

Plans for the Vertical-BGI

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Vertical-BGI functional specification.

<https://edms.cern.ch/document/1233010/1> “Functional specifications for beam transverse profile measurement as part of the LHC injector upgrade and consolidation projects”

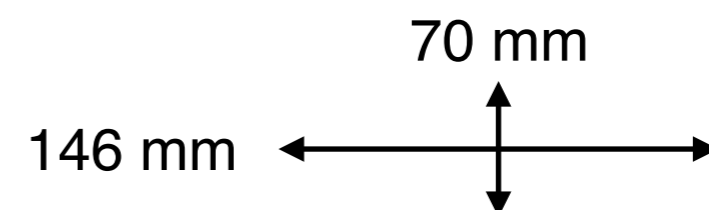
Vertical-BGI functional specification same as for the Horizontal-BGI, including:

“Measurement range entered in the beam pipe BGI: +/- 28mm.”

Is it necessary to have the same 56mm measurement range for the Vertical-BGI?

Beam pipe aperture:

- Maximum horizontal length = 146mm,
- Maximum vertical length = 70mm.



Vertical-BGI design: Starting point.

Rotate Horizontal-BGI design by 90°.

Exactly the same as Horizontal-BGI:

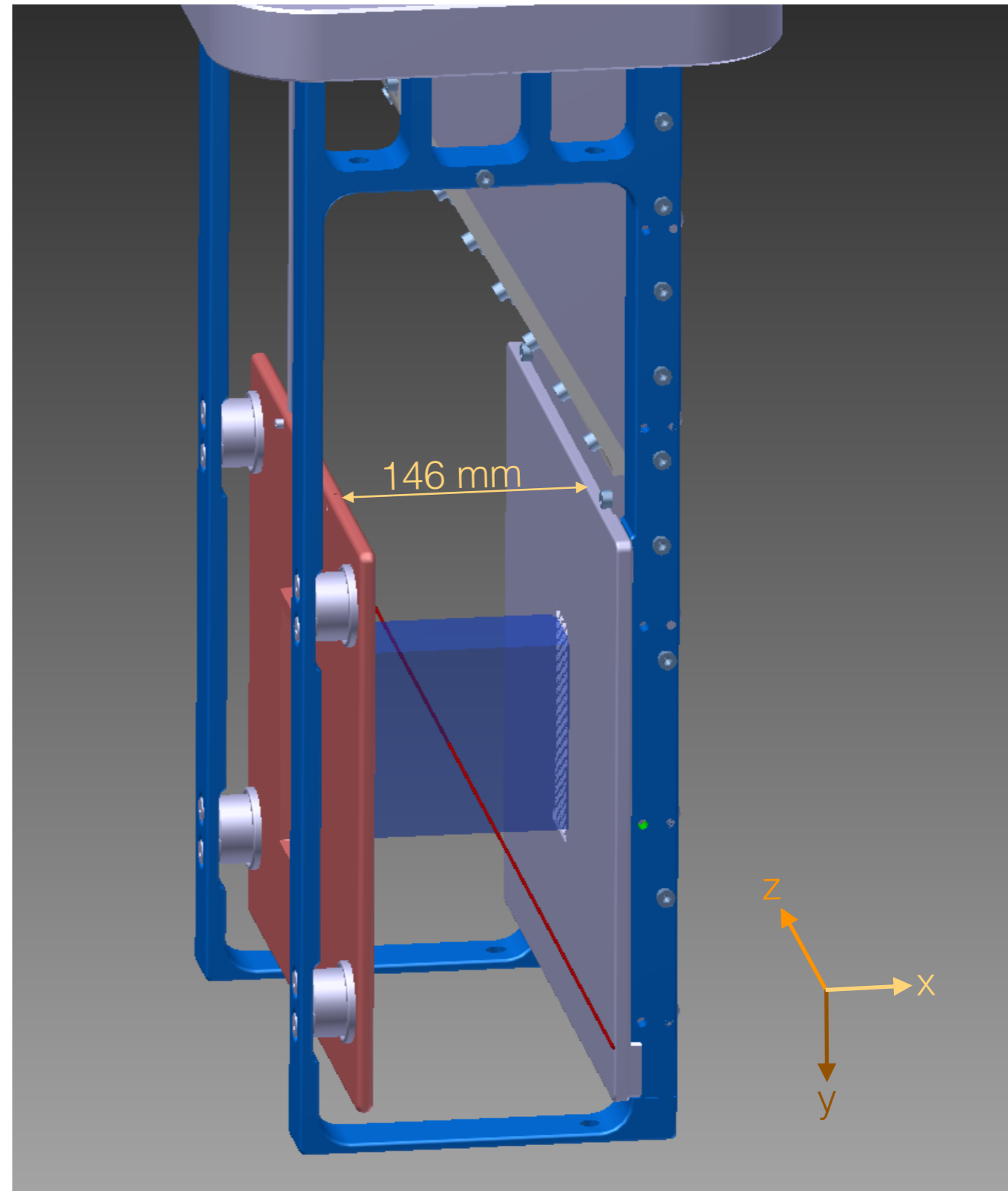
- Pixel detector technology, DAQ, software & cooling system.
- Slow control (PLC) system.

Very similar:

- In-vacuum ceramic carrier board for the pixel detector and LCP flex cables.
- Faraday cage for electronics.

What will be significantly different:

- **Clearance for beam pipe aperture requires that cathode is 146mm from the ground elected compared to 70mm for the Horizontal-BGI.**
- **Electric drift field perpendicular to the fringe field of the bending magnets.**

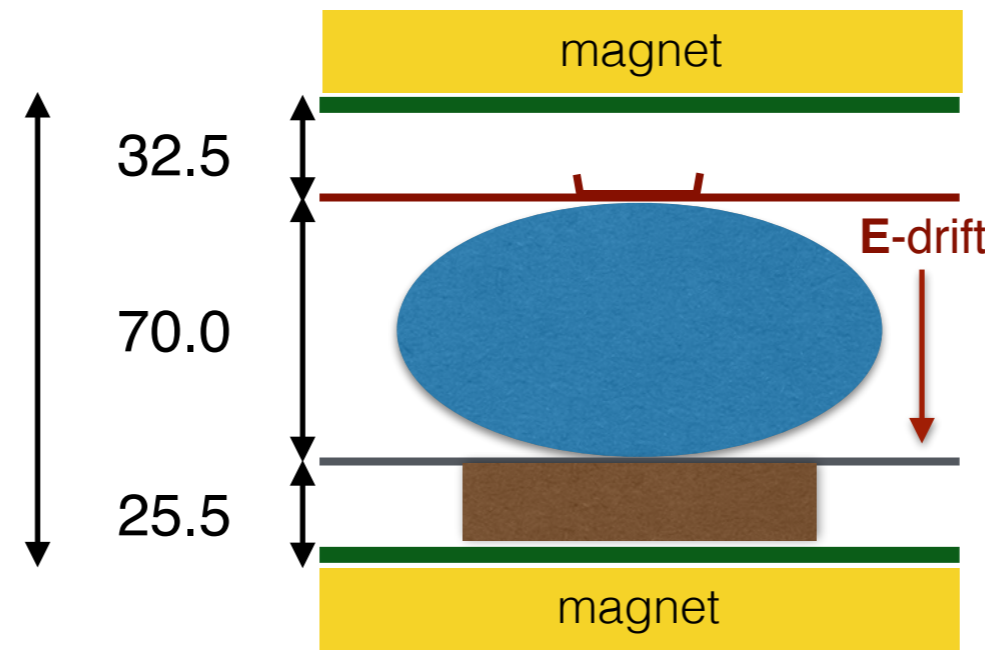


beam axis = (x=0,y=0,-z:+z)

Vertical-BGI design: Aperture constraints.

Horizontal BGI

128.0



vacuum chamber

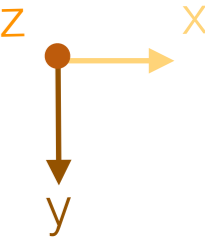
cathode (-20kV)

beam aperture

ground

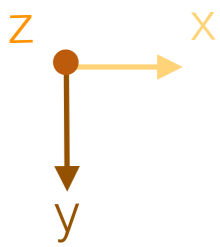
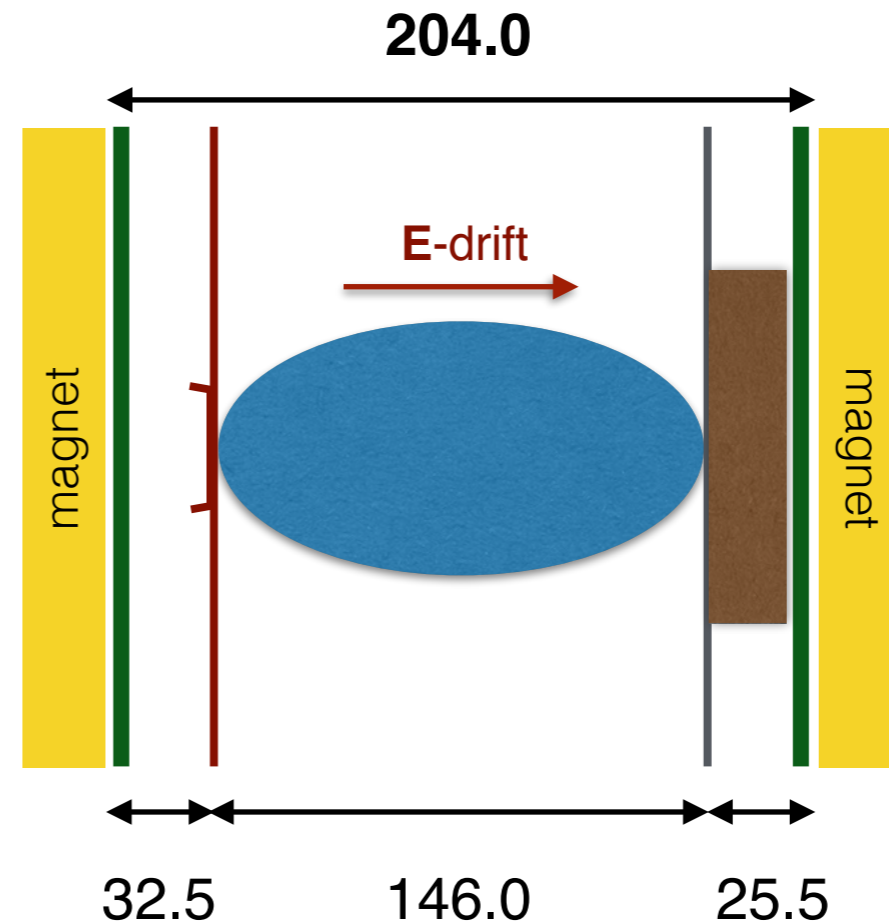
pixel detector

vacuum chamber



Vertical BGI

Clearance needed for beam aperture = 146 mm (c.f. 70 mm for Horizontal-BGI).



Consequences of larger aperture and orientation of drift electric field.

Larger aperture:

- Require Vertical-BGI specific magnet design (see Dominique's talk).
- Require Vertical-BGI specific electric drift field cage design
 - Optimise with CST-Studio / IPMSim.
 - May need to include field shaping side-electrodes (not needed for Horizontal BGI).

Fringe field of bending magnets (B_{bend}) perpendicular to drift electric field (E_{drift}):

- $E_{\text{drift}} \times B_{\text{bend}} \rightarrow$ drift force on ionisation electron could distort beam profile image.
- Possible solution:
 - Vertical-BGI magnet shields ionisation electron drift volume from $B_{\text{bend}} \rightarrow$ could constrain instrument access.

Vertical-BGI planning.

| Milestones | Date |
|--|------------|
| Fix instrument functional specification & magnet specification | 28/02/2018 |
| Fix magnet design & instrument envelope | 30/04/2018 |
| Validate conceptual design with simulation | 30/09/2018 |
| Complete mechanical design | 31/04/2019 |
| Complete manufacturing | 31/10/2019 |
| Ready for installation at PS SS84 | 01/03/2020 |
