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The Visualization Method Pipeline for the Application to Dynamic Data Analysis

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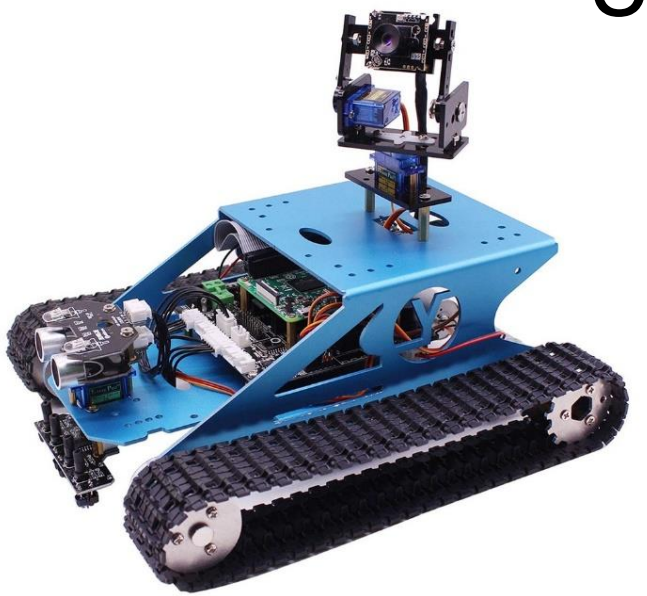
Use-cases of dynamic data



Datasample A – technological data

Statistics:
Features: 11
Objects: 3809
Measurements: 128
Lines of input: 480’000

Datasample B – economical data

Statistics:
Features: 9
Objects: 81
Measurements: 13
Lines of input: 1’000

Nature of dynamic objects, 1/2

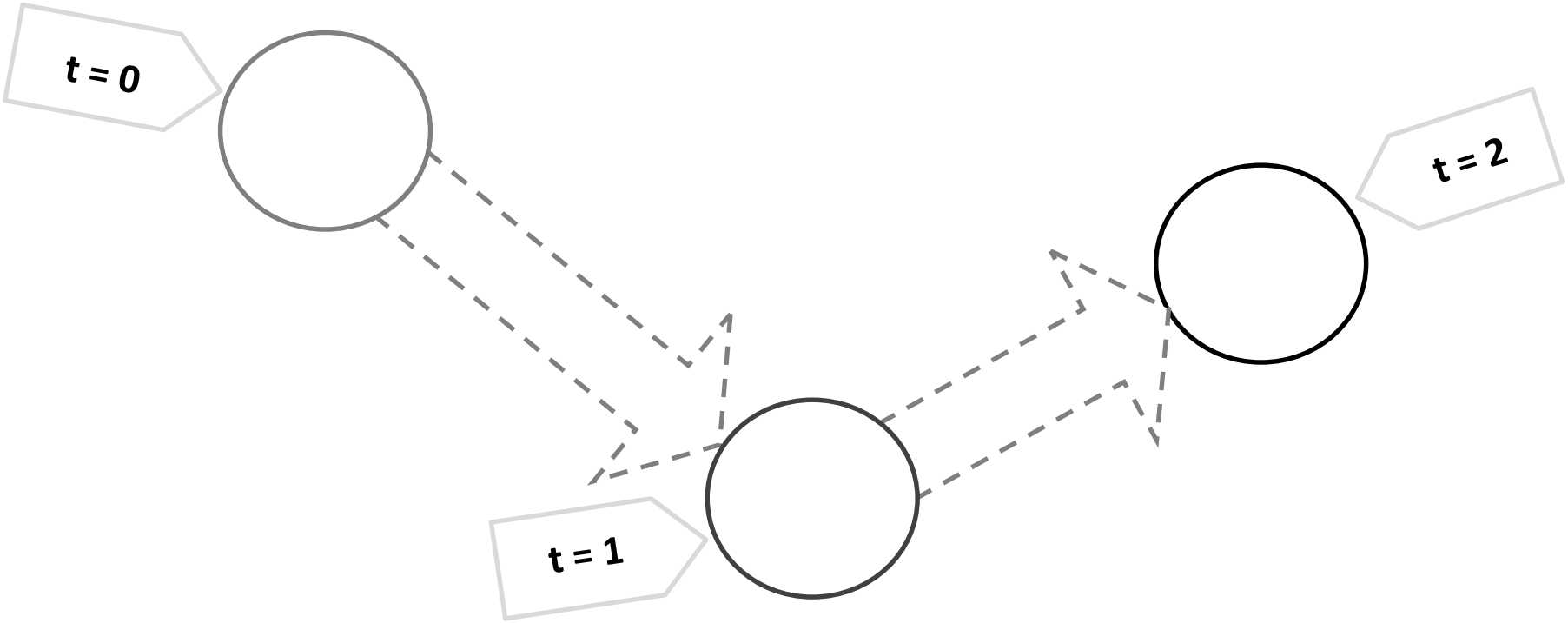


Figure 1. Dynamic object in time

Nature of dynamic objects, 2/2

t = 0	Feature 1	Feature 2	…	Feature n
Obj				
Obj				
Obj				

t = 1	Feature 1	Feature 2	…	Feature n
Obje				
Obje				
..				
Obje				

t = 2	Feature 1	Feature 2	…	Feature n
Object 1	x_{11}	x_{12}	…	x_{1n}
Object 2	x_{21}	x_{22}	…	x_{2n}
…	…	…	…	…
Object m	x_{m1}	x_{m2}	…	x_{mn}

Figure 2. Data tables sample

Visual analysis method, 1/3

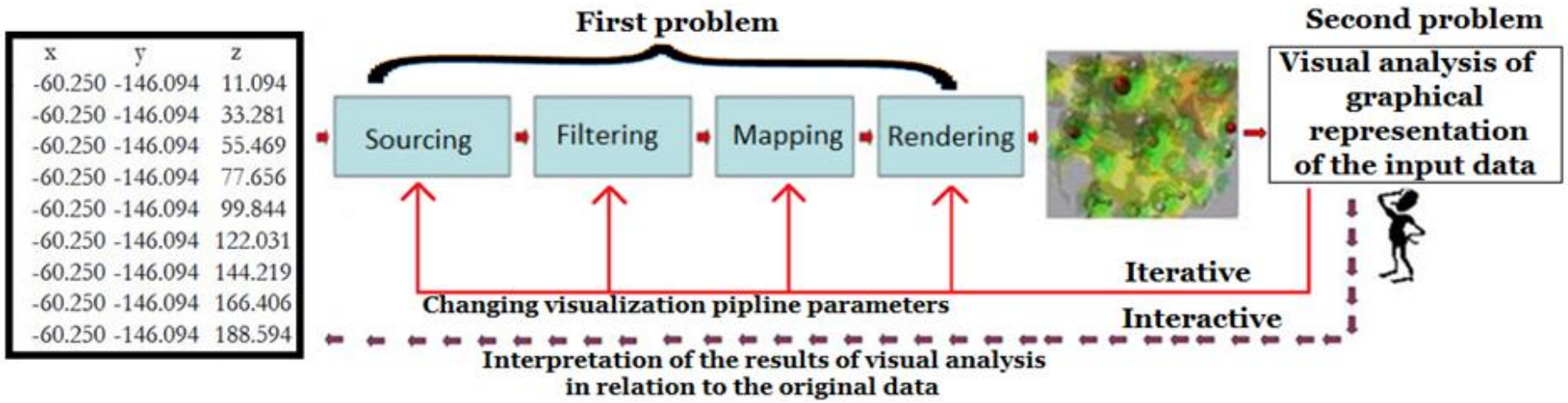


Figure 3. Visualization pipeline

Visual analysis method, 2/3

$$X = \{x_{il}^{j}\}$$

$$l = \overline{1,n}, i = \overline{1,m}, j = \overline{1,k}$$

$$X = \left\{\widetilde{x_{il}^{j}}\right\}, \text{where } \widetilde{x_{il}^{j}} = \frac{x_{il}^{j} - \min x_{il}^{j}}{\max x_{il}^{j} - \min x_{il}^{j}} * 100$$

$$l = \overline{1,n}, i = \overline{1,m}, j = \overline{1,k}$$

$$P'(t) = A_{Pr}P(t)$$

$$P'(t) = \{p'_1(t), p'_2(t), \dots, p'_i(t), \dots, p'_m(t)\}$$

$$p'_i(t) = \{a_1(t), a_2(t), \dots, a_k(t), \dots a_n(t)\}$$

$$a_k(t) = \begin{cases} 0, if\ k \notin Pr \\ a_k(t), else \end{cases}$$

$$Cyl_{1i} = \{Red_{1i}, Green_{1i}, Blue_{1i}, Opacity_{1i}\},$$

$$Red, Green, Blue \in [0; 255]$$

$$Red_{1i}, = 255\left(1 - \frac{\rho(0,_i)}{d_1}\right)$$

$$Green_{1i} = 150\frac{\rho(0,_i)}{d_1}$$

$$Blue_{1i} = 255\frac{\rho(0,_i)}{d_1}$$

$$Opacity_{1i} = \begin{cases} 0, if\ \rho(0,_i) > d_1 \\ 100, else \end{cases}$$

$$\rho(i,j) = \sqrt{\sum_{q=1}^{n}\left(\widetilde{x_{iq}^{k}} - \widetilde{x_{jq}^{k}}\right)^2}$$

Visual analysis method, 3/3

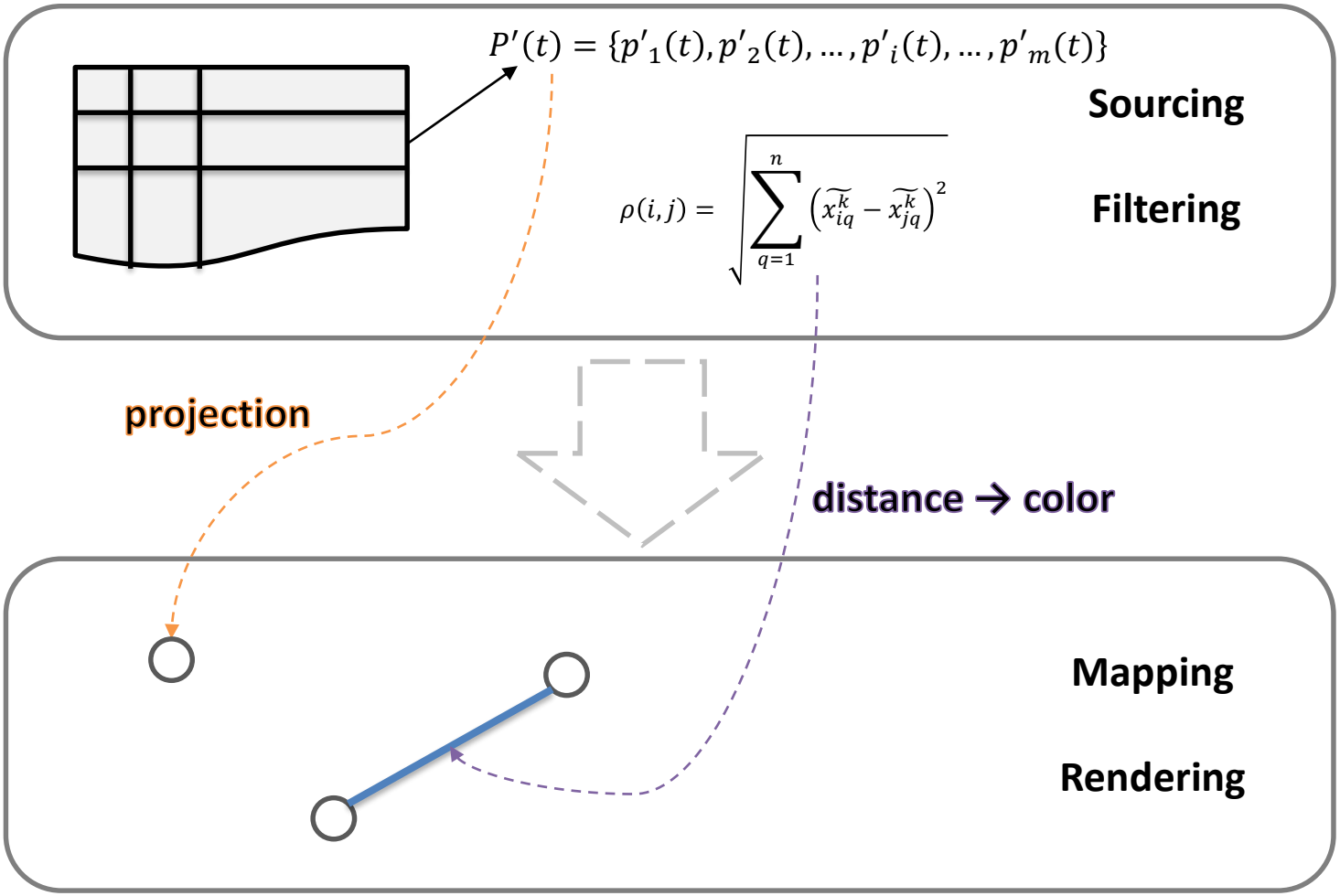


Figure 4. Visualization pipeline

Datasample A - Technological data analysis, 1/3

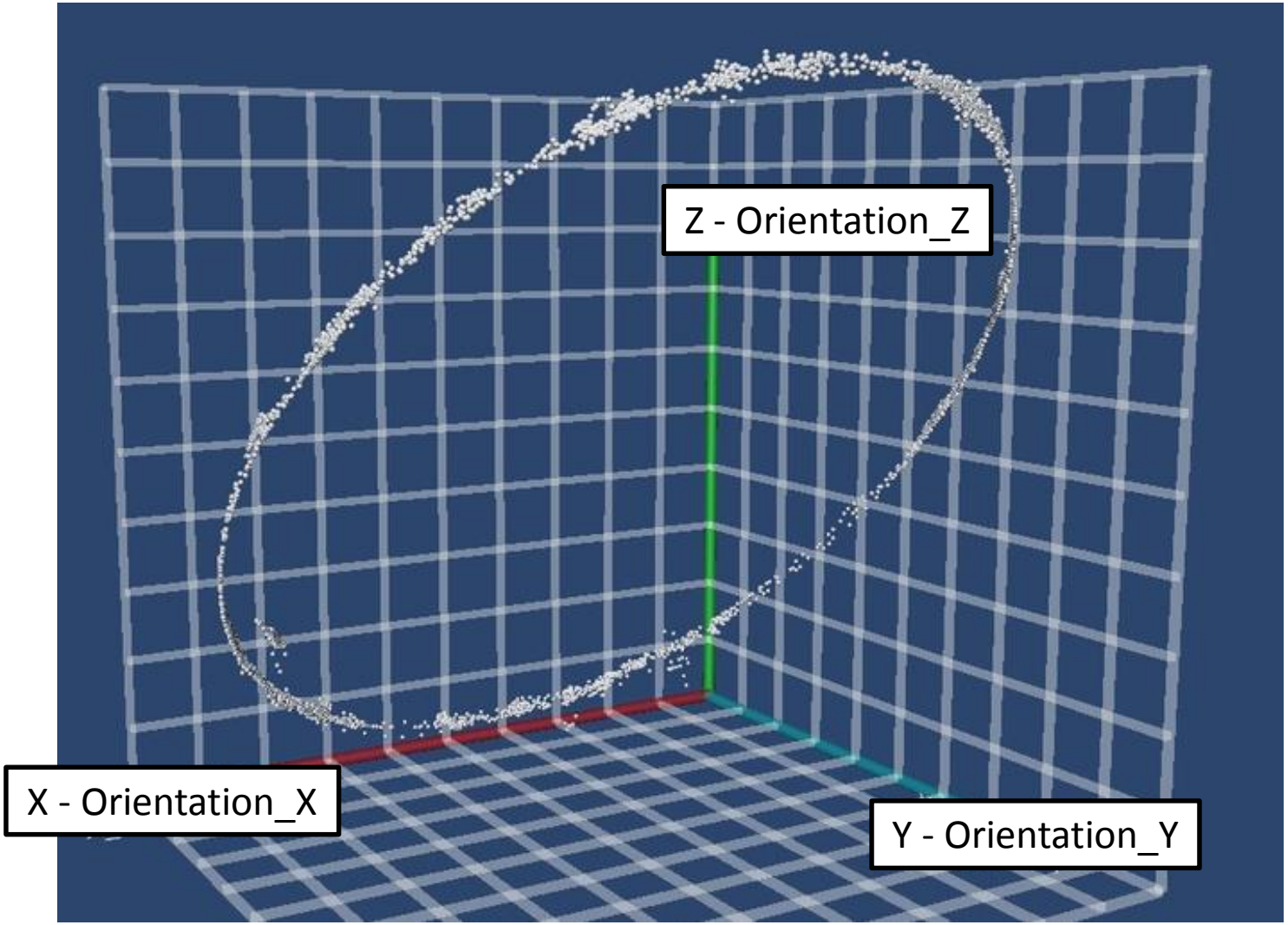


Figure 5. Technological data visualization

Datasample A - Technological data analysis, 2/3

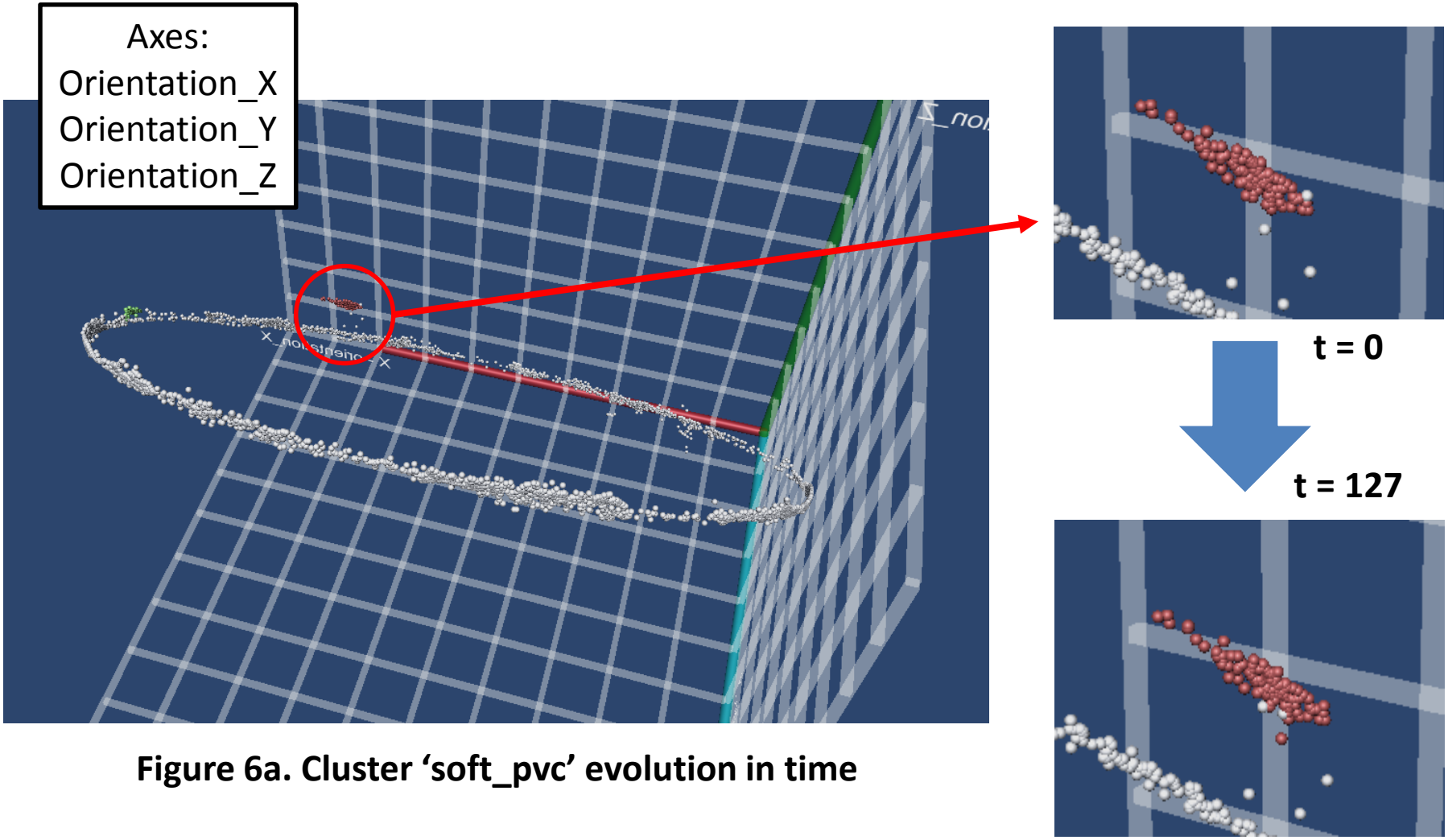
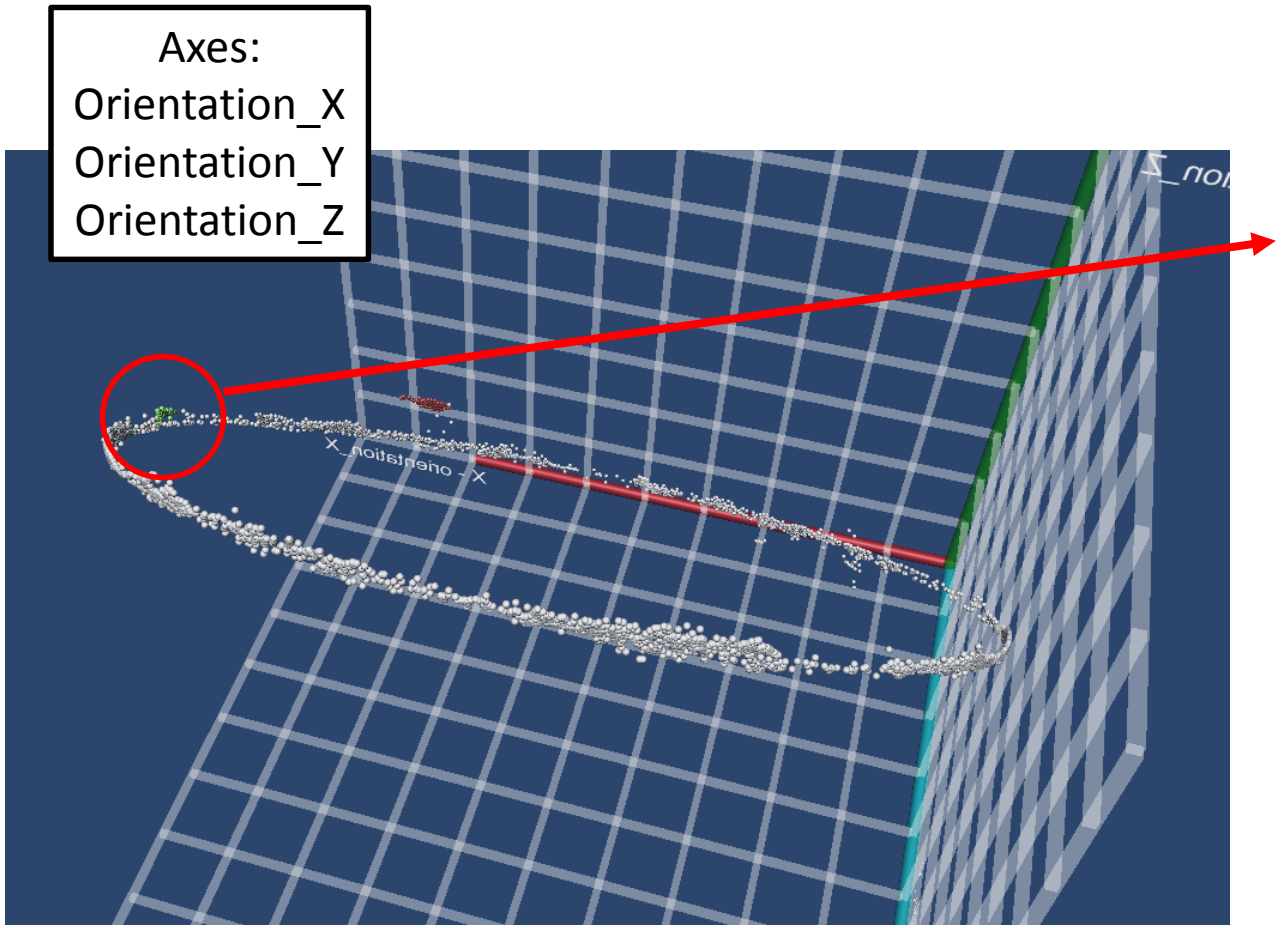
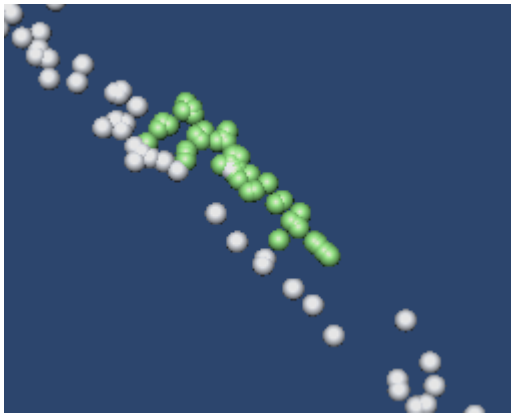


Figure 6a. Cluster 'soft_pvc' evolution in time

Datasample A - Technological data analysis, 3/3





t = 0

t = 127

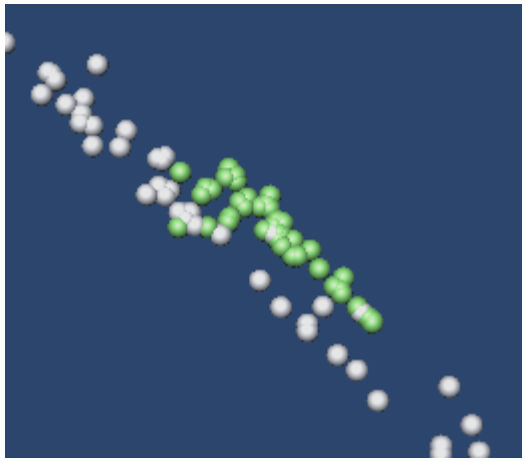


Figure 6b. Cluster 'fine_concrete' evolution in time

Datasample B - Economical data analysis, 1/3

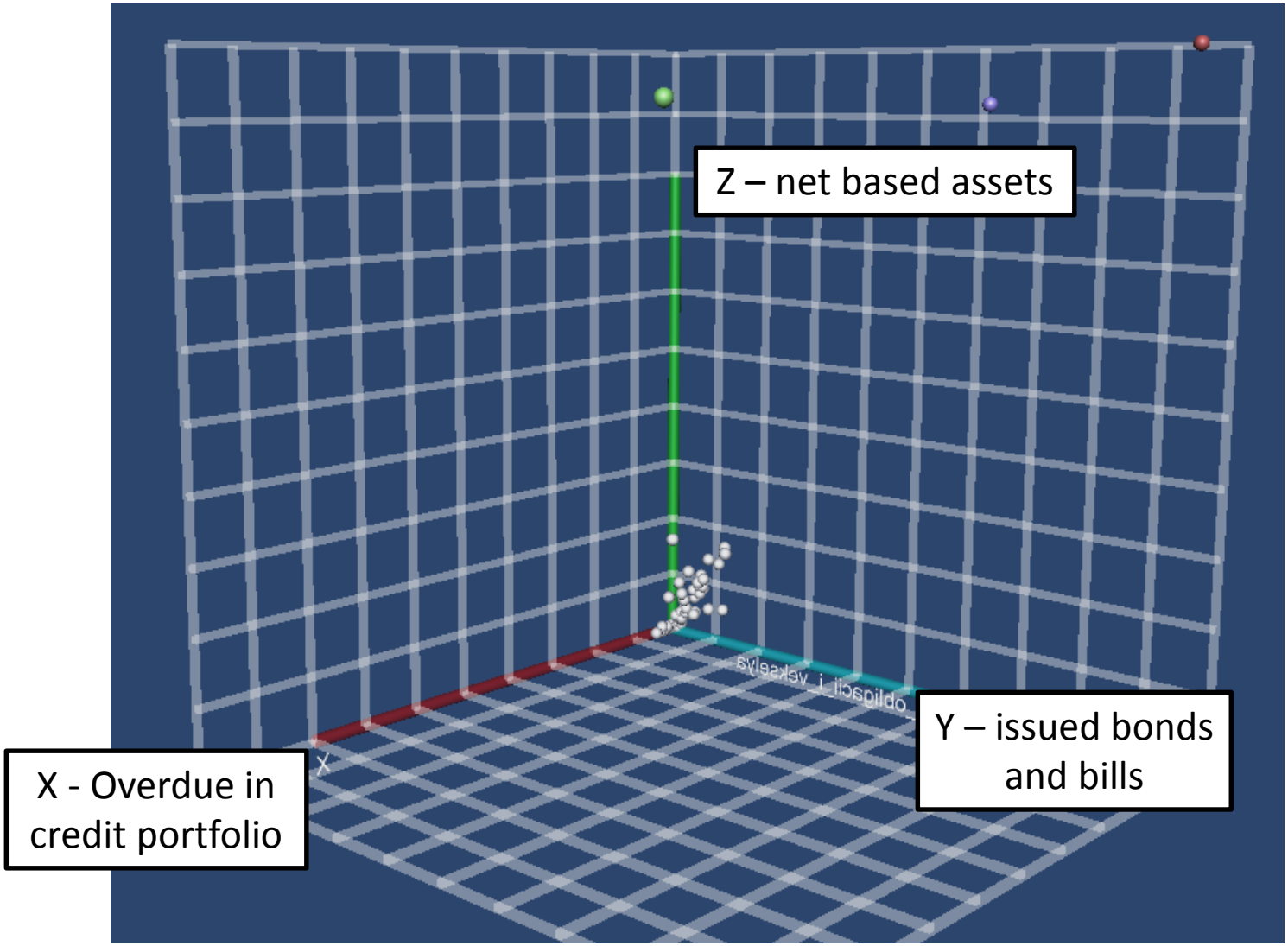


Figure 7. Economical data visualization

Datasample B - Economical data analysis, 2/3

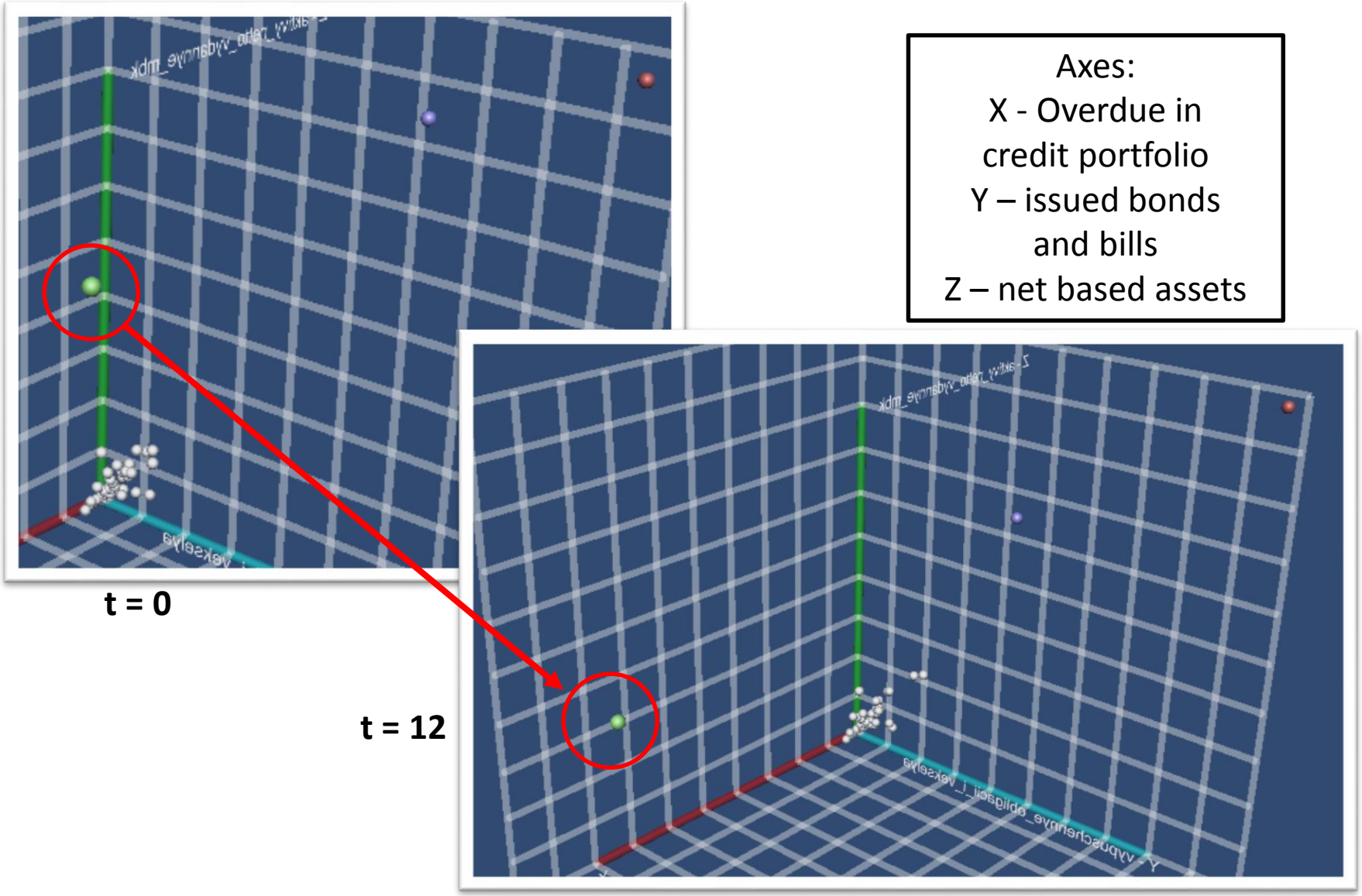


Figure 8a. Bank ID 1000 moving over time

Datasample B - Economical data analysis, 3/3

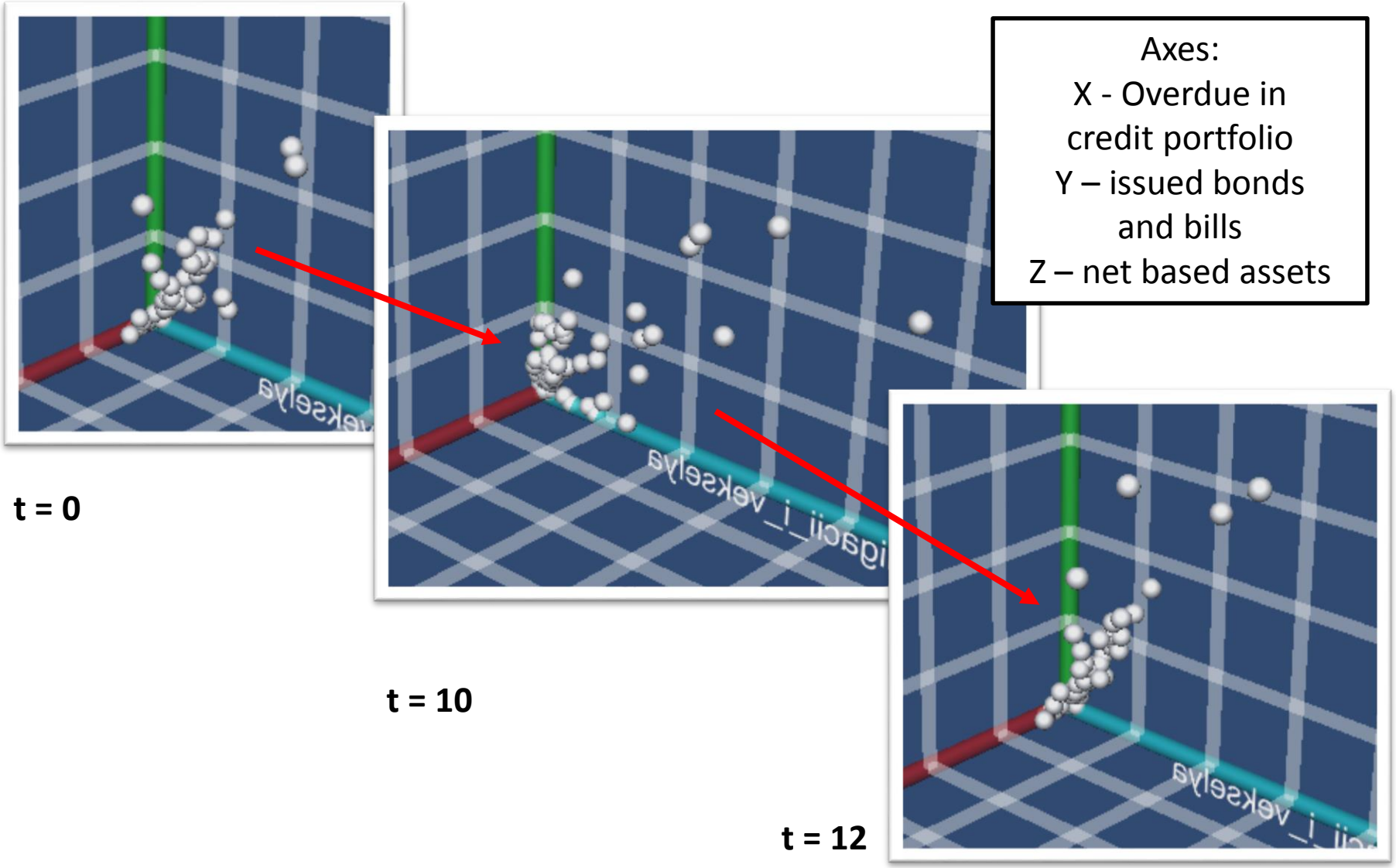


Figure 8b. Cluster at the center transforming

Application for the Nuclear Computing

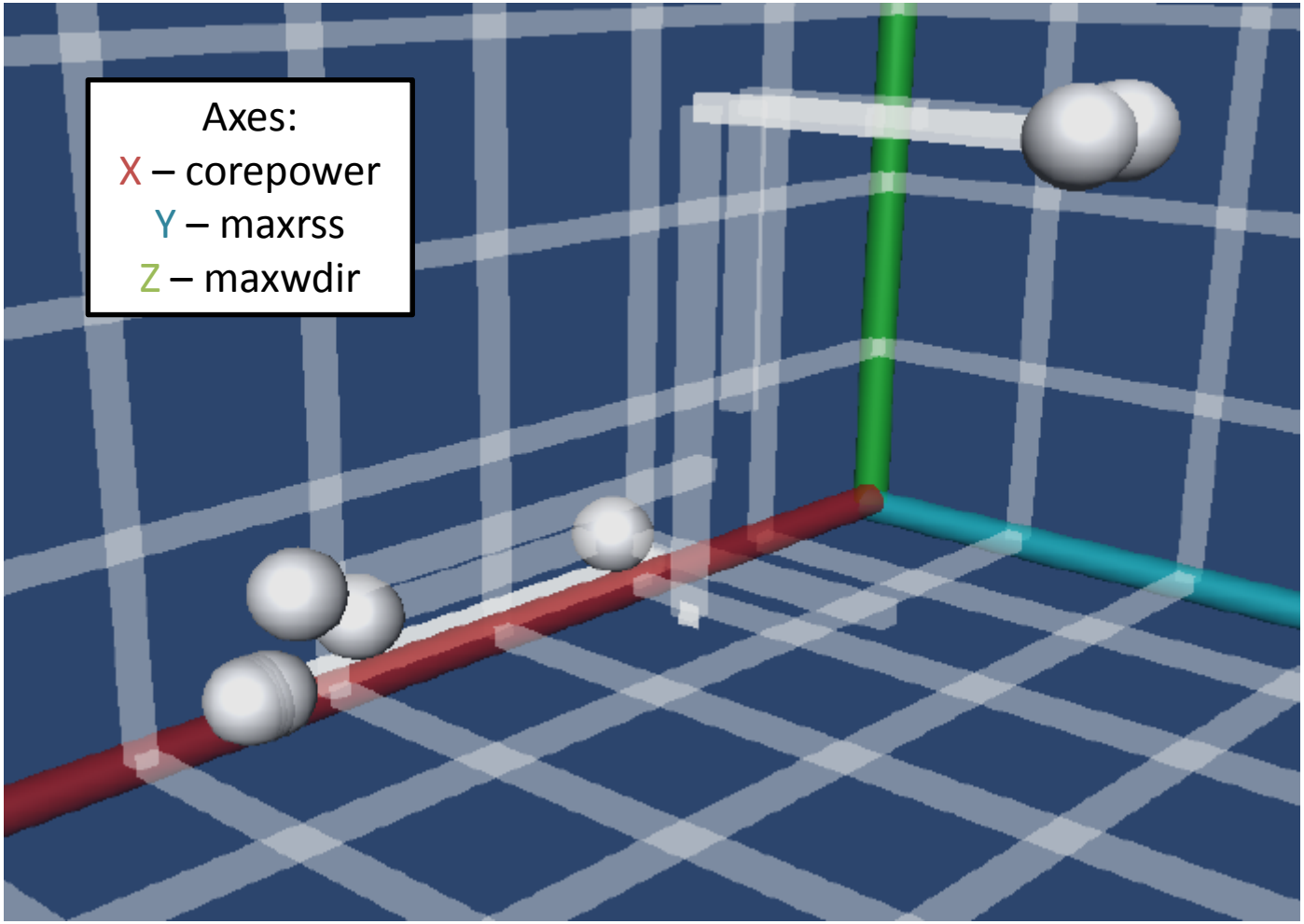


Figure 9. ATLAS Grid Information System metadata visualization

Summary and conclusion

Using the visualization pipeline, we developed:

- Interactive and iterative algorithm of data analysis
- Application for the dynamic data analysis

Acknowledgements

This work has been supported by the RSCF grant No. 18-71-10003.

Backup slides

Program development

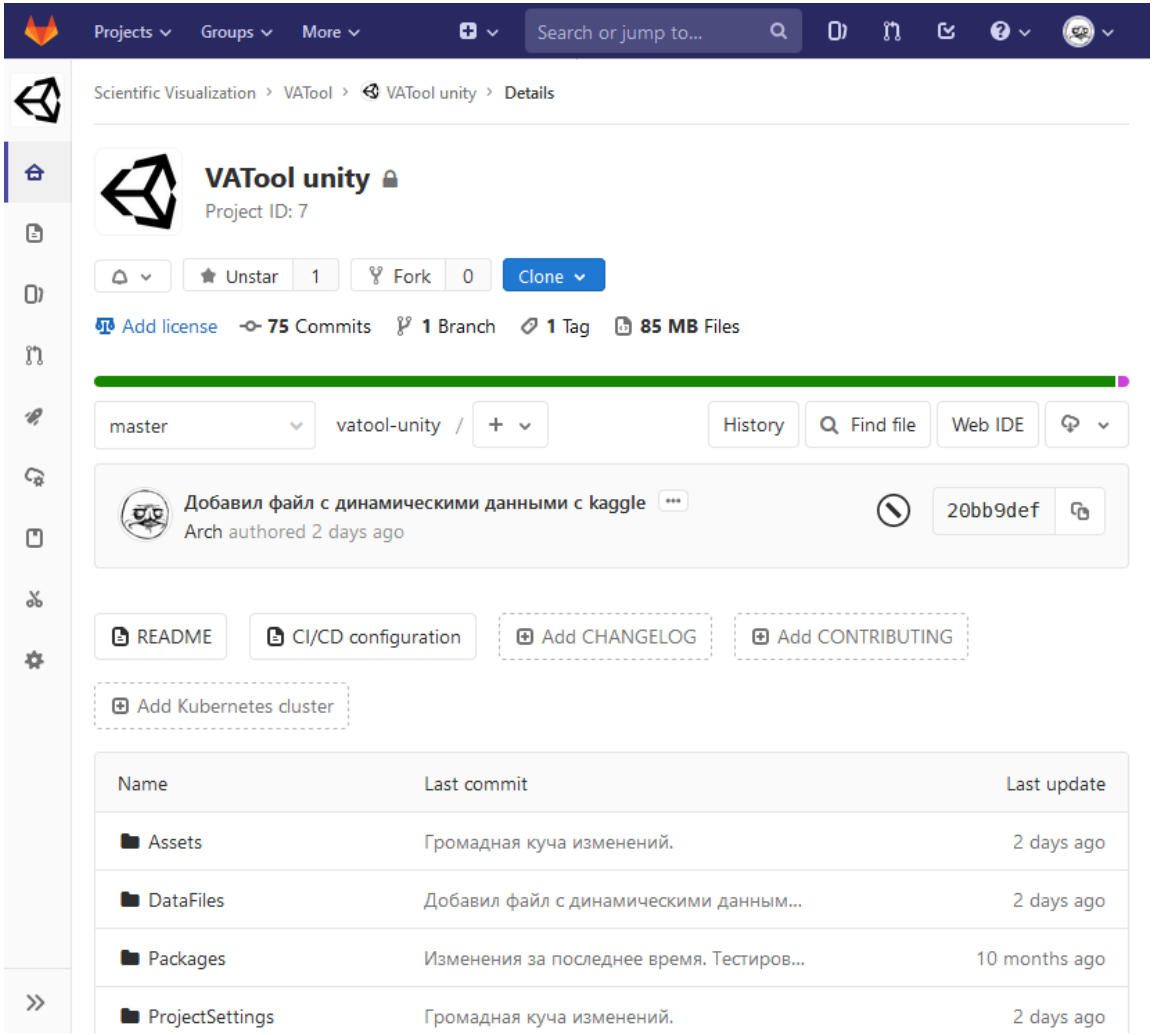


Figure A. Gitlab page