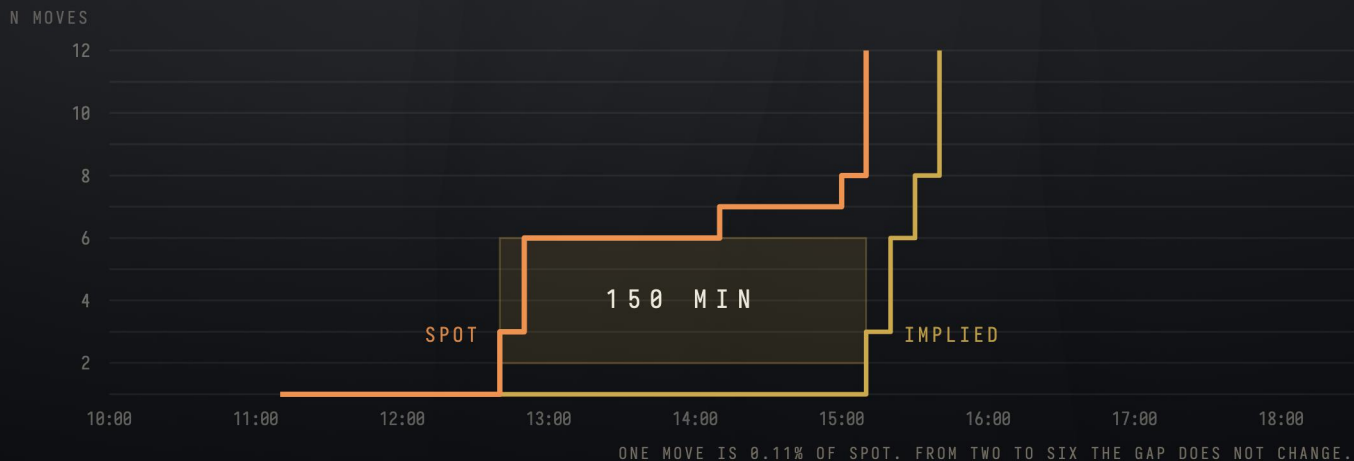


THE ΔNATOMY OF A SURGE

BITCOIN SURGED 6.4% ON 19 ΔUGUST.
THE OPTIONS BOOK TOOK 150 MINUTES TO NOTICE.
HERE IS HOW WE KNOW.

BTC

WHEN EACH SERIES FIRST MOVED N TIMES ITS OWN CALM HALF-HOUR · 19 AUG 2026

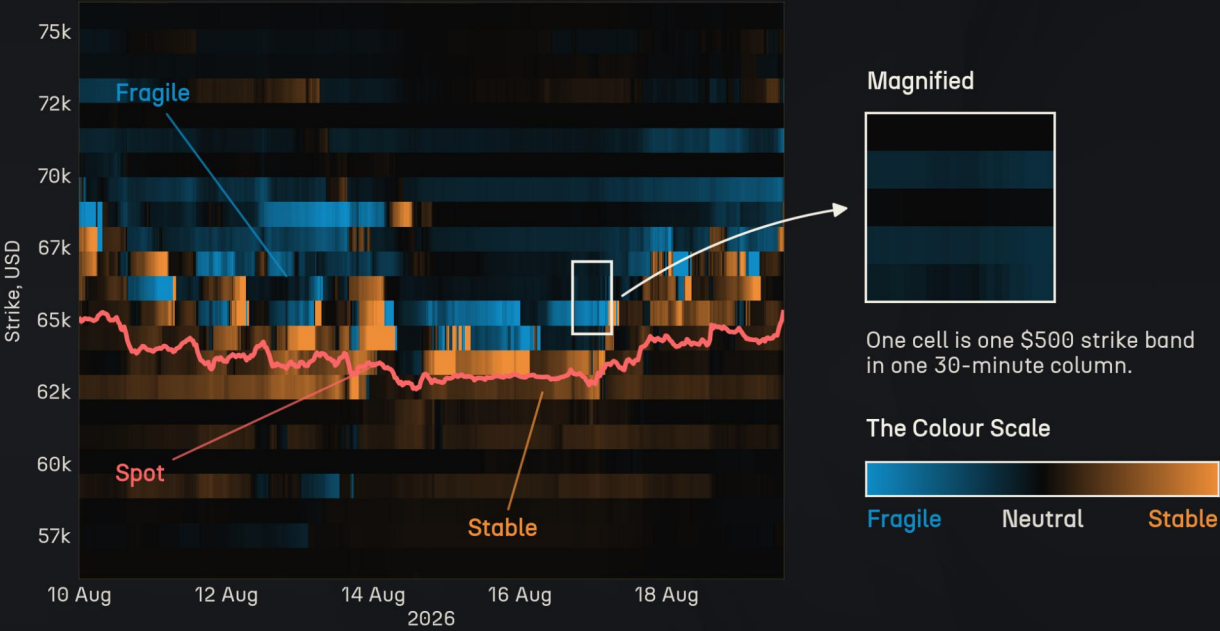


ISSUE 02

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00 BEFORE YOU START
HOW TO READ THE SURFACES IN THIS ISSUE



Six of the pages that follow are the same picture drawn from different data layers. Strike on y-axis, time on x-axis and individual cell in the map is a \$500 band of strikes inside a 30 minute column.

Colour is the only thing that changes from page to page. In the example above, there is the hedging configuration at each strike presented: blue where it is fragile and orange where it is stable. The scale is compressed because a few cells are hundreds of times larger than the rest.

The pink line is BTC spot. Reading one of these comes down to that pairing, i.e. find where the blue sits, then see whether spot is heading into it. The week shown is a calm one, ending hours before anything happened.

THE FORTNIGHT

THE READ

For most of the summer 2026 Bitcoin (BTC) did very little. Through June, July and the first half of August the spot price drifted and Deribit's options book priced that quiet into everything it sold. Going into 19 August 30-day implied volatility (IV) sat at the 0.9th percentile of its 60 day history, vol-of-vol at the 2nd and 10-Delta put implied at the 4th, under a steep curve with nothing priced into the front week.

BTC SPOT, USD • 2026



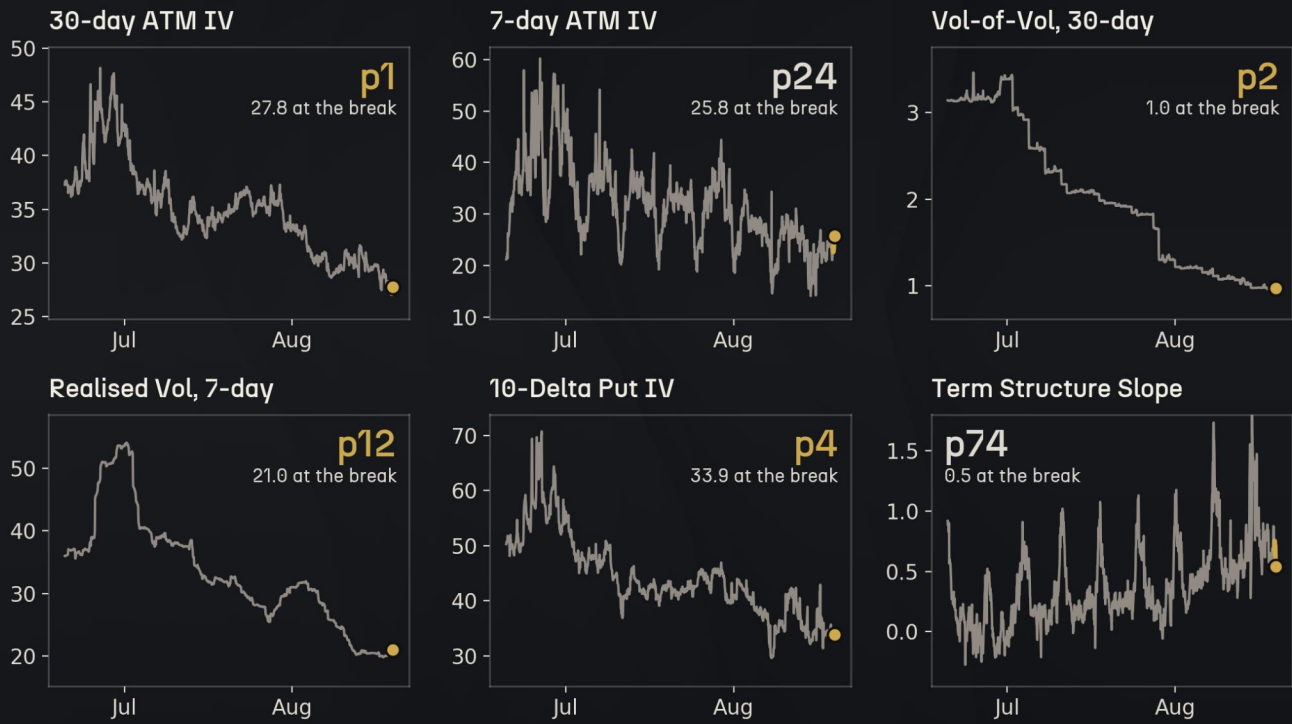
Then, on a Wednesday afternoon, August 19, it moved. Spot began to climb at 12:40 UTC and ran 6.4% in 2 hours. 7-day ATM IV did not react until 15:10. The 60-day ATM IV sat 6.1 vol points above the 7-day ATM IV at 15:00 and 6.2 points below it by 15:40, whale share of volume ran 1.17% before the break and 7.71% after, while at 15:00 the count of quoted near-the-money instruments hit the lowest of 362 days. Market makers did not widen. They left.

Every one of those things happened after the price moved. The question is what came before it. We checked the six hours leading up to the break across seventeen parts of Cayø Largo, about a hundred tests in all. Eleven readings were at their highest or lowest of the year. For each one we asked how often a reading like that is followed by a move this big. None did better than chance.

THIS ISSUE IS ABOUT A BOOK THAT REPRICED. NOT ONE THAT SAW ANYTHING COMING.

THE FLOOR

01 VOLATILITY WAS CHEAP ON EVERY MEASURE

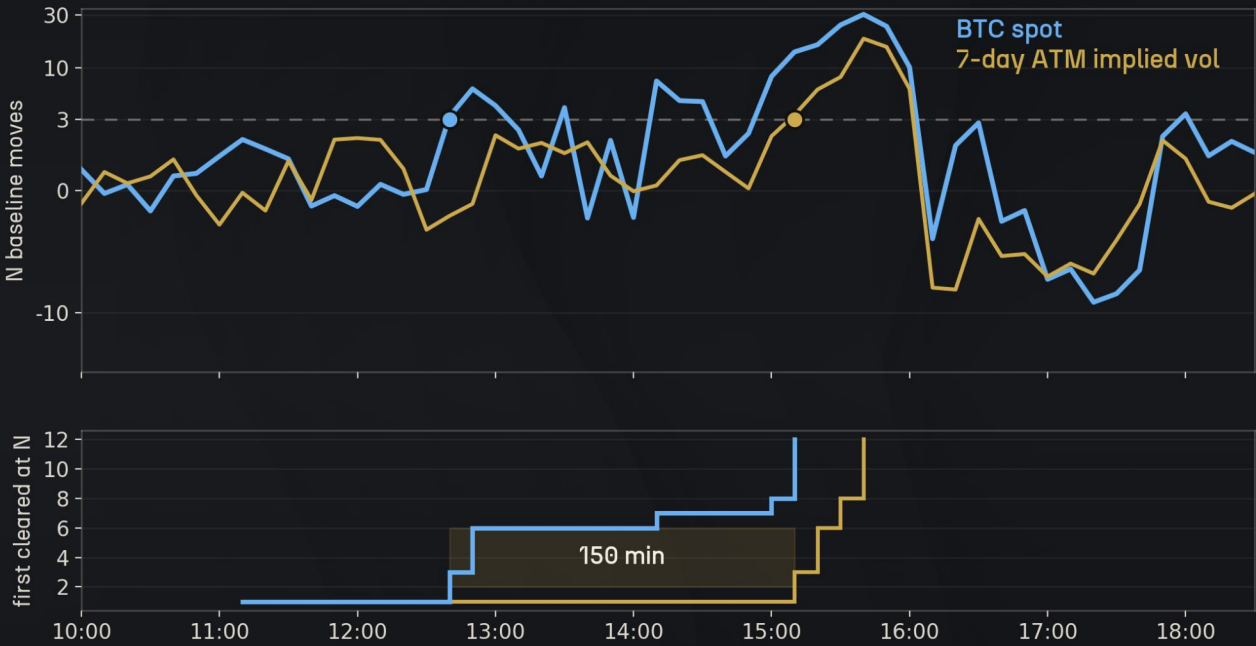


Gold dot = 19 August 2026, 14:00 UTC, the break

Six measures of the same thing over the 60 days ending at the break. Four sat in their bottom 5th and three in their bottom 10th. The term structure was the exception at its 74th percentile, a steep curve with nothing priced into the front week.

The window in the charts stops at 14:00 on 19 August. Carrying it through the event would let the move contaminate the baseline it is measured against.

BTC SPOT AGAINST 7-DAY AT-THE-MONEY IMPLIED VOLATILITY, 19 AUGUST 2026



One baseline move is the typical half-hour change over the 34 cal 0.11% of spot, 0.76 vol points of implied. The dashed line is three of

SPOT CLEARED THREE BASELINE MOVES

12:40

0.34% in half an hour, its first of the day.

IMPLIED CLEARED THREE OF ITS OWN

15:10

2.3 vol points, two and a half hours later.

THE GAP HOLDS FROM

2 TO 6 MOVES

Five levels, the distance fixed at 150 minutes.

02 THE 150 MINUTES SPOT MOVED BEFORE THE BOOK REPRICED

The last page said the book repriced late. This is the measurement behind it.

Spot and implied volatility cannot be compared directly. One is a price in dollars, the other a rate in vol points. The fix is to measure each against its own normal: the typical half-hour change over the 34 calm hours before the event. For spot that is 0.11%. For 7-day ATM IV it is 0.76 vol points. Call one of those a baseline move.

Written as σ , a baseline move is a robust scale of the half-hour change and not a normal-distribution σ . Nothing here is a tail event. BTC cleared 3σ on this scale in 12% of the half-hours over the previous two months.

Spot first moved three baseline moves, 0.34%, at 12:40. Implied volatility first moved three of its own, 2.3 vol points, at 15:10. Two and a half hours later.

The upper panel is noisy because both series wander. That is what a market looks like at ten-minute resolution. The lower panel takes the noise out.

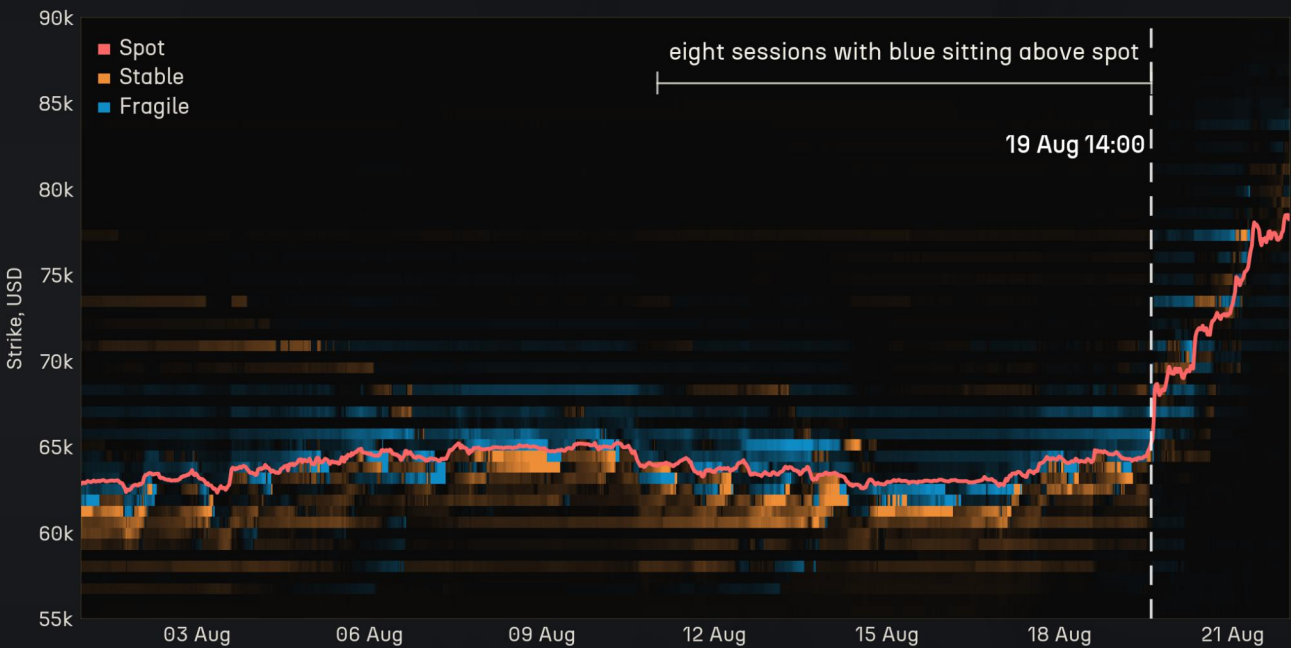
It answers one question at each level from one baseline move to twelve: when did this series first get there? At three the answers are 12:40 and 15:10. At four, five and six both answers move later and the distance between them does not change. It holds at 150 minutes from two through six.

Above six the reading stops being useful. By then both series are inside the move itself.

Does the 7-day tenor create the lag? No. 7-day ATM IV is a reading taken now from options with a week left to run, not an average over the past week, and it carries no smoothing delay at ten-minute resolution. The tenor matters in a different way. The front of the curve is the noisiest part of it: its calm half-hour move is 0.76 vol points against 0.13 for the 30-day ATM IV. It has further to travel before a move stands out from its own noise. By 13:40 the front had already risen 3.1 vol points while the 30-day ATM IV had moved 0.8. The front was moving. It was not yet moving by more than it moves on a quiet afternoon, and 15:10 is where it started to.

EVERYTHING THE BTC OPTIONS BOOK DID AFTER 15:10 WAS A RESPONSE. THE REST OF THIS ISSUE IS THAT RESPONSE, MEASURED.

AURORA PER STRIKE, OPEN-INTEREST WEIGHTED, 1 TO 21 AUGUST 2026, EVERY THIRTY MINUTES



$Aurora = -\partial^4 V / \partial S \partial \sigma \partial K \partial T$ per listed strike, weighted by open interest, every thirty minutes

BLUE ABOVE SPOT FOR

8 SESSIONS

11 August to the break. Crypto never closes, so a session here is one UTC day.

BLUE ABOVE SPOT

80% OF CELLS

Below spot over the same stretch, only 14% was blue.

READING THIS GIVES

WHERE, NOT WHEN

It locates the instability. It says nothing about timing.

03 THE TERRAIN THE SURFACE GOING IN

Delta ($\partial V / \partial S$) and Gamma ($\partial^2 V / \partial S^2$) sensitivities hold the rest of the world still, which is the assumption that fails first when a surface starts to move.

Aurora Greek, $-\partial^4 V / \partial S \partial \sigma \partial K \partial T$, holds nothing still. It is the rate at which the joint spot-and-volatility response itself changes across strike and through time and it is the highest-order Greek in our arsenal of crypto-specific Greeks. The leading minus makes it a rate per unit of calendar time passing, the same convention Theta and Charm carry. We evaluate it for every listed strike and weight it by the open interest resting there.

Nobody else computes Aurora except Cayø Largo. There is no practitioner literature on it, no vendor publishes it and no desk we know of monitors it. What follows is therefore the first time this sensi has been read across a real market break.

The framework is Black-Scholes with a constant-volatility and lognormal model. It is obvious that it is not a perfect home for options in swiftly changing crypto-markets. However, the latter is the exact reason why crypto-options require non-stock-options-like treatment.

Gamma answers how much the hedge has to change when spot moves. Aurora answers whether that amount can be relied on. Where Aurora is small, a trade is absorbed: the hedge moves by roughly what you would expect and the work stops there. Where Aurora is large, one trade sets off adjustments in three directions at once, because the hedge now depends on the strike, on the level of volatility and on how much time is left. Orange marks strikes of the first kind. Blue marks the second.

One number for the whole book would tell you nothing useful. Where the instability sits is the whole point. Blue at strikes far above the market costs nobody anything. Price never goes there, which means those hedges are never tested. Blue sitting just above the market is the opposite. Those are the strikes price reaches first if it rises.

Take the strikes within eight percent above spot. Call it the band above the market. From 11 August until the break, eight sessions in all, four out of every five cells in that band were blue.

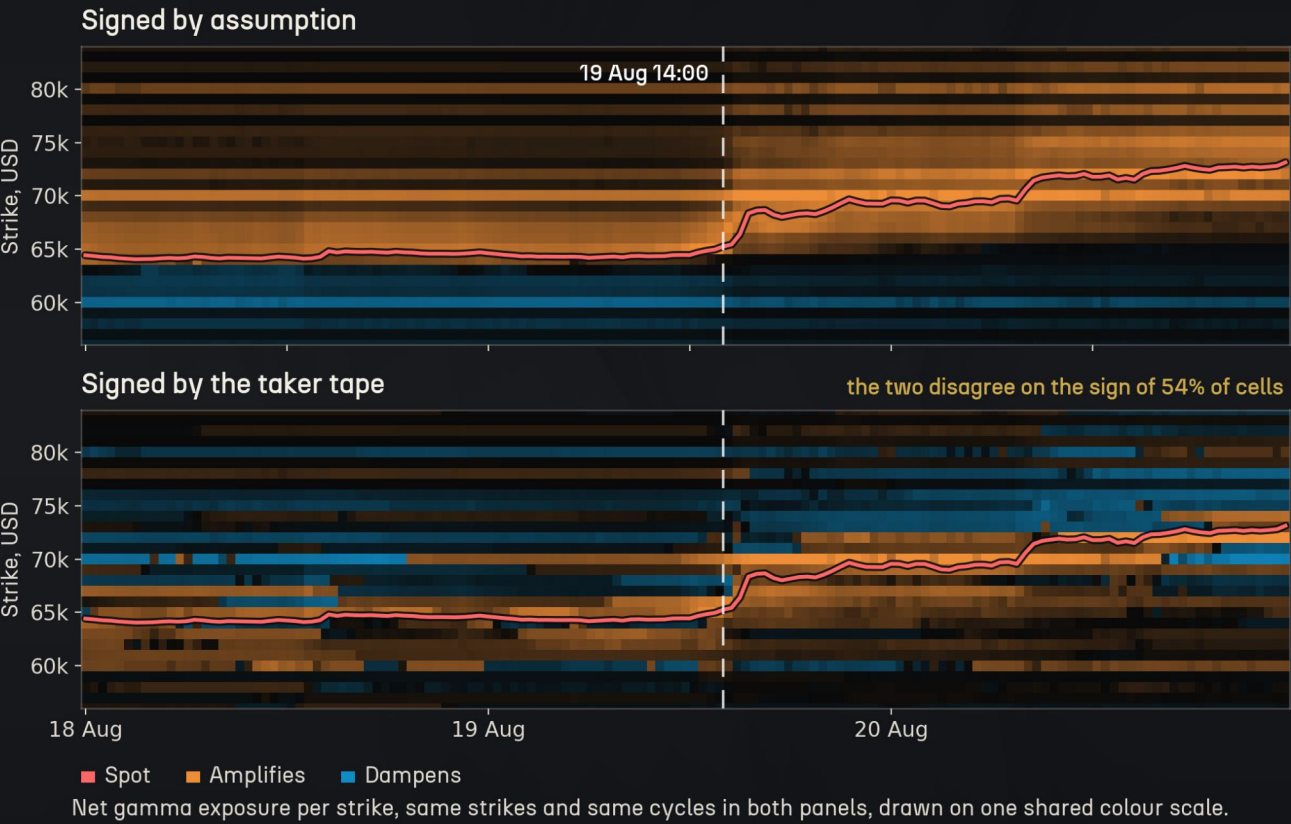
The same eight sessions below spot look nothing like it. There, blue covered 14% of cells and the average Aurora was positive: the strikes underneath the market were the stable ones. Scattered blue does appear below spot, most visibly on 15 and 16 August, and it stays a minority. The split is the point. Above spot 80%, below spot 14%.

On 19 August price rose into the band. Then the band emptied. Over those eight sessions the average Aurora there was -259 per billion dollars of open interest. In the two days after the move it was -30, a fall of roughly eight times. Open interest in the band rose 61% over the same period, which rules out the easy explanation that there was simply less left to measure.

This page does not say when: the same picture sat above the market for eight sessions while nothing happened. It does not say the move could have been called either, because page 17 tests eleven readings from that morning against their own base rates and none beat chance.

THE BOOK WAS UNSTABLE IN ONE BAND OF STRIKES FOR OVER A WEEK. PRICE WENT TO THAT BAND AND THE INSTABILITY CAME OUT OF IT.

NET GAMMA EXPOSURE BY STRIKE, 18 TO 21 AUGUST 2026, SIGNED TWO WAYS



CELLS THAT DISAGREE

54%

Per strike and cycle, over this three-day window.

HOURS THAT DISAGREE

40.5%

Sign of the whole book, hour by hour, over 201 days.

STRIKES THE ASSUMPTION GETS WRONG

63%

Median across 201 days of BTC.

04 THE SIGN
THE SAME BOOK,
SIGNED TWO WAYS

Gamma exposure asks a practical question. If spot moves a little, do the people who hedge options have to buy into the move or sell into it? Buying into it amplifies. Selling into it dampens. The answer depends entirely on which side of each option the dealer is holding.

Nobody publishes that. Every public gamma exposure chart therefore assumes it: dealers are short the calls and long the puts. It is a reasonable guess and it is free.

Cayø Largo does not guess. Every trade on the tape carries a taker side, which tells us who initiated and therefore which way the dealer ended up. We sign each strike from that record instead.

Why that matters to anyone with a position on: the sign is the trade. Read dealers as long gamma and you expect them to sell rallies and buy dips, damping the move, which argues for fading strength and selling premium into it. Read them as short gamma and the same rally gets chased, which argues for standing aside or paying up for convexity. A chart that has the sign backwards does not shade your view, it inverts it.

The two panels are the same strikes over the same three days on one shared colour scale. The upper one is the assumption. The lower one is the tape. They disagree about the sign on 54% of cells.

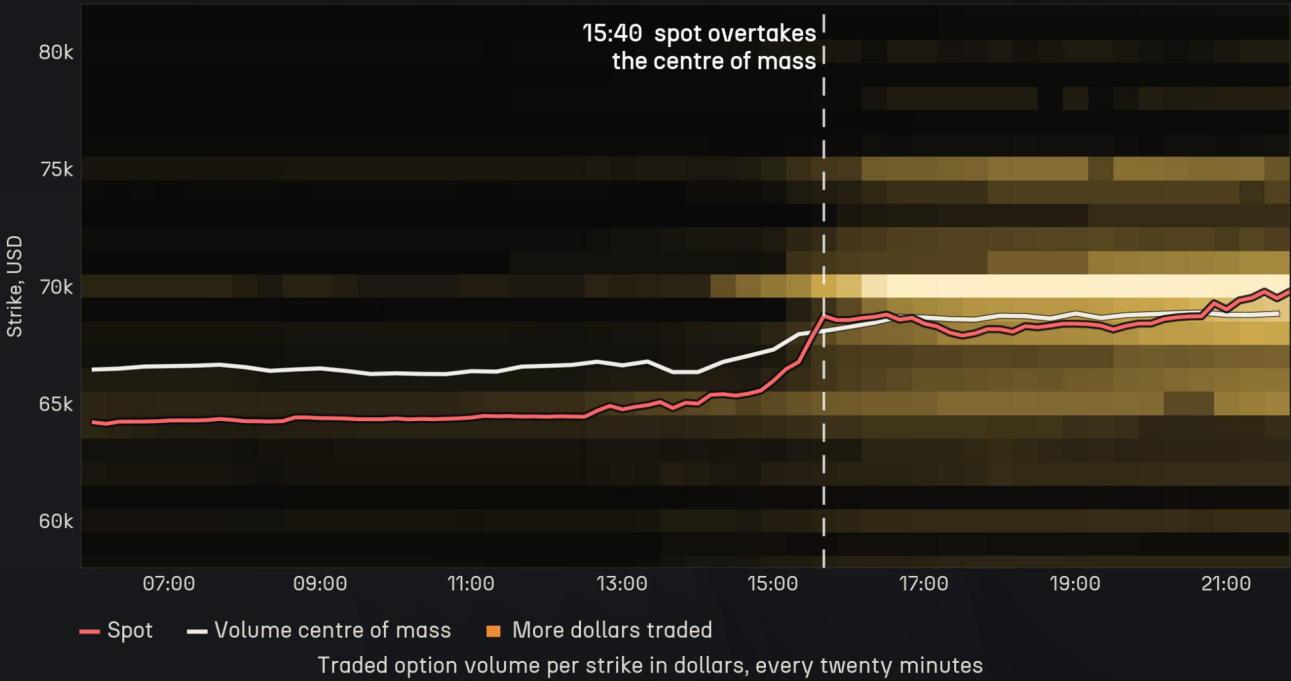
Widen the window and the disagreement holds. Across 201 days of BTC the assumption gets the sign wrong on 63% of strikes, and the whole book's sign is opposite in 40.5% of hours. Those are three different measurements of the same problem and they are not interchangeable: cells here, strikes and hours there.

TWO HOURS IN FIVE, A PUBLIC GAMMA CHART AND OURS SAY OPPOSITE THINGS ABOUT WHICH WAY HEDGING PUSHES.

THE MONEY

05 WHERE THE MONEY ACTUALLY WENT

TRADED OPTION VOLUME PER STRIKE, 19 AUGUST 2026, EVERY TWENTY MINUTES



The white line is the volume-weighted average strike: take every dollar traded that cycle and ask what strike it sat at, on average. Call it the centre of mass of the day's trading.

At noon it stood 3.3% above spot. Money was working the strikes above the market, which is what buying upside looks like. It stayed there while spot climbed underneath it, and at 15:40 spot passed it.

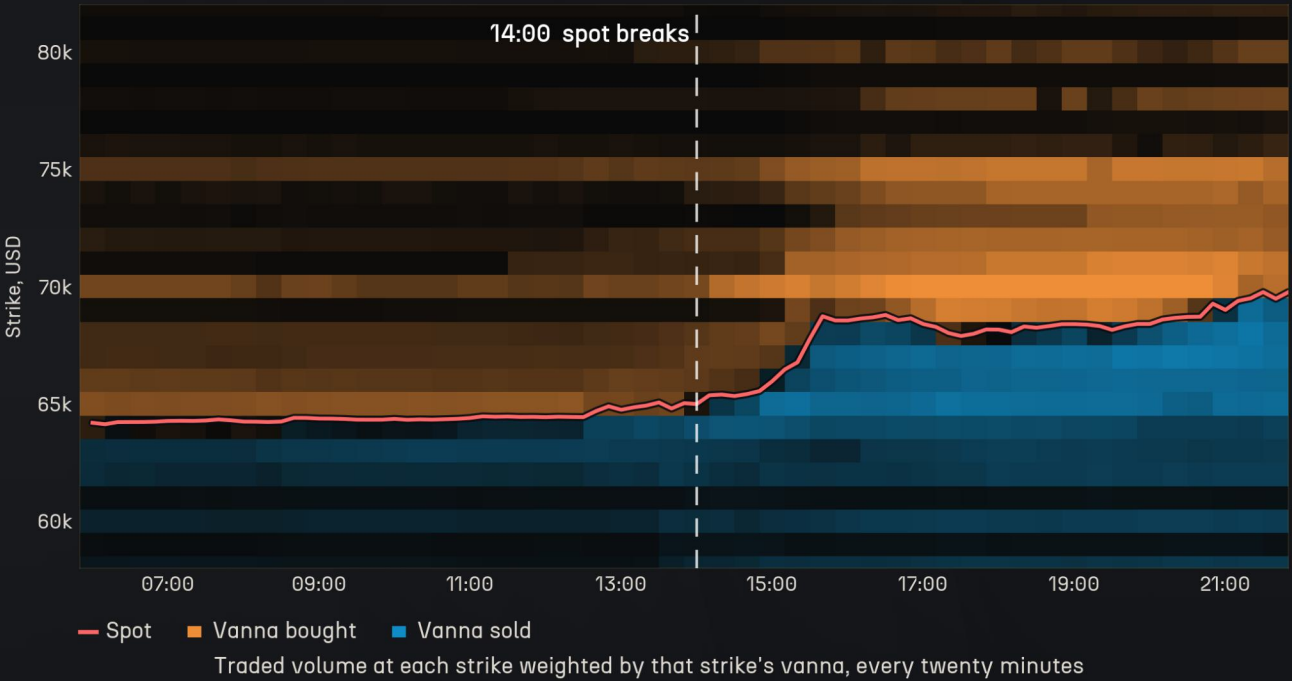
That ordering matters. A tape leading the move would have pushed its centre of mass higher before spot got there. This one did not move. Spot climbed to meet it.

The crossing itself lasted about twenty minutes, and what came after is the more telling part. The 3.3% standoff never came back. From 15:40 to the close the centre of mass sat within 1% of spot in both directions, averaging a fifth of a percent above it. Traded volume over those hours was five times the morning's. Money arrived in size and it stopped reaching for strikes above the market. It traded wherever price happened to be.

THE SIDES

06 THE ONE GREEK BOUGHT ON BOTH SIDES OF SPOT

TRADED VOLUME WEIGHTED BY VANNA AT EACH STRIKE, 19 AUGUST 2026, EVERY TWENTY MINUTES



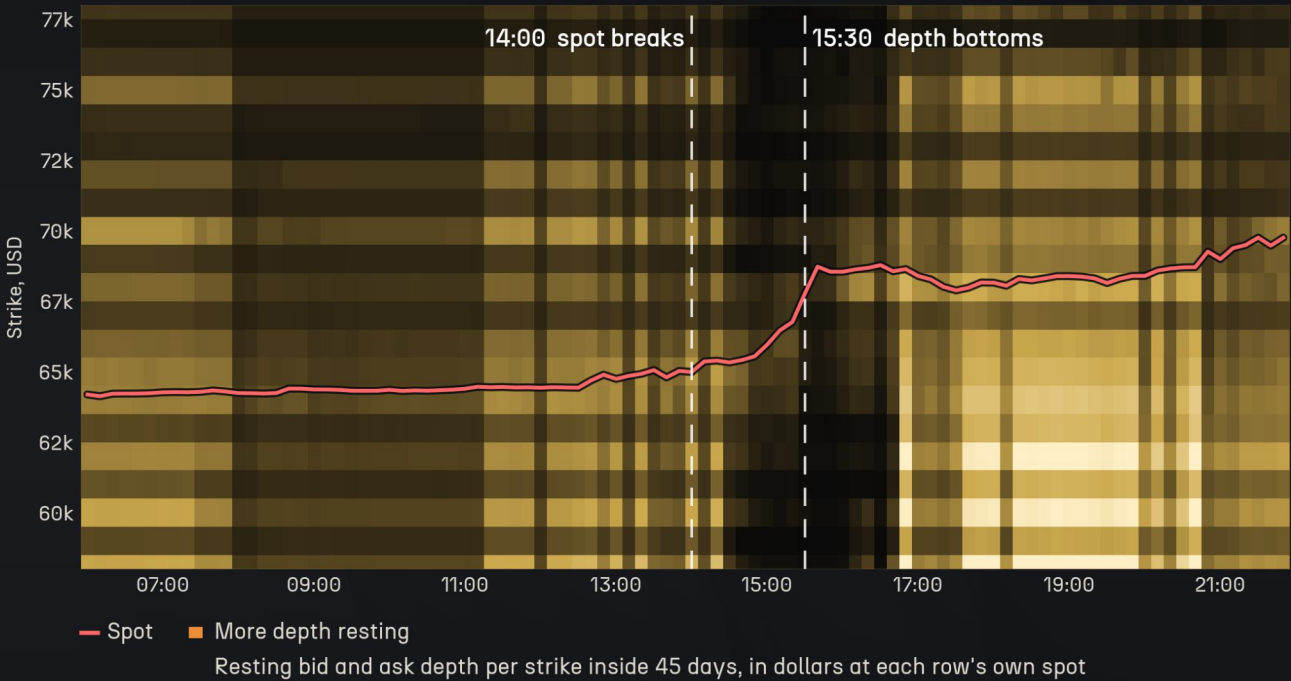
Vanna, $\partial^2 V / \partial S \partial \sigma$, is how much an option's Delta moves when volatility moves. Weight each strike's traded volume by it and the surface shows which way the tape leaned, not merely how much of it there was.

Vanna is the only weighted Greek here that can show a side. Gamma is positive at every listed strike and Vomma, $\partial^2 V / \partial \sigma^2$, at 99% of them, which leaves both one colour whatever the tape did. Vanna splits 64 to 36.

The split lands on spot. Bought above the market, sold below it, with the boundary tracking the pink line through the day. Page 17 records that the Vomma reading on this same morning sat at the 99th percentile of 385 days and predicted nothing.

07 THE WITHDRAWAL
THE BOOK THAT VANISHED

RESTING DEPTH PER STRIKE INSIDE 45 DAYS, 19 AUGUST 2026, EVERY TEN MINUTES



Depth is what a trader can actually hit: every bid and offer resting on the book at each strike, counted in dollars at that cycle's own spot.

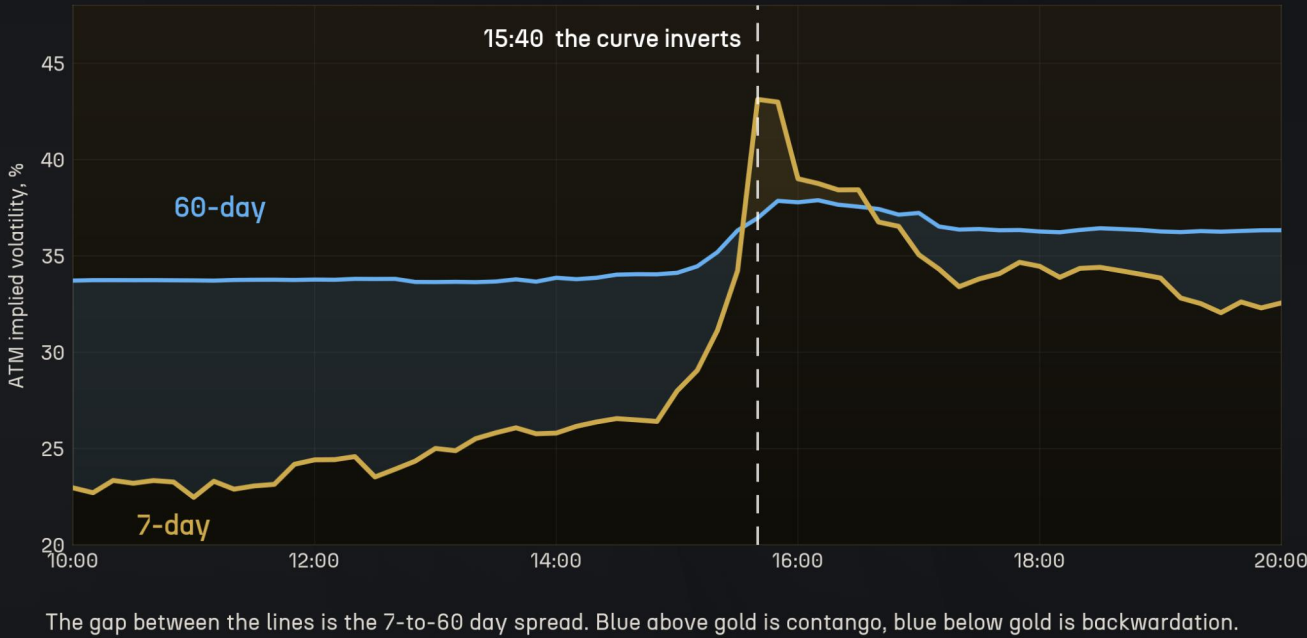
Between 14:00 and 15:30 it fell from 130 million to 18 million. The count of quoted instruments went with it to the lowest reading in 362 days.

Widening a quote and pulling it are two different acts. A wider market still takes your flow, at a worse price. An empty one leaves you to work through whatever is left, which is how a move finds room to run.

Compare that reading to the page 12 write-up. Volume that afternoon was five times the morning's while the depth to trade against was a seventh of it. Both are true at the same time. Together they describe a market that got busier and thinner in the same hour.

08 THE INVERSION
THE CURVE INVERTED
IN FORTY MINUTES

BTC AT-THE-MONEY IMPLIED VOLATILITY AT 7 AND 60 DAYS, 19 AUGUST 2026



A term structure prices time. Short-dated options carry one implied volatility and longer-dated options another. The gap between them says whether the market expects the coming week to be calmer or wilder than the coming quarter.

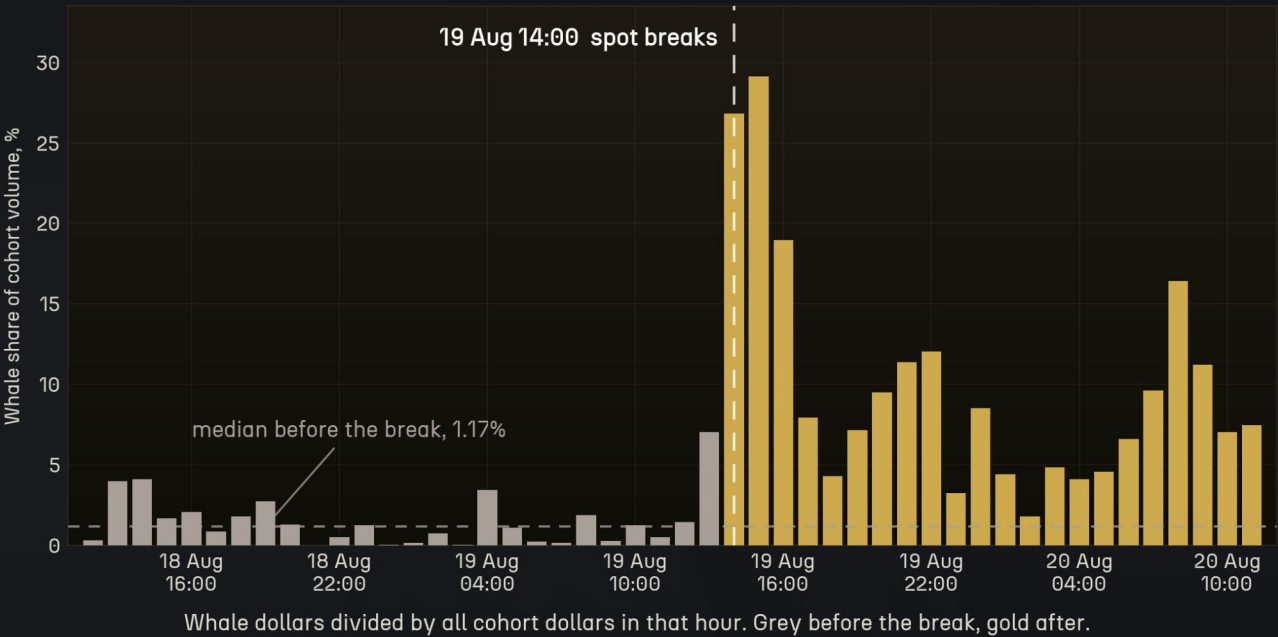
In calm markets that curve sits in contango, with the near term cheaper than the far one. This one sat there all morning, gold below blue. At 15:00 the 60-day ATM IV stood 6.1 points above the 7-day ATM IV.

By 15:40 it stood 6.2 points below. Forty minutes and three cycles, from clean contango to inversion.

Almost all of that came from the front. The 7-day ATM IV ran from 22.9 to 43.1 while the 60-day ATM IV moved only 33.7 to 37.8. An inversion built this way is the near term repricing on its own rather than the whole curve lifting.

09 THE SIZE
WHO SHOWED UP, AND WHEN

WHALE SHARE OF BTC OPTION VOLUME, HOUR BY HOUR, 18 TO 20 AUGUST 2026



A whale here is a single trade large enough to sit in the top cohort by size. The bar is what those trades were worth as a share of everything that traded in the hour.

Before the break the median hour ran 1.17%. After it, 7.71%. The grey bars cover the hours when a position taken ahead of the move would still have been a bet. The gold bars cover the hours after it became public.

Share is a ratio, which means it can rise because size arrived or because everyone else went home. Here total volume rose as well, five times over. This was arrival.

LARGE MONEY DID NOT POSITION FOR THIS MOVE. IT RESPONDED TO ONE
ALREADY ON THE TAPE.

THE TEST

10 WHAT WE TESTED,
AND WHAT FAILED

ELEVEN READINGS AT A ONE-YEAR EXTREME IN THE SIX HOURS BEFORE THE BREAK



Each row is one measure, placed where it sat in the six hours before the break. Position is a percentile against that measure's own hour of day. Far left is the lowest it has ever read, far right the highest.

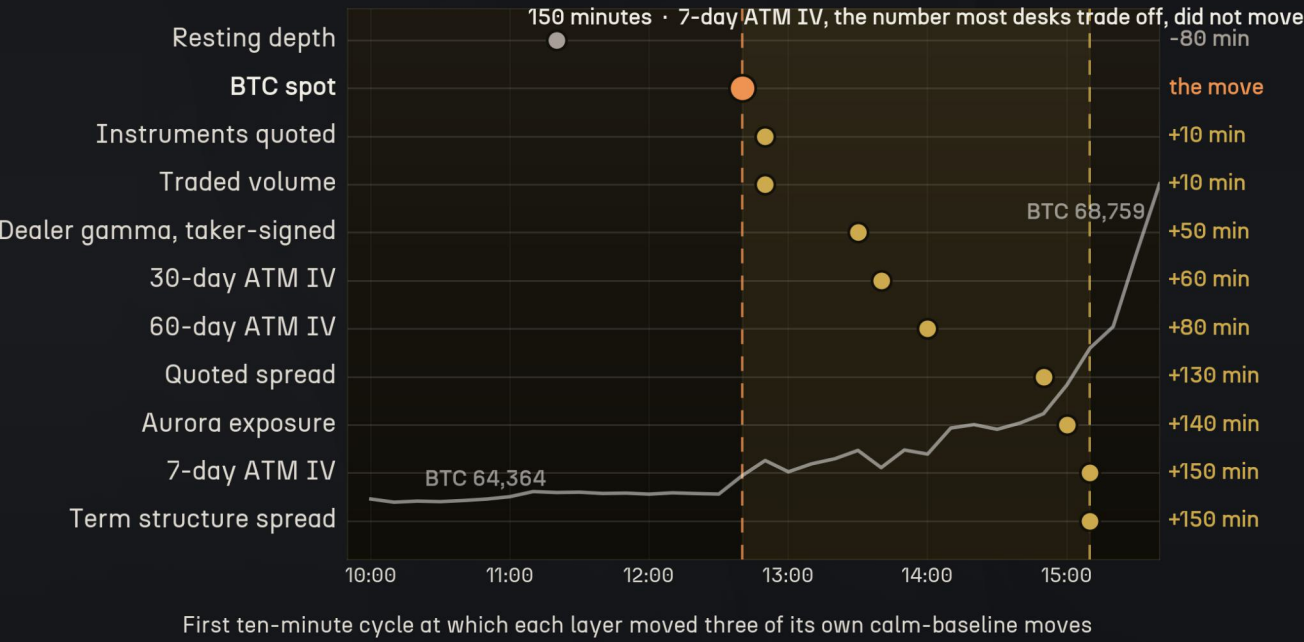
Eleven of the twelve rows sat at an extreme going in. The book was priced for calm at one edge while paying up for the wings at the other. It photographs beautifully.

Position on this chart and the verdict beside it answer different questions. Position is only how unusual that reading was on the morning. The verdict comes from a separate test run over the whole archive: when this measure reads like that, how often does a move of this size follow? Five came back at or below chance. Six could not be tested at all, because every firing sat inside one stretch of the summer and one regime is one observation.

That is why the 7th row is the odd one out. Call Volume Moneyness sits at p88.7, lower than Quoted Spreads at p91.0 directly beneath it, and the two verdicts are opposite. Over 362 days, when this measure reaches its top decile a 4% up-move follows within a day 20.7% of the time against a 5.2% base rate. Quoted Spreads, tested the same way, comes back below chance. The measure that works is the one marked did not fire, because its own trigger is the top decile and 88.7 falls just under it.

ELEVEN READINGS SAT AT A ONE-YEAR EXTREME. NONE OF THEM BEAT CHANCE. THE
TEST IS THE PRODUCT.

WHEN EACH CAYØ LARGO LAYER FIRST MOVED THREE OF ITS OWN CALM-BASELINE MOVES



DEPTH STARTS LEAVING

12:50

Ten minutes after price went. Resting depth 62m, down to 46m.

DEALER GAMMA DOUBLES

13:30

Taker-signed, 40m to 81m, and 127m by 14:00.

7-DAY ATM IV MOVES

15:10

The screen most desks watch, two and a half hours later.

12 THE READ-OUT

REACT. RE-HEDGE. RAPIDLY.

THE TRIGGER. DEFINED

Three series off the BTC book, sampled every ten minutes: (a) resting bid depth on options inside precedent 45 days and within 15% of spot; (b) the number of those instruments actually quoted; (c) total traded volume. For each series take the change over the last 30 minutes and standardise it against its own trailing week, median and MAD. Call a series moved when that z-score exceeds 3. The trigger fires when two of the three have moved in the same cycle and again in the next one.

It carries no direction and no horizon. It just informs the state of the book has changed. The action it calls for is to re-check Delta and re-hedge if it has drifted.

FIRES

3.3x a day, on 2.3% of 10-min cycles

BTC THEN MOVES 1%+ IN 1 HOUR

20.5%, against 5.6% unconditionally

AT A 3% MOVE

12.4x the unconditional rate

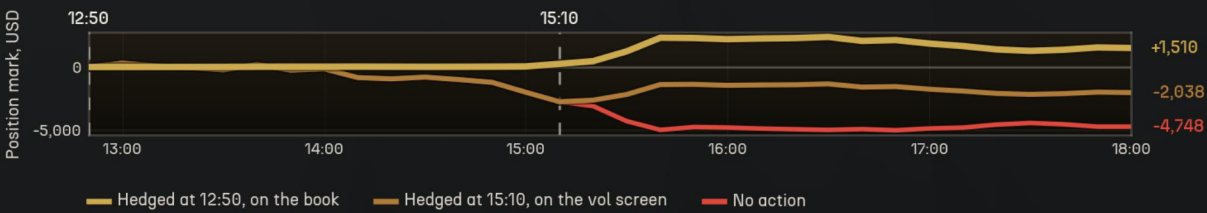
On 19 August it fired at 12:50, 10 minutes after price moved. What one position was worth re-hedged on that cycle, against re-hedged later:

ONE PUT. FOUR WAYS TO HANDLE IT

A trader holds 2 contracts of the 68,000 put expiring 23 August, bought while BTC sat at 64,400. Delta is -0.96. The position is short 1.9 BTC of spot exposure. Then spot rallies into it.

Delta and Gamma alone would have misled you here. The numbers here say by how much. Between 12:50 and 15:10 Delta drifted from -0.957 to -0.799. A Gamma estimate taken off the 12:50 book accounts for barely half of that drift. Gamma itself tripled over the same window, from 0.05 to 0.16 Delta per \$1,000 of spot, which left any hedge ladder sized on the earlier reading at a third of what the position needed. After 15:10 a further 17% of the Delta move came from volatility rather than spot, through Vanna at 0.905. Vomma at 6,847 was paying something back as 7-day IV doubled. Neither term exists in a Delta and Gamma view of this position.

Acting at 12:50 or at 13:40 was worth about the same. Waiting for the 7-day ATM IV cost the position \$3,548.



Doing nothing	-\$4,748
Re-hedged at 15:10, when 7-day ATM IV moved	-\$2,038
Re-hedged at 13:40, when 30-day ATM IV moved	+\$1,658
Re-hedged at 12:50, on the trigger	+\$1,510

THE BOOK CHANGES STATE BEFORE THE CURVE ADMITS IT. THAT IS NOT A FORECAST. IT IS A HEAD START.

ISSUE 02

FINAL PRINT

On 19 August Bitcoin rose 6.4% in two hours. We went back over that day 10 minutes at a time and asked the options book one question: did anything move before price did? Seventeen views. About a hundred tests. Nothing did.

Then we asked the better question. Once it had started, how fast did the book say so? Ten minutes. The 7-day ATM IV took 150. On one ordinary put, two contracts, that gap was worth \$3,548.

OPTIONS VS. SPOT. 0:1 ON THE FORECAST.

1:0 ON THE READ.

Cayø Largo

The Options Data
Your Hedge Is Missing.

CHOOSE YOUR PLAN

cayolargo.fi/pricing

HALCYON WATERS



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Cayø Largo

Halcyon Waters' crypto-options analytics and valuation platform, reading Deribit's book every ten minutes into volatility and positioning intelligence across six crypto-assets.

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