCH Rule 294</p>

- The rules that we are using are taken from the CSX-1998 Signal Rules – 281-298.
- Especially note that each mast configuration can only indicate some, but not all of the possible rules.
- Specifically lets use the example of a single head dwarf signal. It can only show three rules; Slow Clear, Slow Approach, and Stop.
- Using Aspect Signaling; on your model you would simply select the single head dwarf and JMRI will automatically choose the correct aspects to use.

# Adding Signal Masts

Signal Mast basics CSX Rules



CSX TRANSPORTATION			
SIGNAL RULES - 281-298		JANUARY 1998	
<p>CLEAR Rule 281</p>	<p>APPROACH LIMITED Rule 281-B</p>	<p>LIMITED CLEAR Rule 281-C</p>	<p>LIMITED APPROACH Rule 281-D</p>
<p>APPROACH MEDIUM Rule 282</p>	<p>ADVANCE APPROACH Rule 282-A</p>	<p>MEDIUM CLEAR Rule 283</p>	<p>MEDIUM APPROACH MEDIUM Rule 283-A</p>
<p>MEDIUM APPROACH SLOW Rule 283-B</p>	<p>MEDIUM ADVANCE APPROACH Rule 283-C</p>	<p>APPROACH SLOW Rule 284</p>	<p>APPROACH Rule 285</p>
<p>MEDIUM APPROACH Rule 286</p>	<p>SLOW CLEAR Rule 287</p>	<p>SLOW APPROACH Rule 288</p>	<p>RESTRICTING Rule 290</p>
<p>RESTRICTED PROCEED Rule 291</p>	<p>STOP Rule 292</p>	<p>STOP AND CHECK Rule 293</p>	<p>STOP AND OPEN SWITCH Rule 294</p>

- If your turnout number allowed for Medium Clear and Medium Approach speeds, then you would simply use a double head dwarf with a red upper marker or a high mast with red upper marker. JMRI will then adjust to these new available aspects in creating its rules.



# Adding Signal Masts

Signal Mast basics CSX Rules



## CSX TRANSPORTATION

SIGNAL RULES - 281-298

JANUARY 1998

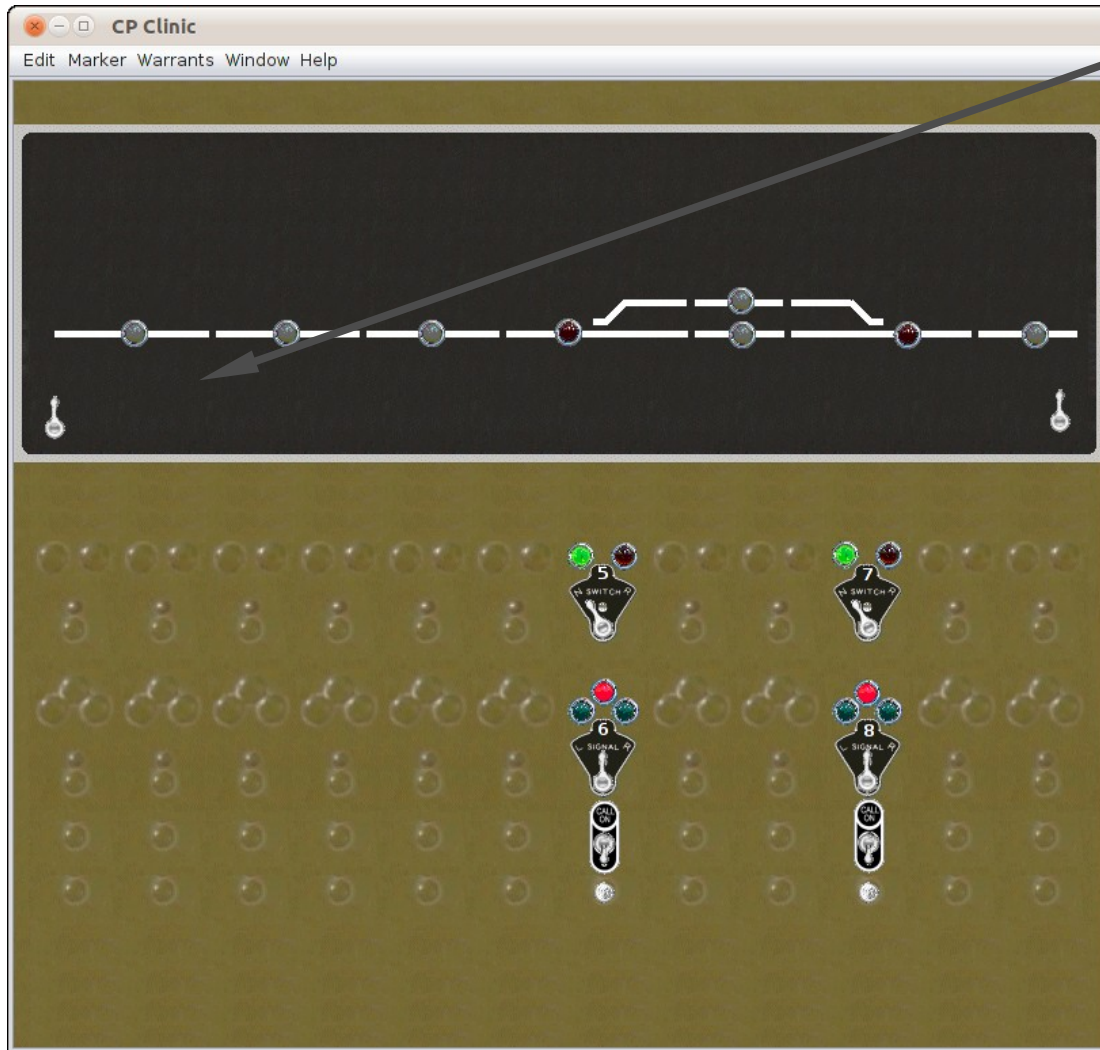
<p><b>CLEAR Rule 281</b></p>	<p><b>APPROACH LIMITED Rule 281-B</b></p>	<p><b>LIMITED CLEAR Rule 281-C</b></p>	<p><b>LIMITED APPROACH Rule 281-D</b></p>
<p><b>APPROACH MEDIUM Rule 282</b></p>	<p><b>ADVANCE APPROACH Rule 282-A</b></p>	<p><b>MEDIUM CLEAR Rule 283</b></p>	<p><b>MEDIUM APPROACH MEDIUM Rule 283-A</b></p>
<p><b>MEDIUM APPROACH SLOW Rule 283-B</b></p>	<p><b>MEDIUM ADVANCE APPROACH Rule 283-C</b></p>	<p><b>APPROACH SLOW Rule 284</b></p>	<p><b>APPROACH Rule 285</b></p>
<p><b>MEDIUM APPROACH Rule 286</b></p>	<p><b>SLOW CLEAR Rule 287</b></p>	<p><b>SLOW APPROACH Rule 288</b></p>	<p><b>RESTRICTING Rule 290</b></p>
<p><b>RESTRICTED PROCEED Rule 291</b></p>	<p><b>STOP Rule 292</b></p>	<p><b>STOP AND CHECK Rule 293</b></p>	<p><b>STOP AND OPEN SWITCH Rule 294</b></p>

- If your turnout number allowed for Medium Clear and Medium Approach speeds, then you would simply use a double head dwarf with a red upper marker or a high mast with red upper marker. JMRI will then adjust to these new available aspects in creating its rules.
- The real beauty of all this is that each rule includes the speed information, both through the interlocking, and once the train has cleared the interlocking. The JMRI automated throttles will obey these different speeds as determined by the aspects shown.



# Using Panel Editor

Opening a new panel

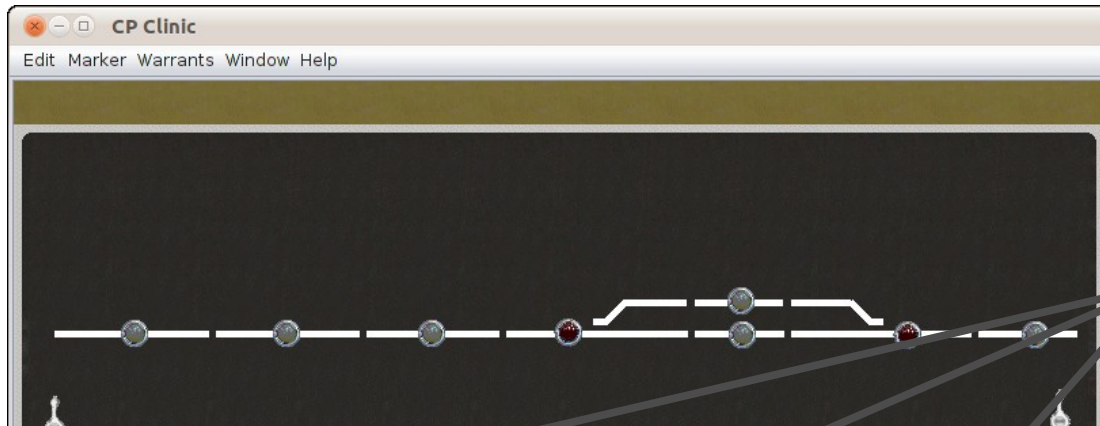


- Lets place our first mast at the first block boundary for east (right) bound traffic.

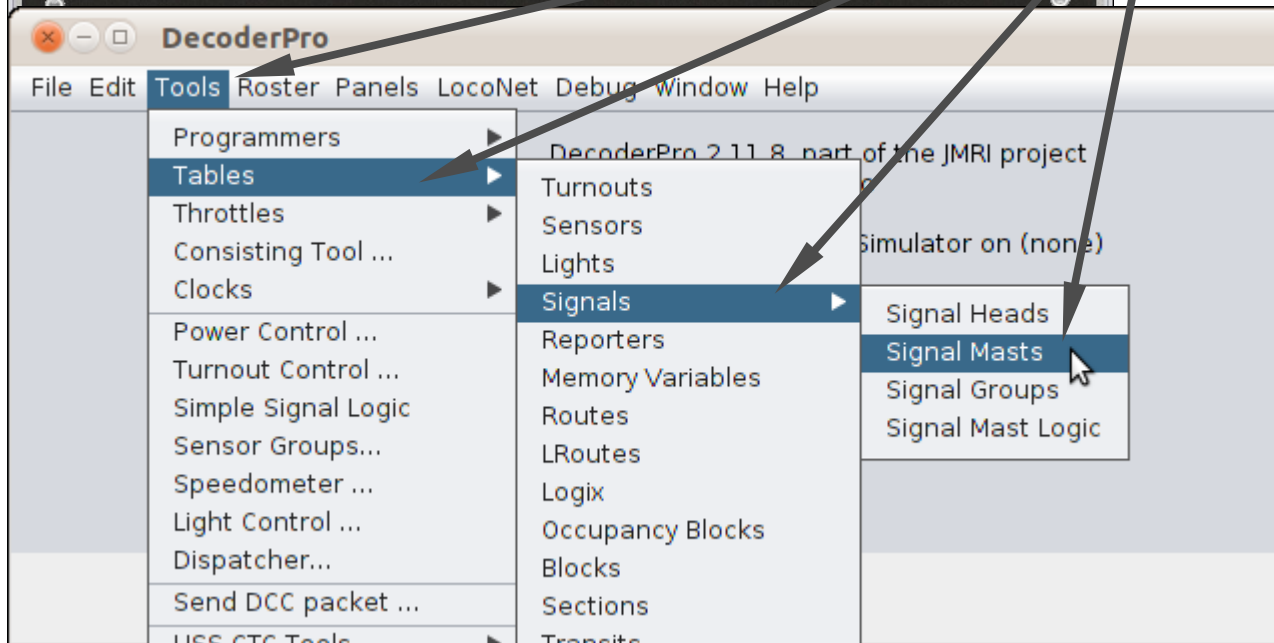


# Using Panel Editor

Opening a new panel



- Lets place our first mast at the first block boundary for east (right) bound traffic.
- Open the 'Tools' and select 'Tables' - 'Signals' - 'Signal Masts'.







# Using Panel Editor

Adding a mast

- Lets place our first mast at the first block boundary for east (right) bound traffic.
- Open the 'Tools' and select 'Tables' - 'Signals' - 'Signal Masts'.
- This opens the Signal Masts window. Click on "Add..." to create our first mast.



# Using Panel Editor

Adding a mast

CP Clinic  
Edit Marker Warrants Window Help

Signal Masts  
File View Window Help

System Name	User Name	Aspect	Comment	Edit Logic	Lit
-------------	-----------	--------	---------	------------	-----

Turnouts  
Sensors  
Lights  
Signal Heads  
Signal Masts  
Signal Groups  
Signal Mast Logic  
Reporters  
Memory Variables  
Routes  
LRoutes  
Logix  
Blocks  
Sections  
Transits  
Audio  
Id Tags

Add Signal Mast  
Window Help

User Name: 2R

Signal system: AAR-2

Mast type: AAR-2  
BN-1989  
BR-2003  
CSX-1998  
DB HV 1969  
NYCS

Heads:

Add ...

- Lets place our first mast at the first block boundary for east (right) bound traffic.
- Open the 'Tools' and select 'Tables' - 'Signals' - 'Signal Masts'.
- This opens the Signal Masts window. Click on "Add..." to create our first mast.
- We will name the mast 2R and select the Signal System 'CSX-1998'. Note: as of the 2.12 release many signal systems are incomplete. Be sure to download the latest version to obtain the most complete rules available.



# Using Panel Editor

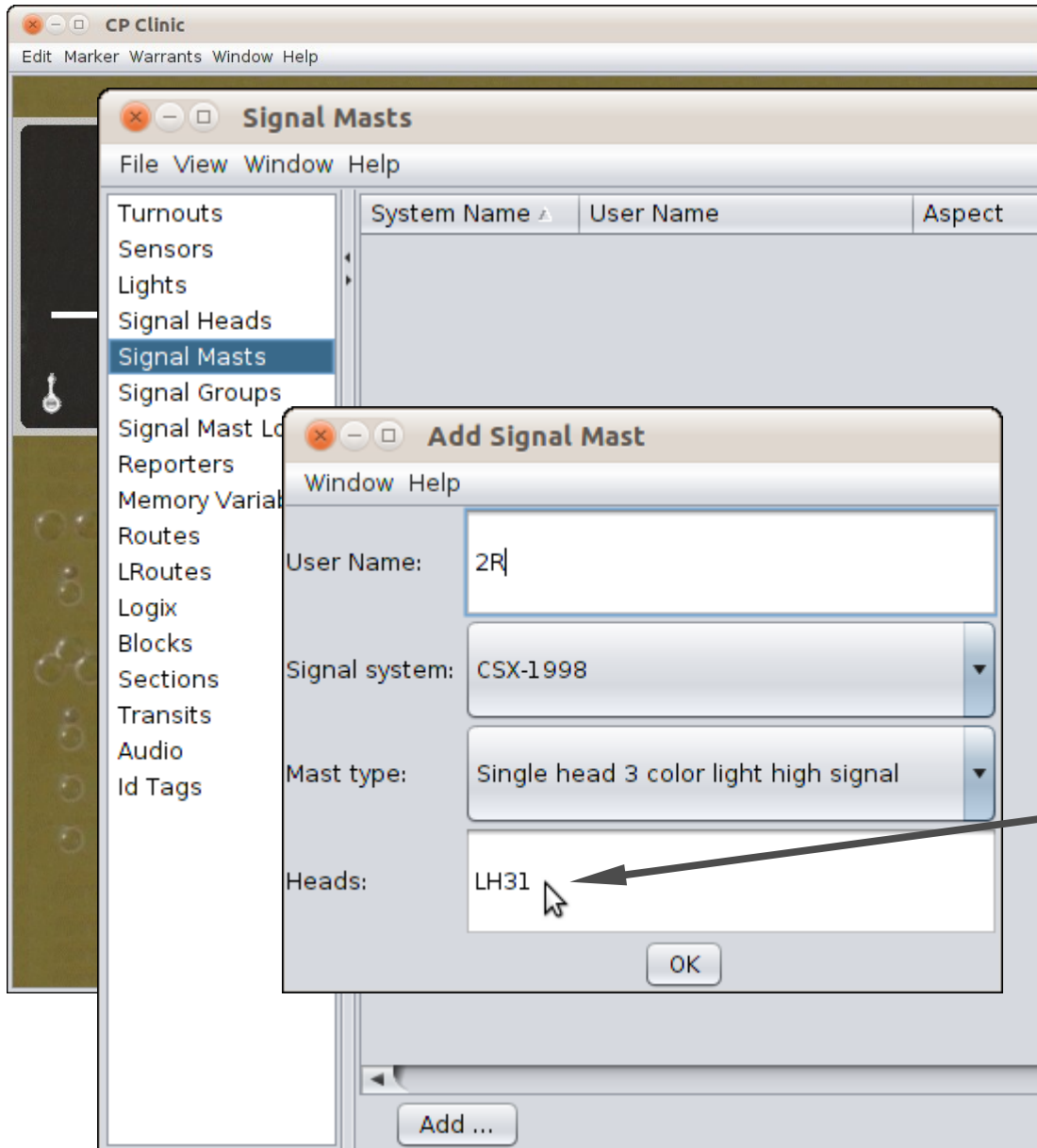
Adding a mast

■ After selecting the desired signal system you need to select the specific mast used at this location. We will use the simple three color light high signal mast. Your options are limited by the types of mast arrangements used by your prototype. Be sure to select the mast type that can display the required aspects for this location.



# Using Panel Editor

Adding a mast



- After selecting the desired signal system you need to select the specific mast used at this location. We will use the simple three color light high signal mast. Your options are limited by the types of mast arrangements used by your prototype. Be sure to select the mast type that can display the required aspects for this location.
- Once you select the type of mast you will need to enter the ID of the head/s that make up the mast. (top to bottom) In this case it only requires one head, LH31, which is already located in our signal head table.



# Using Panel Editor

Adding a mast

- Clicking on OK adds the mast to the table.

CP Clinic

Edit Marker Warrants Window Help

Signal Masts

File View Window Help

System Name ▲	User Name	Aspect	Comment	Edit Logic	Lit
IF\$shsm:CSX-1998:CLS-3-hi(LH31)	2R			Delete Edit Logic	<input checked="" type="checkbox"/>

Turnouts  
Sensors  
Lights  
Signal Heads  
Signal Masts  
Signal Groups  
Signal Mast Logic  
Reporters  
Memory Variables  
Routes  
LRoutes  
Logix  
Blocks  
Sections  
Transits  
Audio  
Id Tags

Add ...



# Using Panel Editor

Adding a mast

- Clicking on OK adds the mast to the table.

- Add a comment.

System Name	User Name	Aspect	Comment	Edit Logic	Lit
IF\$shsm:CSX-1998:CLS-3-hi(LH31)	2R		TK2 Right	Delete	<input checked="" type="checkbox"/>





# Using Panel Editor

Adding a mast

- Clicking on OK adds the mast to the table.

- Add a comment.

- Note that the mast already knows all of the possible indications that it can display. I have not located the error that causes two 'Stop' entries to appear.

CP Clinic  
Edit Marker Warrants Window Help

Signal Masts  
File View Window Help

System Name	User Name	Aspect	Comment	Edit Logic	Lit
IF\$shsm:CSX-1998:CLS-3-hi(LH31)	2R	Aspect	TK2 Right	Delete Edit Logic	<input checked="" type="checkbox"/>

Turnouts  
Sensors  
Lights  
Signal Heads  
Signal Masts  
Signal Groups  
Signal Mast Logic  
Reporters  
Memory Variables  
Routes  
LRoutes  
Logix  
Blocks  
Sections  
Transits  
Audio  
Id Tags

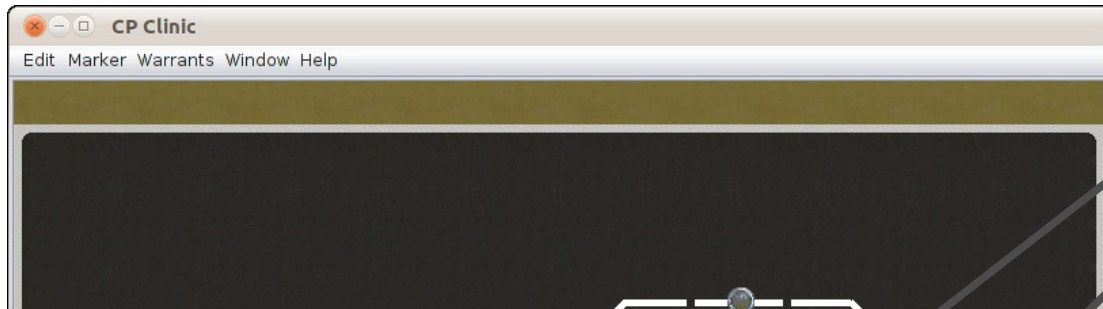
Add ...



# Using Panel Editor

Adding a mast

- Continue to add your masts noting that some masts will require two or even three heads to configure properly.

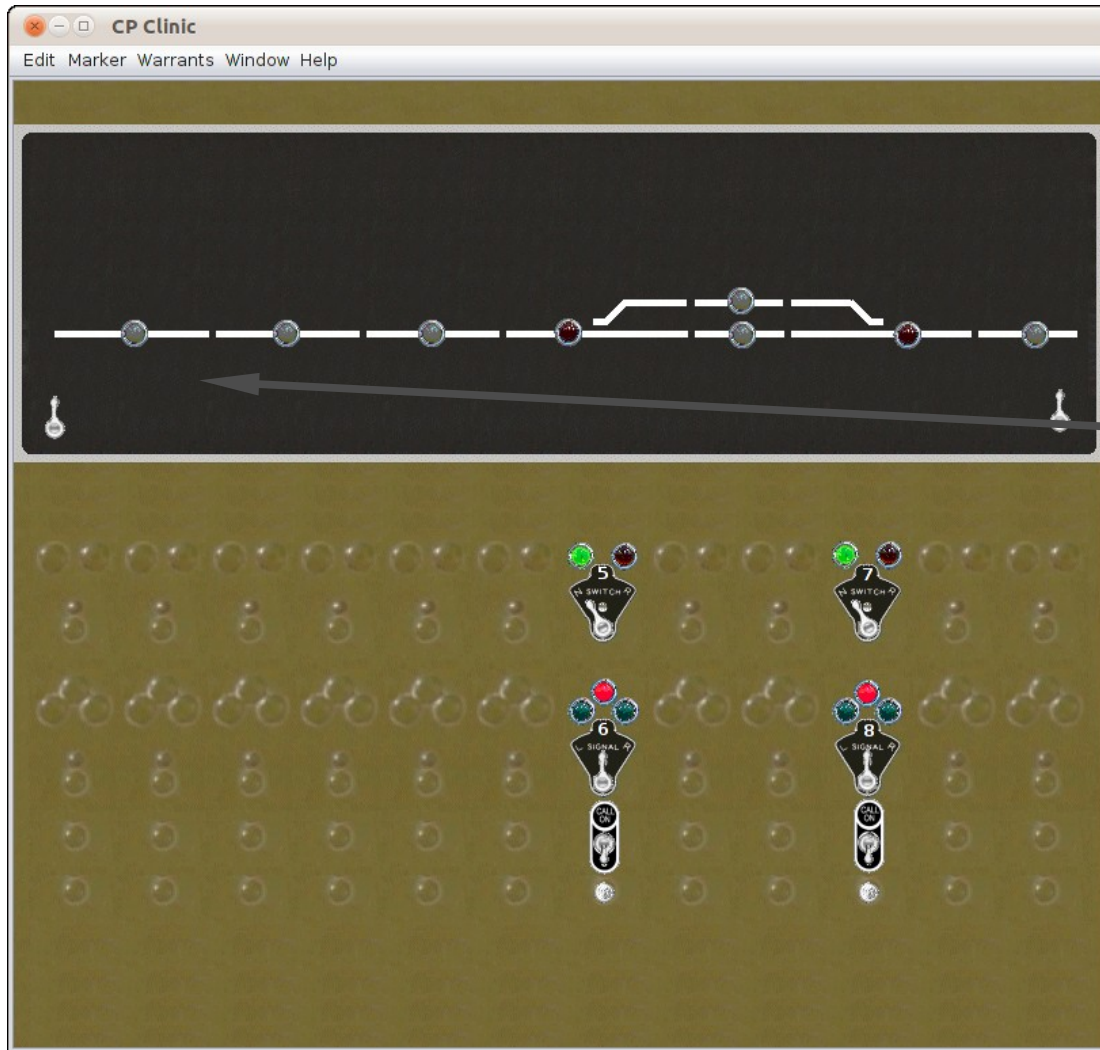


System Name	User Name	Aspect	Comment	Edit Logic	Lit
IF\$shsm:CSX-1998:CLS-1-3-hi(LH13)(LH11)	8R-S	Stop	TK8 Left Siding	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-1-3-hi(LH28)(LH24)	6L-S	Stop	TK6 Left Siding	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-3-2-hi(LH16)(LH14)(LH18)	8L	Stop	TK8 Left	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-3-2-hi(LH19)(LH21)(LH23)	6R	Stop	TK6 Right	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(0L)	0L	Stop	Off panel Left	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(10R)	10R	Stop	Off panel Right	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH26)	6L-M	Stop	TK8 Left Main	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH29)	2L	Stop	TK2 Left	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH31)	2R	Stop	TK2 Right	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH33)	4L	Stop	TK4 Left	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH35)	4R	Stop	TK4 Right	Delete Edit Logic	<input checked="" type="checkbox"/>
IF\$shsm:CSX-1998:CLS-3-hi(LH9)	8R-M	Stop	TK8 Left Main	Delete Edit Logic	<input checked="" type="checkbox"/>



# Using Panel Editor

Adding masts to a panel

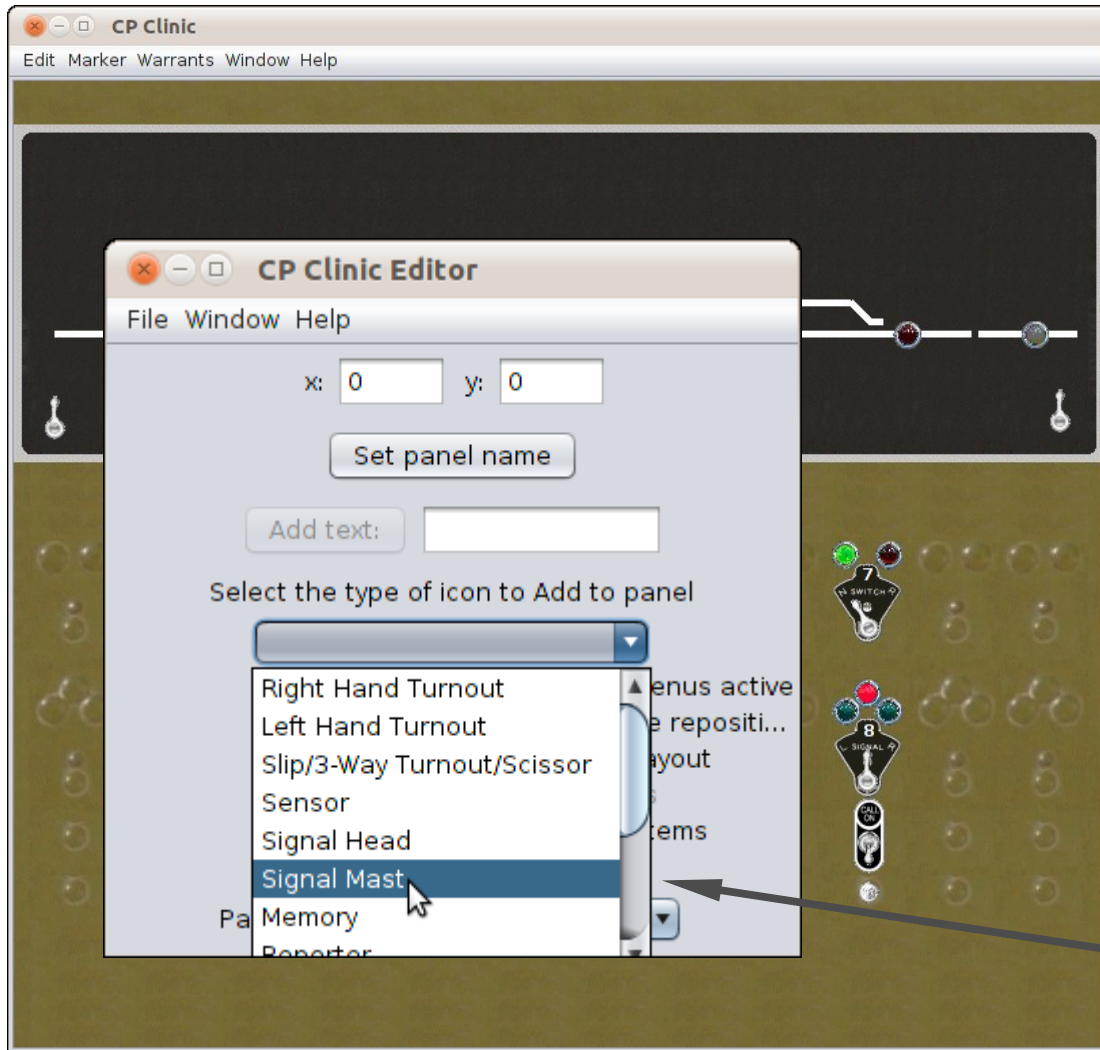


- Continue to add your masts noting that some masts will require two or even three heads to configure properly.
- Once the mast table is built we can add the actual masts to our panel. Remember this part is not prototypical, but rather an aid to understanding and configuration.



# Using Panel Editor

Adding masts to a panel



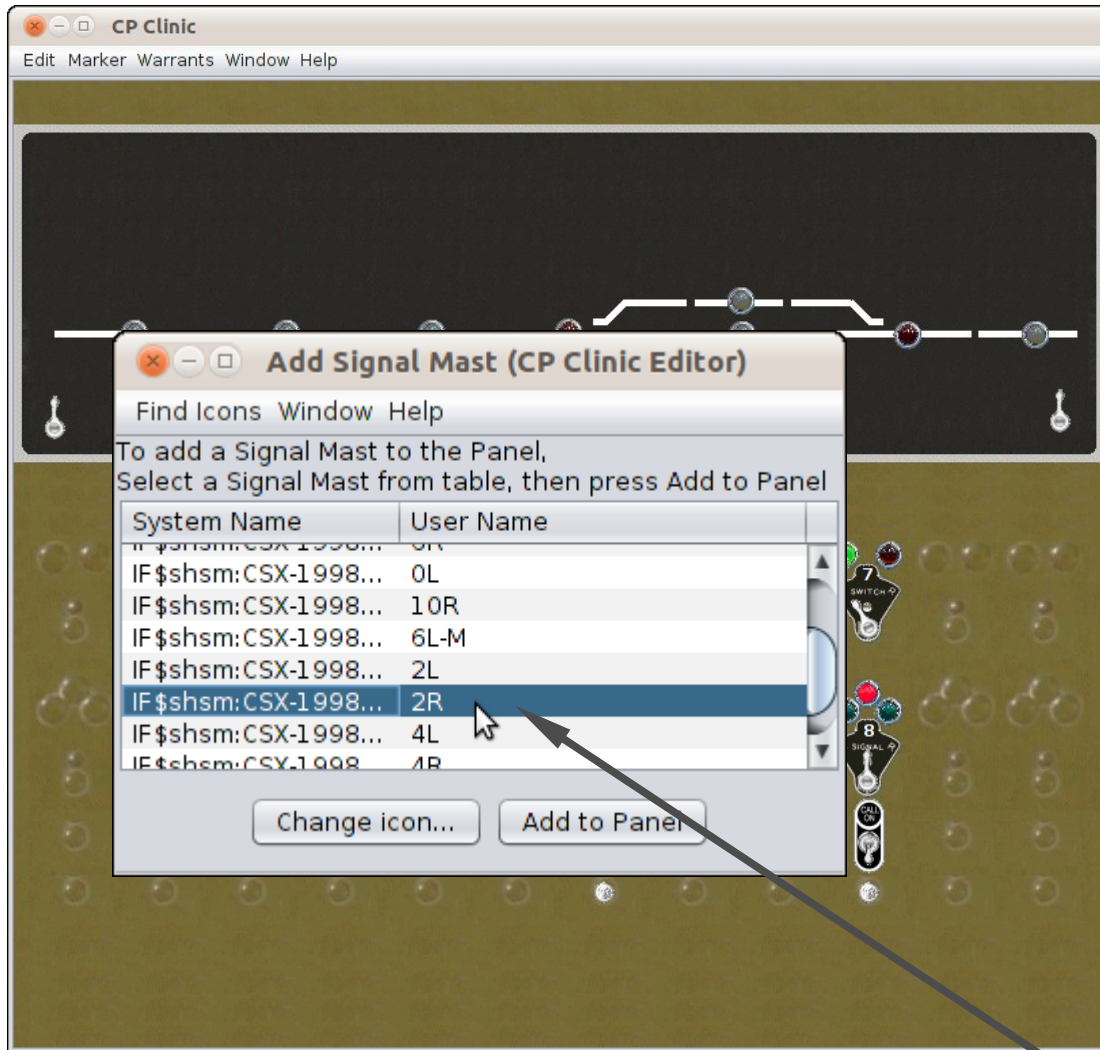
- Continue to add your masts noting that some masts will require two or even three heads to configure properly.
- Once the mast table is built we can add the actual masts to our panel. Remember this part is not prototypical, but rather an aid to understanding and configuration.
- From the Panel Editor window select Add Icon - Signal Mast.





# Using Panel Editor

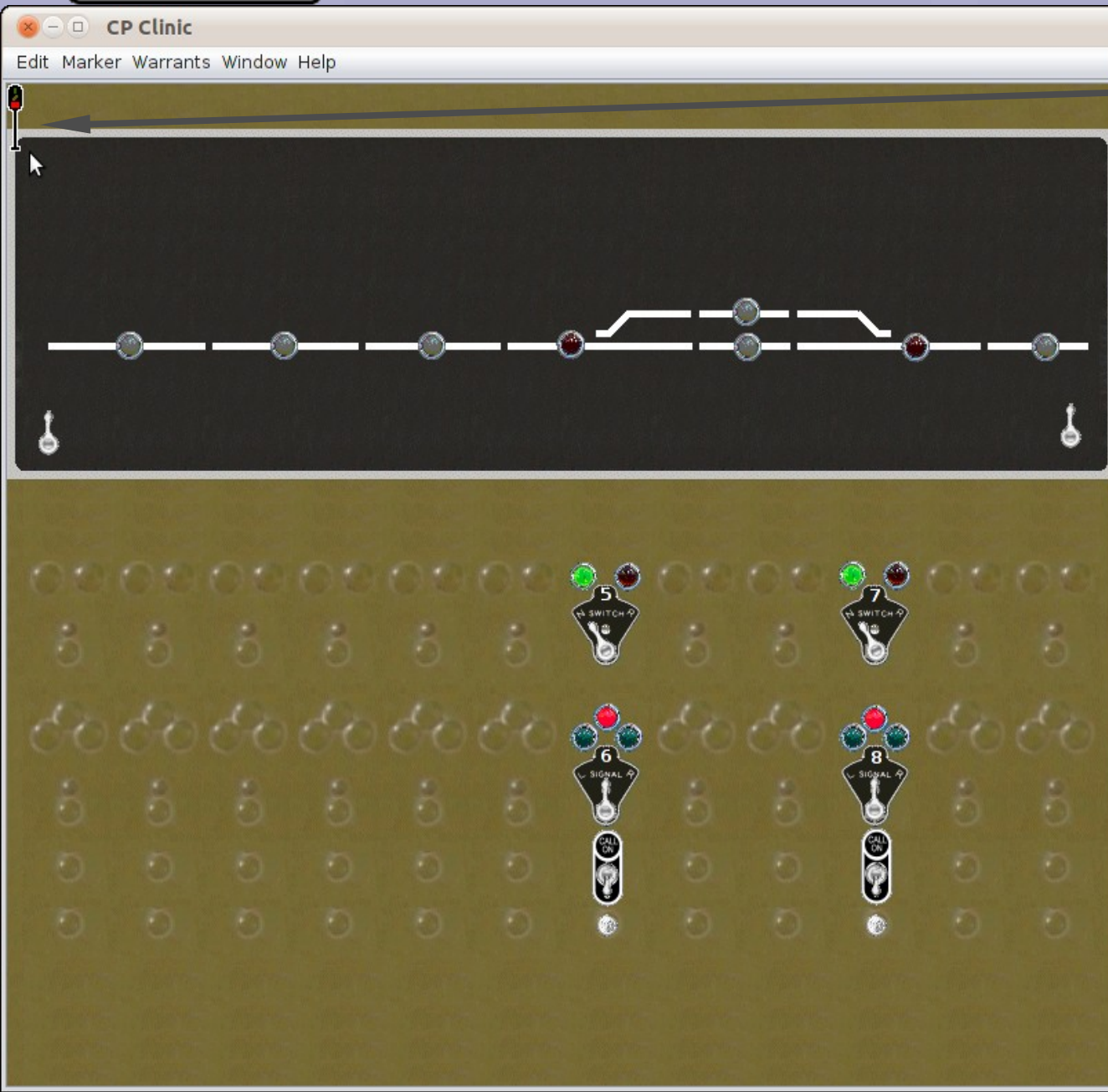
Adding masts to a panel



- Continue to add your masts noting that some masts will require two or even three heads to configure properly.
- Once the mast table is built we can add the actual masts to our panel. Remember this part is not prototypical, but rather an aid to understanding and configuration.
- From the Panel Editor window select Add Icon - Signal Mast.
- Select the '2R' mast from those that we added.

# Using Panel Editor

Adding masts to a panel



- The mast will appear in the usual place.

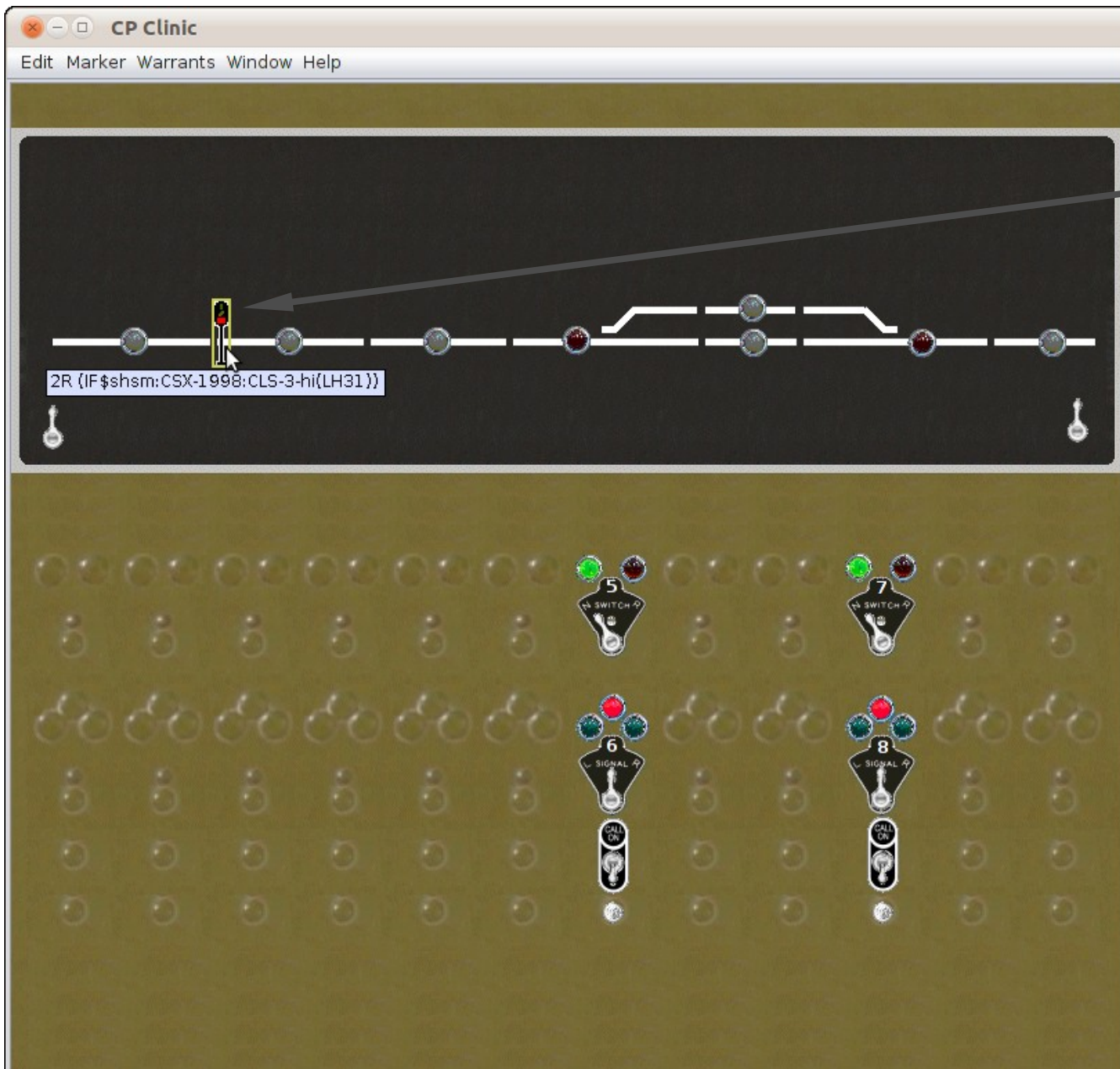




# Using Panel Editor

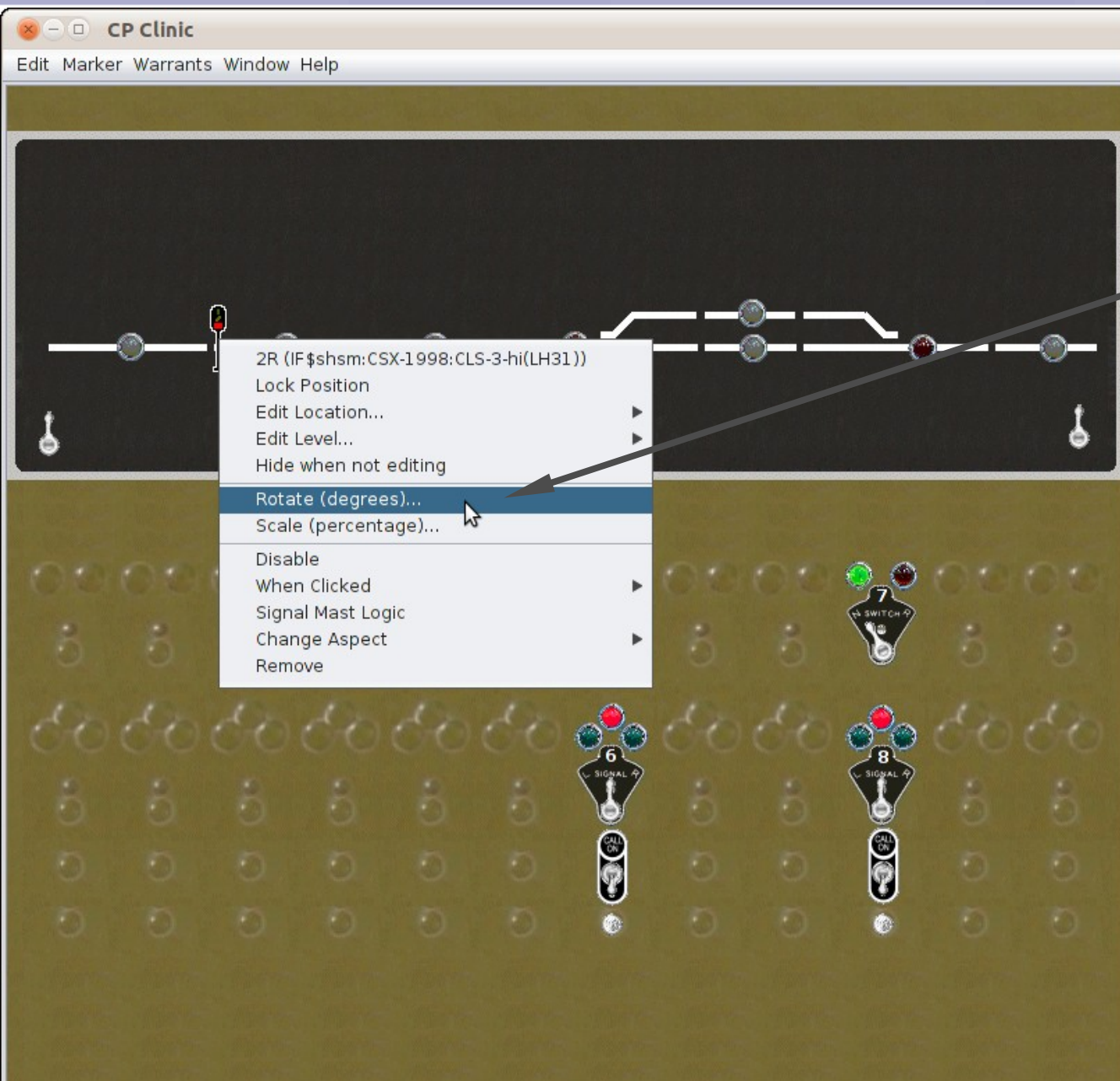
Adding masts to a panel

- The mast will appear in the usual place.
- Move it into position.



# Using Panel Editor

Adding masts to a panel

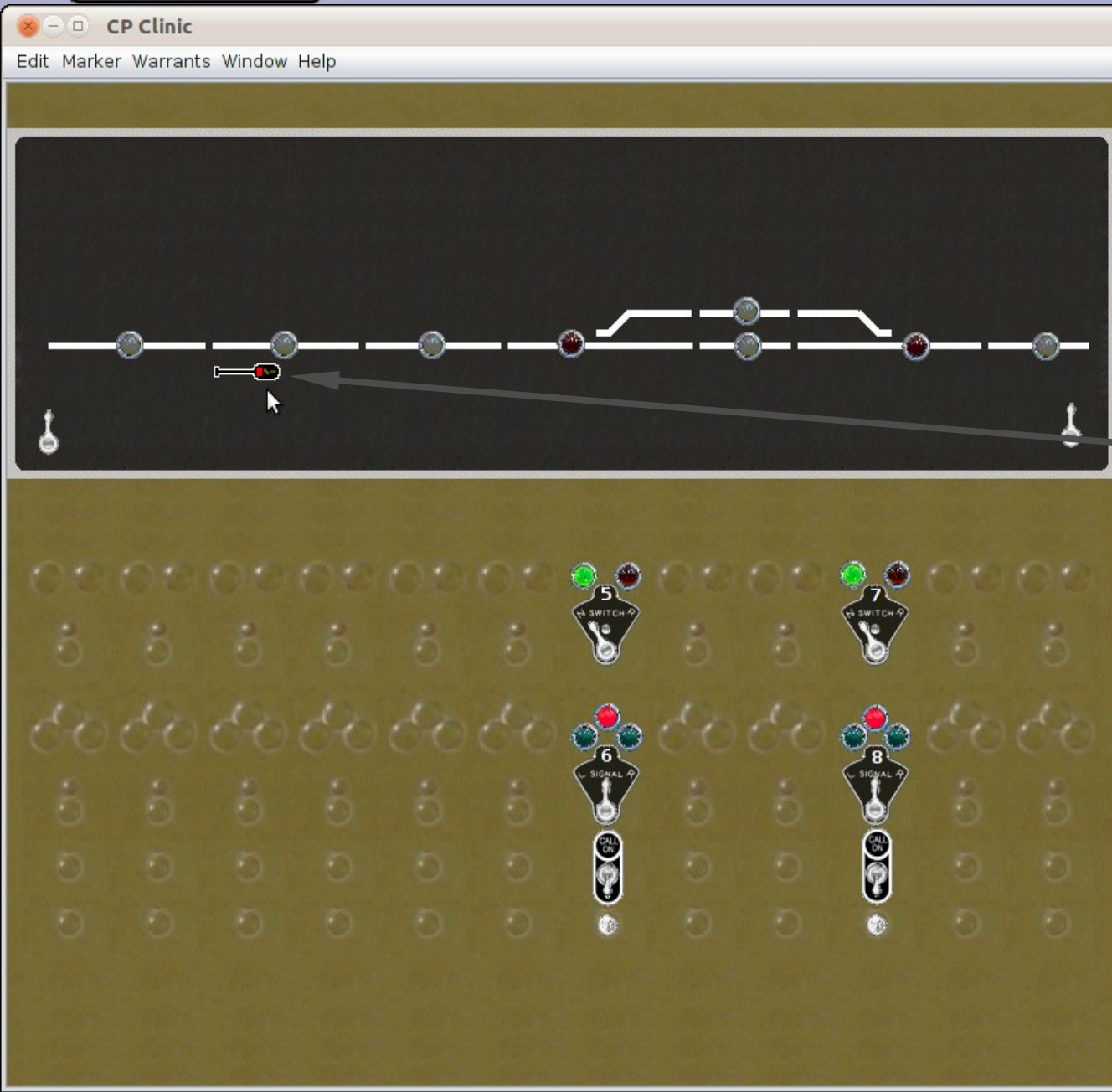


- The mast will appear in the usual place.
- Move it into position.
- Then rotate it into position. (90 degrees)

# Using Panel Editor



Adding masts to a panel

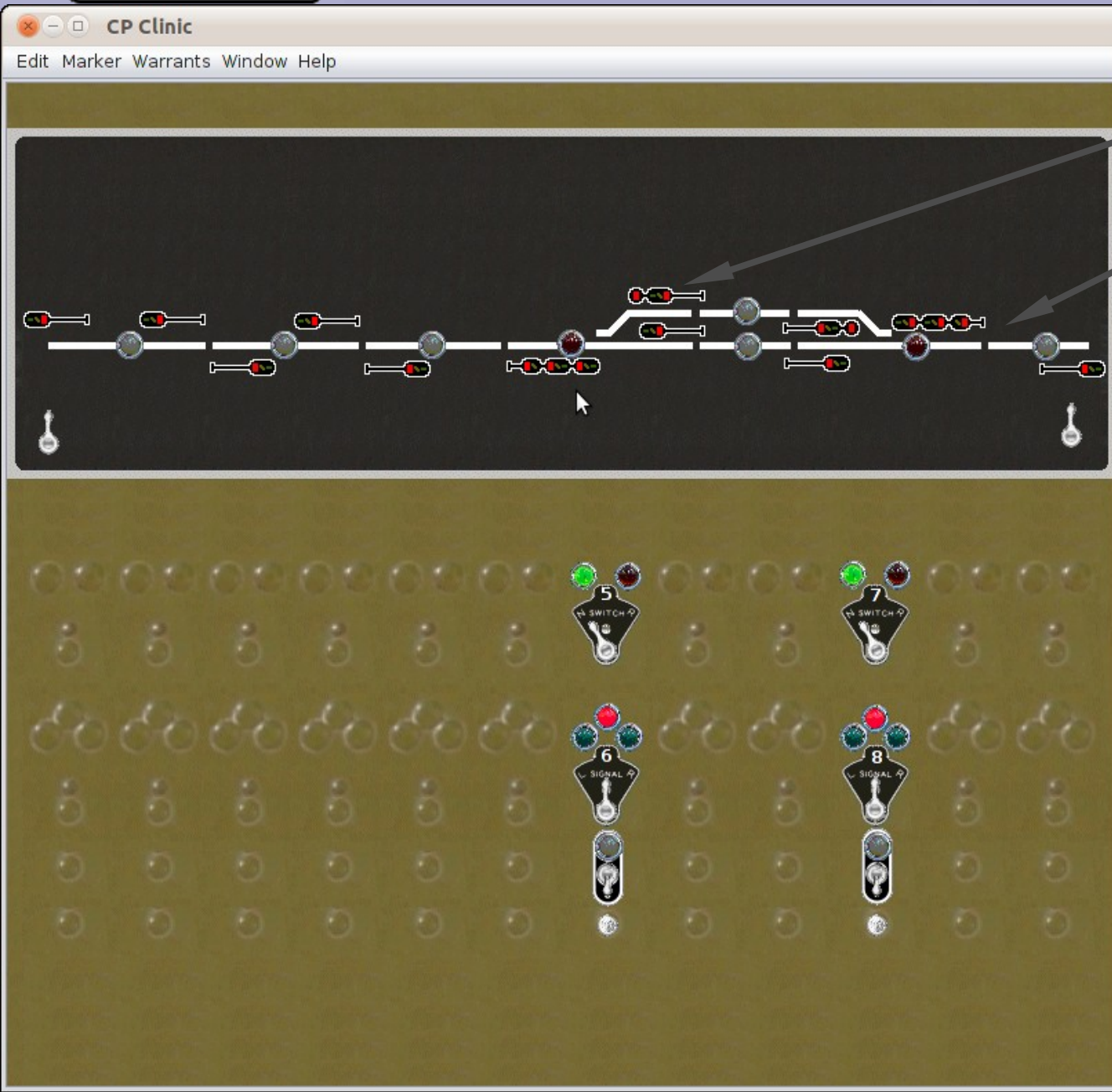


- The mast will appear in the usual place.
- Move it into position.
- Then rotate it into position. (90 degrees)
- Again remember that the classic CTC panels did not have any indications showing any of the actual signal aspects. They did often include small signal images indicating the location of interlocking signals.



# Using Panel Editor

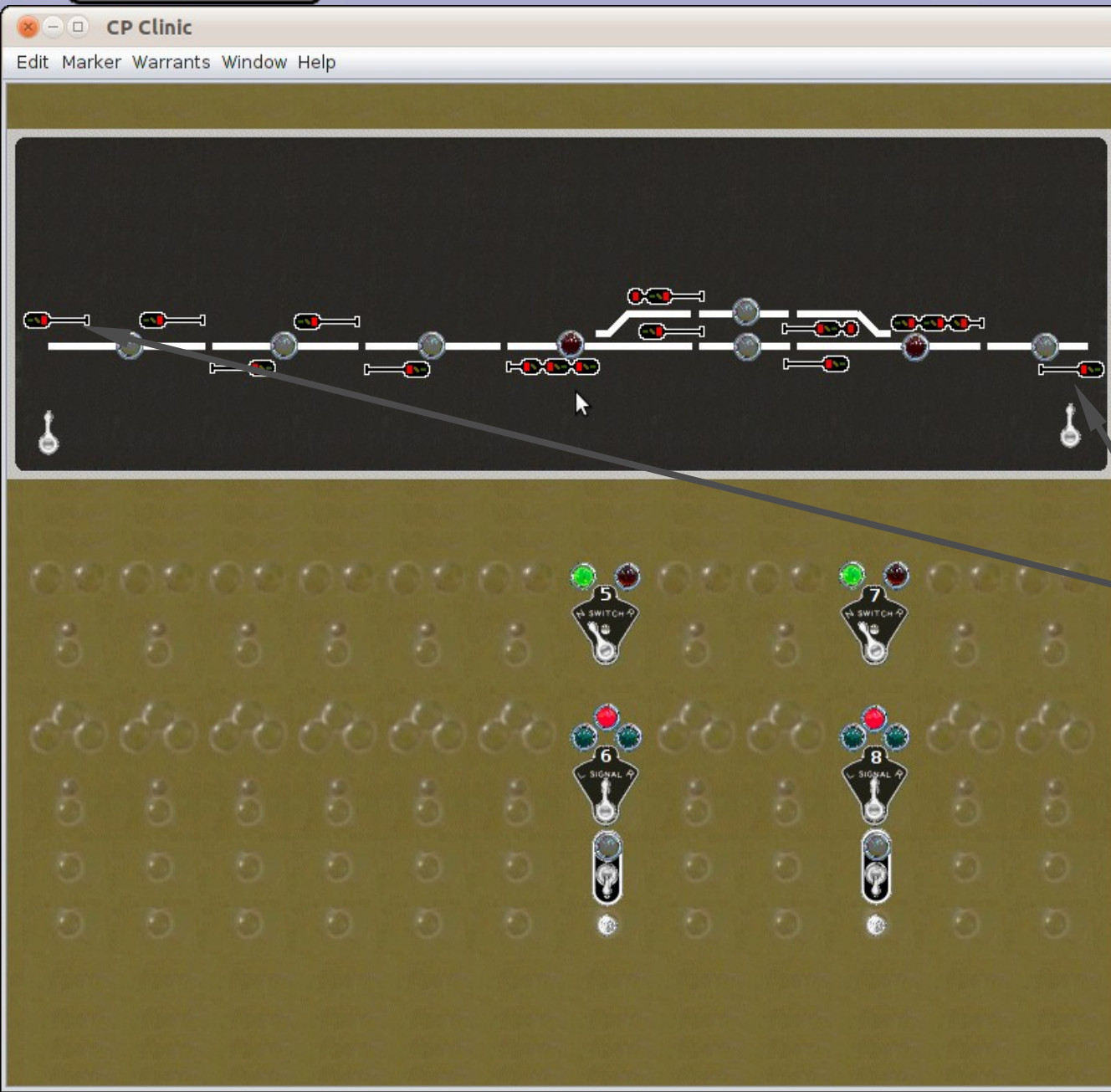
Adding masts to a panel



- Continue by placing the remaining signal masts on your panel. The position doesn't matter other than making it easy for you to understand their relationship to the blocks and turnouts.

# Using Panel Editor

Adding masts to a panel

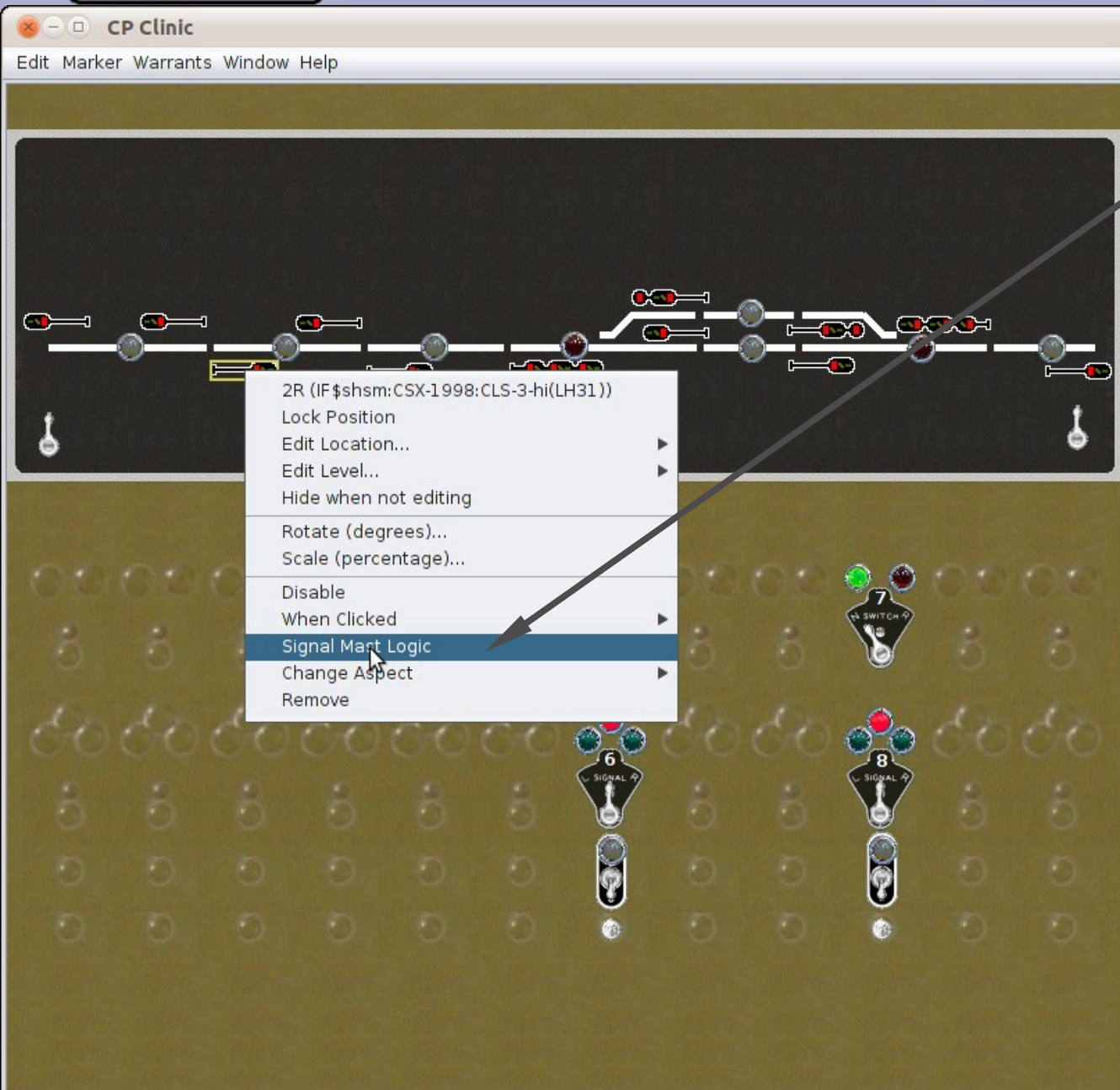


- Continue by placing the remaining signal masts on your panel. The position doesn't matter other than making it easy for you to understand their relationship to the blocks and turnouts.
- These end masts do not appear on the layout. They just represent the 'next' signal masts. They are required by the Aspect Signal system because the logic is entered by pairs of masts. They may be 'Stop' or 'Restricting' virtual masts as appropriate for the track. (end or dark)



# Using Panel Editor

Adding logic to your masts



- Once the masts are 'installed' on your panel, click on one to bring up its menu. Select 'Signal Mast Logic'.

# Using Panel Editor

Adding logic to your masts



CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

2R

System Name ▲	User Name	Active	Enabled	Edit

Discover Add Signal Logic

- Once the masts are 'installed' on your panel, click on one to bring up its menu. Select 'Signal Mast Logic'.
- This opens a 'Signaling Pairs' window for '2R'. Click 'Add Signal Logic' to complete this pair.



# Using Panel Editor

Adding logic to your masts

CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 2R

Destination Mast 0L

Use Layout Editor Paths

Allow The Logic to Autom...

Lock Turnouts when Sign...

Show  All  Included  T...

Blocks Turnouts Sensors Signal Masts

Please select Blocks to be checked

System Name	User Name	Include	Speed	Permissi...
6L-M				
6L-S				

These Blocks are auto generated and can not be changed

Update Signal Logic

- Once the masts are 'installed' on your panel, click on one to bring up its menu. Select 'Signal Mast Logic'.
- This opens a 'Signaling Pairs' window for '2R'. Click 'Add Signal Logic' to complete this pair.
- First choose the destination signal for this pair. In this case it is easy because there is only one option, '4R'.

# Using Panel Editor

Adding logic to your masts



CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 2R

Destination Mast 4R

Use Layout Editor Paths

Allow The Logic to Automatically Determine Conflicting SignalMasts

Lock Turnouts when Signal Mast Logic is active

Show  All  Included  Turnouts and Sensors

Blocks Turnouts Sensors Signal Masts

System	User Name	Include	State
IS8:RDGK		<input type="checkbox"/>	InActive
IS8:RDGL		<input type="checkbox"/>	InActive
IS8:TK		<input type="checkbox"/>	InActive
IS9:TK		<input checked="" type="checkbox"/>	InActive
IS10:LDGL		<input type="checkbox"/>	InActive
IS10:NGL		<input type="checkbox"/>	InActive

Please select Sensors to be checked

Update Signal Logic

- Once the masts are 'installed' on your panel, click on one to bring up its menu. Select 'Signal Mast Logic'.
- This opens a 'Signaling Pairs' window for '2R'. Click 'Add Signal Logic' to complete this pair.
- First choose the destination signal for this pair. In this case it is easy because there is only one option, '4R'.
- Now select the 'Sensors' tab and place a check by 'IS9:TK' which is the BOD for this block.



# Using Panel Editor

Adding logic to your masts



- We have not defined any 'Blocks', and there are no turnouts nor crossing tracks with extra masts to watch, so we are finished. Click on 'Update Signal Logic'.

CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 2R

Destination Mast 4R

Use Layout Editor Paths

Allow The Logic to Automatically Determine Conflicting SignalMasts

Lock Turnouts when Signal Mast Logic is active

Show  All  Included Turnouts and Sensors

Blocks Turnouts Sensors **Signal Masts**

Please select Sensors to be checked

System	User Name	Include	State
IS8:RDGK		<input type="checkbox"/>	InActive
IS8:RDGL		<input type="checkbox"/>	InActive
IS8:TK		<input type="checkbox"/>	InActive
IS9:TK		<input checked="" type="checkbox"/>	InActive
IS10:LDGL		<input type="checkbox"/>	InActive
IS10:NGL		<input type="checkbox"/>	InActive

Update Signal Logic





# Using Panel Editor

Adding logic to your masts

CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 2R

Destination Mast 4R

Path Speed : None Set

Use Layout Editor Paths

Allow The Logic to Automatically Determine Conflicting SignalMasts

Lock Turnouts when Signal Mast Logic is active

Show  All  Included Turnouts and Sensors

Blocks Turnouts Sensors Signal Masts

System	User Name	Include	State
IS0:RDGL		<input checked="" type="checkbox"/>	Active
IS6:LDGK		<input checked="" type="checkbox"/>	InActive
IS9:TK		<input checked="" type="checkbox"/>	InActive

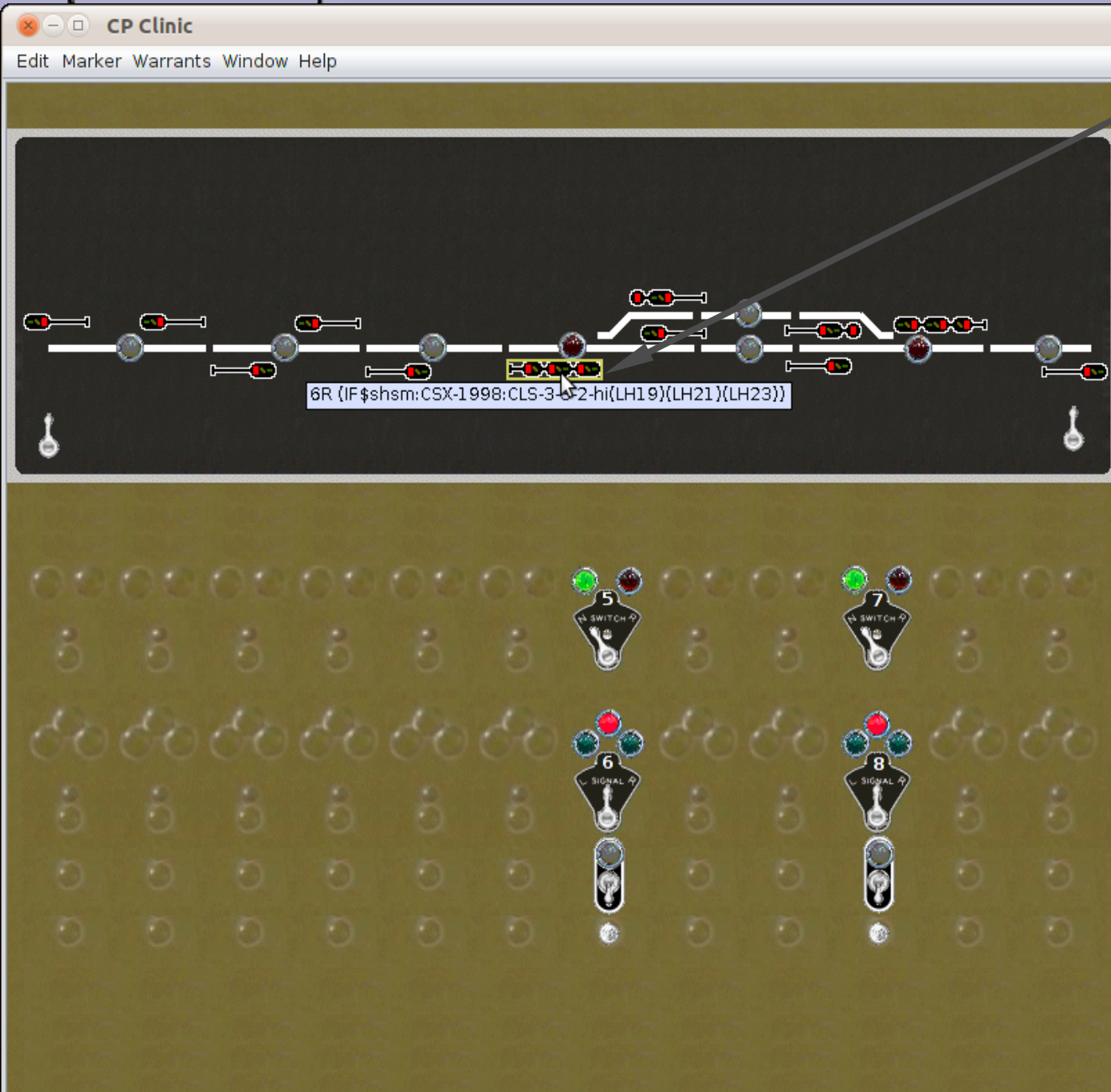
Please select Sensors to be checked

Update Signal Logic

- We have not defined any 'Blocks', and there are no turnouts nor crossing tracks with extra masts to watch, so we are finished. Click on 'Update Signal Logic'.
- Actually for this demo I have added two other sensors to watch. The first is 'IS0:RDGL' (Internal Sensor 0: Right Direction siGnal Lever). The other is 'IS6:LDGK' (Internal Sensor 6: Left Direction siGnal indicaKator). These let me interact with the mast from the panel.

# Using Panel Editor

Adding logic to your masts



- The real power of the new Aspect Signaling shows up when the masts get complex.

# Using Panel Editor

Adding logic to your masts

The screenshot shows the JMRI Panel Editor interface. The top window, titled 'CP Clinic', displays a railway signaling diagram with various signal masts and track segments. A tooltip for mast '6R' is visible, showing its system name: `6R (IF$shsm:CSX-1998:CLS-3-hi(LH19)(LH21)(LH23))`. Below this, the 'Signalling Pairs' window is open, showing a table of signaling pairs. The table has columns for System Name, User Name, Active, Enabled, and Edit. Two pairs are listed: 8R-S and 8R-M. Arrows from the text on the right point to the '6R' label in the diagram, the '8R-S' row, and the '8R-M' row.

System Name	User Name	Active	Enabled	Edit
IF\$shsm:CSX-1998:CLS-1-3-hi(LH13)(LH11)	8R-S	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EDIT
IF\$shsm:CSX-1998:CLS-3-hi(LH9)	8R-M	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EDIT

Buttons at the bottom of the 'Signalling Pairs' window: Discover, Add Signal Logic

- The real power of the new Aspect Signaling shows up when the masts get complex.
- Mast '6R' has two other masts that form pairs, depending on the route through the interlocking. The first is mast 8R-S on the siding. The other is mast 8R-M on the main.

# Using Panel Editor

Adding logic to your masts

CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 6R

Destination Mast 8R-S

Path Speed : None Set

Use Layout Editor Paths

Allow The Logic to Automatically Determine Conflicting SignalMasts

Lock Turnouts when Signal Mast Logic is active

Show  All  Included Turnouts and Sensors

Blocks Turnouts Sensors Signal Masts

System	User Name	Include	State
LT5		<input checked="" type="checkbox"/>	Thrown

Please select Turnouts to be checked

System	User Name	State
--------	-----------	-------

These Turnouts are auto generated and can not be changed

Update Signal Logic

- The real power of the new Aspect Signaling shows up when the masts get complex.
- Mast '6R' has two other masts that form pairs, depending on the route through the interlocking. The first is mast 8R-S on the siding. The other is mast 8R-M on the main.
- Looking at the siding pair we have added the 'Turnouts' LT5 Thrown.



# Using Panel Editor

Adding logic to your masts

CP Clinic

Edit Marker Warrants Window Help

Signalling Pairs

Window Help

Source Mast 6R

Destination Mast 8R-S

Path Speed : None Set

Use Layout Editor Paths

Allow The Logic to Automatically Determine Conflicting SignalMasts

Lock Turnouts when Signal Mast Logic is active

Show  All  Included Turnouts and Sensors

Blocks Turnouts Sensors Signal Masts

System...	User Name	Include	State
IS1:TK		<input checked="" type="checkbox"/>	InActive
IS3:TK		<input checked="" type="checkbox"/>	InActive
IS6:RDGK		<input checked="" type="checkbox"/>	Active

Please select Sensors to be checked

Update Signal Logic

- The real power of the new Aspect Signaling shows up when the masts get complex.
- Mast '6R' has two other masts that form pairs, depending on the route through the interlocking. The first is mast 8R-S on the siding. The other is mast 8R-M on the main.
- Looking at the siding pair we have added the 'Turnouts' LT5 Thrown.
- For 'Sensors' we look at the OS, the Siding, and the direction of traffic.



# Using Panel Editor

Adding logic to your masts

The screenshot shows the JMRI Panel Editor interface. The top window, titled 'CP Clinic', displays a graphical representation of a railway track with various signal masts and track segments. A tooltip for a mast is visible, showing the text: `6R (IF$shsm:CSX-1998:CLS-3-hi(LH19)(LH21)(LH23))`. Below this, a 'Signalling Pairs' dialog box is open, showing a table of signalling pairs for the selected mast '6R'. The table has columns for System Name, User Name, Active, Enabled, and Edit. Two pairs are listed: one for '8R-S' and one for '8R-M'. Both are currently disabled (Active checkbox is unchecked, Enabled checkbox is checked). An arrow points from the '8R-M' row in the table to the corresponding mast in the track layout above.

System Name	User Name	Active	Enabled	Edit
IF\$shsm:CSX-1998:CLS-1-3-hi(LH13)(LH11)	8R-S	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EDIT
IF\$shsm:CSX-1998:CLS-3-hi(LH9)	8R-M	<input type="checkbox"/>	<input checked="" type="checkbox"/>	EDIT

Buttons at the bottom of the dialog: Discover, Add Signal Logic

- The setup for the main track is just as easy.

# Using Panel Editor

Rules

The screenshot displays the JMRI Panel Editor software. The top window, titled "CP Clinic", shows a graphical representation of a railway track with various signal lights and track segments. Below this, the "aspects.xml" file is open in a text editor (Bluefish 2.0.2). The XML code defines several signal aspects, including "Approach Limited", "Limited Clear", and "Limited Approach".

```
47 <aspect>
48 <name>Approach Limited</name>
49 <rule>Rule 281-B</rule>
50 <indication>Proceed approaching next signal not exceeding Limited Speed.</indication>
51 <speed>Normal</speed>
52 <speed2>Limited</speed2>
53 <route>Normal</route>
54 </aspect>
55
56 <aspect>
57 <name>Limited Clear</name>
58 <rule>Rule 281-C</rule>
59 <indication>Limited Speed through turnouts, crossovers, sidings and over power-operated switches; then proceed</indication>
60 <speed>Limited</speed>
61 <speed2>Normal</speed2>
62 <route>Diverging</route>
63 </aspect>
64
65 <aspect>
66 <name>Limited Approach</name>
67 <rule>Rule 281-D</rule>
68 <indication>Limited Speed through turnouts, crossovers, sidings and over power-operated switches; then proceed, prepared to stop
69 <speed>Limited</speed>
70 <speed2>Normal</speed2>
71 <route>Diverging</route>
72 </aspect>
```

- The setup for the main track is just as easy.
- All the 'rules' are built into the JMRI signal master tables, and automatically applied as required by your specific railroad's rule book. No more need to support the dead tree and ink industries to purchase thick signal manuals plus years of study in engineering and computer science just to understand how to write your Logix.

# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.

# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?



# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?
- 3) Choose one of the available appearance and aspects.xml files for your system, or create one. (see next clinic in this series)





# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?
- 3) Choose one of the available appearance and aspects.xml files for your system, or create one. (see next clinic in this series)
- 4) Setup all of your signal heads in the Signal Head table.



# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?
- 3) Choose one of the available appearance and aspects.xml files for your system, or create one. (see next clinic in this series)
- 4) Setup all of your signal heads in the Signal Head table.
- 5) Setup your masts in the Signal Mast table.



# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?
- 3) Choose one of the available appearance and aspects.xml files for your system, or create one. (see next clinic in this series)
- 4) Setup all of your signal heads in the Signal Head table.
- 5) Setup your masts in the Signal Mast table.
- 6) Place the masts onto your panel.



# Recap

Steps

- 1) Setup your track diagram in the Panel Editor or Layout Editor.
- 2) Identify the type of signaling system you're trying to create - speed based, route based or a bit of both?
- 3) Choose one of the available appearance and aspects.xml files for your system, or create one. (see next clinic in this series)
- 4) Setup all of your signal heads in the Signal Head table.
- 5) Setup your masts in the Signal Mast table.
- 6) Place the masts onto your panel.
- 7) Create the signal pairings so the logic will propagate from mast to mast.





- What we have covered so far:
  - Getting started – Panel Editor
  - Adding a background image
  - Adding heads
  - Adding masts
  - Adding mast logic

# Aspect Signaling



- What we have covered so far:
  - Getting started – Panel Editor
  - Adding a background image
  - Adding heads
  - Adding masts
  - Adding mast logic
- Where we are going:
  - Building your own signal sets and their rules
  - Using layout Editor to automate the adding of masts

Questions?



Questions ?