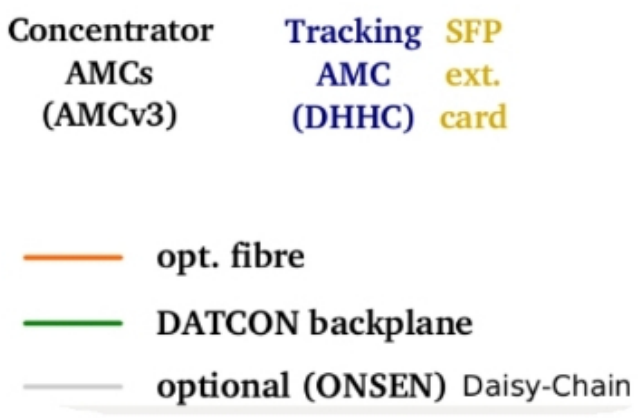
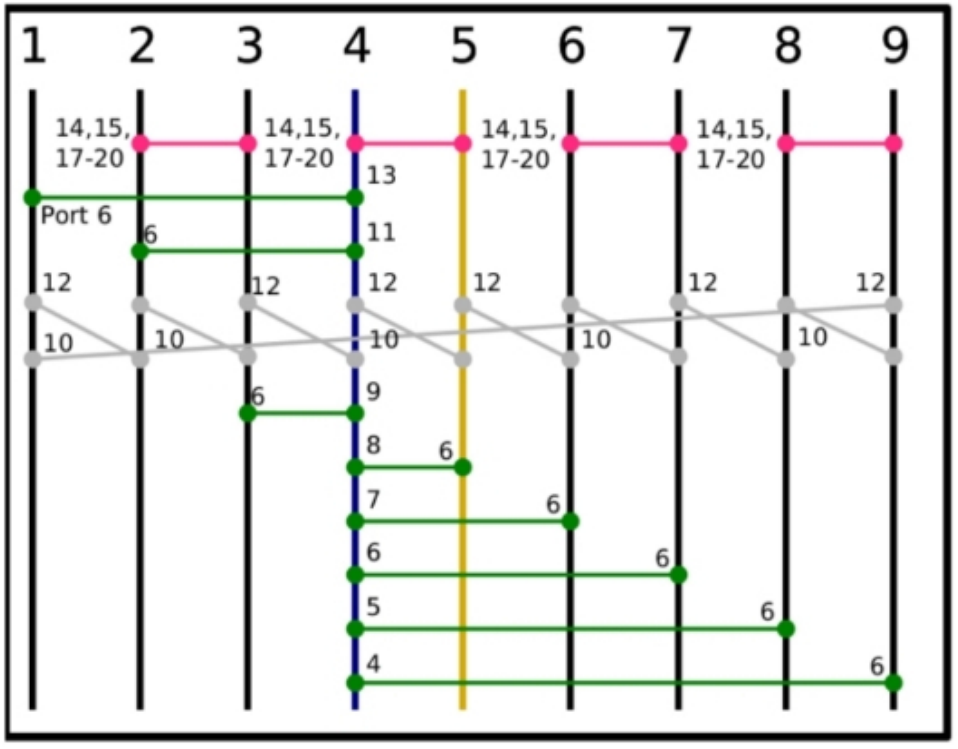
DATCON (Data Concentrator)

Bruno Deschamps, Jochen Dingfelder, Carlos Marinas,
Christian Wessel, (Michael Schnell)

DATCON custom μTCA backplane

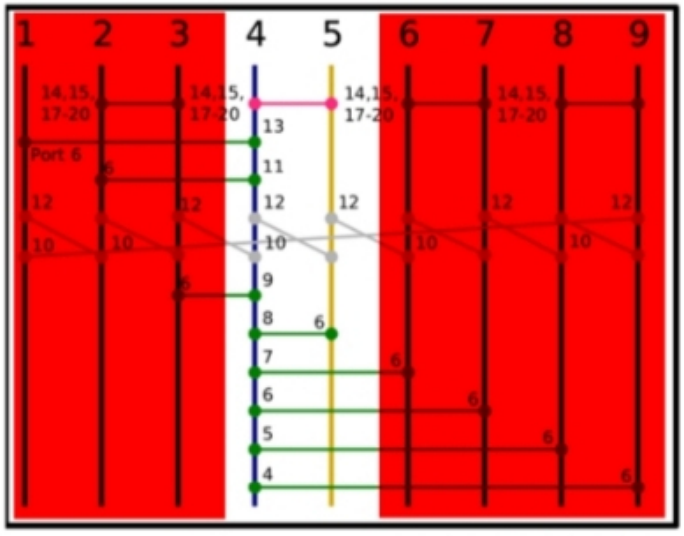




manufactured by Pentair/SCHROFF (Germany)
3 shelfs delivered and tested (2 for ONSEN).

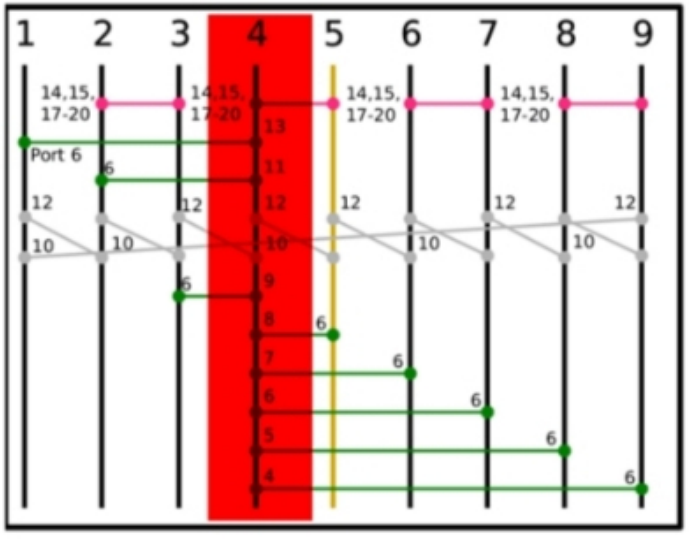
DATCON concentrator board

- for data collection
- 15 AMC boards, produced by IHEP Beijing (similar to ONSEN AMC, v3.1)
- 4 optical links $\times$ 3.125 Gbps (instead of 2 $\times$ 6.25 Gbps)
- smaller FPGA, Virtex-5 LX50 (same as belle2link)



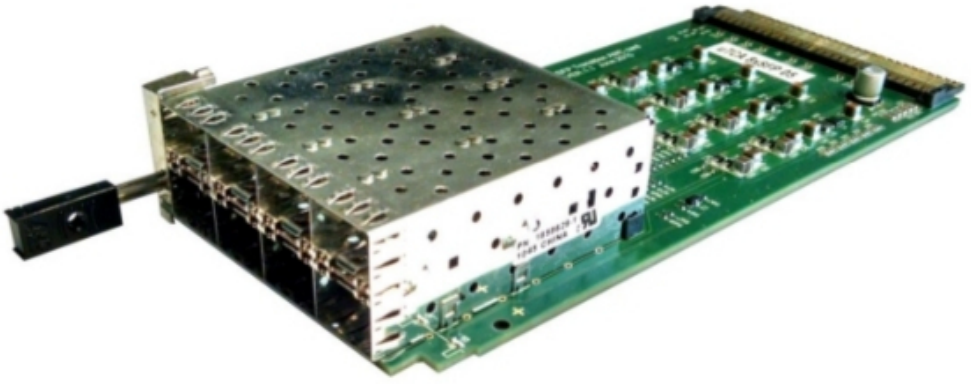
DATCON tracking board

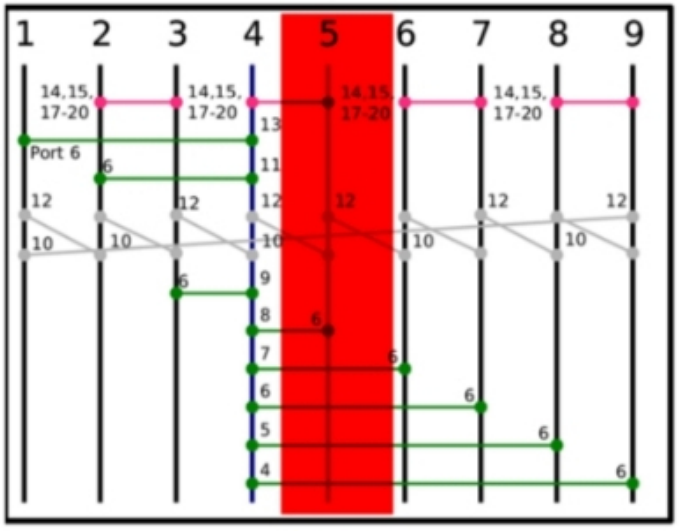
- for tracking and ROI generation
- identical to present DHE



DATCON SFP+ extension board

- for output of ROIs to ONSEN
- 8 × SFP+

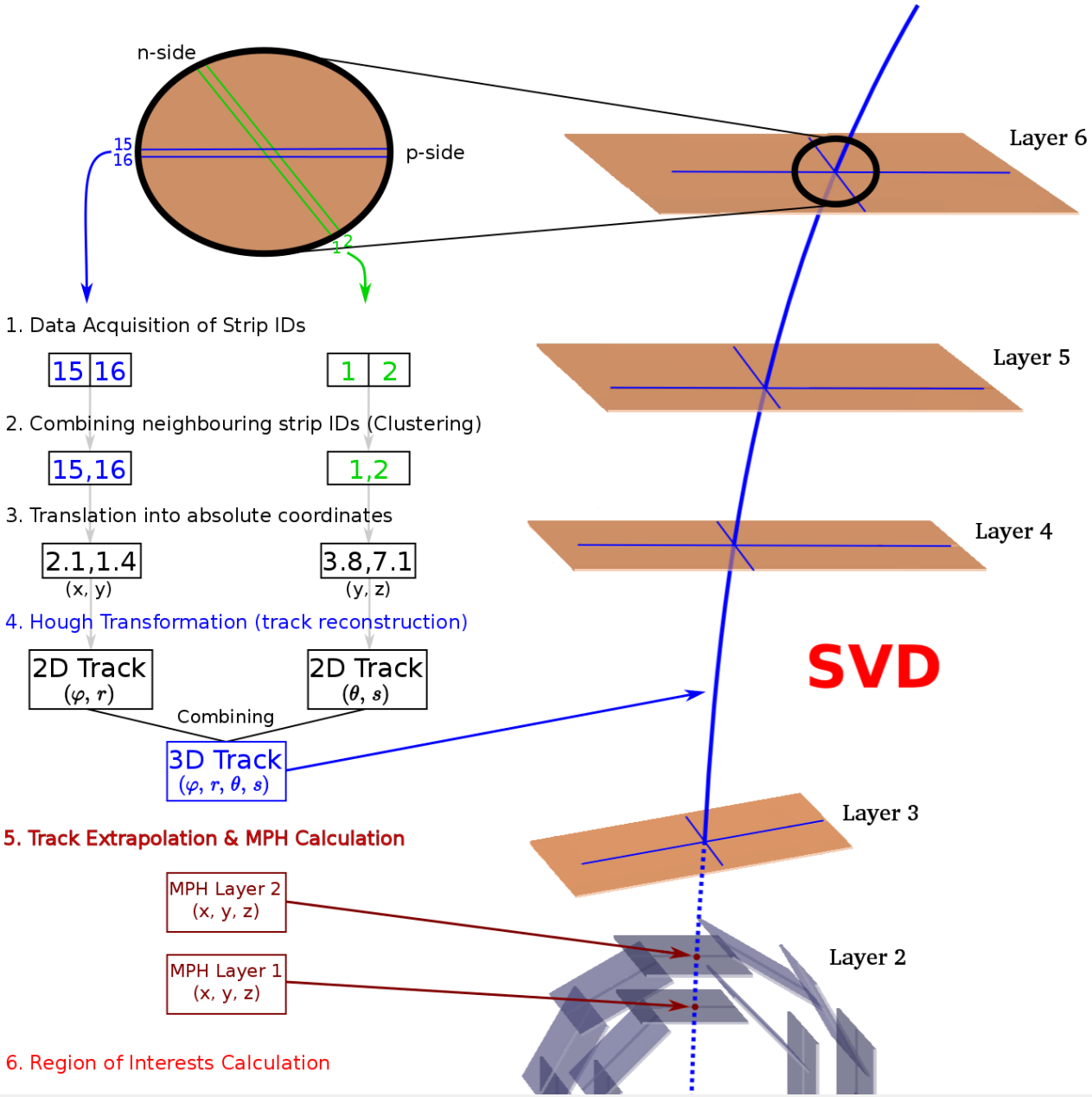




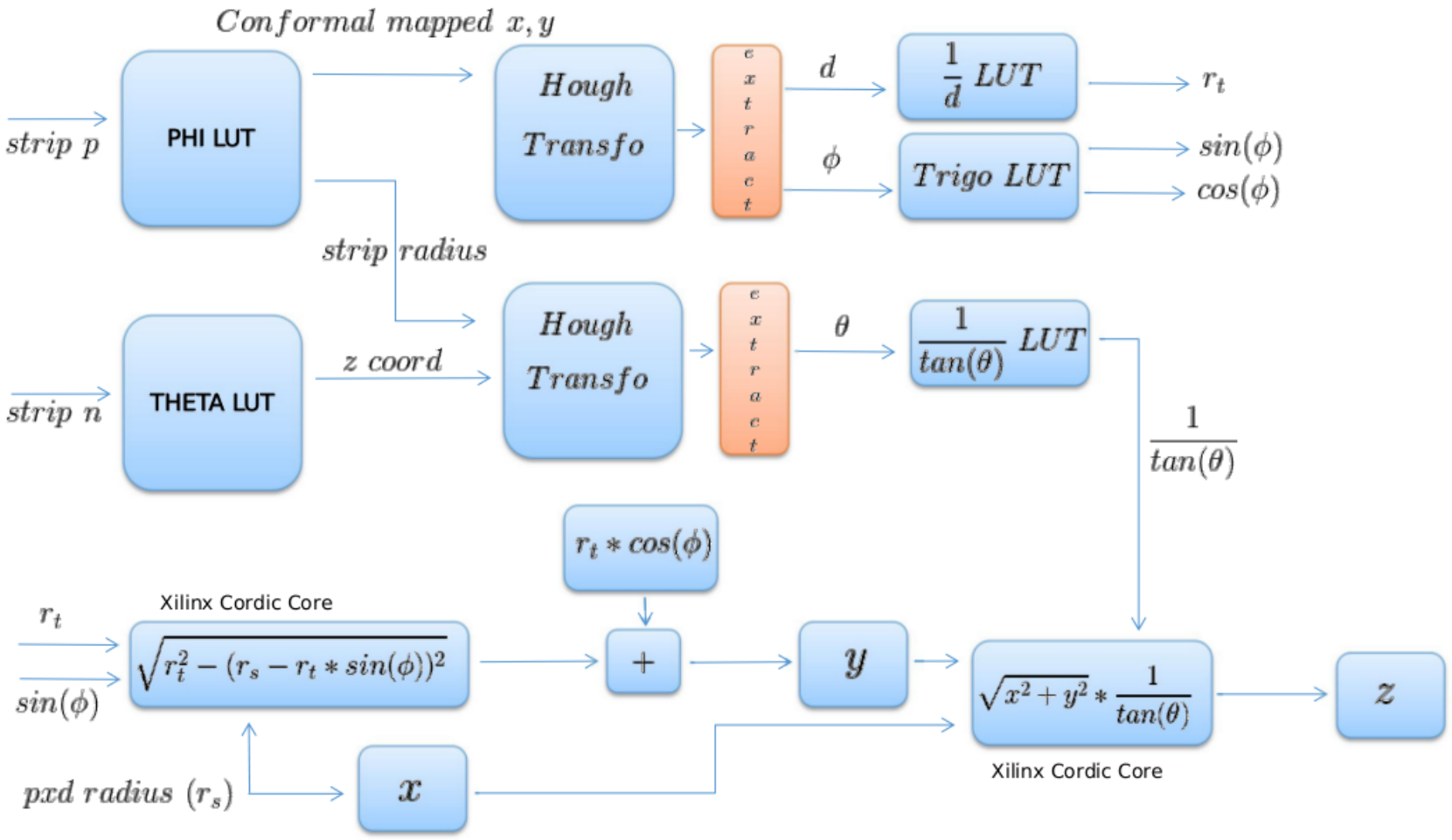
DATCON, Status of hardware

- Complete system (all boards) delivered
  - 3 tracking boards
  - 5 extension boards
  - 15 concentrator boards
- presently only 4 tested
- On every single AMC oscillator has to be replaced

DATCON algorithm

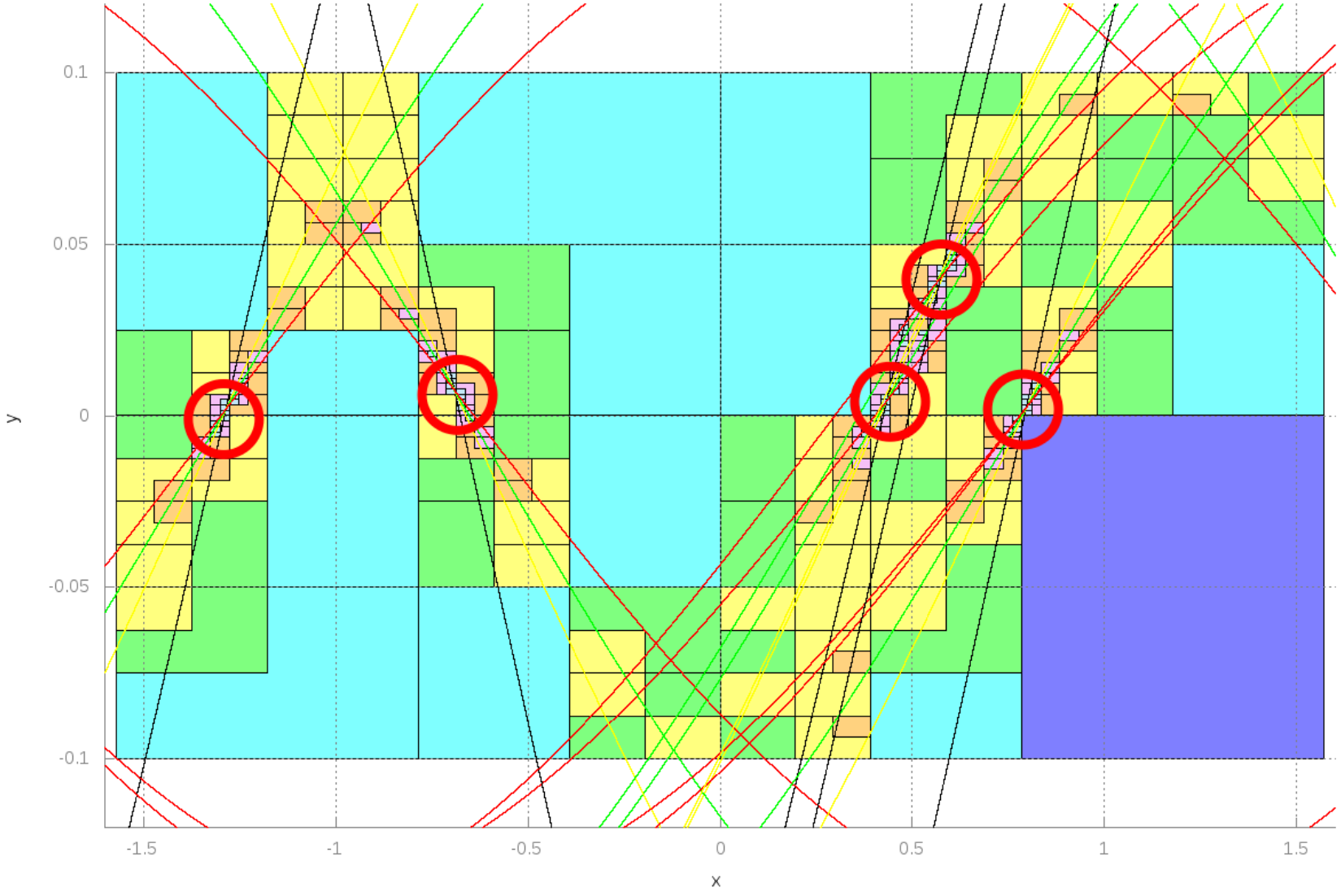


DATCON extrapolation algorithm



C. Wessel (Bonn)

DATCON, Hough space example for 5 $\mu^{\pm}$



C. Wessel (Bonn)

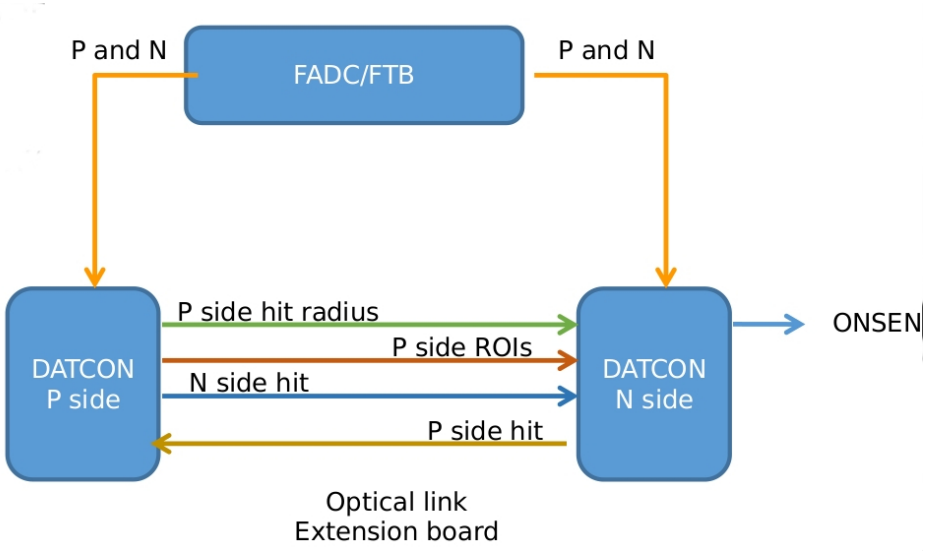
DATCON, find clusters in Hough space

- binning for phase 2: 64×64 bins
- 1 cluster is 1 track candidate
- search based upon connected component theory and DFS (Depth First Search)
- parallelized: find the starting cell of a cluster no need to go through the entire matrix. All cells of a column are checked in parallel to find the first active one. Thus, number of clock cycles always lower or equal to $n \cdot m$.

Christian Wessel (Bonn)

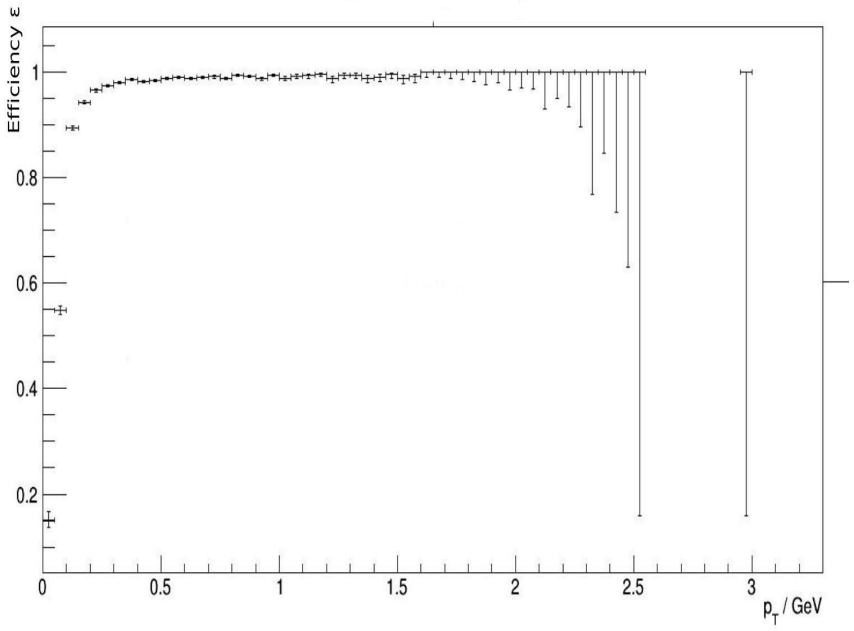
DATCON new concentrator firmware

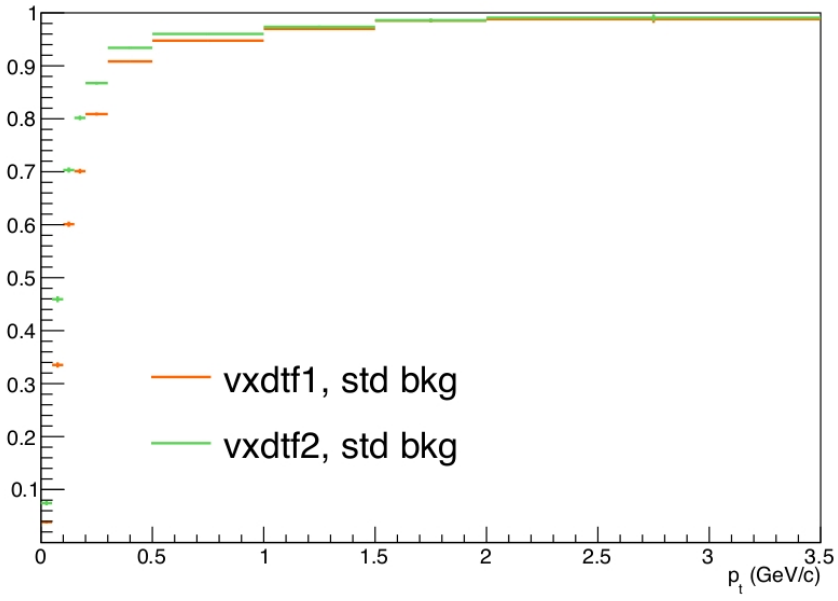
- input to DATCON algorithm is p strip and n strip
- problem: new SVD FADC v4, but DATCON μTCA backplane already ordered
- before: side (p-side or n-side) depend on FADC ID
  new: side depend on FADC id and APV ID
- new firmware: one FTB sends now p-side and n-side



Bruno Deschamps (Bonn)

DATCON and HLT tracking efficiency

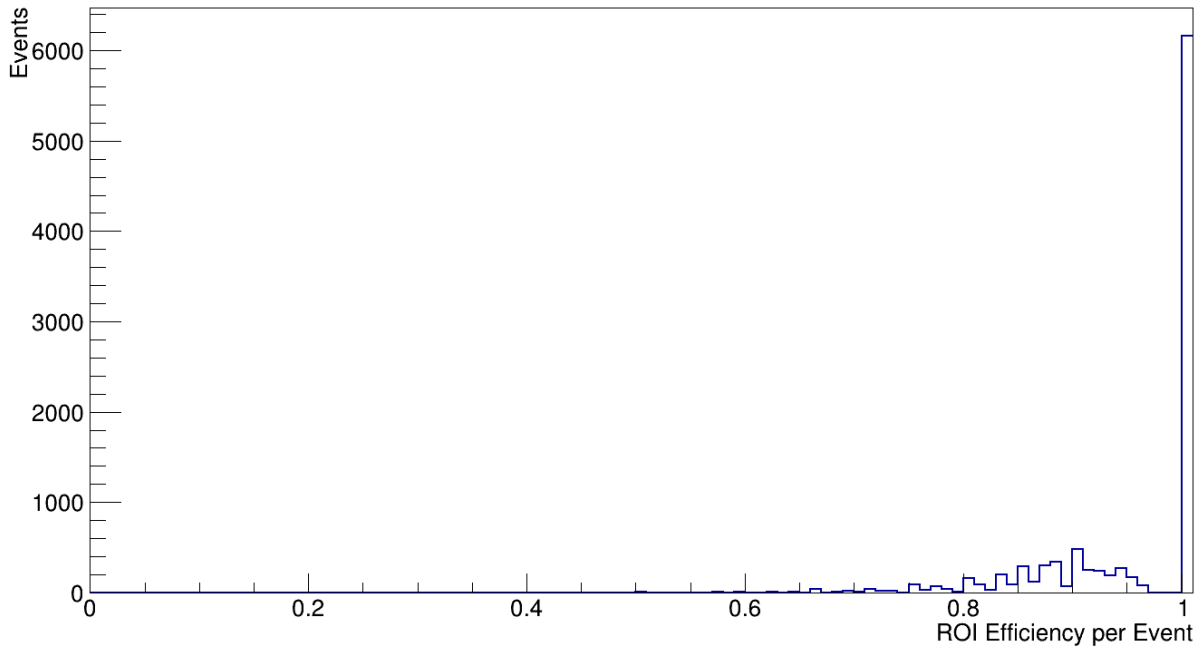




- MC8 campaing, background campaign 15 (Feb 2017)
- for DATCON: based upon 10k Y/4S) events, 50 ns integration time in SVD

$$\varepsilon = \frac{\sharp \text{ of matched tracks } (\Delta\varphi < 1^{\circ}, \Delta\vartheta < 1^{\circ})}{\sharp \text{ of all tracks}}$$

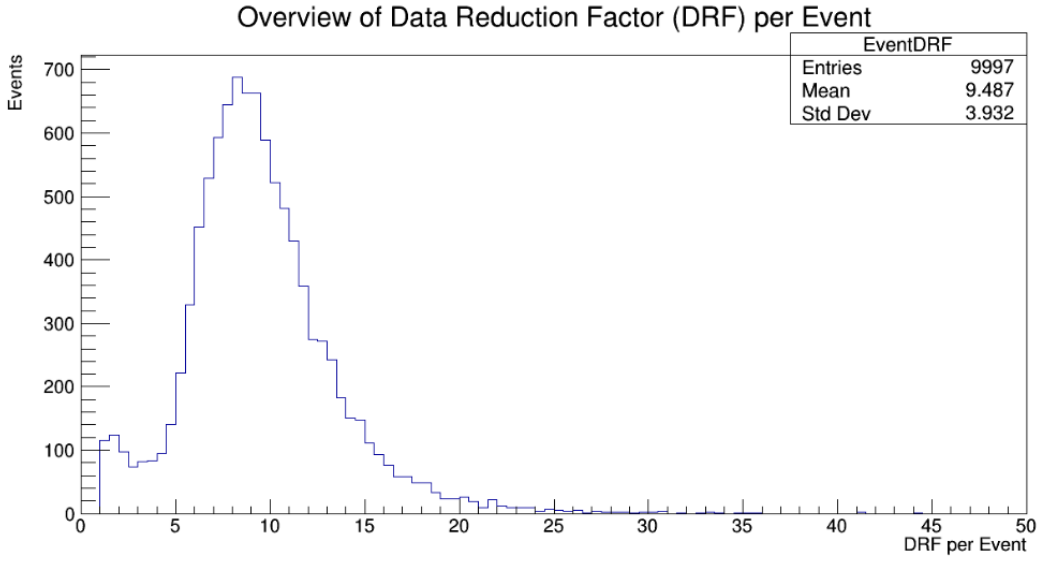
DATCON ROI efficiency, Y(4S) MC



- reminder: DATCON is not designed for competitive tracking
- figure of merit is ROI efficiency (not track efficiency)
  $\rightarrow$ here 94%
- $\varepsilon_{ROI} \simeq 96\%$ fr 12 $e^{\pm}$, $\mu^{\pm}$ or $\pi^{\pm}$ per event
- fake rate can be high

C. Wessel (Bonn)

DATCON, data reduction factor

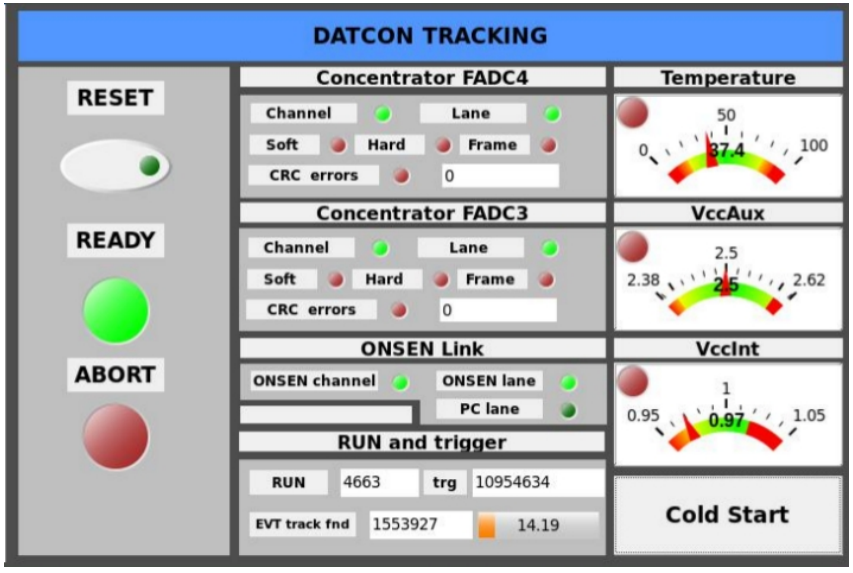


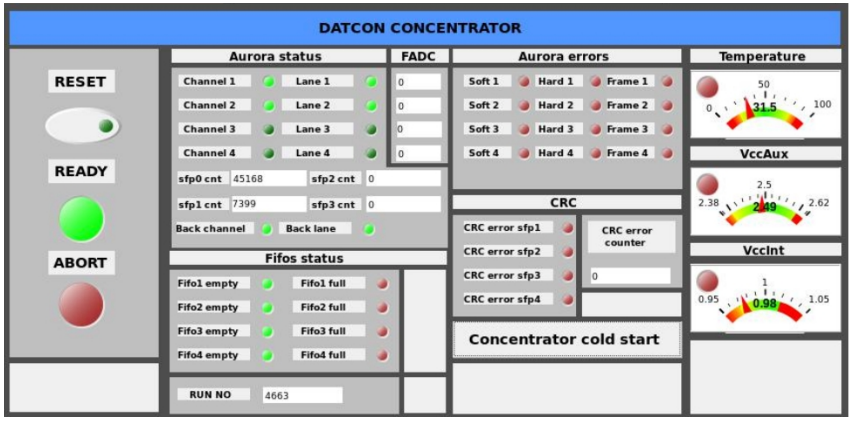
$$\mathrm{DRF} = \frac{\sharp \text{ of hits}}{\sharp \text{ of hits inside ROI}}$$

- average 9.5, but for quite large ROIs (150×100, u×v)
- to increase DRF: reduce ROI size, reduce ♯ of fake tracks
- increase at low DRF: caused by events with very high fake rate, vanishes for different parameter set (almost no effect on efficiency)

(Christian Wessel (Bonn)

DATCON run control (RC)



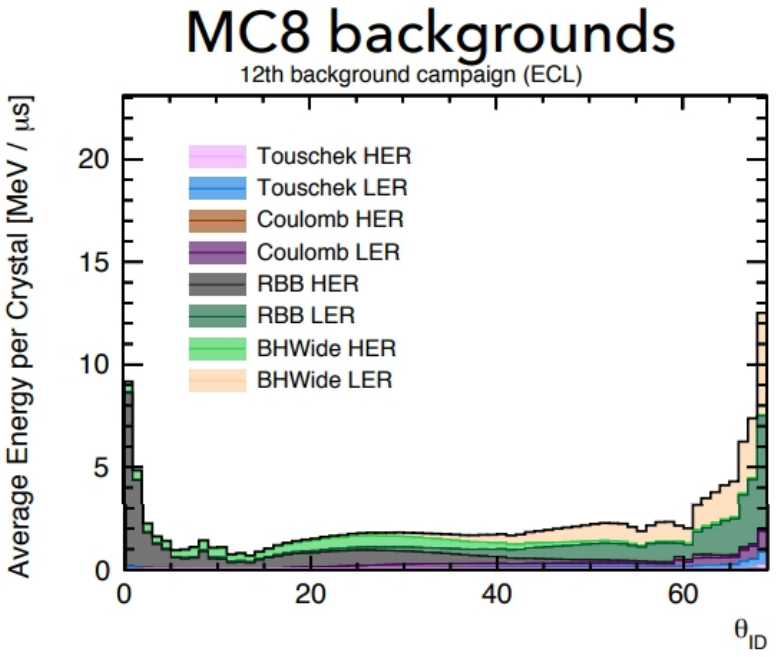


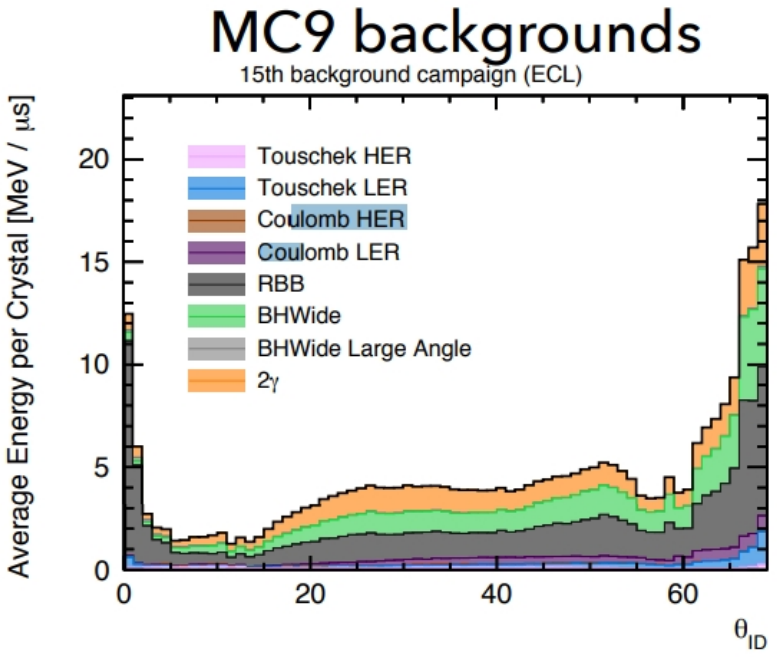
Bruno Deschamps (Bonn)

- uses Epics and IPbus (LX50 has no embedded PowerPC)
- basically ready for phase 2, but presently local DATCON RC only (on a PC), to be integrated in global RC before phase 2

BACKUP

Backgrounds in MC3 and MC9





A. Fodor, T. Ferber