First steps at understanding 2022 Data/MC differences

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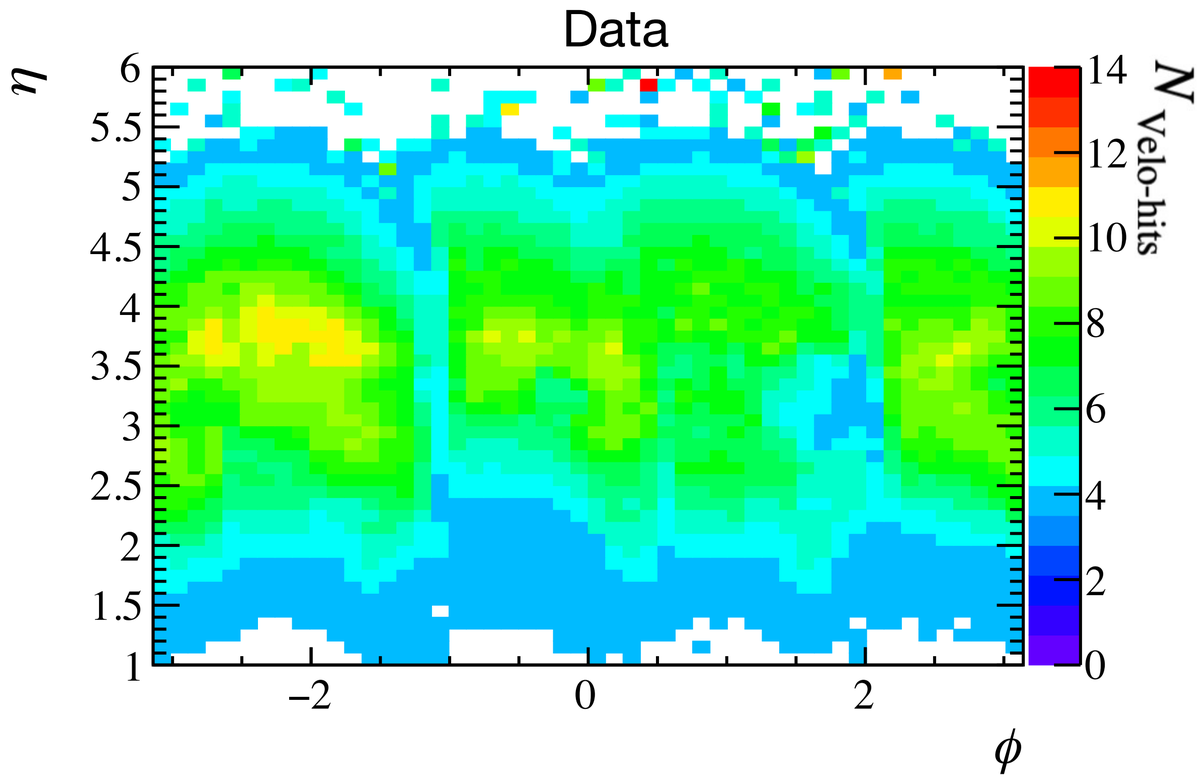
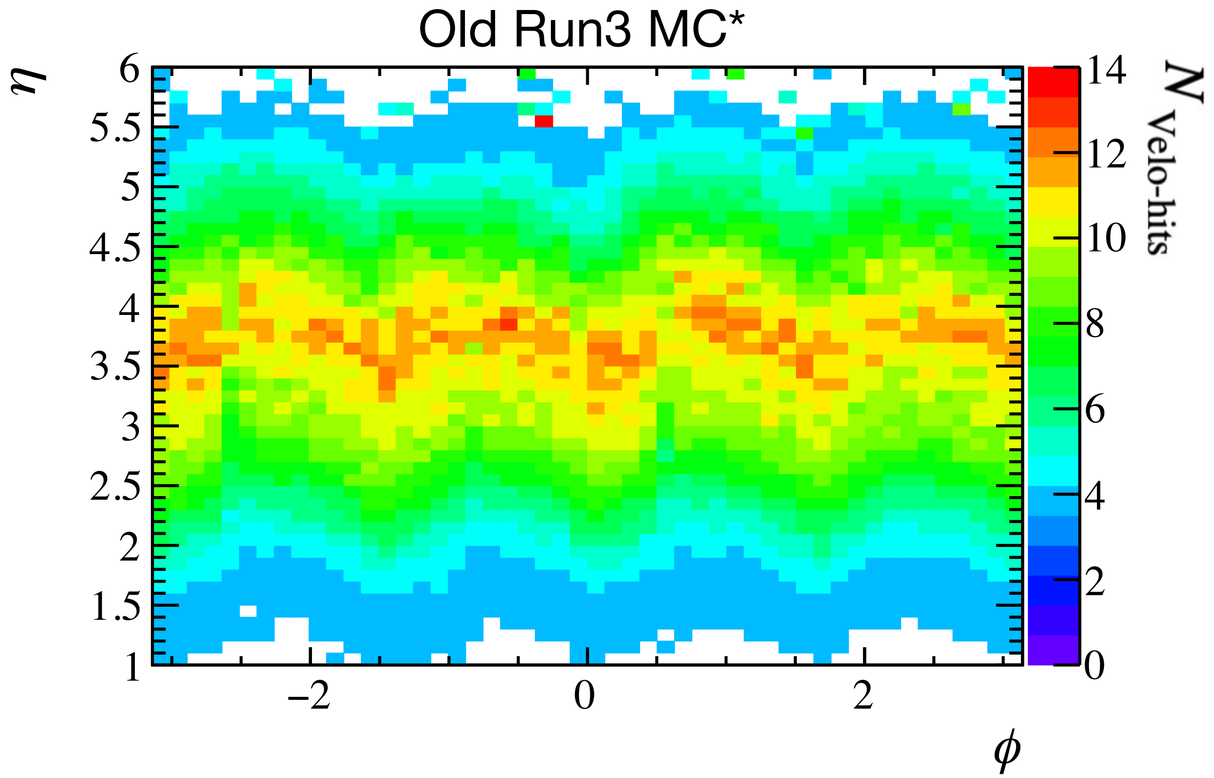
What am I focussed on





- Study the differences in 2022 Data and MC
  —> Study the effects by comparing Velo-hit distributions in the η/ϕ plane

*Details on the exact definition on the next slide

Samples considered

- Data:
  run -> 256289
  taken -> 28/11/2022 04:29:31-> 04:48:53

- (Old) Run3 MC:
  Sim: Sim10aU1
  Event Type: minbias
  Conditions: 7TeV-MagDown-Nu7.6-25ns-Pythia8
  TestDBTag: upgrade_Sim10aU1_minbias_xdigi

- (new) 2022 Simulation:
  Sim: Sim10b
  Event Type: minbias
  Conditions: 6.8TeV-MagDown-Nu2.1-25ns-Pythia8

- Tracks:
  Only Velo tracks

Known differences

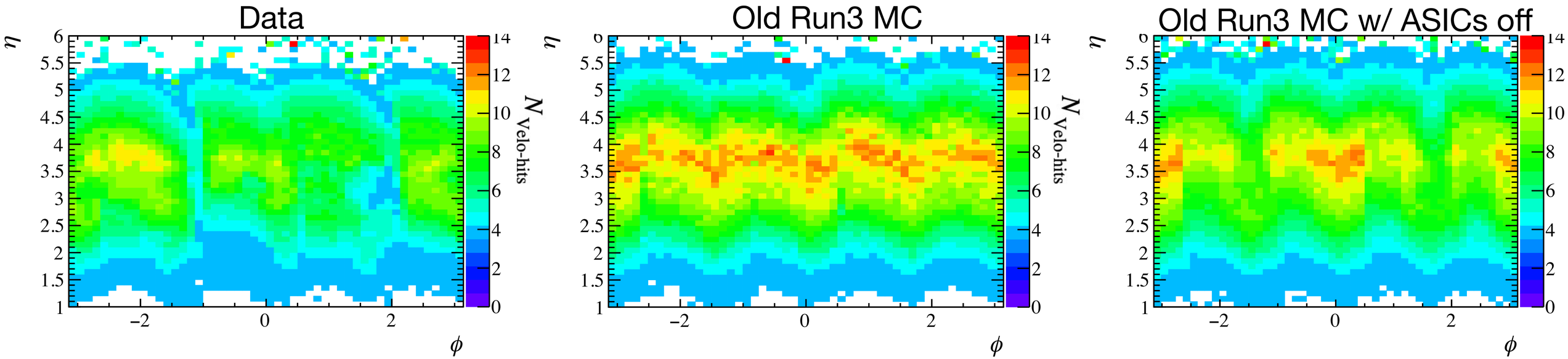
- Some effects we know are not yet implemented:
  - Hit efficiencies of the current detector (not today)
  - 1mm Shims creating a non-active area in between the A/C-sides
- Other effects might be present, but are not yet studied

- Goal: To check if these effects account for the current discrepancy

Effects considered

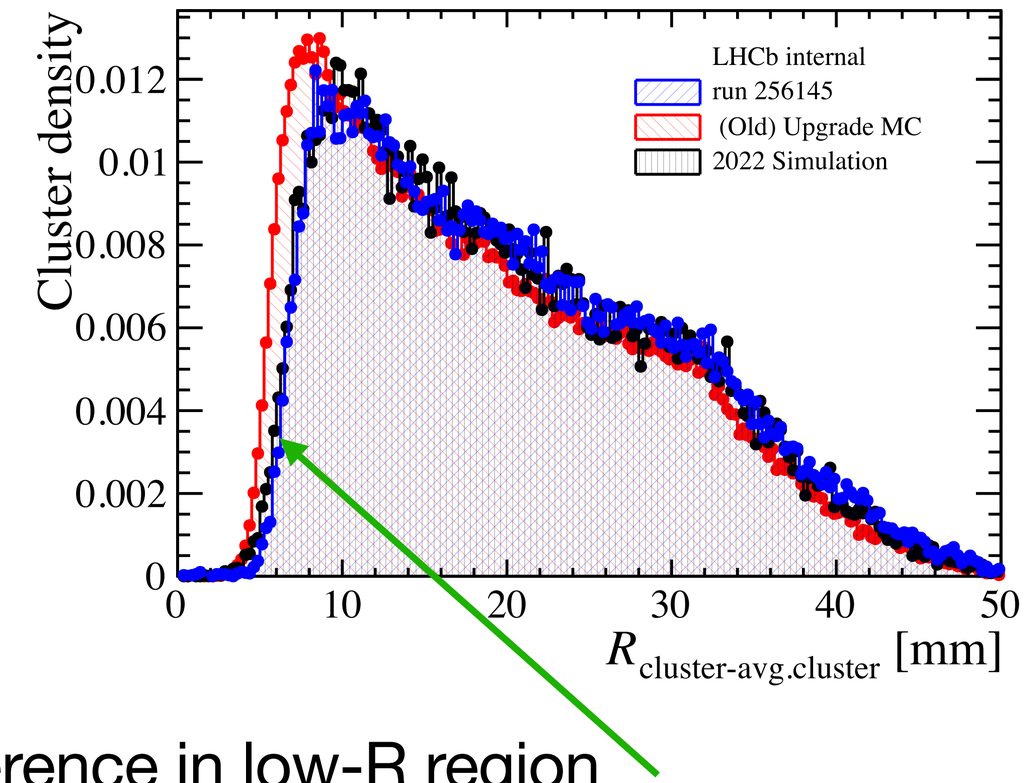
- Problematic ASICs:
  —> Completely turned off
  —> Not time-aligned
- VELO shims causing an opening
- Hit efficiencies of the ASICs (not today)

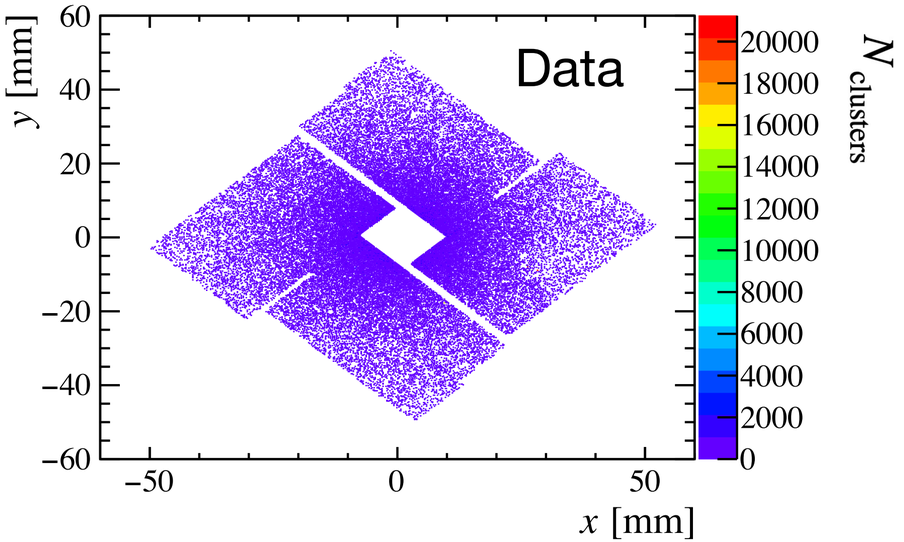
Known ASIC complications

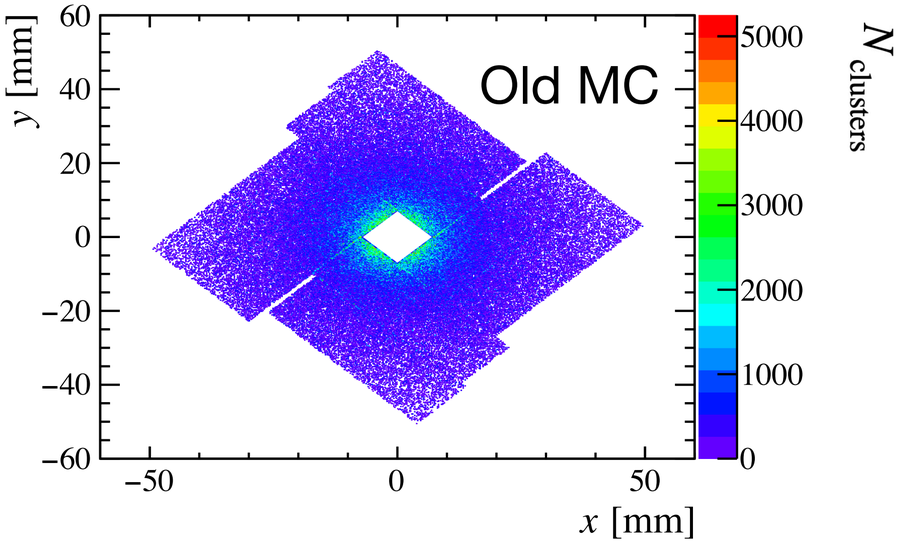


- Either turned off, out-of-time or poor cluster efficiency
- Some ASICs seem to be not time-aligned
  - turned 50% efficient for the moment
- Rough estimation, needs to be studied in more detail before implementation

The shims in the VELO

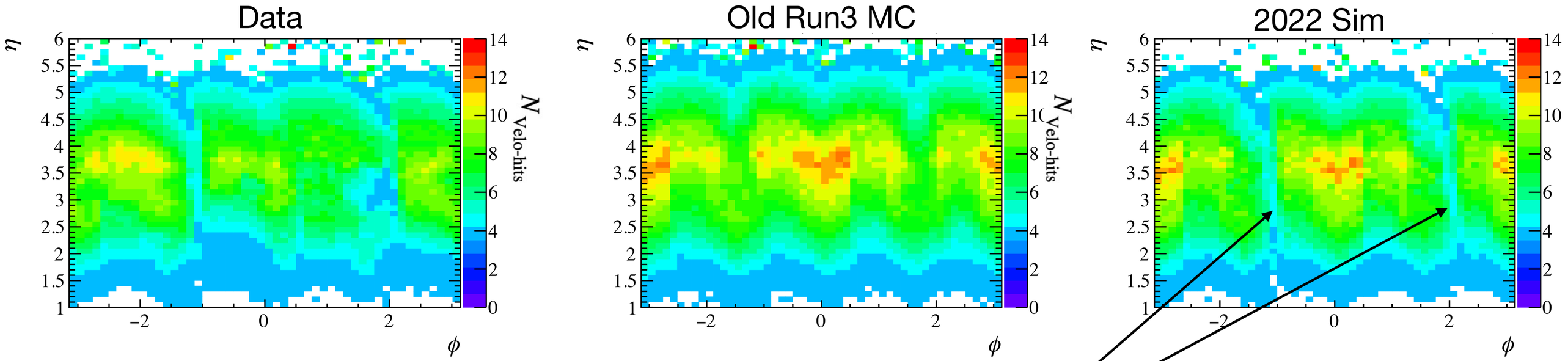






- Clear difference in low-R region
- No homogenous coverage in ϕ
- x/y-Plots show modules: {40, 41}

Effects of opening the VELO

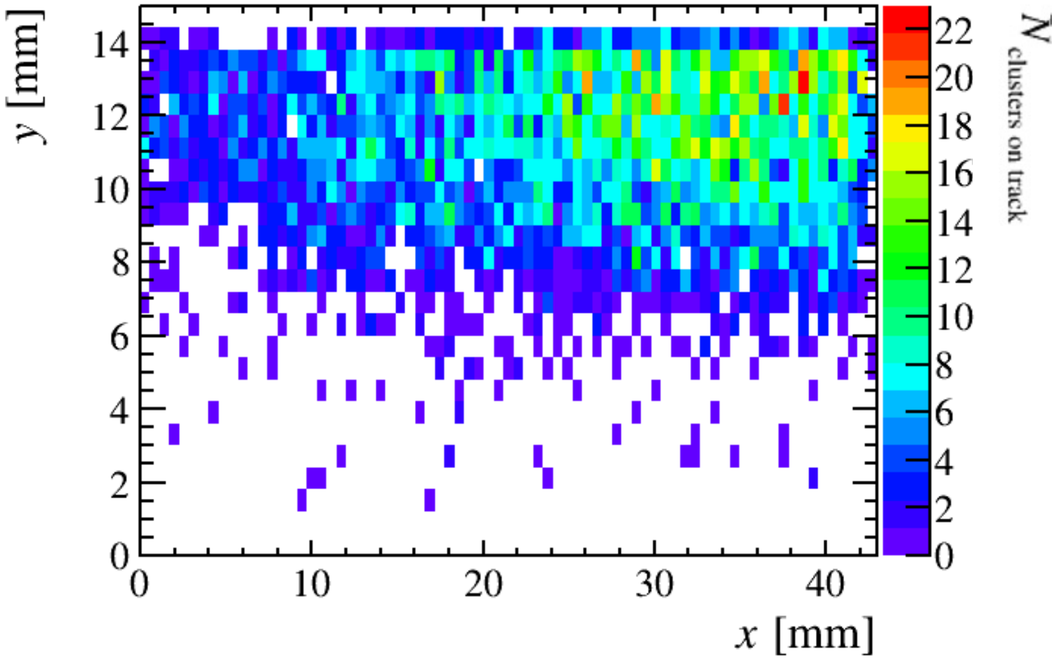


- Changes mainly around $\phi \approx \{-1, 1.5\}$
- Disconnected ASICs are turned off, OoT at 50%

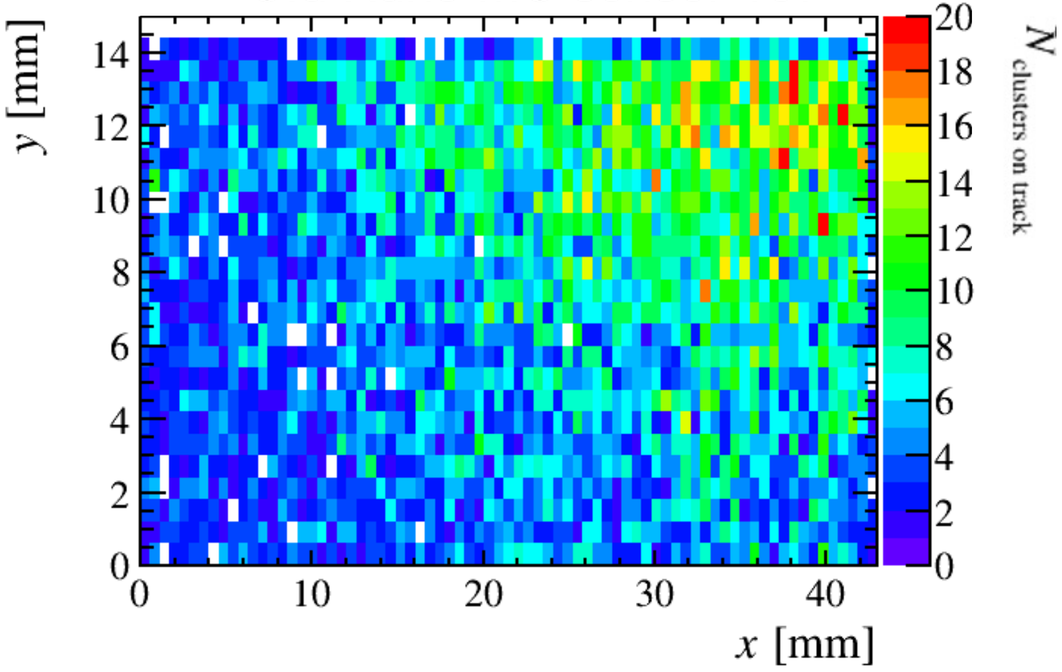
(In depth slide)

3.4 < Eta < 3.8 region

Data sensor 107



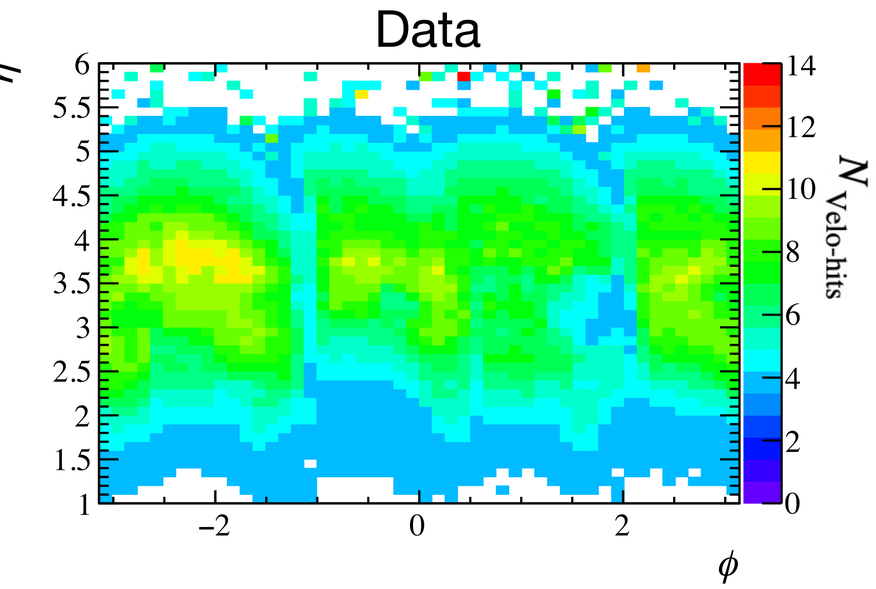
Old Run3 MC sensor 107

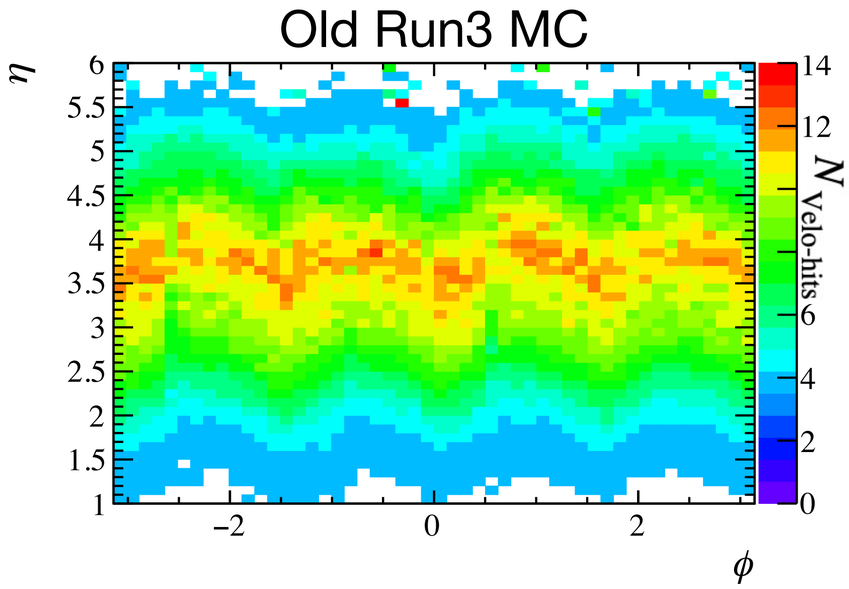


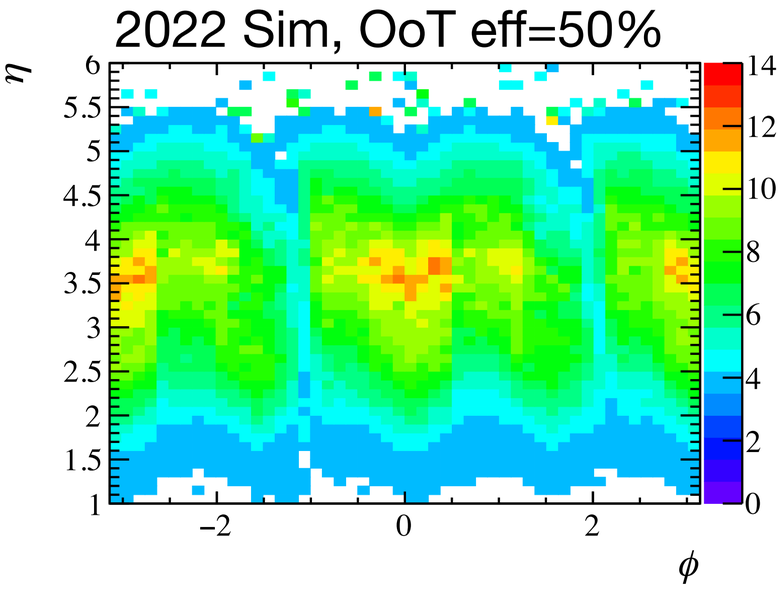
- Hit efficiency too high in MC in 2 regions:
  - $|\phi| > 3.05$
  - $-0.5 < \phi < 0.5$
- Plots shown are in local Velo sensor coordinates

So where are we?

Where we stand

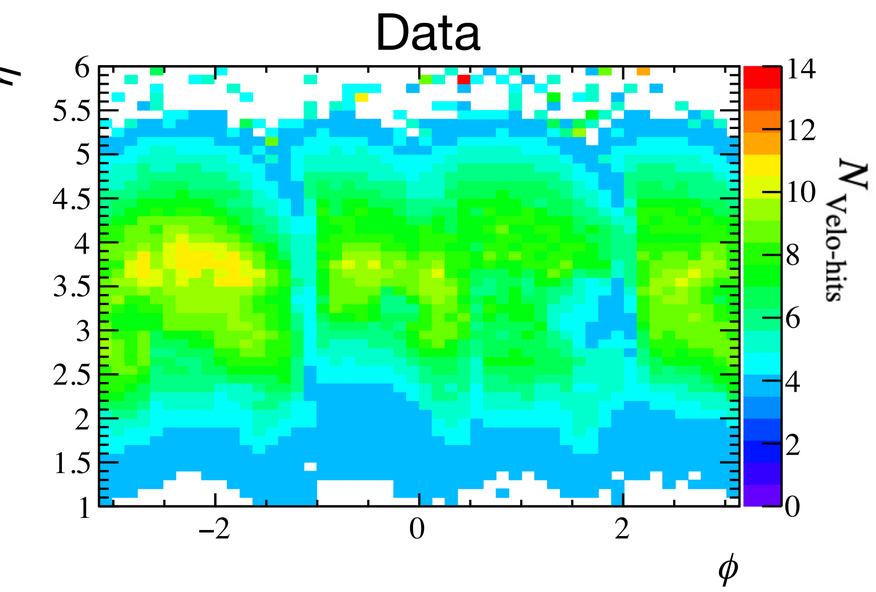


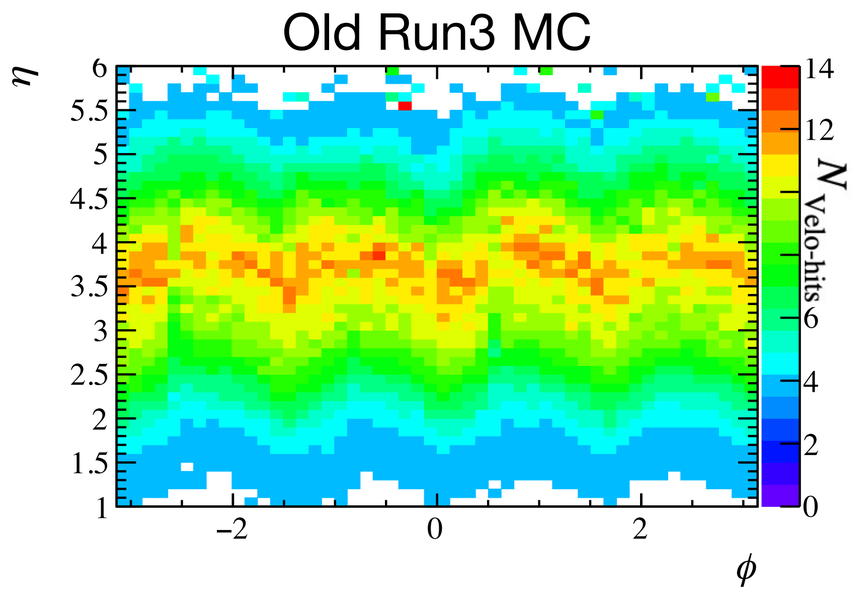


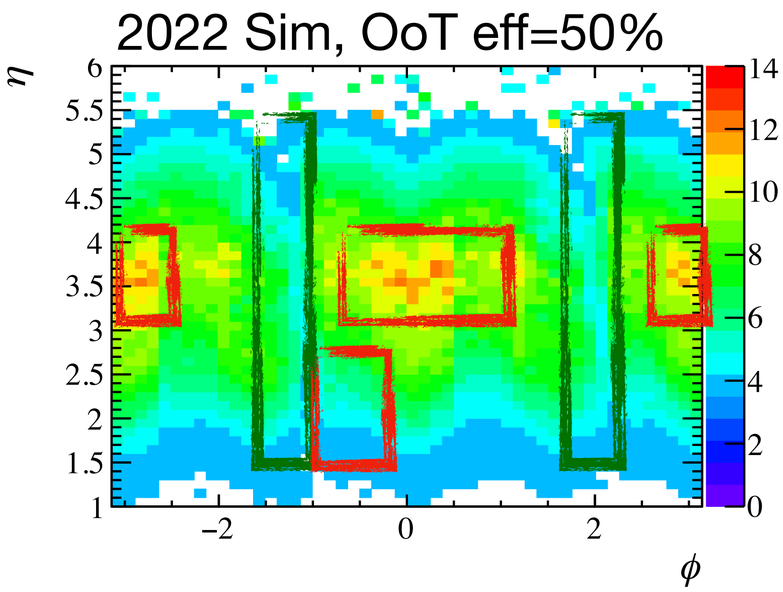


- Disconnected ASICs show to have great impact
- Opening of the VELO also shows to be significant

Where we stand



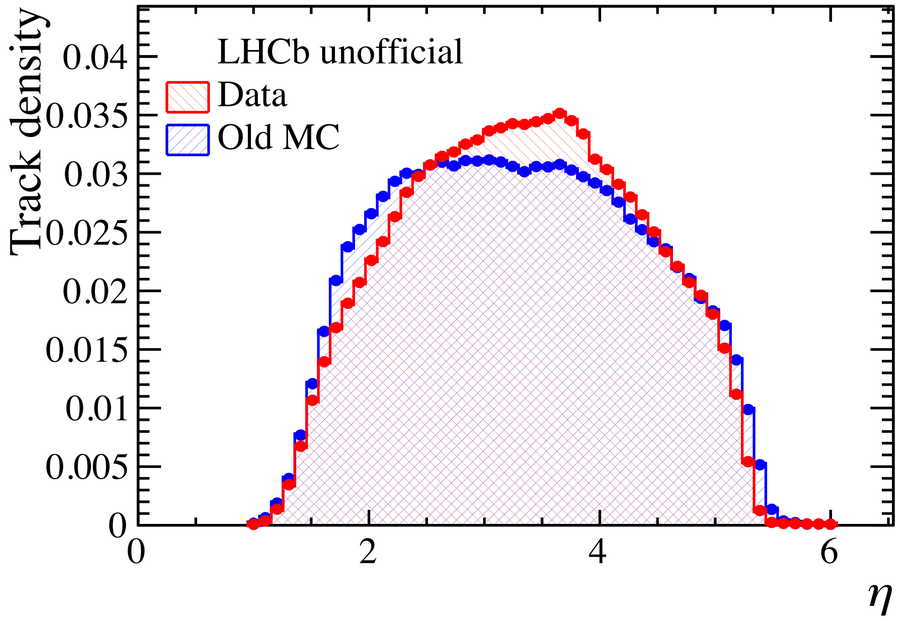




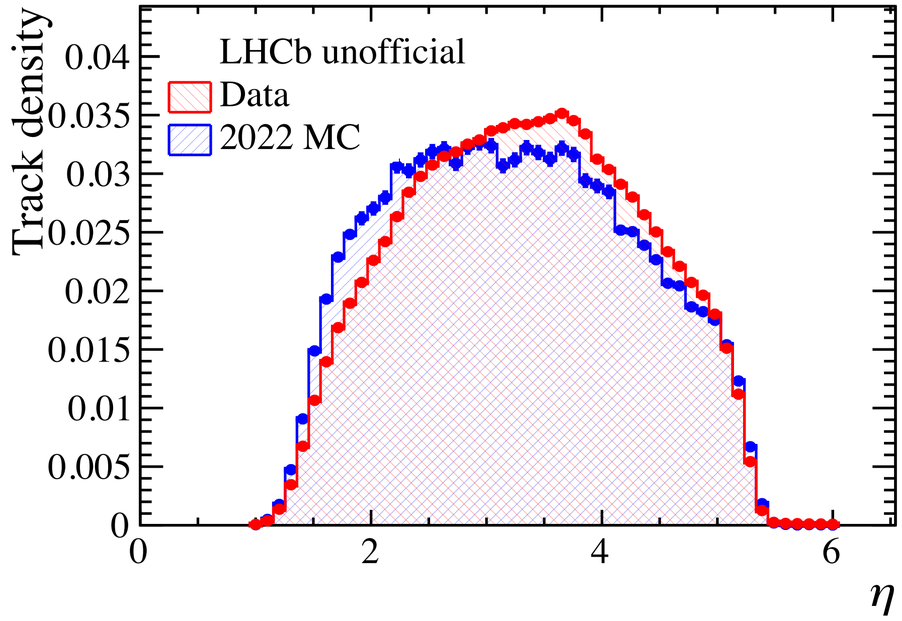
- Some improvements where little change is needed
- Other regions which still need more attention

And for completion

Old MC



2022 MC + corrections



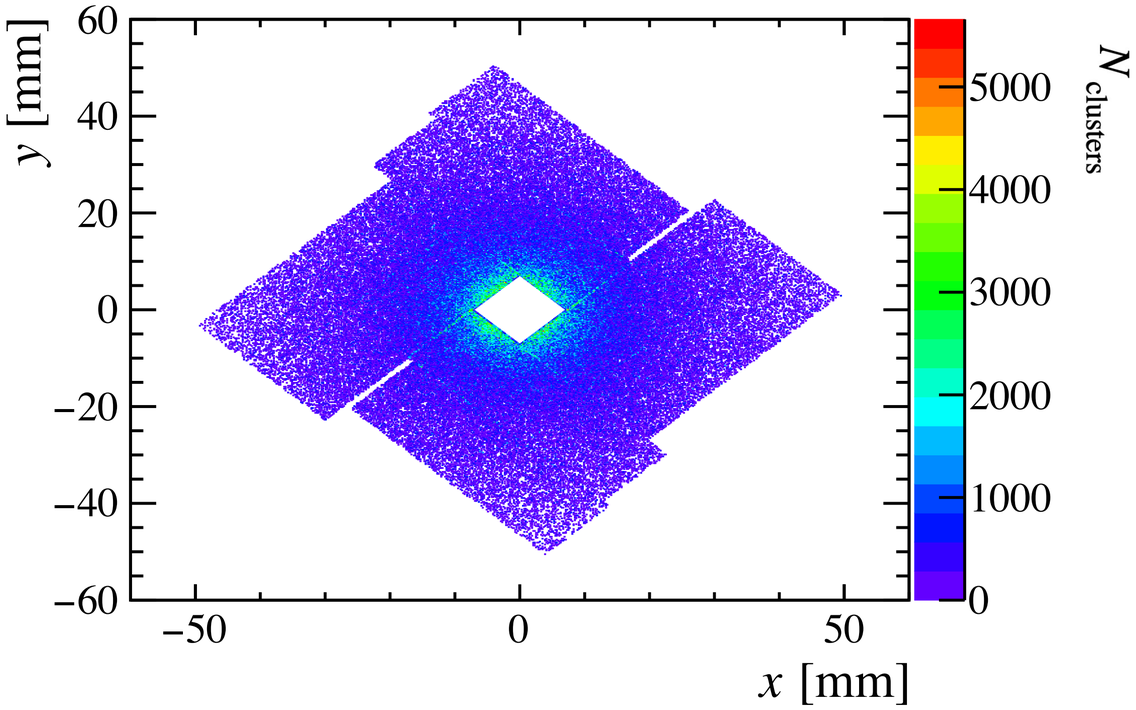
- Shows improvements, but not a complete fix

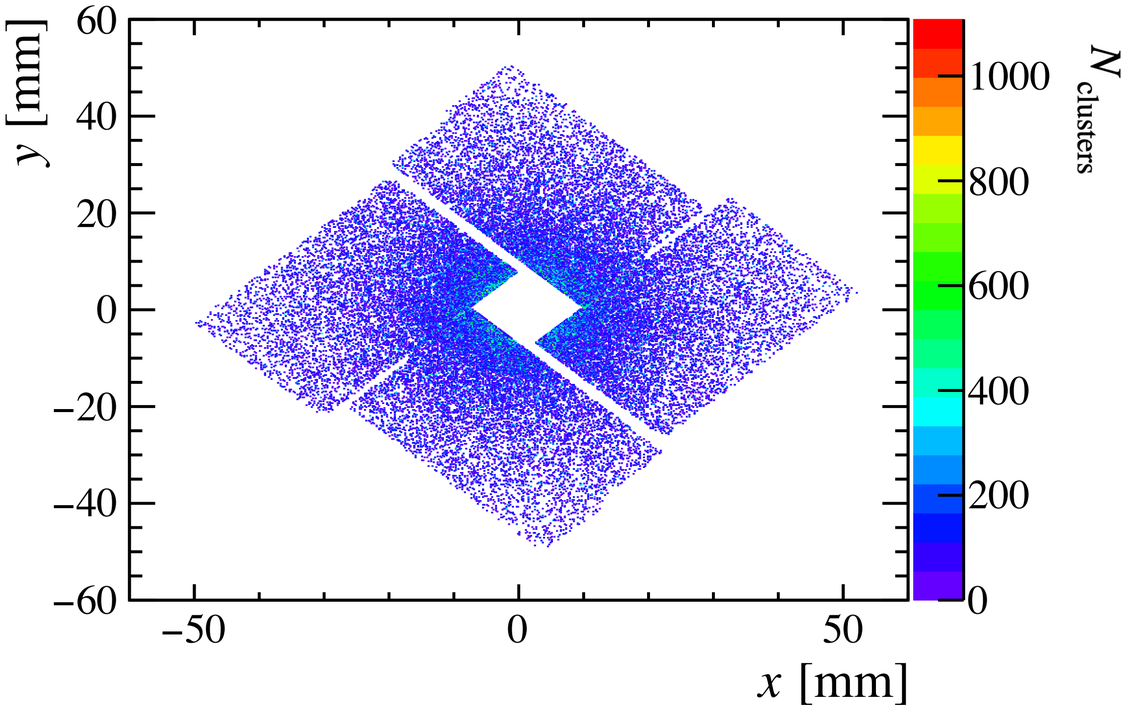
Next steps

- More detailed study of how each ASIC should be treated needed (WIP)
  - Turning of ASICs entirely to coarse in current studies
- The detailed hit efficiencies should be included and further studied (WIP)
  - Some regions of the detector which miss efficiencies at the moment
- For 2022: Proof of concept using just 1 run (conditions still change rapidly)
  - When in stable conditions apply the same procedure for 2023
  - In the long term we should include this information in the CondDB-tags

Questions?

Comparing “Upgrade” with “2022” MC





- Note: statistics are not equal, so just a qualitative comparison for the opening

List of disconnected ASICs

- ASIC_number = sensor_id + chip_id
- outOfTimeAsics = [21,69,93,101,113,117,125,129,135,136,137,141,149,153,161,165,173,185,189,197,201,209,213,221,225,233,237,245,249,257,297,298,301,304,309,310,311,329,382,387,389,397,406,407,441,461,463,464,502,514,516,609,610,622]
- disconnectedAsics = [47,51,52,53,54,55,56,261,262,263,276,277,278,285,286,287,299,316,327,353,356,357,358,359,420,421,422,423,424,425,426,427,428,429,430,431,509,533,563,569,611,623]