



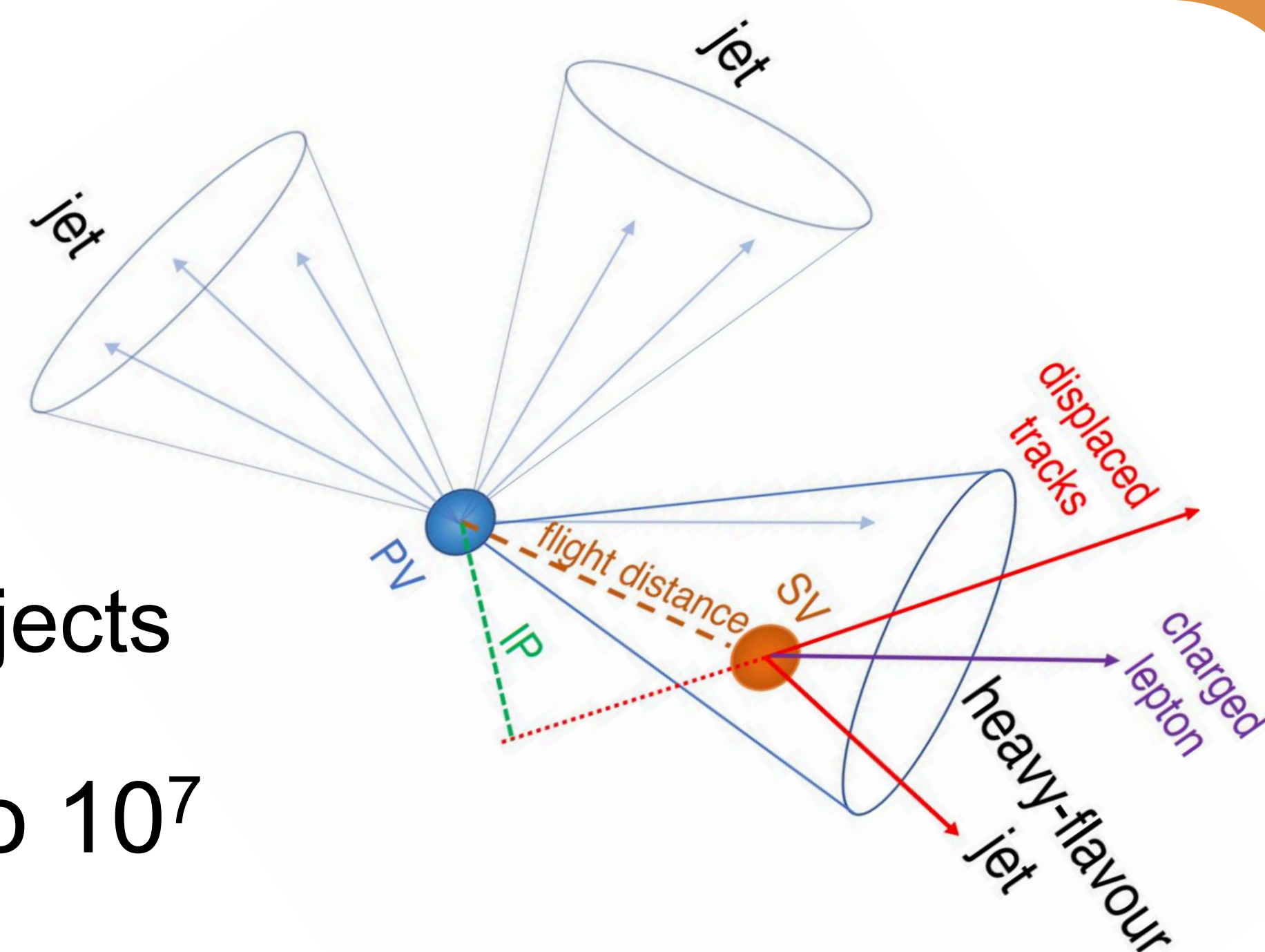
Deep Neural Networks for particle identification in CMS Detector at the LHC



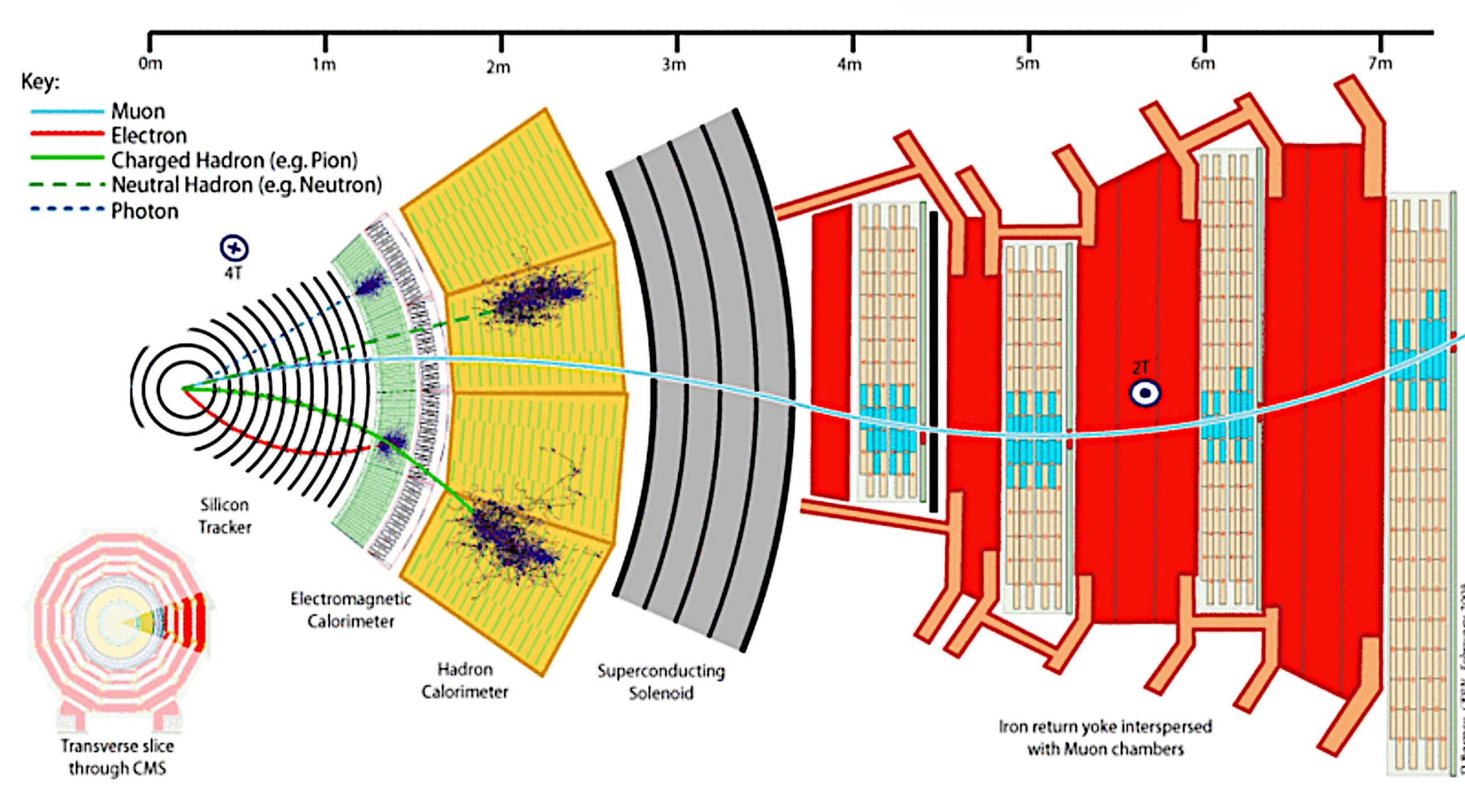
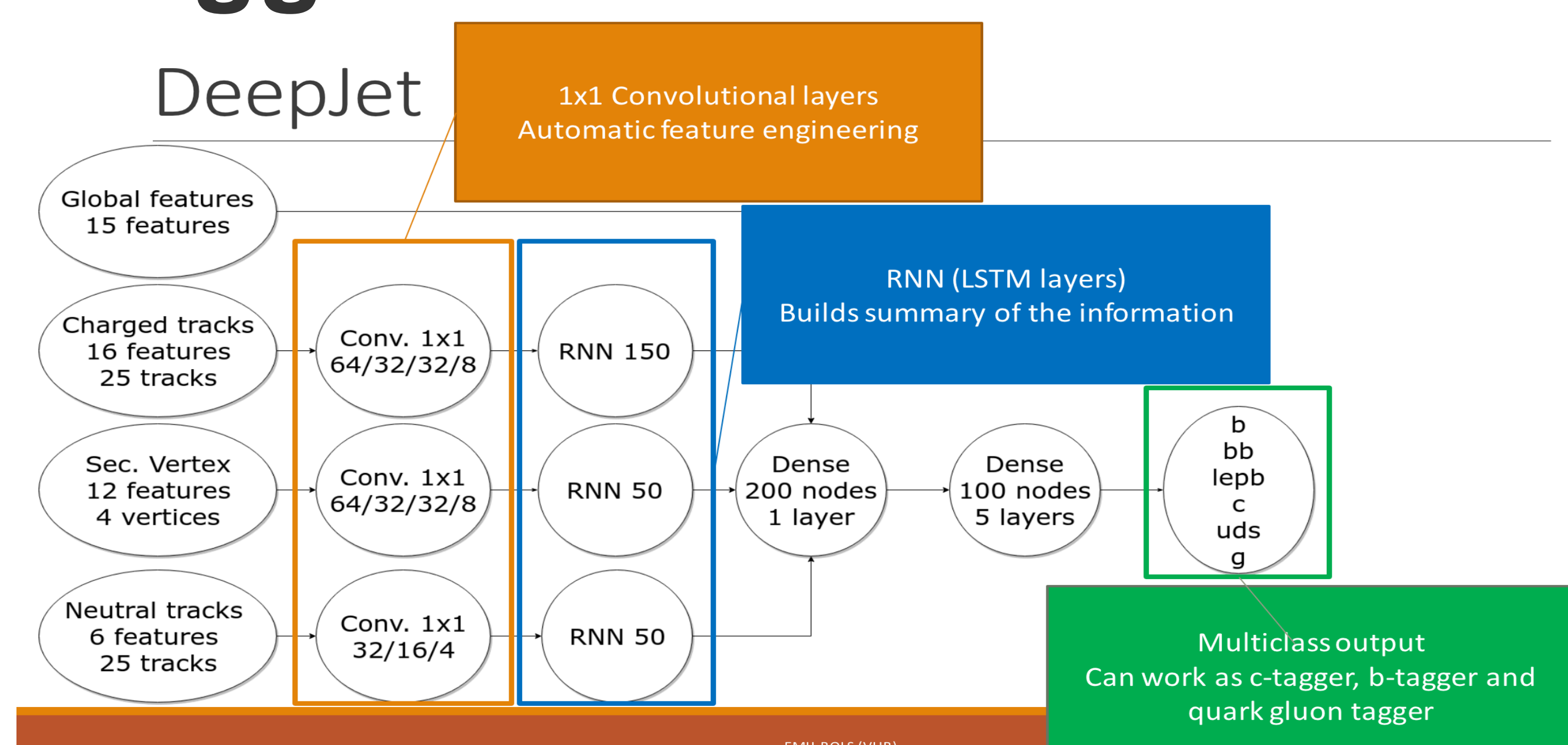
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Jet Tagging at CMS:

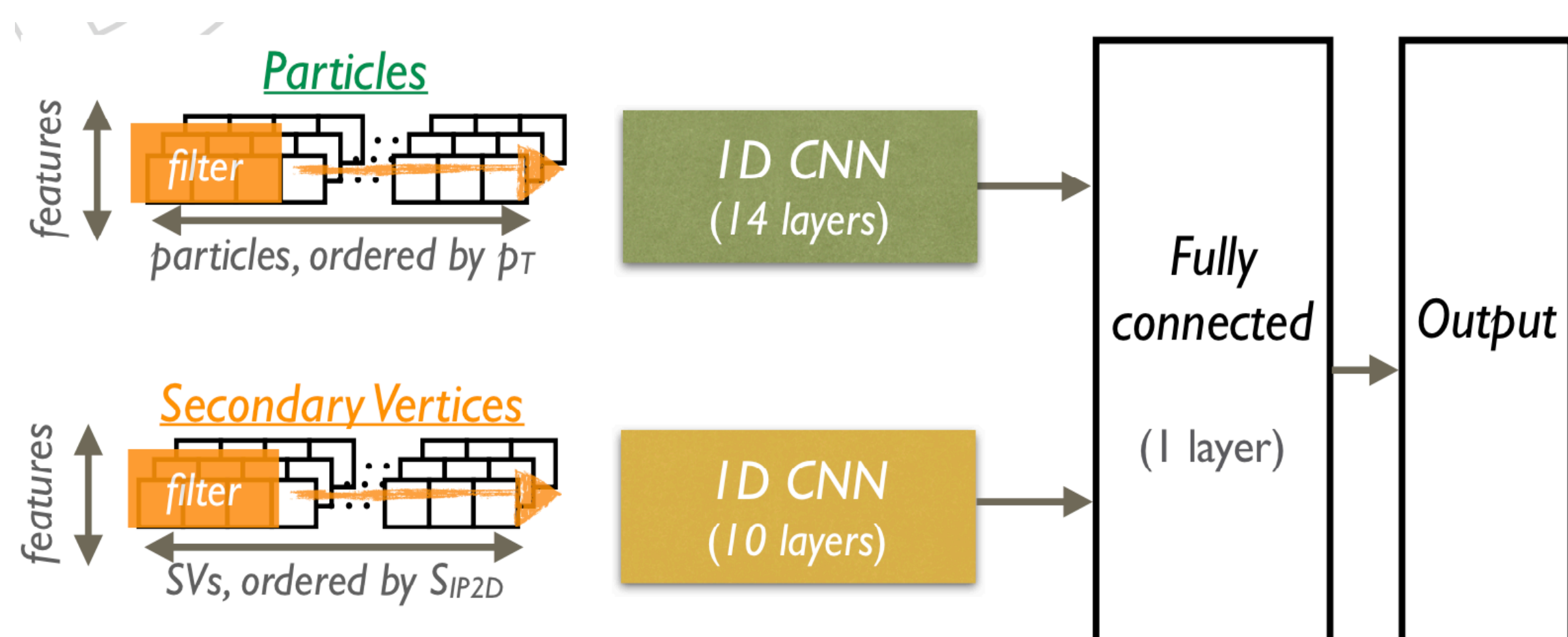
- Jet and heavy boosted objects tagging is important for Standard Model measurements and searches for New Physics
- Top tagging, b-quark identification, hadronic tau identification
- The natural problem for object id is the representation of the input objects (table, image/grid, point cloud/graph)
- Modern tools (Tensorflow, mxnet, PyTorch etc.) allow to handle up to 10^7 parameters



B Tagger:

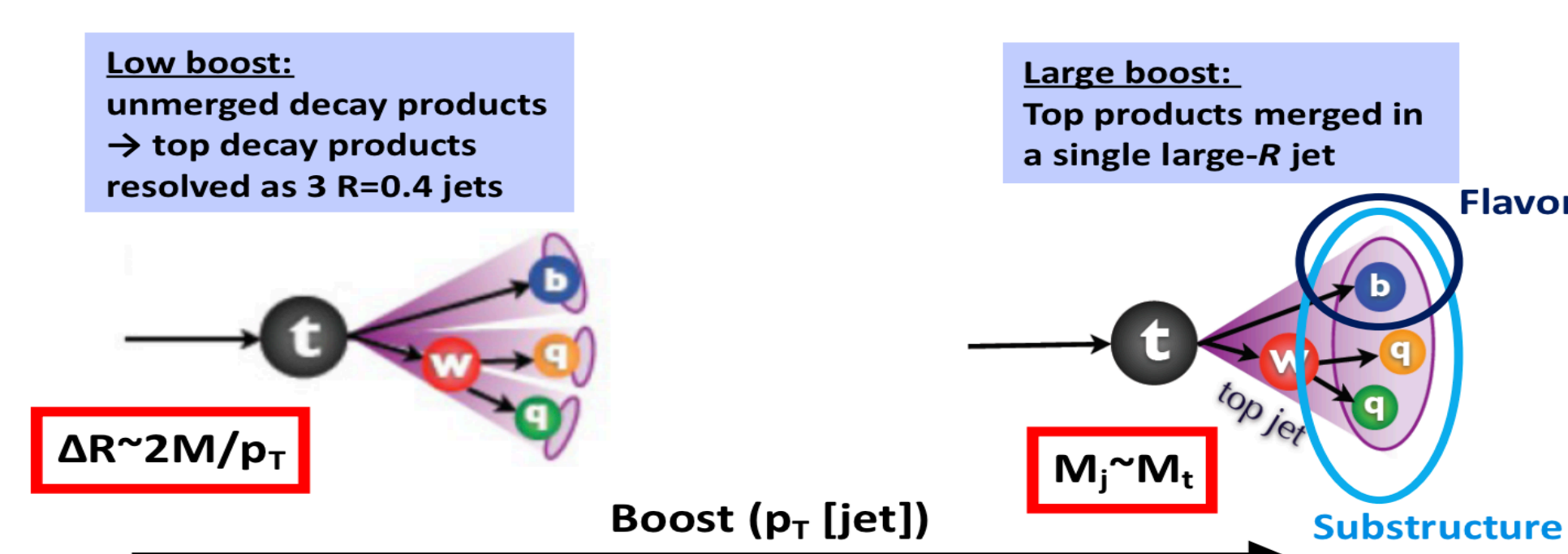


Top Tagging:



DeepAK8:

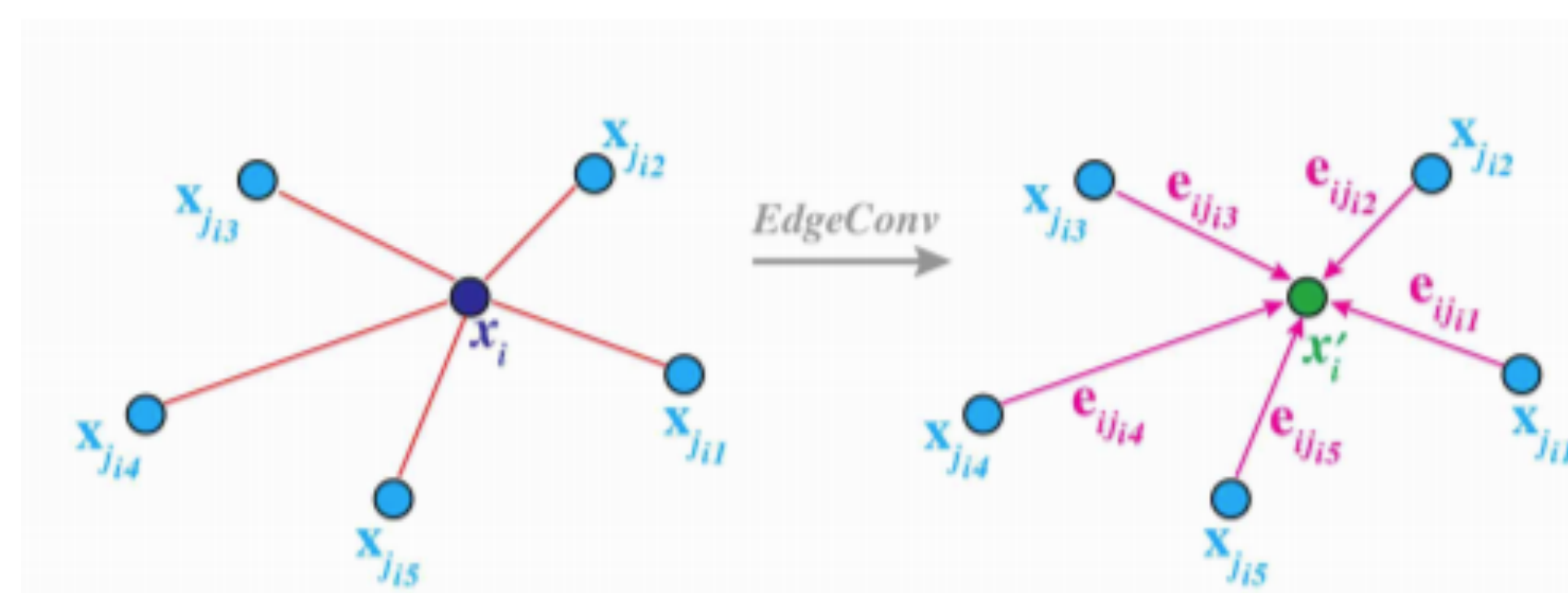
- Inputs: Up to 100 particle with 42 features each
- 14 layers deep with residual connections
- Trained with 50 millions of jets



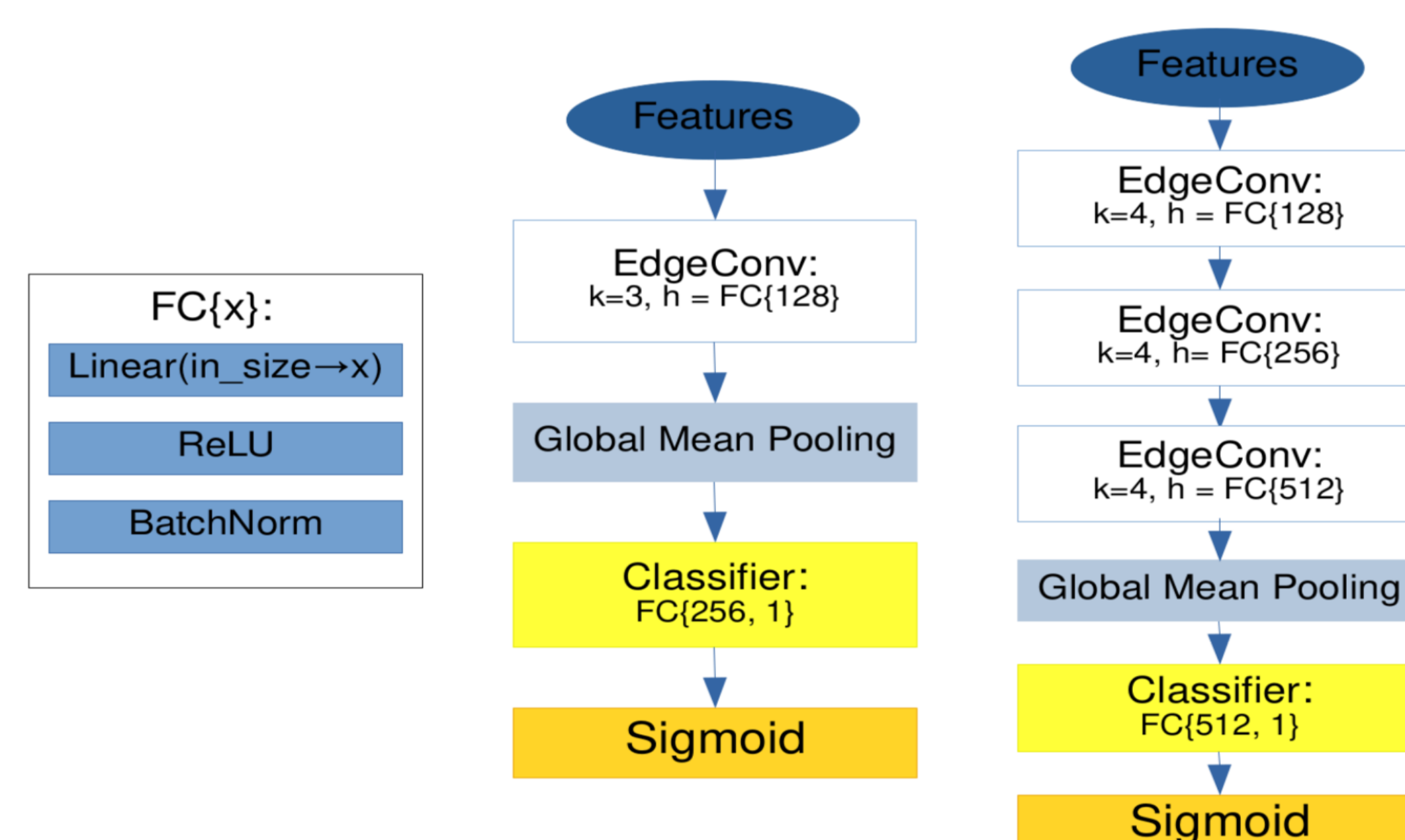
Hadronic Tau Tagger:



L.Didukh, K.Bukin



- Point cloud/graph representation of jet
- Followed by edge convolution operation over k-nn graph build using coordinates (eta, phi, pt) of particles
- Computationally highly efficient tau tagger



References:

1. DeepJet: Generic physics object based jet multiclass classification for LHC experiments, CMS-JME-18-002
2. ParticleNet: Jet Tagging via Particle Clouds, arXiv:1902.08570v2
3. Fast graph representation learning with pytorch geometric, arXiv:1903.02428v3