

# CT Chest Veran (Navigational)

Updated 05/01/24

Reviewed 05/14/25

Indications - pre navigational biopsy of a lung nodule, mass, lesion or opacity and should be ordered as Veran protocol by Pulmonology.

Use CT Chest without Contrast charge.

## GENERAL SCAN NOTES

Remove any metal from the imaging field of view.

Have patient lift chin up.

Have the patient cough a few times to clear secretions. This reduces incidence of small lung nodules.

Topogram - lung apices through diaphragm (obtained during end inspiration).

Craniocaudal scan coverage - lung apices through adrenal glands on both phases (obtained during end inspiration).

Use smallest FOV without cropping anatomy or excluding vPad. Use the same FOV for both scans.

The vPad tracker should be clearly visible in the FOV.

The patients arms are over his/her head for the end inspiratory phase.

The patients arms are by his/her side for the end expiratory phase.

IV Contrast: not given for this protocol.

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## SIEMENS PARAMETERS & RECONS

For the Supine End Inspiration and Supine End Expiration phases:

|               | Scan Mode | kV  | Eff mAs        | Care Dose  | Care kV & Lvl | Pitch | Acq | Coll | Rot Time | Scan Time |
|---------------|-----------|-----|----------------|------------|---------------|-------|-----|------|----------|-----------|
| Sensation 16  | spiral    | 120 | <b>100/150</b> | <b>off</b> | NA            | 1.00  | 16  | 0.75 | 0.5      | 12.5      |
| Go Up 32      | spiral    | 120 | <b>100/150</b> | <b>off</b> | <b>off</b>    | 1.00  | 32  | 0.6  | 0.5      | 7.8       |
| Sensation 64  | spiral    | 120 | <b>105/160</b> | <b>off</b> | NA            | 1.00  | 64  | 0.6  | 0.5      | 7.8       |
| Definition 64 | spiral    | 120 | <b>105/160</b> | <b>off</b> | <b>off</b>    | 1.00  | 64  | 0.6  | 0.5      | 7.8       |
| Go Top 64     | spiral    | 120 | <b>105/160</b> | <b>off</b> | <b>off</b>    | 1.00  | 64  | 0.6  | 0.5      | 3.9       |
| Drive 128     | spiral    | 120 | <b>110/170</b> | <b>off</b> | <b>off</b>    | 1.00  | 128 | 0.6  | 0.5      | 3.9       |
| Force 192     | spiral    | 120 | <b>110/170</b> | <b>off</b> | <b>off</b>    | 1.00  | 128 | 0.6  | 0.5      | 3.9       |

Use lower mAs for BMI ≤25 or higher mAs for BMI >25.

| Name of Series  | Thick       | Interval   | Kernel             | Window             | IR Lvl      | Recon Direction  |
|-----------------|-------------|------------|--------------------|--------------------|-------------|------------------|
| AX LUNG         | 3.0         | 3.0        | Br57 / B70f        | lung               | none        | head/feet        |
| AX SOFT         | 3.0         | 3.0        | Br40 / B41f        | mediastinum        | none        | head/feet        |
| COR SOFT        | 3.0         | 3.0        | Br40 / B41f        | mediastinum        | none        | front/back       |
| SAG SOFT        | 3.0         | 3.0        | Br40 / B41f        | mediastinum        | none        | left/right       |
| <b>TLC INSP</b> | <b>0.75</b> | <b>0.5</b> | <b>Qr36 / B35f</b> | <b>mediastinum</b> | <b>none</b> | <b>head/feet</b> |
| AX MIPS         | 8.0         | 3.0        | Br40 / B41f        | lung               | none        | head/feet        |

**Veran specific recon.**

|                |             |            |                    |                    |             |                  |
|----------------|-------------|------------|--------------------|--------------------|-------------|------------------|
| <b>TLC EXP</b> | <b>0.75</b> | <b>0.5</b> | <b>Qr36 / B35f</b> | <b>mediastinum</b> | <b>none</b> | <b>head/feet</b> |
|----------------|-------------|------------|--------------------|--------------------|-------------|------------------|

**Veran specific recon.**

# CT Chest Veran (Navigational)

## GE PARAMETERS & RECONS

For the Supine End Inspiration and Supine End Expiration phases:

|             | Scan Type | SFOV       | kV  | Manual mA      | Smart mA | Slice Thick | Beam Coll | Pitch | Speed | Rot Time | Dose Red | ASIR | Scan Time |
|-------------|-----------|------------|-----|----------------|----------|-------------|-----------|-------|-------|----------|----------|------|-----------|
| LS 16       | helical   | large      | 120 | <b>180/270</b> | off      | 0.625       | 10        | 1.375 | 13.75 | 0.5      | NA       | NA   | 10.9      |
| Opt 540     | helical   | large      | 120 | <b>180/270</b> | off      | 0.625       | 10        | 1.375 | 13.75 | 0.5      | NA       | NA   | 10.9      |
| LS VCT 64   | helical   | large body | 120 | <b>180/270</b> | off      | 0.625       | 40        | 0.984 | 39.37 | 0.5      | off      | none | 3.8       |
| Disc VCT 64 | helical   | large body | 120 | <b>180/270</b> | off      | 0.625       | 40        | 0.984 | 39.37 | 0.5      | NA       | NA   | 3.8       |

Use 180 mAs for BMI  $\leq 25$  or 270 mAs for BMI  $> 25$ .

| Name of Series  | Thickness    | Interval   | Recon Algorithm | Window Width/Level | Recon Direction  |
|-----------------|--------------|------------|-----------------|--------------------|------------------|
| <b>TLC INSP</b> | <b>0.625</b> | <b>0.5</b> | <b>std full</b> | <b>400/40</b>      | <b>head/feet</b> |
| AX LUNG         | 2.5          | 2.5        | lung            | 1600/-600          | head/feet        |
| AX SOFT         | 2.5          | 2.5        | std full        | 400/40             | head/feet        |
| COR SOFT        | 2.5          | 2.5        | std full        | 400/40             | front/back       |
| SAG SOFT        | 2.5          | 2.5        | std full        | 400/40             | left/right       |
| AX MIPS         | 8.0          | 3.0        | std full        | 1600/-600          | head/feet        |

**This must be the first recon.  
Veran specific recon.**

|                |              |            |                 |               |                  |
|----------------|--------------|------------|-----------------|---------------|------------------|
| <b>TLC EXP</b> | <b>0.625</b> | <b>0.5</b> | <b>std full</b> | <b>400/40</b> | <b>head/feet</b> |
|----------------|--------------|------------|-----------------|---------------|------------------|

**Veran specific recon.**

## PHILIPS PARAMETERS & RECONS

For the Supine End Inspiration and Supine End Expiration phases:

|              | Scan Mode | kV  | Manual mA      | 3D Dose | Pitch | Detect | Colli | Rot Time | Scan Time |
|--------------|-----------|-----|----------------|---------|-------|--------|-------|----------|-----------|
| Incisive 128 | helical   | 120 | <b>130/190</b> | off     | 0.923 | 64     | 0.625 | 0.5      | 4.1       |

Use 130 mAs for BMI  $\leq 25$  or 190 mAs for BMI  $> 25$ .

| Name of Series  | Thick       | Interval   | Filter   | Window             | iDose       | Recon Direction  |
|-----------------|-------------|------------|----------|--------------------|-------------|------------------|
| AX LUNG         | 3.0         | 3.0        | YA       | lung               | none        | head/feet        |
| AX SOFT         | 3.0         | 3.0        | B        | mediastinum        | none        | head/feet        |
| COR SOFT        | 3.0         | 3.0        | B        | mediastinum        | none        | front/back       |
| SAG SOFT        | 3.0         | 3.0        | B        | mediastinum        | none        | left/right       |
| <b>TLC INSP</b> | <b>0.67</b> | <b>0.5</b> | <b>B</b> | <b>mediastinum</b> | <b>none</b> | <b>head/feet</b> |
| AX MIPS         | 8.0         | 2.0        | B        | lung               | none        | head/feet        |

**Veran specific recon.**

|                |             |            |          |                    |             |                  |
|----------------|-------------|------------|----------|--------------------|-------------|------------------|
| <b>TLC EXP</b> | <b>0.67</b> | <b>0.5</b> | <b>B</b> | <b>mediastinum</b> | <b>none</b> | <b>head/feet</b> |
|----------------|-------------|------------|----------|--------------------|-------------|------------------|

**Veran specific recon.**

- Breathe and relax (*Give the patient a few relax breaths. Talk the patient to insure they understand and will tolerate the breath hold. If they cannot hold their breath instruct them to do the best they can and set scanner to scan base to apex*)
- Now we are ready to scan so please
- Take a deep breath in (*watch chest to insure a deep breath in*)
- Let it out (*watch chest to insure air is out*)
- Now breathe all the way IN..IN..IN (*watch chest to insure a deep breath in as far as possible – begin scanning*)
- Keep holding your breath – DO NOT BREATHE!
- At end of scan: Breathe and relax

### 1.3 End Expiration CT Scan

- For the second part of this scan, I am going to ask you to take a couple of deep breaths in and out before we have you hold your breath all the out.
- First, let's practice
- Take a deep breath in (*watch chest to insure a deep breath in*)
- Let it out (*watch chest to insure air is out*)
- Take another deep breath in (*watch chest to insure a deep breath in*)
- Now let it out and hold it (*watch chest to insure subject is holding before starting the scan*)
- Keep holding your breath – DO NOT BREATHE! (*count 10 seconds*)
- Breathe and relax (*Give the patient a few relax breath. Talk the patient to insure they understand and will tolerate the breath hold. If they cannot hold their breath instruct them to do the best they can and set scanner to scan base to apex.*)
- Now we are ready to scan so please
- Take a deep breath in (*watch chest to insure a deep breath in*)
- Let it out (*watch chest to insure air is out*)
- Take another deep breath in (*watch chest to insure a deep breath in*)
- Now let it out and hold. (*watch chest to insure subject is holding – begin scanning*)
- Keep holding your breath out – DO NOT BREATHE!
- At end of scan: Breathe and relax

### 1.4 CT Patient Positioning

- Place patient in a supine position, lower legs supported.
- Inspiration CT (TLC) scan - the arms should be placed comfortably over the head in a head arm rest. The vPad (patient tracker) should be clearly visible in the scanner field of view.
- Expiration CT scan – the arms should be placed comfortably at the patient's sides. The vPad (patient tracker) should be clearly visible in the scanner field of view. Optimal navigation registration is obtained with the full expiration scan.
- Using the laser positioning lights, line up the patient so the chest is iso-center (in the middle) of the CT gantry.
- Move the table so the patient is in the correct position for a chest CT scan

### 1.5 CT Parameters for Inspiration (TLC) and Expiration scans

- The scout scan uses default parameters (only one scout AP/PA)
- TLC (Inspiration) scan is performed with **arms above** head.
- The expiration scan is performed with **arms down** at patient's sides.
- To select the proper Display FOV (DFOV) perform the TLC scan first and set the DFOV to be the smallest possible including lungs and vPad. Use the same DFOV set for the inspiration scan on the expiration scan to maintain the same scan resolution for both scans

**Table 1: CT Protocol Siemens Definition AS PLUS, Siemens Definition AS, Siemens Sensation64 & GE VCT, Philips Brilliance 64, Philips Brilliance iCT**

| Scanner make                                           | SIEMENS                        | SIEMENS                    | SIEMENS                    | SIEMENS                    | PHILIPS                     | PHILIPS                     |
|--------------------------------------------------------|--------------------------------|----------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|
| Scanner model                                          | Definition (AS Plus) 128 slice | Definition (AS) 64 slice   | Sensation 64 slice         | Somatom 64 Slice Dual 64   | Brilliance 64 slice         | Brilliance iCT 256 slice    |
| Scan Type                                              | Spiral                         | Spiral                     | Spiral                     | Spiral                     | Spiral Helix                | Spiral Helix                |
| Scan FOV                                               | No Selection                   | No Selection               | No Selection               | No Selection               | No Selection                | No Selection                |
| Rotation Time (s)                                      | 0.5                            | 0.5                        | 0.5                        | 0.5                        | 0.5                         | 0.5                         |
| Det. Configuration                                     | (128) 64 x 0.6                 | 64 x 0.6                   | (64)32 x 0.6               | 64 x 0.6                   | 64 x 0.625                  | 2 x 128 x 0.625 mm          |
| Pitch                                                  | 1.0                            | 1.0                        | 1.0                        | 1.0                        | 0.923                       | 0.929                       |
| kVp                                                    | 120                            | 120                        | 120                        | 120                        | 120                         | 120                         |
| Siemens = Eff. mAs<br>GE = mA setting<br>Philips = mAs | Effective mAs: M-110 L-170     | Effective mAs: M-105 L-160 | Effective mAs: M-100 L-150 | Effective mAs: M-105 L-160 | mAs: M-130 L-190            | mAs: M-115 L-175            |
| Dose modulation                                        | Care Dose OFF                  | Care Dose OFF              | Care Dose OFF              | Care Dose OFF              | Dose Right (ACS) OFF        | Dose Right (ACS) OFF        |
| Beam Hardening Correction                              |                                |                            |                            |                            |                             |                             |
| Recon 1 Algorithm                                      | B35                            | B35                        | B35                        | B35                        | B                           | B                           |
| Additional Filter                                      | No selection                   | No Selection               | No Selection               | No Selection               | Do not use Adaptive filters | Do not use Adaptive filters |
| Thickness (mm)                                         | 0.75                           | 0.75                       | 0.75                       | 0.75                       | 0.67                        | 0.67                        |
| Interval (mm)                                          | 0.5                            | 0.5                        | 0.5                        | 0.5                        | 0.5                         | 0.5                         |
| Iterative recon (noise reduction algorithm)            | Do Not use IRIS                | Do Not use IRIS            | No Selection               | Do Not use IRIS            | Do Not use iDose            | Do Not use iDose            |
| Scan Time (Sec) 30cm length                            | <10                            | <10                        | <10                        | <10                        | <10                         | <10                         |

| Scanner make                                           | TOSHIBA                                                   | TOSHIBA                                                | GE                    | GE                    | GE                    |
|--------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------|-----------------------|-----------------------|-----------------------|
| Scanner model                                          | Aquilion 64                                               | Aquilion 16 Slice                                      | VCT 64 slice          | VCT Select 32 Slice   | Lightspeed 16 Slice   |
| Scan Type                                              | Helical                                                   | Helical                                                | Helical               | Helical               | Helical               |
| Scan FOV                                               | No Selection                                              | No Selection                                           | Large                 | Large                 | No Selection          |
| Rotation Time (s)                                      | 0.5                                                       | 0.5                                                    | 0.5                   | 0.5                   | 0.5                   |
| Det. Configuration                                     | 64 x 0.5                                                  | 16 x 1.0                                               | 64 x 0.625            | 20 x 0.625            | 16 x 0.625            |
| Pitch                                                  | 0.9 ≤ 1.1                                                 | 0.9 < 1.1                                              | 0.984                 | 0.969                 | 1.375                 |
| kVp                                                    | 120                                                       | 120                                                    | 120                   | 120                   | 120                   |
| Siemens = Eff. mAs<br>GE = mA setting<br>Philips = mAs | mAs:<br>M – 140<br>L – 210<br>mA Field:<br>M-280<br>L-420 | mAs:<br>M-140<br>L- 210<br>mA Field:<br>M-280<br>L-420 | mA:<br>M-180<br>L-270 | mA:<br>M-180<br>L-270 | mA:<br>M-180<br>L-270 |
| Dose modulation                                        | OFF                                                       | OFF                                                    | Auto mA<br>OFF        | Auto mA<br>OFF        | Auto mA<br>OFF        |
| Beam Hardening Correction                              | Boost On                                                  | Boost On                                               |                       |                       |                       |
| Recon 1 Algorithm                                      | FC01                                                      | FC01                                                   | Standard              | Standard              | Standard              |
| Additional Filter                                      | No Selection                                              | No Selection                                           | No Selection          | No Selection          | No Selection          |
| Thickness (mm)                                         | 1.0                                                       | 1                                                      | 0.625                 | 0.625                 | 0.625                 |
| Interval (mm)                                          | 0.5                                                       | 0.5                                                    | 0.5                   | 0.5                   | 0.5                   |
| Iterative recon (noise reduction algorithm)            | Do Not Use                                                | Do Not Use                                             | Do Not use ASIR       | Do Not use ASIR       | Do Not use ASIR       |
| Scan Time (Sec)<br>30cm length                         | <10                                                       | <15                                                    | <10                   | <10                   | <15                   |

## 1.6 CT Radiation Dose Standardization

- CT Dose is standardized so each manufacturer and model are matched within  $\pm 3\%$  of the Target CTDIvol.

**Table 1.6.1 (CTDIvol selection)**

| Body Size  | CTDIvol mGy/cm |
|------------|----------------|
| Large – L  | 11.4           |
| Medium – M | 7.6            |

## 1.7 Size Definition (mAs selection)

- Body Mass Index will be used to determine large or medium mAs setting. The technologist will use the chart below to select the mAs setting for a given BMI.

**Table 1.4.1 (mAs selection)**

| BMI range | mAs selection |
|-----------|---------------|
| >25       | Large         |
| $\leq 25$ | Medium        |

## B. CT Dose Calculation Estimates

- Veran airway segmentation software has the capability to function with a much lesser dose than used on a standard clinical chest CT scan.
- Veran functionality will allow this protocol to include an inspiration & expiration scan while only using the dose equal to or below one standard clinical CT scan.

### Effective Dose (E) mSv

- Effective dose (E) is used in radiation protection, to compare the stochastic risk of a non-uniform exposure of ionizing radiation, with the risks caused by a uniform exposure of the whole body. The stochastic risks are carcinogenesis and hereditary effects. It is not intended as a measure for acute or threshold effects of radiation exposure such as erythema, radiation sickness or death.

**Cumulated Dose (One scan session)**

- The effective dose (E) for a one scan session: Inspiration & Expiration is estimated to be 7mSv. The maximum amount of radiation from the clinical related radiation procedures (E) for subjects having a one scan session of this clinical protocol is equivalent to approximately 14% of the annual radiation limit for a medical worker.

**Statement regarding dose estimates**

- Although there are no proven harmful effects from this amount of radiation, long-term effects on the patient's health cannot be ruled out with certainty. This dose estimate takes into account only the exposure to procedures in this clinical procedure. If the patient has experienced other radiation exposure, they should be aware that the risk of effects of radiation exposure is thought to add up across all their exposures(including studies performed as part of your medical care).

**Statement regarding breast shields**

- It is recommended to have an offset or foam pad between the patient and the breast shield of at least 1 to 2 inches. This allows for optimal sensor recognition and airway segmentation.

**C. CT Data Transfer**

Data will be transferred via network DICOM or to a CD or USB device depending on each site's transfer mechanism.

**Statement regarding the above Protocol:**

Parameters such as slice thickness, slice spacing, rotation speed, pitch, and matrices, should be followed as per the above protocol or significant degradation of the scan airway segmentation will occur. The exposure settings (mA, mAs, or kv) settings in this protocol are only a recommendations based on the goals set forth in this protocol. The final determination and selection of the exposure parameters (mA, mAs, or kv) is the sole responsibility of the imaging institution performing these scans. Although there are no proven harmful effects from this amount of radiation, long-term effects on health cannot be ruled out with certainty.