Final Report: Simple K-decay Elo + Ridge

Baseline reference: commit 9ea582d (known RMSE ≈ 286).
Why simplicity: recent complex approach regressed to RMSE ≈ 354, so this run uses simple Ridge + stable matchup features for better generalization.

HSAC K-decay Elo:
E_home = 1 / (1 + 10^((R_away - (R_home + HOME_ADV))/400))
Update = K_base * K_mult(g) * MOV_mult * (S - E_home)
Linear K_mult(g) = 1 + A * max(0, 1 - g/G)
Exponential K_mult(g) = 1 + A * exp(-g/tau)
Season breaks detected by Date gap > 60 days; single-season => season_id=0.

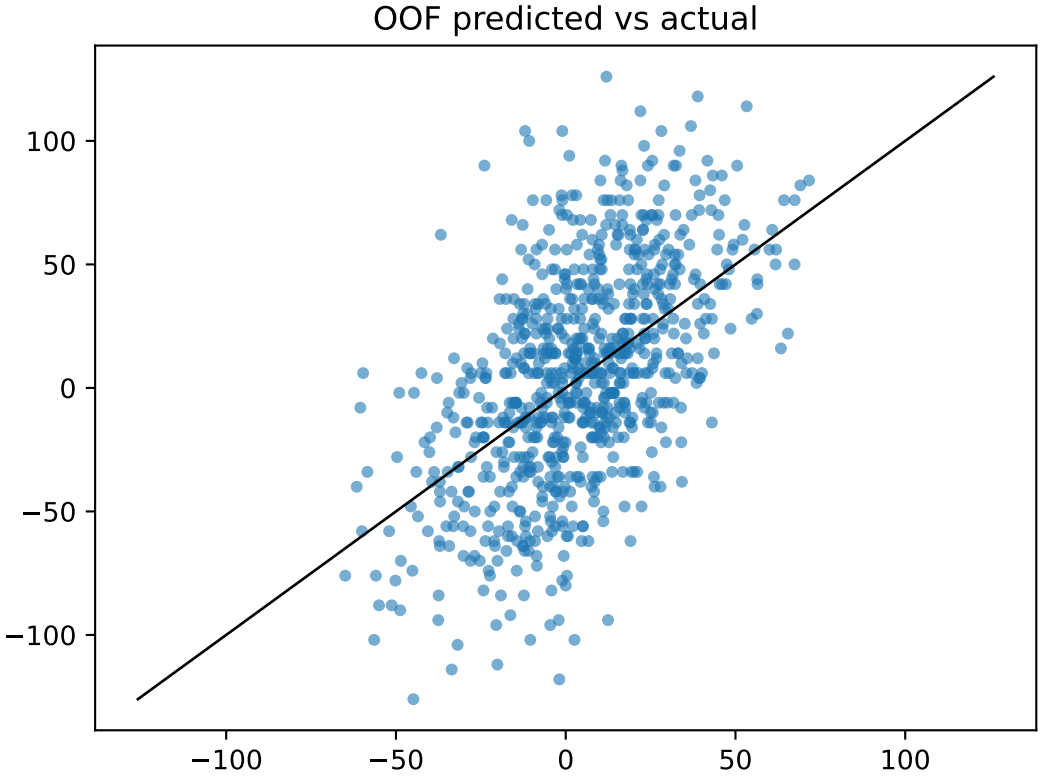
Grid: alpha=[0.1, 1.0, 10.0, 50.0, 100.0]; A=[0.0, 0.25, 0.5, 0.75, 1.0]; G=[50, 100, 150]; tau=[25, 50, 75]; decay_type=[linear, exponential]
Budgets: MAX_TOTAL_SECONDS=360.0, MAX_TUNING_SECONDS=120.0, MAX_MODEL_FITS=200
Budget usage: tuning_elapsed=5.8309s, fit_count=185, stop_reason=None
Time-aware CV: expanding-window folds on Train.csv sorted by Date then GameID.
Chosen settings: decay_type=linear, A=1.0, G=100, tau=50, HOME_ADV=50.0, ridge_alpha=100.0
Chosen CV RMSE/MAE = 36.449/28.806; baseline A=0 RMSE/MAE = 36.467/28.809
K-decay helped (A>0 selected).

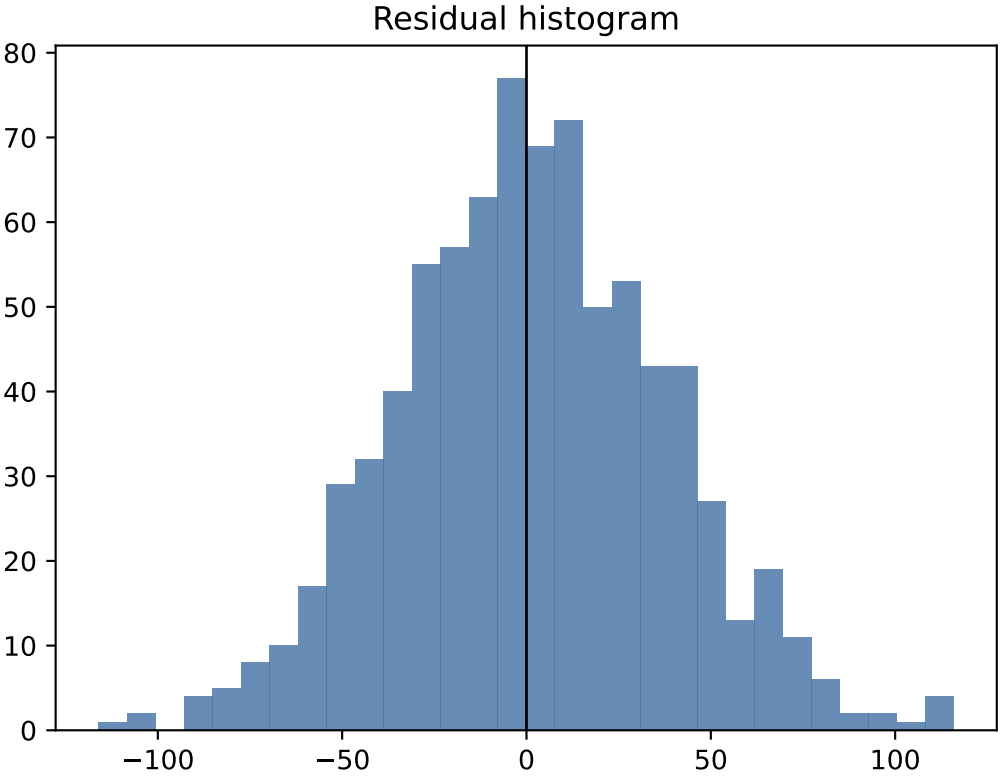
Results Table: Baseline vs Best K-decay

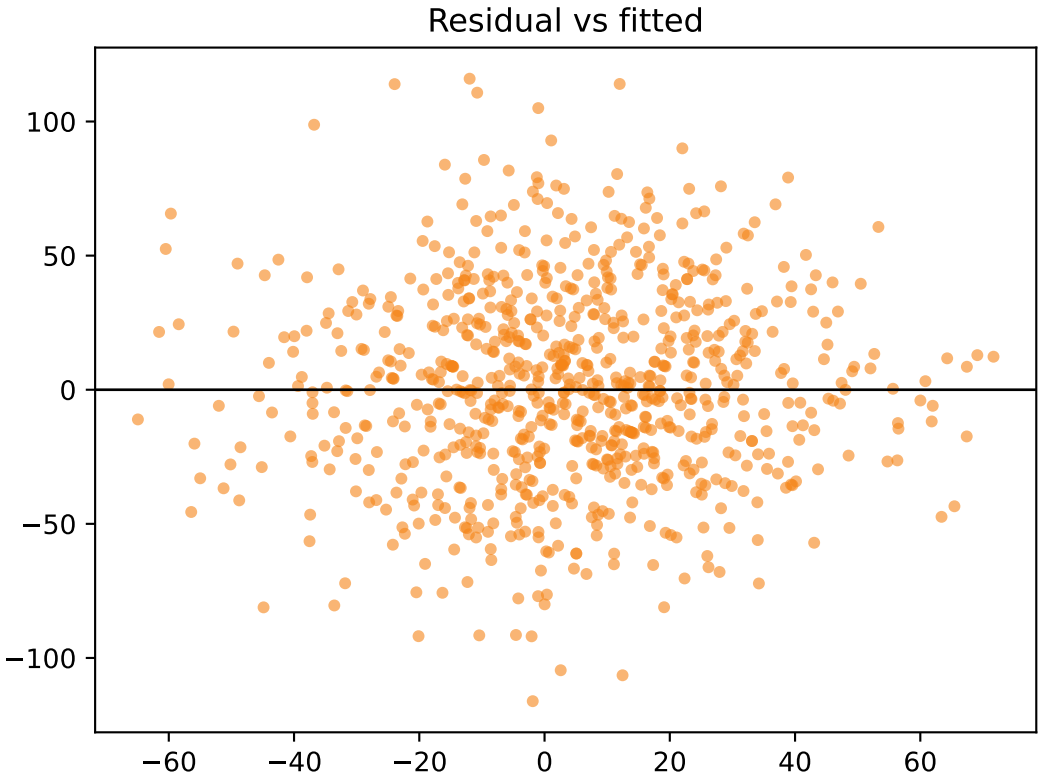
	Variant	DecayType	A	G	tau	alpha	RMSE	MAE	OOF_Pred_STD	OOF_Actual_STD
Baseline (A=0)	linear	0.000	100	50	100.000	36.467	28.809	22.710	43.618
K-decay (A>0)	linear	1.000	100	50	100.000	36.449	28.806	22.934	43.618

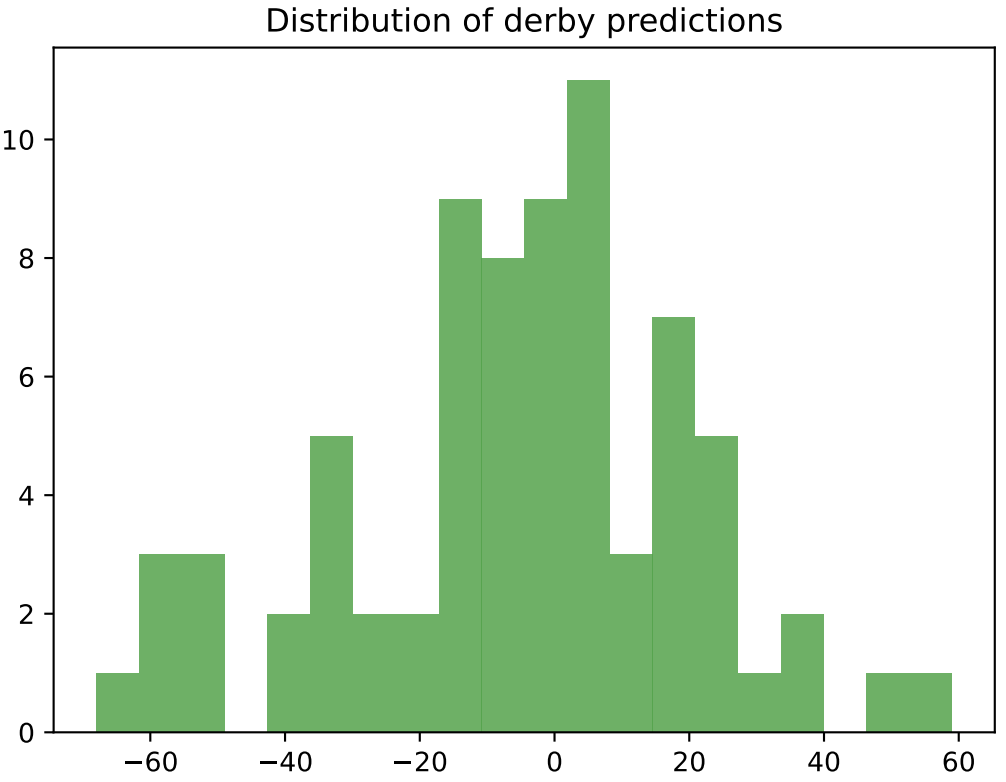
Top CV Configurations (Budgeted Search)

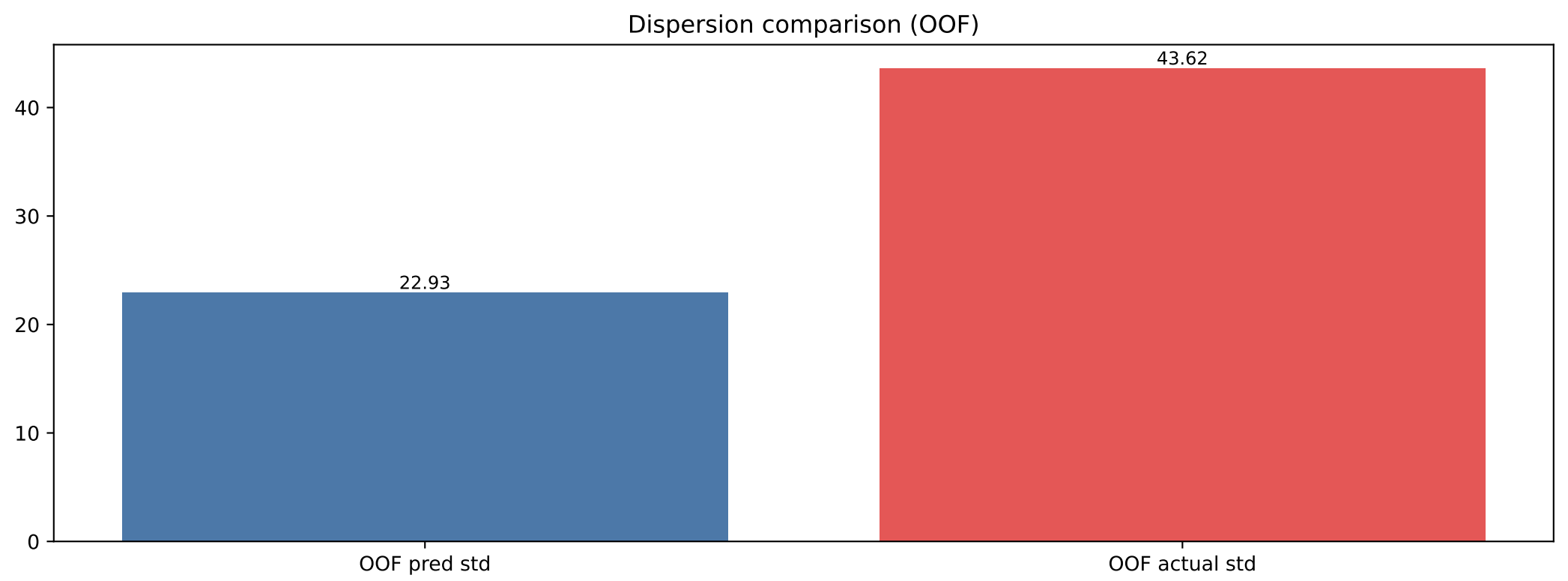
config_key	decay_type	A	G	tau	alpha	rmse	mae	pred_std	actual_std	stage
r_A1.00_G100	linear	1.000	100	50	100.000	36.449	28.806	22.934	43.618	stage2
r_A1.00_G150	linear	1.000	150	50	100.000	36.456	28.813	22.857	43.618	stage2
r_A0.00_G100	linear	0.000	100	50	100.000	36.467	28.809	22.710	43.618	stage2
r_A1.00_G150	linear	1.000	150	50	50.000	36.629	28.911	22.959	43.618	stage2
r_A1.00_G100	linear	1.000	100	50	50.000	36.633	28.911	22.984	43.618	stage2
r_A0.00_G100	linear	0.000	100	50	50.000	36.784	29.017	22.315	43.618	stage2
r_A1.00_G150	linear	1.000	150	50	10.000	37.442	29.426	22.321	43.618	stage1
r_A1.00_G100	linear	1.000	100	50	10.000	37.466	29.449	22.288	43.618	stage1
_A1.00_tau75	exponential	1.000	100	75	10.000	37.535	29.495	22.163	43.618	stage1
_A1.00_tau50	exponential	1.000	100	50	10.000	37.556	29.514	22.053	43.618	stage1
r_A0.75_G150	linear	0.750	150	50	10.000	37.560	29.511	22.037	43.618	stage1
r_A0.75_G100	linear	0.750	100	50	10.000	37.583	29.532	21.997	43.618	stage1
ar_A1.00_G50	linear	1.000	50	50	10.000	37.584	29.547	21.963	43.618	stage1
_A0.75_tau75	exponential	0.750	100	75	10.000	37.646	29.574	21.924	43.618	stage1
_A0.75_tau50	exponential	0.750	100	50	10.000	37.668	29.595	21.826	43.618	stage1


OOF predicted vs actual
100
50
0
−50
−100
−100
−50
0
50
100


Residual histogram
80
70
60
50
40
30
20
10
0
−100
−50
0
50
100


Residual vs fitted
100
50
0
−50
−100
−60
−40
−20
0
20
40
60


Distribution of derby predictions
10
8
6
4
2
0
−60
−40
−20
0
20
40
60




```
Artifact validation proofs:
predictions.csv rows=75, missing=0, numeric=True
rankings.xlsx rows=165, rank_missing=0, rank_set_valid=True
final_report.pdf exists=True, size_bytes=87760
Derby clipping (train 0.5/99.5 pct): not applied; bounds=(-110.61, 107.83)

Tuning meta:
{
  "tuning_elapsed_seconds": 5.8309,
  "model_fit_count": 185,
  "tuning_stop_reason": null,
  "n_eval_rows": 37,
  "n_unique_elo_configs": 25,
  "n_stage1": 25,
  "n_stage2": 12
}
```