INTT-GL1 BCO Matching issue

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Recap.

Collected large cosmic data sets

→ Now performing **low-level GL1–INTT BCO matching study**

- **GL1** sends triggers with **BCO info** to all subsystems
- **INTT FELIXs** receive BCO from GL1, **regardless of hit existence**

→ **INTT BCO must match GL1 BCO**

If not:

- Possible data drop
- Or improper clock reception

Recap.

Joe prepared offline BCO QA

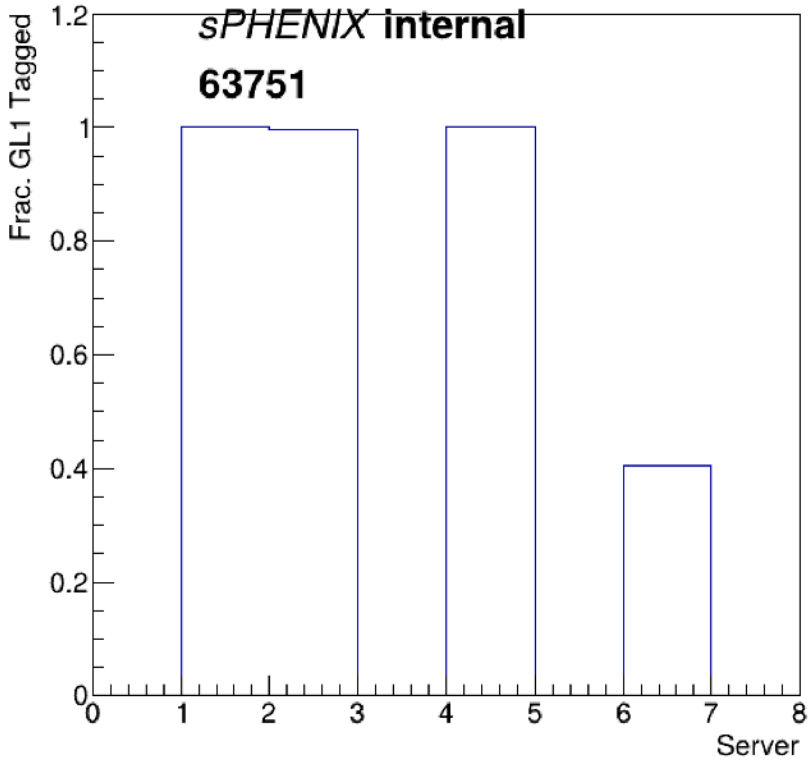
for silicon detectors in the production macro,

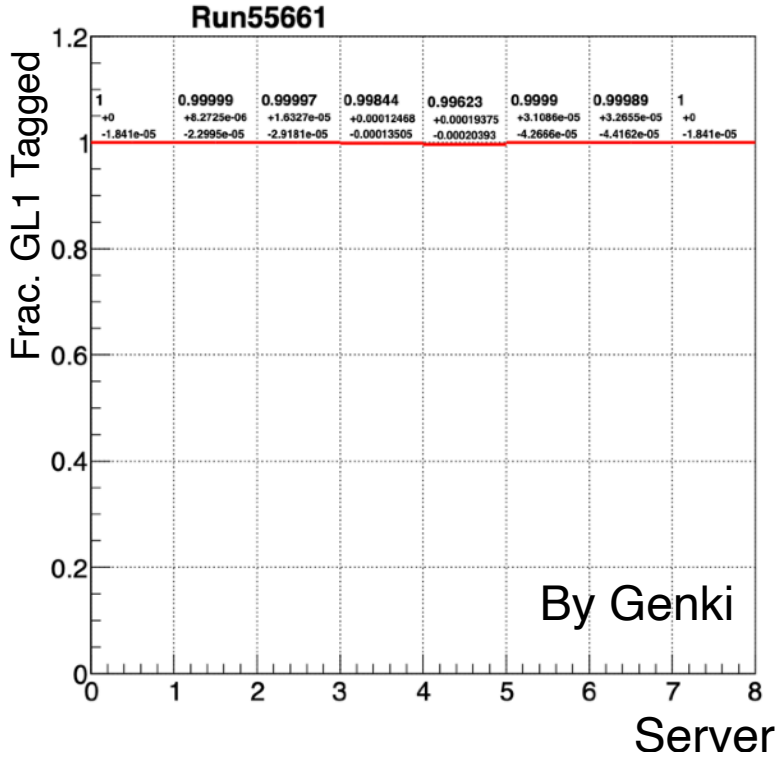
and found an issue with the **BCO matching ratio**.

→ **Cosmic data from last year (Run 55661) was OK**

→ But **current data showed significant degraded matching ratio**

$$\text{Frac. GL1 Tagged} = \frac{\text{\# of INTT BCO matched with GL1}}{\text{\# of GL1 BCO}}$$





INTT received a RED light for transitioning to Physics mode regardless of the cause

Need to solve & understand issue seriously

BCO check with ddump before combiner

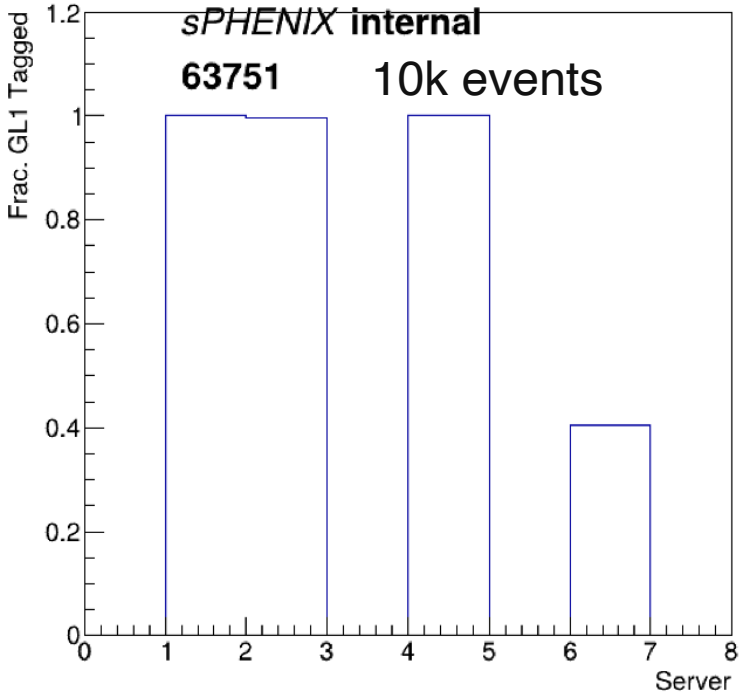
Joe's BCO QA module requires

- raw data decorder (pool)

docodes hexadecimal infomation from raw data to raw data information(BCO, chan ID, chip ID..)

- combiner

combines the raw data information into fun4all events



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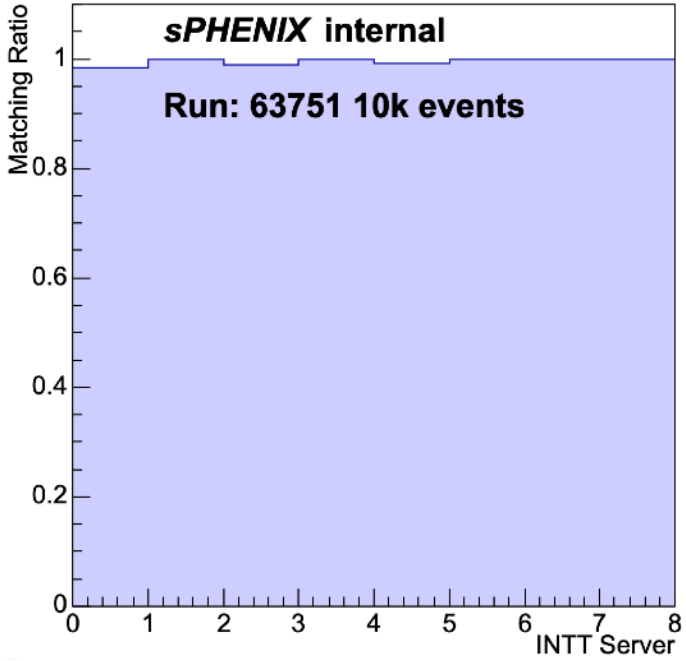


INTT raw data has proper GL1-matching BCO

→ Need to trace down at the logic of the **decoder and combiner**

Abnormal BCO at very beginning of the run

1st GL1 BCO

```
Packet 14001   504 -1 (sPHENIX Packet) 143 (IDGL1V1)
packet nr:       1676440105
Beam Clock:      0x27408b4b529c1   690530693753281
Trigger Input:   0x3c0002   3932162
Live Vector:     0xfd00e1000004   278180216700932
Scaled Vector:   0x1000000   16777216
GTM Busy Vector: 0x0   0
Bunch Number:    5
```

2nd GL1 BCO

```
Packet 14001   504 -1 (sPHENIX Packet) 143 (IDGL1V1)
packet nr:       1676440106
Beam Clock:      0x27408b4b52a36   690530693753398
Trigger Input:   0x3c0006   3932166
Live Vector:     0xfd00ff00000c   278180720017420
Scaled Vector:   0x1000000   16777216
GTM Busy Vector: 0x0   0
Bunch Number:    2
```

```
Packet  3001   132 -1 (sPHENIX Packet) 110 (IDINTTV0)
 Number of unique BCOs: 5
 BCO   0:  0x08b4b529c3    number of FEEs for this BCO   8
           Number of unique FEEs:    0   1   2   3   4   5   7
 BCO   1:  0x08b4b52a38    number of FEEs for this BCO  11
           Number of unique FEEs:    0   1   2   3   4   5   6
 BCO   2:  0xb7005c3c46    number of FEEs for this BCO   5
           Number of unique FEEs:    6   9  10  12  13
 BCO   3:  0xb7005c3dfe    number of FEEs for this BCO   1
           Number of unique FEEs:   10
 BCO   4:  0xb7cadead08    number of FEEs for this BCO   2
           Number of unique FEEs:    6   9
 Number of hits: 4
   #    FEE    BCO       chip_BCO  chip_id channel_id    ADC  ful
   0      6  b7cadead08   0x0       0         1          0     0
   1      9  b7cadead08   0x0       0         1          0     0
   2     10  b7005c3dfe   0x35      19        67          1     1
   3     10  b7005c3dfe   0x0       0         1          0     0
```

abnormal BCO

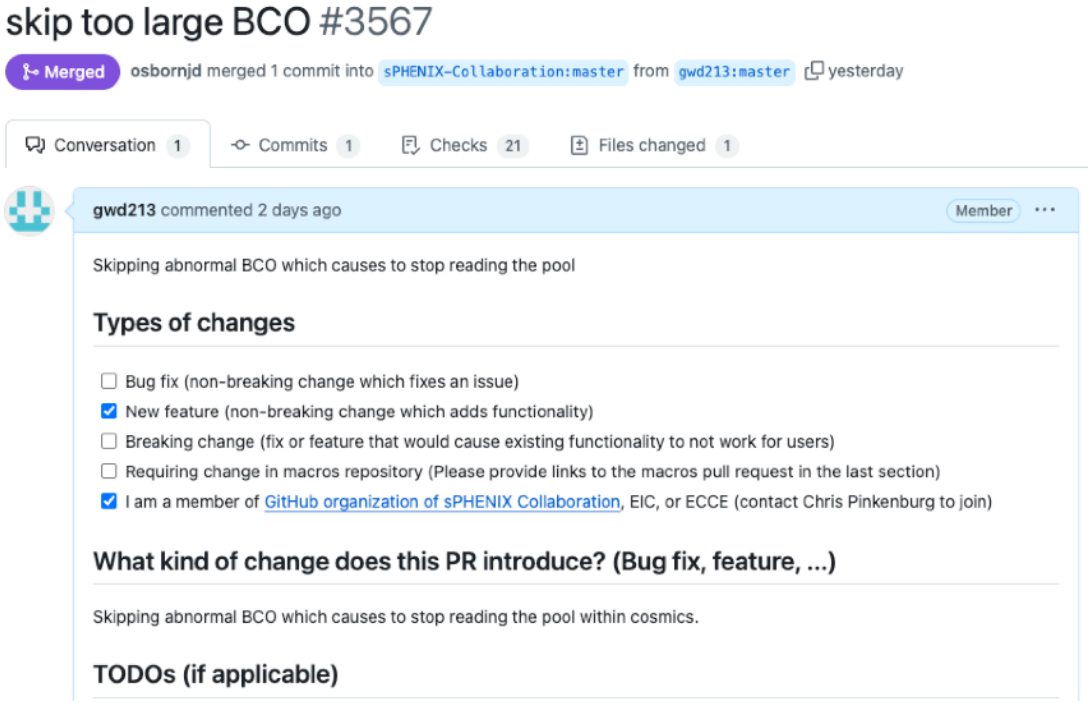
Found that we have **abnormal BCOs** from previous run which cause the combiner cannot decode file anymore

- **Combiner got stuck** at the abnormal BCOs (at the very first data taking)
- Could not find INTT–GL1 BCO match simply because it **hadn't decoded up to that point**

Update on decoder(1)

INTT has been very stable since last year data taking, and published physics result already.
Avoid modifying FELIX firmware unless absolutely necessary
— prefer offline software(decoder or combiner) solutions.

Before passing data to the combiner, check INTT BCO and GL1 BCO.
If INTT BCO is abnormal(if INTT BCO is too larger than GL1 BCO), skip it.



skip too large BCO #3567

Merged osbornjd merged 1 commit into sPHENIX-Collaboration:master from gwd213:master yesterday

Conversation 1 Commits 1 Checks 21 Files changed 1

gwd213 commented 2 days ago Member

Skipping abnormal BCO which causes to stop reading the pool

Types of changes

- [ ] Bug fix (non-breaking change which fixes an issue)
- [x] New feature (non-breaking change which adds functionality)
- [ ] Breaking change (fix or feature that would cause existing functionality to not work for users)
- [ ] Requiring change in macros repository (Please provide links to the macros pull request in the last section)
- [x] I am a member of GitHub organization of sPHENIX Collaboration, EIC, or ECCE (contact Chris Pinkenburg to join)

What kind of change does this PR introduce? (Bug fix, feature, ...)

Skipping abnormal BCO which causes to stop reading the pool within cosmics.

TODOs (if applicable)

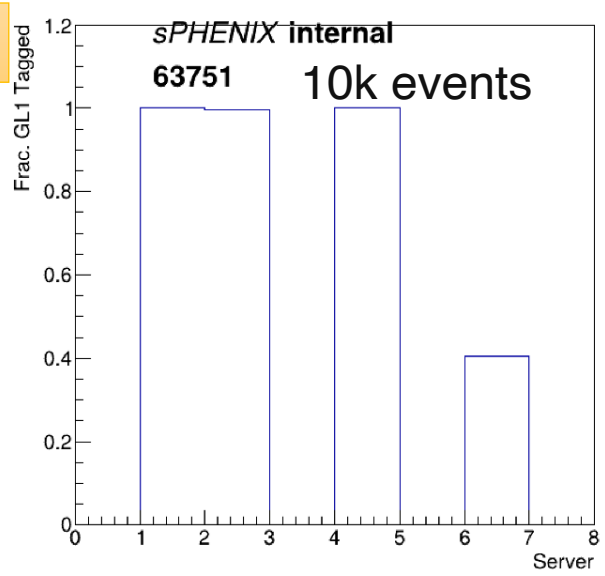
PR has been merged considering urgency for dry-run on this Thusday, Friday(?)

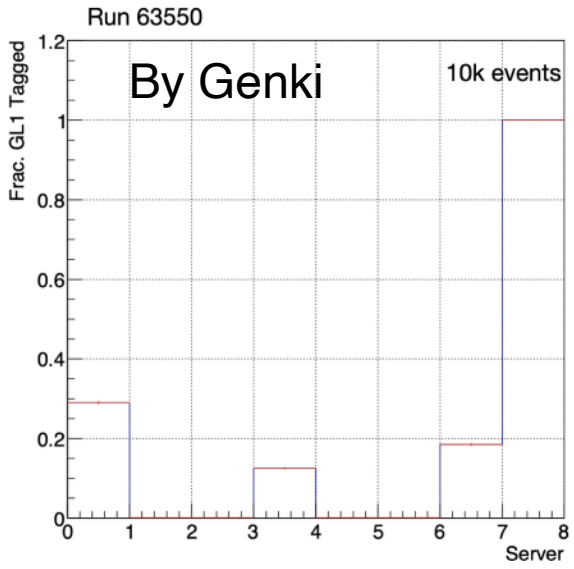
Cosmics production with recent decoder has been started.

https://github.com/sPHENIX-Collaboration/coresoftware/pull/3567

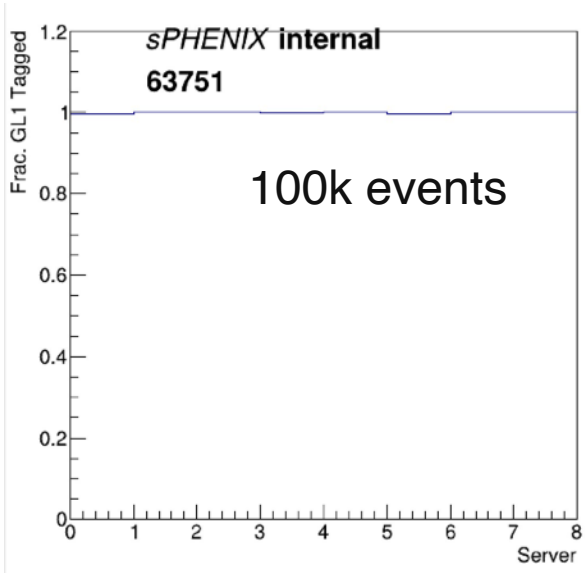
Update on decoder(2)

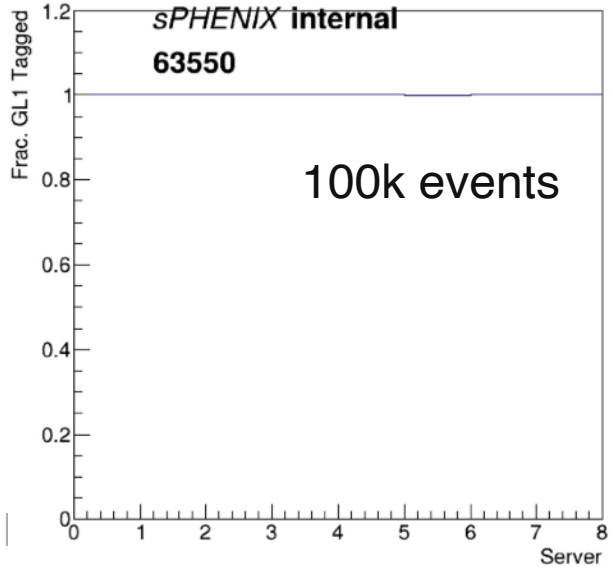
Before





After





INTT has GREEN light for dry-run

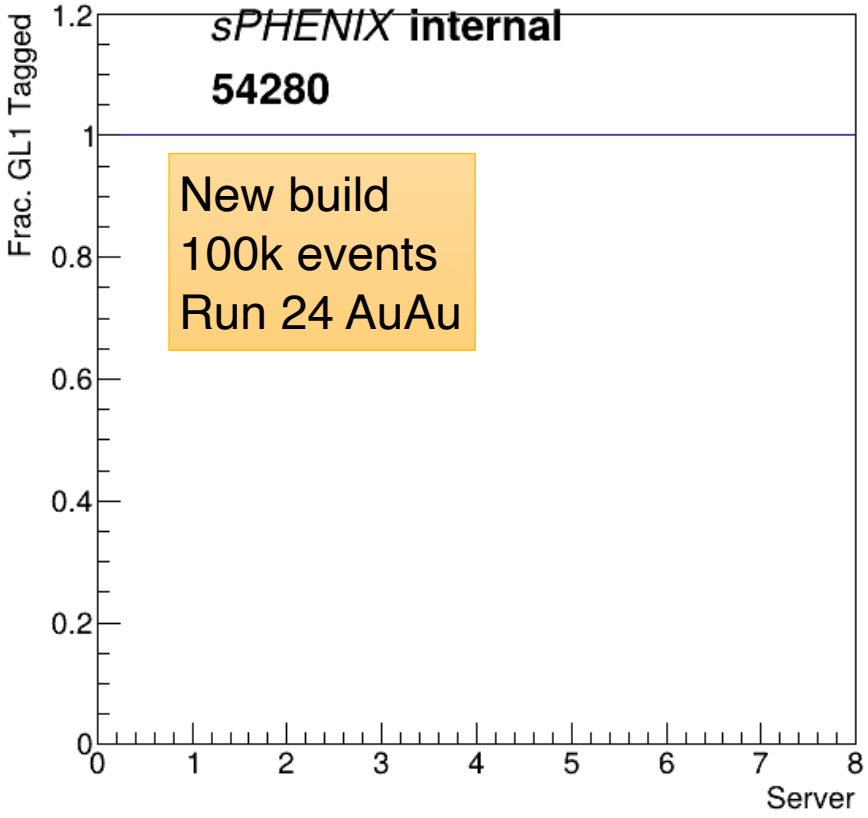
Why abnormal BCO is happening at INTT? (Better to understand)

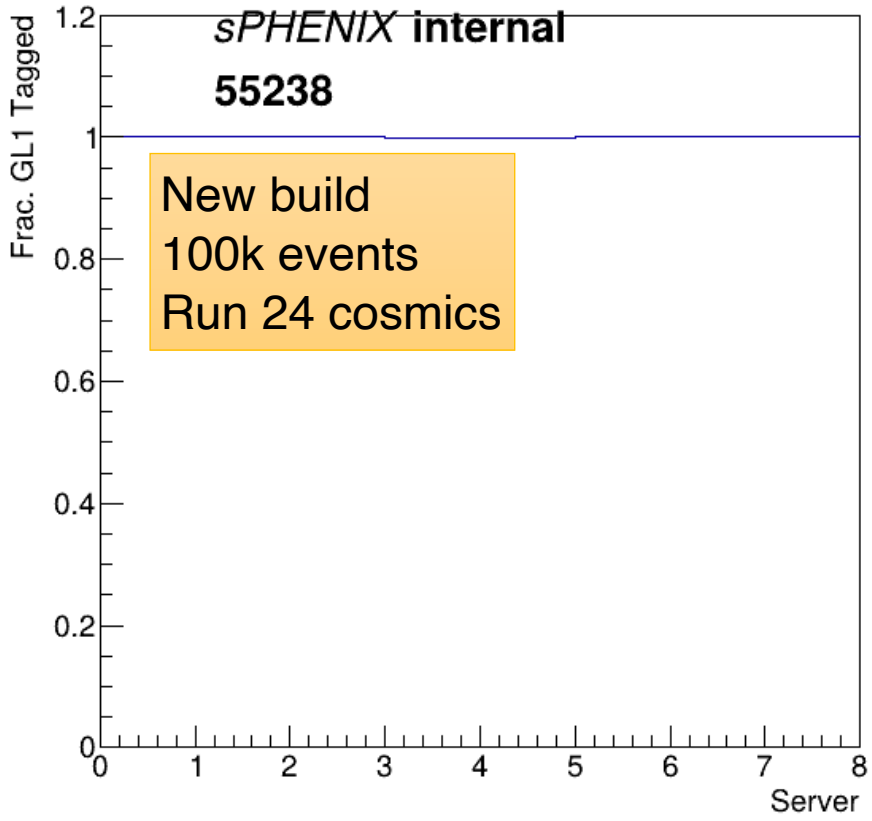
- INTT setup/FELIX has not been changed

Discussion between DAQ expert ongoing

Update on decoder(3)

New PR should not affect on the healthy runs of course.





Summary

INTT–GL1 matching issue has been addressed

→ Resolved through careful raw-level study

→ No critical changes to FELIX firmware were needed

New PR merged

→ Handles abnormal BCOs from previous run

Offline QA for INTT–GL1 matching is confirmed

→ We're now ready to quickly respond if any strange issue appears

→ (Hopefully, it won't happen again!)

Why do we have abnormal BCOs this year?

→ We (including Raul) still don't know

→ Ongoing discussions among DAQ experts

→ Even we cannot answer it, it's fine since we can handle this case.. but always better to understand the reason.

Raw level GL1-INTT matching study ongoing

→ To answer above question

→ To understand why not 100% (Case for 99.6%)

BACKUP

Hexdump

```
Packet  3001   132 -1 (sPHENIX Packet) 110 (IDINTTV0)
  0 |  caf0 f06f 021a 543b ff80 cafe cade adb7
  8 |  005c 3c46 021a 543c ff80 cafe cade adb7
 16 |  caf0 f09f 021a 543b ff80 cafe cade adb7
 24 |  005c 3c46 021a 543c ff80 cafe cade adb7
 32 |  caf0 f0cf 021a 543b ff80 cafe cade adb7
 40 |  005c 3c46 021a 543c ff80 cafe cade adb7
 48 |  caf0 f0df 021a 543b ff80 cafe cade adb7
 56 |  005c 3c46 021a 543c ff80 cafe cade adb7
 64 |  caf0 f0af ff80 cafe cade adb7 005c 3c46
 72 |  021a 543c ff80 cafe cade adb7 005c 3dfe
 80 |  caf0 f06f cade ad08 b4b5 29c3 0000 0001
 88 |  ff80 cafe cade ad08 b4b5 2a38 0000 0002
 96 |  caf0 f00f cade ad08 b4b5 29c3 0000 0001
104 |  ff80 cafe cade ad08 b4b5 2a38 0000 0002
112 |  caf0 f01f cade ad08 b4b5 29c3 0000 0001
120 |  ff80 cafe cade ad08 b4b5 2a38 0000 0002
128 |  caf0 f02f cade ad08 b4b5 29c3 0000 0001
136 |  ff80 cafe cade ad08 b4b5 2a38 0000 0002
144 |  caf0 f03f cade ad08 b4b5 29c3 0000 0001
152 |  ff80 cafe cade ad08 b4b5 2a38 0000 0002
```

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```