

SECTION 11– PLANNED MAINTENANCE ASSIST

Note: Section 11 is specifically for systems at or above release 11.X
For pre-11.X systems, refer to section 12 of the PM manual

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General Requirements

Personnel Requirements:	1 Field Engineer for 2 hours
Tools and Test Equipment:	LVShim Phantom Assembly Nesting Plate Assembly DQA Phantom Head Coil Body Sphere and Loader Service Key
Replacement Parts:	None
Consumables:	None
Safety:	Standard Magnet Safety Procedures for personnel working in and around magnets.
Required Conditions:	System release 11X or higher Completion of a successful LVShim is a prerequisite to performing the SPT procedure. (See the first section of this procedure) For more information about LVShim see direction 2333500 (Signa Excite Service Methods) / Adjust and Cal/System level Procedures/LVshim.

Objective

The goal of PM Assist is to ensure that the Planned Maintenance (PM) is done in a timely manner, is completed, and problems found are resolved quickly. Install In Spec was developed to ensure that the scanner performance after installation and initial calibration meets GEMS quality standards before turning the MR scanner over to the customer. PM Assist was developed to ensure the quality of ongoing scanner maintenance during the lifetime of the scanner.

Flow of PM Assist

A typical PM session using the PM Assist feature will include the field engineer (FE) running SPT in PM mode and LVShim in Gradient Shim Mode, resolving any issues found, and then completing other tasks scheduled for the PM. Before leaving, the FE will run the PM Verification tool to ensure that the required tasks (SPT and LVshim) are recognized by

the system as having been performed. The FE will also be warned of any issues outstanding and reminded that they need to be resolved promptly.

Theory of Operation

PM Assist is designed to perform three checks:

- **Check if a PM is due or overdue** A PM should be done every other calendar month.
- **Check a PM for completeness.** This is defined as LVshim and SPT (in PM mode) completed within 24 hours of each other (it is recommended to run LVshim first). It does not matter whether the tests pass or fail. As long as both tools have been run, the PM is considered complete.
- **Check for severe errors remaining from the PM.** A severe error is an error that is expected to impact clinical image quality. LVshim and SPT PM mode results are checked for this type of errors. You have 21 days from the date the PM was completed to fix the severe errors.

After loading the Excite-II software, you must run the **PM Check** tool and schedule your first PM in order to start PM Assist.

More details:

PM Due / Overdue

- If you did a PM sometime in January, you are expected to do the next PM sometime in March. The PM is considered due starting March 1 and overdue starting April 1.
- While the PM is due, a pop-up appears at each reboot of the scanner. You can avoid this pop-up by scheduling the PM for a specific date (within the due month). If the PM is not completed at that time, the pop-up will start showing up.
- Another pop-up appears at reboot when the PM is overdue. You must complete the PM in the month due to avoid this pop-up.

PM Completeness

- The latest SPT PM Mode results file marks the time of the PM. LVshim must be run within +- 24 hours of that time for the PM to be considered complete. If you do not have an SPT PM mode results file and an LVshim file within 24 hours of each other, the PM is incomplete and you must run both tools again, within 24 hours of each other.
- Each run of SPT PM Mode is considered the marker for a PM and will restart all the checks above. Only run SPT PM Mode at PM time, not between PMs.

Severe Errors Remaining From PM

- Any severe errors in the latest SPT PM Mode results file and the results from the last LVshim run within 24 hours of the SPT PM Mode run will be identified. PM Assist will then search through all subsequent SPT and LVshim files to see if the test(s) that failed passed at a later time. Once PM Assist finds a pass status for a test, it will mark it as successful. It does not matter if the test(s) fail later. Once a test has passed at or after a PM, it is considered successful, even if it fails later.
- You should not run SPT PM Mode again after fixing severe errors. Use SPT Full Mode with one or more of the failing test(s) selected.
- It is not necessary to have all the failing tests pass in the same SPT results file. PM Assist will search through all SPT files acquired after the PM for passing results. This is different from current Install In Spec behavior.
- If you have not fixed all severe errors within 21 days after the PM was completed, a pop-up will appear at each reboot of the scanner.

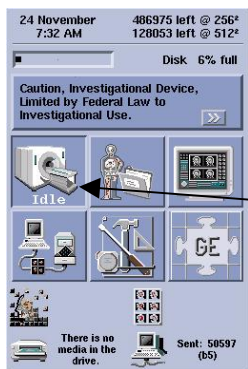
Other Useful Information

- Run **PM Check** to mark the PM as completed.

- Run **PM History** to see the current status of PMs.
- View pm_assist.log Using "gedit" editor

PM Assist Procedure

1. With the LVShim Phantom Properly placed and land marked, the system must be configured to make the appropriate LVShim scans. Click on the Scan Icon to launch the patient information window. **Figure A**



Click the SCAN icon to Enter Patient Information

Figure A

2. The patient Information window will launch with the Patient Protocol's **Figure B.**

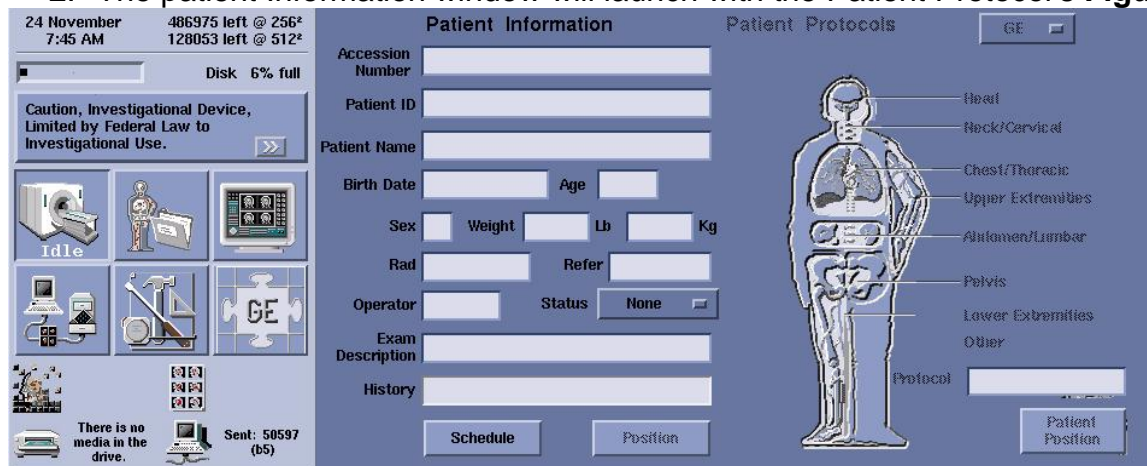


Figure B

3. To run the LVShim procedure it is necessary to insert "geservice" in the Patient ID field and "150" in the Lb weight field. Pick a Patient Name for the Shim Test that will be easy to find in the browser. ("Shim PM Test" for this example) **Figure C**

Patient Information

Accession Number

Patient ID

Patient Name

Birth Date Age

Sex Weight Lb Kg

Rad Refer

Operator Status

Exam Description

History

Insert "Shim PM Test" for Patient Name or some other name easily identified in the browser.

Figure C

4. From the pull down box in the upper right of the Patient Protocol window select Service. **Figure D**
5. Click "Other" in the patient Protocol Window. **Figure D** A protocol selection box will open. **Figure E**

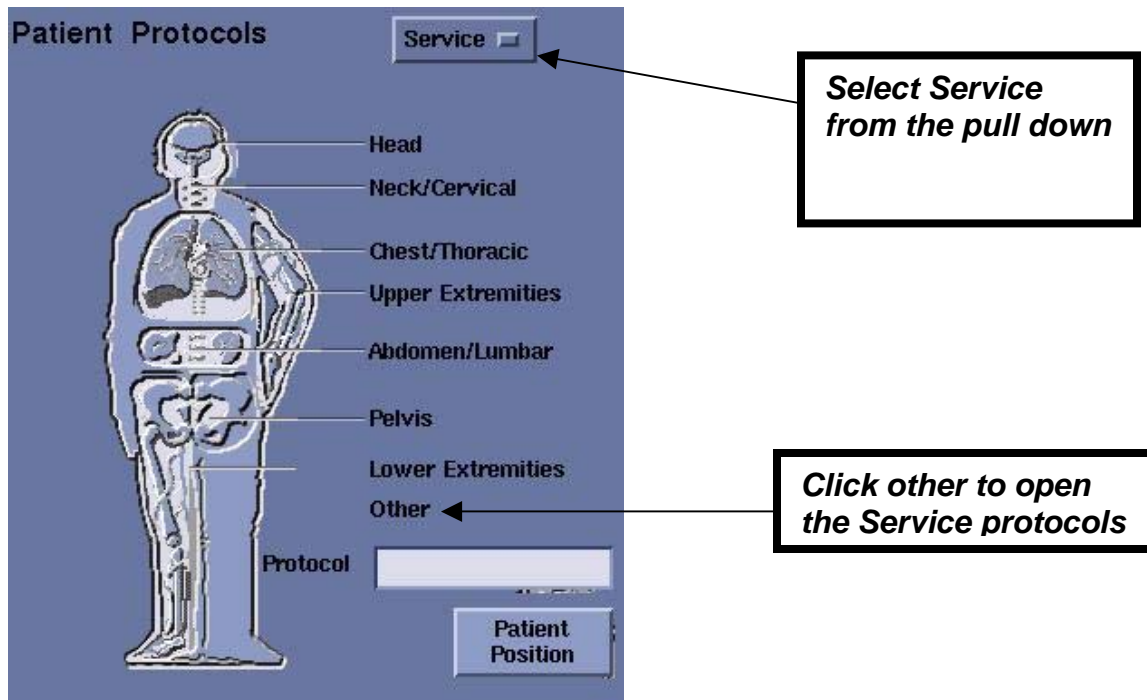


Figure D

6. From the protocol selection box Select “0.19 LVShim” in the Protocol Column and “LVShim Localizer, Cal:Syst” in the Series Column. **Figure E**
7. Click “Accept” when the selections are correct and complete. **Figure E**

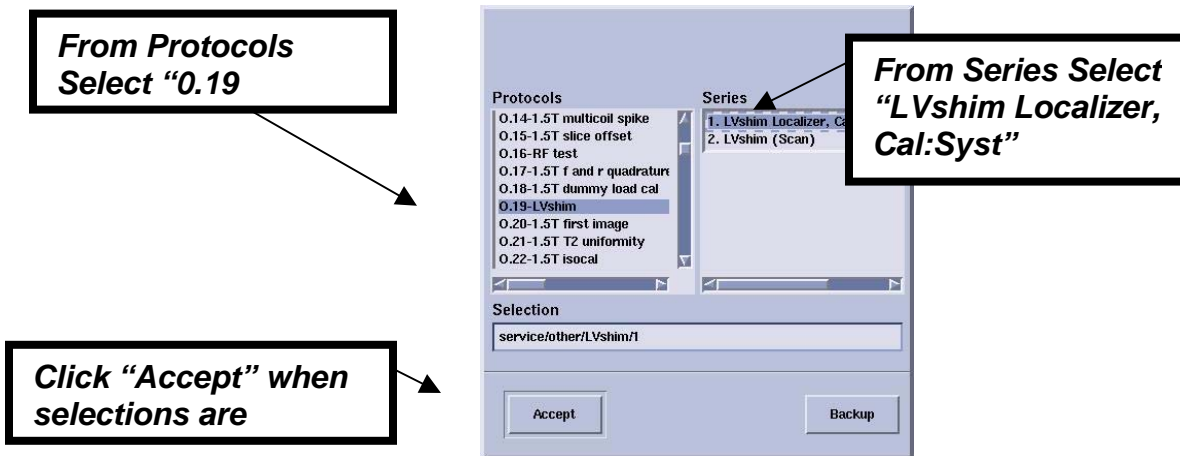


Figure E

8. A pop up message with the text “A change has been made to Patient Position, Patient Entry, and/or coil. Please verify this selection and continue” will appear in the Patient Information section of the console. Click “Apply All” to continue. **Figure F**

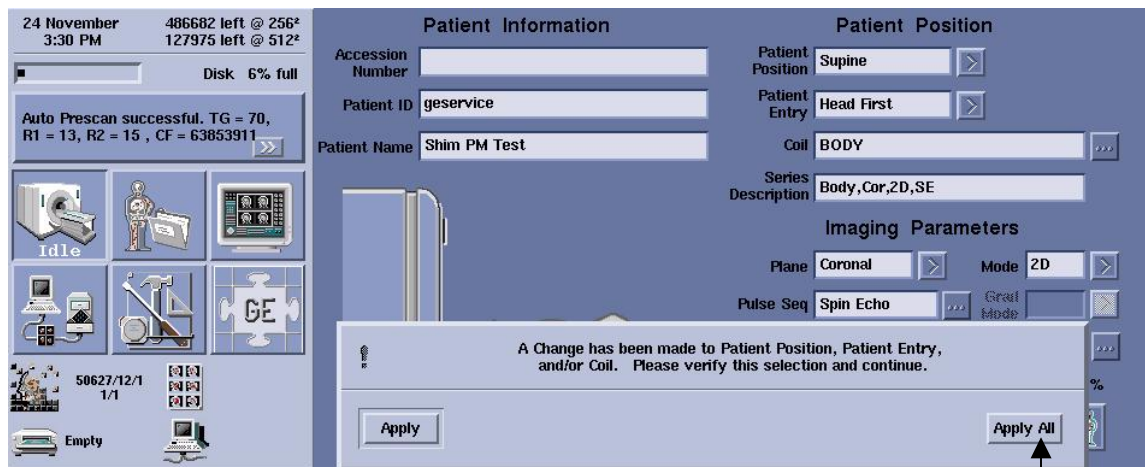


Figure F

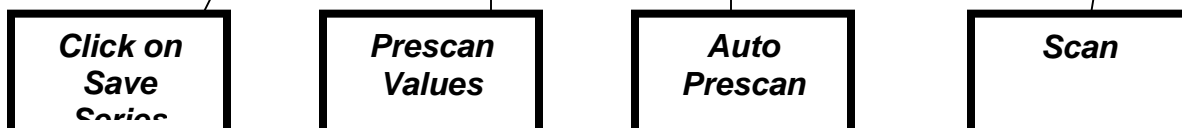
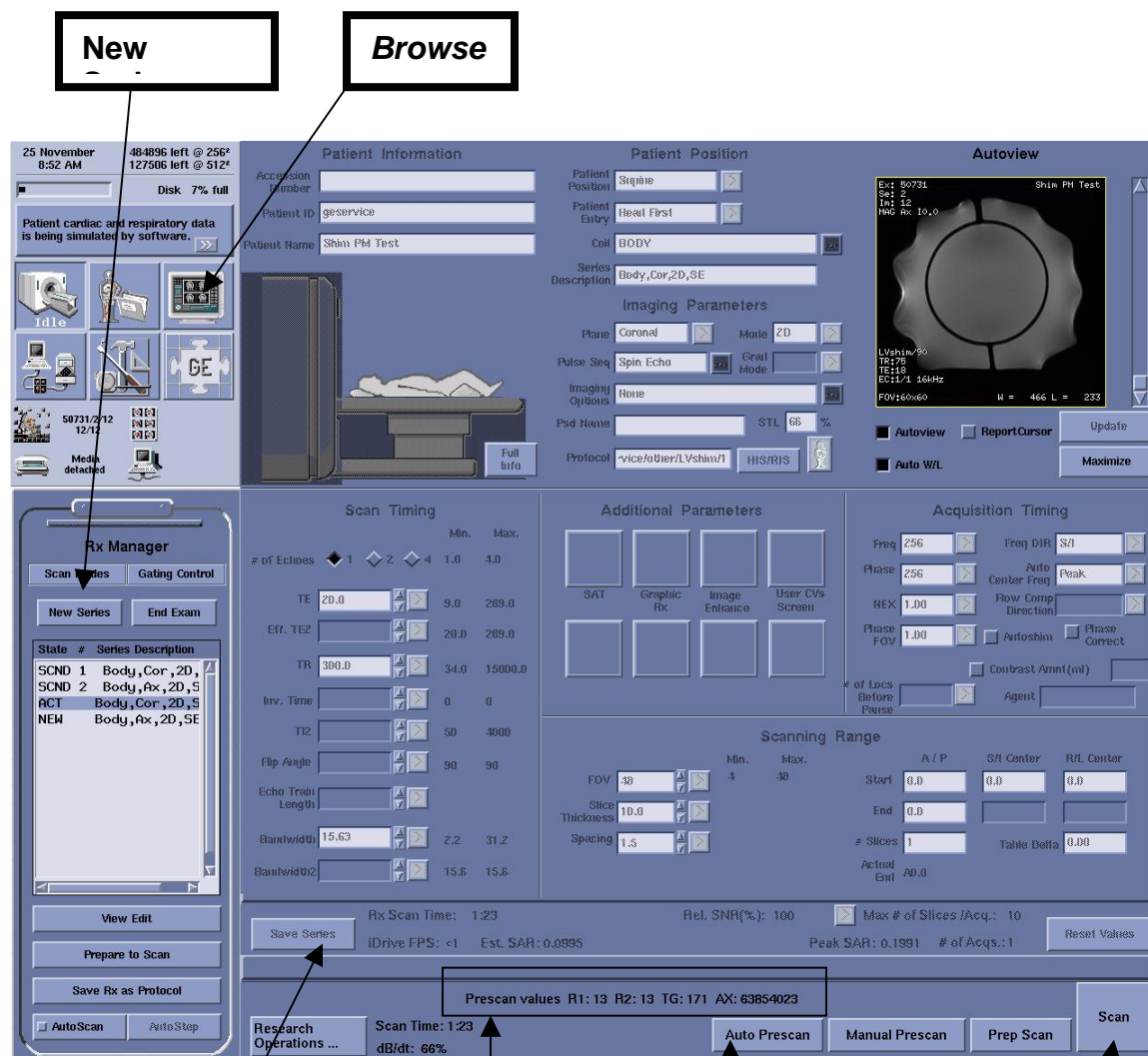
**Click on
 Apply All**

Note : For TwinSpeed a pop up will appear Whole or Zoom ?? Select “Whole”.

9. From the Scan Prescription Screen click “Save Series” **Figure G**
10. From the Scan Prescription Screen click “Auto Pre-scan” Verify the Prescan values are within an acceptable range. **R1 = 13 +/- 2 R2 = 13 +/-2 TG 151-171** **Figure G**

Note: If prescan is not within the acceptable range the issue must be resolved before continuation of this procedure.

11. Click “Scan” on the Scan Prescription Screen to initiate the LVShim Localizer Cal:Sys scan. **Figure G.**



12. To access the Browser Click the Browser Icon. Figure G The Browser window will launch. **Figure H**
13. Locate the image in the Browser created when the “LVshim Localizer, Cal: Syst” Scan was performed. Find The Patient name in the examination column (Left column). Look for the name entered In Step 5. This example used Shim Pm Test. Click on Shim Pm Test. The scans will now be displayed in the Right column. **Figure H**

14. Click on the appropriate series in the right column. If a new name was used in step 5, there will be only 1 series displayed in the Right column at this time. (1 image with the description “Body,Cor,2”) **Figure H**

15. Double clicking on the image line in the lower window **Figure H** will automatically open the image. **Figure I**



Figure H

Scans

16. It is important to center the LVShim phantom in the Magnet bore. As can be seen in this example the Phantom should be moved slightly toward the front of the Magnet (Towards Table). **Figure I** The goal is to overlap the center of the phantom and the display grid.

17. Reposition the phantom and run the “LVShim Localizer, Cal: Syst” until the Phantom is properly centered.

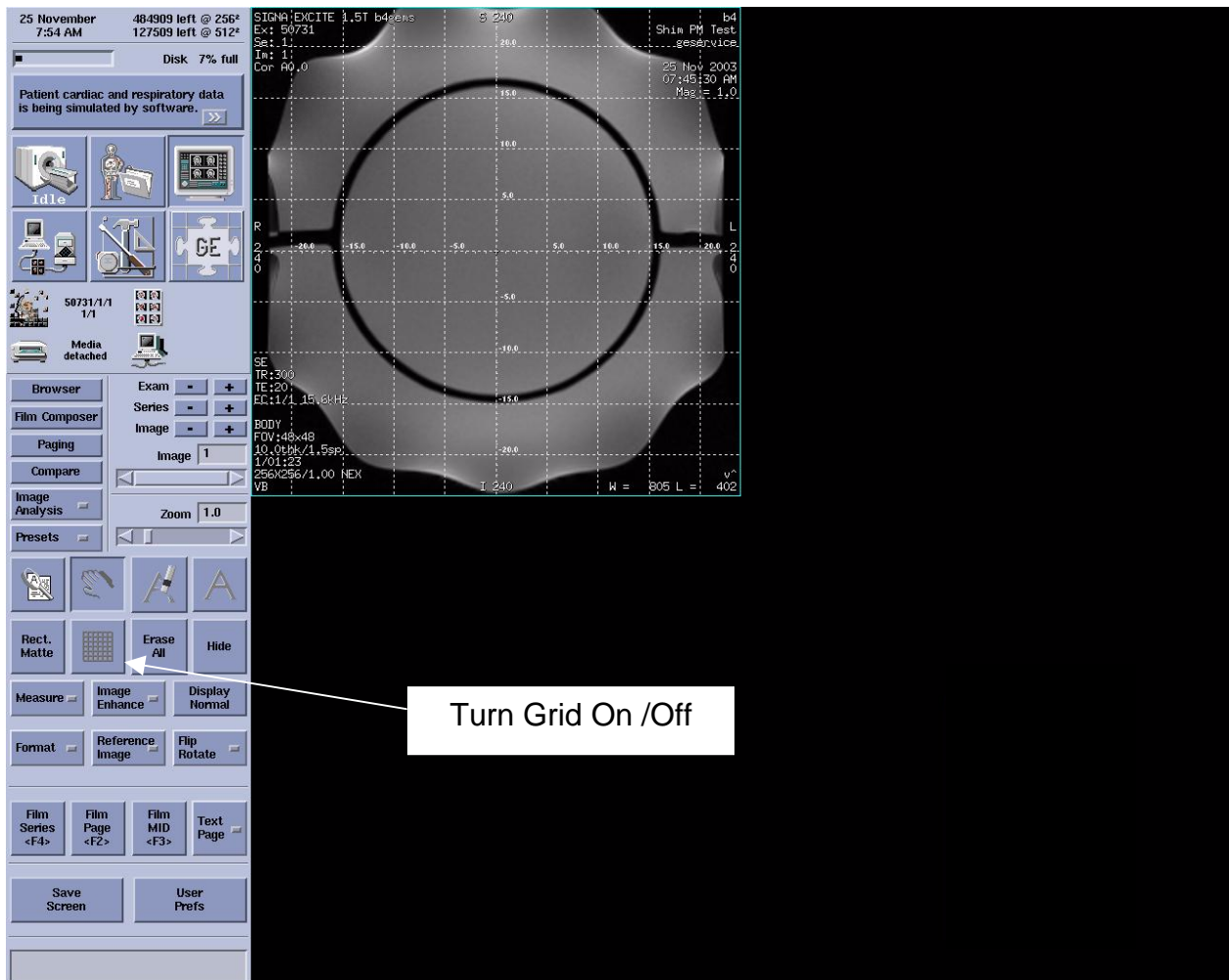


Figure I

18. Now that the LVShim Phantom is properly centered the LVShim scans can be acquired. Return to the Patient Protocol window by clicking the Scan Icon. **Figure A**
19. Click New Series on the Rx Manager **Figure G**
20. Click “Other” in the patient Protocol Window. **Figure D** A protocol selection box will open. **Figure J**
21. From the protocol selection box Select “0.19 LVshim” in the Protocol Column and “LVShim Scan” in the Series Column. **Figure J**
22. Click “Accept” when the selections are correct and complete. **Figure J**

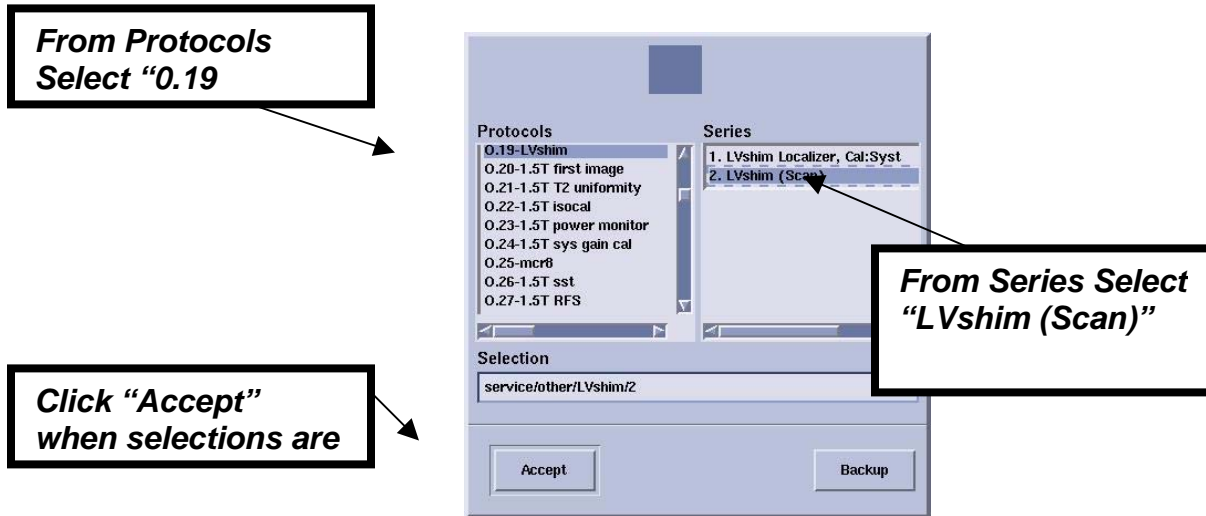


Figure J

23. Start the LVShim Scan. Click in the following order; Save Series, Prepare to Scan, Scan.

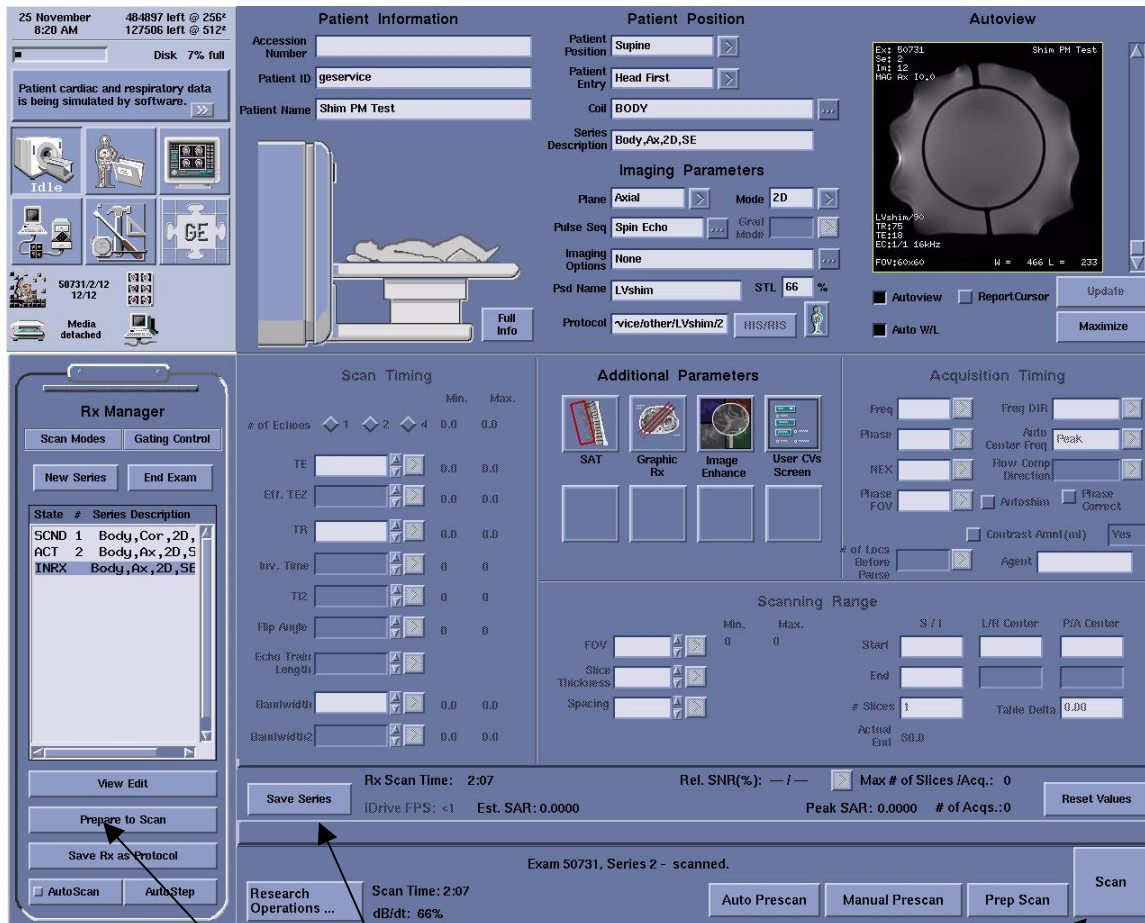


Figure K

**"1" Click
"Save Series"**

**"2" Click
"Prepare to
Scan"**

**"3" Click
"Scan"**

At the completion of the scan sequence proceed to the LVShim tool to verify results. (Next Step)

24. Access the Common Service Desktop by clicking on the Tools Icon. **Figure L**

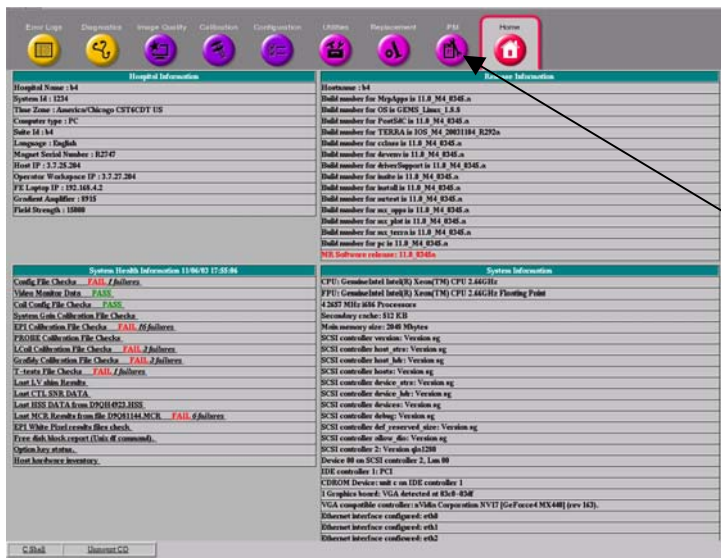


Click on The Tools ICON

Figure L

25. The Common Service Desktop Home Page will open. **Figure 1**

26. From the Common Service Desktop click on the PM ICON **Figure 1**



Click on the PM ICON

Figure 1

27. Click on the PM Assist folder in the left column of the PM main page **Figure2, 2a & Figure 3, 3a**. This will expand the folder and show the PM selections.

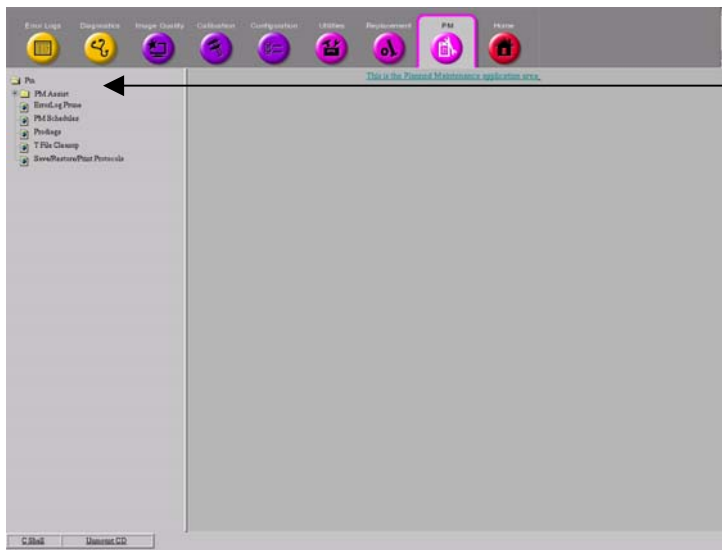


Figure 2

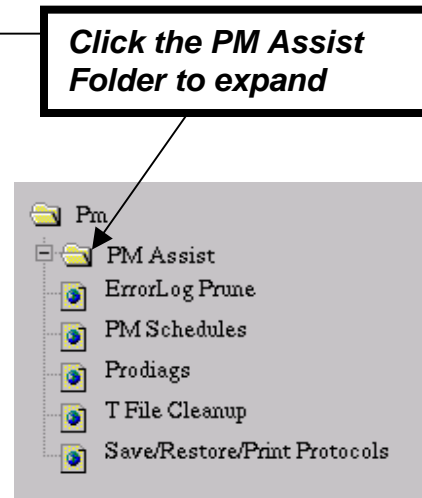


Figure 2a

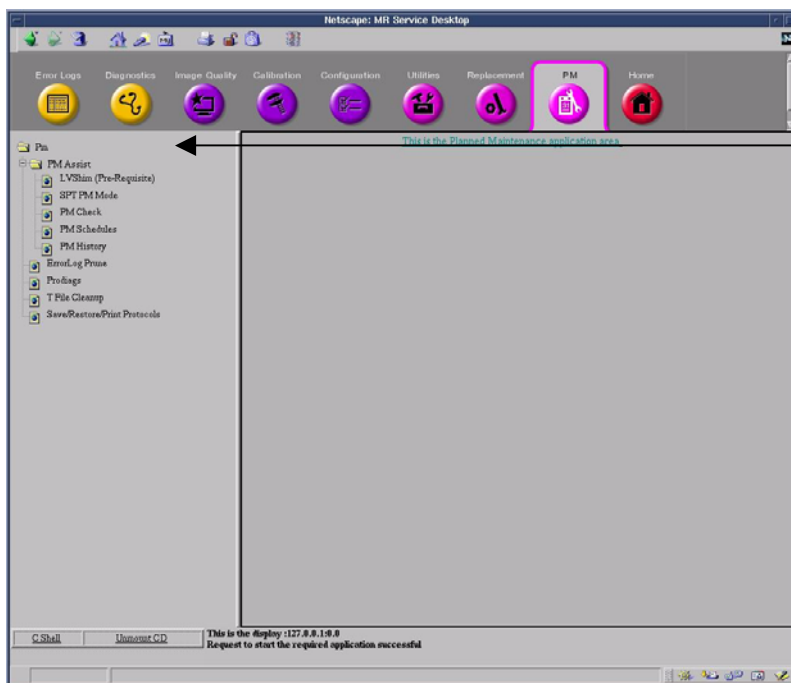


Figure 3

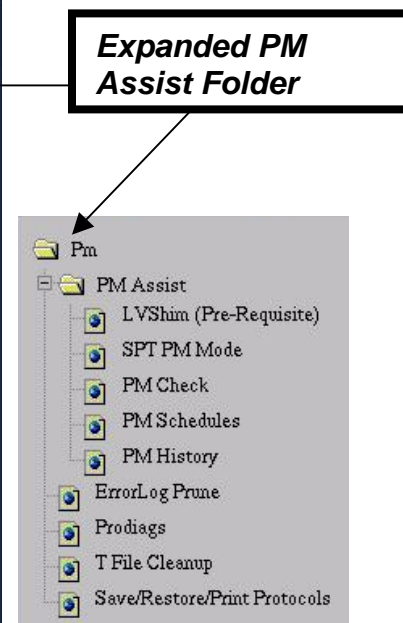


Figure 3a

LVShimTool

1. Click on LVShim in the expanded PM folder. **Figure 4 & 4a**. The Right side of the screen will provide more details about LVShim and a link to start the LVShim PM tool.
2. Click on the Link “Click Here To Start The LV Shim Tool” **Figure 4** to start the tool and open the LVShim tool **Figure 5**.

Note : For TwinSpeed a pop up will appear Whole or Zoom ?? Select “Whole”.

LVShim Page

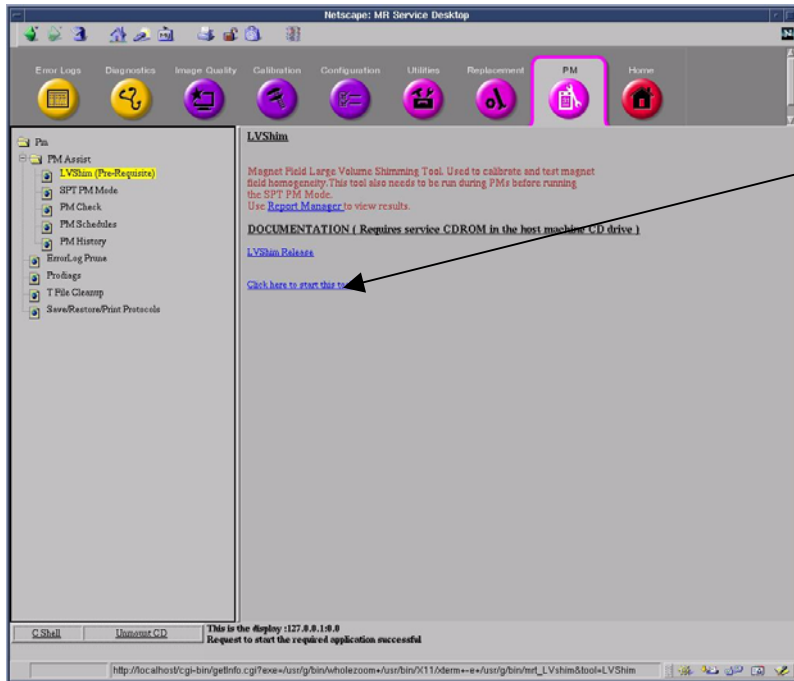


Figure 4

Click here to start the LVShim tool

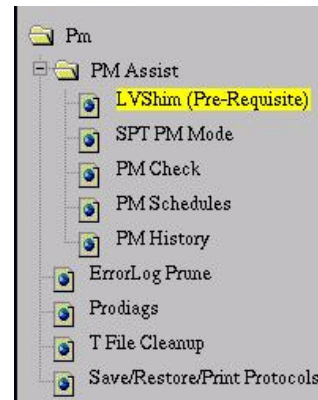


Figure 4a

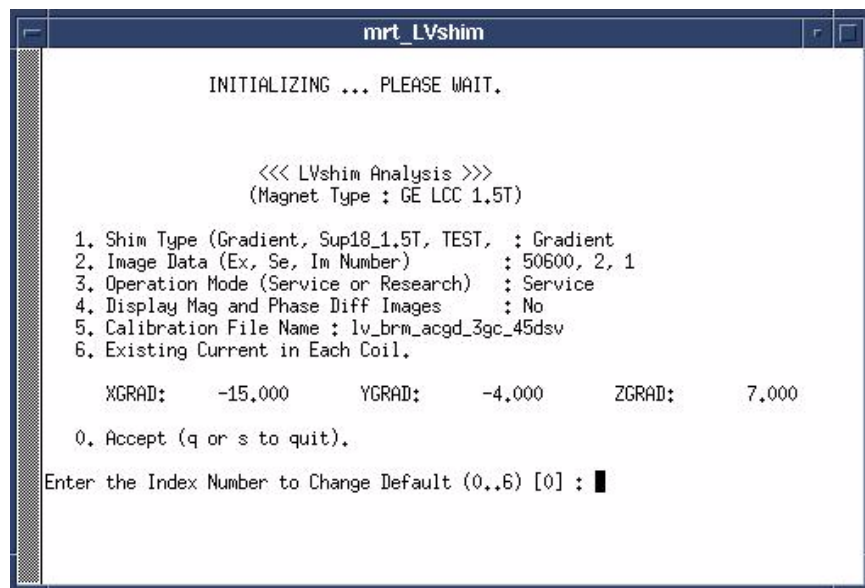


Figure 5

Default Values For LVShim Analysis Tool

1. **Shim Type** = Gradient
2. **Image Data** = This will auto fill with the latest LVshim Images
3. **Operation Mode** = Service
4. **Display Mag and Phase Diff Images** = No
5. **Calibration File** = lv_brn_acgd_3gc_45dsv
6. **Existing Current In Each Coil**

Note: Verify the image data matches the exam series image scanned in step 25.

3. To start the analysis press enter key. The results will be returned as follows:

(1, 0): -137.67 [10] The Z1 limit is 10 the actual measure value -137.67

As shown in **Figure 6**, Grad Shim has not passed

Note: Jump to Step 9 if the message displayed is “Grad Shim Passed”

LVShim Harmonic Correlation

- 1,0 = Z1, 2,0 = Z2, 3,0 = Z3, 4,0 = Z4, 5,0 = Z5
- 6,0 = Z6, 1,1 = Y, 1,-1 = X, 2,1 = ZY, 2,-1 = ZX
- 2,2 = X2-Y2, 2,-2 = XY, 3,1 = Z2Y, 3,-1 = Z2X
- 3,2 = Z(X2-Y2), 3,-2 = ZYX, 3,3 = Y3, 3,-3 = X3

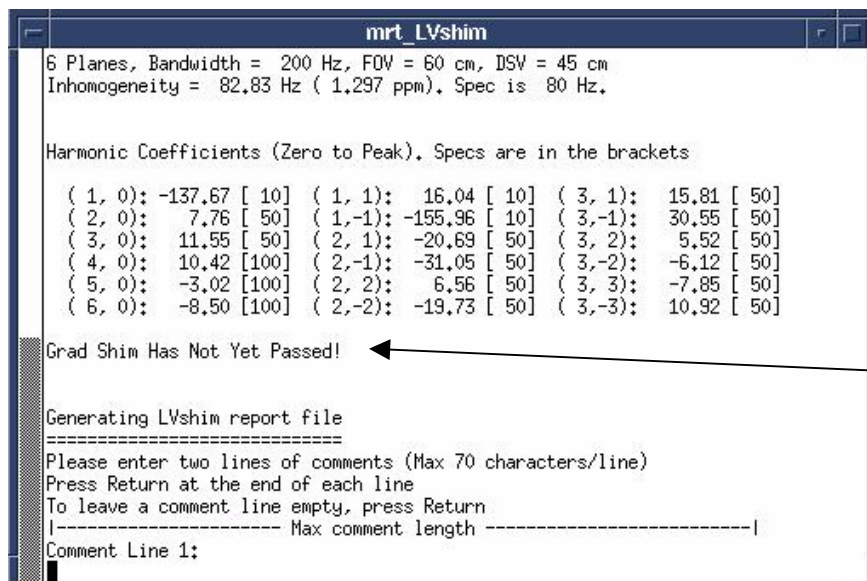


Figure 6

4. Entering comments is allowed but not required. Press the enter button to continue.
5. Accept the new Grad Shim values by entering “y” and pressing the enter key

Figure7

6. The tool will ask “Exit LVShim? “ Type “n” and press the return key. **Figure 8**
7. Return to the Scan prescription page and click the Scan button. When scans are complete return to the LVShim tool (**Figure 9**) and press the enter key.
8. The LVShim tool will automatically select the 12 new images created by the last scan. Press the enter key to start the analysis. **Figure 10**

Note: Grad Shim is capable of reducing the X (1,-1) Y (1,1) and Z (1,0) harmonics. If any of the higher order harmonics are out of specification a Supercom Shim may be required.

9. In This Example The LVShim has now passed. **Figure 11** Depending on the System it may take only one pass or it may take several. Repeat the procedure until the system passes the LVShim
10. Enter any applicable comments. Press the enter key **Figure 12**
11. Reject the new current values by entering “n” and pressing the enter key **Figure 12**
12. The tool will ask “Exit LVShim? “ Type “y” and press the return key. **Figure 13**

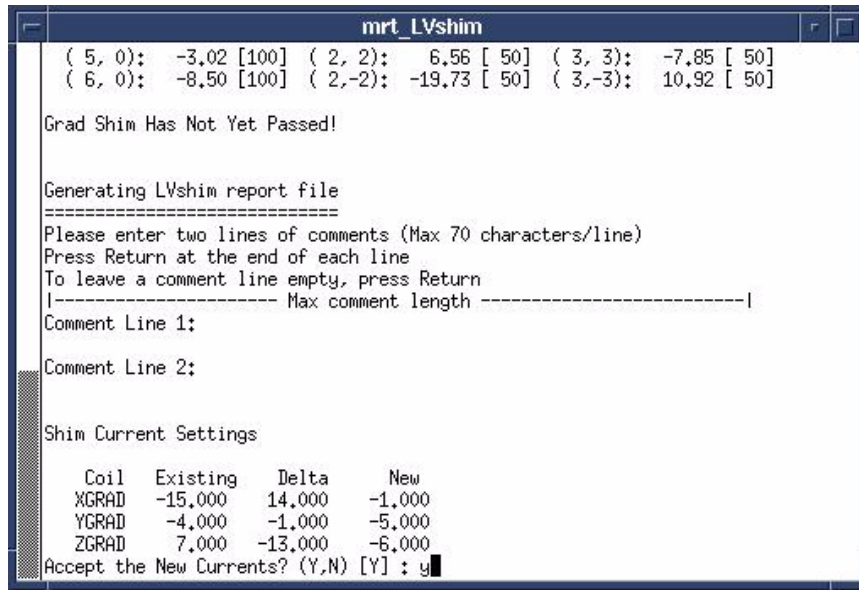


Figure 7

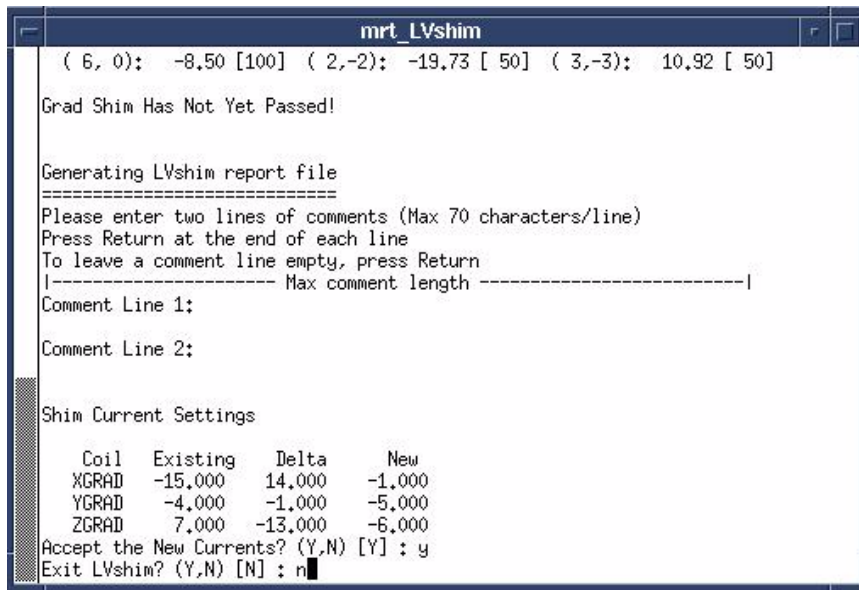


Figure 8

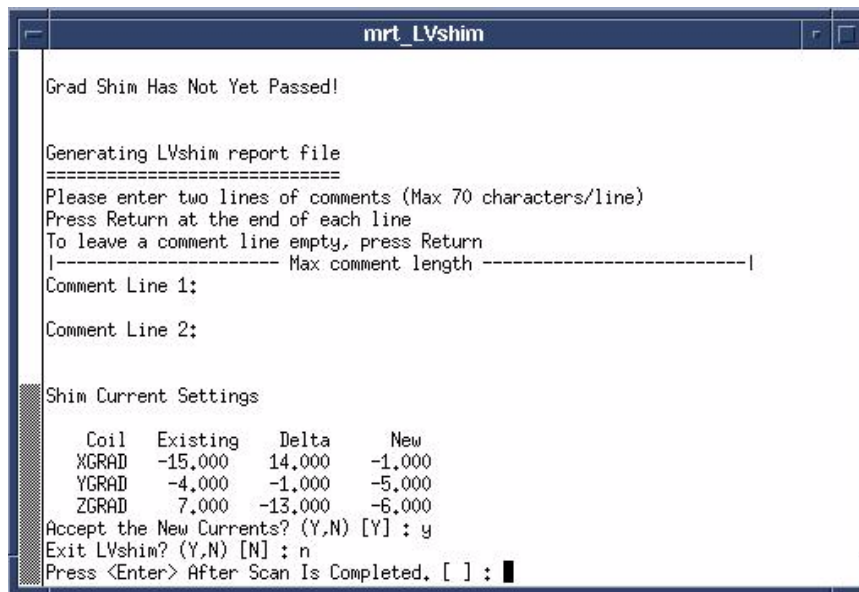


Figure 9

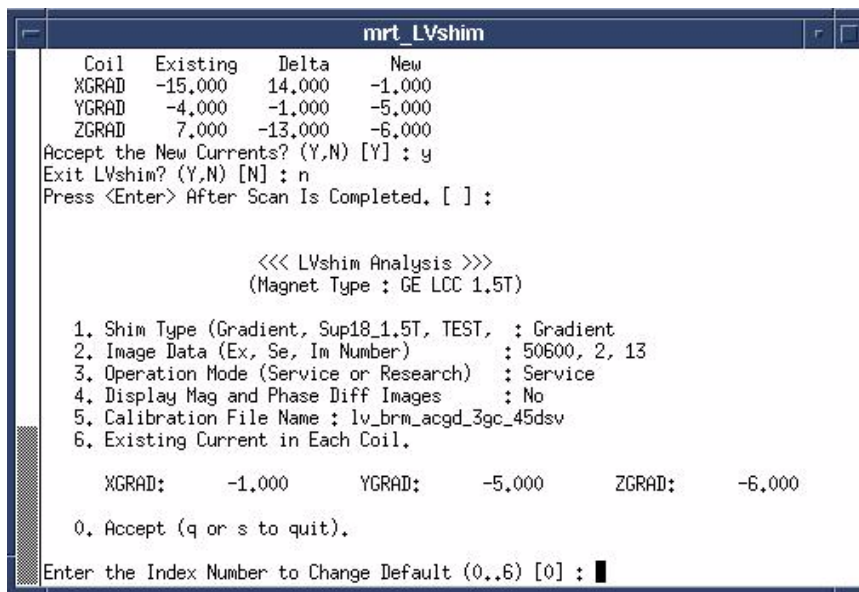


Figure 10

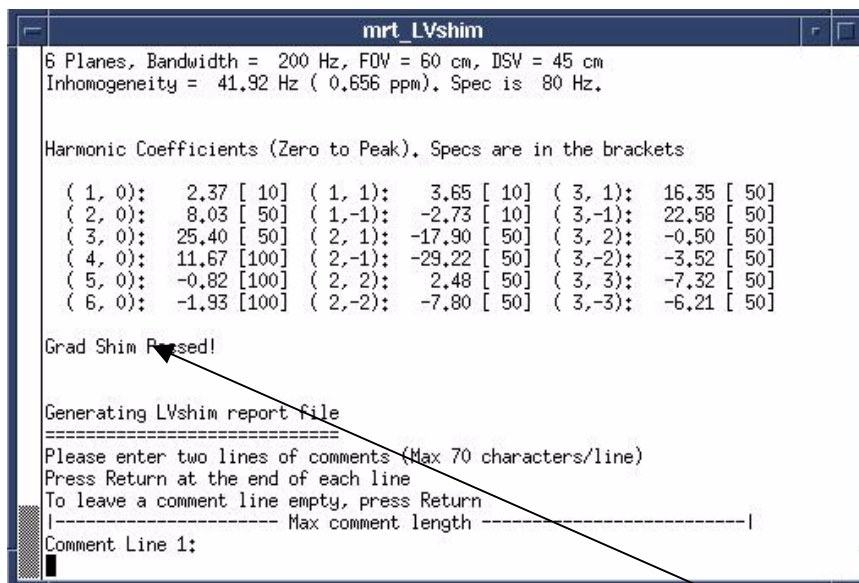


Figure 11

Status
Grad Shim Passed

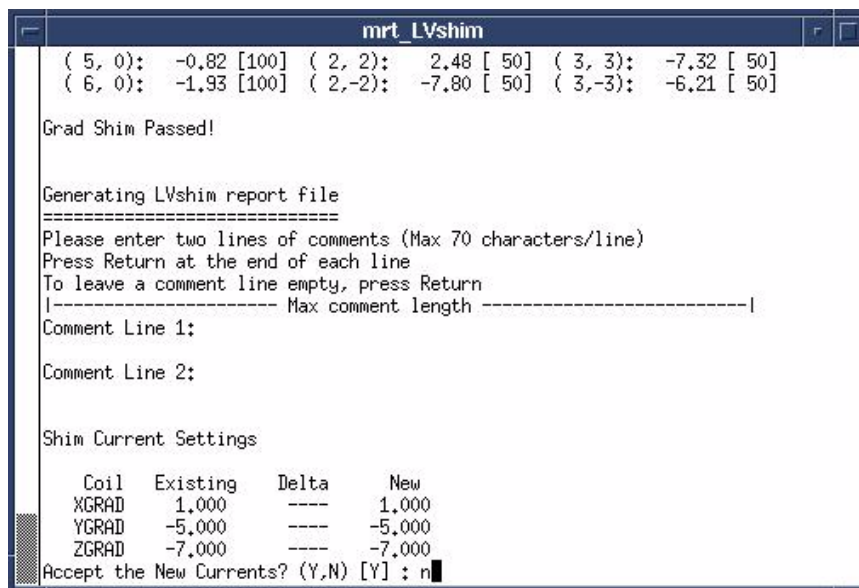


Figure 12

```
mrt_LVshim
( 6, 0): -1.93 [100] ( 2,-2): -7.80 [ 50] ( 3,-3): -6.21 [ 50]
Grad Shim Passed!

Generating LVshim report file
=====
Please enter two lines of comments (Max 70 characters/line)
Press Return at the end of each line
To leave a comment line empty, press Return
|----- Max comment length -----|
Comment Line 1:
Comment Line 2:

Shim Current Settings
      Coil Existing Delta New
XGRAD  1,000  ----  1,000
YGRAD -5,000  ---- -5,000
ZGRAD -7,000  ---- -7,000
Accept the New Currents? (Y,N) [Y] : n
Exit LVshim? (Y,N) [N] : y
```

Figure 13

System Performance Testing (SPT)

1. From the Common Service Desktop PM page select SPT PM mode by clicking on it in the expanded PM folder on the left side of the page. **Figure 14 & Figure 14a**
2. Start the SPT tool by clicking the “Click here to start this tool” link **Figure14**

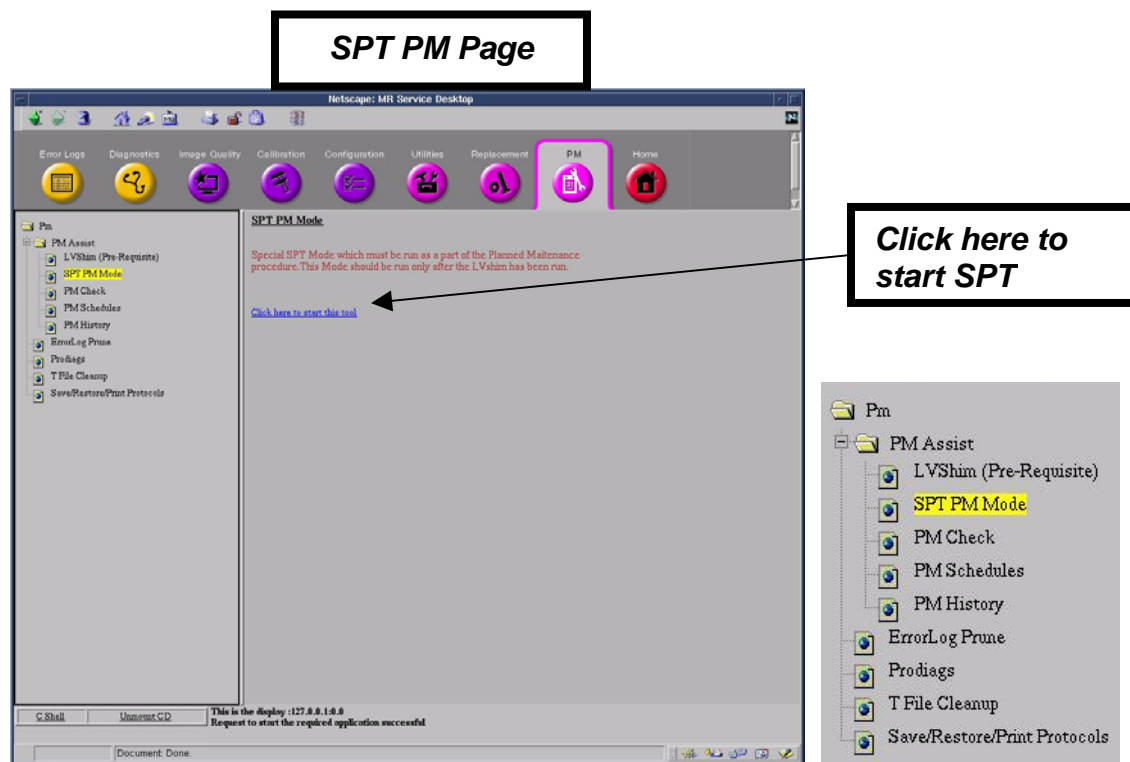


Figure 14

Figure 14a

3. A window will open requesting the Engineer to select the Head Coil and Phantom type. Select the appropriate combination by clicking on the radio button. Then click on the Start button. **Figure 15**

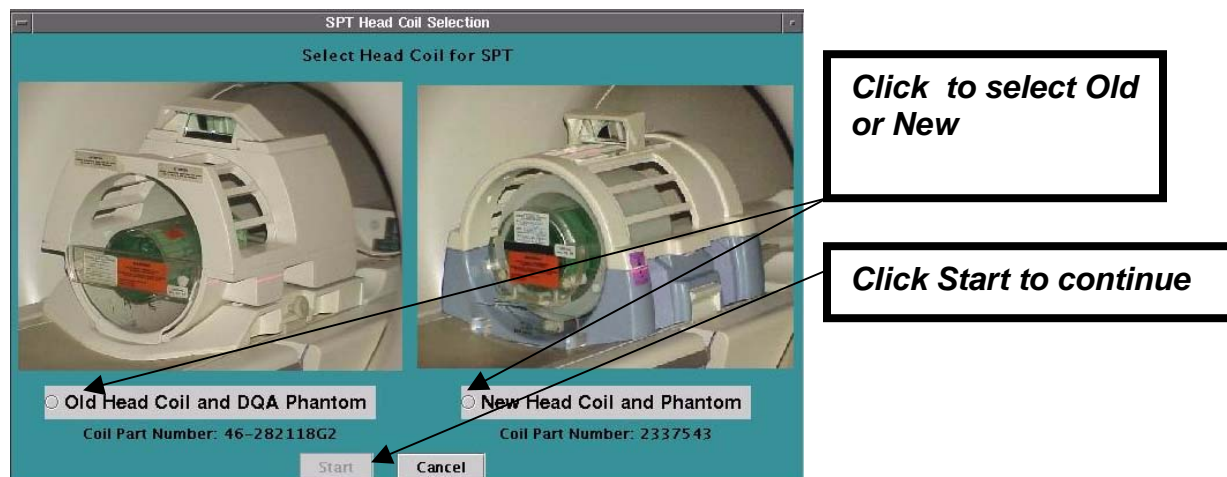


Figure 15

4. The System Performance Test (SPT) screen will open **Figure 16** For the PM SPT mode, all the tests are pre-selected and cannot be changed. The test takes just over one hour to complete. In the upper right-hand corner of the SPT screen the remaining test time will be displayed. **Figure 16 & Figure 16a** Test Progress and Results will be displayed in the lower window of the SPT page. **Figure 17**

For more information on System Performance Tests, including phantom setup, follow direction 2333500 (Signa Excite Service Methods). /Troubleshooting/Image Quality Troubleshooting Tools/System Performance Tests (SPT)/ .

Failures must be resolved and the System Performance Test (SPT) Must Be Re-Run before proceeding to the PM Check.

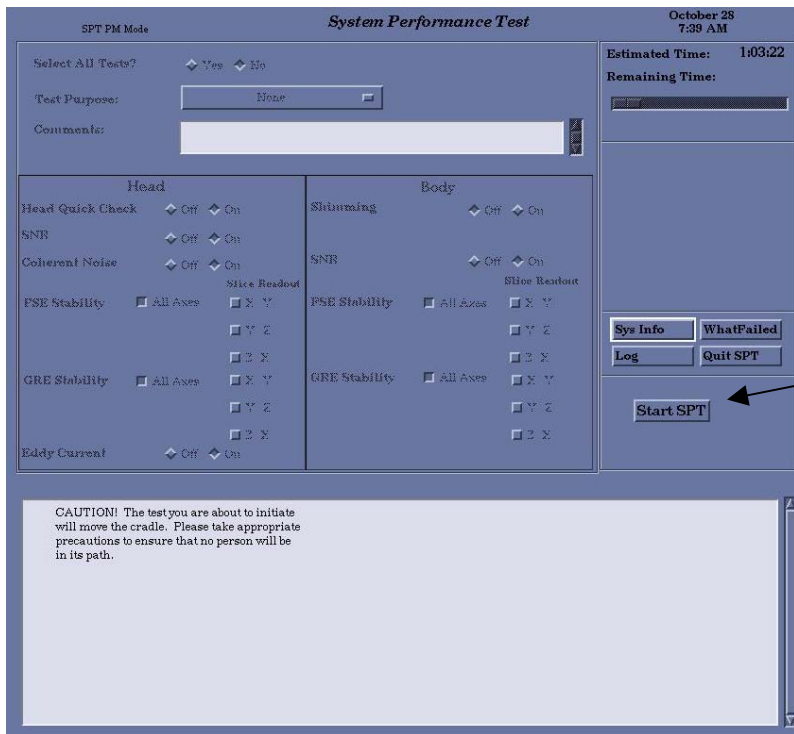


Figure 16

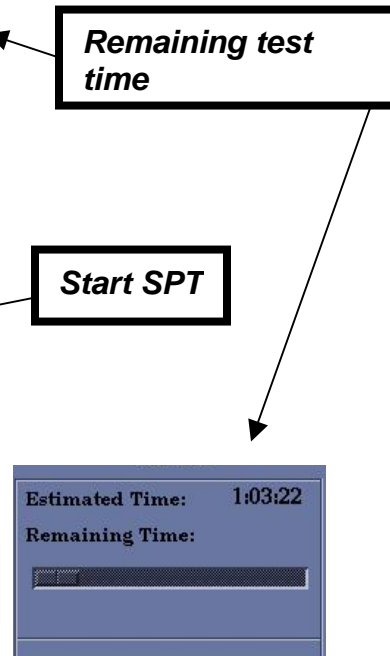


Figure 16a

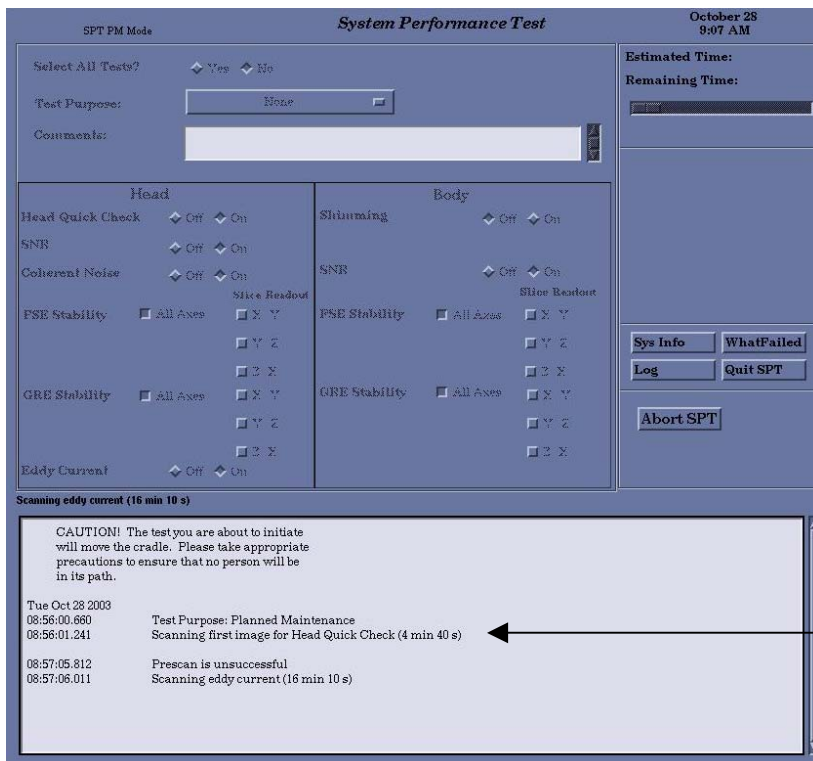


Figure 17

Test Results

PM Check

1. Verify that the PM has been completed successfully. Click on PM check. **Figure 18 & Figure 18a.**

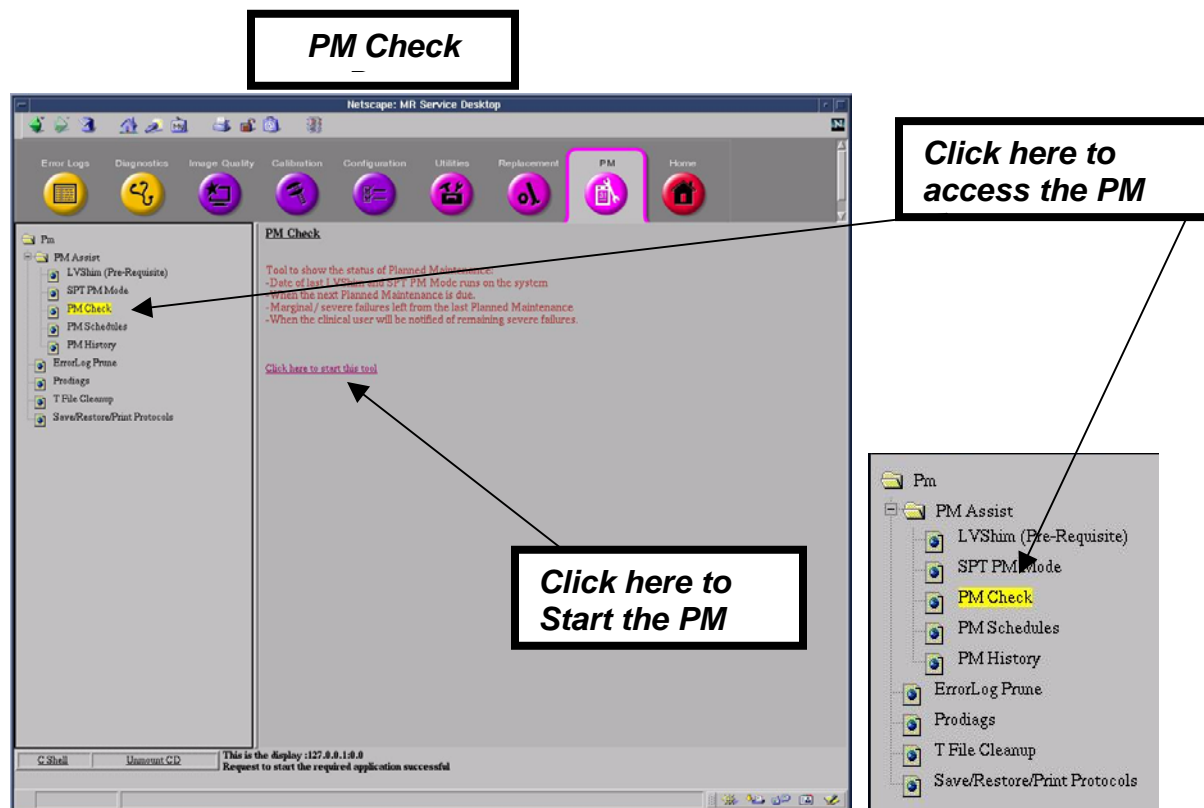


Figure 18

Figure 18a

2. The PM Check window will open. **Figure 19** The following information shall be displayed

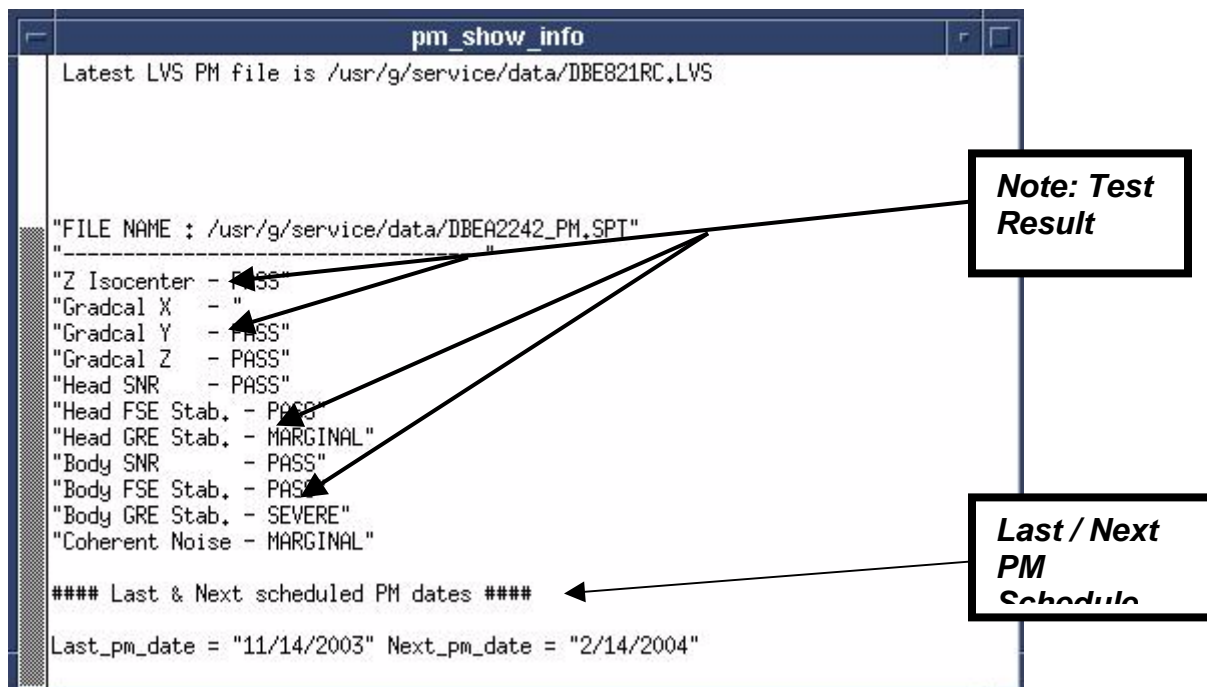


Figure19

3. As you can see in the example “Body GRE Stab” has a SEVERE failure. This must be resolved for the PM Assist to be considered complete. The FE will have 21 days to resolve SEVERE issues. The system will notify the operator of the problem if not resolved in the 21-day window.
4. For the PM assist to be successful and complete all test results must pass **Figure 20**.



```
pm_show_info
Latest LVS PM file is /usr/g/service/data/DB0848RC.LVS

"FILE NAME : /usr/g/service/data/DB0A1914_PM,SPT"
"-----"
"Z Isocenter - PASS"
"Gradcal X - PASS"
"Gradcal Y - PASS"
"Gradcal Z - PASS"
"Head SNR - PASS"
"Head FSE Stab. - PASS"
"Head GRE Stab. - PASS"
"Body SNR - PASS"
"Body FSE Stab. - PASS"
"Body GRE Stab. - PASS"
"Coherent Noise - PASS"

#### Last & Next scheduled PM dates ####
Last_pm_date = "11/24/2003" Next_pm_date = "2/24/2004"
```

Figure 20.

PM Schedule

The PM Schedule Tool will show the following status:

- Date of Last LVShim and SPT PM Mode runs on the System
- When the next Planned Maintenance is due.
- Marginal / Severe failures remaining from last Planned Maintenance
- When the clinical user will be notified of the remaining severe failures

1. Click on PM Schedules in the expanded PM folder. **Figure 21 & 21a**. The right side of the screen will provide more details about PM Schedules and a link to start the PM Schedules tool.
2. Click on the Link “Click Here To Start This Tool” **Figure 21** to start the tool and open the PM Schedules tool **Figure X**.

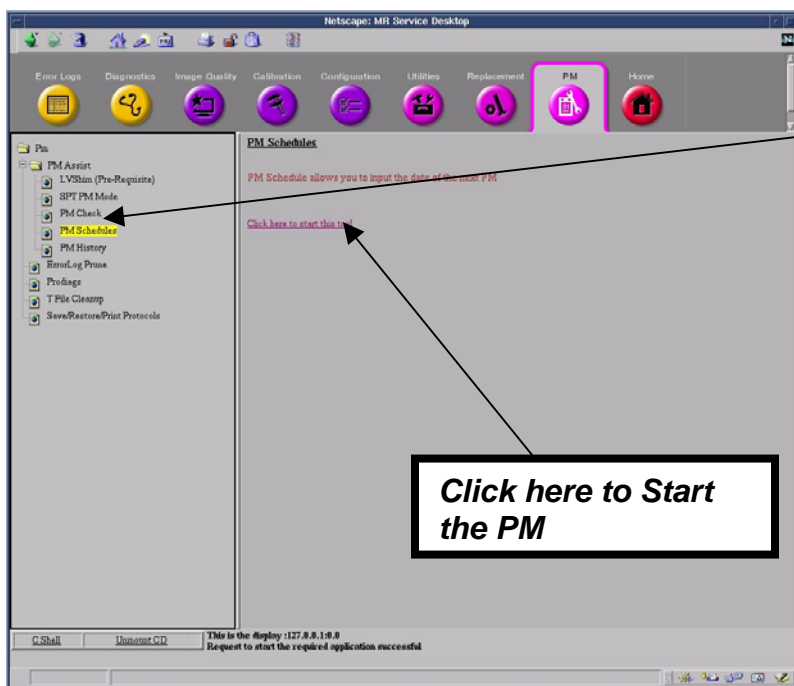


Figure 21

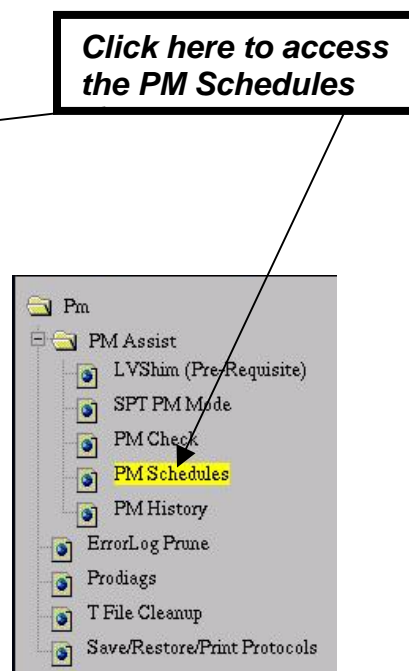


Figure 21a

PM Never Performed On This System

1. If Planned Maintenance has not been performed on this System the following message will be displayed in the tool.
“There is no PM performed on this system at least once. Schedule a date for PM, Run SPT &LVS PM tests and Hit PM Check link on CSD”.
2. Enter your Name or initials **Figure 23**
3. Press the Enter key **Figure 22**

4. Enter The Next scheduled PM date **Figure 22**

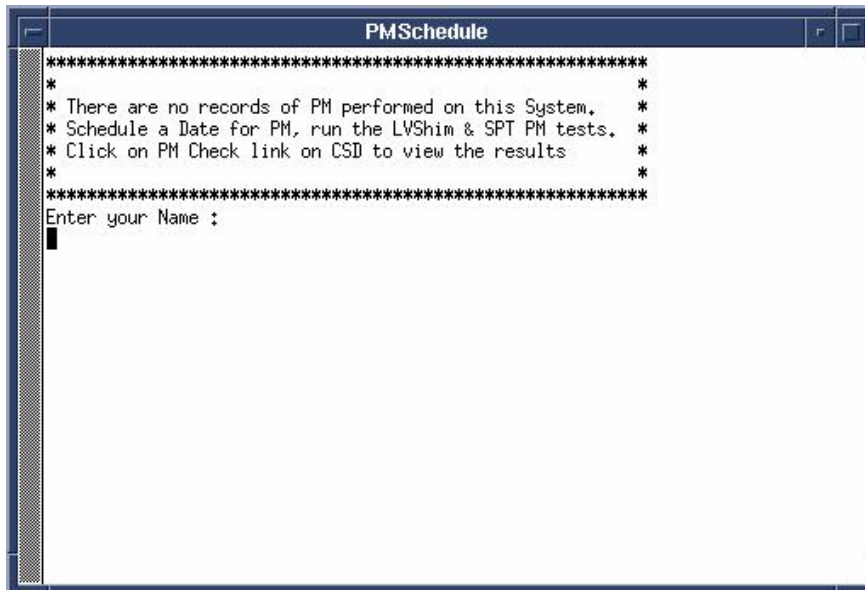


Figure 22

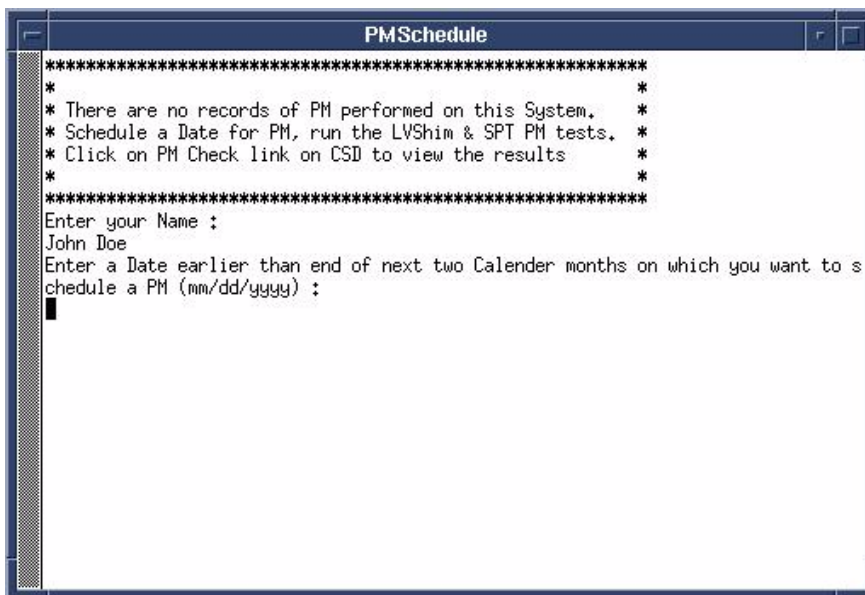


Figure 23

System Following Normal PM Schedule

1. The tool will display the when the last PM was performed and when the next PM is scheduled. **Figure 24**

2. Enter the date the next PM will be performed. Insert the date within the specified time limit provided by the tool **Figure 25**
3. Press the enter key **Figure 25**

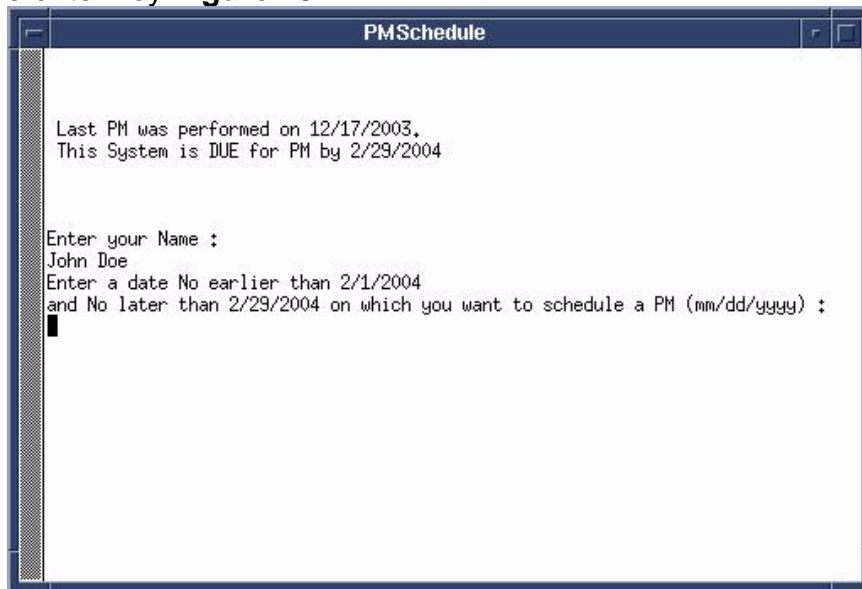


Figure 24

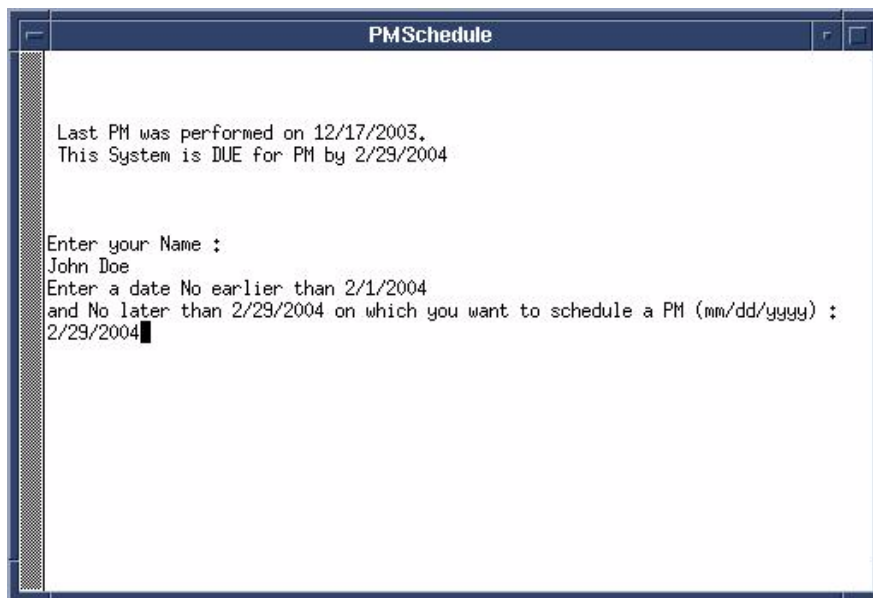


Figure 25

PM History

1. Click on PM History in the expanded PM folder. **Figure 26 & 26a**. The right side of the screen will provide more details about PM History and a link to start the PM History tool.
2. Click on the Link “Click Here To Start This Tool” **Figure 26** to start the tool and open the PM History tool **Figure 27**.
3. The PM History will display the following information. **Also See Figure 27**
 - i. Current Date
 - ii. Last Performed PM Date
 - iii. Month Next PM due.
 - iv. Customer Scheduled PM Date
 - v. Field Engineer PM date

Note: iv. and v should be the same date. If not discuss PM scheduling with the customer immediately.

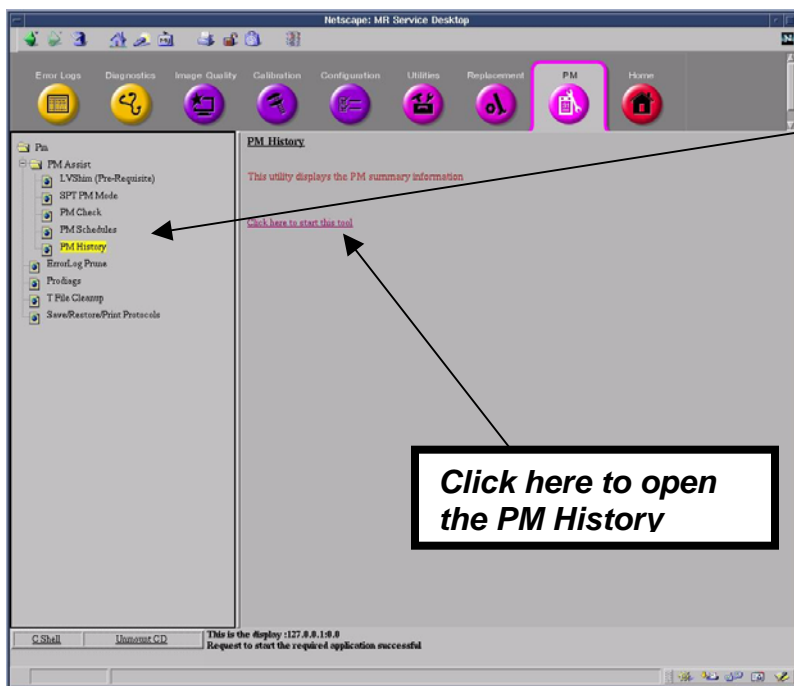


Figure 26

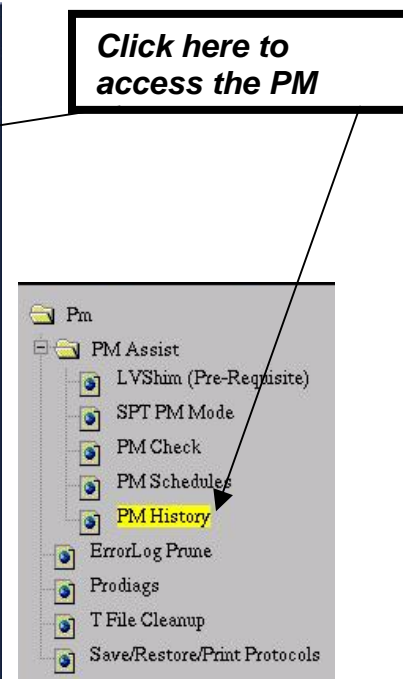


Figure 26a

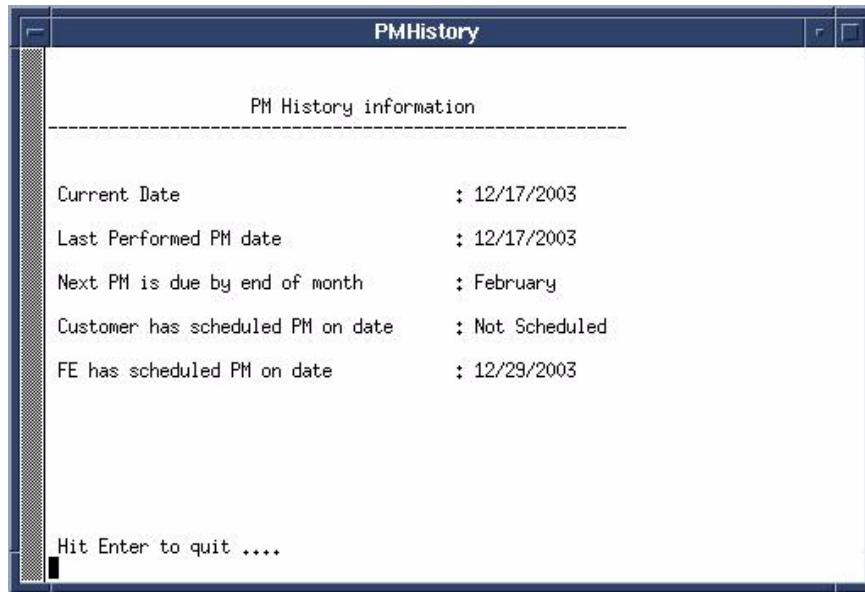


Figure 27