Data Acquisition Overview

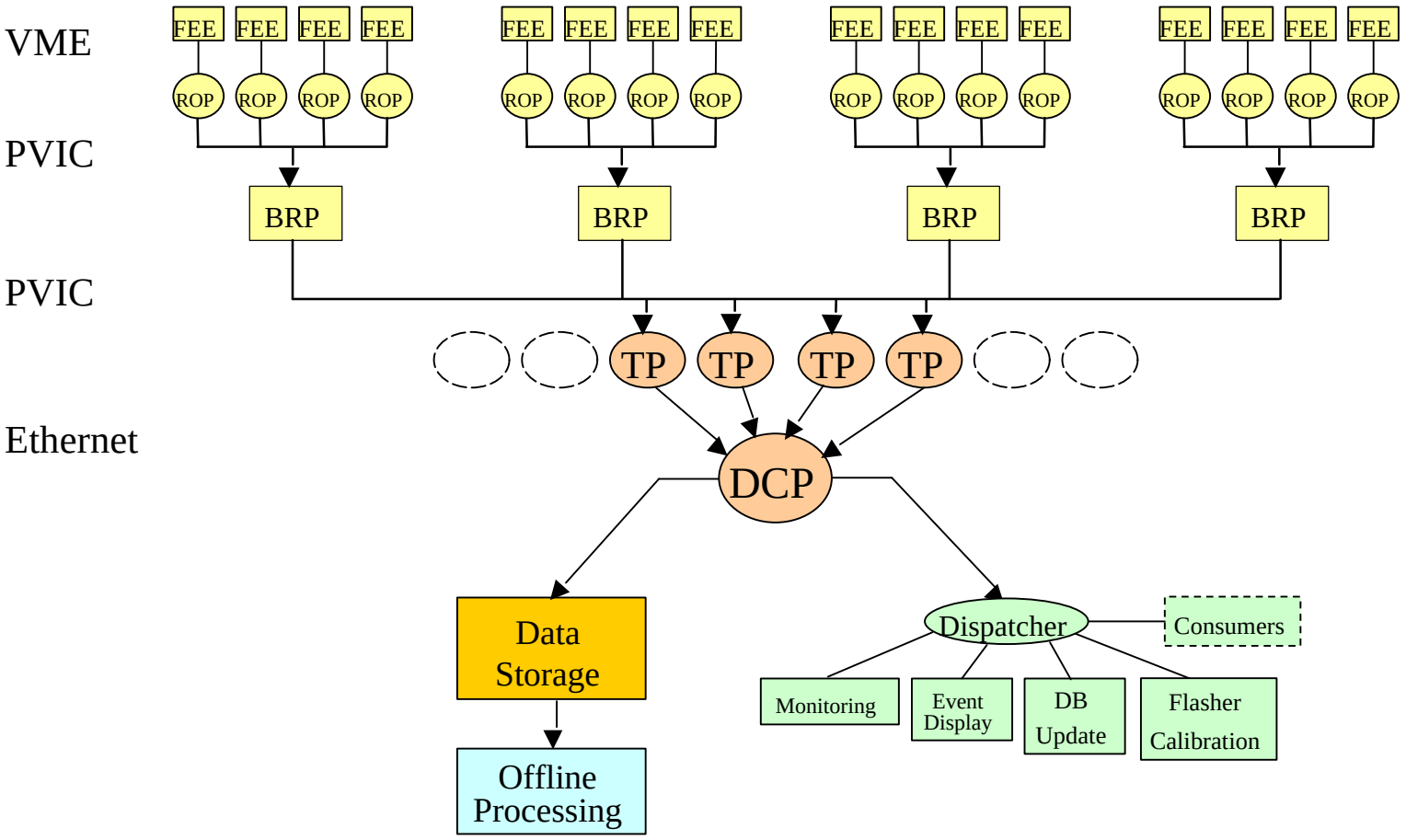
DAQ Overview for the ND electronics tutorials

Not a DAQ tutorial !

Geoff Pearce

Online Data Flow

Near Detector has fewer (8-9) VME crates!



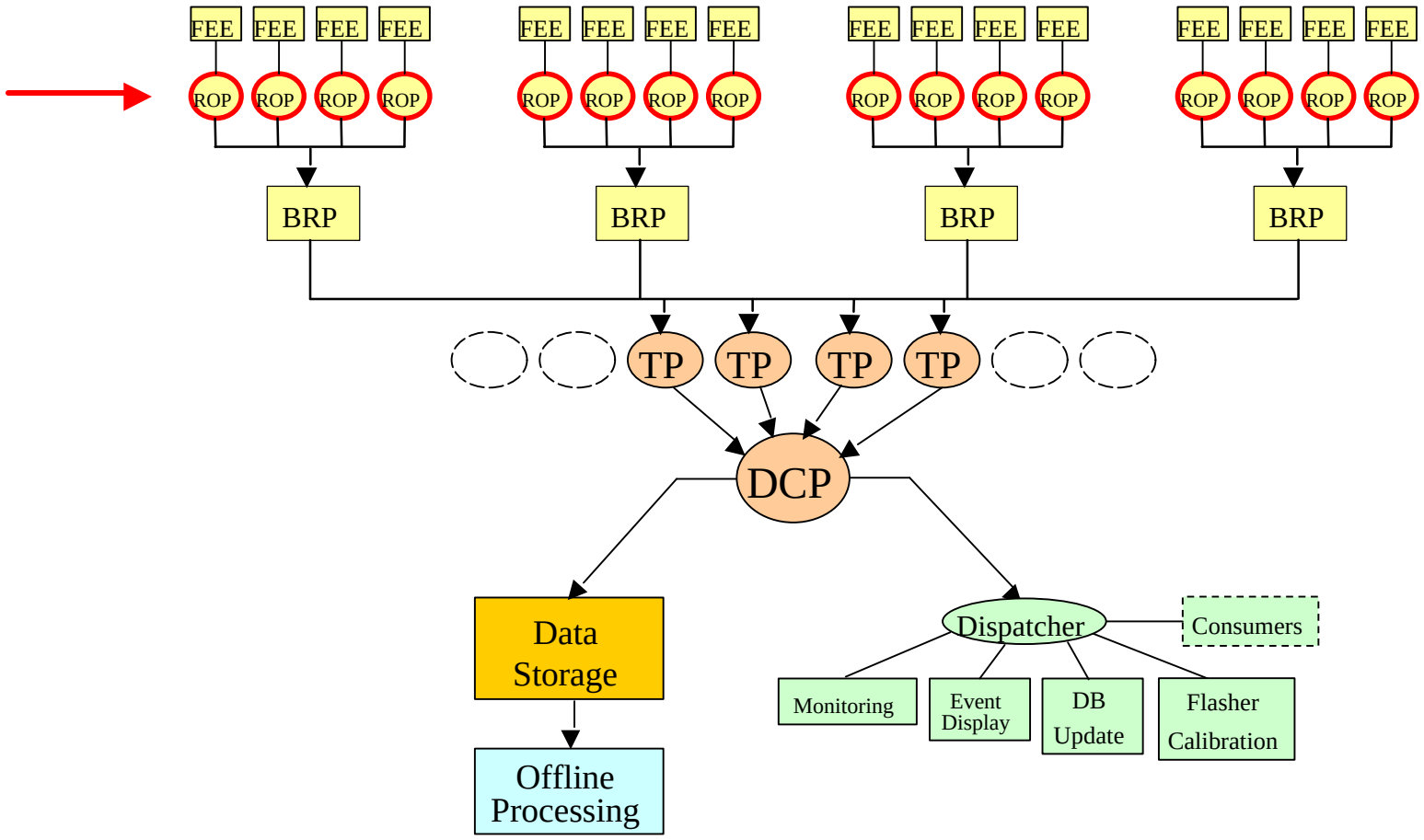
Timing System

ND timing system described by Tom

- Synchronised 1sec signal
  - timeslices stamped to 19ns in FEE with 1-2s rollover
- Synchronised buffer swap signal
- Synchronise ROP clocks - GPS (NTP)
  - Data (each time frame) stamped with absolute time by ROPs

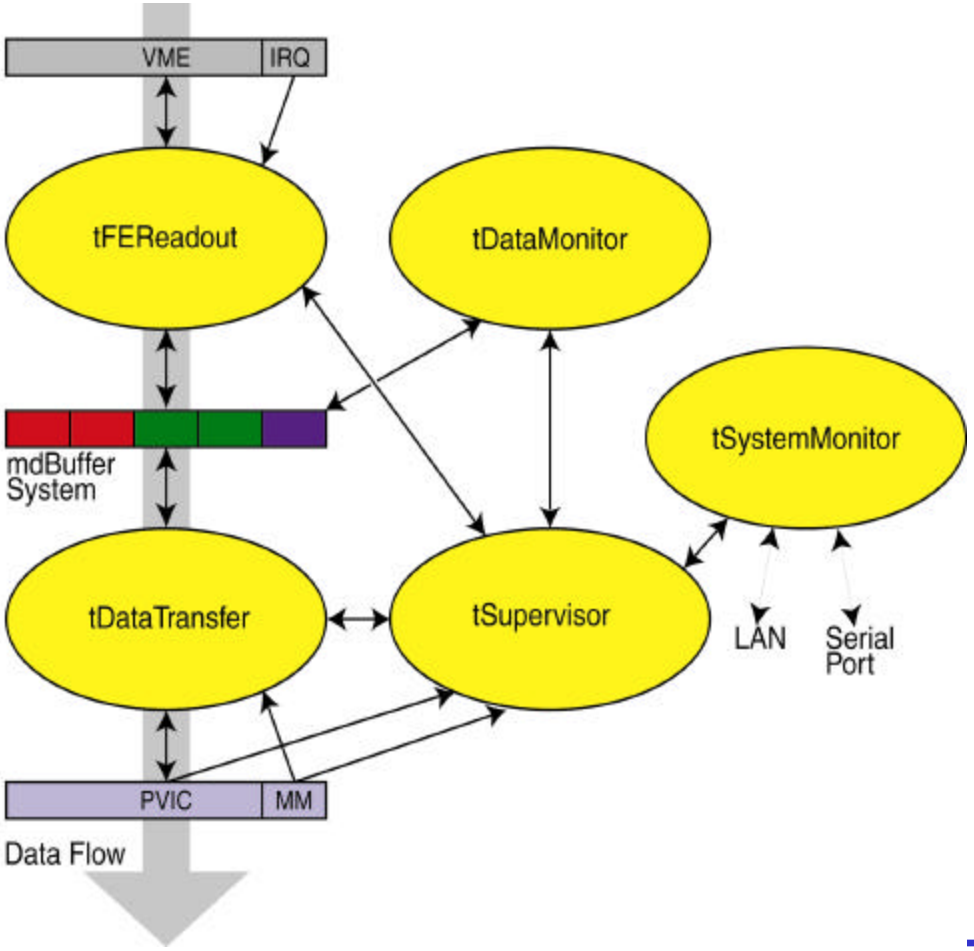
Readout Processor

RIO3 VME processor, VxWorks OS



Readout Processor

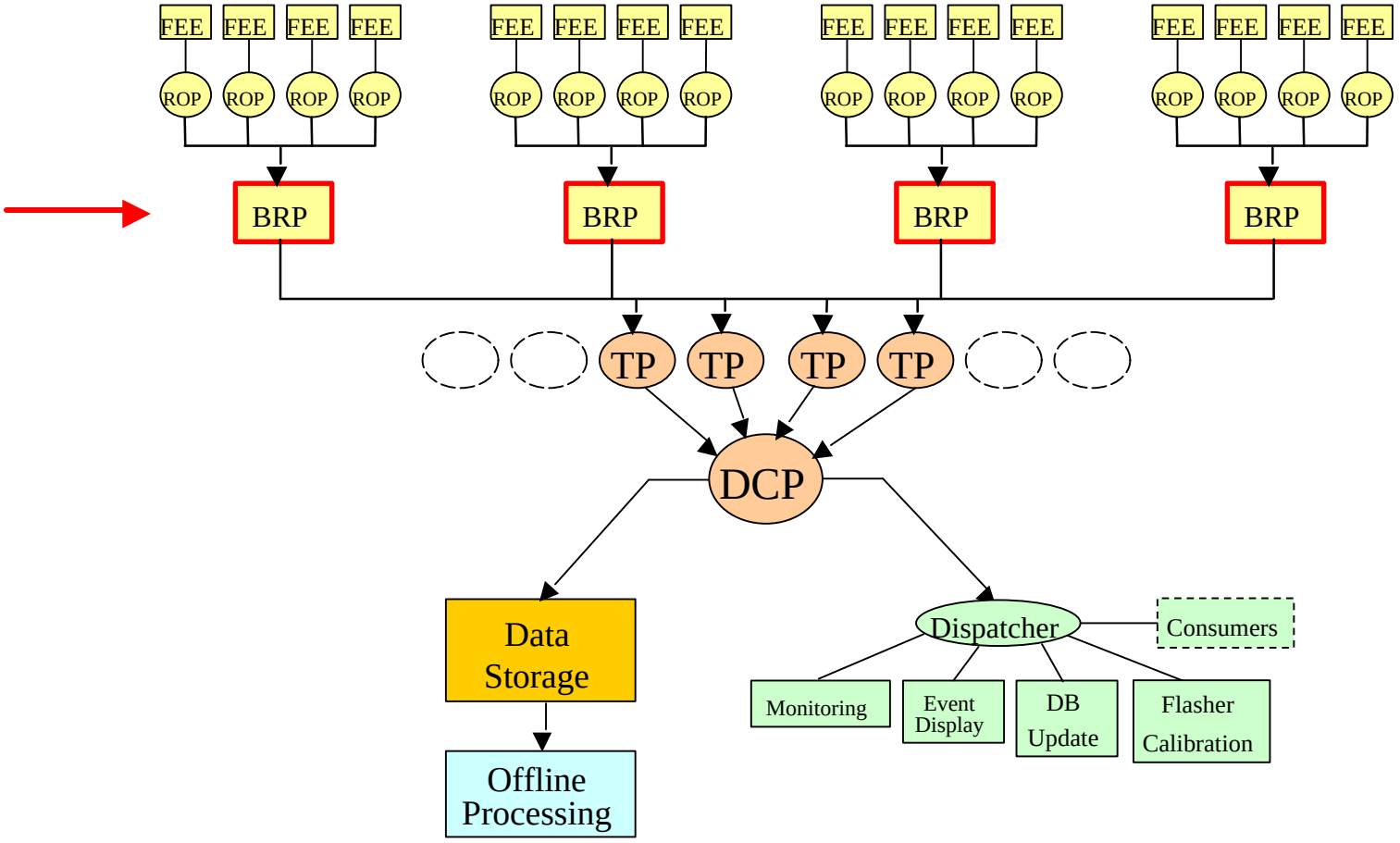
ND system has some special requirements – Dave Reyna presentation



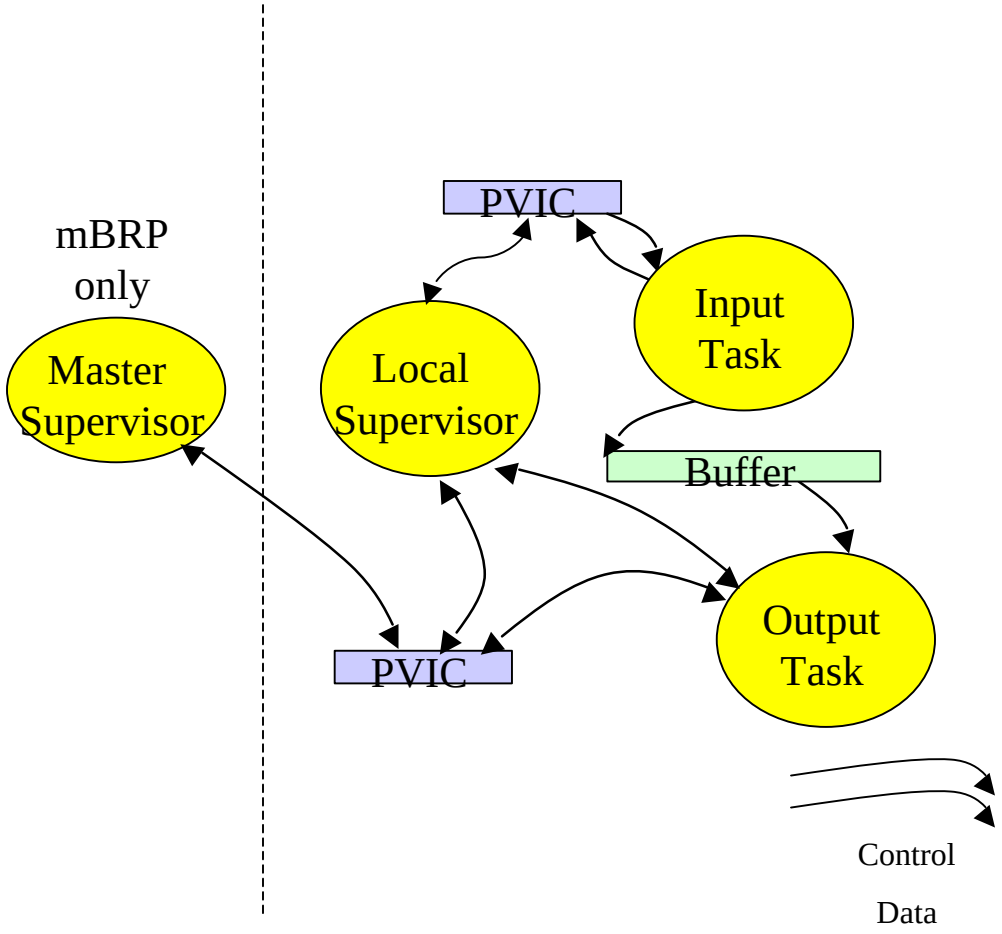
- Readout of FEE buffers
  - alternating FE buffers
  - interupt driven
  - common signal: ROP, FEE
  - Time Blocks ~ 50ms (programmable)
- Control & Monitoring of FEE
- Build Time Frames
  - Time Frame = N Time Blocks (progr.)
  - Absolute time stamp

  Transfer to BRP then TP
- Control from BRP

Branch Readout



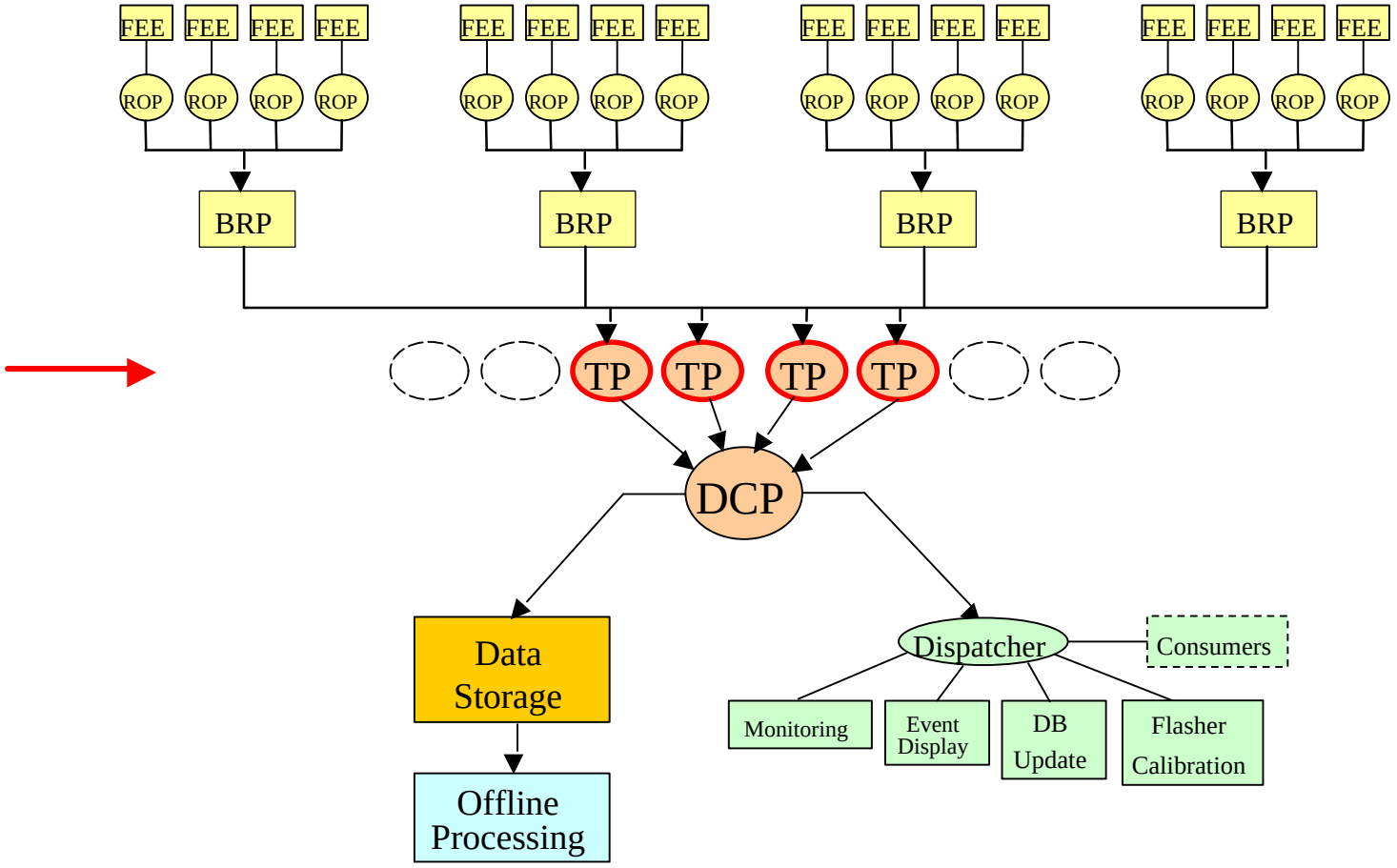
Branch Readout Processor



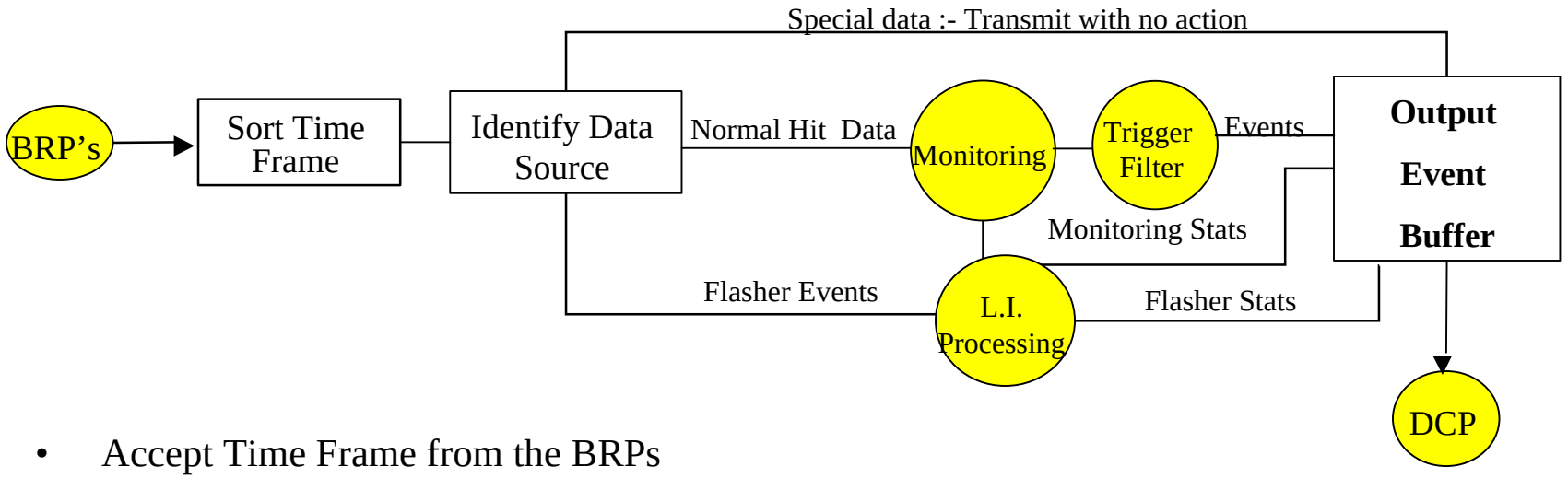
- Communication path to ROP/TP
- Synchronize data transfer from ROPs; buffering of data
- Monitor data flow

- One BRP acts as master
- Sequences readout
- Supervises transfer to TF
- Interface to Run Control

Trigger Processor

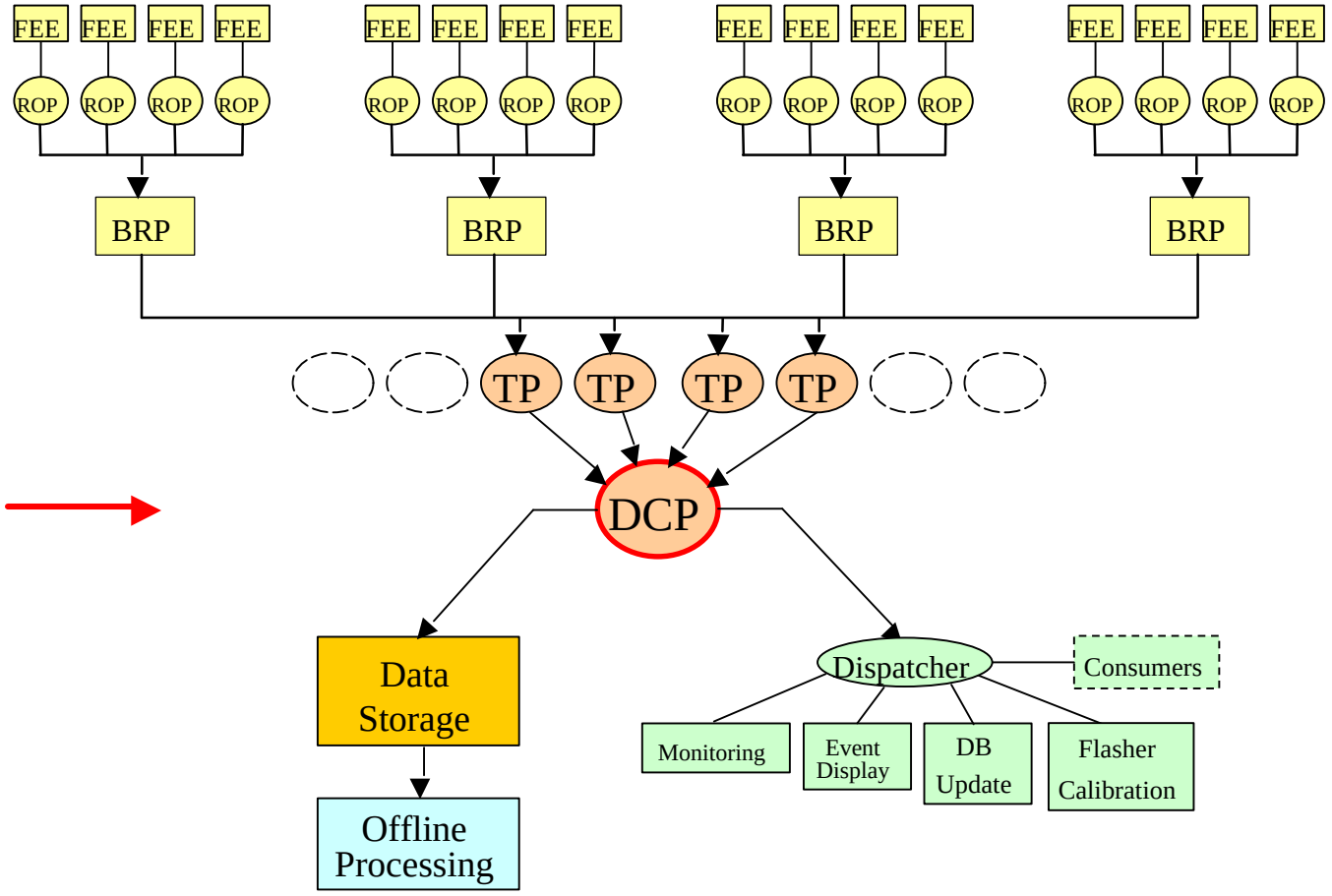


Trigger Processor



- Accept Time Frame from the BRPs
  - First location where all TF data assembled together
- Final time sorting
- Event Selection - by trigger algorithm
- Locate and Process Flasher Data - only processing summary output
- Singles Monitoring
- Output selected data to DCP - into ROOT file

Data Collection Process

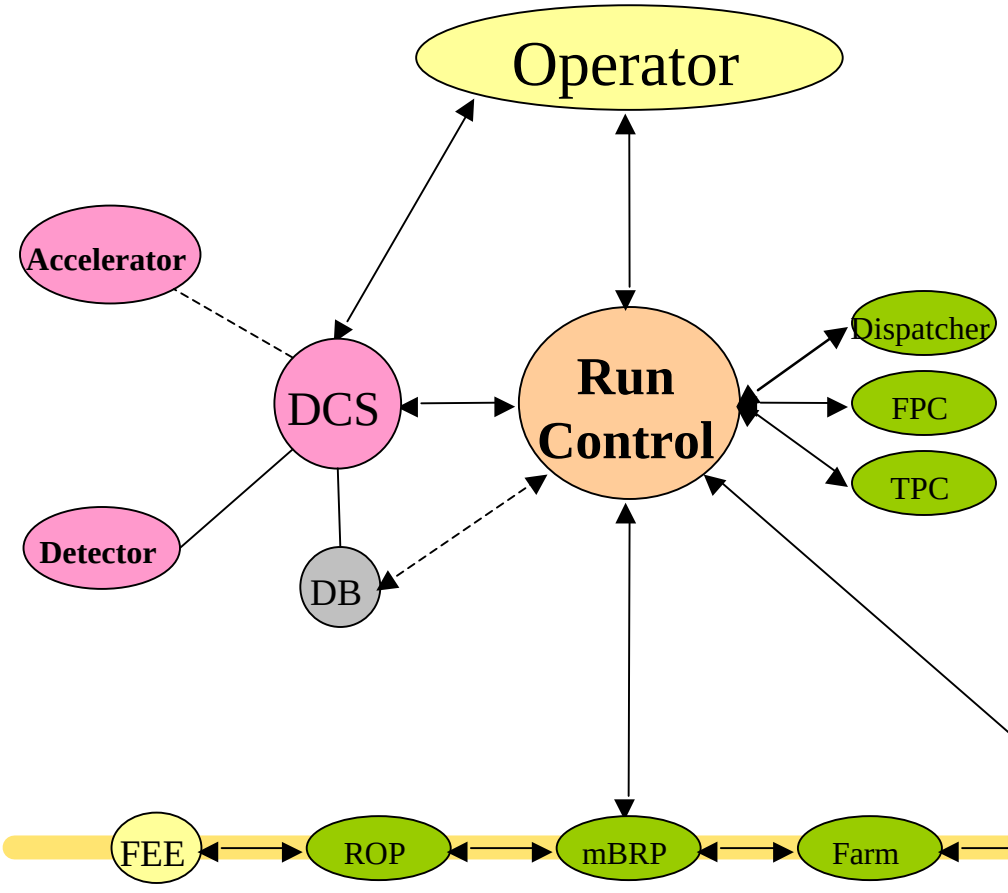


Data Collection Process

Low Rate (!)

- Receive data from TPs
  - over DAQ LAN - low rate so PVIC not required
- Remove duplicate triggers
  - from boundary of overlap Time Blocks (small)
- Insert run start/end/comment blocks
- Format data into ROOT file
- Write data to persistent storage (disk)
- Flag for archival to Fermilab (archiver process)
- Flag current file to dispatcher

Online Management



- Operator in overall control
- Run Control supervises data taking
- Run configuration sent to components at run prepare
- mBRP interfaces to DAQ components

Data Formats

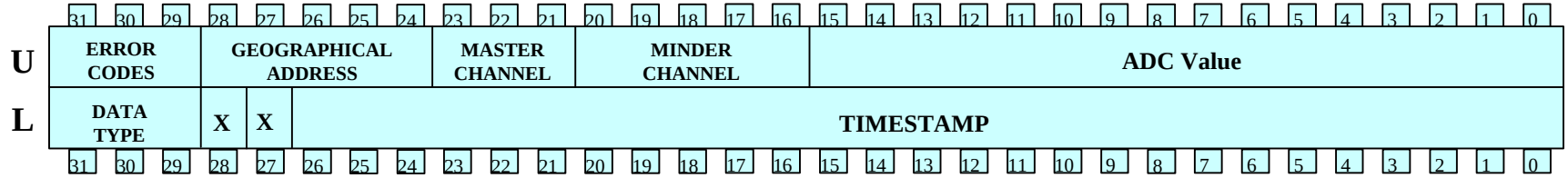
A few words

- FEE —> ROP
  - Time slices packed in Time Blocks (FEE buffers)
- ROP —> BRP —> Trigger Farm
  - Time Blocks packed into Time Frames
- Trigger Farm —> DCP
  - Data blocks grouped into records
- DCP —> Disk
  - Raw data records (native binary files) – optional, not standard o/p
  - Data records with ROOT wrappers - Objects
- Offline users
  - Interface via the raw data classes - *hides* the raw data format

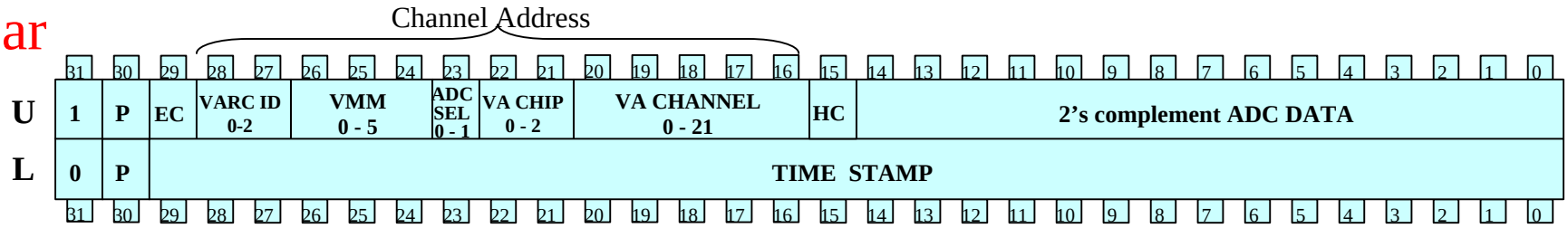
Time Slices / Hits

Beware of Near / Far format differences

Near

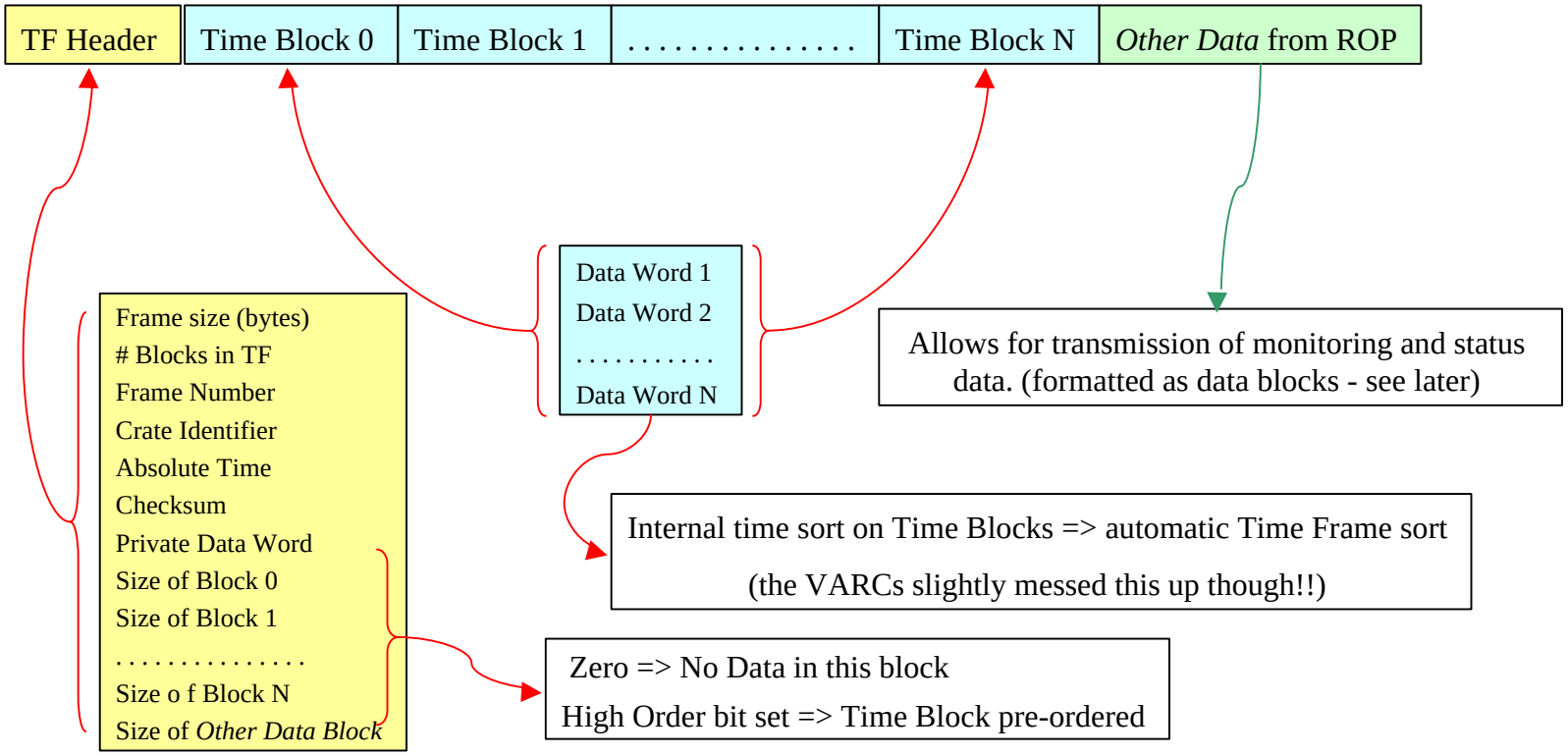


Far



P	*Parity bit*	
HC	*Data Mode*:	0 = Dynode triggering, normal data taking
		1 = Cal-Inject or trigger-less Pedestal
EC	*Error Code*	
	Normal Mode:	0 = FIFO is OK
		1 = FIFO is almost full
	Cal-Inject:	0 = Cal-Inject data OK
		1 = No dynode trigger from Cal-Inject operation

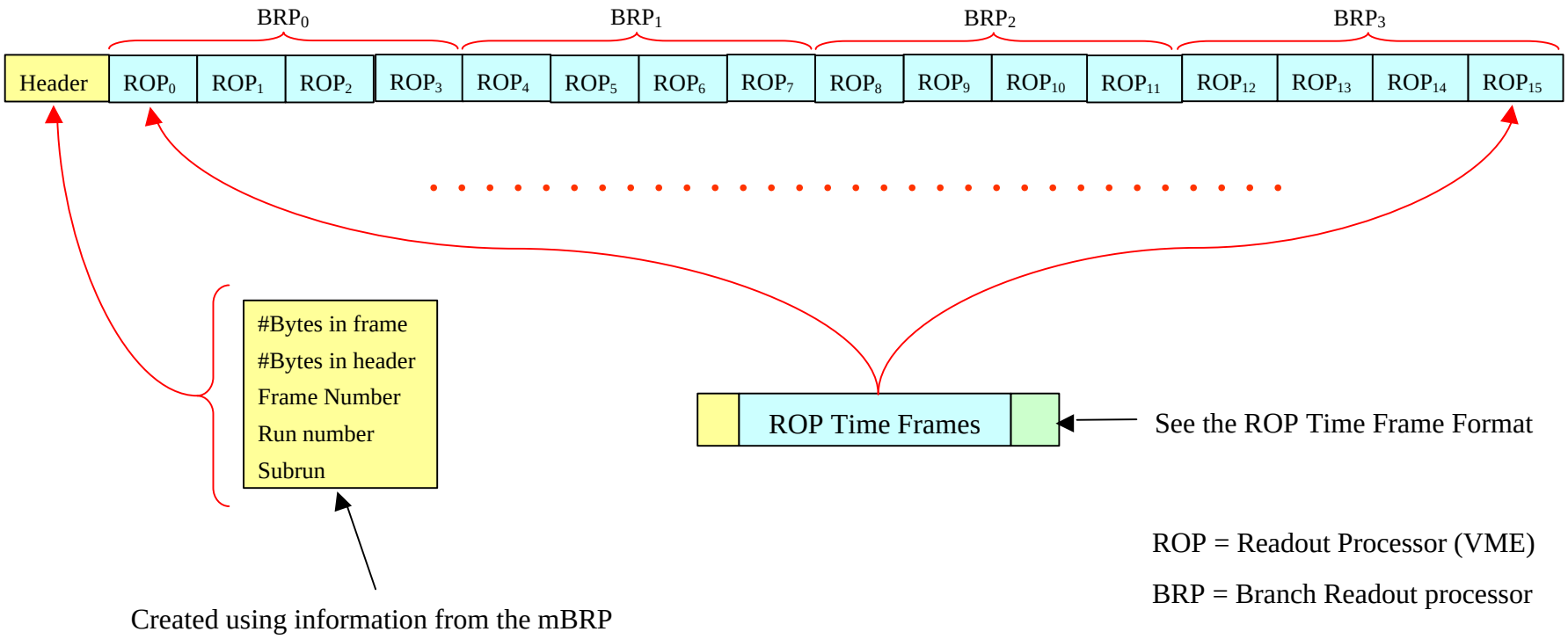
ROP Time Frames



Master Time Frames

Trigger Farm Input

Basic Format: Header followed by Time Frames from the ROPs



ROP = Readout Processor (VME)

BRP = Branch Readout processor

Data Blocks

Written out, multiple blocks per record

Basic Format: Header (record size) followed by a string of blocks containing data.

Written as a ROOT file by the DCP (rotorooter)