ITS3 clusterization activities status

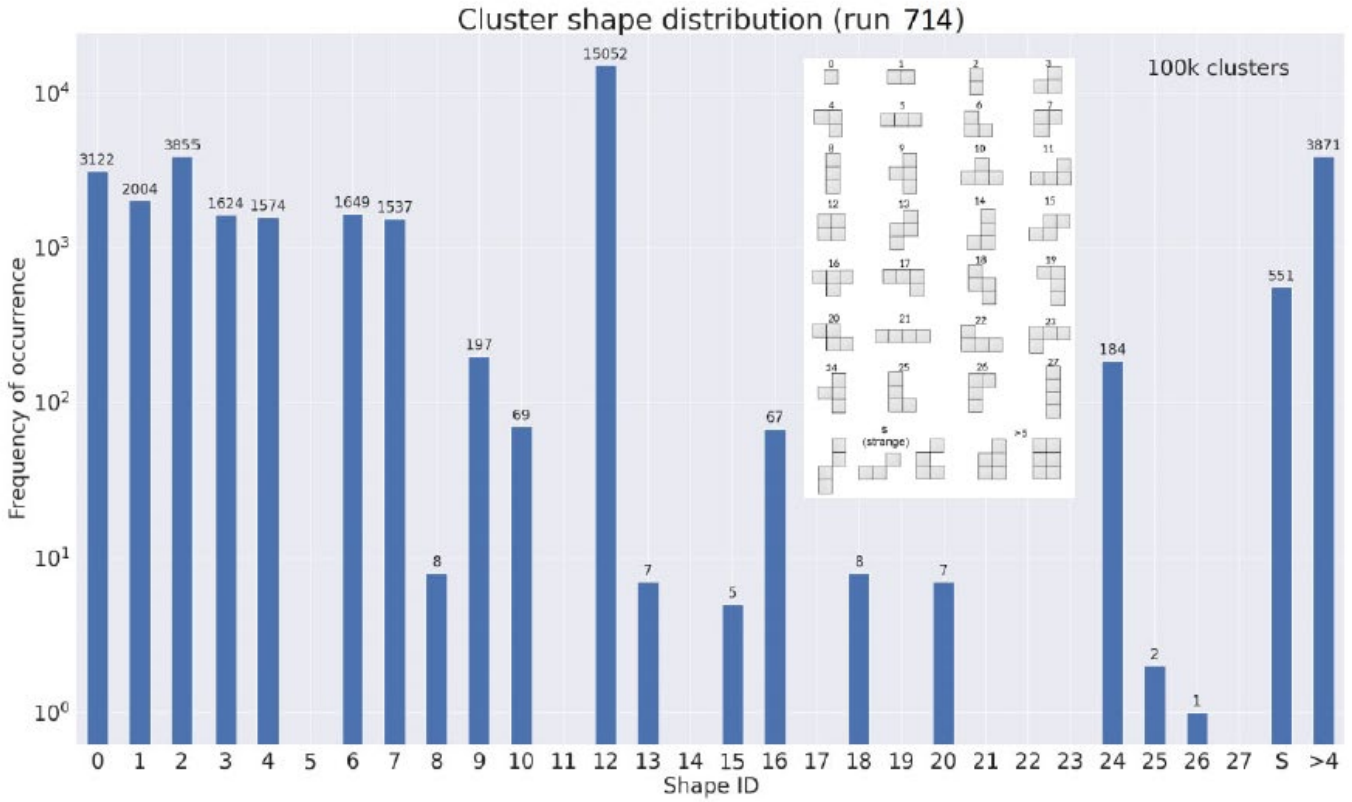
ITS3 Clustering Code status

From: Maximiliano Puccio and Alexander Kalweit

- Basic idea is to use cluster shapes distribution

Cluster shapes

- Stored in this format in order to allow for a maximal compression.



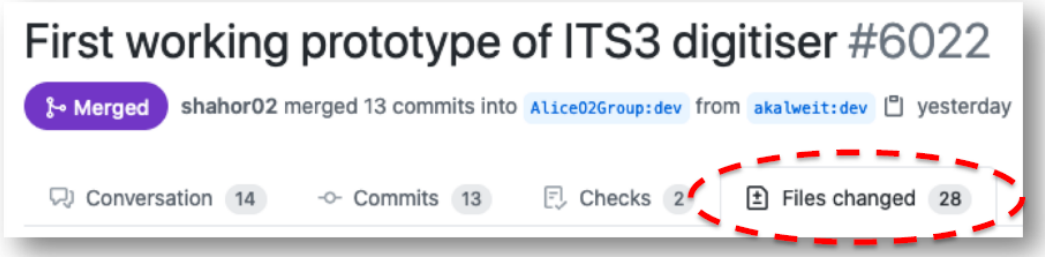
ITS3 Clustering Code status

From: Maximiliano Puccio and Alexander Kalweit

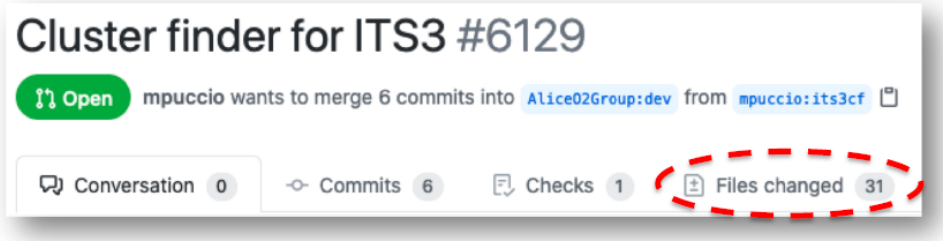
- Respect to the original idea a lot of work was done to implement the chip segmentation

Introduction and status

- First version of digitization for ITS3 is now in the O2 repository:
  - Details explained in previous presentation: [link]
  - Pull request went through: [link]

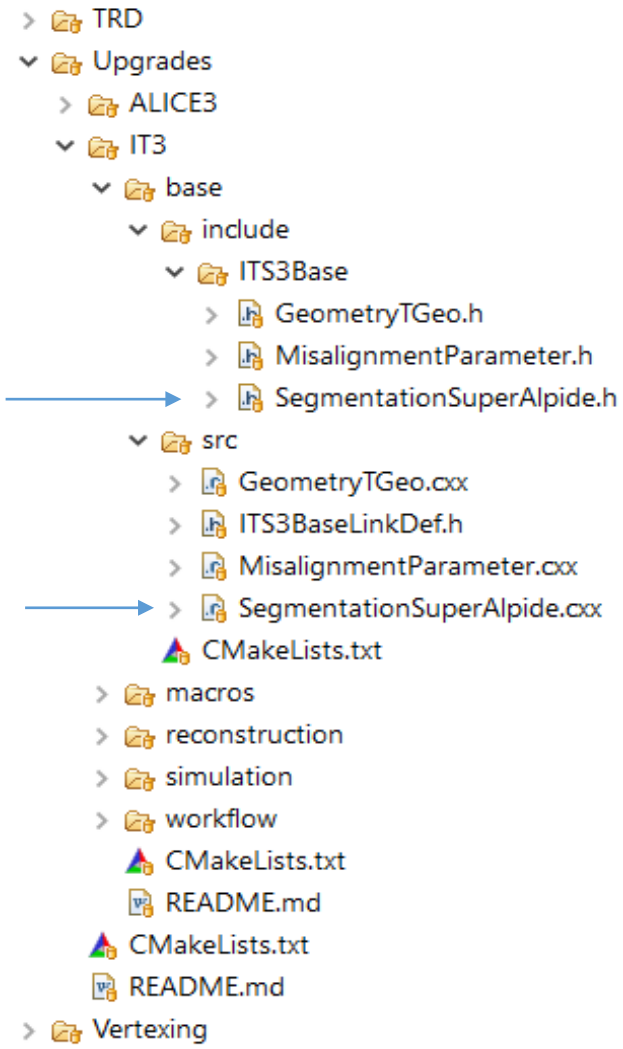


- Next step for physics performance studies: clusterisation
  - Needed similar adaptions as the digitizer to deal with a "SuperAlpide" (one layer = one chip)
  - Pull request is now submitted [link]



ITS3 Clustering Code status

- Segmentation code (seems to me) implementation is advanced (derived from ITSMFT code): in «Detectors/Upgrades»




```
25 namespace its3
26 {
27
28 /// Segmentation and response for pixels in ITSMFT upgrade
29 class SegmentationSuperAlpide
30 {
31  public:
32   SegmentationSuperAlpide(int layer = 0) : mLayer{layer},
33                                            NRows{static_cast<int>(double(Radii[layer]) * double(constants::math::TwoPI) / double(it
34                                            NPixels{NRows * NCols},
35                                            PitchRow{static_cast<float>(Radii[layer] * constants::math::TwoPI / NRows)},
36                                            ActiveMatrixSizeRows{PitchRow * NRows},
37                                            SensorSizeRows{ActiveMatrixSizeRows + PassiveEdgeTop + PassiveEdgeReadOut}
38   {
39   }
40   int mLayer;
41   static constexpr int NLayers = 4;
42   static constexpr float Length = 27.15f;
43   static constexpr float Radii[NLayers] = {1.8f, 2.4f, 3.0f, 7.0f};
44   static constexpr int NCols = Length / itsmft::SegmentationAlpide::PitchCol;
45   int NRows;
46   int NPixels;
47   static constexpr float PitchCol = Length / NCols;
48   float PitchRow;
49   static constexpr float PassiveEdgeReadOut = 0.;                // width of the readout edge (Passive bottom)
50   static constexpr float PassiveEdgeTop = 0.;                    // Passive area on top
51   static constexpr float PassiveEdgeSide = 0.;                   // width of Passive area on left/right of the sensor
52   static constexpr float ActiveMatrixSizeCols = PitchCol * NCols; // Active size along columns
53   float ActiveMatrixSizeRows;                                    // Active size along rows
54
55   // effective thickness of sensitive layer, accounting for charge collection non-unifoemity, https://alice.its.cern.ch/jira/browse
56   static constexpr float SensorLayerThicknessEff = 28.e-4;
57   static constexpr float SensorLayerThickness = 30.e-4;                                                  // physical thickness of sensit
58   static constexpr float SensorSizeCols = ActiveMatrixSizeCols + PassiveEdgeSide + PassiveEdgeSide; // SensorSize along columns
59   float SensorSizeRows;                                                                                  // SensorSize along rows
60
61   ~SegmentationSuperAlpide() = default;
62
63   /// Transformation from Geant detector centered local coordinates (cm) to
64   /// Pixel cell numbers iRow and iCol.
65   /// Returns kTRUE if point x,z is inside sensitive volume, kFALSE otherwise.
66   /// A value of -1 for iRow or iCol indicates that this point is outside of the
67   /// detector segmentation as defined.
68   /// \param float x Detector local coordinate x in cm with respect to
69   /// the center of the sensitive volume.
70   /// \param float z Detector local coordinate z in cm with respect to
```

ITS3 Clustering Code status

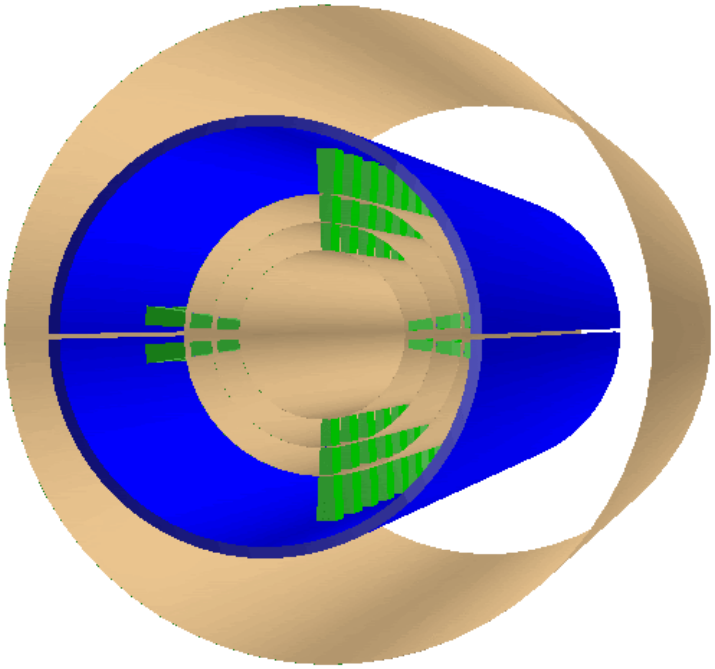
- Assamptions used

Developing a first workaround

- Normal segmentation in geometry: individual alpide chips
- For ITS3 layers: whole layer is one element

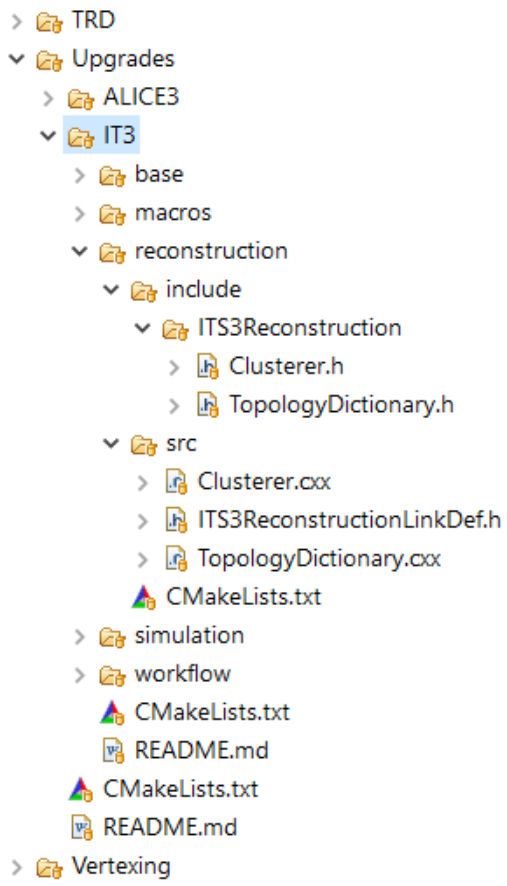
→ to start, we treat the whole cylindrical layer as one super-chip

→ the pixel pitch is slightly adapted such that it matches the cylinder



ITS3 Clustering Code status

- Current Clusterization code:



I'm still looking inside it,
I'm not sure if it is doing only the basic idea or more

ITS3 Clustering Code status

Workflow

→ Please start playing with it and test it!

1.) Simulate events

```
o2-sim -m PIPE IT3 -e TGeant4 -g pythia8 -n 50
```

2.) Run digitization (ITS3 is called automatically)

```
o2-sim-digitizer-workflow -b
```

3.) Run reconstruction (cluster finding) for ITS3 (once PR is approved)

```
o2-its3-reco-workflow -b
```

ITS3 Clustering: comments and status

- The code is quite advanced respect to the original idea
- I'm finishing to look inside it and compare to the ITSMF code
  (*in any case it is good exercise to understand the O2 framework, for me*)
- In a week a should finish it and I'll contact the authors to understand details and to define how to proceed
- (If my perception is right) My guess is to implement the need improvements for the end of the year
- Option: should we consider different chip segmentation?