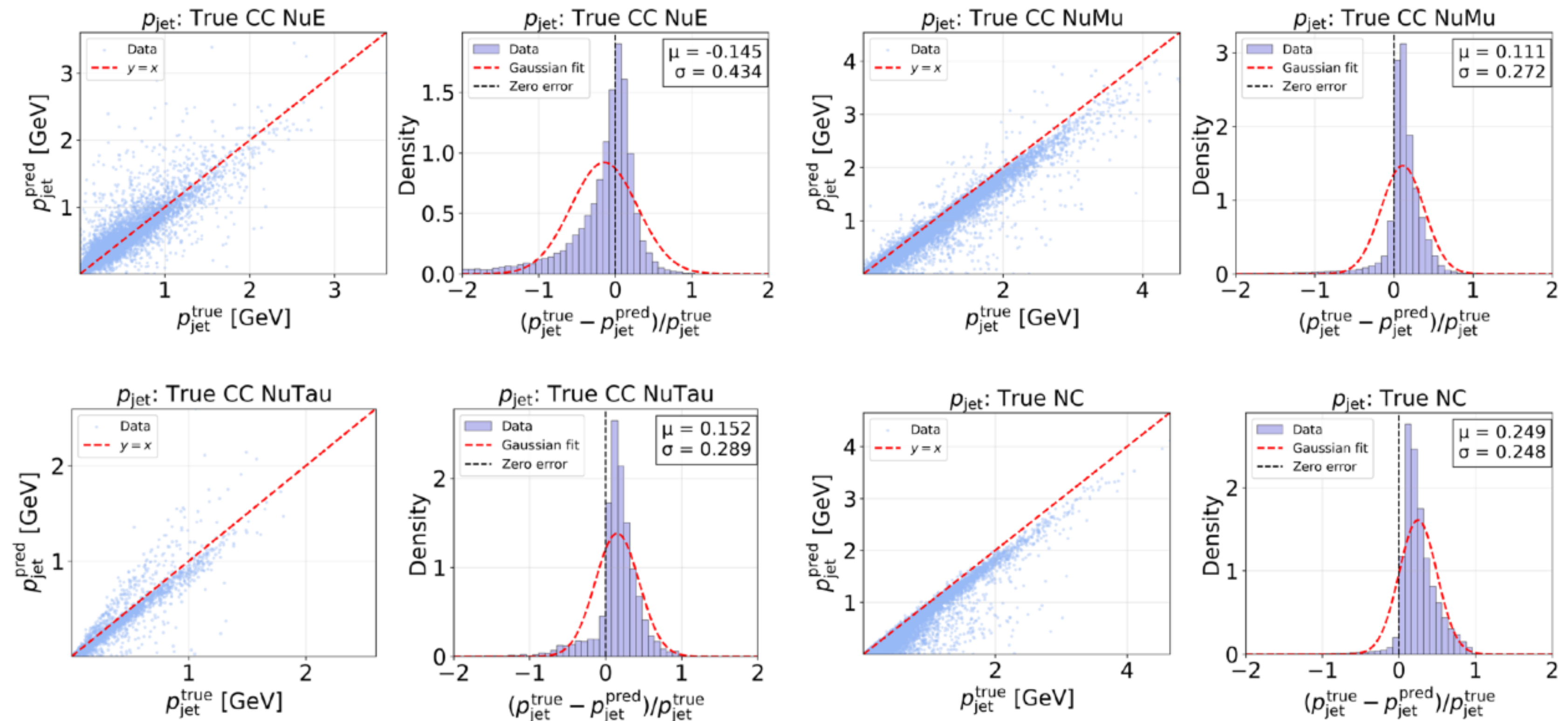


Deep Learning Model: Jet Momentum Magnitude

Regression Results

- The model successfully reconstructs the lepton and jet kinematics:
 - ν_τ **CC**: Challenge!
 - ν_μ **CC**: Misclassification of ν_μ as NC biasing the distribution.
- No direct info on the Primlepton is given to the model!
- Simultaneously successfully reconstructs the jet kinematics.



Conclusions

Summary and Future Prospects



- **The Challenge:** Sparse 3D data from FASERCal demanded methods beyond conventional approaches.
- **The Solution:** *This thesis successfully **developed and validated** a complete deep learning framework, based on a hybrid SCNN-Transformer architecture with self-supervised pre-training.*
 - *Key Breakthroughs:* sensitivity to rare signals, kinematic fidelity reconstruction.
- **Future Prospects:**
 - Bridge Sim-to-Real gap with FASERCal prototype (ETH, 2026).
 - Validation for full detector deployment (2030).
- **Broader Impact:**
 - Results will be presented at *Neutrino Physics & ML 2025* (Tokyo).
 - This work is a foundation for my PhD research at ETH & CERN (Prof. Rubbia, Dr. Alonso-Monsalve)