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# A Software Event Filter as the Trigger for the Linear Collider Detector

ECFA/DESY LC Workshop  
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# Outline

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- **input parameters**
- **occupancies**
- **data volume**
- **readout examples**
- **Z factory**
- **strategy**
- **conclusions**

# Input Parameters

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- **Tesla**

bunches	2820
train rate	5Hz
bunch distance	330ns
train length	930ns
  
- **physics (per BX)**

charged tracks	6
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- **background/BX**

gamma	1200
charged hits :	
VTX region	1200
ITC region	100
TPC region	10

## Input Parameters (cont.)

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	Channels	Sampling (MHz)	Datasize (bit)	Bandwidth (MByte/s)
CCD	840M	50	16	100
APS	200k	10	16	20
FwdSi	10M	50	16	100
ITC	1k	40	16	80
TPC	720k	40	16	80
Calo	340k	3	16	6
Muon	200k	3	1	0,3
Mask	1k	3	16	6

# Occupancies

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- **using :**
  - 6 tracks / bunch
  - 1200 photons / bunch
  - 2% conversions
  - 10 % photons above 10MeV
  - 1200 charged hits for VTX region
  - 100 charged hits for ITC region
  - 10 charged hits for TPC region
- **we get per bunch:**
  - 1230 hits for CCD (assume 2 pads each)
  - 130 for ITC & FwdSi(assume 4 ch. each)
  - 40 for TPC (with 150 pads)
  - 126 for Calo (with 20 channels each)

# Datavolume

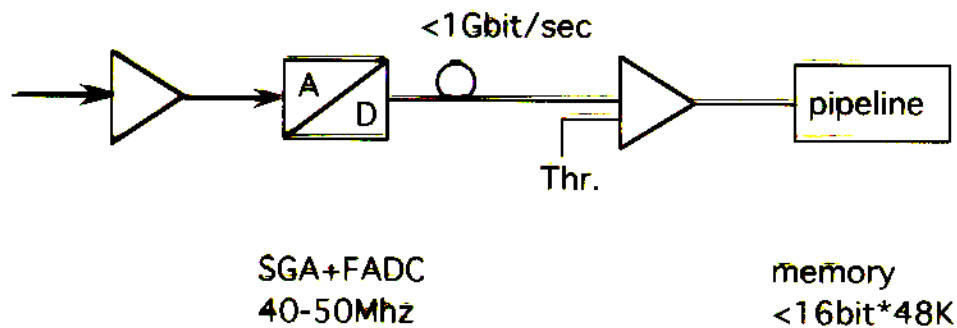
	Samples per hit	hits per BX	hits per train	sample per train	Mbyte per train
CCD	1	1230*2	6,94M	6,94M	27,75
FwdSi	1	130*4	1,47M	1,47M	5,87
ITC	4	130*4	1,47M	5,87M	14,66
TPC	4	40*150	16,9M	67,7M	169,20
Calo	1	126*20	7,11M	7,11M	28,43
Muon	1	30*10	846k	846k	3,38
Mask	1	30*10	846k	846k	3,38
				Total	252,67

assuming 2 byte per sample  
2 byte for time and channel per hit

# Digitising at 40 - 50 MHz (TPC, CCD)

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a possible readout chain at 50Mhz



TPC :

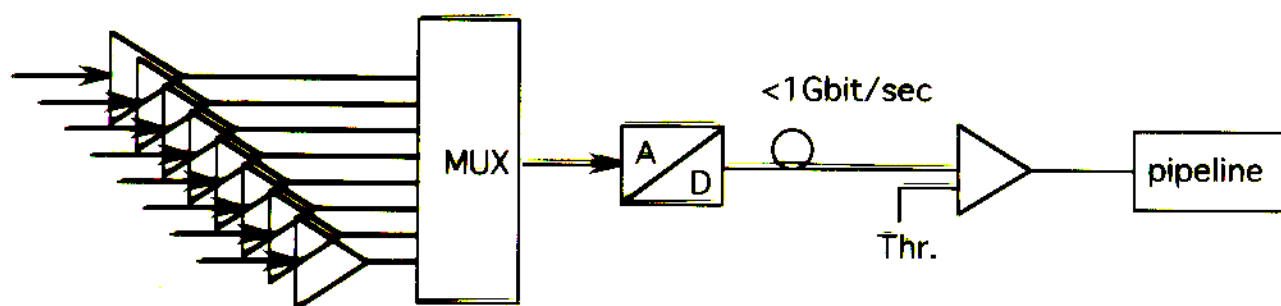
720000 channels with 60GByte

CCD :

3,2Mio channels with 320GByte

# Digitising at 3 - 5 MHz (Calo & Muons)

a possible readout chain at 3 MHz



preamps  
sample&hold  
8\*multiplexing

SGA+FADC  
24 Mhz  
16 bit output

memory  
<math>< 16 \text{ bit} \* 24 \text{ K}</math>

Calo :

44000 channels with 1GByte

Muon :

25000 channels with 0,6GByte

# Z Factory

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- physics rate      200Hz
- track multiplicity      30
  - 40 multihadrons \* 30 tracks / train
  - < 0,5 tracks / bunch crossing
- background rate reduced ?
- do not expect additional load
- BUT
  - every 70 bunches a multihadron
  - » for TPC all bunches with hits
  - » L1 typ trigger will not help here!

# Filter Strategy

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- 200ms to read AND process data
- two step process :
  1. readout (50MB @ 1GB/s : 50ms)
  2. analysis (150ms)use multi event buffering after readout  
(PII 266MHz H1 events @ 500ms)
- get “bunches of interest” ?
- massive parallel computing
  - has each subdetector an own farm ?

## Conclusions

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- about 10Giga channels total
- frond end bandwidth 300TByte/s
- digitising at frond end  
(16bit @ 50MHz output)
- with zero suppression <300MB/tr.  
(bandwidth 1,5GB/sec)
- with MUX about 100M channels
- Z-Factory needs full TPC readout  
(L1 - Trigger would not help!)
- software filter is the right choise
- start thinking about filter strategy  
may have impact on the detector!