ODTE trading strategies: Practical approaches to more efficient backtesting

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Contents

1. The rise of 0DTE options trading

While backtesting has traditionally focused on options strategies with weekly, monthly, or longer holding periods, the emergence of ultra-short-term instruments like zero-days-to-expiration (0DTE) options introduces unique challenges that render conventional approaches insufficient.

> "Zero-days-to-expiration options have exploded in popularity and now account for over 61% of S&P 500 options volume."

Zero-days-to-expiration options have exploded in popularity and now account for over 61% of S&P 500 options volume[1]. These ultra-short-term contracts – which are traded and expire on the same day – demand a new approach to strategy development. Traditional long-horizon backtesting is of limited use because 0DTE strategies play out over mere hours.

This white paper discusses the need for more efficient strategy testing and optimization in the 0DTE arena. We explore how institutional traders leverage high-frequency historical data, intraday market replay, and scenario analysis (including Monte Carlo simulations) to evaluate strategy performance under a multitude of intraday conditions.

Advanced analytics platforms and modern quantitative infrastructure enable quant specialists to model thousands of intraday paths and optimize parameters (like strike selection, entry timing, or stop-loss levels) within a short development cycle. The result is an accelerated strategy lifecycle which allows firms to adapt and deploy 0DTE tactics in days or hours, not months.

2. 0DTE options differences: Index vs. single stock

It is important to clarify what "0DTE" means across different markets. In practice, 0DTE applies somewhat differently to index products versus single stocks.

Index and ETF 0DTE

Major equity indices and index ETFs now list options expiring every trading day. For example, SPX (S&P 500 Index), SPY (S&P 500 ETF), QQQ (Nasdaq 100 ETF) and others have daily expirations. This means any trading day you can trade an option that will expire at today's market close. These products have extremely deep and liquid options markets, and the advent of daily expirations has made same-day strategies a daily opportunity rather than a rare event. Traders often utilize SPX/SPY 0DTE options for intraday index bets or hedges on macro news, knowing that there is always a nearby expiration available.

Single stock 0DTE

In contrast, individual stocks do not have daily option expirations. Even highly liquid stocks like Apple, Tesla, or NVIDIA typically offer weekly expirations (often each Friday). Thus, the term "0DTE" for a single stock usually refers to trading on the stock's expiration day (e.g., trading a TSLA option on the Friday it expires).

[1] Morningstar. Popular 'zero-day' options saw record share of trading volume in May as retail traders piled in. June 2, 2025.

These are effectively same-day expiries but occur only once a week (or less frequently) per stock. As such, single stock 0DTE strategies might be deployed in special situations.

For example, traders may use 0DTE tactics for an earnings event or major news coinciding with expiration day, or to simply take advantage of the weekly expiry dynamics (time decay accelerating on the final day). The liquidity and behavior of single stock 0DTE options can differ from index 0DTEs. Stock-specific news can cause sudden jumps, and bid-ask spreads might be wider for out-of-the-money strikes compared to extremely liquid index options.

Despite these differences, both index and single stock 0DTE options share common traits – rapid time decay, high gamma, and sensitivity to intraday volatility. Both require traders to be precise with timing and strikes. And crucially, both demand intraday-focused evaluation – meaning any serious strategy development must grapple with high-frequency data and intraday risk scenarios.

In this paper, we will discuss backtesting and development considerations that apply broadly to 0DTE tactics.

3. Challenges of backtesting 0DTE strategies

Developing a profitable 0DTE trading strategy is a uniquely demanding task. The usual challenges of backtesting, involving data quality, strategy overfitting, and accounting for trading costs, all apply but are amplified by the ultrashort timeframe.

Intraday volatility and gamma spikes

0DTE options experience wild swings in delta and gamma as the underlying moves, especially near the end of the trading day. A small 5-minute price move can radically change an option's price and risk profile. Traditional backtests that use daily closing prices, or even price snapshots every 30 minutes, will fail to capture these intraday swings. The backtest must utilize high-resolution time-series data (tick or 1 minute data) to see the intraday drawdowns and spikes that a 0DTE strategy endures[2].

[2] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

Time decay concentration

With expiration just hours away, time decay (theta) is extremely nonlinear. Most of the extrinsic value is bleeding off in real-time. Strategies like selling a straddle at noon and buying it back at 3pm require modelling continuous decay. A challenge is that any mis-estimation of timing can flip a trade from profit to loss, so backtests must align option price snapshots very precisely in time. Using end-of-day data (or even hourly snapshots) could misrepresent P&Ls because the option's decay between those points might be missed.

Lack of long histories

A 0DTE strategy by definition does not have long holding periods. It resets daily. This means strategy performance needs to be evaluated over many independent days. However, daily 0DTE options for indices only became widely available in recent years (e.g., SPX daily options in 2022)[3], and it may be difficult or impossible to source 0DTE datasets for a wide range of market regimes.

> "For single stocks, history is effectively as long as weekly options history, but practitioners can only get one 0DTE datapoint per week."

For single stocks, history is effectively as long as weekly options history, but practitioners can only get one 0DTE datapoint per week. Thus, the sample size of historical scenarios is limited. Quant analysts must often supplement historical backtests with synthetic data or resampling techniques to broaden the range of scenarios.

Intraday transaction costs and liquidity

On an intraday timescale, the friction of trading costs is magnified. Bid-ask spreads, exchange fees, and slippage can consume a large fraction of the expected profit of a same-day trade. Backtesting 0DTE strategies requires detailed modelling of execution assumptions. For example, are trades filled at midpoint or do we "pay the spread"? How much slippage is assumed during volatile periods? Ignoring these can wildly overstate a strategy's true edge[4]. In addition, liquidity can vanish in stress moments (e.g., just before a market close or during a news spike), making certain backtest trades unrealistic if not modelled properly.

Path dependence and nonlinear payouts

Many 0DTE strategies use complex option spreads (e.g., iron condors, butterflies) whose P&L is highly path-dependent intraday. Whether a strategy hits a stop-loss or profit target might depend on an intra-minute price excursion that does not show up in coarse data. Capturing this requires both high-frequency data and logic in the backtest to simulate order triggers minute-by-minute.

There is also nonlinear behavior like "gamma traps," where market-makers' hedging of short gamma positions becomes self-reinforcing and amplifies the market's directional move. Moreover, if the market moves quickly, option positions (especially short positions) might need aggressive dynamic hedging, which is challenging to simulate post hoc without high-resolution data.

[3] Cboe. The Evolution of Same Day Options Trading, Spencer Doar, August 3, 2023

[4] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

Rapid strategy decay

Because so many traders have gravitated to short-term strategies, profitable patterns may get arbitraged or crowded quickly. This means a backtest over the last year may not be representative of the next year. The strategy could decay as others exploit similar edges. Quantitative analysts must be cautious of overfitting to recent quirks and instead focus on robust patterns. Incorporating regime-specific backtests (e.g., separate bull, bear, high volatility, and low volatility periods) helps identify if a strategy only worked in a narrow set of conditions.

4. Need for more efficient strategy development

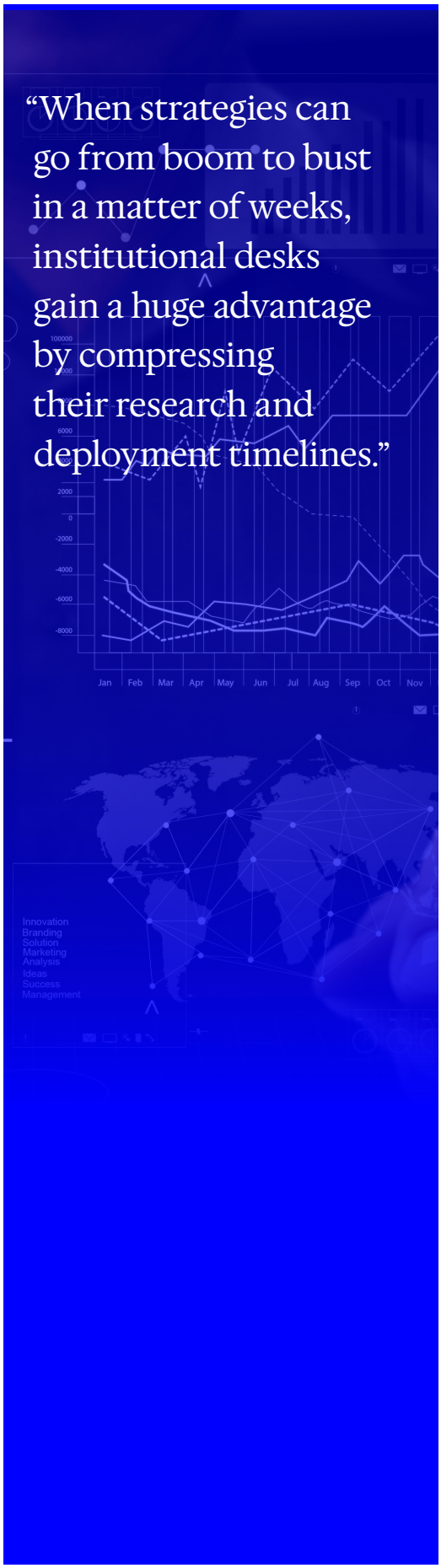
In 0DTE trading, time is not just money – it's edge. When strategies can go from boom to bust in a matter of weeks, institutional desks gain a huge advantage by compressing their research and deployment timelines. Several factors drive the need for lightning-fast strategy development in this domain.

Ephemeral alpha

The opportunity patterns in same-day options can be very short-lived. For example, suppose an arbitrage opportunity exists each morning after a large gap open. If widely noticed, within weeks many traders will pile in, eroding the edge. If it takes months to develop and approve a strategy, it may go live only after the profit opportunity is gone. Rapid backtesting and iteration allow firms to identify and capitalize on these micro-alpha sources before they are arbitraged away.

Adapting to regime shifts

Market volatility regimes can change quickly (consider March 2020's spike or mid-2022's bear market rallies). 0DTE strategies often need different parameters in high-volatility vs. low-volatility environments. By having a fast re-testing framework, a desk can recalibrate strategies (e.g., widen strikes, adjust position sizing) in near real-time as regime shifts occur. This way the strategy stays robust. What would normally be a long model review cycle is shortened to a few trading days of testing new ideas on recent data.



Event-driven tactics

Some 0DTE trades are designed around specific events (e.g., US Federal Reserve announcements, economic releases, earnings days for a stock). These events often come with little advance notice of market reaction character. Being able to develop a scenario analysis overnight is invaluable. For instance, "How would our intraday straddle strategy perform if tomorrow's Fed day behaves like the past 10 Fed days?" Fast backtesting empowers traders to be prepared with event-specific tactics on very short lead times.

> "Hedge funds, market-makers, and proprietary firms are all experimenting with same-day strategies, from automated market-making to directional trading to gamma scalping. It is an arms race where the speed of innovation itself is a competitive advantage."

Competitive pressure and innovation

With 0DTE trading volumes at record highs, most large trading firms are active in this space. Hedge funds, market-makers, and proprietary firms are all experimenting with same-day strategies, from automated market-making to directional trading to gamma scalping. It is an arms race where the speed of innovation itself is a competitive advantage.

> "More efficient backtesting is not just about offense (finding profits) but also defense (managing risk). If a strategy starts to show unexpected losses, risk managers need to diagnose the issue and test mitigations immediately."

Risk management demands

More efficient backtesting is not just about offense (finding profits) but also defense (managing risk). If a strategy starts to show unexpected losses, risk managers need to diagnose the issue and test mitigations immediately. For example, if a 0DTE short premium strategy suddenly has a drawdown due to a volatility spike, the team might want to test new stop-loss rules or hedging techniques using recent intraday data. Quickly simulating these adjustments can mean the difference between pre-emptively fixing a strategy or suffering a blow-up.

In essence, a short development cycle is part of the edge in 0DTE trading. Institutional players are increasingly treating strategy R&D like a high-frequency process itself – with continuous integration of new data and continuous deployment of strategy tweaks. This "research at lightspeed" paradigm relies on powerful infrastructure and methods. Key enablers include comprehensive intraday data feeds, flexible backtesting engines, scenario simulation tools, and often cloud or high-performance computing resources to crunch thousands of runs in parallel.

5. Data requirements for intraday backtesting

High quality data is the foundation of any robust backtest, and this is especially true for 0DTE strategy development. Because we are dealing with intraday timescales and options instruments, the data requirements are more intensive than for typical end-of-day backtesting[5]. Below we outline the critical data components needed.

Intraday options chain history

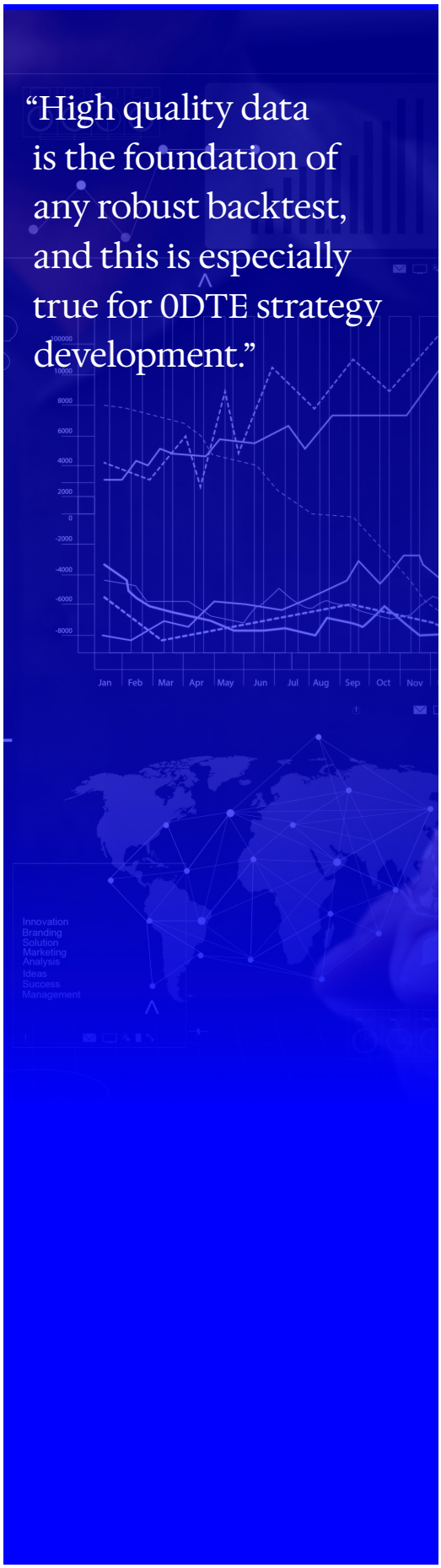
You need historical options quotes at fine time intervals throughout the trading day. This means for each day in your backtest, and for the specific strikes and expirations you care about, you require strike-level prices (bid-ask or mid) sampled frequently (e.g., every 1 minute or tick-by-tick)[6]. Alongside prices, implied volatility and Greeks (delta, gamma, theta) at those moments are extremely useful to gauge risk exposures.

For example, to test a 0DTE SPX iron condor strategy that enters at 11:00 AM and exits at 3:45 PM, you would want the full options order book or at least the at-the-money (ATM) and nearby out-of-the-money (OTM) strikes series at those times and in between (to simulate P&L paths and stops).

Gathering this data often means dealing with massive datasets: every strike, every minute or less, across potentially hundreds of days. It also means ensuring that the data snapshots are synchronized across underlyings and strikes.

Underlying asset intraday data

Along with options prices, one must have the underlying's high-frequency price data (and ideally, bid-ask quotes as well)[7]. For index options, the "underlying" is often the index ETF (e.g., SPY for S&P 500) or the index futures (e.g., ES for S&P 500). Those tick data series are needed. For single stocks, you need the stock's intraday prices at a similar level of granularity. This data should be timestamp-aligned with the options data.



[5] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

[6] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

[7] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

Many 0DTE strategies trigger trades based on underlying moves (e.g., when the underlying hits a level, sell a call spread). Precise alignment prevents lookahead bias (i.e., ensuring you do not use a 10:01:00 option price with a 10:01:05 stock price). Tick-by-tick or 1-minute OHLC data* is commonly used. Some platforms allow replaying the full order book for research into execution (which can be important if your strategy needs to gauge fill probability on large orders).

* OHLC (Open, High, Low, Close) data helps identify market trends, reversals, and key support or resistance levels, making it essential for price analysis.

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Realistic trading cost models

No intraday backtest is complete without incorporating transaction costs. These include broker commissions, exchange fees, and the big ones – slippage and spread costs.

For 0DTE options, bid-ask spreads can be several cents to tens of cents, which may be a large fraction of the option premium (especially near the end of day). A robust backtest will haircut profits by assuming you buy on the ask and sell on the bid (or some model of price impact)[8]. It may also include the possibility of partial fills or delays if liquidity is low. For example, a backtest might assume that large market orders incur a 0.05% underlying price impact or that limit orders fill with a certain probability depending on size.

These assumptions can materially change results. Sometimes a strategy that looks profitable on paper evaporates once realistic slippage is applied. Thus, including them is non-negotiable for institutional-grade analysis.

Corporate and calendar data

For single stocks, knowing earnings dates or major news events can help filter scenarios (e.g., avoid backtesting a normal intraday strategy on days with earnings announcements, or conversely specifically test on those days). For indices, knowing when Fed meetings or economic reports occurred can allow for event-specific backtests. Additionally, intraday data should be paired with trading calendars (so you do not accidentally include half-days and the like without special handling).

Market data integrity

Because of the sheer volume of high frequency data, data integrity checks are crucial. One bad tick (e.g., an erroneous option price spike) can distort an intraday P&L calculation. Backtesters often implement filters or sanity checks (e.g., ignore option price moves that are clearly outliers or ensure no option price exceeds a fair value threshold by an absurd amount). Aligning expiration dates is also important. Ensure that your 0DTE data for a given day truly uses the option expiring that day and roll to the next expiration afterwards.

[8] Medium. Backtesting 0DTE Options: Methods and Tools for Same-Day Expiry Analysis, July 29, 2025

Obtaining and handling all this data is a non-trivial effort. Many institutional teams leverage specialized data providers or in-house data farms to compile intraday options data. The size of intraday options datasets can be enormous (terabytes for a few years of full order book data). This has pushed some firms toward cloud-based solutions where the data can be stored and queried on-demand.

6. Advanced backtesting techniques for 0DTE options

With the right data in hand, quant analysts can employ several advanced techniques to rigorously evaluate 0DTE strategies. Traditional backtesting might simply simulate a strategy on a single historical price series. In contrast, 0DTE strategy testing often involves replaying many days, exploring many scenarios, and crunching numerous parameter variations.

Intraday historical replay

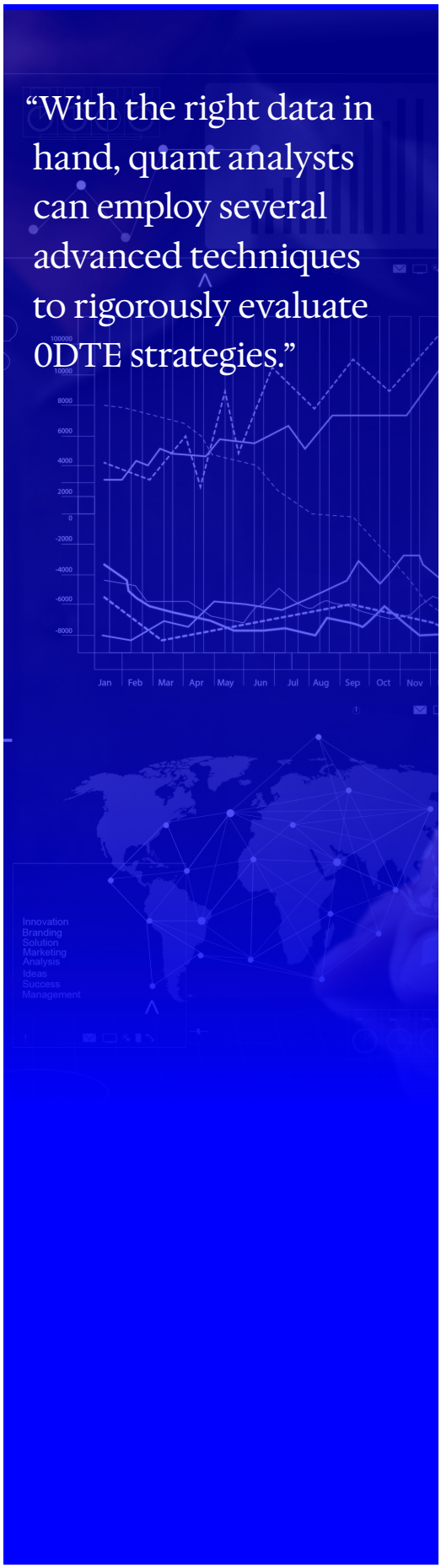
One fundamental approach is historical replay, where you simulate trading the strategy on past days' intraday data as if in real time. This is essentially a high-frequency backtest.

Tick/bar replay

The backtesting engine steps through intraday data (tick-by-tick or minute-by-minute) for each day. At each step, it applies the strategy's logic: does our entry rule trigger? If so, "execute" a trade (record entry price). Does an exit condition hit? Then close the position. By the day's end, record the P&L for that day, then proceed to the next day. This requires careful chronological simulations with no lookahead. For example, if testing a "morning gap fade" strategy, the engine would start at market open each day, check if a gap occurred, take a position against it, and then simulate minute-by-minute whether the gap closes to exit the trade. Doing this across dozens or hundreds of days gives a distribution of outcomes for the strategy.

Controlled market replay

Some advanced platforms allow replaying the full market order book, meaning you simulate not just your strategy but also how the market would have filled your orders at each moment. For instance, a backtesting platform may let quants evaluate strategy logic against a "controlled



market replay" environment – essentially recreating the order-by-order market dynamics. This is useful for strategies that might impact the market or depend on deep liquidity in the order book.

Parallel day simulation

Because each day's 0DTE strategy P&L is (largely) independent – positions are closed by end of day – one can speed up backtesting by running single day simulations in parallel. Modern backtesting tools distribute each day's replay to a different CPU core or cluster node. This is a big reason intraday strategy testing can now be done in hours or even minutes. If you have 200 trading days of data and 20 cores, you can simulate the strategy on all days in roughly 10 chunks, drastically reducing the time to get results.

Event tagging and filtering

In replay, one can tag certain days (like "high volatility day" or "FOMC announcement at 2pm") to later analyze strategy performance conditioned on those tags. For example, you might find the strategy worked well except on days with Fed announcements, which then informs a refinement (maybe avoid trading after 2pm on Fed days). This level of granular analysis is only possible when you replay individual days and retain intraday trace logs of what happened in the simulation.

Historical replay is the backbone of backtesting. It tells you what would have happened on actual past scenarios. But it is still limited by the fact that the future might evolve a scenario that has not been seen before. This is where scenario analysis and Monte Carlo methods come into focus.

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Scenario analysis

Here, you construct specific what-if market scenarios and run the strategy on them. Scenarios could be historical or hypothetical. For example, you might replay the intraday data from the 10 most volatile days of the past decade to see how the strategy holds up in extreme conditions. Or you could create a hypothetical scenario such as "What if the market trends up all day in a straight line?" Even if that exact pattern did not occur, you can simulate data that does that and see how your strategy would fare.

Scenario analysis is often used to stress test a strategy. For example, if you sell 0DTE strangles, you can feed the backtesting tool a scenario of a sudden 5% index drop at noon (a crash scenario) to quantify worst-case losses and verify risk controls.

Synthetic data Monte Carlo

Another approach is to generate synthetic intraday price paths using statistical models (e.g., a Geometric Brownian Motion with intraday volatility patterns, or bootstrapping chunks of real days). Then run the

strategy on hundreds or thousands of these generated "days." This can create a distribution of outcomes under a broad set of simulated conditions, rather than just the ones we observed historically.

For example, a quant analyst might create 1,000 intraday paths for SPX that statistically resemble real behavior (volatility, autocorrelation, jump frequency) and then evaluate a 0DTE spread strategy on each. If, say, 950 out of 1,000 simulated days are profitable and the five worst cases have acceptable losses, the test provides some confidence in the strategy's resilience.

Monte Carlo resampling

Monte Carlo techniques generate randomized variations of market data or trade sequences to assess variability. One common method is shuffling or resampling trades. You take the strategy's actual trade results from the historical backtest and then randomize their order or sample them with replacement thousands of times to see the distribution of possible equity curves[9].

This helps understand statistical ranges for metrics like maximum drawdown or win rate. For instance, if your backtest had 200 daily trades, a Monte Carlo resample can simulate "200 trades in a random order" (or 200 random picks with replacement) to see how luck or streaks could affect outcomes.

As an example, a historical backtest might show a maximum drawdown of 5%, but a Monte Carlo resample reveals that in different random orderings of trades, a drawdown of 15% was possible[10]. This can reveal potential path dependence in a strategy, which may not have been obvious before.

Greeks and parameter sensitivity

Scenario analysis can also vary parameters like implied volatility or interest rates to see how the strategy's P&L responds (for options strategies that might be sensitive to volatility or rates). For instance, "if VIX starts the day at 30 instead of 15, does our short-premium strategy still work?" One can take a historical day and overlay a higher volatility environment (scaling option premiums up by their vegas) to simulate this.

Monte Carlo and scenario analyses are essential for risk management. Many desks now routinely produce

[9] Build Alpha. Monte Carlo Simulation ¦ Complete Guide for Algorithmic Trading with Free Simulator, What is Monte Carlo Simulation?

[10] Build Alpha. Monte Carlo Simulation ¦ Complete Guide for Algorithmic Trading with Free Simulator, What is Monte Carlo Simulation?

risk metrics like CVaR (Conditional Value-at-Risk) or probability of ruin from these simulations. CVaR, for example, might tell you the expected loss in the worst 5% of days for your strategy[11]. These statistical tools allow decision makers (e.g., CIO, portfolio managers, risk officers) to gauge if a strategy fits the firm's risk appetite before deploying capital.

Importantly, this kind of analysis greatly benefits from modern computing. Running thousands of simulations was impractical in the past. Today, optimized code or GPU acceleration* can perform, say, 10,000 scenario runs in a short time. Some trading platforms have Monte Carlo built-in for strategy testing[12], outputting dozens of hypothetical equity curves or outcome distributions at the click of a button.

* GPU acceleration is a technique that uses the parallel processing power of a Graphics Processing Unit (GPU) to speed up compute-intensive tasks that would otherwise be handled by the Central Processing Unit (CPU).

Rapid parameter optimization

Given the need to fine-tune 0DTE strategies for current conditions, fast parameter optimization is a key capability. Traders often have several "dials" they can adjust. For example, traders can tweak the strike selection (delta of option sold), time-of-day to enter, stop-loss level, profit target percentage, and position sizing. Instead of guessing these, modern backtesting allows for systematic optimization.

Grid and evolutionary searches

One can run the backtest across a grid of parameter combinations. For example, evaluate a strategy for entry at 9:30, 10:00, 11:00… and for stop-loss 20%, 30%, 50%… and so on. This could include hundreds of combinations, but parallel computing can handle it. The result might be a heatmap of Sharpe ratios or drawdowns as a function of parameters, highlighting an optimal region. More sophisticated techniques use evolutionary algorithms or Bayesian optimization to home in on good parameters without exhaustive search. The goal is to identify parameter sets that historically performed well across many days, indicating a robust choice.

Walk-forward and cross-validation

To avoid overfitting in optimization, quants can use walk-forward testing. For example, they utilize data from January to June to optimize, then test those parameters on July, then roll forward. This process, repeated over multiple periods, shows if the optimized parameters hold up out-of-sample. Because 0DTE strategies can be inadvertently overfit to transient patterns, such validation is crucial. It ensures that strategy development is not finding a fool's gold parameter that only worked in the past sample.

> "Cross-validation is a technique used to evaluate how well a model 'generalizes' to unseen data. The most common form is k-fold cross-validation, where the dataset is randomly split into k subsets (folds). The model is trained on k-1 folds and tested on the remaining fold, repeating this process k times."

[11] Luckbox. Backtesting the Performance of Short Premium in 0DTE Options, Andrew Prochnow, March 18,2024

[12] Build Alpha. Monte Carlo Simulation ¦ Complete Guide for Algorithmic Trading with Free Simulator, What is Monte Carlo Simulation?

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However, in a finance time-series context, one must be careful to preserve the time order (so typically one uses expanding windows or skip-sample validation rather than random shuffles).

Thousands of runs on HPC/cloud

It is increasingly common to leverage cloud computing for optimizations. A large asset manager might spin up a cluster of 100+ cloud cores to churn through thousands of backtest runs overnight. By morning, the quant team has results for myriad parameter combinations. This effectively compresses what used to be weeks of trial-and-error testing into a single day.

For example, an optimization might test strike deltas from 0.1 to 0.5 in increments of 0.01 for a short option strategy (40 possibilities) against 10 different entry times and 5 stop criteria – that's 40×10×5 = 2,000 backtests. If each intraday backtest takes ~30 seconds, running one after another would take 60,000 seconds (~16.7 hours). With 100 cores in parallel, it could take only 10 minutes.

Such speed means quant analysts can explore strategy tweaks very broadly and refine ideas much faster.

Automated strategy tuning

Some advanced firms implement automated parameter tuning as part of the strategy deployment. For instance, each week, the system re-runs a short-term backtest on the last three months of data to see if the optimal stop-loss or entry time has shifted, then suggests (or automatically applies) a minor adjustment. This continuous optimization approach treats the strategy as a living algorithm that adapts incrementally. This is a concept only feasible with robust automation and backtesting infrastructure.

The result of rapid optimization is that institutional traders can iteratively improve strategy performance metrics (Sharpe ratio, drawdown, win rate) on the fly. If done carefully (with guards against overfitting), this means better risk-adjusted returns and the ability to react to subtle changes in market microstructure. It is worth noting, however, that one must avoid the trap of over-optimization. There is a balance between reacting to data and chasing noise. Many practitioners enforce simplicity – optimizing only a few key parameters – and look for broad plateaus of good performance in parameter space, rather than sharp peaks that might indicate randomness.

7. Conclusion

The 0DTE trading arena exemplifies the adage "time is money" in both trading and strategy development. Because these option strategies unfold over hours, not weeks, traditional backtesting approaches fall short. One must zoom into the intraday realm and be prepared to iterate quickly.

As 0DTE options continue to grow in volume and influence, the winners will be those who not only understand these instruments but can rapidly harness that understanding into actionable strategies. By investing in high-quality data, cutting-edge backtesting technology, and agile research processes, trading firms can backtest more efficiently – gaining the ability to launch well-vetted 0DTE strategies at the speed of the market.

This fusion of high-frequency trading mentality with rigorous quantitative analysis is unlocking new frontiers for institutional investors.

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