Case study 4.3: Hands-off FCL using autoISF on Xmas V.2.2

A *pre-release tester* reports here on trying, for a 5-day period in the 2023 Christmas season, a **completely hands-off** FCL utilization.

Method

FCL with (then not yet released) dev variant of AAPS 3.2.0.4 w/autoISF 3.0.1
Lyumjev 100 (DIA 7h) in Combo pump w/ 10mm Teflon cannula (0-48h)
2 x G6 overlapping (see case study 1.5; sensors used ~ d3 – d15; xDrip; no smoothing in AAPS)
profile basal ~ 14 U (0.41…0.75 U/h); profile_ISF 36…44 mg/dl/U (circadian);
TDD 43 U (which is above his normal TDD, see p.2).

Main settings for 24/7 adaptation of ISF ***)**:

- SMB range extention and autoISFmax both = 2.9; SMB delivery ratio = 0.75 fixed
- bgAccel_ISF_weight = 0.24; pp_ISF_weight = 0.03; dura_ISF_weight 0.8
- iobTH_percent=60

***) Caution: Do not copy settings** from others, not even for starting your tuning.
Why, see FCL e-book section 4.1.

No user interference:

- no boli
- no carb inputs
- no setting Eating Soon
- no "manual nudging" via the top fields in AAPS main screen (%profile, exercise, TT).

Loop did use the following Automations (from the initial FCL set-up, as described in FCL e-book)**:**

- *For meal management:* Automation that sets TT=74 mg/dl for 26m if delta>10 (FCL e-book section 2.5)
- *For nighttime management* "Adjunct Automations." (discussed in FCL e-book section 5.1.2)*:*
    - Operate with an odd profile target at 3am-10am for default SMB shut-off…
    - …complemented by Automations to get temp. SMBs (if bg>160; iob<3.5) during nighttime
    - Note: If tester normally would do breakfasts, set odd profile TT would end earlier than 10 am
- **Activity monitor** 24/7 on. Scale factors 1.2 activity and 0.3 inactivity.

96% TIR (HbA1c ~ 5.6%) during 5 days at Christmas

Glucose distribution (5 days total, Friday 22.12.2023 - Tuesday 26.12.2023)

Range	% of Readings	# of Readings	Average	Median	Standard Deviation	A1c estimation*
Low (<70):	1.3%	19	65.7	66.0	1.9	
In Range:	96.4%	1389	112.4	109.0	22.6	
High (>=180):	2.3%	33	196.1	189.0	13.1	
Overall:		1441	113.7	110.0	26.2	5.6%$_{DCCT}$ | 38$_{IFCC}$

Mean Total Daily Change	Time in fluctuation (>5 mg/dl/5m)	Time in rapid fluctuation (>10 mg/dl/5m)
923.1 mg/dl	14.0%	4.0%
Mean Hourly Change	**GVI**	**PGS**
38.46 mg/dl	1.28	5.21
Out of Range RMS		
3.2 mg/dl		

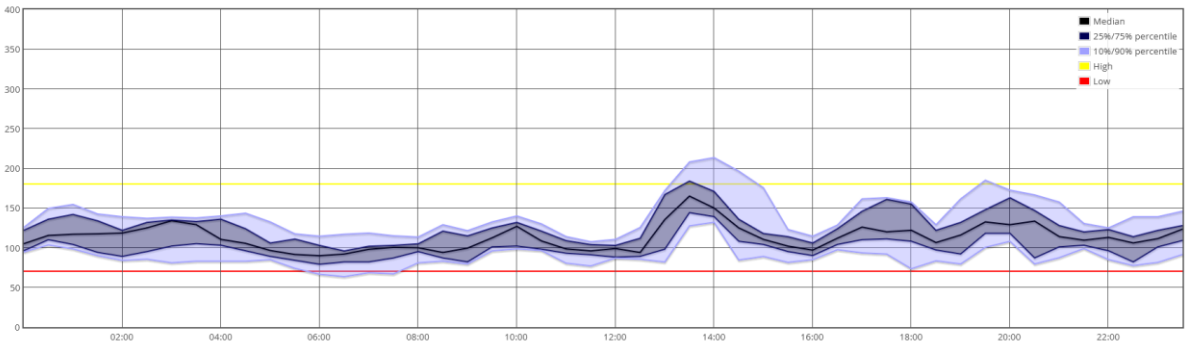
Negligable hypo tendency

The statistics for the “Low < 70 mg/dl” line of above table shows:

- Only 1.3 % of values were below 70 mg/dl
- Half of those (0.7%) were under the group-median of 66 mg/dl
- Virtually no data point below 62 mg/dl (= Median low minus 2 SD)(61 was lowest in Daily stats)

The percentile report shows, that briefly after midnight the low tendency is biggest (down regulation from dinner coincides with a last dogwalk):

Glucose Percentile report (5 days total, Friday 22.12.2023 - Tuesday 26.12.2023)



Details for each of the 5 included days:

Due to some **excessive eating**, TDD was on average 42.8 U (+16% to normal TDD averaging 37U). No big breakfasts. Dinners came relatively late; and once, on Dec 25/26th, there was midnight chocolate fondue w/ 2 gl. sweet hot wine (Glühwein)

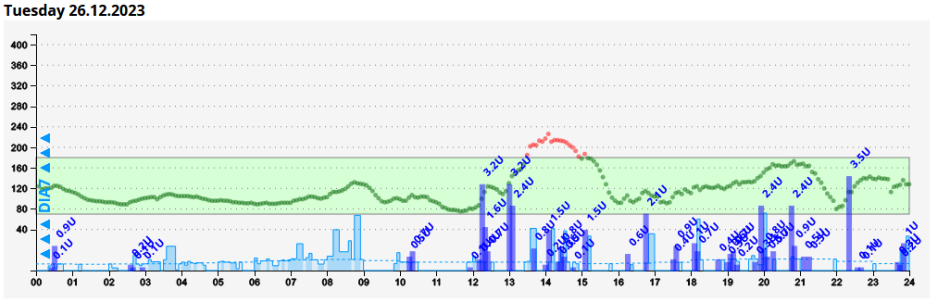
Two very big holiday lunches (25th and 26th), goose resp. turkey, with dumplings, vegetables and small desserts; Christmas cookies. No settings were adjusted.

Daily stats report

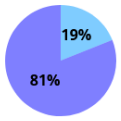
Date	Low	Normal	High	Readings	Min	Max	Average	StDev	25%	Median	75%
Tuesday 26.12.2023	0%	93%	7%	288	75	226	119.2	32.2	96.0	109.0	130.5
Monday 25.12.2023	0%	98%	2%	288	78	189	119.3	22.4	104.0	116.0	131.5
Sunday 24.12.2023	0%	98%	2%	288	71	186	112.9	24.6	96.0	107.5	130.5
Saturday 23.12.2023	7%	93%	0%	288	61	173	114.3	26.8	95.5	114.5	133.5
Friday 22.12.2023	0%	100%	0%	288	73	164	102.7	20.0	85.0	98.0	116.0

In the daily charts that follow, the SMB sizes are indicated (no bolus was ever given).

Tuesday 26.12.2023



Bolus insulin:	42.0U
Base basal insulin:	13.7U
Positive temp basal insulin:	3.9U
Negative temp basal insulin:	-7.7U
Total basal insulin:	9.8U
Total daily insulin:	51.8U
Total carbs:	0 g
Total protein:	0 g
Total fat:	0 g



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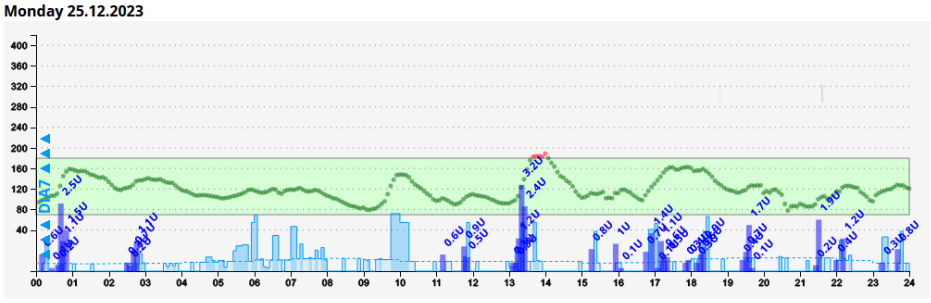
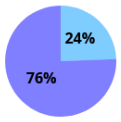
Monday 25.12.2023



Bolus insulin:	34.2U
Base basal insulin:	13.7U
Positive temp basal insulin:	5.1U
Negative temp basal insulin:	-7.7U
Total basal insulin:	11.1U
Total daily insulin:	45.3U
Total carbs:	0 g
Total protein:	0 g
Total fat:	0 g



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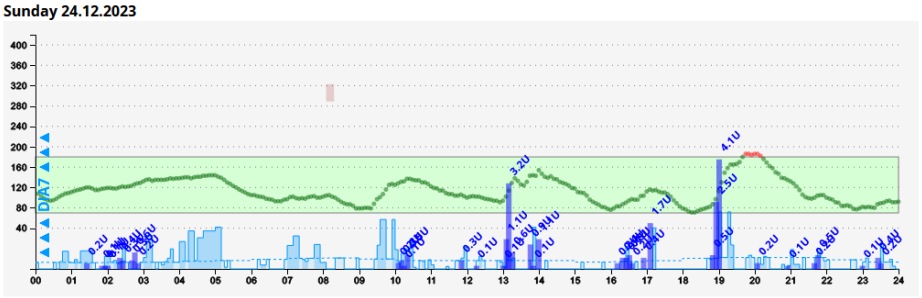
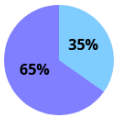
Sunday 24.12.2023



Bolus insulin:	23.5U
Base basal insulin:	13.7U
Positive temp basal insulin:	5.9U
Negative temp basal insulin:	-7.1U
Total basal insulin:	12.5U
Total daily insulin:	36.0U
Total carbs:	0 g
Total protein:	0 g
Total fat:	0 g



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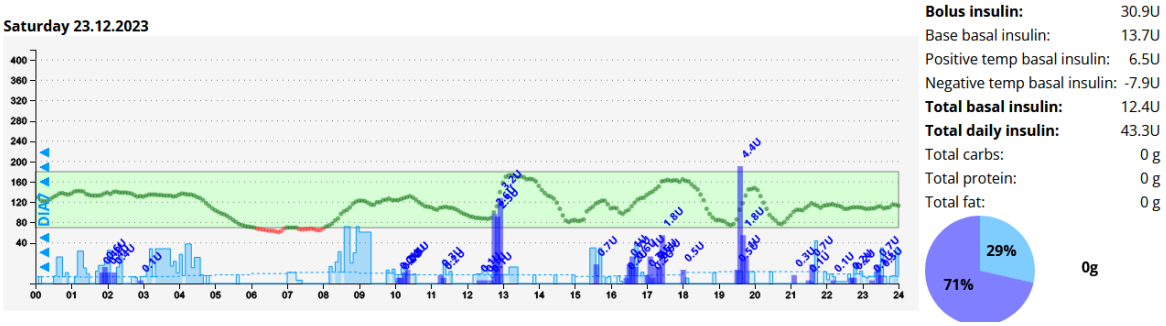

Friday 22.12.2023 …

…was a 100% TIR day (chart not included)

Conclusions

The completely **hands-off** FCL worked very well on these days that were characterized by above-average food consumption, and no major exercise.

Going ~ 20% higher in carb intake was no problem for the sophisticated way autoISF auto-adapts to the predicted further glucose curves.

The new "**Activity monitor"** seemed sufficient to deal with automatic adjustments to frequent inactivity, as well as to several 30-45 minute daily dogwalks.

Discussion regarding limitations

The conclusions that can be drawn from this n=1 user experience rely on a well-run **initial tuning**. Also, the user's diabetes, general health condition, lifestyle, and, notably, familiarity with the system, suggest he should reach better-than-average results.

Users should resist the temptations to "nudge", be it with temporary settings or even by sometimes giving a bolus. Any such user action disturbs the workings of the autoISF loop and is – at least on average –unlikely to lead to further improved results.

What the user should still do, is:

- Look occasionally after **BT connectivity** (especially after meal starts)
- Look occasionally into the bg and iob (or insulin activity, thin yellow curve) development, and develop some “mindfulness” so to some extent, and only sometimes, this might influence the eating/**snacking habit** a bit.
- With very special “disturbances” the hands-off FCL runs into limitations.

  Notably if the need for extra snacks shall be kept low, ahead of **exercise** it can be essential to take special precautions for limiting iob and to elevate the glucose target (as known from hybrid closed loop). See example in case study 6.2
- If more “serious” exercise would have been included, the tester would have used some form of “exercise announcement”, and/or would have required snacks to avert hypos.