Status Report

Vertex of c-flavor hadron decay

$20-300\mu m$

Vertex of b-flavor hadron decay
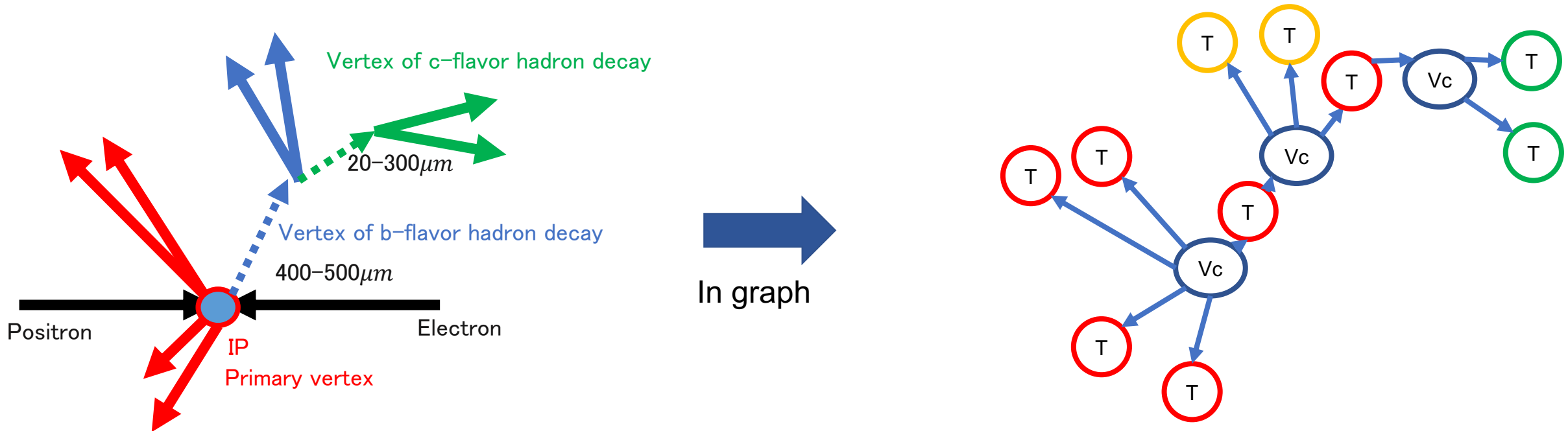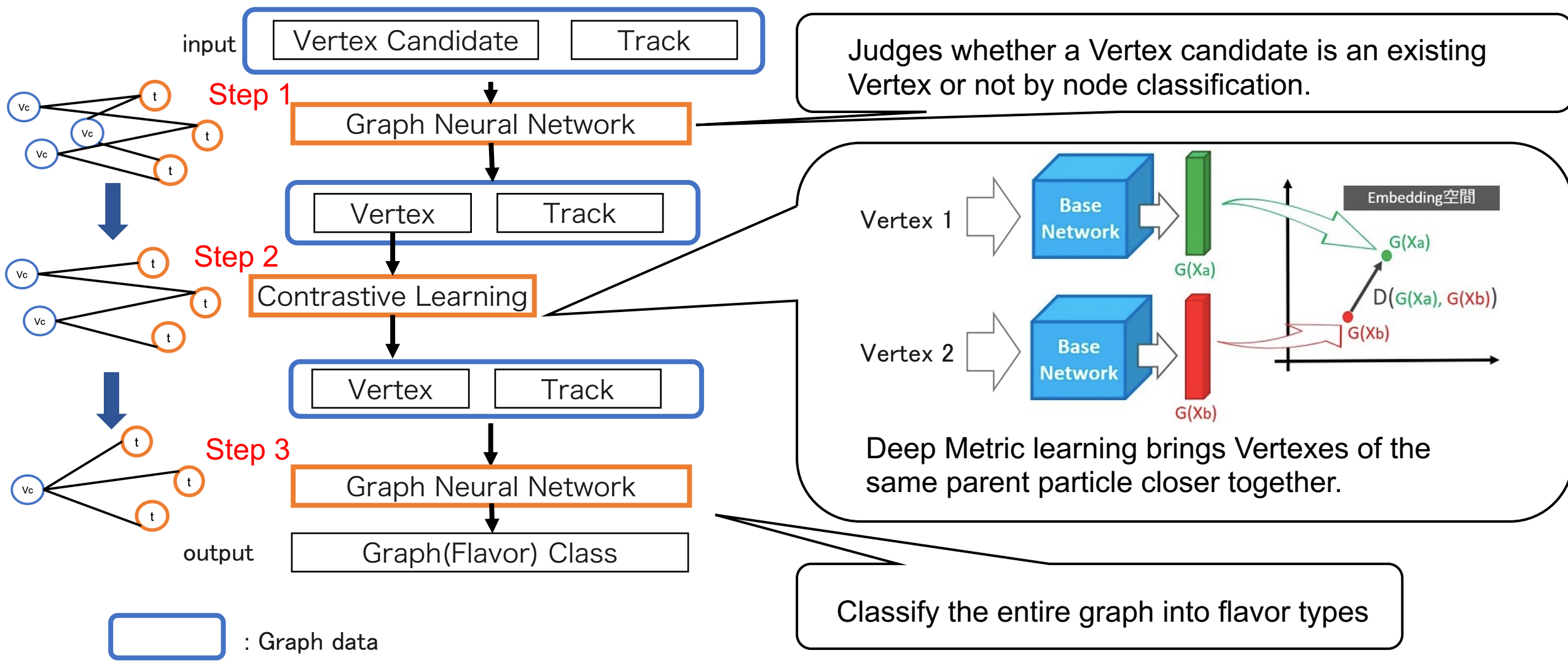
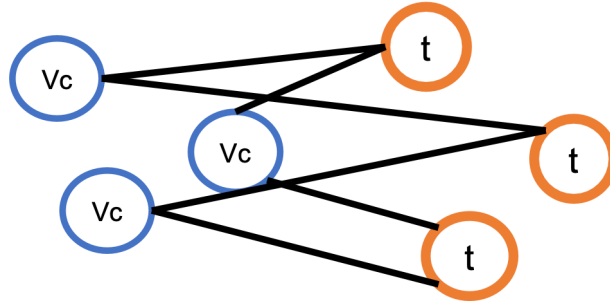$400-500\mu m$

Positron

Electron

IP
Primary vertex

In graph

Problem for constructing graph
・When a graph is constructed with Vertex as a node and Track as an edge, it is not possible to graph a single track.
・The number of tracks connected to one vertex varies depends on the vertex
→ Create vertex candidates from combinations of all tracks including non-existent vertices,
   and discriminate through node classification

・It is necessary to handle heterogeneous nodes of Vertex and Track
→ Treat Vertex and Track as homogeneous nodes and discriminate through node classification

Status Report

input | Vertex Candidate | Track

Step 1

Graph Neural Network

Judges whether a Vertex candidate is an existing Vertex or not by node classification.

Vertex | Track

Step 2

Contrastive Learning

Vertex | Track

Step 3

Graph Neural Network

output | Graph(Flavor) Class

Vertex 1 → Base Network → $G(X_a)$

Vertex 2 → Base Network → $G(X_b)$

Embedding空間

$G(X_a)$

$D(G(X_a), G(X_b))$

$G(X_b)$

Deep Metric learning brings Vertexes of the same parent particle closer together.

Classify the entire graph into flavor types

: Graph data

Status Report

Step 1
・Purpose: Judges whether a Vertex candidate is an existing Vertex or not by node classification.

・One graph has Vertex candidates and tracks in one jet.
・Track has 5-parameters (d0, phi, ω, z0, tanλ) as features.
・Vertex candidates has positions (x,y,z) and probability as features.

・I plan to use GCN for learning.
   An approach for semi-supervised learning on graph structure data.
   1. Take the weightend average of all neighbor's node features
   2. Pass the resulting feature vectors through a nerural network for training