Heiko Itterbeck, DESY–HH for the HERA-B FLT-Group, on IEEE RT99, June 18 1999.

Status and first experiences with the HERA-B First Level Trigger System

Contents:

- Reminder: HERA-B / FLT Goals
- HERA-B FLT Overview
- FLT Network:
  - Pretrigger and Hitmap Data Path Examples
  - Track Finding Unit TFU
  - Track Parameter Unit TPU
  - Trigger Decision Unit TDU
- Experiences: TFU LUT & Hitmap Tests
- FLT Online Software Overview
- Summary

Main HERA-B Goal:

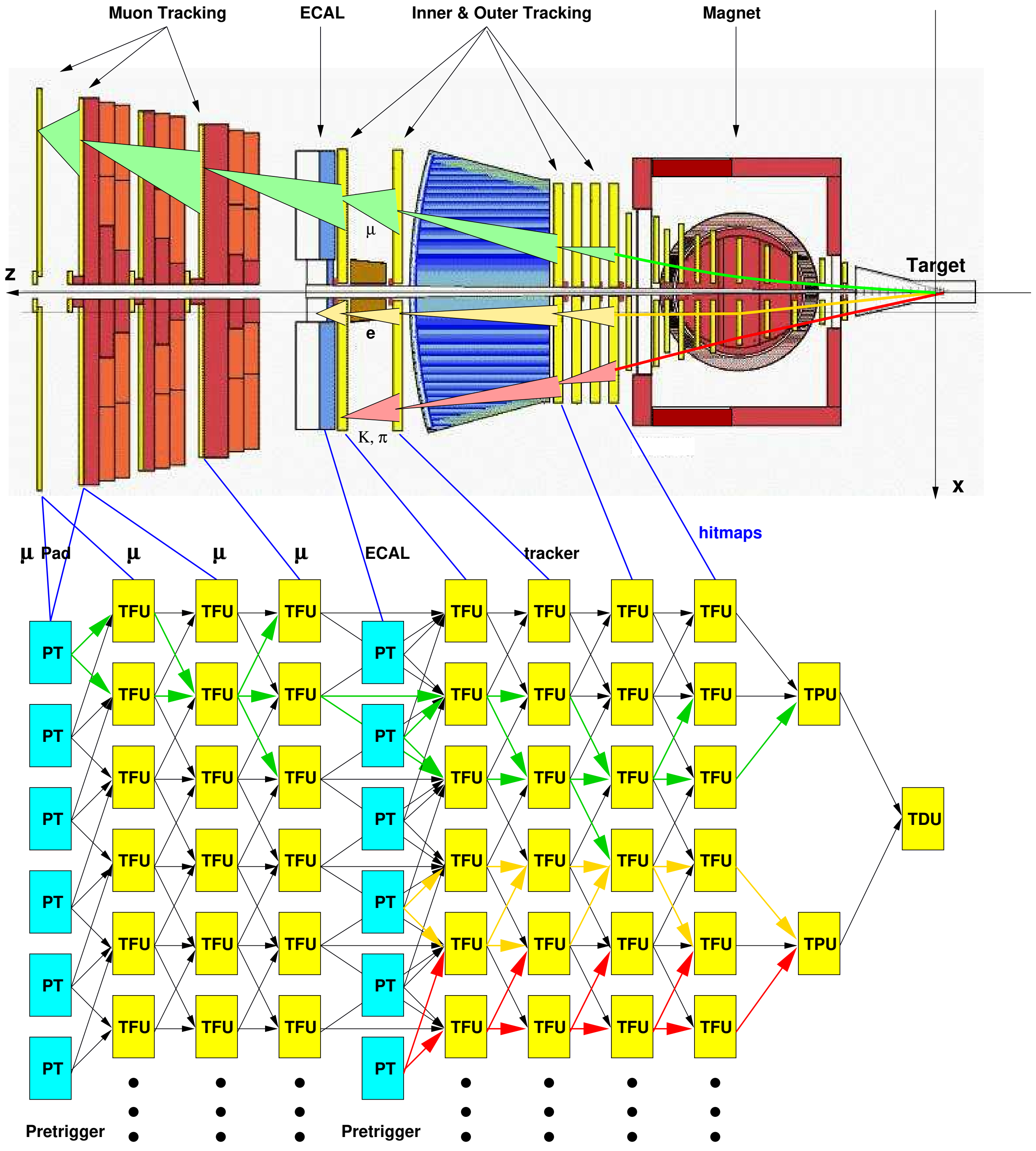
CP Violation Test in $B^0 \rightarrow J/\Psi + K^0_S$

$$\hookrightarrow l\bar{l} \quad \hookrightarrow \pi^+\pi^-$$

then $\sin 2\beta = \frac{N(B^0 \rightarrow J/\Psi\ K^0_S) - N(\bar{B}^0 \rightarrow J/\Psi\ K^0_S)}{N(B^0 \rightarrow J/\Psi\ K^0_S) + N(\bar{B}^0 \rightarrow J/\Psi\ K^0_S)}$

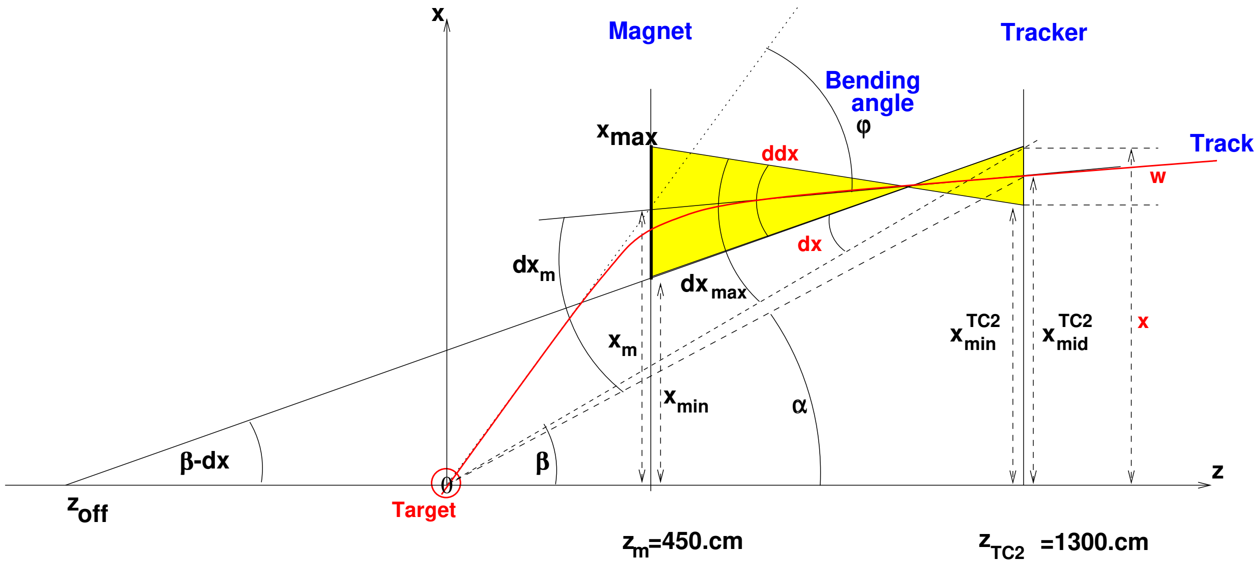
FLT Goals:

Find J/Ψ **by Triggering on** $l\bar{l}$ **with**	$m(l\bar{l}) = m(J/\Psi)$
Rate Reduction from	**10 MHz to 50 kHz**
in max. latency of	**128 * 96 ns** $\approx$ **12.3** μ**s**
at BX rate of	**10.4 MHz**
interactions / BX	**4**
tracks / event	**O(100)**
detector occupancies	**up to 20%**


Muon Tracking
ECAL
Inner & Outer Tracking
Magnet
Target
z
x
μ
e
K, π
hitmaps
μ Pad
μ
μ
μ
ECAL
tracker
PT
TFU
TPU
TDU
Pretrigger
Pretrigger

FLT Track Message

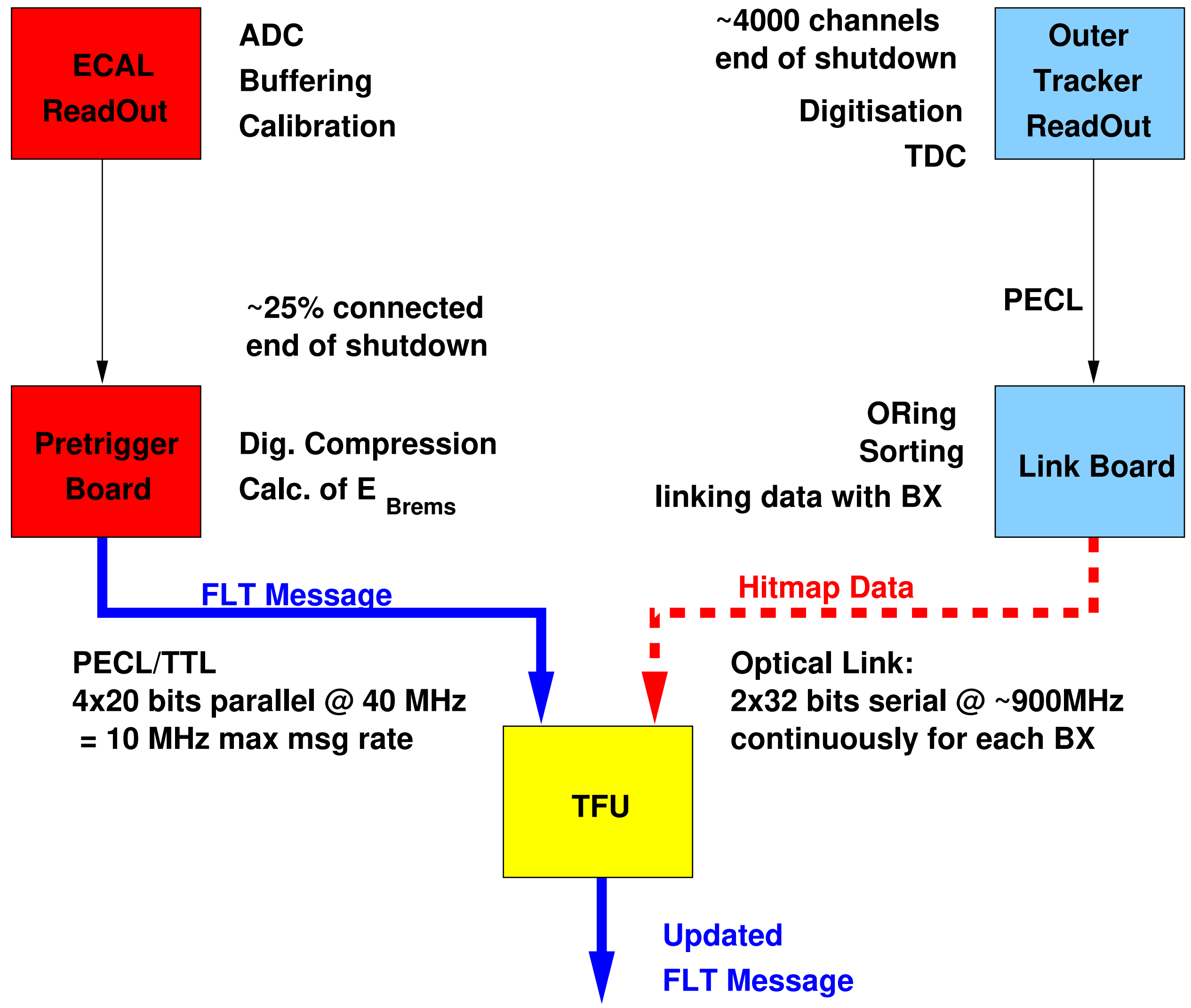
Heiko Itterbeck, HERA-B, DESY



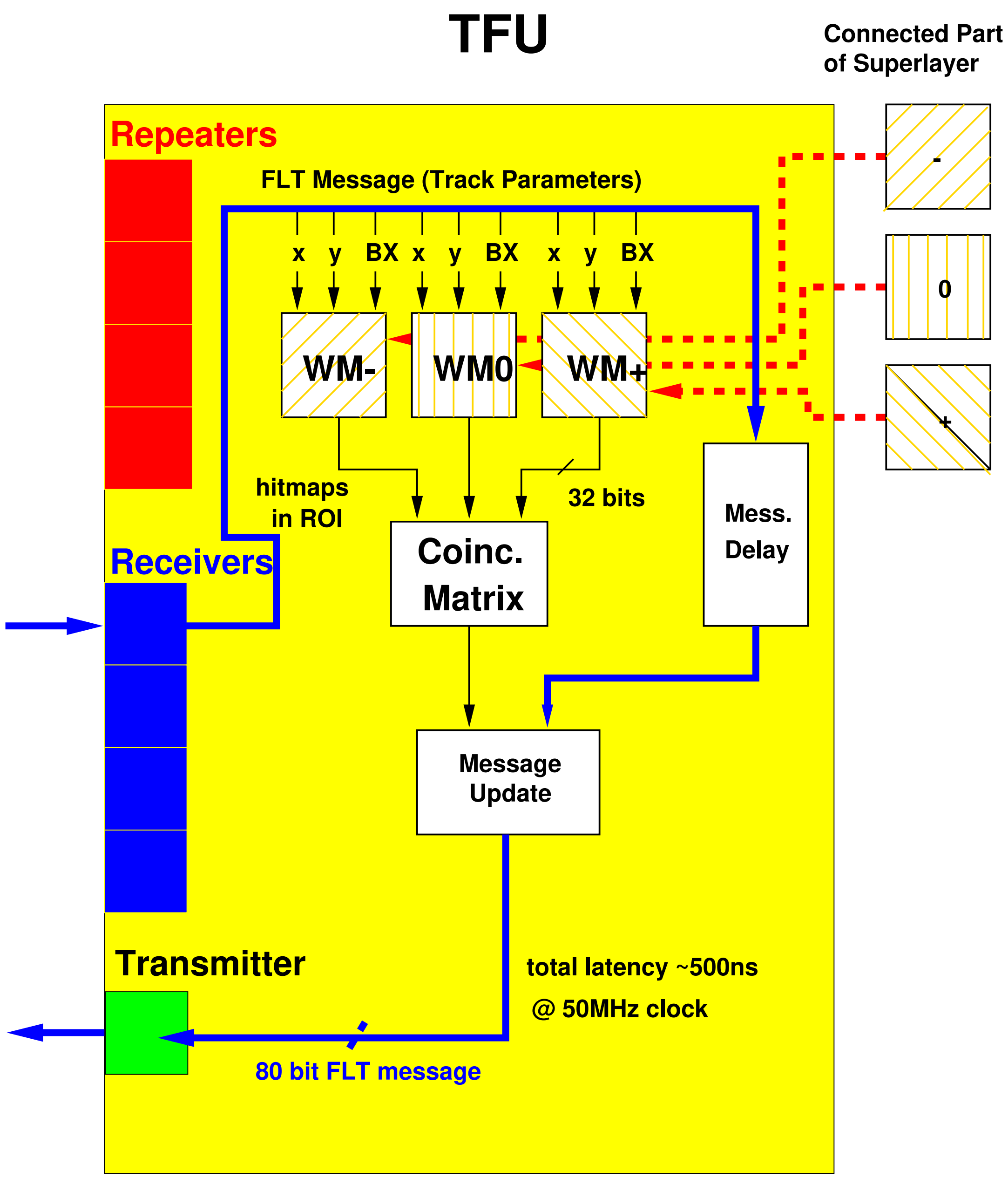
	Dest.	n	x	dx	ddx	y	ROI	all
bits	8	1	10	8	8	9	2	1

	BX	ID	P	flag	E+	E-	nc
bits	8	2	7	1	7	7	1

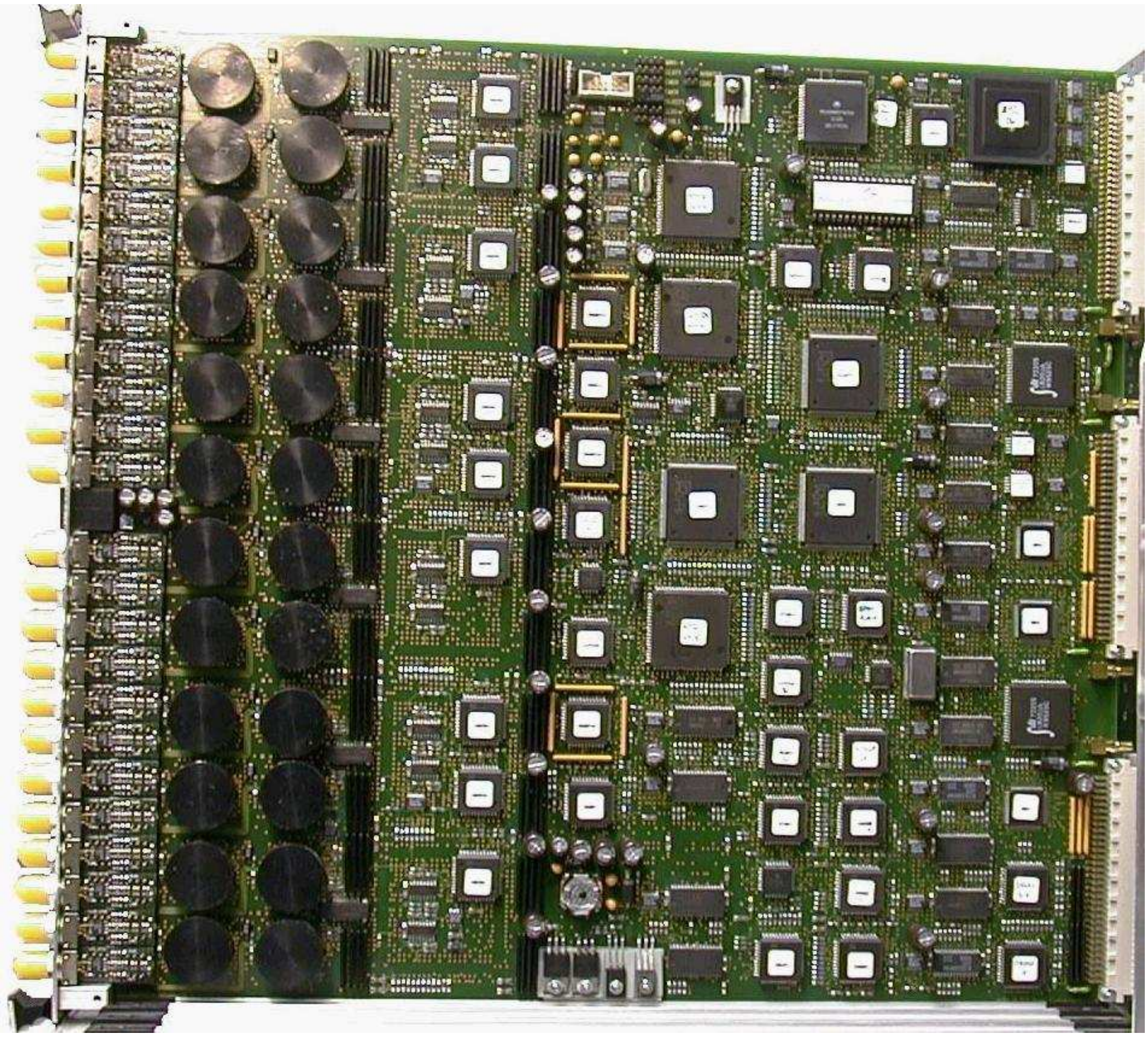
Data Path Examples



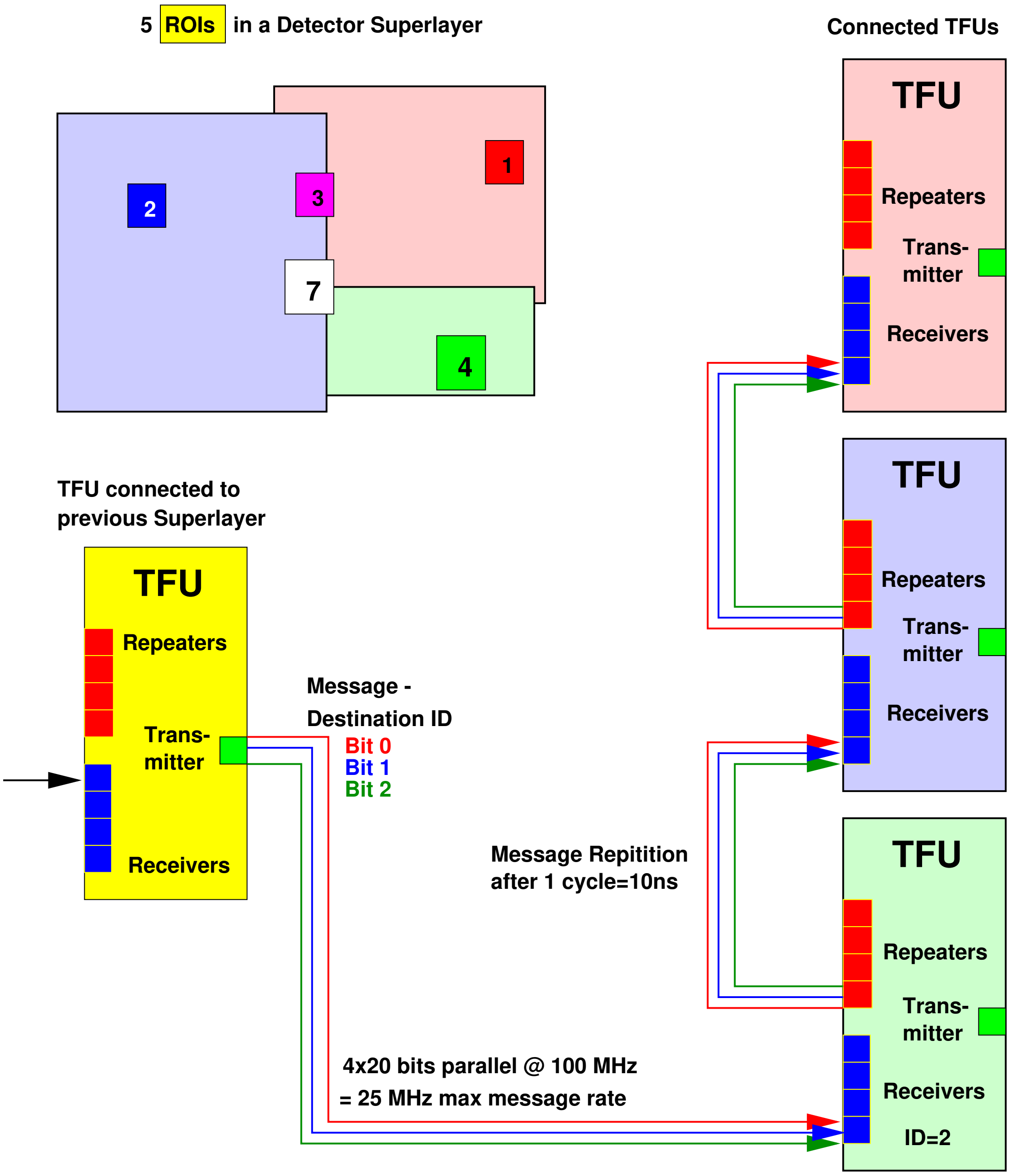
Message Update in the TFU



Track Finding Unit Front View

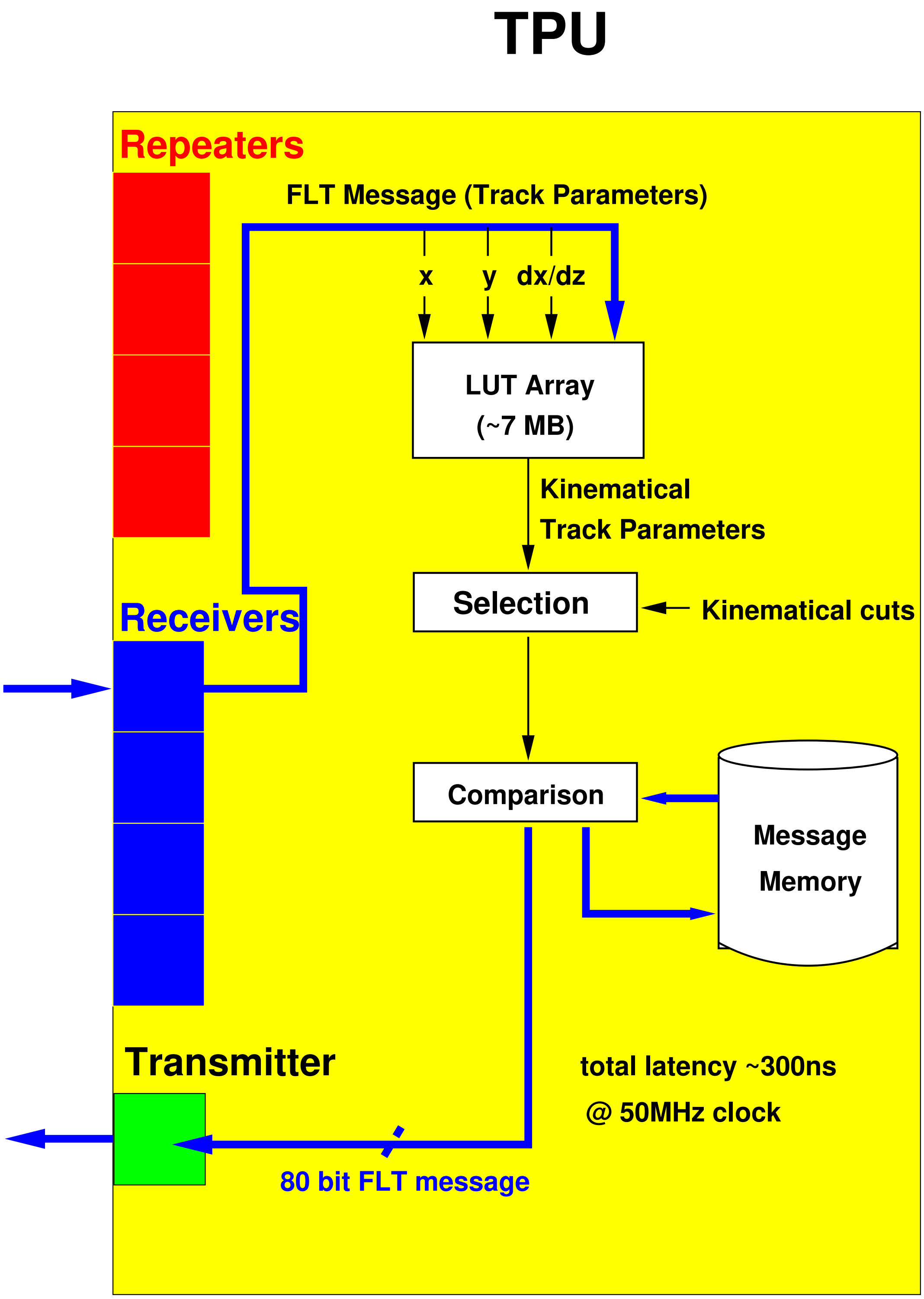


TFU addressing scheme

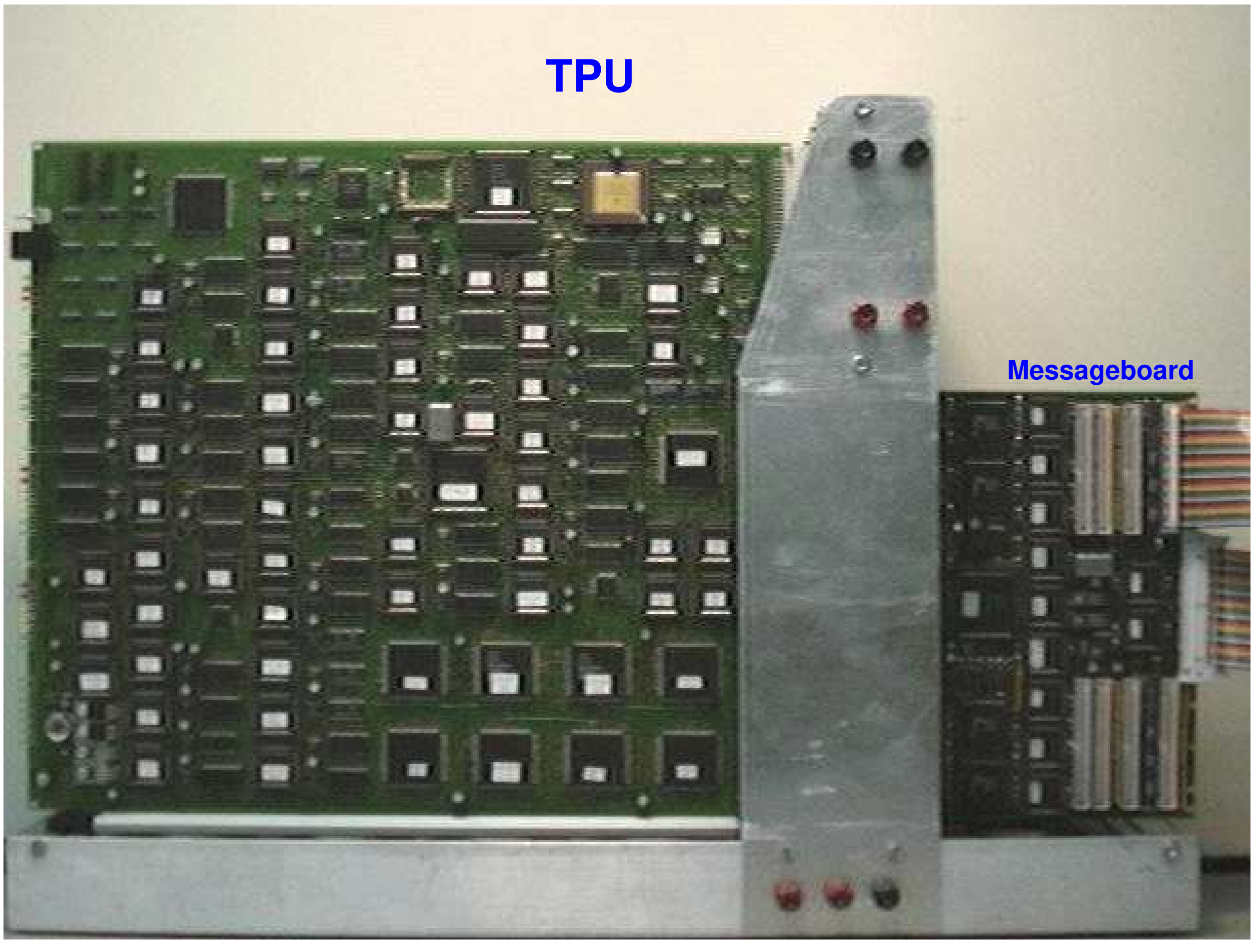


$$\textbf{Destination Identifier} = \sum_{\text{Target TFUs}} (1 \ll \mathbf{ID}_n) \qquad (1)$$

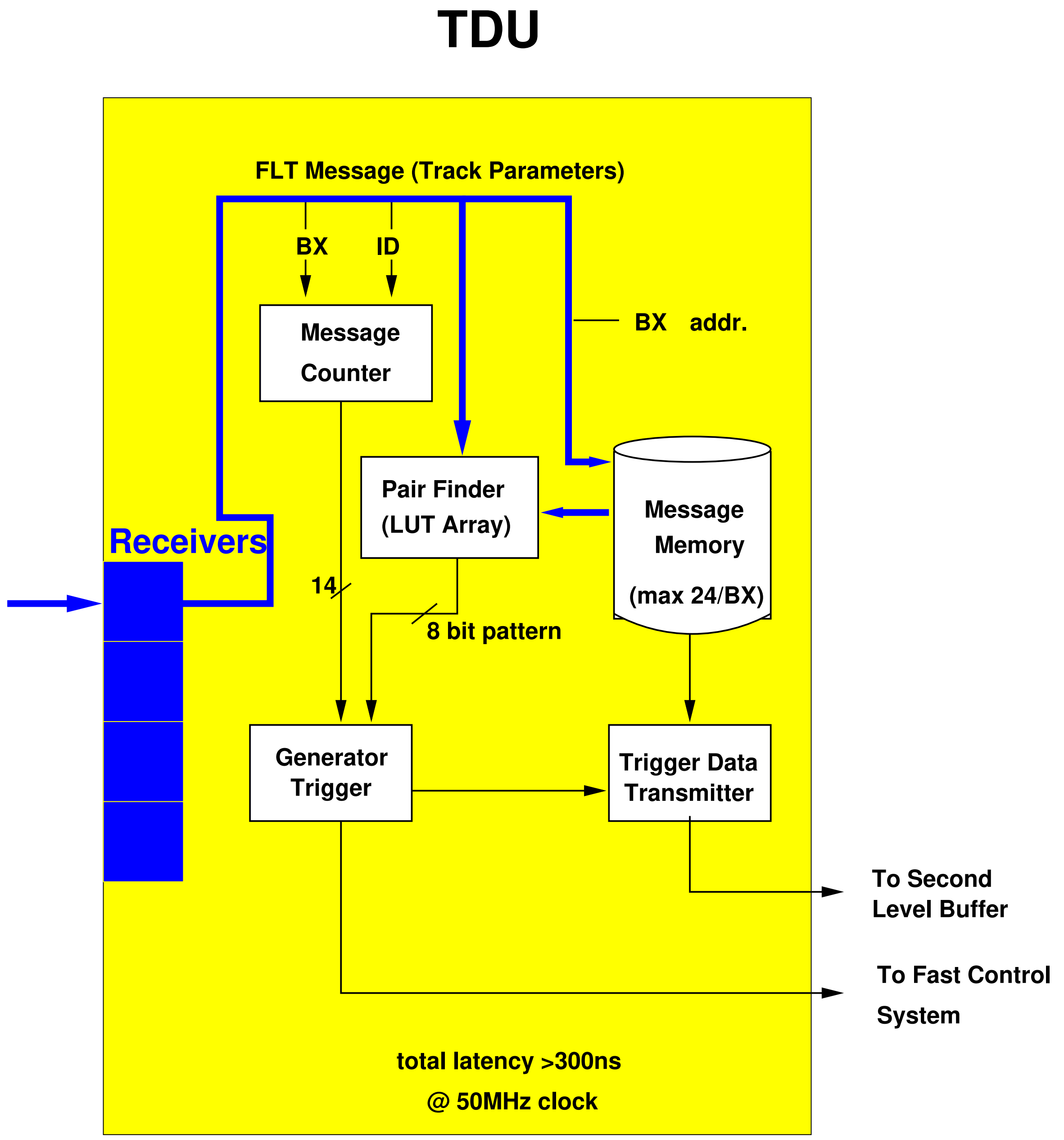
Tracking in the TPU



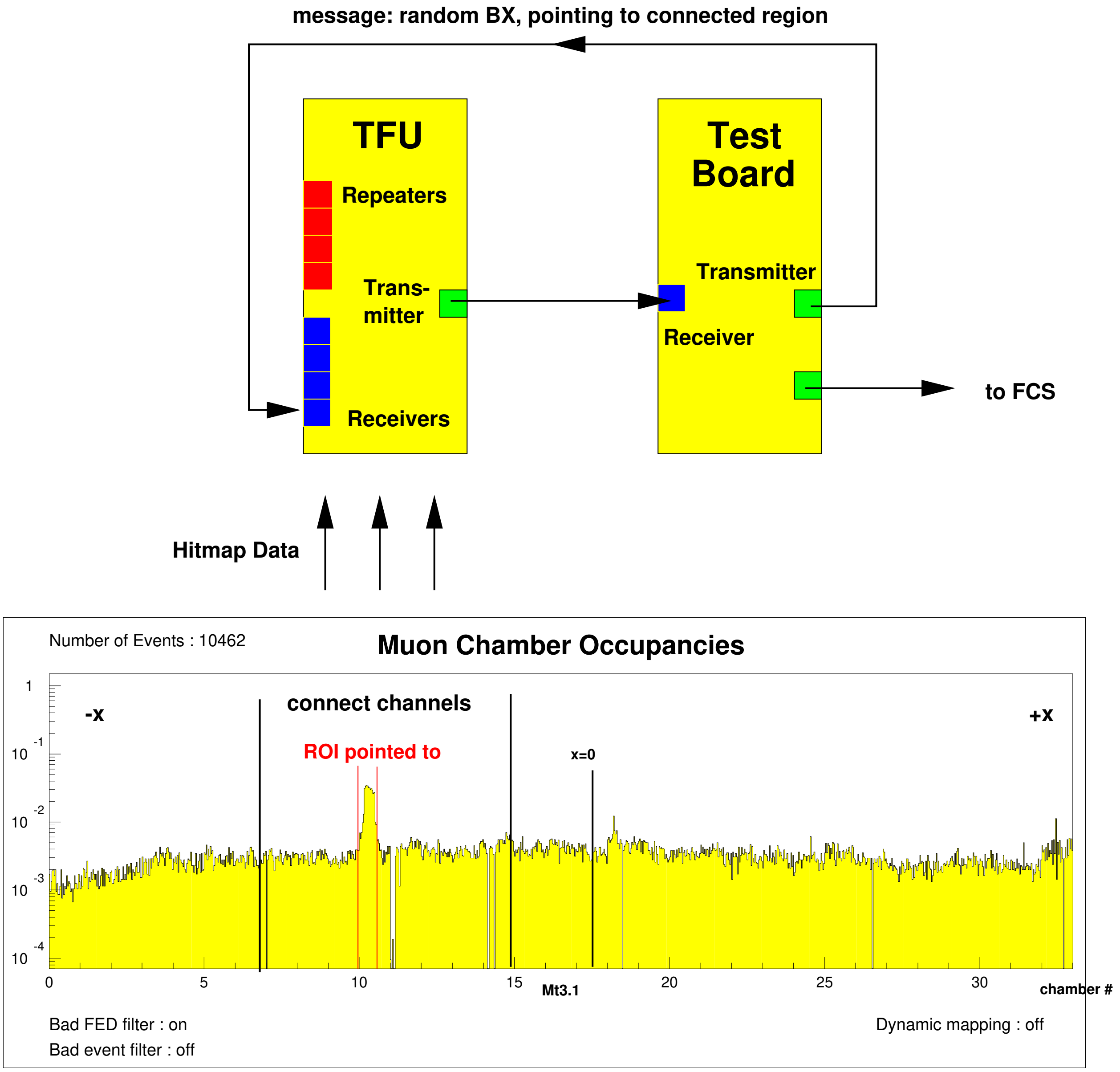
Track Parameter Unit Front View



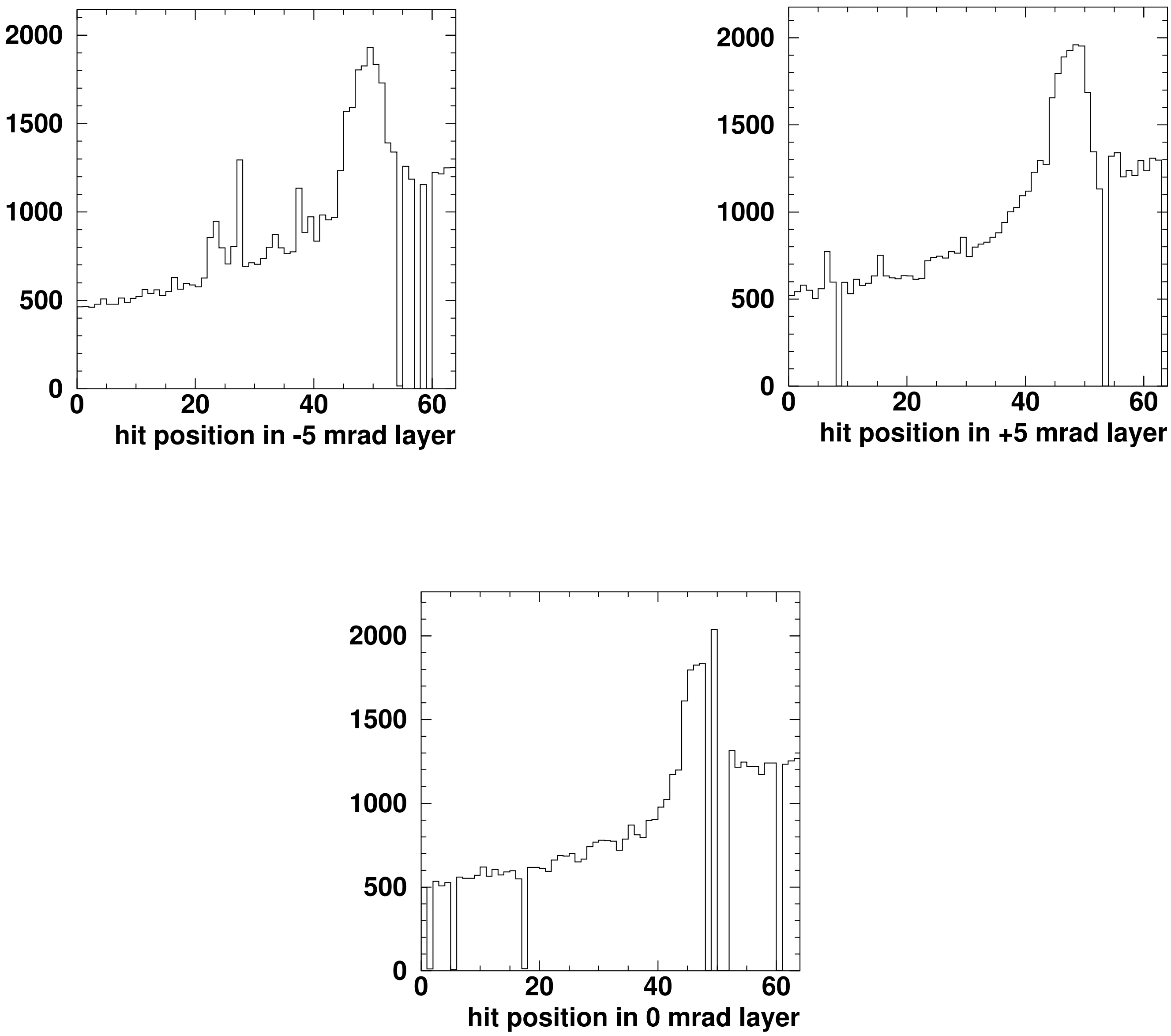
Trigger Decision in the TDU

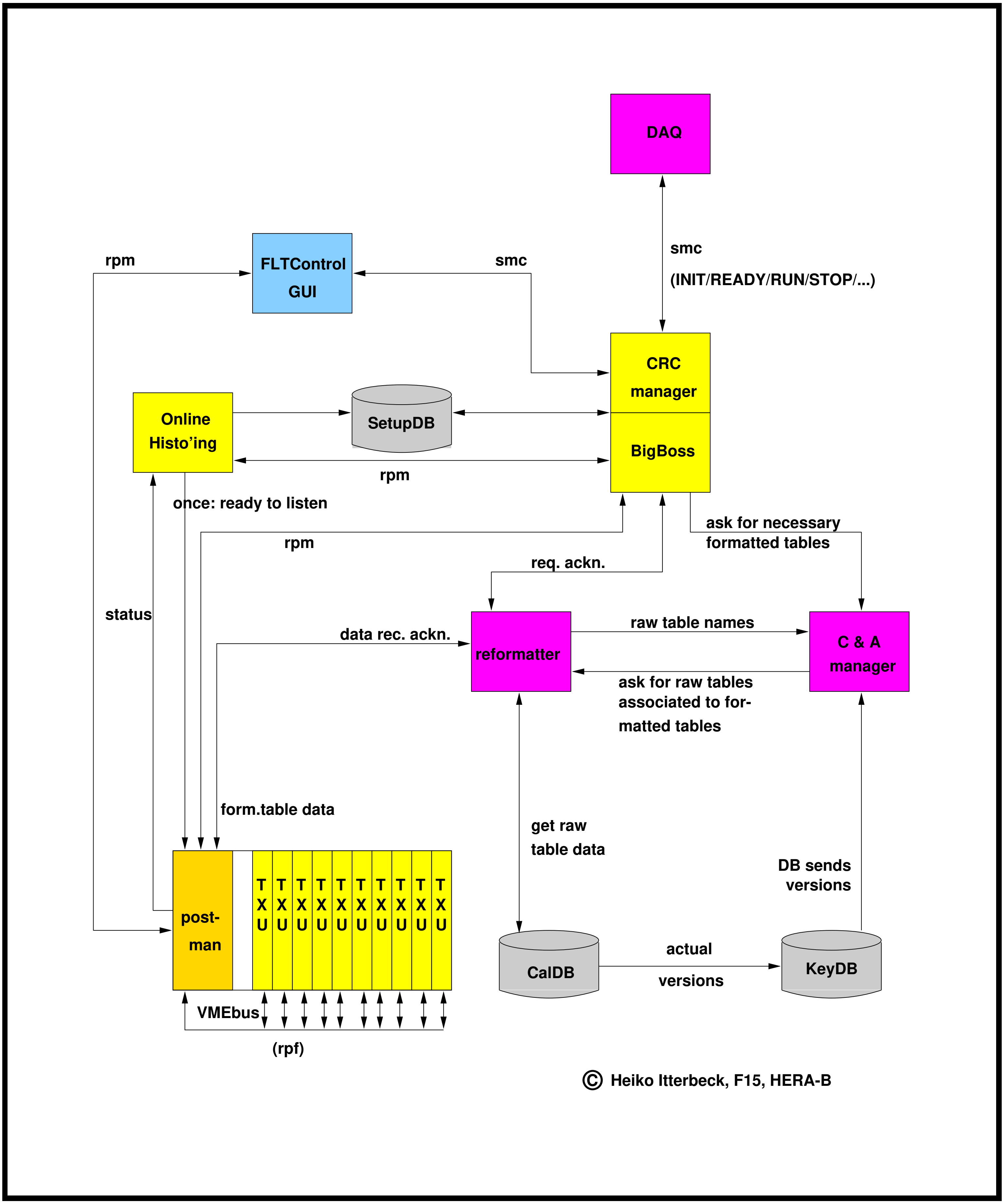


Tests with the Muon System



Tests with the Outer Tracker




DAQ
smc
(INIT/READY/RUN/STOP/...)
rpm
FLTControl GUI
smc
CRC manager
BigBoss
Online Histo'ing
SetupDB
rpm
once: ready to listen
rpm
ask for necessary formatted tables
req. ackn.
status
data rec. ackn.
reformatter
raw table names
C & A manager
ask for raw tables associated to for- matted tables
form.table data
get raw table data
DB sends versions
post- man
T X U
VMEbus
(rpf)
CalDB
actual versions
KeyDB
© Heiko Itterbeck, F15, HERA-B

- Design of all FLT board types finished,
  15 TFUs, 1 TPU, 1 TDU at DESY, Hamburg, Germany
  till end June, rest till Nov.
- Big Part of Pretrigger and Detector Side assembled
- Control Software is written
- LUT Coding and Generation prepared
- Data Transmission trough entire Chain Tested
- THE Event for the FLT Group: the first Data taken with the System
- Next Steps:
  - Generation of Data Base, Monitoring Tools
  - Connection and Running the full network

Copies of this talk soon available from HERA-B FLT webpage
(Presentations and Talks)