CLAS Event Format
Version 2.00

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Introduction

This CLAS note defines Version 2.00 of the CLAS event format. The goal of updating the CLAS event format was to implement a fully CODA compliant structure that was more compact than the Version 1 format.

A complete schematic of the event format is shown in Figure 1. A less cluttered version, describing a standard real event, is shown in Figure 2.

Table 1 lists the tags for the various banks that are presently registered as "official". Table 2 does likewise for the three recognized physics-event types. Tables 3-5 contain the official tags for the sectors, packages, and subpackages respectively.

Implementation

Version 2.00 will be implemented across all major software developments (SDA, CLAS GEANT, ced, EC) by June 1 1993. By that time, it will also be used in the Cosmic-ray test.

Future Development

The overall structure of the event format is hereby frozen until at least June 1, 1994. At that time, the software group will evaluate the format and make recommendations regarding the need of another major upgrade. Throughout this year, strictly nondestructive of the Version 2.00 format, minor changes may be made (indicated by version 2.01, 2.02 etc.). These are likely to consist of registering new types of banks. The software group guarantees that any code written to use Version 2.00, which uses software group libraries such as EVGEN, and does not need any data added in minor upgrades, will work without recompilation for all Version 2.XX event files.

Minor upgrades will be documented as they occur as appendices to this note.

Figure 1: CLAS Event Format

CODA Physical Record Header

Block size	(32768)
Block number	(Starts at zero)
Header length	(8)
Start of 1st logical record	
End of data	(32768 ∀ but last phys rec)
CODA version	(≥ 1)
Reserved	
CODA magic num	(0xCODA0100)

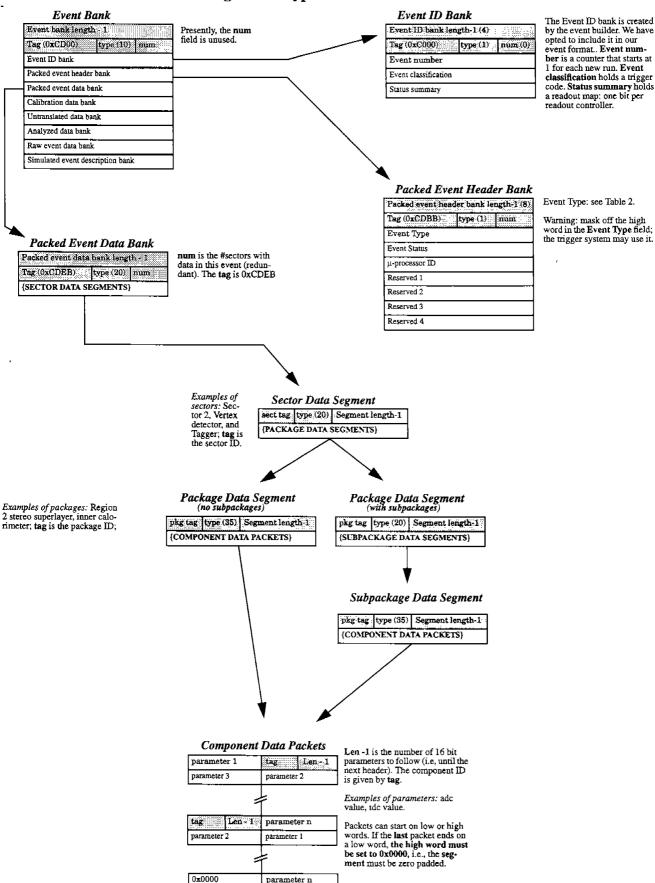add 1 to "Start of..." field → address of the next start of a log rec. If zero, then no log rec begins in this phys rec, i.e., it is comprised entirely of a contribution to a previous log rec. (Rare to never since we expect ~ 7kB events)

Except for 1st phys rec, this is usually not contiguous. In between is the completion of an event (log rec) from the previous phys rec; **type 10** is *CODAese* for banks (this bank contains banks). The **tag** is 0xCD00

Event Bank

Event bank length - 1		
Tag (0xCD00)	type (10)	num
Event ID bank		
Packed event header bank		
Packed event data bank		
Calibration data bank		
Untranslated data bank		
Analyzed data bank		
Raw event data bank		
Simulated event description bank		

Presently, the **num** field is unused.

Packed Event Data Bank

Packed event data bank length - 1		
Tag (0xCDEB)	type (20)	num
{SECTOR DATA SEGMENTS}		

num is the #sectors with data in this event (redundant). The **tag** is 0xCDEB; **type 20** is *CODAese* for segments (this bank contains segments)

Examples of sectors: Sector 2, Vertex detector, and Tagger; **tag** is the sector ID.

Sector Data Segment

sect tag	type (20)	Segment length-1
{PACKAGE DATA SEGMENTS}		

Package Data Segment (no subpackages)

pkg tag	type (35)	Segment length-1
{COMPONENT DATA PACKETS}		

Examples of packages: Region 2 stereo superlayer, inner calorimeter; **tag** is the package ID; **type 35** is *CODAese* for unsigned short (I*2) packets

Package Data Segment (with subpackages)

pkg tag	type (20)	Segment length-1
{SUBPACKAGE DATA SEGMENTS}		

Subpackage Data Segment

pkg tag	type (35)	Segment length-1
{COMPONENT DATA PACKETS}		

Component Data Packets

parameter 1	tag	Len -1
parameter 3	parameter 2	

tag	Len -1	parameter n
parameter 2	parameter 1	

0x0000	parameter n

Len -1 is the number of 16 bit parameters to follow (i.e, until the next header). We can handle the case where the number of parameters for the same component varies. (For example, the DC MUX ambiguity may require this feature). The component ID is given by **tag**.

Examples of parameters: adc value, tdc value.

Packets can start on low or high words. If the **last** packet ends on a low word, **the high word must be set to 0x0000**, i.e., the segment must be zero padded.

Event ID Bank

Event ID bank length-1 (4)		
Tag (0xC000)	type (1)	num (0)
Event number		
Event classification		
Status summary		

The Event ID bank is created by the event builder. We have opted to include it in our event format.. **Event number** is a counter that starts at 1 for each new run. **Event classification** holds a trigger code. **Status summary** holds a readout map: one bit per readout controller.

type 1 is *CODAese* for I*4 data. The tag is 0xC000.

Packed Event Header Bank

Packed event header bank length-1 (8)		
Tag (0xCDBB)	type (1)	num
Event Type (e.g. 0x0000CD50)		
Event Status		
μ-processor ID		
Reserved 1		
Reserved 2		
Reserved 3		
Reserved 4		

type 1 is *CODAese* for I*4 data. The **num** field is unused. The tag is 0xCDBB.

Event Type 0x0000CD50 → "real" event (see Table 2).

Warning: mask off the high word in the **Event Type** field; the trigger system may use it.

Calibration Data Bank

Calibration data bank length - 1		
Tag (0xCDCD)	type (10)	num
{CALIBRATION DATA BANKS}		

Optional (not all events will have this bank). Holds calibration data in a format that has yet to be specified.. The **tag** is 0xCDCD

Untranslated Data Bank

Untranslated data bank length - 1		
Tag (0xCDBD)	type (10)	num
{UNTRANSLATED BANKS}		

Optional. Holds any raw event banks (from the event builder) that the translator cannot understand. The **tag** is 0xCDBD

Analyzed Data Bank

Analyzed data bank length - 1		
Tag (0xCDAD)	type (10)	num
{ANALYZED DATA BANKS}		

Optional. Holds results of a partial or full analysis of the event. The format of the Analyzed Data Banks has not yet been specified. The **tag** is 0xCDAD

Raw Event Image Bank

Raw event image bank length - 1		
Tag (0xCD80)	type (10)	num
{RAW (CODA) EVENTBANKS}		

Optional. Holds an image of the raw event, i.e., the output of *CODA*'s event builder. Useful for debugging. The **tag** is 0xCD80

Simulated Event Description Bank

Simulated evnt descript bank length-1		
Tag (0xCDED)	type (F)	num (nt)
Struct descript	(0x0102002))	
Struct descript	(0x80828031)	
{LUND particle ID	(I*4)	
LUND particle status	(I*4)	
charge (+e)	(I*4)	
x coord of vertex (cm)	(REAL*4)	
y coord of vertex (cm)	(REAL*4)	
z coord of vertex (cm)	(REAL*4)	
px/p	(REAL*4)	
py/p	(REAL*4)	
pz/p	(REAL*4)	
Momentum (GeV)	(REAL*4)	
Mass (GeV)	(REAL*4)	

This bank, present only for simulated data, holds track parameters. **type F** is *CODAese* for a repeating fixed length structure, the only *CODA* structure allowing mixed types. The data types are encoded in the two **Struct descript** fields. (As shown, the structure (3(I*4), 8(REAL*4)) is encoded). The **tag** is 0xCDED. **the num** field holds the number of tracks (redundant).

Figure 2: "Typical" CLAS Event Format

Event Bank

Event bank length - 1		
Tag (0xCD00)	type (10)	num
Event ID bank		
Packed event header bank		
Packed event data bank		
Calibration data bank		
Untranslated data bank		
Analyzed data bank		
Raw event data bank		
Simulated event description bank		

Presently, the **num** field is unused.

Event ID Bank

Event ID bank length-1 (4)		
Tag (0xC000)	type (1)	num (0)
Event number		
Event classification		
Status summary		

The Event ID bank is created by the event builder. We have opted to include it in our event format.. **Event number** is a counter that starts at 1 for each new run. **Event classification** holds a trigger code. **Status summary** holds a readout map: one bit per readout controller.

Packed Event Header Bank

Packed event header bank length-1 (8)		
Tag (0xCDBB)	type (1)	num
Event Type		
Event Status		
μ-processor ID		
Reserved 1		
Reserved 2		
Reserved 3		
Reserved 4		

Event Type: see Table 2.

Warning: mask off the high word in the **Event Type** field; the trigger system may use it.

Packed Event Data Bank

Packed event data bank length - 1		
Tag (0xCDEB)	type (20)	num
{SECTOR DATA SEGMENTS}		

num is the #sectors with data in this event (redundant). The **tag** is 0xCDEB

Sector Data Segment

Examples of sectors: Sector 2, Vertex detector, and Tagger; **tag** is the sector ID.

sect tag	type (20)	Segment length-1
{PACKAGE DATA SEGMENTS}		

Package Data Segment
(no subpackages)

Examples of packages: Region 2 stereo superlayer, inner calorimeter; **tag** is the package ID;

pkg tag	type (35)	Segment length-1
{COMPONENT DATA PACKETS}		

Package Data Segment
(with subpackages)

pkg tag	type (20)	Segment length-1
{SUBPACKAGE DATA SEGMENTS}		

Subpackage Data Segment

pkg tag	type (35)	Segment length-1
{COMPONENT DATA PACKETS}		

Component Data Packets

parameter 1	tag	Len - 1
parameter 3	parameter 2	

tag	Len - 1	parameter n
parameter 2	parameter 1	

0x0000	parameter n

Len -1 is the number of 16 bit parameters to follow (i.e, until the next header). The component ID is given by **tag**.

Examples of parameters: adc value, tdc value.

Packets can start on low or high words. If the **last** packet ends on a low word, **the high word must be set to 0x0000**, i.e., the segment must be zero padded.

Bank	Hex Tag	Dec Tag	Comment
Event bank	0xCD00	52480	Outermost bank wrapper
Event ID bank	0xC000	49152	CODA global data such as event number
Packed event header bank	0xCDBB	52667	CLAS global data such as event type
Packed event data bank	0xCDEB	52715	Contains actual event data
Calibration data bank	0xCDCD	52685	Contains calibration data
Untranslated data bank	0xCDBD	52669	Data that the translator could not decipher
Analyzed data bank	0xCDAD	52653	Full or partially analyzed data
Raw event image bank	0xCD80	52608	Image of raw CODA event for debugging
Simulated event description bank	0xCDED	52717	Description (kinematics) of simulated event

Table 1: CLAS event bank tags.

Event Type	Hex Tag	Dec Tag	Comment
SDA simulated	0x0000CD30	52528	Denotes an event generated by SDA
GEANT simulated	0x0000CD31	52529	Denotes an event generated by GEANT
"Real" physics	0x0000CD50	52560	Denotes a real event

Table 2: Event types in the Packed event header bank.

"Sector"	Tag
Sector 1	1
Sector 2	2
Sector 3	3
Sector 4	4
Sector 5	5
Sector 6	6
Tagger	7
Trigger	8
Vertex detector	9
Cosmic ray test	10

Table 3: Tags used to identify sectors. The tagger, trigger, vertex detector, and cosmic ray test are defined as sectors for convenience

Package	Tag
Region 1 **stereo** suplerlayer	1
Region 1 **axial** suplerlayer	2
Region 2 axial superlayer	3
Region 2 stereo superlayer	4
Region 3 axial superlayer	5
Region 3 stereo superlayer	6
Scintillation counters	7
Cerenkov counters	8
Inner calorimeter	9
Outer calorimeter	10
Inner large angle calorimeter	11
Outer large angle calorimeter	12
Tagger energy scintillators	13
Tagger timing scintillators	14
Trigger	15
Vertex detector readout	16

Table 4: Package tags. Take special note that the order of axial and stereo superlayers is different for region 1.

DC subpackages	Cerenkov subpackages	Calorimeter subpackages	Large angle calorimeter subpackages	Tag
Layer 1	low ϕ detectors	u plane	x plane	1
Layer 2	high ϕ detectors	v plane	y plane	2
Layer 3		w plane		3
Layer 4				4
Layer 5				5
Layer 6				6

Table 5: Subpackage tags. Packages not represented in this table are those that contain no subpackages