

Case study 9.1: Unintended loss of loop aggressiveness

V.0,1



Report from a user of autoISF 3.0 who, “out of the blue” (i.e. after days with perfect %TIR) sees his loop “without bite”, and bg skyrocket.

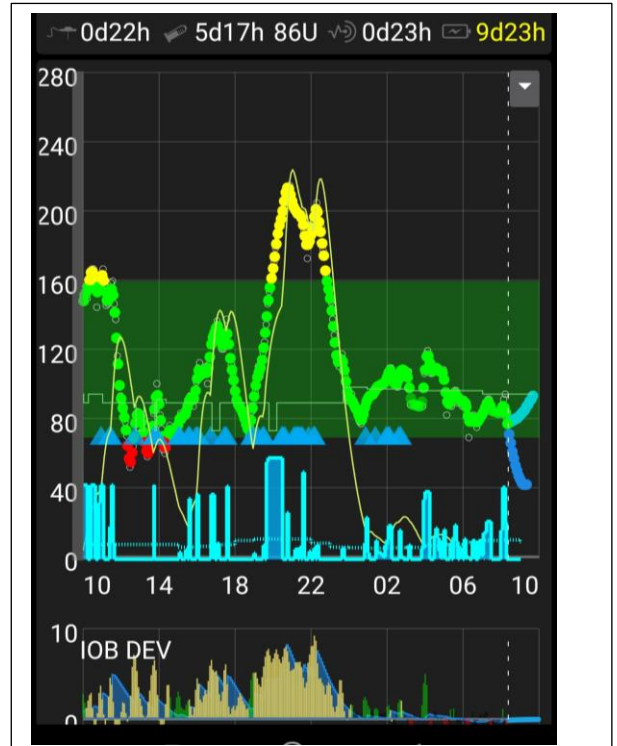
In the Trouble Shooting [section 9.3](#) the following potential reasons for this are laid out (shortened):

- *Meals are not recognized asap*
- *First SMB(s) seem a bit delayed*
- *SMBs are too weak*

All this seemed not at play, here....

...but the next (and last) point:-

- *... iobTH might be too low, and therefore cuts SMBs too early*
- Check whether your FCL really operates with the iobTH you think it uses.*



Indeed, my default iobTH_percent is 65, which should allow delivery of SMBs up to 7.1 U (=multiplied with my iobMAX of 11U). But my actual iob seemed to stagnate between 3 U and 4 U, despite bg climbing to well over 200 mg/dl (which is unusual, and was actually the reason why I recognized the problem at all).

I could rule out an occlusion because my iob was not rewving up high (and also, my cannula time was well under 48 hrs still).

Eating started around 18:30 h. Well over an hour the buffet snacking went quite well regarding the glucose curve (see 1st slide in the series of 6, further below).

However, around 20.30 it became apperent that glucose was rising more than usual. Looking first through details in the AAPS home screen/SMB tab (what limited SMBs?), at 20:26 h:

x 328

Full Loop modified max_iob
11 to effectively 11.33 due to
profile % and/or exercise mode
SMB disabled by Full Loop
logic: iob 4.501 is more than
35% of effective maxIOB 11.33
Full Loop capped
Parabolic fit extrapolates a
maximum of 203 in about 19.9
minutes
acce_ISF adaptation is 0.88
bg_ISF adaptation is 1.07
pp_ISF adaptation is 1.14
dura_ISF adaptation is 1.15
because ISF 37.9 did not do it
for 10 m
strongest autoISF factor
1.15 weakened to 1.01 as bg
decelerates already
final ISF factor is 1.04

iob rose only to 4.501 U, because disabled
from 35% (!) of 11.33 U => disabled above
3.97 U

Looking up my settings in
AAPS/Preferences/SMB/autoISF, I realized
that my iobTH_percent was sitting on 35,
effectively allowing only half of the urgently
required insulin.

However, I had no idea *why that was*. Being
at a party, I had also no further time to dig
any deeper about this. I just set my default
65 percent value, and had autoISF loop
(and party, with further snacking) continue.

The problem switching on SMBs again *now* could be: bg is de-celerating already
(acce_adaptation 0.88) which will reduce the elevated aggressiveness that both, pp_ISF and
dura_ISF call for (1.14 resp. 1.15) to only 1.01

I was aware that I was kind of in uncharted territory there because (apart from very few
instances of an hour or so lost Bluetooth right after a meal start) I had no precedence, and
could not be sure how exactly autoISF would deal with bringing a high bg down, based on
only half of the *usually present* iob from SMBs *in the initial half hour* of rising bg. All
my...ISF_weights were calibrated *without looking into the scenario that was now present*.

- It could well be that my autoISF cannot act aggressively enough now, at high bg, but
de-celeration. Normally, that is when much *milder* ISF modulation is desireable, and
_weights therefore were set this way.
- But also the opposite might happen. Generally, *the later* iob is devised against going
high, *the bigger* the ensuing hypo danger an hour or so later.

- Even worse, a too aggressive treatment of scenarios with high bg and de-celeration might, in the past, have been camouflaged: Because at bg acceleration SMBs were triggered that quickly surpassed my default iobTH, little if any additional insulinRequired usually resulted in the stage of high bg. In my related tuning, I might have dialed in settings that were too aggressive, but never came into play really.

What that meant for the party evening was, that I just needed to keep looking into my smartphone every now and then, to get a feel where things are headed (even if a bit annoying to other guests).

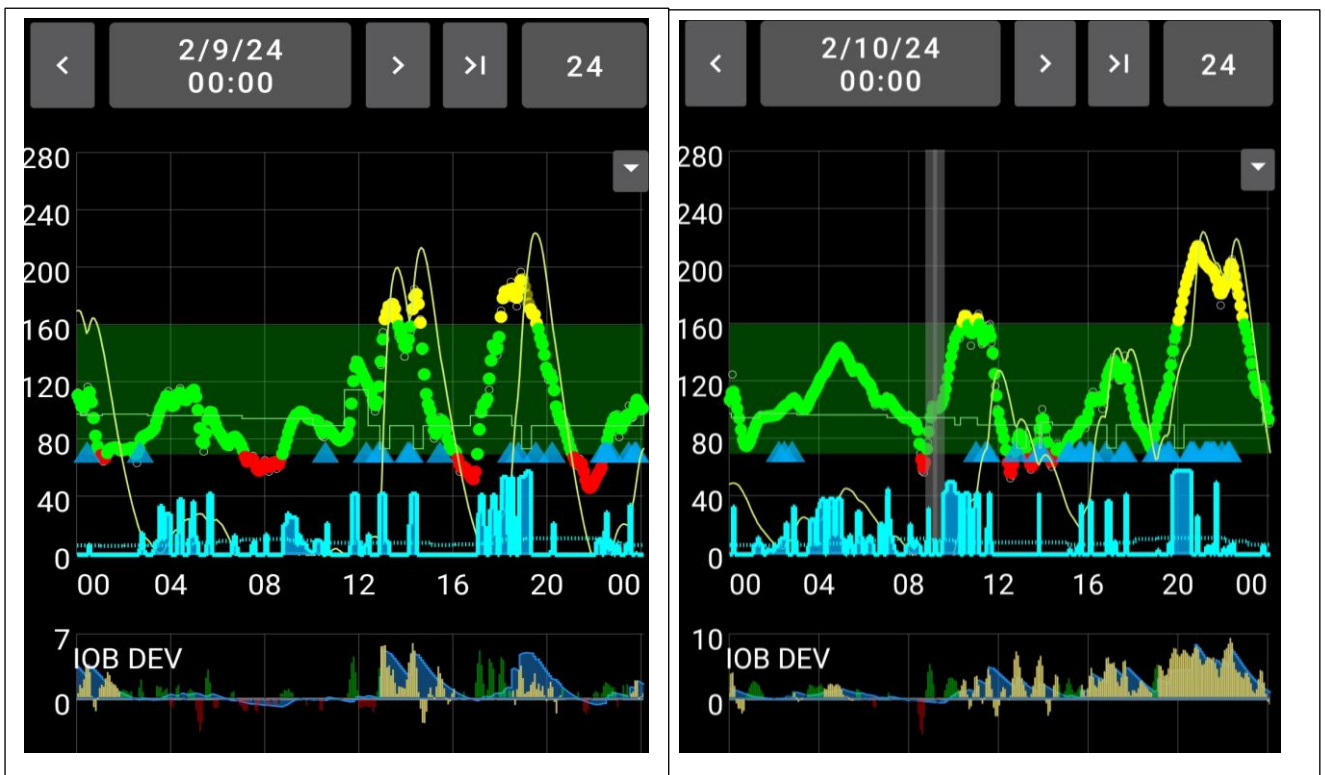
So, next day, time to find out more

.... Observe the Caution notes (e.g. in [section 5.1.4](#)) about needing re-sets to default, after an Automation had lowered the effective iobTH.

Looking at the general curves of the past days, and searching where, *maybe via an Automation*, the problem might have originated:

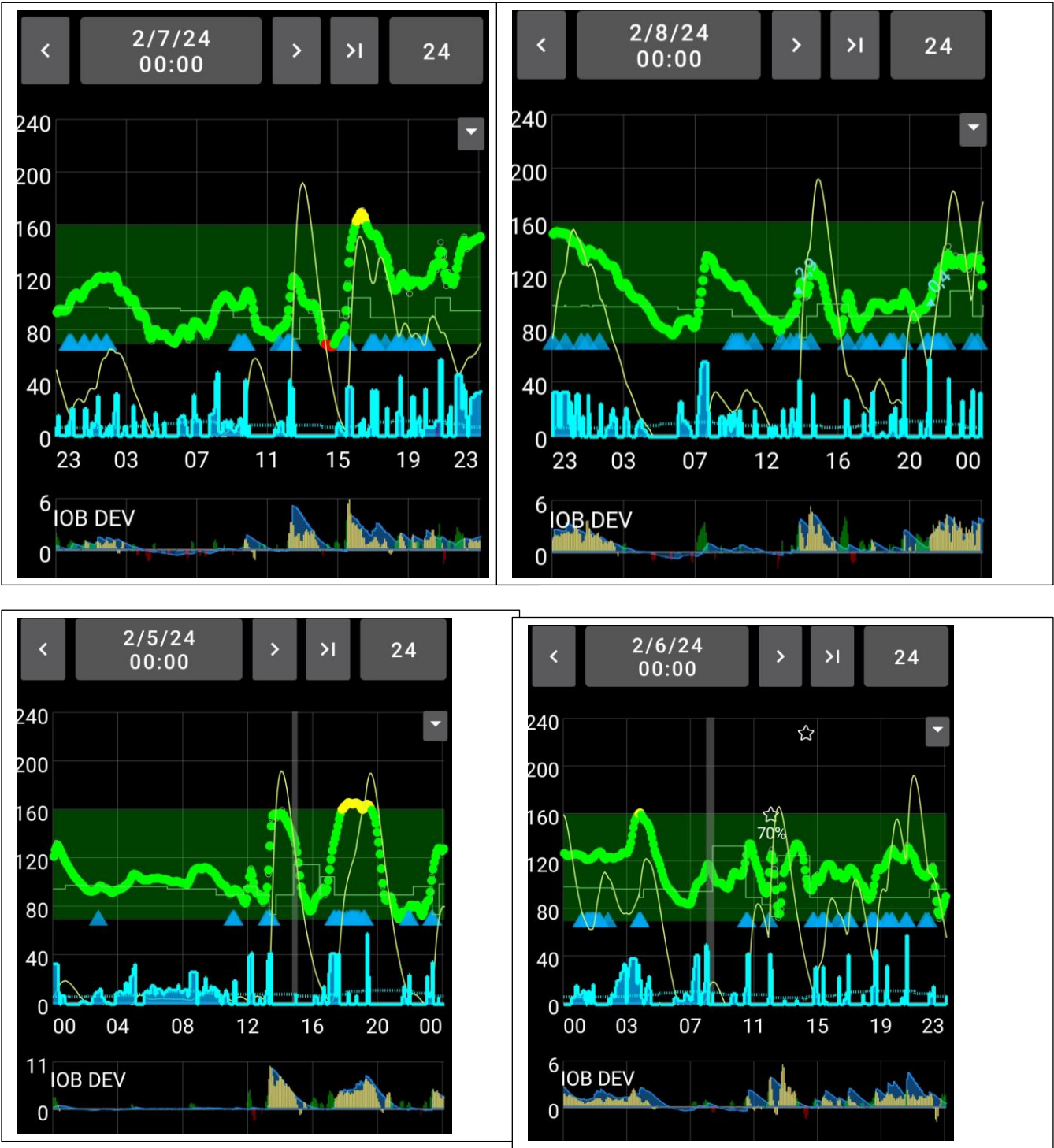
The following 6 screen pictures represent bg, insulin activity, and iob patterns on the day I noticed the problem (2/10), and on 5 preceding days (2/9-5):

#6 – 11 / x443 ...



It looks like the problem originated anywhere *after* noon on 2/9, the day before.

Further back, days had excellent bg curves staying nearly always in range:



Looking at Automations that ran on the day of the problem (2/10, “yesterday”) and the day before (2/9, “2 days ago”) only reveals Automations setting the low 74 mg/dl TT at meal recognition, and some custom even or odd temp. bg target settings – none of which would do anything to the iobTH_percent set in /preferences.

Temporary target	2 days ago	5 days ago
Yesterday		
23:37 - 00:52 99 - 99 75 mins NS Reason: Custom	18:48 - 19:14 74 - 74 26 mins NS Reason: Automation	22:52 - 00:37 97 - 97 105 mins NS Reason: Custom
19:43 - 20:09 74 - 74 26 mins NS Reason: Automation	16:37 - 18:22 97 - 97 105 mins NS Reason: Custom	13:23 - 15:23 125 - 125 120 mins NS Reason: Automation
16:43 - 17:09 74 - 74 26 mins NS Reason: Automation	14:13 - 14:39 74 - 74 26 mins NS Reason: Automation	12:57 - 13:23 74 - 74 26 mins NS Reason: Automation
13:49 - 14:19 92 - 92 30 mins NS Reason: Custom	12:48 - 13:14 74 - 74 26 mins NS Reason: Automation	12:21 - 12:57 84 - 84 35 mins NS Reason: Automation
13:43 - 13:49 74 - 74 6 mins NS Reason: Automation	11:16 - 12:16 115 - 115 60 mins NS Reason: Custom	10:33 - 11:23 133 - 133 50 mins NS Reason: Custom
12:43 - 13:09 74 - 74 26 mins NS Reason: Automation	00:44 - 01:00 97 - 97 16 mins NS Reason: Automation	09:19 - 10:33 133 - 133 73 mins NS Reason: Custom
10:12 - 10:57 95 - 95 45 mins NS Reason: Custom	00:28 - 00:44 97 - 97 16 mins NS Reason: Automation	04:51 - 04:58 90 - 90 7 mins NS Reason: Automation
00:01 - 01:16 95 - 95 75 mins NS Reason: Custom	00:07 - 00:23 97 - 97 16 mins NS Reason: Automation	04:43 - 04:50 90 - 90 7 mins NS Reason: Automation
		6 days ago
		23:37 - 00:52 99 - 99 75 mins NS Reason: Custom

My “shelved” (in-active) User Action Automation “Meal before Exercise” is the only one *that would set 35% iobTH*, and does so in combination with setting 84 mg/dl TT. This was last used “5 days ago” i.e. 2/6 (5th screen in the series of 6 given earlier).

Looking next through all my Careportal *text* entries, nothing of potential relevance came up except, “5days ago” (2/6; 5th screen in the series of 6 given earlier), there was a similar occurrence after lunch, where manually activating the exercise button in effect stopped SMBs at iob 3.3 U:

In searching further for potential reasons of a lowered iobTH_percent might require to look into the logfiles.

5 days ago
13:21 Note NS iob 3.3, forgot press ex.button til now
12:25 Note NS 5 Guys big burger, fries, iobTH35%Auto, biking

Meanwhile, reviewing what else AAPS itself has to offer, the screenshot at the right shows that the problem day stood out regarding much elevated TDD. Still, no occlusion is suspected; eating from party buffet (incl. 2 pc of pie) can explain what we see

TDD					
Date	Σ	Bolus	Basal	Basal %	Carbs
04/02	33.1 U	23.6 U	9.5 U	29%	0 g
05/02	38.1 U	27.0 U	11.1 U	29%	0 g
06/02	32.8 U	22.5 U	10.3 U	31%	0 g
07/02	31.3 U	18.1 U	13.2 U	42%	0 g
08/02	34.8 U	23.2 U	11.6 U	33%	0 g
09/02	30.1 U	17.2 U	12.9 U	43%	0 g
10/02	48.2 U	33.3 U	14.9 U	31%	0 g
Average					
07 days	35.5 U	23.6 U	11.9 U	34%	0 g

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137 The open questions now are:

138 1. Was the iobTH *already since 2/5* at the low 35% level (at 3.97 U)? It sounds
139 unlikely that I could stay *in range* for 4 days. However, these 4 days were well
140 below average regarding TDD. Maybe, with “the last SMB” shooting a bit over
141 4 U, the resulting iob happened to be enough to keep bg in range?

142 So what were the SMB sizes on 2/6-2/10? Candidates that could shoot over 4
143 U, with a pause to the next SMB, are marked “●”:

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19:27	0.30 U	SMB NS PH
18:43	1.80 U	SMB NS PH
18:23	2.00 U	SMB NS PH
15:23	0.30 U	SMB NS PH
14:08	2.40 U	SMB NS PH
14:02	0.30 U	SMB NS PH
12:53	2.60 U	● SMB NS PH
12:48	2.20 U	SMB NS PH
12:17	0.20 U	SMB NS PH
10:32	0.30 U	SMB NS PH
02:42	0.20 U	SMB NS PH
00:27	1.50 U	SMB NS PH
3 days ago		
23:42	1.00 U	SMB NS PH
23:23	2.40 U	SMB NS PH
21:57	1.70 U	SMB NS PH
21:37	0.30 U	SMB NS PH
21:32	1.00 U	SMB NS PH
21:27	0.10 U	SMB NS PH
21:17	0.90 U	SMB NS PH
21:07	0.40 U	Meal NS PH

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11:28	2.50 U	SMB NS PH
11:23	0.20 U	SMB NS PH
10:58	1.40 U	SMB NS PH
09:28	0.20 U	Prime PH
02:48	0.60 U	SMB NS PH
02:27	0.30 U	SMB NS PH
02:12	0.10 U	SMB NS PH
2 days ago		
23:42	0.20 U	SMB NS PH
23:37	0.70 U	SMB NS PH
23:23	0.90 U	SMB NS PH
22:37	0.30 U	SMB NS PH
22:28	0.20 U	SMB NS PH
22:23	0.50 U	SMB NS PH
22:18	0.10 U	SMB NS PH
20:08	0.20 U	SMB NS PH
19:27	0.30 U	SMB NS PH

#18

20:32	0.60 U	SMB NS PH
20:28	2.00 U	SMB NS PH
19:32	1.30 U	SMB NS PH
19:28	1.20 U	SMB NS PH
19:12	0.20 U	SMB NS PH
18:58	2.00 U	SMB NS PH
18:52	0.30 U	SMB NS PH
17:33	1.70 U	SMB NS PH
17:27	0.10 U	SMB NS PH
16:43	2.80 U	SMB NS PH
16:03	0.70 U	SMB NS PH
15:58	2.10 U	SMB NS PH
15:38	0.10 U	SMB NS PH
15:33	1.00 U	SMB NS PH
15:07	0.10 U	SMB NS PH
15:02	0.20 U	SMB NS PH
13:53	0.10 U	SMB NS PH
13:47	0.10 U	SMB NS PH
13:43	1.30 U	SMB NS PH
12:43	1.70 U	● SMB NS PH
11:28	2.50 U	SMB NS PH

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17:57	0.40 U	SMB NS PH
17:53	0.10 U	SMB NS PH
17:47	0.60 U	SMB NS PH
16:27	2.80 U	SMB NS PH
16:23	1.00 U	SMB NS PH
13:17	2.00 U	● SMB NS PH
13:12	1.40 U	SMB NS PH
13:07	1.70 U	SMB NS PH
13:02	0.10 U	SMB NS PH
12:37	0.10 U	SMB NS PH
10:42	0.40 U	SMB NS PH
10:37	0.90 U	SMB NS PH
10:32	0.10 U	SMB NS PH
10:22	0.10 U	SMB NS PH
10:17	0.10 U	SMB NS PH
02:52	0.10 U	SMB NS PH
02:48	0.40 U	SMB NS PH
02:17	0.60 U	SMB NS PH
02:12	0.20 U	SMB NS PH
01:37	0.20 U	SMB NS PH

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10:12	0.10 U	SMB NS PH
10:02	0.20 U	SMB NS PH
02:38	0.40 U	SMB NS PH
01:57	0.80 U	SMB NS PH
01:37	0.20 U	SMB NS PH
00:43	0.90 U	SMB NS PH
00:02	0.90 U	SMB NS PH
4 days ago		
22:17	0.20 U	Prime PH
20:53	0.70 U	SMB NS PH
20:47	0.60 U	SMB NS PH
20:32	0.10 U	SMB NS PH
20:07	0.20 U	SMB NS PH
20:02	0.40 U	SMB NS PH
19:33	0.10 U	SMB NS PH
19:22	0.80 U	SMB NS PH
19:17	0.10 U	SMB NS PH
19:12	0.10 U	SMB NS PH
18:37	0.20 U	SMB NS PH
18:02	0.60 U	SMB NS PH

#21

21:07	0.40 U	Meal NS PH
20:58	1.10 U	SMB NS PH
20:53	0.10 U	SMB NS PH
19:33	2.10 U	SMB NS PH
19:02	0.20 U	SMB NS PH
18:52	0.20 U	SMB NS PH
18:47	0.10 U	SMB NS PH
17:47	0.60 U	SMB NS PH
17:43	0.30 U	SMB NS PH
17:18	0.20 U	SMB NS PH
16:27	0.40 U	SMB NS PH
14:23	2.00 U	● SMB NS PH
13:48	0.20 U	SMB NS PH
13:43	2.90 U	Meal NS PH
13:37	0.30 U	SMB NS PH
13:17	0.30 U	SMB NS PH
12:47	0.30 U	SMB NS PH
11:13	0.20 U	SMB NS PH
10:33	0.10 U	SMB NS PH
10:23	0.30 U	SMB NS PH
10:12	0.10 U	SMB NS PH

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164 2. How do my Automations re-set the iobTH_percent to default?

165 Once iob is over 3.8 U, the Automation that set 84 mg/dl TT AND the iobTH%
166 of 35 is ended with ACTION: stop TT, and start 70% profile. Immediately
167 following, at CONDITION 70% profile, a TT of 125 mg/dl sets in for 120
168 minutes, completing my typical exercise setting (TT 125 @ 70% profile) after
169 what had been a brief interruption with higher aggressiveness until 3.8 U iob
170 was exceeded after the meal-

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172 2A) Usually, the exercise button is activated in addition. This will activate the
173 dynamic iobTH (see section and case study 6.1). After disactivation of the
174 exercise mode, iobTH reverts to former default (?? Is that so ??)

175 On that day, I activated the exercise button on 13:21 h (with just a bit of a
176 delay, when iob was at 3.3 U ; see Note).

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178 2B) If I went without ever activating the exercise mode with dynamic iobTH,
179 and 125 mg/dl TT, and later also 70%profile, had expired, (when?) would
180 iobTH_percent return to default ??

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3. What needs to be changed so users are better aware at all times, what the important settings are their FCL is currently working with?

Unfortunately, the problem day (10/02), plus the preceding one that probably suffered from the same problem already, thoroughly ruined a nice phase when my autoISF FCL was stable running at ~98%TIR (see screenshot)

Actually, this is overall the experience of the author who is testing autoISF 3.0 since nearly 6 months now. The nice extra features allow lots of extra fine tuning and Automation to, in principle, reach a few more %points of TIR. But time and again little stretches of flawless workings at over 95%TIR are interrupted by problems like the one reported here (or see also case studies 1.5 and 1.3).

So, these experiences MUST translate into

actions, how to improve the workings of features, or the user interface to deal with them, safely and effectively.

TIR (70-180)				
Date	Below	In range	Above	
04/02	0%	97%	2%	
05/02	1%	99%	0%	
06/02	0%	100%	0%	
07/02	3%	97%	0%	
08/02	0%	100%	0%	
09/02	18%	79%	3%	
10/02	6%	84%	10%	
Average (70-180)				
07 days	4%	94%	2%	
30 days	4%	93%	3%	
Average (70-140)				
07 days	4%	83%	13%	
30 days	4%	80%	16%	
Detailed 14 days				
Day TIR (0-56-70-180-250-∞)				
Night TIR (0-56-70-149-250-∞)				
Very low	Low	In range	High	Very high
0%	3%	92%	4%	0%
SD: 28				
HbA1c:5.6% (37 mmol/L)				

To iron out some of the problems might be relatively easy in a software update:

The problem of un-recognized, too soft settings (un-intended low iobTH-percent; and same could happen with bgAccel_ISF_weight that was not re-set to default) must be eliminated as far as possible by:

- 1) Having a very obvious indicator on the AAPS main screen as to which iobTH (and bgAccel_ISF_weight?) is actually valid. Staying with the pattern of yellow %profile, TT, and exercise fields when loop aggressiveness is temp. modulated, developers should provide a grey/yellow field with the iobTH next to the actual iob (both in U please, *not* iobTH in %.).

This measure # 1) is the minimum I would see necessary to move autoISF into official AAPS_dev, or even into Master.

- 210 2) What might be helpful is to *always* keep the set default iobTH (and
211 bgAccel_ISF_weight) in /Preferences, and name the temporary altered ones
212 differently, e.g. effective iobTH or eff.iobTH%.
- 213 3) Thoughts need to go into how to *automatically* return from effective to default.
- 214 3A) If User-Automations are the reason for an effective iobTH%, maybe, like for TT, a
215 time corridor must be set. If an effective iobTH results from modulation in exercise
216 mode, a definition is needed when it (latest) automatically expires / tbd.
- 217 3B) Clarification is needed asap as to how, after exercise mode used dynamic iobTH,
218 the system returns eventually to default settings as made in /Preferences.

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220 (The latter point I will just check in the next days.

221 I hope I can conclude what users can do to limit and recognize the problem
222 better. Based on that, I will complete this Case Study)

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224 (Maybe logfiles research would also help to see which iobTH was valid all
225 these days, and why – Except for 2/7 I have the logfiles, but I never had the
226 latest Emulator version running yet)