Re: SPAN initial rat imaging test

From: **Thedens, Daniel R** | dan-thedens@uiowa.edu Thursday, Mar 25, 9:53 AM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu, **Cenk Ayata** | CAYATA@mgh.harvard.edu

Cc: **Karisma A Nagarkatti** | nagarkat@usc.edu

I have uploaded a rat MRI study to the Pilot Stage 2, labelled "IR0001" (Iowa rat 0001). This is a Day 2 post-surgery.

The protocol I used was identical to the mouse protocol except that the field of view was increased to 25.6 mm (from 19.2) and the slice thickness was increased to 0.8mm (from 0.5mm). Matrix sizes were kept at 128x128 to keep the scan time the same. Voxel sizes are thus larger than in the mouse. I also added a second RARE_anatomy_192 scan that increased the matrix size to 192 x 192 in-plane and reduced averages from 4 to 3. This resulted in a very similar scan time and should have approximately the same SNR as in the mouse images.

Comments on this initial run:

- Overall image quality was good for RARE and T2 map sequences. This is not surprising given that the voxel volume is nearly 3x larger.
- The DWI scans are probably unusable in this set as there is a large amount of motion artifact. I can think of variety of causes, including vibration in the fixture, respiratory motion arising from sub-optimal positioning and restraint, or even reduced warm airflow causing the animal to shiver. I will need to investigate.
- The higher resolution RARE scan looks considerably more 'crisp' with the same duration.
- There is a decent amount of phase wrap in the images at this field of view, though it does not affect the brain. Still, in larger animals it might be excessive. I have historically done this with phase in the L/R direction, but I don't think there would be an issue swapping and it might alleviate the problem.
- It may be desirable to increase the matrix on the T2 and DWI, but since these are run at 1 average, this is very likely to require additional time unless we do anisotropic resolution in-plane (say 192 x 128).

Cenk, if you want to see the images and it's more convenient, I can put these at an externally accessible link for download.

--
Dan Thedens
dan-thedens@uiowa.edu

From: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Thursday, Mar 25, 10:05 AM

To: **Karen Crawford** | karen.crawford@loni.ucla.edu

Hi Karen,

Hope you're doing well, just wanted to touch base about this change to the SPAN protocol since I'm not sure if they've coordinated with you yet.

They've added rats to stage 2, and I think they will also be scanning mice concurrently. So, I was wondering if we may need to tag the species in the IDA, since they will probably need different pipelines. What do you think?

Thanks,
Ryan

Ryan P. Cabeen, PhD
Postdoctoral Scholar - Chan Zuckerberg Imaging Scientist
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

> From: **Thedens** | dan-thedens@uiowa.edu To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu Thursday, Mar 25, 9:53 AM
>
> I have uploaded a rat MRI study to the Pilot Stage 2, labelled "IR0001" (Iowa rat 0001). This is a

Day 2 post-surgery.

The protocol I used was identical to the mouse protocol except that the field of view was increased to 25.6 mm (from 19.2) and the slice thickness was increased to 0.8mm (from 0.5mm). Matrix sizes were kept at 128x128 to keep the scan time the same. Voxel sizes are thus larger than in the mouse. I also added a second RARE_anatomy_192 scan that increased the matrix size to 192 x 192 in-plane and reduced averages from 4 to 3. This resulted in a very similar scan time and should have approximately the same SNR as in the mouse images.

Comments on this initial run:

- Overall image quality was good for RARE and T2 map sequences. This is not surprising given that the voxel volume is nearly 3x larger.
- The DWI scans are probably unusable in this set as there is a large amount of motion artifact. I can think of variety of causes, including vibration in the fixture, respiratory motion arising from sub-optimal positioning and restraint, or even reduced warm airflow causing the animal to shiver. I will need to investigate.
- The higher resolution RARE scan looks considerably more 'crisp' with the same duration.
- There is a decent amount of phase wrap in the images at this field of view, though it does not affect the brain. Still, in larger animals it might be excessive. I have historically done this with phase in the L/R direction, but I don't think there would be an issue swapping and it might alleviate the problem.
- It may be desirable to increase the matrix on the T2 and DWI, but since these are run at 1 average, this is very likely to require additional time unless we do anisotropic resolution in-plane (say 192 x 128).

Cenk, if you want to see the images and it's more convenient, I can put these at an externally accessible link for download.

--
Dan Thedens
dan-thedens@uiowa.edu

From: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Thursday, Mar 25, 10:25 AM

To: **Karen Crawford** | karen.crawford@loni.usc.edu

Hi Karen,

Hope you're doing well, just wanted to touch base about this change to the SPAN protocol since I'm not sure if they've coordinated with you yet.

They've added rats to stage 2, and I think they will also be scanning mice concurrently. So, I was wondering if we may need to tag the species in the IDA, since they will probably need different pipelines. What do you think?

Thanks,
Ryan

Ryan P. Cabeen, PhD
Postdoctoral Scholar - Chan Zuckerberg Imaging Scientist
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

From: To: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Thursday, Mar 25, 9:53 AM

Hi Karen,

Hope you're doing well, just wanted to touch base about this change to the SPAN protocol since I'm not sure if they've coordinated with you yet.

> They've added rats to stage 2, and I think they will also be scanning mice concurrently. So, I was wondering if we may need to tag the species in the IDA, since they will probably need different pipelines. What do you think?
>
> Thanks,
> Ryan

From: **Karen Crawford** | Karen.Crawford@loni.usc.edu Thursday, Mar 25, 10:31 AM

To: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu

Hi Ryan,

Yes, we are aware of that change and will be adding species as a variable to be collected at time of upload. We're just waiting for finalization of the REDCap forms so we can configure matching Stage 2 visits in the IDA.

Karen Crawford
Laboratory of Neuro Imaging
Mark and Mary Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN

From: **Ryan Cabeen** | ryan.cabeen@loni.usc.edu Thursday, Mar 25, 10:34 AM

To: **Karen Crawford** | Karen.Crawford@loni.usc.edu

Great, thank you!

Ryan P. Cabeen, PhD
Postdoctoral Scholar - Chan Zuckerberg Imaging Scientist
Laboratory of Neuro Imaging
USC Stevens Neuroimaging and Informatics Institute
Keck School of Medicine of USC
University of Southern California
2025 Zonal Ave.
Los Angeles, CA 90033
Tel: (323) 44-BRAIN
Email: rcabeen@loni.usc.edu
Web: cabeen.io

From: **Ayata, Cenk, M.D.** | CAYATA@mgh.harvard.edu Thursday, Mar 25, 6:17 PM

To: **Thedens, Daniel R** | dan-thedens@uiowa.edu

Cc: **Ryan Cabeen** | Ryan.Cabeen@loni.usc.edu, **Fahmeed Hyder** | fahmeed.hyder@yale.edu, **Huang, Shuning** | Shuning.Huang@uth.tmc.edu, **Joe Mandeville** | jbm@nmr.mgh.harvard.edu, **Arbab, Ali** | AARBAB@augusta.edu, **Adnan Bibic** | adnan.bibic@jhmi.edu, **Basavaraju Ganganna** | basavaraju.ganganna@yale.edu, **Mihailovic, Jelena** | jelena.mihailovic@yale.edu

Thanks, Dan, this is very helpful. I am cc'ing the MRI group for their thoughts and comments, and it would indeed be helpful if you can share the images with all cc'ed here. Ryan and I will take a look at the uploaded images as well. I suspect this will be a core discussion at the April 2 and 6 zooms.
Regards,
Cenk