

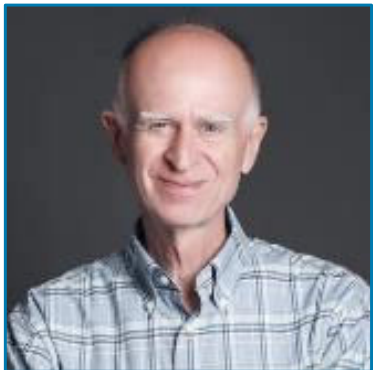


# RHAPSODY – 2 MRI Data Collection and Processing

Dr. E. Mark Haacke  
Miller Fawaz  
Spintech, Inc.

# Who is Spintech, Inc.?

Transforming World-Leading Research to accelerate precision neuroimaging in clinical operations



## E. Mark Haacke, PhD

*Founder & Chief Science Officer*

*Globally recognized MRI innovator*

*Inventor of SWI, MRA*

*Founder of MR Innovations*

*Past President ISMRM, ISNVD*



**FDA 510K**  
Cleared (STAGE)



Research Papers



**60+** Global  
Research Sites



**19** Awarded  
Patents

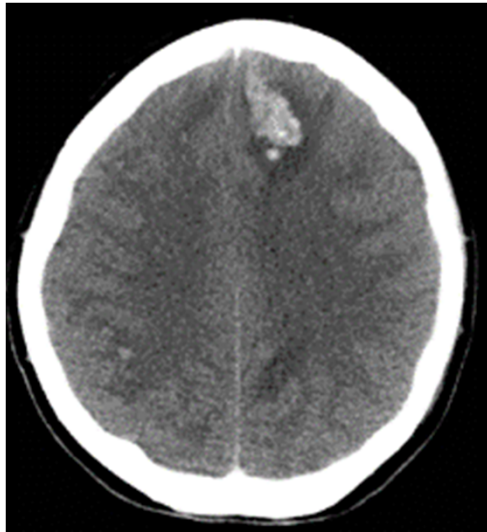


Experienced,  
Integrated Team

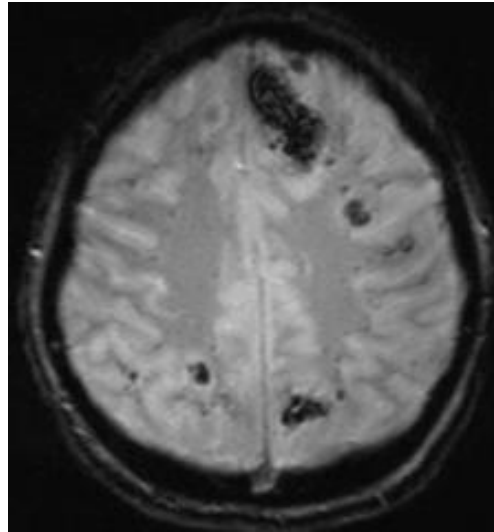


**10,000+**  
Processed Cases

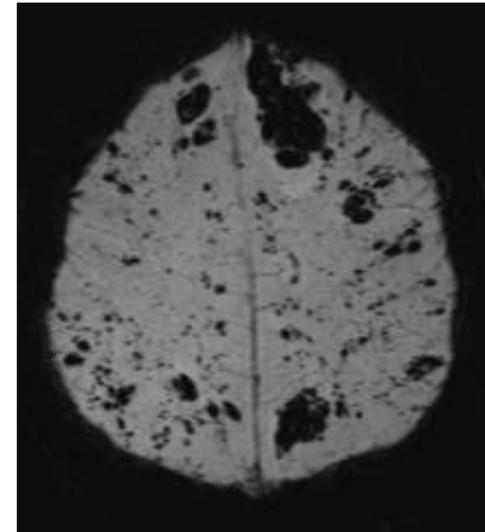
# The Need for Standardization



**Standard CT**  
Computerized Axial Tomography



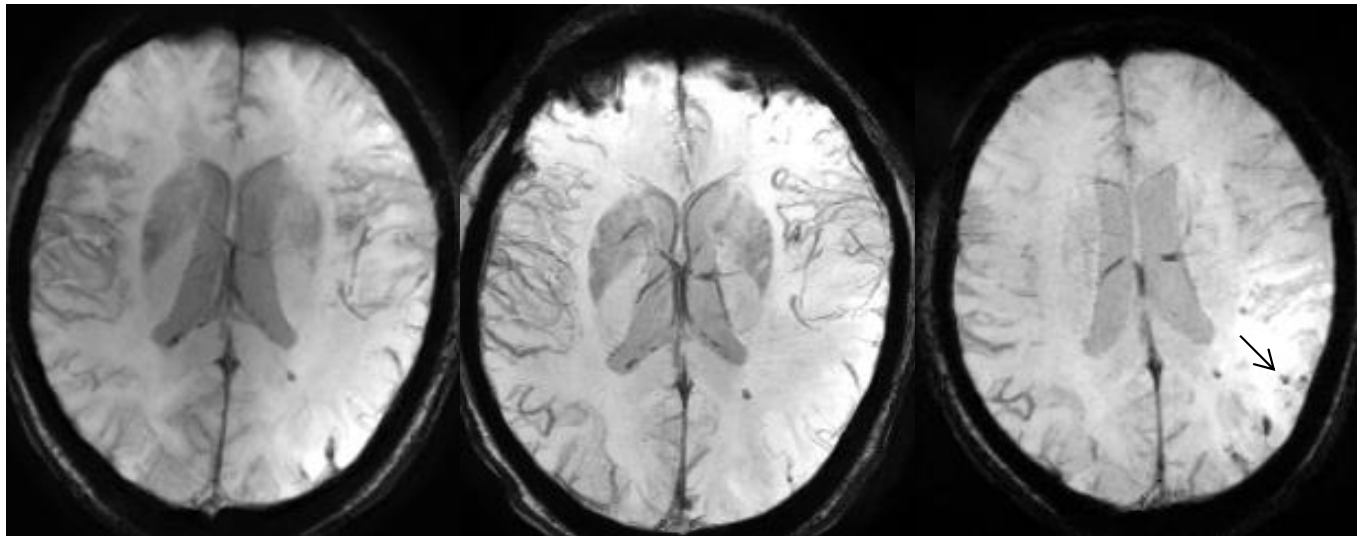
**Standard MRI**  
Gradient Recalled Echo



**STAGE-SWI**  
Susceptibility Weighted Imaging

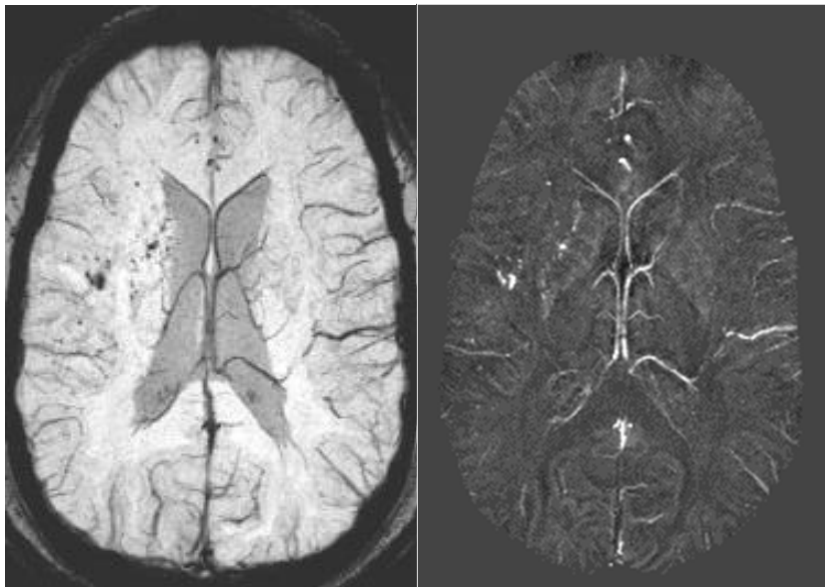
Images courtesy of Karen A. Tong, MD, Loma Linda University

# Example from RHAPSODY – 1



Day 1	Day 7	Day 30
SWAN	SWAN	GRE
0.43*0.43*2.4mm <sup>3</sup>	0.43*0.43*1.2mm <sup>3</sup>	0.9x0.9x2.0mm <sup>3</sup>
3T	3T	1.5T

# Examples from RHAPSODY – 1

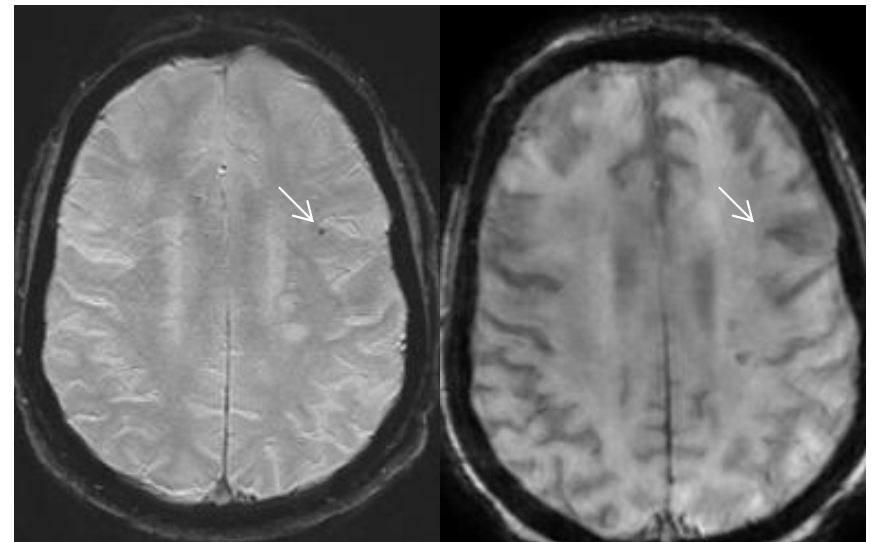


SWI mIP

SWIM MIP

0.6x0.6x2.0mm<sup>3</sup>

Microbleeds not visible at lower resolutions



Day 30

Day 90

GRE

SWAN

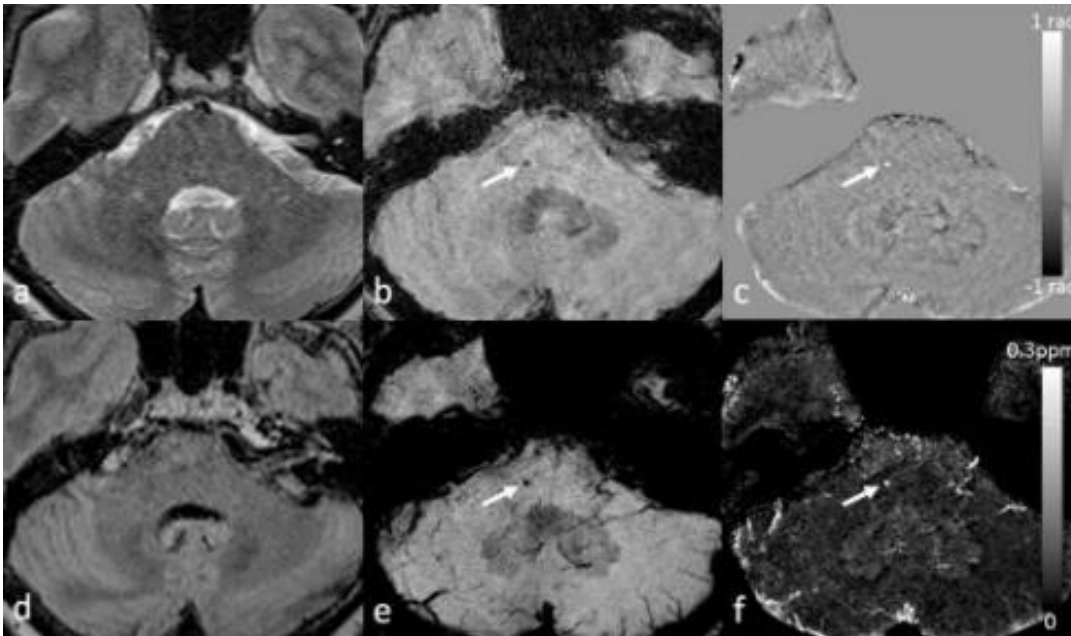
0.47x0.47x3.0mm<sup>3</sup>

0.86x0.86x3.0mm<sup>3</sup>

1.5T

1.5T

# SUSCEPTIBILITY WEIGHTED IMAGING: CURRENT STATUS AND FUTURE DIRECTIONS – MICROBLEEDING



Liu et al. 2017 NMR Biomed

- ▶ Imaging cerebral microbleeds (CMB) using SWI and QSM:
  - T2WI (a)
  - Magnitude (b)
  - Filtered phase (c)
  - FLAIR (d)
  - SWI minIP (e)
  - SWIM MaxIP (f)
- ▶ Paramagnetic and isolated from vessels
- ▶ Iron content quantification

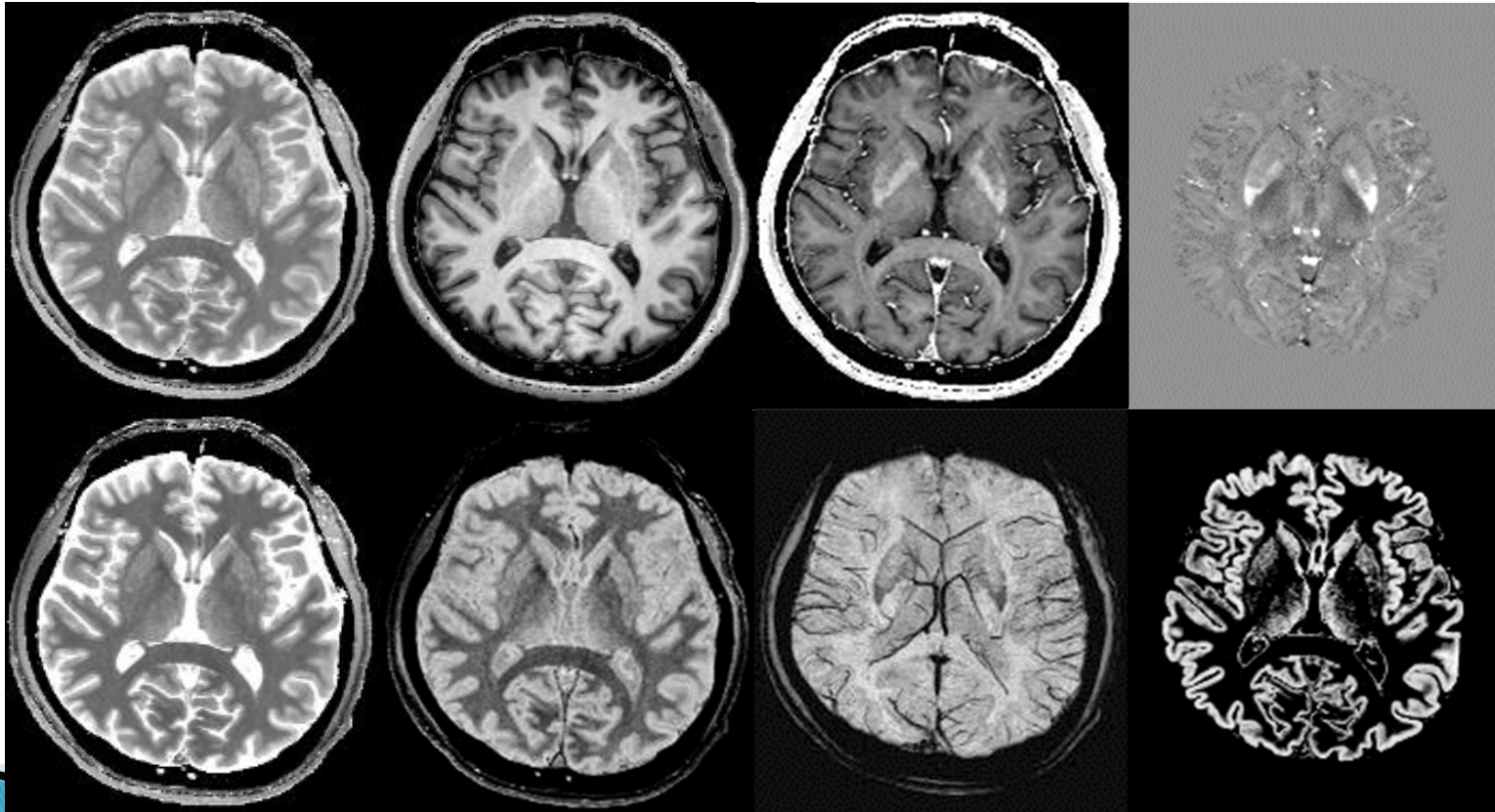
# 3T data from a Skyra in Kyoto: 32 channel head coil

PSD map

T1WE

R2\*

QSM



T1 map

PSDW

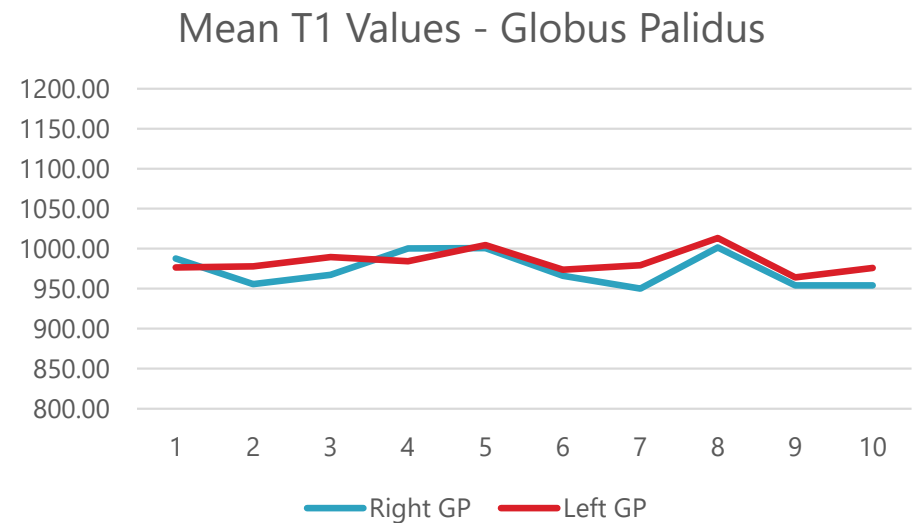
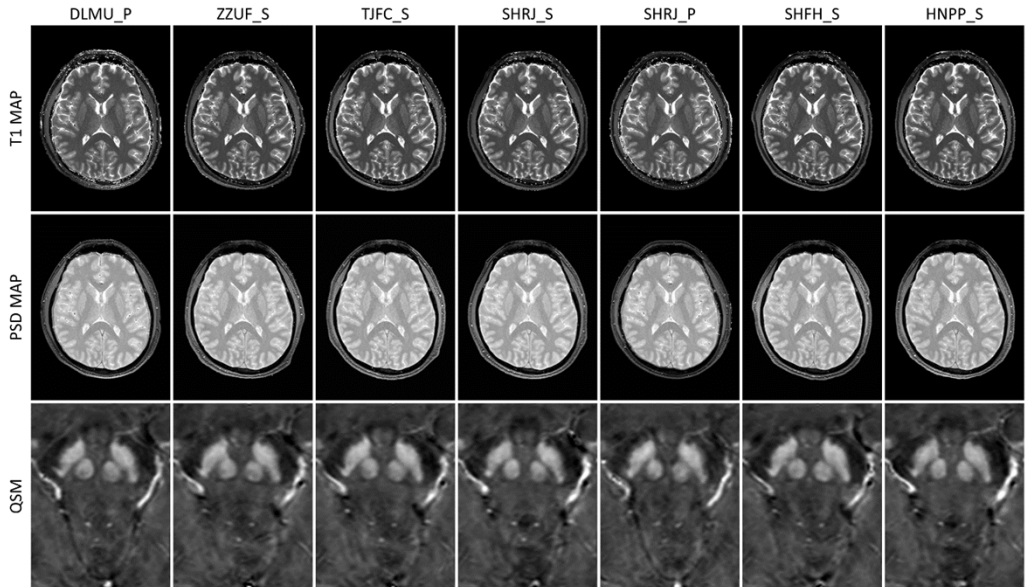
SWI

GM sDIR

# Data Standardization Across Magnets

Standardized data provides consistent contrasts and quantitative values across manufacturers.

*Enables reliable longitudinal tracking across sites and group data analysis.*



**Figure A:** Single subject scanned on 7 different 3T magnets (5 Siemens, 2 Philips)



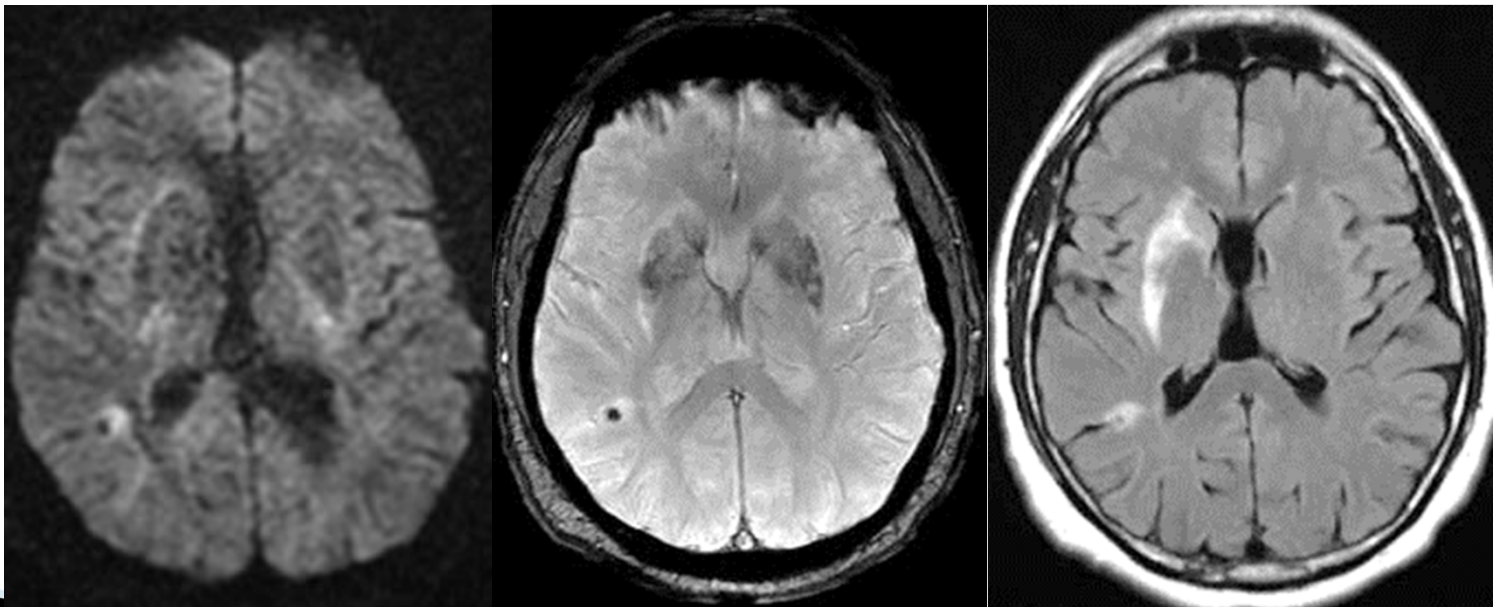
# Recommended Protocol

	Group 1 (required)			Group 2 (STAGE)		Group 3		
Sequence	DWI	HR SWI	3D FLAIR	LR SWI PDW	LR SWI T1W	3D TOF	T1-MPRAGE	T2 TSE
Time on 3T	8m 28s			6m 24s		14m 28s		
Time on 1.5T	9m 38s			7m 36s		18m 0s		

- ▶ Prioritized in descending relevance to study objectives to minimize scan time and patient discomfort
- ▶ Common clinical acquisitions are required
- ▶ STAGE immediately following to produce quantifiable maps
- ▶ Deployed by MR technicians directly coordinating with Spintech, Inc.

# Recommended Protocol

	Group 1 (required)			Group 2 (STAGE)		Group 3		
Sequence	DWI	HR SWI	3D FLAIR	LR SWI PDW	LR SWI T1W	3D TOF	T1-MPRAGE	T2 TSE
Time on 3T	8m 28s			6m 24s		14m 28s		
Time on 1.5T	9m 38s			7m 36s		18m 0s		

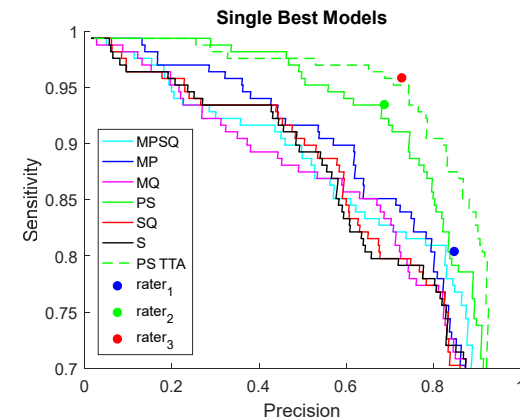
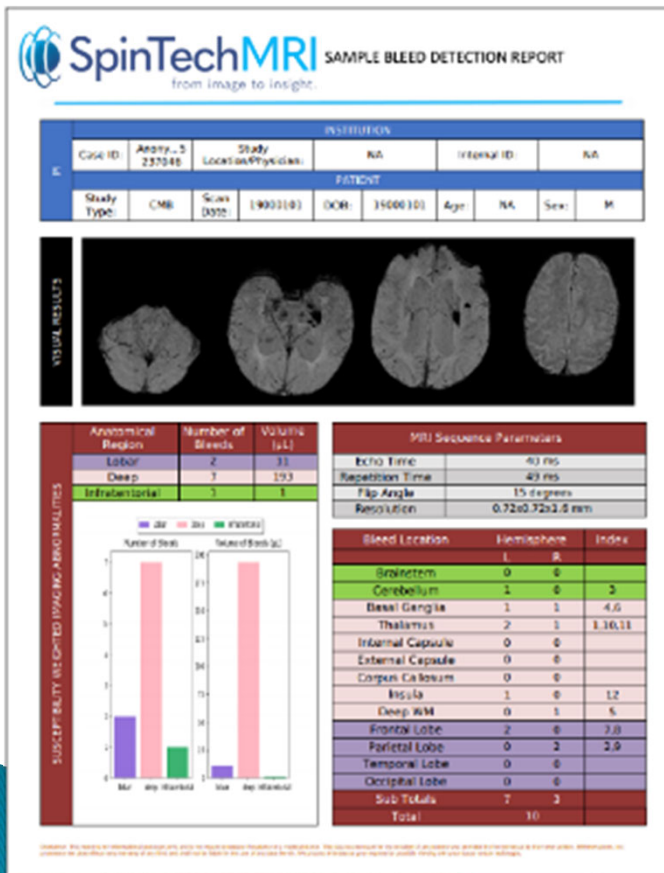


DWI

SWI

T2 FLAIR

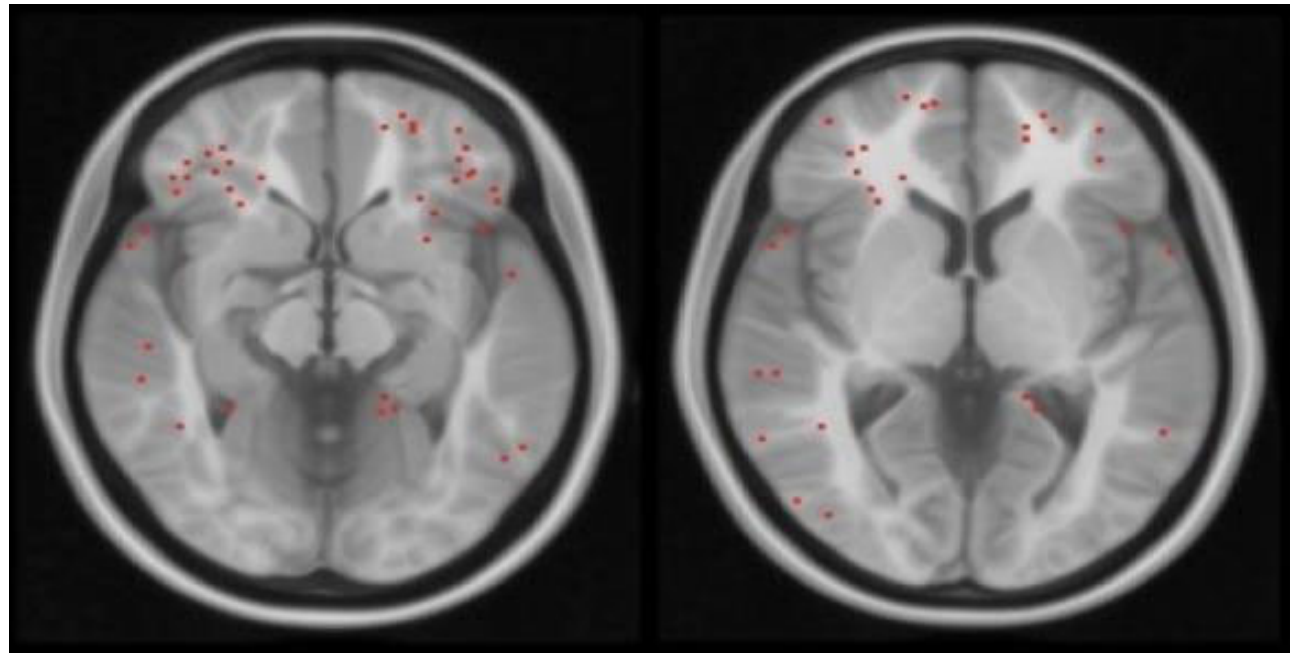
# Planned MRI data analysis: Quantify Cerebral Bleeds



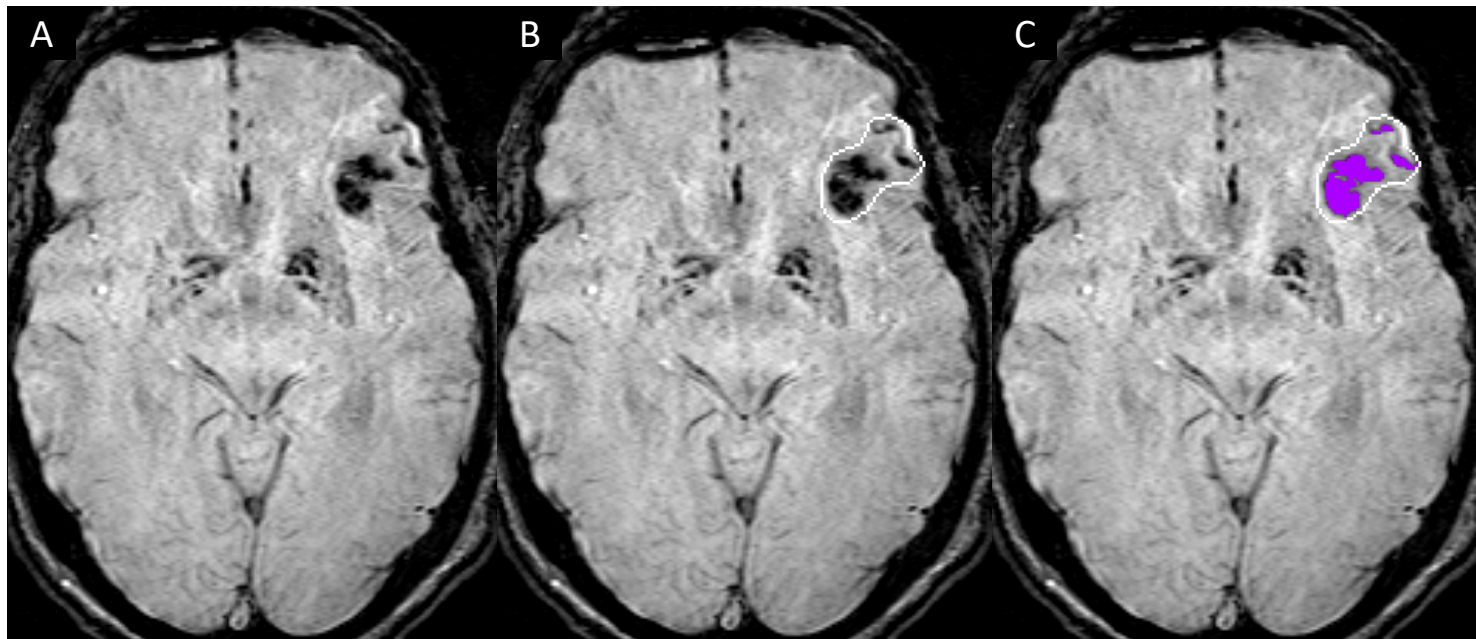
- ▶ Comprehensive quantitative reporting
- ▶ Identification, quantification, and location of bleeds & venous damage
- ▶ Allows for objective monitoring of patients over time
- ▶ Location and number by specific brain region
- ▶ Volume of individual bleeds and total per region

## Planned MRI data analysis: Quantify Cerebral Bleeds

- ▶ CMB-T1WE composite image allowing for enhanced anatomical bleed visualization
- ▶ Differentiate hypertension vs. stroke induced bleeds
- ▶ Complete group analysis and

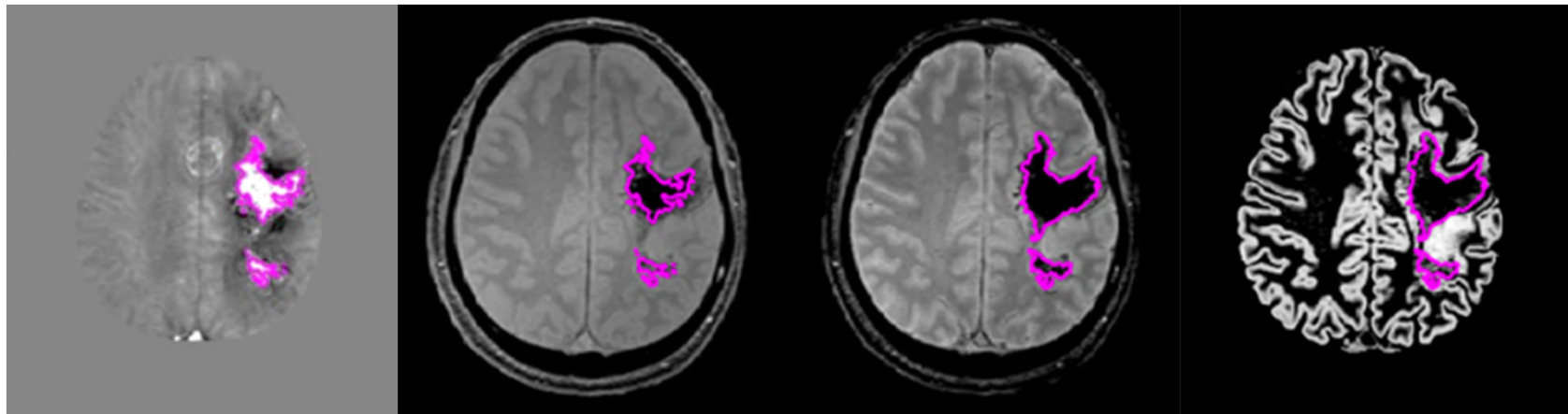


# Example from RHAPSODY – 1



- ▶ Hemorrhage volume quantification in MRI. The analyst identified the infarct region, then reviewed the susceptibility sequence (A). An object was drawn around abnormal findings (B), and a threshold was applied within the object to outline hemorrhage (C) and calculate volume.

# Planned MRI data analysis: Quantify Cerebral Bleeds



Low TE  
SWIM

Low TE  
magnitude

High TE  
magnitude

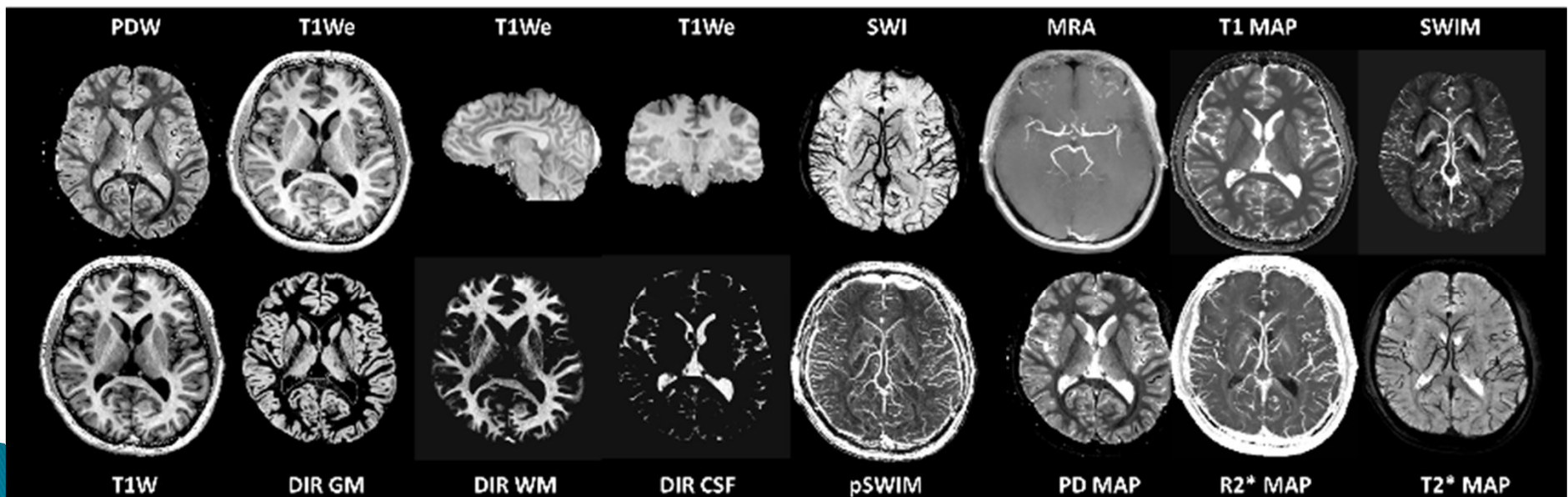
GM sDIR

- ▶ With STAGE:
  - Large bleed detection, classification, and quantification

# Possible processing

STAGE has many maps to be data mined:

- WM/GM Volumetrics
- T1/PD/R2\* maps



# Next steps

- ▶ Distribute and collect site pre-setup questionnaire
- ▶ Schedule remote meetings with MR technicians
- ▶ Complete sequence setup
- ▶ Collect pilot data if possible

SECTION A: PARTICIPATING MR SITE DETAILS	
Site Name	
Site Address	
Scanner Location	
Lead MRI Technician / Imaging Supervisor's Name	
Phone Number	
Email Address	
SECTION B: MR SCANNER SPECIFICATIONS	
Manufacturer	
Field Strength	
Model Type	
Scanner Software Version	
Head Coil Configuration (i.e. # of channels)	
SECTION C: MR SCANNER APPLICATIONS	
If SIEMENS, is SWI available on the system?	
If PHILIPS, is SWIp available on the system?	
If GE, is eSWAN/SWAN available on the system?	
If GE, is Research Mode available?	
If OTHER MANUFACTURER, is a 3D GRE with phase imaging output available? Describe:	
Is 3D T1 MPRAGE available on the system?	
Is 3D T2 FLAIR available on the system?	
Which MR sequences are you currently using clinically for imaging stroke?	



# Conclusion:

- ▶ Spintech, Inc. to coordinate MRI sequence setup directly
- ▶ SOC clinical scans included, with STAGE added for quantitative analysis
- ▶ Call to action:
  - Complete questionnaires as soon as feasible

Thank you!