

Internal and External Calibration of the PHARUS Polarimetric Airborne SAR

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ABSTRACT

If an airborne SAR is used to produce radar backscatter maps with a certain accuracy, the system must be well calibrated. For systems using passive antennas the calibration problem may be divided in two parts: the external calibration taking care of the antenna pattern, including the antenna gain and polarization cross-talk whereas the amplitude and phase relation in the transmitter-receiver chain is calibrated by an internal loop.

In the case of an advanced SAR-system based on the use of a distributed phased-array antenna such as the PHARUS system, both calibrations will mix and the normal internal calibration in particular will become a fiction. Active antennas like this can only be calibrated when they are operational i.e. when all transmitter and receiver modules are active. In fact also in this case one would prefer a system that is as simple as possible since each operational mode (like incidence angle, swathwidth or polarization) will ask for an additional calibration.

In general two options can be considered to be appropriate for the calibration of active antennas: the use of a homogeneous distributed target, of which the scatter coefficient is known or the use of a point target of known cross-section in combination with antenna pattern measurements for all operational modes and a monitoring of the amplitude and phase behavior of all transmitter-receiver modules. The outcome of this book-keeping must be incorporated in the SAR processing. In the PHARUS system the last option was chosen to be implemented in the system design.

This paper will discuss the different calibration aspects in the case of a polarimetric SAR system and the implications for the system design. Results of the PHARUS T/R module and internal calibration will be shown. The effect of the scanning system on the calibration procedure will be discussed. Results of the

system internal calibration and monitoring during flight compared with the measurements performed in the near-field range are shown, together with the outcome of the point target measurements for some operational modes.



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