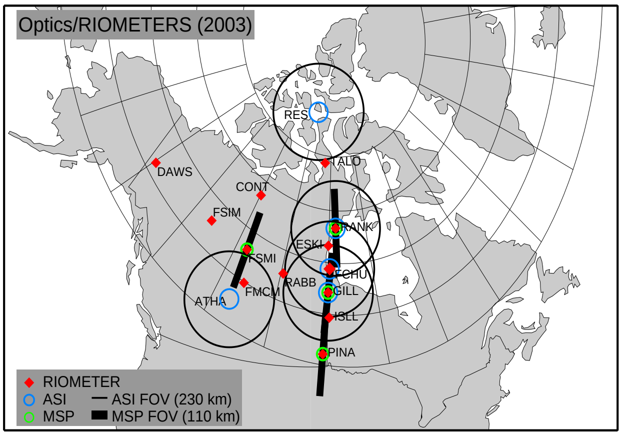
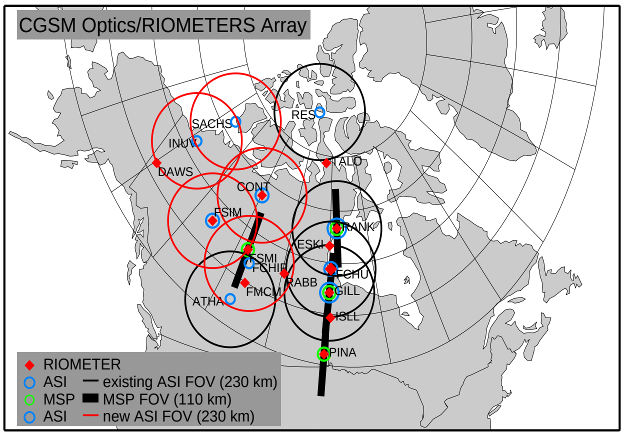
NORSTAR is the imaging component of CGSM, and consists of four CCD-based ASIs, four MSPs, and 13 single beam riometers. The ASIs are located at Resolute Bay, Rankin Inlet, Gillam, and Athabasca. They have five-slot filter wheels accommodating three inch high-pass or narrow bandpass filters. Data is collected at auroral wavelengths (471, 558, 630, 486 nm). Background and star frames provide supporting information. Frame rates of *at least* 0.1 Hz are possible, though the typical cadence is 20-30 seconds/image for each filter. MSPs at Rankin Inlet, Gillam, Pinawa, and Fort Smith operate at four auroral wavelengths (listed above), as well as background intensities. The MSPs deliver data at two different temporal and spatial resolutions (180 elevations twice/minute or 17 elevations once/minute). The riometers operate at 28 MHz at 0.2 Hz. The optical instrument FOVs and riometer locations are shown in the map, below. Solid thick lines indicate MSP FOVs (presuming 110 km emission height), while circles indicate ASI FOV (presuming 110 and 230 km emission heights). NORSTAR will be enhanced through the addition of at least six new ASIs (see map at right), and with the replacement of at least the four MSPs by new photometers to guarantee our ongoing capability to deliver high quality, quantitative, low light level intensity measurements (ie., Hβ, and 4709 Å).





NORSTAR provides quantitative high temporal and spatial resolution mesoscale maps of particle precipitation. NORSTAR's unique contribution is to determine the characteristic energy and energy flux of protons (diffuse) and electrons (diffuse and discrete). The riometers form a thirteen-pixel crude imager, providing mesoscale maps of high energy (ostensibly >30 KeV) electron precipitation[1], observed indirectly through the attenuation of cosmic radio noise (D-region absorption). The MSPs provide intensities of auroral emissions and reasonable estimates of relevant background emissions, from which quantitative estimates of energy flux of protons, and characteristic anergy and energy flux of electrons are possible. The MSPs have a proven capability of identifying both the open-closed field line boundary[2], the b2i/IB, and the equatorward/earthward edge of the electron CPS. The ASIs provide mesoscale maps of diffuse and discrete electron aurora, and potentially the proton aurora. They deliver all of the information that the MSPs do, although due to technical limitations (cannot operate when the moon is up nor simultaneously image at two wavelengths) the current generation of imagers will be unable to match the capabilities of the MSPs. The ASI array provides a two-dimensional high temporal and spatial resolution mesoscale imaging capability from the polar cap to the plasmasphere along the Churchill meridian, and across three hours of local time on field lines typically threading the inner CPS.

NORSTAR imaging capability will support exploration of the nature of: 1) the auroral arc; 2) field-line resonances; 3) the proton aurora; 4) CPS convection; 5) and two-dimensional structure of poleward boundary intensifications; 6) polar cap convection and its relation to CPS dynamics; 7) pulsations; 8) pulsating aurora; 9) sudden impulses and commencements; 9) the storm; 10) the substorm. NORSTAR images integrated with SuperDARN convection maps and the continent wide Canadian magnetic field measurements will provide a unique capability to study magnetospheric dynamics. Specifically, together with our partners in CGSM (CANOPUS and CANMOS magnetometers, SuperDARN, CADI, and FDAM), we will create two dimensional time evolving maps of convection, conductivity, horizontal and field-aligned currents, and precipitation.

[1] Note: On rare occasions MeV solar protons cause blanketing riometer absorption, or PCA events, in the polar cap.

[2] at least in the evening sector