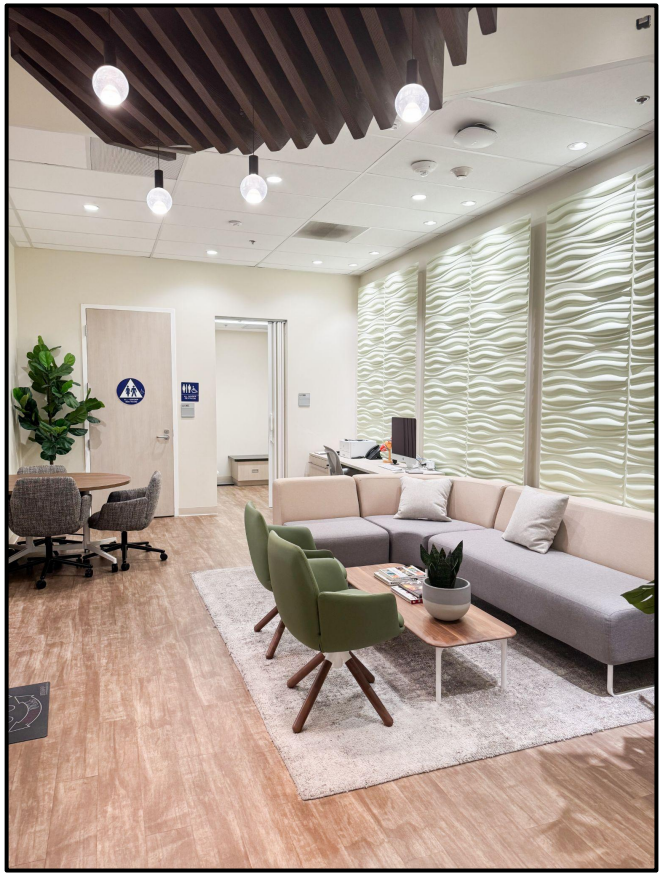
2025 DISC Users Meeting

Welcome


EXIT
USC Michelson Center
Dynamic Imaging Science Center (DISC)



Agenda

1. Center Updates
    a. Protocols & Human Subjects
    b. Research Output
    c. Collaborations & Outreach
    d. Core Facility
2. Logistics
    a. Operator Training
    b. Review of working at DISC
3. Breakout Groups

Imaging Protocols

1. Protocols
    a. Technical Development
    b. Speech
    c. Fetal screening
    d. Hip/spine implant
    e. Lung cancer screening
    f. Myocardial perfusion/arrhythmia/late Gd enhancement
    g. Fatty liver
    h. Body composition
    i. Wrist
    j. Pediatric heart/lung function
    k. Upper airway
    l. GI system
    m. Glossectomy

Human Subjects

1. Number of volunteers ~1100 (90% healthy volunteers)
2. 10% volunteers have clinical interesting conditions
    a. Pregnant women (35 participants)
    b. Orthopedic metallic implants (24)
    c. Lung cancer (18)
    d. Heart disease (4 arrhythmia, 6 myocardial scar, 1 ischemia, 6 Fontan)
    e. Fatty liver disease (10)
    f. Head or neck cancer (20)
    g. Obstructive sleep apnea (?)

Research Output

1. Number of journal publications
   a. Leading author USC **15**
   b. Leading author outside USC **6**
2. Number of conference presentations **>70**
3. Grants (**12M** funded, **6.7M** pending)
   a. NIH R01, Screening of Fetal Abnormalities (5%ile), Apr 2025 - Mar 2030, $4.1M (Wood)
   b. NIH R01, Improved MR Guided Radiotherapy (11%ile); April 2025 - Mar 2030, 2.6M (Fan)
   c. NIH DP2, Reliable AI for Medical Image Reconstruction; Sept 2023 – Aug 2028, 2.4M (Soltanolkotalbi)
   d. NIH U01, Volumetric Real-Time MRI, Jan 2023 - Dec 2026, $2.1M (Nayak)
   e. NIH R21, Improved Myocardial Perfusion Imaging, Jun 2022 - May 2024, $470k (Tian)
   f. NIH R01, Improved MRI Around Orthopedic Metallic Implants, Feb 2022 - Dec 2026, $3.9M (Nayak)
   g. NSF, Instrumental MRI, $2.5M (Nayak, Byrd, Halder, Narayanan, Iskarous)
   h. USC Provost SDRA, Pediatric and Fetal Imaging Pipeline, Jan 2022 - Aug 2023, $300k (Nayak/Wood)
   i. AHA Postdoc Scholarship, Myocardial Perfusion, Jan 2022 - July 2023, $140k (Tian)

National Institutes of Health

American Heart Association.

Collaboration

I. Departments & Labs →
II. CHLA →

Academic Collaborators

Affiliation	Name	Affiliation	Name	Affiliation	Name
UCLA / Radiology	Jay Acharya	Keck / Neurorestoration	Charles Liu	UCSF / Radiology	Daehyun Yoon
CHLA / Cardiology	Jon Detterich	Keck / Neurorestoration	Jonathan Russin	University of Basel	Grzegor Baumann
CHLA / Cardiology	Jay Pruetz	Keck / Radiology	Lucia Flors-Blasco	University of Basel	Oliver Bieri
CHLA / Cardiology	John Wood	Keck / Radiology	Bhushan Desai	University of Toronto	Datta Goolaub
CHLA / Mat Fet Med	Brendan Grubbs	Keck / Radiology	Zhaoyang Fan	University of Toronto	Chris MacGowan
CHLA / Neuro	Vidya Rajagopalan	Keck / Radiology	Darryl Hwang	University of Toronto	Josh van Amerom
CHLA / NICU	Narayan Iyer	Keck / Radiology	Alison Wilcox	Dornsife / Linguistics	Dani Byrd
CHLA / Pulmonology	Stanford Chun	Keck / Otolaryngology	Sebastian Jara	Dornsife / Linguistics	Louis Goldstein
CHLA / Pulmonology	Roberta Kato	Keck / Otolaryngology	Uttam Sinha	Dornsife / Linguistics	Khalil Iskarous
CHLA / Radiology	Eamon Doyle	NIH / NHLBI	A. Campbell-Washburn	Dornsife / Psychology	Jonas Kaplan
CHLA / Radiology	HaiThuy Nguyen	NIH / NHLBI	Marcus Chen	Dornsife / Psychology	Santiago Morales
CUNY / Spch Lang Path	Christina Hagedorn	NIH / NHLBI	Rajiv Ramasawmy	USC Athletics	Russell Romano
CHOC / Radiology	Skorn Ponrartana	NIST	Kalina Jordanova	Viterbi / AME	Abbas Moghaddam
Keck / Cardiology	Parveen Garg	NIST	Kathryn (Katy) Keenan	Viterbi / AME	Niema Pahlevan
Keck / Cardiology	Junaid Zaman	Stanford / EE & Rad	Brian Hargreaves	Viterbi / BME	F. Valero-Cuevas
Keck / Hepatology	Hyosun Han	Stanford / Radiology	Daniel Ennis	Viterbi / ECE	Justin Haldar
Keck / Hepatology	Navpreet Kaur	UC Davis / BME	Abhijit Chaudhari	Viterbi / ECE	Yasser Khan
Keck / Hepatology	Liyun Yuan	UC Davis / Ortho Surg	Robert Szabo	Viterbi / ECE	Richard Leahy
Keck / Oncology	Jorge Nieva	UCLA / Radiology	Jordan Gross	Viterbi / ECE	Shrikanth Narayanan
Keck / Ortho Surgery	Jeffrey Wang	UCLA / Radiology	Holden Wu	Viterbi / ECE	Mahdi Soltanolkotabi

Industry Collaborators

Affiliation	Name	Affiliation	Name	Affiliation	Name
AMRA	Andre Ahlgren	Siemens	Vibhas Deshpande	Siemens	David Grodski
AMRA	Sarah Weston	Siemens	Matthias Fenchel	Siemens	Stefan Popescu
Boston Scientific	Louai Aldayeh	Siemens	Daniel Giese	Vista.AI	Juan Santos

Tours and Demos

I. We provide tours for ECE, BME, and Linguistics trainees, Speech/Language Pathologists, Cardiologists, Pediatric Specialists, undergraduates, and K-12 students. We have hosted 30 tours since Fall 2021 with >500 visitors. In 2023, we hosted 10 tours that included ~200 visitors.

Research Core

USC Viterbi
Dynamic Imaging Science Center

- Since July 2023
- Services + Cost →
- Grant Support
  - IRB Support
  - Major Equipment
  - Letters of Support
  - Price Structure

DISC Price Structure

Category	Type	Description	Price
Assisted	w/ Contrast	DISC technologist conducts scan & administers IV contrast	$650/hr
	w/o Contrast	DISC technologist conducts scan	$400/hr
Unassisted	w/o Contrast	DISC level-2 operator listed on study protocol conducts scan	$250/hr
Pilot study		DISC technologist or level-2 operator listed on study protocol conducts scan (requires DISC Management Oversight Board approval of pilot project application)	Unbilled

Grant Budgeting
In grant proposals, investigators are expected to budget for scan time at the "assisted" and/or "unassisted" rates listed above. Pilot study time is only available for unfunded studies. Be sure to budget for all time that will be potentially needed. This includes scans for testing and technical development (e.g., phantom scans, scans to refine the imaging protocol, scans with/without technologist support, etc.) as well as study participant scans.

Unbilled Scans
All unbilled scans/projects require pre-approval by DISC leadership. These include short phantom scans, unfunded studies, and pilot studies. Unbilled scan time is approved for a limited number of scans or for a specified period.

EQUIPMENT

UNIVERSITY OF SOUTHERN CALIFORNIA

Dynamic Imaging Science Center (DISC)

This project will utilize a research-dedicated high-performance 0.55T MRI system (supported by NSF Grant #1828736) located in the Michelson Center for Convergent Biosciences, which is USC's flagship biomedical research building on our University Park Campus.

System and Console: This system is a Siemens Aera MRI. It includes zero helium boil-off technology, advanced MR gradient technology including a high-performance 100% duty-cycle shielded "XQ" gradient coil (45mT/m, 200mT/m/ms – on each axis), enhanced gradient amplifiers, 48-channel fast receiver (2μs sampling), passive/active shims, a 70 cm bore, and total integrated matrix (TIM) integrated receiver coil technology.

High-performance 0.55T MRI scanner is in the Michelson Center for Convergent Biosciences on the USC University Park Campus (operational since January 2021)

The key attributes of this system are: 1) high performance shielded gradients; 2) stable and proven design; 3) comprehensive and versatile scan options; 4) simplified scan planning and high productivity ("DOT" engine); 5) noise reduction measures such as epoxy-resin cast gradients and acoustically damped mountings; 6) ease of customizing pulse sequences (IDEA programming environment); 7) ease of customizing image reconstruction (ICE programming environment); 8) main field homogeneity <0.5 ppm for 30cm field-of-view.

System Modifications: This system was originally designed to operate at 1.5 Tesla. Siemens engineers' custom modified the system to make it operate at 0.55 Tesla. The main magnetic field was ramped to 0.55 Tesla, and manually shimmed. The whole-body transmit/receive birdcage RF coil was replaced by one that is tuned to 23.6 MHz (^{1}H at 0.55T). The RF amplifier was replaced with one designed for 23.6 MHz. All receiver coils were designed for 23.6 MHz.

Subject Friendly: The physical space of the Dynamic Imaging Science Center was professionally designed to be subject friendly. Subjects enter through a comfortable lounge/reception area, which includes a private area for screening and obtaining informed consent. There is an attached changing area with lockers. There is an attached ADA compliant restroom. For metal screening, we have installed a sensitive and easy-to-use pillar system, and secondary wand system FerrAlert™ SOLO and Target Scanner.

Custom Receiver Coils: In addition to the transmit-receive body coil, this system is equipped with several custom RF receive-only coils tuned to 23.6 MHz: 1) 6-channel body array; 2) 18-channel spine array, 3) 12-channel head and neck array; 4) 8-channel upper airway array. The first three coils were provided by Siemens, and the fourth was provided by Stark Contrast LLC, Erlangen, Germany.

Methods Development: A collaborative research agreement with Siemens Healthcare provides our group with access to pulse sequence (IDEA) and reconstruction (ICE) development environments. We receive a high-level of technical support, including an FTE Siemens scientist who has been on-site since February 2020, continuous hardware and software upgrades as well as access to the latest Siemens imaging and postprocessing software.

USC University of Southern California

Viterbi School of Engineering
Ming Hsieh Department of Electrical and Computer Engineering
Krishna S. Nayak, Ph.D.
Dean's Professor of Electrical and Computer Engineering
Director, Magnetic Resonance Engineering Laboratory
Director, Dynamic Imaging Science Center

24 February 2025

<PI Address Block>

Re: <Grant Title>
<Funding Mechanism>
Anticipated Submission Date: <Date>

Dear <PI>,

I confirm that the MRI facilities and resources of the Dynamic Imaging Science Center (DISC, disc.usc.edu) at the University of Southern California are available for your proposed project, pending any necessary IRB approval and operator training, and subject to the normal policies, procedures and costs associated with the use of the Center. We are a core facility located in the Michelson Center for Convergent Biosciences, the flagship biomedical research building on USC's University Park Campus.

DISC operates a research-dedicated 0.55T MRI and provides substantial infrastructure supporting methodological and translational research. The MRI (Aera XQ, Siemens Healthineers) is equipped with high-performance gradients capable of 100% duty cycle, 45mT/m amplitude, and 200mT/m/ms slew rate on each axis. It is also equipped with a real-time imaging console (RTHawk, Vista.ai), a variety of custom 1H receiver coils (23.6 MHz), a variety of physiological monitoring equipment, and computing infrastructure (LAMBDA Hyperplane 4-A100) for real-time image reconstruction and processing. On staff, we have a full-time clinical research coordinator, full-time MRI physicist, and part-time MRI technologist. We offer MRI safety and operator training for research users, as described on our website.

The current cost of scan time involving human subjects is $650/hour for MRI with contrast and $400/hour for MRI without contrast and this includes an MRI technologist. The cost of scan time without human subjects (e.g. testing, debugging) is $250/hour.

Sincerely,

<signature>
Krishna S. Nayak, PhD
Professor, Ming Hsieh Department of Electrical and Computer Engineering
Director, Dynamic Imaging Science Center
Director, Magnetic Resonance Engineering Laboratory
University of Southern California

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Research Core - Future Plans

- Conversion of MRI Operator Training into a 2-unit course (~1 year)
  - ALT: Per-person charge for operator training: Level 1, Level 2, Level-C

- Migration to Siemens Free.MAX XL (~2 year)
  - FDA-approved
  - Newer software
  - 80cm bore
  - Slightly weaker gradients
  - (would match with CHLA and a more widely adopted platform)

LOGISTICS

Operators

I. Certification Levels

a. Level-0: magnet safety + assistance in research studies

b. Level-1: independent scanning of phantoms

c. Level-2: independent scanning of human subjects

d. Level-C: conducting metal screening + assistance of subject scan prep

LOGISTICS

DISC Users: 84 total researchers have completed trainings

I. Research staff (investigators, staff, postdocs): **32**

II. PhD students: **41**

III. MS students: **1**

IV. Undergraduate students: **10**

LOGISTICS

Review

I. **Clothing Policy**

What type of clothing is considered MRI-safe?

- 100% plant-based fabrics (cotton, bamboo, hemp, etc.)
- fabrics that are metal/magnetic-free

What type of clothing material and/or items should screeners check for before a participant enters the scanner room?

- Buttons
- Zippers
- Buckles
- loose items: pens, clips, wallets, phones, etc.
- advanced/high-tech fabric (e.g., LuluLemon X-static/Silverescent)

If a participant would like to wear their own clothing, what steps should be completed?

1. Confirmation from participant that clothing is 100% plant-based or metal-free/MRI-safe

2. Completion of Clothing Policy Confirmation

3. Metal check

USC Viterbi
Dynamic Imaging Science Center

Clothing Policy Confirmation

As a participant in a research study at the USC Dynamic Imaging Science Center, I understand there are safety issues related to metal in the MRI environment. I am choosing to wear my own clothing during the MRI scan that I will undergo as a study participant and confirm that the garments meet the following guidelines:

- All clothing is made of 100% plant-based fabrics and are metal-free / MRI safe. Elastic and spandex in undergarments, waistbands, and cuffs are permissible if metal-free.
- Clothing is free of fastenings (buttons, zippers, buckles, etc.) or have fastenings that are metal-free / MRI safe.

Name Signature Date

LOGISTICS

Review

I. Clothing Policy

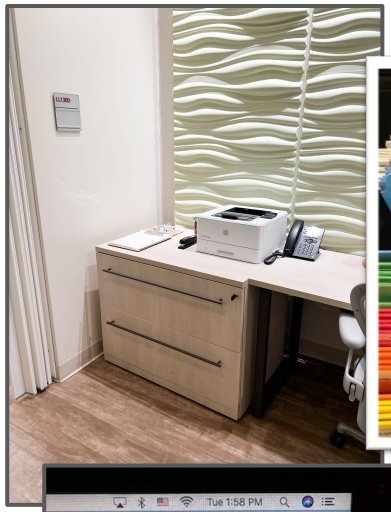
II. **Equipment Storage**

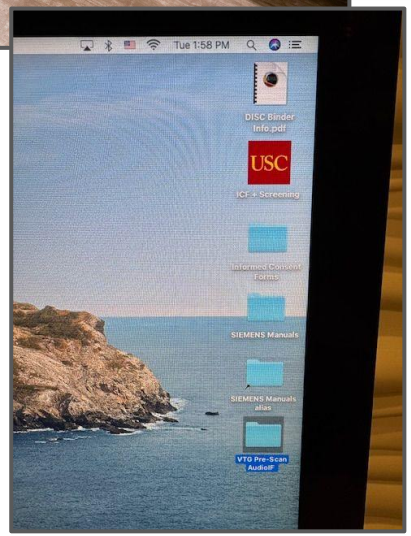

1


2


3


4
5
6



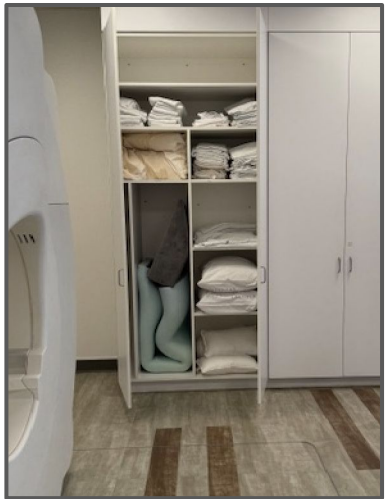


Forms
Screening + IC

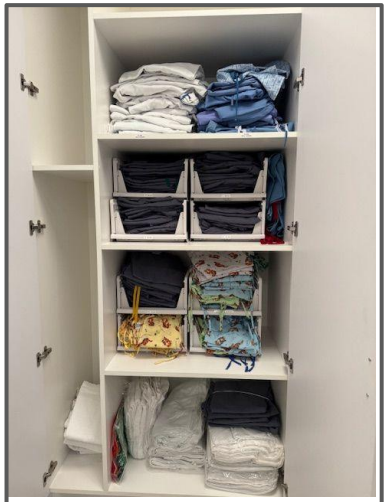
Phantoms + Coils

scanning supplies

pillows, padding, linens



scrubs/gowns



extra stock

Equipment room LL131

LOGISTICS

Review

I. Clothing Policy

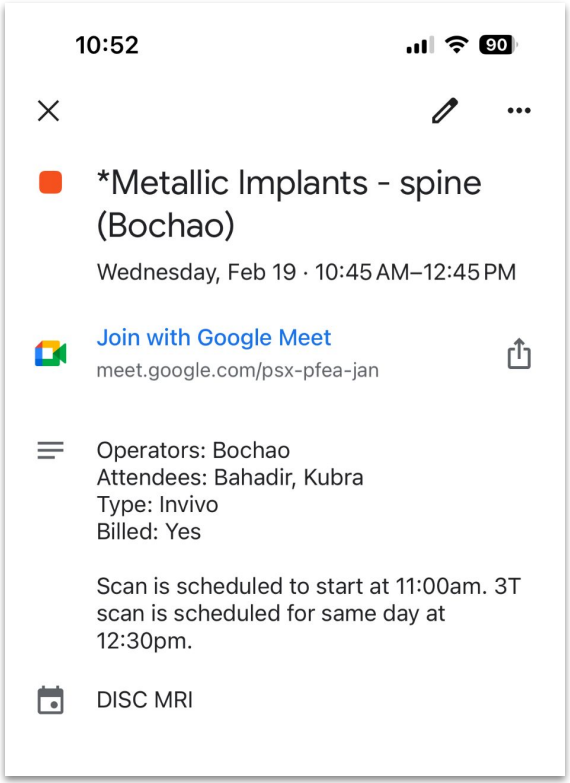
II. Equipment Storage

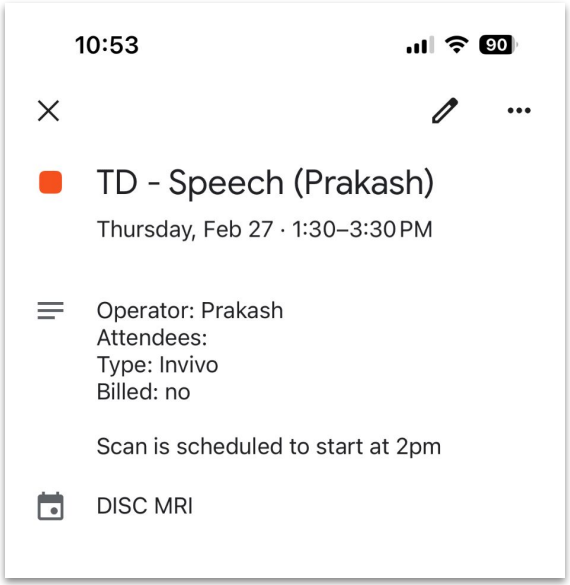
III. **Calendar Reservations**

When making a DISC calendar reservation, what info should be included?

- Project title
- Operator name
- Attendees
- Type: invivo / phantom
- Billed: yes / no

Sample calendar reservations





If an asterisk is included before the project title in a calendar reservation, what does that signify?

- The scan is billed and/or is a priority scan.
- The scan cannot be bumped.

LOGISTICS

Review

I. Clothing Policy

II. Equipment Storage

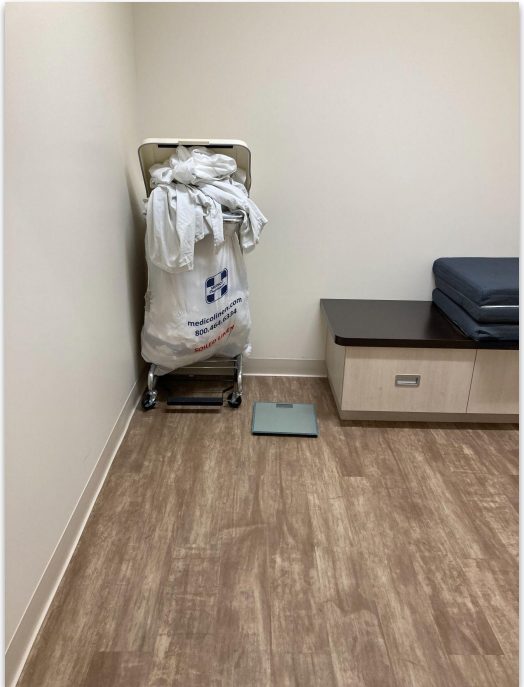
III. Calendar Reservations

IV. Linens/Laundry

Complete this sentence:

Linens/Laundry is **SHARED** responsibility at DISC.

- Service is biweekly.
- Notify Mary if low on any items: sheets, pillowcases, blankets, scrubs/gowns.
- Hamper bag should be placed in hallway bin when ¾ full.



Securing Subjects’ Belongings

- Always offer a locker in the changing room to participants.

- Avoid participants’ personal belongings being left out in the reception room.

BREAKOUT GROUPS