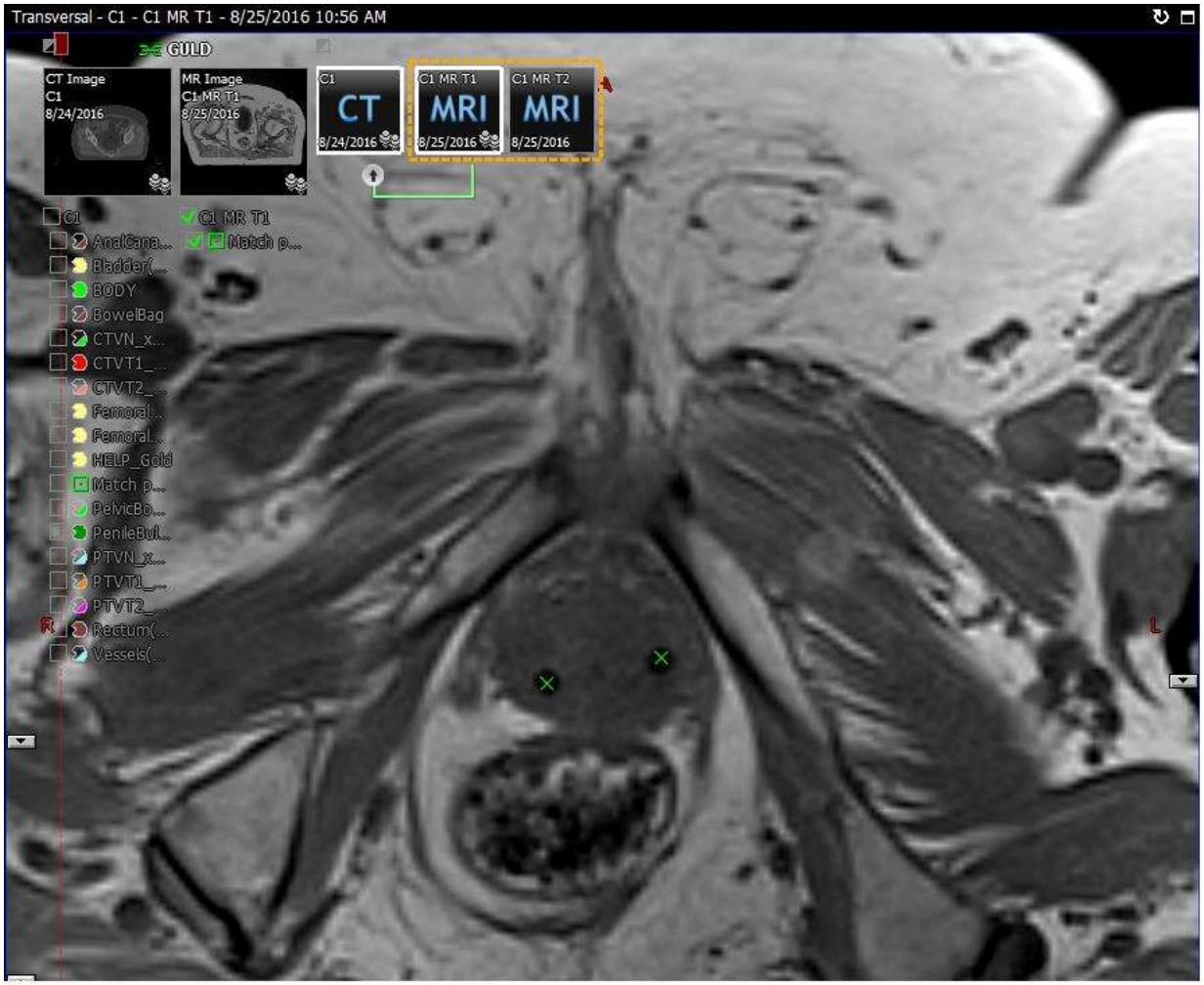
T1-weighted MR image of Gold Anchor markers



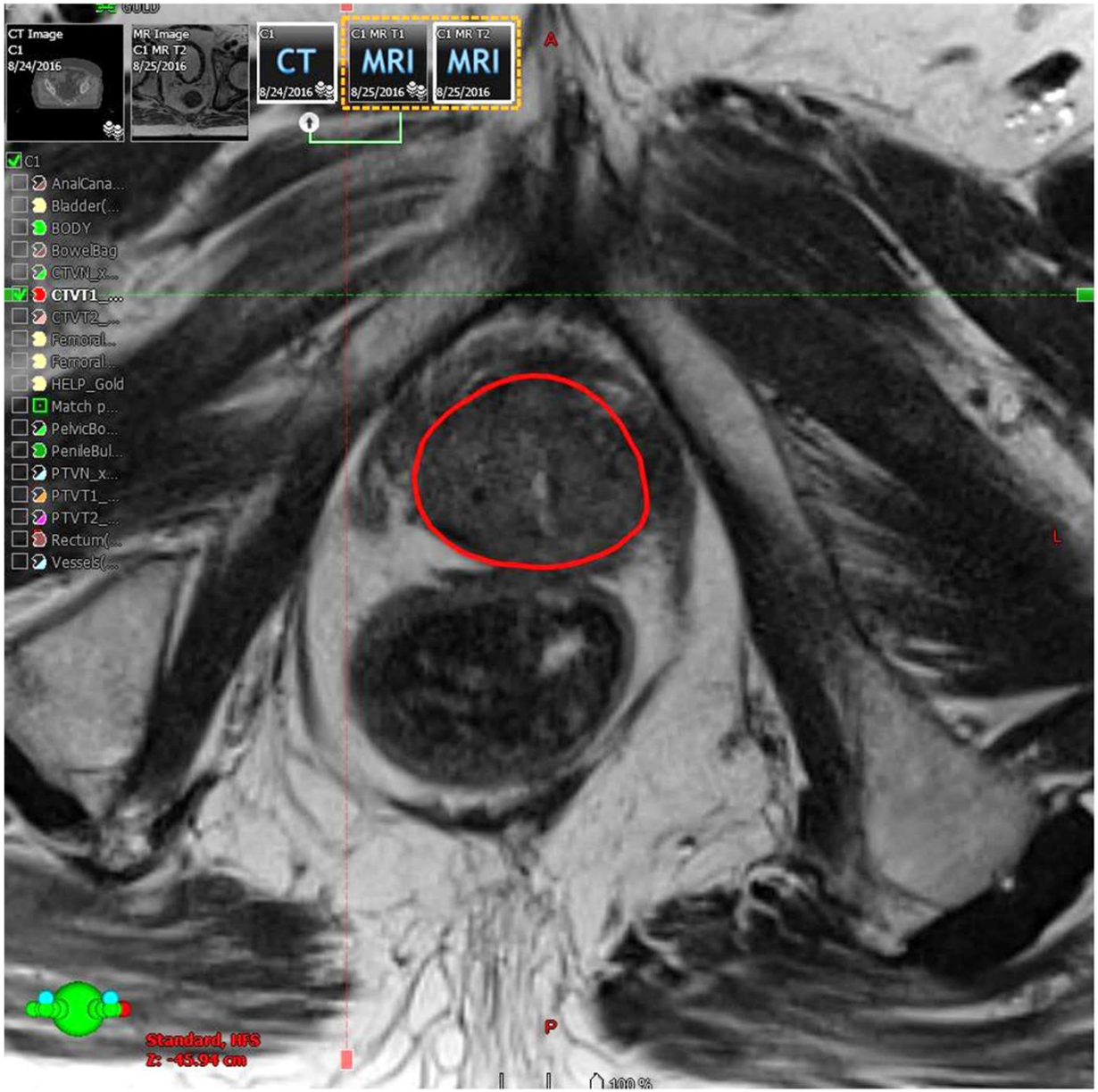
The image is from the Karolinska University Hospital in Stockholm, Sweden, where they use one of our mid-sized markers (0.4x10 mm) implanted with a ball shape in prostate.

They have a 3T Siemens Skyra and use a T1 VIBE sequence with the following specifications:

- Coils: Body 18
- Sequence name: T1_VIBE
- TE: 2.46 ms
- TR: 4.57 ms
- FOV: 390x390 mm
- Slice thickness: 2 mm
- Pixel size: 1.2x1.2 mm
- Bandwidth per pixel: 450Hz
- Slice angle: transverse

Gold Anchor™

T2-weighted MR image of Gold Anchor markers



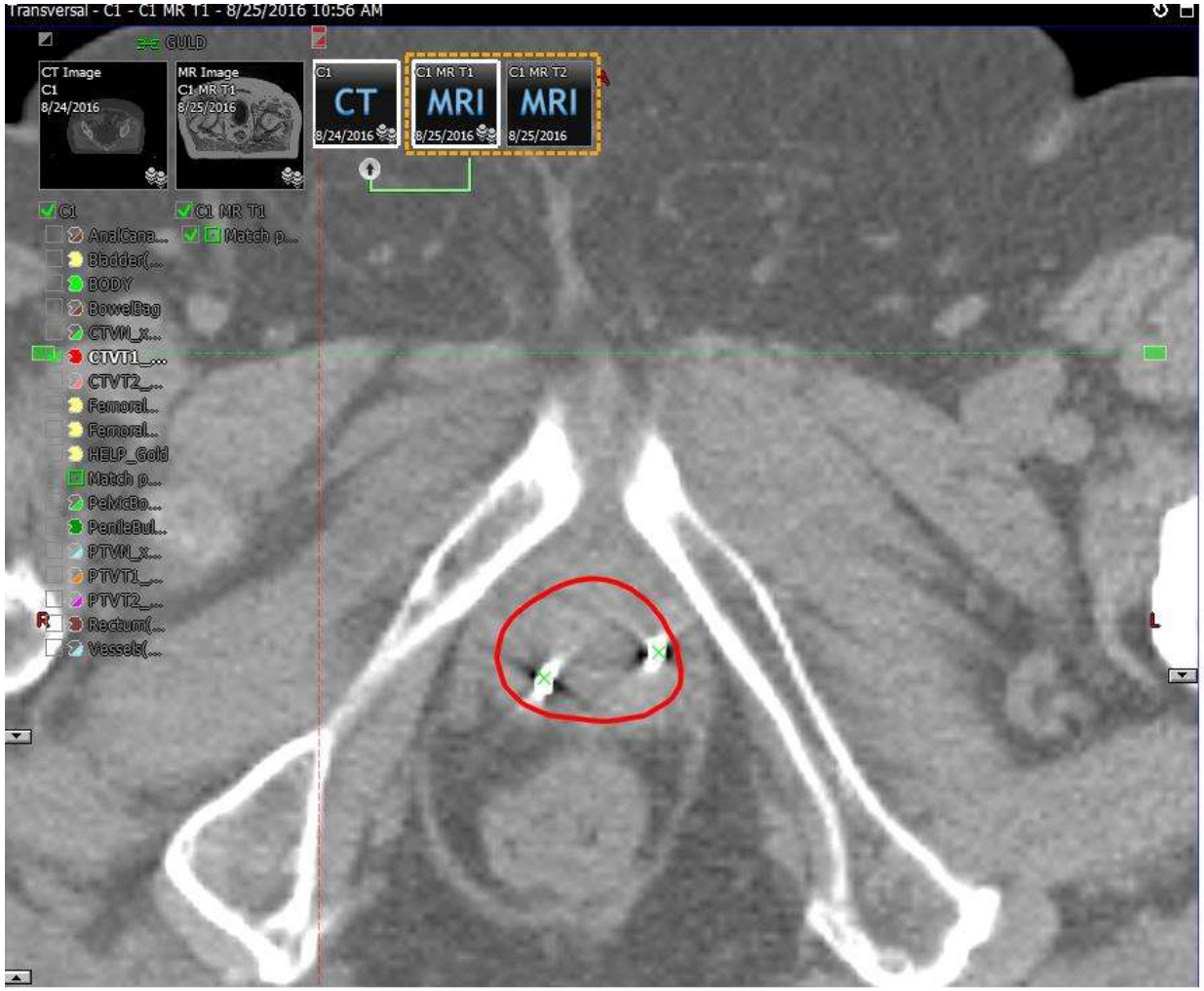
The image is from the Karolinska University Hospital in Stockholm, Sweden, where they use one of our mid-sized markers (0.4x10 mm) implanted with a ball shape in prostate.

They have a 3T Siemens Skyra and use a T2 sequence with the following specifications:

- Coils: Body 18
- Sequence name: T2 Tse tra
- TE: 104 ms
- TR: 15990 ms
- FOV: 220 mm
- Slice thickness: 3.0 mm
- Pixel size: 0.7x0.7 mm
- Bandwidth per pixel: 460Hz
- Slice angle: transverse

Gold Anchor™

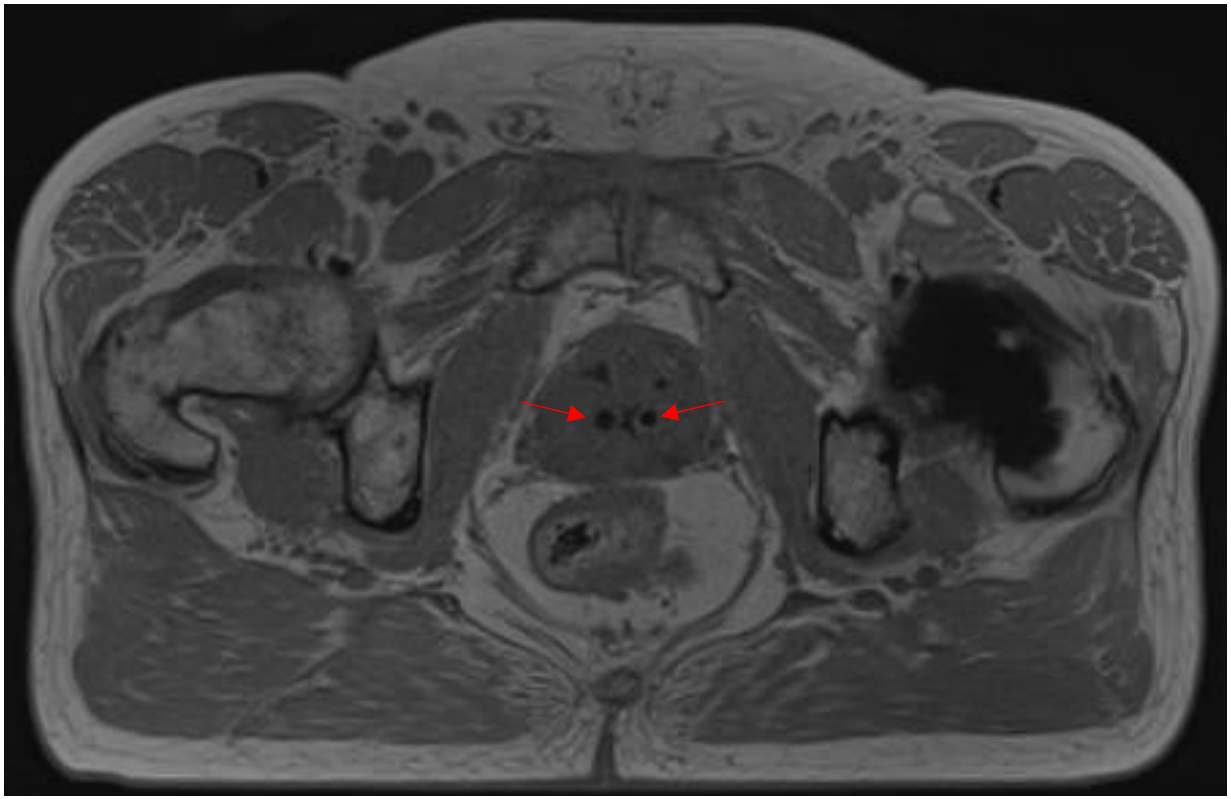
CT image of Gold Anchor markers



The image is from the Karolinska University Hospital in Stockholm, Sweden, where they use one of our mid-sized markers (0.4x10 mm) implanted with a ball shape in prostate.

Gold Anchor™

T1-weighted MR image of Gold Anchor markers



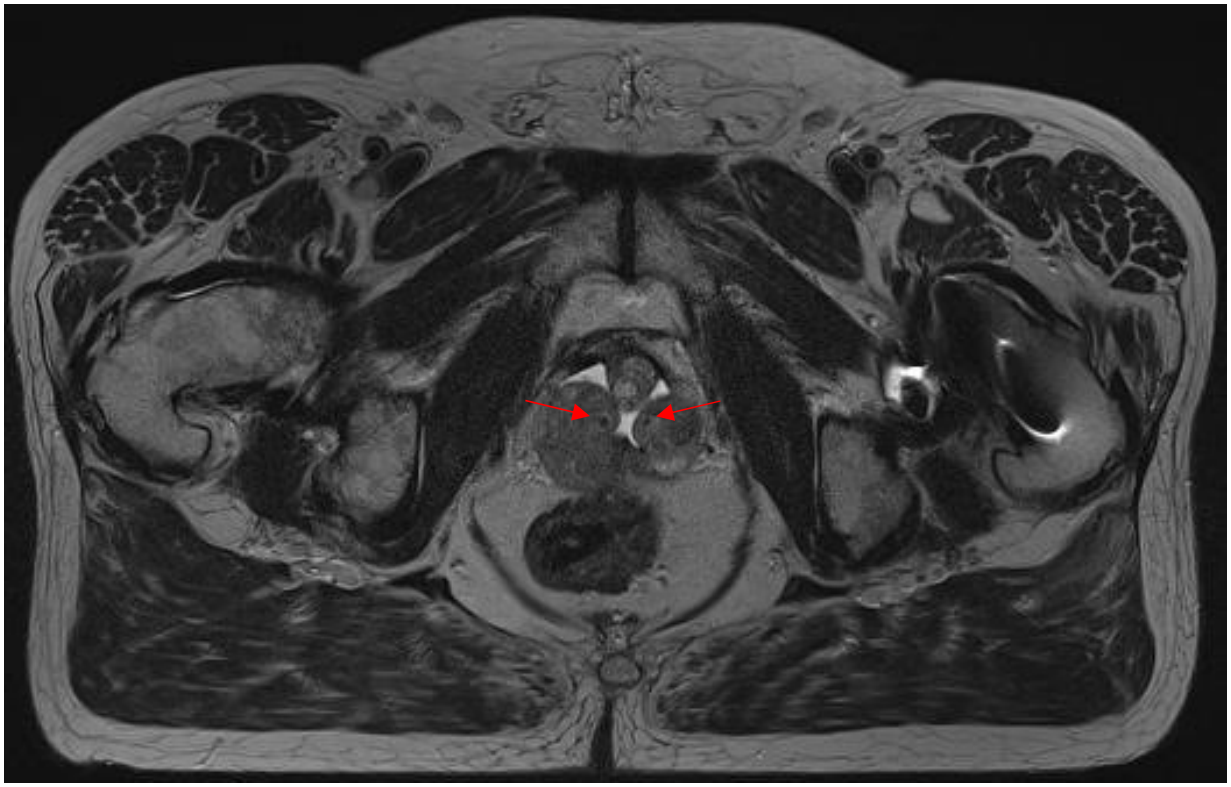
The image is from the Sahlgrenska University Hospital in Gothenburg, Sweden, where they use our largest marker (0.40x20 mm) implanted with a ball shape in prostate.

They have a 1.5T Siemens Aera and use a T1W Tra sequence with the following specifications:

- Coils: Body 18 with coil support (frame/arc) centered over the symphysis
- Sequence name: T1_VIBE
- TR: 7.46 ms
- TE: 4.77 ms
- FOV: 420x420 mm
- Slice thickness: 2 mm
- Distance factor: 20%
- Pixel size: 1.1x1.1 mm
- Bandwidth per pixel: 335Hz
- Slice angle: transverse
- Sequence family: GRE
- 3D
- FA: 10 deg
- NSA: 2

Gold Anchor™

T2-weighted MR image of Gold Anchor markers



The image is from the Sahlgrenska University Hospital in Gothenburg, Sweden, where they use our largest marker (0.40x20 mm) implanted with a ball shape in prostate.

They have a 1.5T Siemens Aera and use a T2W Tra HighRes sequence with the following specifications:

- Coils: Body 18 with coil support (frame/arc) centered over the symphysis
- Sequence name: T2_TSE
- TR: 12940 ms
- TE: 94 ms
- FOV: 448x448 mm
- Slice thickness: 3 mm
- Distance factor: 0mm
- Pixel size: 0.7x0.7 mm
- Bandwidth per pixel: 200Hz
- Slice angle: transverse
- Sequence family: SE
- 2D
- NSA: 1

Gold Anchor™

Some MRI sequences used for Gold Anchor on Siemens

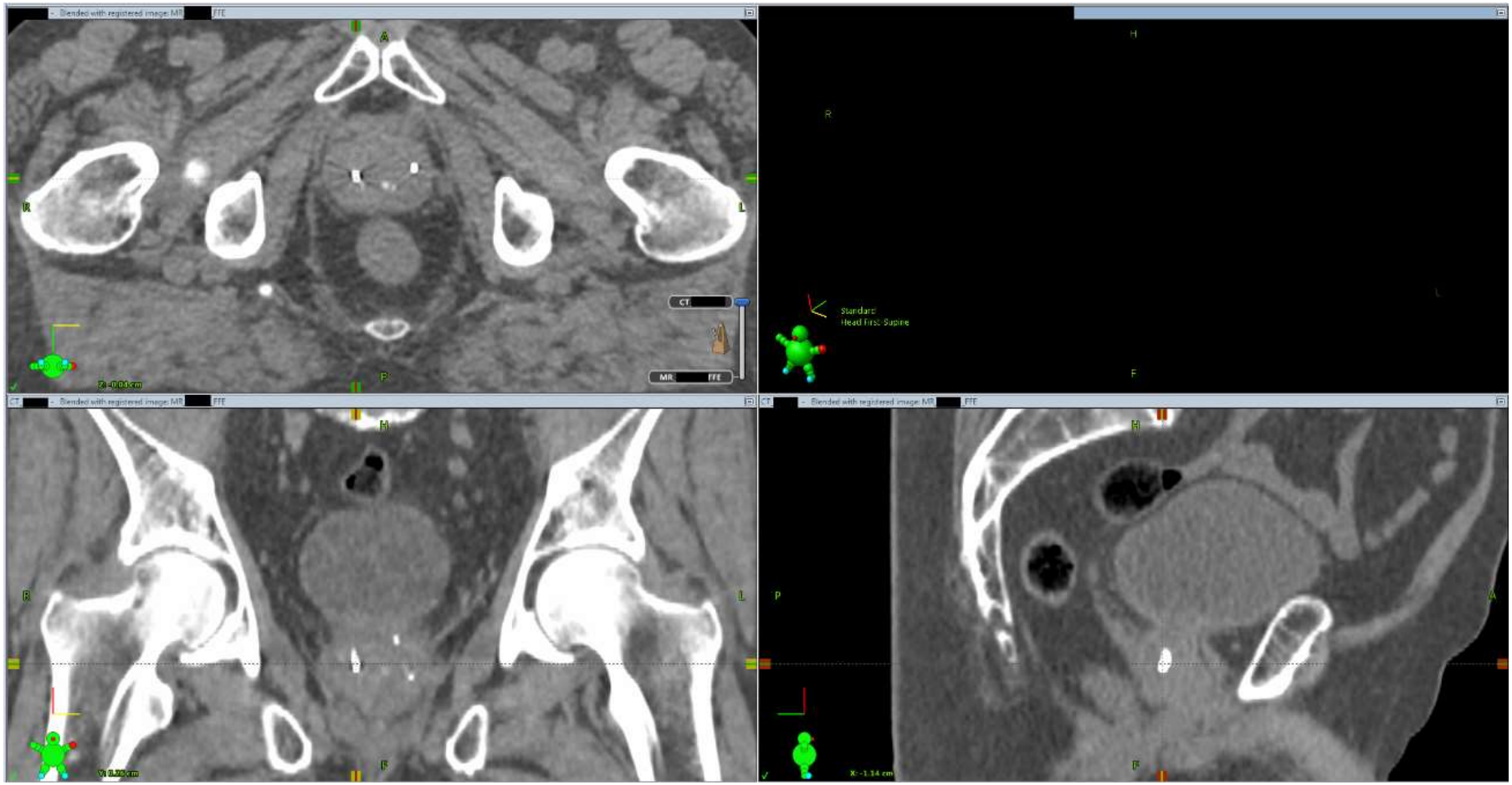
Siemens 3T
Coils: Body 18
Sequence name: **T1_VIBE**
TE: 2.46 ms
TR: 4.57 ms
FOV: 390x390 mm
Slice thickness: 2 mm
Pixel size: 1.2x1.2 mm
Bandwidth per pixel: 450Hz
Slice angle: transverse

Siemens 3T
Coils: Body 18
Sequence name: **T2 Tse tra**
TE: 104 ms
TR: 15990 ms
FOV: 220 mm
Slice thickness: 3.0 mm
Pixel size: 0.7x0.7 mm
Bandwidth per pixel: 460Hz
Slice angle: transverse

Siemens 1,5T
Coils: Body 18 with coil support (frame/arc) centered over the symphysis
Sequence name: **T1_VIBE**
TE: 4.77 ms
TR: 7.46 ms
FOV: 420x420 mm
Slice thickness: 2 mm
Distance factor: 20%
Pixel size: 1.1x1.1 mm
Bandwidth per pixel: 335Hz
Slice angle: transverse
Sequence family: GRE
3D
FA: 10 deg
NSA: 2

Siemens 1,5T
Coils: Body 18 with coil support (frame/arc) centered over the symphysis
Sequence name: **T2_TSE**
TR: 12940 ms
TE: 94 ms
FOV: 448x448 mm
Slice thickness: 3 mm
Distance factor: 0mm
Pixel size: 0.7x0.7 mm
Bandwidth per pixel: 200Hz
Slice angle: transverse
Sequence family: SE
2D
NSA: 1

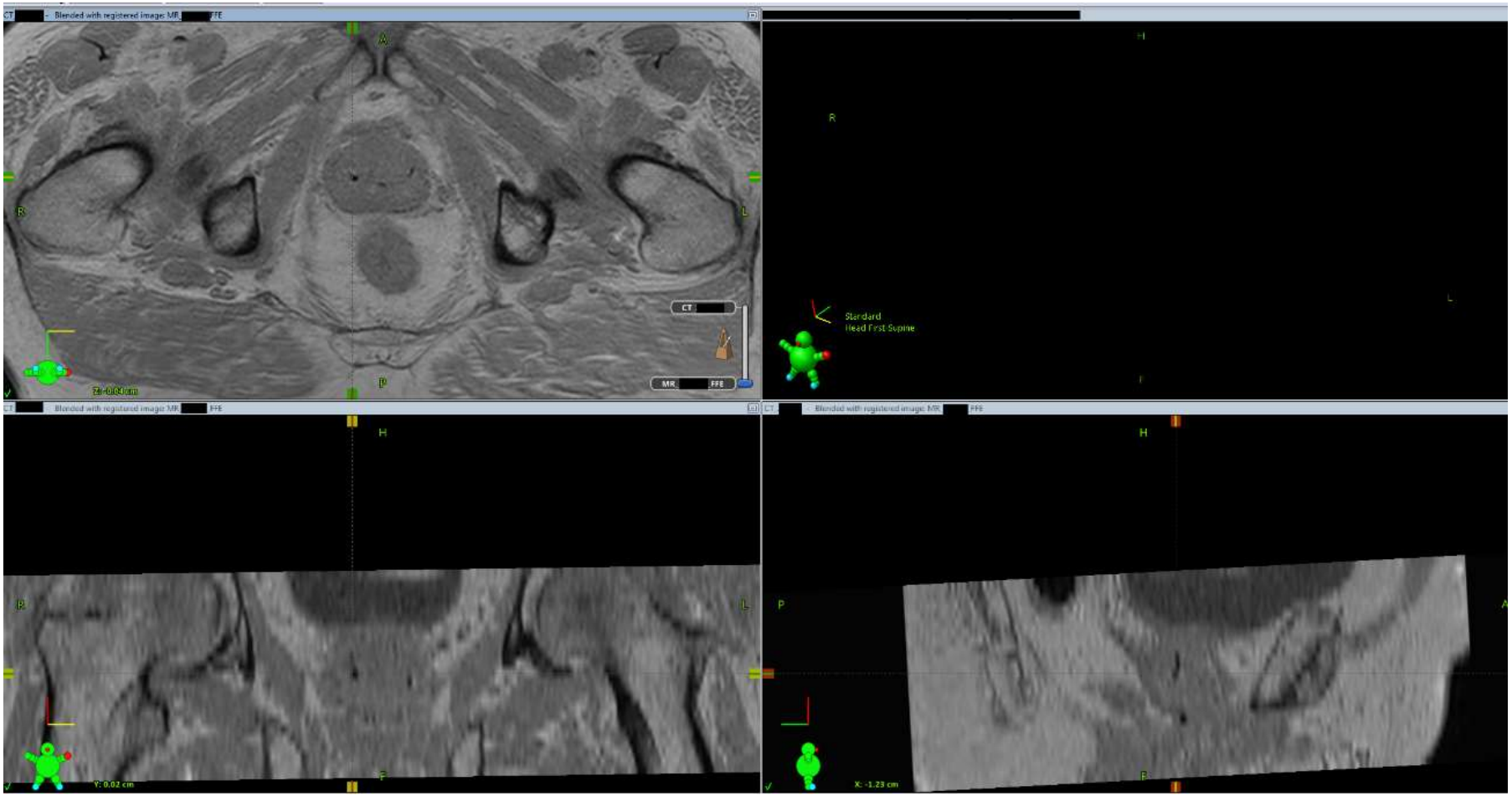
CT image of line shaped Gold Anchor marker



The image is from the Department of Oncology and Radiotherapy, Turku University Hospital, Finland, where they use one of our thicker markers (0.4x10 mm) implanted with a line shape in prostate (two markers per patient). They place one line in each lobe to get 4 matching points, one point on each end of the line.

Gold Anchor™

FFE MR image used to visualize line shaped Gold Anchor marker (”marker series”)



The image is from the Department of Oncology and Radiotherapy, Turku University Hospital, Finland, where they use one of our thicker markers (0.4x10 mm) implanted with a line shape in prostate (two markers per patient).

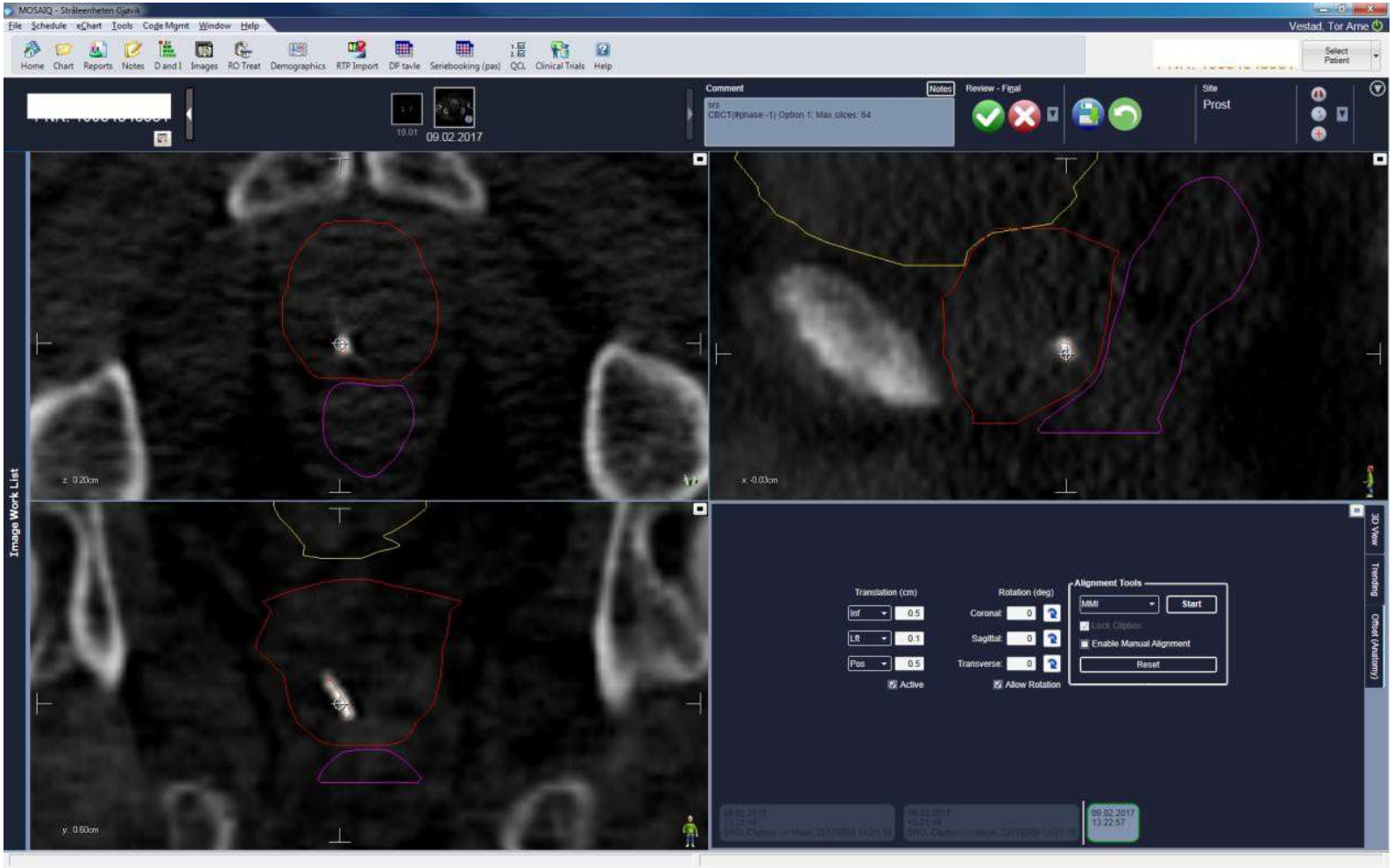
They have a 1.5 T Philips Ingenia MR-RT system and use a Fast Field Echo (FFE) sequence with the following specifications to visualize the markers:

- Voxel size is 1*1*3 mm, 3mm is the head-feet resolution.
- TE 4.6 ms and TR 194 ms
- MRI has been taken with flat tabletop and anterior RT-coil system

Gold Anchor™

CBCT from Elekta Versa HD of Gold Anchor 0.4x10 mm implanted with line shape

Seed Match with XVI is working



The image is from Sykehuset Innlandet in Gjövik, Norway

Gold Anchor™

T1-weighted MR image of Gold Anchor markers

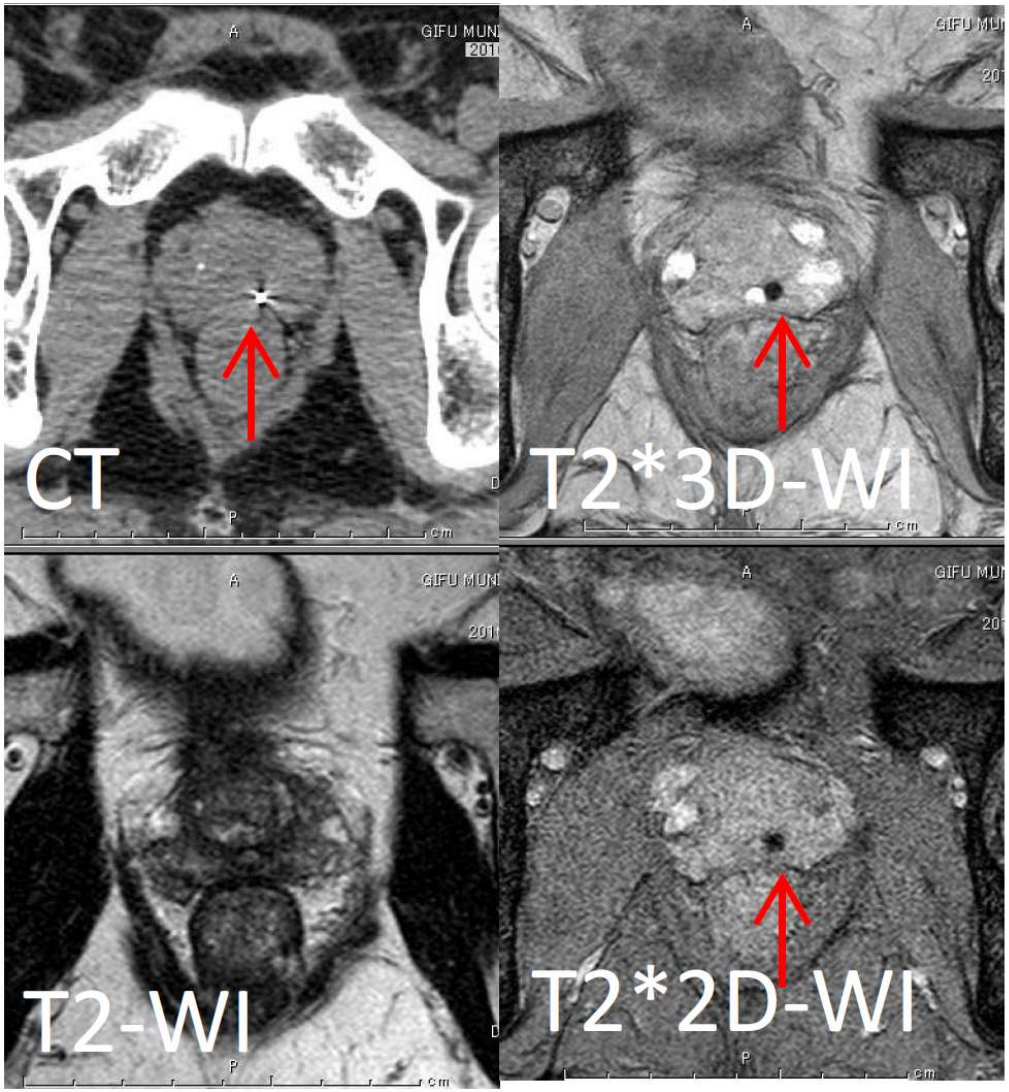
The image is from Sykehuset Innlandet in Gjövik, Norway

They use one of our mid-sized markers (0.4x10 mm) implanted with a line shape in prostate.

3D T1w TFE is the sequence they have used.

Gold Anchor™

T2* images of Gold Anchor marker



The images are from the Gifu Municipal Hospital, Gifu, Japan, where they use our smallest marker (0.28x10 mm) implanted with a ball shape in prostate.

They have a 1.5T Philips Intera Nova and use the following sequences for Gold Anchors.

T2*2D-WI:

- T2*-weighted gradient echo
- TR/TE: 700/18
- NA: 2
- PESs: 205
- FESs: 256
- TPRs of frequency/phase: 0.63/0.78

T2*3D-WI:

- T2*-3D-weighted gradient echo
- TR/TE1/ΔTE: 37/14/7.3
- NA: 2
- PESs: 218
- FESs: 272
- TPRs of frequency/phase: 0.55/0.54

Source: Tanaka, O., Komeda, H., Iida, T., Tamaki, M., Seike, K., Kato, D., Yokoyama, T., Hirose, S., Kawaguchi, D. and Yama, E. (2016) *Usefulness of Iron-Containing Fiducial Marker for Prostate Radiotherapy*. International Journal of Medical Physics, Clinical Engineering and Radiation Oncology, 5, 348-354.
http://dx.doi.org/10.4236/ijmpcero.2016.54033

Gold Anchor™

Some MRI sequences used for Gold Anchor on Philips

Philips 3T
At the Docrates Cancer Clinic in Helsinki, Finland, they implant our 0.4x10 mm marker with a line shape in prostate and still get good MR visibility.

They have a 3T Philips system and use a Balanced Steady-State Free Precession (bSSFP) sequence called b-FFE3D (I believe GE calls this FIESTA and Siemens calls this TrueFISP).

Weighting: T2/T1
FOV (AP*LR*FH): 180*180*90
Resolution (recon, mm): 0.56*0.56*1.00
TE: 3.6 ms
TR: 7.2 ms
Protocol time. 1:46 min

Philips 1.5T
At the Turku University Hospital, Finland, they implant our 0.4x10 mm marker with a line shape in prostate (two markers per patient) and still get good MR visibility.

They have a 1.5 T Philips Ingenia MR-RT system and use a
Fast Field Echo (FFE) sequence
Voxel size is 1*1*3 mm, 3mm is the head-feet resolution.
TE: 4.6 ms
TR: 194 ms

MRI is taken with flat tabletop and anterior RT-coil system.

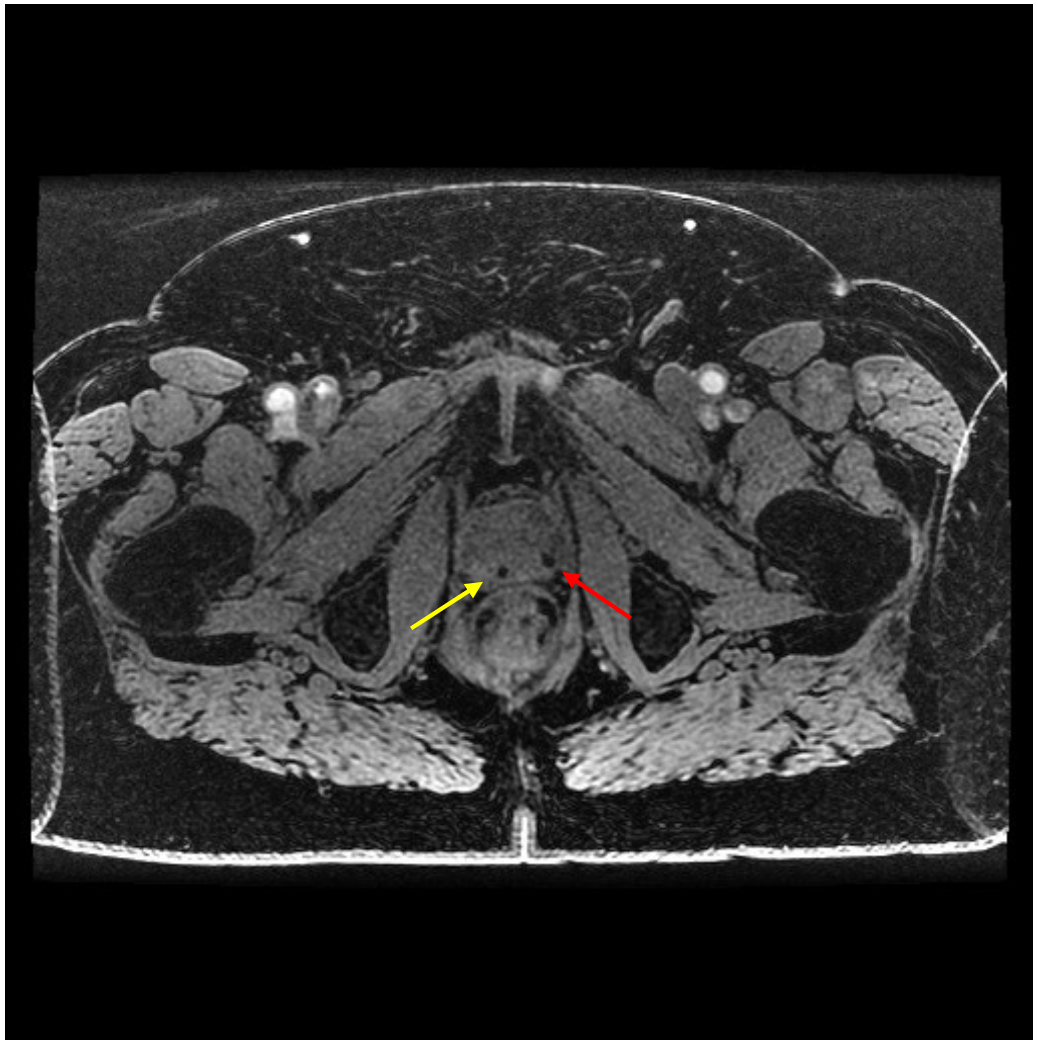
Philips 1.5T
At the Gifu Municipal Hospital, Japan, they implant our 0.28x10 mm marker with a ball shape in prostate.

They have a 1.5T Philips Intera Nova and use the following sequences for Gold Anchors.

Weighting: T2*2D
- T2*-weighted gradient echo
- TR/TE: 700/18
- NA: 2
- PESs: 205
- FESs: 256
- TPRs of frequency/phase: 0.63/0.78

Weighting: T2*3D
- T2*-3D-weighted gradient echo
- TR/TE1/ΔTE: 37/14/7.3
- NA: 2
- PESs: 218
- FESs: 272
- TPRs of frequency/phase: 0.55/0.54

T1-weighted MR image of Gold Anchor markers *"Lava Flex Water", T1w 3D*



The image is from the Umeå University Hospital in Sweden and taken immediately after implantation.

The yellow arrows point at our midsize marker (0.4x10 mm) and the red arrows point at our largest marker (0.40x20 mm), both implanted with a ball shape in prostate.

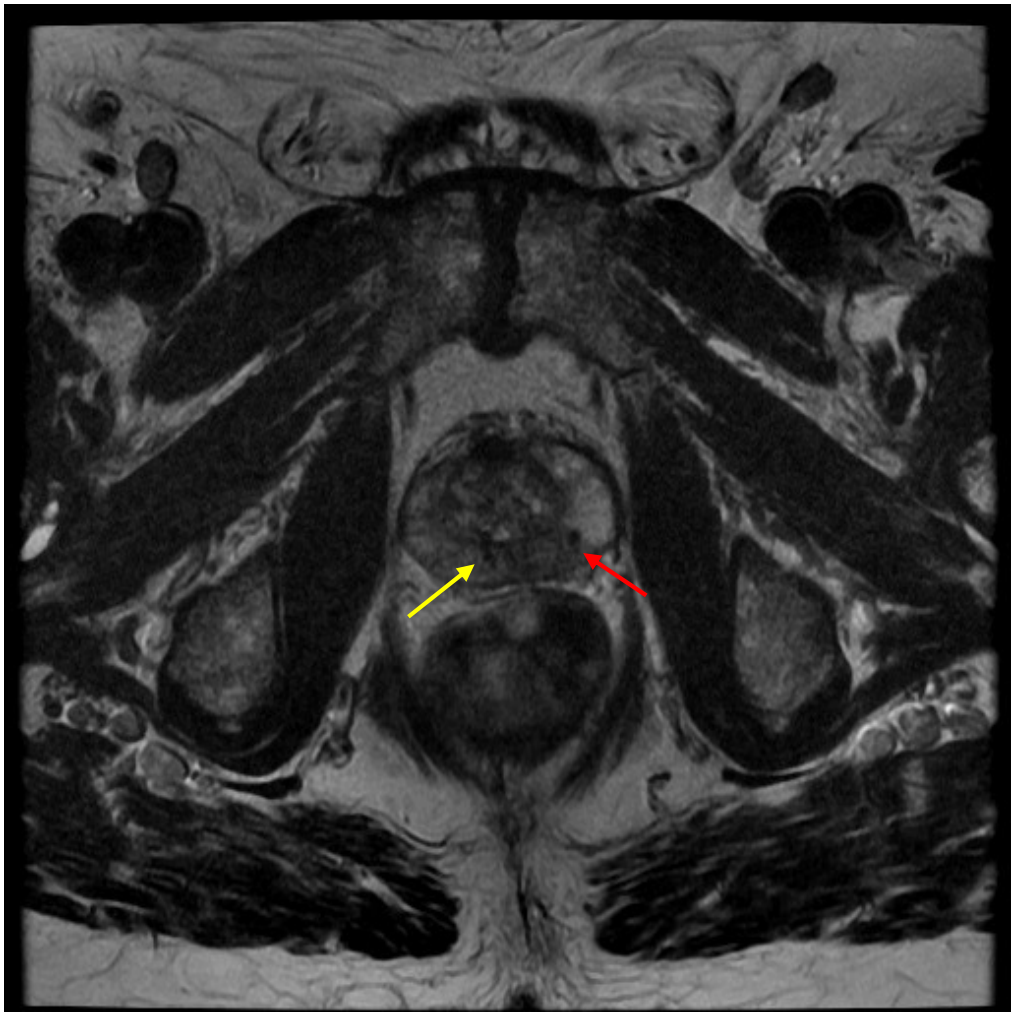
They have a GE Signa PET/MR 3.0T with the following sequences for Gold Anchors:

LAVA-flex Water
TE 2.62 ms
TR 7.882 ms
BW/pixel 558 Hz
Slice thickness 2.0 mm
Inplane 0.766 mm x 0.766 mm

They are not using any sat-bands instead they are basically running a full FOV (covering the whole patient contour) with phase-encode direction anterior – posterior.

Gold Anchor™

T2-weighted MR image of Gold Anchor markers, ”T2 FRFSE”



The image is from the Umeå University Hospital in Sweden and taken immediately after implantation.

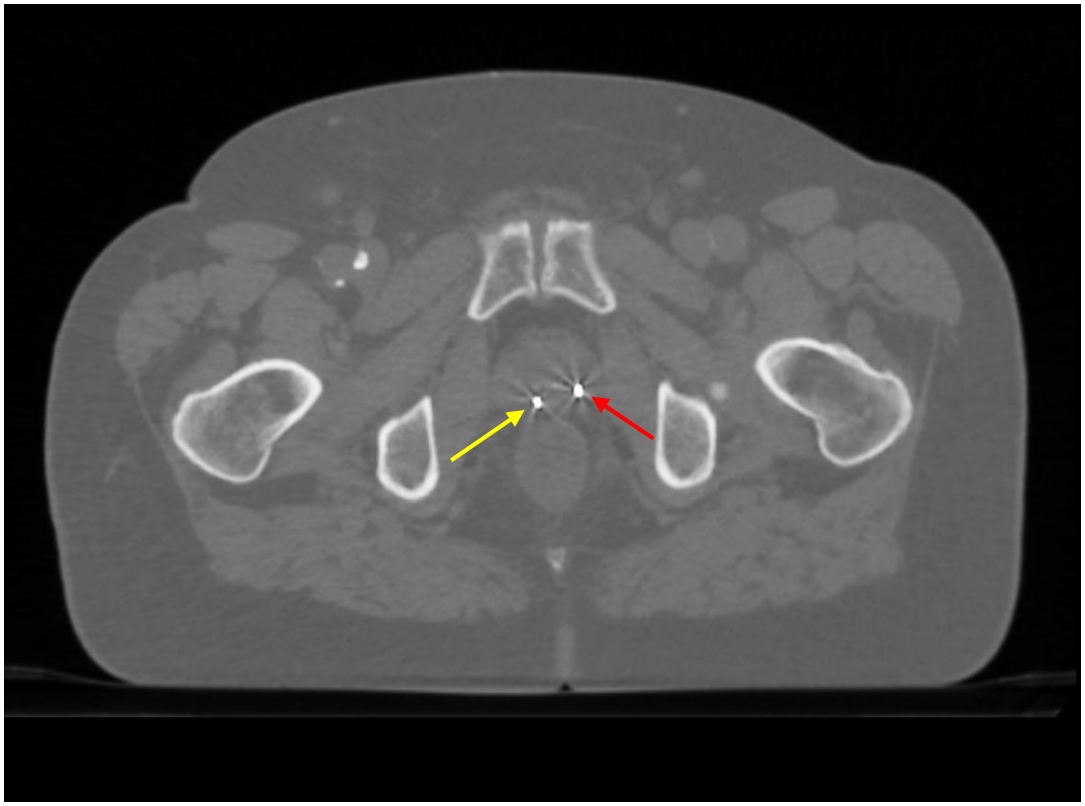
The yellow arrows point at our midsize marker (0.4x10 mm) and the red arrows point at our largest marker (0.40x20 mm), both implanted with a ball shape in prostate.

They have a GE Signa PET/MR 3.0T with the following sequences for Gold Anchors :

T2 FRFSE
TE 99 ms
TR 6601 ms
BW/pixel 195 Hz
Slice thickness 3.0 mm
Inplane 0.41 mm x 0.41 mm

Gold Anchor™

CT of Gold Anchor patient immediately after implantation



The image is from the Umeå University Hospital in Sweden and taken immediately after implantation.

The yellow arrows point at our midsize marker (0.4x10 mm) and the red arrows point at our largest marker (0.40x20 mm), both implanted with a ball shape in prostate.

Gold Anchor™

Visibility of 0.4x10 mm Gold Anchor markers, implanted with line shape, on Philips 0.23T MRI

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University of Florida Proton Therapy Institute
September 2016

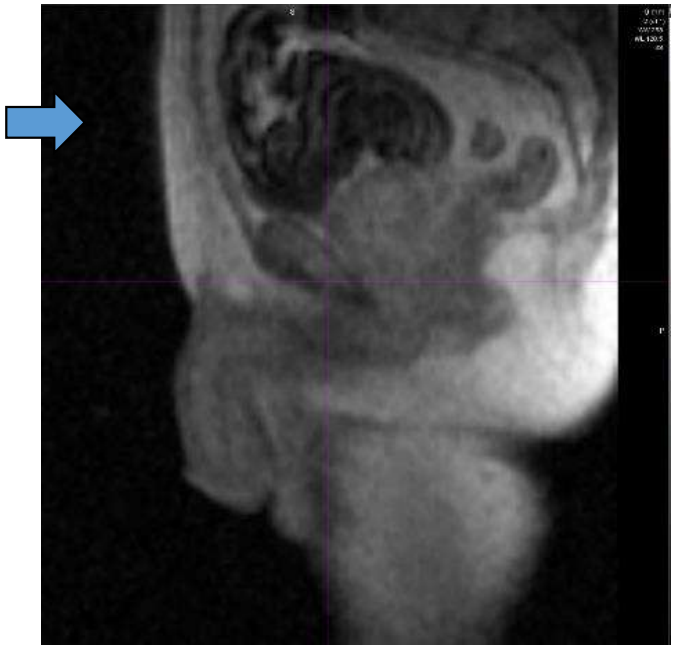
Optimizing the visibility of line shaped 0.4x10mm Gold Anchor markers on 0.23T MRI

Step 1: Use abdominal compression to minimize motion

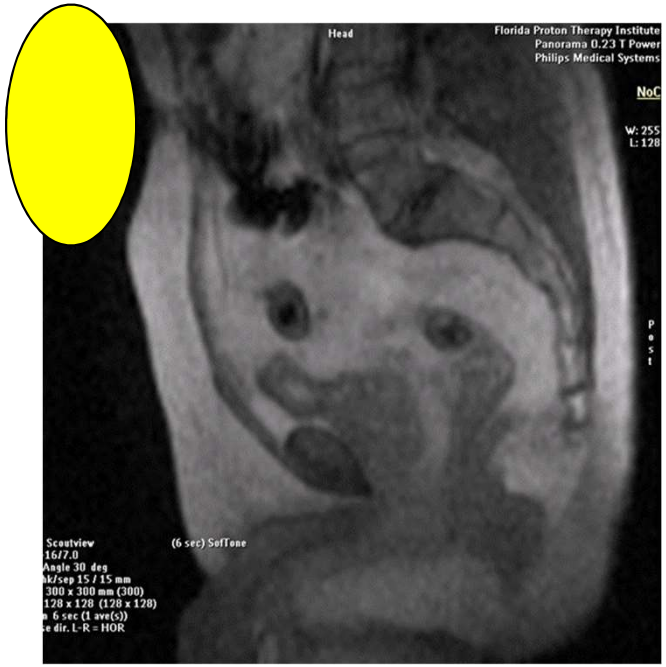
(1) minor: <60mmHg

(2) moderate: ~100mmHg

No compression

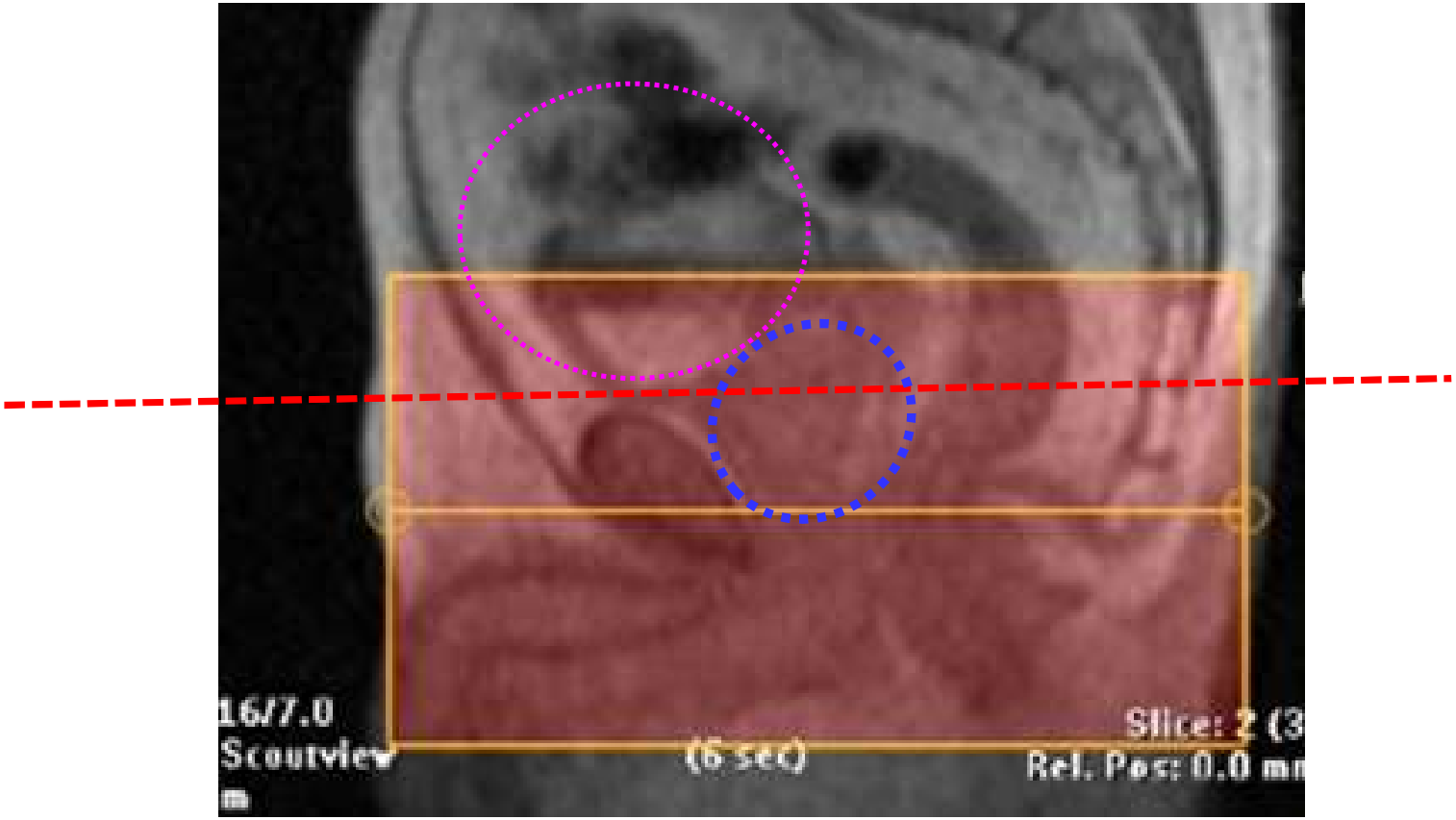


Minor compression



Optimizing the visibility of line shaped 0.4x10mm Gold Anchor markers on 0.23T MRI

Step 2: Ensure marker location is below inferior wall of bladder



Optimizing the visibility of line shaped 0.4x10mm Gold Anchor markers on 0.23T MRI

Step 3: Use MR THRIVE sequence

CT

MR THRIVE