

Intelligent Detectors – Data Reduction for Future Missions

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Improvements in IR detectors for use in space with more channels and higher efficiency lead to scientifically more valuable data, but also to much higher data volumes. So far most science satellites have been able to downlink their plain raw data or at least compressed them in a lossless manner using popular algorithms like *Rice*, but modern missions can't do so any longer. Given the data rates of next-generation infrared detectors, the typical compression ratios of 2-3 and (in some cases maybe up to 5) are by far not sufficient to lead to reasonable downlink rates. Especially satellites with a very limited lifetime, such as in the IR, cannot afford lengthy downlink periods and must therefore reduce the data to the required amount.

Considerations on feasibility and implementation of on-board reduction and compression concepts are given with respect to the PACS (Photodetector Array Camera and Spectrometer) instrument of the *Herschel Space Observatory*. PACS' on-board software features reductions steps that have normally been done on ground, such as glitch detection and ramp fitting. Experiences from *Herschel/PACS* can be well applied to subsequent projects with a need for complex on-board data processing. Furthermore, from instrument specific lossless compression to sophisticated wavelet transform methods, insight shall be given to give an impression on the importance and amount of effort of data reduction *in situ*, which is a critical component for future instrumental design. Since the complexity of on-board software depends strongly on the available processing power, the question for available hardware is also treated.

One consequence from all that is, that future missions, which will have to conduct destructive reduction steps, will no longer provide raw data to the community, but at least partly reduced data products.

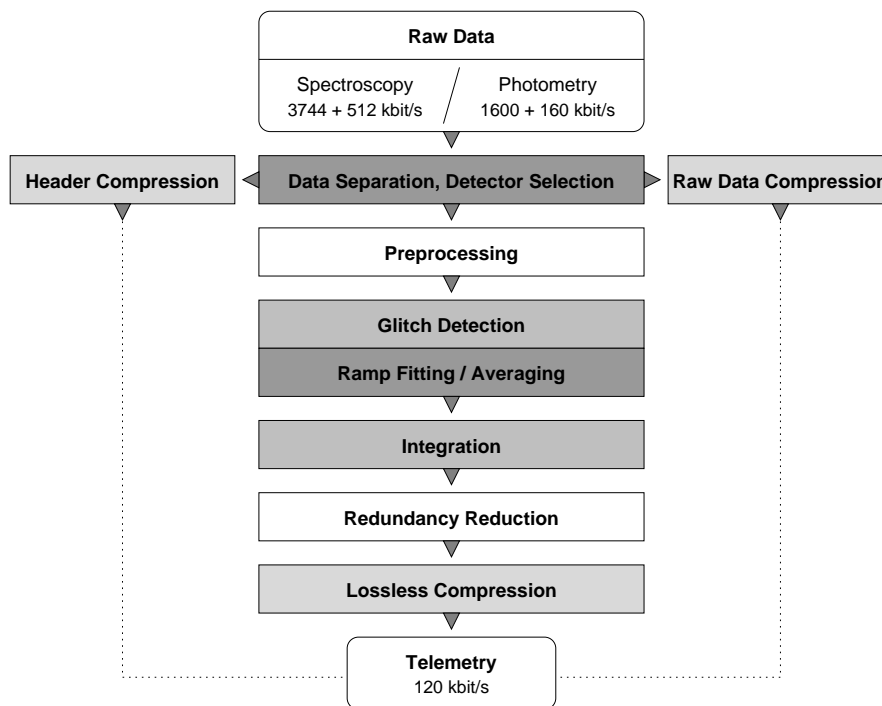


Figure 1: The PACS data reduction scheme, representing the software modules.