

CORSO DI LAUREA
TECNICHE DI RADIOLOGIA MEDICA, PER IMMAGINI E RADIOTERAPIA

CORSO INTEGRATO
«**FISICA E APPARECCHIATURE TC E RM – RMX012**»

ANNO ACCADEMICO 2024/2025



Gemelli



Insegnamento:
APPARECCHIATURE RISONANZA MAGNETICA
RMX054 - 13 ore MED/50 CFU 1



gen. '25

2° anno I semestre

Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore



Insegnamento:
APPARECCHIATURE RISONANZA MAGNETICA
RMX054 - 13 ore MED/50 CFU 1

MRI – L'ESAME MR



Gemelli



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gen. '25

Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore



Insegnamento:
APPARECCHIATURE RISONANZA MAGNETICA
RMX054 - 13 ore MED/50 CFU 1

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gen. '25
🌐 www.variodyne.it

Fondazione Policlinico Universitario Agostino Gemelli IRCCS
Università Cattolica del Sacro Cuore



Argomenti del Corso

- G+ Introduzione
- G+ Sicurezza in RM
- G+ Mdc e sicurezza
- G+ Passato, presente e futuro della RM
- G+ Fenomeno «RM» e principi fisici di base
- G+ Magnete e i vari componenti
- G+ Radiofrequenza e Bobine
- G+ Gradienti
- G+ Generazione di un'immagine RM
- G+ Tecniche di acquisizione – *Parallel Imaging*
- G+ Intelligenza artificiale – *Deep Learning*
- G+ Artefatti
- G+ **Esame RM**
- G+ Sequenze RM
- G+ Apparecchiature Fondazione

**Dove è il
locale
tecnico??
?**





GE Healthcare

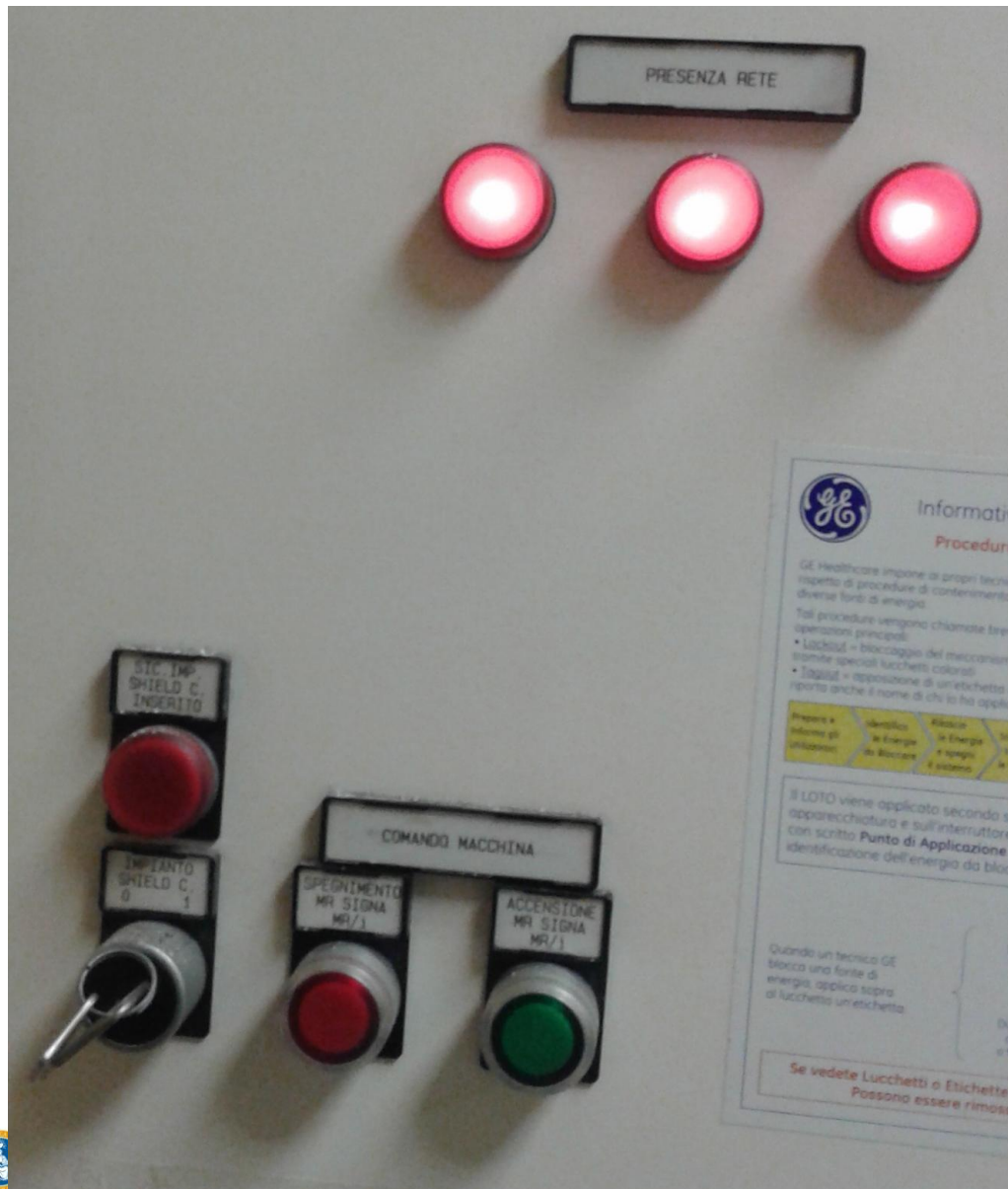


Individuare
l'armadio PDU-
GRADIENT ...



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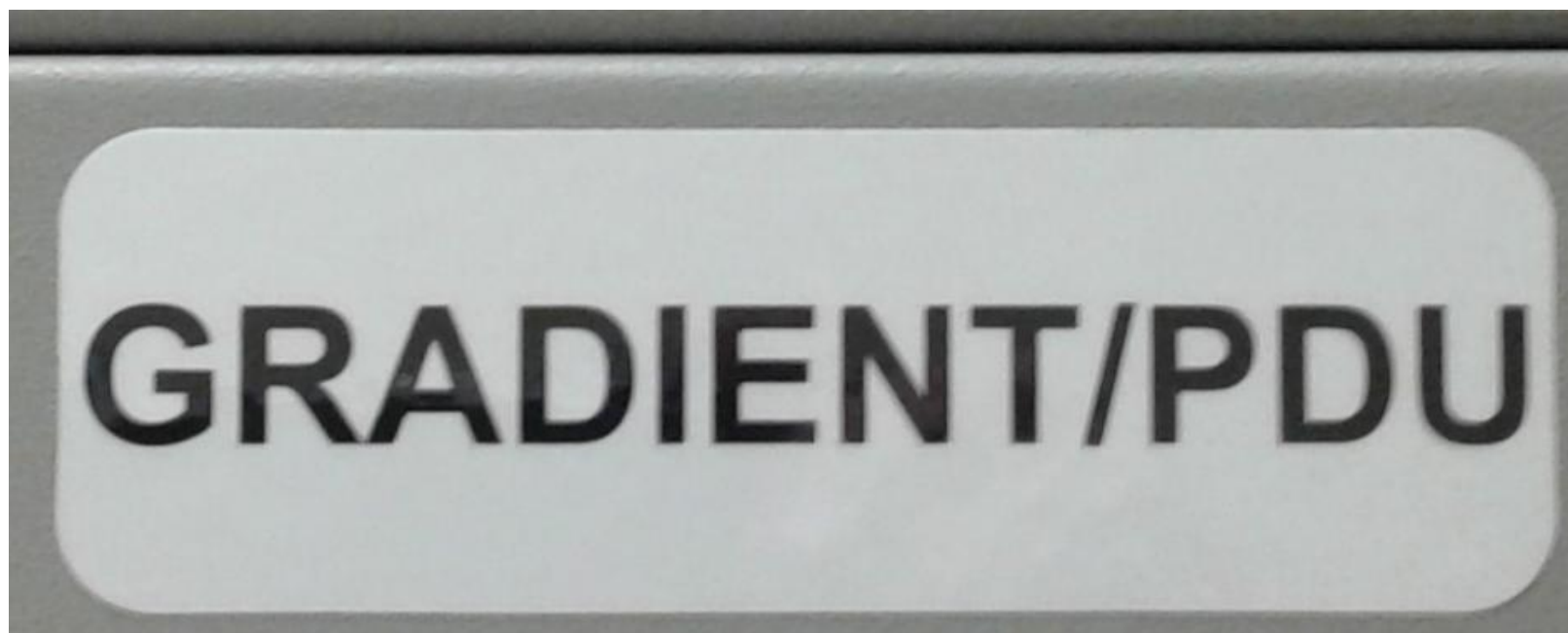




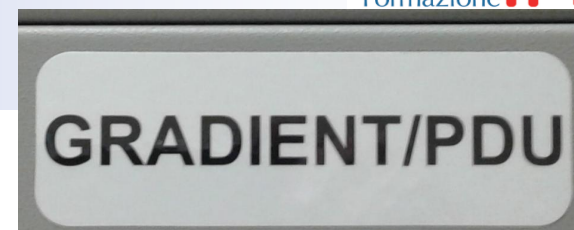
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Accensione RM

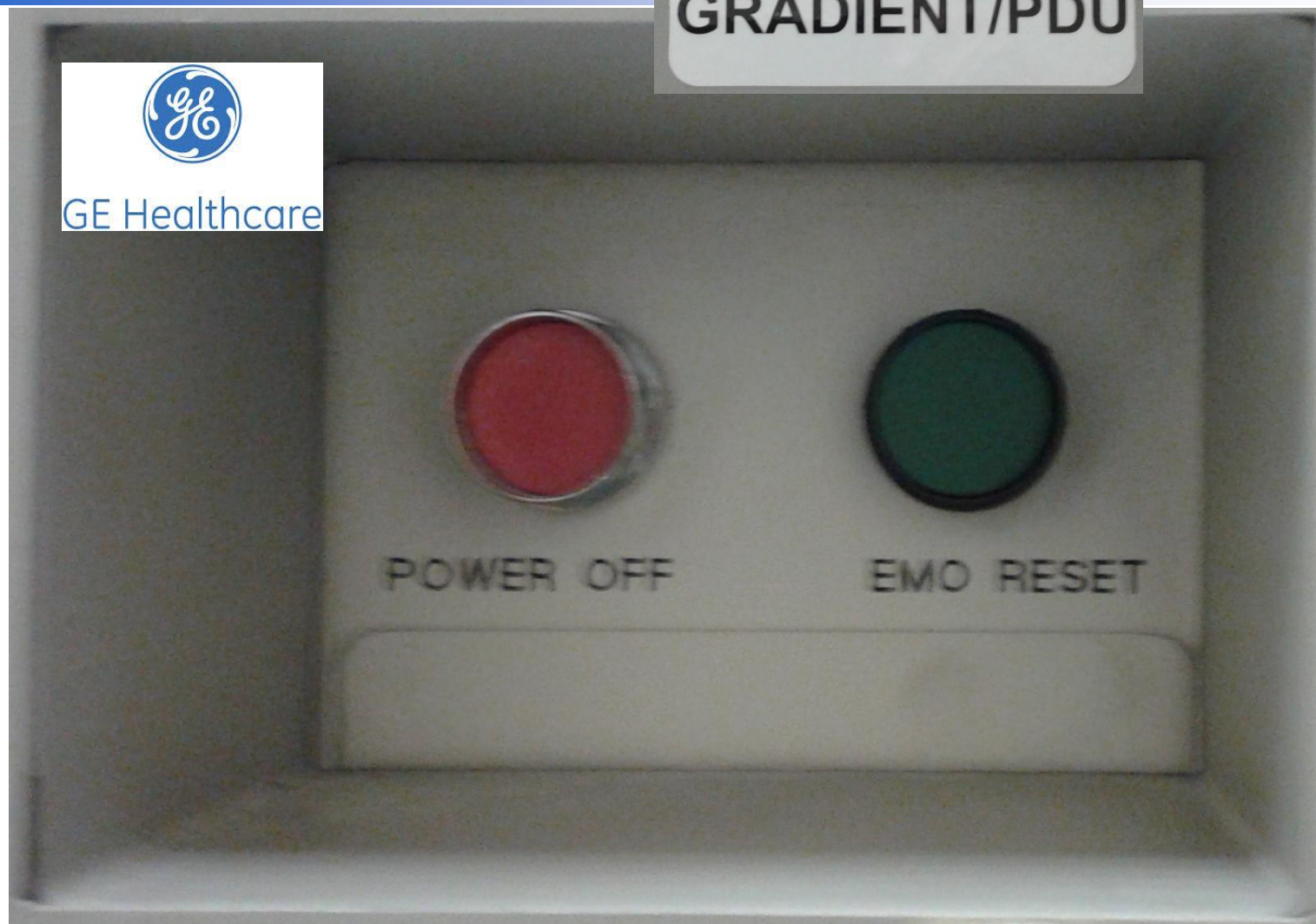


GRADIENT/PDU

Portare la
leva su «I»



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Avvio dopo un arresto prolungato

1. Dall'ISC, eseguire i seguenti passaggi:
 - a. Aprire la piccola porta di accesso per visualizzare l'interruttore principale e il pulsante EMO. Vedere 1 nella Figura.
 - b. Reset dell'interruttore. Spostare l'interruttore dalla posizione orizzontale a quella di On (completamente verticale). Vedere 2 nella Figura.
 - c. Premere il pulsante di **reset EMO**. Vedere 3 nella Figura.
- Il pulsante di reset EMO attiva l'alimentazione ai componenti ad alta tensione e provoca un rumore diaria e di relè.
- Il computer del sistema deve accendersi automaticamente.



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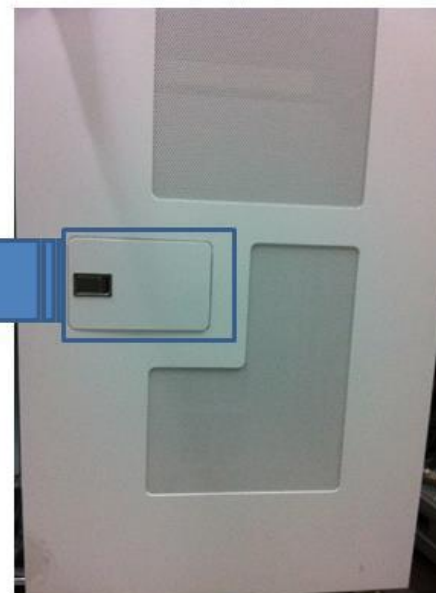
Accensione RM 3-4-5



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2



1

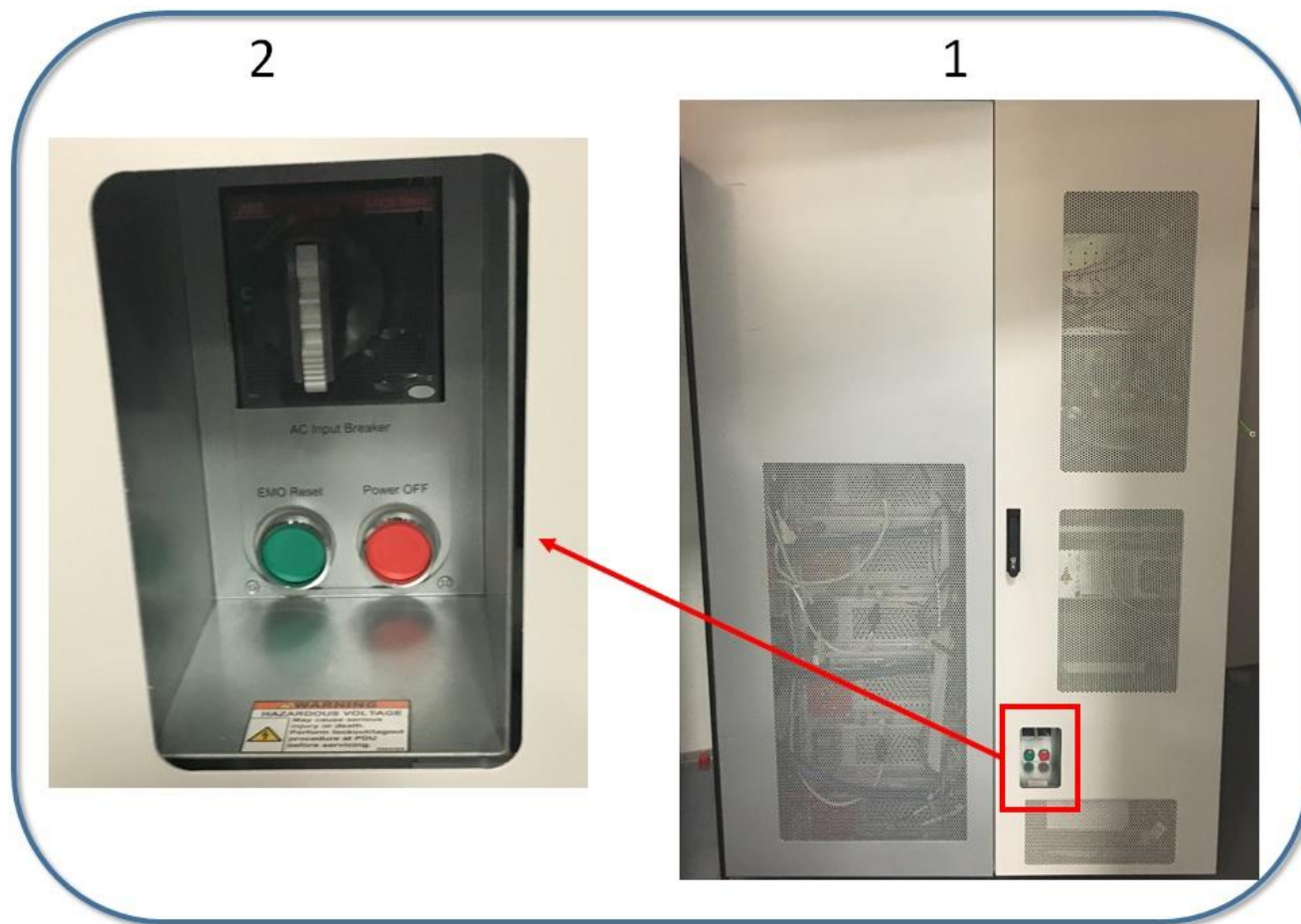


3

Accensione RM 3-4-5



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Usare questa procedura per avviare il sistema RM.

1. Premere il pulsante di accensione/arresto per accendere il **computer**.

Quando la macchina è accesa, anche la spia dell'alimentazione è accesa.

Viene visualizzato un messaggio con conto alla rovescia per il collegamento.

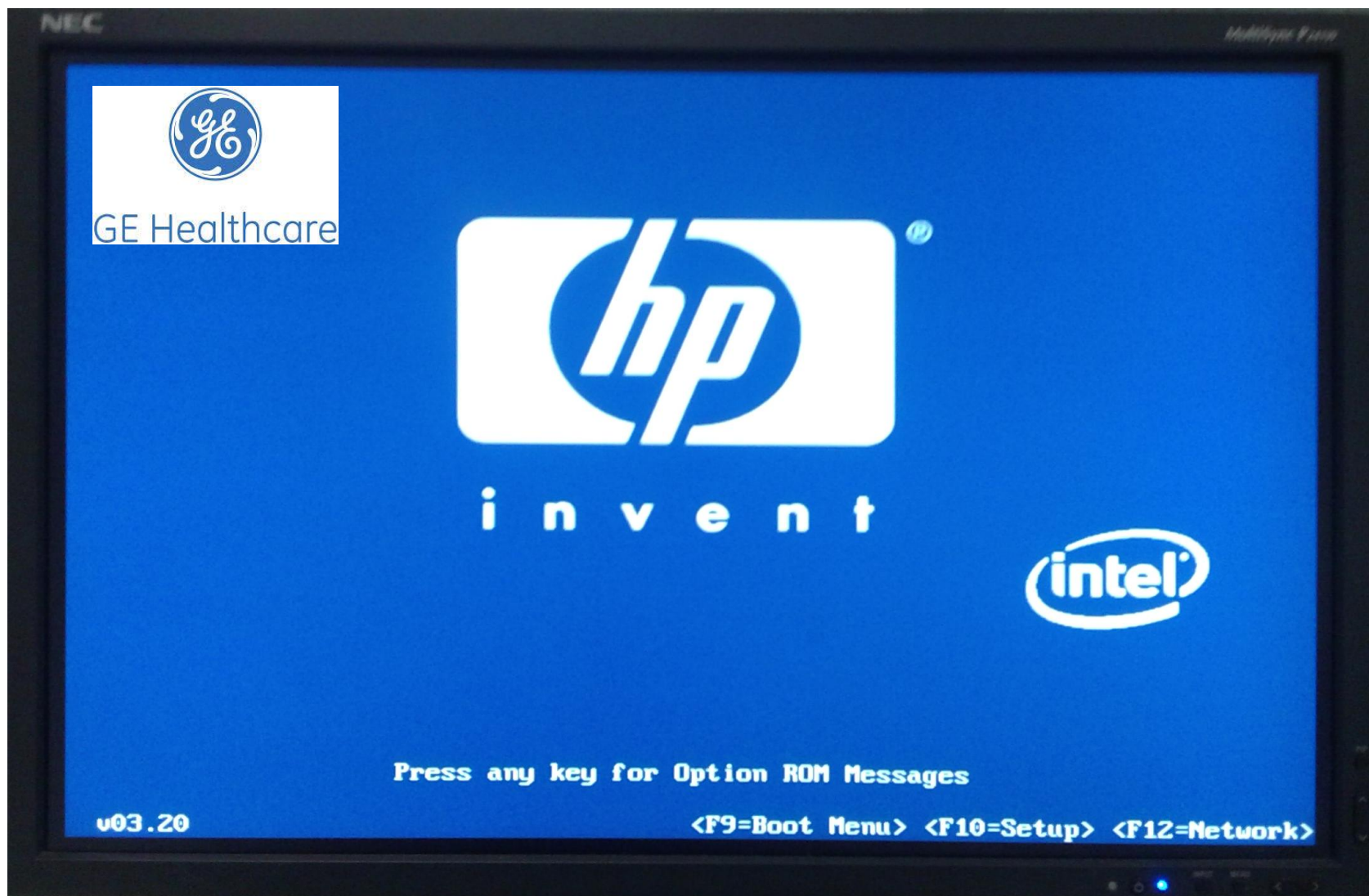
Se si decide di spegnere il computer a questo punto, dalla schermata di collegamento, fare clic su **System > Halt** (Sistema > Arresta).

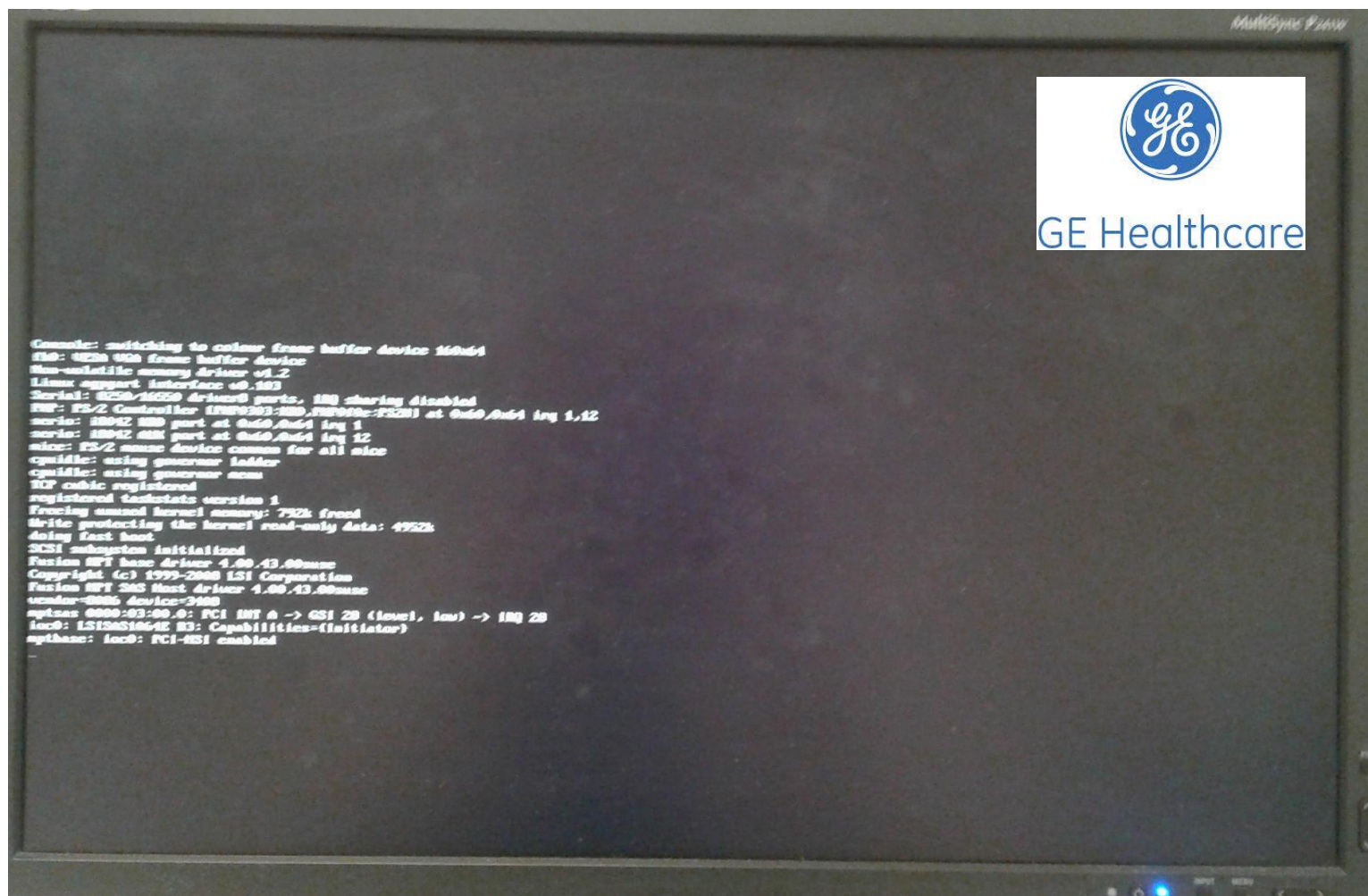
2. Per inserire il nome e la password di accesso attendere fino a quando vengono rimossi dallo schermo tutti i messaggi.

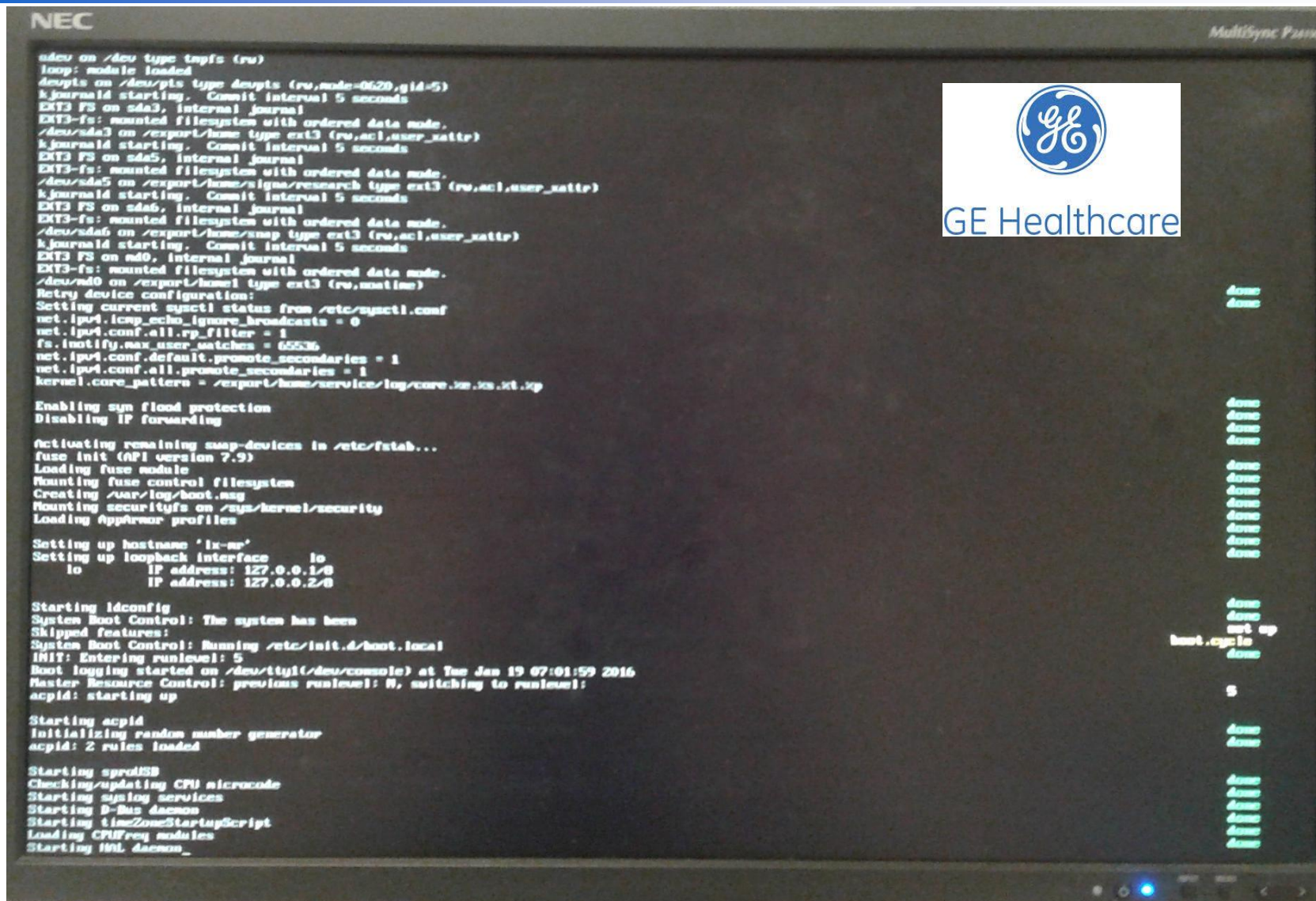
a. Nel campo Logon Name (Nome di accesso), digitare ***.

b. Nel campo Password, digitare la propria password.

La password predefinita di sistema GE è *****.







```

sdev on /dev type tmpfs (rw)
loop: module loaded
dmgpts on /dev/pts type dmegpts (rw,mde=0620,gid=5)
kjournald starting. Commit interval 5 seconds
EXT3 FS on sda3, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
/dev/sda3 on /export/home type ext3 (rw,acl,user_xattr)
kjournald starting. Commit interval 5 seconds
EXT3 FS on sda5, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
/dev/sda5 on /export/home/signa/research type ext3 (rw,acl,user_xattr)
kjournald starting. Commit interval 5 seconds
EXT3 FS on sda6, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
/dev/sda6 on /export/home/snap type ext3 (rw,acl,user_xattr)
kjournald starting. Commit interval 5 seconds
EXT3 FS on md0, internal journal
EXT3-fs: mounted filesystem with ordered data mode.
/dev/md0 on /export/home1 type ext3 (rw,usrtime)
Retry device configuration:
Setting current sysctl status from /etc/sysctl.conf
net.ipv4.icmp_echo_ignore_broadcasts = 0
net.ipv4.conf.all.rp_filter = 1
fs.inotify.max_user_watches = 65536
net.ipv4.conf.default.promote_secondaries = 1
net.ipv4.conf.all.promote_secondaries = 1
kernel.core_pattern = /export/home/service/log/core.%e.%s.%t.jp

Enabling syn flood protection
Disabling IP forwarding

Activating remaining swap-devices in /etc/fstab...
fuse init (API version 7.9)
Loading fuse module
Mounting fuse control filesystem
Creating /var/log/boot.log
Mounting securityfs on /sys/kernel/security
Loading AppArmor profiles

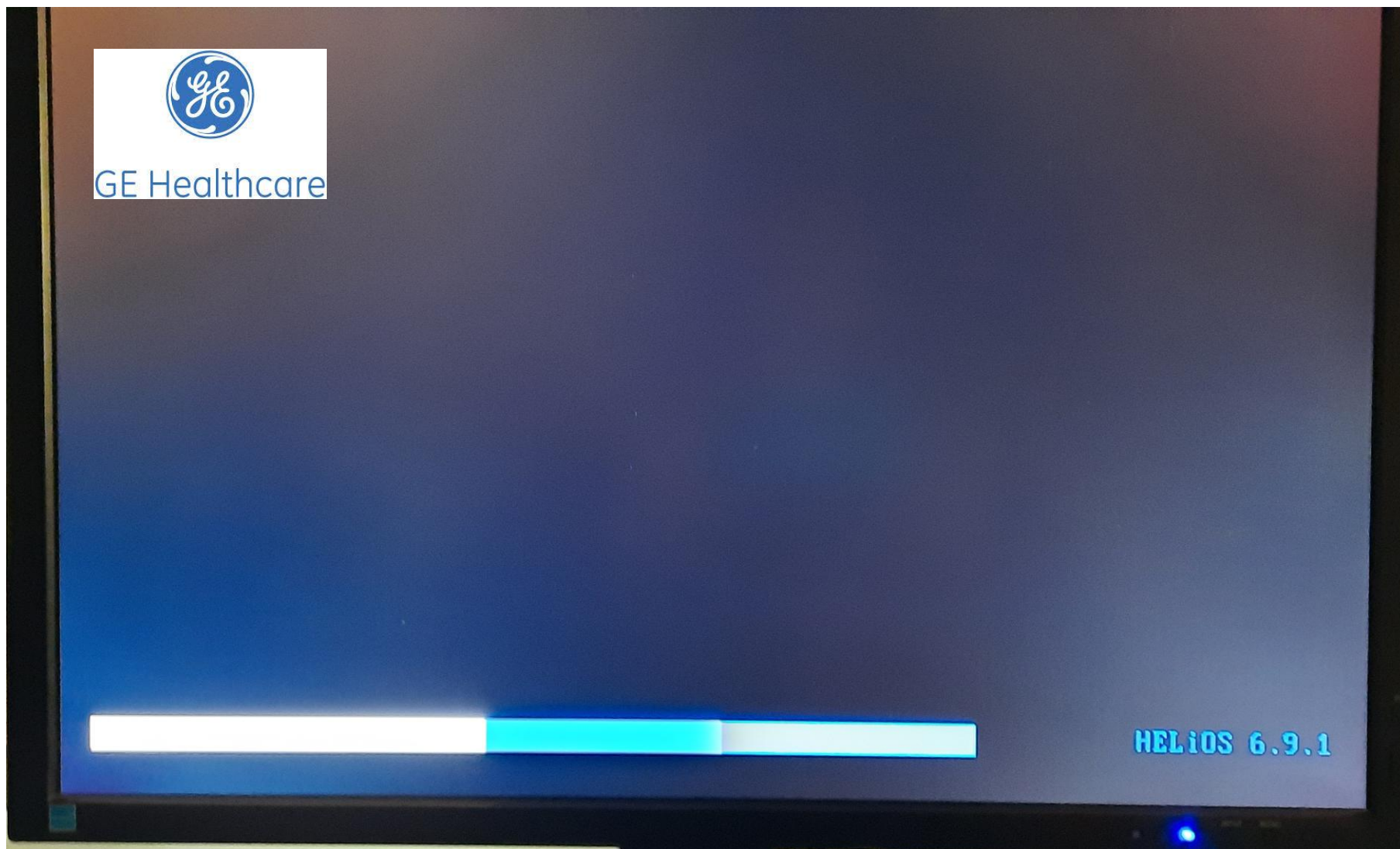
Setting up hostname 'lx-rp'
Setting up loopback interface lo
lo IP address: 127.0.0.1/8
lo IP address: 127.0.0.2/8

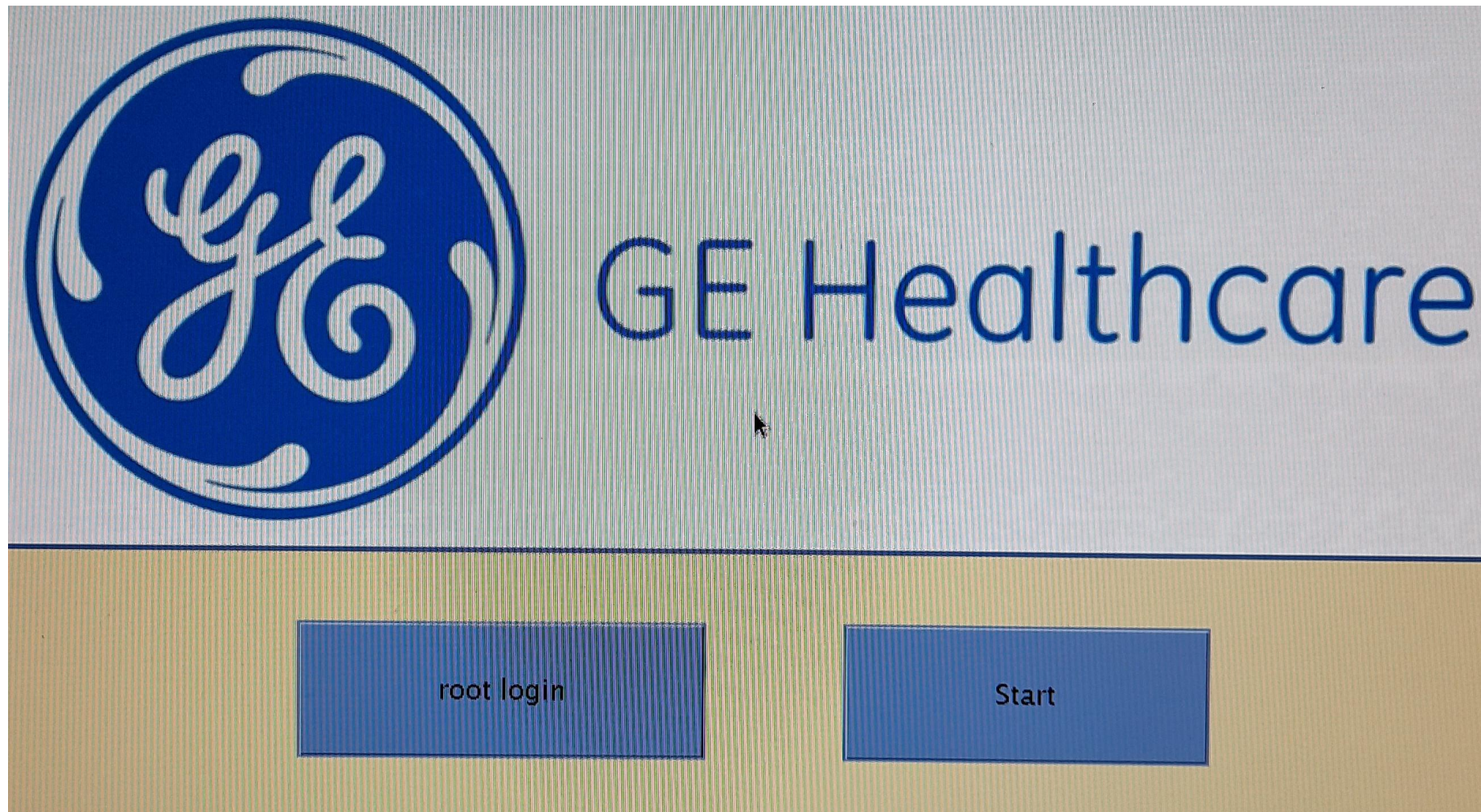
Starting lxcconfig
System Boot Control: The system has been
Skipped features:
System Boot Control: Running /etc/init.d/boot.local
INIT: Entering runlevel: 5
Boot logging started on /dev/tty1(/dev/console) at Tue Jan 19 07:01:59 2016
Master Resource Control: previous runlevel: N, switching to runlevel:
acpid: starting up

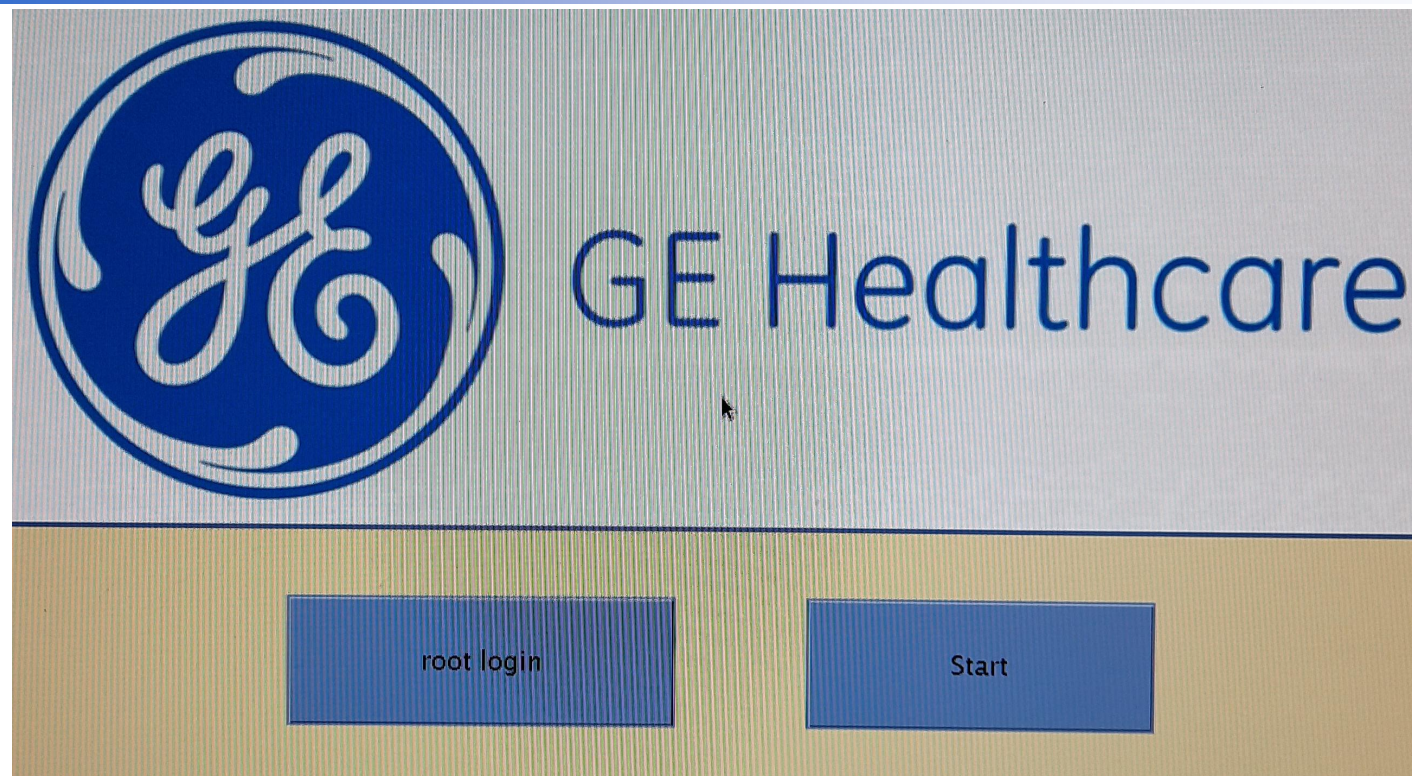
Starting acpid
Initializing random number generator
acpid: 2 rules loaded

Starting sprogUSB
Checking/Updating CPU microcode
Starting syslog services
Starting D-Bus daemon
Starting timeZoneStartupScript
Loading CPUFreq modules
Starting INIL daemon_
    
```

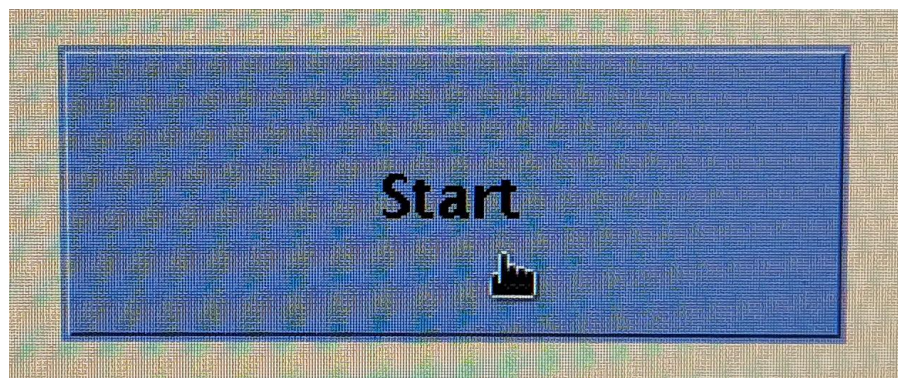








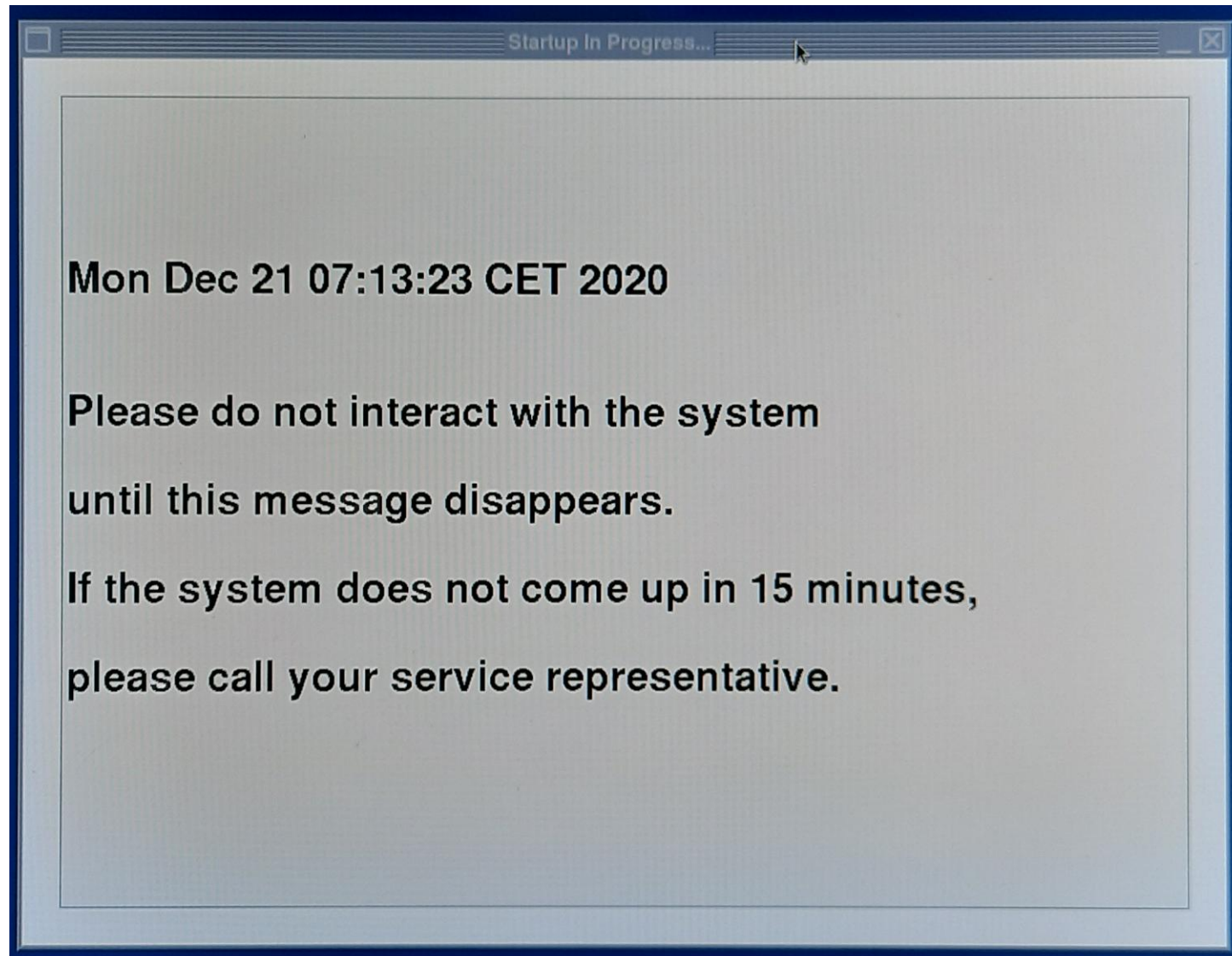
Fare clic su
«start»...

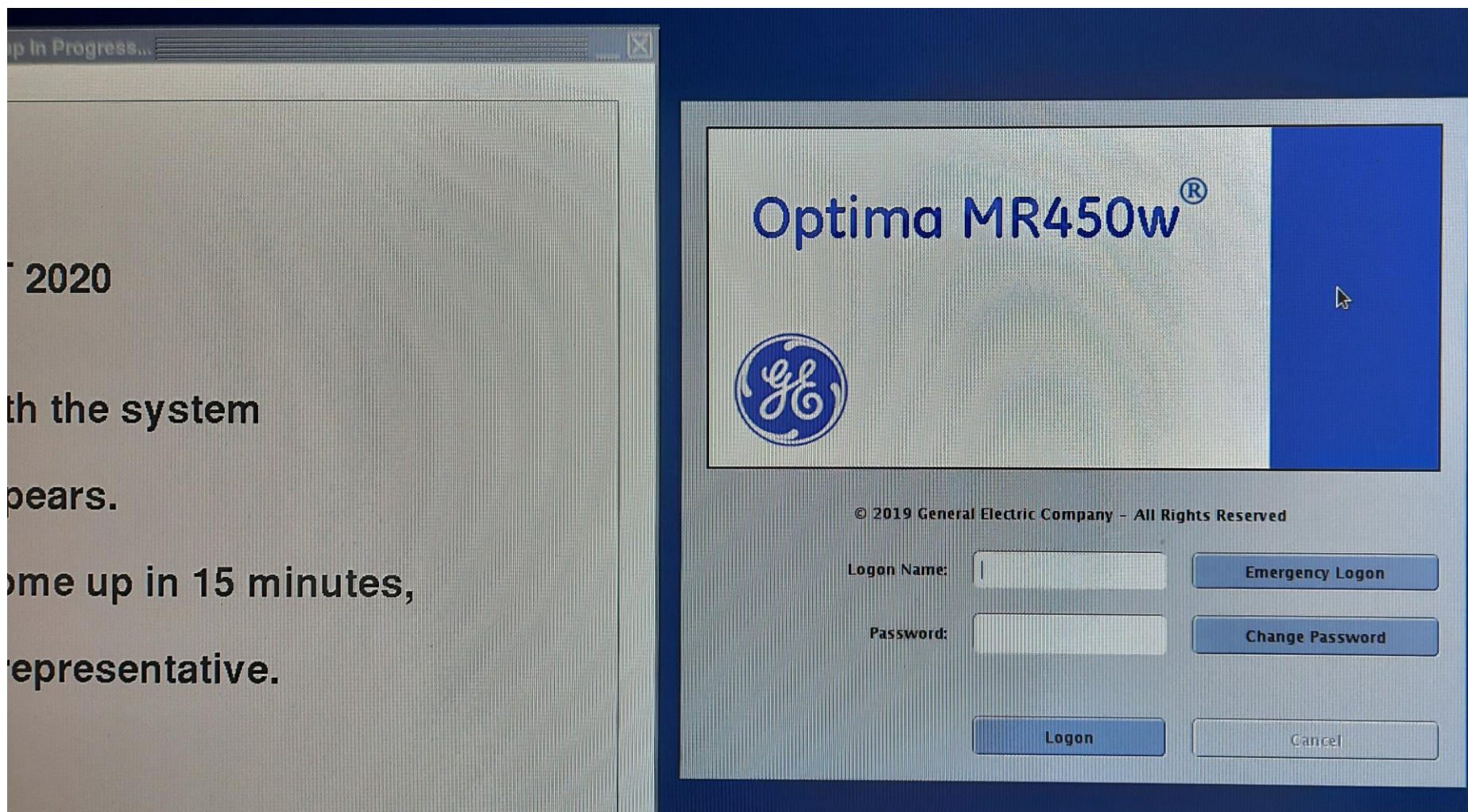


Aspettare
che
scompaia
questo
messaggio..



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Spostare la schermata a sin per potere accedere alla schermata di login ...



Optima MR450w[®]

© 2019 General Electric Company - All Rights Reserved

Logon Name:

Password:

Emergency Logon

Change Password

Logon

Cancel

Inserire login
e password...



SIGNA™ Premier

© 2020 General Electric Company - All Rights Reserved

Logon Name:

Password: **Change Password**

Logon **Cancel**



Inserire login
e password...

© 2019 General Electric Company - All Rights Reserved

Logon Name:

Password:

Emergency Logon

Change Password

Logon

Cancel

E fare clic su
«logon»



GE Healthcare

Welcome to MR System - lx-mr

Username:

Password:

Login Menu▼

Welcome to MR System - lx-mr

Username:

Password:

Login Menu▼

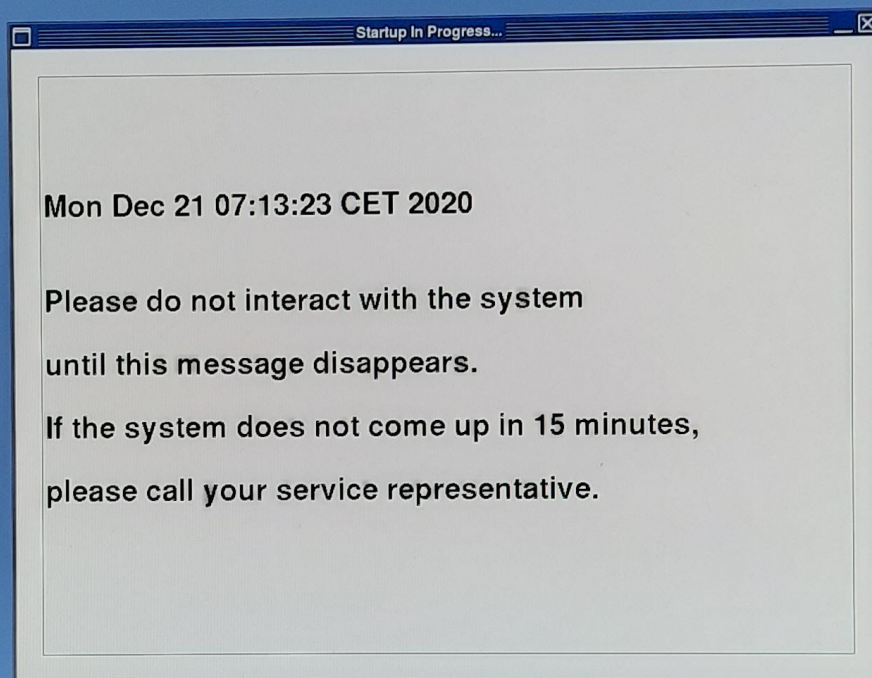
Welcome to MR System - 1x-mr

Username:

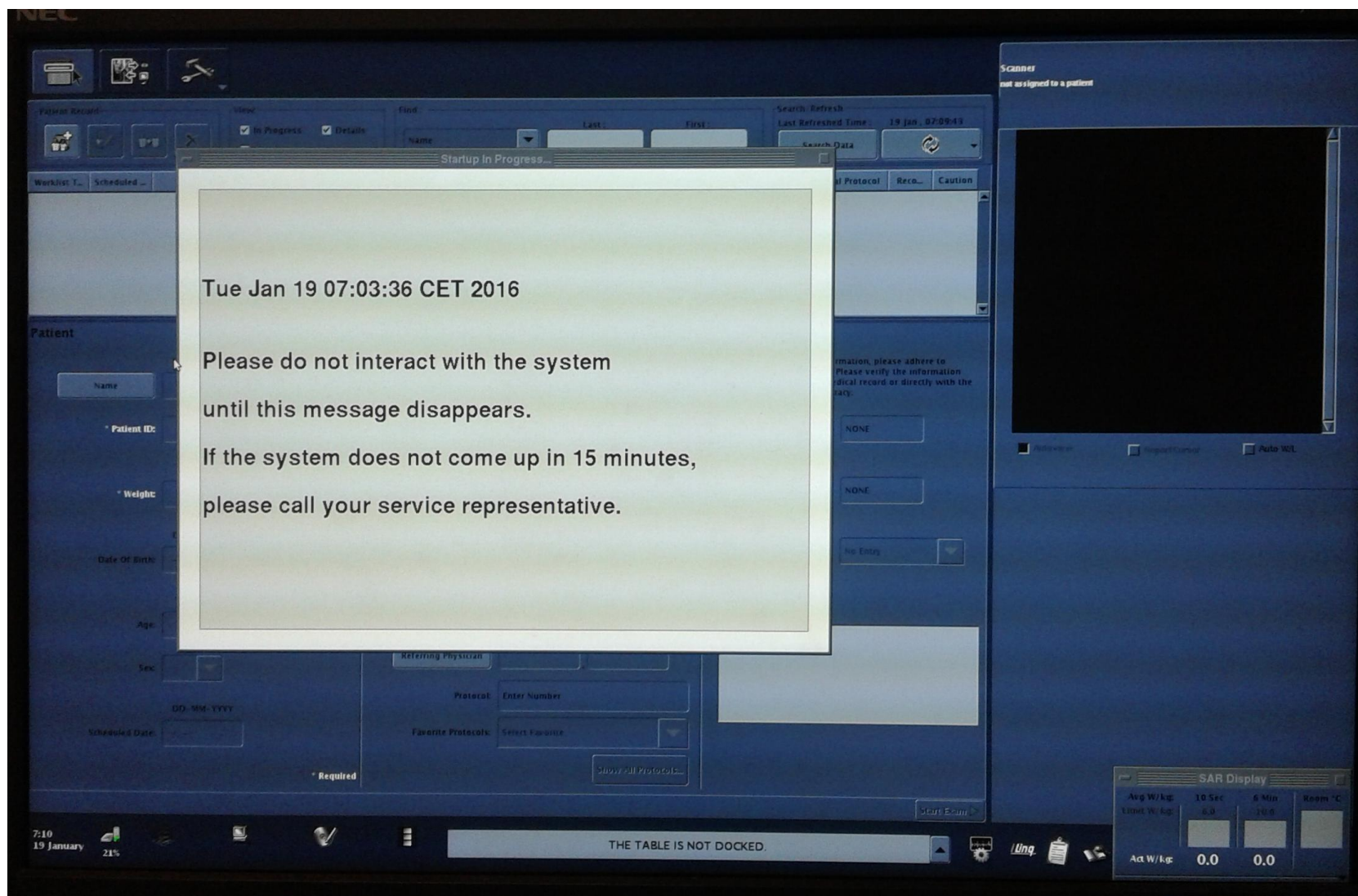
Password:

Login

Menu▼



Aspettare che finisca il processo di avvio...



NEC **MultiSync P240W**

Patient Record

☐ In Progress ☐ Details ☐ Completed

Find:

Name Last First

Search: Refresh

Worklist T...	Scheduled...	Name &	Patient ID	Accession	SPS Description	Moda...	Referring P...	Scheduled...	Status	Local Protocol	Reco...	Cadastre

Patient

Name Last Name First Name

* Patient ID:

Wts Kgs

* Weight:

DD-MM-YYYY

Date Of Birth:

Year Month Weeks Days

Age:

Sex:

DD-MM-YYYY

Scheduled Date:

* Required

Exam

Accession:

Exam Description:

SPS Description:

Procedure ID:

Operator Last Name First Name

Radiologist Last Name First Name

Referring Physician Last Name First Name

Protocol:

Favorite Protocols:

Other Information

This is patient sensitive information, please adhere to patient confidentiality rules. Please verify the information using either the patients medical record or directly with the patient to guarantee its accuracy.

Allergies:

Pre-Med:

Pregnancy Status:

History:

Screen

and multiplex to a patient

☐ Auto-Med

☐ Report/Custom

☐ Auto-Med

SAR Display

Avg W/kg	10 Sec	6 Min	Room °C
Limit W/kg	6.5	10.5	
Act W/kg	0.0	0.0	

7:10 19 January 21%

THE TABLE IS NOT DOCKED.

Patient Record

View:
☒ In Progress ☒ Details
☐ Completed

Find:
 Name: Last: First:
 Search/Refresh:

Search/Refresh
 Last Refreshed Time: 21 Dec, 07:16:31

SPS Description	Schedul...	Worklist...	Name ▲	Patient ID	Accession	Status	Modality	Schedu...	Local Pr...	Referri...	Recom...	Caution

Patient

Last Name

First Name

Name

* Patient ID:

lb

kg

* Weight:

DD-MM-YYYY

Date Of Birth:

year(s)

month(s)

week(s)

day(s)

Age:

Sex:

DD-MM-YYYY

Scheduled Date:

* Required

Exam

Accession:

Exam Description:

SPS Description:

Procedure ID:

Last Name

First Name

Operator

Last Name

First Name

Radiologist

Last Name

First Name

Referring Physician

Protocol:

Enter Number

Favorite Protocols:

Select Favorite

Show All Protocols...

Other Information

This is patient sensitive information, please adhere to patient confidentiality rules. Please verify the information using either the patients medical record or directly with the patient to guarantee its accuracy.

Other Patient ID:

Current Location:

Special Needs:

Requested Contrast Agent:

Allergies:

NONE

Pre-Med:

NONE

Pregnancy Status:

No Entry

History:

Start Exam

Scanner

not assigned to a patient

☒ Full view ☐ Report Cursor ☐ Auto W/L

SAR Display

Avg W/kg	10 Sec	6 Min	Room °C
Limit W/kg:	6.0	10.0	
Act W/kg:	0.0	0.0	18.0

7:18

21 December

47%

THE TABLE IS NOT AT SCANNING HEIGHT.

The screenshots illustrate the GE MRI console interface during a scan:

- 1. Patient Setup:** Displays patient information (Doe Jane, ID 1234567, DOB 11-12-2000), weight (123 lbs.), and position. A diagram shows the patient on the table with a green line indicating the scan area.
- 2. Monitoring:** Shows real-time waveforms (ECG, Respiration, etc.) and vital signs (80, 80, 80, 15).
- 3. Timing:** Displays the current time (01:47) and the remaining time (12 mm).
- 4. Coil Selection:** Shows the selected coils: Flex Large 16ch (Port 1) and Spine Posterior 60ch (Port E). It also includes a Port Compatibility Key and a Notes section.
- 5. Fan/Light Control:** Provides controls for the fan and light, including a fan speed slider and a light intensity slider.

MR Systems Ingenia

Ingenia (2017-09-19)

 0344

Philips Medical Systems Nederland B.V.
Veenpluis 4-6, 5684 PC Best, The Netherlands.

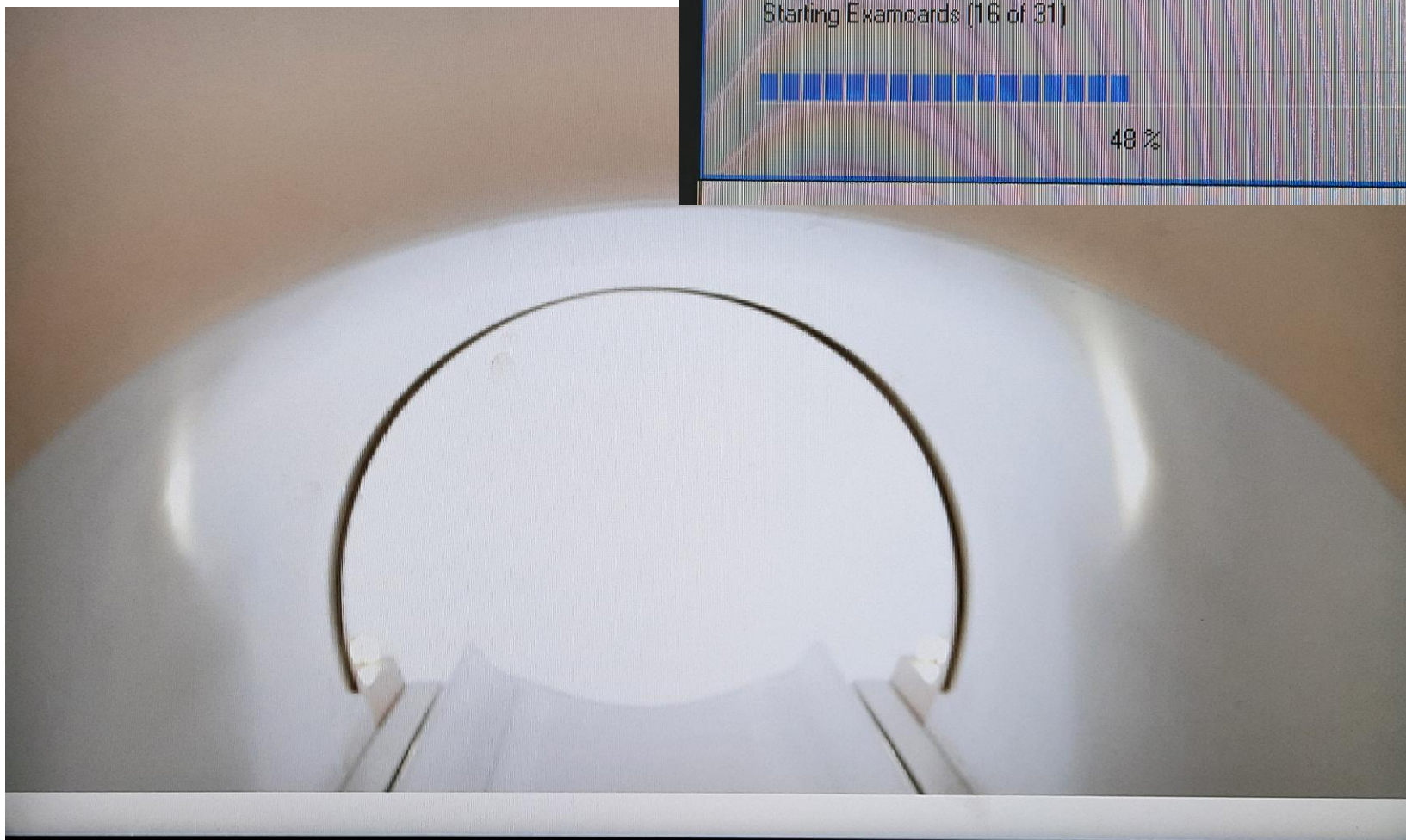
Logon

Name

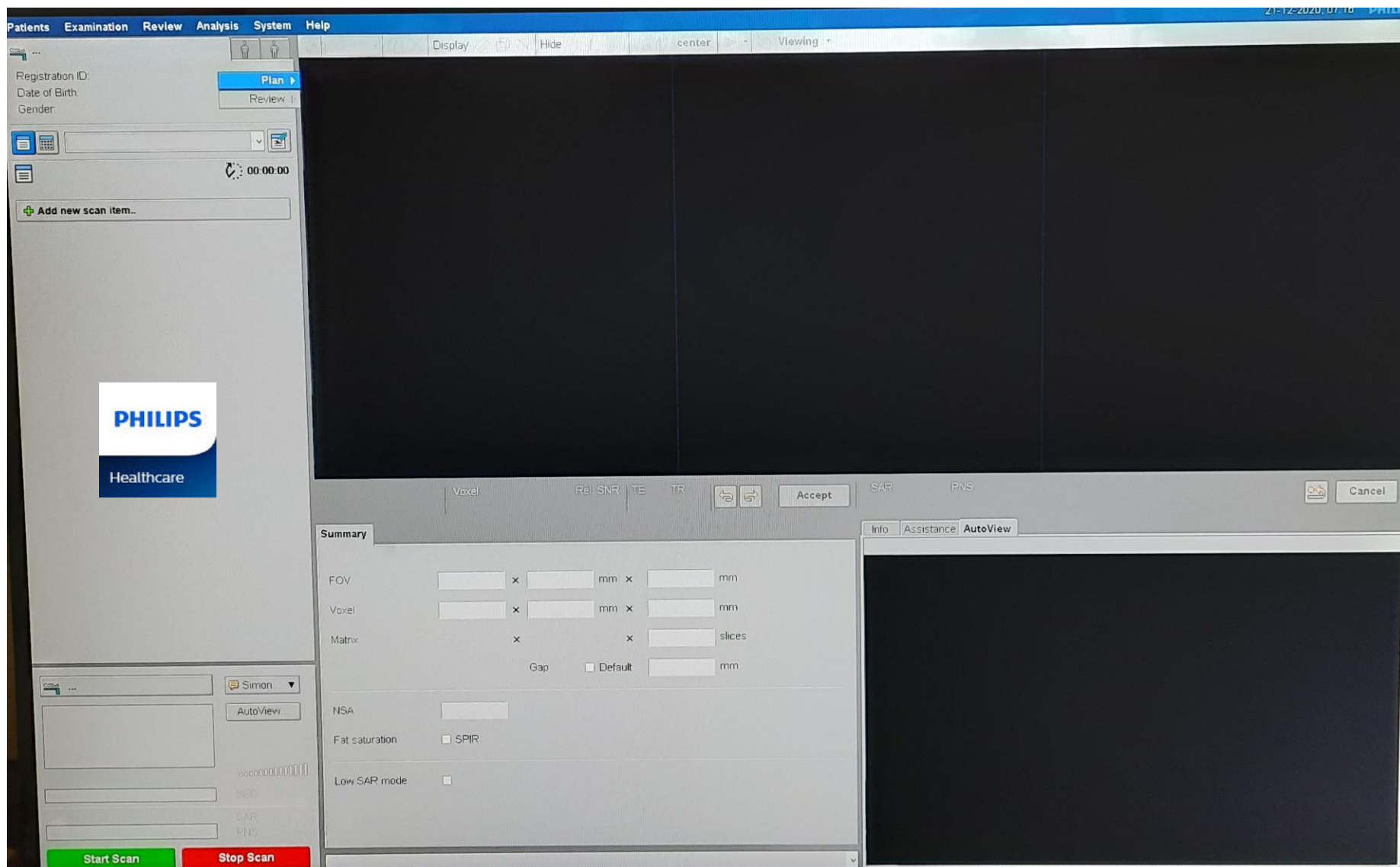
Password

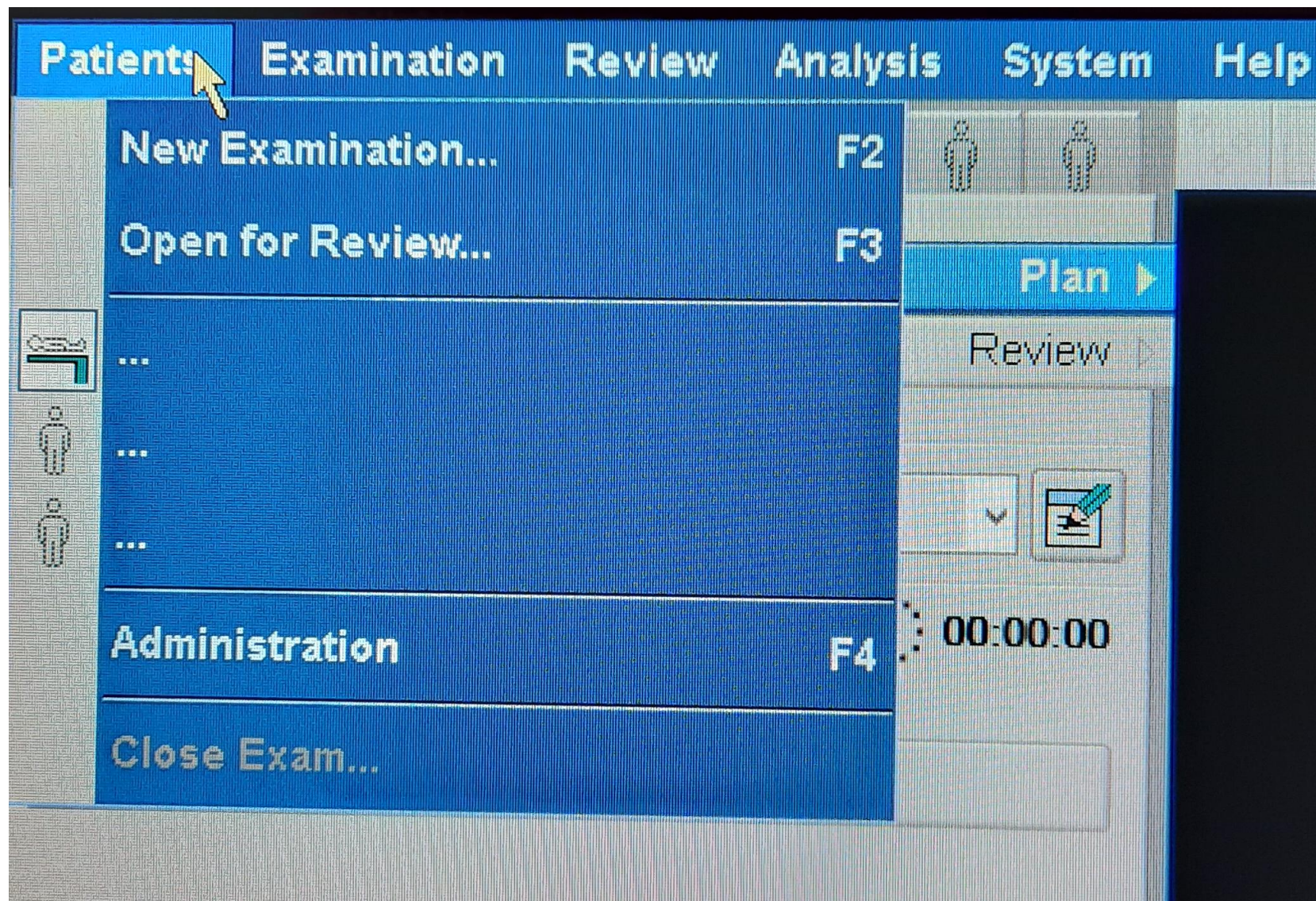
PHILIPS

Healthcare



PHILIPS
Healthcare





PHILIPS

Healthcare

New Examination

Patient

Patient name: *

Registration ID: *

Date of birth: * dd-mm-yyyy

Age:

Gender: *

Patient weight: * kg

Examination

Exam name:

Accession number:

Examination date: 21-12-2020

Referring Physician:

Performing Physician:

Study Comments:

Allowed SAR mode:

Patient conditions

Pregnant: *

Implant: *

Medical alerts:

Allergies:

Start Date	Start TI...	Patient Name	Registration ID	Accession N...	Date Of Bl...	Gender	Procedure Step
No exams scheduled.							

PHILIPS

Healthcare



fenix
the healthcare solution by elco

Autenticazione

Utente

Password

Cambio Pwd **Login**

FenoX

Worklist

Worklist Paz. Cognome, Nome e Data Paz. Codice Fiscale Ricerca Esami

CDC: UCRIS,ALPI,PET-TAC,GMC

Sala: RM2

Metodica: ANG,BIOPSIE,DENS,ECO,GEN,GINE,INTERV,PET-TAC/MEDNUC,RM,RX,SEN,TC

Stato: Inviata,Prenotato,Accettato,Inizio Esecuzione

UDC: ESTERNO,INTERNO,LIBERA PROFESSIONE,ALTRI

Medico: Tutti

Da Data: 21/12/2020

A Data: [REDACTED]

Tipo Ricovero: SCONOSCIUTO,RICOVERO ORDINARIO IN CORSO,RICOVERO ORDINARIO IN LISTA,RICOVERO

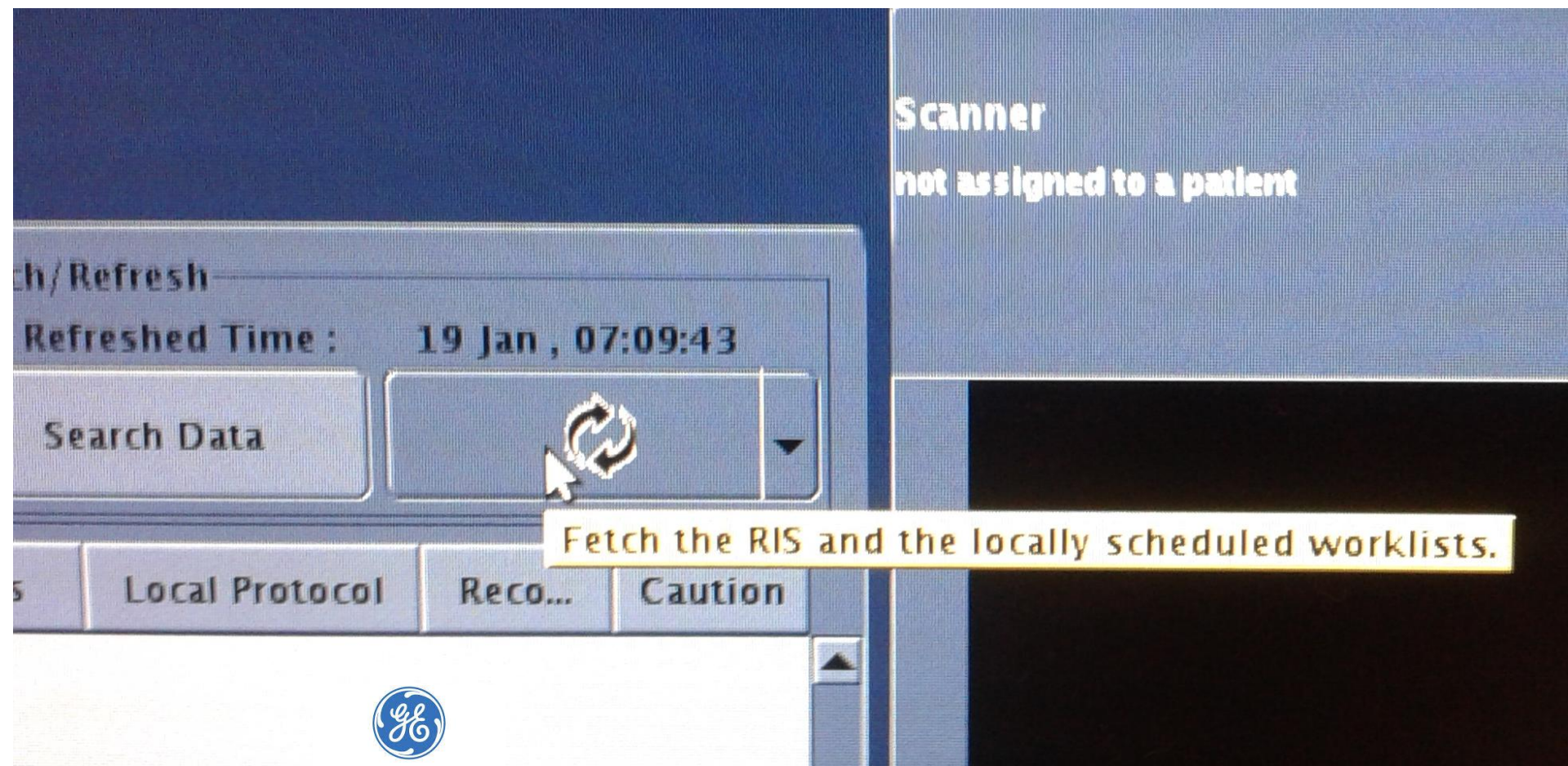
Urgenze: Tutte

Applica

N.	Ricovero	S. R.	Urg	Info	C. S.	Paziente	Stato Esame	Sala	Data Ora Esame	Descrizione Esame	ID Esame	UDC	ULD	CDC
1	+			A			Prenotato	RM2	21/12/2020 08:00	RM ENCEFALO (S/C MDC) IN ANESTESIA		NEUROPSICHIATRIA INFANTILE	03M PIANO 3 - ALA M	UCRIS
2	+			A			Prenotato	RM2	21/12/2020 08:00	RM ENCEFALO IN ANESTESIA		PEDIATRIA	05M PIANO 5 - ALA M	UCRIS
3	+			A			Prenotato	RM2	21/12/2020 08:00	RM ENCEFALO (S/C MDC) IN ANESTESIA		NEUROPSICHIATRIA INFANTILE	03M PIANO 3 - ALA M	UCRIS
4	+			E			Inizio Esecuzione	RM2	21/12/2020 08:30	RM ENCEFALO (S/C MDC) IN ANESTESIA		MALATTIE INFETTIVE	04U PIANO 4 - ALA U	UCRIS
5	+			A			Prenotato	RM2	21/12/2020 10:00	RM ENCEFALO (S/C MDC) IN ANESTESIA		CENTRO CLINICO NEMO ADULTI	04M PIANO 4 - ALA M	UCRIS
6	+			A			Prenotato	RM2	21/12/2020 12:00	RM ENCEFALO IN ANESTESIA		CARDIOLOGIA INTENSIVA	08C PIANO 8 - ALA C	UCRIS
7	+			A			Prenotato	RM2	21/12/2020 14:00	RM CUORE (S/C MDC)		CARDIOLOGIA INTENSIVA	08C PIANO 8 - ALA C	UCRIS
8	+			A			Prenotato	RM2	21/12/2020 14:00	RM CUORE (S/C MDC)		CARDIOLOGIA INTENSIVA	08C PIANO 8 - ALA C	UCRIS
9	+			A			Prenotato	RM2	21/12/2020 15:00	RM CUORE (S/C MDC)		GERIATRIA	08M	UCRIS
10	+			A			Prenotato	RM2	21/12/2020 16:00	RM GINOCCHIO SN (S/C MDC)		RADIOLOGIA (RADIOLOGIA)	RADIOLOGIA (RADIOLOGIA)	UCRIS

☒	Inviata	☒	Prenotato	☒	Accettato
☒	Inizio Esecuzione	☐	Fine Esecuzione	☐	Refertato
☐	Sospeso	☐	Validazione pesante	☐	Validazione Referto Annullato
☐	Non erogato				

☐	URGENZE PS	☐	SALA ORTOP 7P	☒	RM2
☐	URGENZE DEA	☐	20 BIS	☐	41
☐	DEA RX	☐	08	☐	11
☐	URGENZE DEA REP	☐	16	☐	DIAGSEN
☐	DEA TC 1	☐	02	☐	RADSEN1
☐	DEA TC 2	☐	03	☐	RADSEN2
☐	DEA ROSSA	☐	04	☐	RADSENM
☐	DEA RM	☐	05	☐	ECO ALPI
☐	SALAOP RAD 2P	☐	06	☐	MAMMO ALPI
☐	ANGIO01 (SIEMENS)	☐	07	☐	RM ALPI
☐	ANGIO02 (PHILIPS)	☐	24	☐	TC ALPI
☐	RX TORACE 1	☐	24 BIS	☐	GMC-ECO
☐	14	☐	28	☐	GMC-MAMMO
☐	17	☐	29	☐	GMC-RM
☐	18	☐	38	☐	GMC-TC
☐	19	☐	RM1	☐	SPORTELLLO
☐	PET_TAC1	☐	PET_TAC2	☐	PET_TAC3
☐	PET-TC BIOGRAPH	☐	PET-TC DUAL	☐	PET-TC GXL
☐	PET-TC VISION				



GE Healthcare



08:00:00 [Name] [Patient ID] [Accession] RM cranio con MDC in anestesia MR 19-01-2016

Patient

Last Name: FONTANA First Name: GIOELE

* Patient ID: 28973899

Lbs: Kgs:

* Weight:

DD-MM-YYYY

Date Of Birth: 11-04-2013

Year: Month: Weeks: Days:

Age: 2

Sex: M

DD-MM-YYYY

Scheduled Date: 19-01-2016

* Required

Exam

Accession: IU116GG3DXCX

Exam Description: RM cranio con MI

SPS Description: RM cranio con MI

Procedure ID: REQ2016001752

Operator: Last Name: First Name:

Radiologist: Last Name: First Name:

Referring Physician: Last Name: First Name:

Protocol: Enter Number

Favorite Protocols: Select Favorite

Show All Protocols...

Other Information

This is patient sensitive information, please adhere to patient confidentiality rules. Please verify the information using either the patients medical record or directly with the patient to guarantee its accuracy.

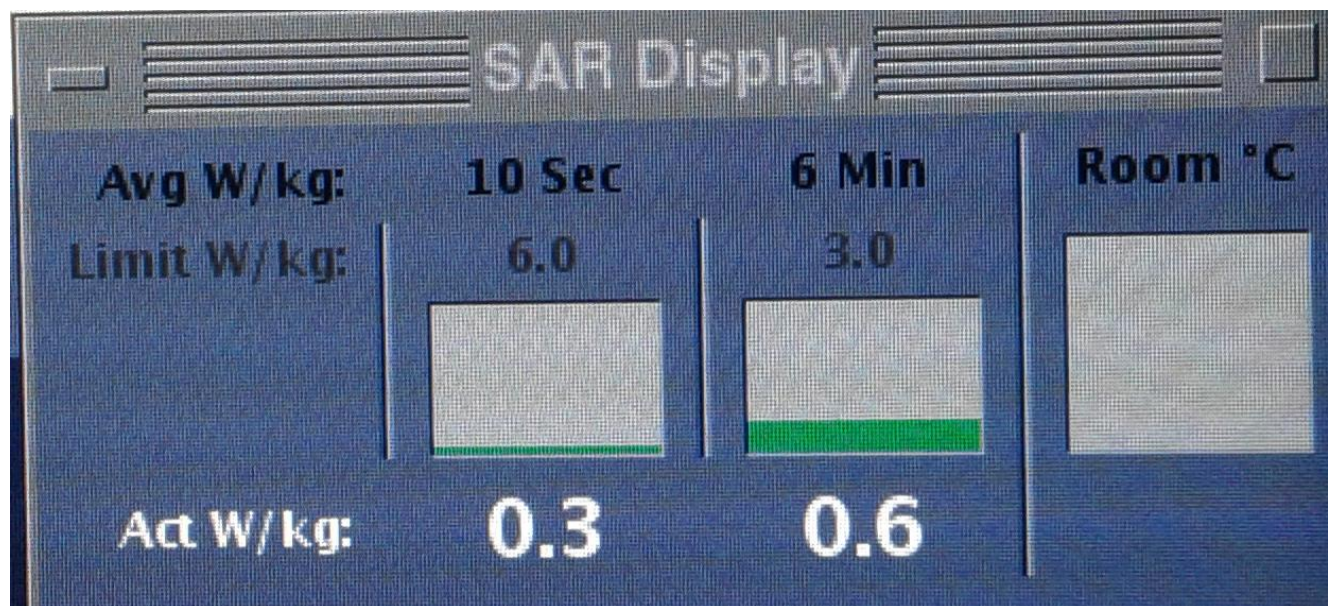
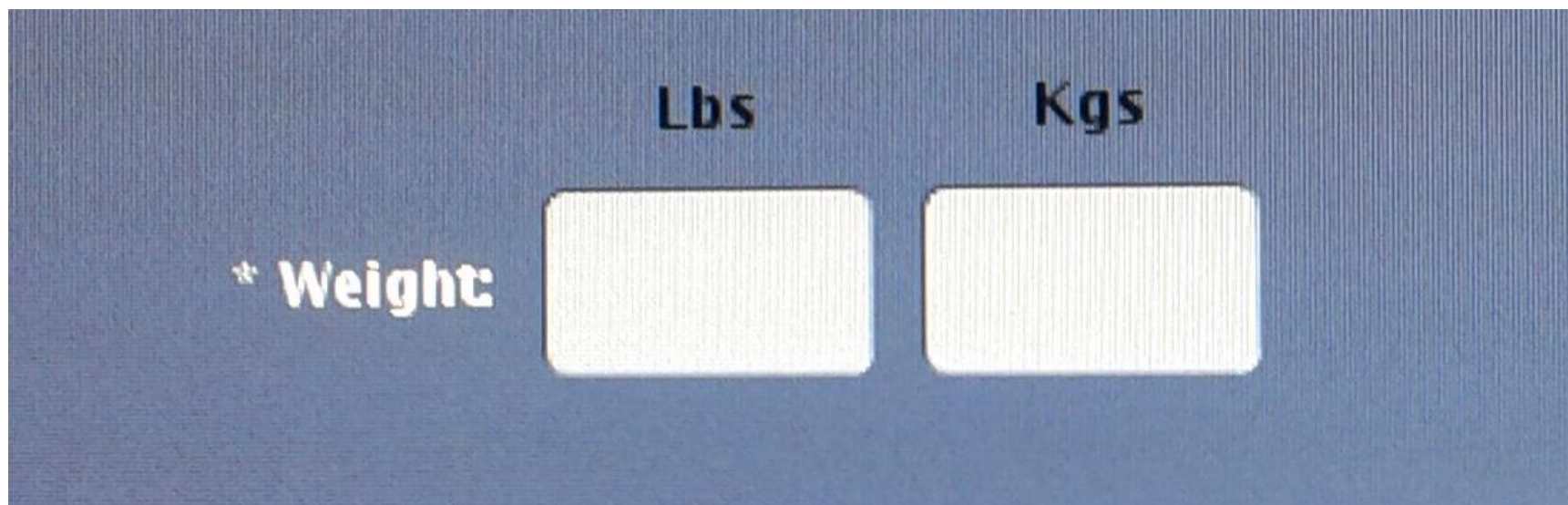
Allergies: NONE

Pre-Med: NONE

Pregnancy Status: No Entry

History:

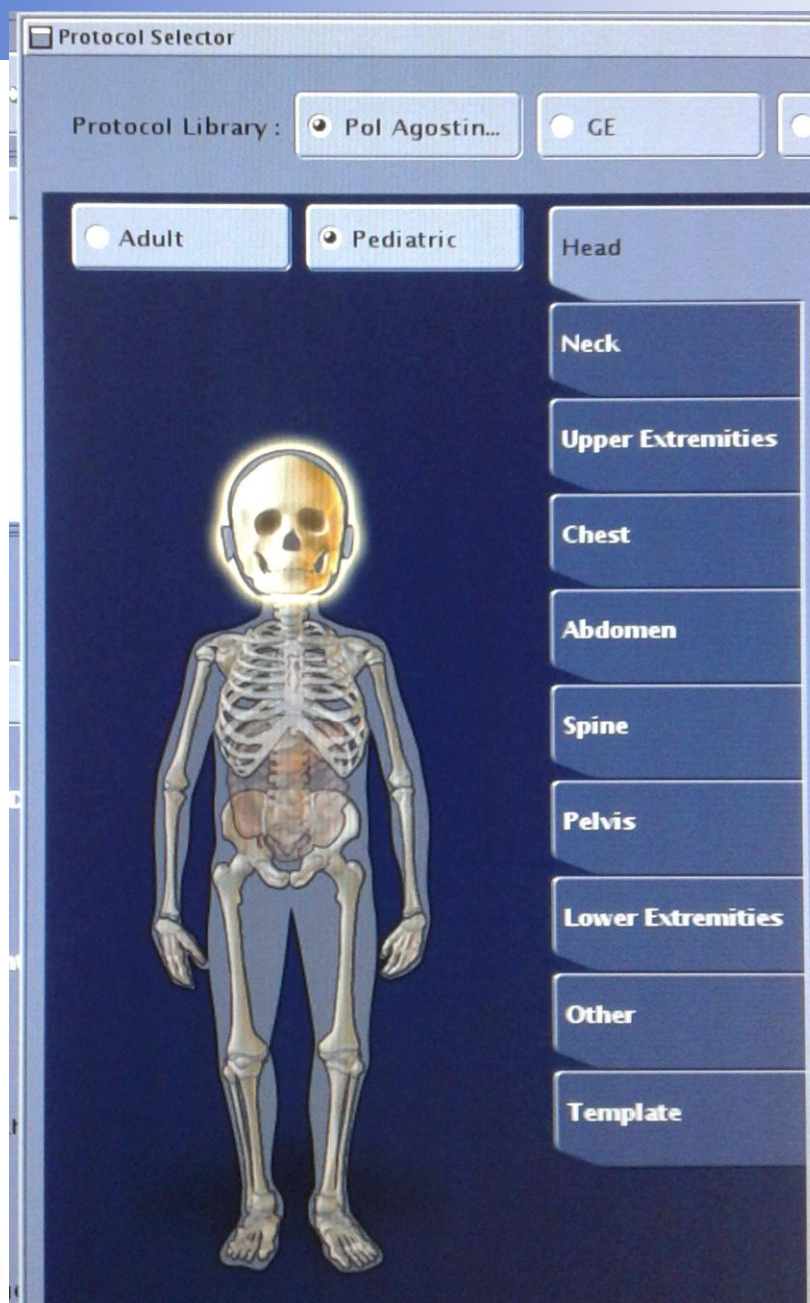
Start Exam



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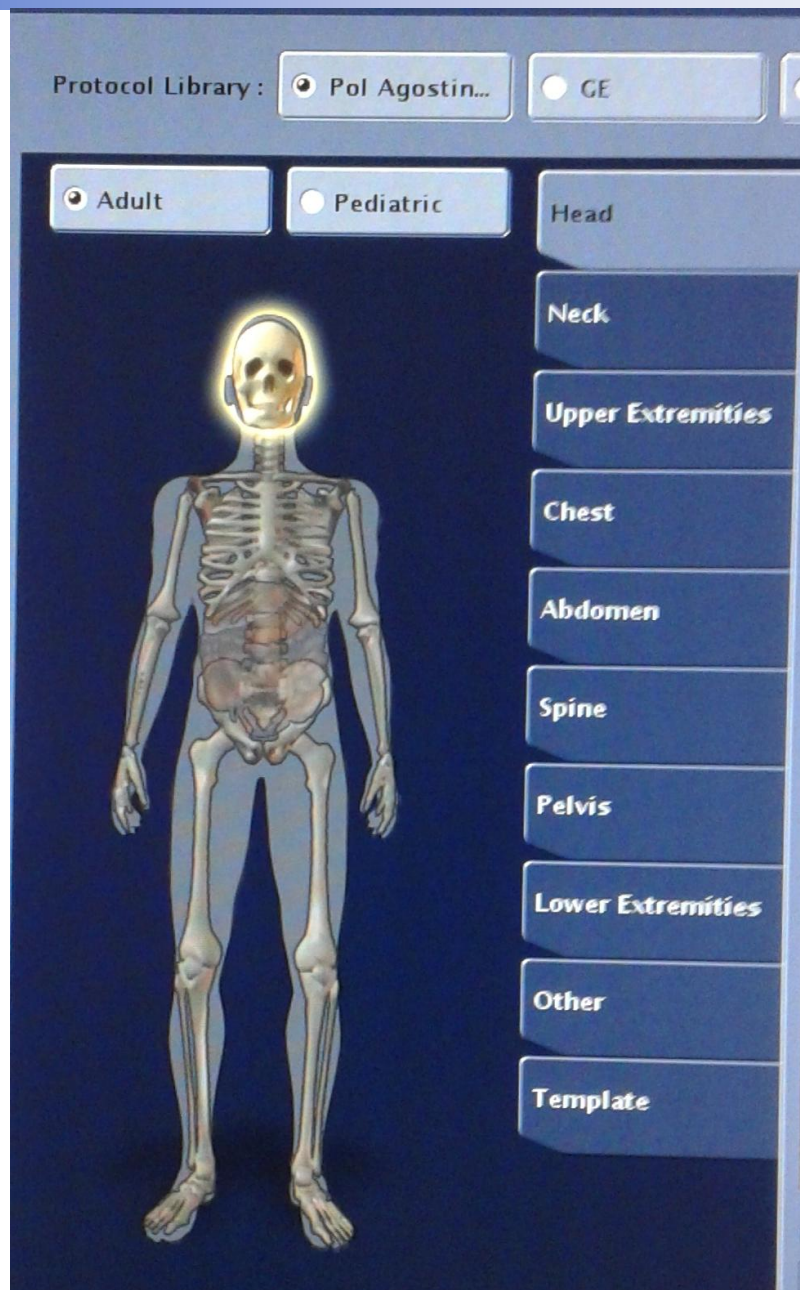
Radiologist	Last Name	First Name
Referring Physician	Last Name	First Name
Protocol:	Enter Number	
Favorite Protocols:	Select Favorite	
	Show All Protocols...	

History:



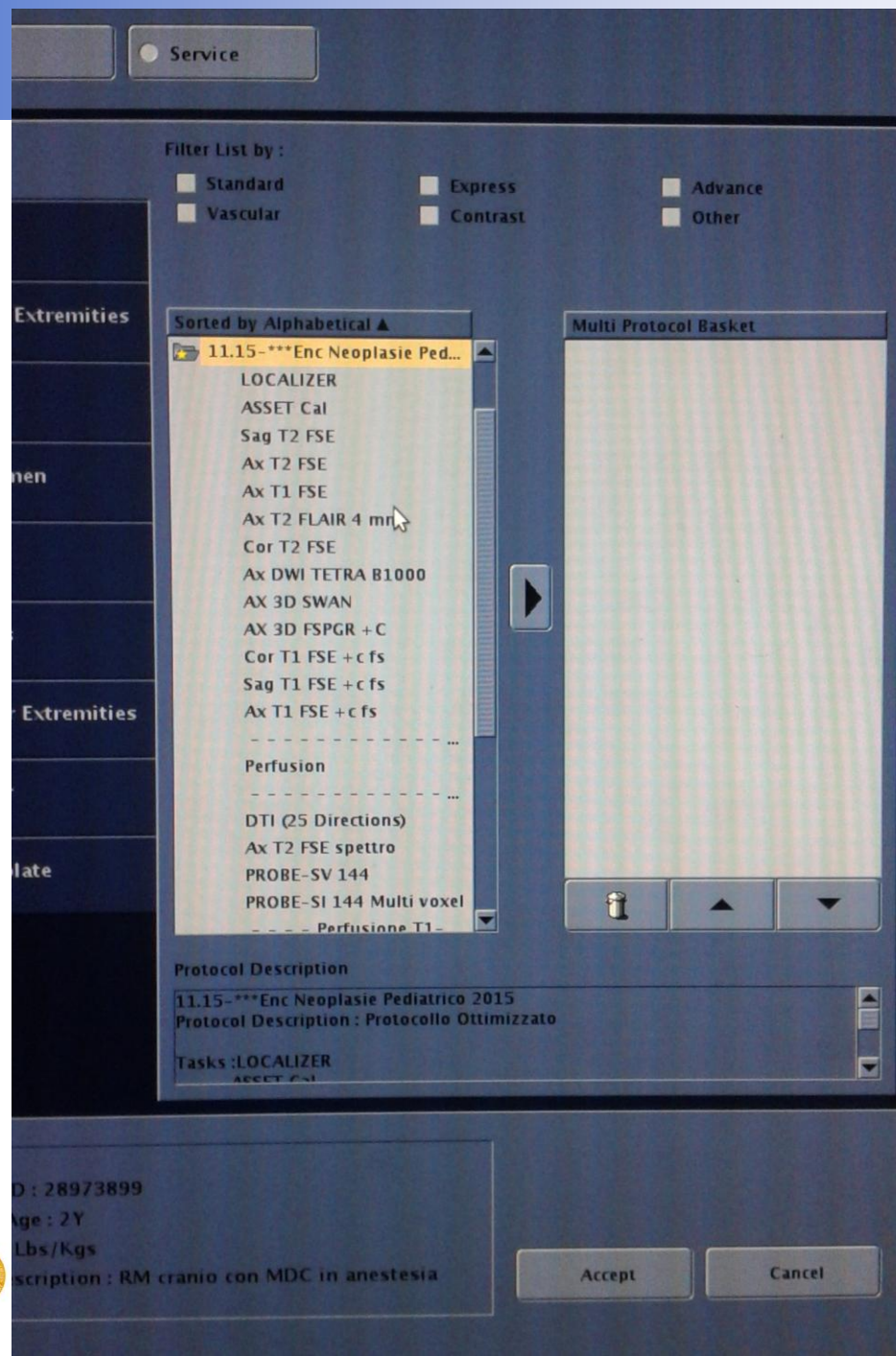


GE Healthcare





GE Healthcare



Exam dB/dt and SAR Limits

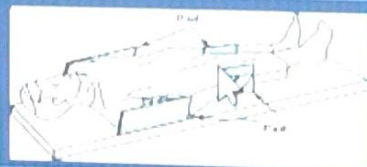
Select the desired Operating Mode:

dB/dt:	SAR:
☐ Normal dB/dt	☐ Normal SAR
☒ First Level dB/dt	☒ First Level SAR

Entering First Level for dB/dt.
Operator/Physician confirms awareness of potential risks and accepts the responsibility.

Entering First Level for SAR.
Operator/Physician confirms awareness of potential risks and accepts the responsibility.

Follow proper patient padding and positioning instructions to prevent patient warming.



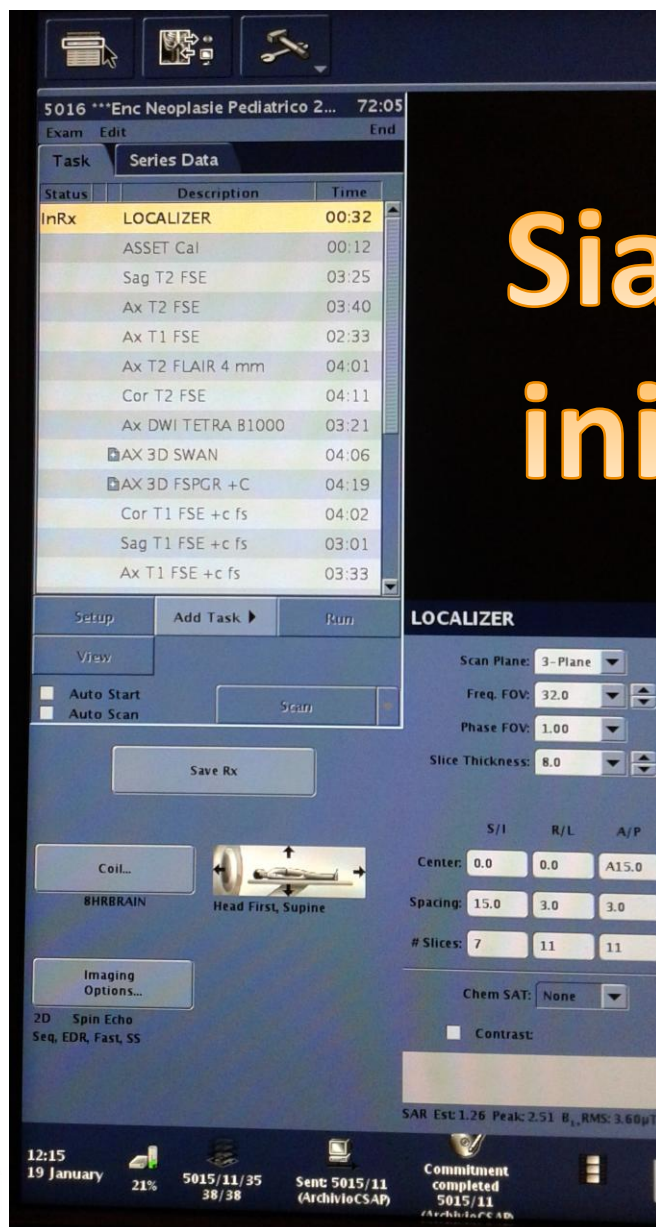
Accept Normal Mode



GE Healthcare

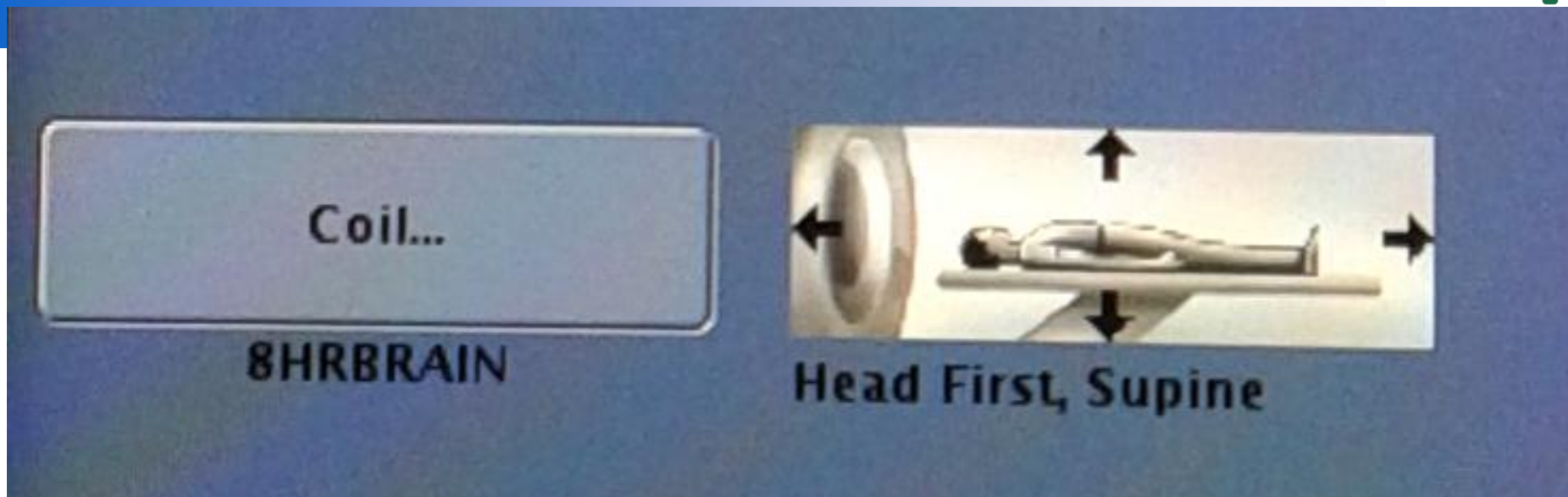


GE Healthcare



Siamo pronti ad iniziare l'esame

...



Facciamo sempre
attenzione alla corretta
impostazione della
posizione del Paziente...



GE Healthcare

ExamCard Properties

General

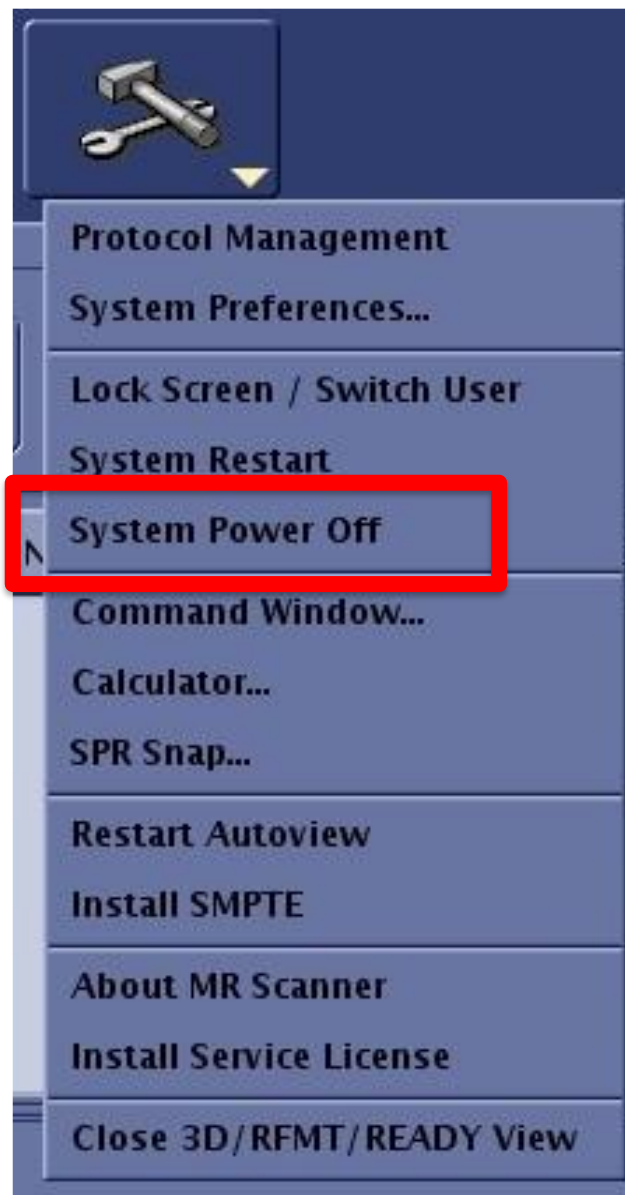
Push Nodes

Patient Position	Supine
Patient Orientation	Head First
Laterality:	Unpaired
Anatomy:	Head
Anatomic Region:	Brain
Table Usage	Use
Heart Rate (beats/min)	60
Align Overlap (mm)	30
GeoLink Propagation	No
Geometries	AXX
Disengage posterior coil	No

PHILIPS

Healthcare

Per il controllo del livello dell'Elio ... cfr. lezione n.5 MRI – Magnete e componenti



When prompted, click on the reason for the system shutdown: ***Daily, Service, Other*** or ***Cancel*** to exit the shutdown of your system.

Se è stato premuto il pulsante di emergenza ...

ACCENSIONE E SPEGNIMENTO

SIGNA™ Premier: procedura di ripristino da arresto di emergenza

Utilizzare questa procedura per ripristinare il normale funzionamento del sistema, in seguito a un arresto di emergenza. Per i dettagli sull'arresto di emergenza, vedere **Procedura di arresto di emergenza**.

1. Recarsi nella sala apparecchiature e individuare l'armadio ISC.
 - Generalmente solo i tecnici dell'assistenza utilizzano la sala apparecchiature per effettuare l'assistenza delle apparecchiature. Prestare attenzione all'interno della sala apparecchiature.
 -  **NON** aprire nessun armadio o protezione del sistema MRI GE. Negli armadi sono presenti tensioni elevate.
2. Dall'armadio ISC, premere il pulsante verde **EMO Reset** (Ripristina EMO).

Figura 3-11: Armadio ISC

