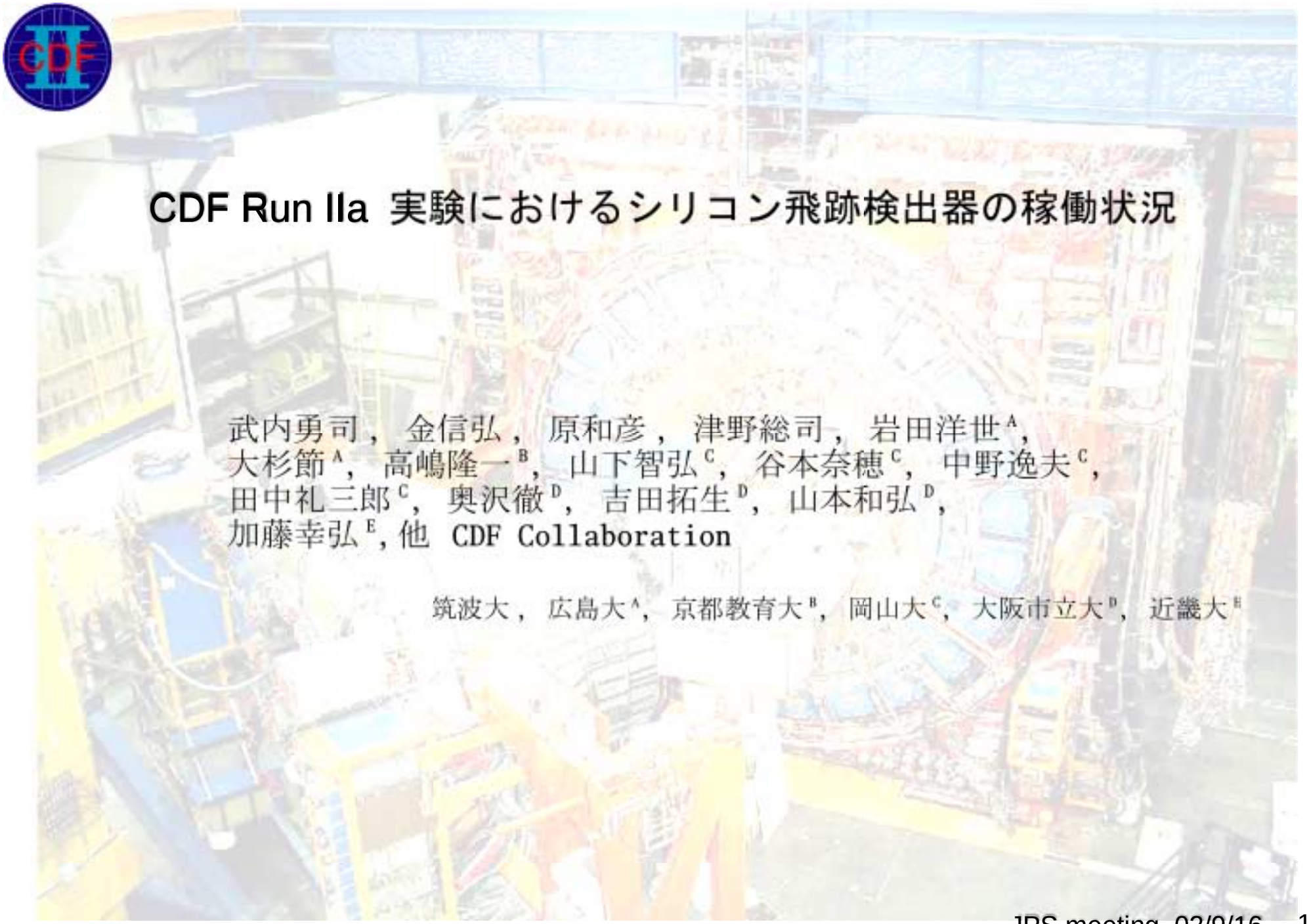

CDF Run IIa 実験におけるシリコン飛跡検出器の稼働状況

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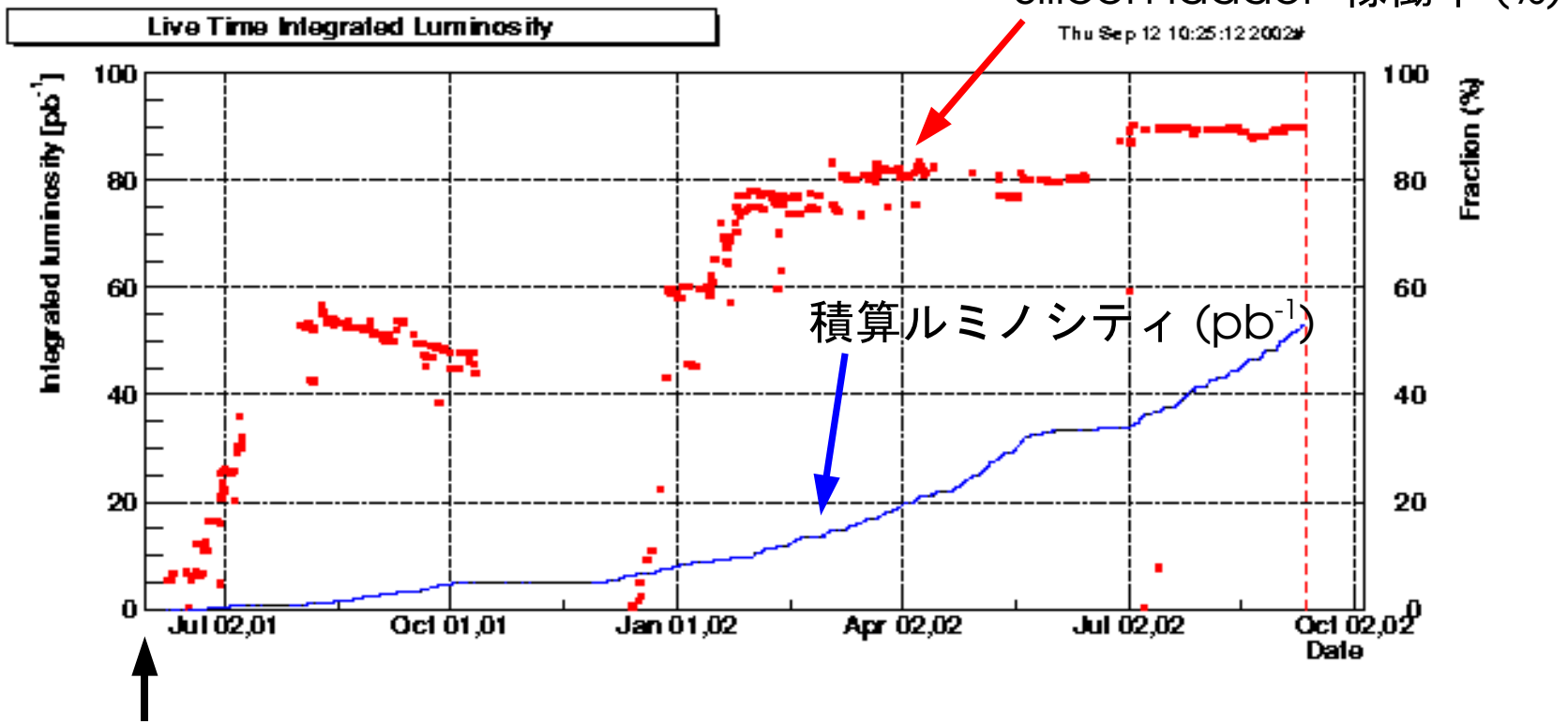
大杉節[A]，高嶋隆一[B]，山下智弘[C]，谷本奈穂[C]，中野逸夫[C]，
田中礼三郎[C]，奥沢徹[D]，吉田拓生[D]，山本和弘[D]，
加藤幸弘[E]，他 CDF Collaboration

筑波大，広島大[A]，京都教育大[B]，岡山大[C]，大阪市立大[D]，近畿大[E]

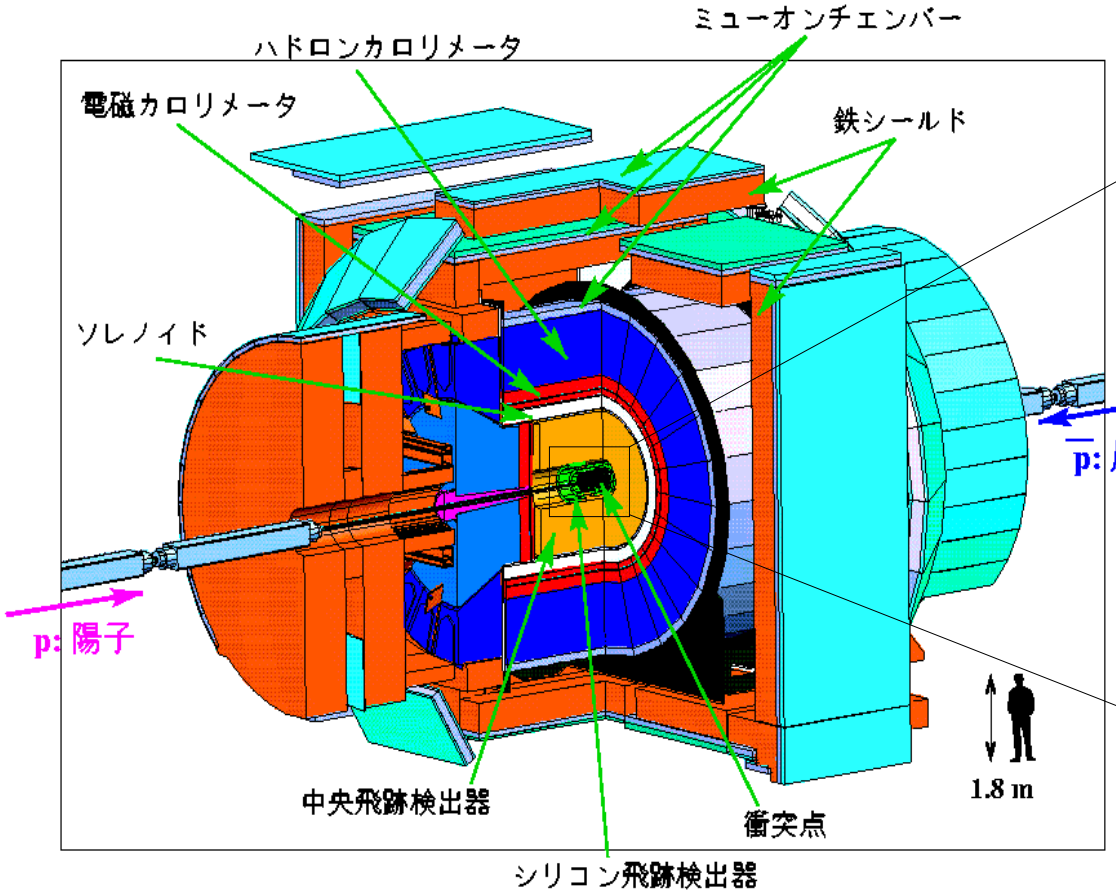
Introduction

CDF 実験 ($p\bar{p}$ $\sqrt{s}=2\,TeV$ @FNAL)

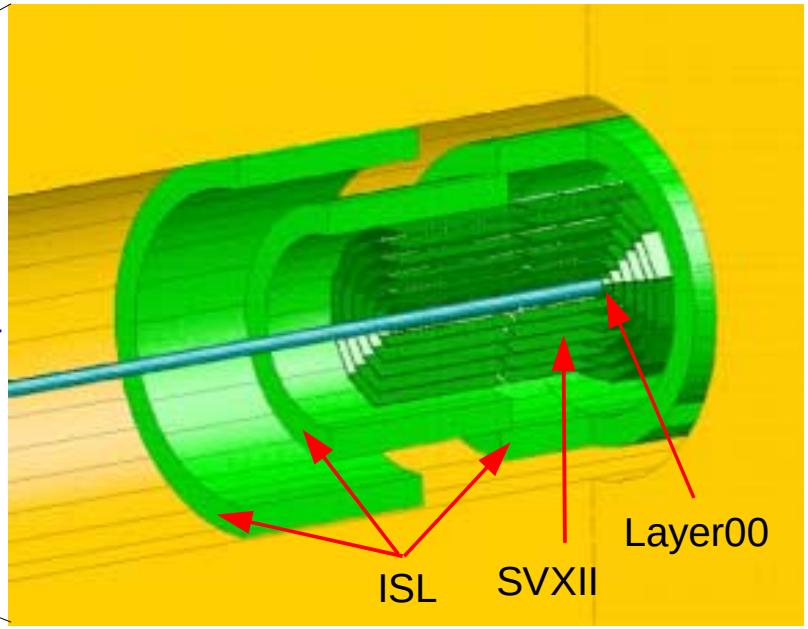
- Run IIa : 2004 年末までに 2 fb^{-1}
- Run IIb : 2005 年から開始，15 fb^{-1} ⇒ SVX2b



CDF Run IIa Detector



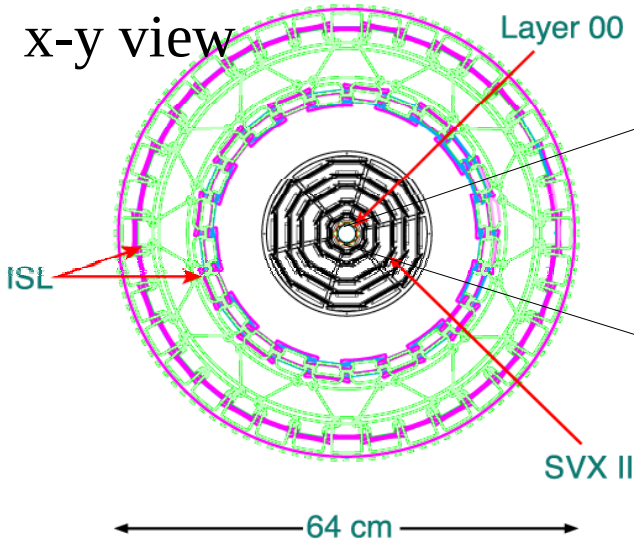
Run IIa Silicon

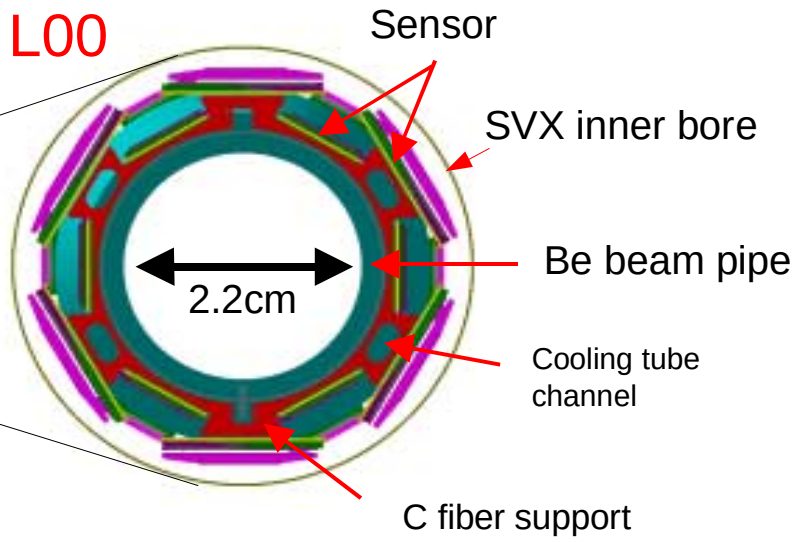


- Run IIa Silicon tracker consists of Layer00(L00), SVXII, and Intermediate Silicon Layers(ISL)

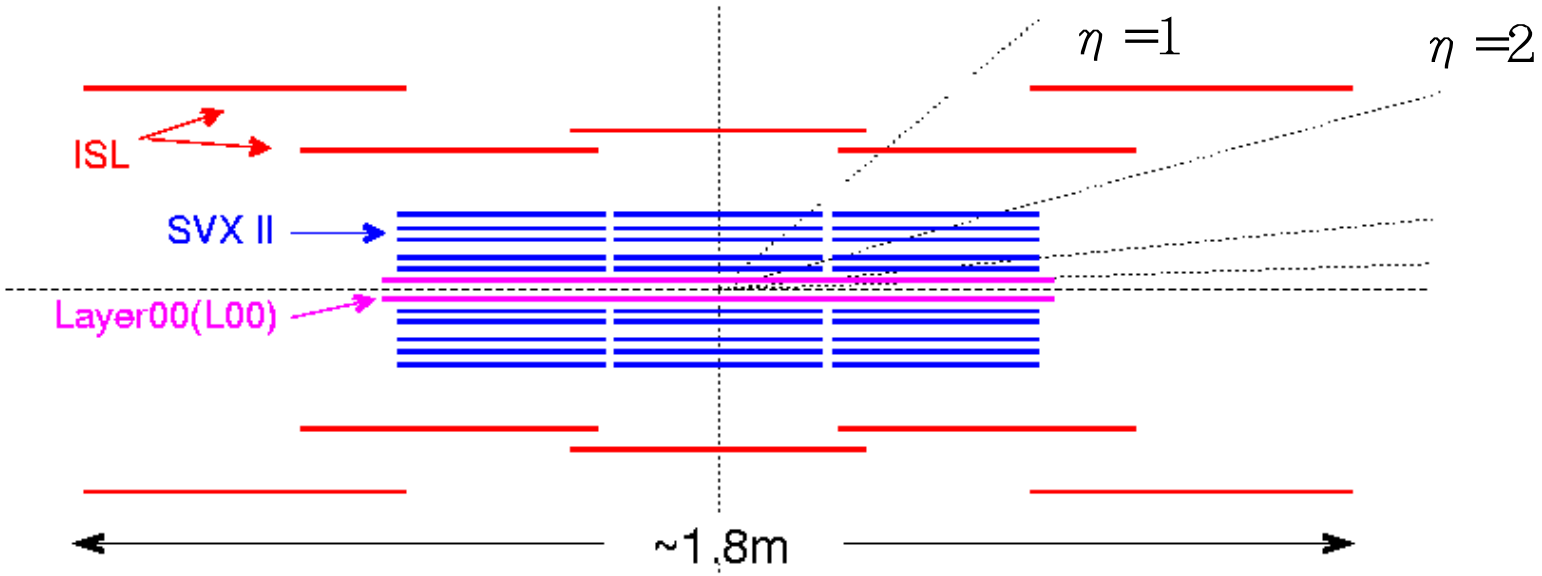
Run IIa Silicon Tracking System

x-y view

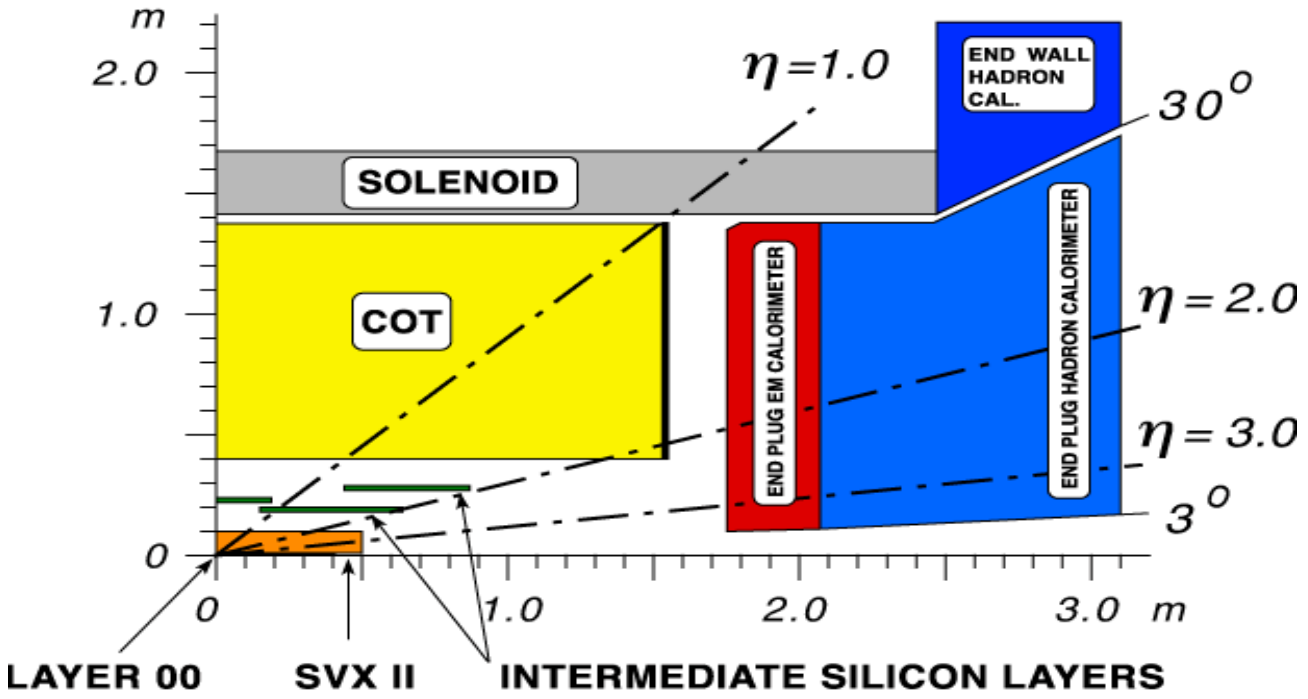




z-y view

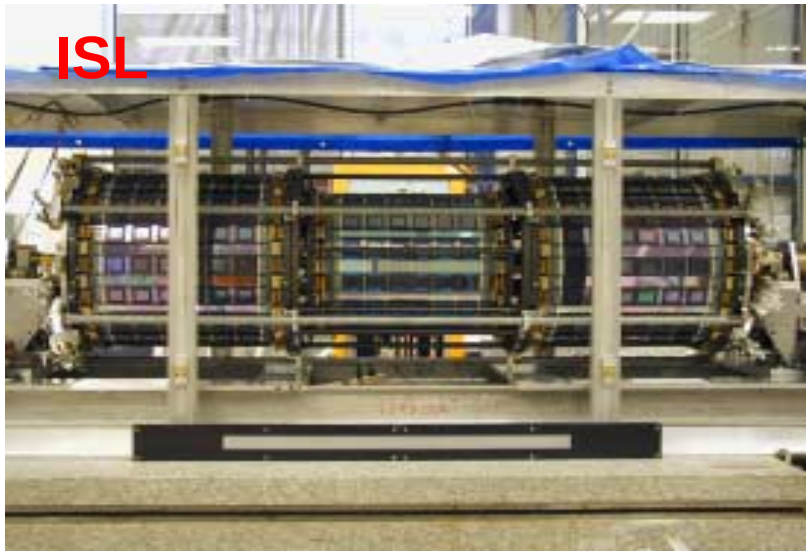


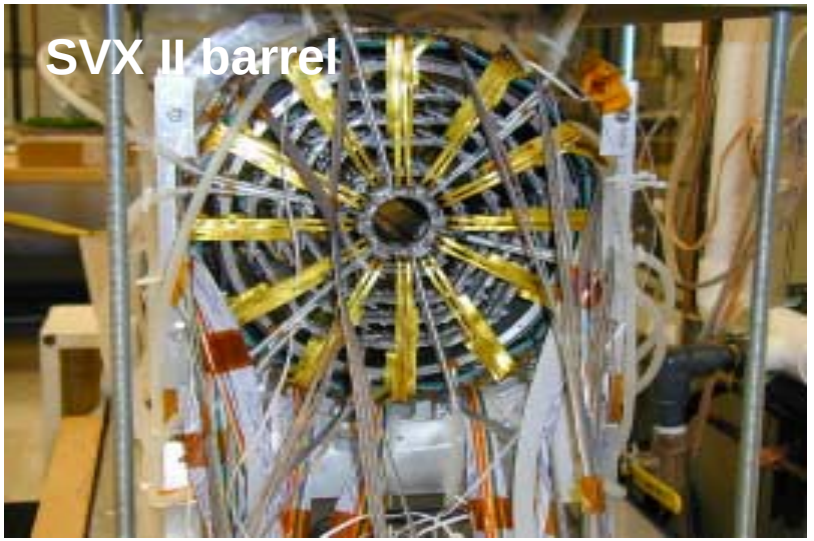
CDF Run IIa Tracking

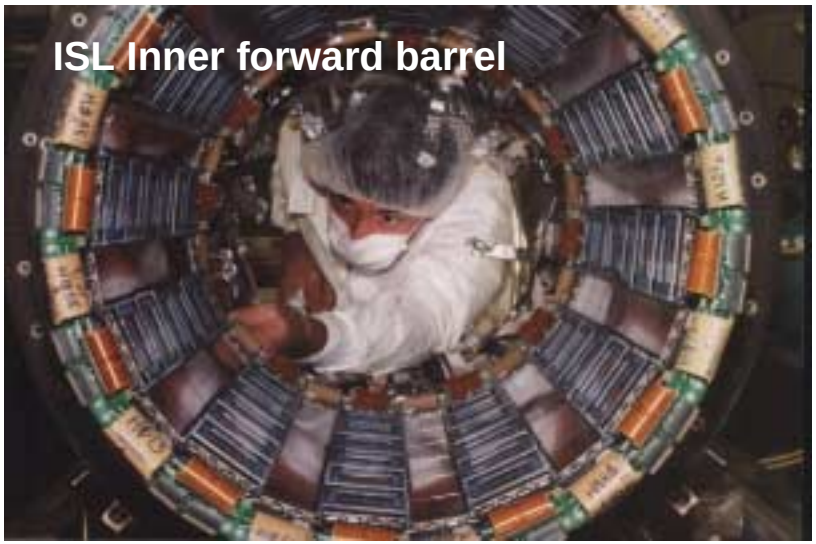


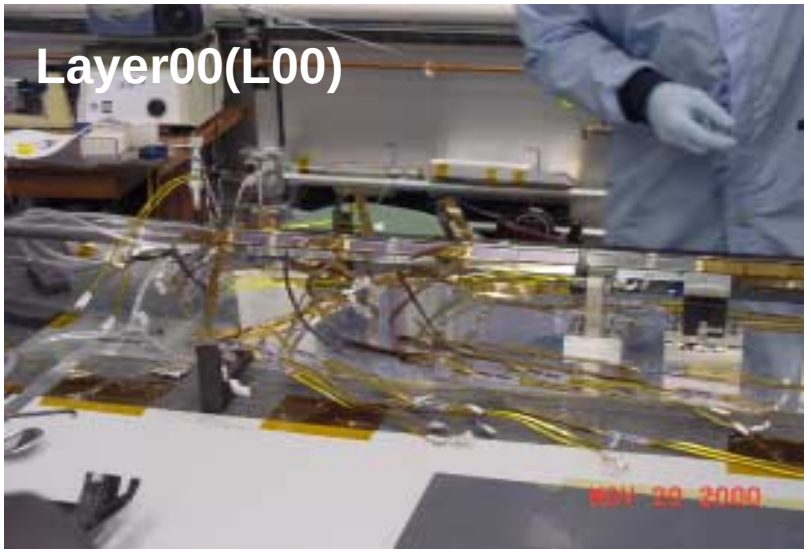
- 8 Layers, 704 ladders, 722432 Channels
  - Layer00(L00) : 1 Single Sided layer
    - 48 ladders, 13824 Channels, Improves IP resolution
  - SVXII : 5 Double Sided Layers
    - 360 ladders, 405505 Channels, 3 90º, 2 1.2º, l = 90 cm
    - 3D tracking, Displaced Track L2 trigger
  - ISL : 2 Double Sided Layers
    - 296 ladders, 303104 Channels, l = 1.8 m, |η|<2

Construction Pictures

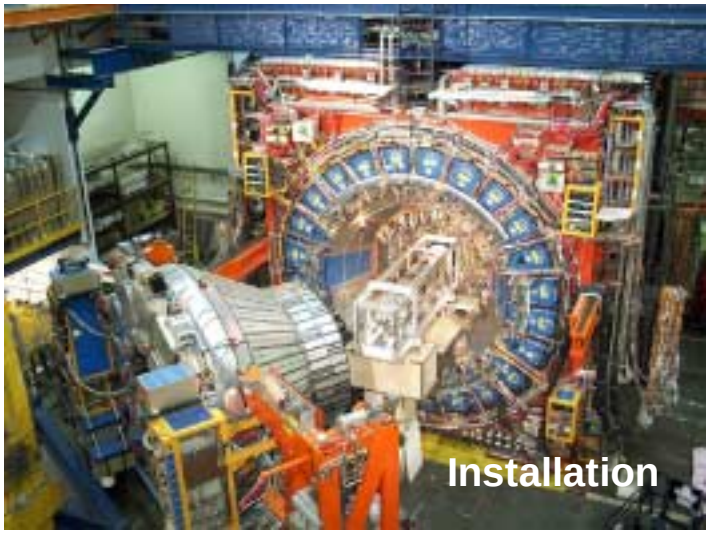






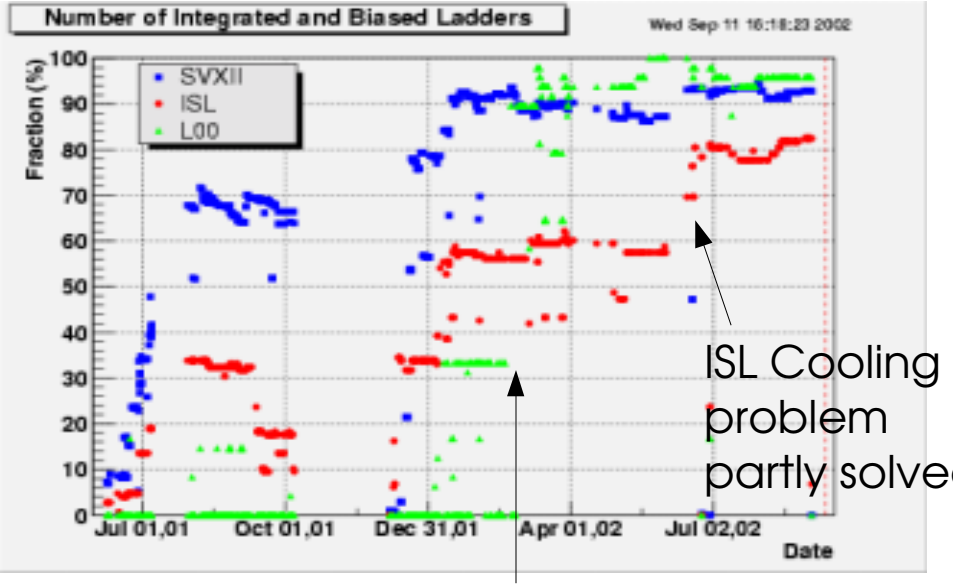


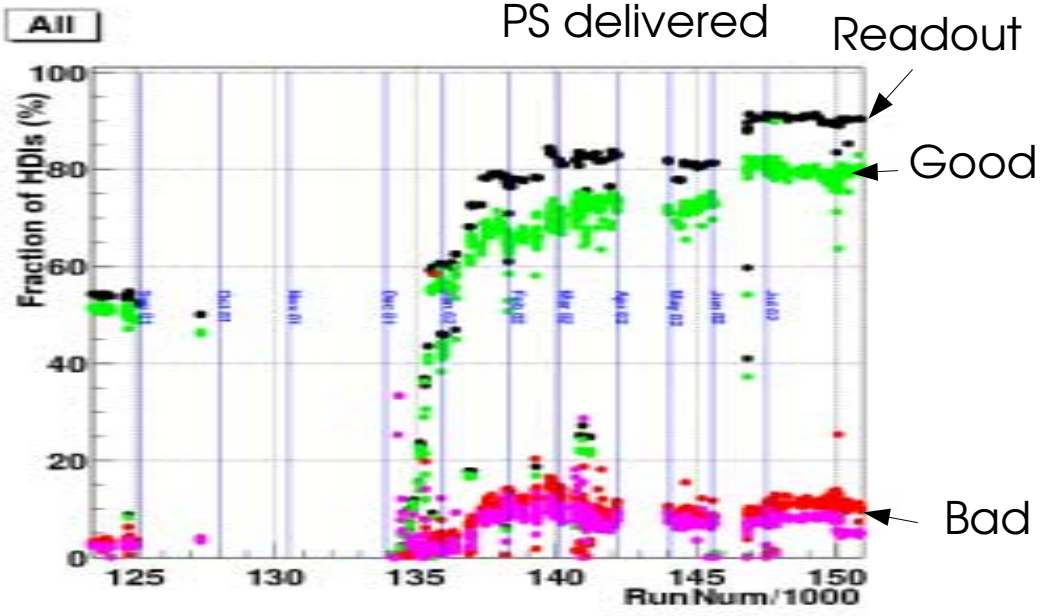
Silicon Integration and Installation



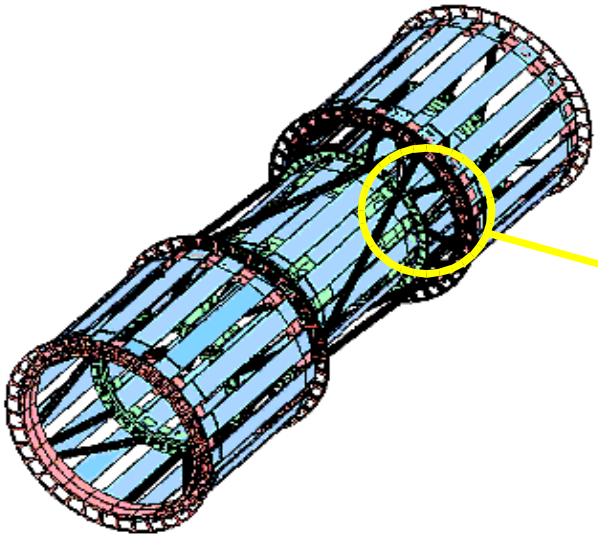
Silicon commissioning

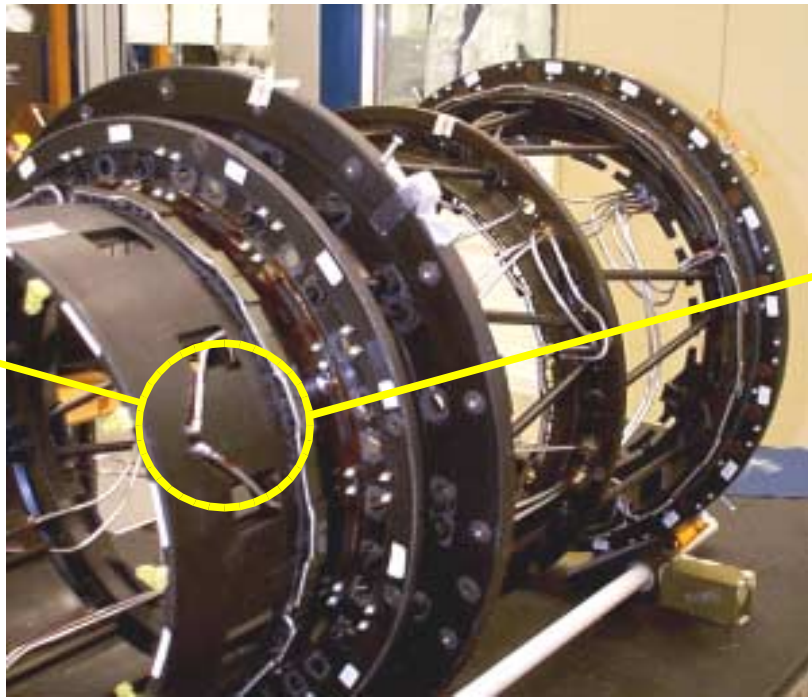
- Installed in CDF in Jan/2001
- Operation with the beam started in Apr/2001
  - Delay in PS delivery, failure of PS(radiation-related)
  - Cooling blockage in the central ISL barrel.
  - Beam incident in March, 2002 caused about 1 month delay.
- Exiting Commissioning phase
  - Now operating 97% of L00, 93% of SVXII, and 82% of ISL
  - 80% of whole ladders are producing physics quality data.
  - Optical transmission problems (bit errors)

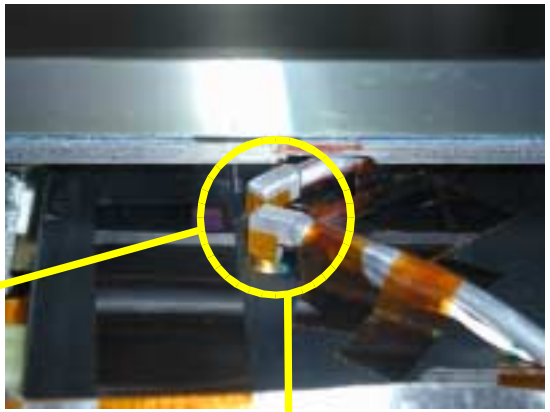


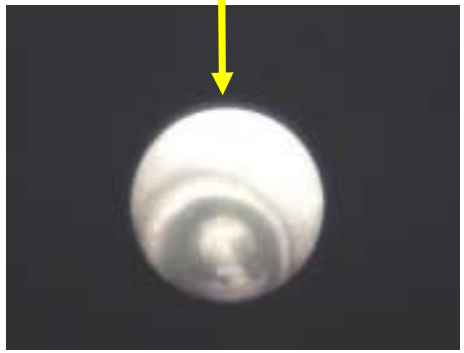


ISL Cooling Problem







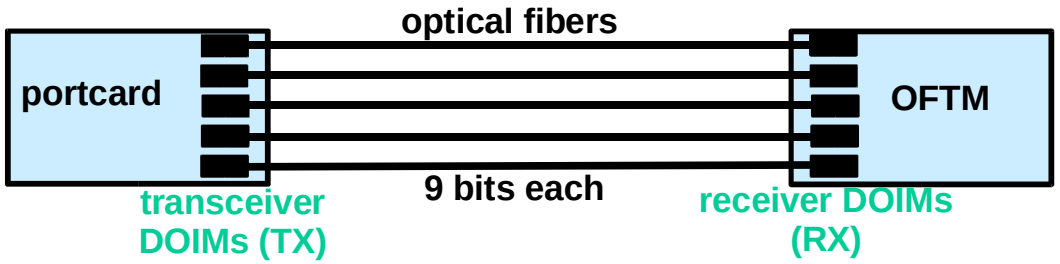


Unable to cool central part of ISL:

- Blockage w/ epoxy at Al elbows
- Solution: Nd-YAG Laser + Prism →

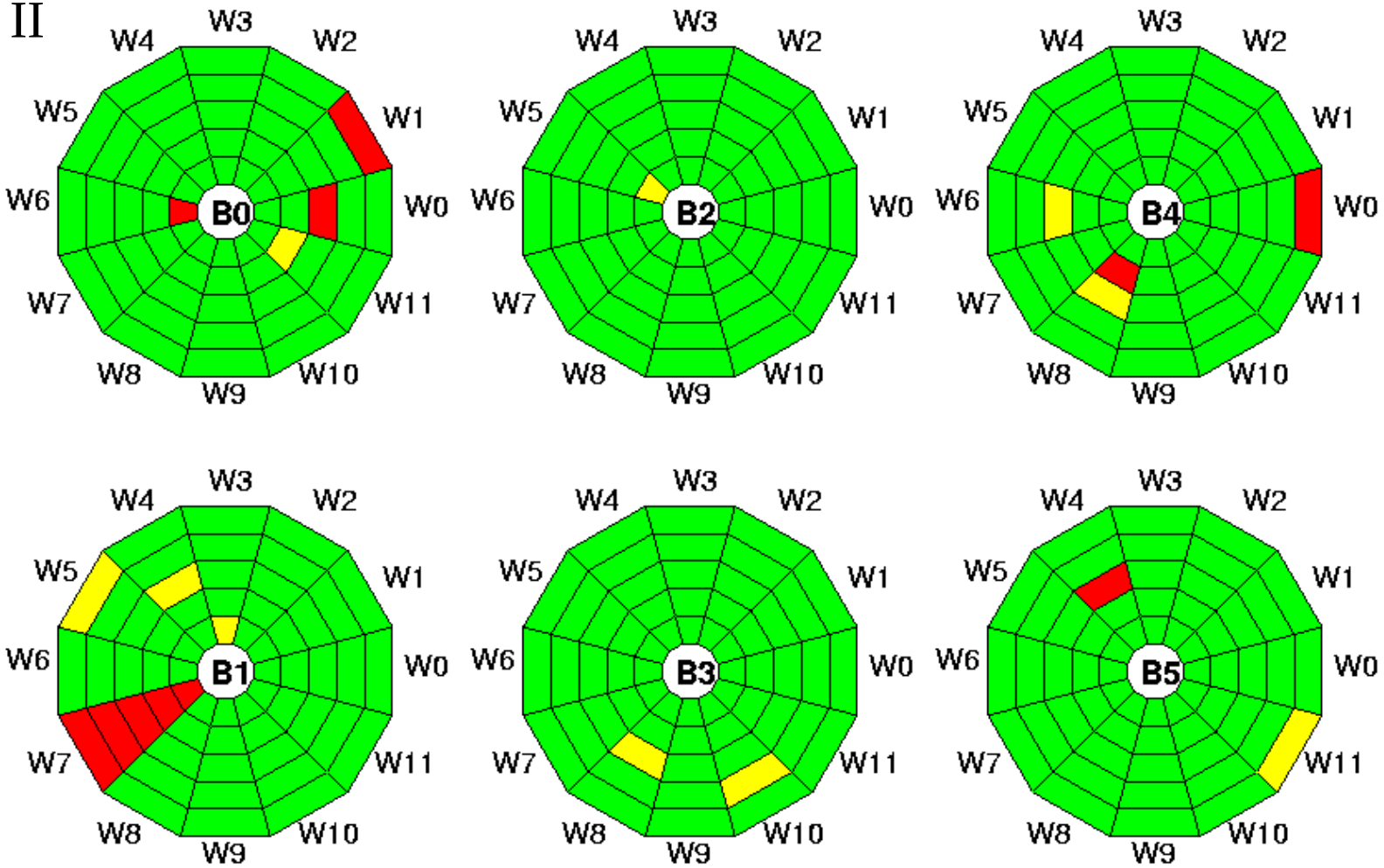
Optical Problems

- Largest single source of problems
- "Easy" but time consuming to fix
  - ➢ Level too low: Increase voltage
    - Voltage shared by 5 ladders x 9 bits
  - ➢ Level too high: Introduce attenuation
    - Attenuation shared by 9 bits



SVX II Ladder Status

SVX II

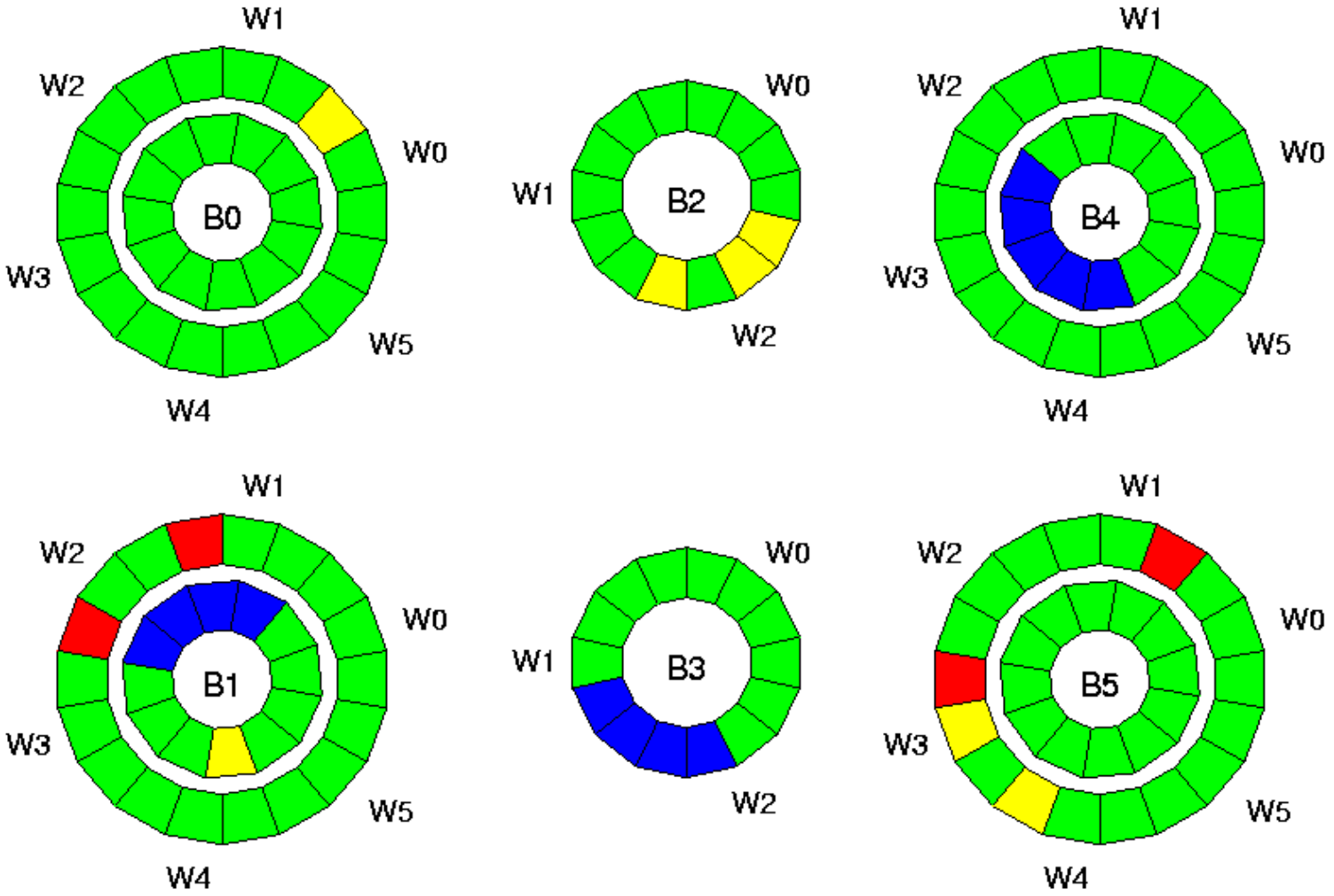


unrecoverable

with problem, may recoverable, need access work

CDF Run IIa Tracking

ISL

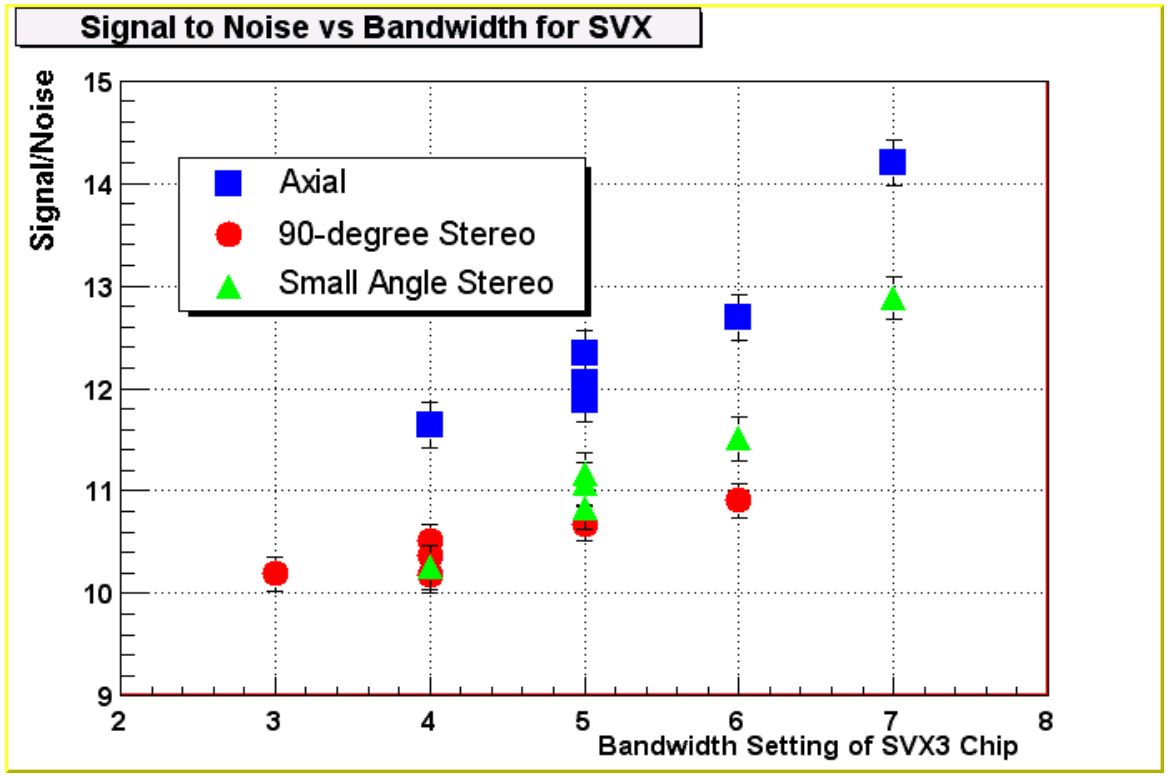


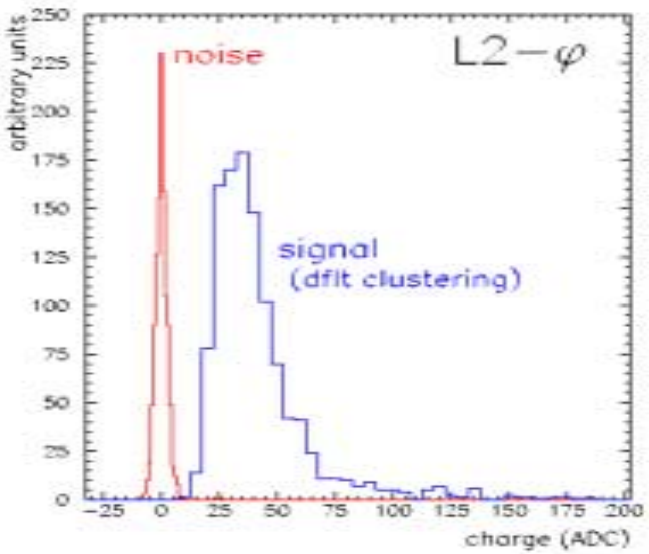
unrecoverable

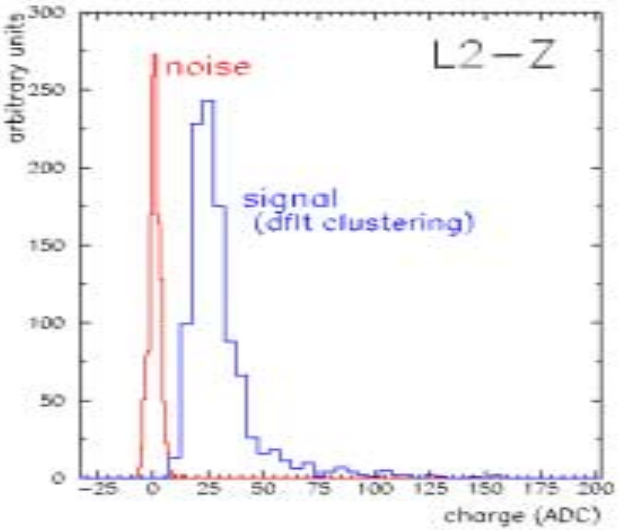
with problem, may recoverable, need access work

uncooled

Signal / Noise Ratio





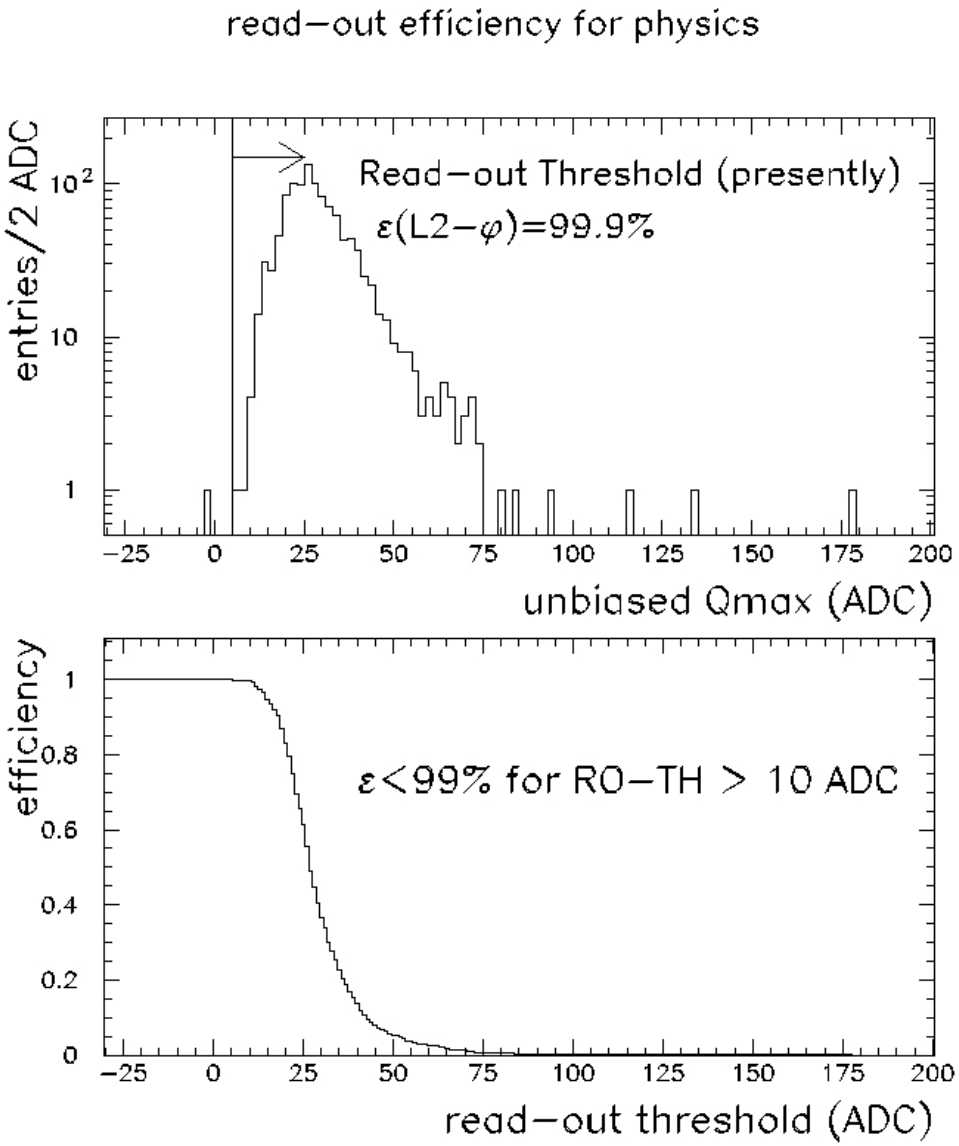


- Good strips
- Track P_T>1GeV
  - Signal to Noise > 10

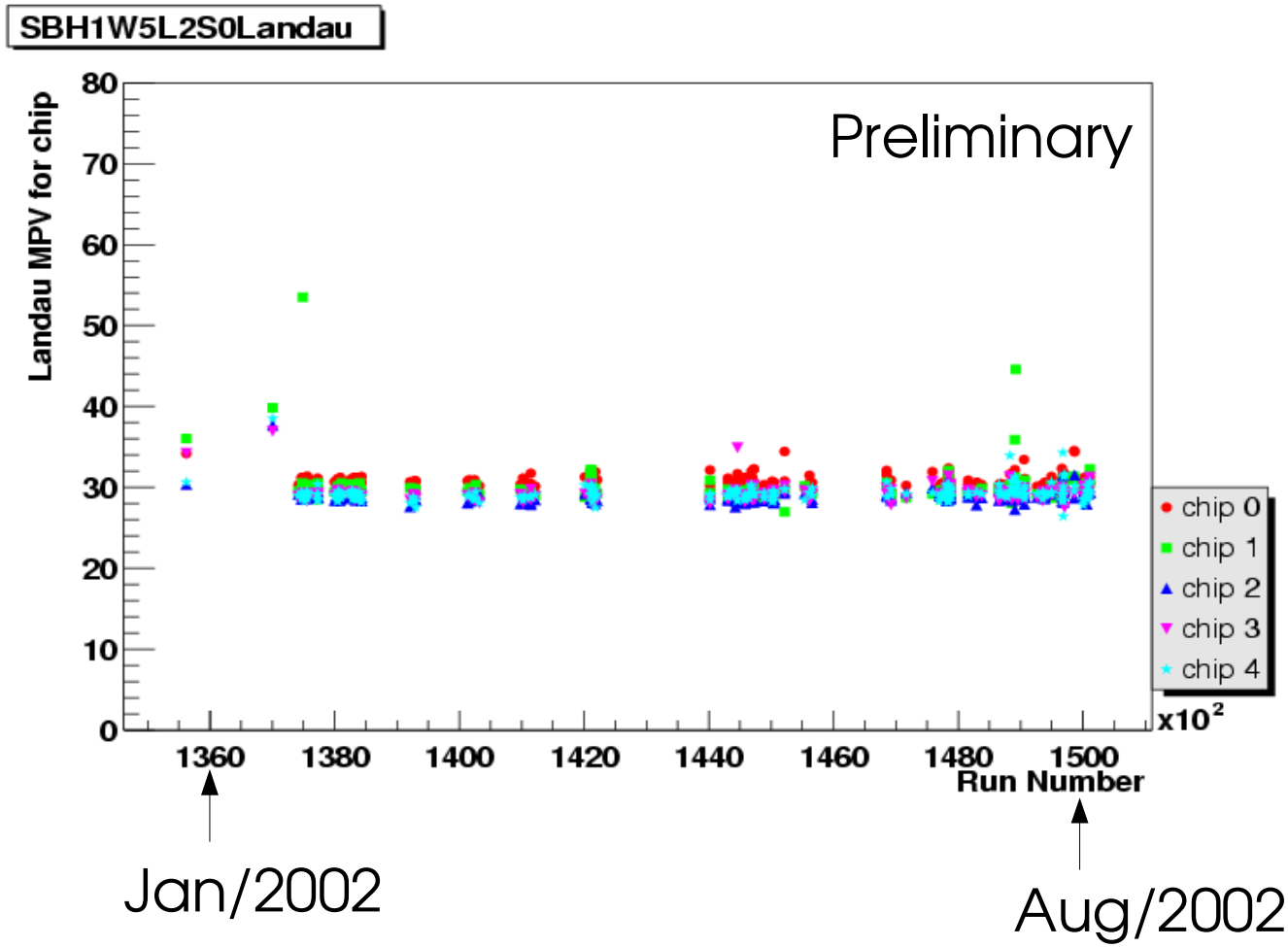
Single Hit Efficiency

- The distribution of ADC on the strip with maxium charge with ±2 strips of a track(P_T>1GeV).
- Typical readout threshold is 5-7 ADC.

➢ Single Hit ε > 99%

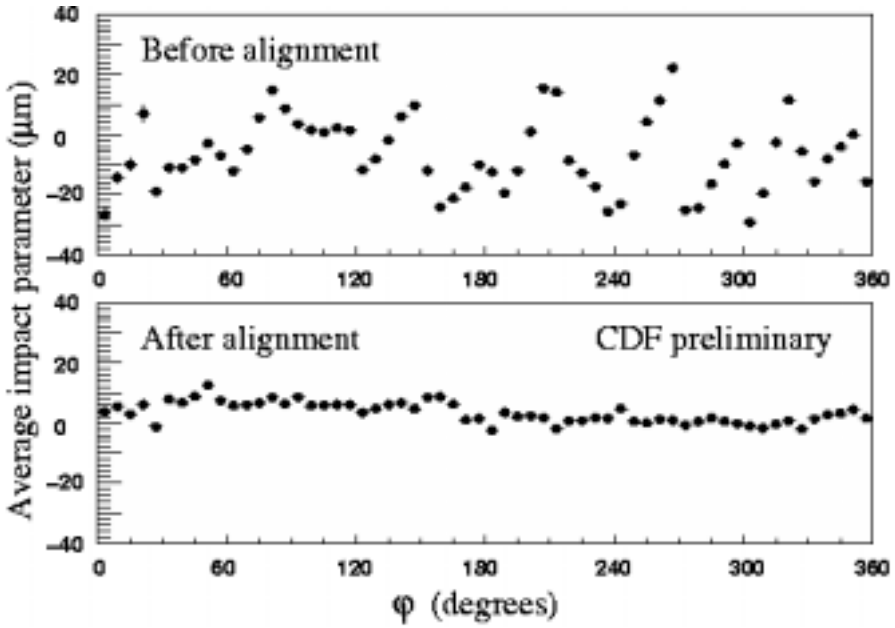


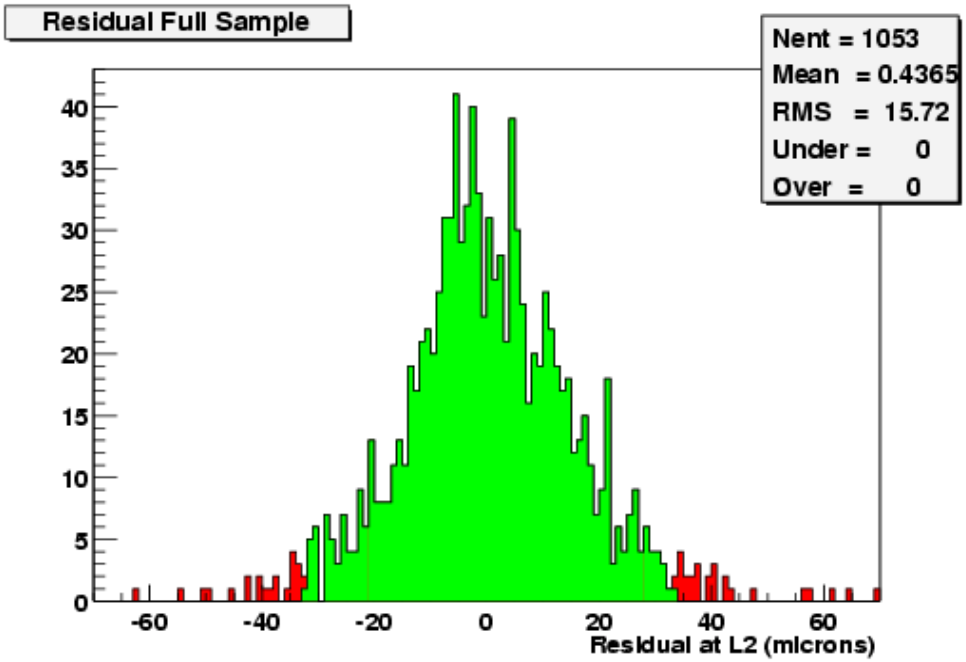
Gain Stability



- Most probable values(mode) of Landau distribution taken run by run.
- A example of "Good" ladder.
- Gains are stable for months.

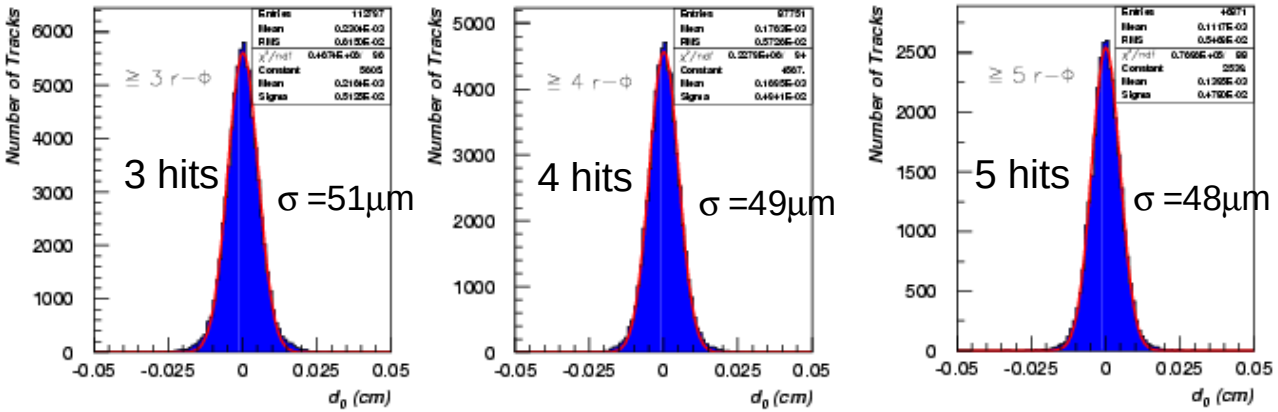
SVX II Alignment

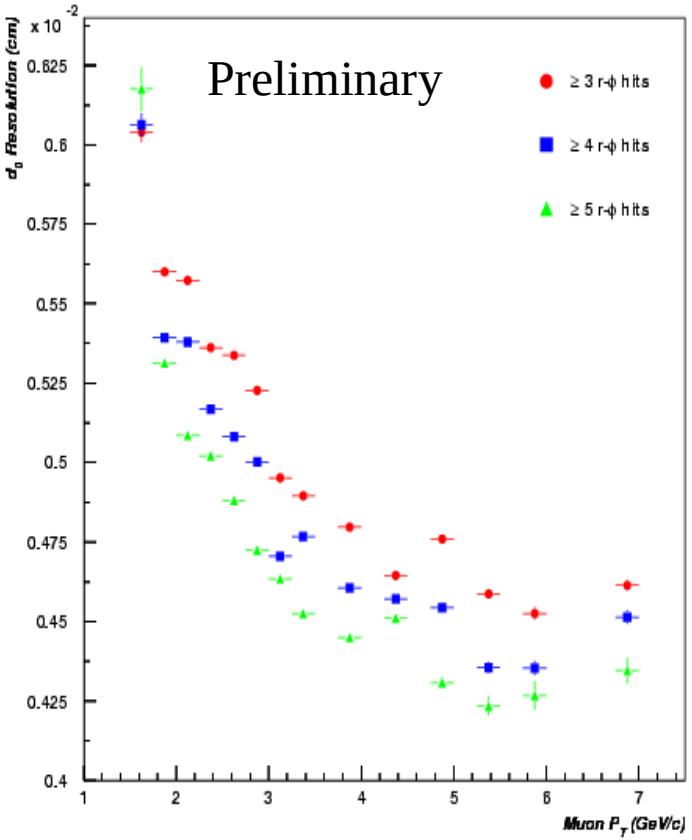




- SVXII Alignment
  - ➢<D_0> vs. φ before and after
- Position resolution of 2-Strip cluster in SVXII
  - ➢Deconvolute pointing resolution ⇒ σ~ 11 μm

Impact Parameter Resolution



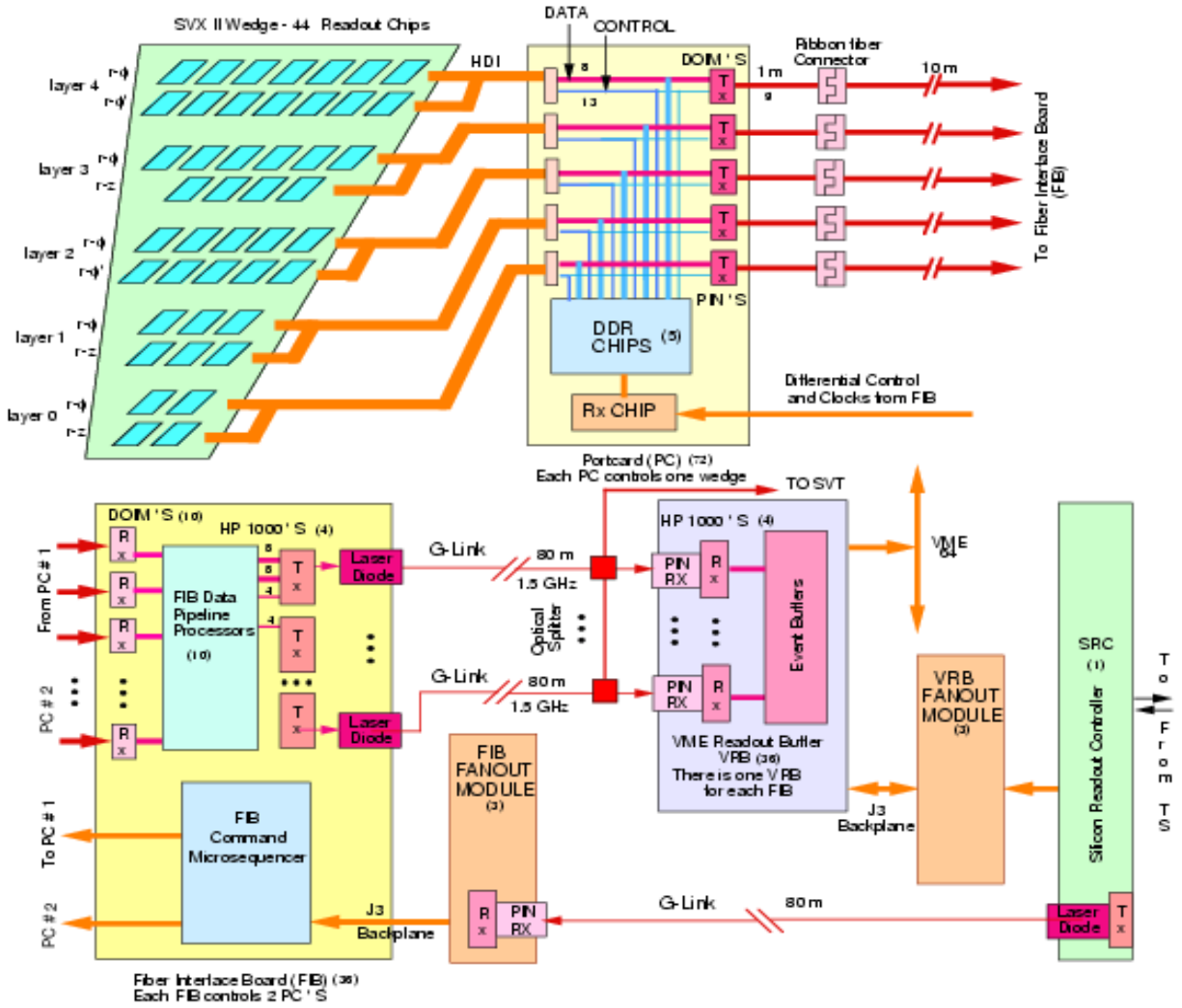


- J/ψ→μμ sample.
- only r-φ sides in SVX II are used.
- L00 and ISL are not used in the plots. Alignment is preliminary.
- Convolution with beam spot resolution of ~30μm.
- The d0 resolution is ~48μm if we use 5 hits on r-φ sides of SVXII, which will be improved when L00 is included.

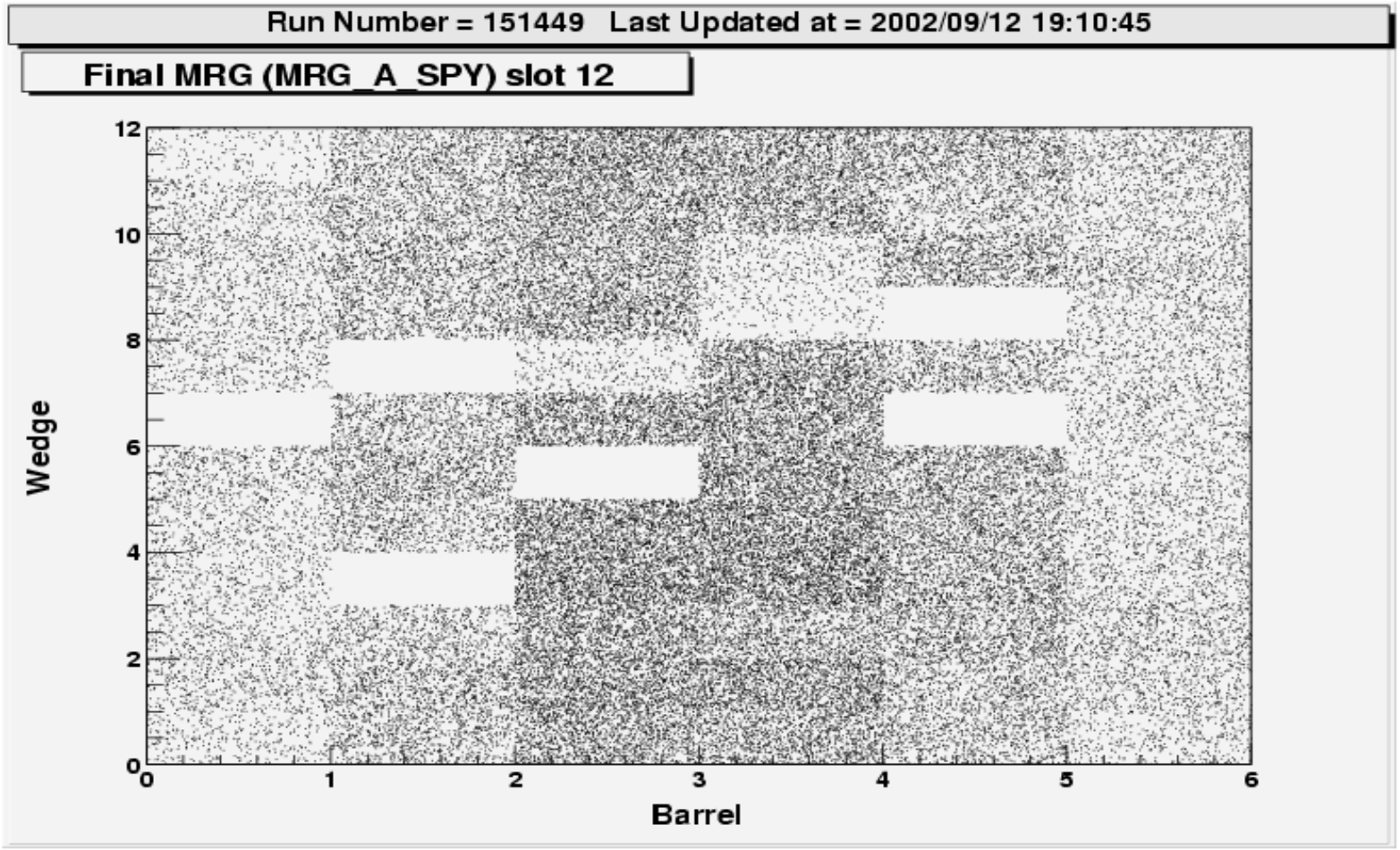
Summary

- CDF Run IIa Silicon detector is
  - ➢ now operating at 80% of all ladders with physics qualities.
  - ➢ Exiting Commissioning phase, entering Maintenance.
  - ➢ Producing decent clusters and tracks.
- Still fair amount of work yet to do
  - ➢ SVX II and ISL have ladders which need repair by access works.
  - ➢ There are still 2 lines with cooling blockages.

SVX II Data Acquisition

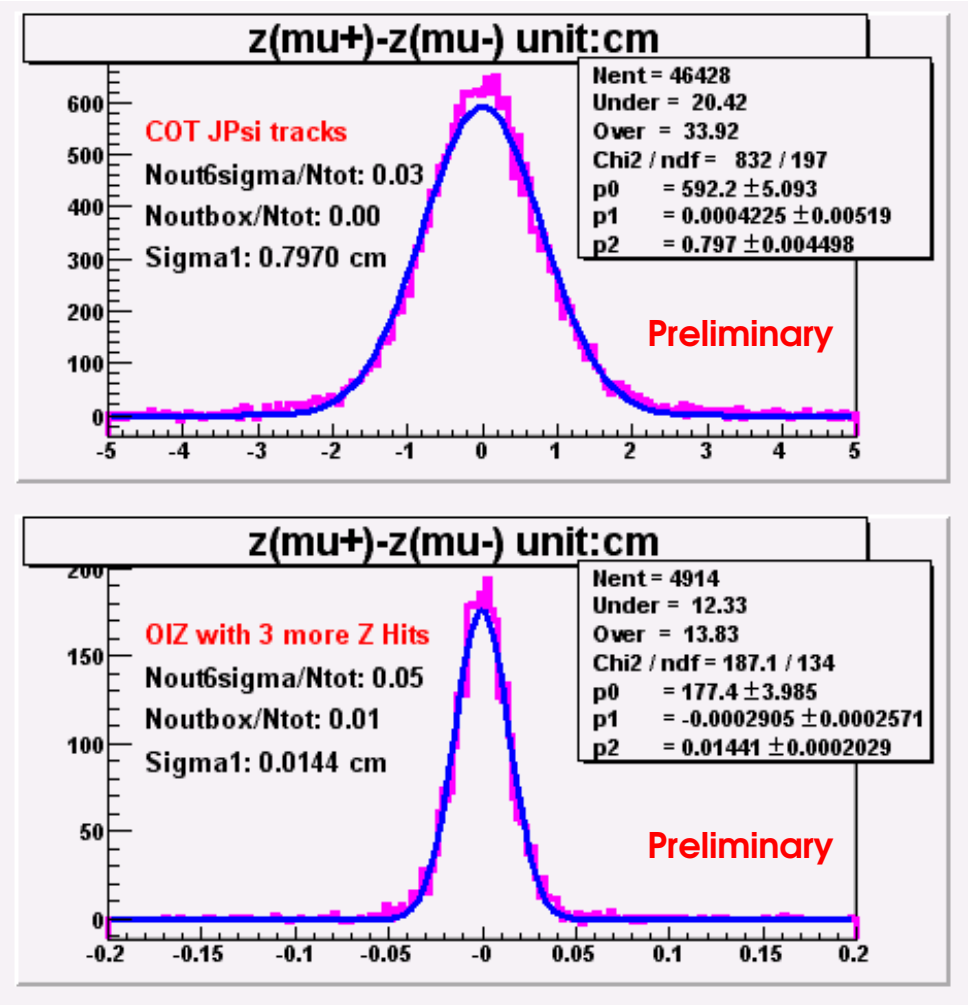


Silicon Vertex Tracker(SVT) efficiency



Z Resolution

z distributions for J/ψ → μμ tracks



COT only

High quality SVX tracks

Data taken from Aug to Oct 2001
J/ψ mass window: 3.08 ± 0.05 GeV
Sidebands: (2.88, 3.00) and (3.16, 3.28) GeV