INTT Run QA Analysis

Jaein Hwang (Korea Univ.)
Takahiro Kikuchi(Rikkyo Univ.)

Mar.14 2025

Review / Motivation

Thanks to Devon for his initial effort on temporary INTT QA for upcoming QuarkMatter

Jaein and Takahiro co-work with Devon for temporary GoodRunList and has been published.

- Check BCO alignment based on Calibration result
- Check HitMap distribution from Offline RawHit QA

✅ INTT BCO Diff ✅ INTT Hit Acceptance ✅ INTT FEE RMS ✅ MVTX Hit Acceptance ✅ MVTX chi2/ndf ✅ MVTX B/A ratio ✅ MVTX Run length

> 51732 51733 51735 51736 51740 51741 51742 51753 51754 51762 51763 51764 51768 51772 51777 51778 51825 51826 51827 51828
> 51829 51831 51837 51838 51839 51840 51841 51842 51843 51854 51855 51856 51858 51860 51865 51874 51877 51878 51881
> 51886 51900 51901 51902 51905 51906 51907 51908 51914 51915 51921 51936 51979 51981 51988 52020 52027 52031 52050

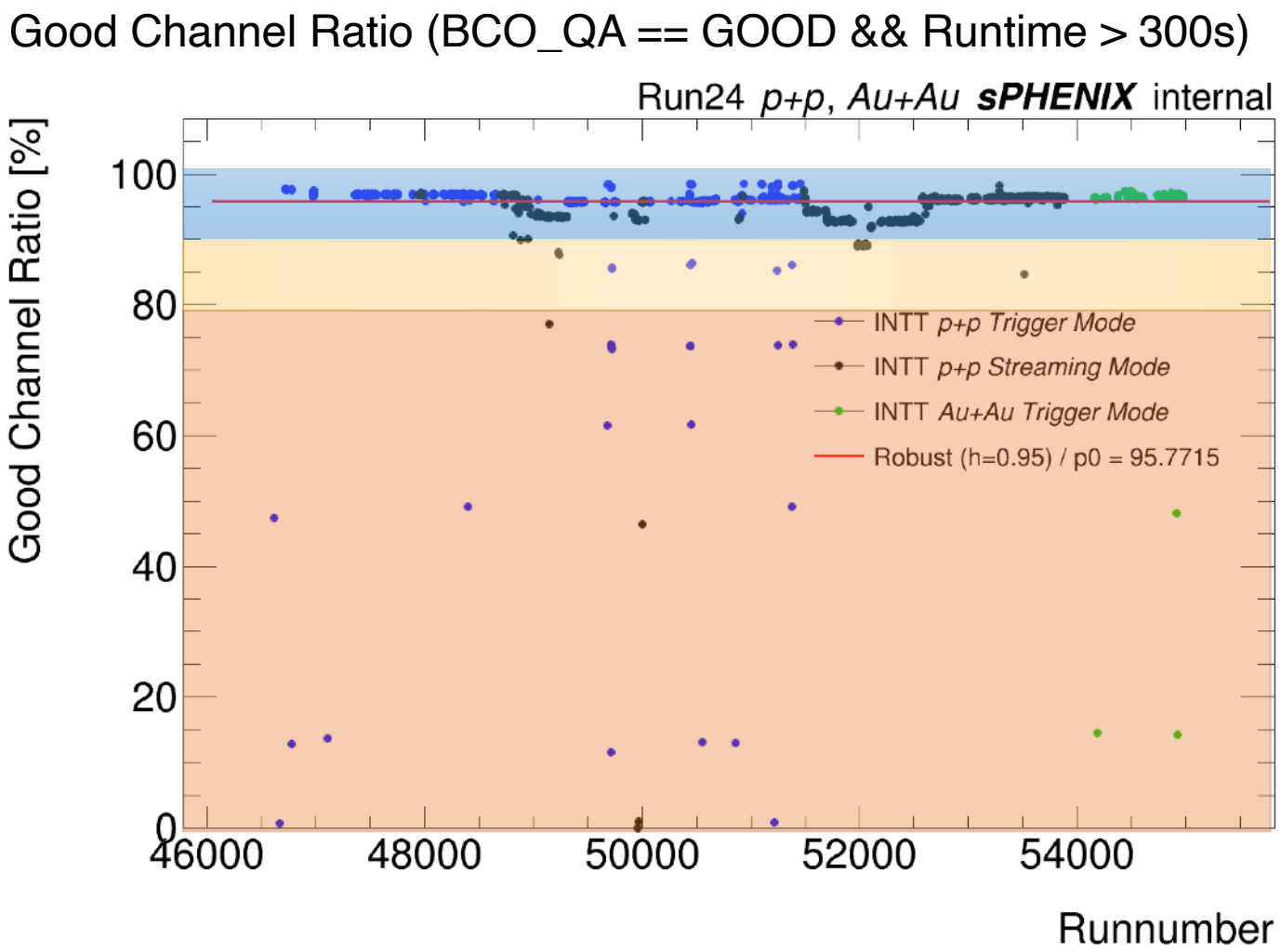
limitation of previous temporary QA

- Only cover some streaming runs -> Only silicon runs has to be included for final list
- No hot/cold channel rejection is included -> Only one hot channel can affect on entire half-ladder
- Bug revealed on Offline QA code(fixed)

Considering time-limit, It's enough for QuarkMatter as we discussed in privies INTT meeting,

But, final good run list has to be performed by INTT expert. (Responsibility on INTT group)

INTT Run QA criteria



- Golden Run
  BCO alignment = GOOD
  Runtime >= 5 mins
  GOOD Channel ratio > 90%

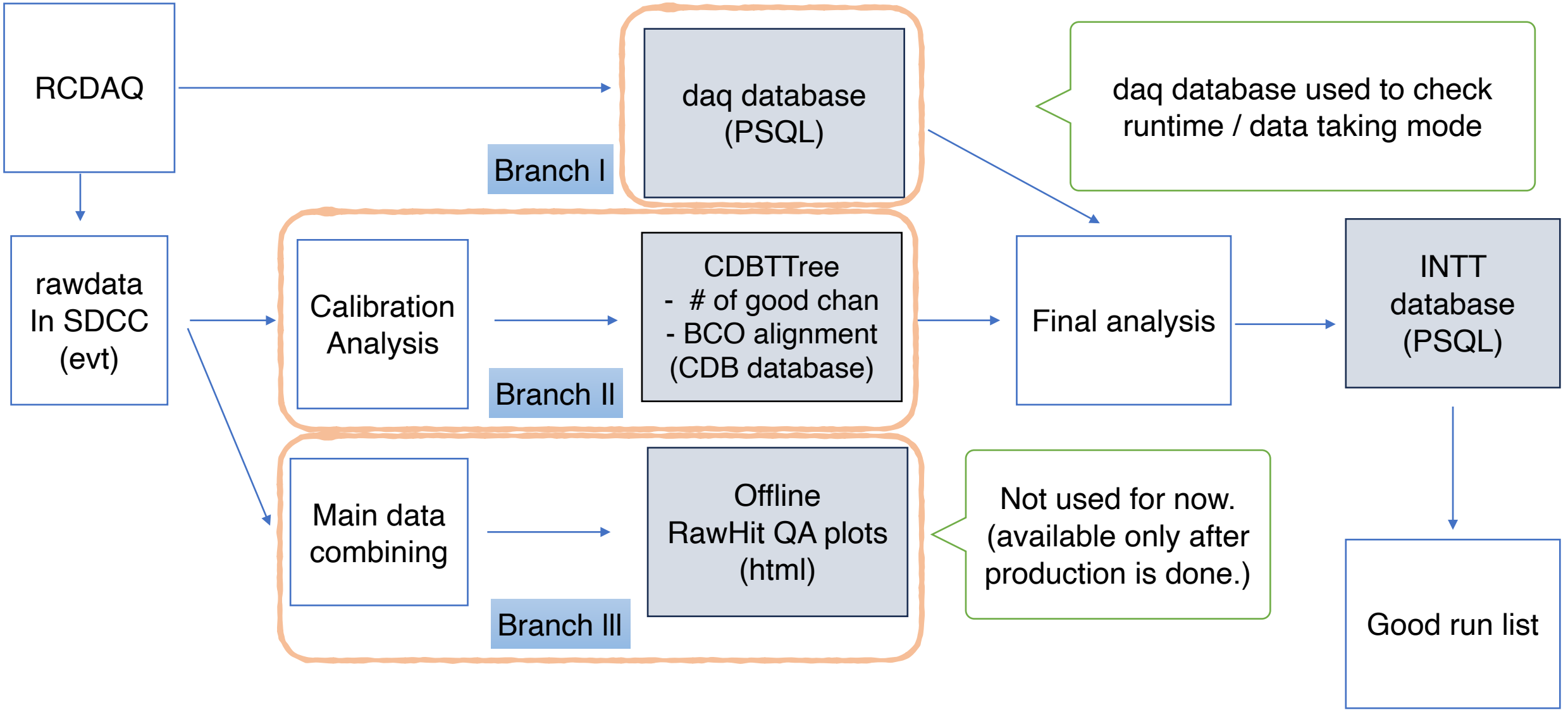
- Questionable case 1
  Runtime < 5mins

- Questionable case 2
  Runtime >= 5mins
  80% < Good Channel ratio < 90%

- Bad Run case 1
  Runtime >= 5mins
  BCO alignment = BAD

- BAD Run case 2
  Runtime >= 5mins
  Good Channel ratio < 80%

INTT Run QA structure



INTT PSQL database updated

RCDAQ

rawdata In SDCC (evt)

```
intt=# SELECT * FROM intt_qa_expert;
 runnumber |  runtime  | runmode | nevents  |    goodchanratio     | n_dead | n_cold | n_hot  | intt_bco_diff_qa
-----------+-----------+---------+----------+----------------------+--------+--------+--------+------------------
     40874 |       199 |       0 |  2110767 |   98.50671789148352  |   5022 |    360 |    184 |                0
     40875 |        53 |       0 |   331514 |    61.7423592032967  | 142340 |    230 |     30 |                0
     40876 |       430 |       0 |  4179688 |   98.56520432692307  |   4931 |    177 |    240 |                0
     40877 |       253 |       0 |  2048792 |    98.5338148179945  |   4890 |    371 |    204 |                0
     40878 |       561 |       0 |  5260820 |   98.47210894574175  |   4999 |    445 |    251 |                0
     40879 |       208 |       0 |  1788060 |   98.51583962912088  |   4889 |    425 |    218 |                0
     40880 |        49 |       0 |   273104 |   98.59525240384616  |   4968 |     86 |    182 |                0
     40881 |        66 |       0 |   515869 |   98.54991200206044  |   4879 |    341 |    185 |                0
     40882 |        29 |       0 |    92559 |   98.58639895260988  |   4881 |    264 |    124 |                0
     40883 |        40 |       0 |   227832 |   98.55286315247253  |   4941 |    294 |    159 |                0
     40884 |       759 |       0 |  7314997 |    98.5598385989011  |   4924 |    277 |    167 |                0
     40885 |       171 |       0 |  1683075 |    86.1314710679945  |  51263 |    198 |    232 |                0
     40886 |       430 |       0 |  4395602 |   74.22653030563187  |  95670 |    374 |     23 |                0
     40887 |       124 |       0 |  1167236 |   74.21928657280219  |  95746 |    320 |     28 |                0
     40888 |        92 |       0 |   699469 |   74.17823875343407  |  95670 |    552 |     25 |                0
     40889 |       467 |       0 |  3470711 |   98.50269359546702  |   4860 |    514 |    207 |                0
     40890 |       661 |       0 |  8336680 |   98.49008413461539  |   4990 |    422 |    216 |                0
     40891 |       195 |       0 |   894990 |   98.43401227678571  |   4879 |    766 |    192 |                0
     40892 |       277 |       0 |  2609623 |   98.40503734546702  |   4997 |    778 |    170 |                0
     40893 |      1231 |       0 | 14396800 |   98.44930460164835  |   5002 |    612 |    166 |                0
     40894 |       230 |       0 |  1361405 |   86.02737594436813  |  51366 |    569 |    146 |                0
     40895 |      1070 |       0 | 13729762 |   86.07808207417582  |  51389 |    297 |    206 |                0
     40896 |       545 |       0 |  4853906 |   86.00698617788461  |  51385 |    591 |    181 |                0
     40897 |       158 |       0 |   479919 |   86.06278974931318  |  51393 |    366 |    190 |                0
     40898 |       417 |       0 |  5476186 |   85.01888736263736  |  55287 |    366 |    187 |                0
     42201 |       616 |       0 |  2219825 |   98.47532838255495  |   5144 |    475 |     64 |                1
     42202 |      2042 |       0 |  7289536 |   98.45091432005495  |   5148 |    580 |     46 |                1
     42203 |      2018 |       0 |  1687526 |   98.51369333791209  |   5151 |    328 |     61 |                1
```

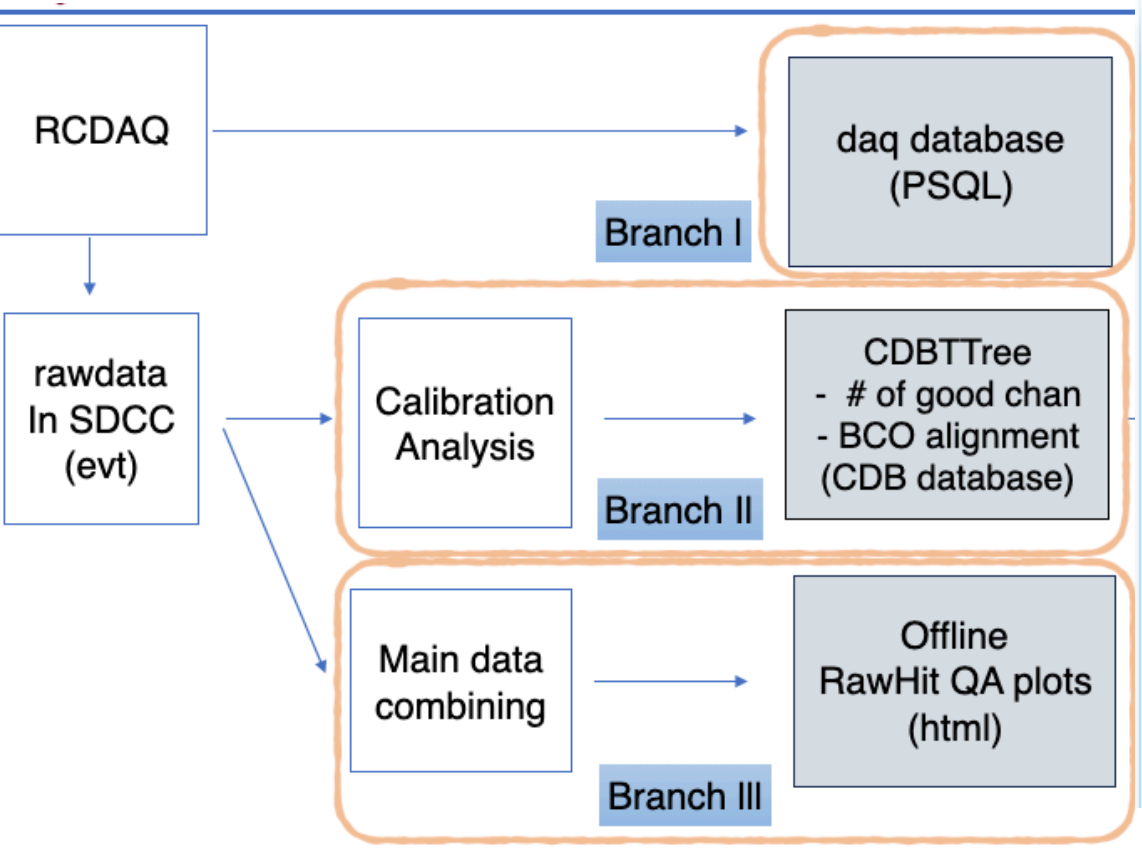
INTT database (PSQL)

Good run list

- Every QA iteams are listed in database before applying the criteria
  - runtime(s), runmode[0 : trigger , 1 : streaming] nevents(number of gl1 events)
  - Goodchanratio , n_dead, n_cold, n_hot
  - intt_bco_diff_qa[0 : bad, 1: GOOD]

Organization for documentation(1)

- Wiki documentation https://wiki.sphenix.bnl.gov/index.php?title=INTT_Offline_QA



Page Discussion

INTT Offline QA

This page provides details on all aspects of the INTT run24 QA based on InttRawHit and calibration analysis.

Contents [hide]

Everything related to INTT
Run QA will be written here

Organization for documentation(2)

- Offline QA in officical production trace has been created

INTT QA item proposal

파일 수정 보기 삽입 서식 데이터 도구 확장 프로그램 도움말

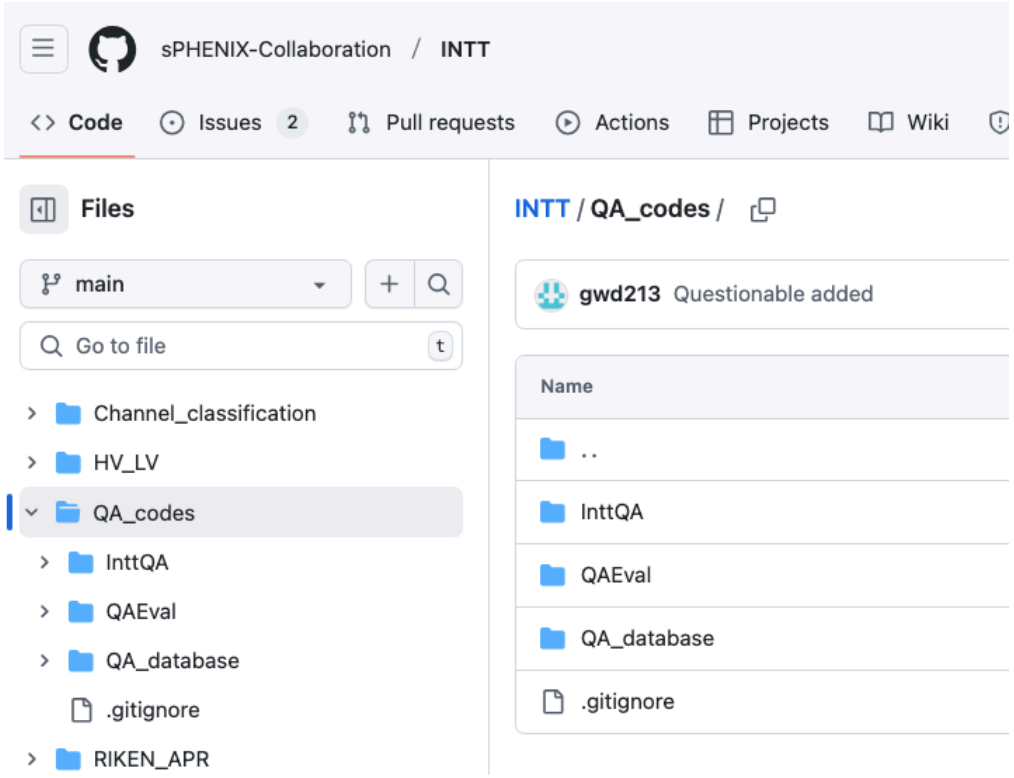
A1 | Label

	A	B	C	D	E
1	Label	Name	QA level	Status	Note
2	1	**MixUp QA**	RawHit QA	Code is in GIthub. No one use it	Should it be merged to IntRawHitQA?
3	2	**Cluster phi size QA**	Cluster QA	Plot is already available. Not not used for QA	What is next step for it?
4	3	**# of cluster correlation**	Cluster QA	Not developed yet	Can be devloped in InttClusterQA
5					

https://docs.google.com/spreadsheets/d/1HqQ7VDKrWo2ibPOf9SLO4XE6nFhlrqQZeKfOXQ4b358/edit?gid=0#gid=0

Organization for documentation(3)

- Code is available in GitHub



InttQA -> Genki's Offline QA code
QAEval -> Main analysis for Run classification

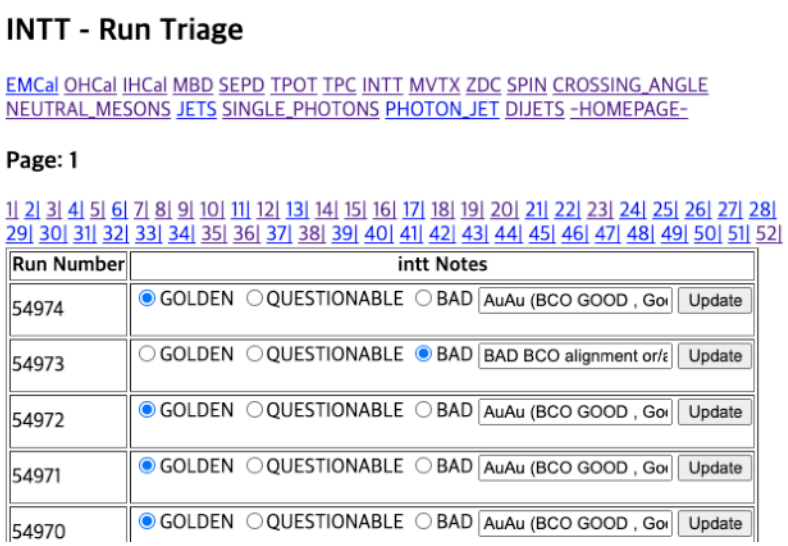
```
#include <InttQAEval.h>

R__LOAD_LIBRARY(libInttQAEval.so)

void run_INTTQA()
{
    InttQAEval *eval = new InttQAEval();
    eval->SetDebug(false);
    eval->SetUseHtml(false);
//  eval->SetQAhtmlInputDir("/sphenix/data/data02/sphnxpro/QA
for (int i = 40874; i < 55030; i++)
    {
        eval->SetRunNumber(i);
        eval->DoInttQA();
    }
    eval->SaveTreeToFile("InttQAEval_2.root");
}
```

QA_database -> Code related to PSQL maintenance

```
[jaein213 20:55:02 QA_database] $python3 put_in_database.py
Enter the task to execute (create_inttdb / insert_into_inttdb / i
nsert_into_runtriage / init_runtriage / help / exit): exit
Exiting... Goodbye!
```

Organization for documentation(4)

- sPHENIX official Run Triage has been updated



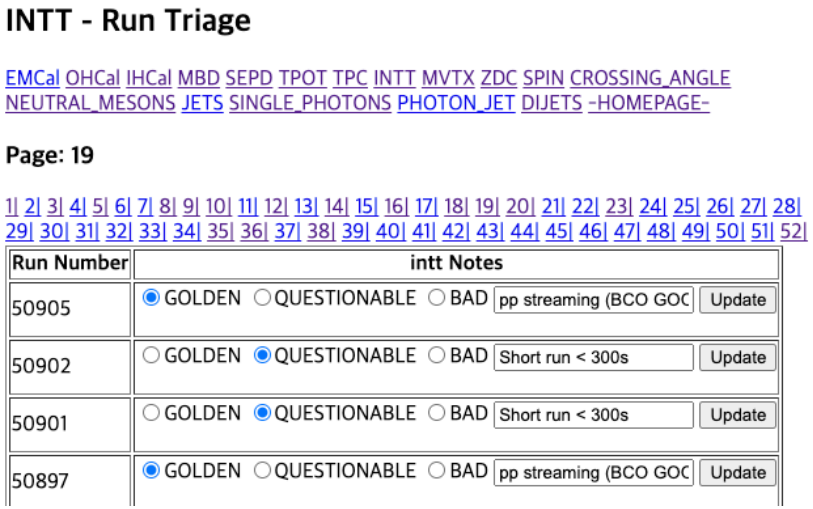
INTT - Run Triage

EMCal OHCal IHCal MBD SEPD TPOT TPC INTT MVTX ZDC SPIN CROSSING_ANGLE
NEUTRAL_MESONS JETS SINGLE_PHOTONS PHOTON_JET DIJETS -HOMEPAGE-

Page: 1

1| 2| 3| 4| 5| 6| 7| 8| 9| 10| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20| 21| 22| 23| 24| 25| 26| 27| 28| 29| 30| 31| 32| 33| 34| 35| 36| 37| 38| 39| 40| 41| 42| 43| 44| 45| 46| 47| 48| 49| 50| 51| 52|

Run Number	intt Notes
54974	GOLDEN QUESTIONABLE BAD AuAu (BCO GOOD , Go Update
54973	GOLDEN QUESTIONABLE BAD BAD BCO alignment or/ Update
54972	GOLDEN QUESTIONABLE BAD AuAu (BCO GOOD , Go Update
54971	GOLDEN QUESTIONABLE BAD AuAu (BCO GOOD , Go Update
54970	GOLDEN QUESTIONABLE BAD AuAu (BCO GOOD , Go Update



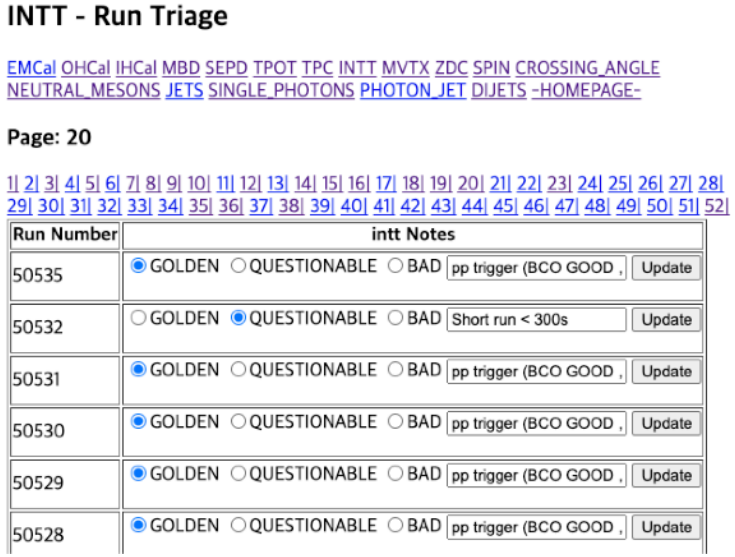
INTT - Run Triage

EMCal OHCal IHCal MBD SEPD TPOT TPC INTT MVTX ZDC SPIN CROSSING_ANGLE
NEUTRAL_MESONS JETS SINGLE_PHOTONS PHOTON_JET DIJETS -HOMEPAGE-

Page: 19

1| 2| 3| 4| 5| 6| 7| 8| 9| 10| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20| 21| 22| 23| 24| 25| 26| 27| 28| 29| 30| 31| 32| 33| 34| 35| 36| 37| 38| 39| 40| 41| 42| 43| 44| 45| 46| 47| 48| 49| 50| 51| 52|

Run Number	intt Notes
50905	GOLDEN QUESTIONABLE BAD pp streaming (BCO GOC Update
50902	GOLDEN QUESTIONABLE BAD Short run < 300s Update
50901	GOLDEN QUESTIONABLE BAD Short run < 300s Update
50897	GOLDEN QUESTIONABLE BAD pp streaming (BCO GOC Update



INTT - Run Triage

EMCal OHCal IHCal MBD SEPD TPOT TPC INTT MVTX ZDC SPIN CROSSING_ANGLE
NEUTRAL_MESONS JETS SINGLE_PHOTONS PHOTON_JET DIJETS -HOMEPAGE-

Page: 20

1| 2| 3| 4| 5| 6| 7| 8| 9| 10| 11| 12| 13| 14| 15| 16| 17| 18| 19| 20| 21| 22| 23| 24| 25| 26| 27| 28| 29| 30| 31| 32| 33| 34| 35| 36| 37| 38| 39| 40| 41| 42| 43| 44| 45| 46| 47| 48| 49| 50| 51| 52|

Run Number	intt Notes
50535	GOLDEN QUESTIONABLE BAD pp trigger (BCO GOOD , Update
50532	GOLDEN QUESTIONABLE BAD Short run < 300s Update
50531	GOLDEN QUESTIONABLE BAD pp trigger (BCO GOOD , Update
50530	GOLDEN QUESTIONABLE BAD pp trigger (BCO GOOD , Update
50529	GOLDEN QUESTIONABLE BAD pp trigger (BCO GOOD , Update
50528	GOLDEN QUESTIONABLE BAD pp trigger (BCO GOOD , Update

https://sphenix-intra.sdcc.bnl.gov/WWW/scripts/triage/home.py

Triage flag : GOLDEN, QUESTIONABLE BAD
NOTE : Beam type, runmode[if run is pp], reason..(why bad or why questionable is also written on the note

Summary

- The official INTT run QA has been published. (still available to get comments from INTT expert)
- Several documentation tasks done
  Main wiki page
  https://wiki.sphenix.bnl.gov/index.php?title=INTT_Offline_QA
  QA items list
  https://docs.google.com/spreadsheets/d/1HqQ7VDKrWo2ibPOf9SLO4XE6nFhlrqQZeKfOXQ4b358/edit?gid=0#gid=0
  Official Run Triage
  https://sphenix-intra.sdcc.bnl.gov/WWW/scripts/triage/home.py
  GitHub
  https://github.com/sPHENIX-Collaboration/INTT/tree/main/QA_codes

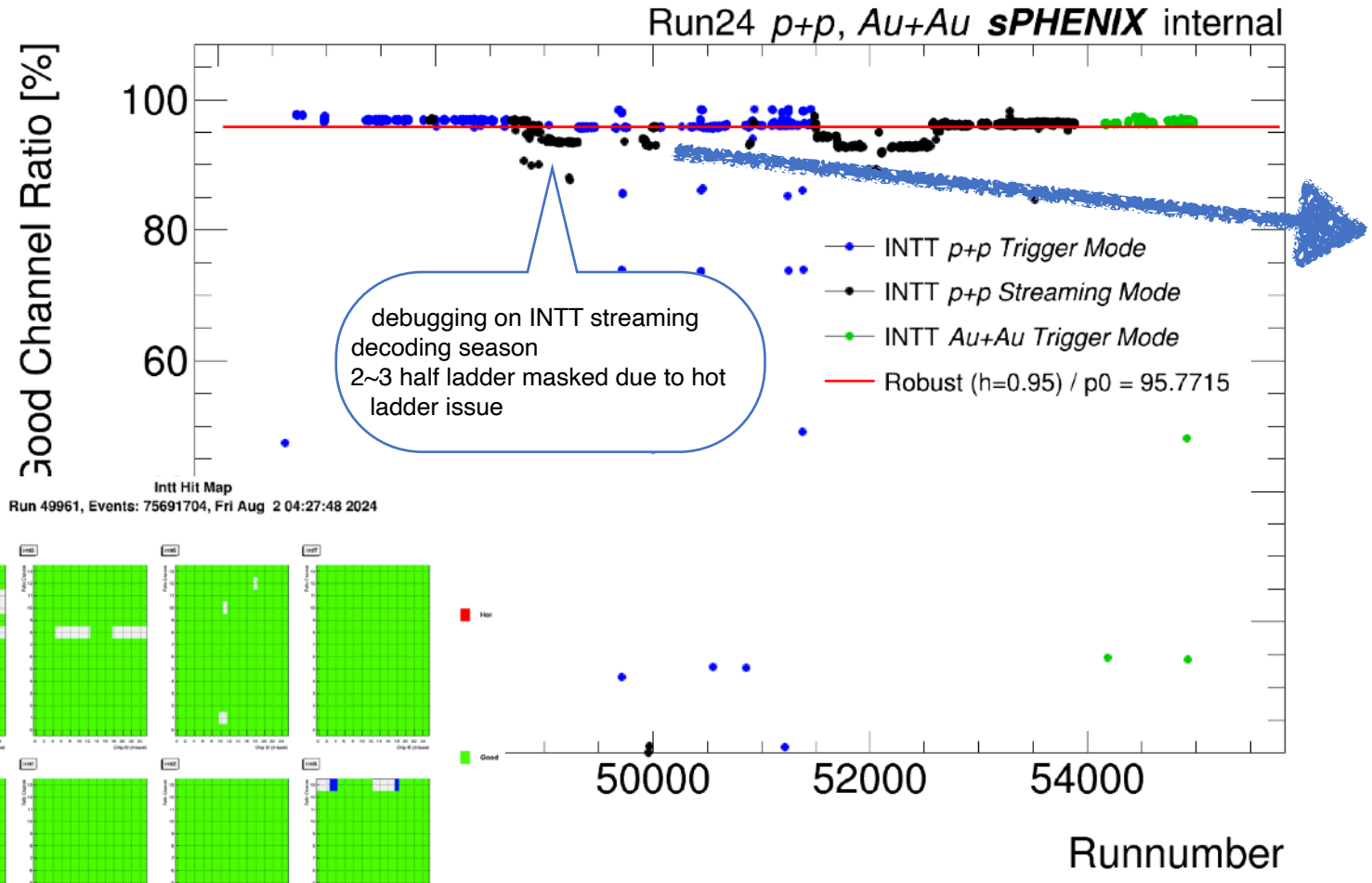
Plan

- I will present in Tracking meeting (When? Will contact to Joe/probably after QM?)
- INTT QM poster (will circulate until next week Fri.)

BACKUP

Remarkable past record(1)

Good Channel Ratio (BCO_QA == GOOD && Runtime > 300s)



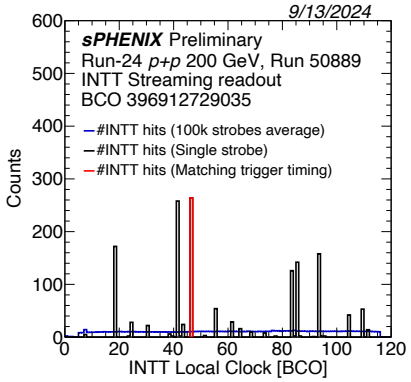
BLUE : Triggered mode

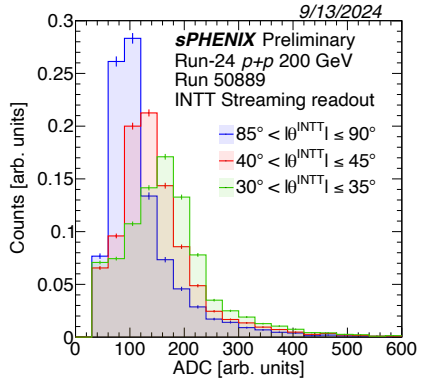
BLACK : Streaming mode

GREEN : AuAu Trigger mode

Linear / Robust (h=0.95) Fit

Run 50,889 / Golden run to clarify INTT is ready for streaming readout





INTT Run QA Result

RC-DAQ events in daq database
is used for # of events estimation

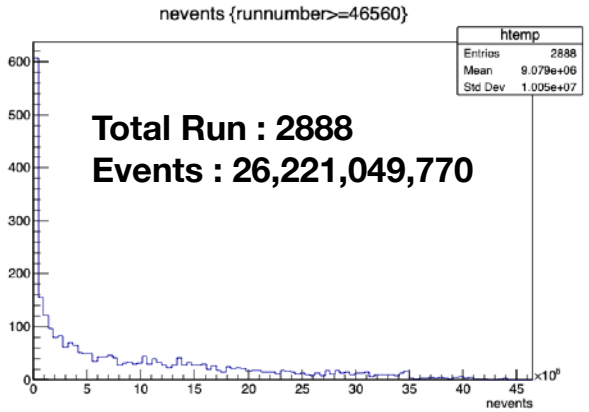
From Jun 21(Run 46560) to End of Run

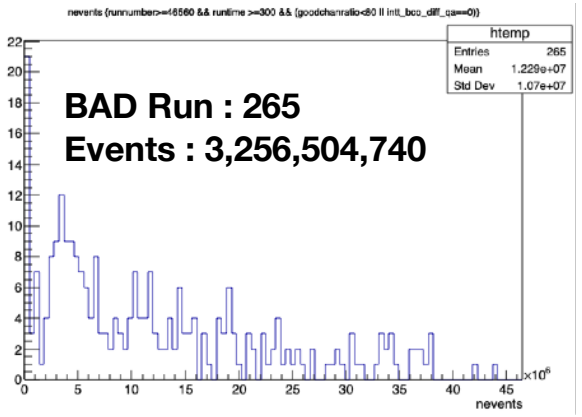
- Golden Run
  BCO alignment = GOOD
  Runtime >= 5 mins
  GOOD Channel ratio > 90%

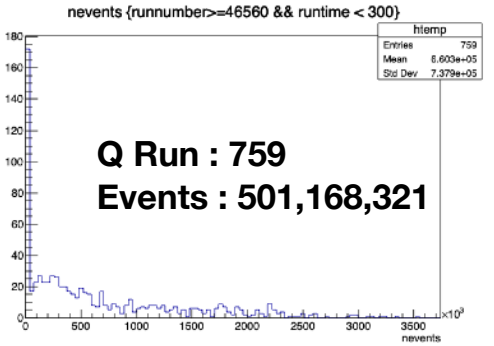
- Bad Run case 1
  Runtime >= 5mins
  BCO alignment = BAD

- BAD Run case 2
  Runtime >= 5mins
  Good Channel ratio < 80%

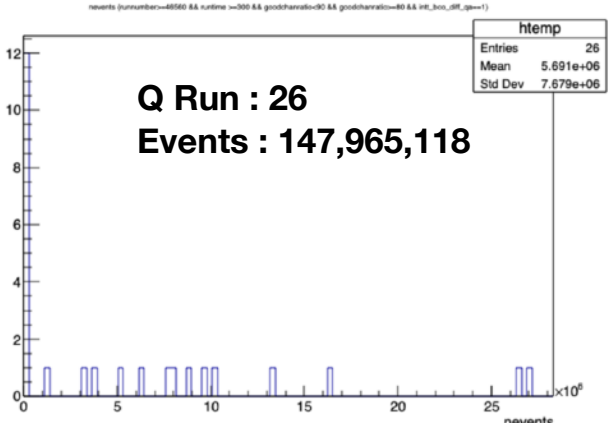
- Questionable case 1
  Runtime < 5mins







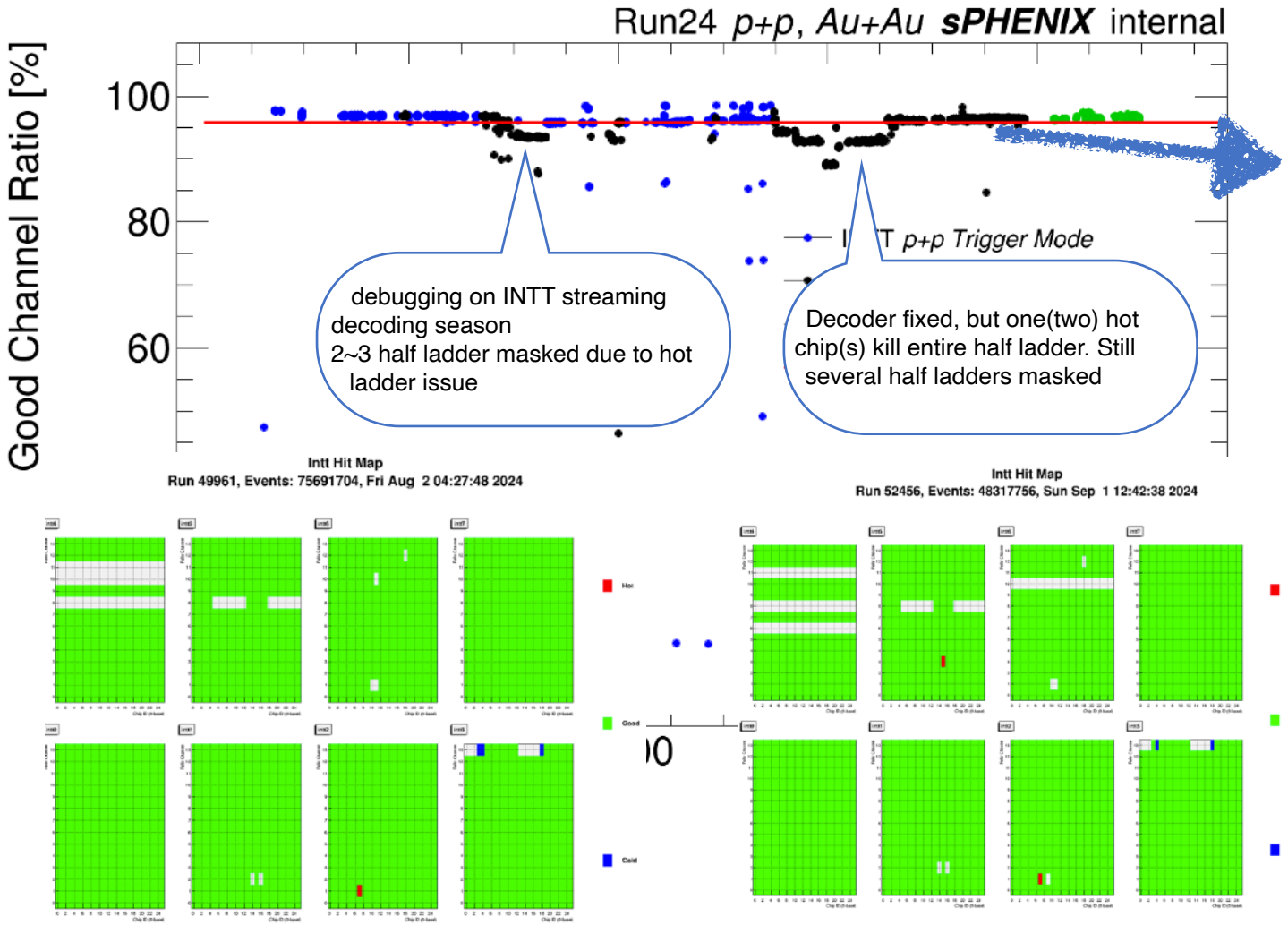
- Questionable case 2
  Runtime >= 5mins
  80% < Good Channel ratio < 90%



Category	Fraction of Runs (%)	Fraction of Event (%)
GOOD	63.67%	85.09%
BAD	9.18%	12.42%
Questionable	27.15%	2.49%

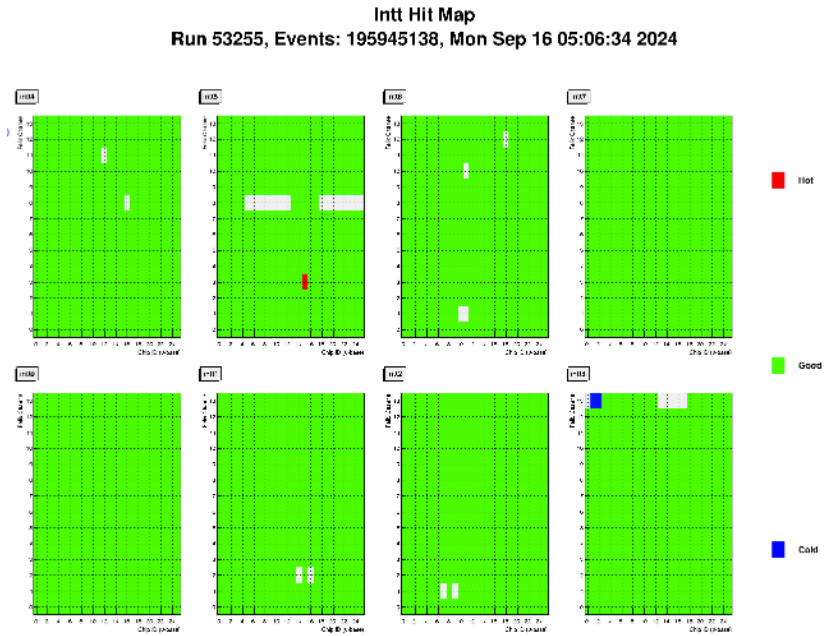
Remarkable past record(2)

Good Channel Ratio (BCO_QA == GOOD && Runtime > 300s)



FELIX Update by Raul
-> Chip masking on FELIX side available

INTT back to operating with ~95% GOOD channel



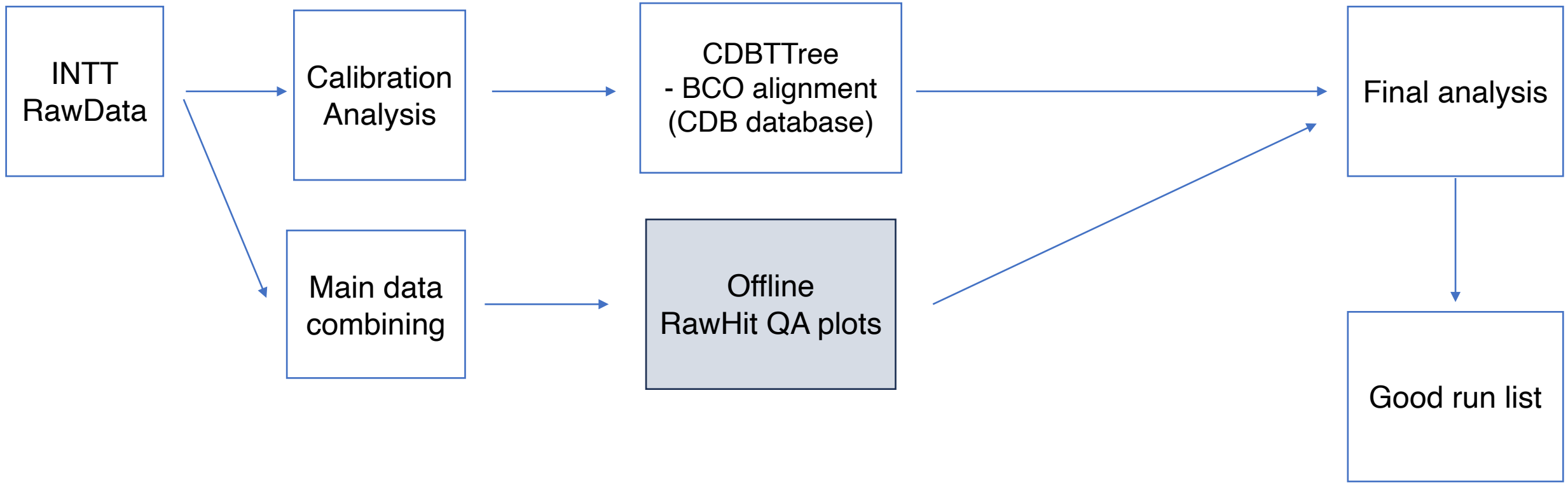
INTT Run QA structure(OLD)

RCDAQ

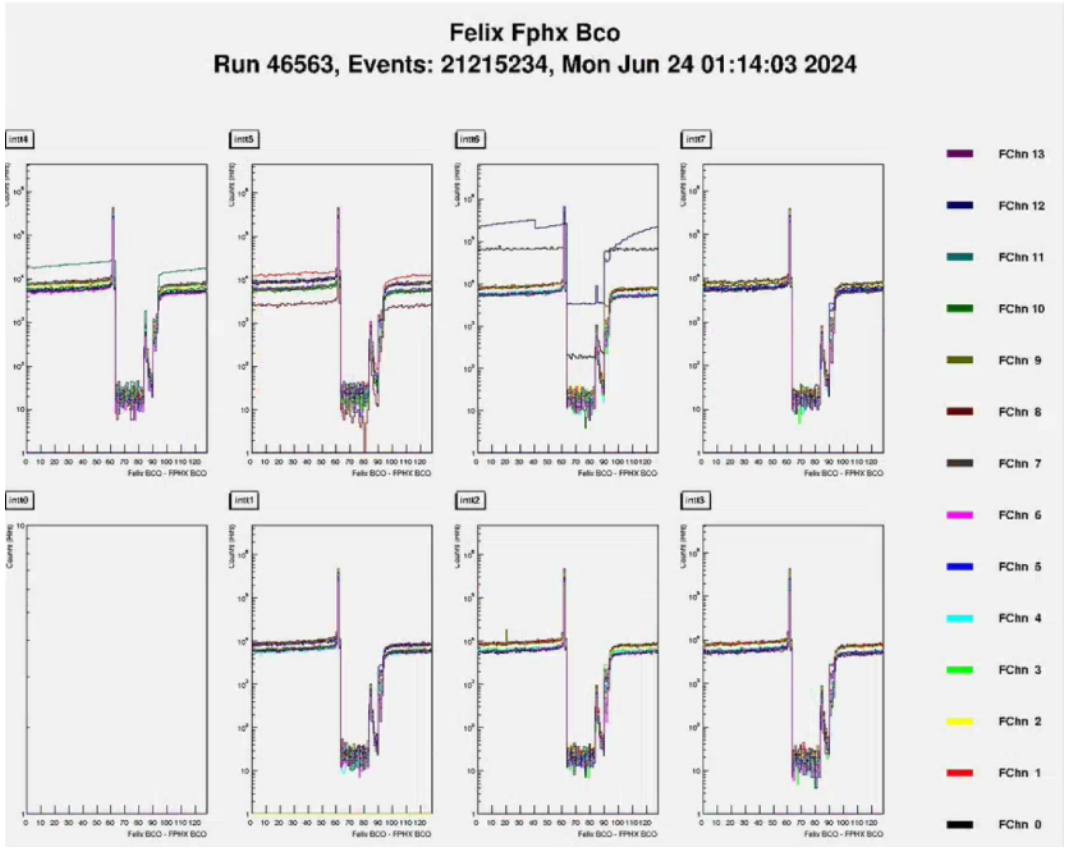
- Check BCO alignment based on Calibration result
- Check HitMap distribution from Offline RawHit QA, BUT..

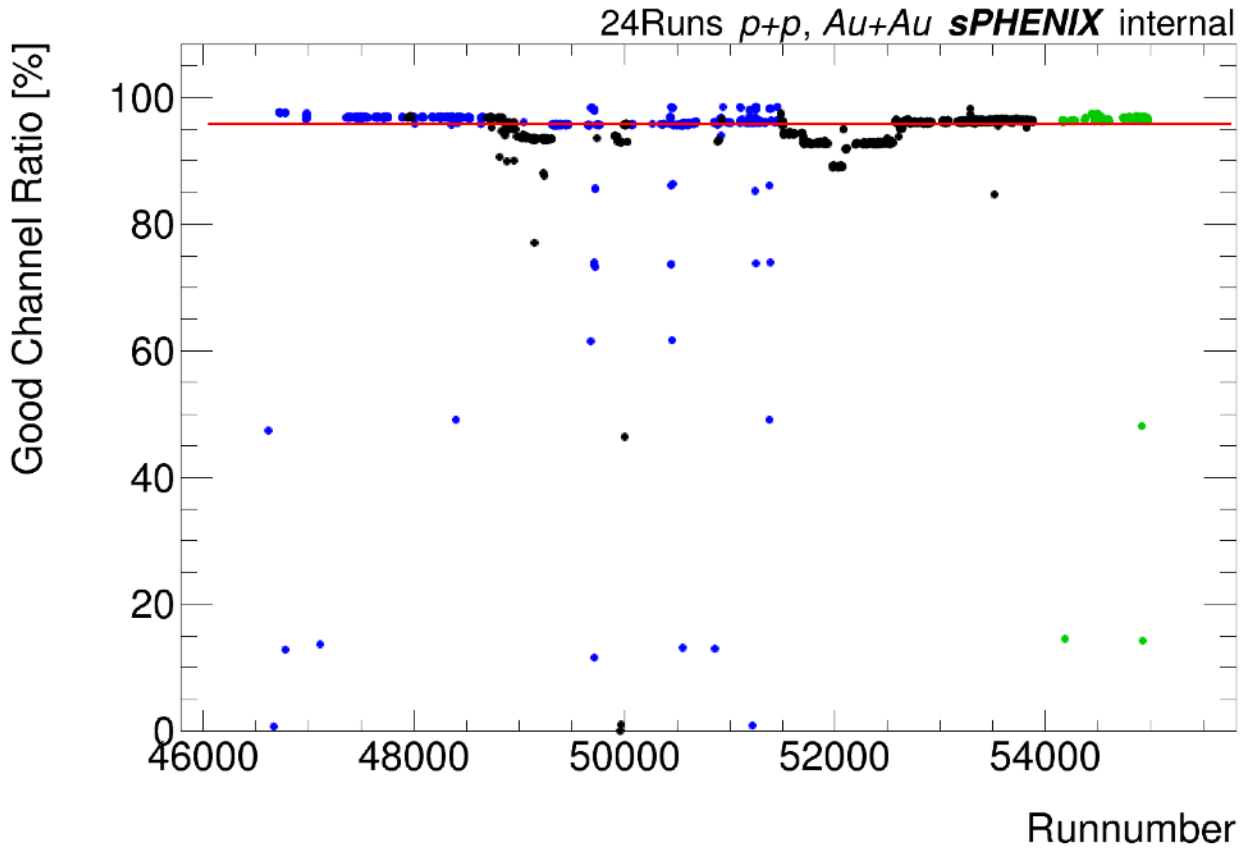
Only cover some streaming runs -> Only silicon runs have to be included for final list

No hot/cold channel rejection is included -> Only one hot channel can affect on entire half-ladder

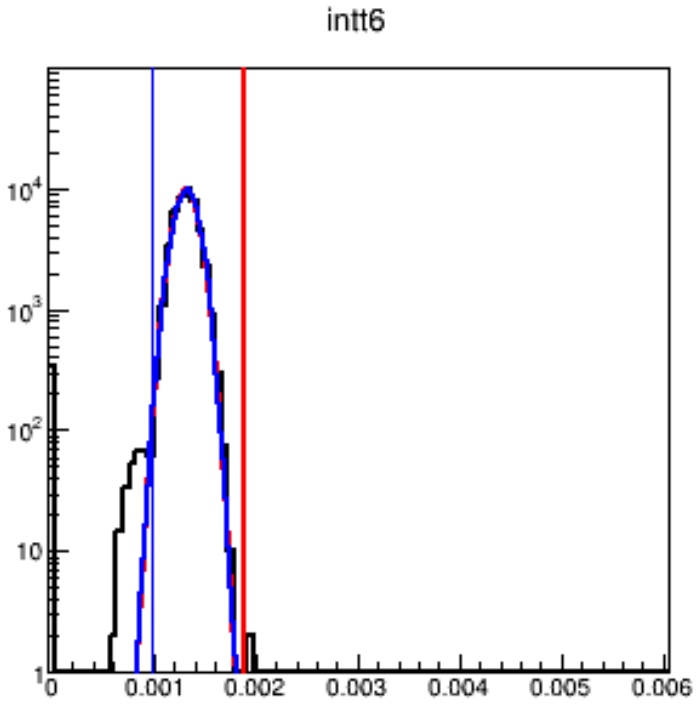


BACKUP


Felix Fphx Bco
Run 46563, Events: 21215234, Mon Jun 24 01:14:03 2024
FChn 13
FChn 12
FChn 11
FChn 10
FChn 9
FChn 8
FChn 7
FChn 6
FChn 5
FChn 4
FChn 3
FChn 2
FChn 1
FChn 0

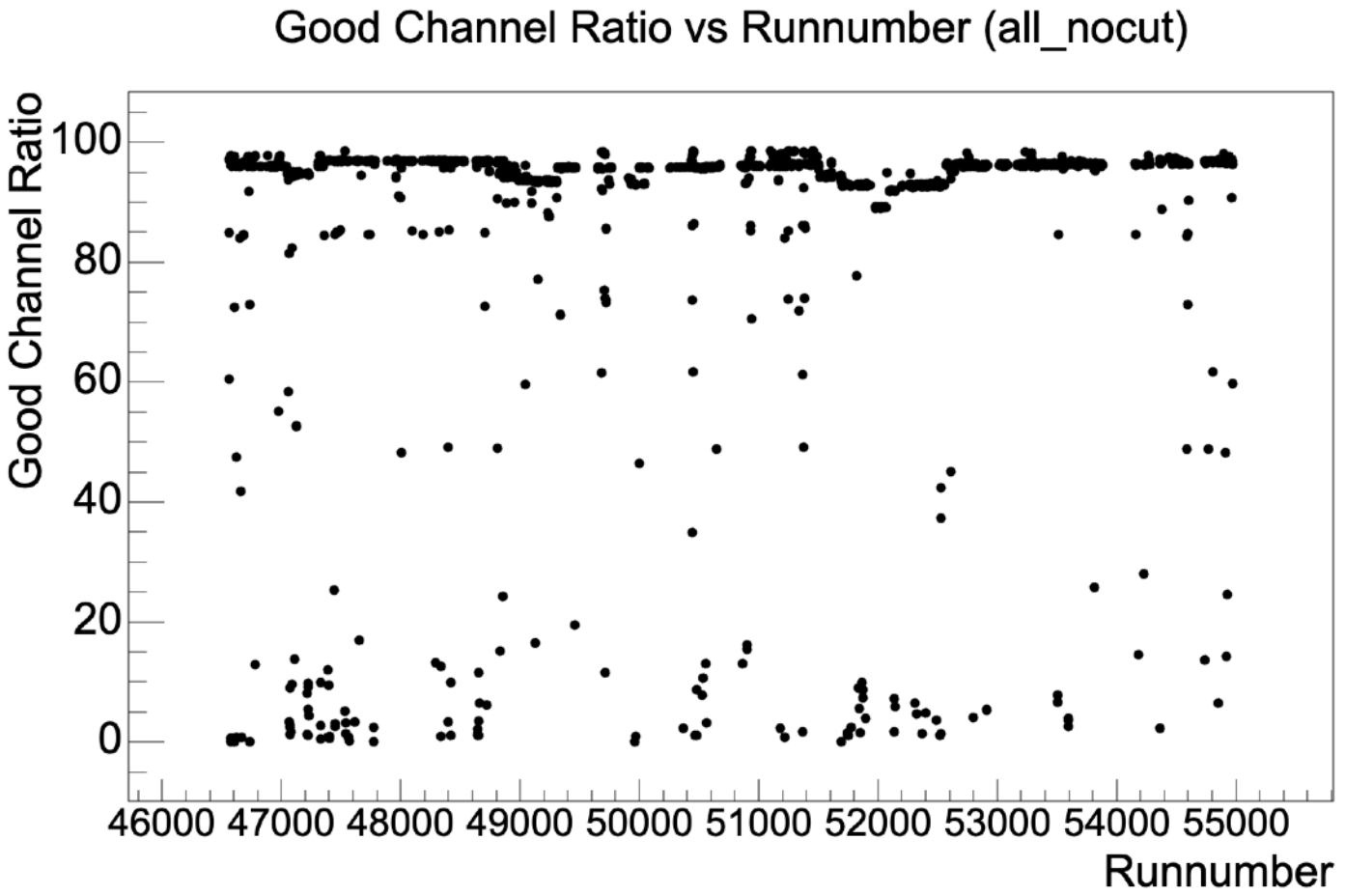

24Runs p+p, Au+Au sPHENIX internal
Good Channel Ratio [%]
100
80
60
40
20
0
46000
48000
50000
52000
54000
Runnumber

BACKUP

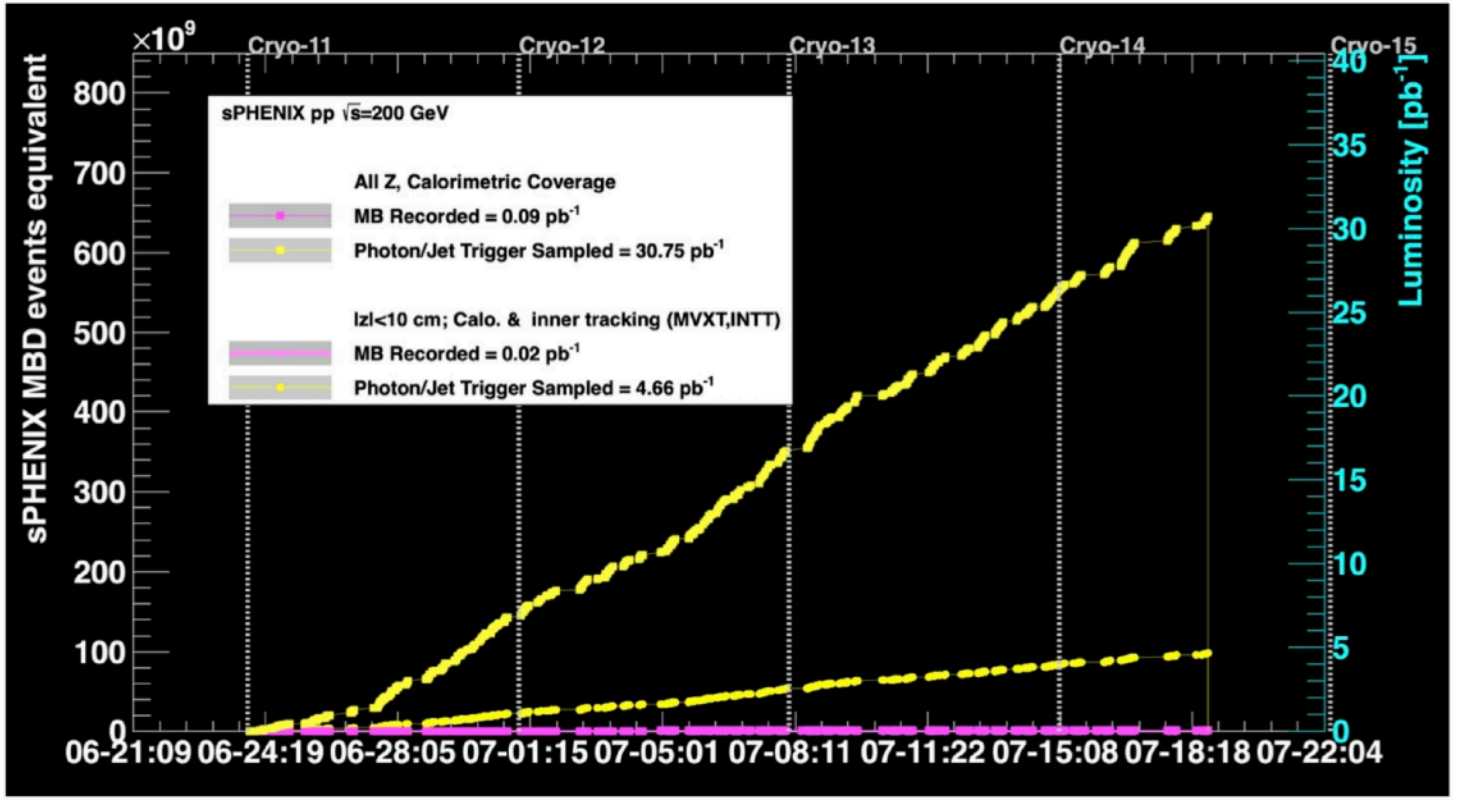


Dead/No hit Cold Hot

mean-3sig<good<mean+5sig



BACKUP

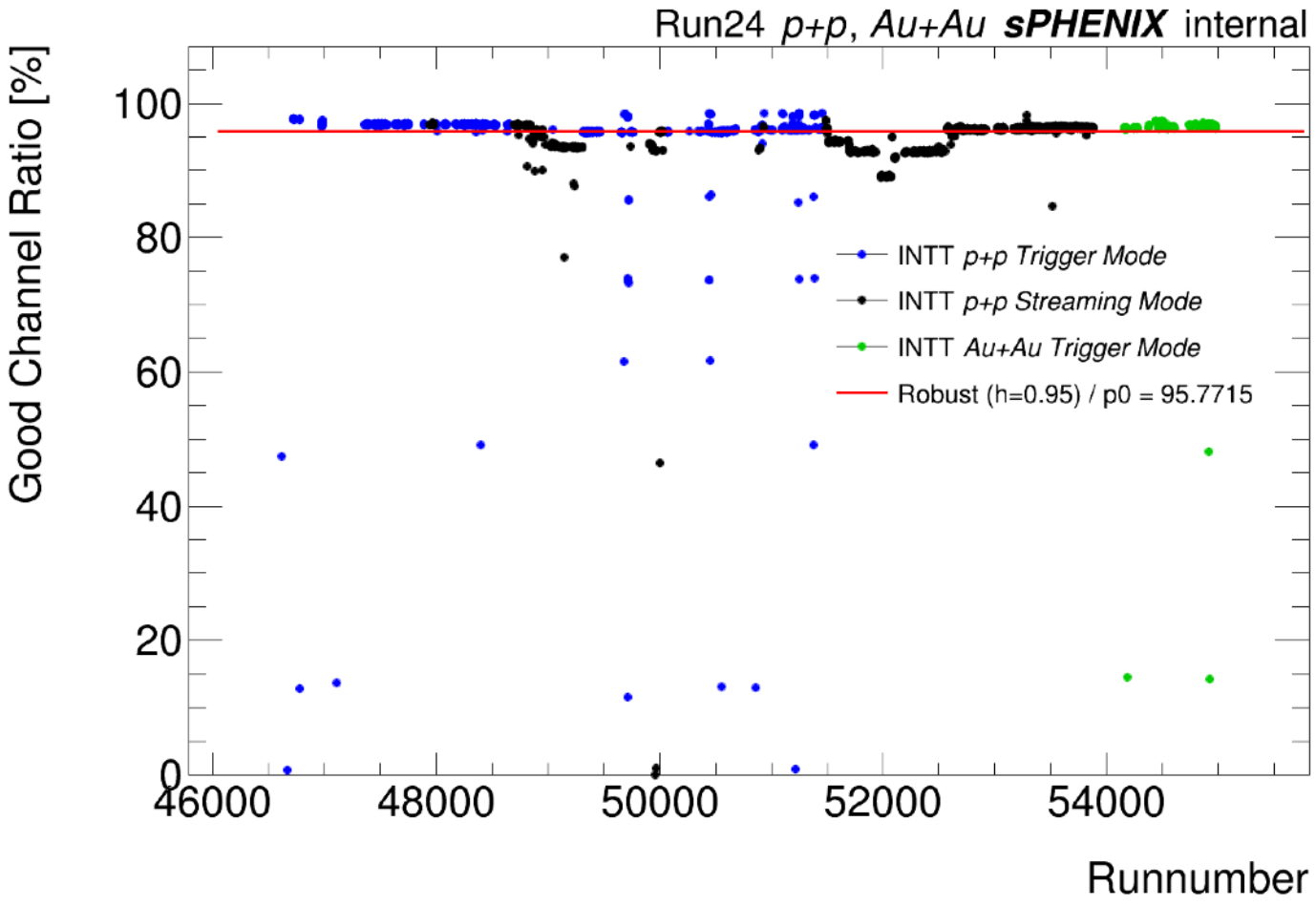


All our quality data is in the last three weeks.
30.7 pb^{-1} over all z-vertices, 4.6 pb^{-1} within |z| <10 cm

My personal suggestion, only worth analyzing data after June 24, 2024.

Good Channel Ratio for Run24

Good Channel Ratio (BCO_QA == GOOD && Runtime > 300s)



BLUE : Trigger mode

BLACK : Streaming mode

GREEN : AuAu Trigger mode

Linear / Robust (h=0.95) Fit

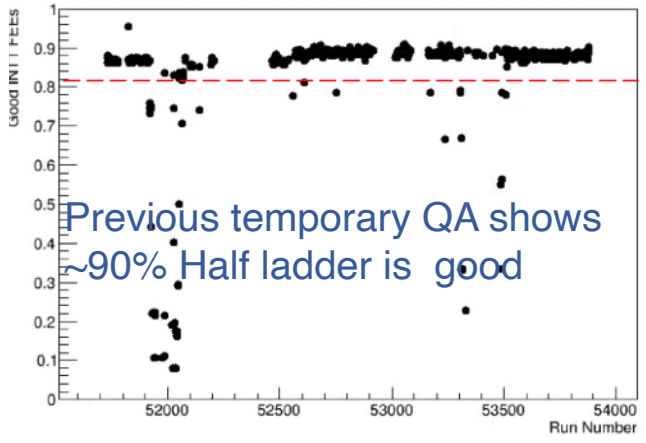
```
Minimizer is Linear / Robust (h=0.95)
Chi2                      =       107060
NDf                       =         1890
p0                        =      95.7715
```

95% of the INTT channels are GOOD for overall Run24 data

WHEN

1)FELIX is properly configured.

2)At least more than 5mins run to ensure stability and to accumulate the statistics



Previous temporary QA shows ~90% Half ladder is good