



DZHK

DEUTSCHES ZENTRUM FÜR
HERZ-KREISLAUF-FORSCHUNG E.V.

BART



Sequence framework

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Institute of Biomedical Imaging
Graz University of Technology

Open MR days - DACH + Nordic ISMRM

September 14, 2025

Programme

- BART introduction

Martin Uecker

Hands-on: How to use BART

- Sequence framework

Daniel Mackner

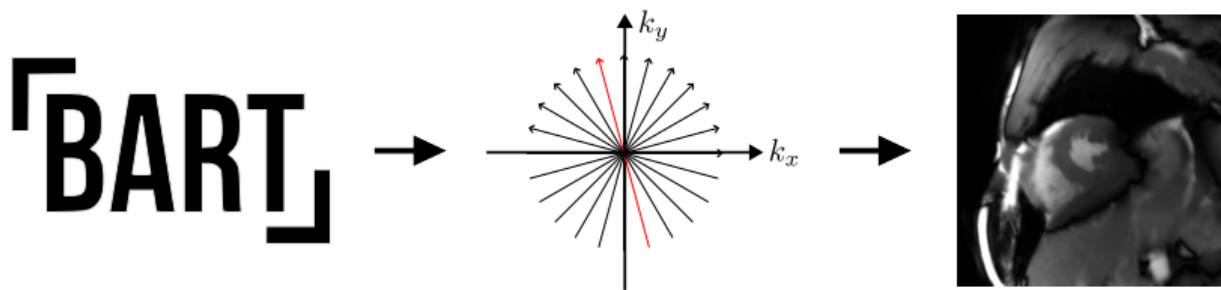
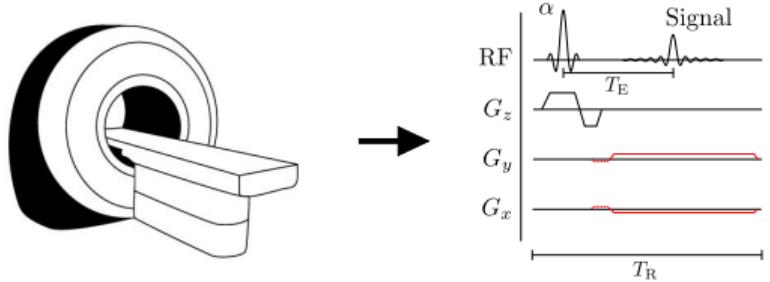
Hands-on: How to create a sequence & scanning

- MRI reconstruction

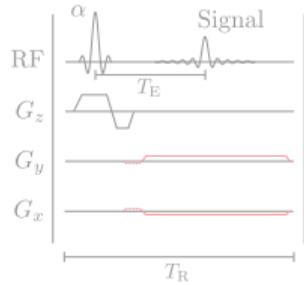
Vitali Telezki

Hands-on: Subspace-constrained model-based T1 mapping

Motivation

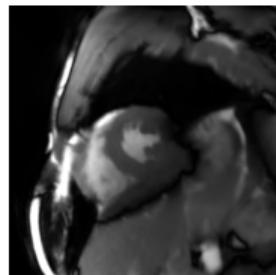
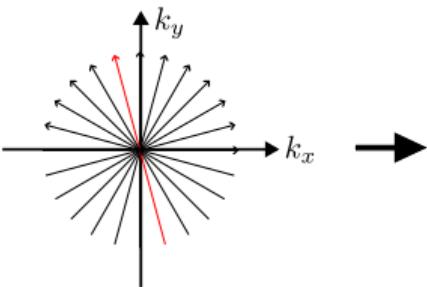


Motivation



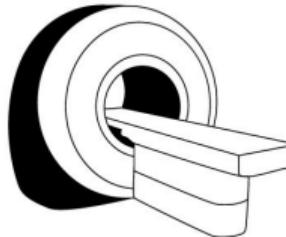
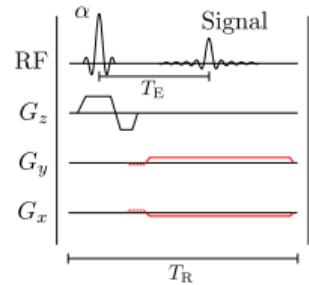
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BART

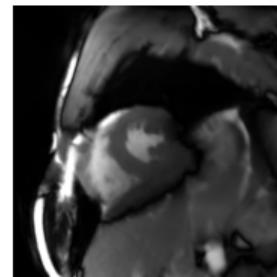
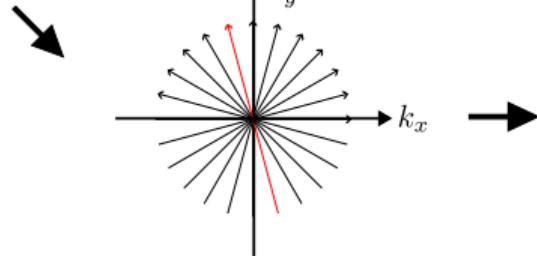


Motivation

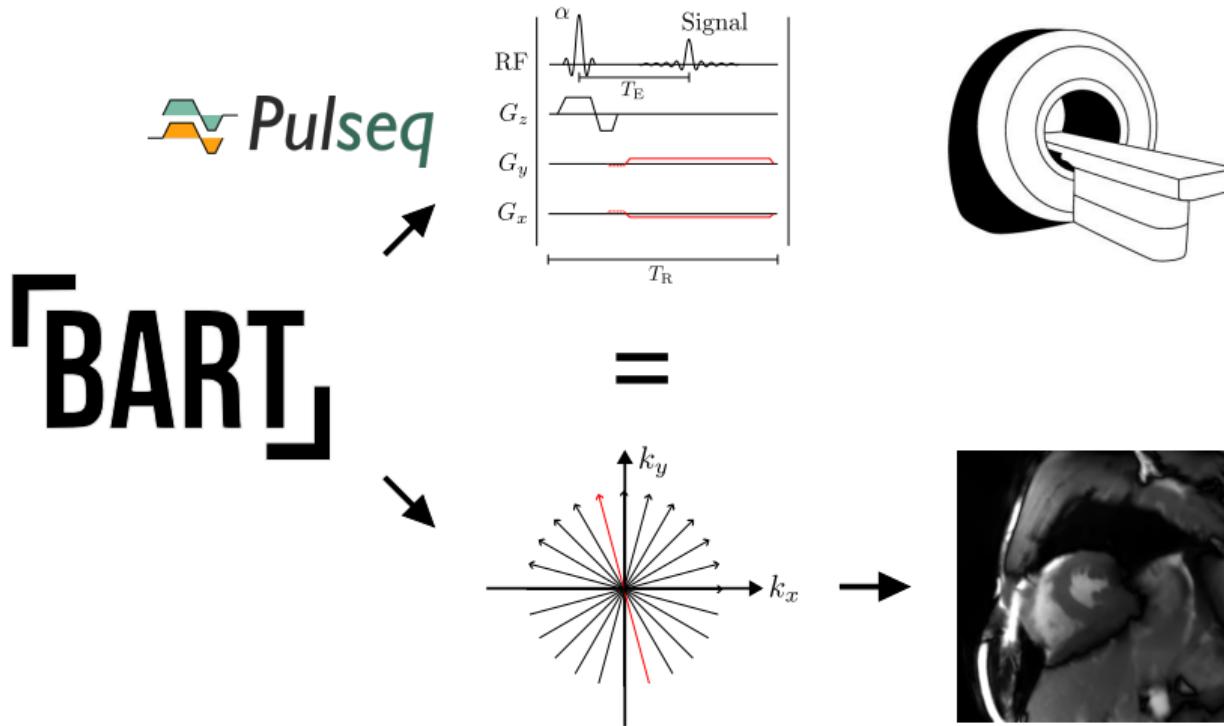
BART



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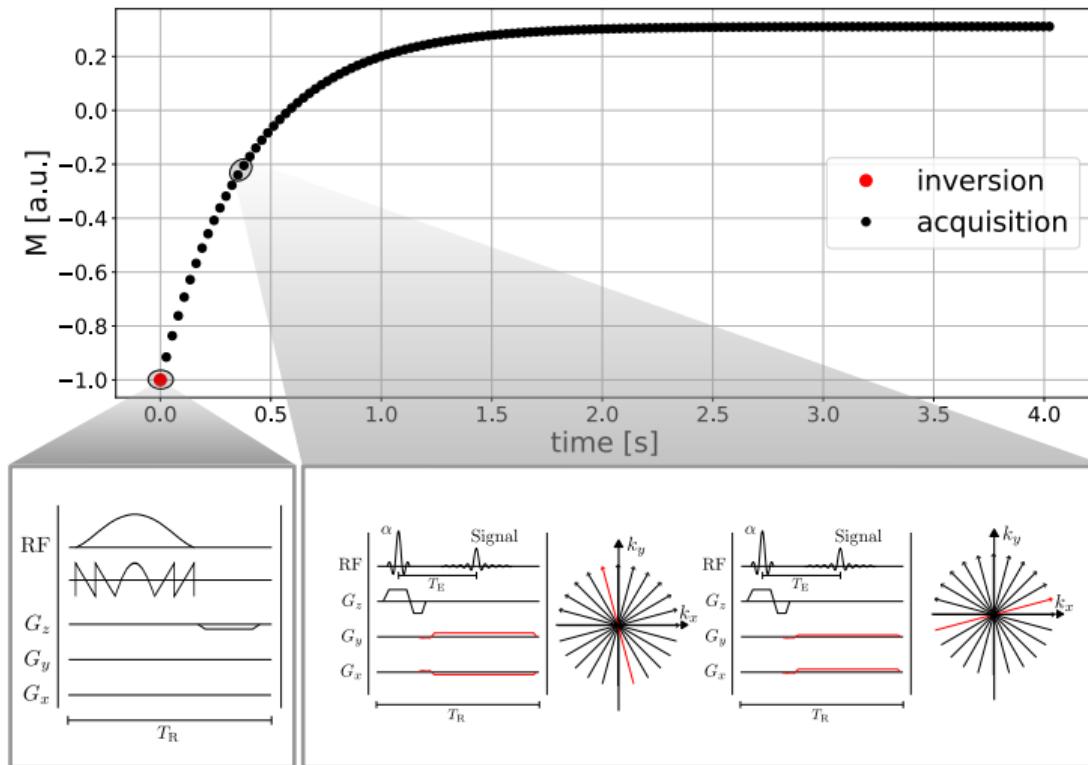
Motivation



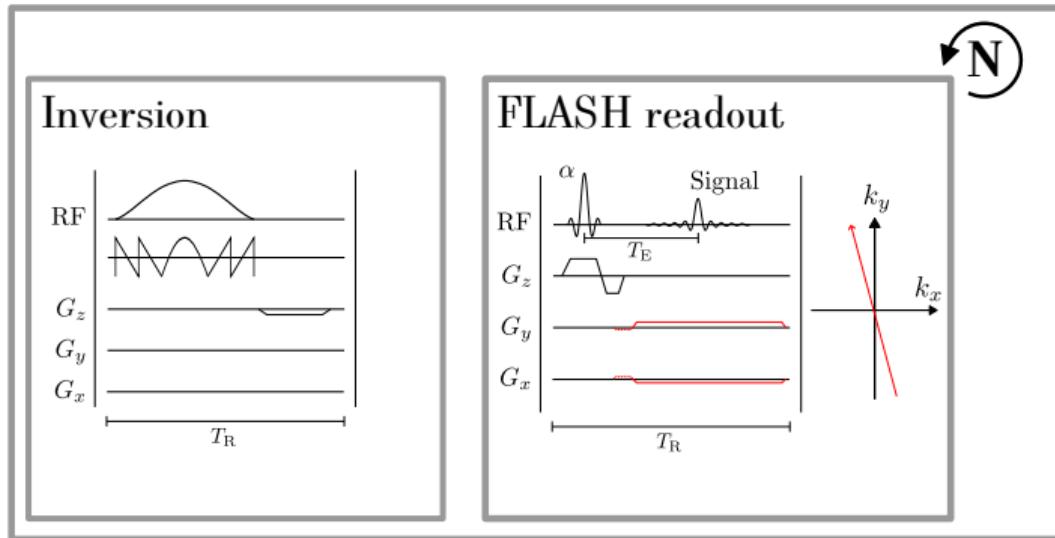
Outline

- Motivation
- **What do we need?**
- Interface to the scanner?
- How can we create a sequence?

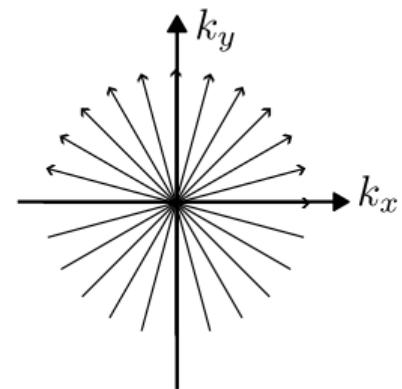
IR-FLASH



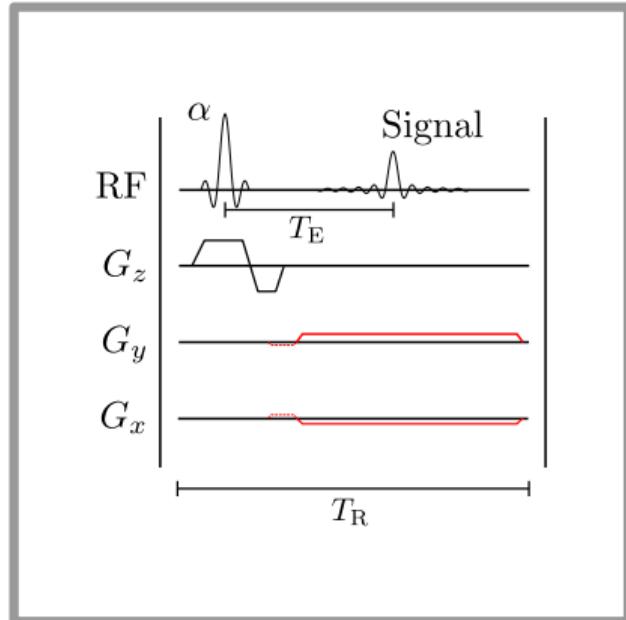
Sequence Framework 1/4: Looping



1



Sequence Framework 2/4: Blocks



- RF pulse(s)
- ADC(s)
- gradients
- timing

Sequence Framework 3/4: Events and RF pulse shapes

- events: start / mid / end time

GRAD



- amplitude
- phase/read/slice - axis

ADC



- frequency / phase
- dwell time

RF



- frequency / phase
- samples
- pulse shape

Sequence Framework 4/4: Parameters

- TE / TR
- Dwell time / base resolution
- RF pulse shape / duration / flip angle / BWTP
- FOV / slice thickness
- Slice position / orientation

- Inversion pulse (type) / TI

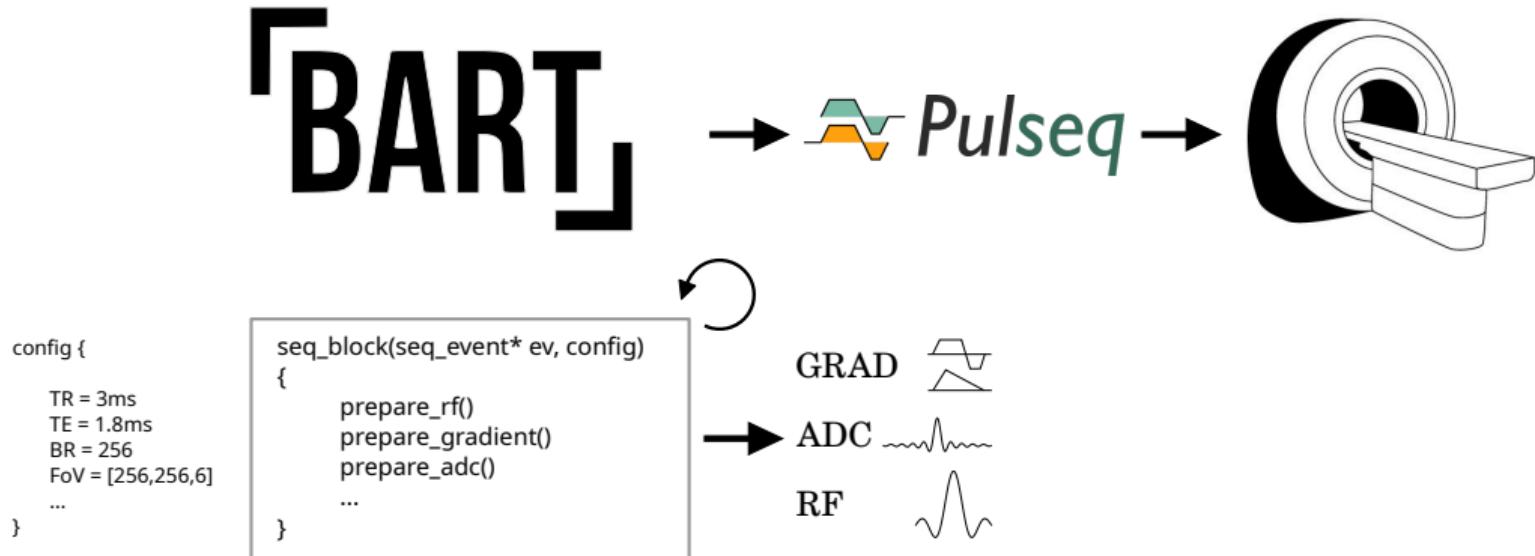
- System limits (max. gradients, slew rate, etc.)

- Looping dimensions (e.g. spokes, slices, frames, inversions, etc.)

Outline

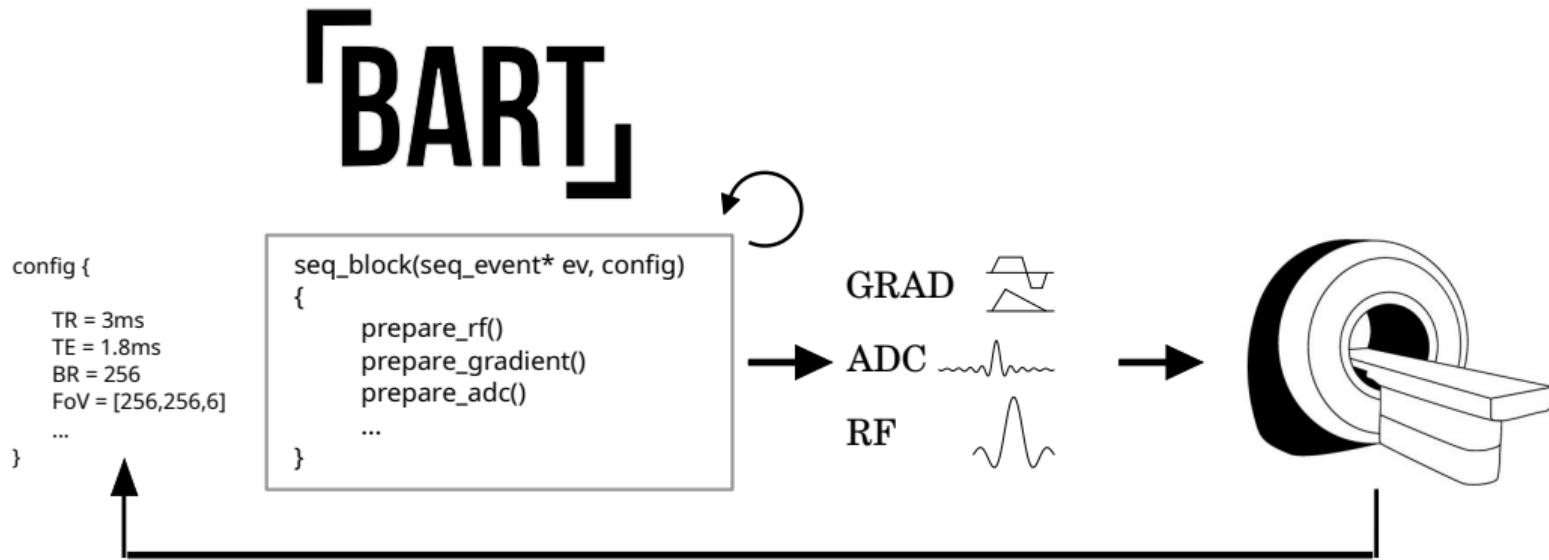
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BART sequence framework



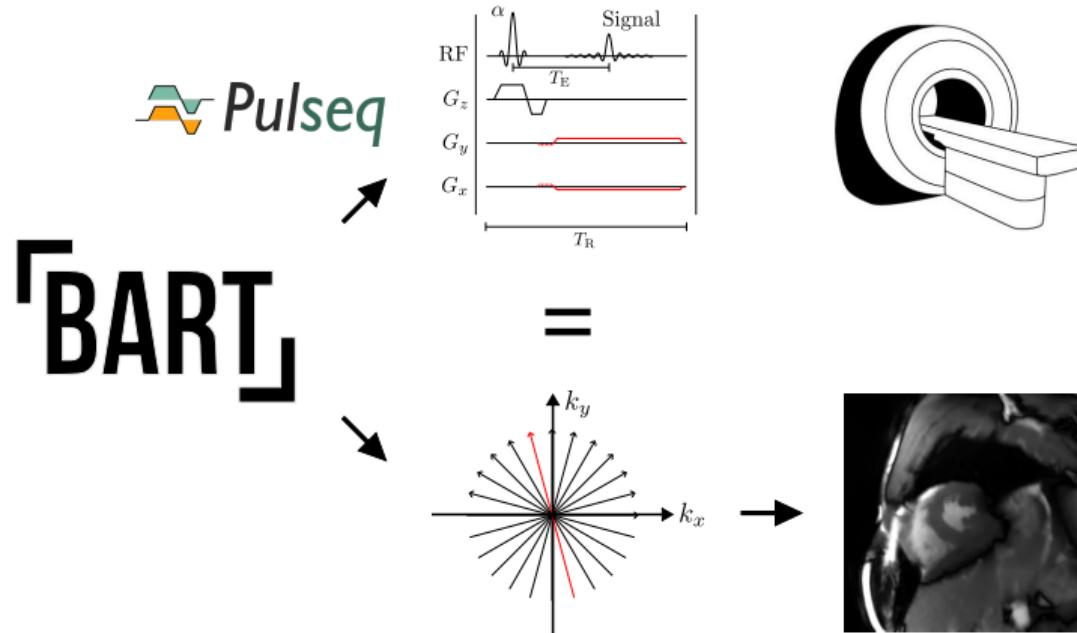
- BART: parameters / events and pulse shapes / blocks / looping
- Scanner: event and pulse shape interpretation (pulseq)

BART sequence framework



- BART: parameters / events and pulse shapes / blocks / looping
- Scanner: event and pulse shape interpretation (pulseq/vendor)
- User interface: parameters

BART sequence framework



- Sequence parameters
 - open-source sequence
 - reconstruction parameters (e.g. trajectory)

Outline

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- How can we create a sequence?**



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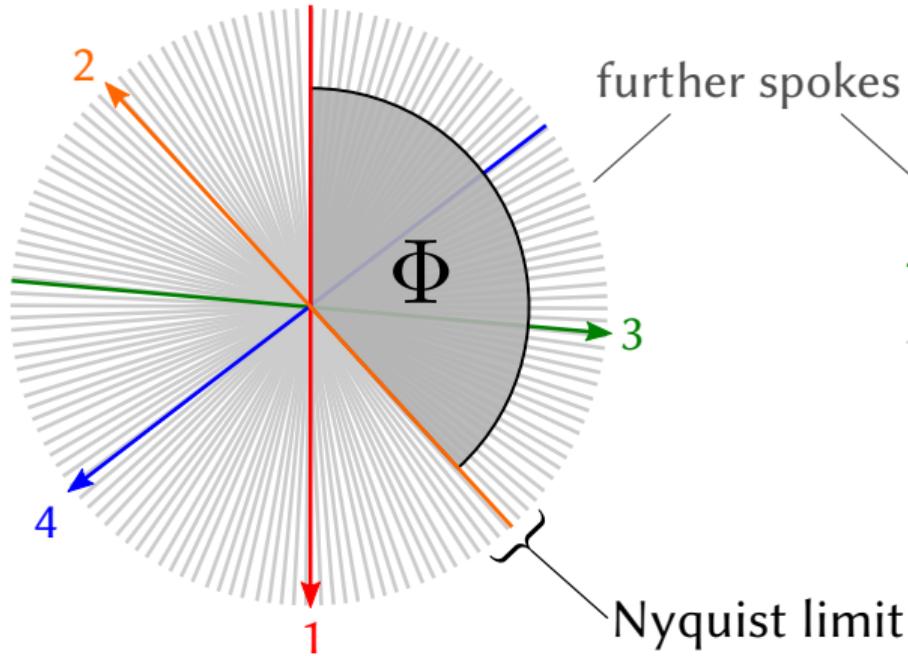
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RAGA concept

Golden Ratio Sampling Φ



RAGA Sampling $2\psi_5^2$

