

# Designing experiments at PFISR

Mike Nicolls and Anja Strømme

# Today's exercise

We have 6 timeslots 2 hours each at the PFISR in Alaska.

Each group should :

- Discuss and decide on a science topic you want to study with PFISR.
- Decide on the what mode to run to accomplish your science goals.
- Write a request for radar time and send it to Mike and Anja.
- Get the request approved by Mike and Anja.
- Then Mike will prepare and submit the mode to the PFISR system, and wait for it to run.

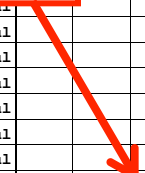
# For the rest of the week:

- Lectures before lunch
- Group work after lunch
  - Make sure to include everyone in your group
  - Make sure everyone has assigned tasks
- Group presentations Friday morning
  - Everyone on every group have to participate!
  - One presentation, several presenters
  - All presentation need to be handed in before the first group starts

POKER FLAT ISR OPERATIONS SCHEDULE FOR JULY 2013

	LDT	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
	UT	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
Mo	1-Jul			↑																					
Tu	2-Jul																								
We	3-Jul	PMSE/Thin Layers																							
Th	4-Jul																								
Fr	5-Jul																								
Sa	6-Jul																								
Su	7-Jul																								
Mo	8-Jul																								
Tu	9-Jul	World Day (E-region E fields)																							
We	10-Jul	World Day (E-region E fields)																							
Th	11-Jul	World Day (E-region E fields)																							
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	UT	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24
	ADT	16-17	17-18	18-19	19-20	20-21	21-22	22-23	23-24	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16

Time slots



# Experiment specifics:

Three different pulse schemes are available for use:

**Long Pulses** - LP-(480 $\mu$ s)

resulting in 37 km resolution data between ~100-700 km

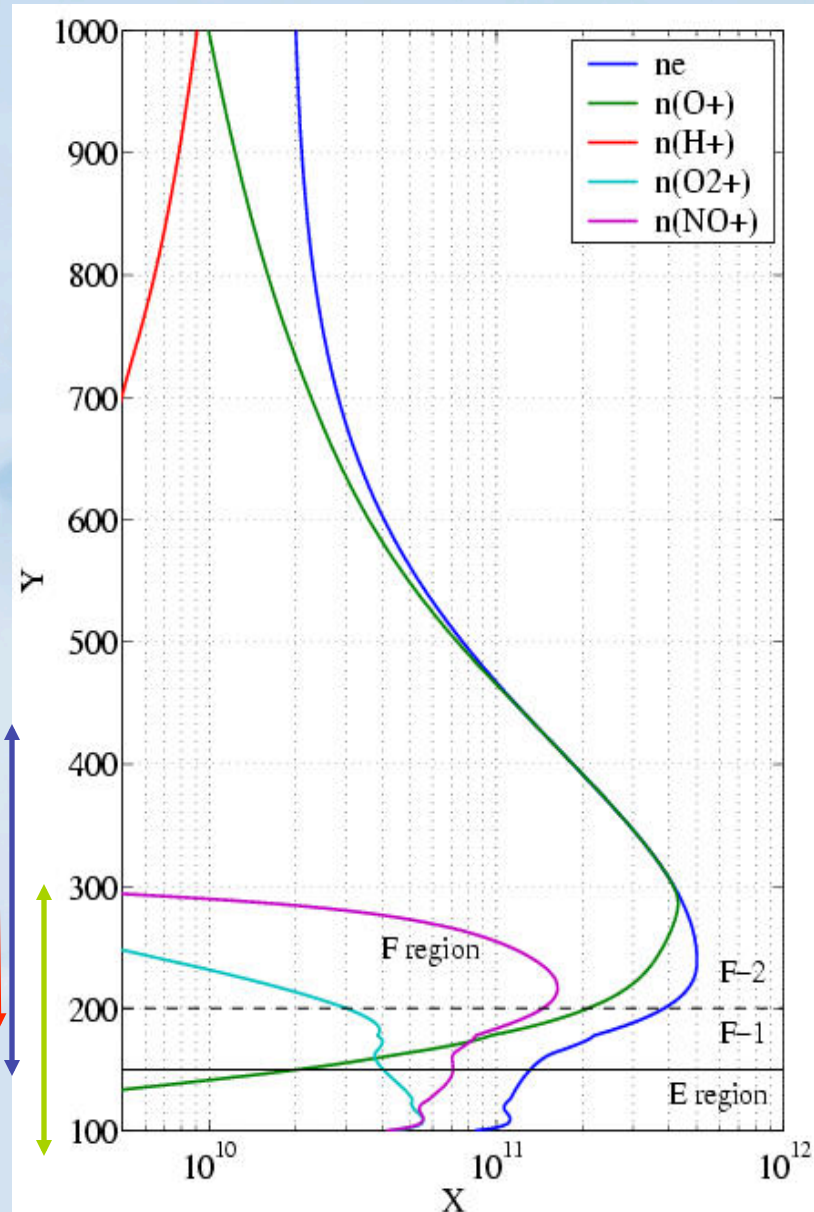
**Alternating Codes** - AC - (16 baud

30 $\mu$ s - 32 pulses) resulting in 4.5 km resolution between ~90-350 km

**Barker Codes** - BC - (13 baud

10 $\mu$ s) resulting in 1.5 km resolution between ~90-150 km

5-10% duty cycle



# Cartoon of Pulses



30  $\mu$ s sampling => 16 lags

LP:



Poor range resolution, Good sensitivity,

AC:



16 x 30  $\mu$ s = 480  $\mu$ s

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

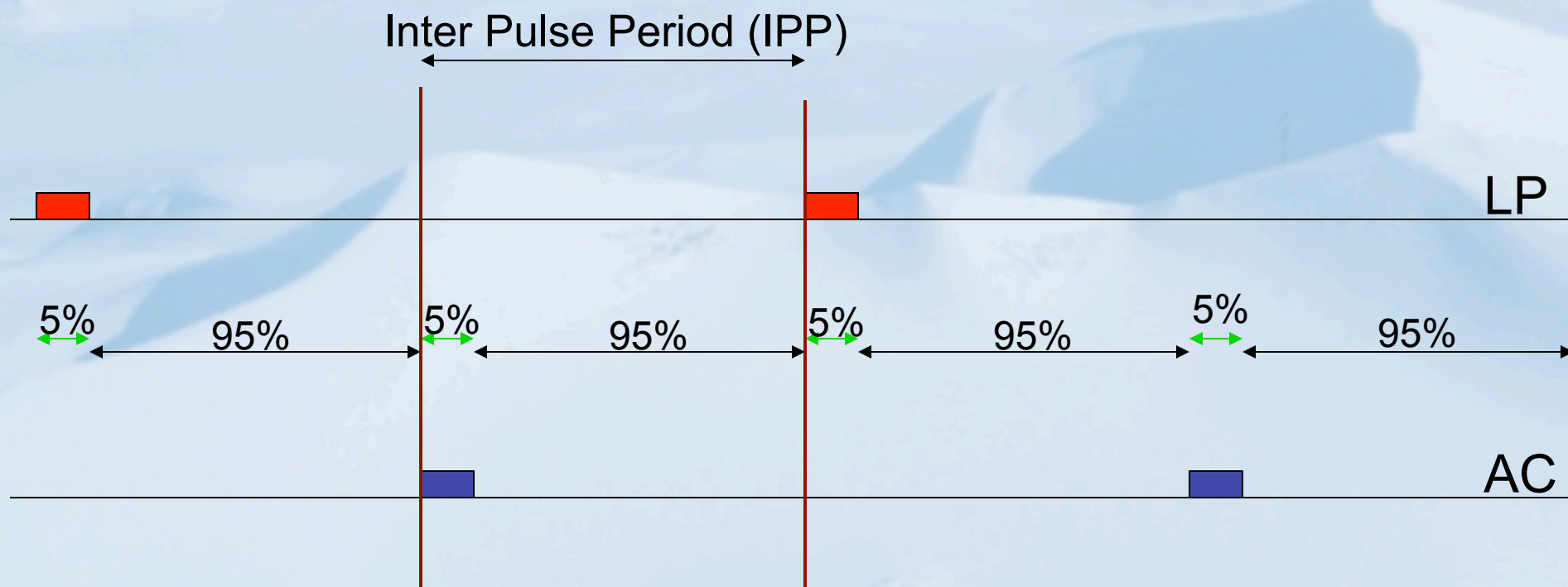
BC:



13 x 10  $\mu$ s = 130  $\mu$ s

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

63119	-95.35	67.98	1.091868e-19
63125	-90.61	68.69	1.158532e-19
63131	-85.61	69.25	1.222506e-19
63137	-80.38	69.66	1.283182e-19
63143	-74.98	69.92	1.339997e-19
63149	-69.50	70.00	1.392446e-19
63155	-64.02	69.92	1.440089e-19
63161	-58.62	69.66	1.482562e-19
63173	-53.39	69.25	1.519583e-19
63179	-48.39	68.69	1.550948e-19
63185	-43.65	67.98	1.576535e-19
63191	-39.22	67.15	1.596284e-19
63197	-35.09	66.19	1.610178e-19
63203	-31.27	65.14	1.618221e-19
63209	-27.74	63.99	1.620410e-19
63215	-24.50	62.76	1.616715e-19
63221	-21.51	61.46	1.607074e-19
63227	-18.77	60.10	1.591399e-19
63233	-16.23	58.68	1.569607e-19
63245	-13.89	57.20	1.541640e-19
63251	-11.73	55.69	1.507500e-19
63257	-9.72	54.13	1.467272e-19
63263	-7.85	52.53	1.421139e-19
63269	-6.11	50.90	1.369388e-19
63275	-4.48	49.24	1.312413e-19

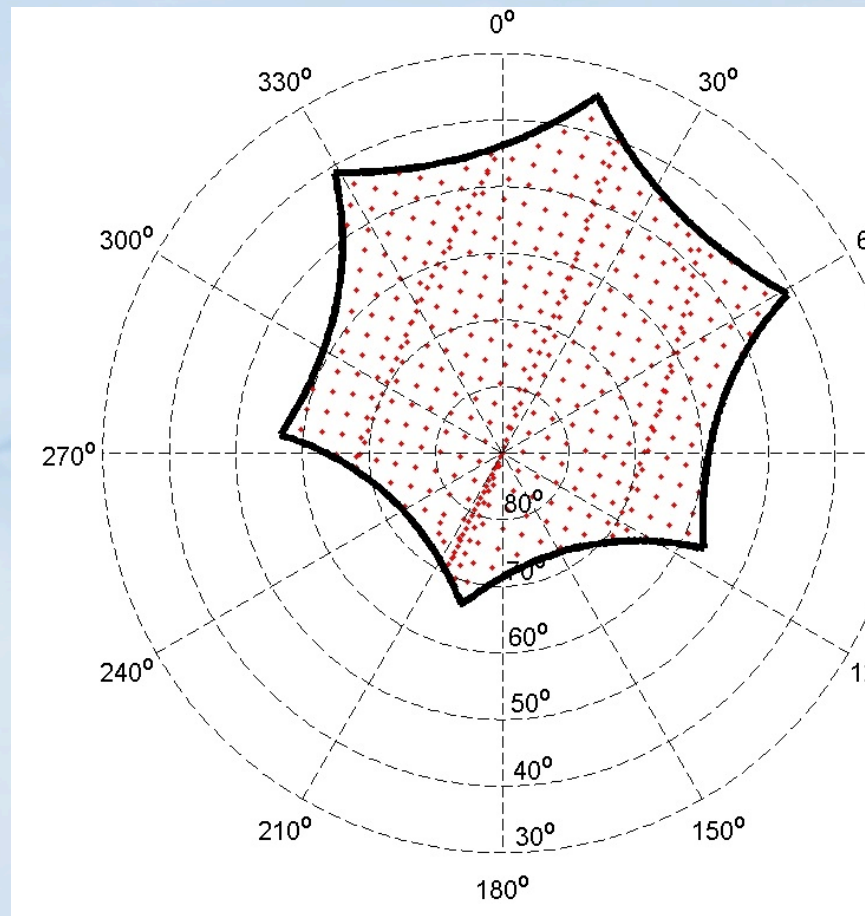
Elevation (EI)

Azimuth (AZ)

Beam Code

64157: up B

<http://amisr.com/amisr/media/pfisar/bcotable.txt>



<http://amisr.com/amisr/media/pfisar/pokerazel>

# 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.

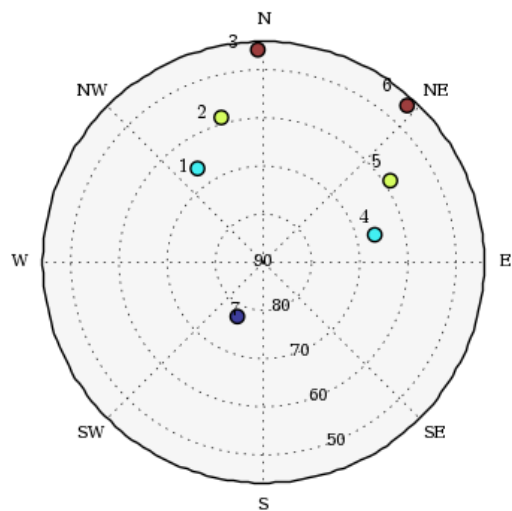
The mode I'm requesting is one being worked out by Mike Nicolls involving combined coded double pulses for high-res F region drifts interleaved with combined long and alternating coded pulses for E region temperatures. It is sufficient to store lagged products with a time resolution of a few seconds. 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 Russel 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.

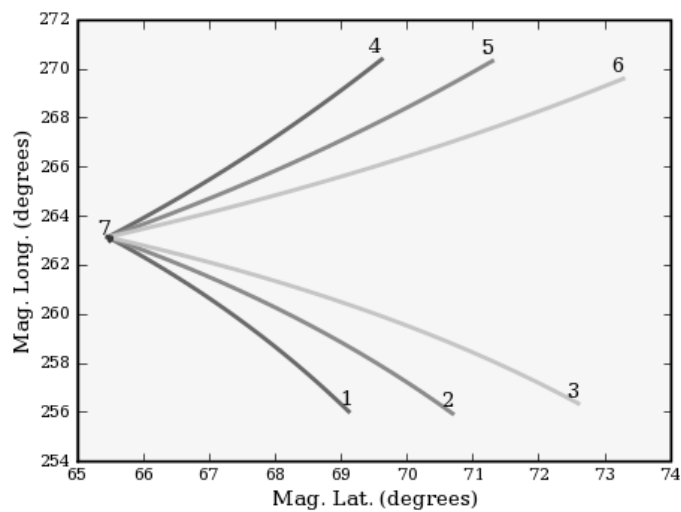
Thanks for your consideration,  
Person2

# E-fields with AMISR

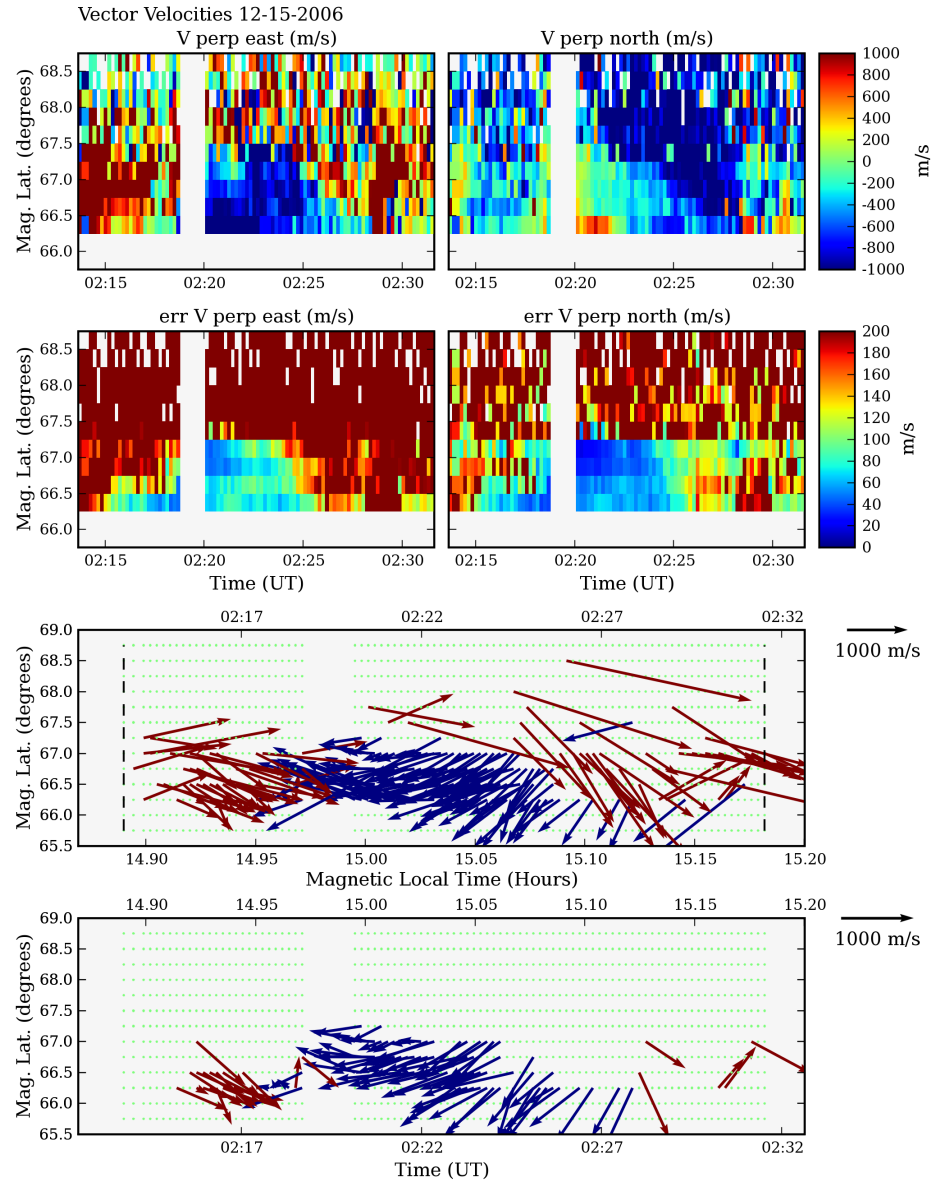
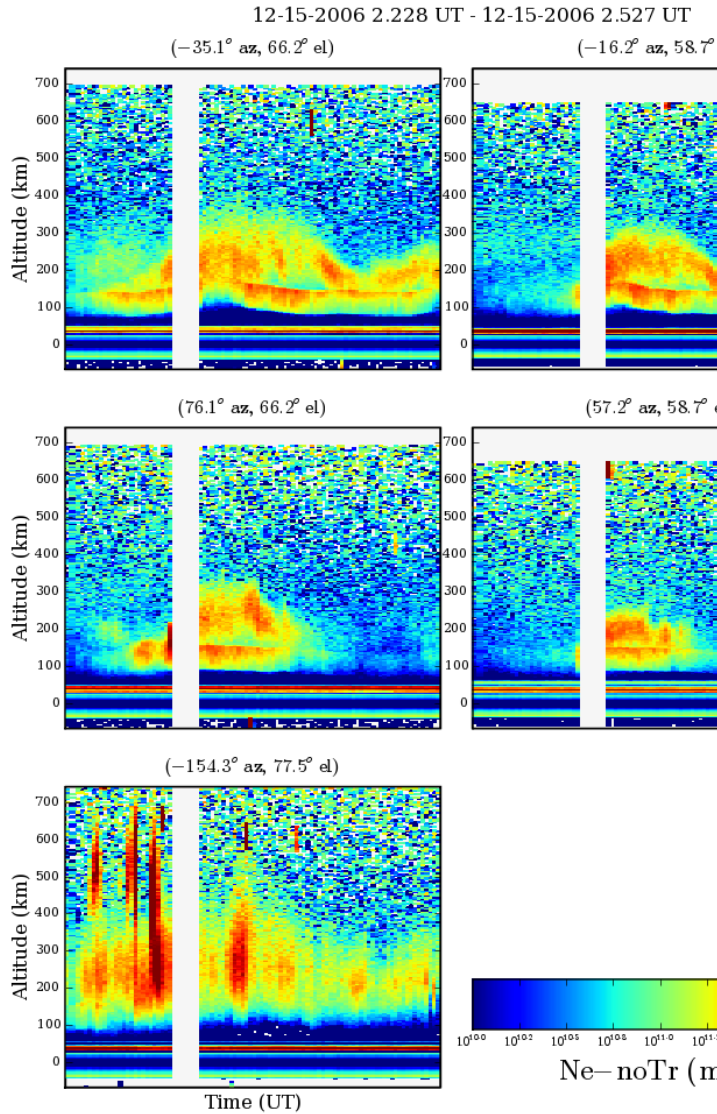


7 positions (one up B)

Pre-integration ~11 s



# Standard Parameters and resolved velocities

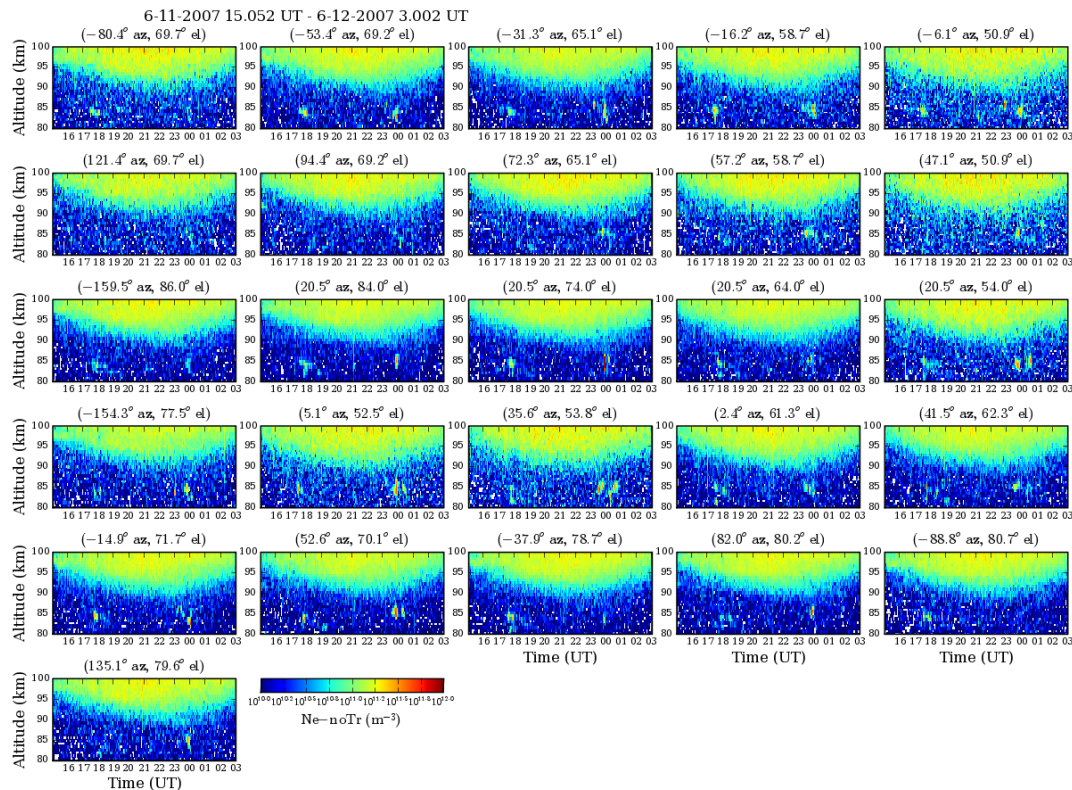
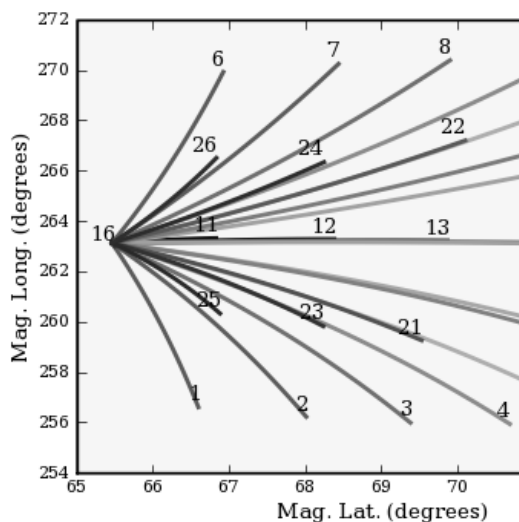
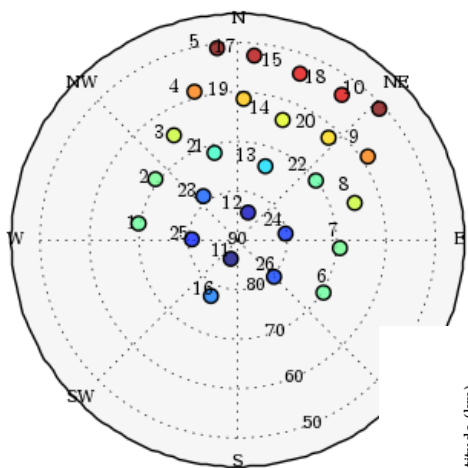


# Imaging - PMSE?

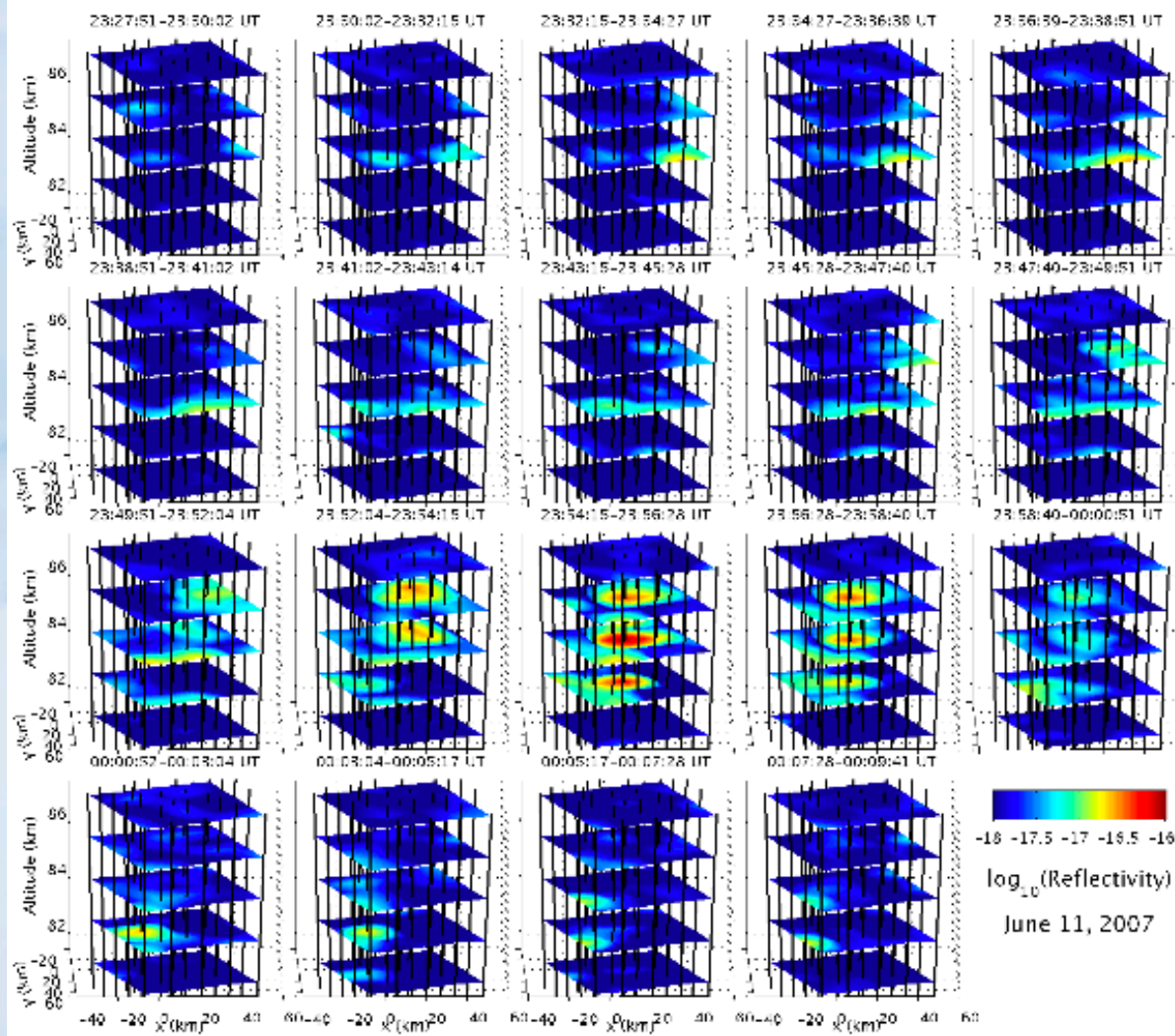
# ospheric Summer Echoes)

26 positions (one up B)

Pre-integration ~11 s



# Imaging PMSE over Poker Flat

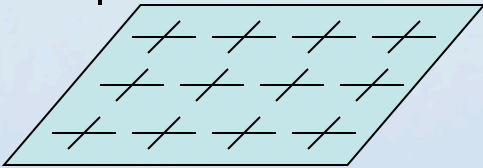
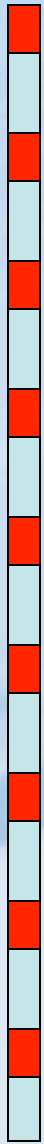




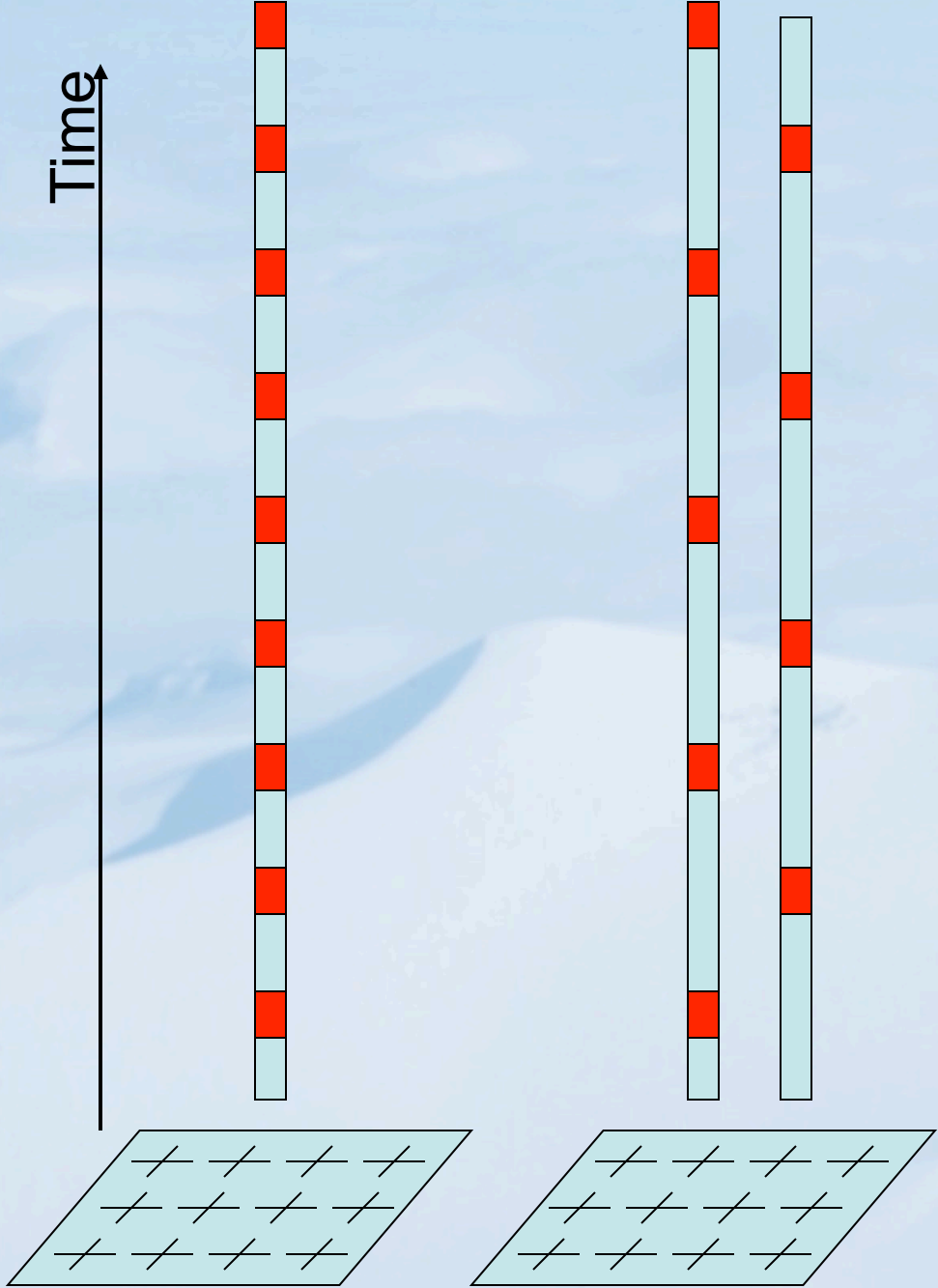
# Word of warning!

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

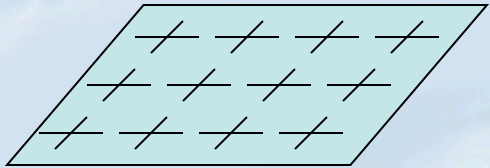
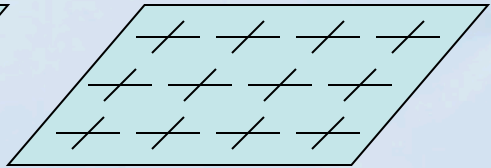
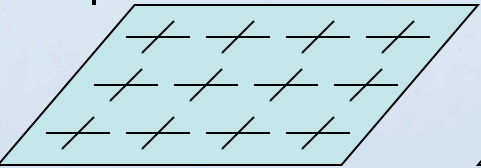
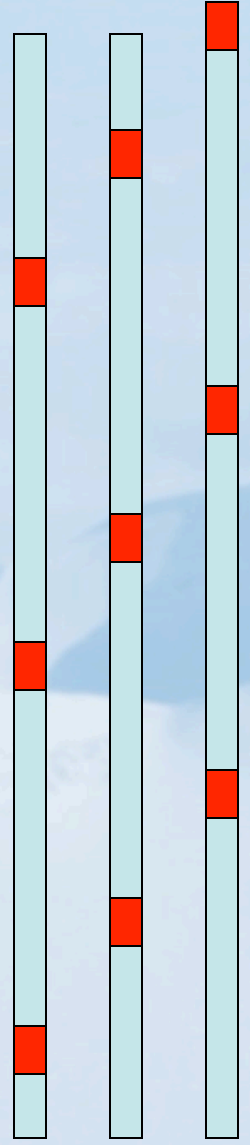
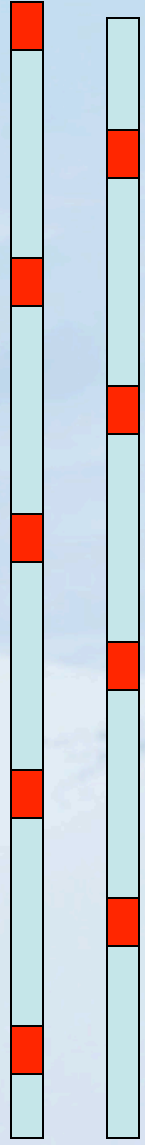
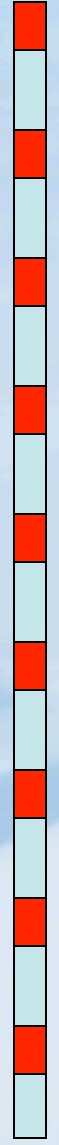
Time



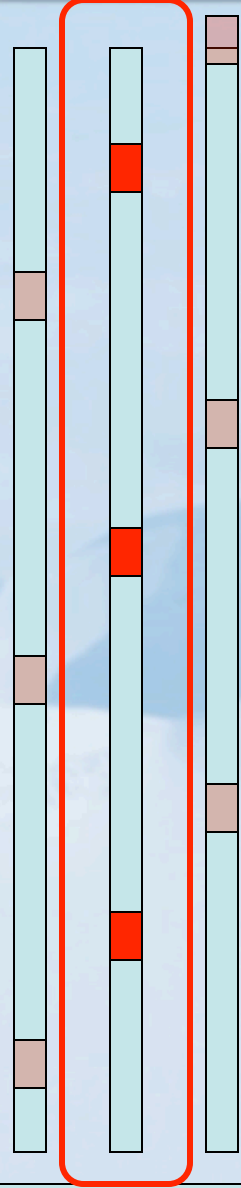
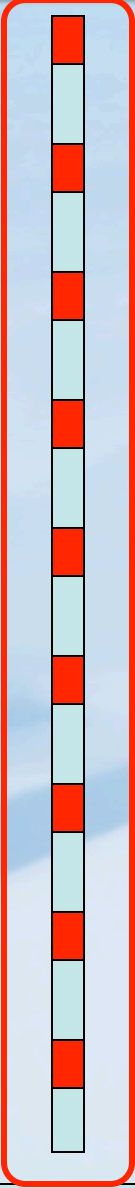
Time



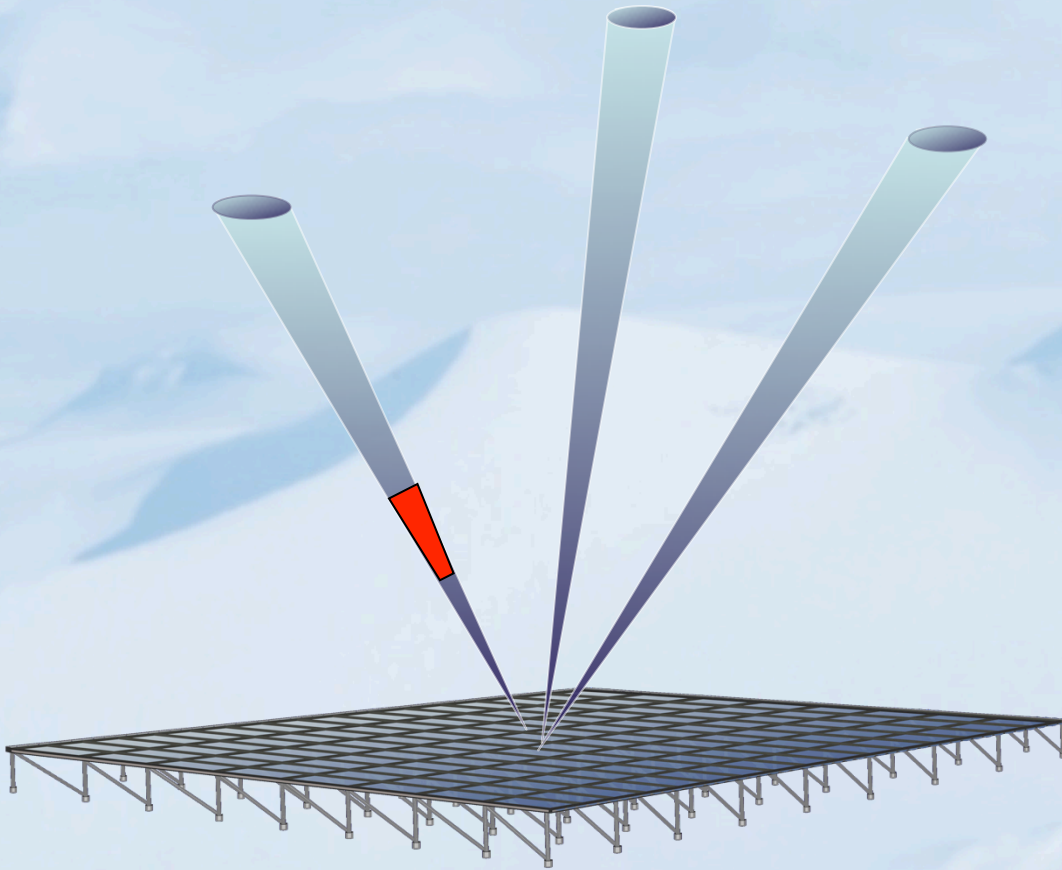
Time



Time

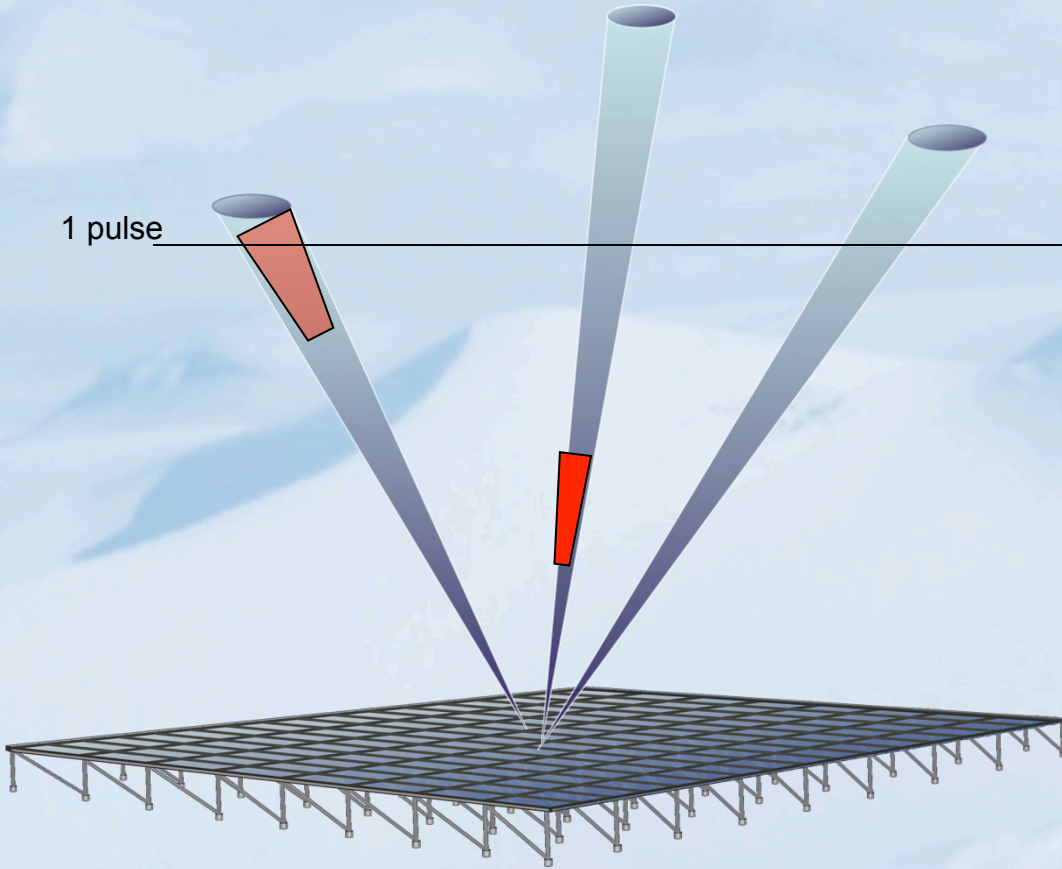


# Imaging with AMISR

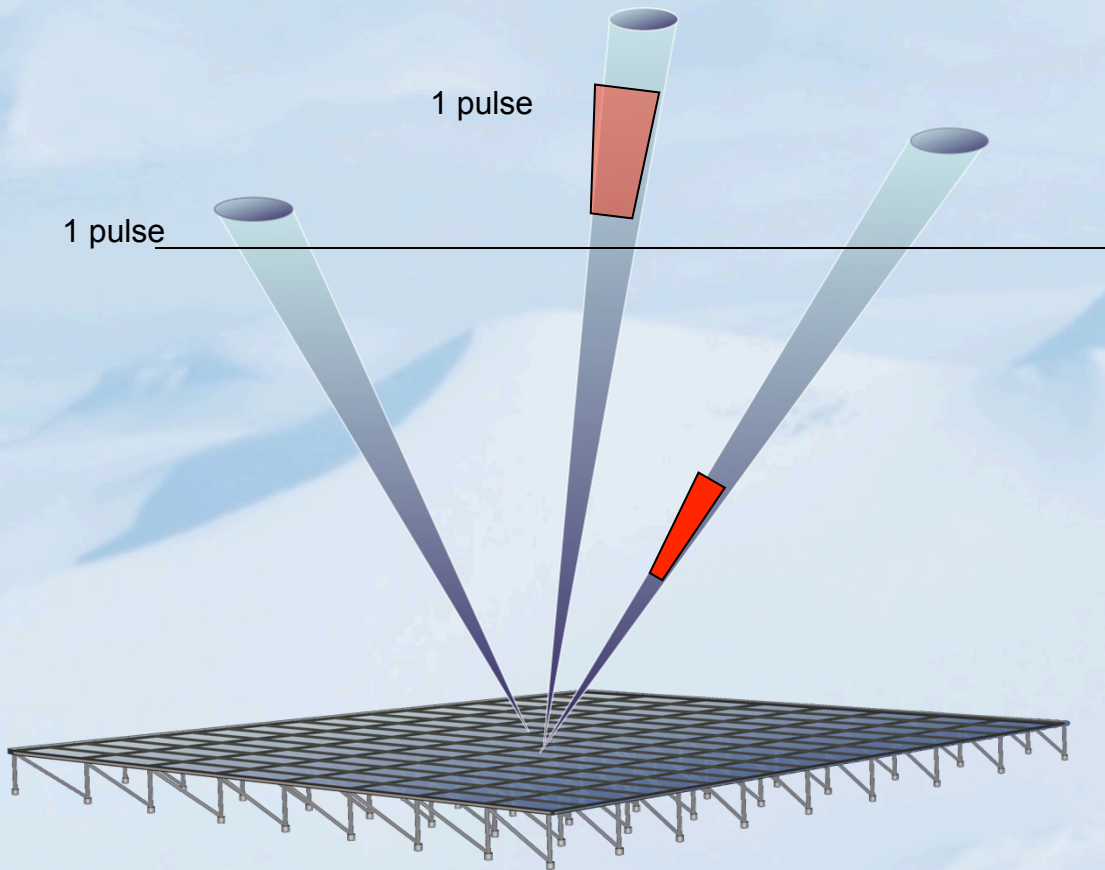


# Imaging with AMISR

1 pulse

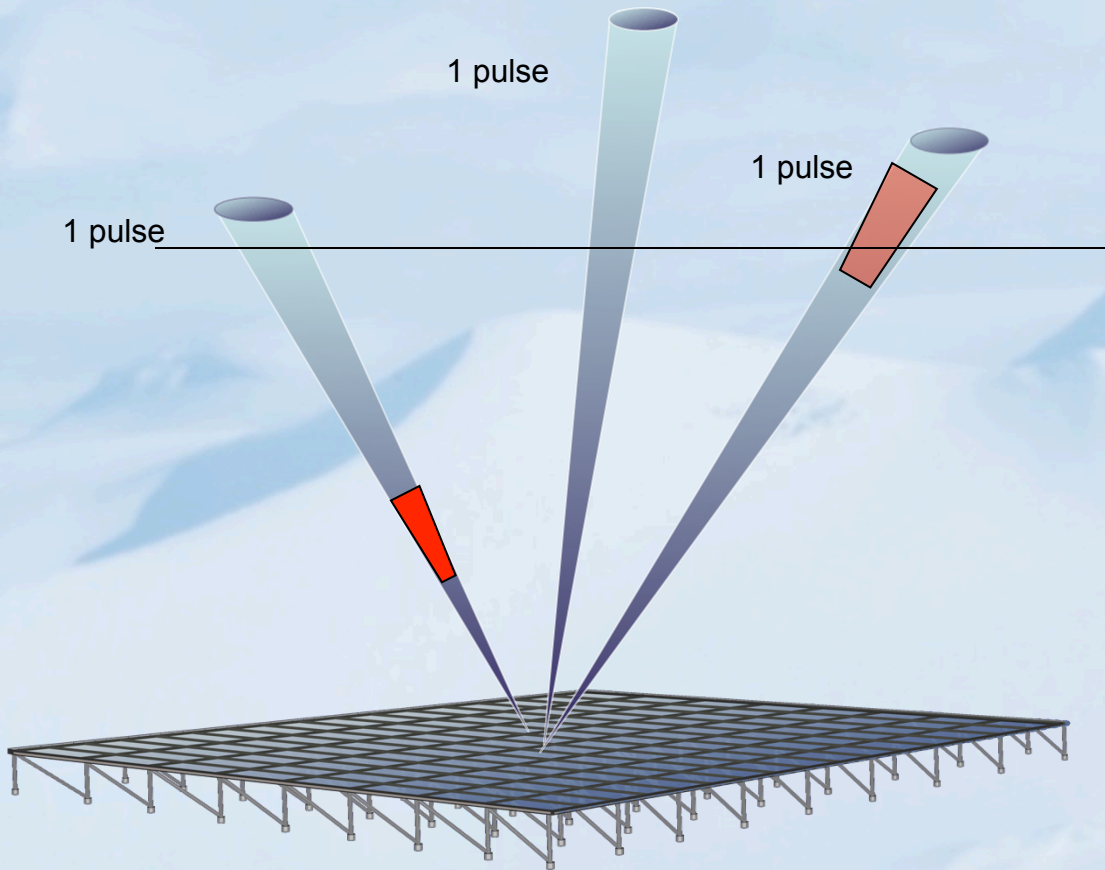


# Imaging with AMISR

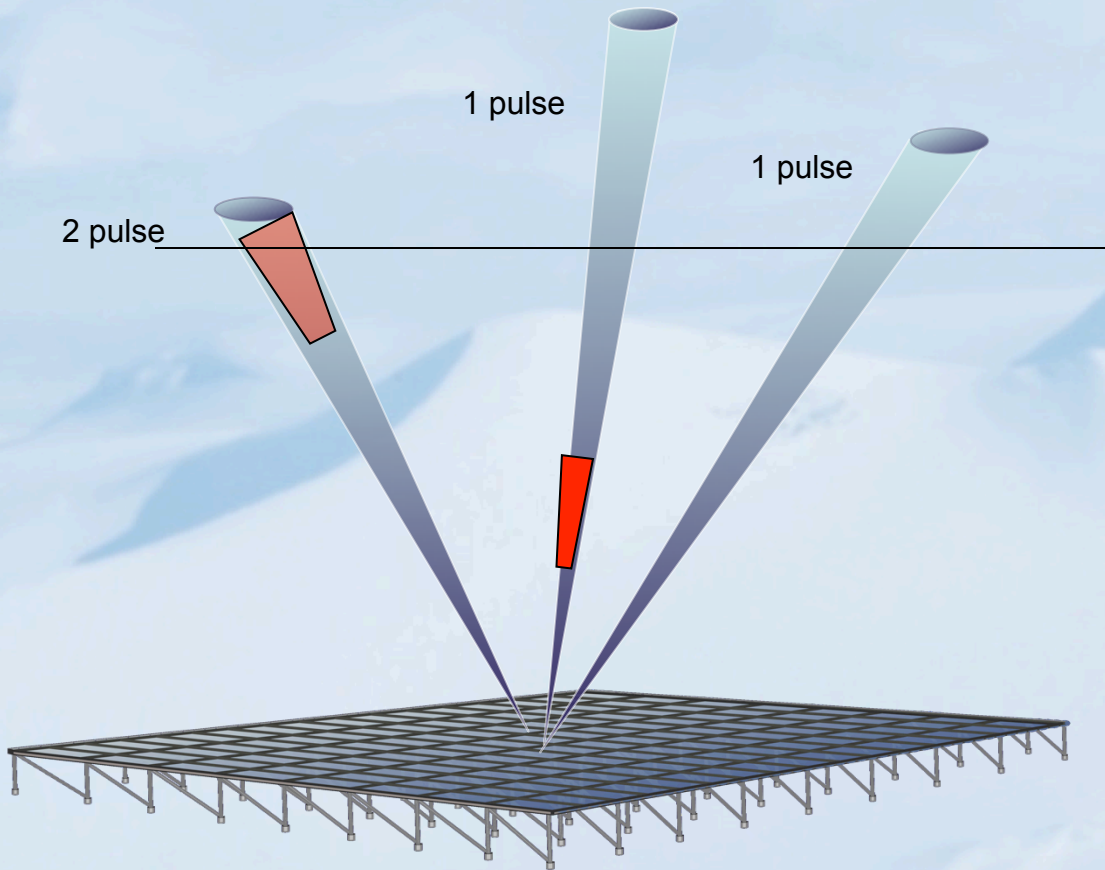




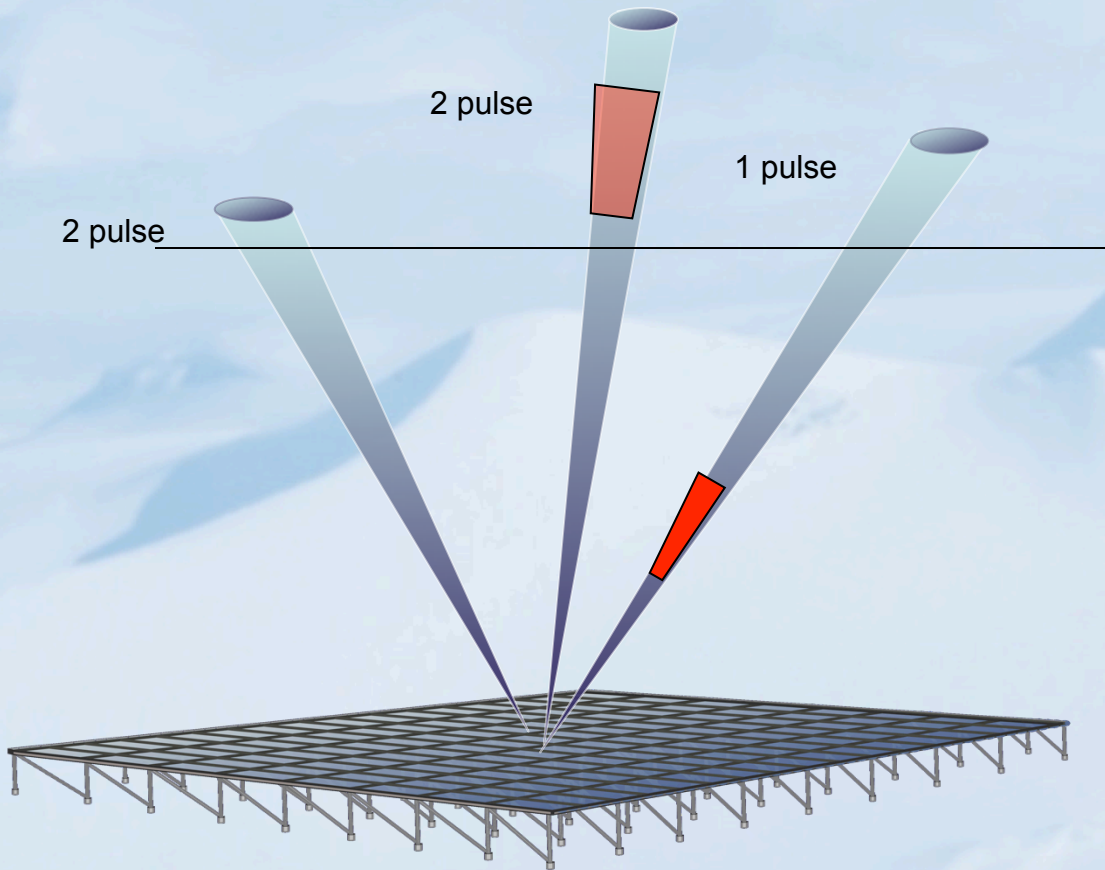
# Imaging with AMISR



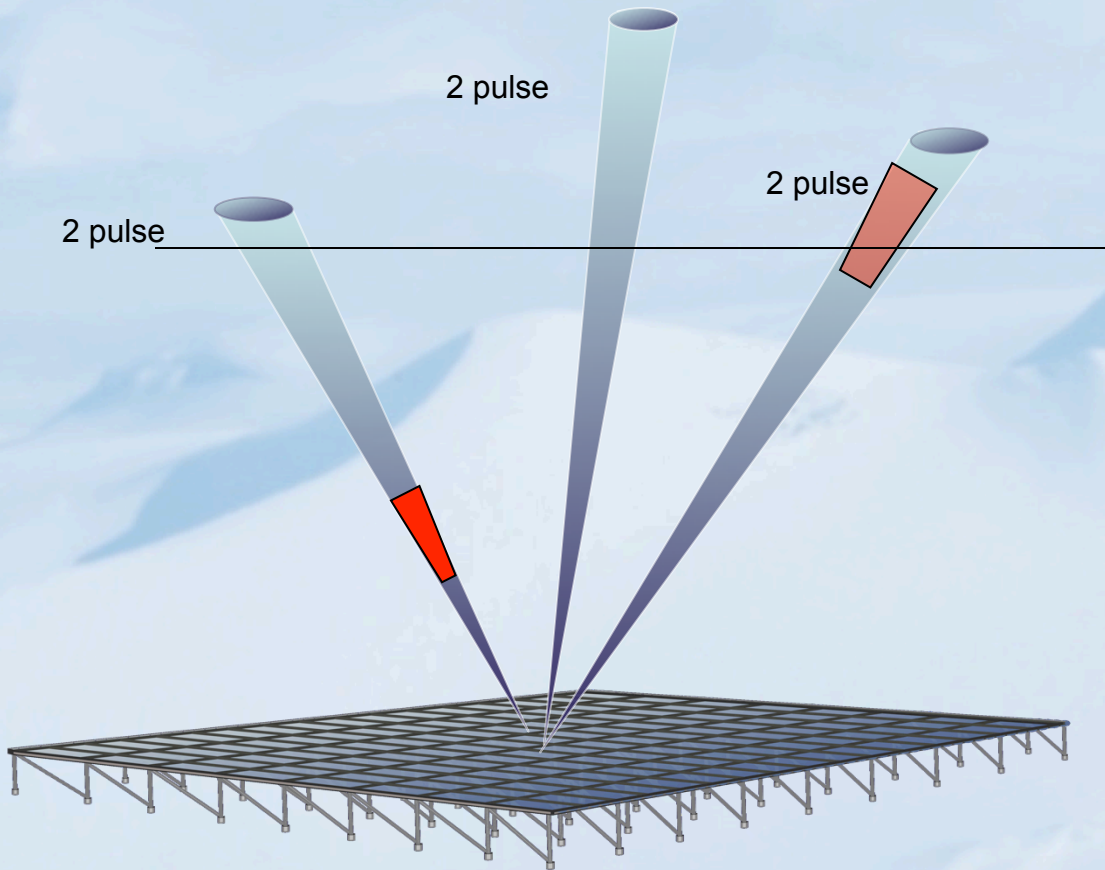
# Imaging with AMISR



# Imaging with AMISR

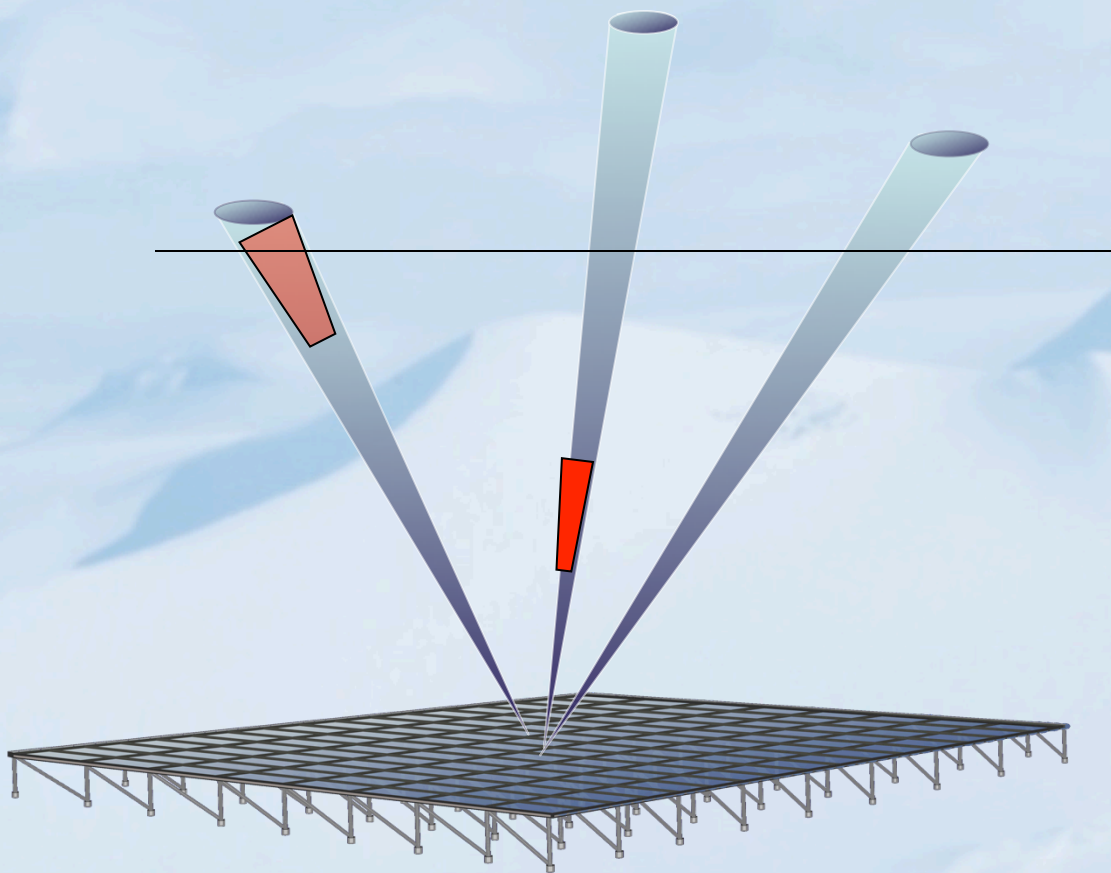


# Imaging with AMISR

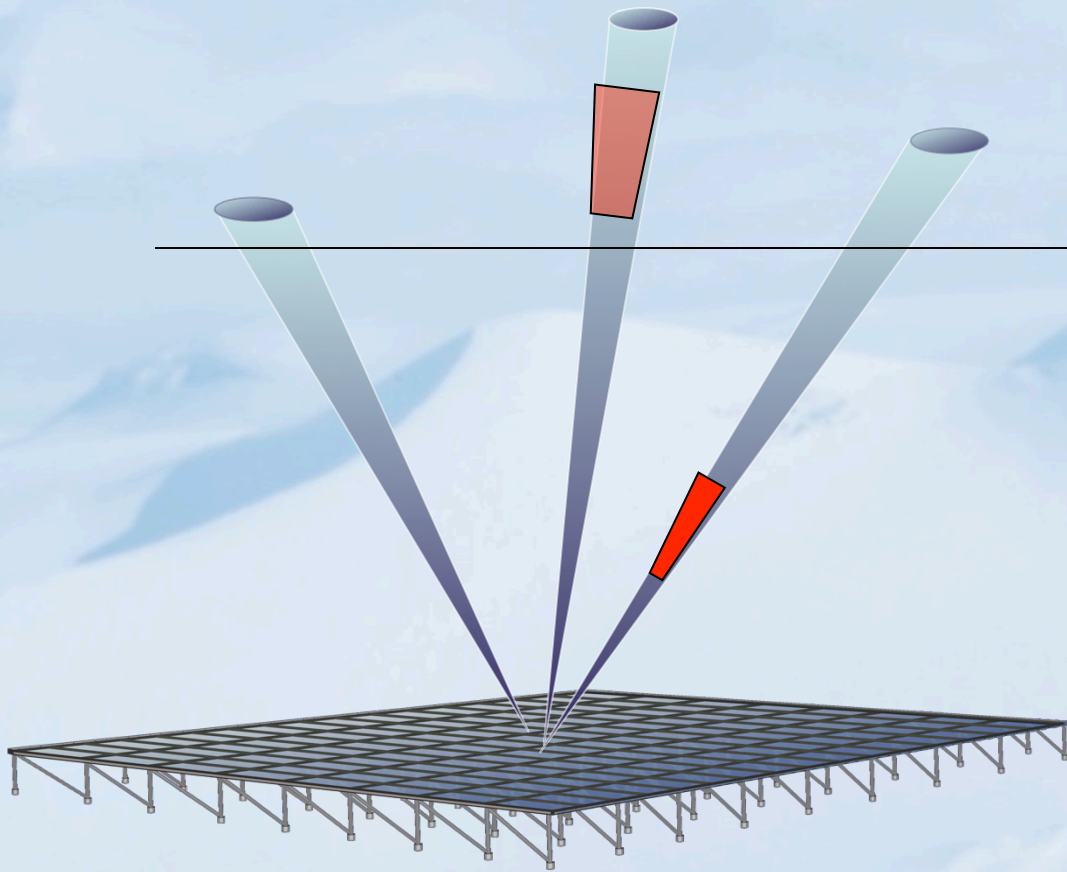


# Imaging with AMISR

...until “enough” pulses  
in each direction



# Imaging with AMISR



# Remember:

- The request for radar time should contain:
  - Science goals
  - Desired time slot (between 22:00-10:00 UT)
  - Number of Beams
  - Plot indicating the beam positions
  - Desired Data Product (density, temperature, velocity, spectra, voltage level data etc)
  - Submit to:

[Michael.Nicolls@sri.com](mailto:Michael.Nicolls@sri.com)

[Anja.Stromme@sri.com](mailto:Anja.Stromme@sri.com)

# Other radars providing data tonight:



- Millstone Hill

A "regional vector" mode will be executed. It combines a vertical (zenith) profiling mode covering E, F, and topside regions with measurements to the north and west @ 45 degrees elevation. This provides regional information on scalar and velocity parameters within a +/- 2 degree cone around Millstone Hill. 20:00 – 12:00 UT on 30. – 31. July 2013

[http://www.haystack.mit.edu/cgi-bin/midasw\\_radar\\_status](http://www.haystack.mit.edu/cgi-bin/midasw_radar_status)

- Sondrestrom

Full comp-scans will be run from 22:00-10:00 UT on 30.-31. July 2013. This will give convection vs latitude with 5-minute resolution, in addition to standard parameters. The data will be posted in Madrigal shortly after the run

- Jicamarca

A vertical drift mode will be scheduled for 22:30 to 13:00 UT on 30. July. The processed data (Drifts) will be put in Madrigal as soon as the run ends.



# Last slide with what you need to remember:



## Proposal should contain:

- Science objective
- Pointing directions matching science objective
- (suggested) timeslot
- Data product wanted

## Timeslots available:

- 22:00 – 00:00 UT
- 00:00 – 02:00 UT
- 02:00 – 04:00 UT
- 04:00 – 06:00 UT
- 06:00 – 08:00 UT
- 08:00 – 10:00 UT

## Beam maps and list:

<http://amisr.com/amisr/media/pfisr/pokerazel.jpg>

<http://amisr.com/amisr/media/pfisr/bcotable.txt>

## Send to:

[Michael.Nicolls@sri.com](mailto:Michael.Nicolls@sri.com)

[Anja.stromme@sri.com](mailto:Anja.stromme@sri.com)

## Absolute deadline for submission:

**18:15 LT (06:15pm) TODAY**

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<http://amisr.com/amisr/media/pfisr/bcotable.txt>

**Collaborate!!!**



## Send to:

[Michael.Nicolls@sri.com](mailto:Michael.Nicolls@sri.com)

[Anja.stromme@sri.com](mailto:Anja.stromme@sri.com)

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