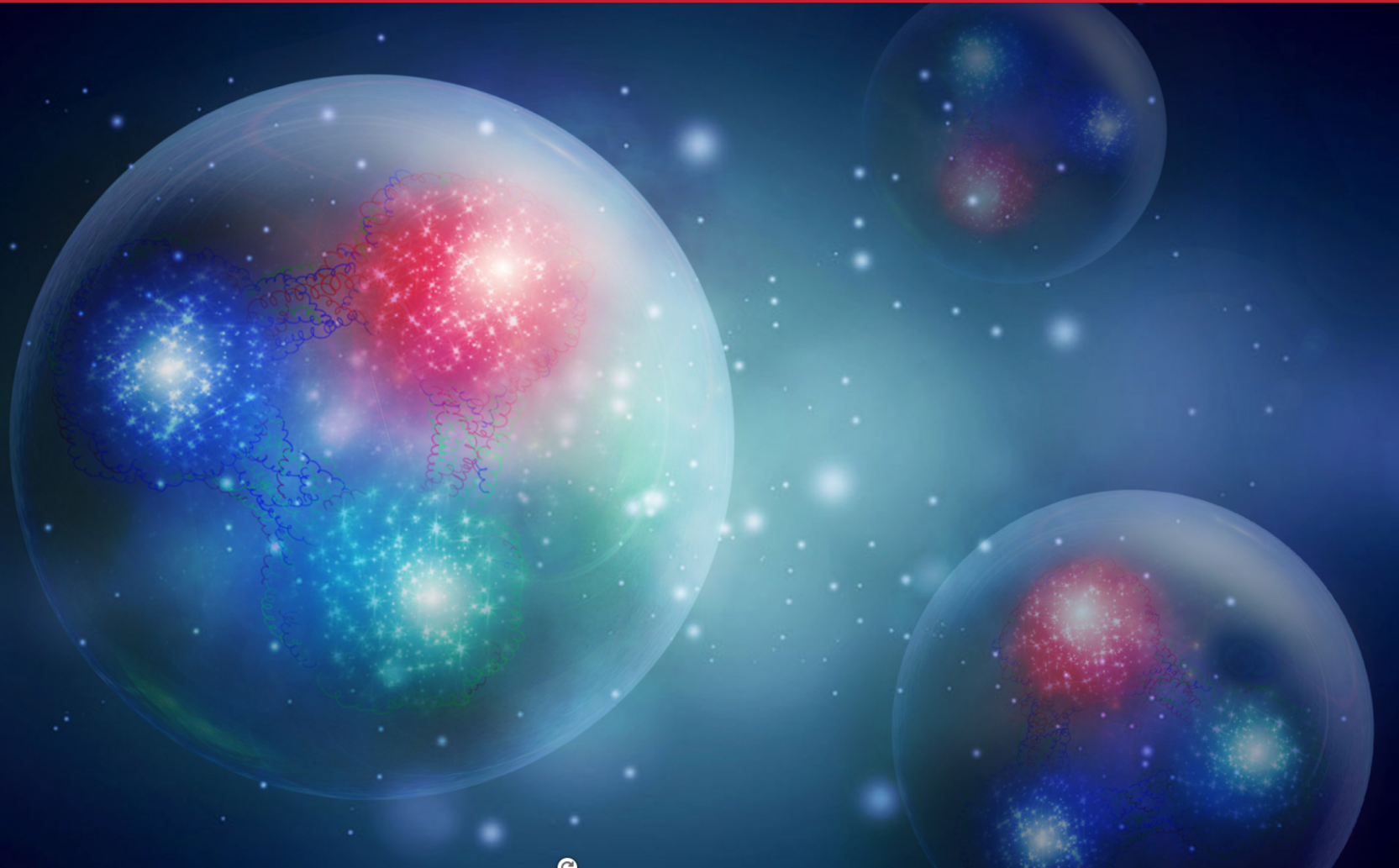


# Integration and naming scheme

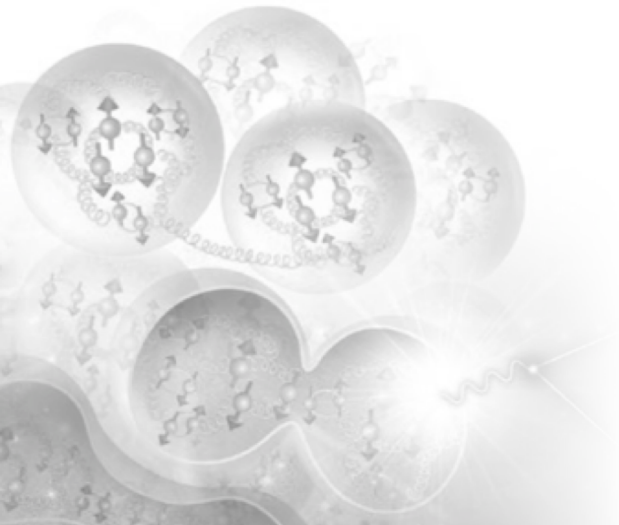
Yulia Furletova



# Outline

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- Integration: accelerator lattice => detector design and physics studies => back to accelerator
- Naming scheme



# Accelerator-Detector integration

File with magnet geometry, and field gradients

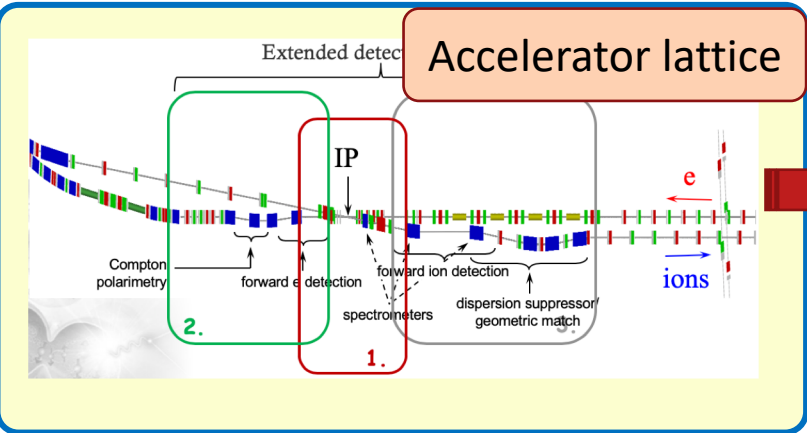
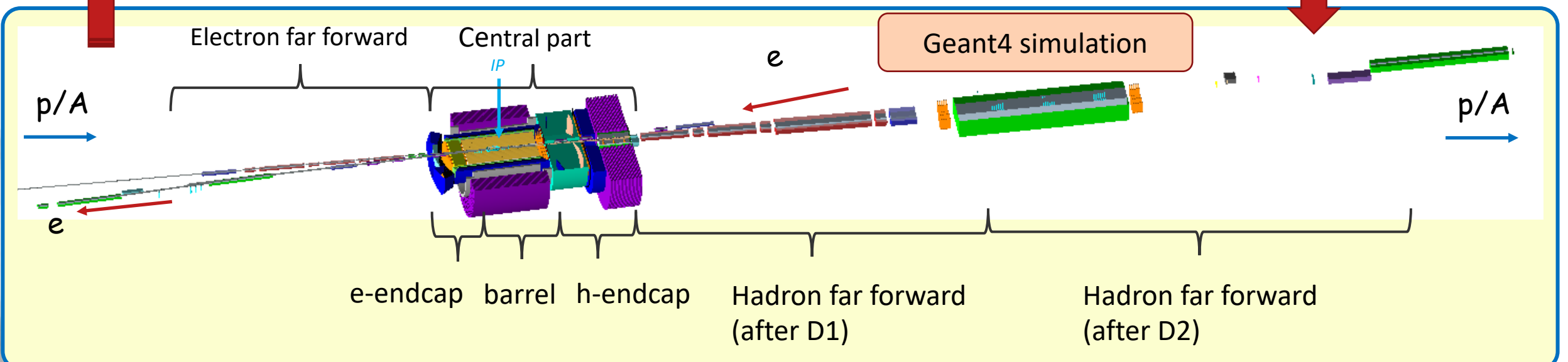


Table 7.1: Parameters of the ion detector region magnets at the maximum ion momentum of 100 GeV.

| Name                       | Type   | Length (m) | GFHA <sup>1</sup> (cm) | IHA <sup>2</sup> (cm) | OR <sup>3</sup> (cm) | Dipole field |           | Quad gradient                           |   | Solenoid (T) | Position and orientation <sup>4</sup> |         |                |
|----------------------------|--------|------------|------------------------|-----------------------|----------------------|--------------|-----------|---|---|--------------|---------------------------------------|---------|----------------|
|                            |        |            |                        |                       |                      | $B_x$ (T)    | $B_y$ (T) | $\frac{\partial B_x}{\partial x}$ (T/m) | $\frac{\partial B_x}{\partial z}$ (T/m) |              | $x$ (m)                               | $z$ (m) | $\theta$ (rad) |
| Upstream ion IR elements   |        |            |                        |                       |                      |              |           |   |   |              |                                       |         |                |
| iASUS                      | Sol    | 1.6        | 3                      | 4                     | 12                   | 0            | 0         | 0                                       | 0                                       | 3.0          | 0.455                                 | -9.089  | 0.05           |
| iQUS3                      | Quad   | 1          | 3                      | 4                     | 12                   | 0            | 0         | -115.8                                  | -1.666                                  | 0            | 0.385                                 | -7.690  | 0.05           |
| iQUS2                      | Quad   | 1.5        | 3                      | 4                     | 12                   | 0            | 0         | 149.0                                   | 2.144                                   | 0            | 0.302                                 | -6.042  | 0.05           |
| iQUS1                      | Quad   | 1.2        | 2                      | 3                     | 10                   | 0            | 0         | 140.5                                   | -2.022                                  | 0            | 0.210                                 | -4.195  | 0.05           |
| iCUS1                      | Kicker | 0.2        | 2                      | 3                     | 10                   | -0.949       | 0.144     | 0                                       | 0                                       | 0            | 0.155                                 | -3.096  | 0.05           |
| iCUS2                      | Kicker | 0.2        | 2                      | 3                     | 10                   | 1.548        | -0.148    | 0                                       | 0                                       | 0            | 0.095                                 | -1.898  | 0.05           |
| iDSUS                      | Sol    | 1.6        | 2                      | 160                   | 210                  | 0            | 0         | 0                                       | 0                                       | -3.0         | 0.040                                 | -0.799  | 0.05           |
| Downstream ion IR elements |        |            |                        |                       |                      |              |           |   |   |              |                                       |         |                |
| iSDS                       | Sol    | 2.4        | 2                      | 160                   | 210                  | 0            | 0         | 0                                       | 0                                       | -3.0         | -0.060                                | 1.199   | 0.05           |
| iBDS1                      | Dipole | 1.0        | 4                      | 23.5                  | 31                   | 1.477        | 2.098     | -7.630                                  | -5.370                                  | 0            | -0.276                                | 5.493   | 0.0530         |
| iCDS2                      | Kicker | 0.5        | 4                      | 25.25                 | 33                   | -2.637       | -0.160    | 0.511                                   | 8.439                                   | 0            | -0.317                                | 6.242   | 0.0560         |
| iQDS0S                     | Quad   | 0.1        | 4                      | 7                     | 17                   | 0            | 0         | 0                                       | 53.47                                   | 0            | -0.356                                | 6.941   | 0.0560         |
| iQDS1                      | Quad   | 1.2        | 4                      | 8.5                   | 17                   | 0            | 0         | -77.94                                  | 0                                       | 0            | -0.392                                | 7.590   | 0.0560         |
| iQDS1S                     | Quad   | 0.1        | 4                      | 10                    | 25                   | 0            | 0         | 0                                       | -34.28                                  | 0            | -0.479                                | 9.137   | 0.0560         |
| iQDS2                      | Quad   | 2.4        | 4                      | 12.6                  | 25                   | 0            | 0         | 52.39                                   | 0                                       | 0            | -0.549                                | 10.385  | 0.0560         |
| iQDS2S                     | Quad   | 0.1        | 4                      | 12                    | 27                   | 0            | 0         | 0                                       | -17.90                                  | 0            | -0.619                                | 11.633  | 0.0560         |
| iQDS3                      | Quad   | 1.2        | 4                      | 14.8                  | 27                   | 0            | 0         | -46.09                                  | 0                                       | 0            | -0.706                                | 13.181  | 0.0560         |
| iQDS3S                     | Quad   | 0.1        | 4                      | 15                    | 27                   | 0            | 0         | 0                                       | 19.02                                   | 0            | -0.742                                | 13.830  | 0.0560         |
| iASDS                      | Sol    | 2.4        | 4                      | 17                    | 29                   | 0            | 0         | 0                                       | 0                                       | 3.0          | -0.840                                | 15.577  | 0.0560         |
| iBDS2                      | Dipole | 4.0        | 4                      | 40                    | 90                   | 0            | -4.670    | 0                                       | 0                                       | 0            | -1.019                                | 19.773  | 0.0280         |
| iBDS3                      | Dipole | 4.0        | 4                      | 30                    | 47                   | 0            | 4.670     | 0                                       | 0                                       | 0            | -1.131                                | 38.319  | 0.0280         |
| iQDS4                      | Quad   | 0.8        | 3                      | 4                     | 20                   | 0            | 0         | 71.828                                  | 0                                       | 0            | -1.472                                | 45.400  | 0.0560         |

<sup>1</sup> GFHA stands for Good-Field Half Aperture.  
<sup>2</sup> IHA stands for Inner Half Aperture.  
<sup>3</sup> OR stands for Outer Radius.  
<sup>4</sup> Position and orientation are specified for the center of each magnet.



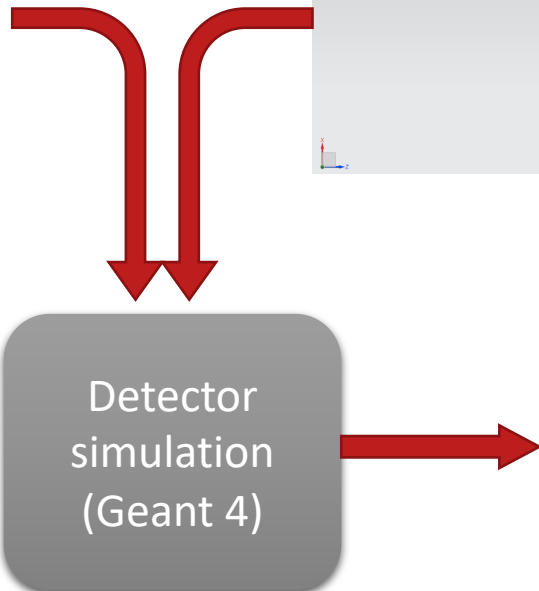
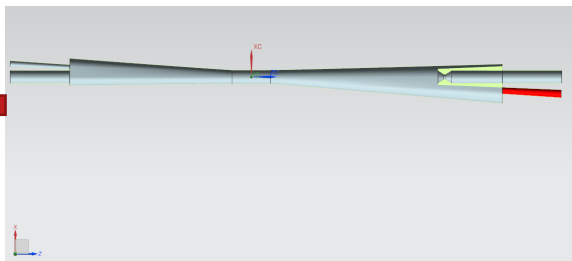
# Design integration (accelerator/detectors/reconstruction)

## Beam elements design

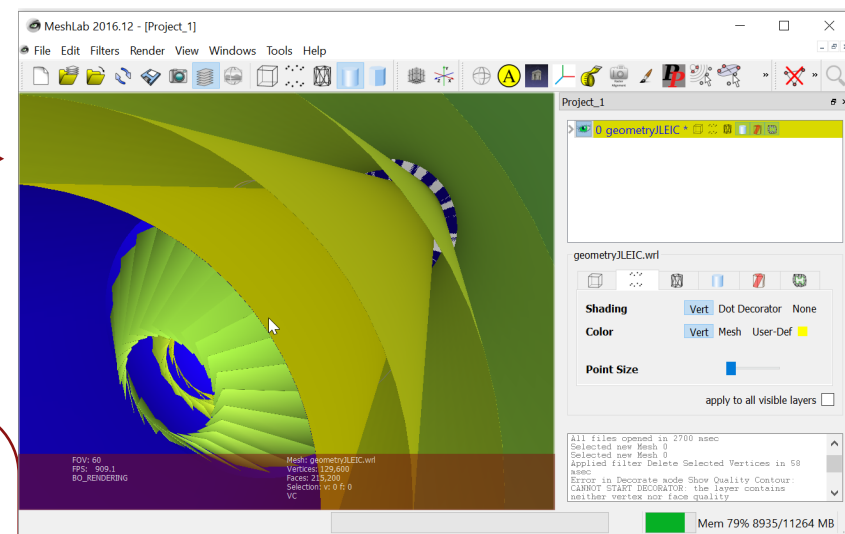
## Engineering Design CAD (*M. Wiseman*)

Table 7.1: Parameters of the ion detector region magnets at the maximum ion momentum of 100 GeV.

| Name                       | Type       | Length (m) | GFHA <sup>1</sup> (cm) | IHA <sup>2</sup> (cm) | OR <sup>3</sup> (cm) | Dipole field $B_x$ (T) | Dipole field $B_y$ (T) | Quad gradient $\frac{dB_x}{dz}$ (T/m) | Quad gradient $\frac{dB_y}{dz}$ (T/m) | Solenoid (T) | Position and orientation <sup>4</sup> x (m) | z (m)  | $\theta$ (rad) |
|----------------------------|------------|------------|------------------------|-----------------------|----------------------|------------------------|------------------------|---------------------------------------|---------------------------------------|--------------|---|--------|----------------|
| Upstream ion IR elements   |            |            |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iASUS                      | Sol        | 1.6        | 3                      | 4                     | 12                   | 0                      | 0                      | 0                                     | 0                                     | 3.0          | 0.455                                       | -9.089 | 0.05           |
| iQUS3                      | Quad       |            |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQUS2                      | Quad       | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQUS1                      | Quad       | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iCUS1                      | Kicker     | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iCUS2                      | Kicker     | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iDSUS                      | Sol        | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| Downstream ion IR elements |            |            |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iBDS1                      | Dipole     | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iCDS2                      | Kicker     | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS0S                     | Quad       | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS1                      | Quad       | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDSIS                     | Quad       | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS2                      | Quad       | 2          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS2S                     | Quad       | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS3                      | Quad       | 1          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iQDS3S                     | Quad       | 0          |                        |                       |                      |                        |                        |                                       |                                       |              |   |        |                |
| iASUS                      | Solenoid   | 2.4        | 2                      | 160                   | 210                  | 0                      | 0                      | 0                                     | 0                                     | 0            | 3   | 0      | 0              |
| iGUS1                      | Quadrupole | 0.6        | 2                      | 4.5                   | 10                   | 0                      | 0                      | -36.9                                 | 8.10                                  | 0            | 0   | 0      | 0              |
| iGUS2                      | Quadrupole | 0.6        | 3.2                    | 4.5                   | 11                   | 0                      | 0                      | 33.7                                  | -7.38                                 | 0            | 0   | 0      | 0              |
| iGUS3                      | Quadrupole | 0.6        | 1.5                    | 4.5                   | 11                   | 0                      | 0                      | -20.8                                 | 4.56                                  | 0            | 0   | 0      | 0              |
| iSUS                       | Solenoid   | 1.8        | 2.2                    | 4.5                   | 11                   | 0                      | 0                      | 0                                     | 0                                     | 0            | -4  | 0      | 0              |



Full detector export to CAD



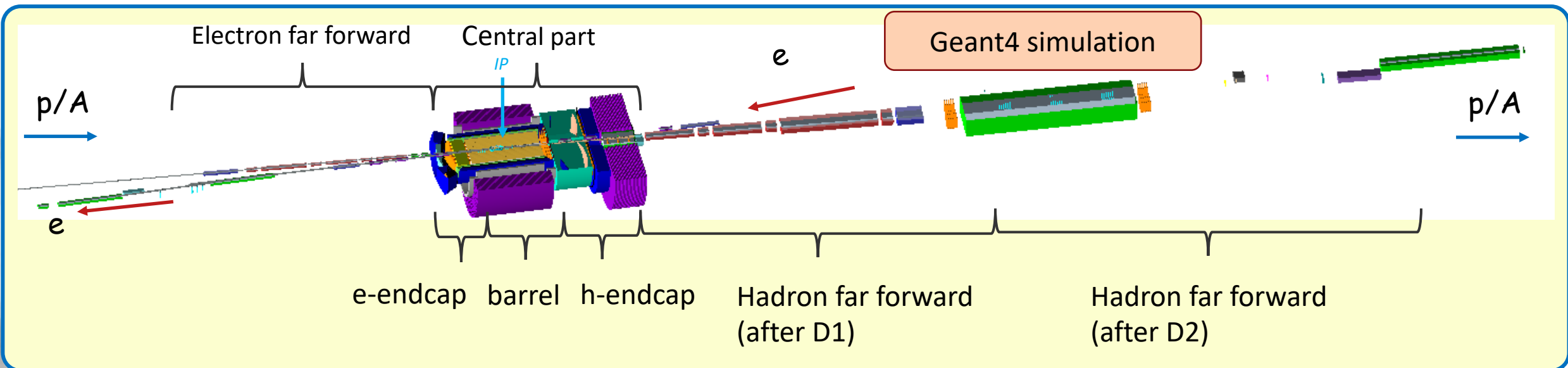
Optimization of elements  
(*V. Morozov*)

Root ntuple, Occupancy plots,  
Reconstruction,  
Physics analysis  
eJANA  
(see D. Romanov's talk)

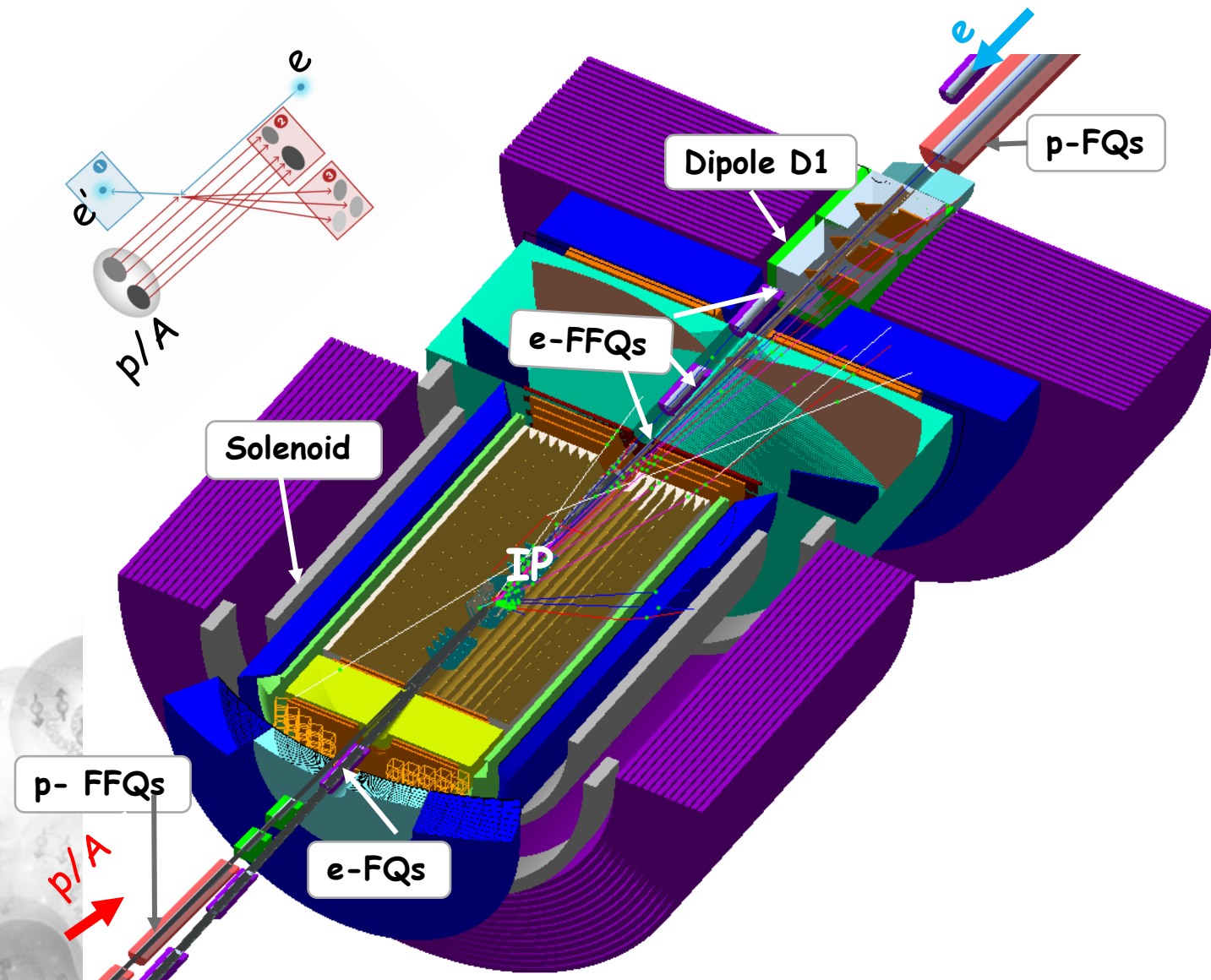
- Automated way of including beam elements (via text file )
- Relative placement of detector components ( if detector-A is located inside dipole-B, then geometry and placement of detector -A is defined by parameters of dipole-B)
- Description of all sub-detectors is independent. This would allow detector R&D groups take care of granularity, material, sensitive elements, etc.
- Integration of sub-detectors is managed by providing a global volume, with sizes and locations, calculated depending on configuration ( example: position of mRICH is defined by size/length of the tracker inside solenoid and GEMS in endcup)
- To make in global for eRHIC and JLEIC, we need to define a naming scheme

# Naming scheme proposal ( to be discussed)

- ✓ Define a prefix for sub-detectors in different areas:
  - Central detector (barrel) - "cb\_"
  - Central detector (electron-endcap) - "ce\_"
  - Central detector (ion-endcap) - "ci\_"
  - Far-forward electron side - "ffe\_"
  - Forward ion side - "fi\_"
  - Far-forward ion side - "ffi\_"



# Naming scheme proposal ( to be discussed)



- ✓ Central detector barrel
    - cb\_Solenoid
    - cb\_VTX ( vertex detector)
    - cb\_CTD ( central tracker)
    - cb\_DIRC (dirc)
    - cb\_EMCAL ( EMCAL)
    - cb\_HCAL ( HCAL)
    - ...
  - ✓ Electron endcap
    - ce\_GEM
    - ce\_MRICH
    - ce\_EMCAL
    - ce\_HCAL
    - ..
  - ✓ Hadron endcap
    - ci\_GEM
    - ci\_DRICH
    - ci\_TRD
    - ci\_EMCAL
    - ci\_HCAL
    - ...
- \*\*\*Sept 24 , 2019

# Far-Forward detection systems

- ✓ Far-forward electron side
  - ffe\_LOWQ2
  - ffe\_LUMI
  - ffe\_EPOL
- ✓ Forward ion side
  - fi\_TRK\_D1
  - fi\_TRK\_D2 (?)
- ✓ Far-forward ion side
  - ffi\_ZDC
  - ffi\_RPOT1, ffi\_RPOT2...





