

### SODANET specifications

- In order to make SODANET compatible with other TRB protocols, SODANET package will have a following structure (total length 64 bits, each block corresponds to 1 byte):

K (FB)	Data, bits 31-24	K (FB)	Data, bits 23-16	K (FB)	Data, bits 15-8	K (FB)	Data, bits 7-0
--------	---------------------	--------	---------------------	--------	--------------------	--------	-------------------

Data with highest bits is coming first.

**There are two types of SODANET package:**

- Super-burst start, eventually end of previous superburst  
 Bit 31: 1  
 Bits 30-0: Super-burst number
- Command data  
 Bit 31: 0  
 Bit 30: Time calibration  
 Bit 29: DAQ start  
 Bit 28: DAQ stop  
 Bit 27: Reset  
 ...  
 Bits 7-0: CRC checksum (CRC8-CCITT)

- SODANET commands with **Super-burst (16 bursts of (2+0.4) μs each)** number are issued at the beginning of each Super-burst. Burst number and time counting within the Super-burst takes place at each DC.  
 DC checks if received super-burst number is sequential. In the case of error (not sequential number) the DC uses number distributed by the SODANET, set special error bit in the output data, and informs slow-control system. If part of SODANET message is missing, DC uses super-burst number from a local counter, and reports problem to the slow-control system.
- SODANET packet with command data can be issued at any time.
- Each received SODANET packet is acknowledged to implement continuous monitoring of the readout. The feedback packet is 16-bit long:
  - Reply to super-burst start: [ K(FB) ] [ bits 7-0 of the super-burst number ]
  - Reply to command data: [ K(FB) ] [ CRC checksum ]

The monitoring protocol is defined as:

- DCs have a report-register and a status-register with n-bits for n-clients/FEEs.
  - Status-register holds '1' for each *known* failing-client; '0' for others.
  - At soda-command transmit, status-register is copied to report-register; watchdog started.
  - Client soda-reply causes corresponding bit to be set in report register.
  - At watchdog timeout '0's in report-register cause error-report to HUB; all '1' = success.
  - HUB handles DC-reports in a similar way.
  - Slow-control handles error-reports, tracing through HUB- and DC- report-registers
  - Slow-control can set/reset status-bits on HUB and DCs.
- A dedicated SODANET command is foreseen for calibration of the signal-propagation time. Once the command is received a reply is sent to the transmitter side, and original message is

forwarded further through the SODANET network. At the transmitter side propagation time is calculated and stored in a register. The register values are read out by a slow control system. These data are used to pre-calculate signal-propagation delays with precision of about 10 ns. These values are used at the DC level to delay SODANET synchronisation signals before redistribution to FEE.

The longest delay value is used by the SODANET source to send synchronisation commands prior to a bunch crossing.

- For test purposes it should be possible to operate readout in a “triggered” mode. In this case the SODANET source should be connected to the burst-building network as a DC. External trigger signal is fed to the SODANET source. Each trigger pulse is timestamped and sent to the burst-building network as a FEE data. At the event building stage the data stream should be checked for events which coincide with the trigger event.

### **Output data format for DC**

- DC can start transmitting FEE data once it is available, without waiting till the end of a super-burst.
- In case no CN infrastructure is available (huge offset costs for new users), the TRB3-based DC can directly connect to a GbE infrastructure using Greg Korcyls GbE code directly in the TRB3
- Each data-packet should contain:
  - Super-burst number
  - System ID (EMC, MVD, etc.)
  - Packet number within super-burst data
  - A flag “last packet”, for the last packed with data associated to current super-burst
- The HADES sub-event structure is used as a base for DC data-format:
  - size (byte) →
    - bits 0-15: data size in bytes
    - bits 16-30: packet number within the super-burst
    - bit 31: last-packet flag
  - reserved → status and error
  - sub-event ID → System ID, including ID of the DC
  - (trigger number + trg. code) [32 bits] → super-burst number
- The adoption of the existing data structure allows to reuse major parts of code (at least during the development and testing stage): GbE paket builder in FPGA, “Eventbuilder” server software.
  - Data as defined below is packed in Hades transport queues, UDP packets, ethernet frames
  - maximum packet size is ~62kB (UDP packet size),
  - arbitrary number of packets per super-burst (with current server code: 1 packet only)

31	16	15	0
last-packet flag; packet number		data size in bytes	
Not used (same as HADES)		Not used (same as HADES)	
Status and error		System ID	
Super-burst number			
Data			

PANDA data-header

