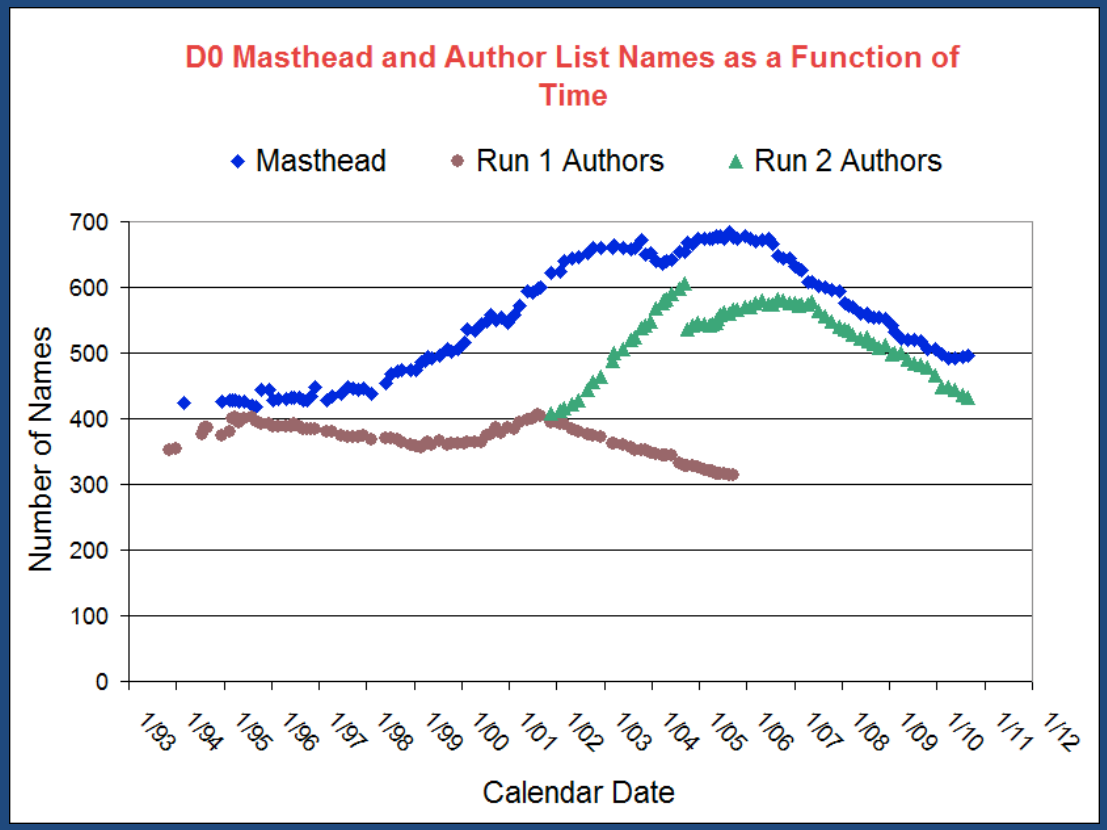
# Detector Ageing & Manpower

Dmitri Denisov & Stefan Söldner-Rembold

# Collaboration Members

Q5: "More detailed and up-to-date full-time equivalent personal commitments of the collaborations for an extended run"




80 Institutions
19 countries

August 2009-August 2010:

- Ukraine joined DØ
- 4% drop in collaboration membership
- 46 new members joined

# Effort Reports

| Task | 2008 | 2009 |
|---|---|---|
| Algorithms | 26 | 27 |
| Computing | 16 | 13 |
| Management | 19 | 19 |
| Operations | 55 | 52 |
| **Sum** | **116** | **111** |
| Student Supervision | 18 | 15 |
| Analysis | 173 | 151 |
| **Total** | **307** | **277** |

- Yearly, detailed “Effort Reports” for every collaboration member.
- About 90 FTEs needed to operate the experiment.
- Physics Group FTEs: Higgs 42, Top 32, other groups ~15 each.

# Effort Reports

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| | | |
| 2007 MOU | 272 | 184 |

Manpower above expectation from 2007 MOUs

# Future Manpower

Within the last two weeks we performed a complete survey of all groups asking them to provide manpower estimates for 2012-2014.
Groups were asked to assume that funding is available.

| Category | 2012 | 2013 | 2014 |
|---|---|---|---|
| Academics/Senior Researcher | 94 | 89 | 86 |
| Postdocs | 71 | 64 | 62 |
| Students | 80 | 76 | 73 |
| **Total FTEs** | **244** | **228** | **220** |

- Excellent return rate: 93% of the collaboration responded.
- Most of the collaboration committed for the full three years.
- Sufficient manpower for experiment operation and physics programme.
- Past experience shows that these estimates tend to be conservative.

# Community Support

Some Examples:

"The opportunity to leverage and extend our current investment in the Tevatron is truly exceptional."
Letter by theorists to the Secretary of Energy, Steven Chu

"I believe the physics case, especially in terms of a low mass Higgs boson, is potentially strong."
Letter by the Director of the Science Programme, STFC, John Womersley

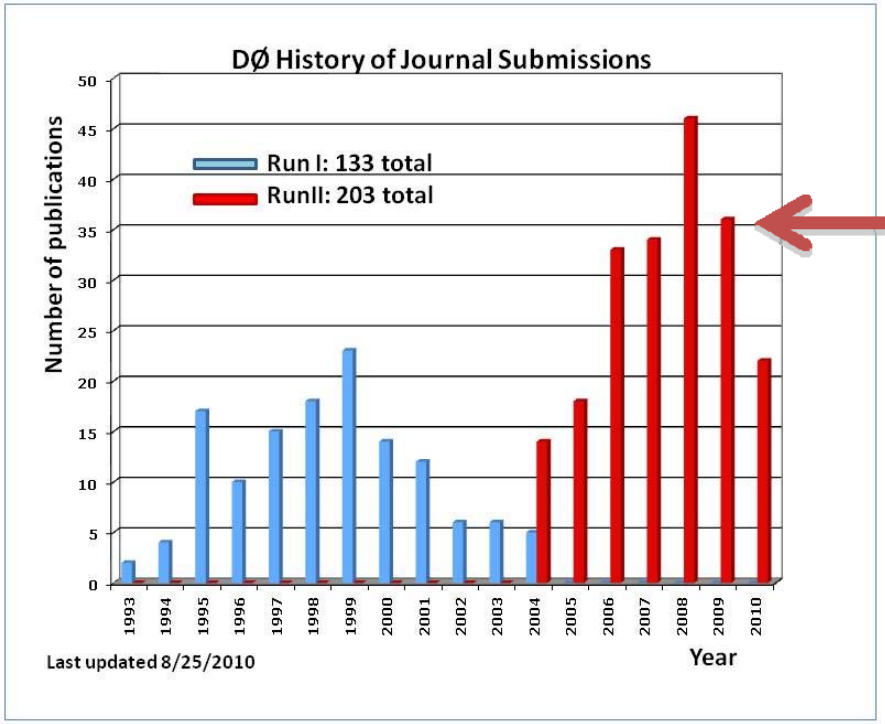
"We expect that many more exciting results may be achieved with longer machine operation."
Letter by the Director of JINR, Dubna, Mikhail Itkis

# Physics Output

- stable physics output (expect ~35 papers in 2010).

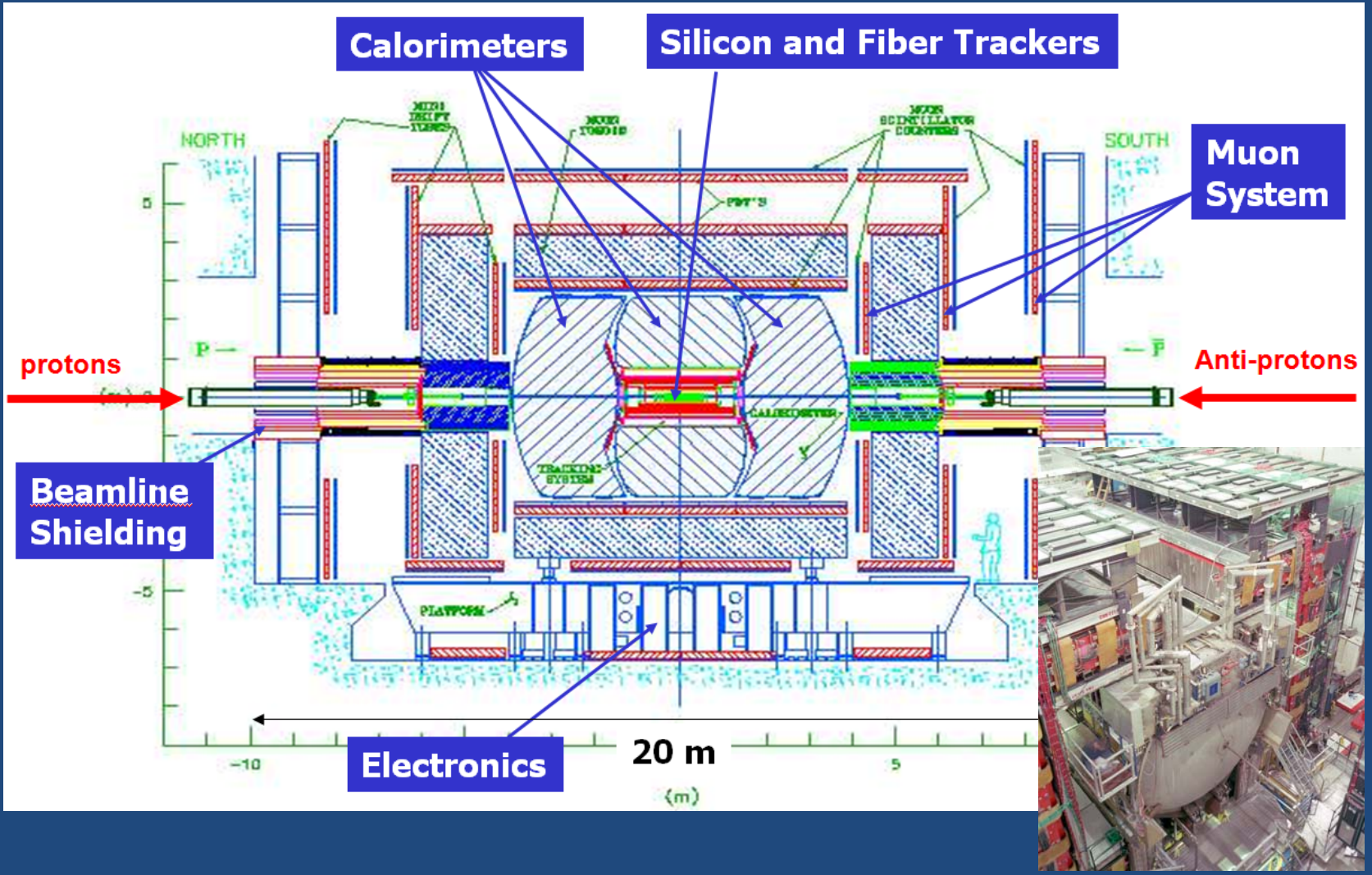
- 40 parallel and 4 plenary talks for Tevatron at ICHEP.

- Very large number of talks (~200) demonstrate continuing interest in physics programme.

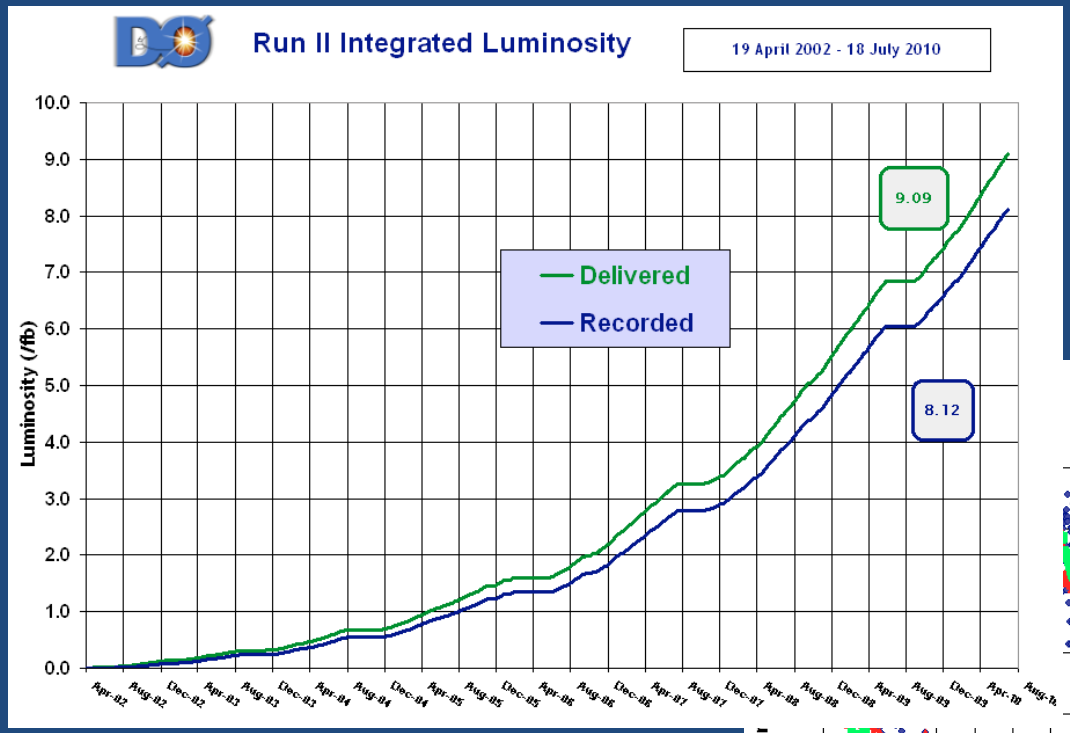



Highlights in 2011:
- “Anomalous Dimuon Asymmetry” accepted by PRL & PRD last week, 42 citations
- “Combination of Higgs Searches in WW decays”, published in PRL, 28 citations

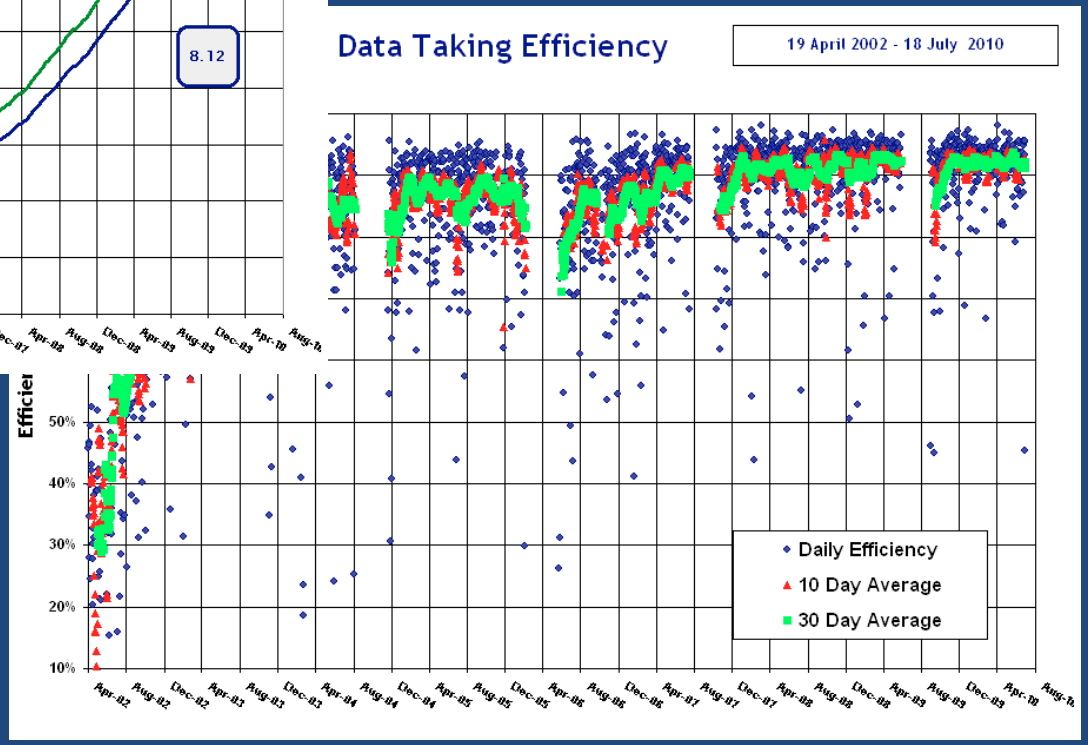
# DØ Detector


Calorimeters
Silicon and Fiber Trackers
Muon System
NORTH
SOUTH
protons
Anti-protons
Beamline Shielding
Electronics
20 m
(m)
-10
5
-5

# Data Taking

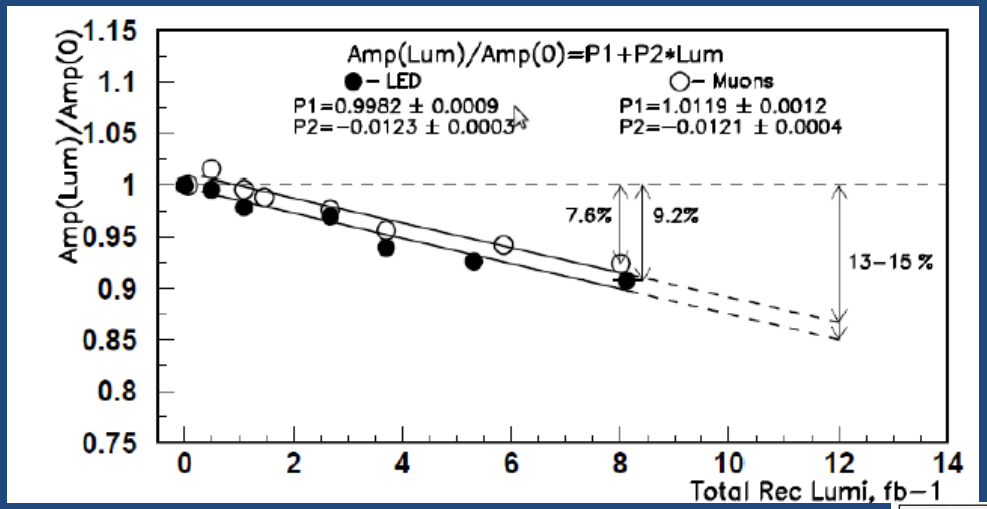



- 9/8 $fb^{-1}$ delivered/recorded
- Stable operation with > 90 % efficiency




- Just coming out of 4 week shutdown
- Fast and efficient start-up

# Muon System

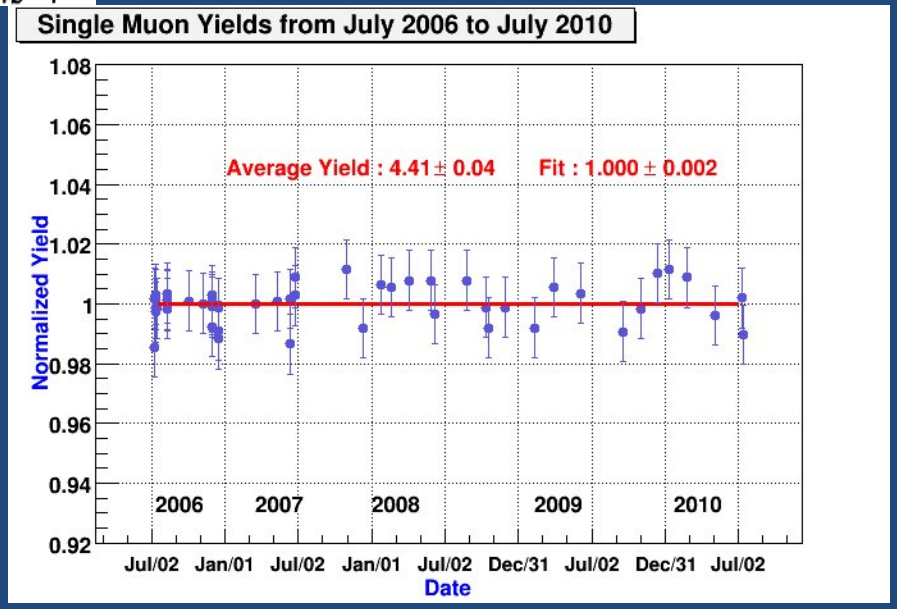



Amplitude drop of 15-18% expected for 16 $fb^{-1}$ .

Pixel counter performance not affected.

Forward muon yield perfectly stable over time.

Muon system ageing closely monitored.
No significant ageing expected through 2014.



# Calorimeter

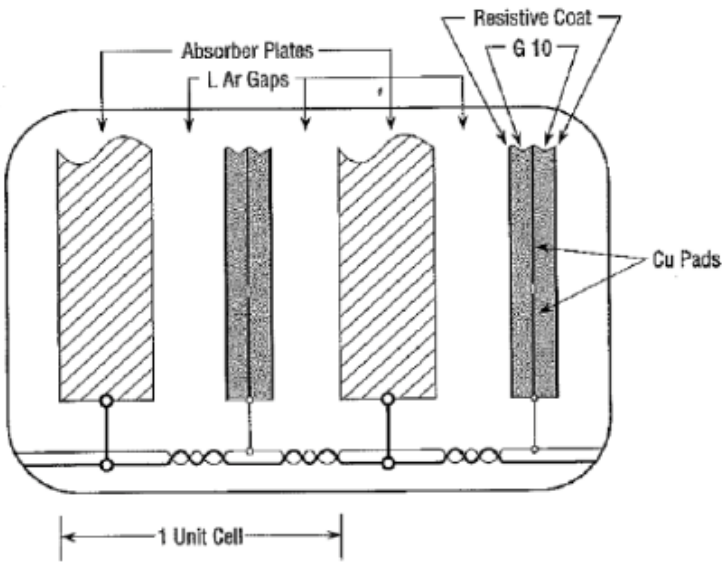
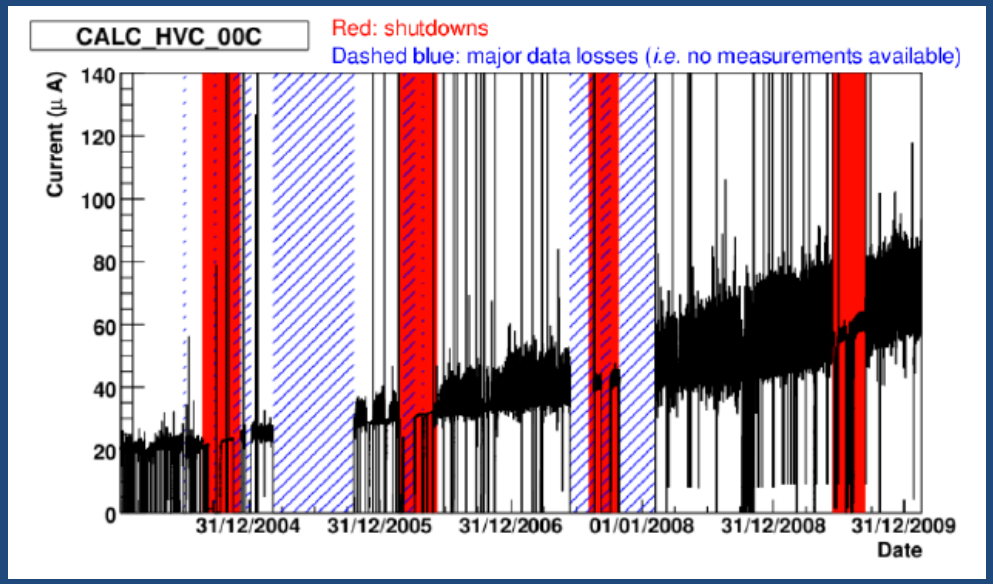



Fig. 27. Schematic view of the liquid argon gap and signal board unit cell.

Calorimeter is regularly monitored and calibrated.

No significant ageing expected and none observed.




Increase in current not expected to affect calorimeter performance

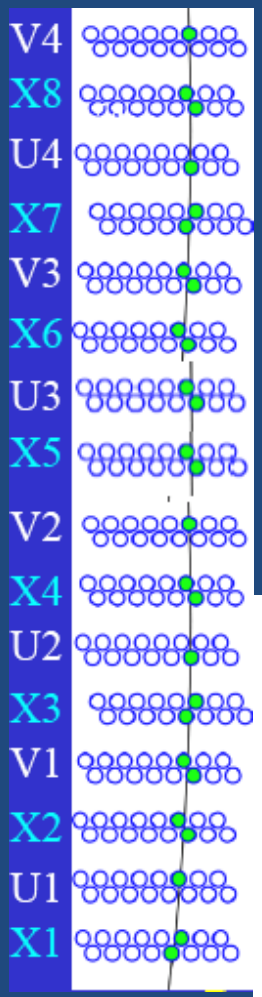
# Luminosity System

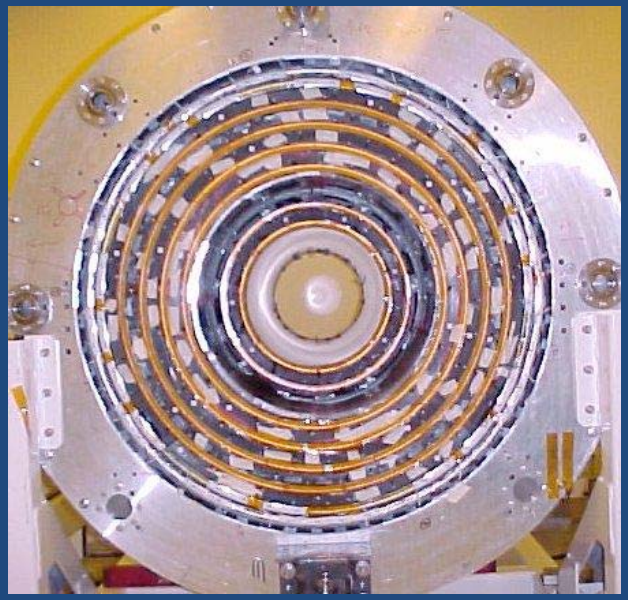
Luminosity measurements have 6% uncertainty.

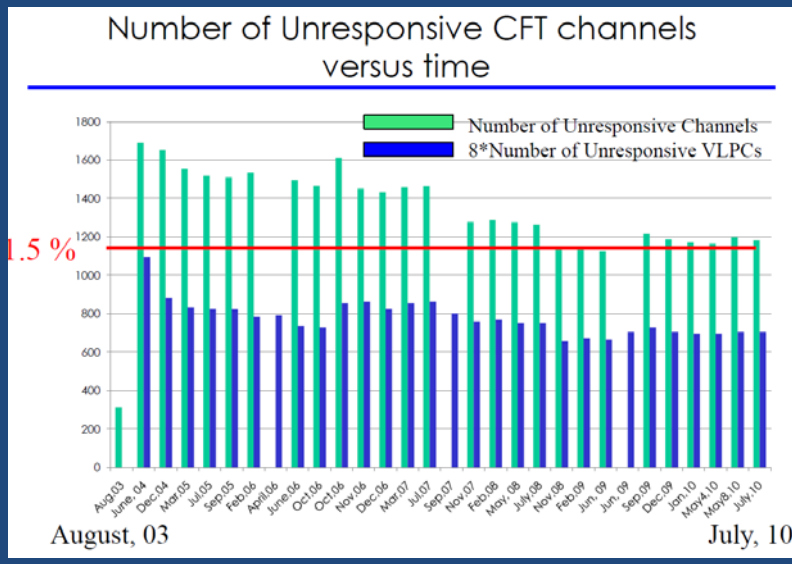
Ageing of luminosity counters (2*24 scintillator counters) expected in high radiation environment.

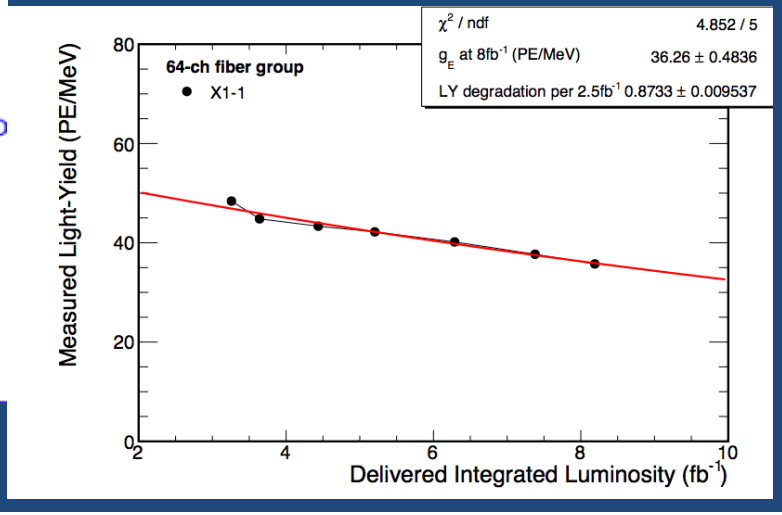
Lots of experience with replacements of counters. Successfully replaced all scintillators and about 30% of the PMTs during the 4 week shutdown last month.

# Fiber Tracker (CFT)



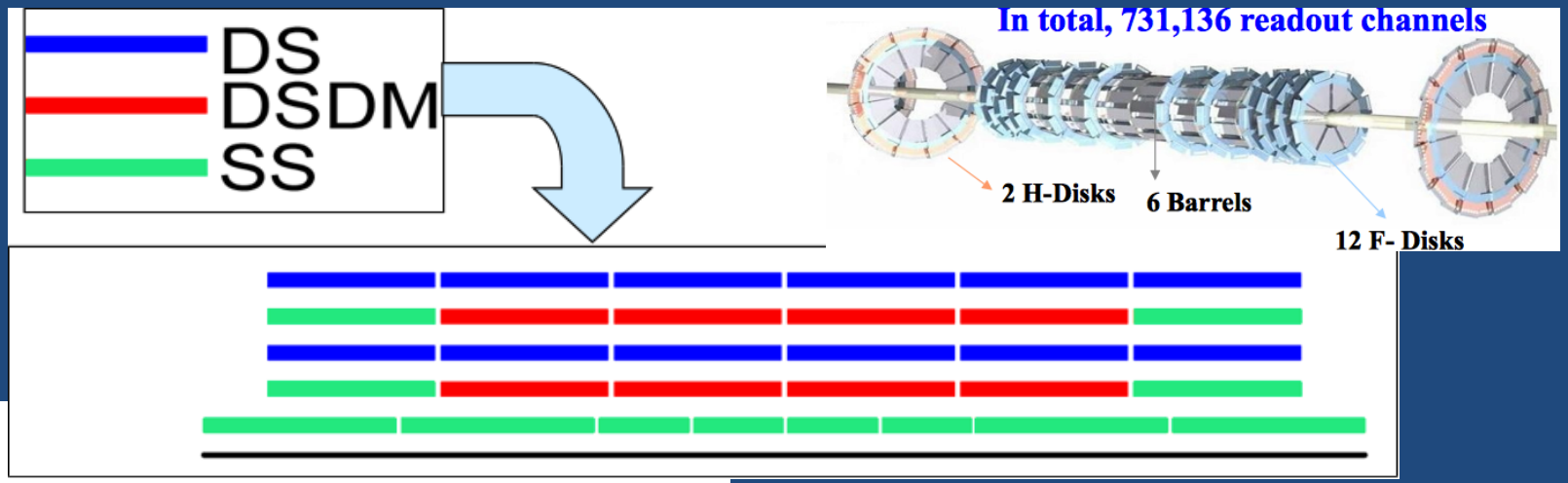


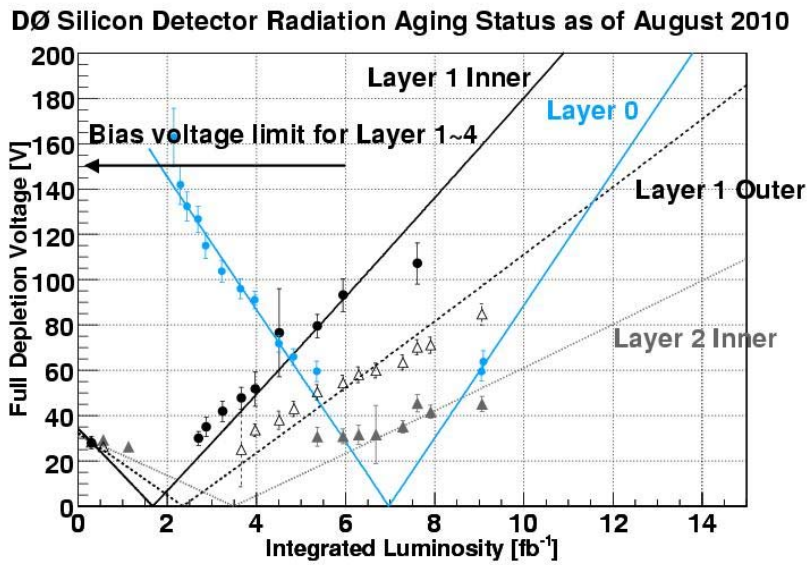




- Number of unresponsive channels at 1.5% level.

- About 10% light yield loss for every 2.5 fb$^{-1}$ of luminosity

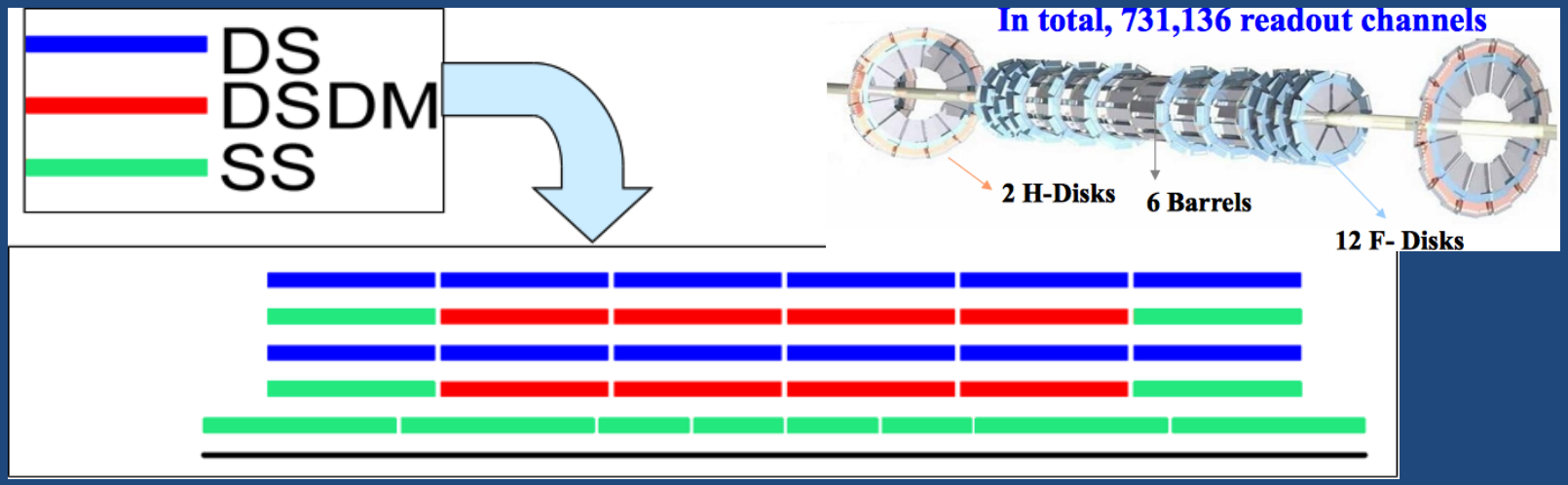
# Silicon Detector (SMT)

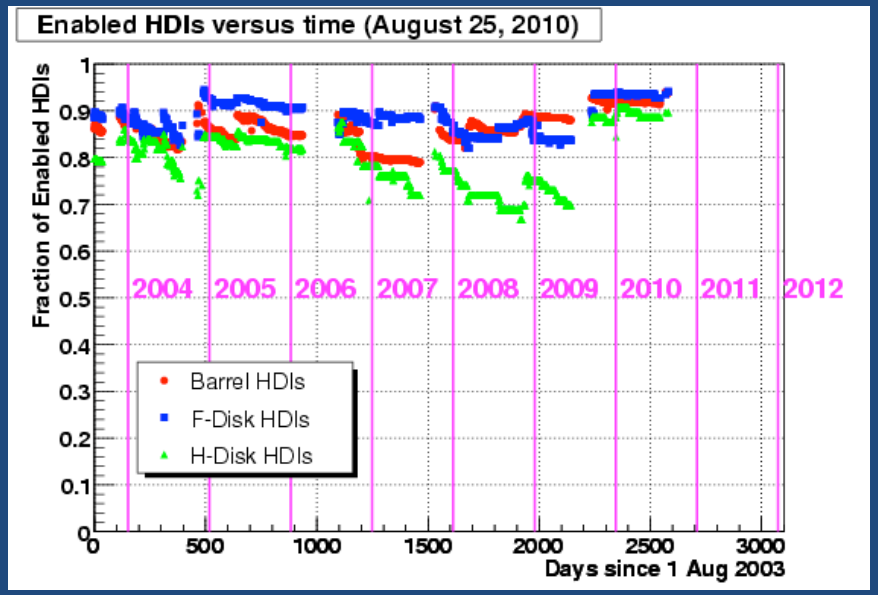



- Layer 1 (inner) reaching bias voltage limit now.
- Layer 0 installed for Run 2b.
- Layer 0 will eventually need bias voltage above the current 300 V limit, which will require some minor infrastructure modifications.

# Silicon Detector (SMT)

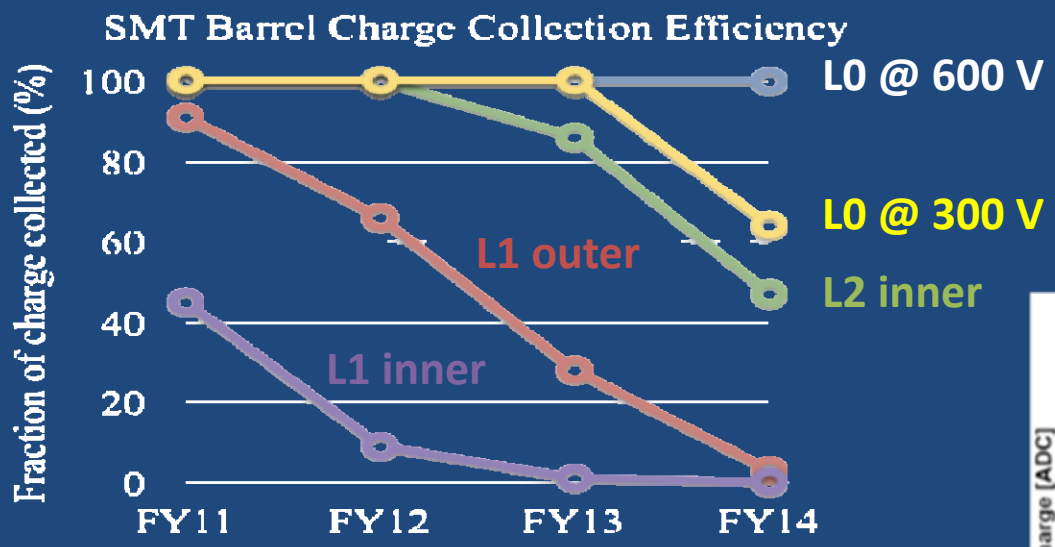


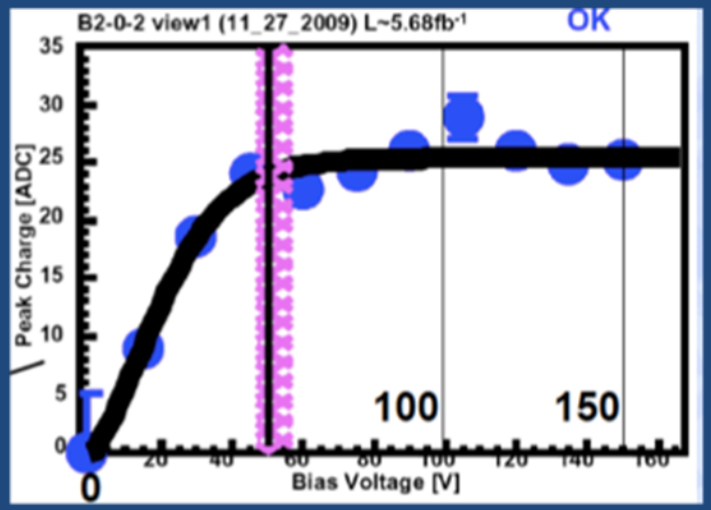

- Significant number of HDIs (readout circuits) recovered in 2009
- Not included in extrapolations.

# Extrapolating to 2014

Assume that biggest effect is from tracking (CFT/SMT) and that there is no ageing effect from Calorimeter and Muon System.

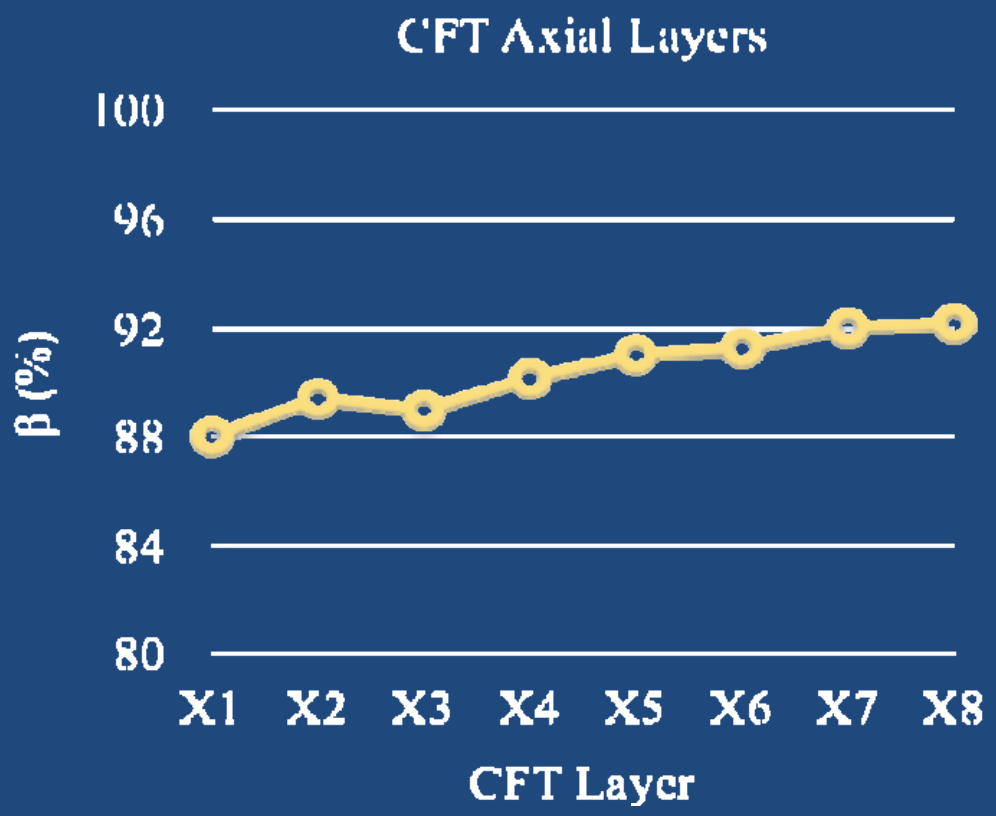



End of FY




Use information about charge collection efficiency in SMT for underdepleted detectors and add additional noise

# Extrapolating to 2014



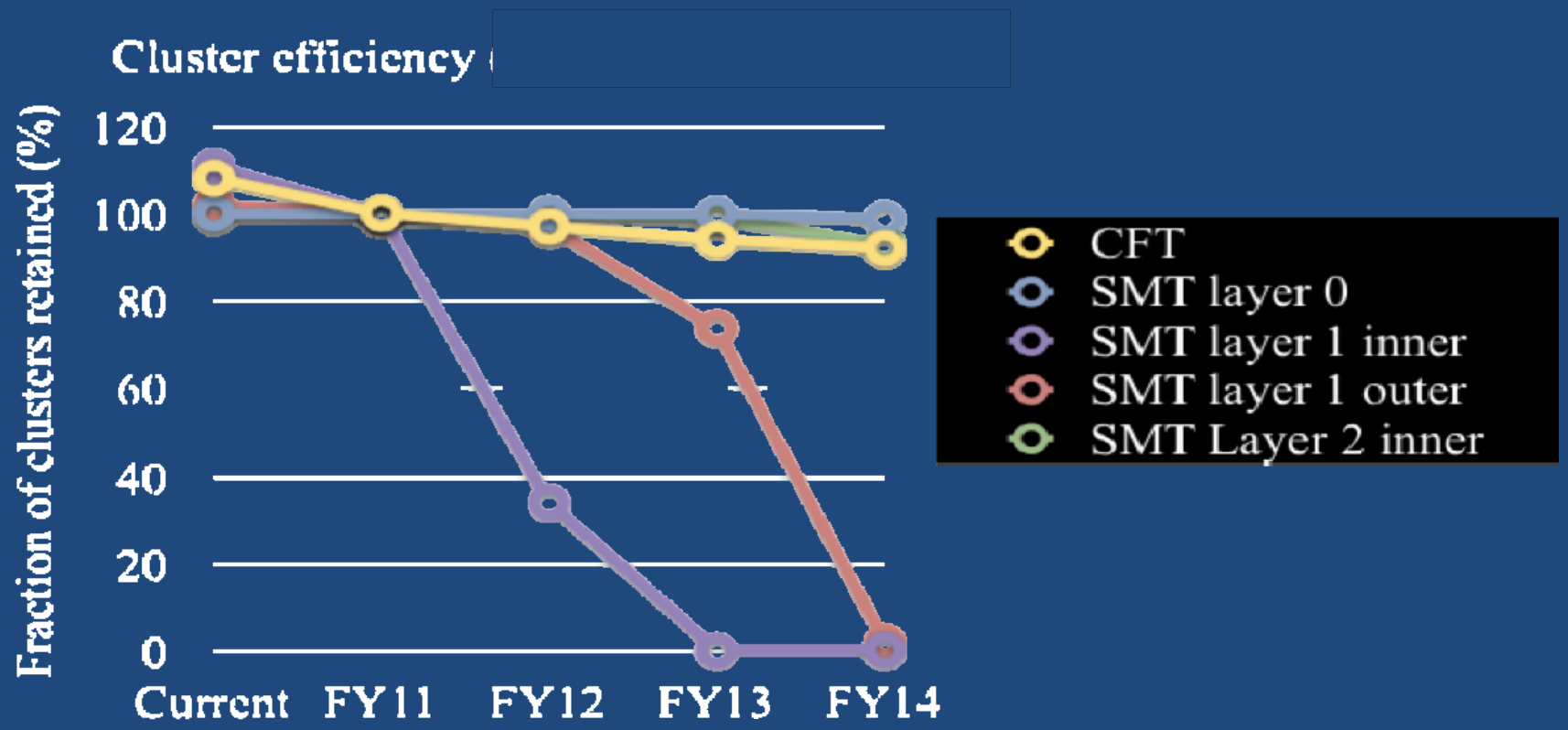

Ageing in CFT:

β is reduced light yield for every year of running at 2.5 $fb^{-1}$

Little radial dependence

The ageing model is applied to data and MC by modifying the SMT and CFT hits according to the prescriptions given above.

# Efficiencies in Di-muon Data

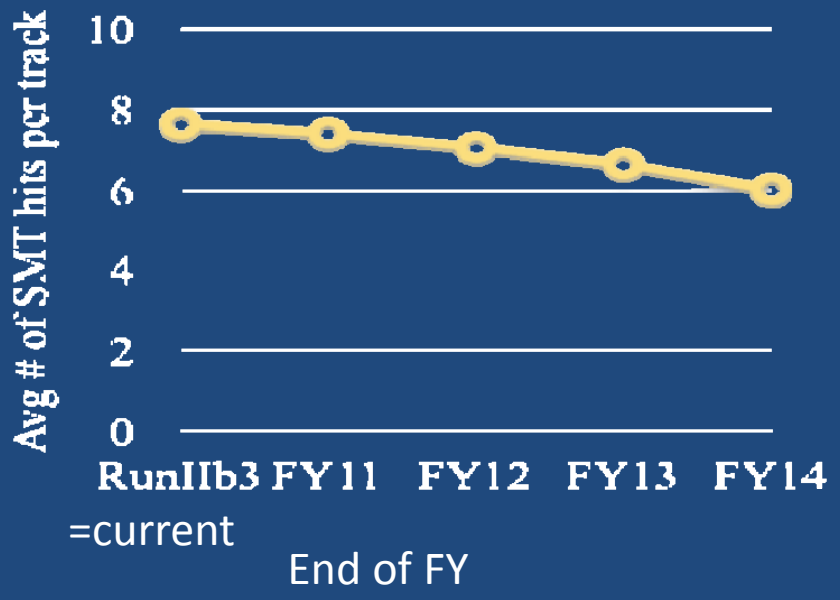



End of FY

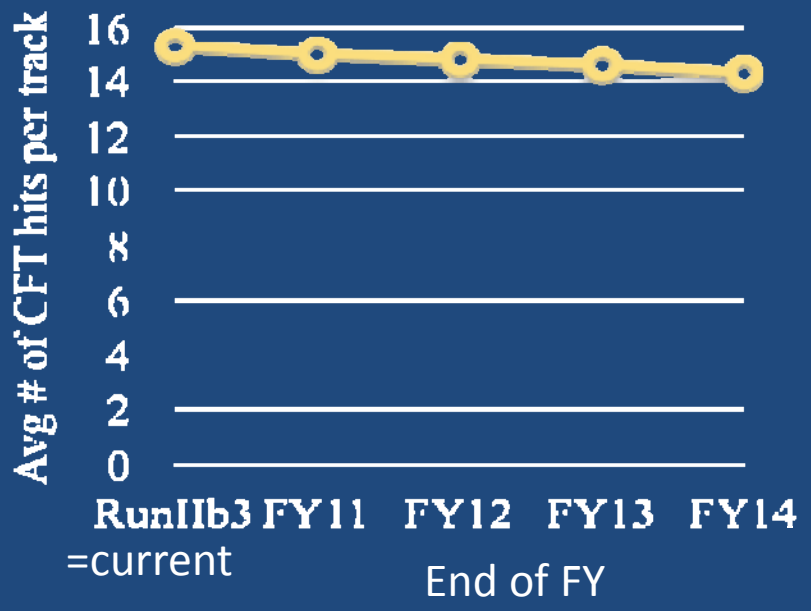
Layer 1 degradation as expected

# Number of Hits on Tracks

SMT




CFT




- Small reduction in the number of hits per track
- These extrapolations do not include the impact of algorithm enhancements

# What can be done ?

Examples of possible improvements:

Making tracking more tolerant of missed hits.

Efficiency increase for isolated muons:

2% in 2009 configuration
6% in 2014 configuration

DØ Workshop “Analysing 10 fb-1 and Beyond” in Marseille, 29 July – 4 August 2011

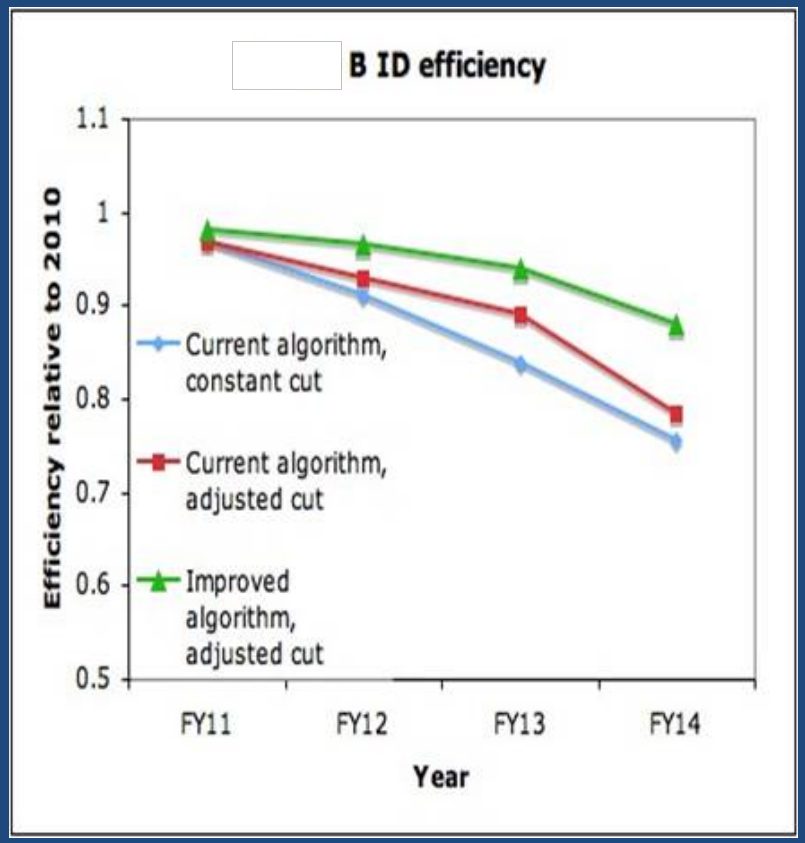
# b tagging

Three scenarios:

(1) Ageing w/o improvements

(2) Adjust cut on b-tagging variable to keep fake tag rate constant

(3) Put in tracking improvements



# Conclusions

- DØ is enthusiastic about the physics opportunity of an extended Tevatron run.
- Survey shows that there will be sufficient manpower for operations and physics analysis until 2014.
- Detailed studies demonstrate that ageing effects expected for tracker will not significantly impact the physics performance.