5. Modulation of autoISF aggressiveness.

Please note that with autoISF 3.0 you are in an early-dev. environment, where the user interface is **not optimized for safety** of users who stray away from intended ways to use. Good safety features exist, but these are only as good as the development-oriented user understands and implements them. This is not a medical product, refer to disclaimer in

Once the initial tuning according to section 4. is done, you are ready to use autoISF for your automated meal management.

You will have three major other challenges to manage:

- recognize and manage (partial) occlusions, or other technical (CGM or BT related) obstacles (see section 2 on pre-requisites of FCL, and related case studies)

- deal with times when the loop should be set "milder" as a precaution (e.g. nights; or in an exercise context)

- deal with times when insulin given by the loop must be restricted (e.g. a snack could be "misinterpreted" as a meal)

How big the remaining challenge is depends very much on your individual lifestyle. Sections 5 and 6 discuss this in more detail.

In order to run the loop fully automatically around the clock, the times outside the meal blocks must also be precisely analyzed, and solutions to problems (if any) must be sought.

It is up to every user to decide where to draw the line.

- With a technically well functioning system, moderate meals, moderate or no exercise, moderate %TIR expectations and a bit of mindfulness it should be possible to go into Full Closed Loop 24/7, after working through, and observing, sections 1-4.

- Especially if you are a bit shy of using the emulator for really detailed analysis, it is likely that you will not hit a real good system calibration (section 4) for an entire range of diets.

- In that case you will occasionally run out of range, and your options to prevent, react, or improve are

  o accepting a few % higher time outside range for that day (and avoiding what seemed to have caused it in the future)

- o taking a snack (whenever you tend to go low from the "tails" of insulin activity that was required to fight a peak)

- o doing a manual override (if you can think of one in time, to manage the problem manually)

- o temporarily resorting to the well-known hybrid closed loop.

- • Instead of accepting such instances, you could launch "improvement projects"

  - o that refine your initial tuning (section 4.)

  - o that make you and your FCL loop fit to manage an increasing number of disturbances either automatically, or via a user intervention (sections 5-6).

To tailor the loop's response to disturbances may require specific **modulation of the aggressiveness** as set for your meal management.

There are many avenues to achieve this. The main ones, that are also easy accessible via Automations in AAPS, are:

- • temp. shut-off SMBs (odd-numbered target)

- • temp. reduce bgAccel_ISF-weigh

- • temp. reduce iobTH

- • temp. reduce set %profile

- • temp. set higher TT (especially in connection with exercise mode)t

5.1 Permanent fully automatic modulation of FCL aggressiveness

In setting up your FCL, you now have another difficult and time-consuming job at hand, to define

fully automated solutions (that require **no user intervention** at all) for any of your

„other" situations, outside of meal management.

In section 5.2 and 5.3 we will look at options *to ease that job by "allowing" a 1-button push or data entry* intervention, like for a snack or exercise announcement.

5.1.1 autoISF generally switched off outside of meal-time windows

If, aside from meal management, you were rather happy in hybrid closed loop, you could continue

to run in that mode, and just focus your new autoISF FCL on management of meals (on all meals,

70 or only on a sub-set of them, like only dinners – which might make sense especially in your initial

71 transitioning phase).

72

73 For this, you define Automations

74

75 • that set **meal time windows** in which autoISF gets fully turned on

76 • _or:_ that turn *all* autoISF's ISF modulations (*or* just *bgAccel_ISF*) off in time windows in

77   which surely no meal occurs. For instance, you can go for all nights back into your Hybrid

78   Closed Loop, as you had before.

79

80 Other early DEV AAPS variants (see section 13.3) all work with meal-time windows. The

81 window is either set by time of day in the settings, or it always must be „set" by the user via

82 giving a mandatory small pre-bolus before any meal starts. **Outside** of these time windows,

83 these loops then runs with less aggressive SMBs like oref(1) SMB+UAM in AAPS Master.

84 This mode is not really FCL, but an advance over traditional HCL that often achieves satisfying

85 degrees of automation and performance.

86 The term **Meal Announcement** (MA) is often used to label this closed looping mode. Trigger to

87 set a meal time window could also be a pre-bolus given by the user, a carb entry made, an

88 EatingSoonTT set or a meal announcement button pushed.

89

90 Note: Outside of the meal time windows you would be in hybrid closed loop. To the extent you

91 rarely face disturbances (aside from meals), you could be looping in full automatic mode around

92 the clock. Your temp. autoISF shut-down is only meant to prevent problems from the loop over-

93 reacting to bumps in the glucose curve in times of day (night) when standard oref(1) performance

94 is sufficient.

95

96 5.1.2 Odd-numbered profile targets used to block SMBs

97

98   Ensure the even/odd logic in the settings is toggled on in Preferences> openAPS SMB>

99   autoISF settings> smb delivery settings>: "Enable alternative activation of SMB depending

100   on profile target" ON.

101

102 In time blocks with an odd-numbered profile target you can prevent any SMBs being given by your

103 loop. The (unchanged) aggressive settings can only translate within the limits set by %TBR

104 possible.

105

106 This will very much slow down any more insulin being given, and is an excellent solution for night
107 times, especially if you occasionally experience compression lows.
108
109 Notably it is an excellent solution to prevent getting too much insulin because of jumpy CGM
110 values, like after a compression low. This is therefore a good solution for night time.
111
112   Alternatively, you could use the new included options for Automation Conditions and
113   temporarily tune your bgAccel_ISF_weight much lower.
114   Yet another alternative would be to go into hybrid closed loop for the night, with or without
115   SMBs (section 5.1.1).
116
117 In case you occasionally do have nights that would benefit from a couple of SMBs (to treat temp.
118 highs from a late fatty pizza, raclette and such): Define suitable Automations like the two „night"
119 ones here:
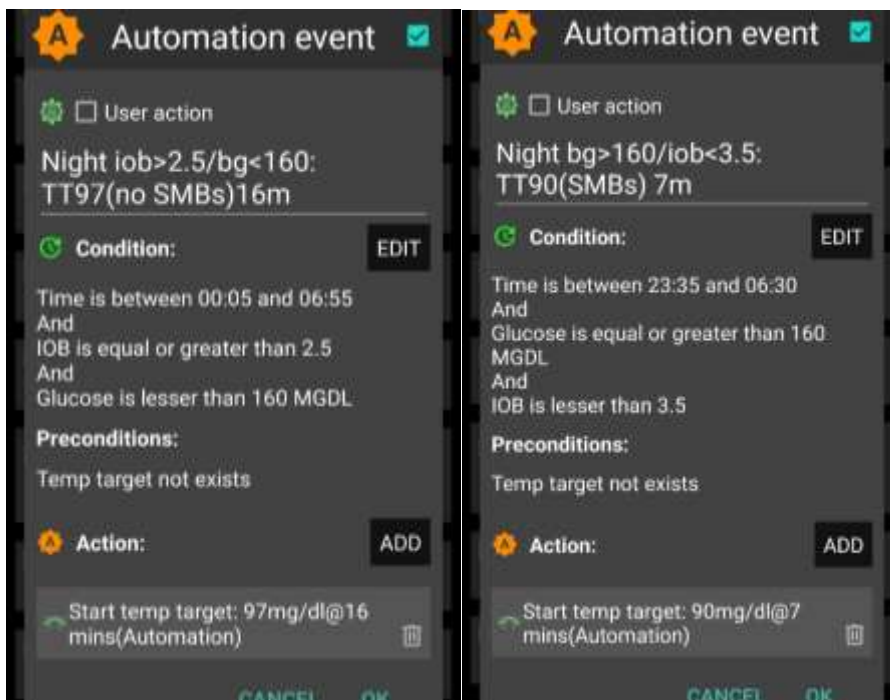
120
121
122 **Never underestimate the „trickyness" of getting your Automations „right".**
123 Night data (with your thought-out Automations in place) need to be analyzed to see
124 • whether the bg and iob limits defined in the given example work sensibly
125 • whether the TT duration is chosen appropriately
126 • Swapping the sequence in which the automations appear in the automation list would also
127   lead to different SMB impacts.
128
129
130

5.1.3 Odd-numbered temp. targets used to block SMBs

A widely used ACTION that strongly modifies how fast your FCL can add more iob is setting an **odd-numbered temp. glucose target** which makes the loop operate without giving any SMBs (%TBR modulation only).

> Ensure the even/odd logic in the settings is toggled on in Preferences> openAPS SMB> autoISF settings> smb delivery settings>: "Enable alternative activation of SMB depending on TempTarget" ON.

So, from patterns you find in YOUR data, at times where you want your loop act differently, you need to carve out CONDITIONS that describe the respective situations (and either for how long it typically lasts, or at which *other* CONDITIONS you want your loop get back to default FCL operation).

From, autoISF 3.0 onwards, also the following parameters are provided as CONDITION and/or as ACTION for defining YOUR Automations:

- Enable ISF weights / Disable ISF weights => Allows temp. ON/OFF for the key ISF modulation parts of autoISF

- Trigger/set iobTH percent => Keeps default aggressiveness, but only until a modified iob threshold is surpassed

- Trigger/set bgAccel_ISF_weight => Modifies the default aggressiveness

An odd TT is often set for an anti-hypo snack or sports snack. In both instances, you do not want SMBs to quickly counter act.

In case of sweet "fun" snacks, this is entirely different -> next section.

5.1.4 Automatic differentiation of FCL aggressiveness using Automations

Personalized Automations tailor the loop exactly to **your** data so **fully automated handling** of situations with different aggressiveness of the loop can be made.

So, you first must analyze patterns you find in YOUR data, at times where you want your loop act differently, to carve out CONDITIONS that describe the respective situations (and either for how long it typically lasts, or at which *other* CONDITIONS you want your loop get back to default FCL operation).

From, autoISF 3.0 onwards, also the following parameters are provided as CONDITION and/or as ACTION for defining YOUR Automations:

- Enable ISF weights / Disable ISF weights => Allows temp. ON/OFF for the key ISF modulation parts of autoISF

- Trigger/set iobTH percent => Keeps default aggressiveness, but only until a modified iob threshold is surpassed

- Trigger/set bgAccel_ISF_weight => Modifies the default aggressiveness

A variant of this mode is to define **several meal time windows** in which autoISF aggressiveness (bgAccel_ISF_weight) and/or iobTH are **set differently** for different meal time slots of your day (or even for a geo-location etc).
Unless your meals differ vastly in size and in fast carb content this may not be needed, but it can make initial tuning (setting the …_ISF_weights, iobTH and size limits) a lot easier

5.1.5 Automatic adjustment of FCL aggressiveness via the Activity Monitor

If you choose to make use of your smartphone's **stepcounter**, you can (automatically) adjust insulin sensitivity ratio to activity level in the past minutes to one hour time frame. This is another little tuning opportunity, in which you study your body's response to light exercise (like walking) or to not moving at all (like desk, couch), and select appropriate settings which, in the future, will automatically adjust insulin delivery to suit activity state of the past minutes (up to 1 hour).(AAPS Preferences/OpenAPS SMB/Activity modifies sensitivity/ -> set two scaling factors.)

This autoISF feature (new since V.3.0) is much quicker responding than Autosens or dynamicISF to adjust insulin sensitivity to your current „lifestyle state".

More see sections 3.5 and 6.5

5.1.6 Pro/con completely hands-off Full Closed Loop

Remaining 24/7 in a completely „hands-off" FCL can be a realistic goal with autoISF 3.0 if besides meals also some special challenges as discussed in section 5.1. were analyzed and addressed.

Clearly it depends very much on your lifestyle, and how interested, willing, and capable you are to recognize, deal with, (and in the future avoid?) situations that get you outside of your desired %TIR on occasion.

> So, this is also about what %TIR you are aiming at, and can accept, as it averages out for the week, for instance.

Everybody must weigh for her/himself how much **upfront effort** to put into getting it all 100% automatic, **or** whether to take an **easier start, with a couple of situations left to take care of when and as they arise in daily life**

Even if a principal capability for a fully automatic running FCL is given, this still means that

- the user should be knowledgeable about what exactly is going on, and

- has a principal capability to „nudge", or to take over in a manual mode.

In the sections that immediately follow, we present the options to nudge or temporarily take over from the AAPS home screen serving as your **FCL cockpit:**

- Section 5.2 describes how you can build your own DIY cockpit

- Section 5.3 describes how a FCL cockpit might look like in the future

5.2 Modulating aggressiveness manually, from the DIY-FCL-Cockpit*

> * Like in the airplane cockpit: Cruising in full auto mode should involve having an eye on the instruments, and on potential disturbances ahead in the environment.

Life in Full Closed Loop is easy if your lifestyle largely consists of real meals, and not much other disturbances like from snacking in between. In section 4. we dealt with major meals.

In section 5.1 we looked into ways to automate also a modified loop response to foreseeable situations, or to those the loop could recognize (with enough time to react).

Other „disturbances" might come up, and you must find an easy way to

- call up a pre-programmed routine for automatic management, with auto-adjusted aggressiveness, or:

- tweak a setting or two, to temporarily adjust the aggressiveness

236 • There may also arise a desire to just exit the FCL mode, and be your own captain for
237   mastering a special situation.

238 For peace of mind, and to learn/stay informed (especially so in your initial tuning phase, or when
239 your glucose curve goes in unexpected ways) we also must be able to

240 • find the key parameters that frame and drive the recent and upcoming loop decisions.

241

242 All this is facilitated within seconds right from the AAPS home screen, serving as a **FCL cockpit**
243 after you built a couple of DIY cockpit features via Automations (as described below and in case
244 studies 5.2 and 6.2):

245   Thoughts went also into how to improve the cockpit in future releases, see section 5.3

246

247 5.2.1 Triggered Automations: Grey extra DIY cockpit buttons for pre-programmed "responses"

248

249 Recognizing conditions for fully automatic handling by the loop may not be not possible or come
250 too late for the loop to act on. Examples would be exercise, where minimum an hour before start-
251 ing "the loop should know. Or for instance: snacks …

252

253 High carb snacks, sweets, consuming ice cream or having a sweet drink comes with the problem
254 of even steeper glucose rises, but overall a lesser insulin need, compared to major meals (for
255 which we tuned our FCL).

256

257 This not necessarily implies that snacks need different settings than a meal. After all, autoISF was
258 designed to act to all available data, especially to where the developing glucose curve is headed.
259 So, depending on your effort to set parameters for a broad variety of meals (notably: how well you
260 avoid to invariably bounce fast against your iobTH), you might be able to accommodate low carb,
261 snack, and major meals with *one* set of settings.
262 If not, or just for increased comfort and safety, you might want to differentiate, and make use of
263 what follows.

264

265 Tuning aggressiveness
266 Key is that a sweet snack likely benefits from even more aggressive FCL performance
267 than the meals in your normal spectrum of diets.
268 Therefore, you could set

269 • a higher **temp. profile%** and/or

270 • a temp.elevated **bgAccel_ISF-weight** (see screenshot of my Automation).

271   •   a **low temp. target** (76 for instance); it additionally helps maximize the first SMBs

272   that will automatically be triggered at detection of acceleration.

273

274 When first defining and testing this Automation, also check:

275   •   that the safety limits as discussed in <u>section 2</u> will not block the intended elevated

276   aggressiveness

277   •   SMBs will not get outrageously big and iobTH sometimes exceeded by too mucht

278   Note that "the last SMB" is allowed to overshoot the valid iobTH by 30%

279

280 Limiting iob

281 For "just a snack", insulin need will in total probably not amount to as much as for a meal.

282   If you would just have your sweet drink and your meal-oriented FCL would "attack",

283   iob likely would become too high, and a glucose rollercoaster would start, with you

284   needing to consume more =>

285 If you just have a snack, or drink a glass of juice, you can lower the **iobTH_percent**

286 accordingly.
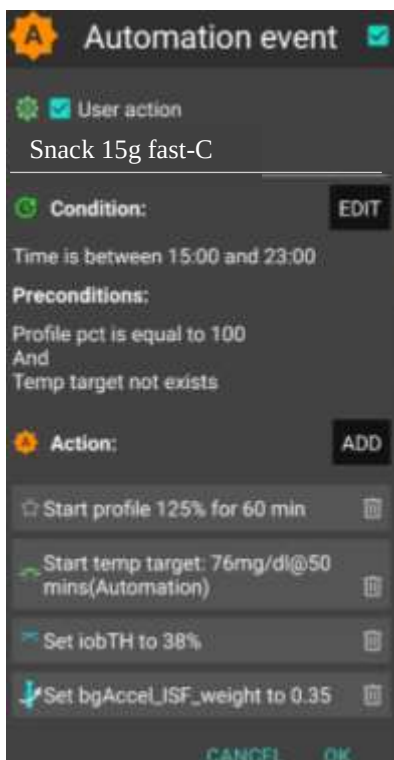
"User action" is always ticked-on

This will, in the defined time space ..

..offer the "DIY cockpit" button..

..which I must press any time (~90…30 minutes) before my snack.

<u>Note:</u> Make sure that iobTH and bgAccel_ISF_weight revert to default afterwards

287

288

289 So, this is a little **extra "project" when setting up your FCL**. You need to research your

290 snack habits (if any), and over time find out which settings in the snack-related Automation

291 work well.

In everyday life you **then just** must **press the related button in your cockpit** (which is not time critical at all, except it should be clicked latest a couple of minutes after you took the drink or snack).

If you consume more, and also eat something with your sweet drink, this will more resemble a full meal… however, with unusual amounts of fast carbs.

Note: Pressing your snack button *a second time* would ***not*** help because the lowered iobTH does not allow iob going high enough. So you are better off just letting your normal FCL meal routine run after your snack mode expired.

Other options when snacks keep extending would require a manual modulation regarding %profile and/or bgAccel_ISF, but keeping the full default set iobTH_percent, or even elevating it (refer to section 5.2.3). If often… do like above for a bigger snack (grey button)

Installing the DIY cockpit button

In the related Automation, just keep the "User action" box clicked at all times, and define in the Conditions when you want to see that button available for cockpit use (see screenshot above) => you will see that button offered.

Besides snacks, also any other recurring special situations can be addressed via a cockpit button, and receive different aggressiveness up to a suitable iobTH level.

In the future you might be able to set the stage for a snack and other "disturbances" also via an extended menue below the TT button on the AAPS home screen, see section 5.3.3.1

Discussion

If I had *regular* snacking habits in certain parts of day, I might take an **alternative** route and **modify my FCL settings in those time slots** to run automatically upon acceleration detection.

326 Yet another **alternative** would be to temporarily leave the FCL mode and handle the sweet
327 snack or drink "the traditional way" in **hybrid closed loop**.

328   The suggested FCL cockpit user interface with an extra version of violet loop on the
329   AAPS home screen facilitates that, including automatic removal and re-appearance
330   of the insulin button at the bottom of the APS home screen.

331

332 As mentioned in section "Limiting iob" above, it is essential though to either avoid snacks,
333 or select one of the discussed easy ways to deal with them in everyday life.

334

335 5.2.2 Status recognition

336

337 Before considering any manual interventions into the ongoing FCL, you should be aware what the
338 current mode of action is, and hence which button eventually to fine-tune or lever to switch, in or-
339 der to adjust to the disturbance you see coming up.

340

341 See section 5.4

342

343 5,2.3 Manual interventions from the (DIY-) FCL cockpit

344

345 Trouble with all these is, not to forget to set back manually, too   (=> better solutions in 5.3)

346

347 5.2.3.1 Tuning aggressiveness via temp. %profile or TT settings

348

349 The set **% profile** multiplies with both, the ISF resulting from autoISF, and also with the default
350 iobTH you have set, so both are nicely modulated in a linear way with the % temporarily chosen

351

352 A lowered (relative to profile glucose target) temporary bg target (**TT**) signals lowered sensitivity
353 (more insulin need), and an elevated TT (as often used with exercise) increases sensitivity and
354 hence works in the direction of a lowered % profile to also reduce insulin given by the loop.
355 Moreover, the **exercise button** (top center on your AAPS home screen) can be activated (turns
356 yellow, then). This will **further boost** how your set TT elevates the resulting ISF, and sharply
357 lowers iobTH, as often desired for sports. See section 6.1).

358

359

360 5.5.3.2 Making temp. changes in settings made in /preferences

361

362 Going into /preferences allows to:

363   -   Limit/expand SMB sizes

364   -   set different iobTH

365   -   set milder or stronger …._ISF_weights

366   -   switch OFF the even <-> odd SMB on/off

367

368

369   5.2.4 Temporarily exiting the FCL

370   One **alternative** always is to temporarily leave the FCL mode, and handle any disturbance

371   "the traditional way" in **hybrid closed loop**.

372

373   The suggested FCL cockpit user interface with an extra version of violet loop on the

374   AAPS home screen (<u>section 5.3.1</u>) would facilitate that, including automatic removal

375   and re-appearance of the insulin button at the bottom of the APS home screen.

376   In case this feature is not yet available, you must:

377

378   Exit the FCL mode by going to AAPS/preferences/put in your password/OpenAPS SMB/scrolldown

379   to autoISF settings and switch "Enable ISF adaptation.." OFF.

380

381   Unfortunately, there is no way yet for it to come automatically back on, after a selected time for

382   instance. So do not forget to switch your autoISF fully back on, later.

383

384   As this will often be forgotten, it may be worth doing a "User action" Automation, for a "temp.

385   FCL OFF" grey button (see section 5.2.1).

386   Caution though, there is very limited experience with this brand new feature, and it might be

387   accidentially activated . – To make things worse:

388

389   To recognize whether autoISF currently runs with ISF adaptation or not, you must consult the

390   profile_sens -> actual_sens indicator below the Autosens%. However, this gets also modified

391   by %profile switches or TT +/- exercise mode. So it is not as easy as it would be with the "violet

392   loop" proposal mentioned already above.

393   Ultimately, you can of course study the SMB tab to find out what is going on.

394
395
396

5.3 Modulating aggressiveness manually from the improved FCL-cockpit

autoISF 3.0 is an early dev variant of AAPS, and as user you are participating in an on-going development. Of note, autoISF 3.0 is first launched without many of the cockpit features that are presented below in this font color. (Only what is written in black is at this point of some relevance for using autoISF 3.0)

For the time being, multi-step work-arounds may become necessary

- In many cases, going into AAPS Preferences and changing settings would be needed (…plus not forgetting to change these settings back, afterwards).

- Automations allow a DIY FCL cockpit, see section 5.2 and case studies 5.2 and 6.2

    This is also an open invitation for you to contact us in case you could help program a module for one of the required user interface extras.
    For future integration into AAPS Master, an eye should be kept also on the question which other modes (like FCL using Automations and others metioned in section 13.) might benefit from some of the extra features.

Keep in mind, though, that the **goal should be to interfere with the loop as little as possible**. Under the described conditions it can run **fully automatically** without any user interaction (= after the initial tuning phase, and related settings made in AAPS /preferences/SMB/autoISF. See section 4. and 5,1).

However, just like in the airplane cockpit: Cruising in full auto mode should involve having an eye on the instruments, and on potential disturbances ahead in the environment.

    E.g.: storm ahead => instruct your plane to climb to another flight height.
    Anology: exercise ahead => setting an exercise TT, or => pressing a button that activates a sequence of instructions (some of them probably hinging on conditions, like actual iob) how to manage through that exercise situation).

So, for the occasional „disturbance" coming up, you should find an easy way to

- call up a pre-programmed routine for automatic management, with auto-adjusted aggressiveness, or:

- tweak a setting or two, to temporily adjust the aggressiveness

- There may also arise a desire to just exit the FCL mode, and be your own captain for mastering a special situation.

434 All this is facilitated within seconds right from the AAPS home screen's **cockpit features** to the
435 extent they are already incorporated, or to the extent you can build alike DIY cockpit features via
436 Automations, as described in section 4.1.3 and case studies 5.2 and 6.2):
437

438 • The button that is integrated into the **violet FCL icon** serves as emergeny off button, to
439 quickly stop FCL, or to at least to immediately stop any more SMBs (…just for a couple of
440 minutes, or for the remaining meal time: pick from the options offered with just one
441 keystroke).

442 Via the violet FCL icon on your AAPS home screen, you also can access a temp. switch-off
443 button for SMBs (see section that next follows below).
444

445 • The **three top fields** (%profile, exercise, TT) provide access to temp. tuning of core
446 parameters, and/or to some pre-programmed routines.

447 Taken together with some **new indicator fields** about your loop state, and the **grey DIY cockpit**
448 **buttons** this makes the AAPS home screen your **cockpit** for Full Closed Looping.
449

450 Let us look on each of these cockpit elements in some detail:
451

452 5.3.1 Violet FCL icon and underlying buttons
453

454 Novices to FCL, or really anyone running into a very special situation, may appreciate that the new
455 closed loop icon on the AAPS home screen in pink (for FCL) has buttons to quickly shut off getting
456 more SMBs (1st row), or to enter other loop modes (second row).
457

458 It functions very much as the other ones that you know from HCL already, and in fact you
459 get offered some of the same options (for instance, to switch the (full) closed loop off for 15
460 minutes for going to take a shower)
461

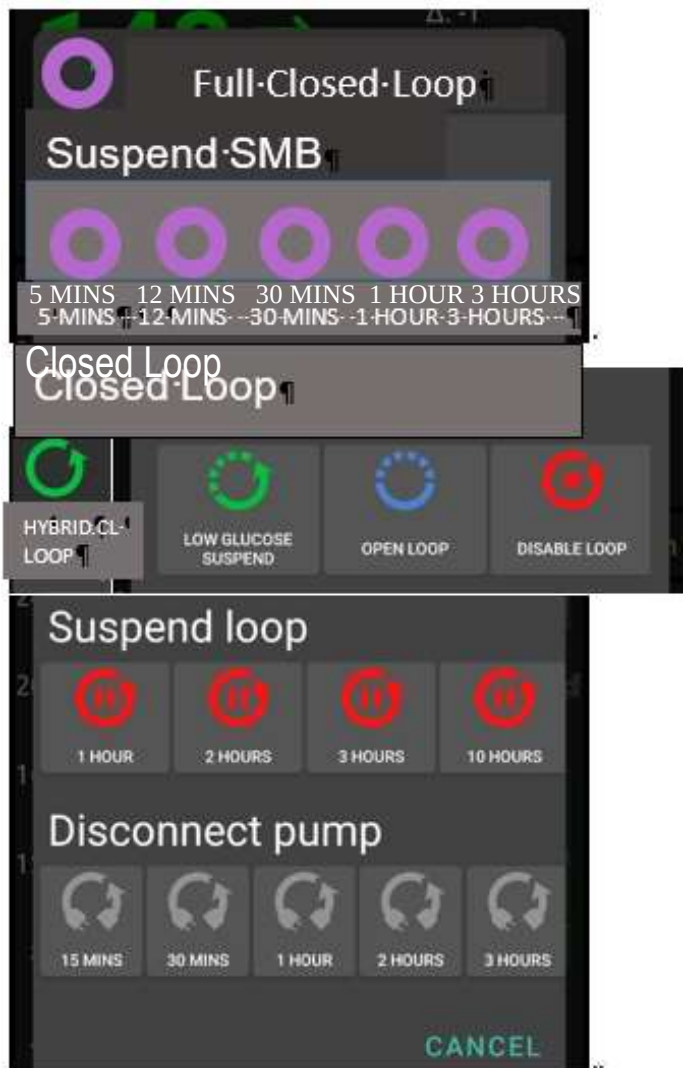462 Note that in FCL you leave all BG regulation, notably against meal spikes, to the loop. So, try not to
463 disconnect in phases when your FCL must ramp up your iob.
464 The required insulin would still be supplied *after* you reconnect. However, without the user
465 pre-bolussing, the delay would be more of an issue in FCL than it had been in HCL.
466

467 Just pressing on the FCL icon, a dialogue box comes up:

Full·Closed·Loop

Suspend·SMB

5 MINS 12 MINS 30 MINS 1 HOUR 3 HOURS
5·MINS··12·MINS··30·MINS··1·HOUR·3·HOURS···

Closed Loop

Closed·Loop

HYBRID·CL·LOOP   LOW GLUCOSE SUSPEND   OPEN LOOP   DISABLE LOOP

Suspend loop

1 HOUR   2 HOURS   3 HOURS   10 HOURS

Disconnect pump

15 MINS   30 MINS   1 HOUR   2 HOURS   3 HOURS

CANCEL

<-add·arrow,·,·form·like··like·Cl.Loop···¶

<-dotted·+·arrow,·form·like··like·LGS·¶

DEV:·when·in··Hybrid·Closed·Loop·=·top·
headline·+·green·circle),·there·is·no·Suspend·
SMB·part·but·it·starts·right·with·„Closed·
Loop".·In·that·screen.·There,·the·1st·element·
must·be·option·to·pick·¶

··········pink·circle,·FULL·Cl.·LOOP·¶

where·here·the·green·HYBRID·CL.·LOOP·
stands·¶

For·loopers·who·did·not·set·up·FCL,·a·
feedback·must·come·up·~·„FCL·not·installed"·
if·they·press·on·that·button·¤

468

469 Pressing „**Suspend SMB**"provides fast and easy „emergency braking" regarding delivery of more

470 SMBs:

471 Select the one with the desired number of minutes: 5 or 12 for just blocking the potential next

472 SMB(s), and up to 3 hours to manage the entire rest of this meal with %TBR from then on.

473

474 Whenever, and whyever, your FCL is in „no SMBs allowed mode (e.g. automatically after

475 surpassing an iobTH also, or might be triggered by an odd TT), the FCL icon will turn into a dotted

476 one.

477 Instead of remaining **duration to end time** it indicates in the middle „the condition", „**iob**" or „**TT**

478 Add an indication **if** suspend SMB comes from an Automation, e.g. add an **„ (A) „ underneath** the

479 #minutes, iob, or TT in the middle of the dotted violet field.

480 So, as in other (already in HCL existing) cases, those icons show in the middle the minutes left that

481 they will be running, or the condition which would have to go away for this temp. setting to stop.

482 It always auto-reverts into the FCL state and FCL icon, when time (or other condition) has elapsed.

483

484 Pressing „**HYBRID CL. LOOP**" or other buttons from the 2nd row provides fast and easy

485 „emergency **exit" into other modes**.

This enables beginners an easy „temp. escape" into their well-known HCL (green) at any point of time. bgAccel_ISF_weight is set to zero when going FCL->HCL. HCL can run with autoISF (for instance dura_ISF) uninhibited otherwise. (check implications for HCL users of autoISF ??).

Note: These options from row 2 have no time limit. Loop will **not** by itself go back to FCL. You see the different loop icon as a reminder to manually revert, when ready.

5.3.2 Buttons „Insulin", „Calculator" etc at bottom of AAPS home screen

These buttons are **not useful any longer in FCL**, and automatically disappear whenever in FCL mode (also in Suspend SMB state), and re-appear when leaving FCL. This applies also when an Automation or technical system failure shut off FCL.

Users who, maybe in the beginning phase, feel better having those buttons, can override the removal (of the insulin button, or any other) by going into /preferences/overview/buttons and forcing them on. They only remain on until the next re-entry into FCL mode, when auto-off happens again.

The reason why we do this: It really is important to let the loop loop, and not interfere more than absolutely needed. Any bolus the user gives will sure distort the bg curve, on which autoISF, especially when aggressively tuned for FCL, builds a lot of its decisions!

5.3.3. Three top fields (%profile, exercise, TT)

Depending on the variedness of lifestyle, the desired %TIR, and the initial tuning effort put in, the user may want occasionally **to „tweek" the aggressiveness of her/his FCL**.

The top 3 fields (grey in default mode, **yellow when temp. in mode with changed agressiveness**) serve as quick and easy entry points to make temp. switches (as users will be used to for %profile switches, or for setting an EatingSoonTT in HCL, .. which they still can do in FCL … but more:)

Expert FCL users might need this feature rarely, but probably at least to manage activity after meals: Each require opposite aggressiveness, and the switch has to come in a certain point in time that would be difficult to capture. (More see section 6.4)

520

521 **5.3.3.1 TT dialoque field** *((Currently not available in the pictured form and function !)*
522 *f extended design for FCL cockpit is already launched)*
523 The TT field (top right of AAPS home screen) is the primary daily interface, and a dialogue field
524 opens when pressing on it

Initially, the form can be entirely
empty re. TT inputs and just
show the default iobTH and
bgAccel parameters.

Two lines appear for Target and
get labeled ES, AC or HY
depending on what was pushed
at the bottom buttons. (HY =>
red frame; evtl 1 empty => grey)

TT entries can be made or
overridden.

iobTH calculates from Target
AC and other settings shifts
away from default set in
/preferences (here 0.7) but
could be overridden here
0...200 % is allowed

bgAccel ISF_weight can be
modulated here, too. Note: It
can change again if %profile is
also changed. 0...200 % is
allowed

CANCEL allows to start fresh
(select one or two of the
square buttons, ES, AC or HY

OK needed to use the settings

Duration input is made in minutes. In the exceptional case that both,
ES and AC targets are defined, the duration input is for AC and
framed blue. (This is because the preceding AC mode is automatically
determined in length by the loop observing when iobTH is exceeded)

525
526

527 This looks complicated but only because it allows 4 different modes of use. Each user will primarily
528 use her/his preferred one.
529 (1) Who is happy with the initially well tuned FCL and does not have huge variations in daily eating
530   and moving around, will **not use** the TT **at all**. FCL is possible without an intervention via the

531 TT button in your cockpit. Actually 4 of 8 modes (GGG …YYY permutations, list see section
532 5.3.1) are not making use of TT.

533 (2) Super easy is also, to just input **any odd-TT** (odd-numbered temporary target) that will shut out
534 any SMBs for the set duration. *That can be a good idea when having a snack, for instance*.

535 Super quick access to stop SMBs is possible also via the loop icon (section 5.2.1).

536 Specifically, an **EatingSoon TT** can be activated here (limited relevance see section 2.5). It is
537 time-un-critical, can be manually set, or come up via an Automation.

538 The cockpit enables you to set the iobTH differently (override) for the current meal.

539 Alternatively, iobTH can be temporarily changed in /preferences or using an Automation.

540

541 Temp. iobTH will always revert to default when the TT expires. If another TT immediately
542 follows, like in the example of the screen above, it will calculate, (then) show and use a new
543 temp. iobTH.

544 (3) The third way is to **use the input mask** (*if already ncluded in your software version* see picture
545 above) **to freely modulate the loop aggressiveness** for a declared number of minutes. Click
546 the bottom big square(s): Either HYPO, or ACTIVITY, or EATING SOON, or ACTIVITY and
547 EATING SOON (*example in the pictured screen above*). Make or override entries in the offered
548 fields. Press OK.

549 (4) The fourth way is to exclusively use one of the 4+4+2 little buttons seen in the bottom part of
550 the TT dialogue box *(if already included in your software version)*. They provide a set of
551 settings (as will immediately show in all input fields above) that the user has set up in
552 Preferences/SMB/autoISF/FullLoop (refer to section 6.3), and can freely label there. *For
553 instance „hiC" at high carb EatingSoon, „piz" for Pizza/fatty meals, „grd" for garden work,
554 „mtb" for mountain biking …*

555 **Capturing good settings for not-everyday situations in /preferences** *(if already included)*
556 **allows calling them up within 1 second**, from your cockpit on the AAPS home screen (…and
557 won't ruin the FCL experience at all , especially because in most cases it is not time-critical,
558 how long before the intended exercise the buttons are pressed).

559 Case study 6.2 demonstrates that nearly the same performance and comfort can be reached
560 via the **DIY FCL cockpit** with the grey extra buttons appearing at the bottom of the AAPS home
561 screen, based on Automations with User action (see also section 4.2).

562 The example picture given above, and also case study 6.2, is the most complicated (but also most
563 useful) case, **when exercise follows after a sizeable meal.** It is then that you need (a) aggressive

564 FCL initial performance at the meal, but, exactly when (!) a (for the intended sport already
565 temp.lowered) iobTH is exceeded, you need (b) to have SMBs automatically switched off and go
566 into the „milder" mode, as defined for the exercise (with high instead of lowTT, that automatically
567 significantly reduces iobTH again, and insulin sensitivity(resistance) settings too).
568 Pressing exercise related buttons will automatically also light the **exercise button** on the main
569 screen yellow.
570
571 To summarize, the TT dialogue field offers easy but powerful ad-hoc modulation of loop
572 aggressiveness for FCL (if already included).
573
574
575 5.3.3.2 Exercise button *(see more in section 6.)*
576
577 The exercise button automatically lights yellow when exercise related TTs are activated in the TT
578 dialogue box. 4 of 8 modes are making use of the exercise button.
579 If pressing on the exercise button, a dialogue box appears *(if extended design for FCL cockpit is*
580 *already launched)* with info on exercise setting first (and opportunity to override), plus below the
581 activity monitor (experimental for auto-tracking of lighter movement during the day, and effects on
582 sensitivity that may have. *See* section 4.5).
583
584 So, first the exercise settings (as set under TT) are there to read. Example :

585

activity¤	TT¤	dura¤	%·profile¶	iobTH¤	bgAccel¤	%overall¤	¤
mtb¤	171¤	180¤	70¶	3.0·U¶	0.24··¶	70 ¶	¤

Dynamic·exercise·mode **OFF¶**

🟢·Mode·set·to·run·for··**134**··more·minutes

🔴·Mode·starting·after·meal·when·iob>·**4.4·U**·or··   n/a¶

586
587 The exercise (here mtb) is selected in the dialogue box of the neigboring TT field, and there auto-
588 filled with settings made in the set-up and tuning stage by the user under preferences (see
589 above,….). They are reported also under the exercise button here, and TT, duration, and % sens
590 (which also shows active on the %profile field on the left side of the exercise button) can be temp.
591 changed there. iobTH, bgAccel_ISF and overall resulting sensitivity ratio is given in the other fields.
592 The **middle field** of the table, **„% profile"** either picks up the % set under the %profile button, or
593 an input can be made here, in the exercise button domain, which will:

594   •   turn the neighboring %profile button on yellow and show that inputted % on it, too

595   •   be multiplied with the result from the exercise mode settings per se, and change the %
596   overall, accordingly.

597 So, if this middle field of above table (dialogue box of sports button) contains a figure other than
598 100, input field becomes yellow,and you are operating with a combination of traditional PLUS new
599 exercise mode (with all three top buttons of your FCL cockpit yellow). This maximally will soften
600 aggressiveness, for which you get an idea by the last calculated figure.
601
602 The mode is either running already (for another number of minutes, as probably also shown in the
603 yellow TT field anyways). Or it is scheduled to run, after insulination for a started meal reaches
604 iobTH (as in table). Or, no exercise is scheduled (both points red, no entries.
605
606 The lower part of the exercise dialogue box (not pictured above, but see in <u>section 6.5</u>) is
607 dedicated to the Activity Monitor
608
609 5.3.3.3 Profile button
610 The profile button can still be used to set a different profile, or profile%, for instance to adjust for
611 days with sickness (as you are used to from hybrid closed looping). 4 of 8 modes are not making
612 use of the profile button.
613
614 Any inputs made here will be used to modify profile_ISF on which all further changes are made on
615 (multiplied with).
616
617 The profile field remains grey if standard profile is applied.
618 It turns yellow, displaying a %figure relating to any altered loop overall aggressiveness:

619   •   When no inputs (changes from 100% profile) are made here, but inputs in the TT field,
620   e.g. for exercise, automatically lead to different insulin sensitivity ratio ~~that ratio is shown~~
621   ~~here~~

622   •   when% is changed by input in the profile button itself, it will be multiplied with with
623   profile_ISF and be used in place of profile_ISF *by the algorithm*.

624 However, for exercise (sports) you no longer must make an entry here, because
625 reasonable %reductions should be automatically provided, driven by your set TT (and half-basal
626 exercise target), see <u>section 6</u>.
627
628
629

5.4 Recognizing your loop state in the AAPS home screen

5.4.1 Color scheme of top cockpit buttons tells kind of closed loop that is running

3 Buttons (%profile; exercise; TT) each in 2 states (yellow Y, or grey G) makes 2 exp 3 = 8 possible combinations:

GYY = dynamic exercise mode

YGY = not-dynamic „traditional" exercise mode (if <100%) or hypo mode (if >100%)

GYG = basic closed loop with Activity Monitor running

GGG = basic closed loop (FCL or HCL) without any altered sensitivities etc

YGG = basic closed loop but with a „long wave" sensitivity shift (e.g. sickness)

GGY =temp. target like e.g. EatingSDoonTT is set; or Hypo mode

YYG = closed loop with „long wave" sensitivity adjustement and Activity Monitor running

YYY = dynamic exercise mode in time with additional „long-waved" sensitivity shift

5.4.2 Information printed on the top buttons

The yellow TT field shows the currently valid TT (and further duration):

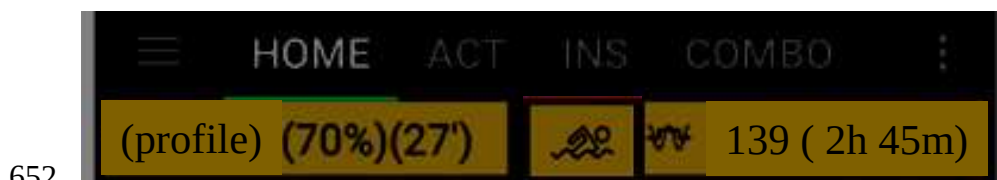(profile) stands for the abbreviation you labeled your selected running profile

In the special case of settings for meal preceding sports, the field will look slightly differently:

 …and …

… when iobTH is first time exceeded, this automatically switches to:

Likewise, if on the AAPS main screen just an **EatingSoonTT** is set (e.g.72), this is entered with the desired duration. Afterwards, it automatically reverts to profile target and the display turns grey again there with e.g. 90 on it (and no time limit).

 Without sports context, the middle field remains grey.

658

659

660 Independently from setting a TT, the user can choose to set a **%profile in the left top field**, for an

661 independent number of minutes, e.g. 70% in this screen example: Also, or additionally, this will

662 influence the resulting ISF and sensitivity%

663

664

665

666 The % might change and turn yellow also in context of making TT inputs in the related dialogue

667 box (see chapter TT dialogue field, above). Still, the % (or the length of time the profile switch shall

668 be active) can be independently overriden in the top left field, if so desired.

669

670 If an **Automation** sets a %profile, and/or a TT *(e.g. automatic detection of meal start at condition*

671 *e.g. when delta >10*) , this would automatically show in respective field(s) turning yellow and

672 showing the temp. setting. To show the set parameter comes from an Automation, „ **(A)** „ is added

673 in the end of button text.

674   Note that an Automation is usually/ always (?) only permitted to temp. change <u>default profile</u>

675   settings, not other pre-existing temp. settings. This is for a good reason : Why should a

676   sometimes in the past thought-out Automation supersede your - just for the occasion

677   specified – temp.settings that you consciously activated for the day?

678   Advice: Try to stay away from Automations that also aim at temp. modifying

679   aggressiveness. For the reason just given in above note, they often will not kick in anyways.

680   Generally, it also is no good idea to double up sub-algorithms for tweaking loop behaviours.

681

682 Try to **keep things as simple and clear as possible.**

683

684 That said, a limited number of Automations can be of help in distinct scenarios (that differ in

685 purpose and in applicable time of day*).*

686   A good one could be for night time, when your odd profile TT has SMBs shut off, but your

687   experience after pizza nights tells you that, under certain condition patterns (bg, iob), an

688   SMB or two should be „allowed in". Another good example, if you go usually FCL without

689   any use of the TT button (which you could call a meal announcement of sorts), is to define

690   an Automation that, after detecting a meal start, automatically sets a low TT to get

691   maximally aggressive first SMBs.

692

693 ### 5.4.3 FCL related indicator fields in the AAPS home screen

694

695 In extra data fields of the AAPS main screen you can always see (not change) the key

696 „aggressiveness" parameters your loop currently operates operates with (see also home screen

697 example below):

698   •   how profile sensitivity (**ISF**) changes by the %profile input, by autoISF, and/or a set

699   exerciseTT.

700   •   next to current available iob number is an indication of your **valid iobTH** (the iob above

701   which no more SMBs will be given)

702   •   The AAPS home screen additionally shows, above the deltas, the current **acceleration**

703

704

5.4.4 Overall home screen:

706

Overall home screen:

<- Cockpit: yellow fields=>temp. modulated sens.

here additionally: acceleration-factor

< - Violet < - > green circle for FCL < - > HCL dotted if SMB off
in the middle: minutes counting down if temp.set;
below: (A) if coming from an Automation that is running

<- % reduced insulin supply... because of resulting...

< - higher (weaker) ISF

< - iobTH

<- buttons „bolus" „carbs" etc. eliminated
(auto- re-appearing when violet –> green loop)

707

708

709