

## Overview - EPI White Pixel Troubleshooting:



### Theory:



White Pixels in the rawdata (also known as Spike Noise), is one of the most common problems in MR and can be even more problematic in EPI scans due to the vigorous gradients applied during these scans (hence a EPIWP test).



These white pixels in the rawdata can cause Corduroy artifacts and Ghosting problems if they occur during the EPI Reference scan. ("Corduroy" refers to the parallel line patterns that are often seen in the affected image. These lines are caused by intensified or bright areas in raw data "White Pixels".) These intensified areas are typically created by arcs or "Spike Noise" received by the system. The source of these arcs can be any current carrying conductor. This includes cables and electronic components. Also any conductor in a changing magnetic field (i.e. gradient fields) or any conductor moving in a magnetic field will have eddy currents flowing in it. This could include the rear pedestal, magnet enclosure frame, or any loose metal object. The arcing is usually happening in the magnet room. As long as the Scan Room's RF shielding is working, any arcing outside the room should be attenuated by the RF shield and filters. The only exceptions are the RF transmit and receive chains since the RF cables are not filtered. Although it happens very rarely, it is possible for digital data handling problems during the data acquisition to create White Pixels. White Pixels requires thorough troubleshooting to reduce the time and cost to repair it.



Corduroy can appear very differently from image to image. It may only be apparent on one image in the series or on every image. It may be just subtle fine lines that are hardly noticeable or it may completely envelope the entire image. It may even look like an SNR problem where the image is "grainy". The magnitude of the arc and where it happens in raw data "K-space" determines how it will effect the image. Arcs or white pixels near the center of K-space have more effect on the image. These many variations of corduroy artifact can lead one to believe there are multiple problems when it is really just one source.



### How to run it:



The EPI White Pixel (EPIWP) can be run from EPT. However, from EPT you cannot get the Mode 2 portion of EPIWP which allow you to loop on a single image (the worst image) and saves a lot of time. To run EPIWP from a c-shell go to /usr/g/service/cclass and type "epiwp" and just follow along.



### Typical problem scenarios, etc.



The majority of my noise sources have been gradient induced, often only effecting a single axis, sometimes two. Quite often it from loose hardware (i.e. nuts & bolts in rear pedestal) or connections (poor mating of center pins to body hybrid, etc.). Inspect and tighten all you can. Another common cause is coupling. Make sure all the Gradient cables are separated from all the receive lines.

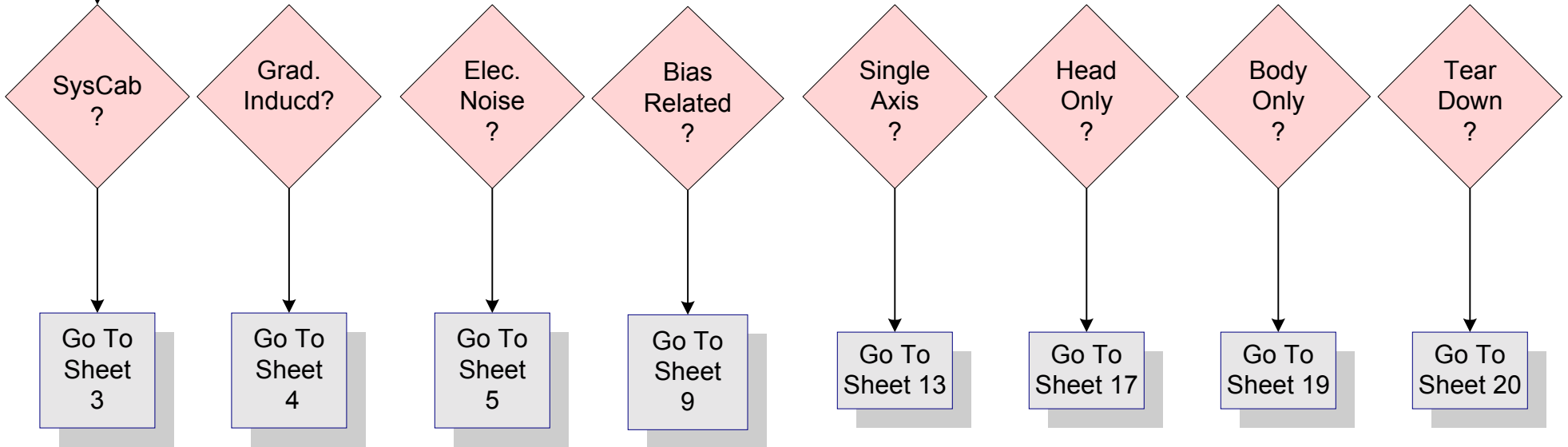


### FlowChart Begins on Page 2

# EPI White Pixel Troubleshooting

Start EPI White Pixel TS \*

**NOTE**  
Items with shadows are linked to other areas in or out of the chart.

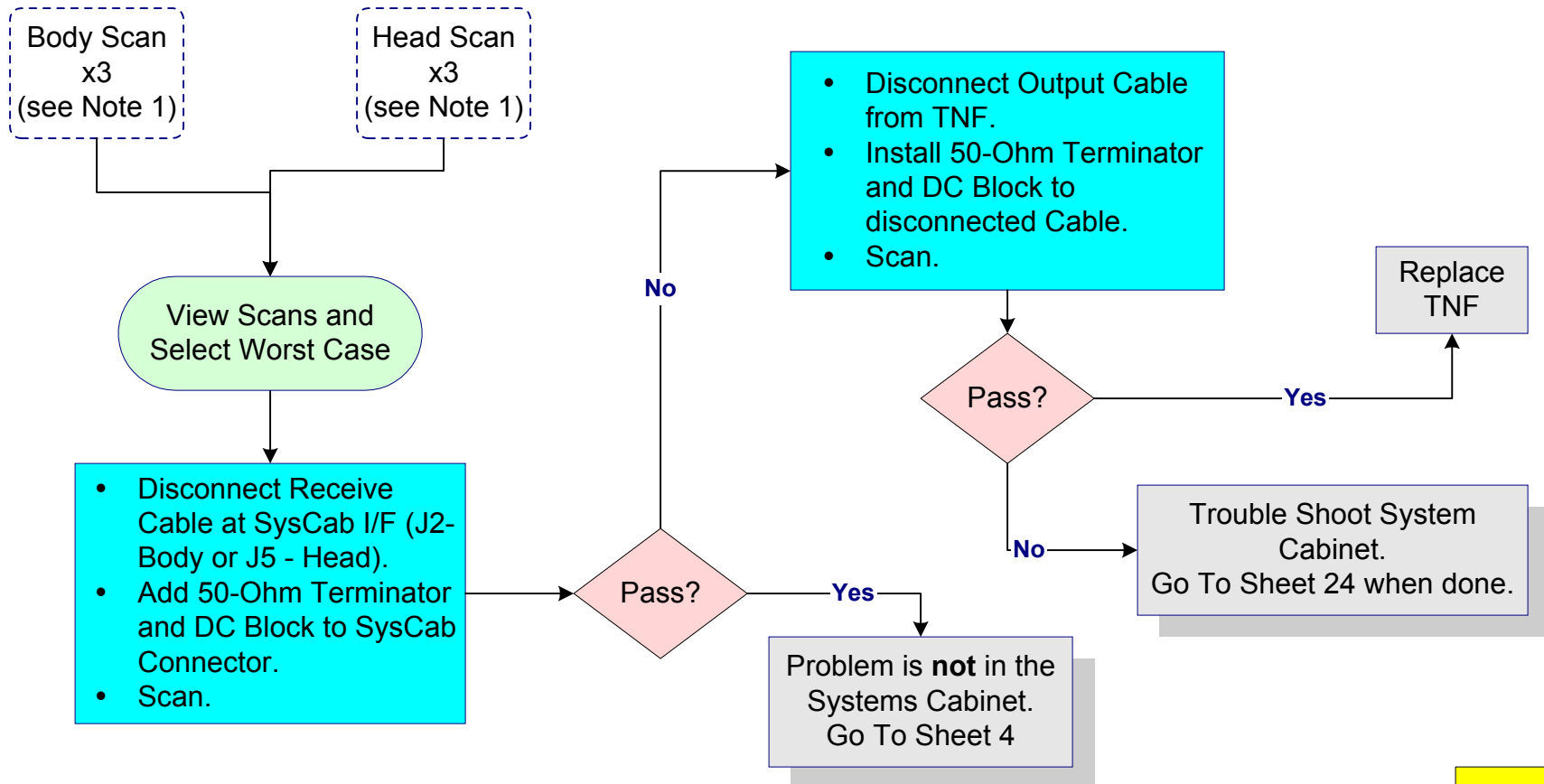


\* If EPI begins passing at any time in the flow chart, follow the instructions on Sheet 24 BEFORE reassembly and placing the scanner back in service.

Page 2

# EPI White Pixel Troubleshooting

## Failing on Both Head & Body Scans - Rule out Systems Cabinet (SysCab)

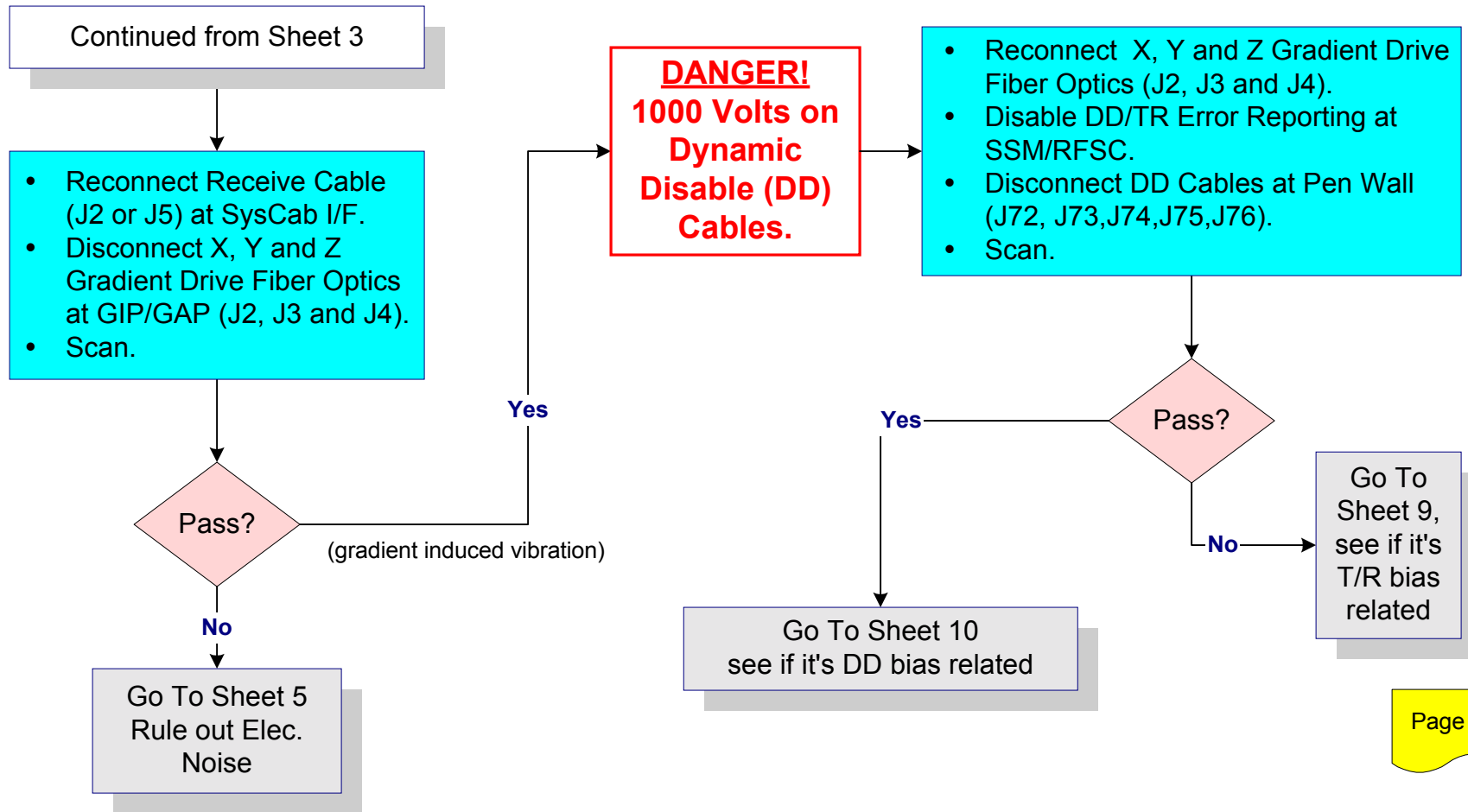


### NOTES

- (1) Scan means run EPI White Pixel Test (RF disabled by switch on CERD/UCERD board).
- (2) Anytime a test begins to pass, scan three times (x3) to rule out an intermittent fault..

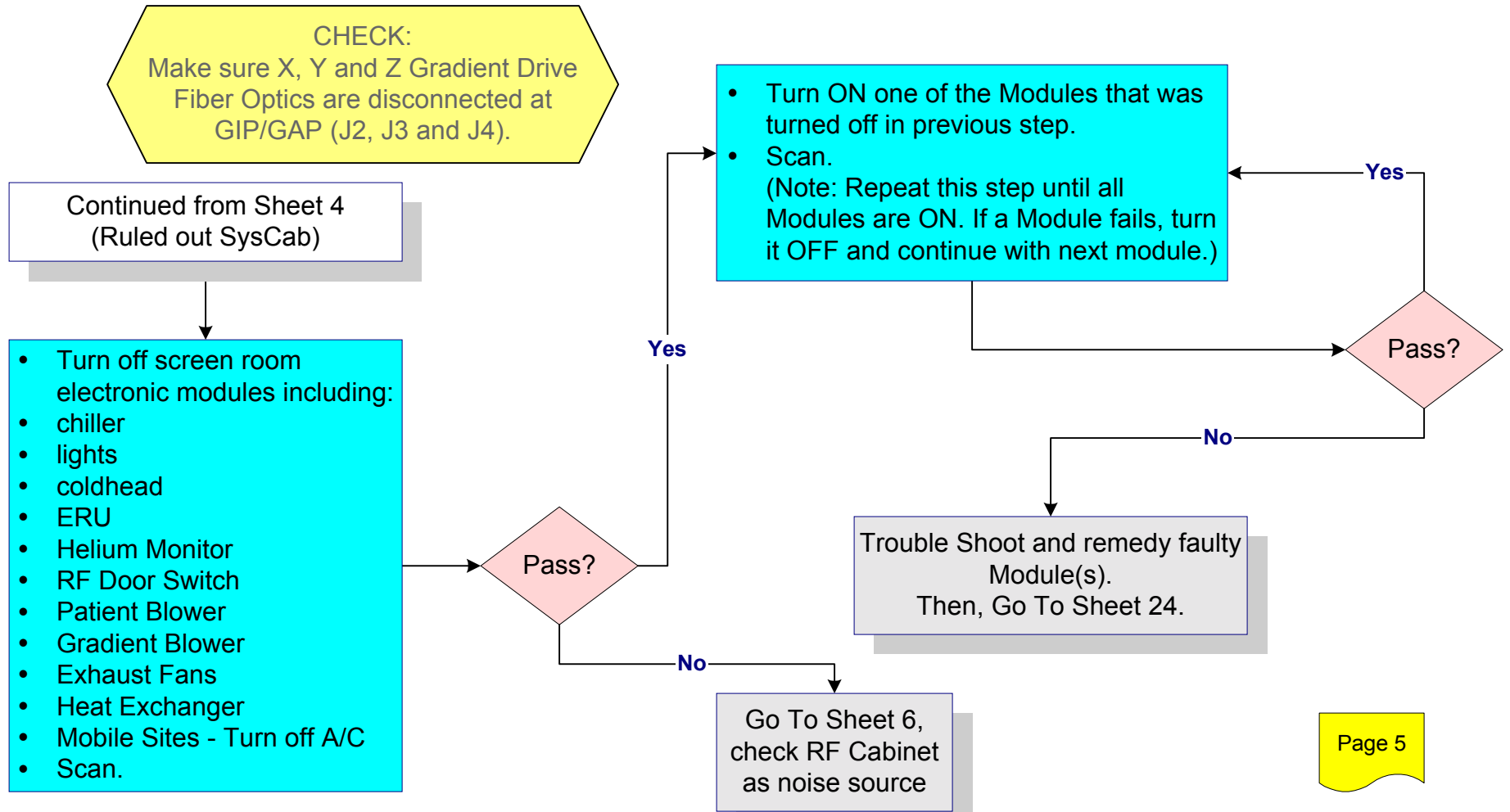
# EPI White Pixel Troubleshooting

## Failing on Both Head & Body Scans (Continued)



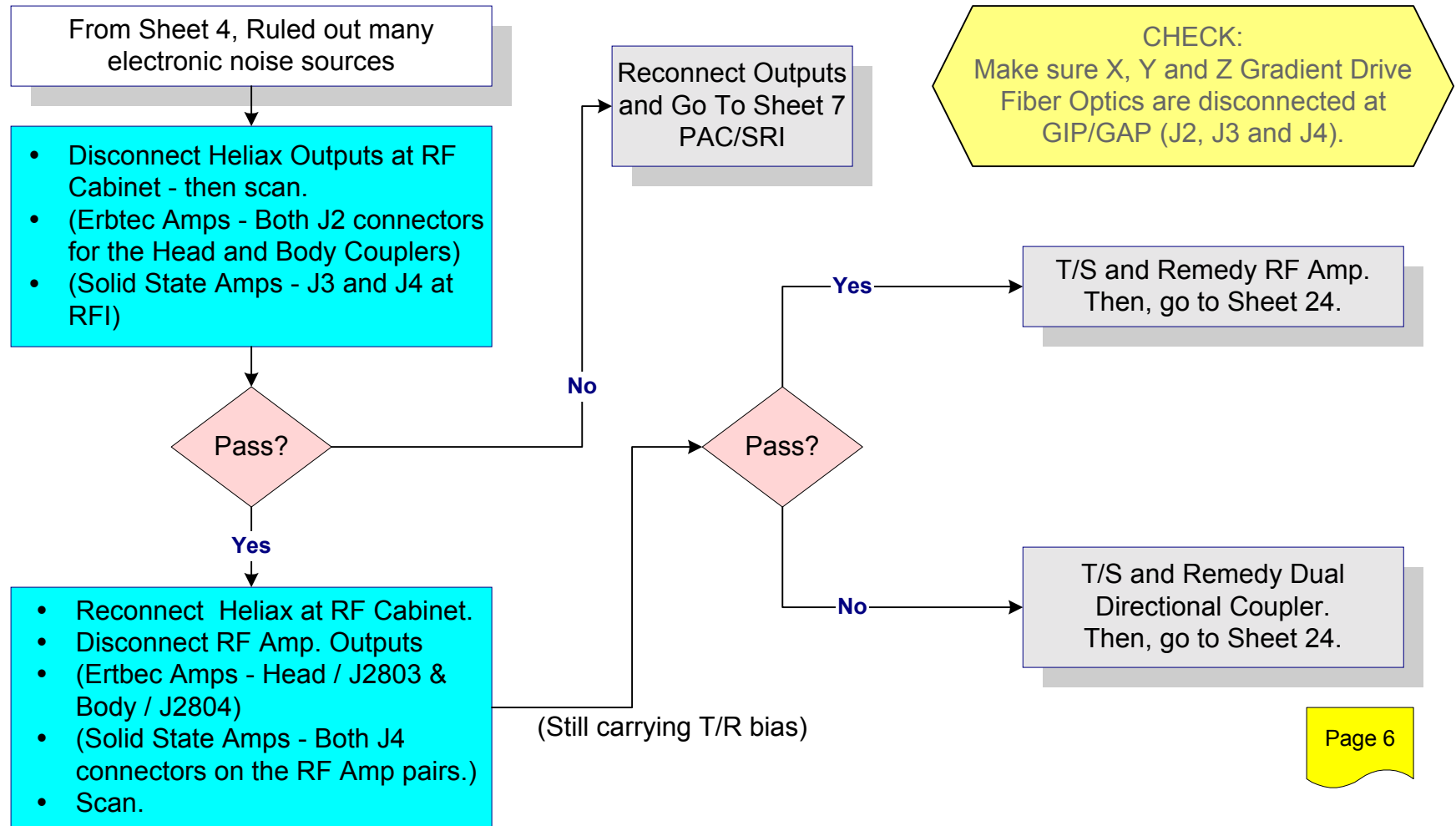
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics OFF - Rule Electronic Noise Sources



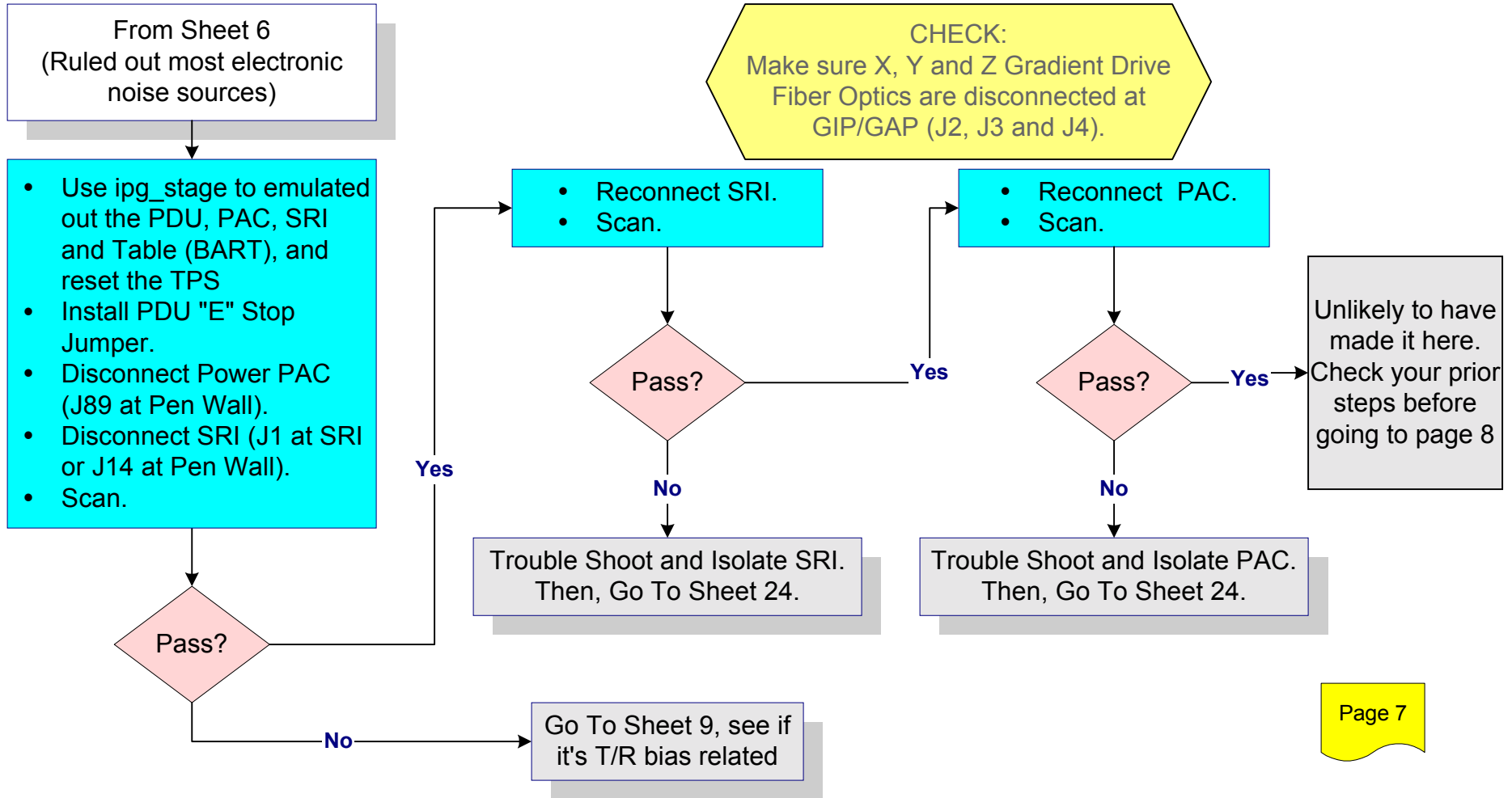
## EPI White Pixel Troubleshooting

### Failing with Fiber Optics OFF- Rule Electronic Noise Sources - Head and Body Heliax Disconnected



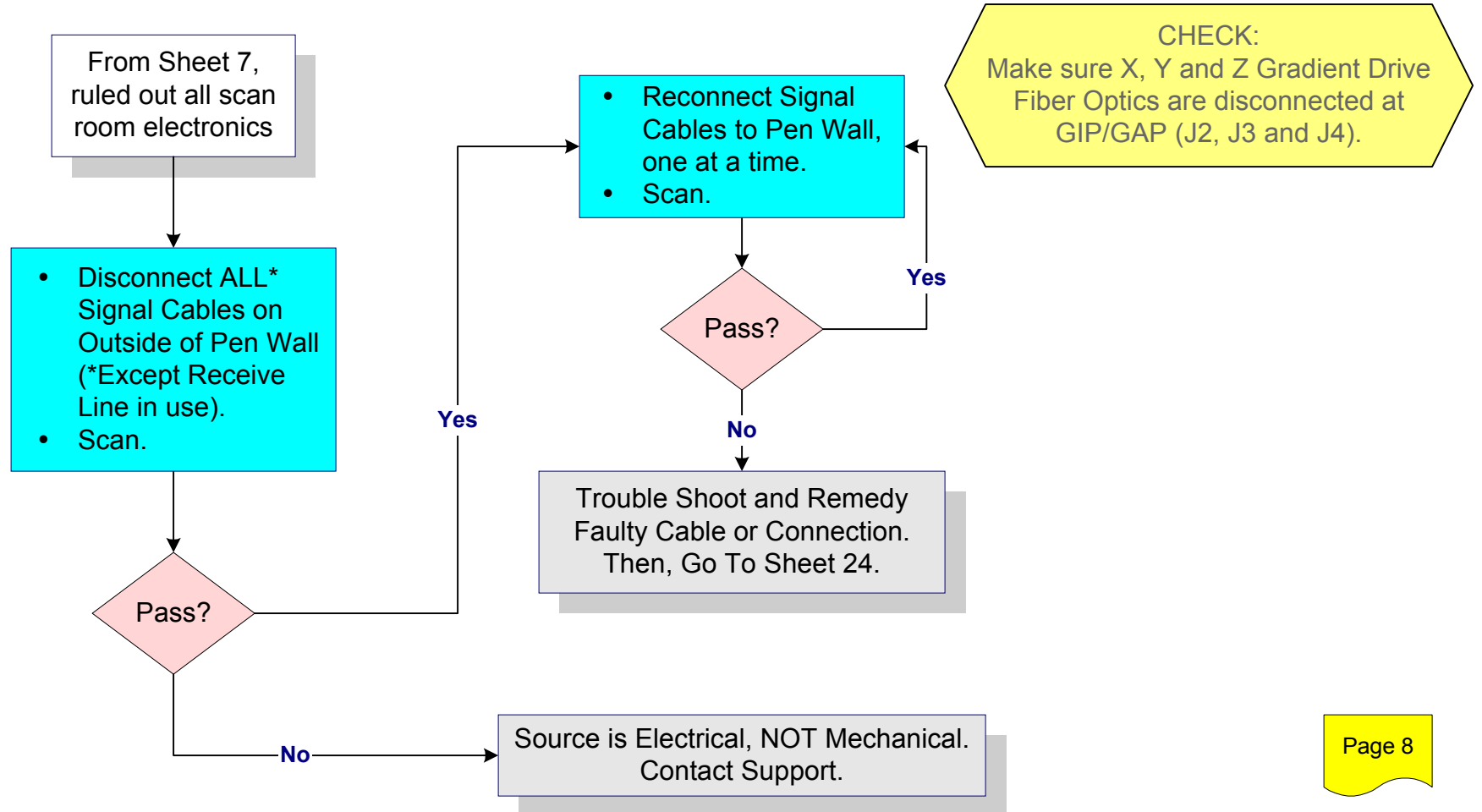
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics OFF (continued) - Rule Electronic Noise Sources - Disconnect PAC and SRI



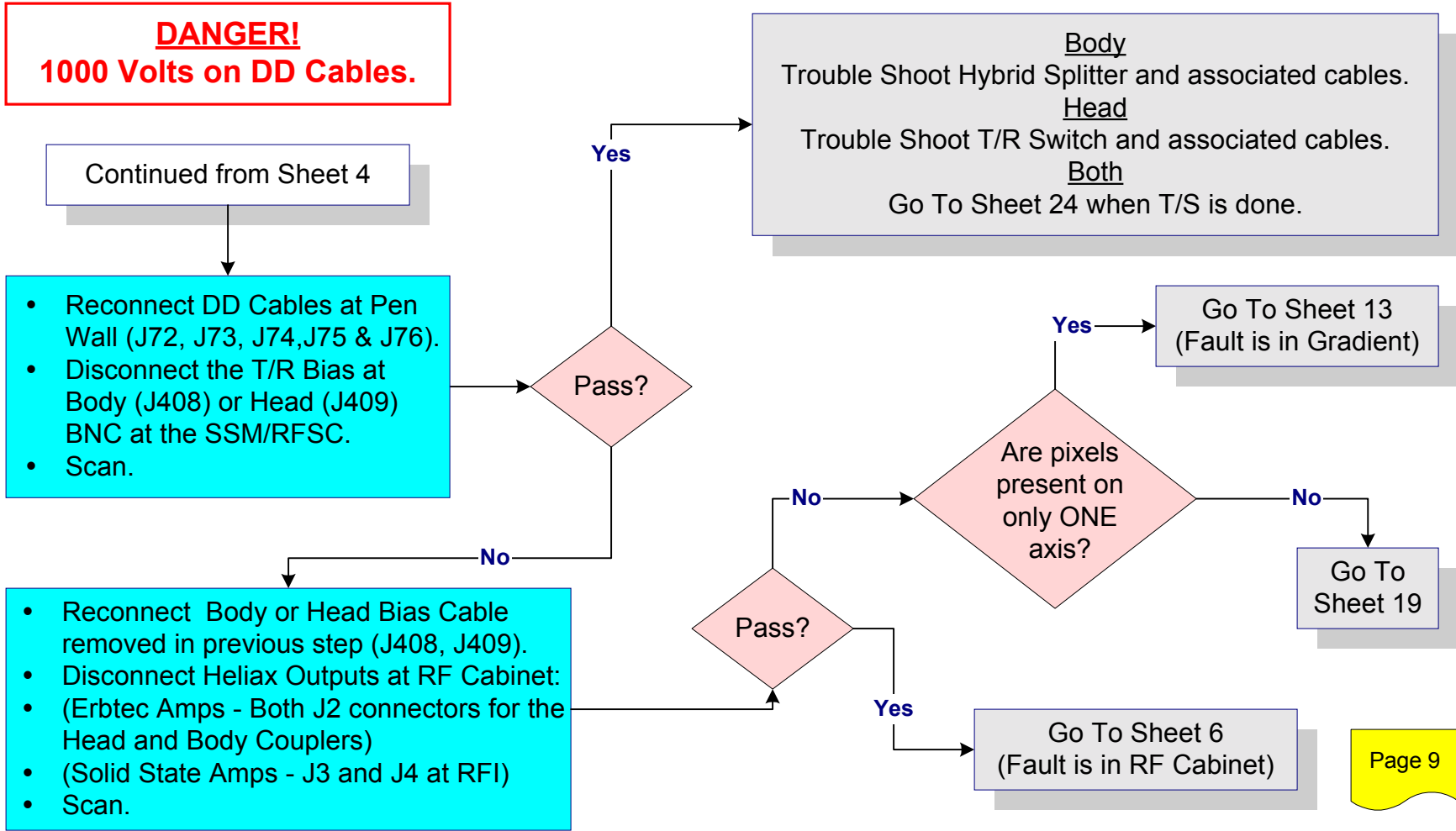
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics OFF (continued) - Rule Electronic Noise Sources



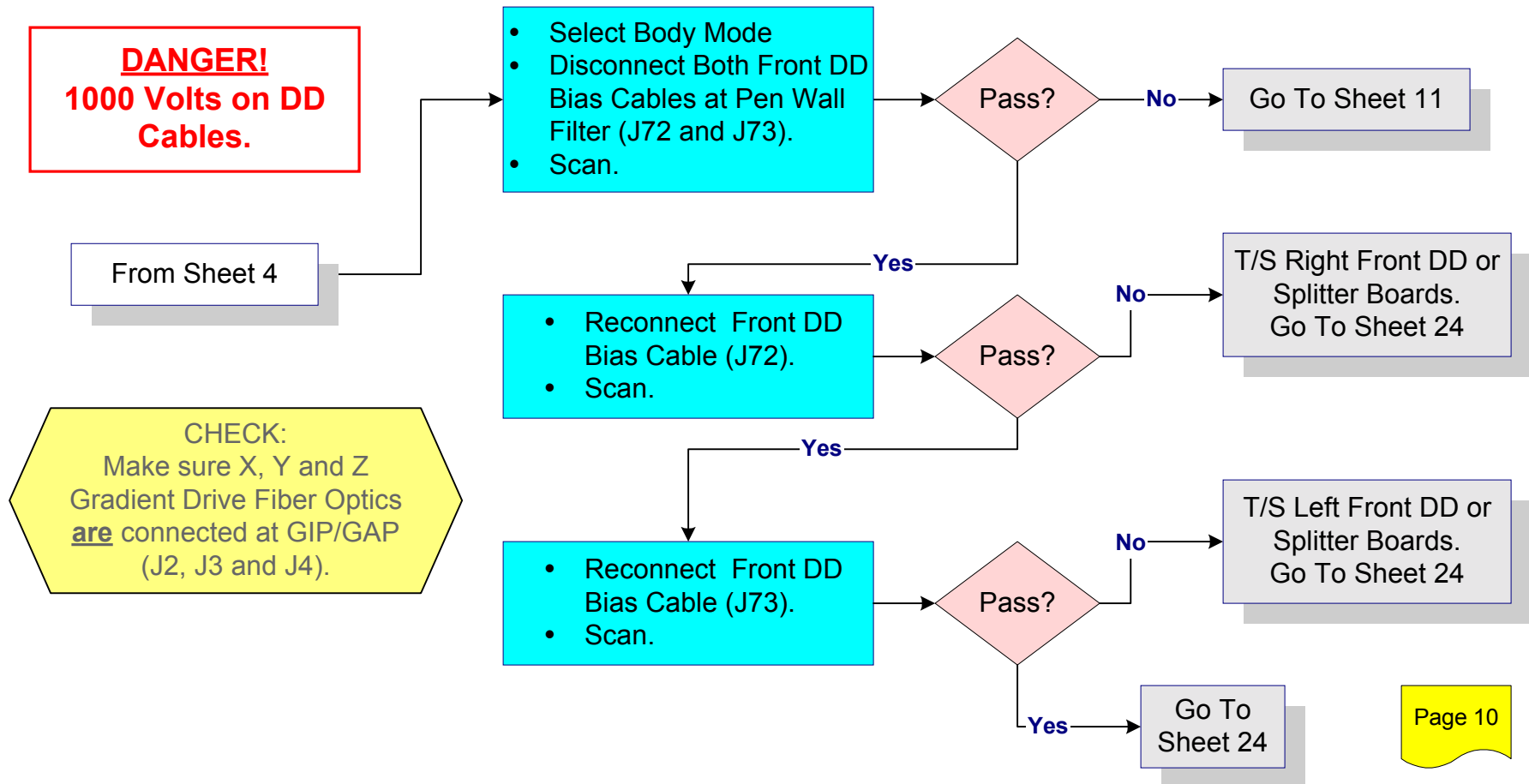
# EPI White Pixel Troubleshooting

## Failing on Both Head & Body Scans (Continued) - Rule out bias related problems



# EPI White Pixel Troubleshooting

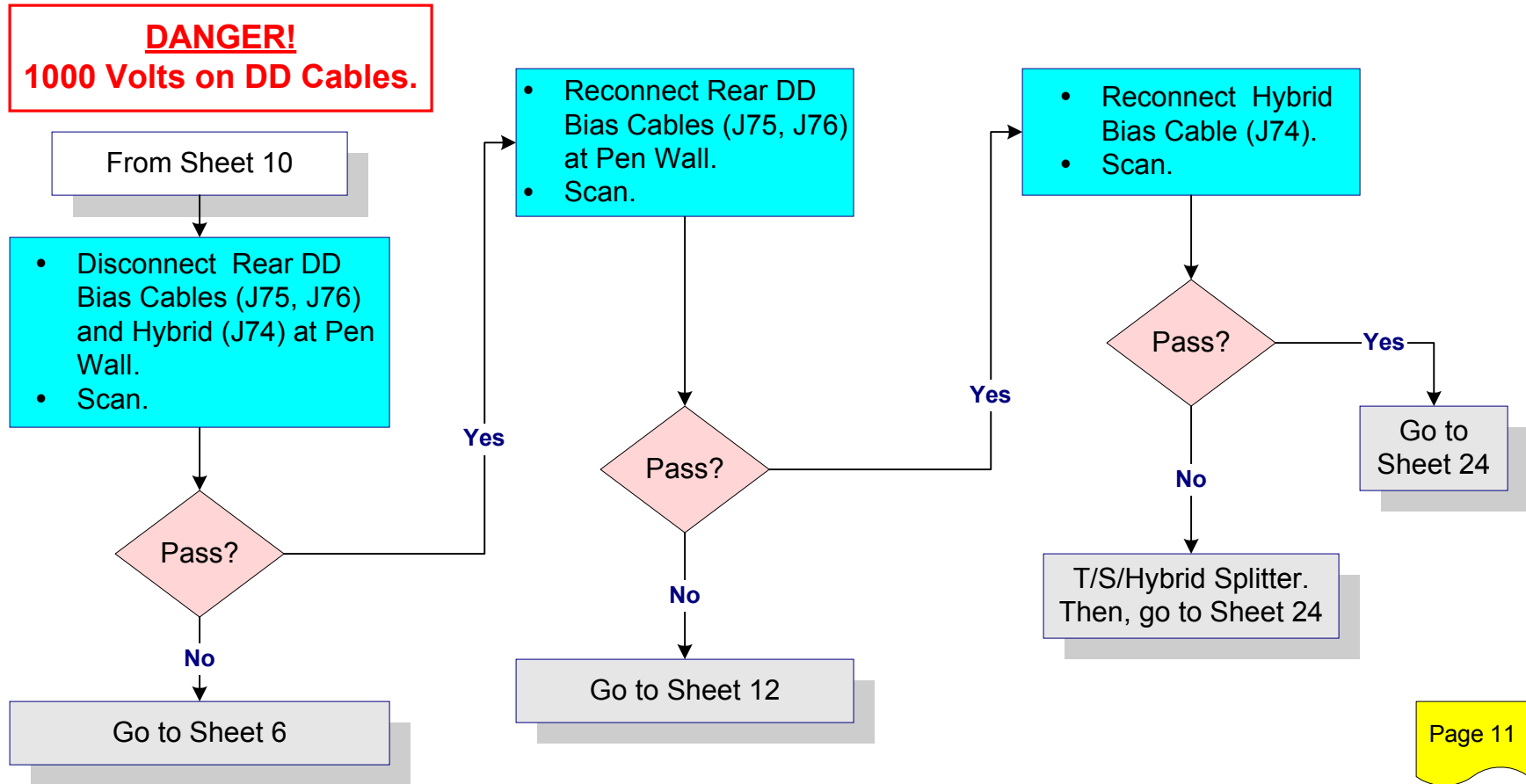
## Failing on Both Head & Body (continued)



# EPI White Pixel Troubleshooting

**Failing with Front DD Bias Lines Disconnected at Pen Wall  
(Fiber Optics ON, BART Emulated Out)**

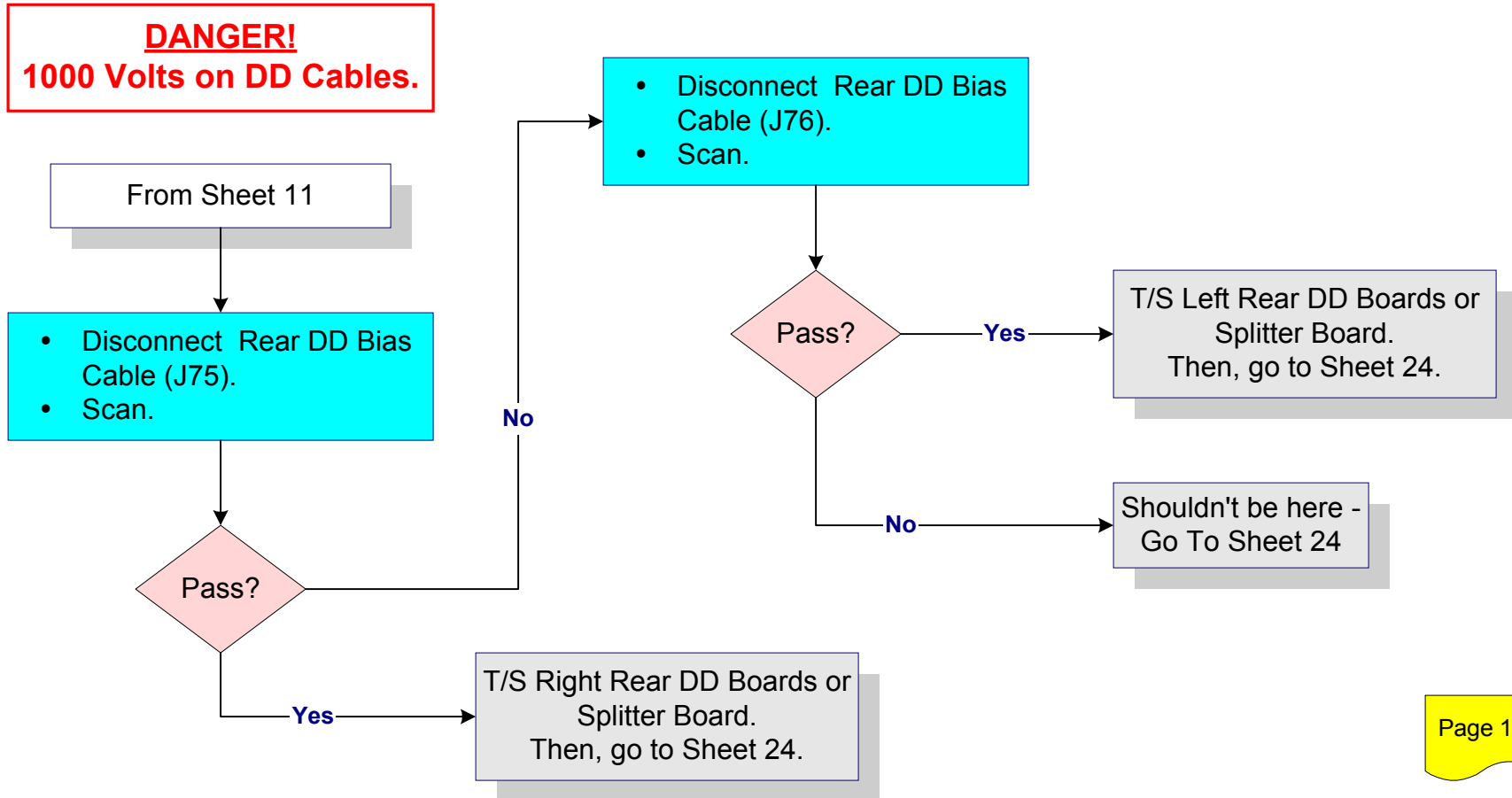
**DANGER!**  
**1000 Volts on DD Cables.**



# EPI White Pixel Troubleshooting

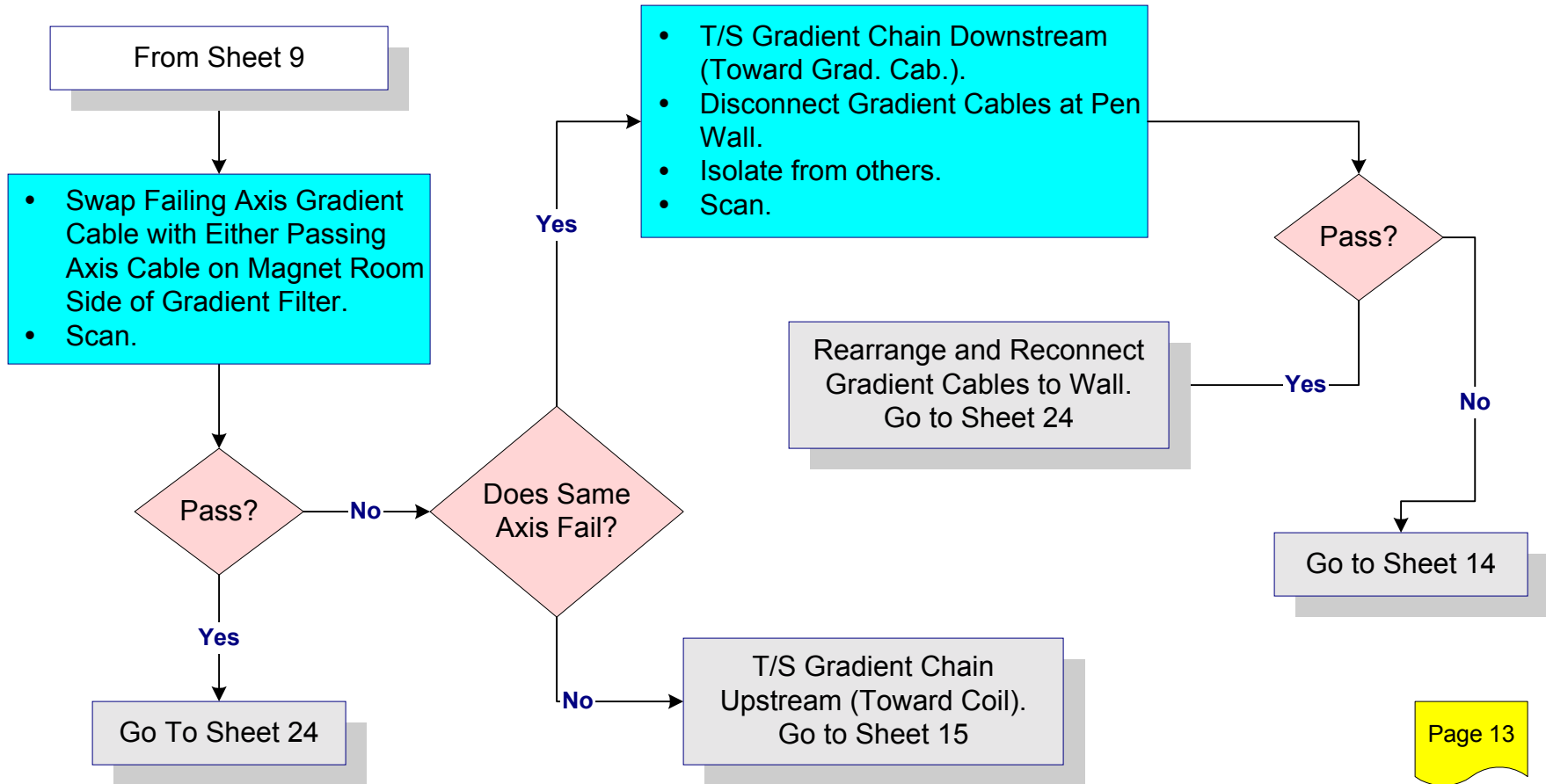
**Failing with Front DD Bias Lines Disconnected at Pen Wall  
(Fiber Optics ON, BART Emulated Out)**

**DANGER!  
1000 Volts on DD Cables.**



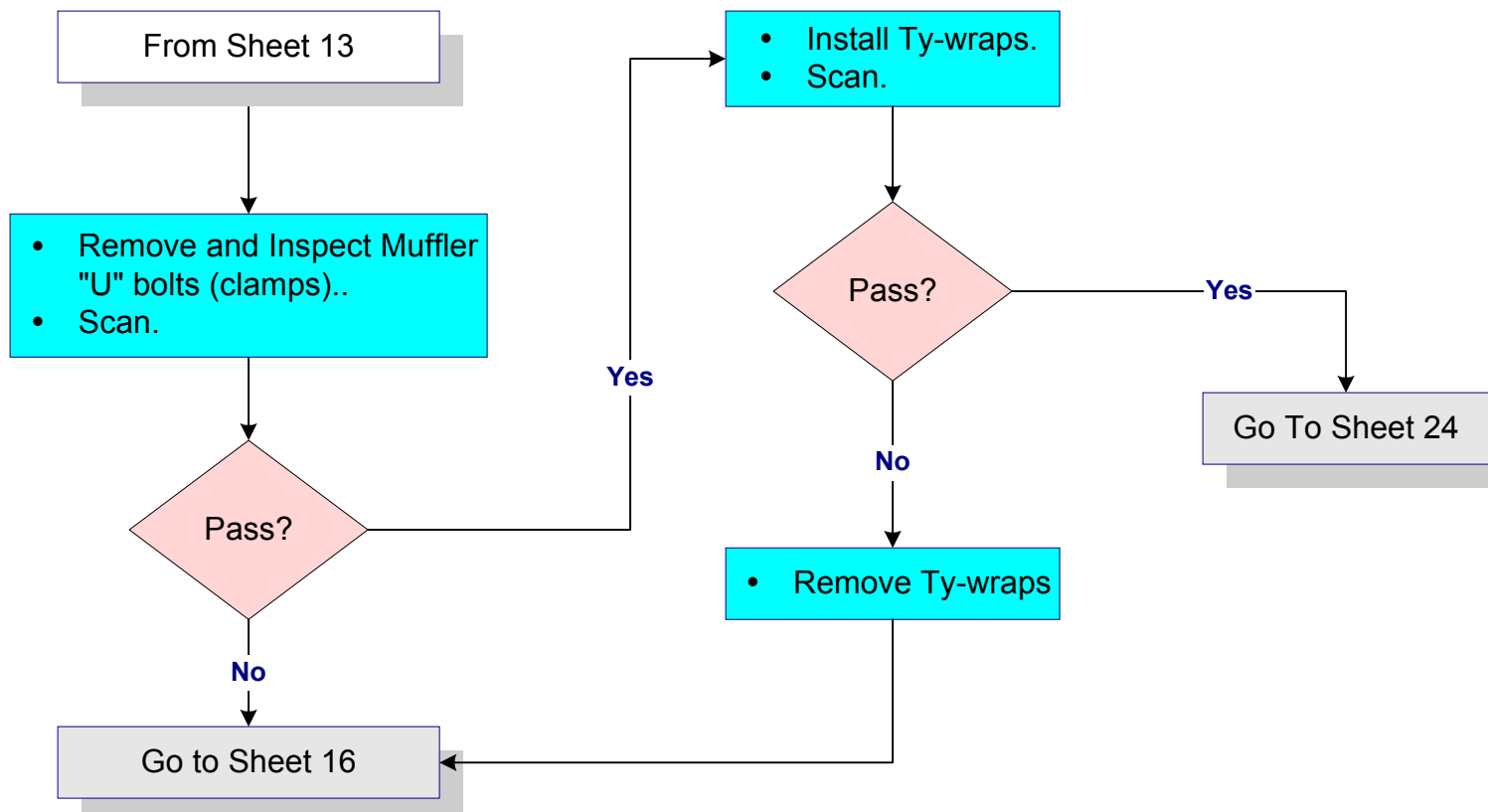
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics ON (Failing ONE Axis Only)



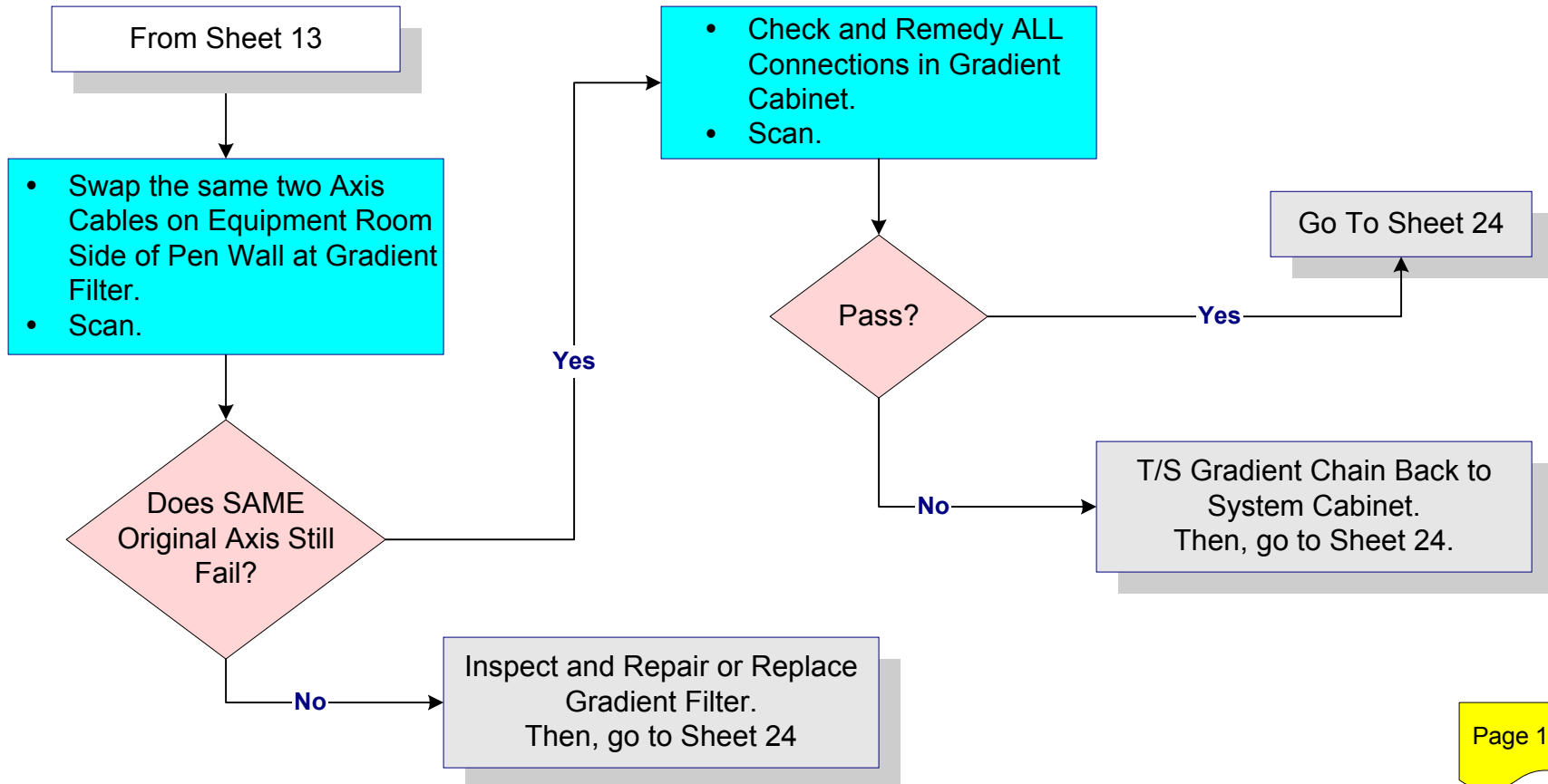
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics ON (Failing ONE Axis Only - Continued)



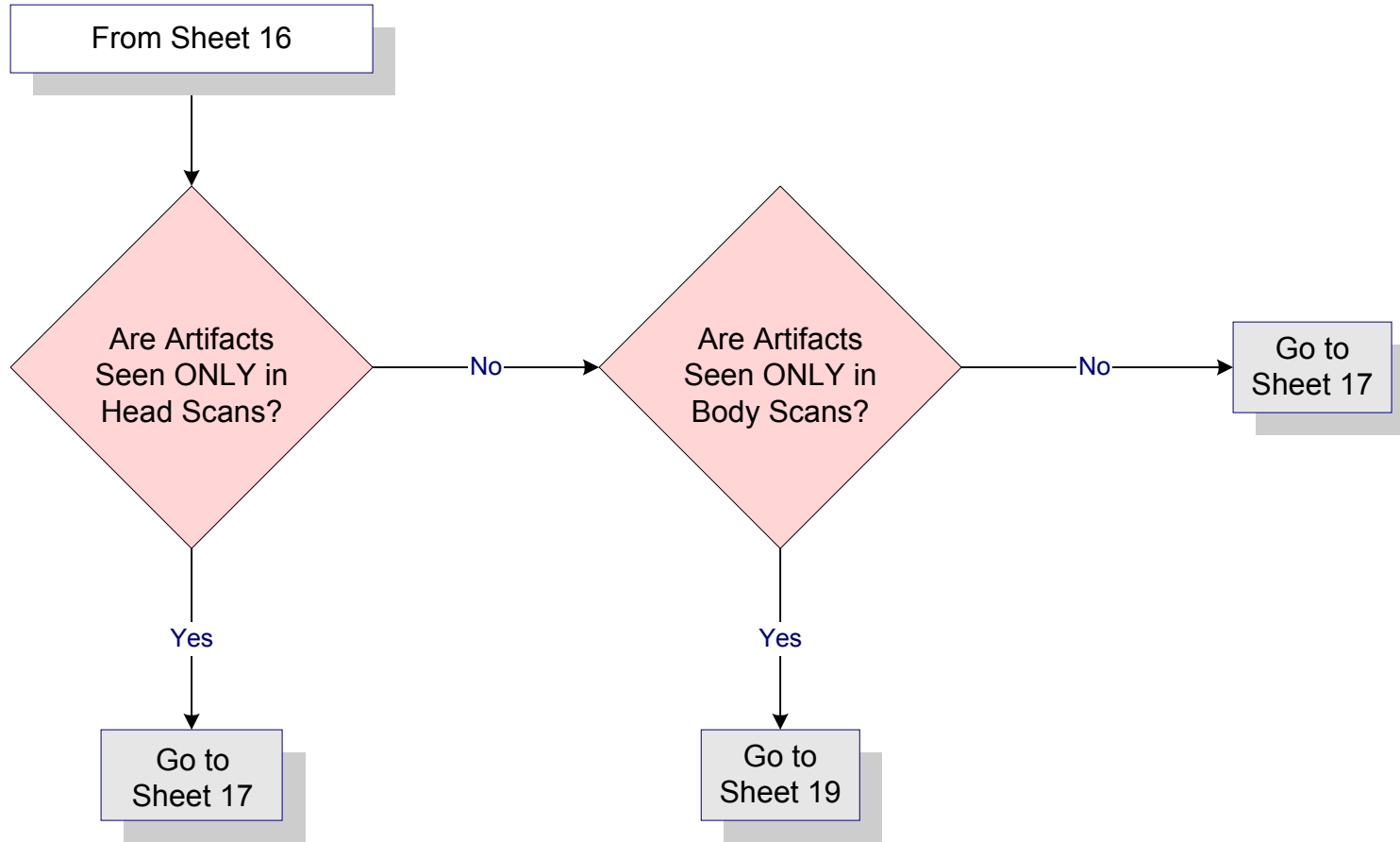
# EPI White Pixel Troubleshooting

## Failing with Fiber Optics ON (Continued) (Failing ONE Axis Only - Same Axis DID NOT Fail When Swapped)



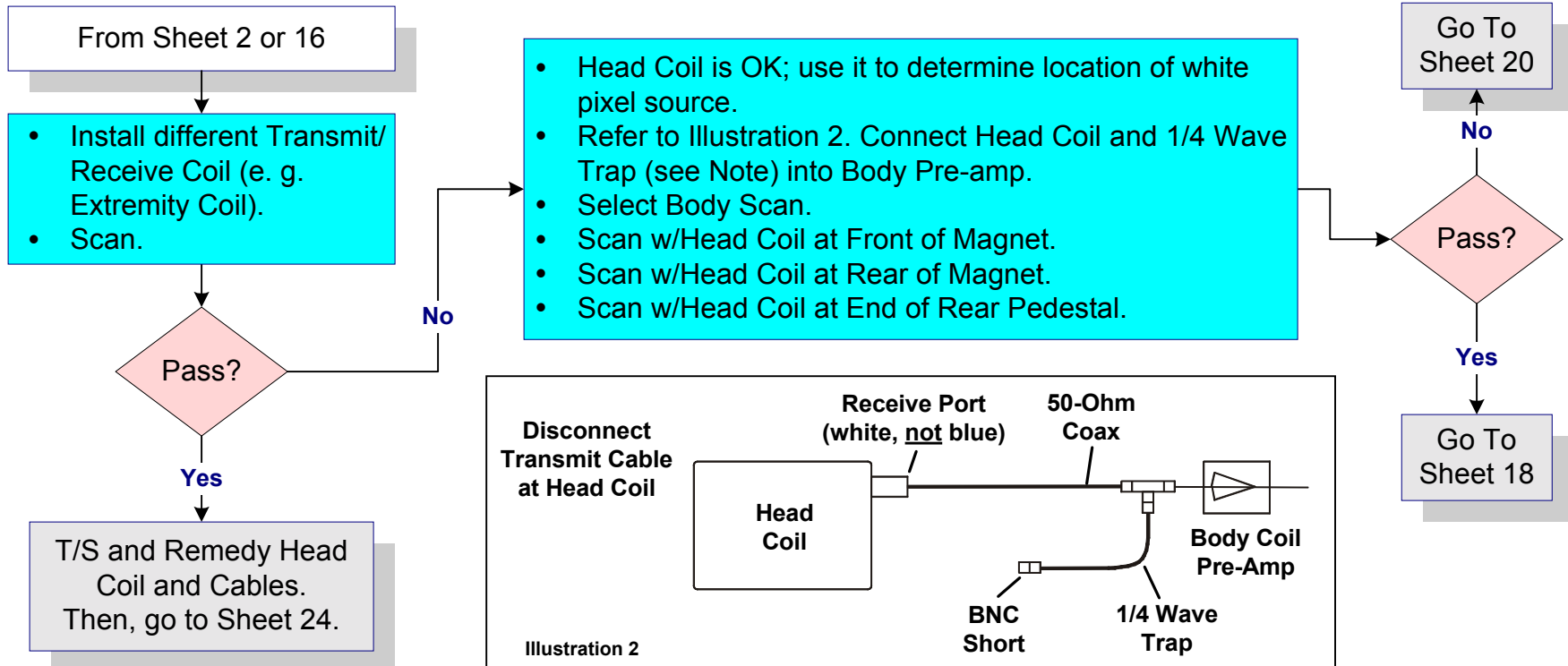
# EPI White Pixel Troubleshooting

## After Running Head and Body Scans



# EPI White Pixel Troubleshooting

## Failing on Head Scans Only



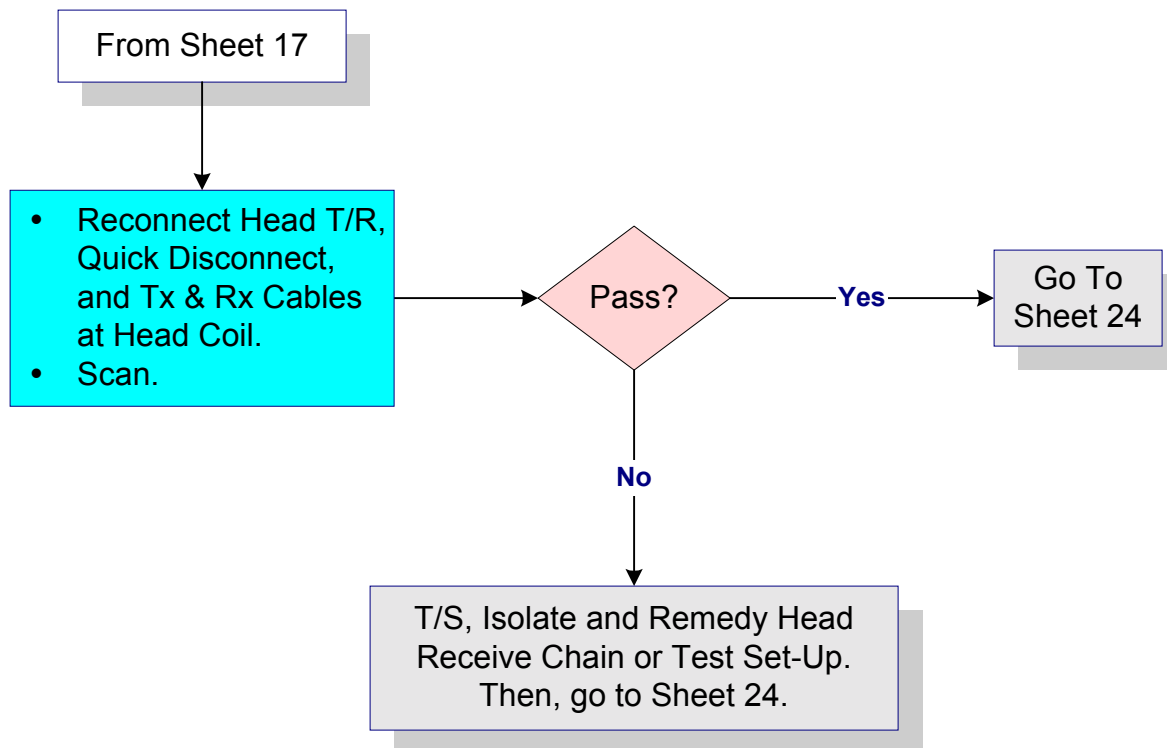
Note: 1/4 Wave Trap is 1/4 Wave Cable with Shorting Connector at end. This is used to prevent saturation of the Pre-Amp.

1.5T 1/4 Wave = 0.78m (White Cable between Quick Disconnect and Head Coil may be used).

1.0T 1/4 Wave = 1.15m.

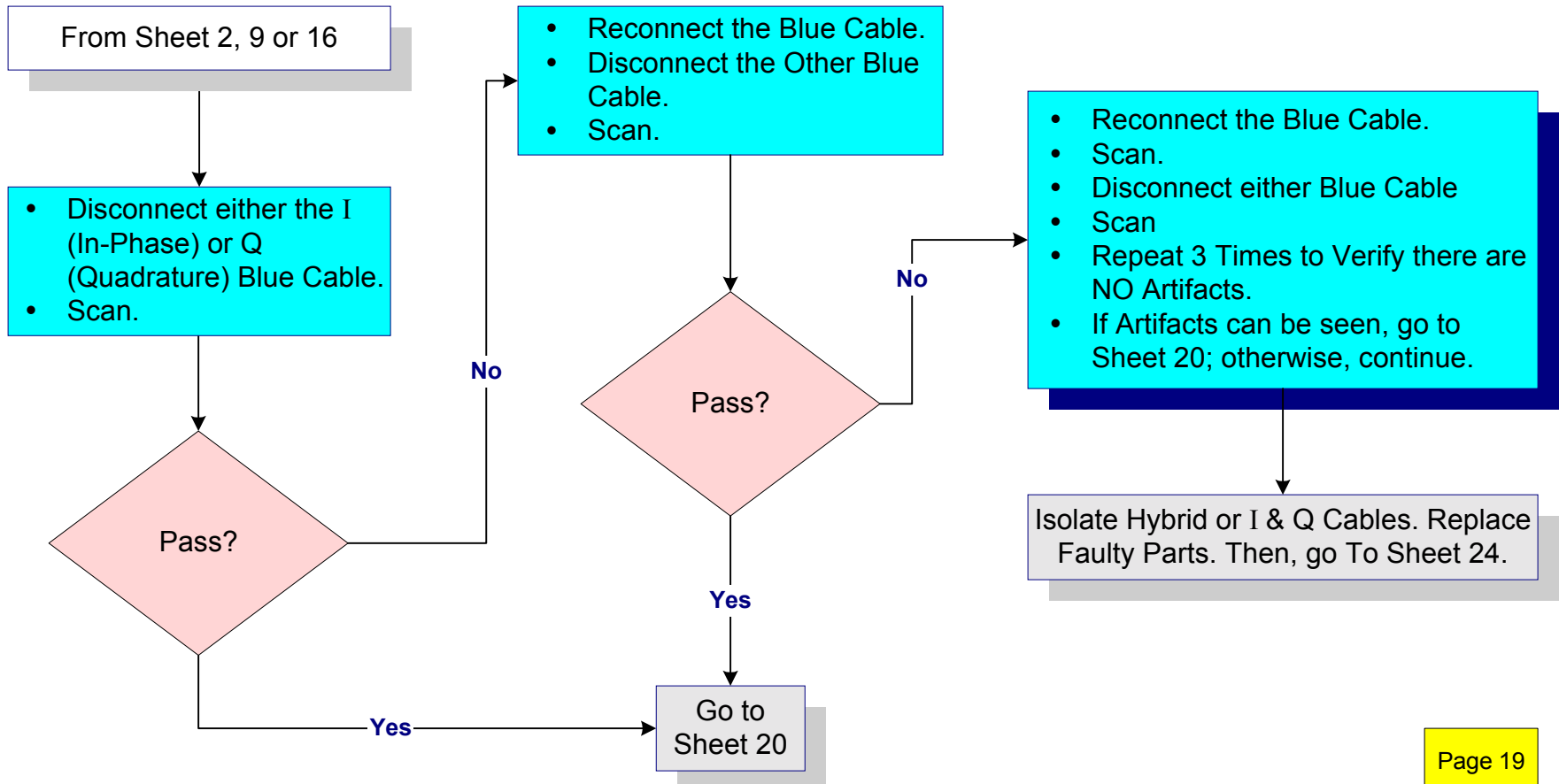
# EPI White Pixel Troubleshooting

## Failing on Head Scans Only (Continued)



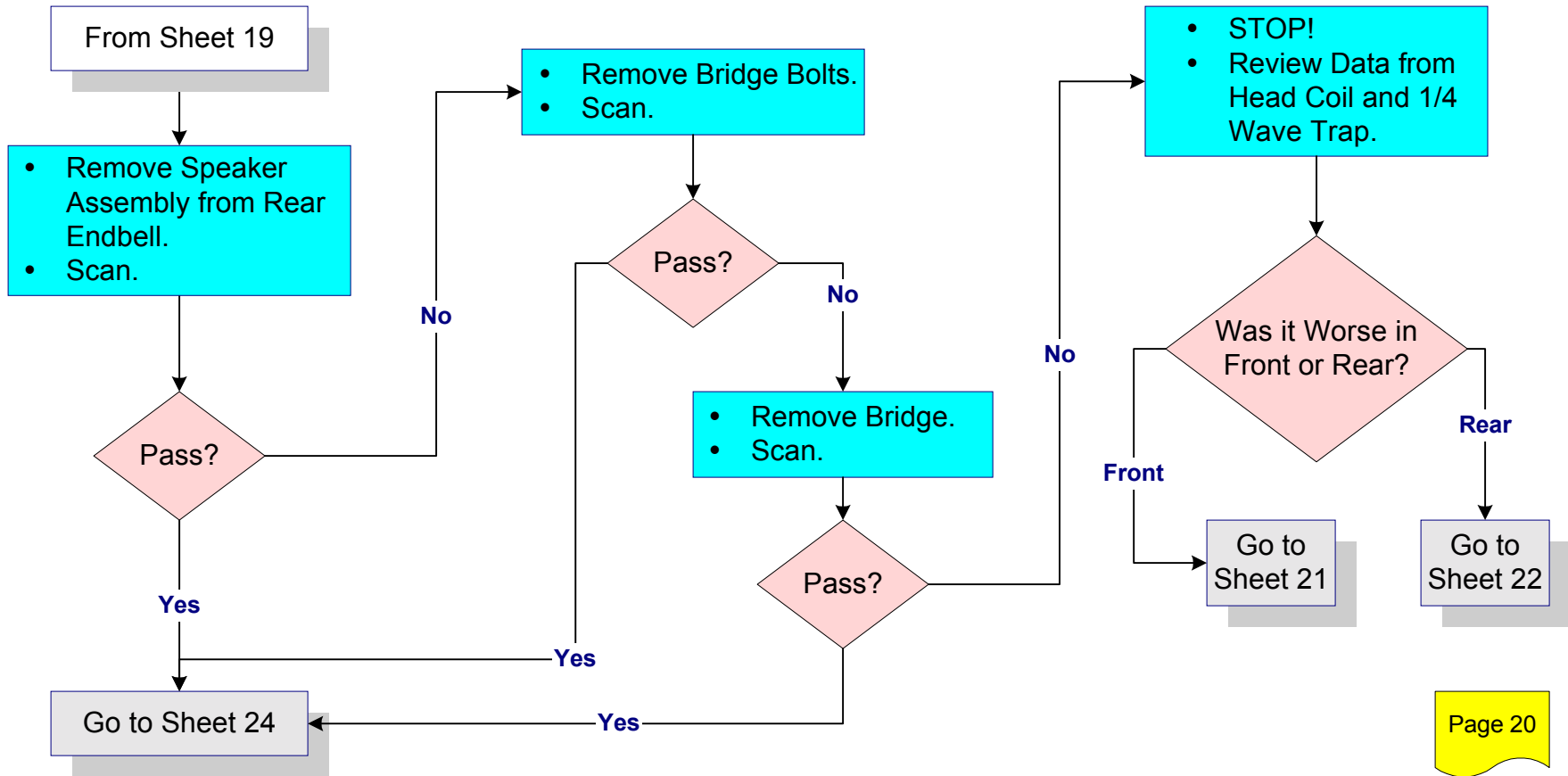
# EPI White Pixel Troubleshooting

## Failing on Body Scans Only



# EPI White Pixel Troubleshooting

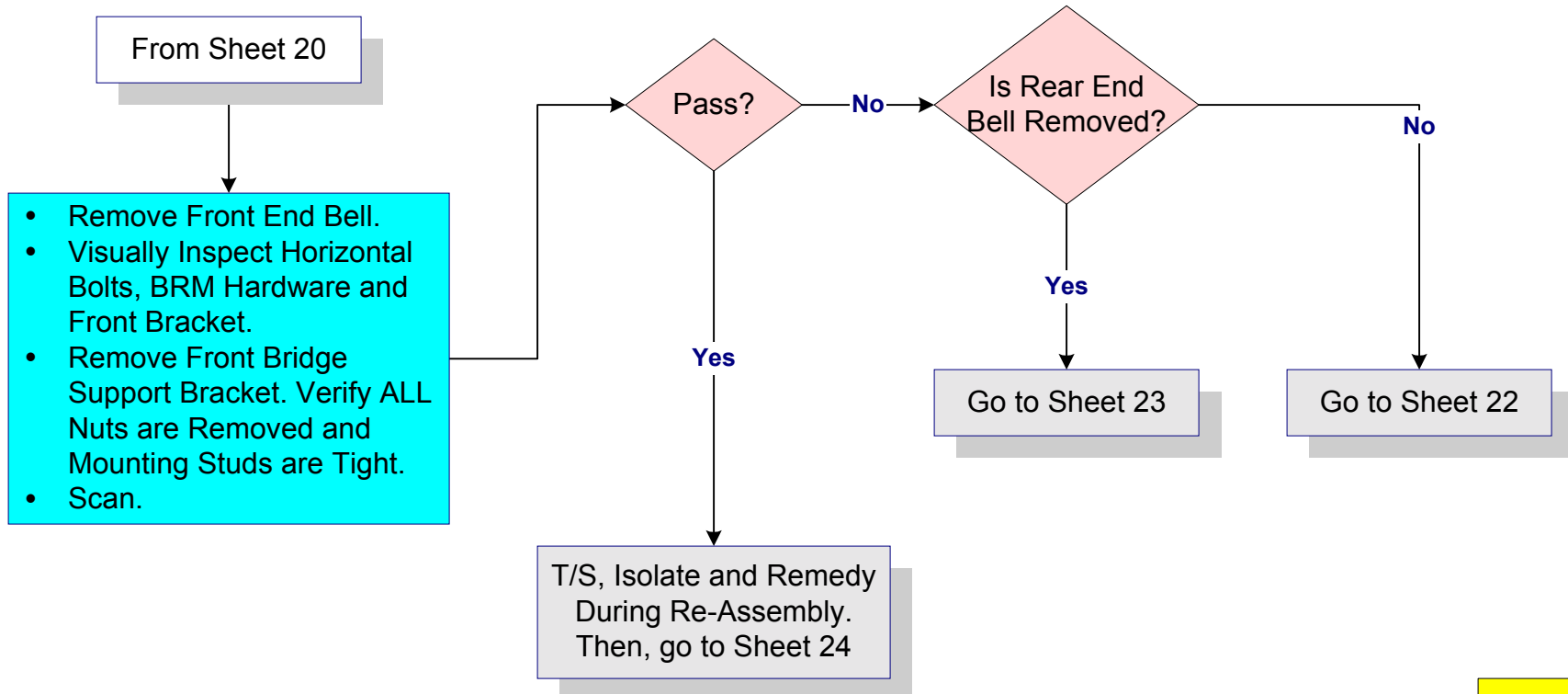
## Tear-Down Flow Chart Setup: Head Coil with 1/4 Wave Trap\* into Body Pre-Amp, Body Scan



\* See Illustration 2 on Sheet 18 for Reference

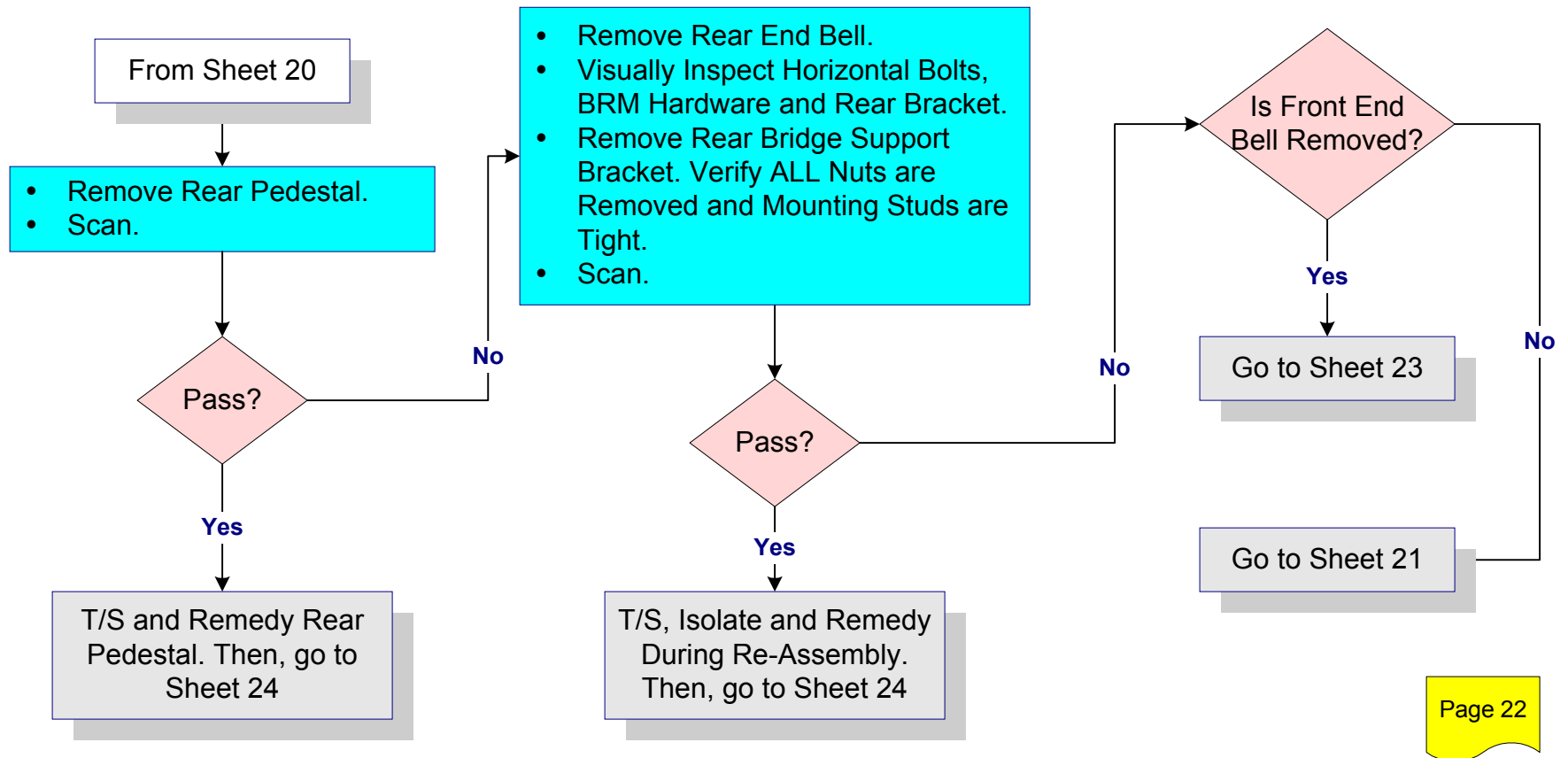
# EPI White Pixel Troubleshooting

## Tear-Down Flow Chart (Continued) Front is Worse



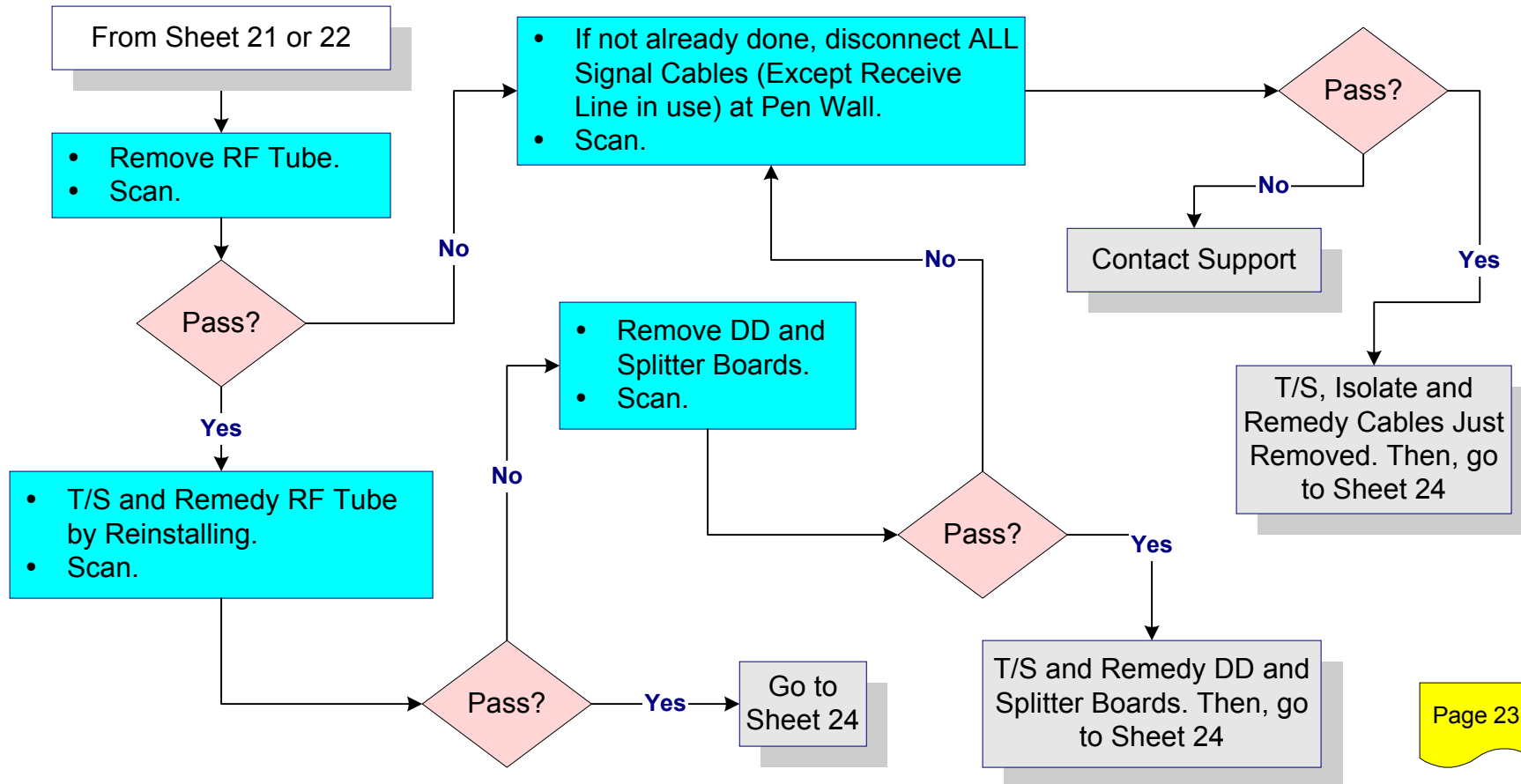
# EPI White Pixel Troubleshooting

## Tear-Down Flow Chart (Continued) Rear is Worse



# EPI White Pixel Troubleshooting

## Tear-Down Flow Chart (Continued) BOTH End Bells are Removed



## EPI White Pixel Troubleshooting

### Post Test (Any Time After EPI Passes)

- See NOTE below.
- Scan 3 times.
- Scan 3 more times.
- Scan 2 times AFTER each step in reassembly.

**DONE!!!!**

NOTE: If EPI fails at any time, return to previous step in flow chart.

Page 24

Acknowledgments: I'd like to thank the European Support community for helping me sketch this thing out in Paris. I'd also like to thank our own System Bay-Techs for their inputs, especially Brian Larson and Don Kosak plus Mark Conway from the Windy City. Last and most loudly, I'd like to thank Wendle Norton for getting the ball rolling and letting me pick his brain along the way.  
- John Johnson, MR Service Engineering