Experiment Guide

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Experiment Design and Analysis Exercise

- We have 4 timeslots 2 hours each at the PFISR in Alaska.
- You have been divided in 4 groups of 6-8 people

Each group should :

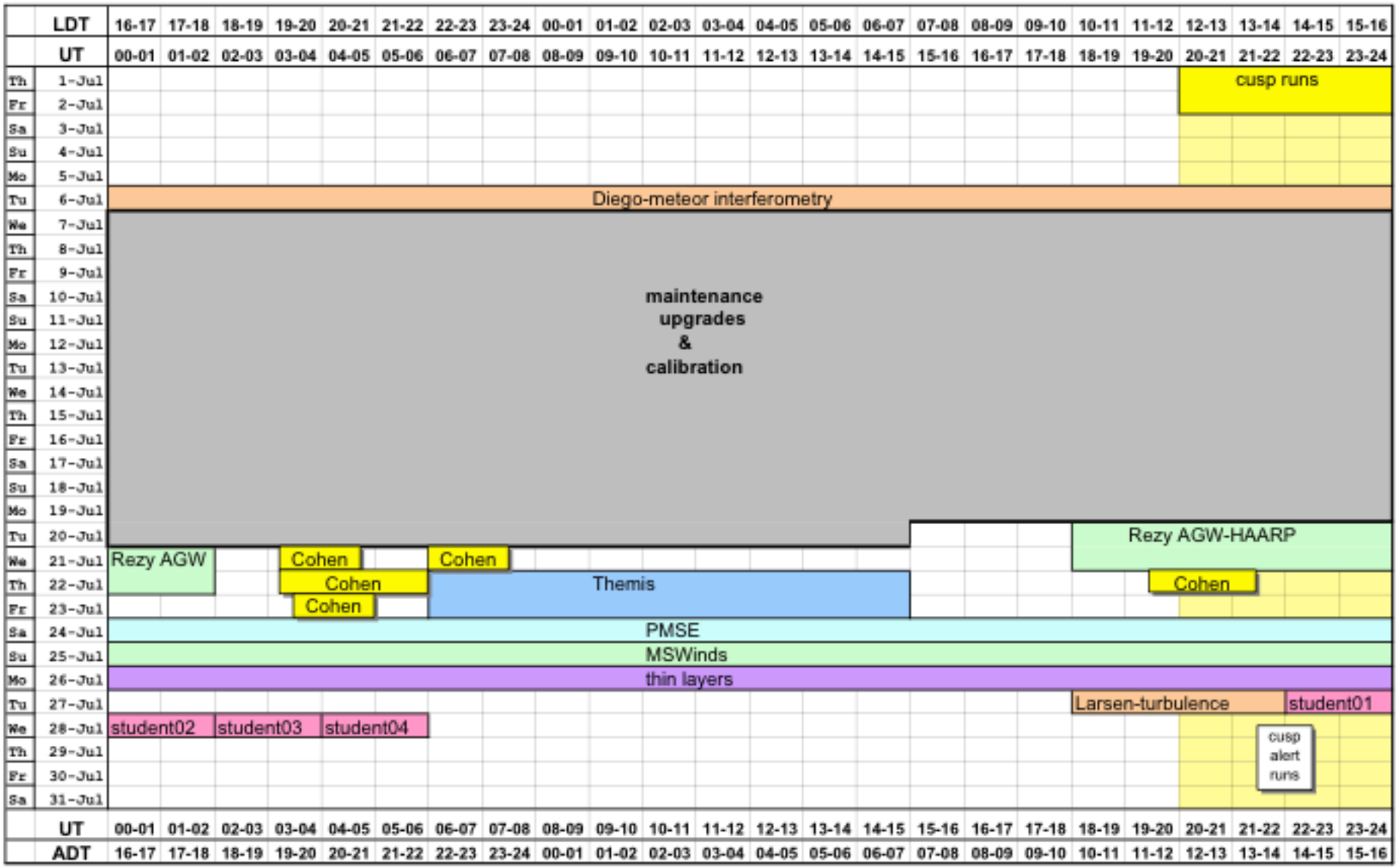
- Discuss and decide on a science topic you want to study with PFISR within the limitations of experiment design for the school.
- Decide what mode and beam positions to run to accomplish your science goals.
- Write a request for radar time and send it to Anja and me.
- Get the request approved by one of the advisors.
- Submit the mode to the PFISR system, and wait for it to run...

We will also have pre-run “backup” datasets available for additional fun (see handout).

Possible Things To Do

- Raw Voltage Level
  - *Understand how we obtain basic products from raw voltage level data*
- Lag Profile Level
  - *Understand how we obtain basic products and IS parameters from lag profile measurements*
- Processed Level - ISR Imaging
  - *Understand the science that can be done with multi-beam distributed measurements with AMISR*
- Processed Level - Derivables / Electrodynamics
  - *Understand the science that can be done with E and F region distributed IS measurements with AMISR*

PFISR Operations Schedule for July



Experiment specifics:

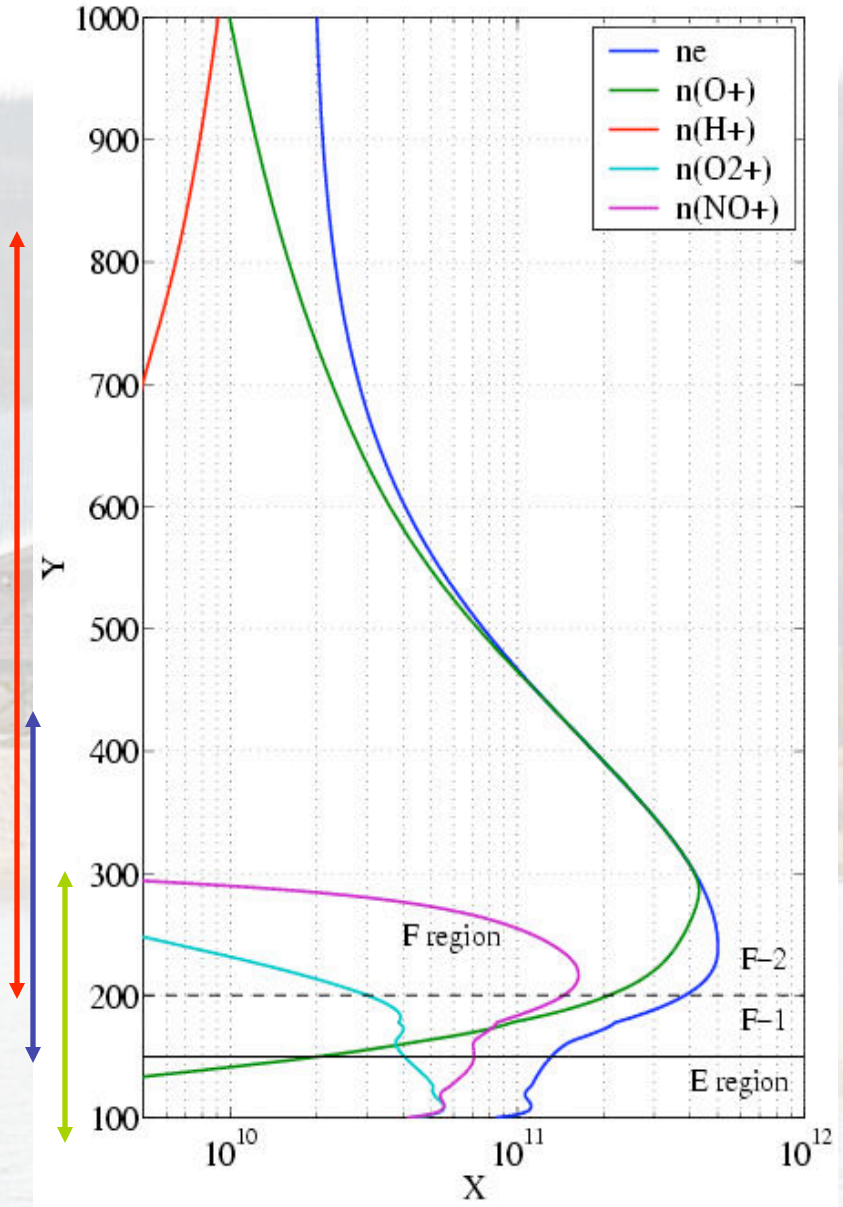
Three different pulse schemes are available for use:

Long Pulses - LP-(480μs) resulting in 37 km resolution data between ~100-700 km

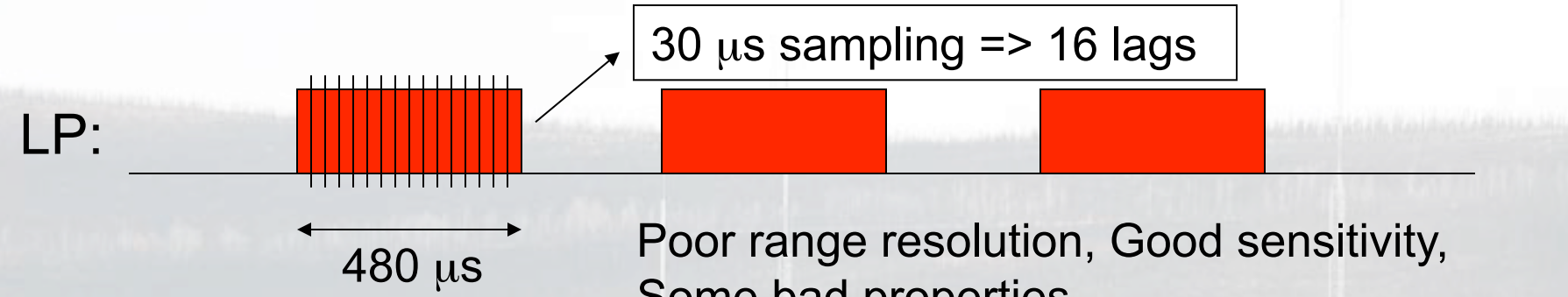
Alternating Codes - AC - (16 baud 30μs - 32 pulses) resulting in 4.5 km resolution between ~90-350 km

Barker Codes - BC - (13 baud 10μs) resulting in 1.5 km resolution between ~90-150 km

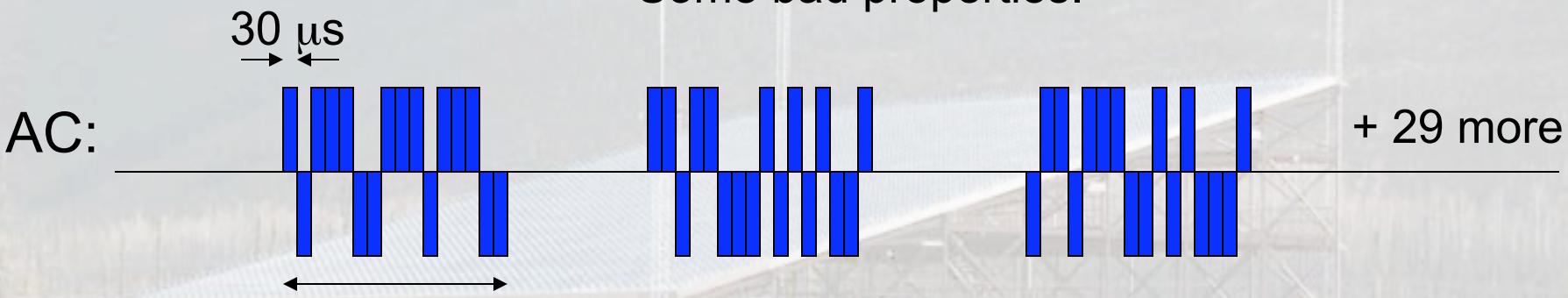
5-10% duty cycle



Cartoon of Pulses

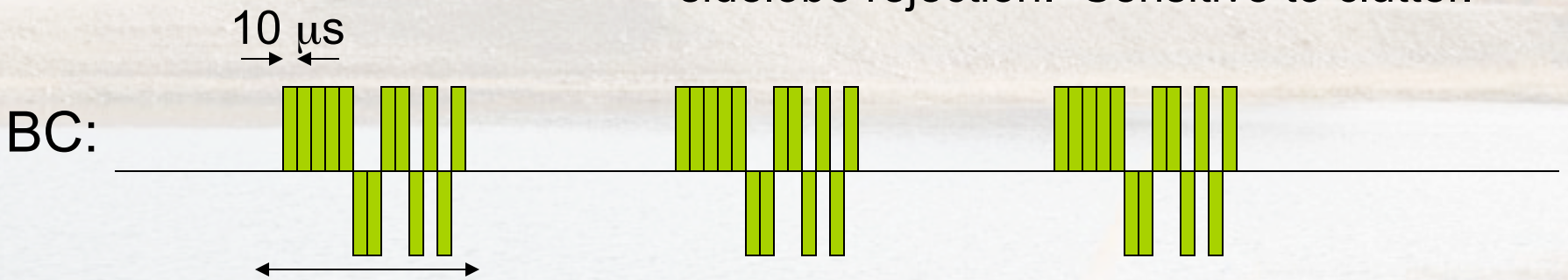


Poor range resolution, Good sensitivity,
Some bad properties.



16 x 30 μs = 480 μs

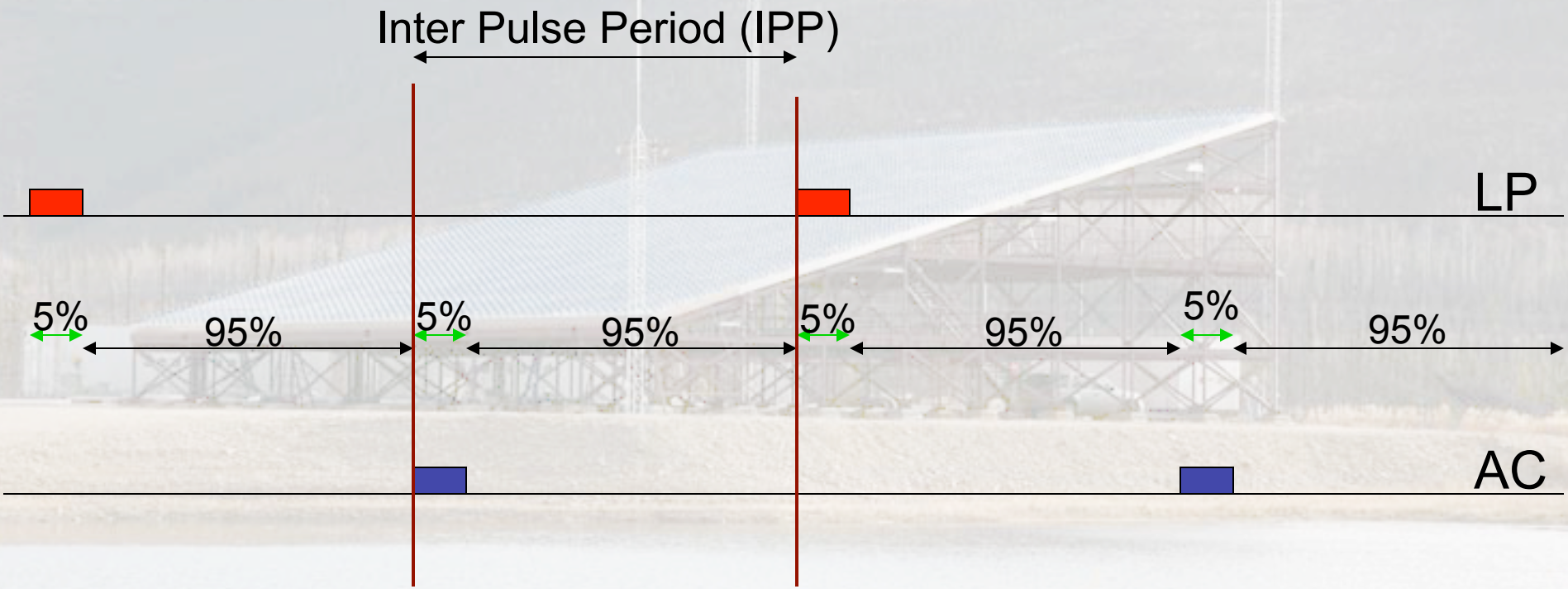
Good range resolution (sub-baud). Perfect sidelobe rejection. Sensitive to clutter.



13 x 10 μs = 130 μs

Good range resolution. Low sidelobe levels.
Good for 0-lag measurements only.

What 5% duty cycle means…



In the 95% of “non-transmitting” we do sample the signal, noise and calibration.

What can/should you "design" today?

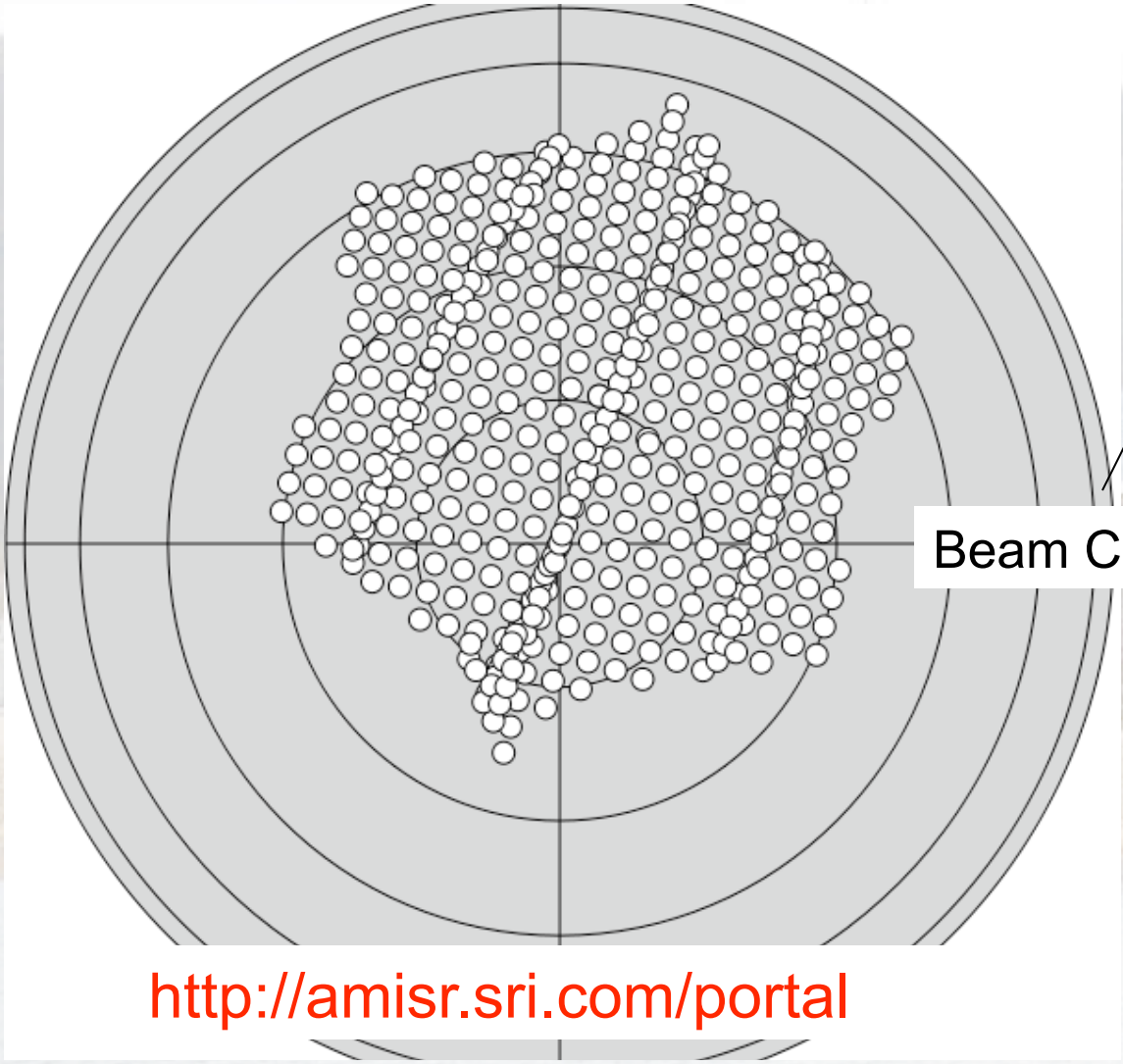
- Decide on a scientific or experimental goal
  - **What do you want to investigate? How will you accomplish this?**
- Design an experiment that is consistent with the goals
- Choose a combination of pulse schemes (or single pulse scheme): BC, LP, and AC
- Choose your beam positions (out of ~475 possible)

The most important thing for you is identify an interesting science case AND find the experiment setup most suitable to study it!

You will have both the real-time and any processed datasets to achieve these goals.

You need to justify your use of pulse schemes and your choice of beam positions!

Available beam positions



http://amisr.sri.com/portal

63221	-21.51	61.46	1.361447e-19
63227	-18.77	60.10	1.346032e-19
63239	-16.23	58.68	1.324891e-19
63245	-13.89	57.20	1.298195e-19
63251	-11.73	55.69	1.266172e-19
63257	-9.72	54.13	1.229106e-19
63263	-7.85	52.53	1.187336e-19
63269	-6.11	50.90	1.141255e-19
63275	-4.48	49.24	1.091302e-19
63281	-2.95	47.55	1.037957e-19
63287	-1.51	45.84	9.817419e-20
63293	-0.15	44.10	9.232058e-20
63299	126.61	69.25	9.356377e-20
63305	121.38	69.66	9.845681e-20
63311	115.98	69.92	1.031870e-19
63317	110.50	70.00	1.074713e-19
63323	105.02	69.92	1.115083e-19
63329	99.62	69.66	1.151791e-19
63335	94.39	69.25	1.184474e-19
63341	89.39	68	
	84.65	67	
	80.22	67	
	76.09	66.19	1.268898e-19
63371	72.27	65.14	1.277260e-19
63377	68.74	63.99	1.280215e-19
63383	65.50	62.76	1.277695e-19
63389	62.51	61.46	1.269685e-19
			3e-19
			3e-19
			3e-19
63413	52.73	55.69	1.184336e-19
63419	50.72	54.13	1.150550e-19
63431	48.85	52.53	1.112323e-19
63437	47.11	50.90	1.070012e-19
63443	45.48	49.24	1.024620e-19
63449	43.95	47.55	9.747898e-20
6345			
6347			
6358			
6377			
63809	-159.50	76.00	9.499506e-20
63905	-159.50	78.00	1.023999e-19

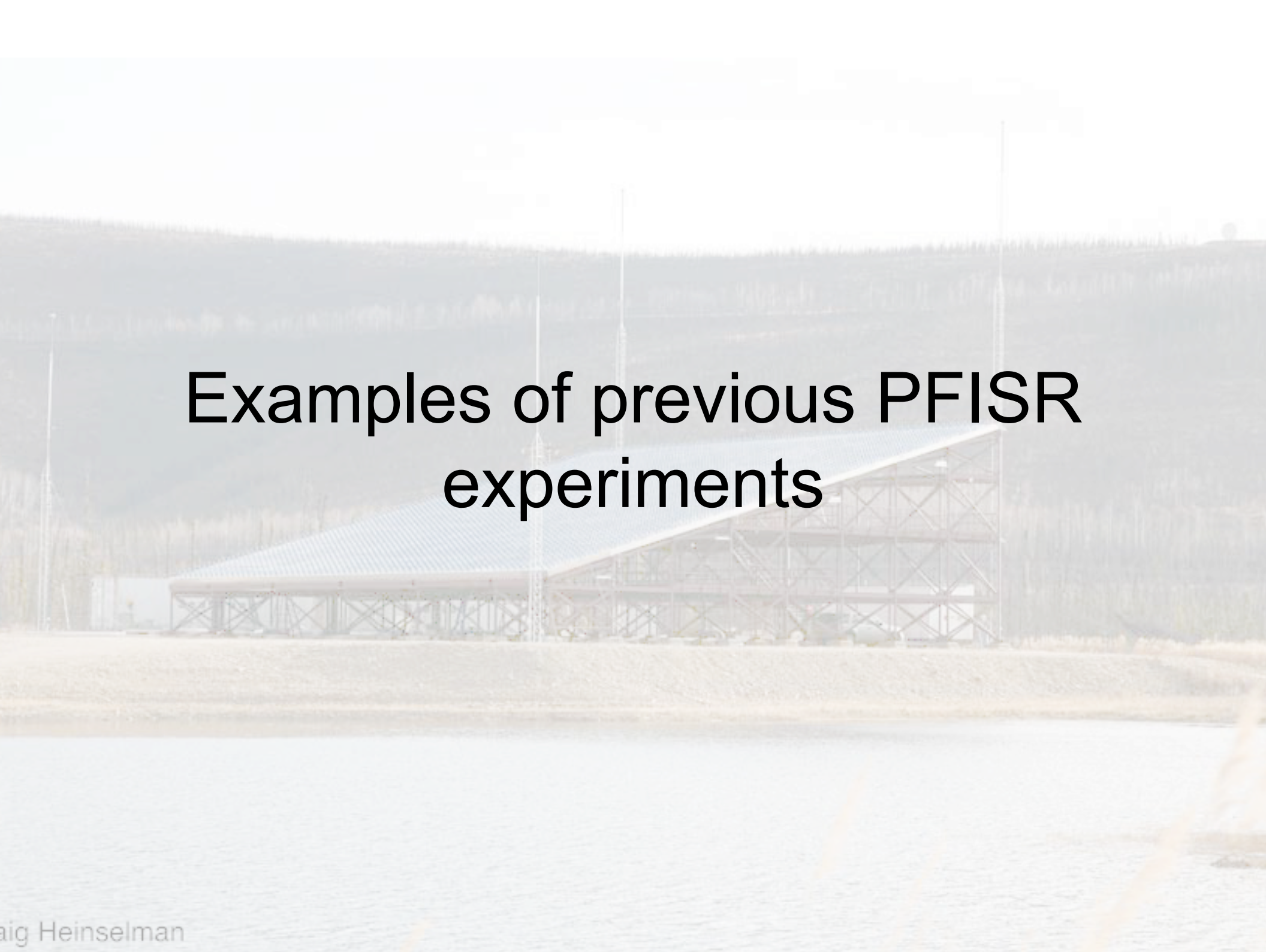
Beam Code

Elevation (El)

Azimuth (AZ)

System “constant”

+ ~400 more…



Examples of previous PFISR experiments

Example….

Dear Craig and Mary,

I just got off the phone with Person1, and he seemed to think the best way for me to initiate an experiment with the PFISR is with a direct request. So here goes ...

We request PFISR time for observations to be made in concert with our coherent scatter radar in Anchorage in support of our ongoing CEDAR project. The local time of the observations should be from 2100-0400. The period of the experiments should be for 7-10 days, preferably in January before the start of classes here (Jan 21). Failing that, we would request observations during the moon-down period in February.

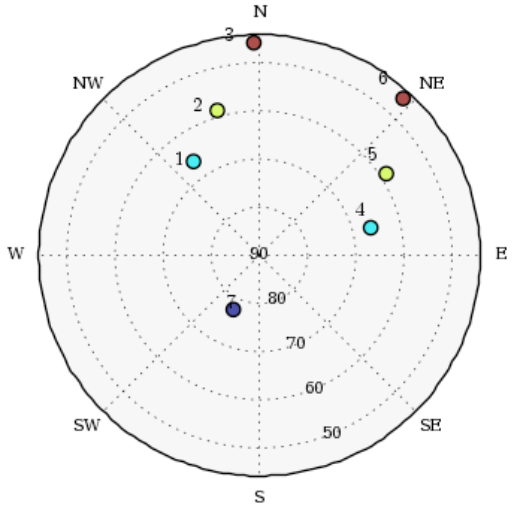
The mode I'm requesting is one involving combined coded double pulses for high-res F region drifts interleaved with combined long and alternating coded pulses for E region temperatures. It is sufficient to store lagged products with a time resolution of a few seconds. The scientific objective here is to compare coherent scatter spectra with incoherent scatter-derived parameters (E-fields, drifts) in a common volume to better understand Farley Buneman waves and turbulence.

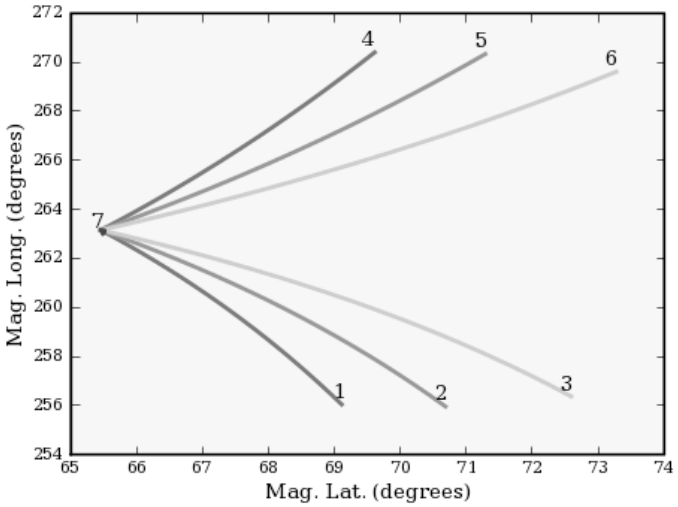
Rick and Russell would also like to run an experiment with support from the coherent scatter radar. Rather than interleaving their PFISR pulses with ours, which would cost us both in terms of statistics, or alternating days, which could well cause one of us to come home empty handed, I propose alternating their PFISR mode with ours on a regular basis - say in half-hour intervals. This way, we could both get what we want from a single substorm event, which is all we're really likely to get in a week of observations. The request isn't intended to make your life more difficult but rather to accommodate everyone's needs in a compact time interval.

Please let me know if you require more information. I hope what we're requesting will be possible.

Thanks for your consideration,
Person2

E-fields with AMISR



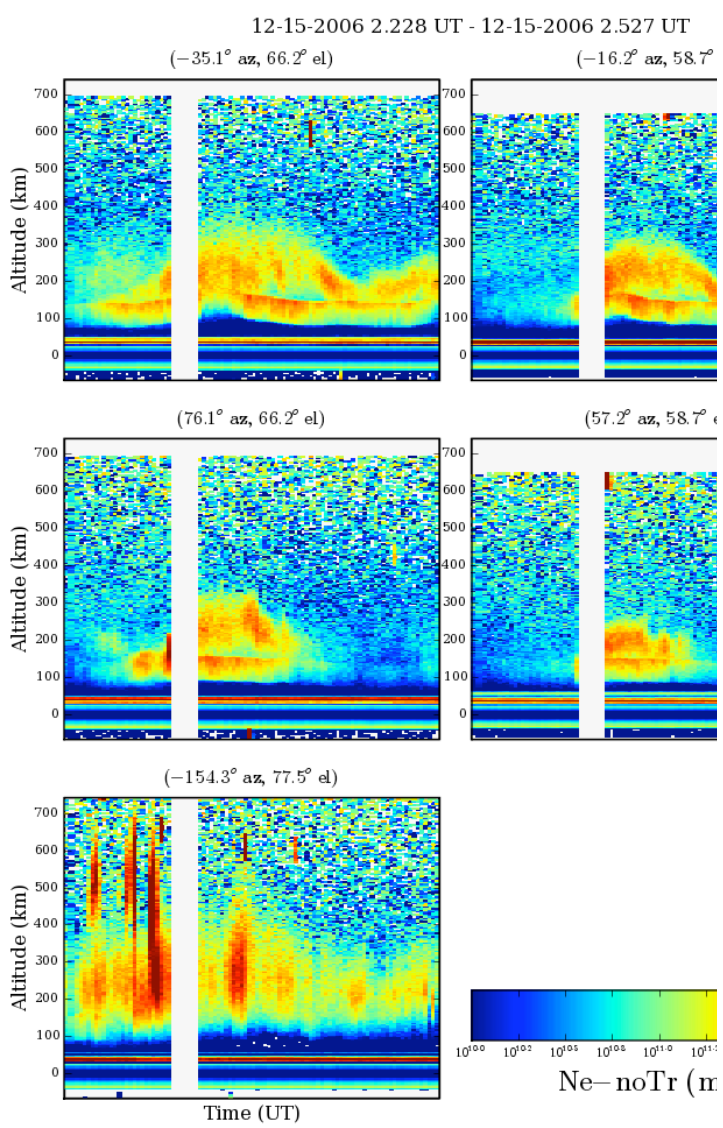


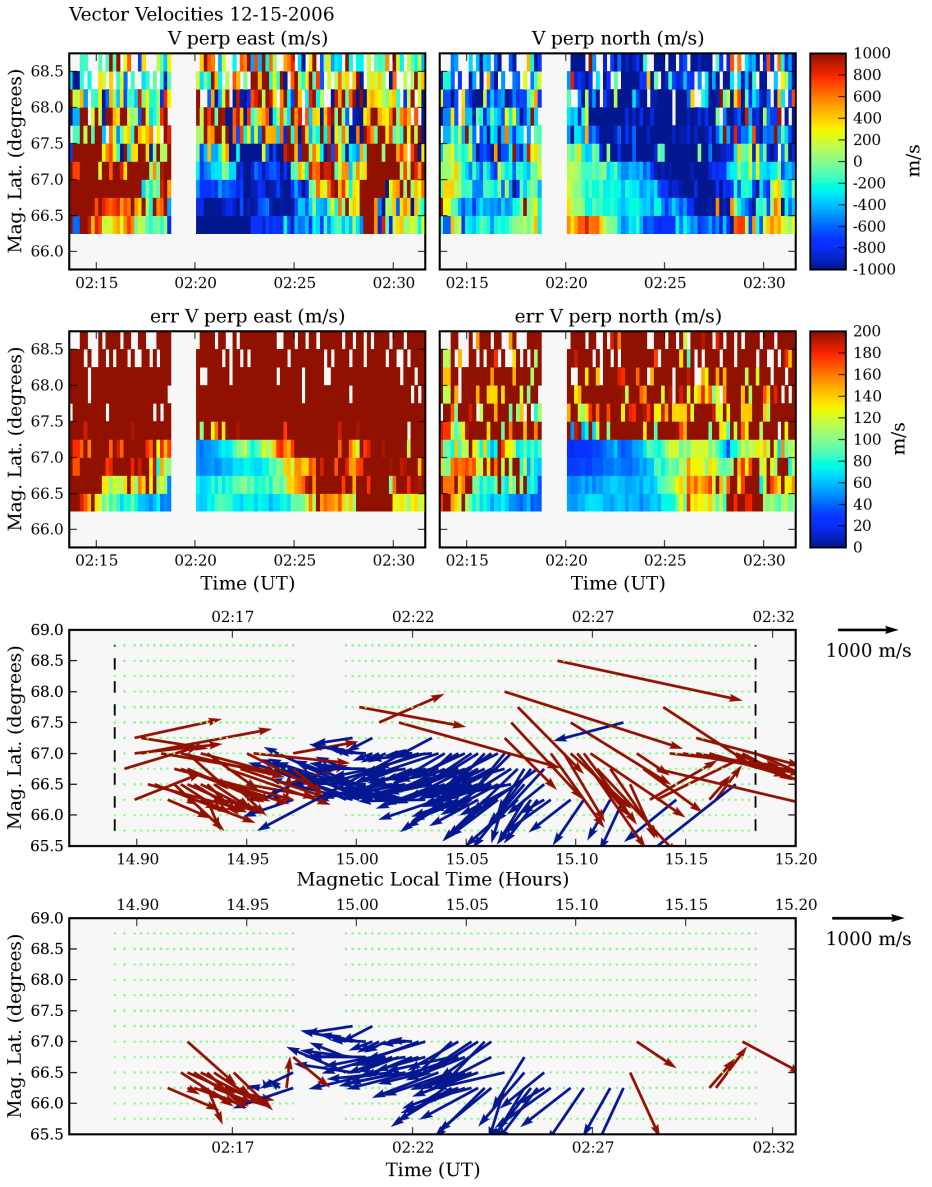
480 μs pulses (72 km)

7 positions (one up B)

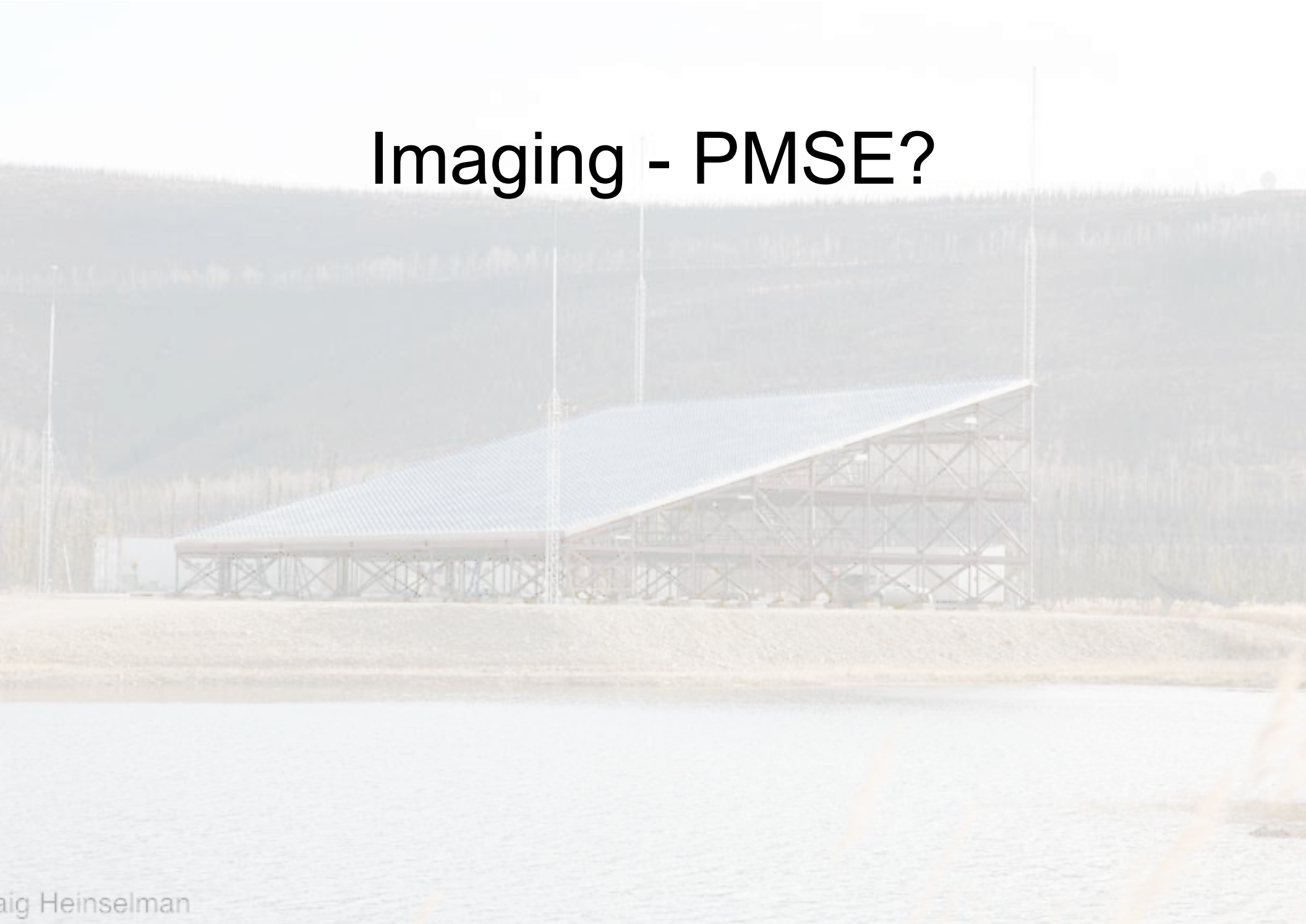
Pre-integration ~11 s

Standard Parameters and resolved velocities

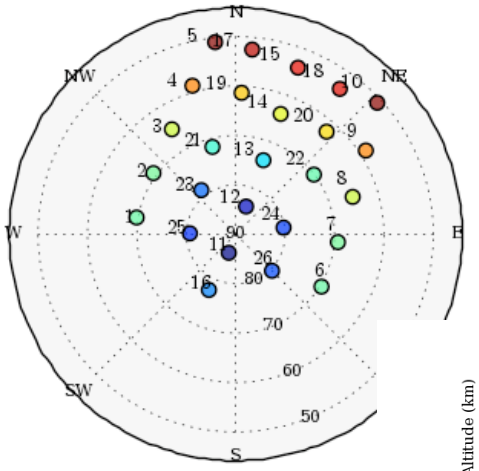


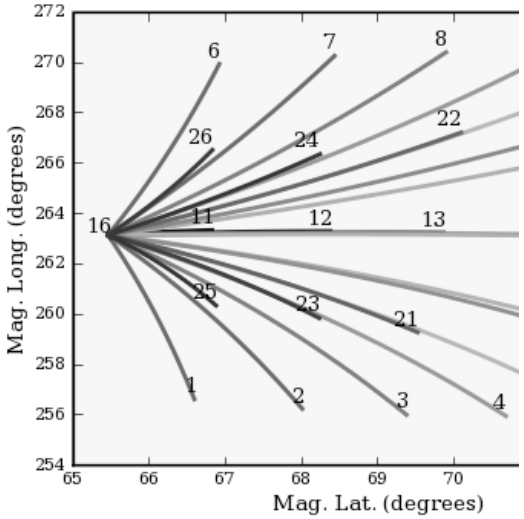


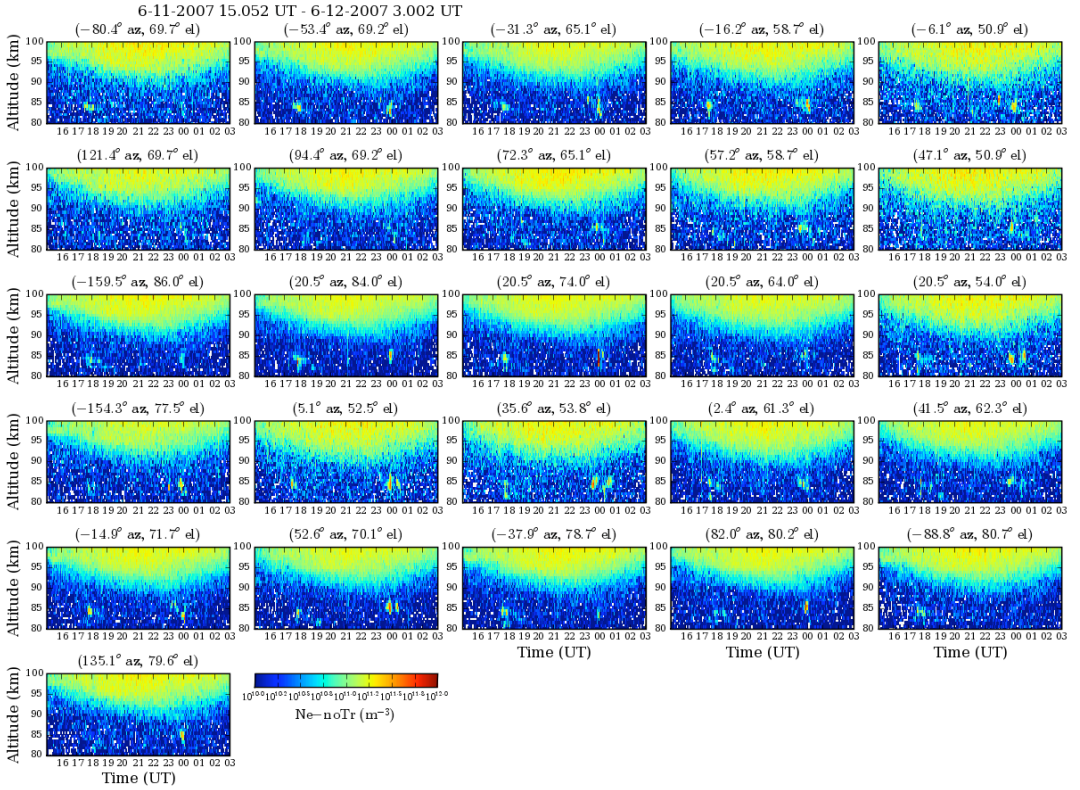
Imaging - PMSE?



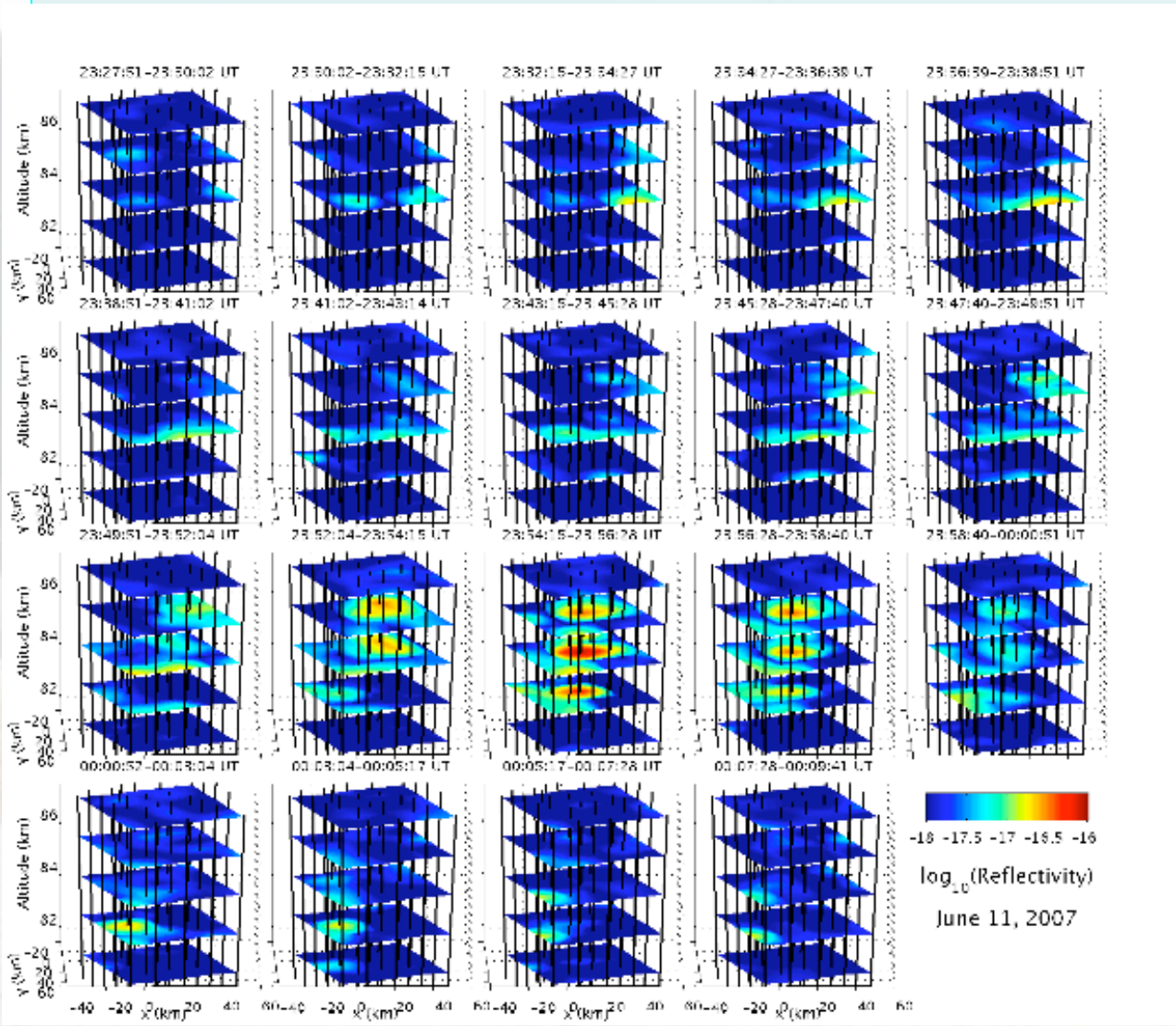
ospheric Summer Echoes)



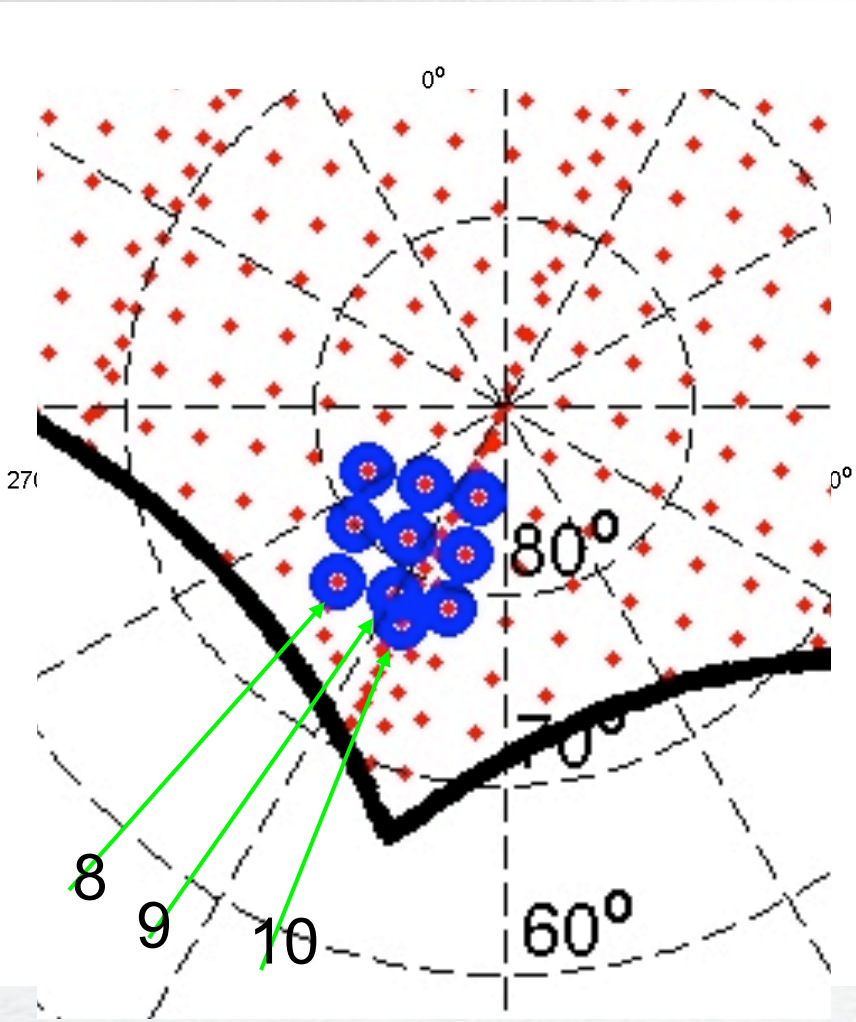




Imaging PMSE over Poker Flat



Small scale studies/aspect sensitivity



- 9 positions in 3 degree grid
- 10th position up B
- 480 μs pulses (72 km range)
- Raw voltage sampling
- Plasma line data

We cycle through the 10 pulses in a fixed order

- 7.5 ms between pulses
- 75 ms between pulses in same direction

Word of warning!

As all other things in life - designing PFISR experiments is a game of tradeoffs….

- Please consider the tradeoff b/w time resolution and # of look directions!

Remember:

- The request for radar time should contain:
  - Science goals
  - Desired time slot
  - Number of Beams
  - Beam Positions
  - Desired Data Product (density, temperature, velocity etc)
  - Submit to:

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