Using device: cuda

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🚀 ENHANCED PHYSGAZE LOSO EVALUATION WITH DYNAMIC EPOCHS

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👁 ENHANCED PHYSGAZE: LOSO EVALUATION WITH DYNAMIC EPOCHS

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📋 Enhanced Configuration:

 data_dir: ./data/MPIIGaze/MPIIGaze

 batch_size: 128

 max_epochs: 50

 early_stopping_patience: 5

 early_stopping_min_delta: 0.001

 overfitting_threshold: 0.1

 lr: 0.0001

 weight_decay: 0.0001

 patience: 3

 image_size: (36, 60)

📁 Loading MPIIGaze dataset...

Loading MPIIGaze dataset from: ./data/MPIIGaze/MPIIGaze

Found 15 subjects: ['p00', 'p01', 'p02', 'p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Loading subjects: 7%|█ | 1/15 [00:02<00:41, 2.94s/it]

Error loading day39.mat: object of type 'numpy.float64' has no len()

Loading subjects: 13%|█▊ | 2/15 [00:05<00:34, 2.64s/it]

Error loading day69.mat: object of type 'numpy.float64' has no len()

Loading subjects: 100%|████████████| 15/15 [00:22<00:00, 1.49s/it]

✅ Dataset loaded successfully!

Total samples: 427,312

Subjects: ['p00', 'p01', 'p02', 'p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Eye distribution: {'right': 213656, 'left': 213656}

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🚀 STARTING ENHANCED LOSO CROSS-VALIDATION

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🎯 ENHANCED LOSO EVALUATION SETUP

Total subjects: 15

Subjects: ['p00', 'p01', 'p02', 'p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Dynamic epoch stopping: Enabled

Max epochs per fold: 50

Early stopping patience: 5

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🚀 ENHANCED LOSO CROSS-VALIDATION WITH DYNAMIC EPOCHS

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🧪 FOLD 1/15

Test Subject: p00

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Train subjects (12): ['p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p01', 'p02']

Created train dataset: 263070 samples (test subject: p00)

Created val dataset: 104320 samples (test subject: p00)

Created test dataset: 59922 samples (test subject: p00)

🏋️ Training for fold 1 (Test: p00)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 263,070

Val samples: 104,320

Max epochs: 50

Early stopping patience: 5

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📊 Epoch 1/50

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📈 Epoch 1 Summary:

 Train - Loss: 2.6790, MAE: 2.61°, Outliers: 0.0%

  Reg: 2.6127, Cycle: 0.3258, ACM: 0.0106

 Val - Loss: 3.7041, MAE: 3.65°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.65°)

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📊 Epoch 2/50

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📈 Epoch 2 Summary:

 Train - Loss: 2.0730, MAE: 2.03°, Outliers: 0.0%

  Reg: 2.0262, Cycle: 0.2280, ACM: 0.0115

 Val - Loss: 3.5388, MAE: 3.49°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +4.28%

 🎯 New best model! (MAE: 3.49°)

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📊 Epoch 3/50

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📈 Epoch 3 Summary:

 Train - Loss: 1.8724, MAE: 1.83°, Outliers: 0.0%

  Reg: 1.8315, Cycle: 0.1990, ACM: 0.0116

 Val   - Loss: 3.4039, MAE: 3.36°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +3.78%

 🎯 New best model! (MAE: 3.36°)

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📊 Epoch 4/50

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📈 Epoch 4 Summary:

 Train - Loss: 1.7451, MAE: 1.71°, Outliers: 0.0%

  Reg: 1.7057, Cycle: 0.1911, ACM: 0.0113

 Val   - Loss: 3.2507, MAE: 3.21°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +4.56%

 🎯 New best model! (MAE: 3.21°)

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📊 Epoch 5/50

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📈 Epoch 5 Summary:

 Train - Loss: 1.6498, MAE: 1.61°, Outliers: 0.0%

   Reg: 1.6107, Cycle: 0.1899, ACM: 0.0110

 Val   - Loss: 3.4777, MAE: 3.44°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -7.09%

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📊 Epoch 6/50

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📈 Epoch 6 Summary:

 Train - Loss: 1.5784, MAE: 1.54°, Outliers: 0.0%

   Reg: 1.5394, Cycle: 0.1897, ACM: 0.0107

 Val   - Loss: 3.4976, MAE: 3.46°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -0.58%

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📊 Epoch 7/50

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 ⚠️ Overfitting detected! Train trend: -0.0880, Val trend: 0.0741

📈 Epoch 7 Summary:

Train - Loss: 1.5156, MAE: 1.48°, Outliers: 0.0%

Reg: 1.4766, Cycle: 0.1897, ACM: 0.0103

Val - Loss: 3.6511, MAE: 3.61°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -4.43%

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📊 Epoch 8/50

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⚠️ Overfitting detected! Train trend: -0.0696, Val trend: 0.0950

📈 Epoch 8 Summary:

Train - Loss: 1.4642, MAE: 1.43°, Outliers: 0.0%

Reg: 1.4252, Cycle: 0.1897, ACM: 0.0100

Val - Loss: 3.6389, MAE: 3.60°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: +0.33%

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📊 Epoch 9/50

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⚠️ Overfitting detected! Train trend: -0.0836, Val trend: 0.0706

🛑 Early stopping triggered after 9 epochs

📈 Epoch 9 Summary:

Train - Loss: 1.2889, MAE: 1.25°, Outliers: 0.0%

 Reg: 1.2500, Cycle: 0.1897, ACM: 0.0100

Val   - Loss: 3.7600, MAE: 3.72°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: -3.37%

🛑 Stopping early after 9 epochs due to no improvement

✅ Loaded best model from epoch 4 (MAE: 3.21°)
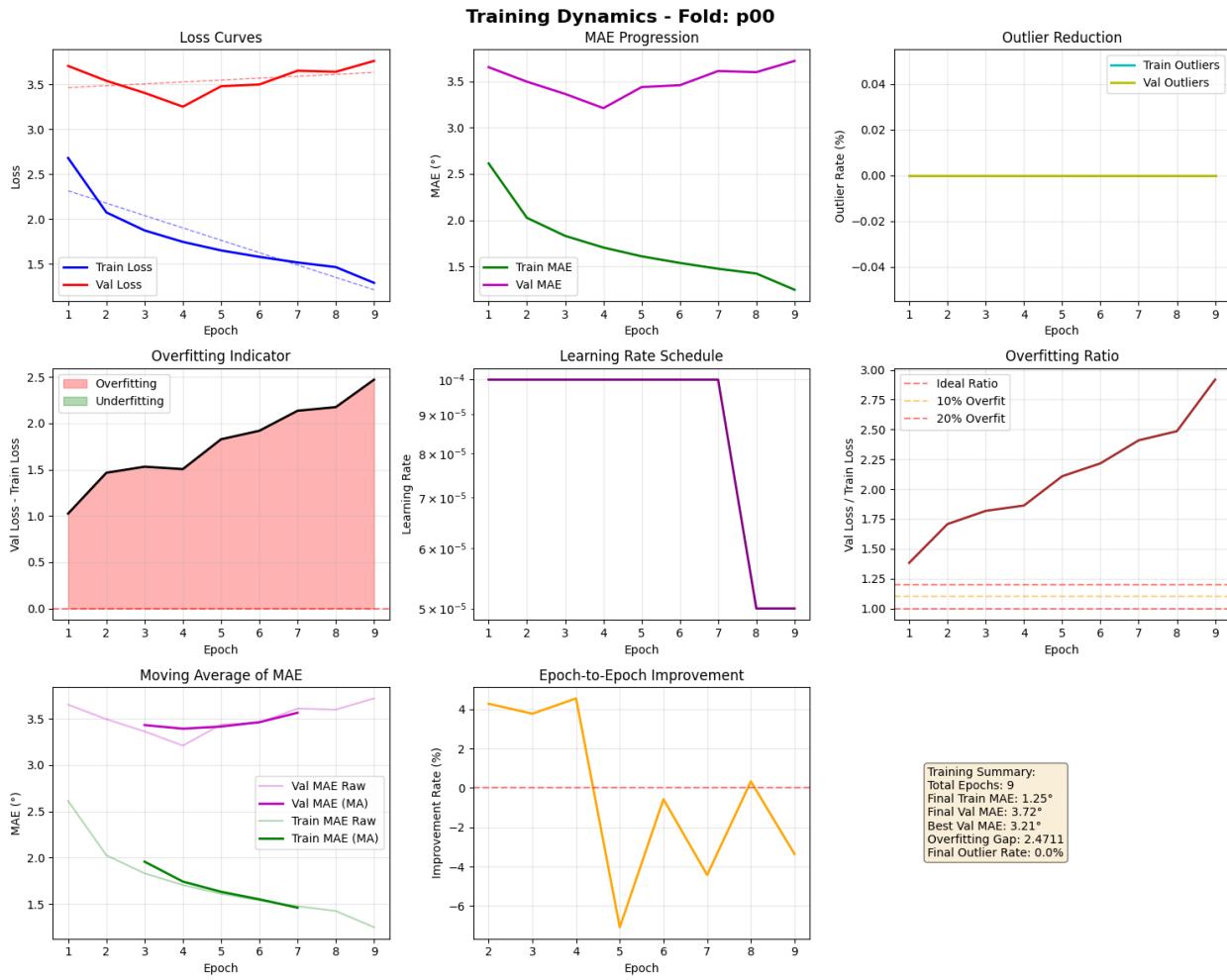

📋 Training Summary:

 Total epochs: 9

 Best epoch: 4

 Best val MAE: 3.21°

 Final train-val gap: 2.4711

 Overfitting ratio: 191.71%

📊 Generating training visualizations for p00...

📊 Saved training curves to: training_curves_fold_p00_20260210_105035.png

Training Dynamics - Fold: p00

🧪 Evaluating on test subject p00...

Testing p00: 100%|██████████| 469/469 [00:09<00:00, 50.00it/s]

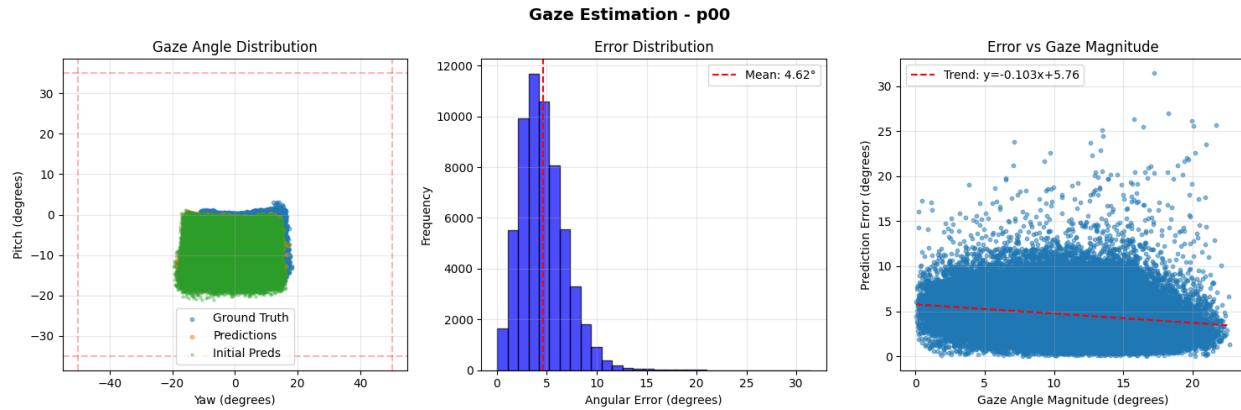📊 Results for p00:

MAE: 2.84°

Yaw MAE: 4.00°

Pitch MAE: 1.69°

Init Outliers: 0.0%

Final Outliers: 0.0%

Outlier Reduction: 0.0%

Samples: 59,922

Training Epochs: 9

Gaze Estimation - p00

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🧪 FOLD 2/15

Test Subject: p01

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Train subjects (12): ['p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p02']

Created train dataset: 263070 samples (test subject: p01)

Created val dataset: 115960 samples (test subject: p01)

Created test dataset: 48282 samples (test subject: p01)

🐂 Training for fold 2 (Test: p01)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 263,070

Val samples: 115,960

Max epochs: 50

Early stopping patience: 5

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📊 Epoch 1/50

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📈 Epoch 1 Summary:

 Train - Loss: 2.7099, MAE: 2.64°, Outliers: 0.0%

  Reg: 2.6425, Cycle: 0.3317, ACM: 0.0107

 Val   - Loss: 3.3023, MAE: 3.25°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.25°)

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📊 Epoch 2/50

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📈 Epoch 2 Summary:

 Train - Loss: 2.0742, MAE: 2.03°, Outliers: 0.0%

  Reg: 2.0276, Cycle: 0.2275, ACM: 0.0111

 Val   - Loss: 3.5110, MAE: 3.47°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -6.72%

==

📊 Epoch 3/50

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📈 Epoch 3 Summary:

 Train - Loss: 1.8732, MAE: 1.83°, Outliers: 0.0%

  Reg: 1.8323, Cycle: 0.1989, ACM: 0.0109

 Val   - Loss: 3.4652, MAE: 3.43°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +1.22%

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📊 Epoch 4/50

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📈 Epoch 4 Summary:

 Train - Loss: 1.7510, MAE: 1.71°, Outliers: 0.0%

  Reg: 1.7116, Cycle: 0.1916, ACM: 0.0106

 Val   - Loss: 3.8394, MAE: 3.80°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -10.93%

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📊 Epoch 5/50

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📈 Epoch 5 Summary:

Train - Loss: 1.6521, MAE: 1.61°, Outliers: 0.0%

Reg: 1.6130, Cycle: 0.1905, ACM: 0.0102

Val   - Loss: 3.4671, MAE: 3.43°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: +9.77%

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📊 Epoch 6/50

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🛑 Early stopping triggered after 6 epochs

📈 Epoch 6 Summary:

Train - Loss: 1.4463, MAE: 1.41°, Outliers: 0.0%

Reg: 1.4072, Cycle: 0.1904, ACM: 0.0103

Val   - Loss: 3.4083, MAE: 3.37°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: +1.71%

🛑 Stopping early after 6 epochs due to no improvement

✅ Loaded best model from epoch 1 (MAE: 3.25°)

📋 Training Summary:
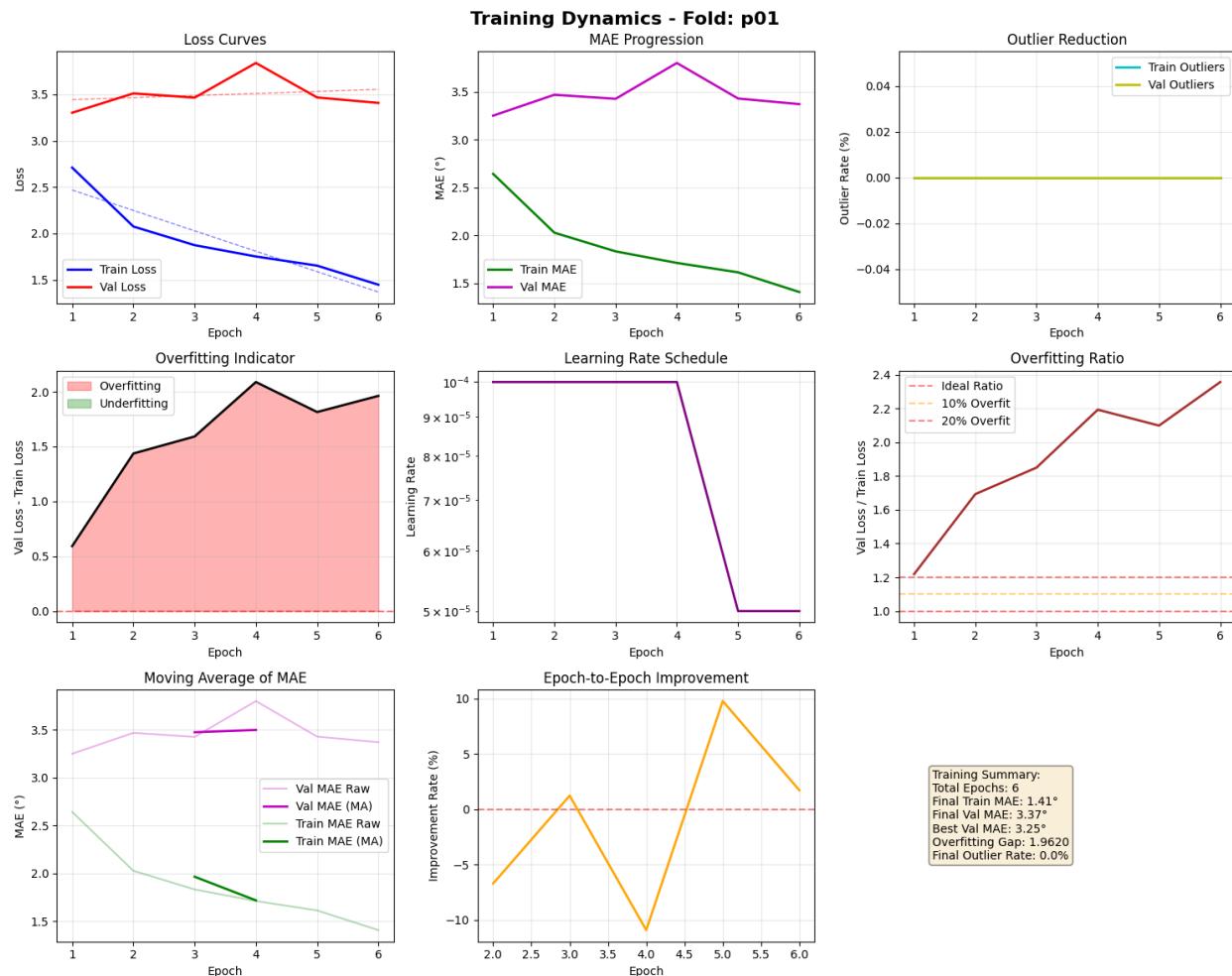
Total epochs: 6

Best epoch: 1

Best val MAE: 3.25°

Final train-val gap: 1.9620

Overfitting ratio: 135.66%

📊 Generating training visualizations for p01...

📊 Saved training curves to: training_curves_fold_p01_20260210_110123.png

🧪 Evaluating on test subject p01...

📊 Results for p01:

 MAE: 3.79°

 Yaw MAE: 4.23°

 Pitch MAE: 3.36°
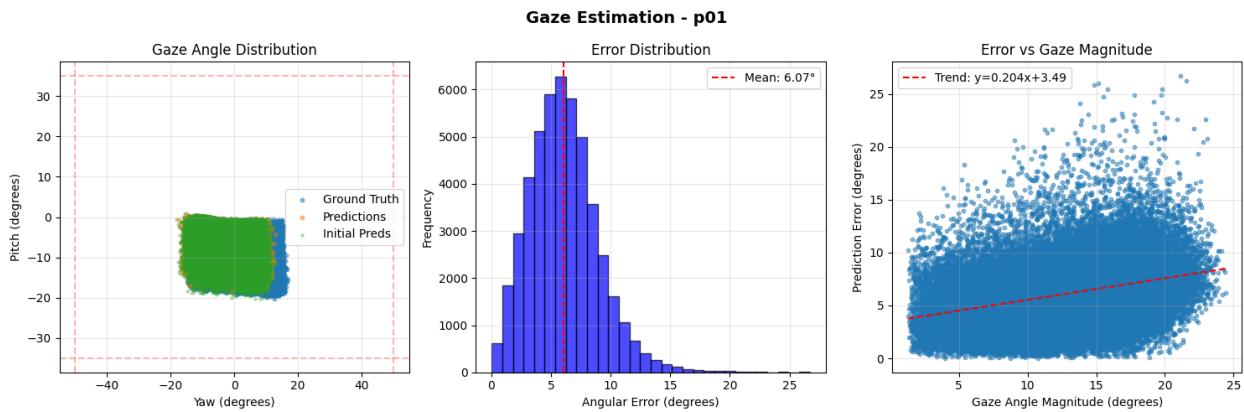
 Init Outliers: 0.0%

 Final Outliers: 0.0%

 Outlier Reduction: 0.0%

 Samples: 48,282

 Training Epochs: 6

Gaze Estimation - p01

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🧪 FOLD 3/15

Test Subject: p02

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Train subjects (12): ['p03', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p01']

Created train dataset: 263070 samples (test subject: p02)

Created val dataset: 108204 samples (test subject: p02)

Created test dataset: 56038 samples (test subject: p02)

🐂 Training for fold 3 (Test: p02)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 263,070

Val samples: 108,204

Max epochs: 50

Early stopping patience: 5

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📊 Epoch 1/50

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📈 Epoch 1 Summary:

 Train - Loss: 2.7045, MAE: 2.64°, Outliers: 0.0%

  Reg: 2.6387, Cycle: 0.3237, ACM: 0.0105

 Val - Loss: 3.6716, MAE: 3.62°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.62°)

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📊 Epoch 2/50

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📈 Epoch 2 Summary:

 Train - Loss: 2.0729, MAE: 2.03°, Outliers: 0.0%

  Reg: 2.0263, Cycle: 0.2277, ACM: 0.0106

 Val - Loss: 3.0184, MAE: 2.98°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +17.77%

 🎯 New best model! (MAE: 2.98°)

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📊 Epoch 3/50

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📈 Epoch 3 Summary:

 Train - Loss: 1.8692, MAE: 1.83°, Outliers: 0.0%

  Reg: 1.8281, Cycle: 0.2007, ACM: 0.0101

 Val - Loss: 3.3997, MAE: 3.36°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -12.91%

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📊 Epoch 4/50

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📈 Epoch 4 Summary:

 Train - Loss: 1.7404, MAE: 1.70°, Outliers: 0.0%

  Reg: 1.7007, Cycle: 0.1935, ACM: 0.0097

 Val   - Loss: 3.4521, MAE: 3.41°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -1.56%

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📊 Epoch 5/50

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📈 Epoch 5 Summary:

 Train - Loss: 1.6444, MAE: 1.60°, Outliers: 0.0%

  Reg: 1.6049, Cycle: 0.1925, ACM: 0.0094

 Val   - Loss: 2.9775, MAE: 2.94°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +13.90%

 🎯 New best model! (MAE: 2.94°)

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📊 Epoch 6/50

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📈 Epoch 6 Summary:

Train - Loss: 1.5704, MAE: 1.53°, Outliers: 0.0%

 Reg: 1.5310, Cycle: 0.1924, ACM: 0.0091

Val - Loss: 3.0287, MAE: 2.99°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -1.74%

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📊 Epoch 7/50

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📈 Epoch 7 Summary:

 Train - Loss: 1.5109, MAE: 1.47°, Outliers: 0.0%

 Reg: 1.4715, Cycle: 0.1924, ACM: 0.0089

Val - Loss: 3.2410, MAE: 3.20°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -7.11%

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📊 Epoch 8/50

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📈 Epoch 8 Summary:

 Train - Loss: 1.4611, MAE: 1.42°, Outliers: 0.0%

 Reg: 1.4218, Cycle: 0.1923, ACM: 0.0087

Val - Loss: 2.9863, MAE: 2.95°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +7.96%

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📊 Epoch 9/50

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📈 Epoch 9 Summary:

Train - Loss: 1.4152, MAE: 1.38°, Outliers: 0.0%

 Reg: 1.3758, Cycle: 0.1923, ACM: 0.0087

Val   - Loss: 2.9092, MAE: 2.87°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +2.59%

🎯 New best model! (MAE: 2.87°)

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📊 Epoch 10/50

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📈 Epoch 10 Summary:

Train - Loss: 1.3746, MAE: 1.34°, Outliers: 0.0%

 Reg: 1.3353, Cycle: 0.1923, ACM: 0.0086

Val   - Loss: 2.9028, MAE: 2.87°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +0.24%

🎯 New best model! (MAE: 2.87°)

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📊 Epoch 11/50

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📈 Epoch 11 Summary:

 Train - Loss: 1.3375, MAE: 1.30°, Outliers: 0.0%

  Reg: 1.2982, Cycle: 0.1923, ACM: 0.0086

 Val   - Loss: 3.1065, MAE: 3.07°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -7.11%

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📊 Epoch 12/50

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📈 Epoch 12 Summary:

 Train - Loss: 1.3048, MAE: 1.27°, Outliers: 0.0%

  Reg: 1.2655, Cycle: 0.1923, ACM: 0.0086

 Val   - Loss: 2.9131, MAE: 2.88°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +6.29%

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📊 Epoch 13/50

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📈 Epoch 13 Summary:

 Train - Loss: 1.2760, MAE: 1.24°, Outliers: 0.0%

  Reg: 1.2367, Cycle: 0.1923, ACM: 0.0086

 Val   - Loss: 3.0043, MAE: 2.97°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -3.17%

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📊 Epoch 14/50

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📈 Epoch 14 Summary:

 Train - Loss: 1.2495, MAE: 1.21°, Outliers: 0.0%

  Reg: 1.2102, Cycle: 0.1923, ACM: 0.0085

 Val   - Loss: 3.2291, MAE: 3.19°, Outliers: 0.0%

 LR: 5.00e-05

 Val MAE Improvement: -7.58%

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📊 Epoch 15/50

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🛑 Early stopping triggered after 15 epochs

📈 Epoch 15 Summary:

Train - Loss: 1.1006, MAE: 1.06°, Outliers: 0.0%

  Reg: 1.0613, Cycle: 0.1920, ACM: 0.0087

Val   - Loss: 3.0375, MAE: 3.00°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: +6.02%

🛑 Stopping early after 15 epochs due to no improvement

✅ Loaded best model from epoch 10 (MAE: 2.87°)

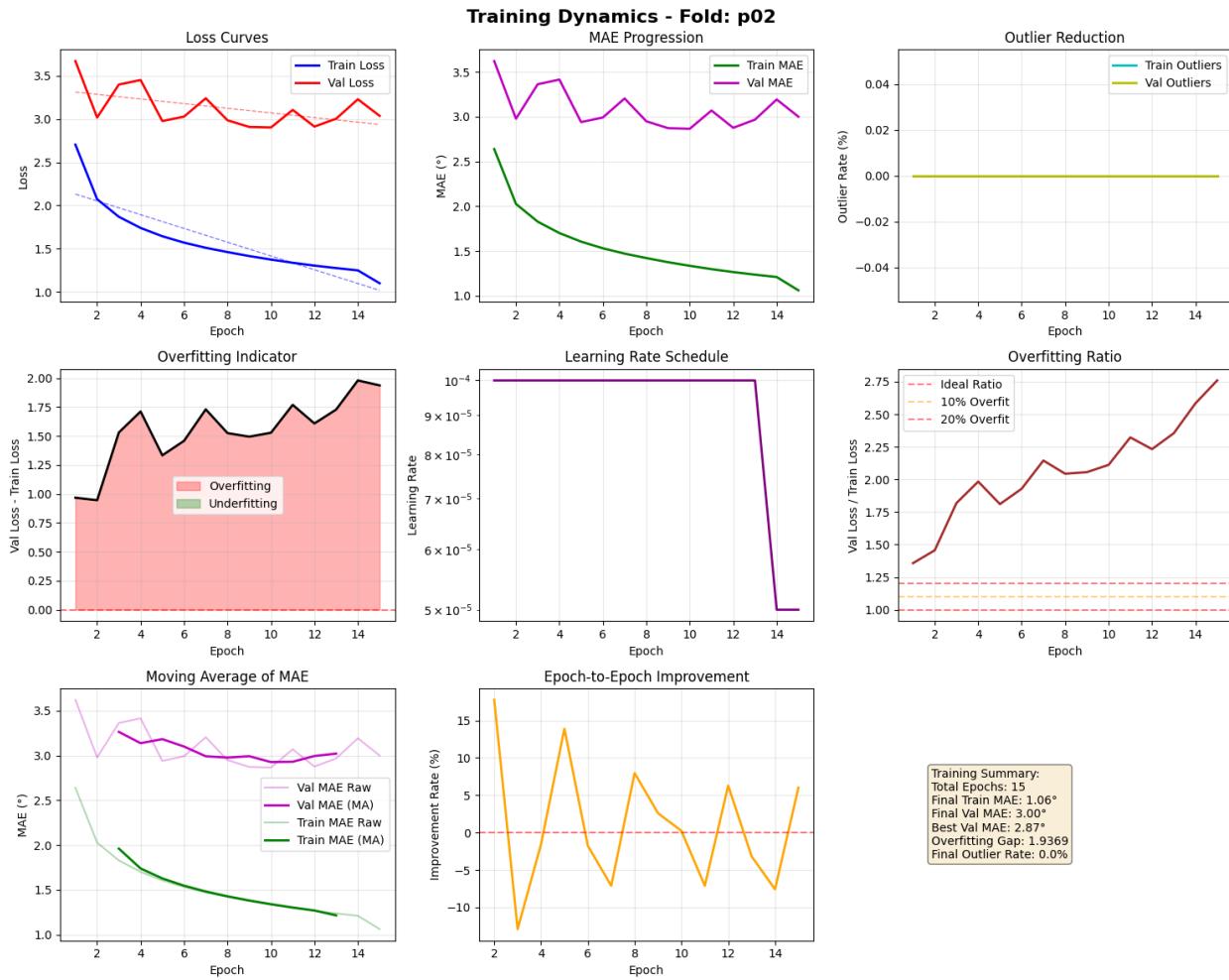📋 Training Summary:

 Total epochs: 15

 Best epoch: 10

 Best val MAE: 2.87°

 Final train-val gap: 1.9369

 Overfitting ratio: 175.99%

📊 Generating training visualizations for p02...

📊 Saved training curves to: training_curves_fold_p02_20260210_112821.png

Training Dynamics - Fold: p02

🧪 Evaluating on test subject p02...

Testing p02: 100%|████████| 438/438 [00:08<00:00, 48.80it/s]

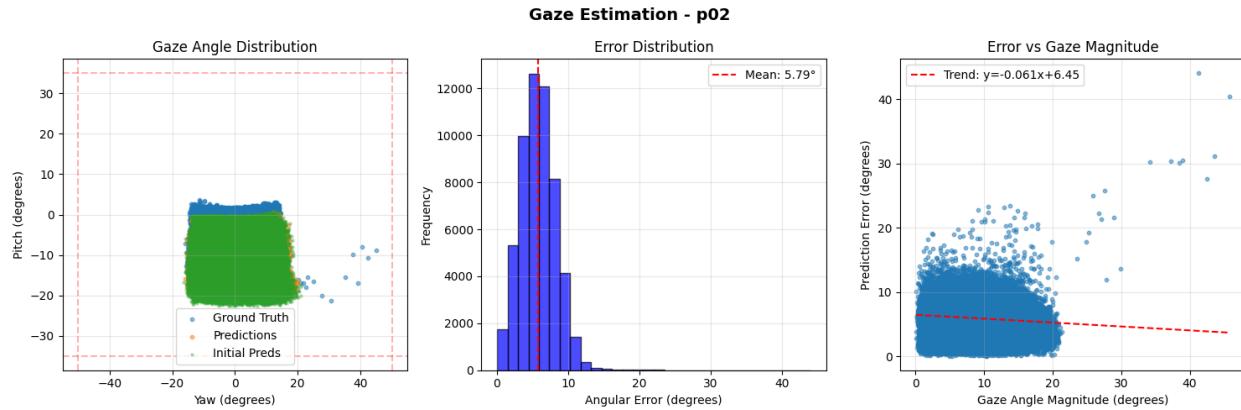📊 Results for p02:

MAE: 3.61°

Yaw MAE: 2.18°

Pitch MAE: 5.05°

Init Outliers: 0.0%

Final Outliers: 0.0%

Outlier Reduction: 0.0%

Samples: 56,038

Training Epochs: 15

Gaze Estimation - p02

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🧪 FOLD 4/15

Test Subject: p03

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Train subjects (12): ['p02', 'p04', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p01']

Created train dataset: 248958 samples (test subject: p03)

Created val dataset: 108204 samples (test subject: p03)

Created test dataset: 70150 samples (test subject: p03)

🦾 Training for fold 4 (Test: p03)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 248,958

Val samples: 108,204

Max epochs: 50

Early stopping patience: 5

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📊 Epoch 1/50

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📈 Epoch 1 Summary:

 Train - Loss: 2.6165, MAE: 2.55°, Outliers: 0.0%

  Reg: 2.5487, Cycle: 0.3342, ACM: 0.0087

 Val   - Loss: 3.3157, MAE: 3.26°, Outliers: 0.0%

 LR: 1.00e-04

  🎯 New best model! (MAE: 3.26°)

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📊 Epoch 2/50

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📈 Epoch 2 Summary:

 Train - Loss: 2.0119, MAE: 1.97°, Outliers: 0.0%

  Reg: 1.9651, Cycle: 0.2291, ACM: 0.0092

 Val   - Loss: 3.0703, MAE: 3.03°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +7.21%

🎯 New best model! (MAE: 3.03°)

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📊 Epoch 3/50

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📈 Epoch 3 Summary:

Train - Loss: 1.8166, MAE: 1.78°, Outliers: 0.0%

  Reg: 1.7765, Cycle: 0.1960, ACM: 0.0090

Val   - Loss: 2.6201, MAE: 2.58°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +14.76%

🎯 New best model! (MAE: 2.58°)

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📊 Epoch 4/50

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📈 Epoch 4 Summary:

Train - Loss: 1.6899, MAE: 1.65°, Outliers: 0.0%

  Reg: 1.6520, Cycle: 0.1853, ACM: 0.0089

Val   - Loss: 2.9449, MAE: 2.91°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -12.59%

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📊 Epoch 5/50

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📈 Epoch 5 Summary:

 Train - Loss: 1.5975, MAE: 1.56°, Outliers: 0.0%

   Reg: 1.5600, Cycle: 0.1831, ACM: 0.0088

 Val   - Loss: 2.6753, MAE: 2.64°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +9.30%

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📊 Epoch 6/50

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📈 Epoch 6 Summary:

 Train - Loss: 1.5272, MAE: 1.49°, Outliers: 0.0%

   Reg: 1.4898, Cycle: 0.1829, ACM: 0.0086

 Val   - Loss: 2.9243, MAE: 2.89°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -9.46%

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📊 Epoch 7/50

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⚠️ Overfitting detected! Train trend: -0.0872, Val trend: 0.0430

📈 Epoch 7 Summary:

 Train - Loss: 1.4622, MAE: 1.42°, Outliers: 0.0%

  Reg: 1.4248, Cycle: 0.1828, ACM: 0.0085

 Val   - Loss: 2.8455, MAE: 2.81°, Outliers: 0.0%

 LR: 5.00e-05

 Val MAE Improvement: +2.72%

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📊 Epoch 8/50

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🛑 Early stopping triggered after 8 epochs

📈 Epoch 8 Summary:

 Train - Loss: 1.2841, MAE: 1.25°, Outliers: 0.0%

  Reg: 1.2467, Cycle: 0.1828, ACM: 0.0087

 Val   - Loss: 2.7057, MAE: 2.67°, Outliers: 0.0%

 LR: 5.00e-05

 Val MAE Improvement: +5.00%

🛑 Stopping early after 8 epochs due to no improvement

✅ Loaded best model from epoch 3 (MAE: 2.58°)
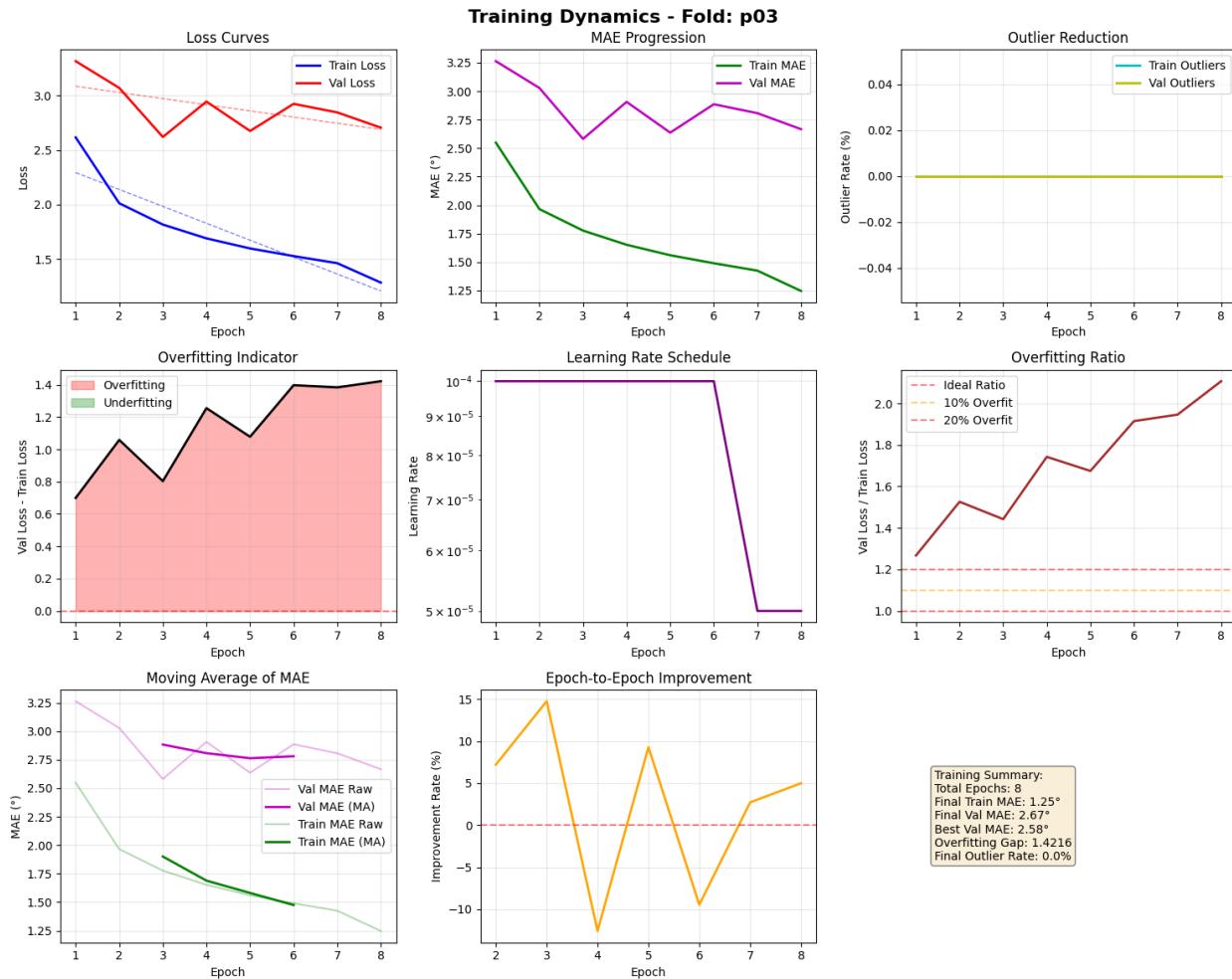
📋 Training Summary:

Total epochs: 8

Best epoch: 3

Best val MAE: 2.58°

Final train-val gap: 1.4216

Overfitting ratio: 110.70%

📊 Generating training visualizations for p03...

📊 Saved training curves to: training_curves_fold_p03_20260210_114217.png

Training Dynamics - Fold: p03

🧪 Evaluating on test subject p03...

Testing p03: 100%|███████████| 549/549 [00:11<00:00, 47.78it/s]

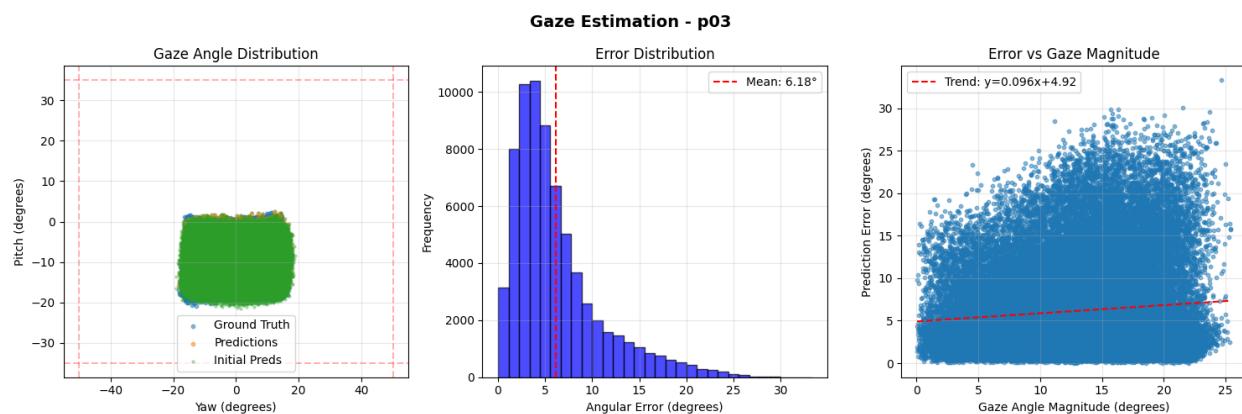📊 Results for p03:

 MAE: 3.92°

 Yaw MAE: 4.50°

 Pitch MAE: 3.35°

 Init Outliers: 0.0%

 Final Outliers: 0.0%

 Outlier Reduction: 0.0%

 Samples: 70,150

 Training Epochs: 8

Gaze Estimation - p03

==

🧪 FOLD 5/15

Test Subject: p04

==

Train subjects (12): ['p02', 'p03', 'p05', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p01']

Created train dataset: 285446 samples (test subject: p04)

Created val dataset: 108204 samples (test subject: p04)

Created test dataset: 33662 samples (test subject: p04)

🏋️ Training for fold 5 (Test: p04)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 285,446

Val samples: 108,204

Max epochs: 50

Early stopping patience: 5

==

📊 Epoch 1/50

==

📈 Epoch 1 Summary:

 Train - Loss: 2.6207, MAE: 2.55°, Outliers: 0.0%

  Reg: 2.5534, Cycle: 0.3319, ACM: 0.0093

 Val   - Loss: 3.3503, MAE: 3.30°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.30°)

==

📊 Epoch 2/50

==

📈 Epoch 2 Summary:

 Train - Loss: 2.0169, MAE: 1.97°, Outliers: 0.0%

  Reg: 1.9707, Cycle: 0.2262, ACM: 0.0096

 Val   - Loss: 3.0599, MAE: 3.02°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +8.51%

 🎯 New best model! (MAE: 3.02°)

==

📊 Epoch 3/50

==

📈 Epoch 3 Summary:

 Train - Loss: 1.8197, MAE: 1.78°, Outliers: 0.0%

  Reg: 1.7794, Cycle: 0.1968, ACM: 0.0092

 Val   - Loss: 2.7303, MAE: 2.69°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +10.84%

 🎯 New best model! (MAE: 2.69°)

==

📊 Epoch 4/50

==

📈 Epoch 4 Summary:

 Train - Loss: 1.6974, MAE: 1.66°, Outliers: 0.0%

  Reg: 1.6586, Cycle: 0.1896, ACM: 0.0090

 Val   - Loss: 3.0788, MAE: 3.04°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -12.96%

==

📊 Epoch 5/50

==

📈 Epoch 5 Summary:

 Train - Loss: 1.6047, MAE: 1.57°, Outliers: 0.0%

  Reg: 1.5660, Cycle: 0.1887, ACM: 0.0088

 Val   - Loss: 3.1768, MAE: 3.14°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -3.21%

==

📊 Epoch 6/50

==

📈 Epoch 6 Summary:

 Train - Loss: 1.5327, MAE: 1.49°, Outliers: 0.0%

Reg: 1.4942, Cycle: 0.1887, ACM: 0.0086

Val   - Loss: 2.5993, MAE: 2.56°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +18.41%

🎯 New best model! (MAE: 2.56°)

==

📊 Epoch 7/50

==

📈 Epoch 7 Summary:

Train - Loss: 1.4746, MAE: 1.44°, Outliers: 0.0%

  Reg: 1.4360, Cycle: 0.1886, ACM: 0.0085

Val   - Loss: 2.7114, MAE: 2.67°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -4.39%

==

📊 Epoch 8/50

==

📈 Epoch 8 Summary:

Train - Loss: 1.4239, MAE: 1.39°, Outliers: 0.0%

  Reg: 1.3854, Cycle: 0.1886, ACM: 0.0084

Val   - Loss: 2.9376, MAE: 2.90°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: -8.47%

==

📊 Epoch 9/50

==

📈 Epoch 9 Summary:

 Train - Loss: 1.3814, MAE: 1.34°, Outliers: 0.0%

  Reg: 1.3429, Cycle: 0.1886, ACM: 0.0084

 Val   - Loss: 2.8725, MAE: 2.83°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +2.26%

==

📊 Epoch 10/50

==

📈 Epoch 10 Summary:

 Train - Loss: 1.3391, MAE: 1.30°, Outliers: 0.0%

  Reg: 1.3005, Cycle: 0.1886, ACM: 0.0083

 Val   - Loss: 2.7548, MAE: 2.72°, Outliers: 0.0%

 LR: 5.00e-05

 Val MAE Improvement: +4.15%

==

📊 Epoch 11/50

==

🛑 Early stopping triggered after 11 epochs

📈 Epoch 11 Summary:

 Train - Loss: 1.1851, MAE: 1.15°, Outliers: 0.0%

   Reg: 1.1465, Cycle: 0.1886, ACM: 0.0085

 Val   - Loss: 2.9374, MAE: 2.90°, Outliers: 0.0%

 LR: 5.00e-05

 Val MAE Improvement: -6.73%

🛑 Stopping early after 11 epochs due to no improvement

✅ Loaded best model from epoch 6 (MAE: 2.56°)

📋 Training Summary:

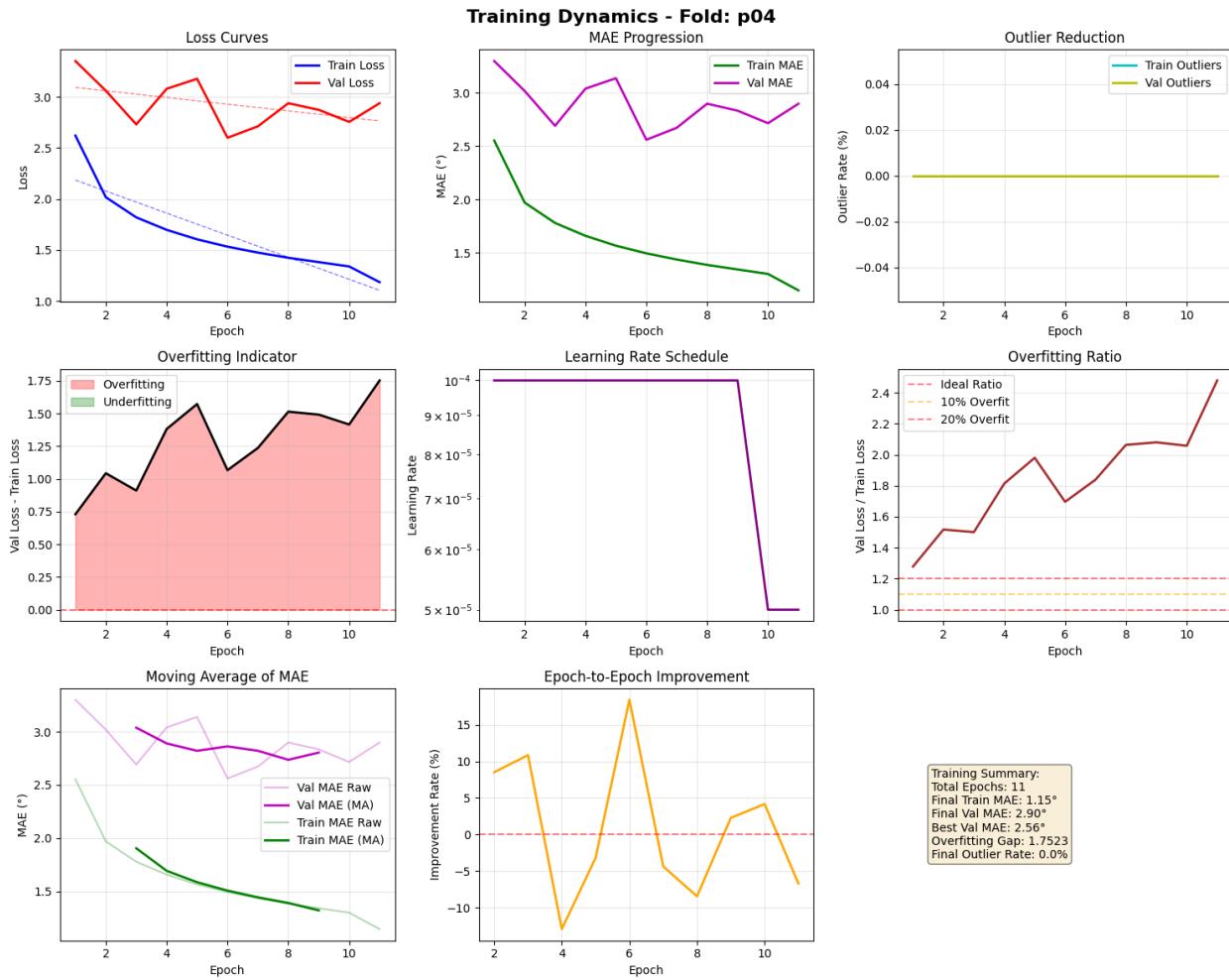 Total epochs: 11

 Best epoch: 6

 Best val MAE: 2.56°

 Final train-val gap: 1.7523

 Overfitting ratio: 147.86%

📊 Generating training visualizations for p04...

📊 Saved training curves to: training_curves_fold_p04_20260210_120316.png

Training Dynamics - Fold: p04

🧪 Evaluating on test subject p04...

Testing p04: 100%|███████████| 263/263 [00:06<00:00, 41.18it/s]

📊 Results for p04:

MAE: 3.88°

Yaw MAE: 5.07°

Pitch MAE: 2.69°
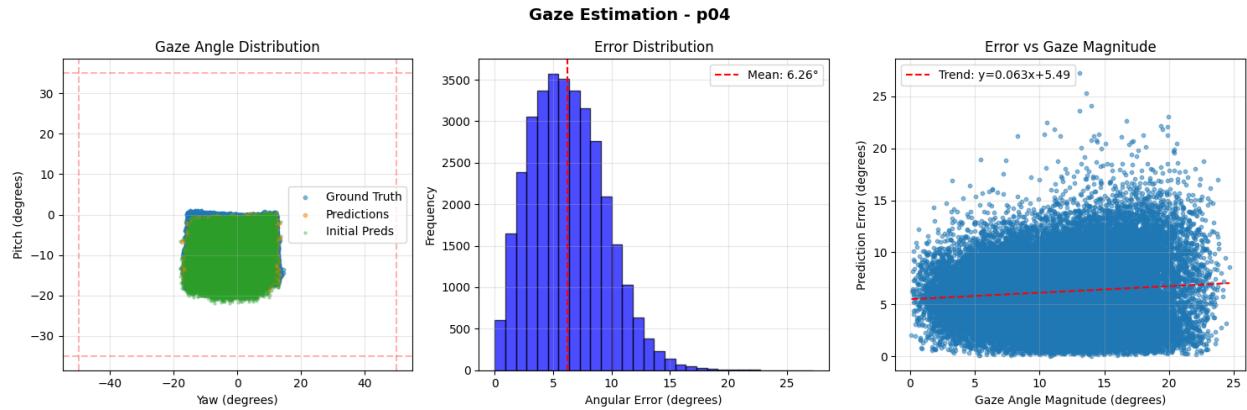
Init Outliers: 0.0%

Final Outliers: 0.0%

Outlier Reduction: 0.0%

Samples: 33,662

Training Epochs: 11

Gaze Estimation - p04

===

🧪 FOLD 6/15

Test Subject: p05

===

Train subjects (12): ['p02', 'p03', 'p04', 'p06', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p01']

Created train dataset: 285954 samples (test subject: p05)

Created val dataset: 108204 samples (test subject: p05)

Created test dataset: 33154 samples (test subject: p05)

🏋️ Training for fold 6 (Test: p05)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 285,954

Val samples: 108,204

Max epochs: 50

Early stopping patience: 5

==

📊 Epoch 1/50

==

📈 Epoch 1 Summary:

 Train - Loss: 2.5602, MAE: 2.49°, Outliers: 0.0%

  Reg: 2.4946, Cycle: 0.3231, ACM: 0.0094

 Val   - Loss: 3.5002, MAE: 3.45°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.45°)

==

📊 Epoch 2/50

==

📈 Epoch 2 Summary:

 Train - Loss: 1.9758, MAE: 1.93°, Outliers: 0.0%

  Reg: 1.9300, Cycle: 0.2240, ACM: 0.0103

 Val   - Loss: 2.9862, MAE: 2.95°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +14.62%

🎯 New best model! (MAE: 2.95°)

==

📊 Epoch 3/50

==

📈 Epoch 3 Summary:

 Train - Loss: 1.7805, MAE: 1.74°, Outliers: 0.0%

  Reg: 1.7401, Cycle: 0.1971, ACM: 0.0104

 Val   - Loss: 2.8589, MAE: 2.82°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +4.23%

 🎯 New best model! (MAE: 2.82°)

==

📊 Epoch 4/50

==

📈 Epoch 4 Summary:

 Train - Loss: 1.6615, MAE: 1.62°, Outliers: 0.0%

  Reg: 1.6222, Cycle: 0.1912, ACM: 0.0103

 Val   - Loss: 3.0158, MAE: 2.98°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -5.55%

==

📊 Epoch 5/50

==

📈 Epoch 5 Summary:

 Train - Loss: 1.5739, MAE: 1.53°, Outliers: 0.0%

  Reg: 1.5348, Cycle: 0.1905, ACM: 0.0102

 Val - Loss: 2.8360, MAE: 2.80°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +6.03%

 🎯 New best model! (MAE: 2.80°)

==

📊 Epoch 6/50

==

📈 Epoch 6 Summary:

 Train - Loss: 1.5018, MAE: 1.46°, Outliers: 0.0%

  Reg: 1.4627, Cycle: 0.1904, ACM: 0.0100

 Val - Loss: 2.4965, MAE: 2.46°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +12.14%

 🎯 New best model! (MAE: 2.46°)

==

📊 Epoch 7/50

==

📈 Epoch 7 Summary:

 Train - Loss: 1.4442, MAE: 1.41°, Outliers: 0.0%

  Reg: 1.4051, Cycle: 0.1904, ACM: 0.0098

 Val   - Loss: 2.8396, MAE: 2.80°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: -13.97%

==

📊 Epoch 8/50

==

📈 Epoch 8 Summary:

 Train - Loss: 1.3953, MAE: 1.36°, Outliers: 0.0%

  Reg: 1.3562, Cycle: 0.1904, ACM: 0.0096

 Val   - Loss: 2.8218, MAE: 2.78°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +0.64%

==

📊 Epoch 9/50

==

📈 Epoch 9 Summary:

Train - Loss: 1.3536, MAE: 1.31°, Outliers: 0.0%

  Reg: 1.3146, Cycle: 0.1903, ACM: 0.0094

Val   - Loss: 2.7214, MAE: 2.68°, Outliers: 0.0%

LR: 1.00e-04

Val MAE Improvement: +3.61%

==

📊 Epoch 10/50

==

📈 Epoch 10 Summary:

Train - Loss: 1.3132, MAE: 1.27°, Outliers: 0.0%

  Reg: 1.2742, Cycle: 0.1903, ACM: 0.0092

Val   - Loss: 2.7288, MAE: 2.69°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: -0.27%

==

📊 Epoch 11/50

==

🛑 Early stopping triggered after 11 epochs

📈 Epoch 11 Summary:

Train - Loss: 1.1611, MAE: 1.12°, Outliers: 0.0%

Reg: 1.1221, Cycle: 0.1903, ACM: 0.0092

Val   - Loss: 2.8913, MAE: 2.85°, Outliers: 0.0%

LR: 5.00e-05

Val MAE Improvement: -6.04%

🛑 Stopping early after 11 epochs due to no improvement

✅ Loaded best model from epoch 6 (MAE: 2.46°)
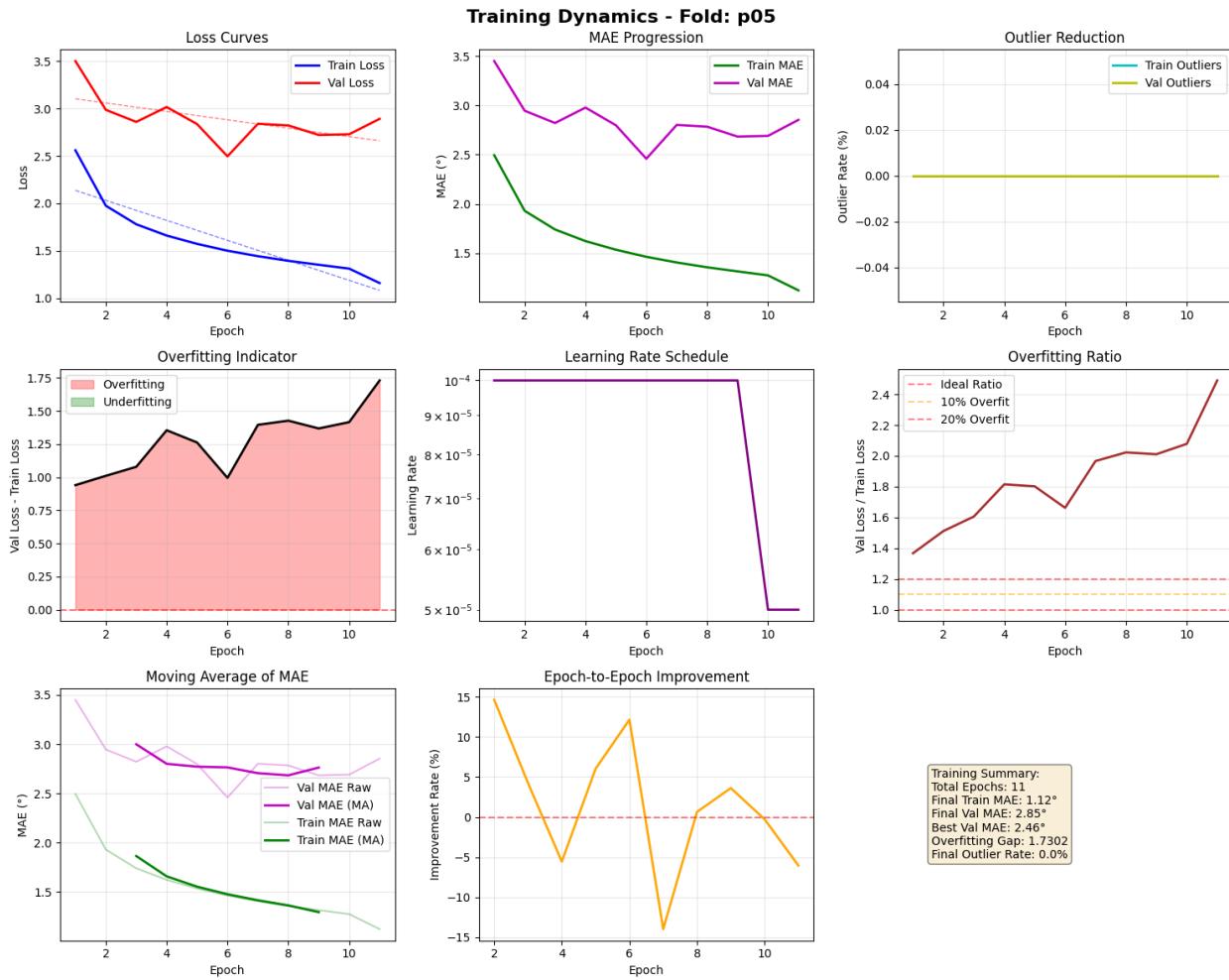
📋 Training Summary:

Total epochs: 11

Best epoch: 6

Best val MAE: 2.46°

Final train-val gap: 1.7302

Overfitting ratio: 149.01%

📊 Generating training visualizations for p05...

📊 Saved training curves to: training_curves_fold_p05_20260210_122416.png

Training Dynamics - Fold: p05

🧪 Evaluating on test subject p05...

Testing p05: 100%|████████████| 260/260 [00:06<00:00, 43.30it/s]

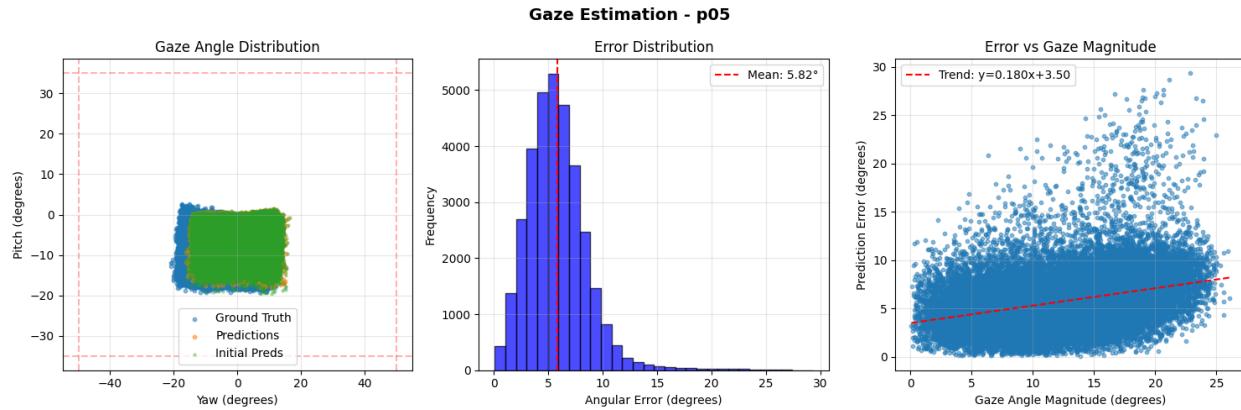📊 Results for p05:

MAE: 3.73°

Yaw MAE: 4.29°

Pitch MAE: 3.18°

Init Outliers: 0.0%

Final Outliers: 0.0%

Outlier Reduction: 0.0%

Samples: 33,154

Training Epochs: 11

Gaze Estimation - p05

==

🧪 FOLD 7/15

Test Subject: p06

==

Train subjects (12): ['p02', 'p03', 'p04', 'p05', 'p07', 'p08', 'p09', 'p10', 'p11', 'p12', 'p13', 'p14']

Val subjects (2): ['p00', 'p01']

Created train dataset: 282212 samples (test subject: p06)

Created val dataset: 108204 samples (test subject: p06)

Created test dataset: 36896 samples (test subject: p06)

🐂 Training for fold 7 (Test: p06)...

🚀 Starting training with dynamic epoch stopping...

Device: cuda

Train samples: 282,212

Val samples: 108,204

Max epochs: 50

Early stopping patience: 5

==

📊 Epoch 1/50

==

📈 Epoch 1 Summary:

 Train - Loss: 2.5406, MAE: 2.48°, Outliers: 0.0%

  Reg: 2.4755, Cycle: 0.3216, ACM: 0.0082

 Val   - Loss: 3.4215, MAE: 3.37°, Outliers: 0.0%

 LR: 1.00e-04

 🎯 New best model! (MAE: 3.37°)

==

📊 Epoch 2/50

==

📈 Epoch 2 Summary:

 Train - Loss: 1.9568, MAE: 1.91°, Outliers: 0.0%

  Reg: 1.9115, Cycle: 0.2224, ACM: 0.0086

 Val   - Loss: 3.0951, MAE: 3.06°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +9.41%

🎯 New best model! (MAE: 3.06°)

==

📊 Epoch 3/50

==

📈 Epoch 3 Summary:

 Train - Loss: 1.7667, MAE: 1.73°, Outliers: 0.0%

  Reg: 1.7265, Cycle: 0.1964, ACM: 0.0085

 Val - Loss: 3.0036, MAE: 2.97°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +2.92%

 🎯 New best model! (MAE: 2.97°)

==

📊 Epoch 4/50

==

📈 Epoch 4 Summary:

 Train - Loss: 1.6472, MAE: 1.61°, Outliers: 0.0%

  Reg: 1.6083, Cycle: 0.1903, ACM: 0.0084

 Val - Loss: 2.7669, MAE: 2.73°, Outliers: 0.0%

 LR: 1.00e-04

 Val MAE Improvement: +7.98%

 🎯 New best model! (MAE: 2.73°)