EIS Science Processing Dataflow

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A flowchart is attached and critical/key features are as follows :-

- **Max readout rate from CCD**
  -> Assume ≤0.5 Mpixels/sec to maintain quality of pixel data.
  -> Assume can only readout one CCD at a time, even if 2 CCD's.
  -> Is key as directly affects the required processor computational loading rate (i.e. pixels/sec to be processed).

- **Pixel Readout Resolution**
  -> Assumed 12 to 14 bits resolution
  -> Readout 16 bits makes it convenient for computer storage and processing.
  -> Get 2 to 4 bits spare per pixel for flags as necessary (e.g. overscan).

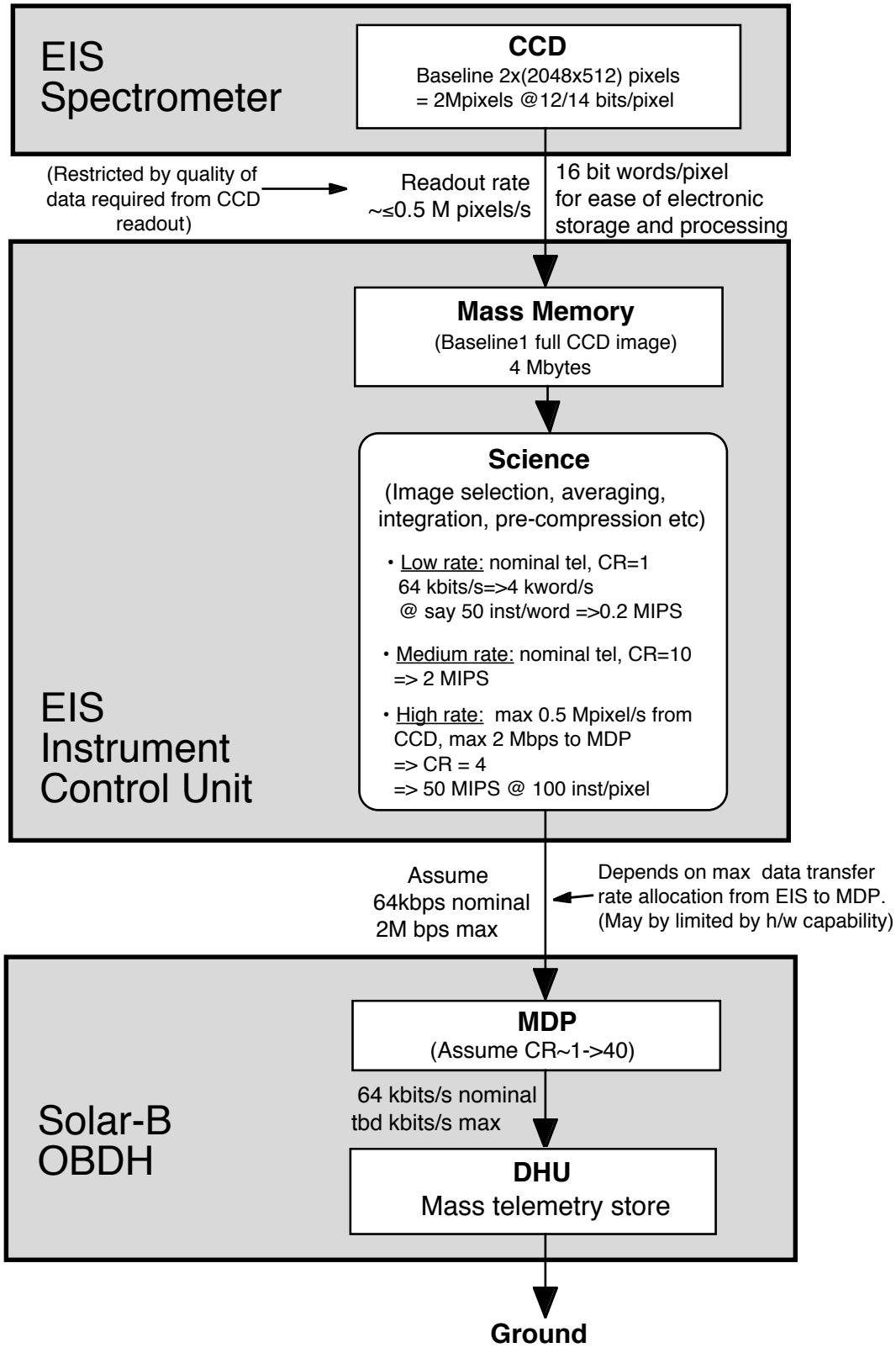
- **Mass Memory**
  -> Assume baseline to store 1 complete ccd image
  i.e. not 2 full ccd's
  -> 512x2048 by 16 bits = 4 Mbytes.
  -> Assume CCD exposures can be simultaneous, but sequential readout.

- **Data Transfer Rate from EIS -> MDP**
  -> Assume ≤2 Mbps
  -> Is critical/key as directly limits the throughput of data to the MDP and affects :-
  • quality of science
  • flexibility of science
  Needs to be as high as possible.
  -> At max ccd readout rate requires CR=4 to pass all data into MDP for short periods (Will fill up EIS nominal 48 Mbytes of spacecraft mass memory in 3 minutes)

- **CPU Processing Rate Requirements**
  -> Rough maximum estimate can be obtained as product of max data input rate from CCD times estimate of instructions per pixel.
  i.e. 50 MIPS with estimate of 100 instructions/pixel for 0.5 Mpixels/sec.
  -> Desire would be to implement processor(s) capable of double maximum rate, to allow for engineering margin from estimating errors and avoidance of real-time congestion situations.
  -> Complex compression schemes would need to be evaluated to determine their processor loading requirements.
  -> Moderate processing rate estimate can be obtained by assuming nominal 64 kbits/sec telemetry rate allocation and CR=10.
  (i.e. 64 kbit/s = 4 kpixel/s -> 40 kpixel/sec before compression, and at say 50 instructions/pixel -> 2 MIPS.)
  -> Floating point instructions may be required for certain compression schemes, and therefore consideration of a hardware floating point unit may be required.

- **Data Compression**
  - -> Nominal EIS telemetry allocation of 64 kbits/sec -> 4 kpixels/sec (for 16 bit pixels)
    -> 32 pixel columns 128 pixels high (i.e. ~ 1 spectral line ?)
  - -> Therefore EIS can only succeed if :-
    - Use much higher telemetry allocations
      (but will not get these all the time, and s/c telemetry store will quickly fill up)
    - Implement powerful data compression schemes
  - -> Suggest :-
    - No compression only used for engineering software processing verification purposes.
    - Lossless compression schemes are adopted as standard.
    - Lossy, but very powerful, schemes are seriously considered & evaluated.
  - -> Suggest evaluation of lossy schemes is evaluated by someone close to the science who is capable of assessing how particular lossy schemes will affect use of the data.

EIS Science Processing Flowchart



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