

Intensity Frontier data base Validation

Note by Joseph M. Kiveni

On behalf of Minos+ batch group

(Joseph M. Kiveni, Michelle Meideros, Rashid Mehdiyev, Art Kreymer and Robert Hatcher)

Abstract

This note documents the ifbeam data validation checks performed by comparing the Minos data to the ifbeam data acquired during the period the two data bases were running. Also, since the ifbeam is the only data base that is going to be maintained, a check to rnsure that all the Minos physics devices are in the new data base was necessary. These two checks was performed and reported below.

I. Numi Physics Devices

A thorough check has been carried out checking whether all Minos data base devices are in the new data base: the Intensity Frontier beam data base (or IFb DB). This check is required since we are completely migrating to the new data base, and for Minos+ experiment, we have to ensure that we have all of our devices we need for the physics analysis ahead.

During this task, several NuMi_Physics devices has not been found in the IFb DB. After a check with Phil Adamson (pa@fnal.gov), we have come to the **conclusion that only 4 devices were missing and added to the NuMi_Physics bundle in the data base.**

In this new data base configuration, 49 devices do not show up, but they are there. These devices don't return any position (information) when there is no beam. 10 devices that we found missing are no longer supported in the new system (ifbeam data base); these devices were used for the old profile monitors and were removed during shutdown and replaced by different hardware which has different way indicating whether it's in the beam. Phil Adamson may provide more and clear details in regards of these devices if they are part of the Physics bundle.

Table 1 shown below summarizes the results of this investigation. Other subsequent tables lists separately the devices that are missing now (and that should be

added) shown in Table 2, the devices that are in IFb DB and not showing up because there is no beam and the devices, shown in Table 3, and finally the defunct devices, i.e. the devices that were removed and replaced by other hardware (do not how they named), shown in Table 4.

Table 1: summary		
	Number	Note
Missing devices	4	Device now added
Dormant devices	49	They don't show up when there's no beam
Disabled devices	10	Removed after shutdown and replaced by new devices

Table 2: Missing devices from the IFb DB	
1	I:NUTGDH
2	I:NUTGDV
3	I:NUTGUH
4	I:NUTGUV

Table 4: Disabled devices (replaced by new hardware)	
1	E_M101LV
2	E_M105LV
3	E_M107LV
4	E_M108LV
5	E_M112LV
6	I:PM114
7	I:PM115
8	I:PM117
9	I:PM121
10	I:PMTGT

1	E:HI101
2	E:HI102
3	E:HI104
4	E:HI105
5	E:HI107
6	E:HI109
7	E:HI112
8	E:HI114
9	E:HI115
0	E:HI117
1	E:HI119
2	E:HI121
3	E:HITGT
4	E:HP101
5	E:HP102
6	E:HP104
7	E:HP105
8	E:HP107
9	E:HP109
20	E:HP112
21	E:HP114
22	E:HP115
23	E:HP117
24	E:HP119
25	E:HP121
26	E:HPTGT
27	E:VI101
28	E:VI103
29	E:VI106
30	E:VI108
31	E:VI110
32	E:VI111
33	E:VI113
34	E:VI116
35	E:VI118
36	E:VI121

37	E:VITGT
38	E:VP101
39	E:VP103
40	E:VP106
41	E:VP108
42	E:VP110
43	E:VP111
44	E:VP113
45	E:VP116
46	E:VP118
47	E:VP121
48	E:VPTGT
49	I:KPS6N

II. IF beam Data validation

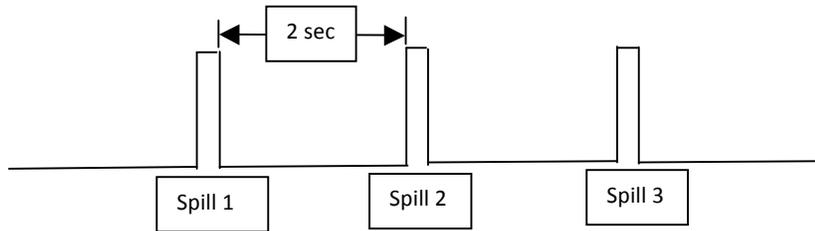
To validate the data acquired with the intensity frontier data base, we looked at fractional difference of several devices. This check was performed using the Numi Physics bundle, i.e. list of devices used by Minos for physics analysis. The fractional difference is defined as

$$\text{Fractional difference} = \frac{2(\text{Value}_{\text{Minos}} - \text{Value}_{\text{ifbeam}})}{\text{Value}_{\text{Minos}} + \text{Value}_{\text{ifbeam}}}$$

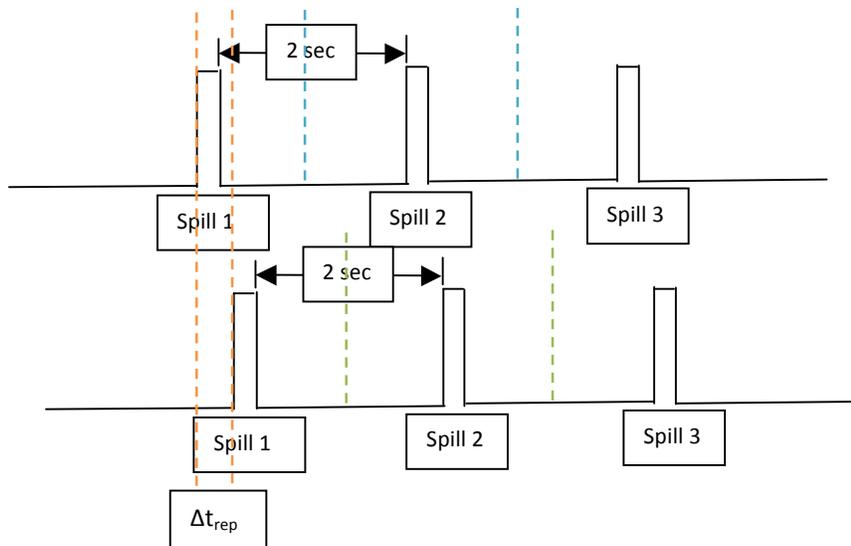
The comparison results showing the fractional difference between IFBeam and MINOS for all devices using the 6 months data were produced by Michelle de Meideros and can be found in DocDB-9823:

II. Error rate

In a normal cycle, spills are interspaced with 2 sec of time interval as indicated below.



However during the period of May 2012 to September 2012, Minos data base acquired data simultaneously with the ifbeam data base, but their readout time differed by about 0.5 sec. In this section, it is question to check whether spills are readout rate is the same for the time of the entire Minos data file (~8 hour). Ideally, such a check should be performed for an extremely long period of time; however given the ifbeam data fetching speed, we are limited to do that.



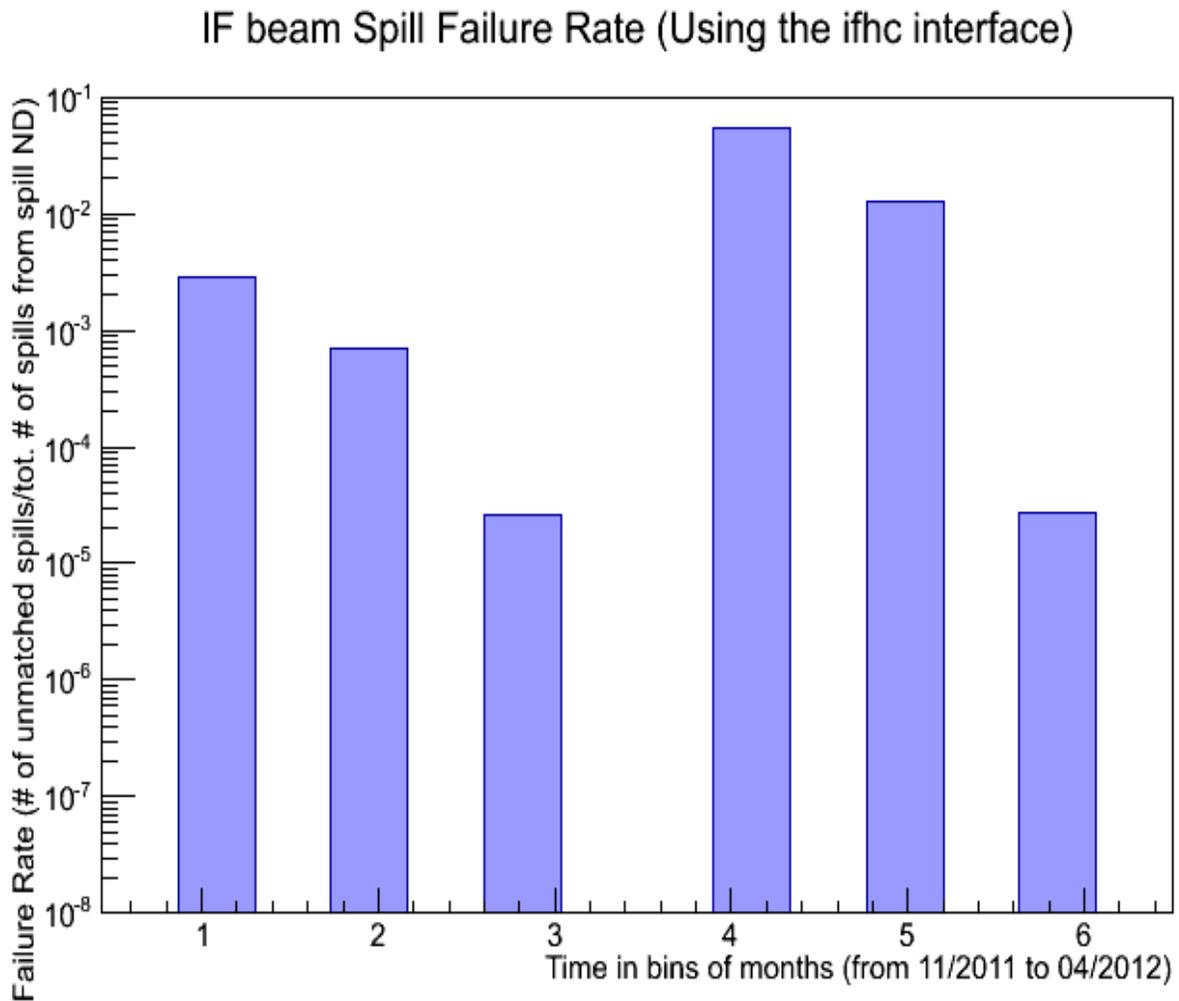
Given the time stamps t_{minos} and t_{ifbeam} from Minos and Ifbeam data bases:

$$t_{\text{minos}} = [t_0, t_1, \dots, t_N]$$

$$t_{ifbeam} = [t'_0, t'_1, \dots, t'_N]$$

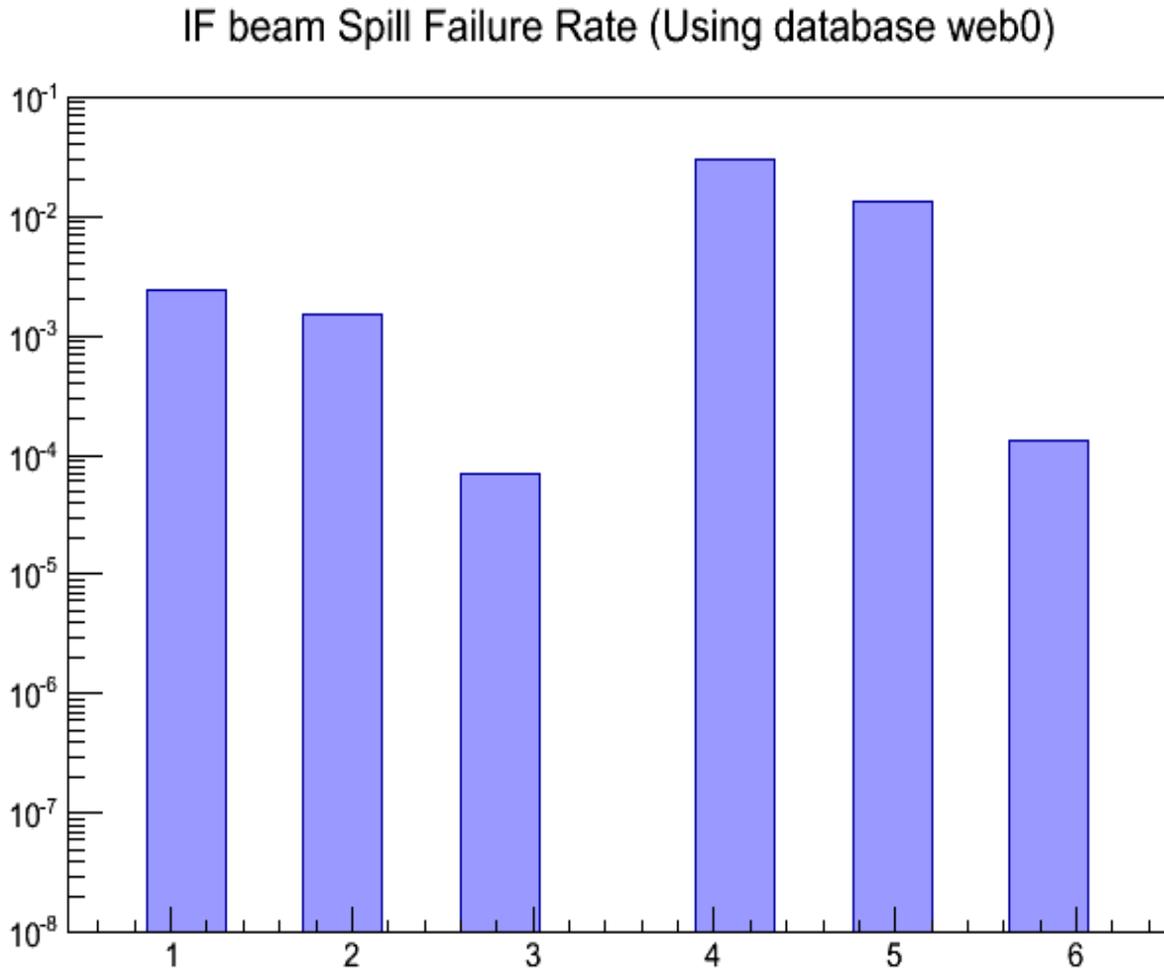
We looked for t'_k (in t_{ifbeam}) closest to t_g (in t_{minos}), then form a cut on $(t_g - t_{closest}') \leq \frac{\Delta t_{rep}}{2}$

A quick way to get a rough idea of the failure rate, it to count just the number of spills both side and take the ratio of these two counts. Assuming that the TRUTH (denominator) is the SPILLTIMEND queried from the Minos database (GPS time), the following plots were then produced:



To cross check this result, the curl command was used to get all (daily) spills across a month worth of time and concatenate them together and count to get the total number

of spills for the month. The ratio of the number of the missing spills (number of spills in SPILLTIMEND – number of spills found in the IB database) to the number of spills found in the SPILLTIMEND for this month is the failure rate. The plot below, show the check we performed by extracting the time stamps directly from the web (dbweb0). Counting the number of spills and taking the ratio between them:

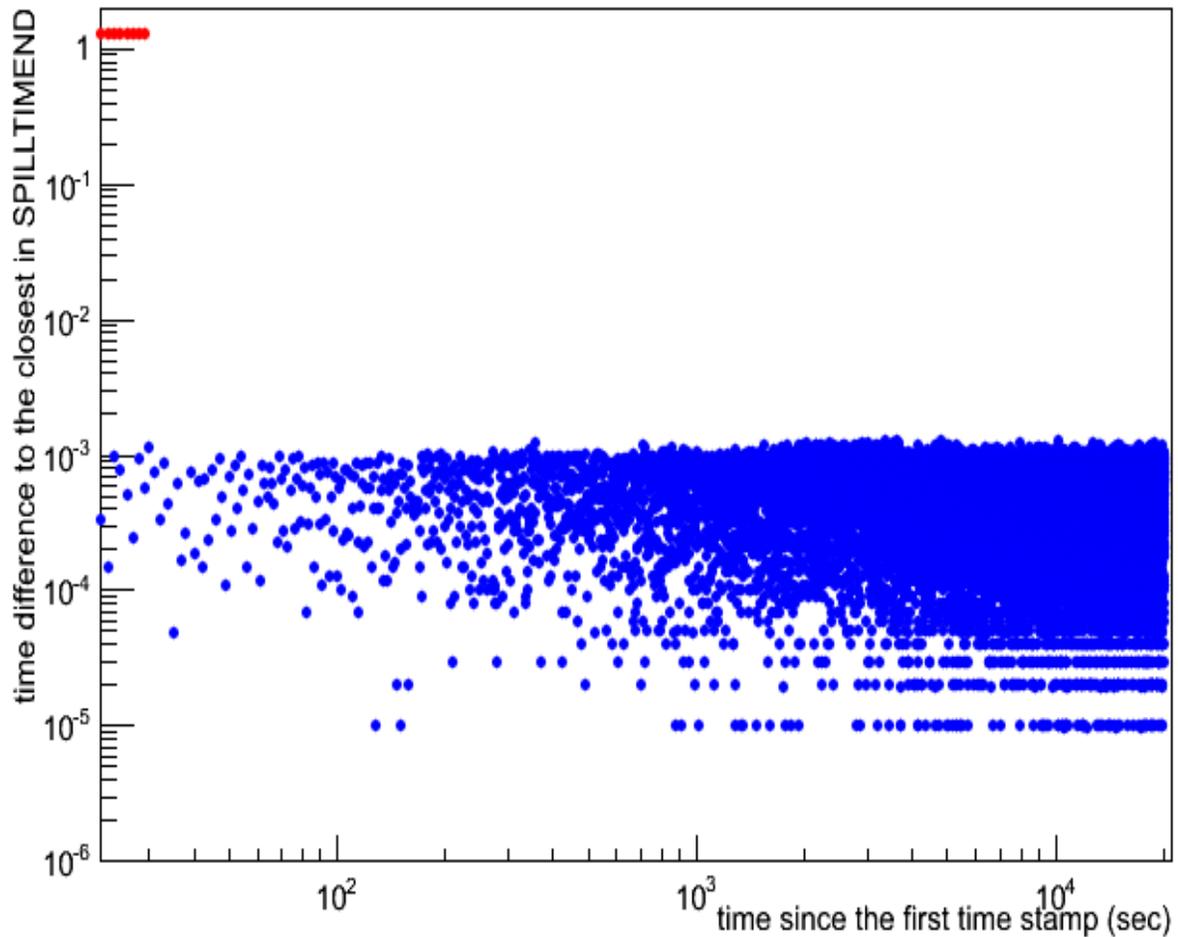


NOTE:

Arthur and I noticed today that the **SPILLTIMEND is not a good denominator to use** because it also contains time stamps during some moments that we know there was no beam. The above ratio should be corrected by removing the number of spills (in the numerator and denominator) corresponding to the time there was no beam or we should think of another alternative to match spills.

Below are few plots showing the time difference between the IF beam time stamp to the closest matched time stamp (from the SPILLTIMEND) as function of time. The red dots are the mismatched (missed) spills while the blue dots are the matched spills.

2012_01: matched spills (diff<0.7 blue) - missed spills (red)



2011_12: matched spills (diff<0.7 blue) - missed spills (red)

