Hardware Track Finder

- New physics with final states having b-jets, tau-jets, etc
- CPU consumption of software tracking with PC farms
- Combinatorics with increasing luminosity

High Quality Tracks at High Rate

- CDF SVT: precise track impact parameter measurement for b-quark studies
- ATLAS FTK: a proposed upgrade project of hardware track finder

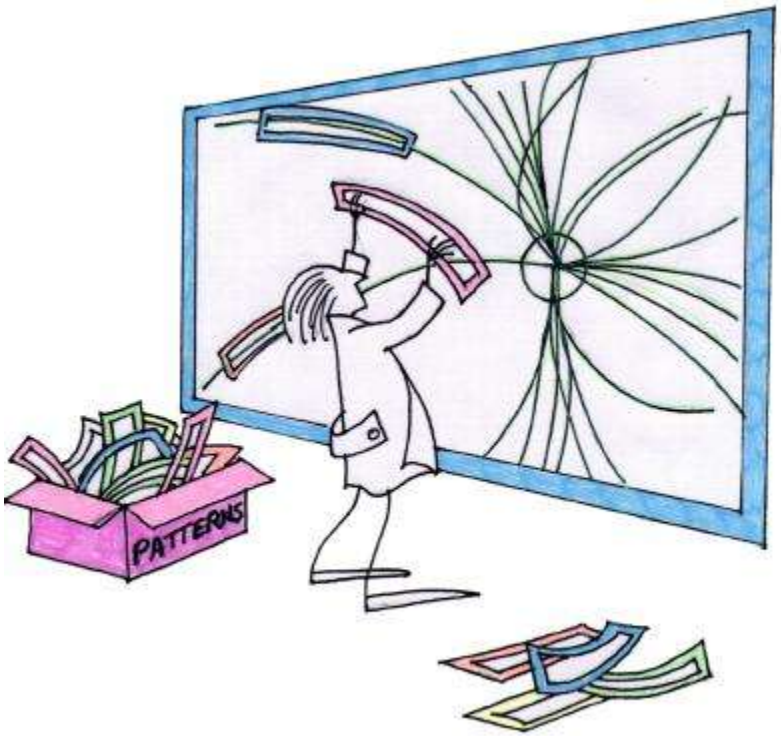
Associative Memory

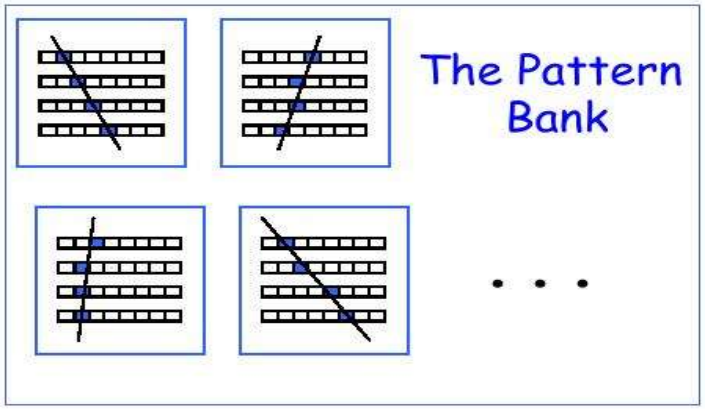
- Returning associated data to user input data
- Simultaneous parallel operation in the entire memory
- Faster than the regular RAM in all search applications
- Expensive due to the silicon area and power consumption
- Computer networking devices
- Custom chip in HEP: INFN AMChip used for CDF SVT

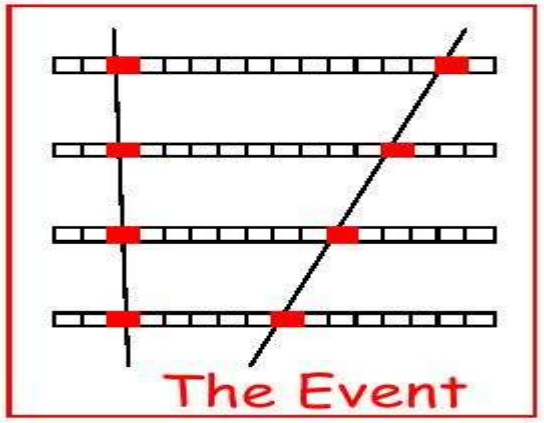
State-of-the-art

	AM INFN	CAM*
Availability	Non-commercial	good
Technology	180 nm	55 nm
Speed	40 MHz	500 MHz
Size	(6X16) x 5K	72 x 512k 576 x 64k
Flexibility	Low	High
Price	ASIC submissions	O(100-200 €)

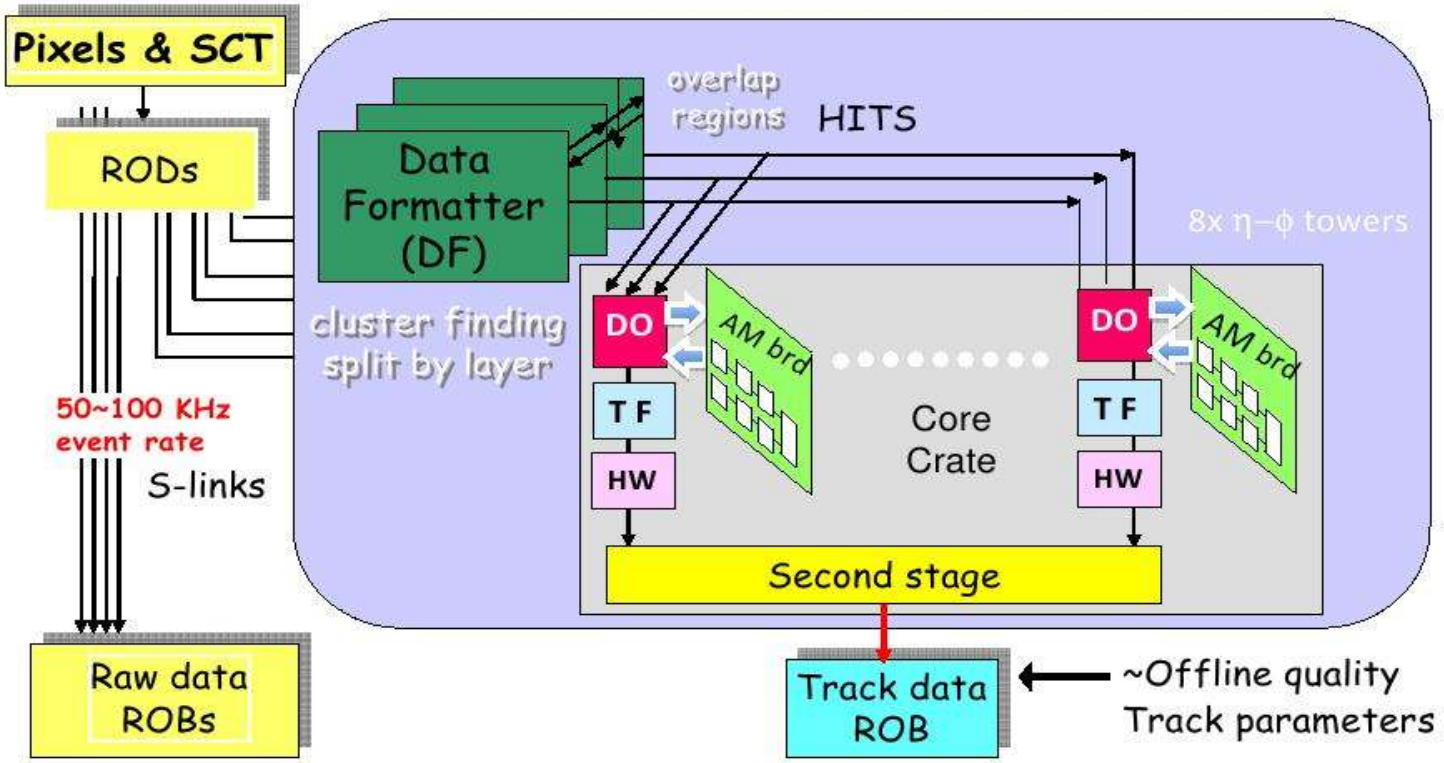
Track Finding







ATLAS FTK


Pixels & SCT
RODs
50~100 KHz
event rate
S-links
Raw data
ROBs
Data
Formatter
(DF)
cluster finding
split by layer
overlap
regions
HITS
8x η−ϕ towers
DO
AM brd
TF
HW
Core
Crate
DO
AM brd
TF
HW
Second stage
Track data
ROB
~Offline quality
Track parameters

Status

- **Testbed to be built with the current AMChip**
- **40M patterns possible with the current AMChip but 10^9 needed for sLHC luminosity**
- **R&D proposed by INFN with 90 nm technology**
- **2.5D and 3D technology being Investigated (Fermilab)**