Beam summary data in MR Run42 (T2K Run3c)

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Overview

- Apply the Good spill selection to the beam data in the MR Run42
  - Use improved fitting for horn current (by Suzuki-san)
  - Used data set : Beam line Run# **420022 (4/8) ~ 420212 (5/5)**
- Horn current setting in this period : **250kA**

Spill selection

1. Physics run
   - "run_type" is "physic run" and all Horn ON
   - exclude spills for beam tuning, beam study
2. TriggerFlag is "Beam Trigger" (beam during MR operation)
3. Good GPS status
4. CT05 # of protons per spill > 1e11 in order to exclude spills which no beam in MR (due to machine interlock etc...)

Quick spill selection

5. Normal condition cut
   - exclude unusable spills (e.g. PV2 magnet unstable etc...)
6. Horn current cut
   - Nominal current ± 5 kA for all three horns
7. MUMON cut
   - beam angle within 1mrad (|Si fit X|<10cm & |Si fit Y|<10cm)
   - Si total Q / CT05 cut : mean of Q/CT05 ± 5%

Good spill selection

Horn & MUMON cut

- Horn current & MUMON Si Q /CT5 cut are defined as the followings table.
  - Horn cut : (Mean of three horns current in physics run) ± 5 kA
  - MUMON SiQ / CT5 cut : (Mean of this ratio in physics run) ± 5%

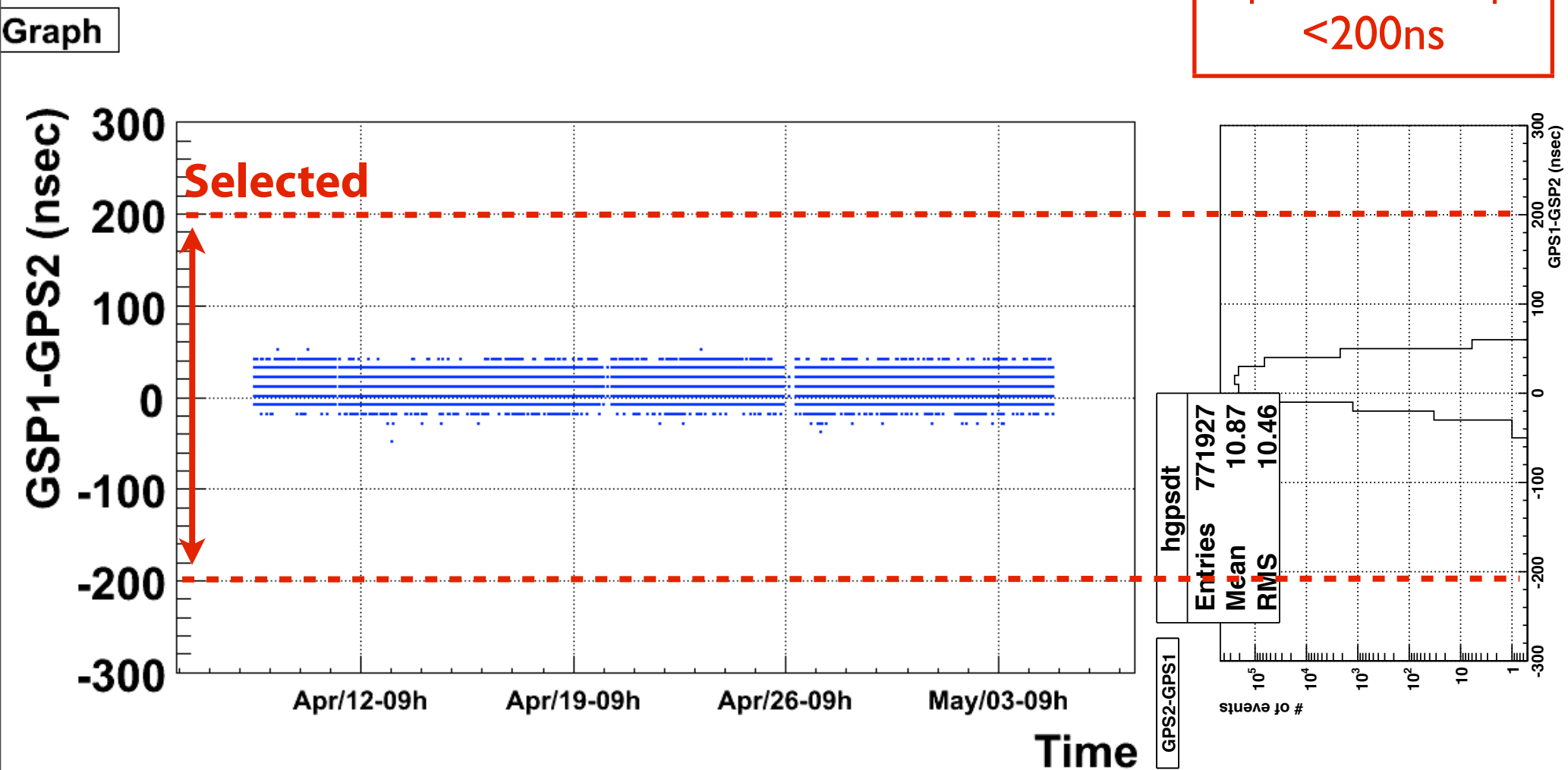
run#	Horn current setting	Horn current cut	MUMON SiQ/ CT5 cut
420022~420212	250kA	249.5 ± 5kA	32.14 ± 5%

Normal condition cut

- Remove 1 spill by normal condition cut
  - Run#420189, Spill#3032400 : Neutrino BLM MPS

GPS Status

|GPS1-GPS2|
<200ns



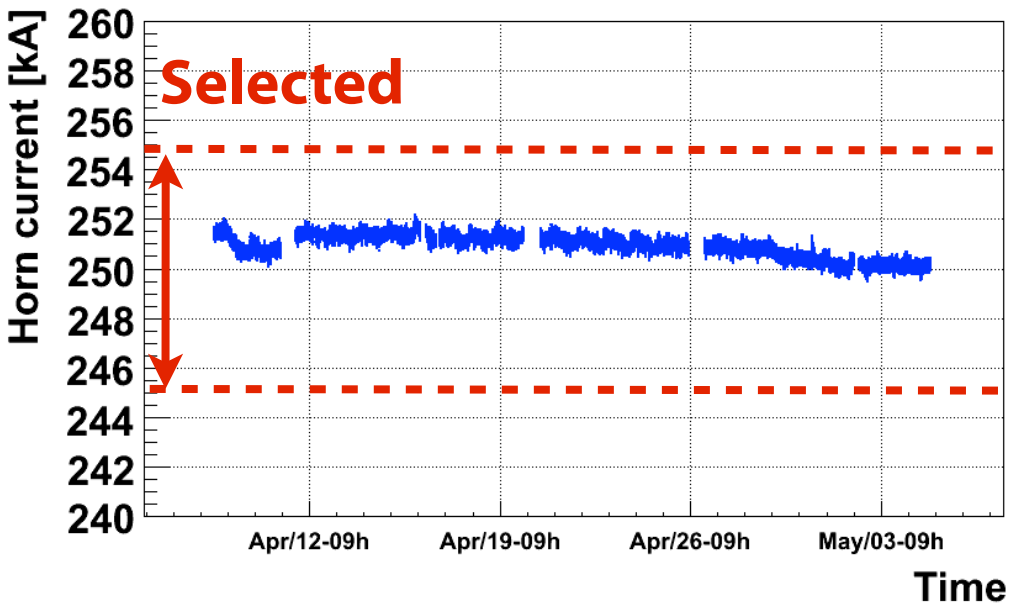
GPS1,2 status are good during this period

No Bad spill

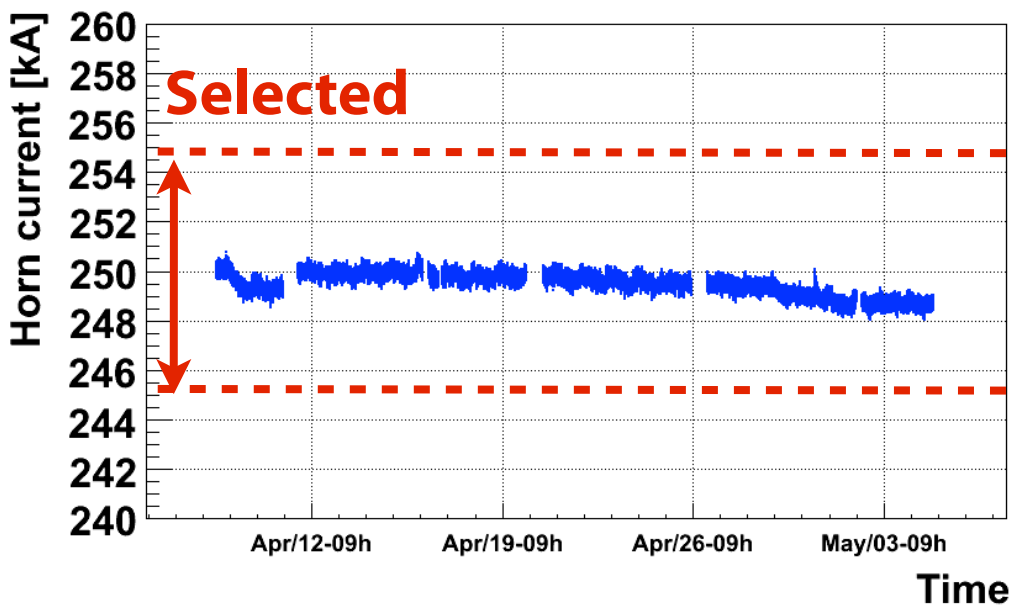
Horn current

249.5 ± 5kA

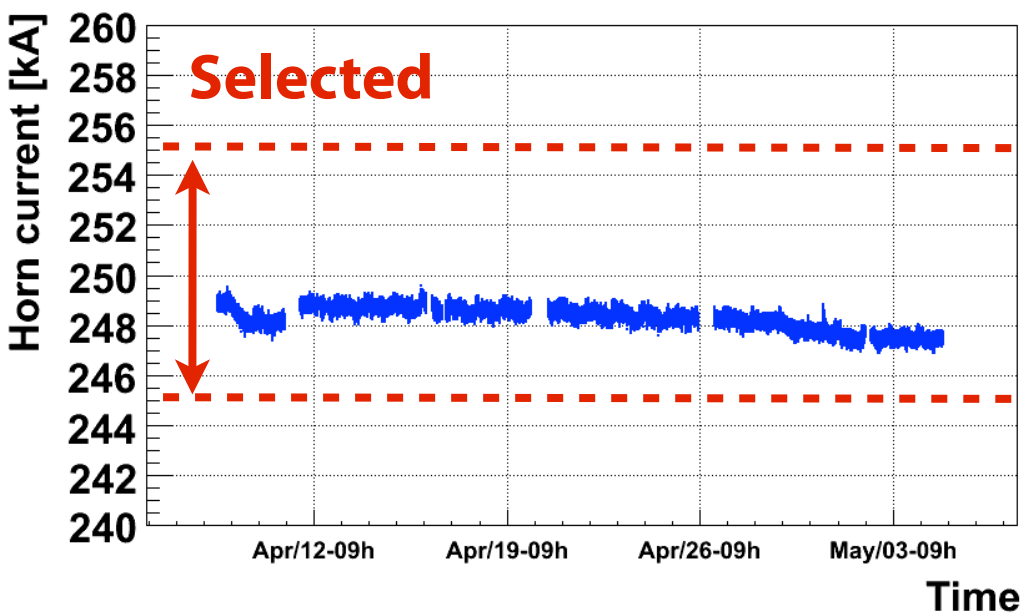
Horn1 current



Horn2 current

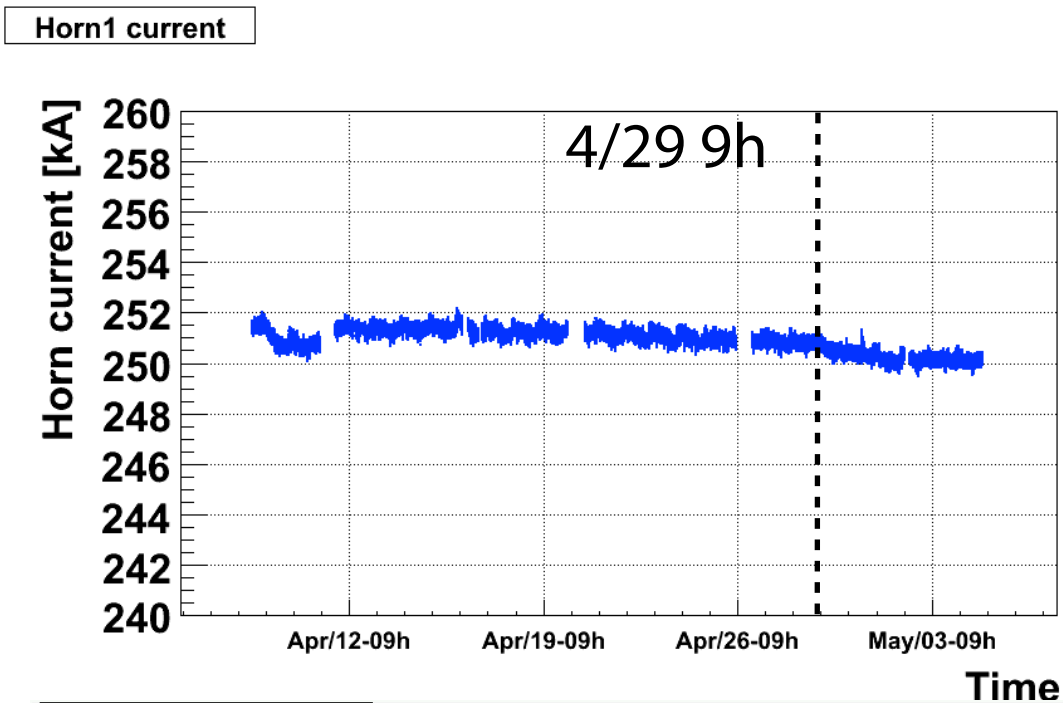


Horn3 current



- No bad spill, but horn current decreasing gradually (especially from Apr/29)
- But, current is stable from 5/3

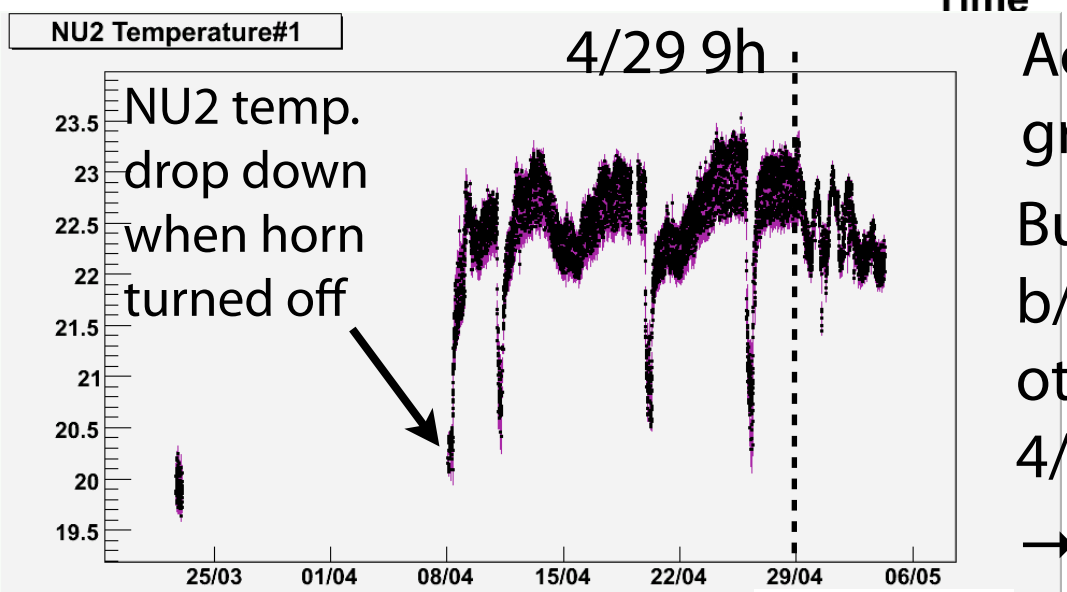
Horn current decreasing



Waring for NU2 temperature at 4/2913:38 (from shift summary)

NU2 temperature was slowly rising. Air conditioner setting was too high. The setting was adjusted. Now it is stable.

Other troubles at 4/29 are shown on backup page.



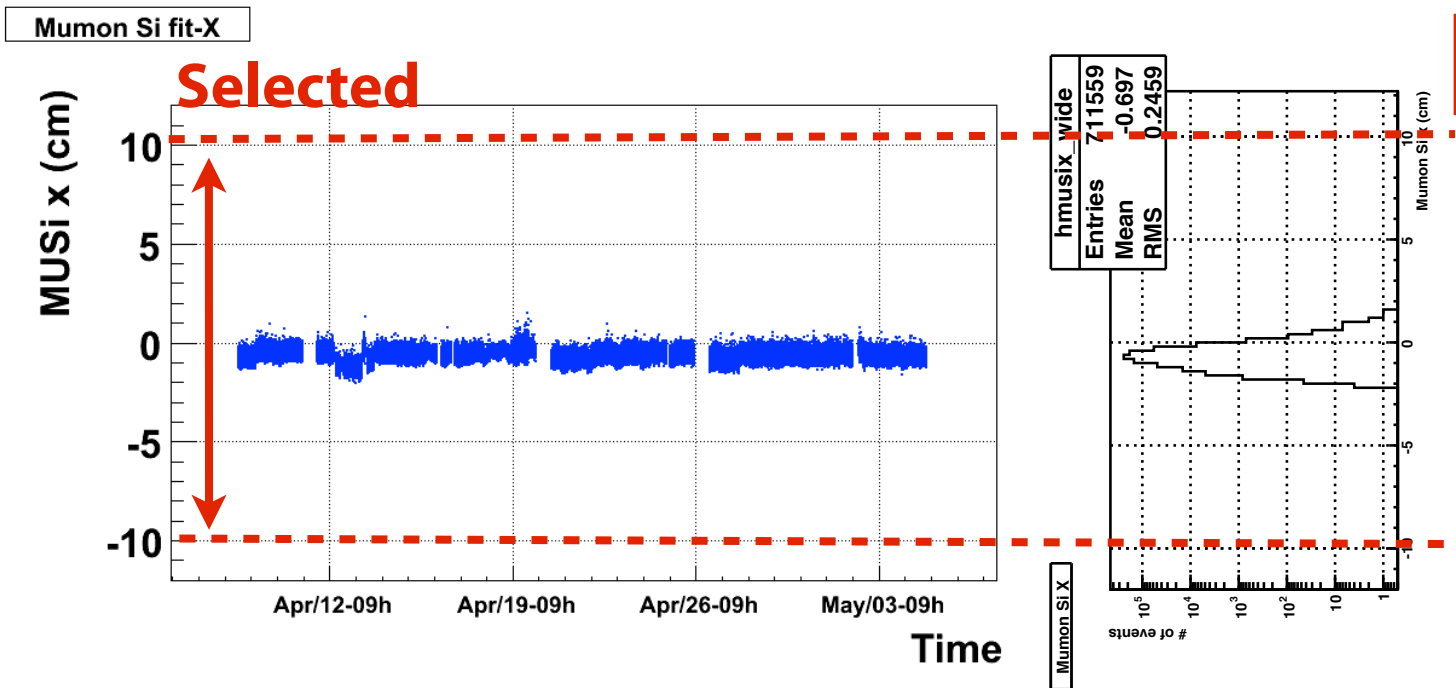
*This time scale is diff. from above plot **Day/Month**

Actually, NU2 temp. decreasing gradually from Apr/29

But, there seems to be no correlation b/w horn current and NU2 temp. in other time region(NU2 temp. rising in 4/22~4/26).

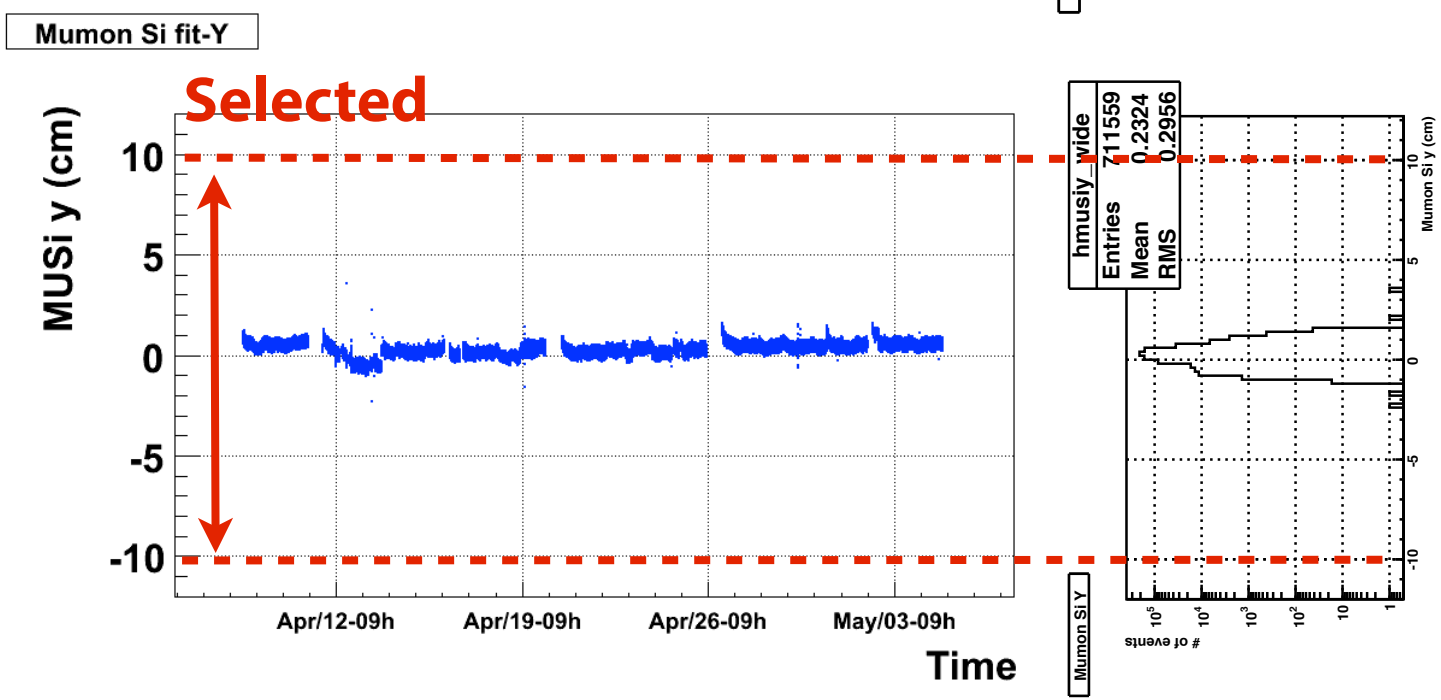
→ Other reason ? Anyway, be careful for horn current stability.

MUMON Si fit center



|fit center| < 10cm

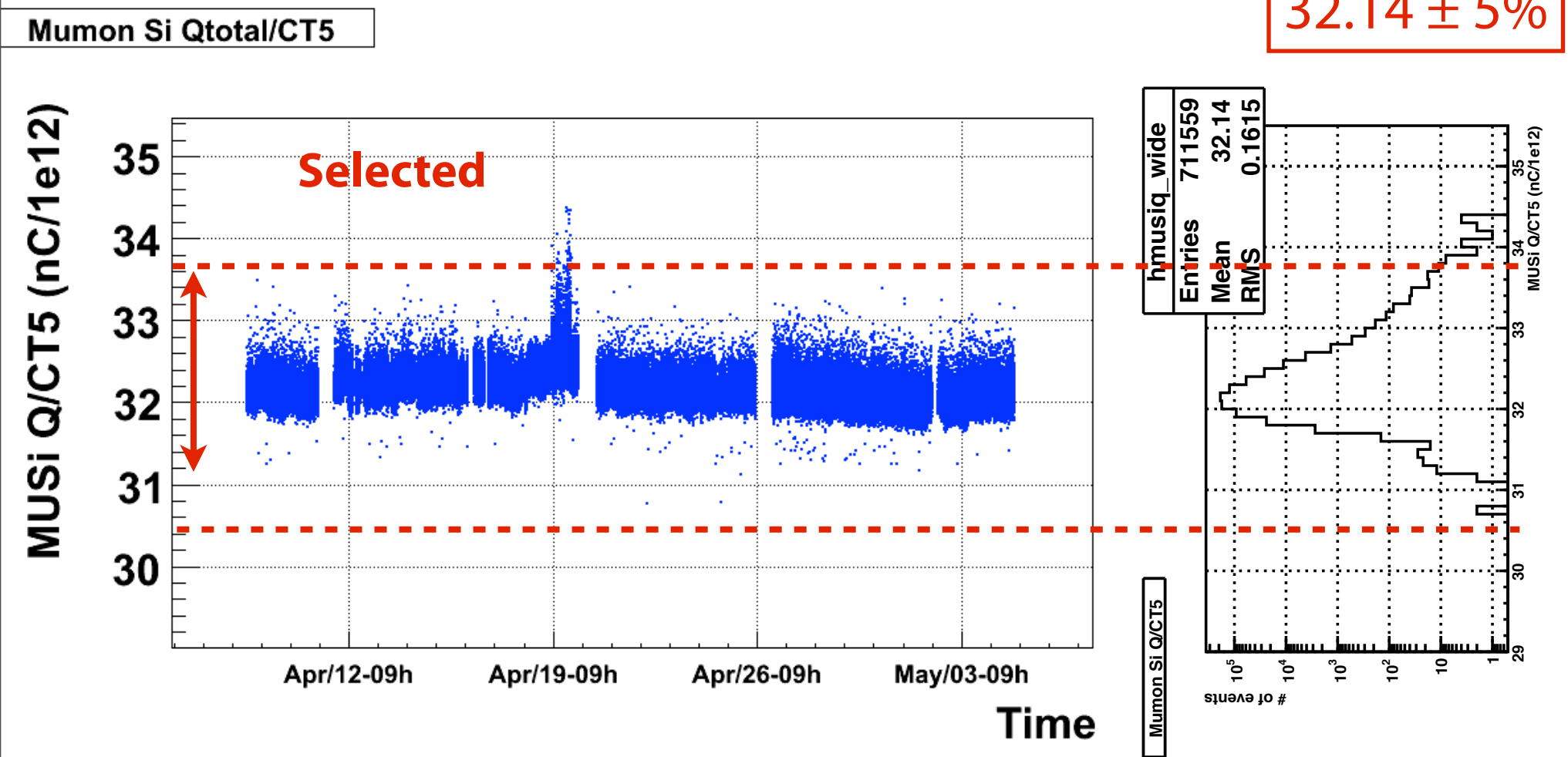
No Bad spill



After beam restart, MUSi-y was about 1cm larger than MUSi-y before beam stop and decrease

MUMON Si Q / CT05

32.14 ± 5%



24 Bad spill (→ increase from prev.(18 spills at 4/25 report) because mean of this ratio slightly decrease by including latest data)

→ Still investigate the reason of bad spills

Summary of Good spill selection (MR Run42)

Run# 420022(4/8)~420212(5/5)

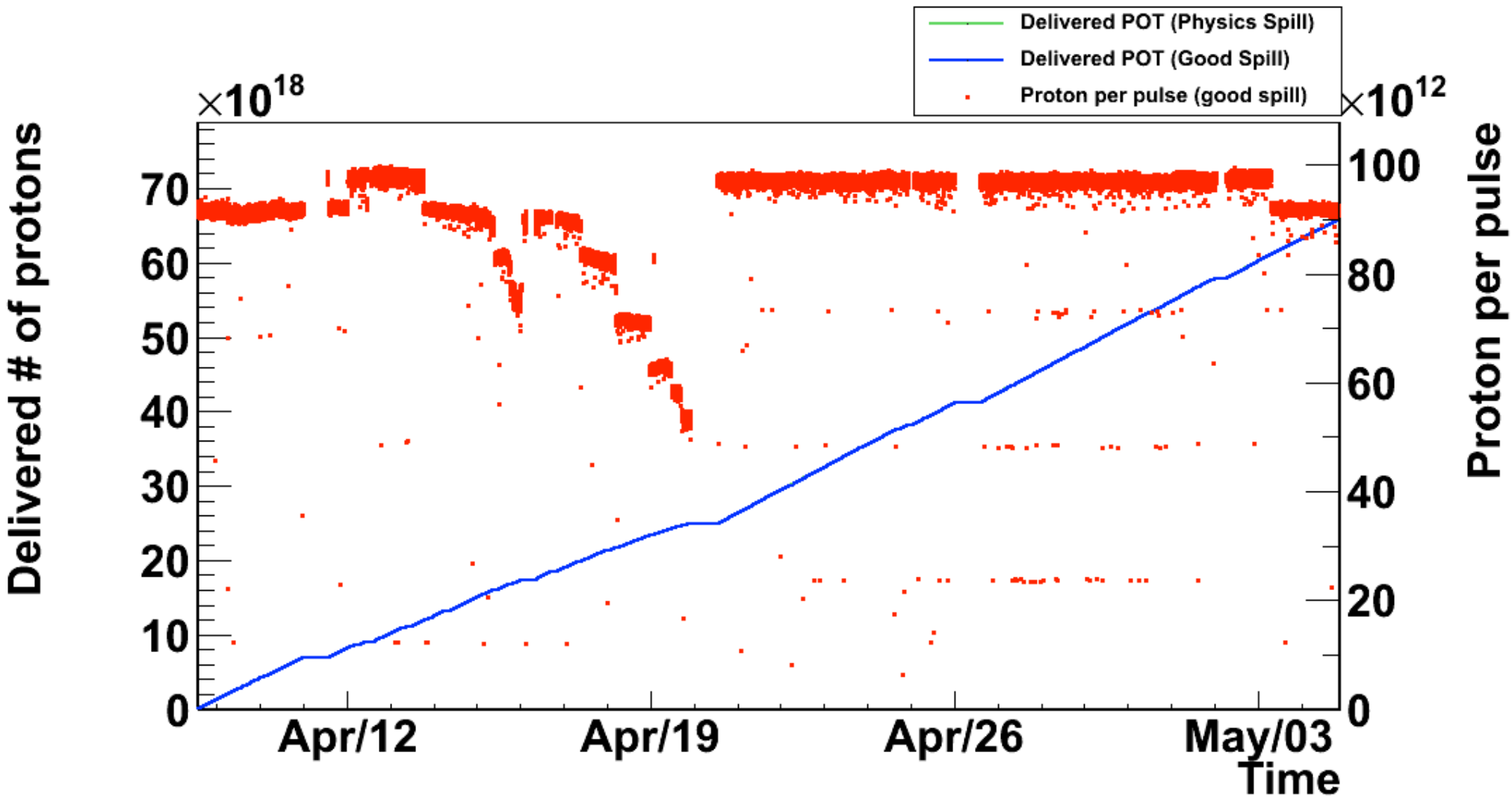
	# of spills	Ratio
Physics spills	720980	1
Beam trigger	712202	0.988
Good GPS	712202	0.988
ppp(CT5)>1e11	711560	0.987
Normal beam	711559	0.987
Horn cut	711559	0.987
MUMON cut	711535	0.987

Bad spills during beam operation : **24** = **0.003%** of good spills

# of delivered protons (CT5) after Good spill selection :

6.583 e+19

Integrated POT (MR Run42)



Definition of Good spill flag

- In order to distinguish the Horn-off spill from the horn ON spill, the value of the good flag will be re-defined.
  - flag =0 : Not suitable data for physics analysis.
  - flag =1 : Good spill for Horn 250kA operation.
  - flag =100 : Good spill for Horn OFF.
  - flag = 2, 3 ... 99: Reserved for the other horn operation mode.
  - flag =-1,-2 ... -99: Reserved for the other horn operation mode with opposite polarity.

horn current	0 kA	200 kA	250 kA
good spill flag	100	2	1

T2K RUN1, 2, 3c : Flag = 1　T2K RUN3b : Flag = 2

Back up

Neutrino Event/Trouble around 4/29 (from Shift summary)

4/26 Maintenance (10:00-21:00 MR injection Kicker)
[NU maintenance]
+ Horn CW: cover gas sampling, flushing
+ 32deg-CW: 4/20 by-pass of degasfier was open in TS-B2.
+ NU2 30deg CW:4/27 AM Change broken strainer by new one.
+ DAQ maintenance: Control network maintenance: done.
+ NU3 CW: Low flow rate:
+ Slow-monitor maintenance:

4/29
4:22 DAQ abort
MIDAS status had no error. it was known case written in the shift manual. Alert was rest and run was changed.
5:35 Online Mon.
"MAG,PH3" is larger value (12.8A) than threshold. In plot, error bar was very large (+/-2A), but center value is almost zero.
Alert was reset and run was changed.It was informed to Nakadaira-san and Fujii-san.
13:38 Slow alarm
NU2 temperature was slowly rising. Air conditioner setting was too high. The setting was adjusted. Now it is stable.

4/30 21:01 NU MPS Horn current balance
-> checked -> no problem
-> 21:47 Horn recovered
-> 21:53 beam is back
5/2 10:00-12:00 MR study

5/2 11:30 Horn CW He sampling
--> Stop horn operation during sampling work.

Bad spills by mumon/ct cut

The list of 24 bad spills by mumon/ct cut

Run# Event# Spill# : MUMON SiQ / CT05 [nC/1e12 pot]

420129 399 2787394 : 33.8941
420131 4245 2792766 : 34.0369
420131 6614 2795135 : 33.8097
420131 6690 2795211 : 33.7969
420133 99 2802369 : 33.8241
420133 282 2802552 : 34.3632
420133 365 2802635 : 34.0714
420133 842 2803112 : 34.3079
420133 1663 2803933 : 33.9289
420133 1981 2804251 : 33.8019
420133 2736 2805006 : 34.3291
420133 3397 2805667 : 34.2762
420133 3744 2806014 : 34.1580
420133 3781 2806051 : 33.8342
420133 3975 2806245 : 33.9332
420133 4121 2806391 : 33.8077
420133 4359 2806629 : 33.8676
420133 4409 2806679 : 34.2070
420133 4540 2806810 : 33.8394
420133 5709 2807979 : 34.0246
420133 5883 2808153 : 33.7843
420133 5893 2808163 : 34.0234
420133 6015 2808285 : 33.7949
420133 6067 2808337 : 34.3270

Now investigate the reason of these bad spills. At this moment, these spills are still “Bad”.