STEAMR breadboard results and demonstrator status

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***Abstract*—Omnisys is responsible for the design and demonstration of the STEAMR instrument hardware. The breadboard phase was concluded in December 2010 and the Demonstration / Engineering Model phase has started in January 2011. The presentation will be on system implementation, test results and expected performance for Flight.**

STEAMR is a limb sounding instrument and an array of receivers cover different altitudes without scanning, thus providing an order of magnitude performance improvement compared to a scanned single receiver implementation. STEAMR consist of 14 receivers covering 320-360 GHz with 12 GHz spectrometer bandwidth each.

The upper receiver channels will be based on the DSB principle while Sideband Separation has been considered for the lower altitudes. The pros and cons of using SSB versus DSB are considered from scientific view, based on demonstrated and estimated performance of different SSB implementations. To first order, the SSB implementation implies twice the complexity and power consumption compared to DSB and promise less confusion in the separation of line responses in the two sidebands, while the sensitivity impact is not clear today. Test results used as an input for estimation of scientific impact on different topologies will be presented..

For front-ends, this include planar diode based DSB and IQ mixers (used for SSB) with embedded custom LNA's and different types of LO generation chains. Excellent results have been achieved with both Chalmers/MC2 produced diodes as well as with VDI supplied diodes. These will be presented both for DSB as well as IQ mixer implementations.

For back-ends, this will include the first presentation of a spectrometer covering 6 GHz bandwidth based on a single chip autocorrelator with integrated ADC's. Two has been operated in parallel to meet the 12 GHz specified STEAMR bandwidth. With 14 receivers operating in the array, 168 GHz spectrometer bandwidth will be covered and we are now entering into the THz domain in bandwidth, not only operating frequency. Omnisys has currently >200 ASIC's in storage and about 40-50 is needed for the complete project, including spares.

The front-end's and back-end's have been tested in linearity, stability as well as sensitivity. For the sensitivity, both the Y-method has been used to determine T_{rec}, complemented with noise estimation in the computed spectra, enabling a determination of impact on sensitivity as a function of autocorrelation efficiency, system stability and other effects on the complete instrument. These effects increase the noise with a factor between 1.08-1.14, i.e. the effective T_{rec} would rather be about 1540 K with a T_{rec} determined by the Y-method to 1400 K.