General Guidelines

 NEVER hesitate to reach out to a radiologist for guidance!

 Use “Weak” FS (Siemens) or “Classic” FS (GE) on all sequences with FS

 ALL MSK mass / infection exams should be performed using is T1 & T2 FS all 3 planes with appropriate T1 FS pre & post.
  ➢ Always need
    ▪ Mass / tumor exams - request prior x-ray study for comparison, if applicable.
    ▪ T1 FS pre – prior to contrast injection for direct comparison with post imaging.
    ▪ Generally short axis to the mass is the best option for pre/post imaging.
    ▪ T1 (generally coronal) for ALL bone metastasis, infection or fracture cases.
    ▪ If contrast is contraindicated a T1 FS pre does not need to be performed.

 Metal Protocols
  ➢ Total joint replacements use T1 & IR series (TSE/FSE sequence types)
  ➢ Hardware such as pins, screws, etc. use standard protocols with metal reduction techniques.
  ➢ Metal reduction techniques
    ▪ Bandwidth 400 Hz or more with signal compensation, fast RF mode
    ▪ E-line (3T & Aera) WARP on, VAT 100%

 All PEDI MSK arthritis exams should be performed using the standard adult protocols, unless specifically requested for pediatric radiologist to read.

 MSK Guidelines, portal page reference.
  ➢ T1 & T2 weighted imaging is needed to accurately differentiate mass and infection.
  ➢ PD’s are generally useful for tendons, ligaments, & joint spaces.

 Pelvis vs Hip
  ➢ Hip – evaluation of cartilage & labrum
  ➢ Pelvis – evaluation of fractures, soft tissue & cancer
    ▪ AVN, Osteonecrosis or history of “steroid use with hip pain”
    ▪ Cancer (mass, tumor), metastasis, myeloma
    ▪ IV contrast

 Long Bones
  ➢ Focal symptoms, mass or bone lesion
    ▪ Image area of interest only
    ▪ Do not need to include joint to joint, single joint imaging will suffice to target location of pathology
    ▪ Center axials on area of interest, no need to include joint. DO NOT split pathology in upper / lower axial series
  ➢ General pain, myositis, cellulitis or non-focal history
    ▪ Image anatomy as indicated
Inflammatory Arthritis (rheumatoid arthritis, psoriatic arthritis, juvenile rheumatoid arthritis, reactive arthritis, gout, CPPD [calcium pyrophosphate deposition disease], or septic arthritis)

- The entire hand and entire foot must be scanned for arthritis cases without any other indications such as a tear or mass
  - Contrast is needed to differentiate joint fluid from synovitis
- If a hand and wrist exam are ordered with a diagnosis of arthritis without any other indications, the wrist and hand need to be scanned together in the same FOV
ANKLE ACHILLES TENDON
PD Axial (150 FOV, 3.5x1, 36 slices)
T2 FS Axial (150 FOV, 3.5x1, 36 slices)
T1 Cor (160 FOV, 3.5x1, 32 slices, perpendicular to lateral/medial malleoli)
T2 FS Cor (160 FOV, 3.5x1, 32 slices)
T1 Sag (160 FOV, 3x1, 21 slices, parallel to lateral/medial malleoli)
STIR Sag (160 FOV, 3x1, 21 slices)
T2 FS Sag (~250 FOV, 3x1, 22 slices, mid-calf through calcaneus, parallel to lateral/medial malleoli)

NOTE:
- Increase the FOV of the Sag sequences if the Achilles is torn & retracted outside of a 160 FOV.

ANKLE (plantar fasciitis, posterior tibial tendon pathology)
PD Axial (~140 FOV, 3.5x1, 24 slices)
T2 FS Axial (~140 FOV, 3.5x1, 24 slices)
PD Axial Obl (~140 FOV, 3.5x1, 32 slices)
T1 Cor (~140 FOV, 3.5x1, 32 slices, perpendicular to lateral/medial malleoli)
T2 FS Cor (~140 FOV, 3.5x1, 32 slices)
T1 Sag (~140 FOV, 3x1, 21 slices, parallel to lateral/medial malleoli)
STIR Sag (~140 FOV, 3x1, 21 slices)

NOTE: The following arthrogram protocols must include tech notes regarding the patient’s pain post arthrogram “fluoro” procedure.
- Is the pain the same, improved or worsened since the procedure?

ARTHROGRAM SHOULDER
- Patient positioned with affected arm at side in external rotation (palm directed upward). Place handbag on palm if necessary to help the patient maintain this position.
T1 FS Axial
T2 FS Axial
T1 FS Cor
T2 FS Cor
T1 Sag Obl (~140 FOV, 4x1, approx. 24 slices, must include approx. 6cm of medial anatomy from glenoid fossa)
T2 FS Sag

ABER – Perform last, position the affected arm above the patient’s head with elbow flexed & palm of the hand under patient’s head. The slices must be prescribed from a Cor Scout image, parallel to the long axis of the humerus & centered to the joint, see the picture protocol if any questions.
Cor Localizer
T1 FS ABER View

ARTHROGRAM ANKLE
T1 Axial
T1 FS Axial
T1 FS Cor (perpendicular to lateral/medial malleoli)
T1 FS Sag (parallel to lateral/medial malleoli)
T2 FS Sag
ARTHROGRAM HIP
T1 Axial
T1 FS Obl Axial
T2 FS Cor (full FOV to include both hips)
T1 FS Cor
T1 FS Sag

ARTHROGRAM KNEE
T1 FS Axial
T1 FS Sag
PD Sag
T1 FS Cor
T2 FS Cor
T1 Cor (trauma/fracture or if technologist suspects a possible fracture)

ARTHROGRAM ELBOW
T1 Axial
T1 FS Axial
T1 FS Cor
T1 FS Sag
T2 FS Cor

ARTHROGRAM WRIST
T2 FS Axial
T1 Cor
T1 FS Cor
T1 FS Sag
T2 FS Cor

INDIRECT ARTHROGRAM ANY JOINT
- Requires Radiologist consultation / approval.
- Inject IV gadolinium.
- Instruct patient to move the affected joint for 15 minutes in rotation, abduction, & adduction prior to scanning.
- Follow the applicable routine Arthrogram protocol.

CHEST WALL MASS
T1 Axial
T2 FS Axial
T1 Cor
T2 FS Cor
T1 Sag
T2 FS Sag
T1 FS Axial pre
T1 FS Axial pre

NOTE: Run phase direction to best minimize motion artifact.
CLAVICLE
T1 Axial (~200 FOV, 3x0)
T2 FS Axial
T1 Cor (~200 FOV, 3x0)
T2 FS Cor
T1 Sag (~180 FOV, 3x0)
T2 FS Sag

NOTE: All planes are orthogonal to body, do not angle with clavicle. Include opposite SC joint in all series.

ELBOW (FABS view)
PD Axial (~120 FOV, 4x1, 24 slices)
T2 FS Axial
PD Cor (~140 FOV, 3x0, 30 slices, parallel to condyles)
T2 FS Cor
T1 Sag (~140 FOV, 3x1, 21 slices, perpendicular to condyles)
STIR Sag

NOTE:
- Additional FABS view, requests per Dr. Daniel Stewart – T2 FS long axis (130, 3.x5, ~24 slices)
- FABS View Positioning – Shoulder Coil

EXTREMITY / LONG BONES PAIN/MASS Tailor FOV to body part. See picture protocol.
T1 Axial
STIR Axial
T1 Cor
STIR Cor
T1 Sag
STIR Sag

Contrast: mass, infection or post-op tumor, consult radiologist for appropriate planes.
T1 FS Axial pre
T1 FS Axial post

NOTE: Hands, fingers, feet & toes
- Always place marker to indicate area of concern!
- If scanning an entire hand, you must include the distal radius/ulna through the fingertips on all sequences.
- Limit FOV to the area of interest when there is specific indication. Any questions should be addressed to the radiologist. Evening shifts will need to be preemptive. Late add on exams should be directed to the radiologists on shift in the evening.

MID OR FOREFOOT (metatarsal pain, swelling or mass)
T1 Axial
STIR Axial
T1 Cor
STIR Cor
T1 Sag
STIR Sag
HIND FOOT (metatarsal pain, swelling or mass)
PD Axial (~140 FOV, 3.5x1)
T2 FS Axial
PD Axial Obl (~140 FOV, 3.5x1)
T1 Cor (~140 FOV, 3.5x1, perpendicular to lateral/medial malleoli)
T2 FS Cor
T1 Sag (~140 FOV, 3x1, parallel to lateral/medial malleoli)
STIR Sag

FOOT MORTON’S NEUROMA OR CONTRAST EXAMS
Morton’s Neuroma: Limit FOV from mid-foot through end of toes.
Contrast exams: Consult with Rad regarding FOV & anatomical coverage.
T1 Axial
STIR Axial
T1 Cor
STIR Cor
T1 Sag
STIR Sag
T1 FS Cor pre
T1 FS Cor post
T1 FS Axial post

FINGERS (not for thumb) – 3T Preferred
PD Axial
STIR Axial
T1 Cor
T2 FS Cor
PD Sag (affected & adjacent 2nd – 5th digit for comparison)
T2 FS Sag

FINGERS MASS / INFECTION (not for thumb) – 3T Preferred Always place marker to indicate area of concern.
T1 Axial
T2 FS Axial
T1 Cor
T2 FS Cor
T1 Sag (affected & adjacent finger for comparison)
T2 FS Sag

Contrast:
- Mass: T1 FS Axial pre & post, with additional plane which best demonstrates mass.
- Inflammation: T1 FS Dixon Cor pre & post

HAND Always place marker to indicate area of concern, must include distal ulnar/radius through finger tips.
T1 Axial (120 FOV, 4x1, 40 slices)
T2 FS Axial
T1 Cor (220 FOV, 2.5x0, 21 slices)
T2 FS Cor
PD Sag (220 FOV, 4x1, 24 slices, affected & adjacent finger for comparison)
T2 FS Sag
HAND MASS / INFECTION (not for thumb) Always place marker to indicate area of concern, must include distal ulnar/radius through finger tips.
T1 Axial
T2 FS Axial
T1 Cor
T2 FS Cor
T1 Sag (affected & adjacent finger for comparison)
T2 FS Sag

Contrast:
- Mass: T1 FS Axial pre & post, with additional plane which best demonstrates mass.
- Inflammation: T1 FS Dixon Cor pre / post & T1 FS Axial post

HIPS BILATERAL AVN
STIR Cor (~360 FOV, 4x0, 28 slices)
T1 Cor
T1 Axial (~360 FOV, 5x1, TE 40-45, above sacrum through ischium)
T2 FS Axial (STIR Axial for Espree)
LT T1 Sag (~220 FOV, 4x1, 22 slices)
RT T1 Sag (~220 FOV, 4x1, 22 slices)

HIPS BILATERAL
STIR Cor bilateral
T1 Cor bilateral
T1 Axial bilateral (above sacrum through ischium)
T2 FS Axial bilateral (STIR Axial for Espree)
LT PD FS Axial (TE 40-45, unilateral, above acetabulum through ischium)
LT PD FS Cor (TE 40-45, unilateral)
LT PD FS Sag (TE 40-45, unilateral)
RT PD FS Axial (TE 40-45, unilateral, above acetabulum through ischium)
RT PD FS Cor (TE 40-45, unilateral)
RT PD FS Sag (TE 40-45, unilateral)

NOTE:
- Send bilateral sequences to both folders in Synapse.
- Consider MSK Pelvis with history of arthroplasty / joint replacement.
- Bilateral hips can be performed on a patient at any age, it is not necessary to change to a MSK pelvis exam.
HIPS BILATERAL WITH CONTRAST (osteomyelitis or mass)
STIR Cor bilateral
T1 Cor bilateral
T1 Axial bilateral (above sacrum through ischium)
T2 FS Axial bilateral (STIR Axial for Espree)
LT PD FS Axial (TE 40-45, unilateral, above acetabulum through ischium)
LT PD FS Cor (TE 40-45, unilateral)
LT PD FS Sag (TE 40-45, unilateral)
RT PD FS Axial (TE 40-45, unilateral, above acetabulum through ischium)
RT PD FS Cor (TE 40-45, unilateral)
RT PD FS Sag (TE 40-45, unilateral)
T1 FS Cor whole pelvis pre
T1 FS Cor whole pelvis post
T1 FS Axial whole pelvis post

NOTE:
- Send bilateral sequences to both folders in Synapse.
- Consider MSK Pelvis with history of arthroplasty / joint replacement.
- Bilateral hips can be performed on a patient at any age, it is not necessary to change to a MSK pelvis exam.

HIPS UNILATERAL
STIR Cor bilateral (~360 FOV, 4x0, 28 slices)
T1 Cor bilateral
T1 Axial bilateral (~360 FOV, 5x1, TE 12-20, above sacrum through ischium)
T2 FS Axial bilateral (STIR Axial for Espree)
PD FS Axial ((200 FOV, 4x1, 24 slices, TE 40-45, unilateral, above acetabulum through ischium)
PD FS Cor (~200 FOV, 4x1, 24 slices, TE 40-45, unilateral)
PD FS Sag (~200 FOV, 4x1, 24 slices, TE 40-45, unilateral)

NOTE: Consider MSK Pelvis with history of arthroplasty / joint replacement.

HIPS UNILATERAL WITH CONTRAST
STIR Cor bilateral (~360 FOV, 4x0, 28 slices)
T1 Cor bilateral
T1 Axial bilateral (~360 FOV, 5x1, TE 12-20, above sacrum through ischium)
T2 FS Axial bilateral (STIR Axial for Espree)
PD FS Axial (~200 FOV, 4x1, 24 slices, TE 40-45, unilateral)
PD FS Cor (~200 FOV, 4x1, 24 slices, TE 40-45, unilateral)
PD FS Sag (~200 FOV, 4x1, 24 slices, TE 40-45, unilateral)
T1 FS Cor whole pelvis pre
T1 FS Cor whole pelvis post

NOTE: Consider MSK Pelvis with history of arthroplasty / joint replacement.
HIP REPLACEMENT (DEPUY HIP PROSTHESIS RECALL) Include entire bony pelvis
T1 FSE Axial (6x1, include entire bony pelvis)
STIR FSE Axial
T1 FSE Cor (5x1, include entire bony pelvis)
STIR FSE Cor
T1 FSE Sag (6x1, include entire bony pelvis)

NOTE:
- Perform for partial and total hip arthroplasty.
- Use Fast Spin Echo (FSE) sequences & a high bandwidth in order to reduce the artifact from the hip prosthesis.
  Siemens – up to 400 hz/pixel, GE – up to 64khz.

JOINT CONTRAST (synovitis, rheumatoid arthritis, inflammatory arthritis, or inflammatory arthropathy)
Hand: Include the distal radius/ulna through the fingertips on all sequences.
Hip: Follow unilateral hip with contrast protocol.

All joints in addition to routine protocol (except for feet, ankles, hips)
T1 FS Cor pre & post
Shoulder – add T1 FS Ax post
Elbow – add T1 FS Sag post
Wrist – add T1 FS Ax post
Hand – add T1 FS Ax post
Knee – add T1 FS Sag post

Foot in addition to routine protocol
T1 FS Axial pre
T1 FS Axial post
T1 FS Sag post

Ankle in additional to routine protocol
T1 FS Axial pre
T1 FS Axial post
T1 FS Sag post

KNEE
PD FS Axial (~140 FOV, 4x1, 24 slices, TE 40-45)
PD FS Sag (~140 FOV, 3x1, 24 slices, TE 40-45)
PD Sag (~140 FOV, 3x1, 24 slices, TE 15-20, as close to 15 as possible)
T2 FS Cor (~140 FOV, 3x1, 24 slices)
PD Cor (~140 FOV, 3x1, 24 slices, TE 15-20, as close to 15 as possible)

NOTE:
- Add T1 Cor for possible fracture / trauma / soft tissue pathology (mass) / bright bone marrow on T2 sequences
PECTORAL MUSCLE/TENDON TEAR  *Radiologist approval must be obtained prior to completing exam.
PD Axial
STIR Axial
T1 Cor
T2 FS Cor
T1 Sag
T2 FS Sag
STIR Axial bilateral

NOTE:
- Affected side only, patient prone & orient phase direction to best minimize motion artifact, see picture protocol for detailed instructions.
- Must include pectoralis attachment on humeral shaft.

PELVIS MSK (inguinal hernia, coccyx or sacrococcygeal indications)
T1 Axial (minimum FOV to include entire bony pelvis 6x1)
T2 FS Axial (STIR Axial for Espree)
T1 Cor (minimum FOV to include entire bony pelvis 5x1)
STIR Cor
T2 FS Sag (minimum FOV to include entire bony pelvis 6x1) (STIR Sag for Espree)
T1 Sag (through sacrum only, add for fracture of sacrum or coccyx and sacrococcygeal disorders)

NOTE:
- If the diagnosis or patient history, particularly when the patient is under the age of 60, indicates possible hip pathology such as labral tear, cartilage abnormality, etc., consult with an MSK Radiologist to see if a Hip protocol should be used instead.

PELVIS MSK WITH CONTRAST (sacroiliitis)
T1 Axial (minimum FOV to include entire bony pelvis 6x1)
T2 FS Axial (STIR Axial for Espree)
T1 Cor (minimum FOV to include entire bony pelvis 5x1)
STIR Cor
T2 FS Sag (minimum FOV to include entire bony pelvis 6x1) (STIR Sag for Espree)
T1 Sag (through sacrum only, add for fracture of sacrum or coccyx and sacrococcygeal disorders)
T1 FS Cor pre/ post
T1 FS Axial post

NOTE:
- Attempts should be made to perform with & without contrast, however, an exam does not need to be rescheduled if unable to obtain a new order/authorization.

PELVIS MSK PEDIATRIC SLIPPED CAPITAL EPhipYSIS Use thinner slice on small patients.
T1 Axial (minimum FOV to include entire bony pelvis 6x1)
T2 FS Axial (STIR Axial for Espree)
T1 Cor (minimum FOV to include entire bony pelvis 5x1)
STIR Cor
T1 Sag (minimum FOV to include entire bony pelvis 6x1)
PELVIS MSK ATHLETIC PUBALGIA (sports hernia, athletic pubalgia, osteitis pubis, groin pain, adductor muscle/tendon) – 3T Preferred
First/last slice must be completely out of the bony pelvis for full FOV series.

T2 FS Axial (360, 5x1)
T1 Cor (360 5x1)
STIR Cor
T2 FS hr Obl Ax (160, 4x.5)
T2 FS hr Obl Cor (160, 4x.5)
T2 FS hr Sag (160, 4x.5)

SCAPULA
T1 Cor (240 FOV, 4x1mm, 20 slices, oblique to obtain true cor)
T2 FS Cor
T1 Axial (220 FOV, 6x1mm, 24 slices, oblique to obtain true axials)
STIR Axial
T1 Sag (240 FOV, 6x1mm, 24 slices, oblique to obtain true sagittal)
T2 FS Sag

SHOULDER
PD FS Axial (~150 FOV, 3x1, 22 slices, TE 40-45)
STIR Axial
PD Cor Obl (~140 FOV, 3x1, 18 slices)
T2 FS Cor Obl
T1 Sag Obl (~140 FOV, 4x1, approx. 24 slices, must include approx. 6cm of medial anatomy from glenoid fossa)
T2 FS Sag Obl (~140 FOV, 3x1, 24 slices)

NOTE: Affected arm at side with external rotation, palm facing upward. Place sandbag on palm if necessary to help the patient maintain this position.

SHOULDER, Austin Sports Medicine, Dr. Elenz
PD FS Axial (~150 FOV, 3x1, 22 slices, TE 40-45)
STIR Axial
PD Cor Obl (~140 FOV, 3x1, 18 slices)
T2 FS Cor Obl
T1 Sag Obl (~140 FOV, 4x1, approx. 24 slices, must include approx. 6cm of medial anatomy from glenoid fossa)
T2 FS Sag Obl (~140 FOV, 3x1, 24 slices)
T1 Axial (5x1, shoulder joint through mid-humerus)
T2 FS Axial

NOTE:
- Affected arm at side with external rotation, palm facing upward. Place sandbag on palm if necessary to help the patient maintain this position.
- Use shoulder & torso coils for upper arm series.
**SI JOINTS**
- T1 Axial (perpendicular to Sacrum)
- T2 FS Axial
- T2 FS Axial (minimum FOV to include entire bony pelvis, straight, non-oblique)
- T1 Cor (parallel to Sacrum)
- STIR Cor
- T1 Sag
- T1 FS Cor pre
- T1 FS Cor post

**NOTE:**
- Only perform if exam is specifically ordered as SI Joint protocol.
- Send scout images to Synapse.
- If not administering contrast, do not perform T1 FS Cor pre.

**STERNUM** Patient Prone whenever possible!
- T1 Axial
- T2 FS Axial
- T1 Cor
- T2 FS Cor
- T1 Sag
- T2 FS Sag

**STERNOCLEAVICULAR JOINTS**
- T1 Axial
- T2 FS Axial
- T1 Cor
- T2 FS Cor
- T1 Sag
- T2 FS Sag

**NOTE:** Scan patient prone & orient phase in direction that minimizes motion artifacts.

**For the following protocols:** Hands, fingers, feet & toes
- Always place marker to indicate area of concern!
- If scanning an entire hand, you must include the distal radius/ulna through the fingertips on all sequences.
- Limit FOV to the area of interest when there is specific indication. Any questions should be addressed to the radiologist. Evening shifts will need to be preemptive. Late add on exams should be directed to the radiologists on shift in the evening.

**THUMB – 3T Preferred**
- PD Axial
- STIR Axial
- PD Cor
- T2 FS Cor
- PD Sag
- T2 FS Sag
THUMB MASS / INFECTION – 3T Preferred
T1 Axial  
T2 FS Axial  
T1 Cor  
T2 FS Cor  
T1 Sag  
T2 FS Sag  
T1 FS Cor pre / post  
T1 FS Sag post

NOTE: Additional post plane is beneficial, consult radiologist for appropriate plane.

TOE ROUTINE / TURF TOE / PLANTAR PLATE (not Morton’s Neuroma) – 3T Preferred  
* Place marker on area of interest.  
PD FS Dixon Axial  
T1 Cor  
T2 FS Dixon Cor  
PD Sag  
T2 FS Dixon Sag  

Contrast, if needed:  
- T1 FS Dixon Cor pre / post  
- Additional post plane is beneficial, consult radiologist for appropriate plane.

TOE MASS / INFECTION – 3T Preferred *Place marker on area of interest.  
T1 Axial  
T2 FS Axial  
T1 Cor  
T2 FS Cor  
T1 Sag  
T2 FS Sag  
T1 FS Cor pre / post  
T1 FS Sag post

WHOLE BODY MULTIPLE MYELOMA – 3T Preferred  
IR Cor Skull (6-7x.5 mm slice thickness)  
IR Cor Sternum (5x.5mm, include medial half of clavicles)  
RT IR Cor Humerus (6-7x.6mm, include partial wall and distal clavicle)  
LT IR Cor Humerus  
IR Cor Pelvis (500 FOV, 6-7x.6mm, include as much as femurs as possible)

T1 Sag Total Spine Localizer (3T auto-composing)  
T1 Sag Cervicothoracic (~400 FOV, 5x.5mm)  
IR Sag Cervicothoracic  
T1 Sag Thoracolumbar (~400 FOV, 5x.5mm)  
IR Sag Thoracolumbar
**WRIST**

PD Axial (100 FOV, 3x0, 24 slices)
PD FS Axial (100 FOV, 3x0, 24 slices, TE 40-45)
T2 FS Cor (100 FOV, 3x0, 21 slices)
PD Cor
T2 3D Cor (120 FOV, 1.5x0, 36 slices)
T1 Cor (only if history of trauma/fracture or possible fracture)
STIR Sag (100 FOV, 3x0, 24 slices)

Contrast, if needed:
- Pain: T1 FS Cor pre / post with additional T1 FS Axial post
- Mass: Perform T1 & T2 FS protocol with T1 FS Axial pre & post, with additional plane which best demonstrates mass.
- Follow JOINT CONTRAST protocol for other inflammatory/arthritis/etc. diagnosis.

NOTE: Not performed at WLK.