Proton Detection

Status of the proton drift chambers for R^3B

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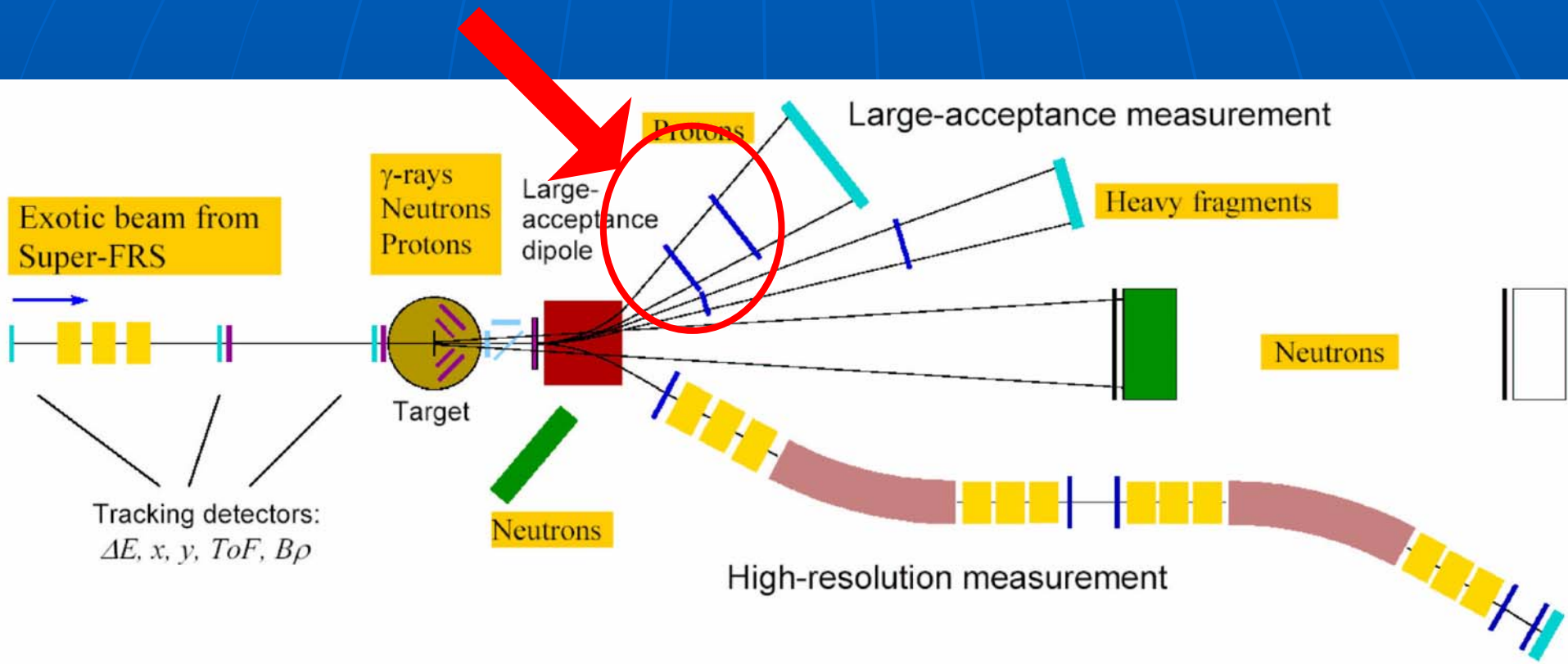
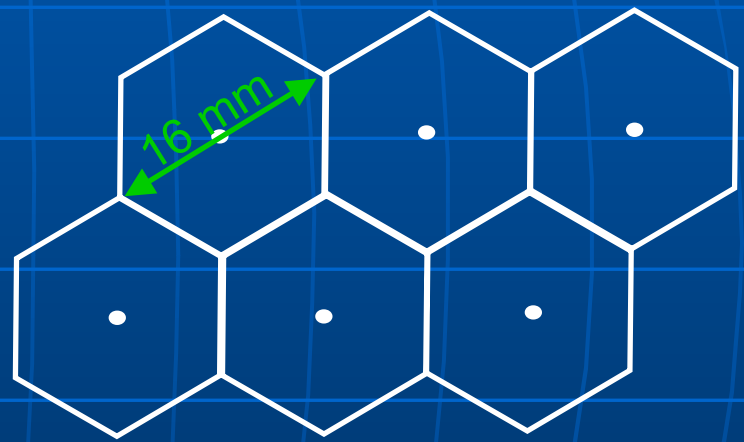
Fast protons in forward direction



Requirements: close to 100% detection for MIPs,
$\Delta p/p \leq 3\times10^{-3} \Rightarrow \Delta X$ and $\Delta Y \leq 200$ μm,
geometrical acceptance ±80 mrad

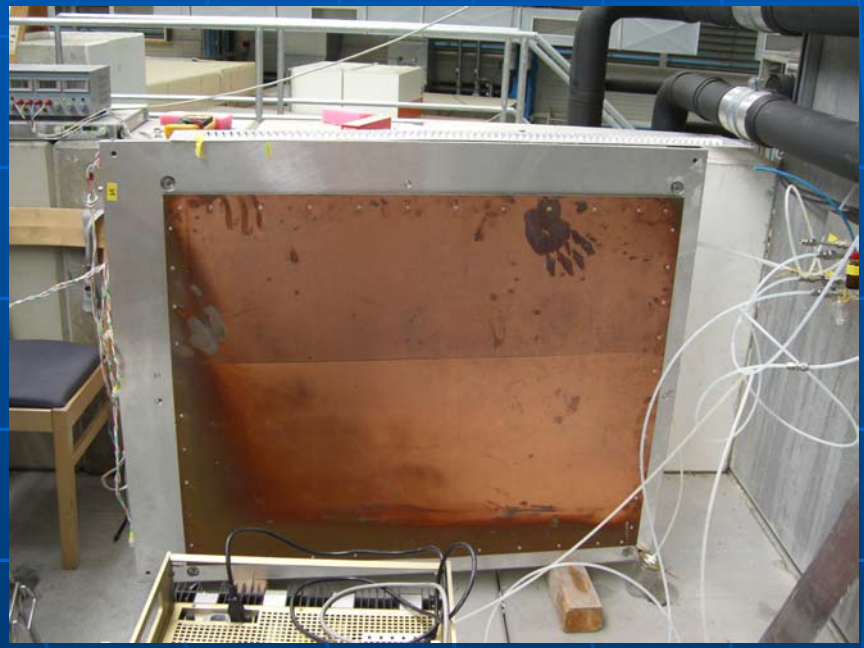
Basic parameters of detectors

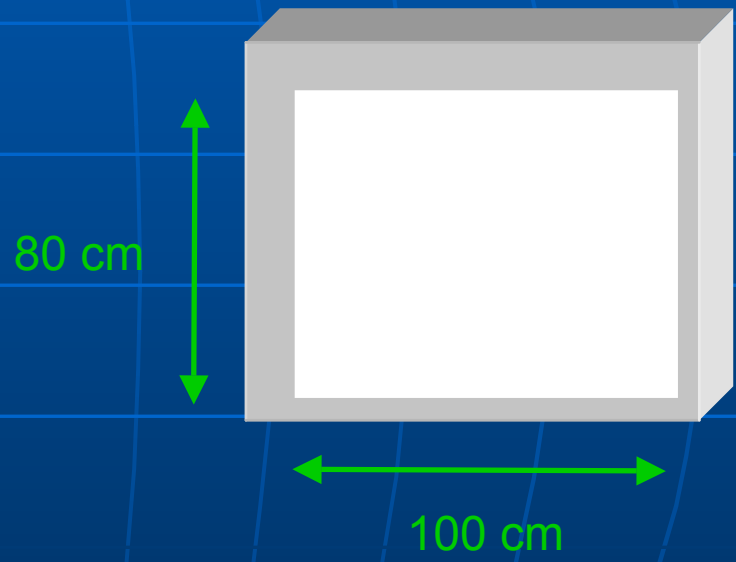
- Two drift chambers
- Active area: 100 x 80 cm^2
- 144 (x) and 112 (y) channels per chamber
- Cells with hexagonal geometry
- Wires: 75 μm, Cu-Be (field); 25 μm, W-Au (sense)
- Cell diameter 16 mm
- Gas mixture Ar:CO_2 = 80:20
- Efficiency ~ 95%
- Spatial resolution ≤ 200 μm



Proven solution - SPES-4π experiment at Saclay

Prototypes





- Two detectors made in May 2006 at PNPI, St. Petersburg
- Complete detector system with full readout

Infrastructure

- Special test stand is organized at GSI
- Two mounting frames
- Gas system
- HV system
- LV system
- Responsibility of Frankfurt University

Basic scheme of CROS3 readout

16_AD Board:
16-channel
Amplifier Shaper
Discriminator

- Complete On-Chamber Multiwire Readout System
- Programmable Thresholds, Delays and Gates
- Time Distribution Measurement for Hit within Gate
- High Density, Low Power Packaging
- Interfaces to PCI and Ethernet
- Extremely Low Cost
- Two options of the system in progress:

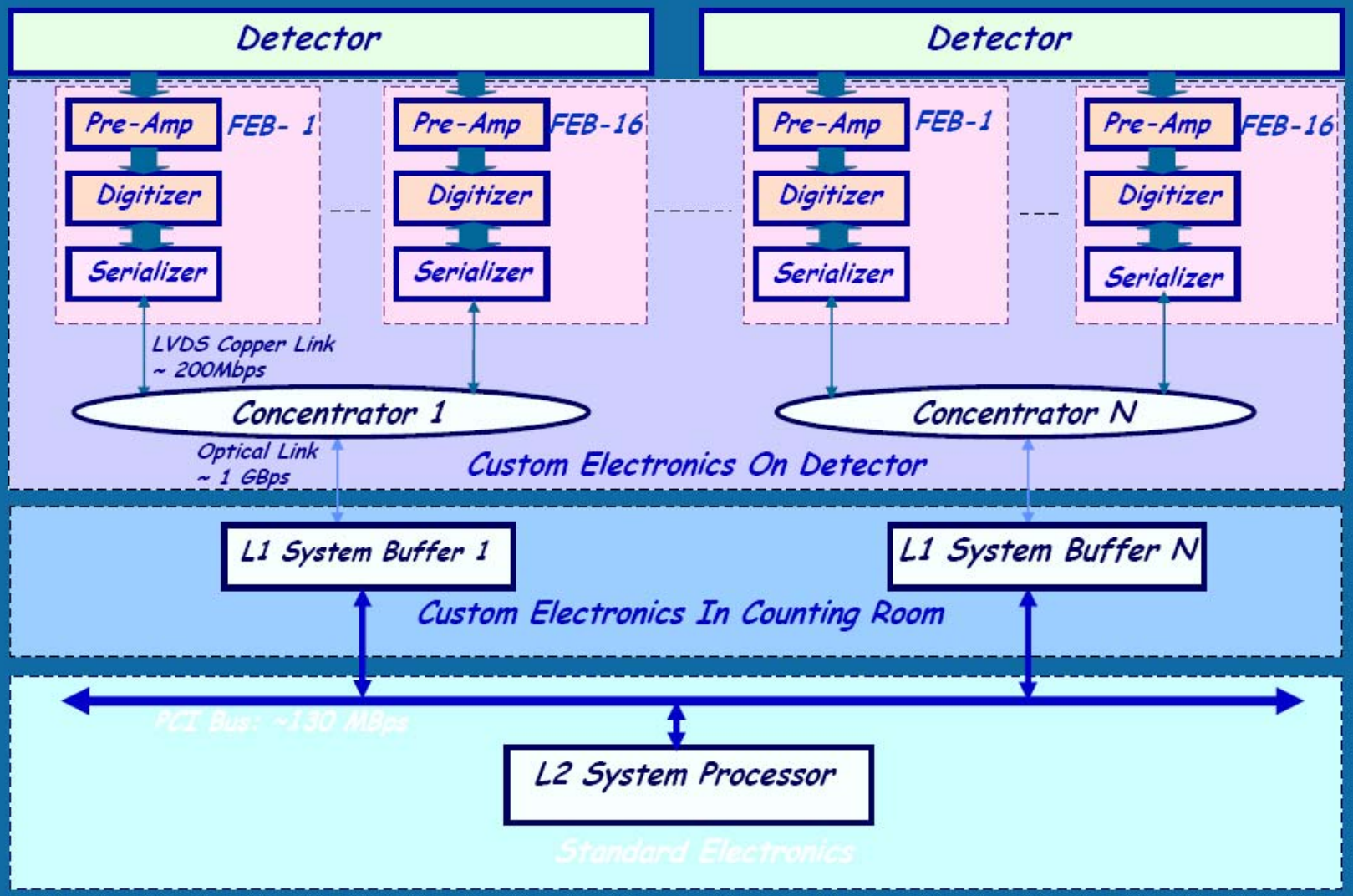
CROS3_PWC – for Proportional Wire Chambers
CROS3_DC – for Drift Chamber

The System Specific Features:

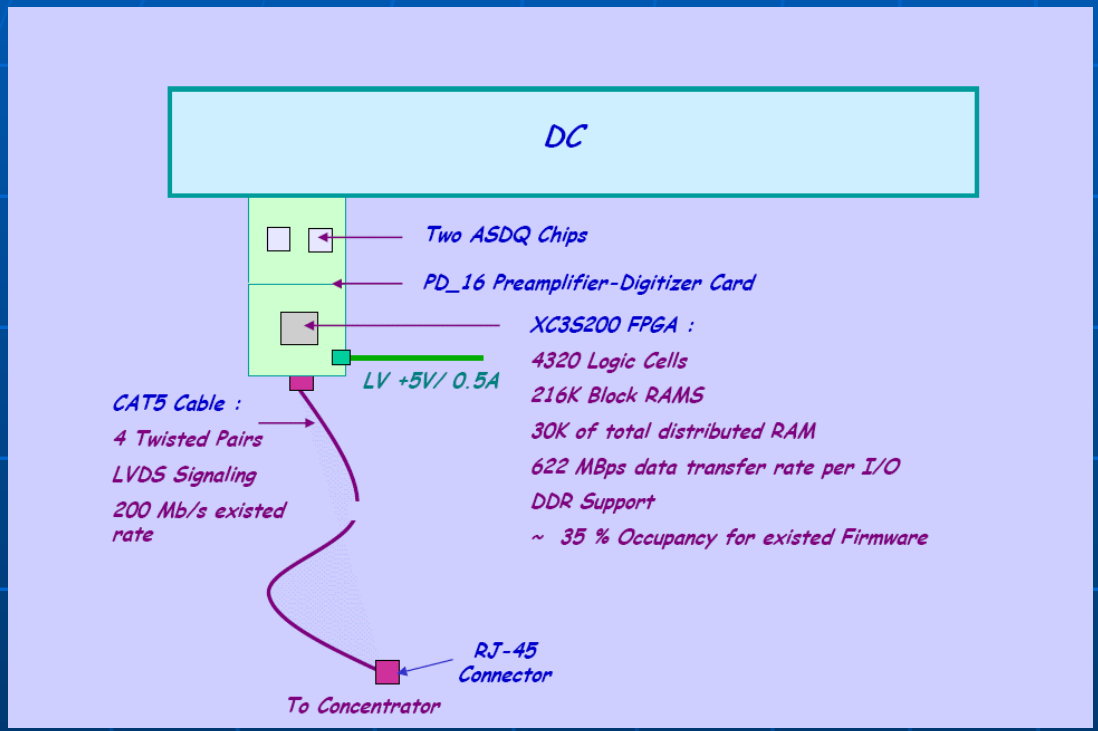
Continuous digitization of the input data stream
Adjustable digital delay within 512 steps. The step ≤2.5 ns
Adjustable digital gate within 128 slices. The step ≤2.5 ns
LVDS signaling interconnect technology for short distance data path
Optical link technology for long distance data path
The core elements of the system are CMP16_G ASIC , SPARTAN 3 FPGA XC3S200

ACD8 ASIC

CROS3 structure

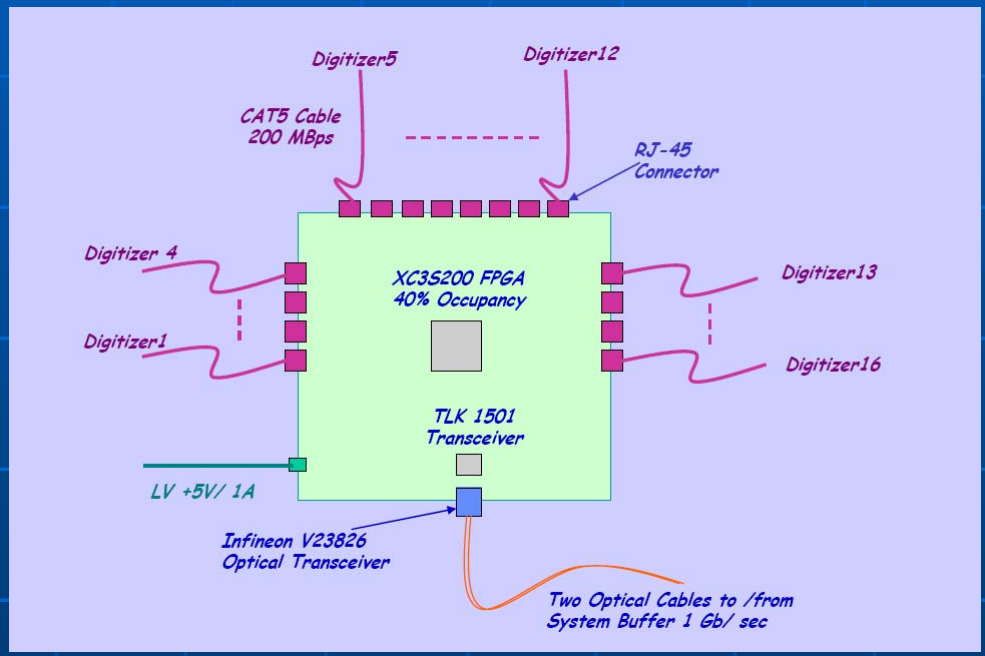


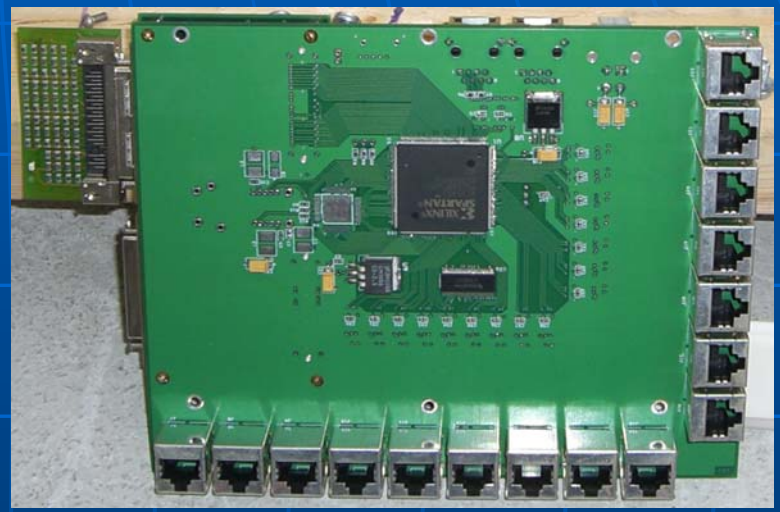
Frontend board



32 boards for two detectors, successfully tested

Concentrator board





- External Trigger needed
- Interface to PCI-based DAQ and GSI DAQ via GTB
- PCI-based version tested

Timescale

October 2005	visit to PNPI
May 2006	Detectors and part of FEE delivered
June - August 2006	commissioning of detectors (HV stability)
September 2006	final delivery of read-out components commissioning of readout electronics by experts from PNPI, readout via PCI

Future activities

- Programming of GTB Interface (GSI responsibility)
- Development of software for unpacking and hit reconstruction
- Measurement of intrinsic chamber parameters (efficiency and spatial resolution)
- Test under realistic conditions 20-21 November
- Possible first use during an experiment in Cave C – first part 2007

(If all successful) – first detector system for R3B!