7. Advanced HCL: Meal Announcement (MA) via a pre-bolus… V2.5next

Please note that with autoISF 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 section 0

Available related case studies:

Case study 7.1:
Case study 7.2:

See also Case study 13.3 from a user of Boost

- - - - incomplete first draft - - - - -

Originally it was planned to provide an extra section on FCL for kids here. However, we came to realize that the approach is no different for kids than already laid out. It just seems some implementation hurdles are significantly higher for implementing a safe FCL for minors.

For that reason, we like to explore in this section 7. how a **hybrid closed loop without carb inputs, using autoISF**, might get you to a **solution that removes most of the everyday burden** associated with having to co-manage meals.

This could (not only for kids) also be an **intermediary step, from which to progress into FCL as soon as a currently missing pre-requisite resolves** for you in the future.

7.1 Frequently encountered hurdles

Deficit making FCL difficult or unsafe	Bridging solution in Advanced HCL
Lyumjev or Fiasp (also in 50% mix w.slower insulin) not tolerated/too many occlusions; poor discipline re. scheduled infusion site changes	Difficult. Experiment with different insertion (site, depth, angle, cannula material), injection speed, site exchange frequency. (all difficult w/ pod pumps). Low carb diet
Poor discipline regarding keeping 100% BlueTooth connectivity	Given bolus (and profile basal running) will reduce the problem significantly; install alarm on (parent) phone
Leaking pods	(still a “no go”)

Deficit making FCL difficult or unsafe	Bridging solution in Advanced HCL
Jumpy CGM	Use strong smoothing (HCL does not rely on early aggressive action upon first signs of rising bg)
Very low hourly basal	No problem as HCL does not require super boosted SMBs
Erratic patterns of sweet drinks and snacks	Much less of a problem as a bolus is given with it

To establish and maintain *any loop* for kids brings about some extra challenges if:

- Going through marked changes of insulin sensitivity or of circadian pattern makes it difficult to keep the FCL appropriately tuned.

  This problem is about the same in all loops (Autotune, self-learning systems etc…??). You should try to set appropriate (temp.?) changed profiles, that serve also as a basis for your autoISF loop.

- Between kid and supervising parent it must be guaranteed, especially in the initial weeks, that an eye is kept on whether the "Advanced HCL (MA) loop" is working about as to be expected.

On CGM might expand a bit ~ *pre-requisites, CGM, for kids: what works well ??*

If not G6 is used: (re CGMs, observe latest developments re 1 minute vs 5 minute readings, see github/ga-zelle pls)

include implications of (from wiki aaps):

Dexcom G6 or Dexcom ONE with xDrip+ Companion Mode

The noise-level data is not shared with AAPS using this method. Therefore 'Enable SMB always' and 'Enable SMB after carbs' are disabled.

xDrip+ with FreeStyle Libre

None of the FreeStyle Libre systems (FSL1, FSL2, or FSL3) broadcast any information about the level of noise detected in the readings, and therefore 'Enable SMB always' 'Enable SMB after carbs' are disabled for all setups using the FreeStyle Libre.

In addition, many people have reported the FreeStyle Libre often produces noisy data. In xDrip+ there are a few options to help with this:

Smooth Sensor Noise. In xDrip+ Settings > xDrip+ Display Settings ensure that Smooth Sensor Noise is turned on. This attempts to apply smoothing to noisy data.

Smooth Sensor Noise (Ultrasensitive). If you are still seeing noisy data in xDrip+ you can apply more aggressive smoothing using the Smooth Sensor Noise (Ultrasensitive) setting. This will attempt to apply smoothing even on very low levels of detected noise. To do this, first enable engineering mode in xDrip+. Then navigate to Settings > xDrip+ Display Settings and turn on Smooth Sensor Noise (Ultrasensitive).

7.2 Ready to advance?

Switch off dynamicISF, forget what Autotune tries to tell you, and make sure your profile parameters are set right. Refer to guidance given in the HCL repo here:

Optimize meal management, notably watch that your ISFs are set right to deal with rising bg once your given meal bolus looses power.

With properly set ISFs, you should be able to expand allowed SMBV sizes to 120 minutes worth of basal.

Next, introduce a method that allows your loop take care of temp. insulin resistance from fats. (In the past, dynamicISF might have helped you for that.)
Now you have two options:

- Temporary increase of %profile via an Automation at signs of post-meal fatty acid resistance. See: (readthedocs)
- Or step into using the AAPS dev variant with autoISF, but make exclusively use of the dura_ISF component there.

Make sure your HCL now works at satisfying performance.
In the next steps, you try to get same performance, but with only a very rough idea, what you will eat (and no carb inputs)

7.3 Reduced pre-bolussing

Note that by continuing to make (albeit reduced) boli at meal start we remain in Hybrid Closed Loop (HCL) territory. Do **not boost** your SMBs *nearly as much as* enabled if you already work with the AAPS dev variant, and advised in section 02 *for FCL*!

- Add link to ga-zelle “To pre-bolus or not to pre-bolus?”

7.4 Implications for autoISF tuning (HCL vs FCL)

- **warning**, regarding implications for settings bgAccel_ISF-weight tuning should be factor 5 if not 10 milder ??)

- FCL => implications for remote parent monitoring ?

- Extra caution needed re. elevating the **SMB delivery ratio ?**
    - The fixed 0.5 value in AAPS was installed also with a consideration on user/follower (parent) set up and limiting potential problems from a bolus being initiated from both phones in parallel
    - As in FCL neither phone should initiate a manual bolus, this precaution seems not really needed (dev – check)

Discuss risk from a “loose” bolussing habit in MA

* shooting from the hip against highs …

* Need to learn interpret iob, insulin activity curve, prediction curves etc …

7.5 Dealing with special situations / insulin sensitivity / Disturbances

7.5.1 manually, via temp%profile and TT Tuning aggressiveness

Key is that a sweet snack likely benefits from even more aggressive initial FCL performance than the meals in your normal spectrum of diets require.

Therefore, you could set

- a higher **temp. profile%** and/or
- a **low temp. target** (76 for instance; this additionally helps maximize the first SMBs that will automatically be triggered at detection of acceleration)..

- 7.5.2 via Automations a temp.elevated **bgAccel_ISF-weight** (see screenshot of my Automation).

7.5.3 via custom buttons

The DIY Cockpit (shorten quoted section 5.2.2.3 that follows!) allows to have buttons dedicated to kindergarten hours etc that can in a time-uncritical manner activate special routines – **should be very helpful to custom program Automations for kids**!

Grey extra DIY cockpit buttons for pre-programmed "responses"

Recognizing conditions for fully automatic handling by the loop may not be not possible, or come too late for the loop to act on. Examples would be

- *exercise:* Minimum an hour before starting "the loop should know" to be able to lower iob and elevate bg by the time exercise starts.
- *snacks*: High carb snacks, sweets, consuming ice cream or having a sweet drink comes with the problem of even steeper glucose rises, but overall a lesser insulin need, compared to major meals (for which we tuned our FCL according to section 4).

You need to research your snack habits (if any), and over time find out which settings in the snack-related Automations 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).

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 DIY cockpit button, and receive different aggressiveness up to a suitable iobTH level**.

Over time you can have a big number of User action Automations, and keep them "shelved" rather invisibly (clicked in-active, top left box) in your long list of potential Automations. Even when active, they only show in your cockpit (bottom grey field of your

AAPS home screen) in the time slot you assigned as potentially relevant. radically need to shorten this quote from chapter 5.2.2.3 ----------

End with something like:

There are a couple of parents and kids pioneering this area, see also Case studies 7.x.

We highlighted areas that would require some minimum compliance. In the end it comes down to compare the achieved ease in daily use and achieved %TIR to how it was when hybrid closed looping.