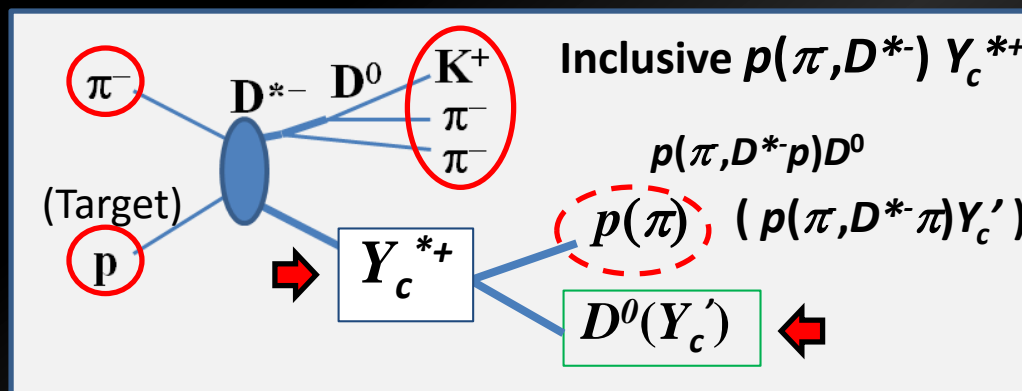


E50

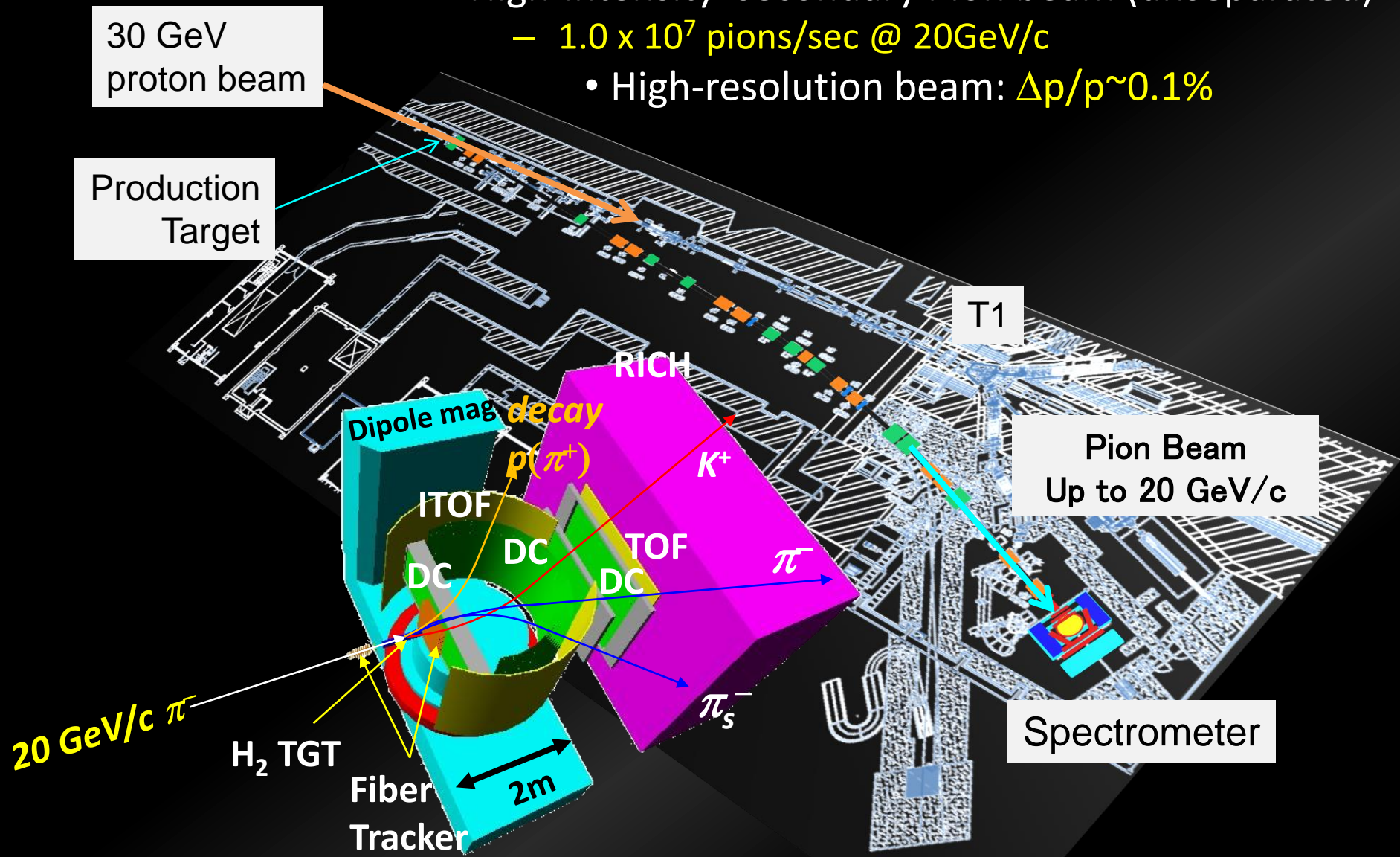
Charmed Baryon Spectroscopy via the (π, D^{*-}) reactions

H. Noumi for E50, RCNP, Osaka University



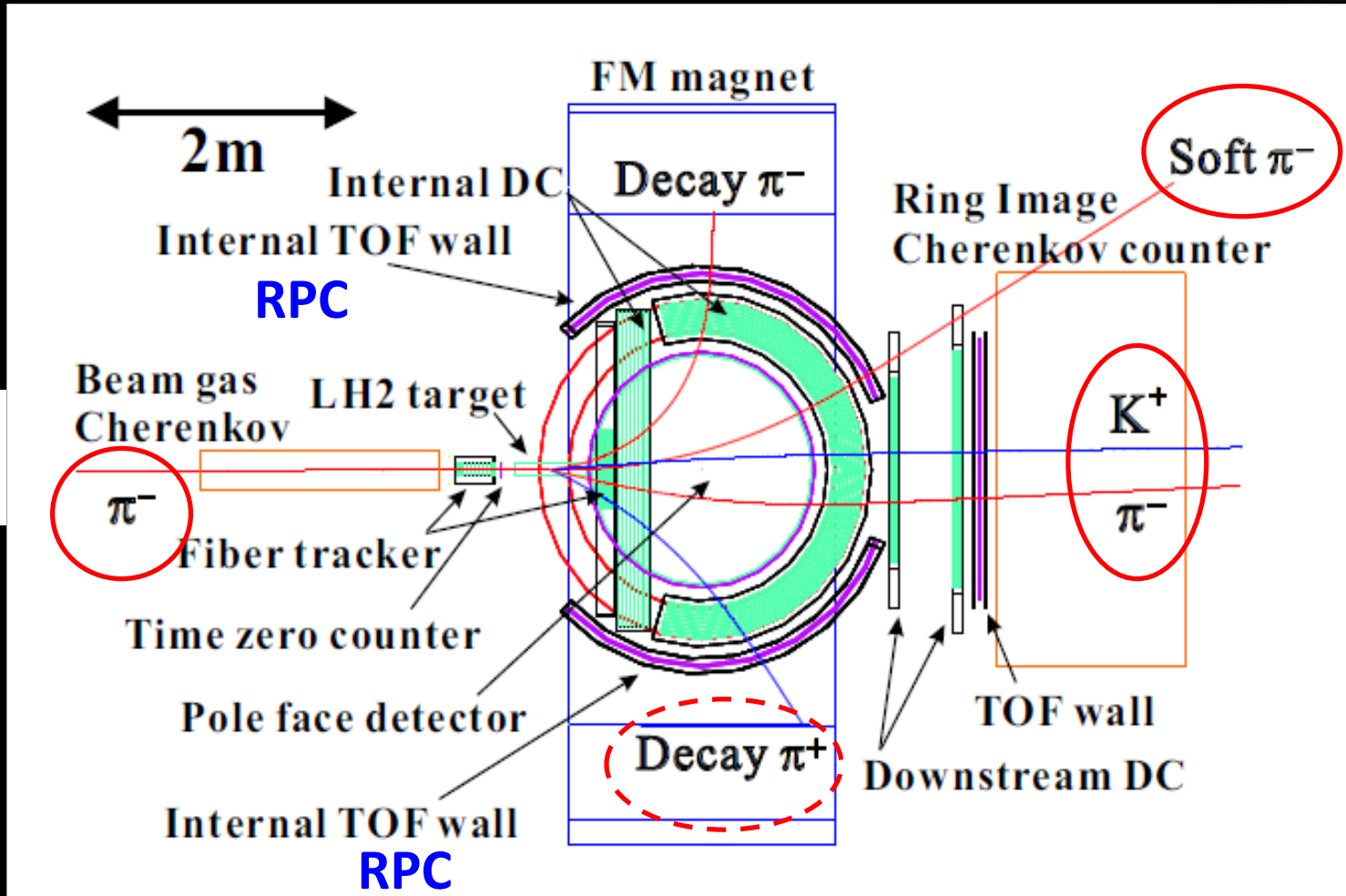
High-res., High-momentum Beam Line

- High-intensity secondary Pion beam (unseparated)
 - 1.0×10^7 pions/sec @ 20 GeV/c
- High-resolution beam: $\Delta p/p \sim 0.1\%$



Spectrometer

Design for realistic layout is under progress.



Large acceptance $\sim 60\%$ (for D^*), $\sim 85\%$ (for decay π^+)
Good resolution: $\Delta p/p \sim 0.2\%$ at $\sim 5 \text{ GeV}/c$

Missing Mass Spectrum (Sim.)

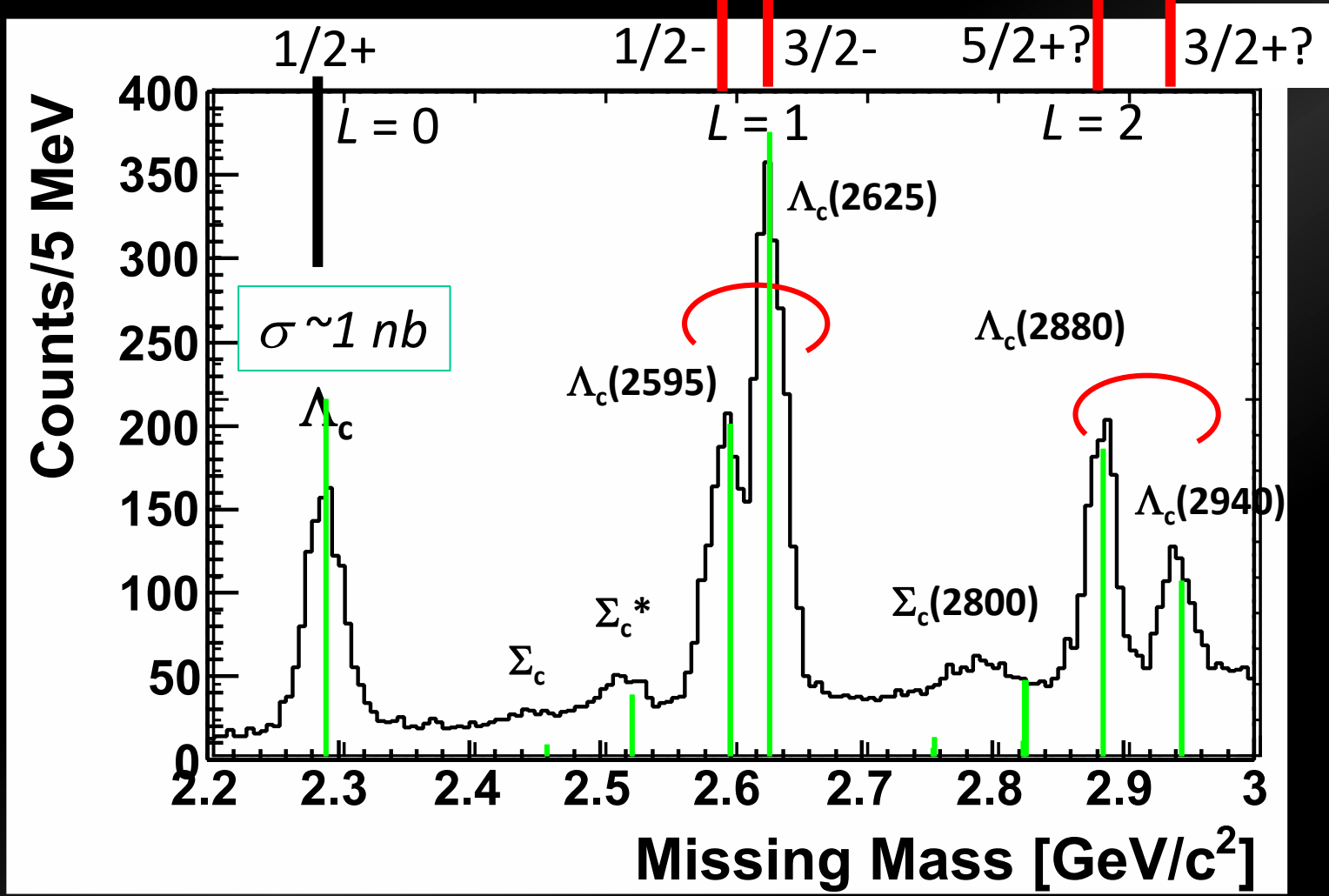
- $\sim 1000 Y_c^*/\text{nb}/100 \text{ days}$
- Sensitivity: $\sigma \sim 0.1 \text{ nb}$ for $Y_c^* w/ \Gamma = 100 \text{ MeV}$

1 : 2

3 : 2

LS partner
(HQS doublet)

LS partner?
(HQS doublet?)



Last PAC minutes

E50 presented an update on their plans for a charm baryon experiment using the recoil mass technique. Following PAC suggestions, the collaboration has started a closer interaction with QCD lattice theorists to better investigate the hadronic amplitudes relevant to this experiment, and correspondingly optimize its physics goal. The PAC looks forward to see the first results of this interaction.

At the same time, the collaboration has started to investigate a possible extension of its physics program joining forces with other experimental groups interested in related activities on the high-P beamline at J-PARC. Particularly interesting could be the possibility of studying the formation of the recently discovered pentaquark state, via an appropriately modified experimental set-up aimed at precise identification of di-muon resonances ($J/\psi\pi\psi$, etc....).

The PAC strongly encourages this and other extensions of the physics program of E50, as well as the extension of the original experimental set-up toward a “multi-purpose” detector. A systematic analysis of possible realistic options along these lines should be pursued.

Concerns on safety aspects of the high-P beam-line for E50 have been raised by the FIFC. In view of this potentially serious impact, the PAC suggests that IPNS further investigate this issue in detail.

Collaborations w/ theorists

- Production: S.H. Kim, H.C. Kim, Hosaka, HN
 - Phys.Rev. D92, (2015)094021:
- Decay: Nagahiro, Yasui, Hosaka, HN
 - $Y_C^* \rightarrow \pi Y_C$: rho/lambda mode (to be submitted soon)
- LQCD: Ishii, Murano, Sugiura, Watanabe, Hosaka, HN
 - Form Factor, Coupling Constant

Recent News

- Grant in Aid from MEXT (A: JFY2016-2018)
 - R&D for High Speed Detectors
 - Fiber Tracker and High Speed T0 counter
 - RPC (high time resolution)
 - R&D for High Speed DAQ
 - Front-end Electronics with Trigger-less Readout
 - Test Bench for Streaming DAQ: PC Farm
 - Load-balancing of CPU/GPU (Alice O2 Project)
 - Fast On-line Tracking
 - Hire PD
 - BL Equipment under Supervision of the Facility Group
- Joint Effort under the High-p Collaboration

High-p Collaboration

- Cooperative works of activities at High-p BL
 - E50+E16+J-PARC-HI+Potential Users+Facility Group
 - SSD to be installed for E16
- Detectors
 - Large Strip RPC for LEPS2
- High Speed DAQ
 - ALICE O2 as associate members ([approved recently](#))
- Enhances Physics Cases
 - Muon ID: J/ψ , dimuon \rightarrow preparing the Lol (W.C.Chang et al.)
- Facility
 - Production TGT, BSO, Magnets, Radiation Safety, etc.

High-rate detectors

- * High-rate beam

- 6×10^7 /spill
- (30 MHz @ 2 sec spill)

- Focal plane detector

- Focal plane region
- Beam momentum analysis
 - Position and angle

- Beam tracker

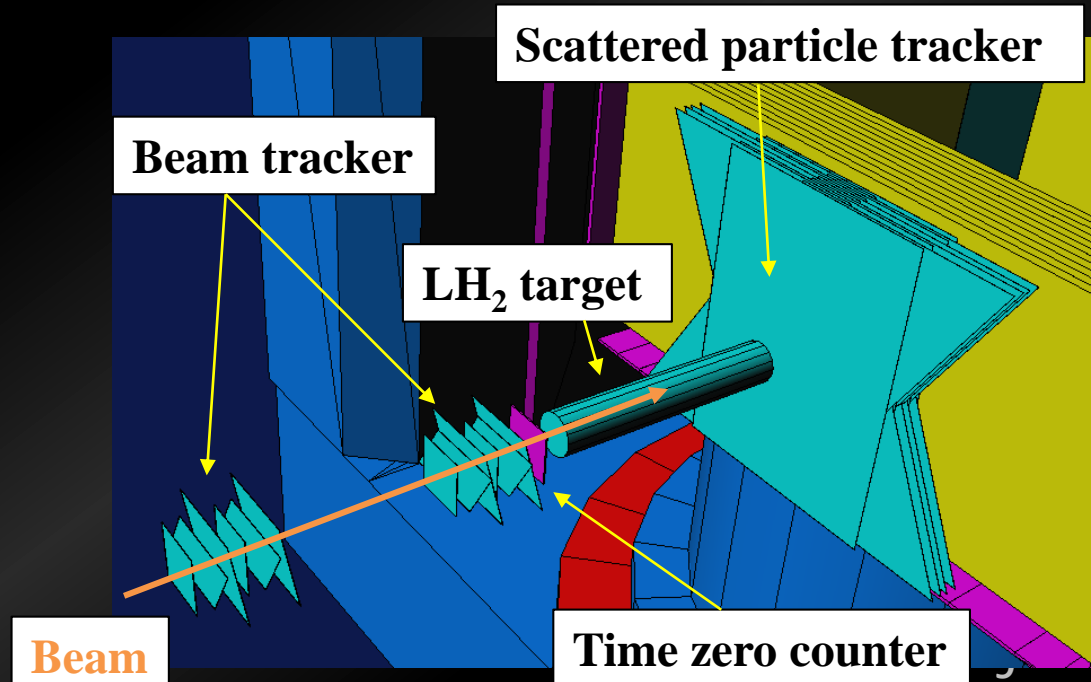
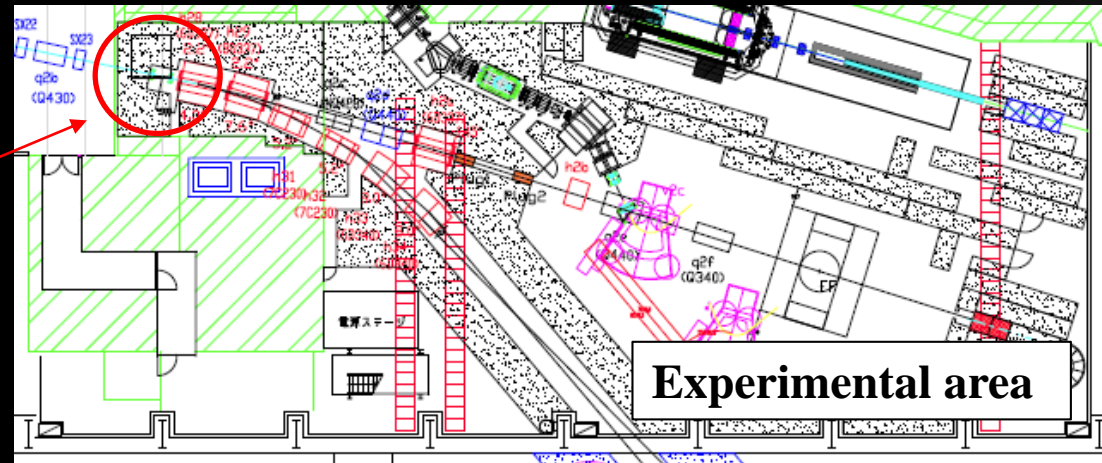
- At the target upstream
- Size: 100 mm × 100 mm

- Scattered particle tracker

- At the target downstream
- 600 mm × 800 mm

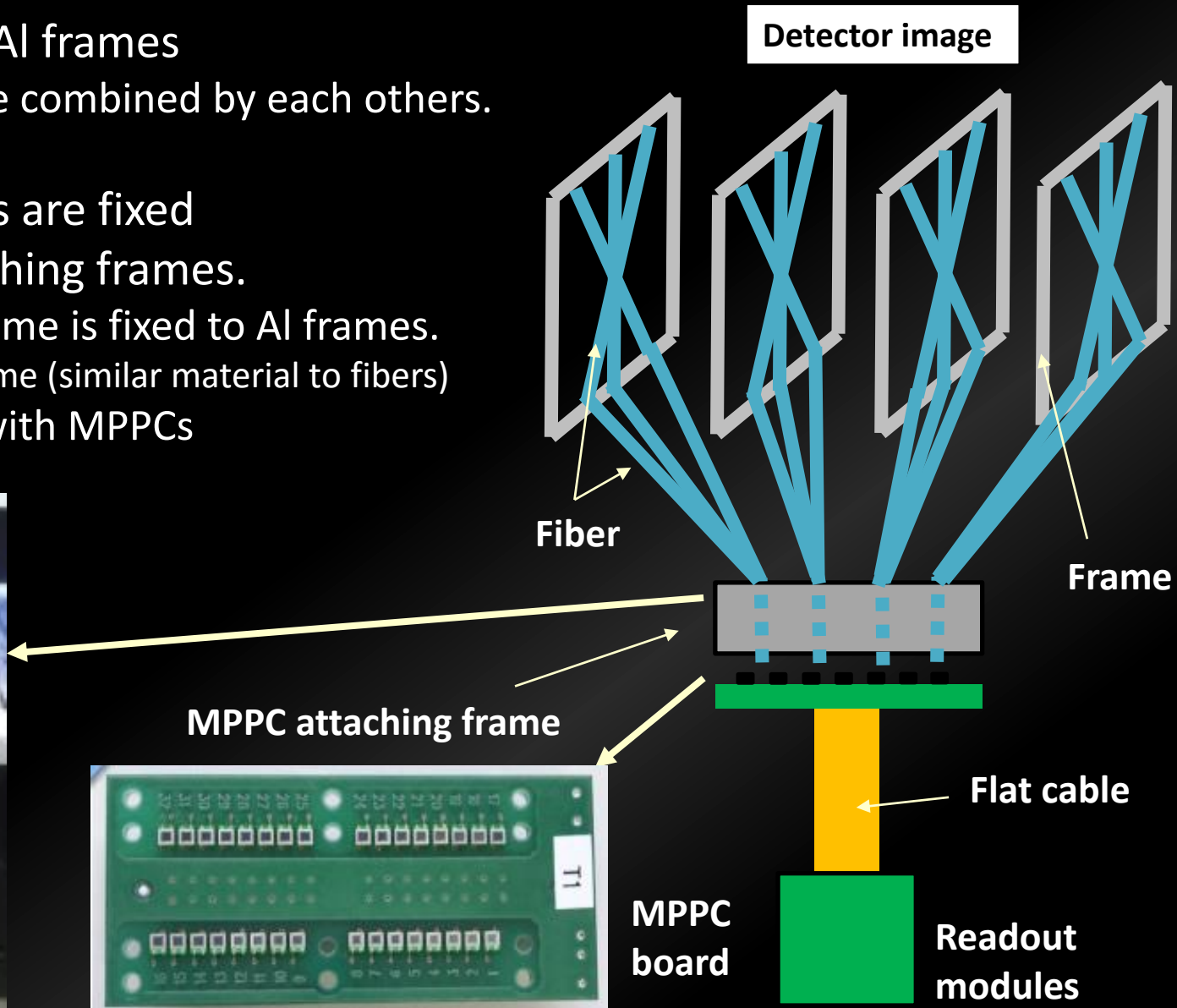
- Time zero counter

- At the target upstream
- Reference timing for TOF



Production of prototype detector

- Fibers fixed to Al frames
 - Al frames are combined by each others.
- Extracted fibers are fixed to the MPPC attaching frames.
 - Attaching frame is fixed to Al frames.
 - Plastic frame (similar material to fibers)
 - Air contact with MPPCs



Production of prototype detector

Fiber Sheet Tech. is well established (M-Line Co.)

Detector image

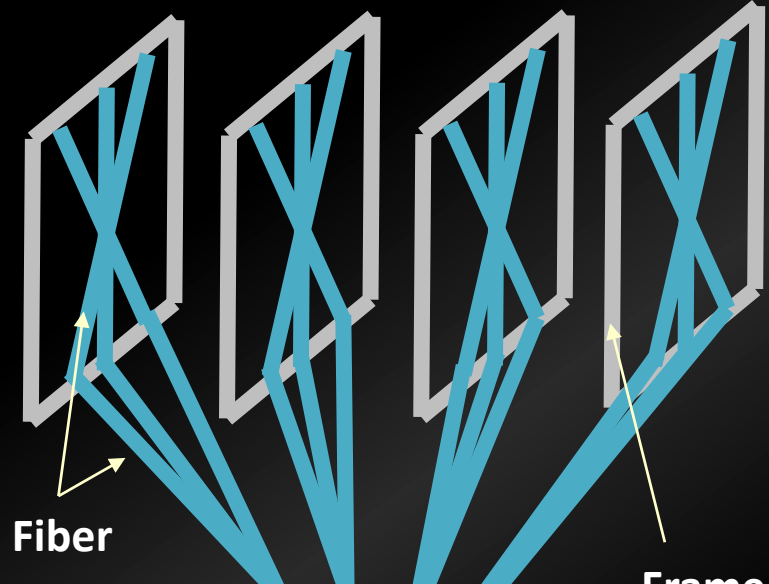
Thickness ($150\mu\text{m} + 25\mu\text{m}$)

Glue (Epoxy)

SCIFI $\times 40$ 本

PIシート

PEI sheet ($25\mu\text{m}$)



Fiber

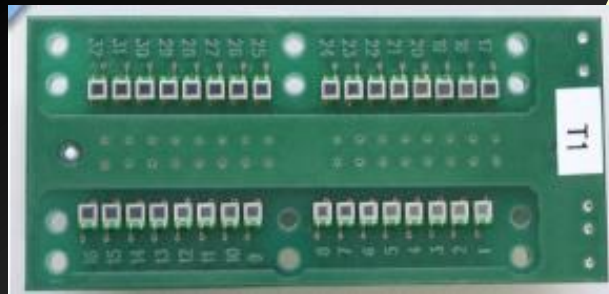
Frame

MPPC attaching frame

Flat cable

MPPC board

Readout modules

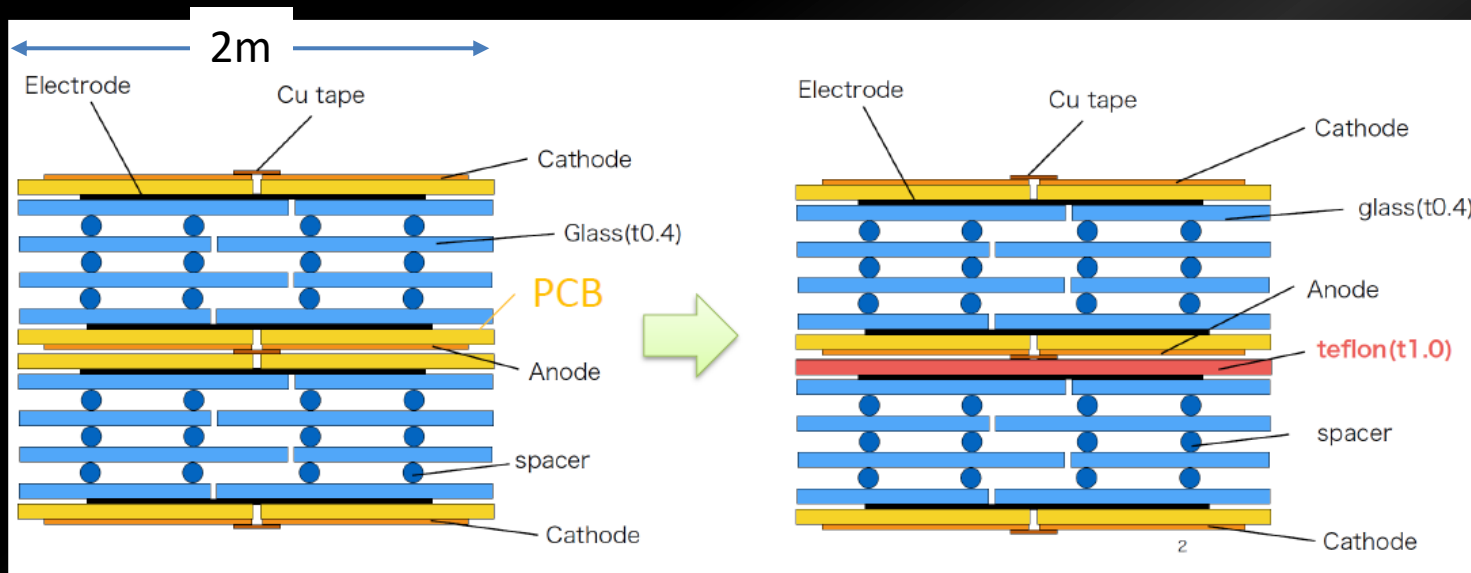


Large Strip RPC

By N. Tomida (RCNP)

- 2m Long RPC for LEPS2
 - Signal reflection caused by Impedance Matching
 - Dispersion during Signal Propagation
 - Transmission Line Theory (D. Gonzalez-Diaz)

Change Materials to minimize dispersion during Signal Propagation,
changing coupling C to control Signal Propagation Speed



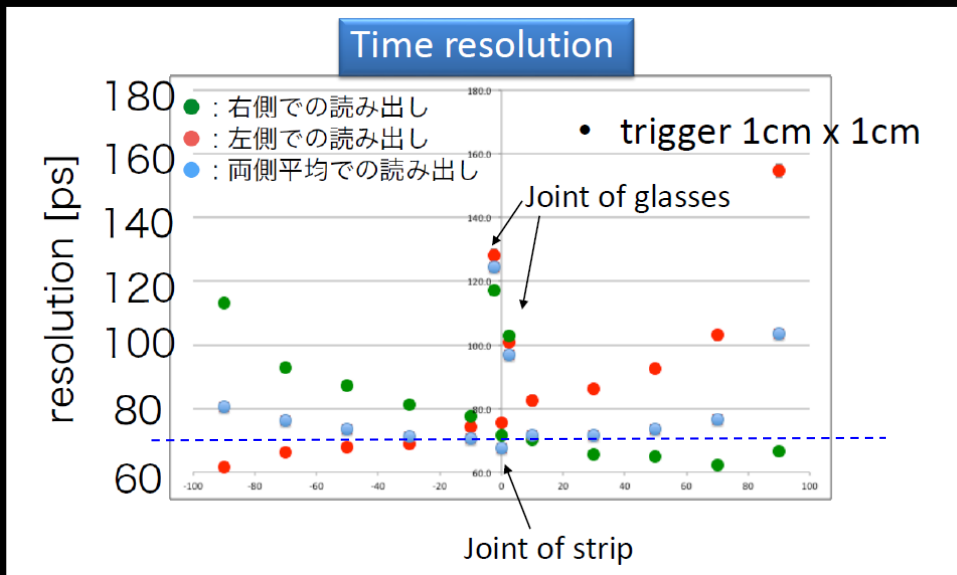
Large Strip RPC

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 - Transmission Line Theory (D. Gonzalez-Diaz)

Before (res. ~ 70 ps)

After (res. to be improved)



Now Testing
at SPring-8

High-speed DAQ system for E50

Streaming DAQ (~50 GB/spill)

Frontend modules

- * Signal digitalization
- Pipelined system

Buffer PCs

- * Data accumulation
- Several 10 GB memories

* High-speed data link (Local)

~50 GB/spill

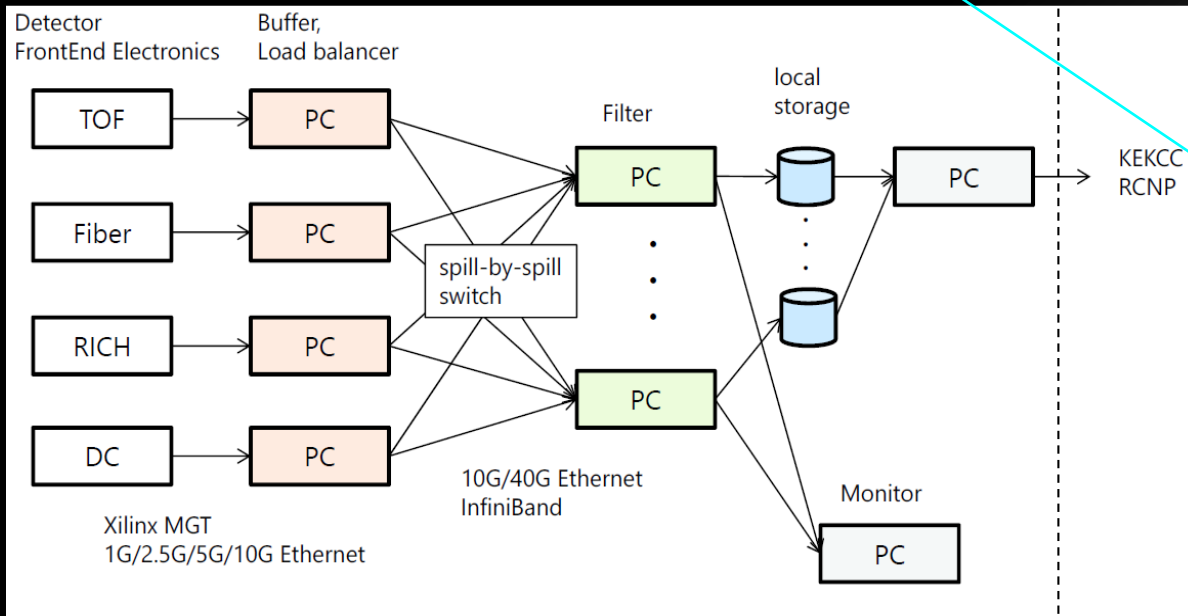
Filter PCs

- * Event reconstruction
- 100-200 CPUs

<0.5 GB/spill

Storage

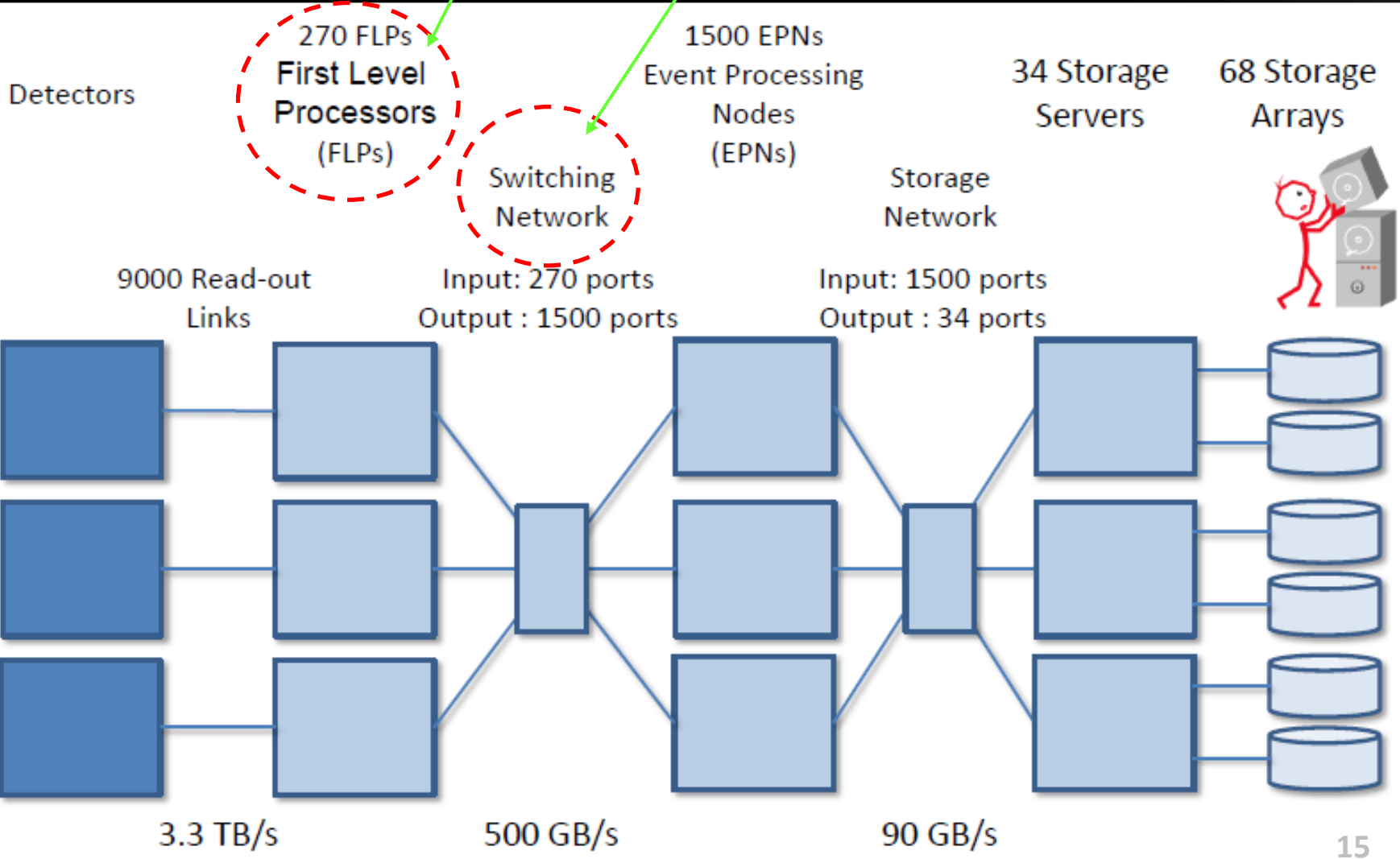
- Local storage
- Transferred to KEKCC/RCNP



ALICE O2 Hardware Facility

Software R&D (Sako)

Load Balancing/Data Flow Regulation R&D (Ma)



LEPS/J-PARC joint R&D FPGA-based HR-TDC Test Board

OPamp
comparator
DRS4
AD9637
(ADC 12bit, 40MSPS)

$\sigma_t \sim 20\text{ps}$ ($=28/\sqrt{2}\text{ps}$)
w/ Clock Pulse
→ Test at LEPS

FPGA
Spartan-6
LX150

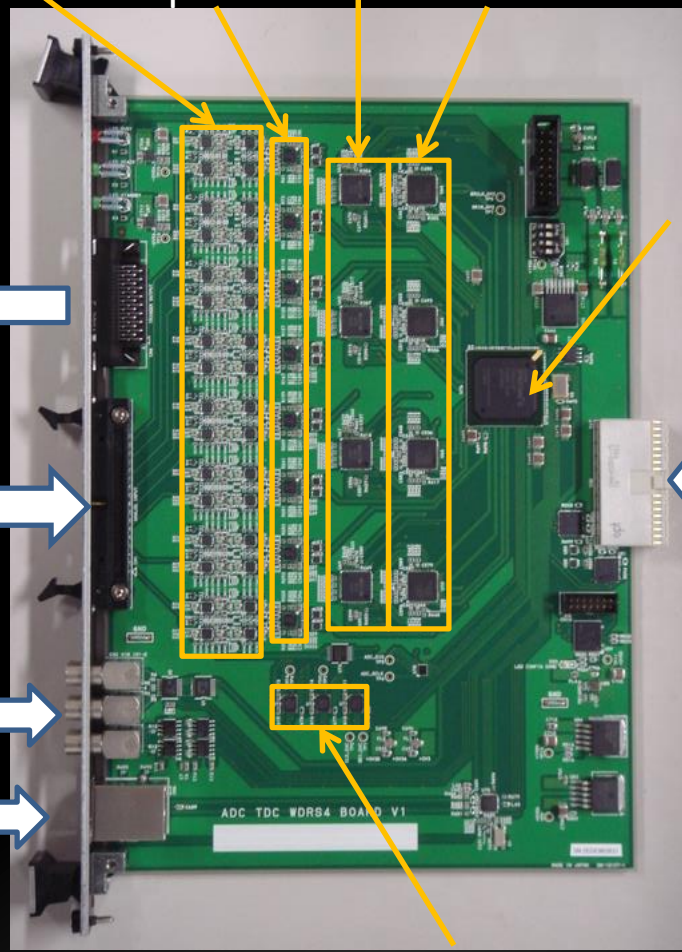
comparator out
(LVDS)
16 ch

analog input
(single-end)
16 ch

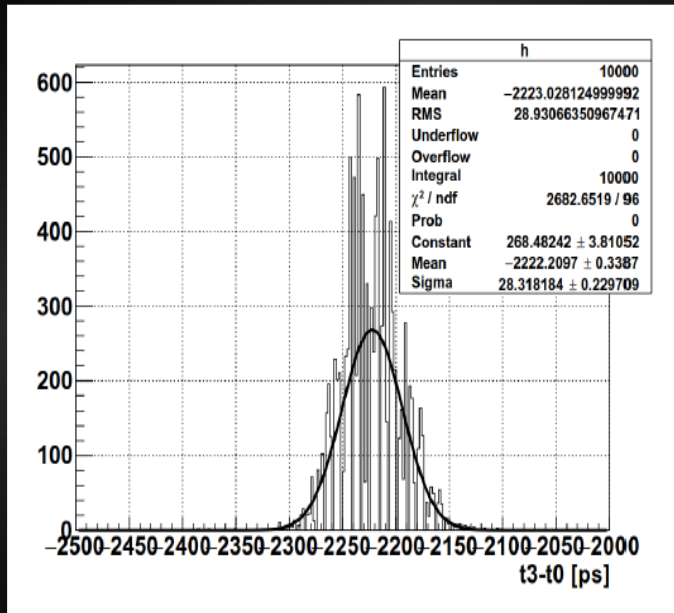
User I/O (NIM)

100BASE-T

KEK-VME
+3.3V
-3.3V



DAC (for bias, threshold)



By T.N. Takahashi(RCNP)

High-p Collaboration

- Cooperative works of activities at High-p BL
 - E50+E16+J-PARC-HI+Potential Users+Facility Group
 - SSD to be installed for E16
- Detectors
 - Large Strip RPC from LEPS-II
- High Speed DAQ
 - ALICE O2 as associate members ([approved recently](#))
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 - Muon ID: J/ψ , dimuon \rightarrow preparing the Lol (W.C.Chang et al.)
- Facility
 - Production TGT, BSO, Magnets, Radiation Safety, etc.

We will continue joint efforts under the High-p Collaboration...