

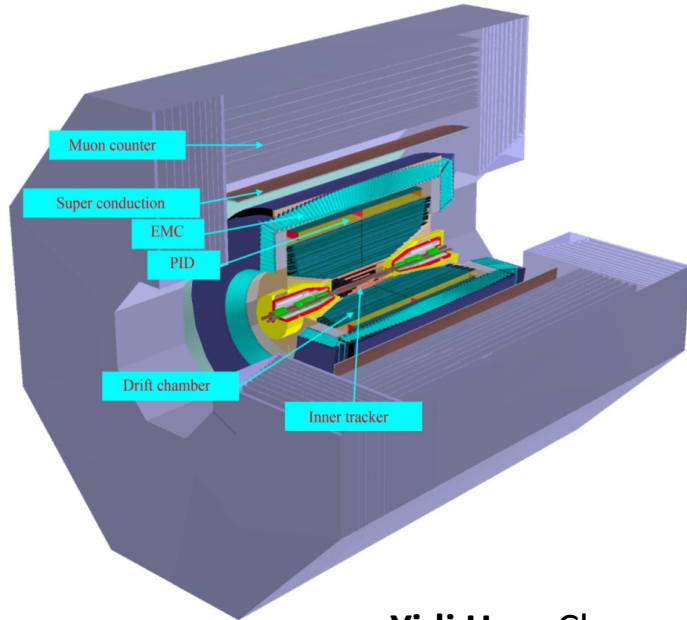
A 3D track reconstruction algorithm for the pre-research of STCF MDC L1 trigger

- Super τ -Charm Facility (STCF)

A new generation of high-luminosity electron-positron collider

CME: 2-7 GeV

Peak luminosity: $>0.5 \times 10^{35} \text{ cm}^{-2}\text{s}^{-1}$ at 4 GeV

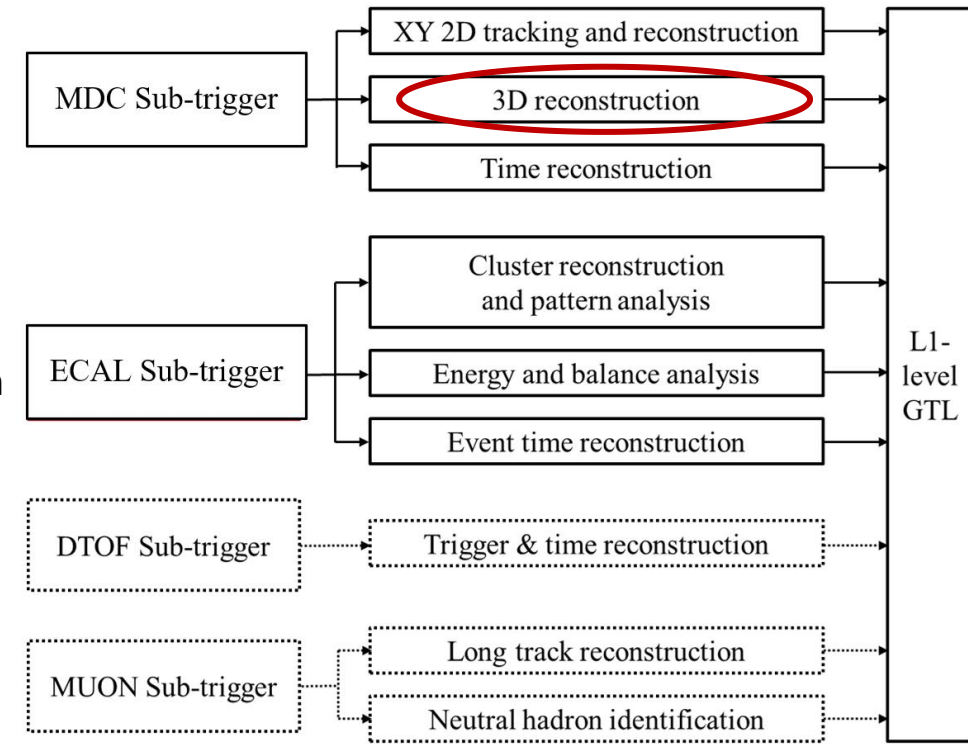


High luminosity generates:

- High physics event rate: over **400 kHz**
- High background: \sim **400 kHz/channel** in MDC

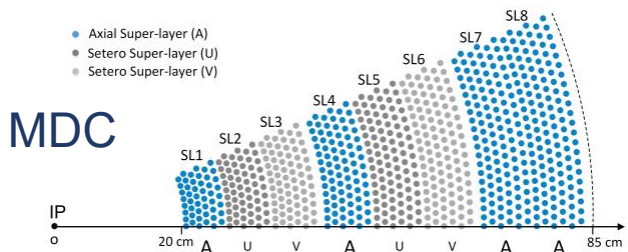
Good background suppression capability

Low latency



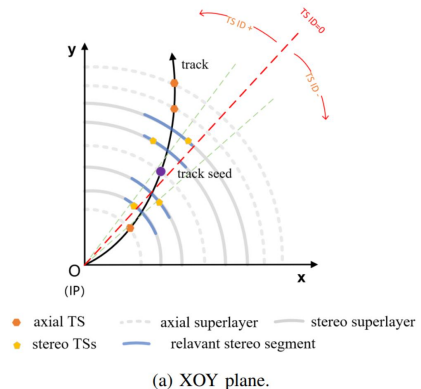
3D track reconstruction algorithm

Preprocessing



Track segment (TS) finding

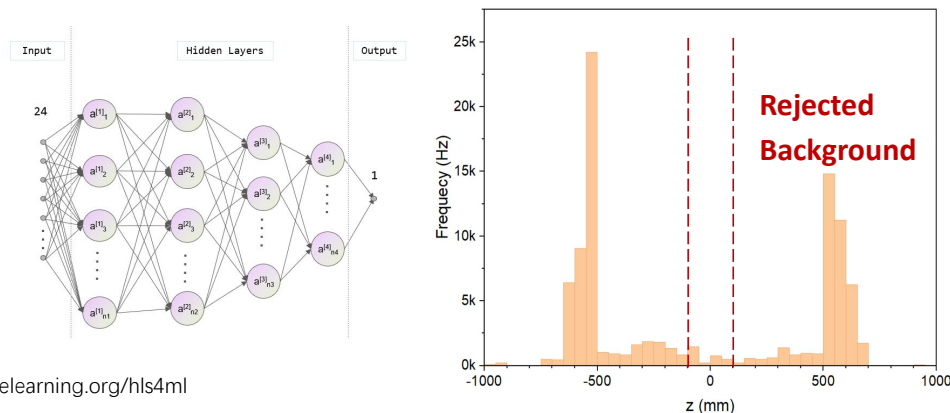
2D reconstruction (axial layer TSs and p_t) & stereo TSs matching



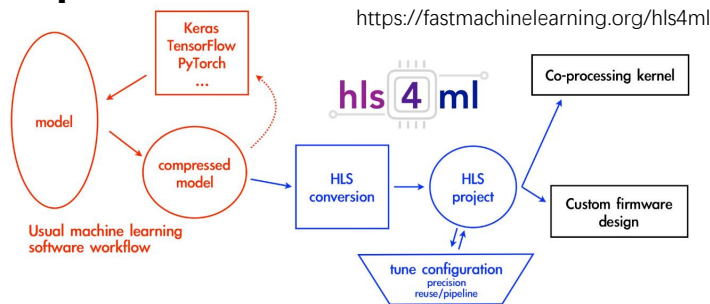
MLP training

24 input: TS ID & TDC timing of 12 TSs
1 output: z-vertex estimation

Qkeras---quantization aware training
Pruning---reduce model's size



FPGA implementation



Test result

Test data set: 100k clear single tracks
MLP structure: 24-48-32-16-8-1 Sparsity: 0.4
CLK: 400MHz FPGA: XCKU060
Dead time: 4 clks **Latency: 30clks**

