



# AMISR experiment design

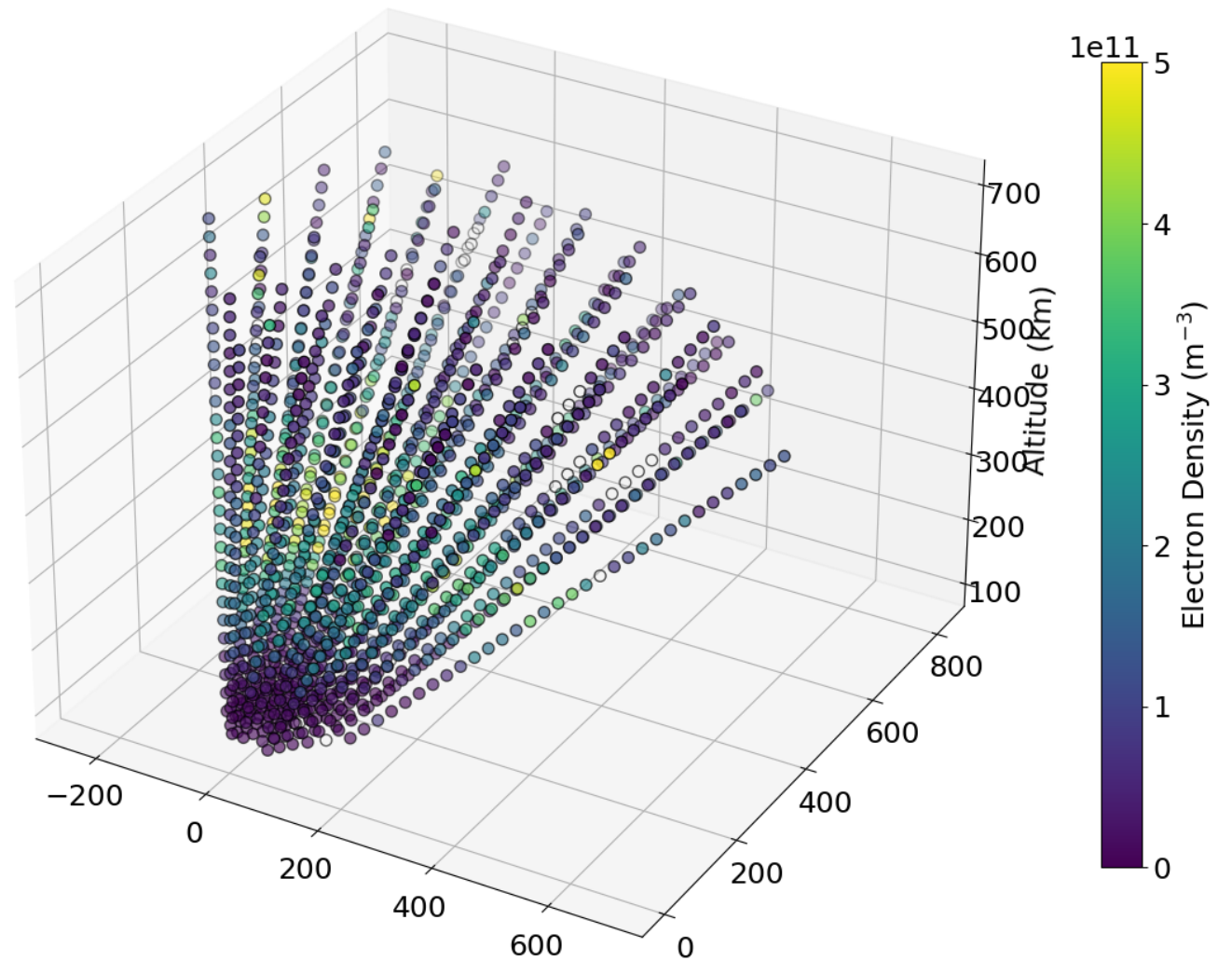
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ISR Summer School 2024



AMISR can  
volumetrically  
image the  
ionosphere



Key things  
to keep in  
mind

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What region are you interested in?

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What is the time resolution you need?

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What is the spatial extent and resolution?

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Do you want to look in a specific direction?

# Types of pulses

## Long Pulse (LP):

- a long transmit pulse that is correlated against itself to resolve range
- low range resolution, high sensitivity

## Alternating Code (AC):

- phase modulated pulses designed to avoid range ambiguity,
- high range resolution, medium sensitivity

## Barker Code (BC):

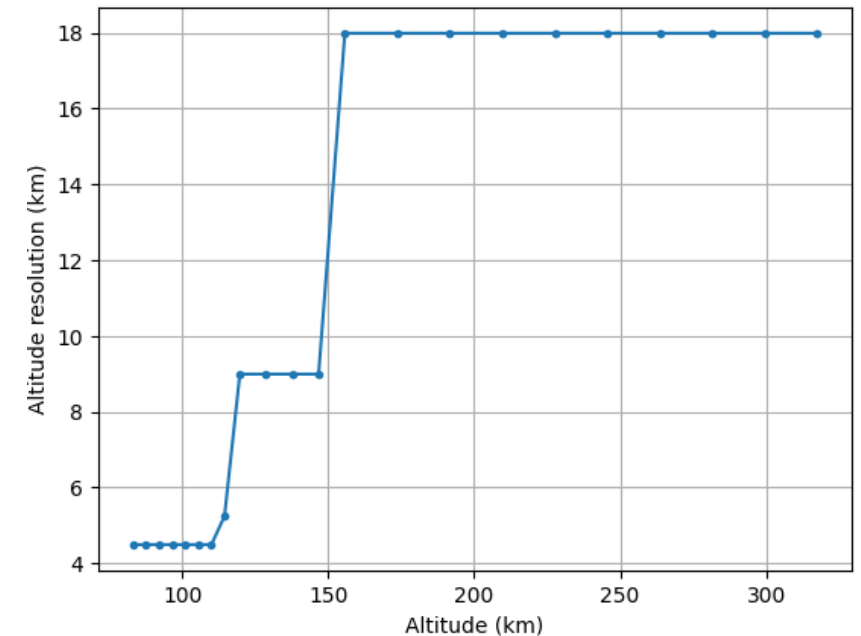
- similar to AC but applicable in D-region due to –
- highest range resolution, high sensitivity

Modes can be interleaved

# Regions and pulse types

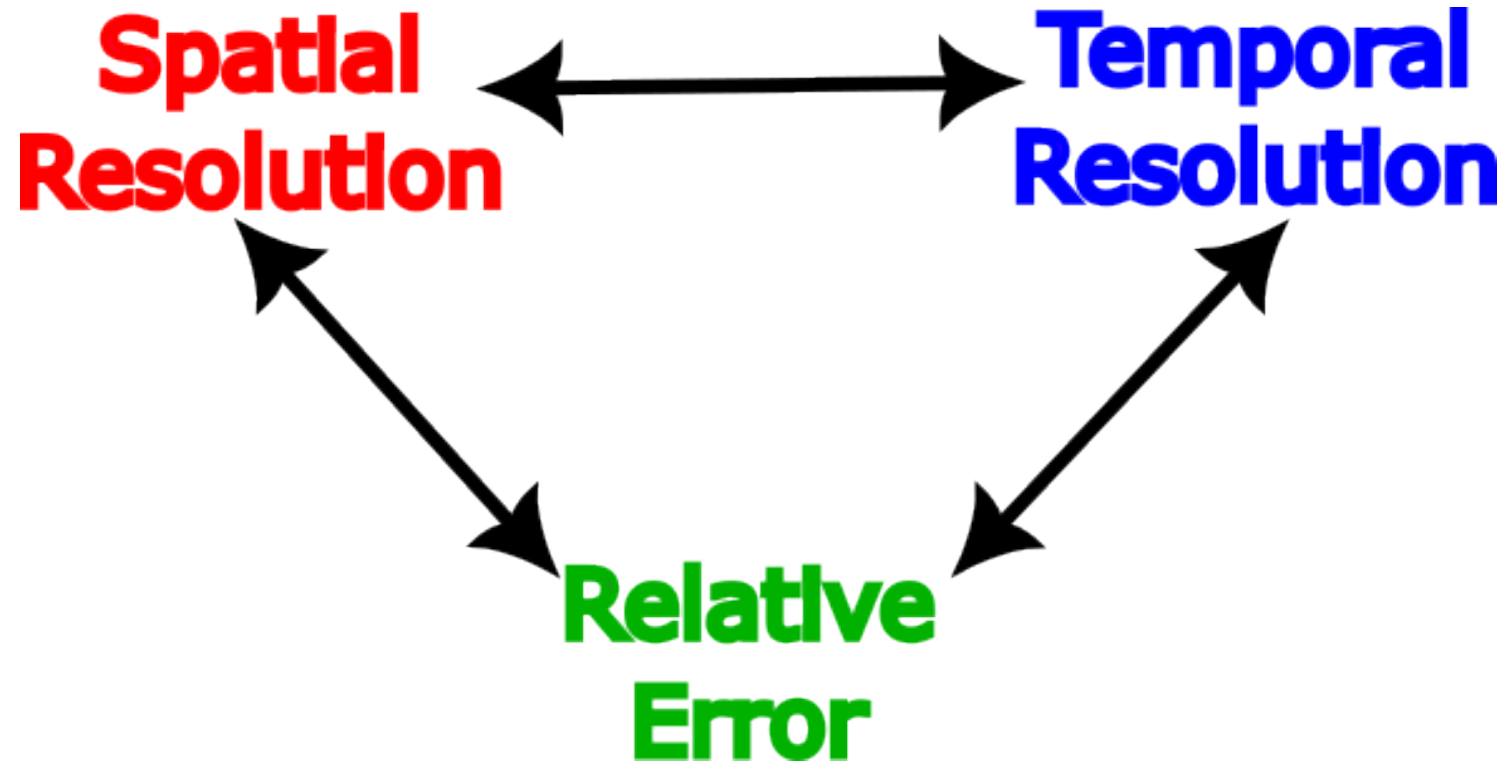
- F-region only
  - Long pulse (~6km range resolution)
- E- and F-regions
  - Alternating code
  - Long pulse
- D-region focus, sporadic E, E- and F-region context
  - Barker code (~750m range resolution)
  - Alternating code
  - Long pulse

Altitude resolution as a function of altitude for AC mode at PFISR



# Trade space for mode design

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# Trade space for mode design

## Temporal resolution == integration period

- Long integration period means lower temporal resolution, less noisy data and less error
- Short integration period means higher temporal resolution, relatively higher errors

## Spatial resolution == Beam positions

- More beam positions give higher spatial resolution, each beam is revisited less frequently, meaning longer integration time
- Fewer beam positions give better statistics but lower spatial resolution
- Option to revisit a single beam more often during the cycle

## Signal-to-Noise ratio

- Time of the day is important when denser plasma may give higher SNR, allowing for lower integration times, better statistics

# PFISR Mode menu

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## 1. Tri-Frequency Long Pulse

- 330 us long pulse with multiple frequencies to improve statistics
- Good mode for F-region studies needing high time resolution

## 2. World Day 35

- 330 us long pulse + alternating code
- Good mode for studies spanning E- and F-regions

## 2a. World Day 35 with a privileged beam

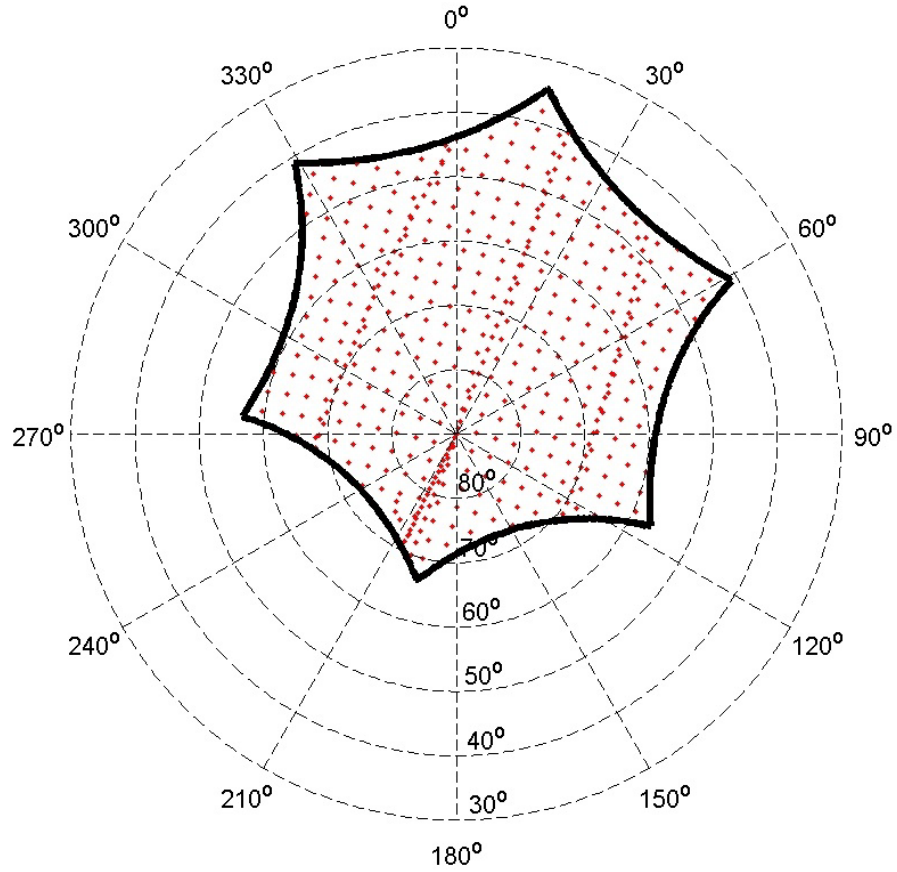
- Same as 2, but revisits a single beam multiple times in a cycle

## 3. MSWinds26

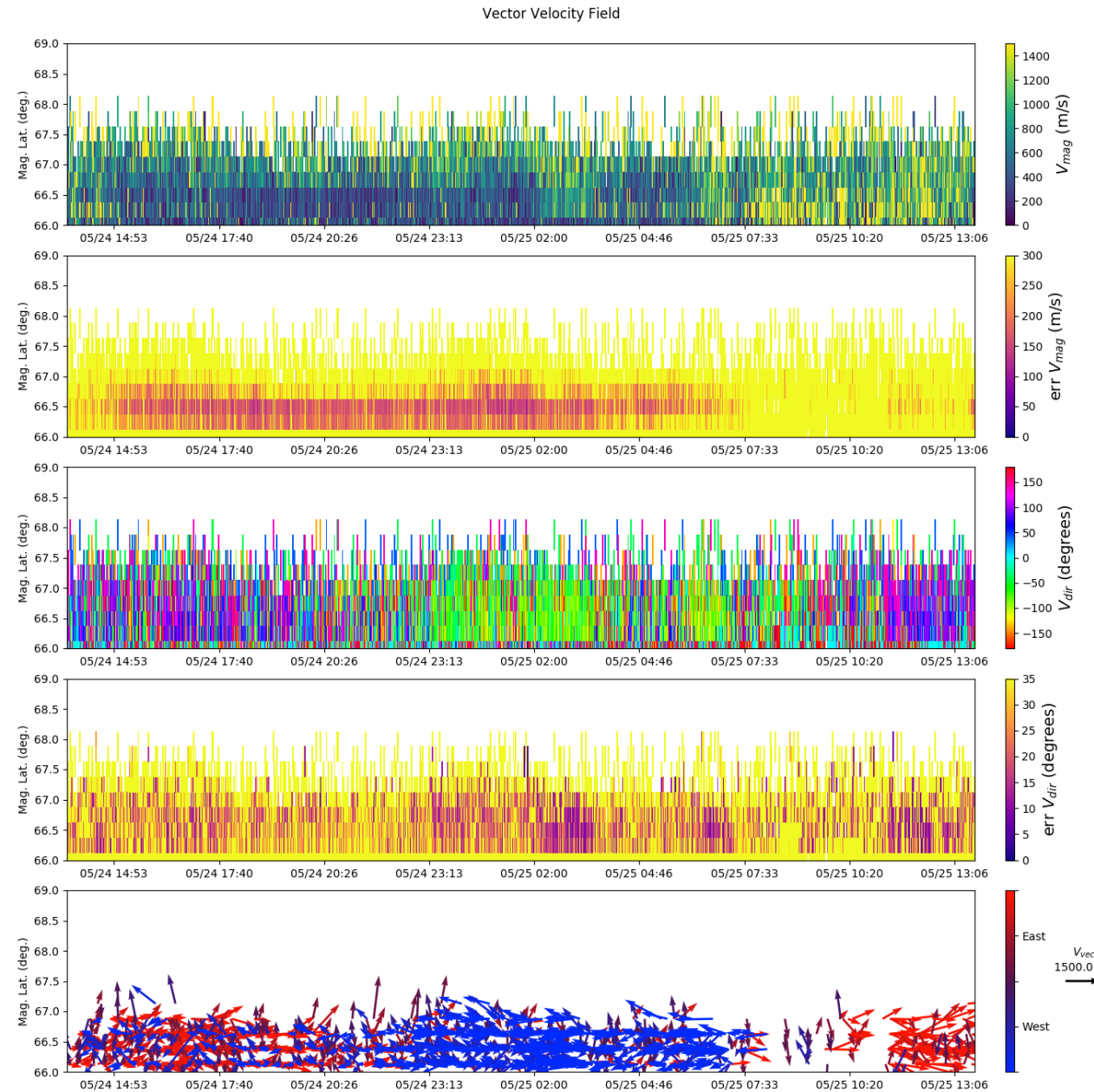
- 330 us long pulse + alternating code + barker code
- Good mode for studies needing D-region measurements with E- and F-regions for context



# Beam positions and vector velocities



<https://amisr.com/amisr/media/pfiser/bcortable.txt>



You can get resolved vector velocities/electric field from any experiment with 3 or more beam positions

# RISR-N Mode menu

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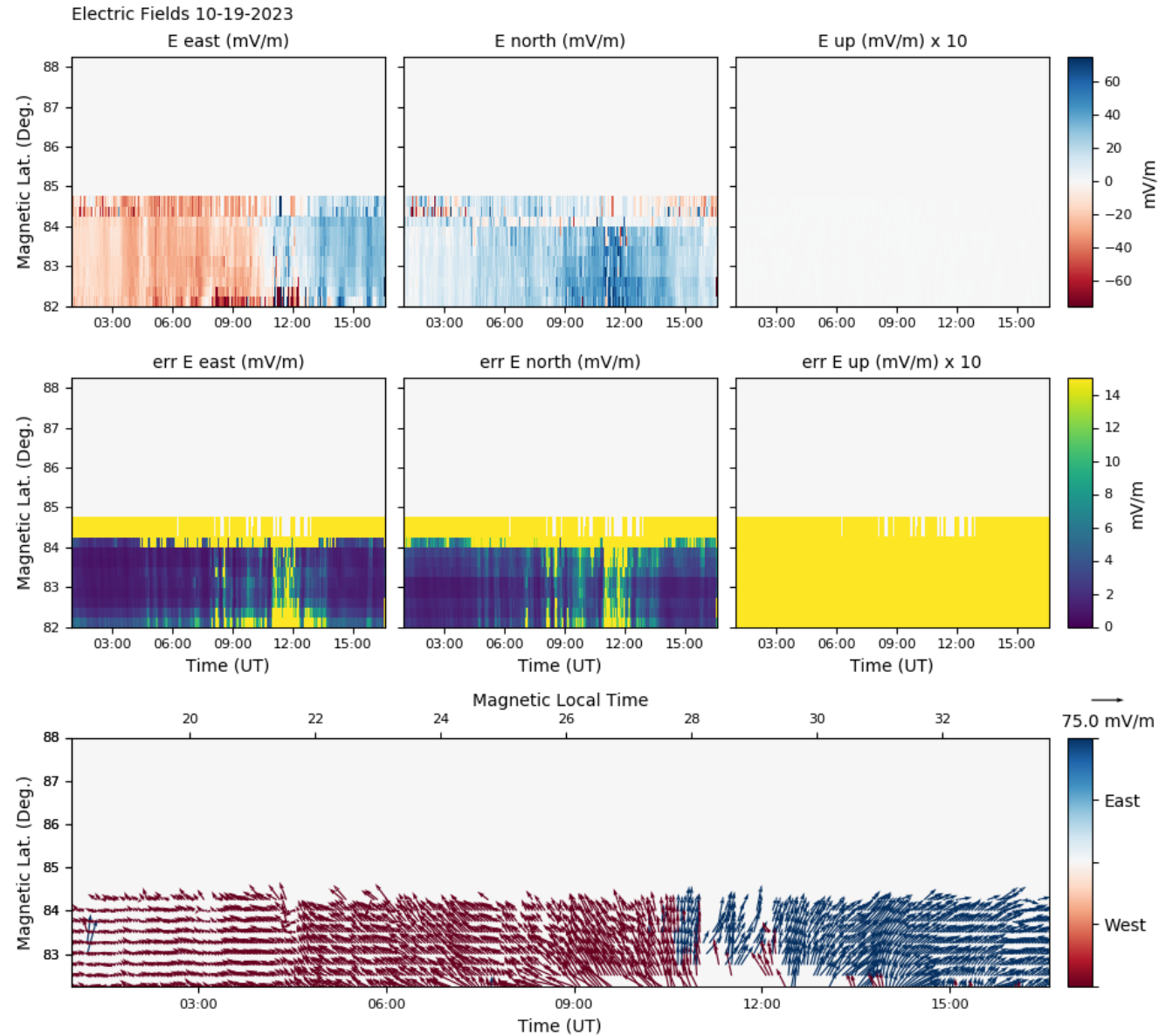
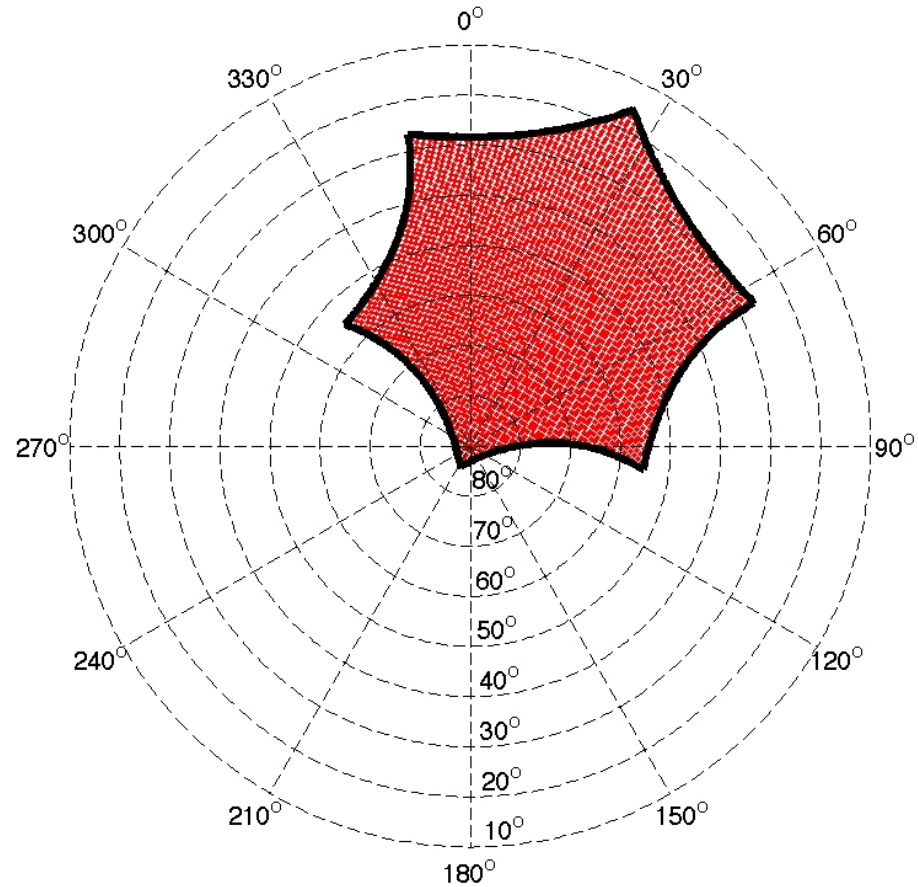
## 1. Dual-frequency Long Pulse with 9 beams

- 480 us long pulse with multiple frequencies to improve statistics
- Good mode for F-region studies needing high time resolution with spatial coverage

## 2. Long pulse + Alternating code with 5 beams

- 330 us long pulse + alternating code
- Good mode for studies spanning E- and F-regions with high time resolution but low spatial coverage

# Beam positions and vector velocities



[https://amisr.com/amisr/media/risrn/RISRN\\_beamcodes.txt](https://amisr.com/amisr/media/risrn/RISRN_beamcodes.txt)

You can get resolved vector velocities/electric fields from any experiment with 3 or more beam positions