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StreamLine XR+ Pulsed Doppler Lidar

The Streamline XR+ Lidar belongs to the StreamLine series, which is a range of compact Doppler Lidar systems offering high resolution wind measurements with all sky scanning. It offers the benefit of low power consumption, light weight and portable operation coupled with autonomous operation. The StreamLine series advantageously complement the Wind Pro for met masts and vertical profiling Lidar and provide among the most flexible and accurate wind measurements tools for wind mapping, wake analysis for onshore and offshore projects.

Long range

Low purchase And running costs

Low power consumption

Wide temperature range

Real-time processing

Flexible software

Mature, proven technology

Key features:

- Turn key operation
- Scan queue synchronised to GPS time
- Multiple Lidar syncing via master controller over network
- Step-stare and continuous scanning
- Full control of scanner parameters
- Overlapped range gates – 3 m range resolution
- Raw data storage
- Velocity precision < 20 cm/s for SNR > -17 dB
- Eye safe (Class 1M)
- Data logged in ASCII
- Arbitrary scan patterns
- UPS power cut protection
- Remote monitoring/control
- UDP data broadcasting
- Email alerts

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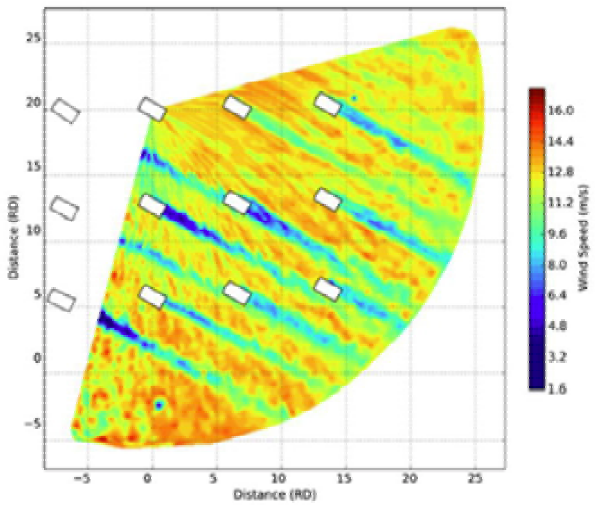
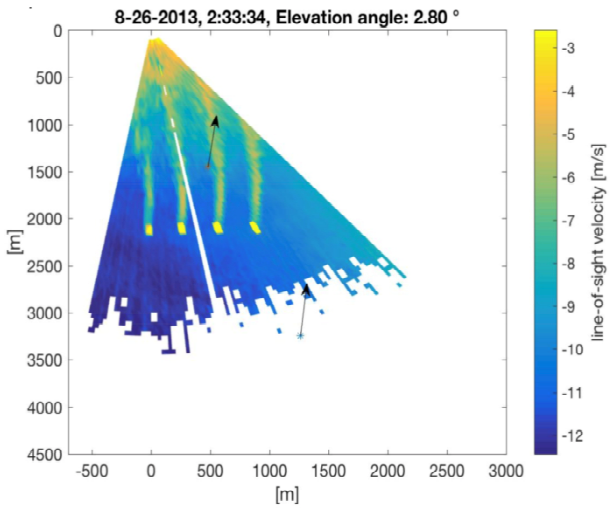
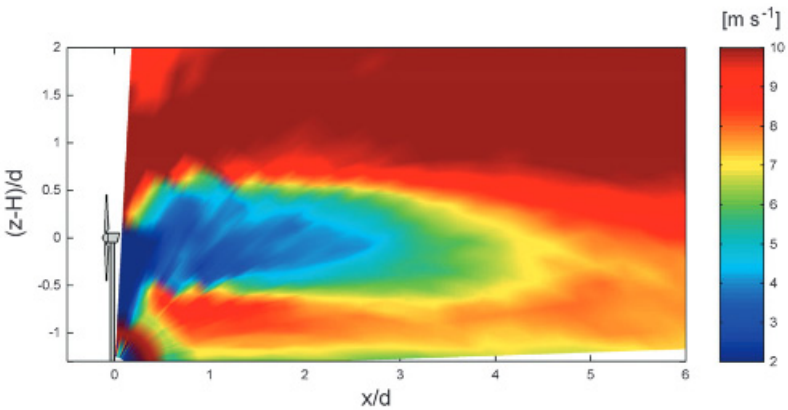
The Streamline XR+ Lidar is well suited to performing wide angle PPI or VAD scans to long range and also for other wind turbine research. The two data plots below show turbine positions and their wakes. The are at a lower velocity compared to the prevailing wind due to the energy being extracted from it after passing through the blades.







An individual turbine wake measured using one Lidar located at the base of the turbine.

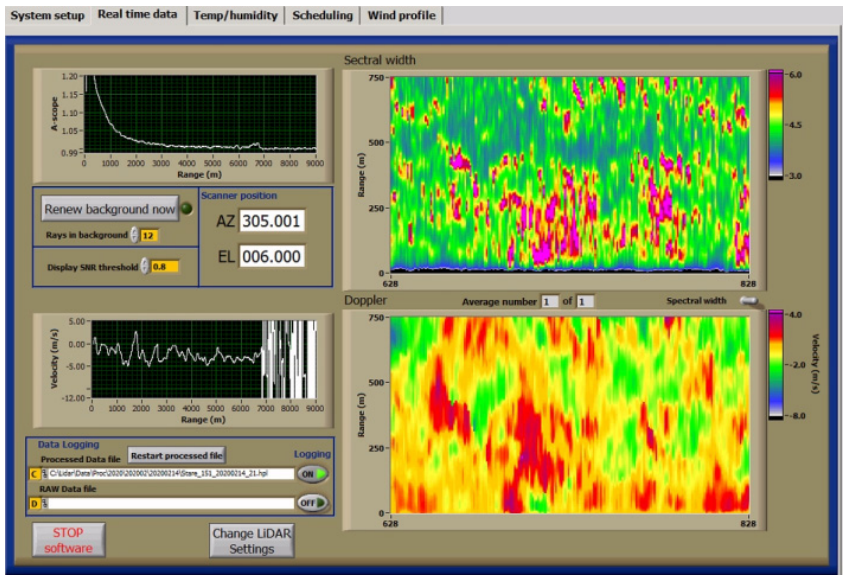
Image courtesy of EPFL.

Wind power related features:

- **Small form factor 63 x 53 x 65cm 85Kg**
- **Full hemispheric scanner -15° to 195° elevation**
- **Rugged, proven technology**
- **Continuous scanning mode**
- **Integrated GPS for time synchronisation**
- **Near real-time data processing**
- **User selectable range gates from 18m to 120m**
- **24V DC 500W maximum**
- **+/-38m/sec LoS Doppler**
- **High IP rating**
- **UPS power cut protection**
- **Remote monitoring/control**
- **UDP data broadcasting**
- **Email alerts**

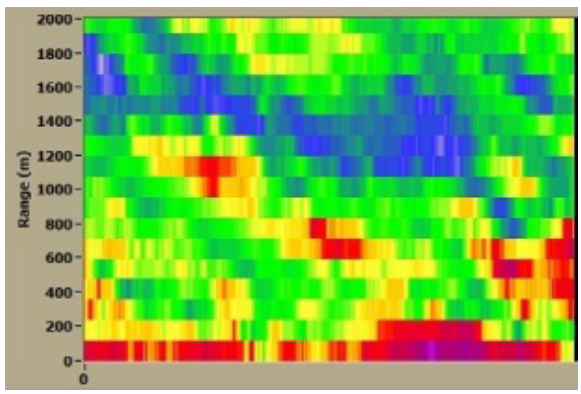
StreamLine XR+ Pulsed Doppler Lidar

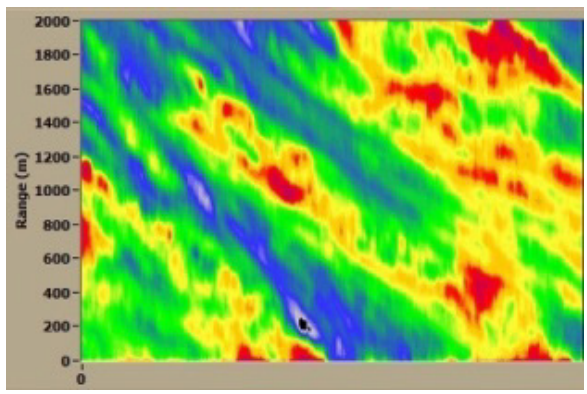
The StreamLine XR+ provides 12km measurement range with up to 8000 individual range gates that can be acquired and processed in near real-time. The processed data products are radial velocity, atmospheric backscatter and spectral width versus range.



This screen shot shows the XR+ collecting high resolution data. The bottom colour plot shows radial velocity versus range out to 750m. The upper colour plot shows the corresponding spectral width.

The left plots show (upper) SNR return power, and (lower) radial velocity. The Lidar was measuring out to around 7km range on this occasion.



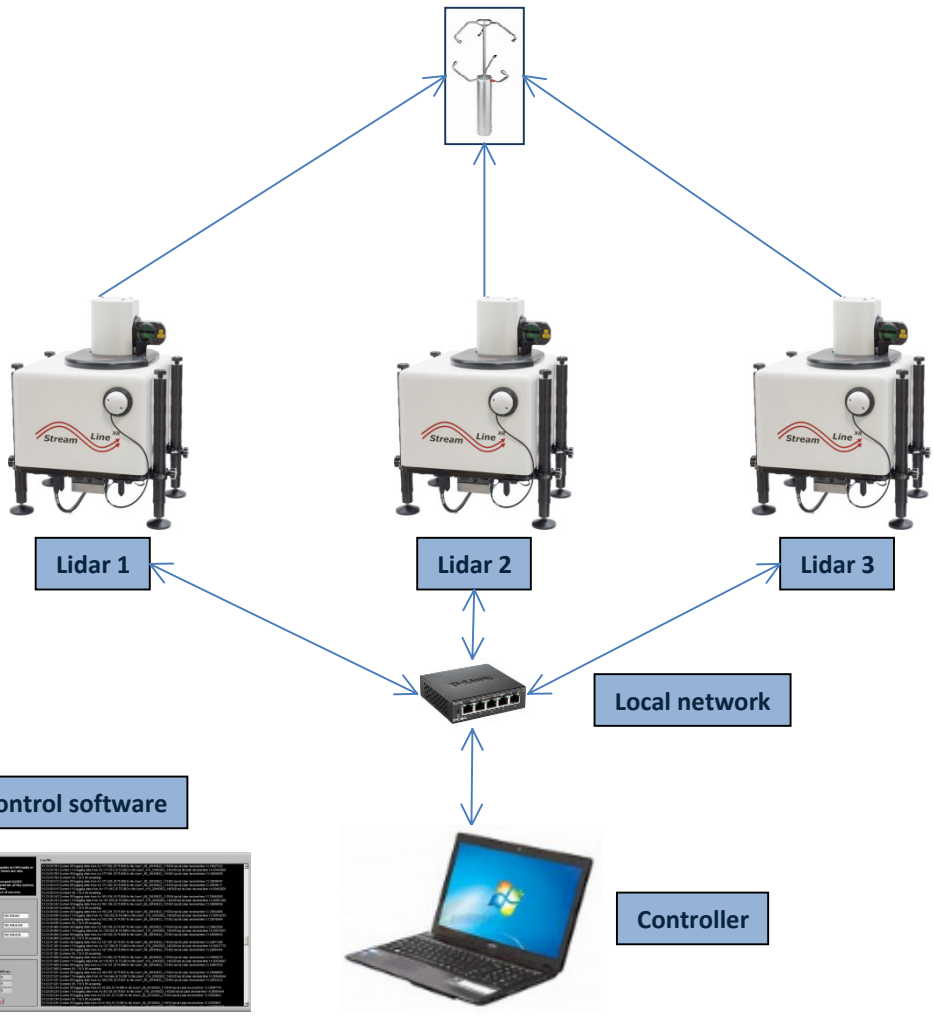


The above data examples show the advantage of utilising a powerful real-time signal processing system. The left plot shows regular acquisition mode with 120m gate length and 2km range = 17 gates. The right plot shows the same 2km range and the same 120m gate length, but now each gate is moved forward by 1.5m instead of 120m, so there are now 1333 gates making up the very much more detailed plot.

StreamLine XR+ Pulsed Doppler Lidar

Synchronised scanning and data acquisition.

The all-sky scanning StreamLine XR+ system ships with free software that will allow it to be synchronised with other StreamLine, XR or XR+ units. This is very useful for operating several Lidars in dual or triple Doppler mode.



A controller PC connects to the same network as the Lidars, and co-ordinates data acquisition timing and scanner movement. The controller will log all of the commands and responses from each Lidar, and will ensure that all timings are good to within 10mS. It is not important for each individual Lidar to be set to exactly the same system time (because time can quickly drift on a PC), and so all acquisition and scanner movement is performed with respect to the controller's time. More details about this mode of operation can be sent on request.

StreamLine XR+ Pulsed Doppler Lidar

Usage	
Airports	Wind profiles Windshear detection Vortex detection and tracking
University research	PBL mapping Eddy dissipation rate Cloud research
Climate and environmental monitoring	City pollution mapping Air quality assessment Pollution dispersion Forest fire detection and tracking
Meteorology	Wind profiling Visibility Boundary layer mixing height Scanning ceilometer
Wind energy	Site prospection Calibration Continuous wind monitoring Power performance verification Wind resource assessment Site suitability

All StreamLine Lidars ship inside a rugged custom built and lined transit case, and are fully assembled ready to be lifted out and powered up. It's possible to begin data acquisition a few minutes after deployment, with no calibration or special equipment needed. No special lifting equipment is needed in order to move the systems thanks to the relatively light weight of the units.

StreamLine XR+ Pulsed Doppler Lidar

Technical specifications

Wind measurement accuracy	
Wind direction measurement range	0 - 360 °
Wind direction measurement resolution	≤ 2°
Wind speed measurement resolution	≤ 0.5 m/s
Wind speed measurement accuracy	≤ 0.5 m/s
Radial wind speed range	-38to +38 m/s
Spatial resolution	18m to 120m

Operating modes / scan patterns (user programmable)	
PPI (Plan position indicator)	• User defined angular step per data ray (step/stare or continuous mode • Angular speed up to 30°/s
RHI (Range Height Indicator)	User defined no. of steps, feedback from wind profile can be used to define azimuth position.
Wind profile	6 azimuth beams at user defined elevation
Elevation angle	≤ 0.01°
Azimuth angle	-≤ 0.01°
Azimuth, elevation	Integrated slip-ring giving full hemispherical coverage 0 - 360° in azimuth and -15° to 195° in elevation, with 0.01° resolution in both axes

Other parameters	
Minimum range	Typically <60m
Range-gated data products	• Line-of-sight velocity • SNR and backscatter • Spectral width
Wavelength	1.5µm
Thermal control	Active heat exchanger with options for extreme cold or hot fitments.
Operating temperature	-20°C to +45°C but further options are available.

StreamLine XR+ Pulsed Doppler Lidar

Other parameters continued	
Transceiver aperture	75mm
Enclosure dimensions	63 x 53 x 65 cm
Weight	85 kg
Power requirement	24 V DC 150 W (Extra 340 W [maximum] for extended cooling option)
Pulse rate	10 kHz
Temporal resolution selectable	0.1 – 30 seconds
Bandwidth	±19 m/s ±38 m/s (optional)
Data collection to 12 km with near 100 % duty cycle (set up dependent)	
Raw averaged data can be logged (un-range gated), and re-processed using different gate lengths and averages	
Eye safe, Class 1M	
Software selectable range gate size, number of shots to average and number of gates to process per ray	
Both step-stare and continuous scanning modes are available and user adjustable. A daily schedule, synchronized to GPS time can be defined where the scan mode and scan parameters are set for each element of the scan sequence.	
Windows 10, solid-state hard drive	
UDP data broadcasting	
Email alerts (low drive space, power cut, over temperature etc.)	
Integrated GPS	
Standard 1 year warranty (terms & conditions on request)	