

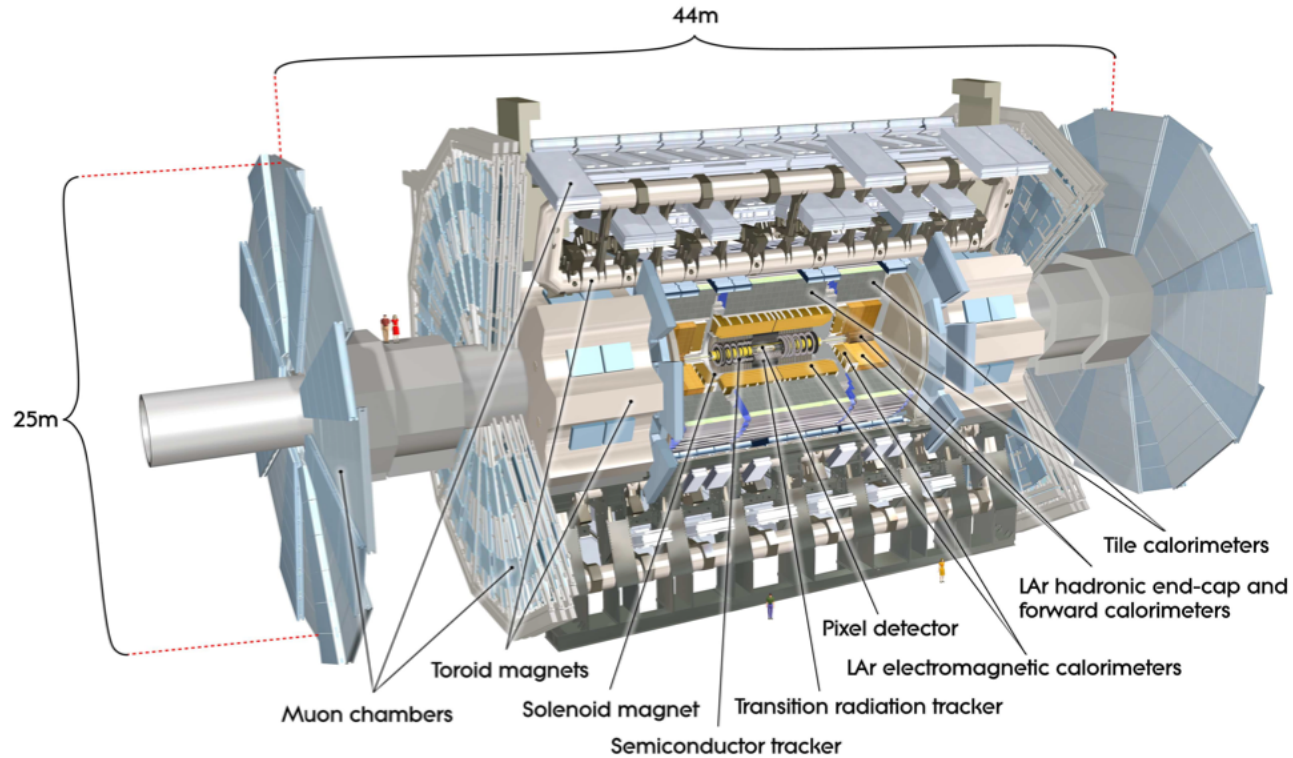
Institut für Kern- und Teilchenphysik, Professur für experimentelle Teilchenphysik

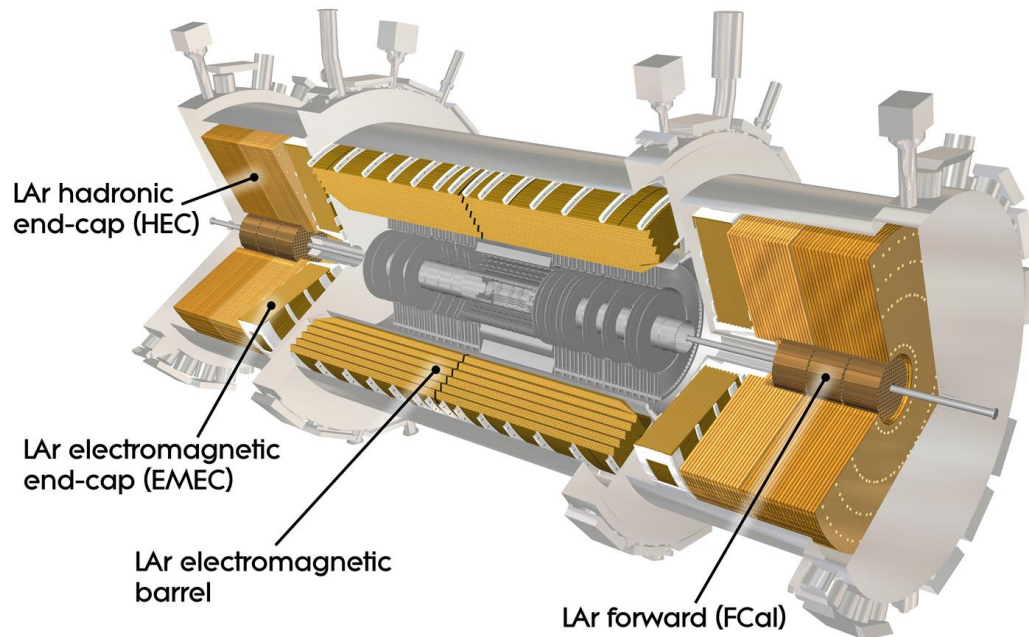
SYSTEMTESTS DER LATOME-FIRMWARE DES ATLAS FLÜSSIGARGON-KALORIMETERS IM RAHMEN DES PHASE-I-UPGRADES

Yves Bianga
Münster, 29. März 2017

Flüssigargon-Kalorimeter (LAr) im ATLAS Detektor

Flüssigargon-Kalorimeter im ATLAS Detektor

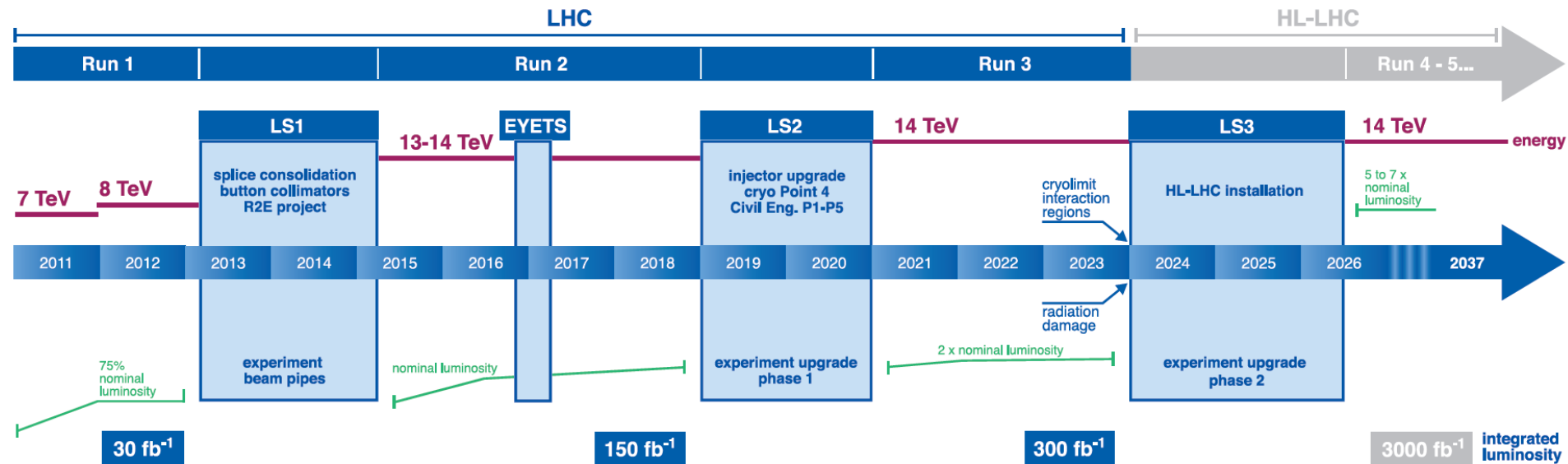




- Absorber: Pb; Active: Liquid Ar
- 182468 Detektorzellen
- 4 Schichten mit untersch. räumlichen Auflösungen
- Auslese aller 25ns
- speist den Level-1 Trigger

Phase-I Upgrade am LHC / ATLAS / LAr

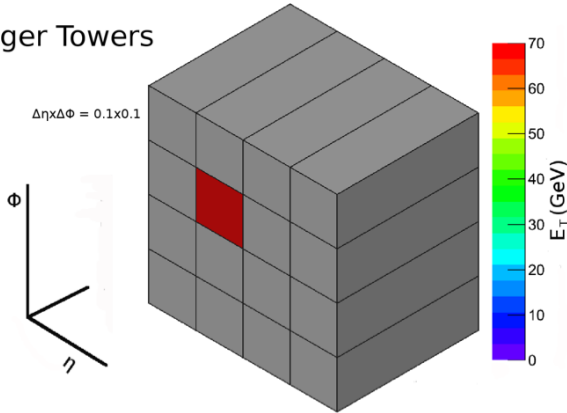
LHC / HL-LHC Plan



- Steigerung der Auflösung des Triggers
- Höhere Granularität und longitudinale Zelleninformation im Level-1 Trigger

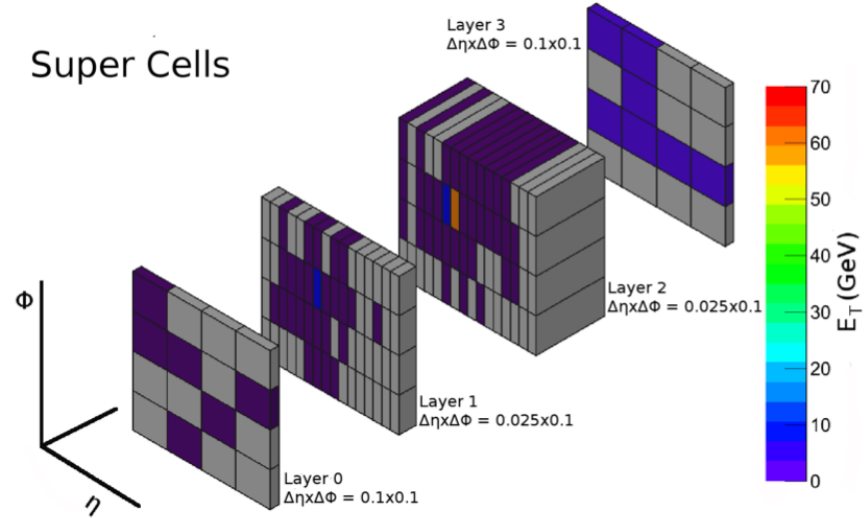
ca. 6000 TT

Trigger Towers



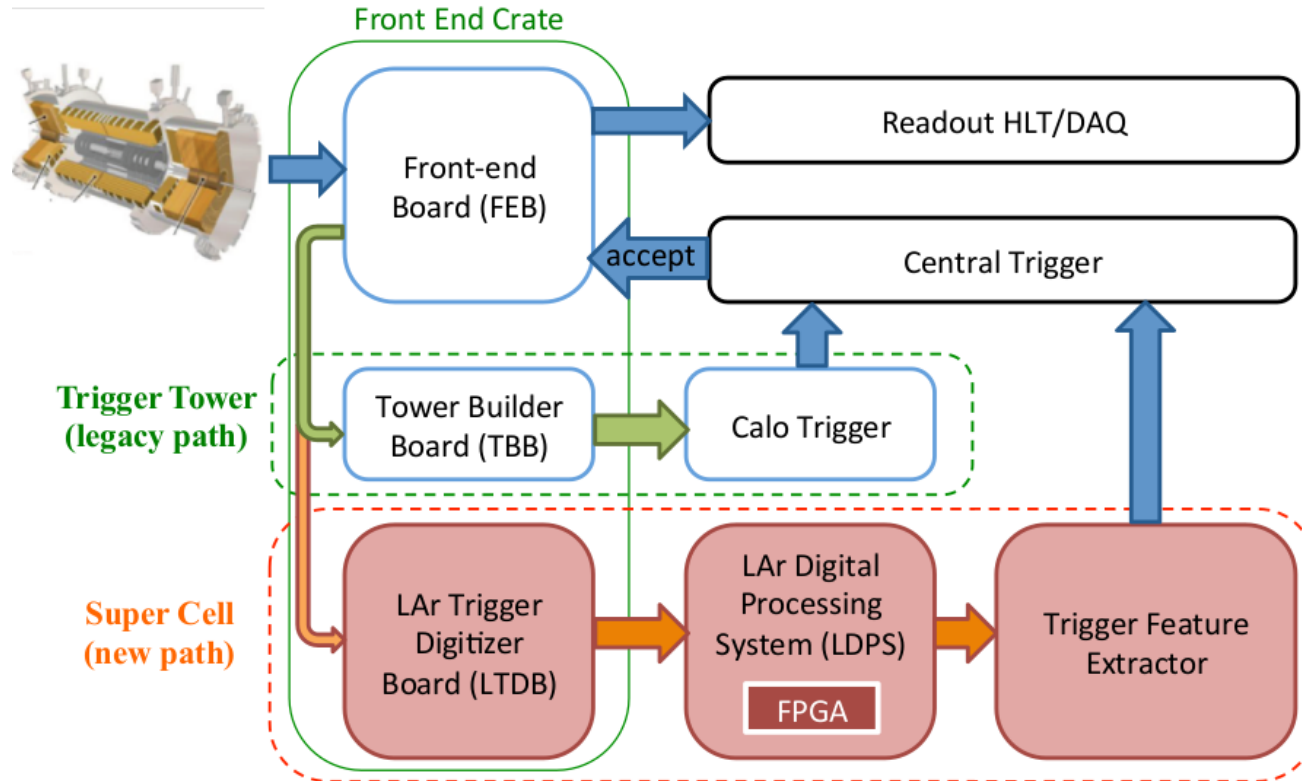
ca. 35000 SC

Super Cells

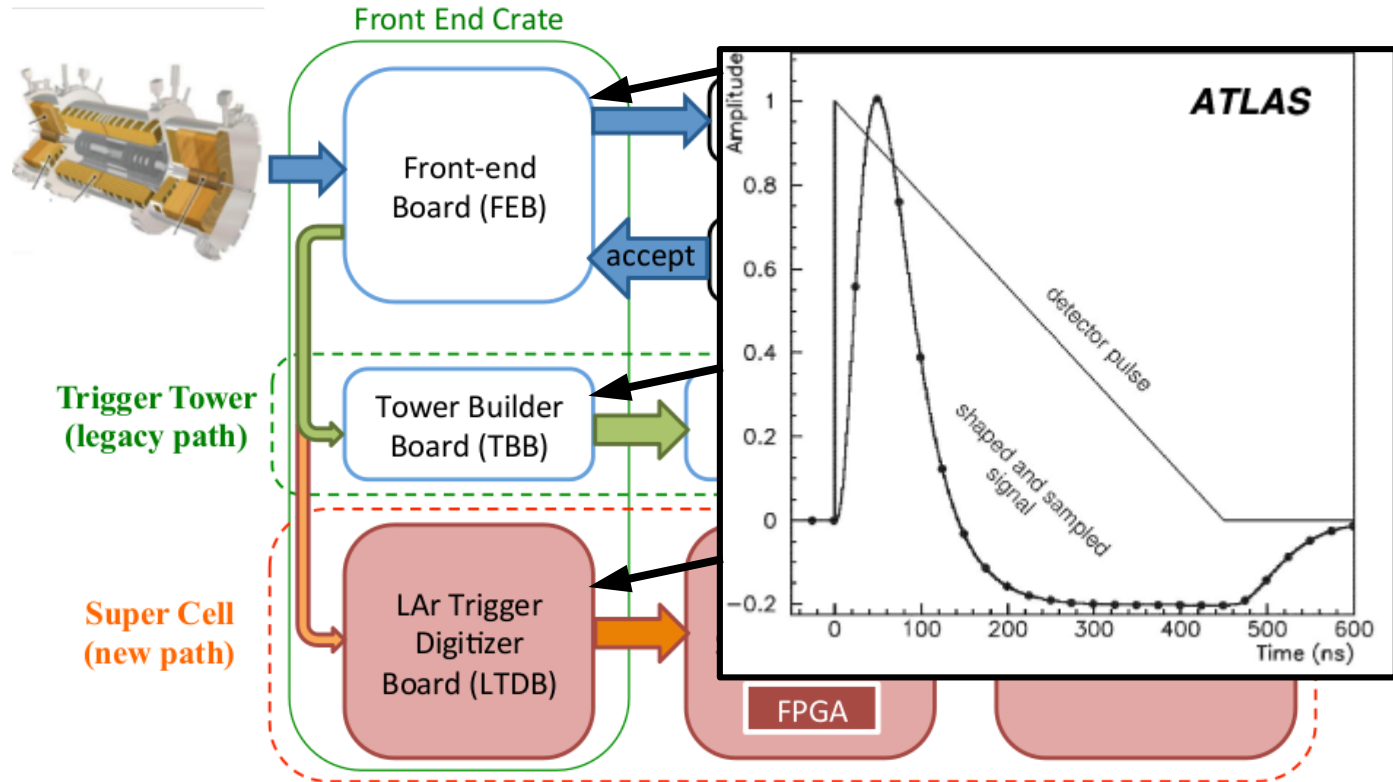


Bsp.: 70GeV Elektronen-Schauer

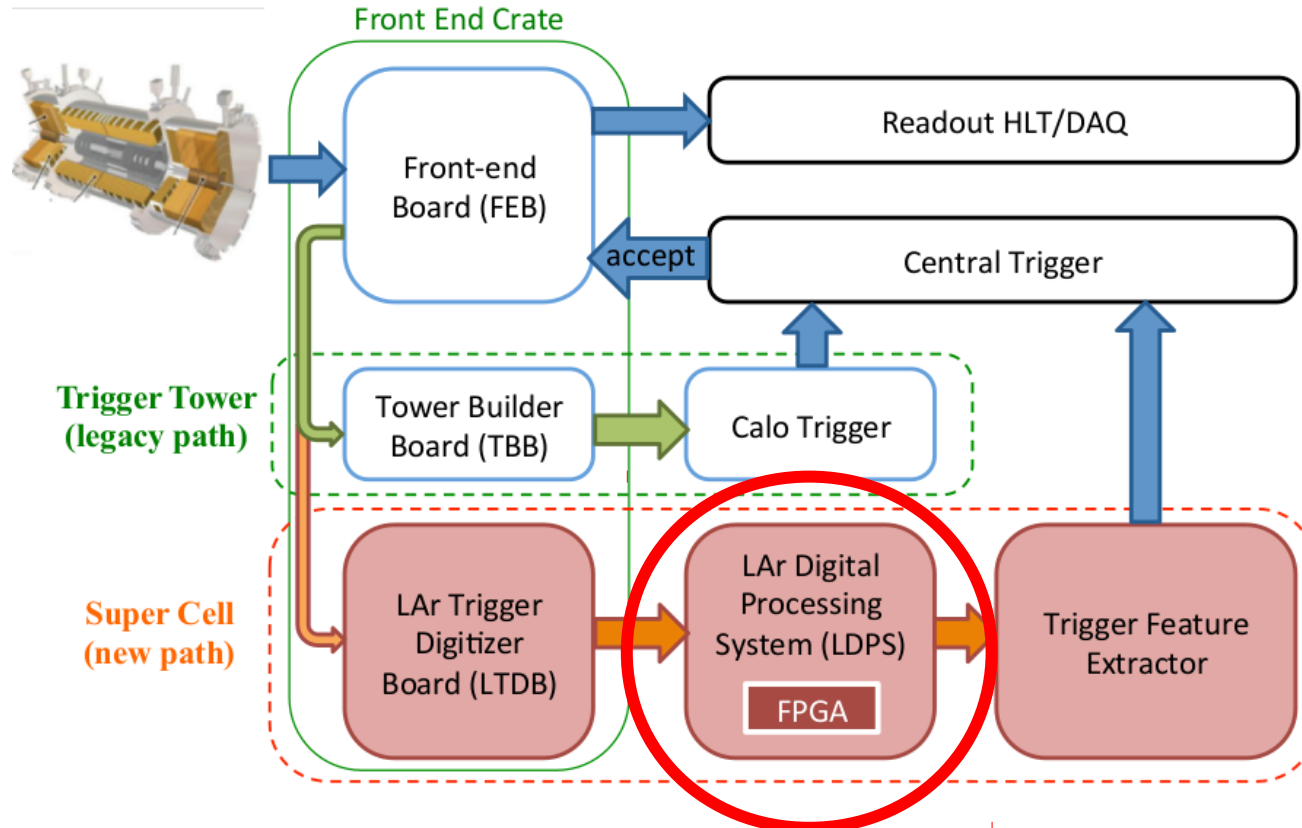
leistungsfähigere FrontEnd- und BackEnd-Elektronik



leistungsfähigere FrontEnd- und BackEnd-Elektronik

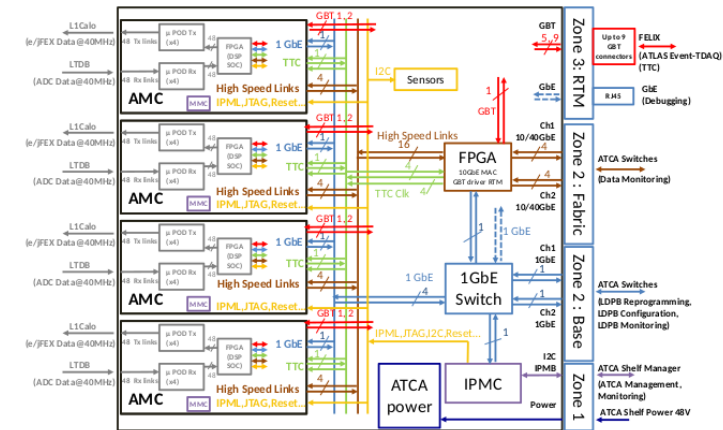
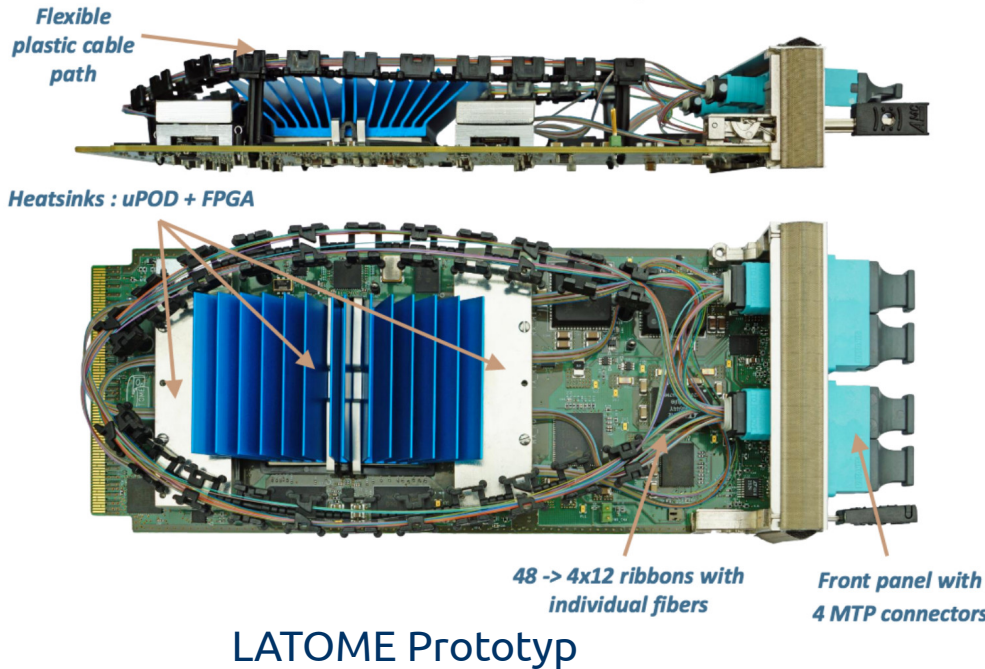


leistungsfähigere FrontEnd- und BackEnd-Elektronik



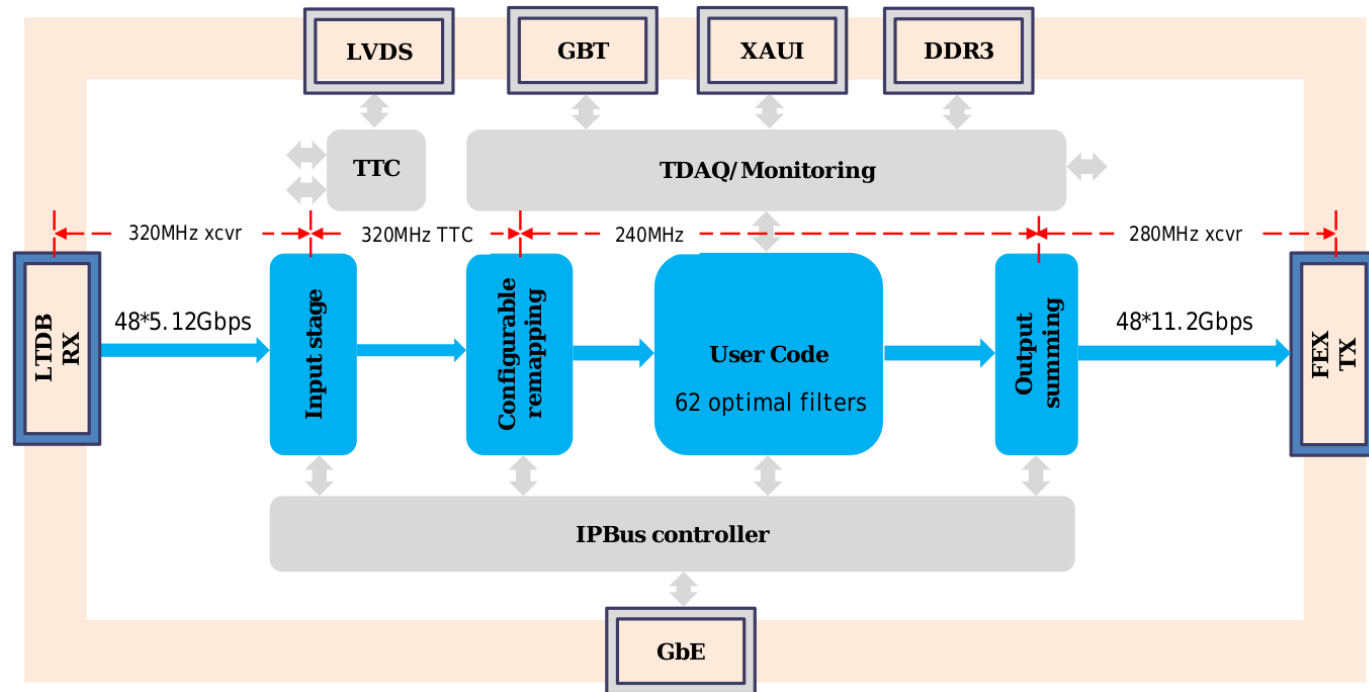
LATOME Hardware & Firmware

- LAr Trigger prOcessing MEzzanine
- ARRIA-10 FPGA, 48 RX/TX 10GBit Fibers



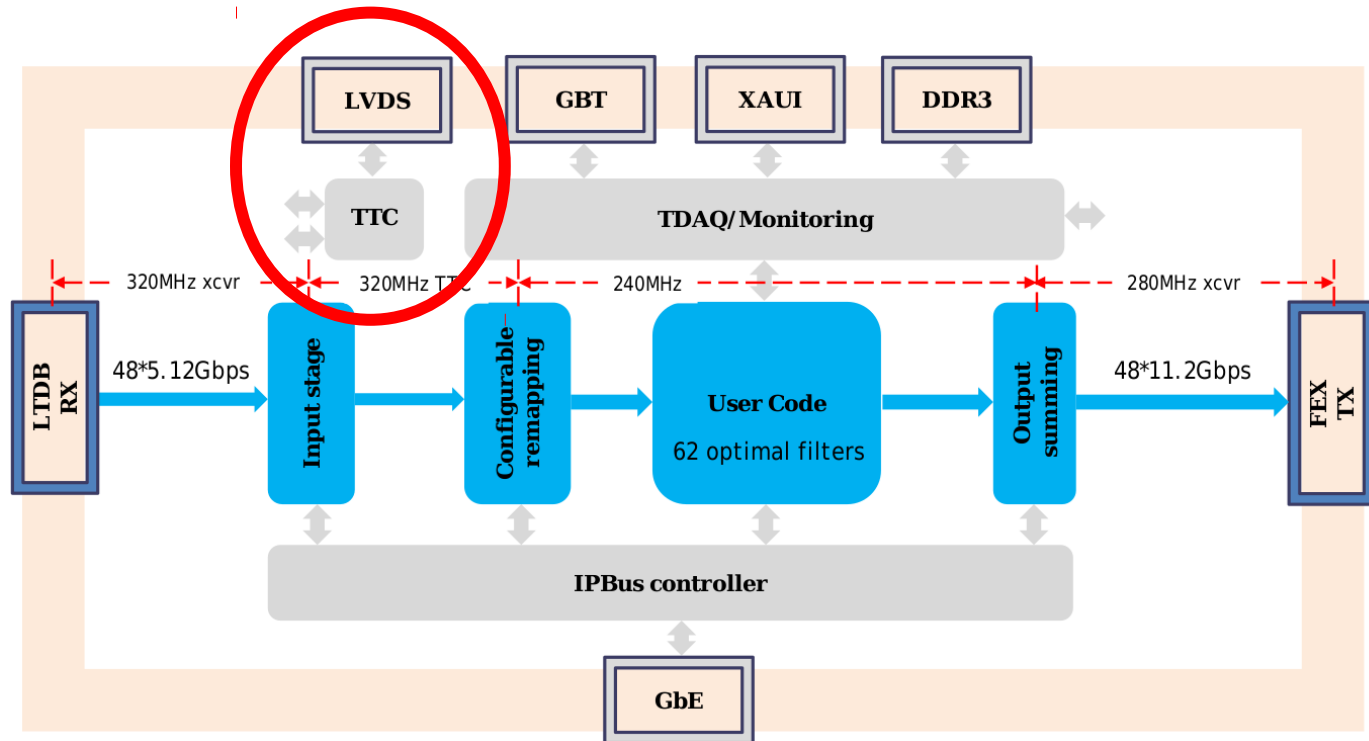
ATCA Blade

- modularer Aufbau
- internationale Entwicklungsbeteiligung

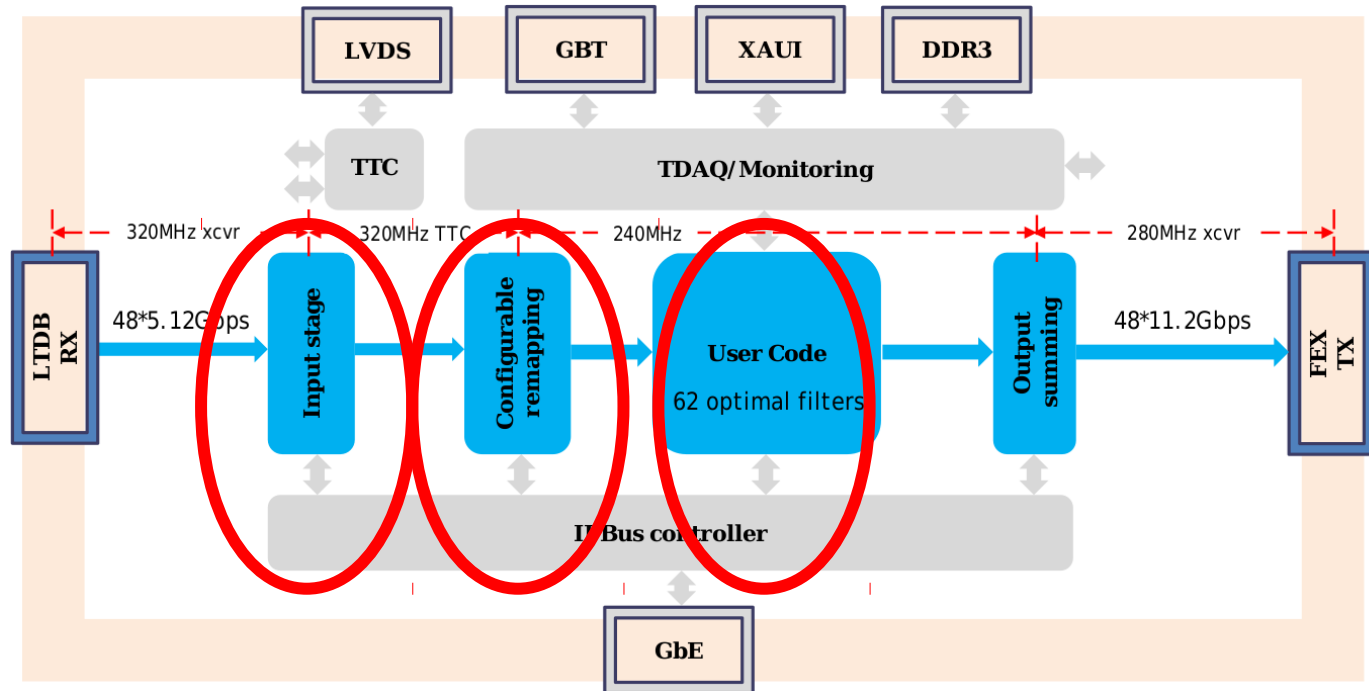


Systemtests der LATOME-Firmware

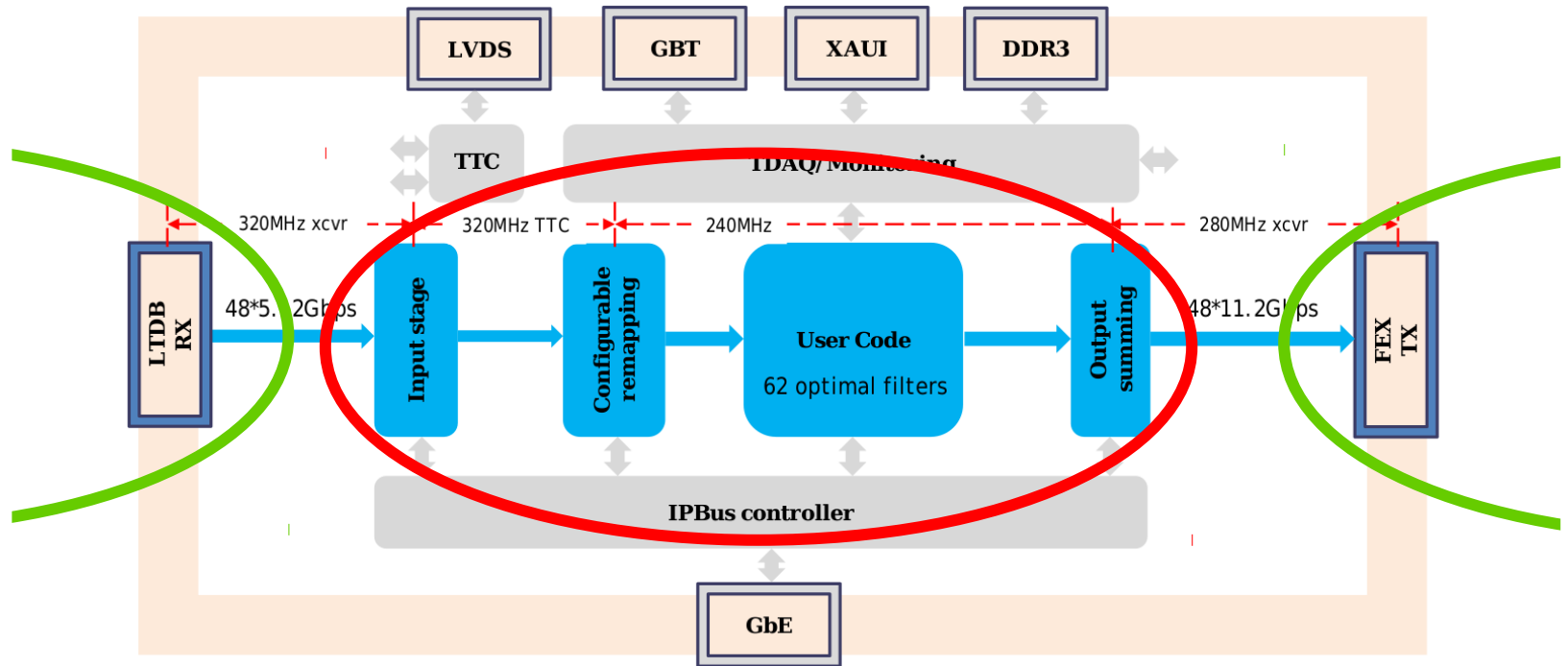
Systemtest M0



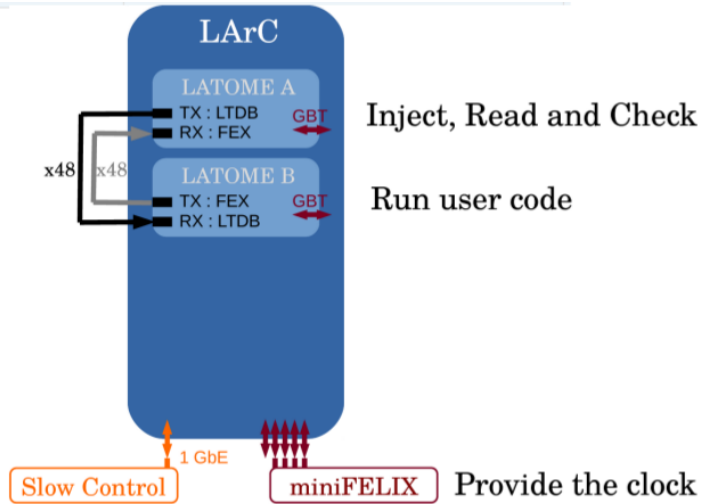
Systemtest M1, M2



Systemtest M3 (3.4. - 7.4.17 @ CERN)



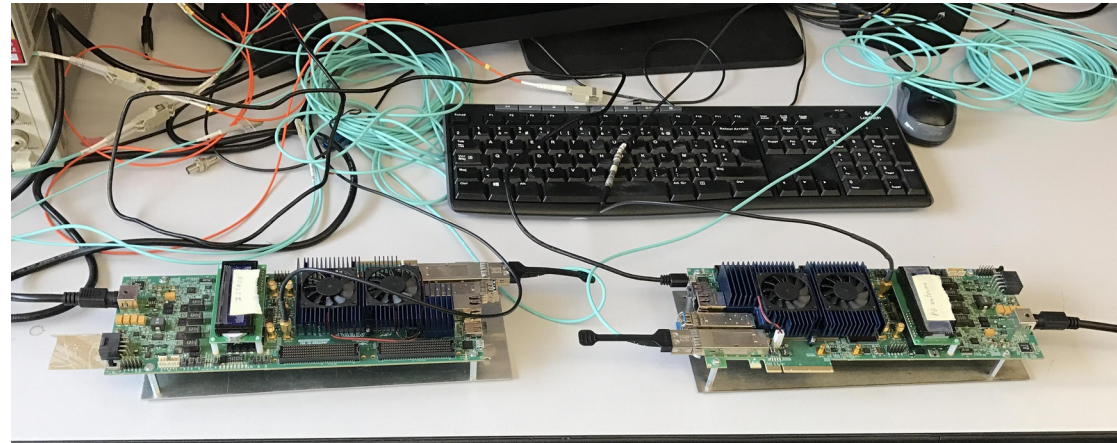
schematischer Aufbau von M3



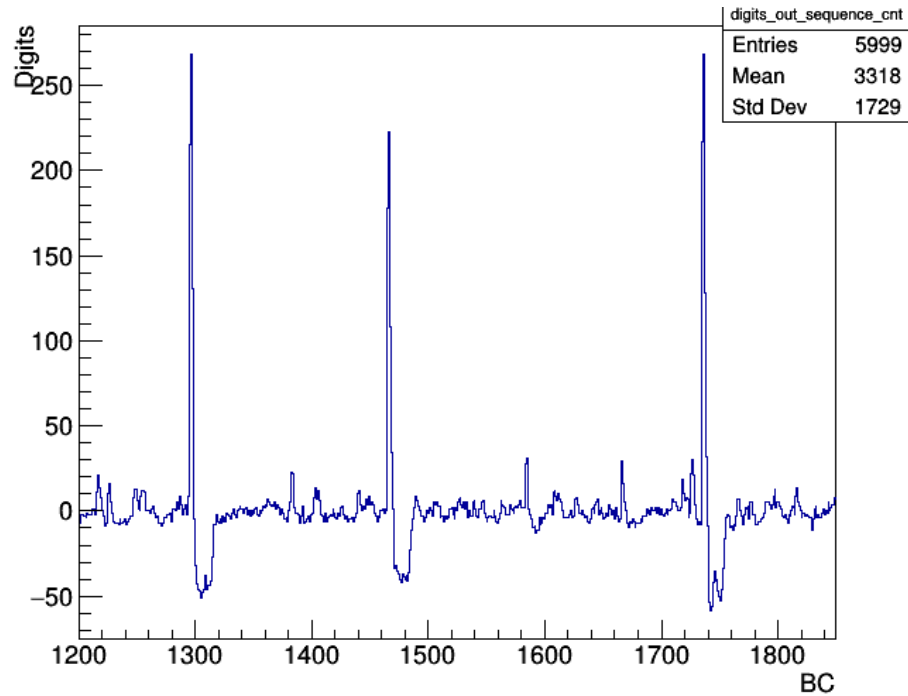
Inject, Read and Check

Run user code

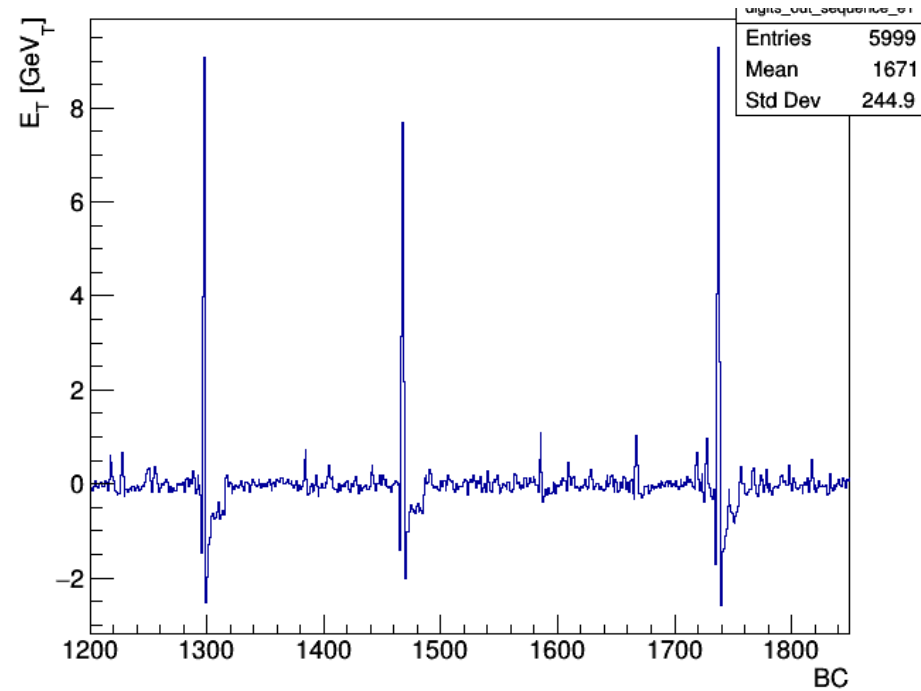
Vorbereitungen zu M3



Input: simulierte Daten des AREUS Frameworks (ROOT-Format)

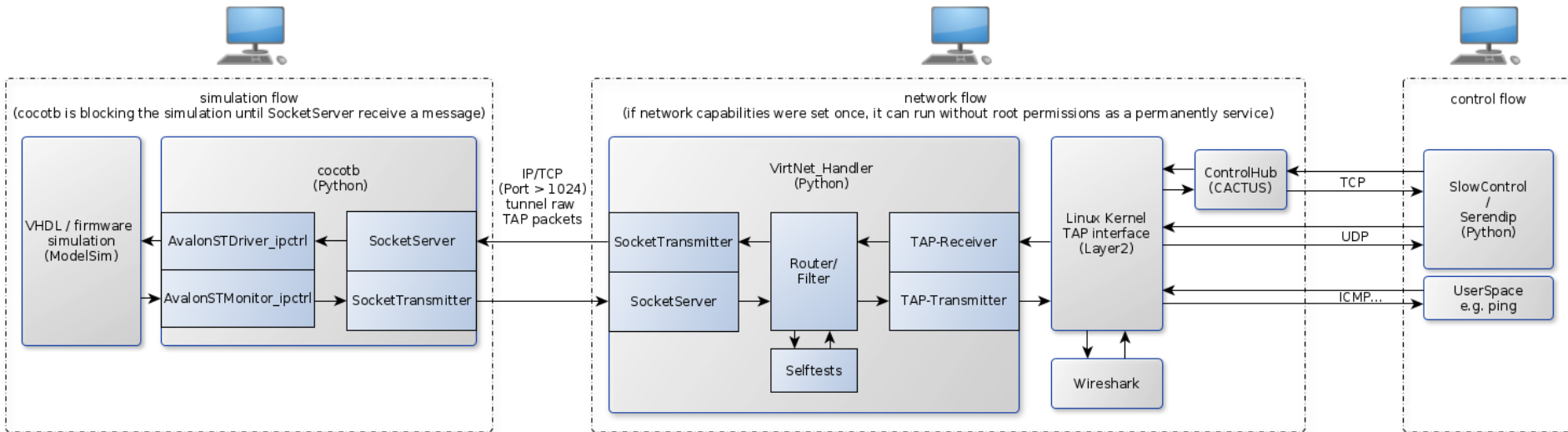


digitalisierter Raw-Input



gefilterter Output

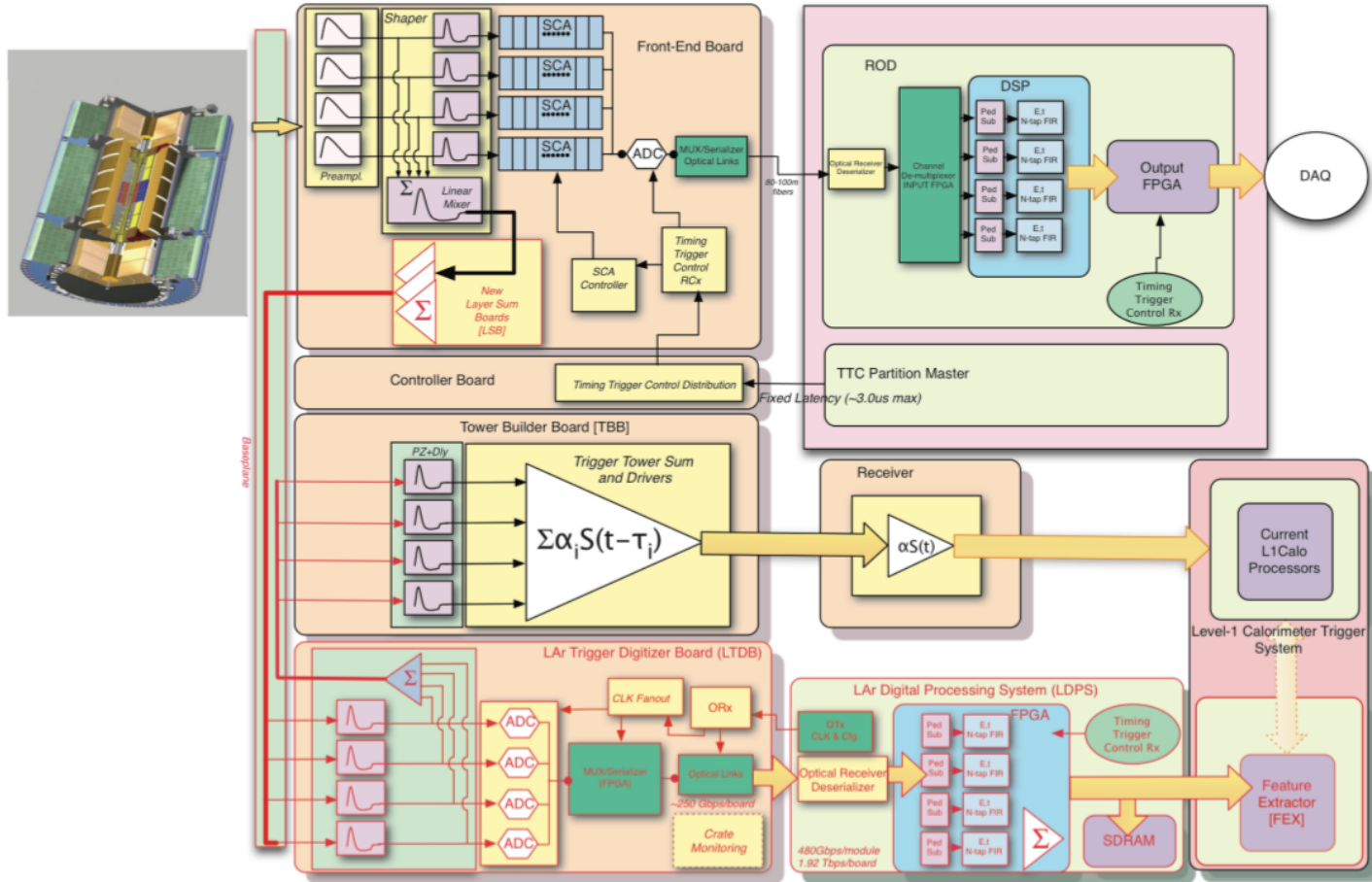
Virtueller Netzwerk Router, Transport der simulierten EMB Daten in die Hardware

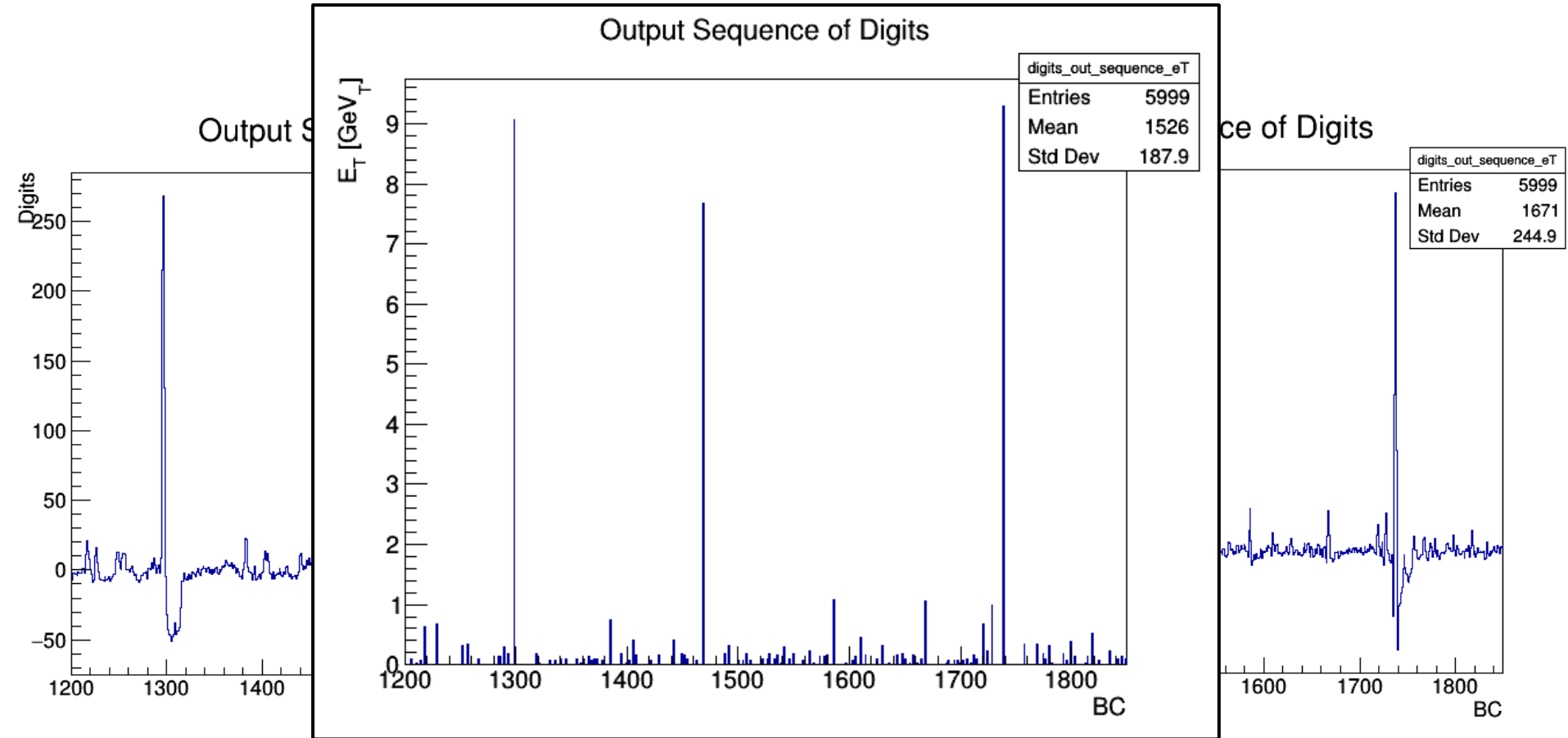


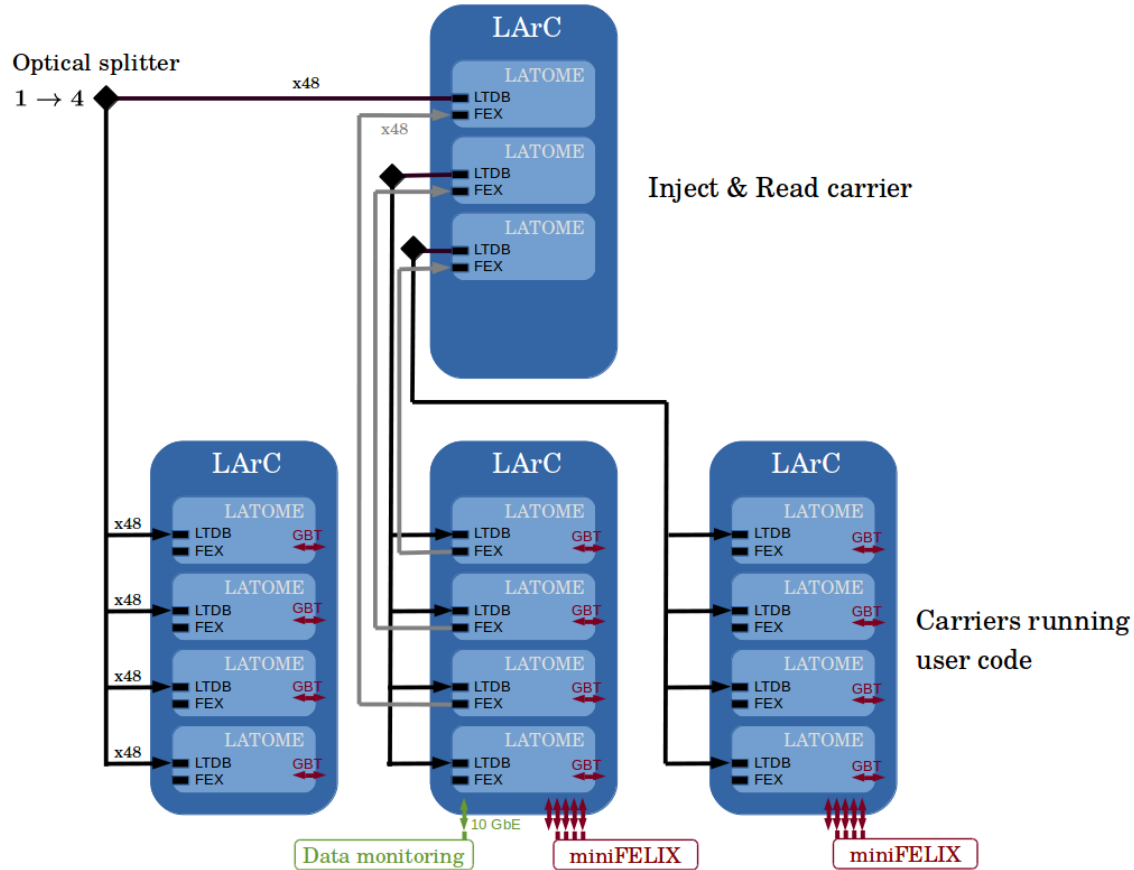
Vielen Dank für Ihre Aufmerksamkeit!

Fragen?

BACKUP: Triggerelektronik







BACKUP: Milestones der Systemtests

Milestone	Status	Date of Completion	Comments	Goal (done at EMF)	Online SW	FW	HW
M0	DONE	15/10/2016 10/02/2017	<ul style="list-style-type: none"> Power management of the boards via IPMC working (up to ~5/6h of run) Clock recovered from FELIX with some jitter (not annoying for BE, but for FE) → to be investigated with FELIX group 	<ul style="list-style-type: none"> Recover the TTC clock with LArC up to LATOME v1 (FW needed to be ready). Running: 1 LArC + 1 LATOME v1 + 1 Felix (TTC only) Test done in the ATCA crate moved from building 104 to EMF. 	IPMC soft ready (no other online sw needed) → power the board properly	Test of clock for LArC, LATOME with FELIX	<ul style="list-style-type: none"> 1 LATOME v1 1 LArC v2.1 1 pseudo-FELIX 1 PC (felix) on GPN ATCA crate 1 PC with a screen (to run quartus, vivado...), on GPN 1 switch for ATCN
M1	DONE	1/11/2016 15/03/2017	<ul style="list-style-type: none"> Reading/Writing of LATOME and LArC registers via IPbus validated 	<ul style="list-style-type: none"> Board configuration: hw, some mapping and some calibration parameters via Largonline Read board status: read some status registers 	<ul style="list-style-type: none"> Partition "EMF_Phase1" with GUI hw config: OKS mapping: OKS 	Read and write in registers	+ 1 switch ATCA
M2	Ongoing	1/11/2016 24/03/2017	-	<ul style="list-style-type: none"> DCS: understand how to deal with DCS and get monitoring info (T, V, I histograms) 		Determine critical FPGA parameters to be monitored by DCS (via ATCA)	+1 PC running DCS software
M3	-	1/12/2016 31/03/2017	-	<ul style="list-style-type: none"> FEX test: 1 LATOME inject & read (A) + 1 LATOME operating (B), A inject LTDB data into B, B compute E_T and send FEX data to A (via μPods), check that data injected and read by A are OK via base interface (1 GbE) Power and thermal tests (test by varying the number of samples used for the E_T computation) Overnight tests <p>MoreDetailsOnM3</p>	Read FEX data + check	<ul style="list-style-type: none"> Generate LTDB data (pulse) Compute E_T Read and check FEX data 	+1 LATOME v1
M4	-	15/12/2016 14/04/2017	-	<ul style="list-style-type: none"> L1A, Trigger Type and BCR decoding (+possible other TTC commands) [GBT down flow] Check time alignment (BCR in injected data compared to BCR from FELIX) 	LTP program to generate different Trigger Type	<ul style="list-style-type: none"> Decoding of TTC Check of time alignment (put by hand some delay in the FW) 	

BACKUP: Milestones der Systemtests

M5	-	15/01/2017 28/04/2017	-	<ul style="list-style-type: none"> • Readout TDAQ data with FELIX to local disk (+possible other TTC commands) [GBT up flow] • BUSY test (to be discussed with L1CALO) • Stress test: run >100 kHz to see the freq. max (need some basic "HLT" to write on disk only reasonable amount of data) 	[Offline analysis of data]	GBT link fully bidirectional	FELIX-PC (felix-02) in Testbed +1 PC with 10 GbE
M6	-	15/01/2017 12/05/2017	-	<ul style="list-style-type: none"> • Readout monitoring data of operating LATOME through 10 GbE (fabric interface), write on disk. <p>To be determined: which data we want to monitor</p>	Develop readout via push mode? (pull mode may be less efficient)	fabric readout	
M7	-	1/02/2017 19/05/2017	-	<ul style="list-style-type: none"> • LATOME v2: redo up to M6 with LATOME v2 • Fully functional user code (use all constants, complete mapping) 	Constants read from DB	User code fully functional	<ul style="list-style-type: none"> • 1 LATOME v2 (operating) • 1 LATOME v1 or v2 (I&R)
M8	-	8/02/2017 26/05/2017	-	<ul style="list-style-type: none"> • Operate 2 LATOME (can be done first with v1 in case v2 is not yet ready), check time alignment 			<ul style="list-style-type: none"> • 2 LATOME (operating) • 2 LATOME (I&R)
M9	-	15/02/2017 09/06/2017	-	<ul style="list-style-type: none"> • Operate 4 LATOME • Test time alignment: use fibres of different length? (or simply put some delays in FW) 			<ul style="list-style-type: none"> • 4 LATOME (oper.) • 1 LATOME (I&R) [can also use 2 other LATOME v1 to read in total 3 operating LATOME] • 2 LArC • 1 optical split. 1 – 4
M10	-	28/02/2017 ?	-	<ul style="list-style-type: none"> • Operate 2 carriers (8 LATOME), 2 TTC to test delay between them 			<ul style="list-style-type: none"> • 8 LATOME (operating) • 2 LATOME (I&R) • 3 LArC • 2 optical split. 1 – 4 • 2 FELIX
Final	-	March 2017 ?	-	<p>Full setup running in an ATCA crate:</p> <ul style="list-style-type: none"> • 12 LATOME v2 running fully functional user code (e.g. compute E_T + saturation detection) • 3 LATOME emulating LTDB + FEX (+3 optical splitter) • mini Felix reading TDAQ data (warning: only 4 GBT links whereas 5 needed for 1 carrier → not all GBT links can be tested together) 			<ul style="list-style-type: none"> • 15 LATOME (12 operating, 3 I&R) • 4 LArC • 3 optical split. 1 – 4 • 1 PC running DCS software • 1 PC with 10 GbE for