Final Focus latest developments

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LNF SuperB Workshop

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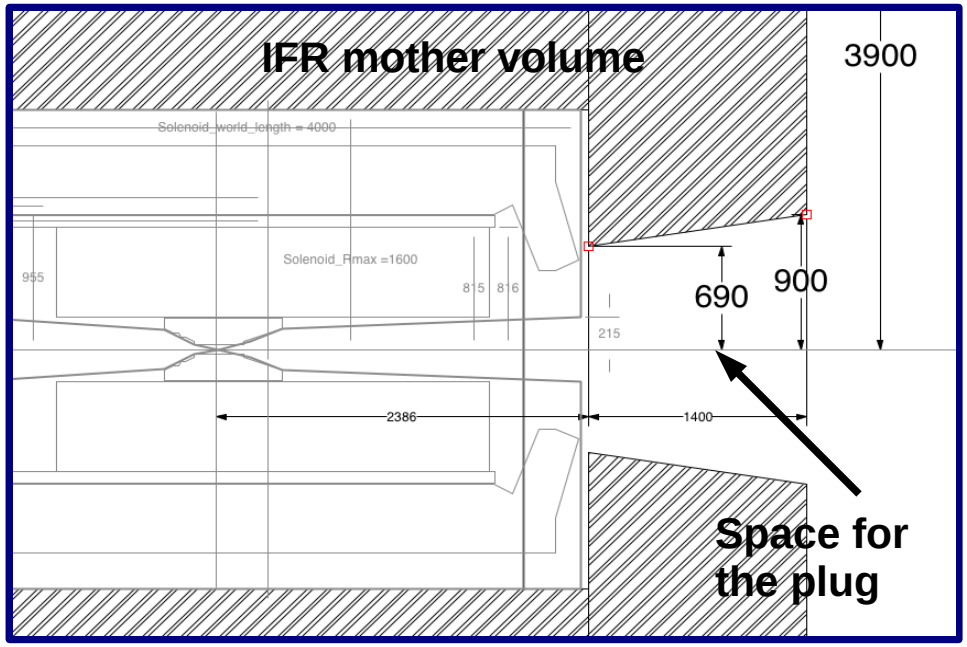
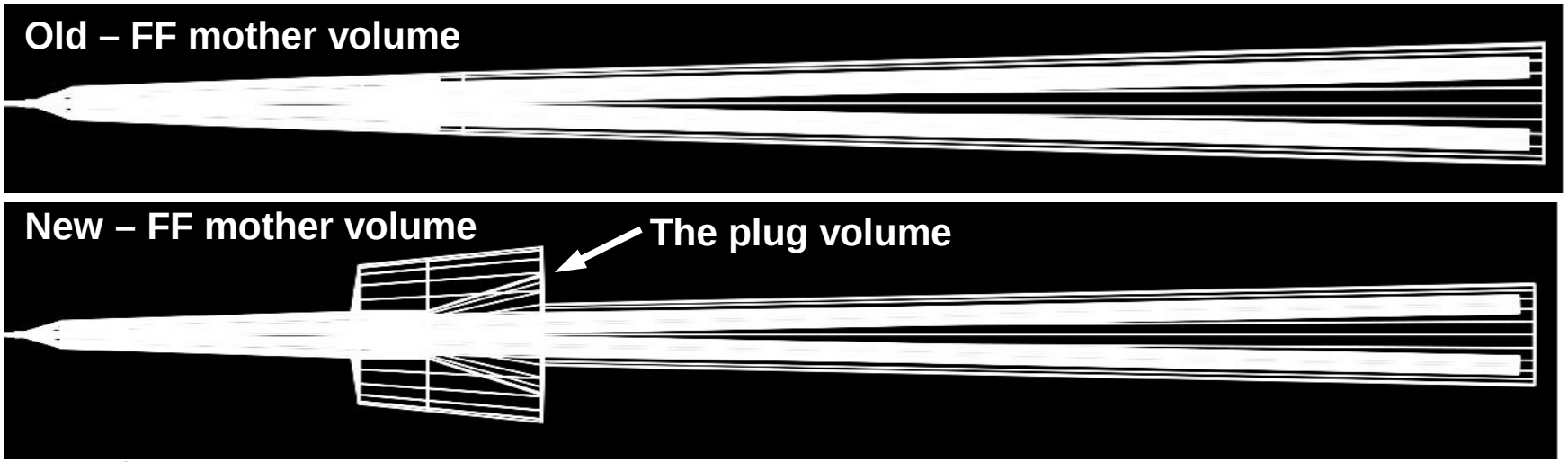
Outline

- **Plug and Horseshoe implementation**
- **Beam pipes implementation from Mike Sullivan's design**
- **Detector Hall**
- **Bruno latest developments:**
  - Magnetic datacard
  - Rad-Bhabha: IP datacard
- **Summary**

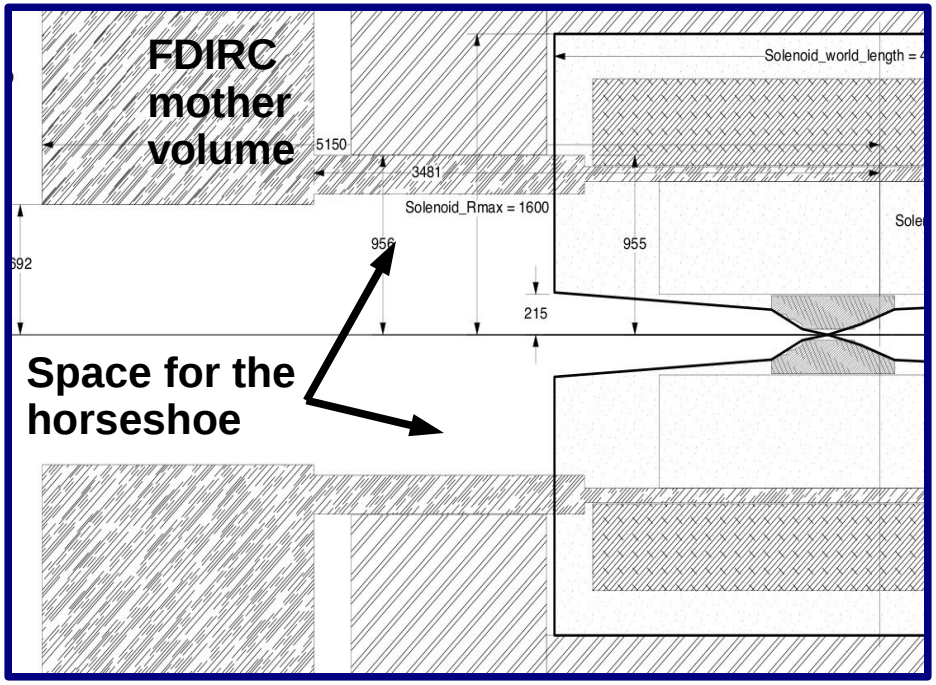
New Final Focus (FF) mother volume (Fwd)



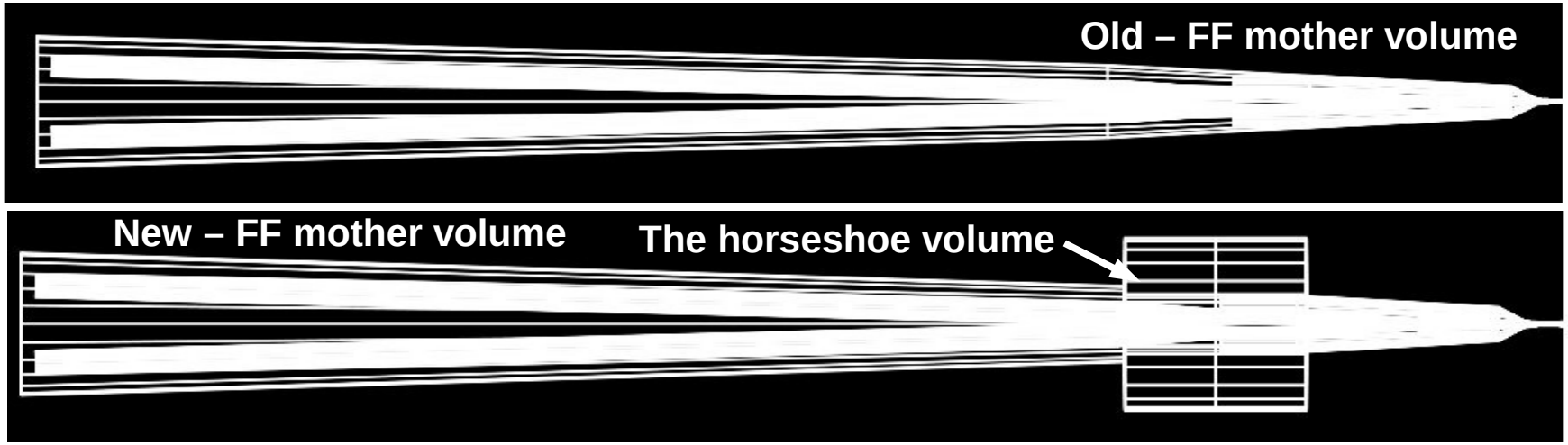
- Increased FF mother volume around 2.4 and 3.8 m taking care on not touching IFR mother volume



New FF mother volume (Bwd)



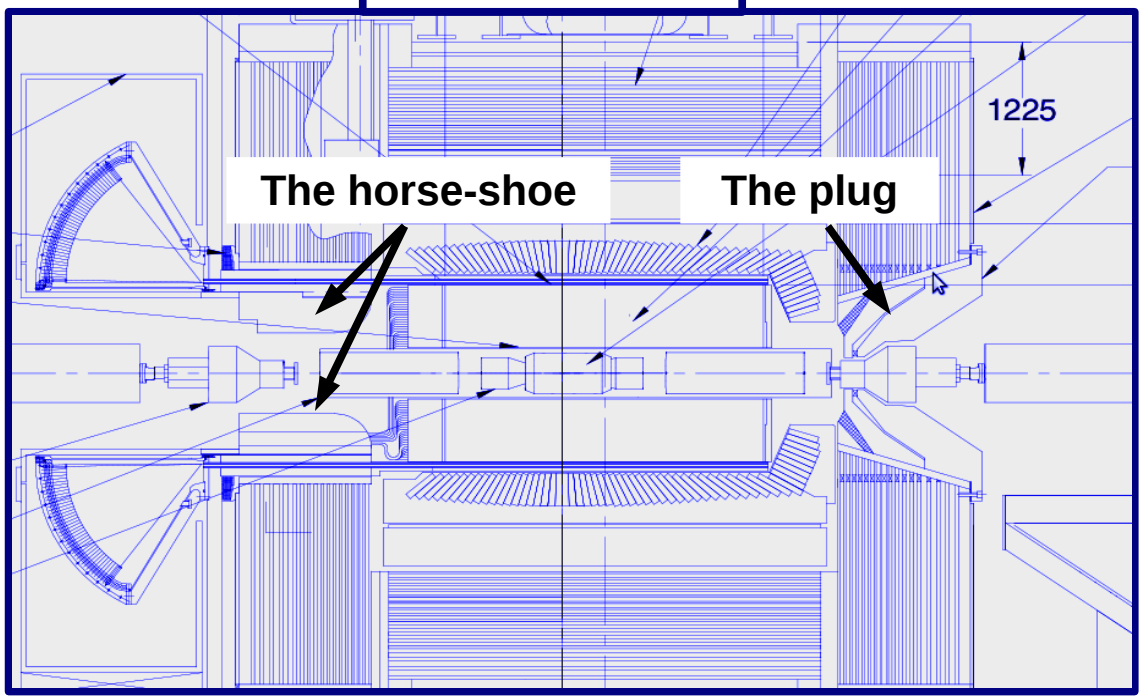
- **Increased FF mother volume around -2.8 and -1.6 m taking care on not touching Bwd FDIRC mother volume**



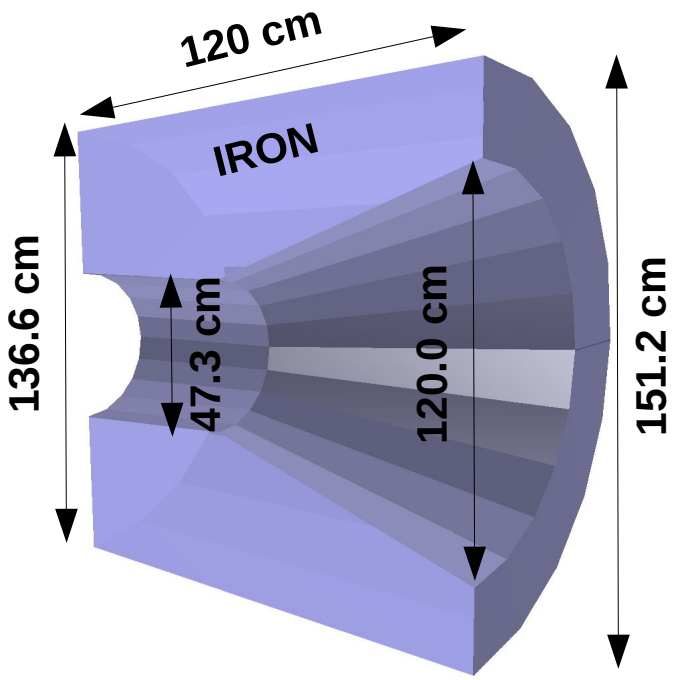
The Plug profile

- Use some BaBar drawings as reference for the dimensions
- Try to include particularities of SuperB design (FF tungsten shield)

BaBar drawing

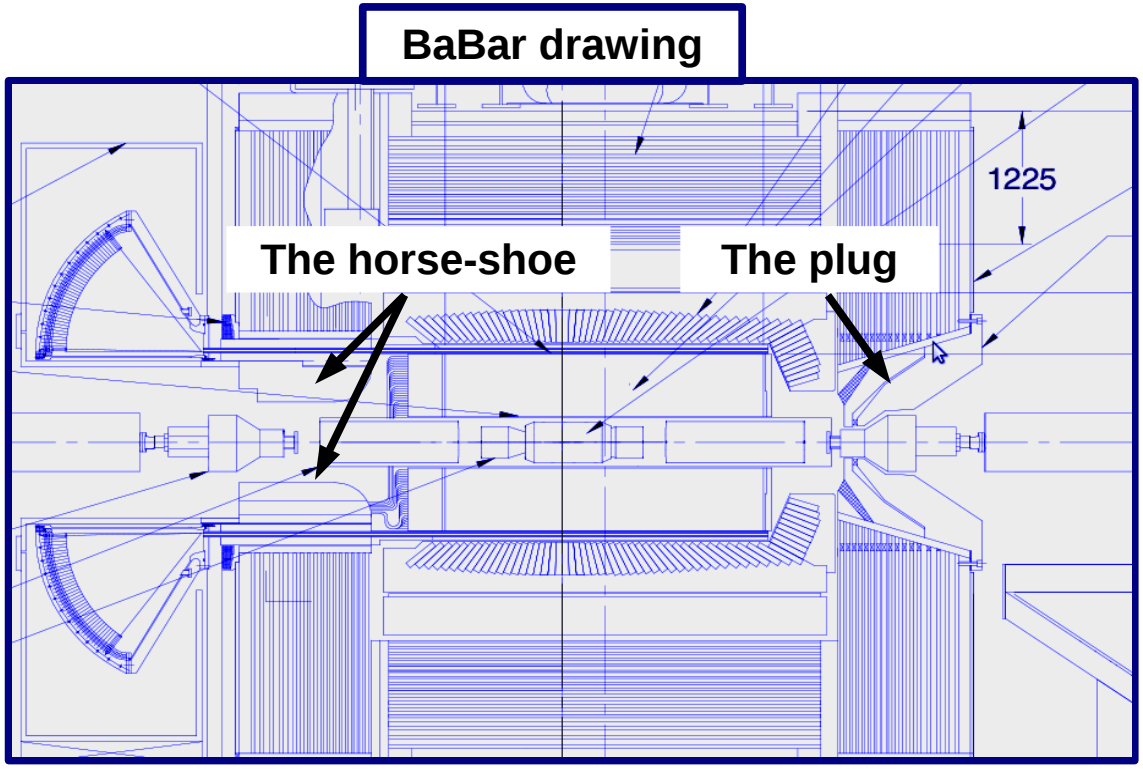


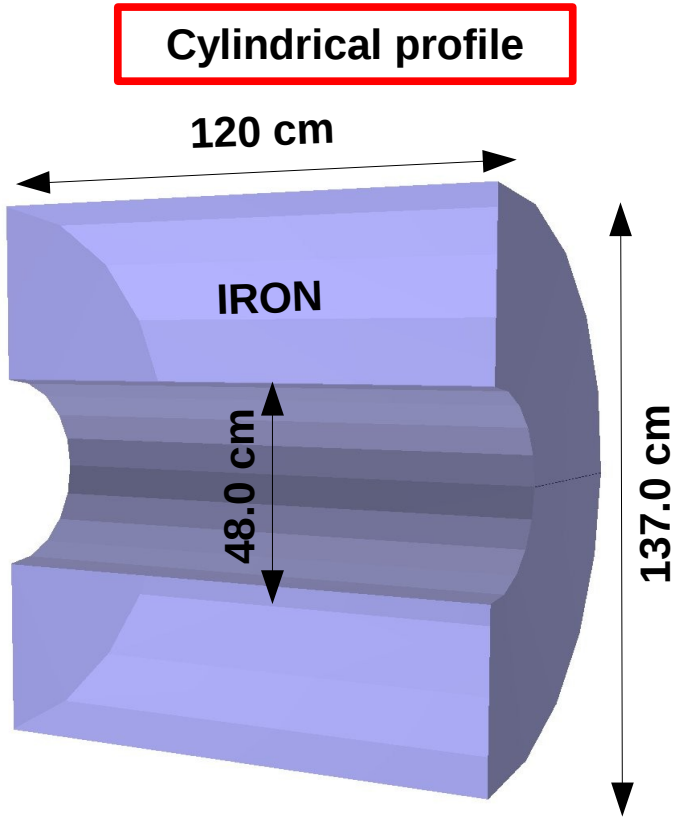
Conical profile



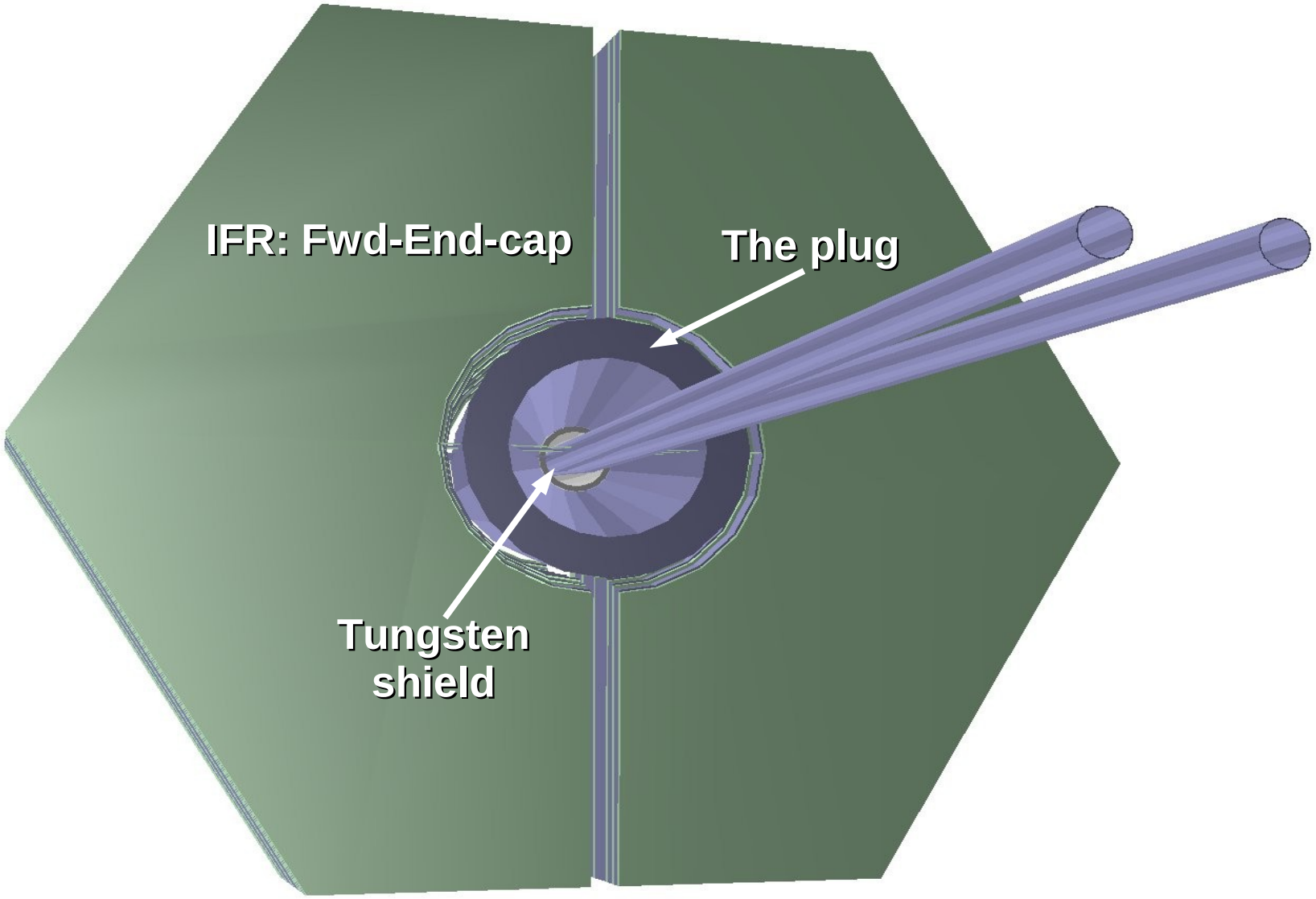
The Horseshoe profile

- Use some BaBar drawings as reference for the dimensions
- Try to include particularities of SuperB design (FF tungsten shield)

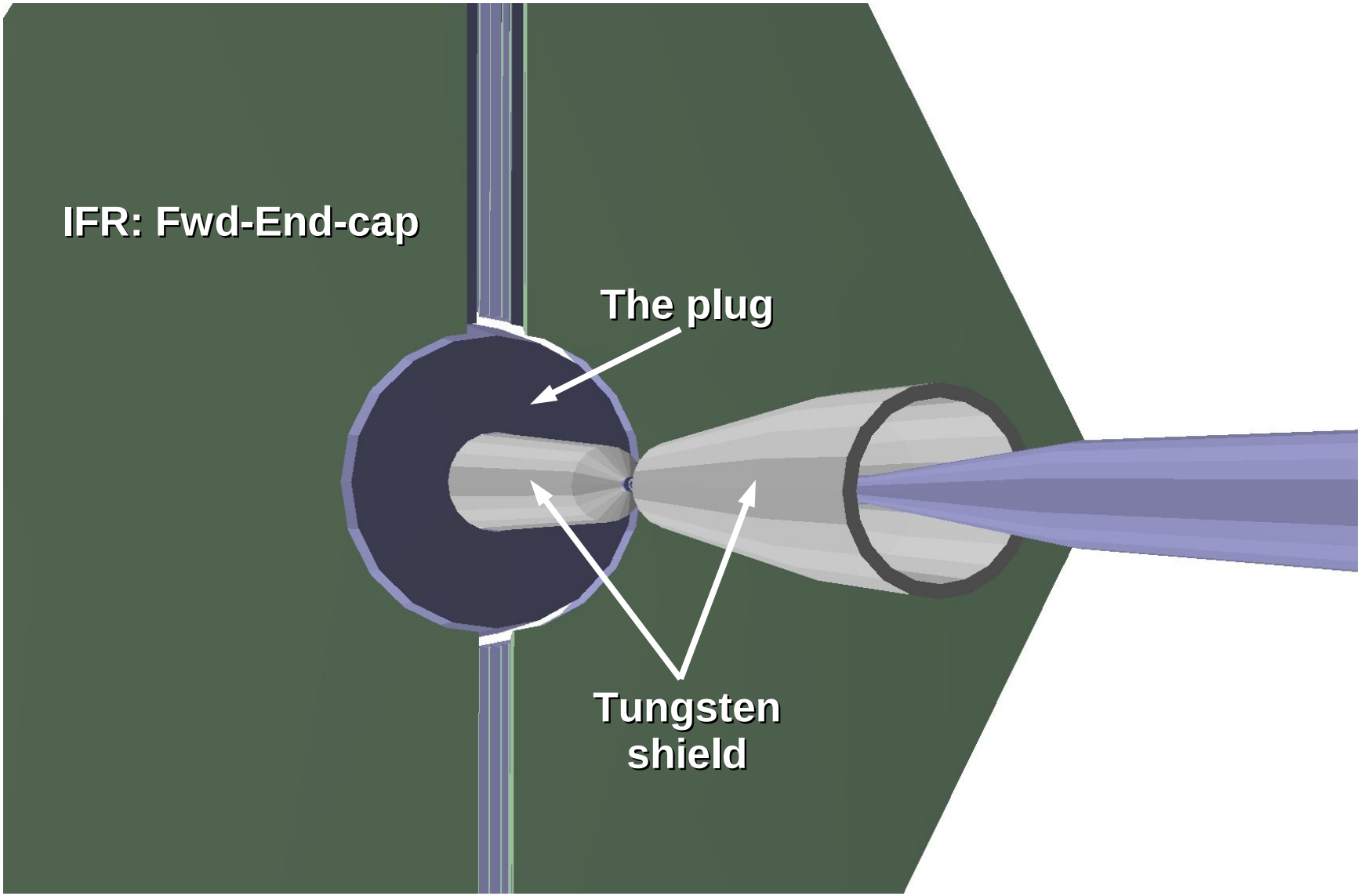




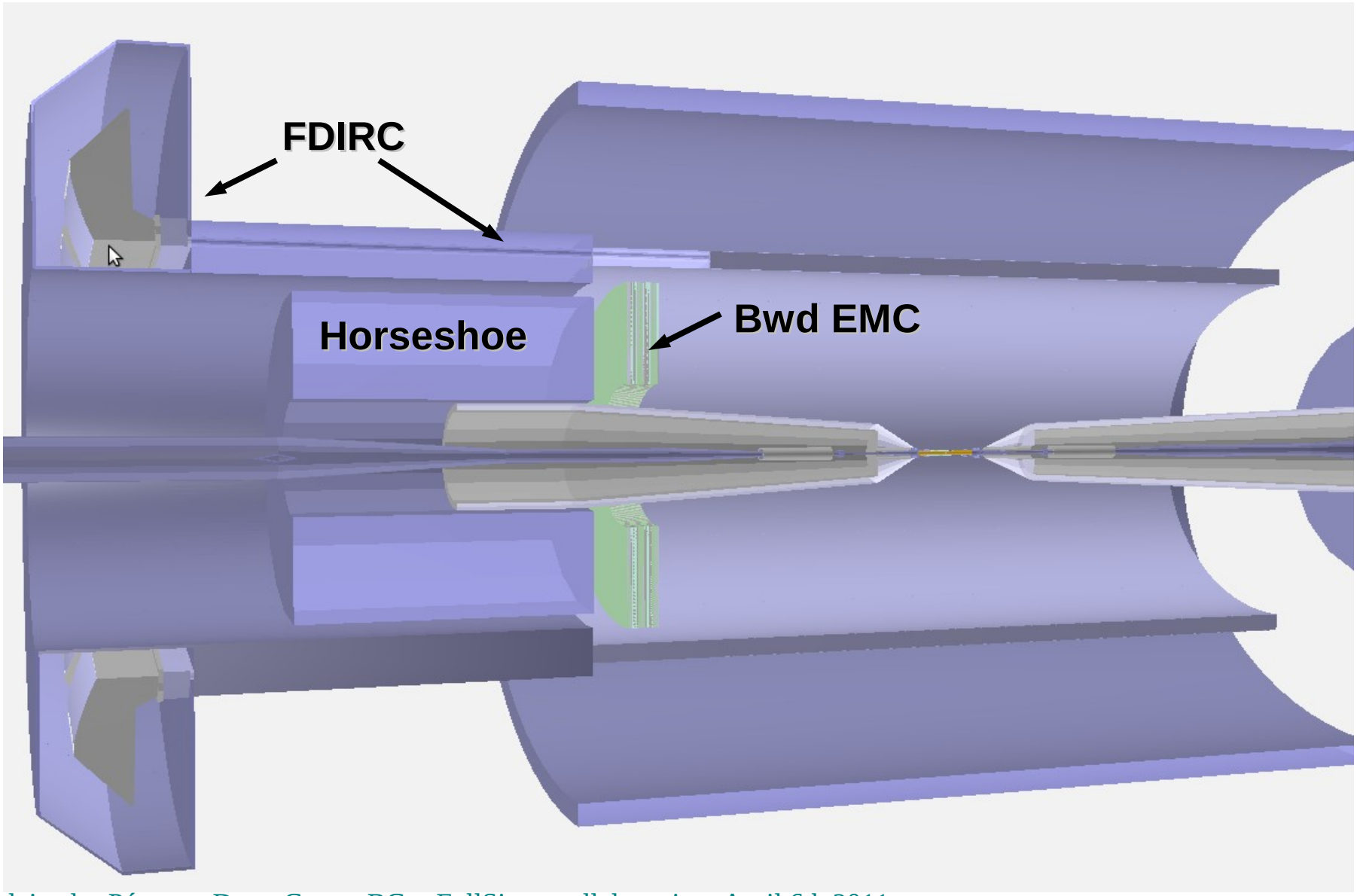
Some plots (Fwd Plug)



Some plots (Fwd Plug)

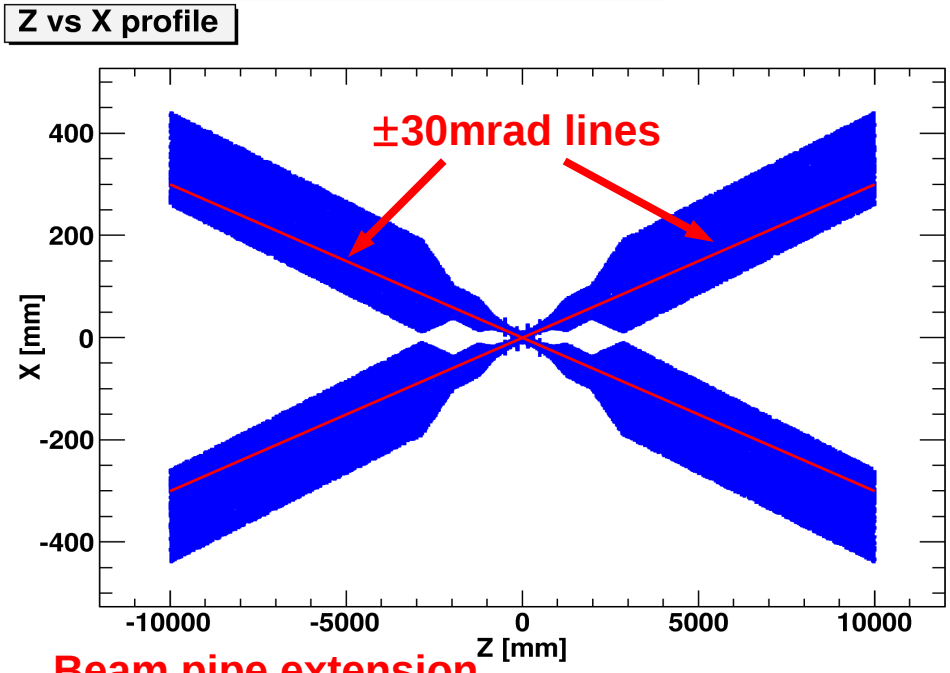


Some plots (Bwd Horseshoe)

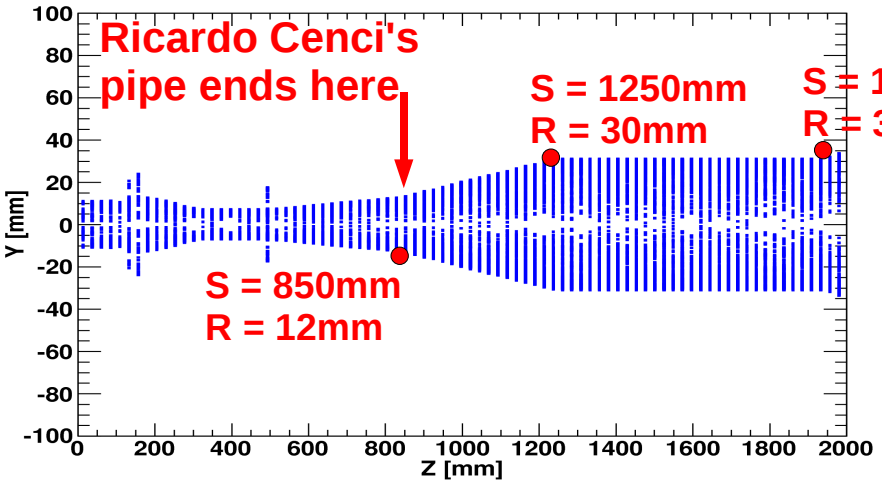


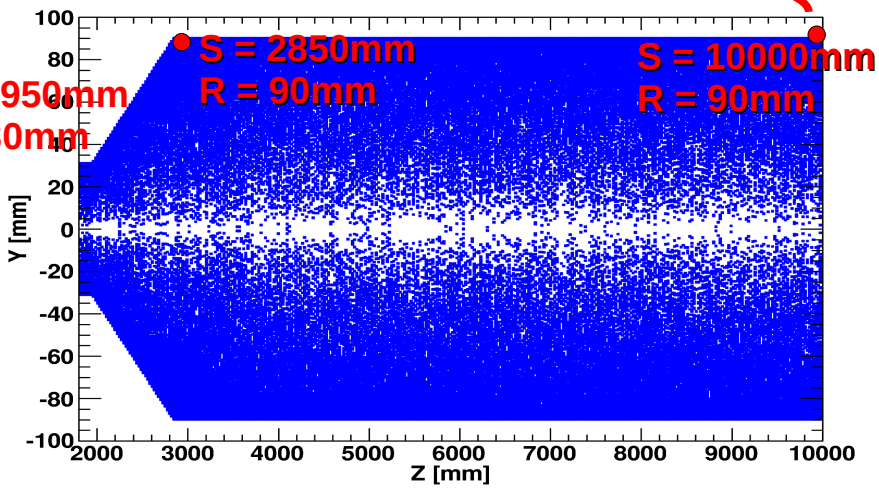
Previous beam pipes profile

- Beam pipes tilt is higher (35mrad) than 30mrad
- Pipes up to up to ±10m from IP
- Ad-hoc pipe profile. No precise model from Accelerator group design

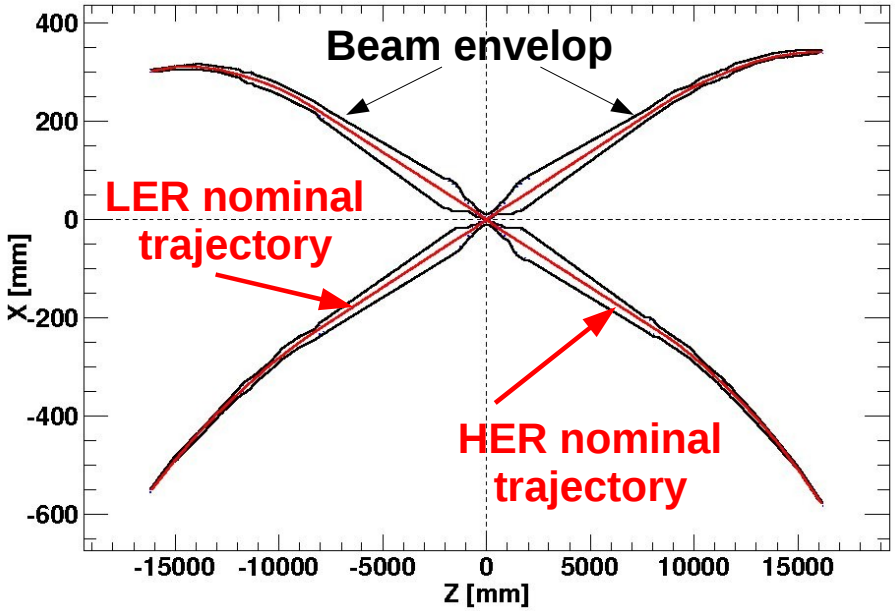


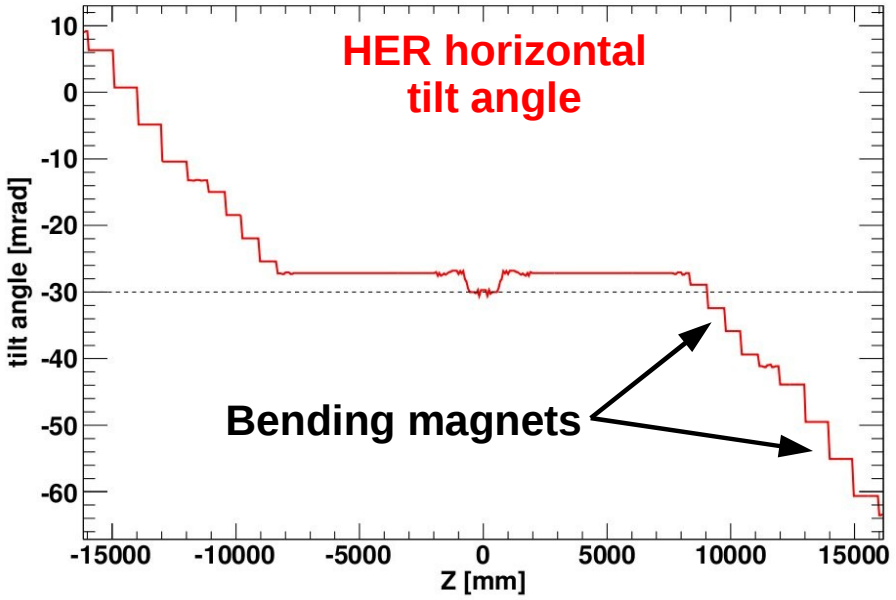
Beam pipe extension





V12 SF11 nominal trajectories

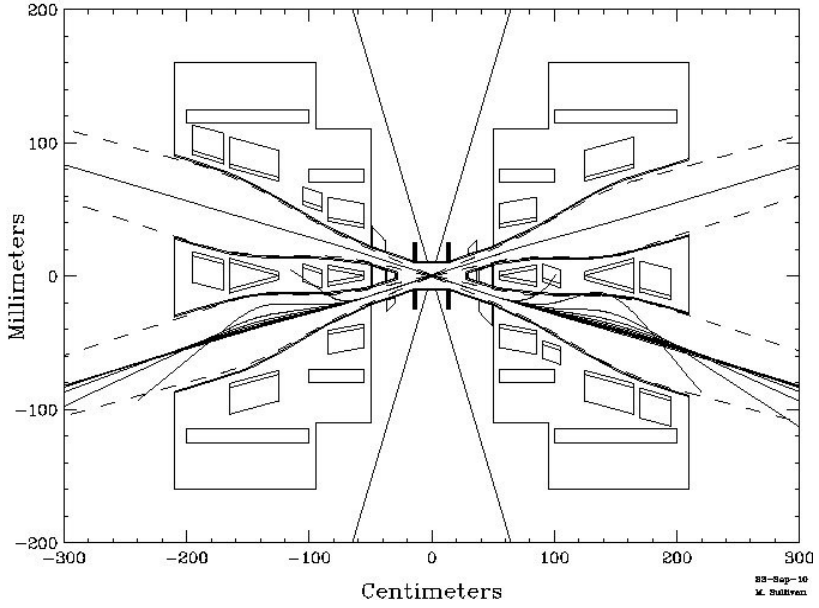


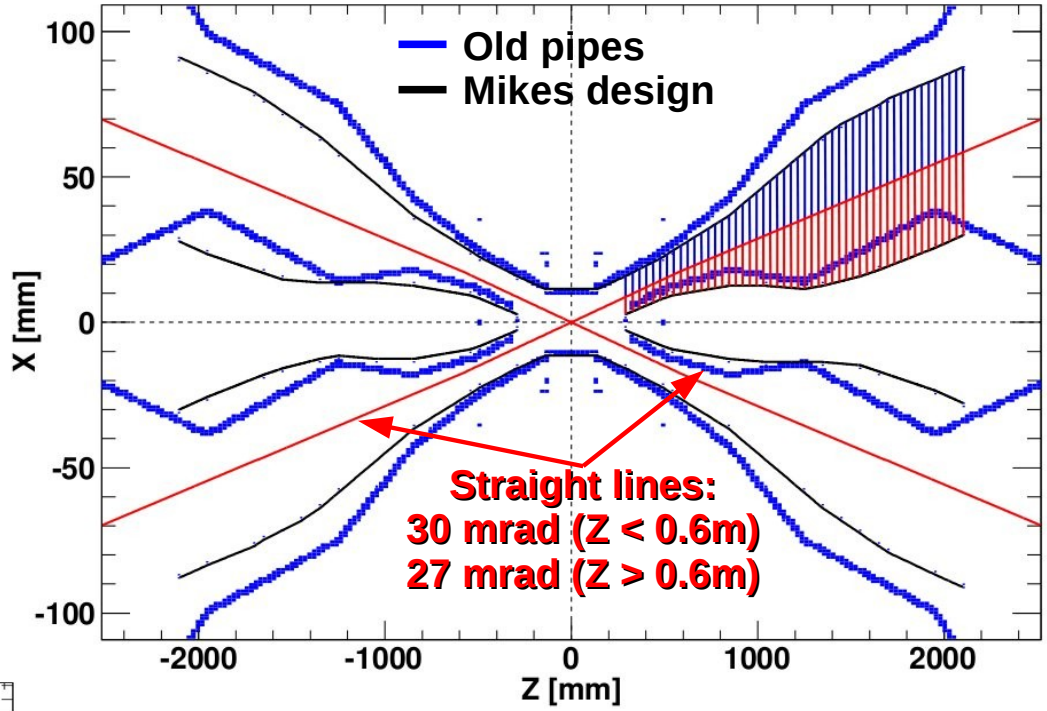


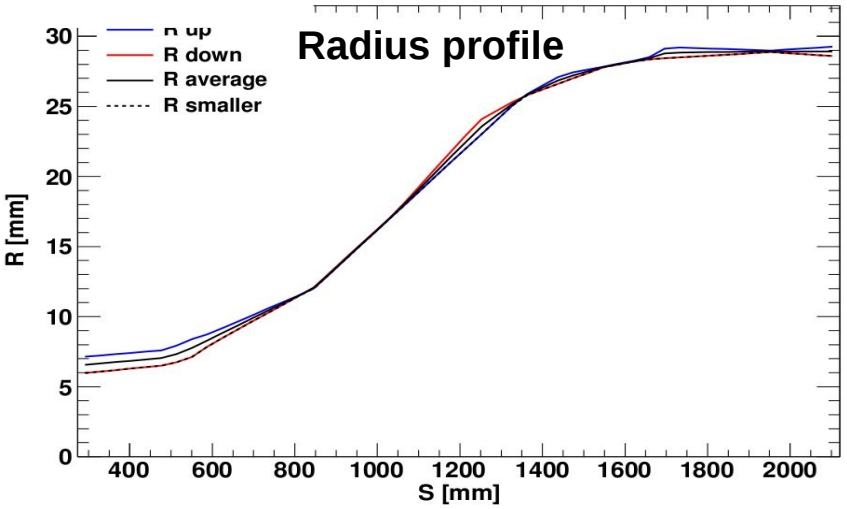
- Beam pipe design only up to ~2m from IP
- After that only have beam envelop ($10\times\sigma_X$ and $10\times\sigma_Y$ beam sizes) up to ±16m from IP
- Essentially two horizontal tilt before 1st bend:
  - 30mrad near IP (Z < 0.6m)
  - 27 mrad up to 1st bend
- Will try to use two straight sections for the beam pipe modeling

V12 SF11 beam pipes profile (I)

Mikes drawings

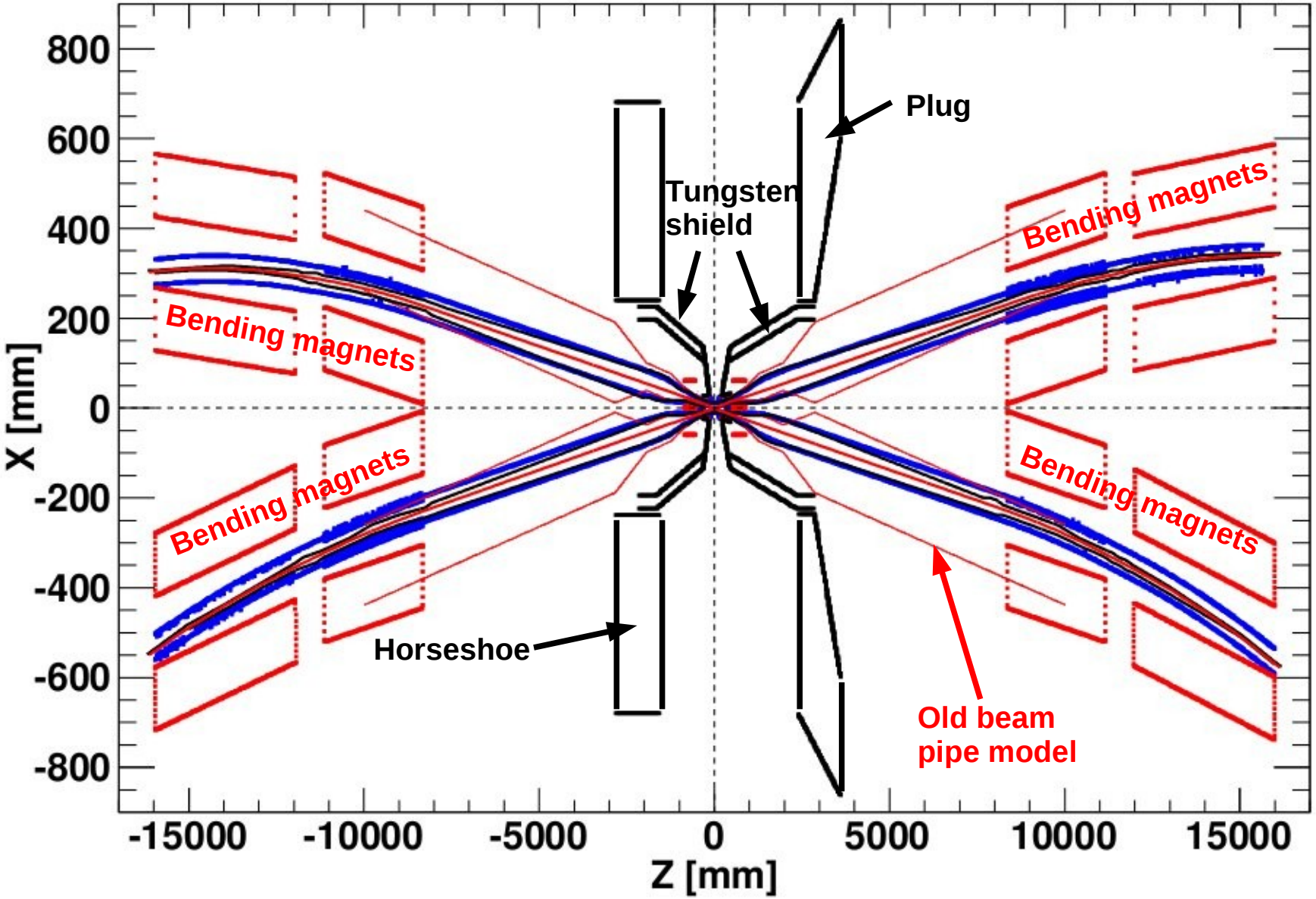




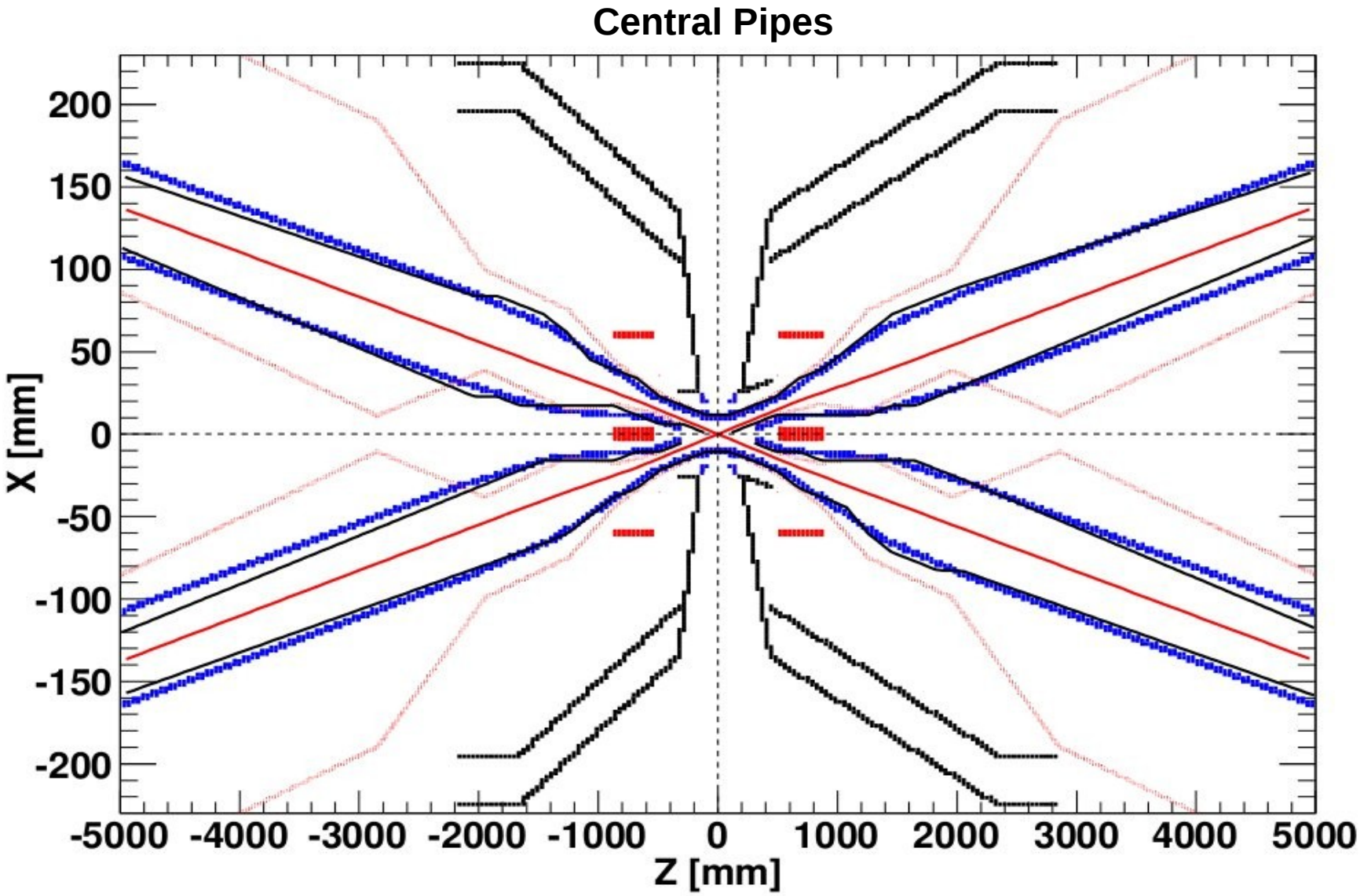


- **Use Mike Sullivan's drawings as inputs (no information on the vertical dimensions)**
- **Out of that get:**
  - Curves with the pipes walls
  - Calculate pipes radius profile as a function of distance to IP
- **Use straight pipes with constant radius from 2.4 m on until 1st bend**

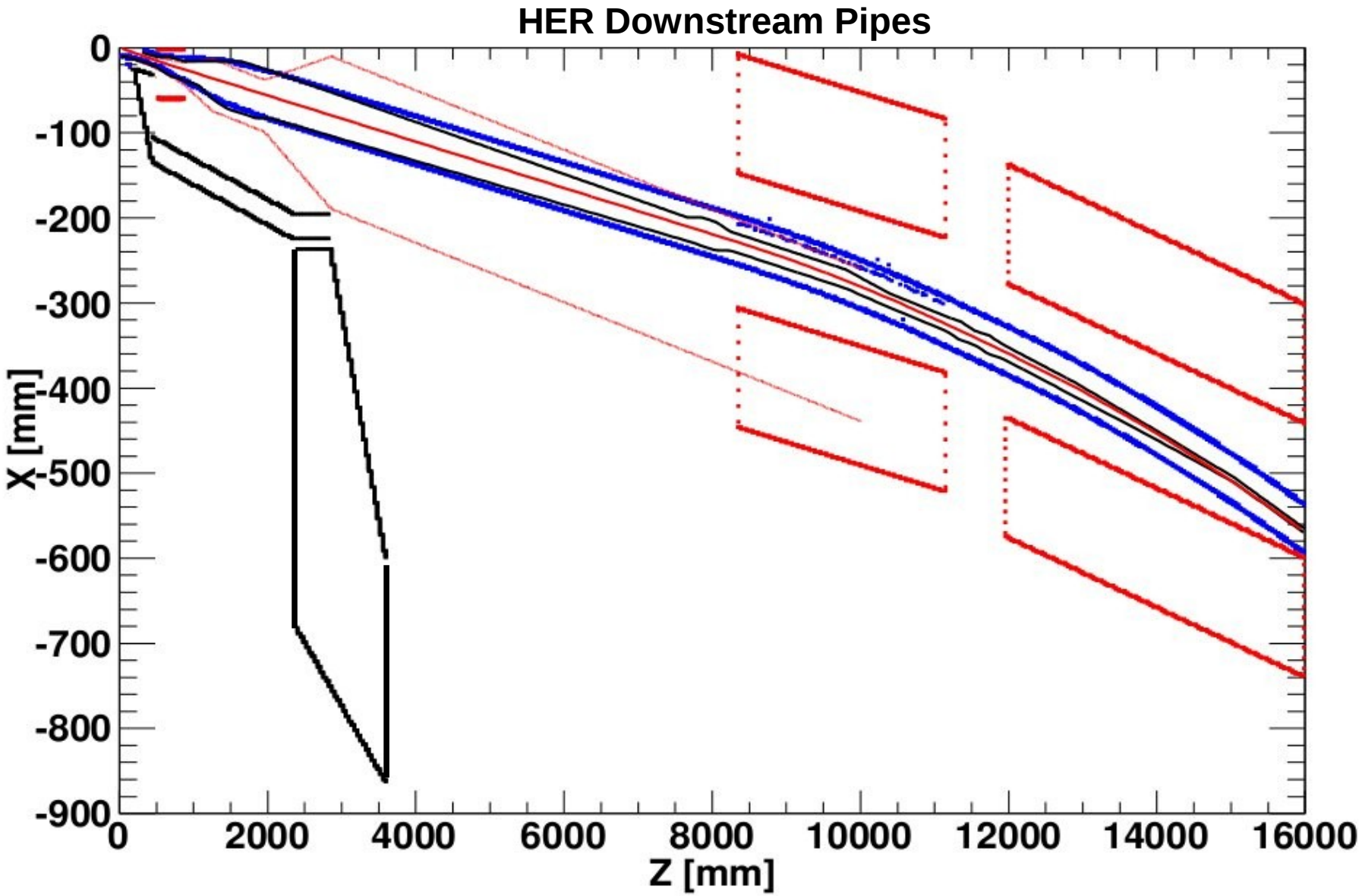
V12 SF11 beam pipes X-Rays (I)



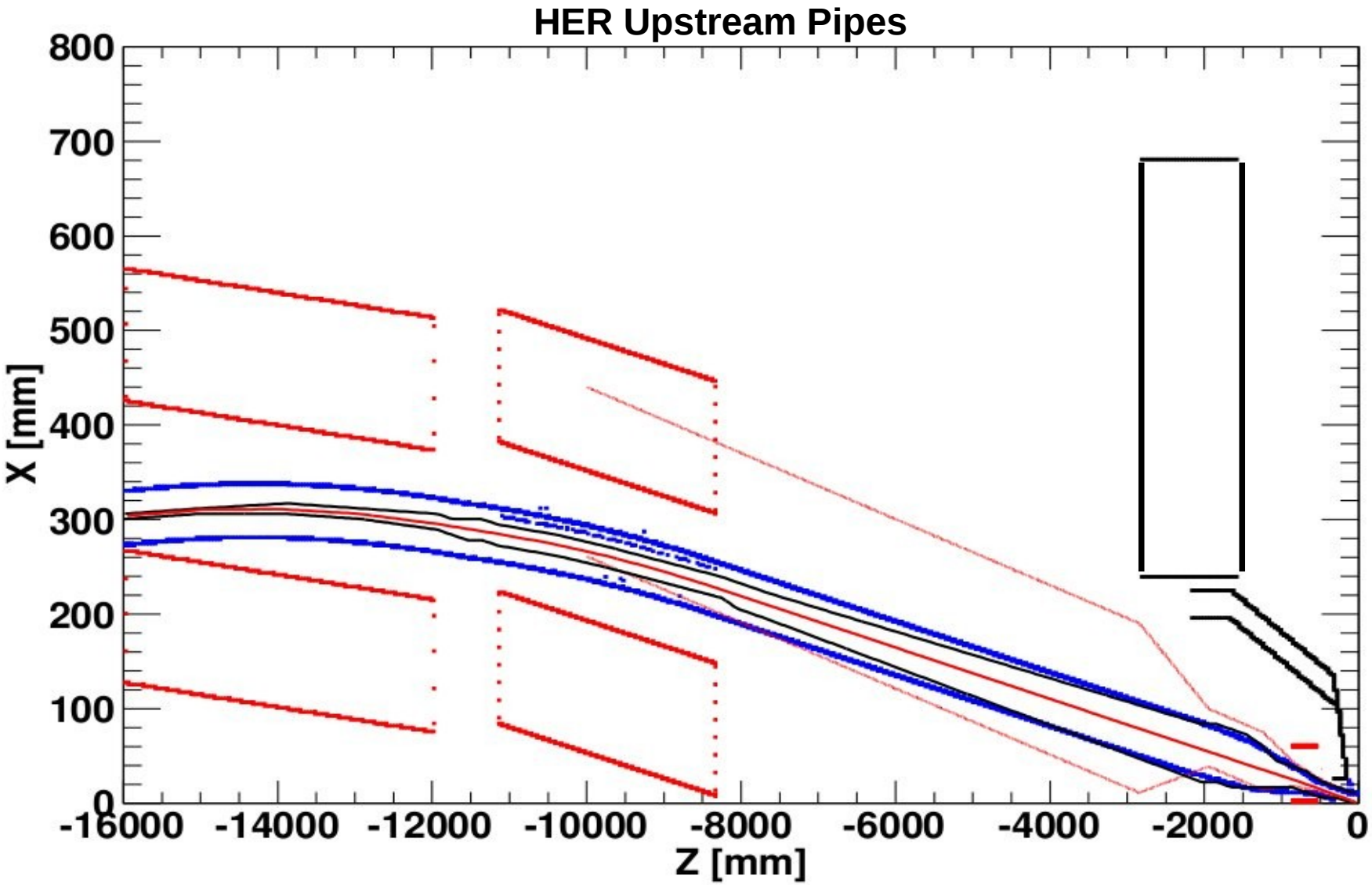
V12 SF11 beam pipes X-Rays (II)



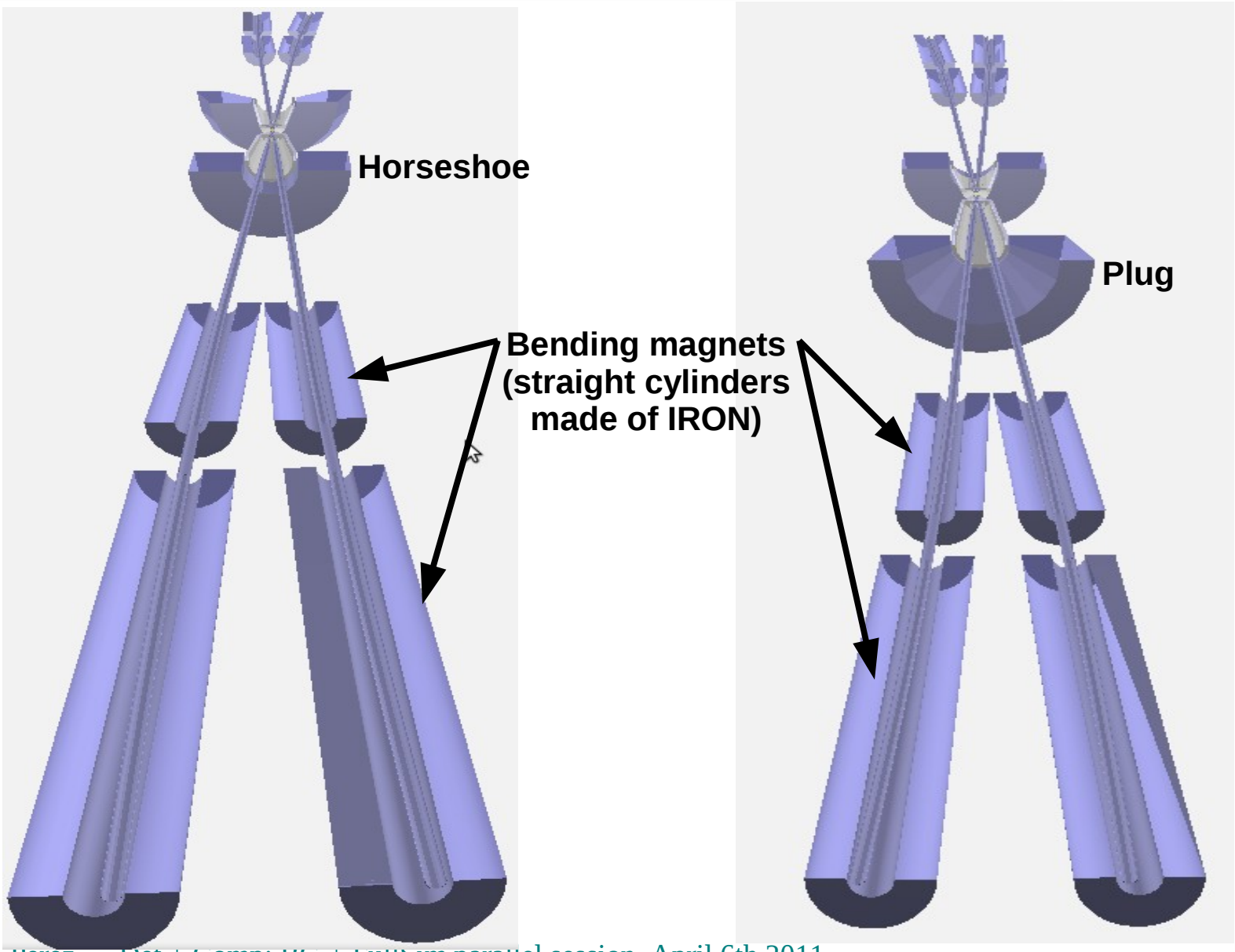
V12 SF11 beam pipes X-Rays (III)



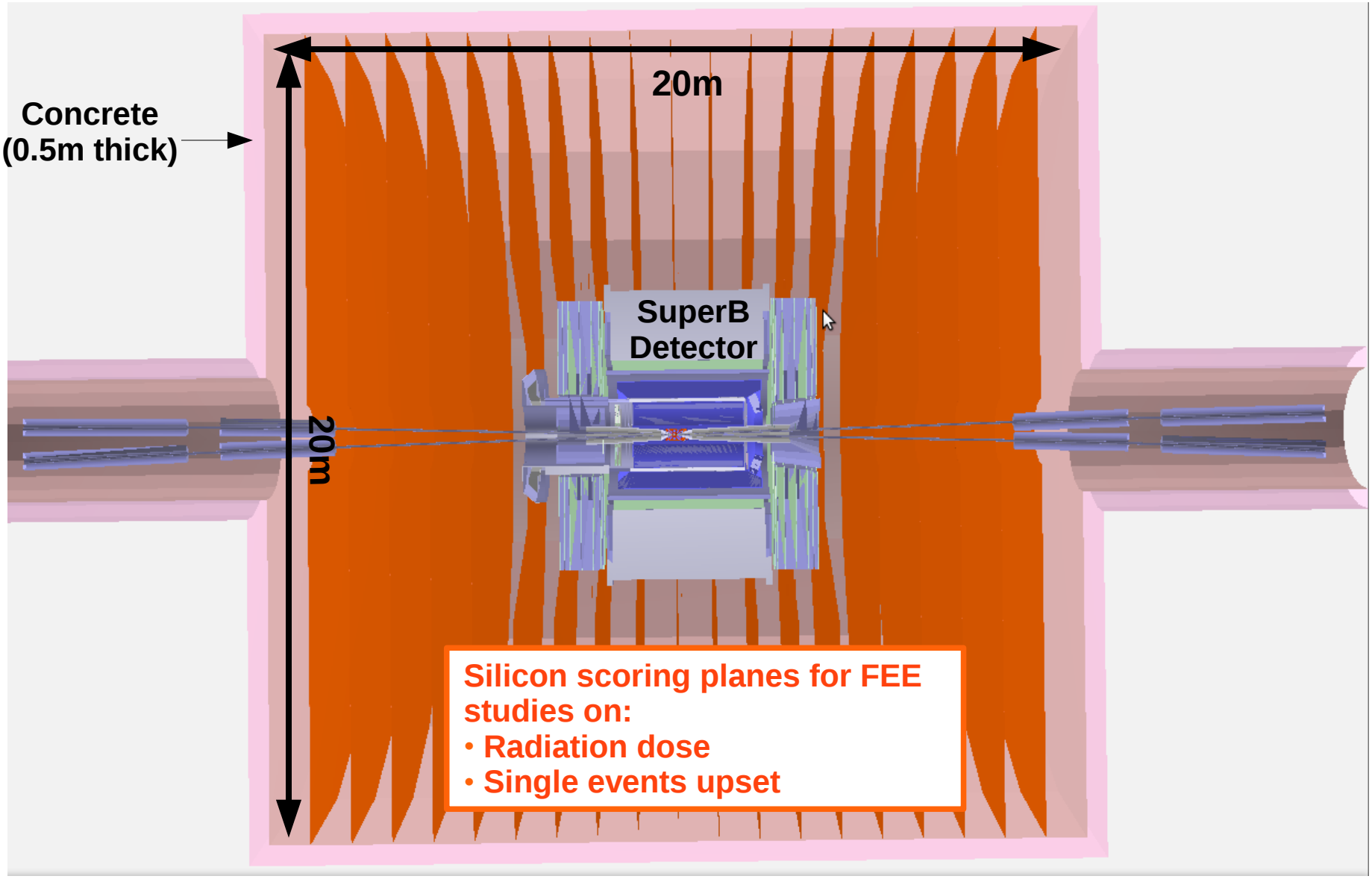
V12 SF11 beam pipes X-Rays (IV)



New beam pipes model in Bruno



Detector Hall



Bruno development: Magnetic IR

- **Previously:**
  - Final focus magnetic field was hard-coded inside Bruno
  - Difficult to follow the evolution of the final focus design
- **Currently:** (Need to document this in the wiki)
  - Modified Bruno to use a magnetic layout input datacard

    http://mailman.fe.infn.it/superbwiki/index.php/Bruno_Invocation
  - Datacard structure: define a list of magnetic elements (cylinders)
  - New parameters (Radius_int, ConstantRadialBField). Need final testing

```
BeginMagneticElement
  Name            QD0PA
  StartPoint      0.899865   0.   29.9865   cm
  EndPoint        0.929861   0.   30.9861   cm
  Radius          0.899865   cm
  Radius_int      0.4        cm (default is zero)
  MagCenterPoint  0.914863   0.   30.4863   cm
  MagAxisVector   -0.0299955 0    -0.99955
  Gradient        -0.99955   0    0.0299955  139.12   tesla/m
  ConstantBField  0   0   0   0   tesla
  ConstantRadialBField  1.0  tesla (default is zero)
EndMagneticElement
```

Cylinder definition

Quadrupolar field

Constant B-field

Radially constant B-field

Bruno development: bbbrem IP parameters

- **Previously:** Bbbrem generator (Radiative Bhabha) needs beam IP parameters for luminosity calculation
  - IP parameters were hard-coded inside Bruno (src/BbbremGenerator.cc)
  - Difficult to follow the evolution of the final focus magnetic layout
- **Currently:** (Need to document this in the wiki)
  - bbbrem generator reads an input datacard with IP parameters (/generator/bbbrem/IPdatacard)
  - New parameter: IP location (IP_coor). Need final testing

HER parameters

her_energy	6.69	GeV
her_pdt	-11	
her_sigma_x	7.334e-3	mm
her_beta_x	26.0	mm
her_sigma_y	36.0e-6	mm
her_beta_y	253.0e-3	mm
her_sigma_z	5.0	mm
her_deltaEoE	1.0e-3	
her_alpha_z	-30.0e-3	
her_npart	5.08e+10	

LER parameters

ler_energy	4.18	GeV
ler_pdt	11	
ler_sigma_x	8.701e-3	mm
ler_beta_x	32.0	mm
ler_sigma_y	35.0e-6	mm
ler_beta_y	205.0e-3	mm
ler_sigma_z	5.0	mm
ler_deltaEoE	1.0e-3	
ler_npart	6.56e+10	

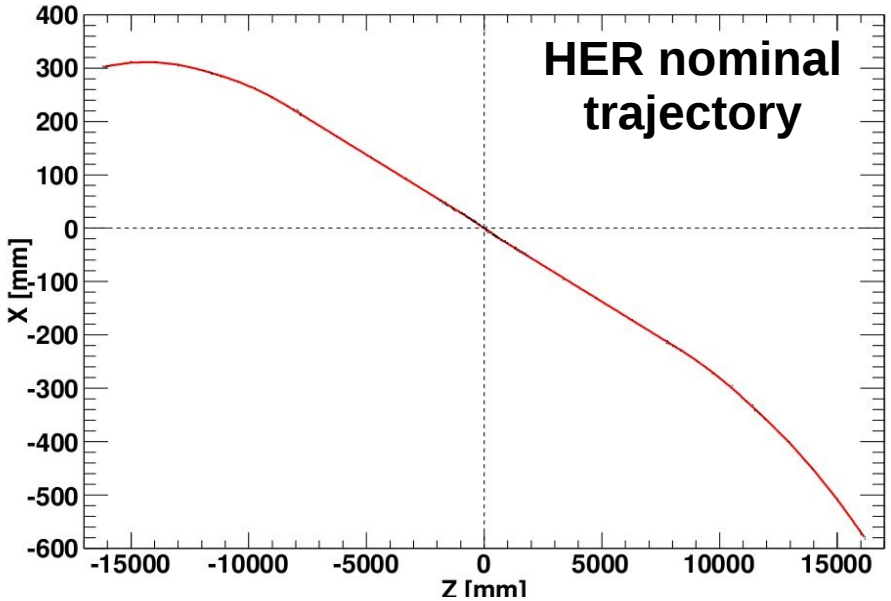
IP_coor 0.0 0.0 0.0 mm (default is (0,0,0))

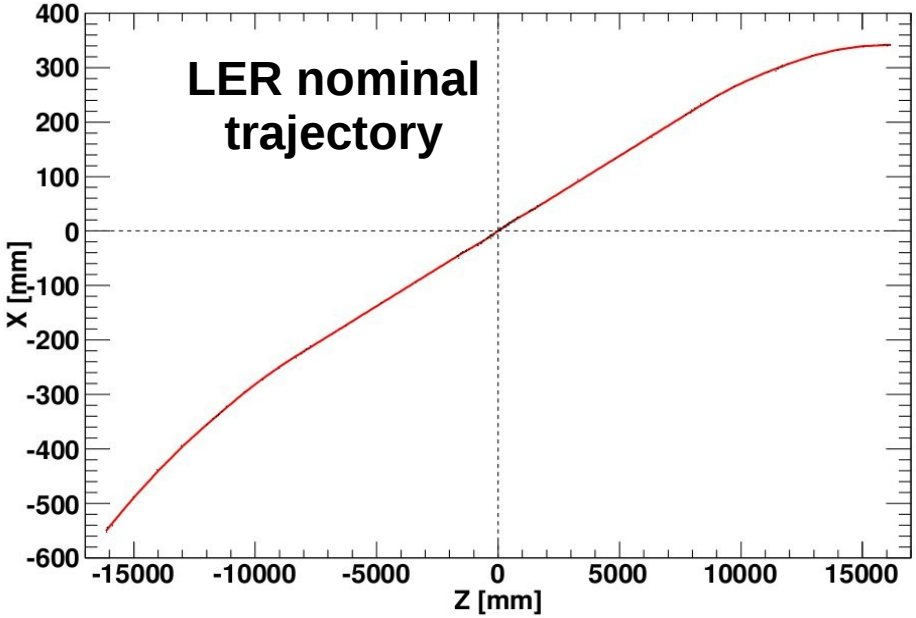
Summary and outlook

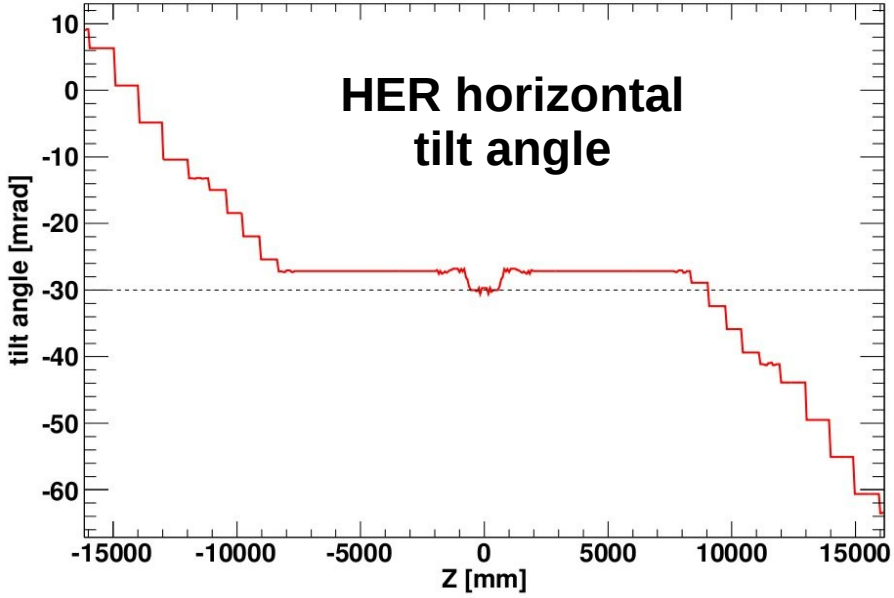
- **Final focus is well shielded:** extended Tungsten shield, Plug and Horseshoe in place
- **Beam pipe profile:** simple approach gives good results,
  - Two straight section: 30mrad (< 0.6 m) and 27mrad (> 0.6)
  - Use Mike Sullivan's radius profile up to ~2m from IP
  - From that point on use constant radius pipes (29 mm)
  - Beam pipe modeled up to ±16 m from IP (including bending magnets)
- **Detector hall:**
  - Concrete wall (polycone with simple profile)
  - Silicon scoring planes for FEE studies (Eugenio Paoloni)
- **Bruno developments:**
  - Magnetic datacard new parameters: internal radius and radially constant B-field
  - Rad-Bhabha generator IP datacard: new IP location parameters
- **Next steps:**
  - Implementation of magnetic elements material
  - Diag36 (2-photon background) generator inside Bruno

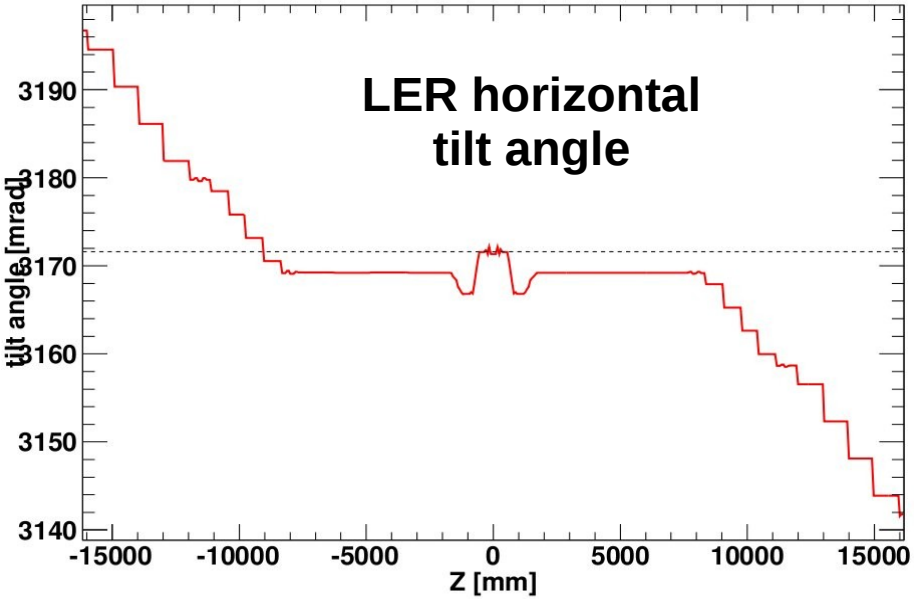
Backup

V12 SF11 nominal trajectories

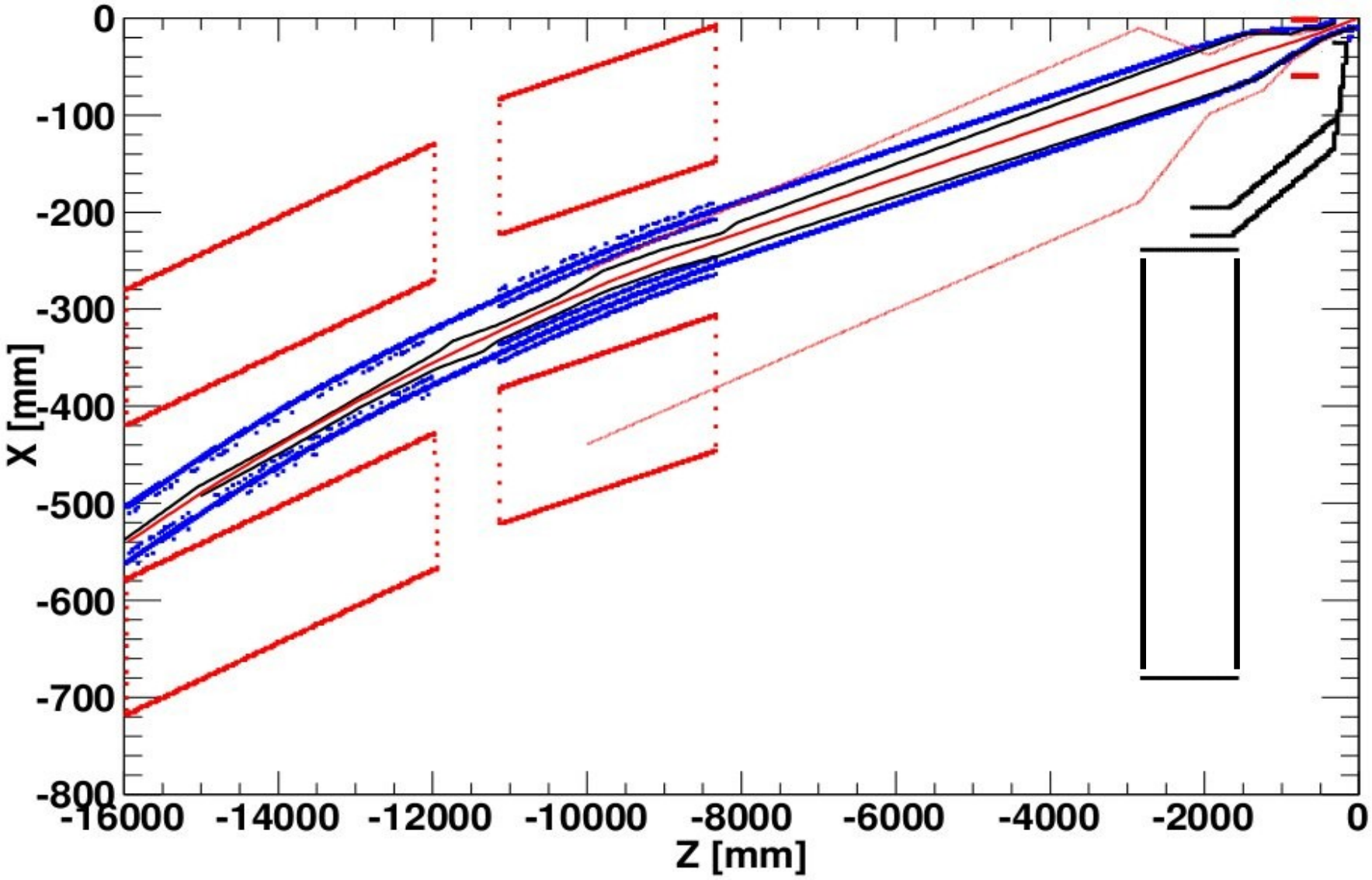
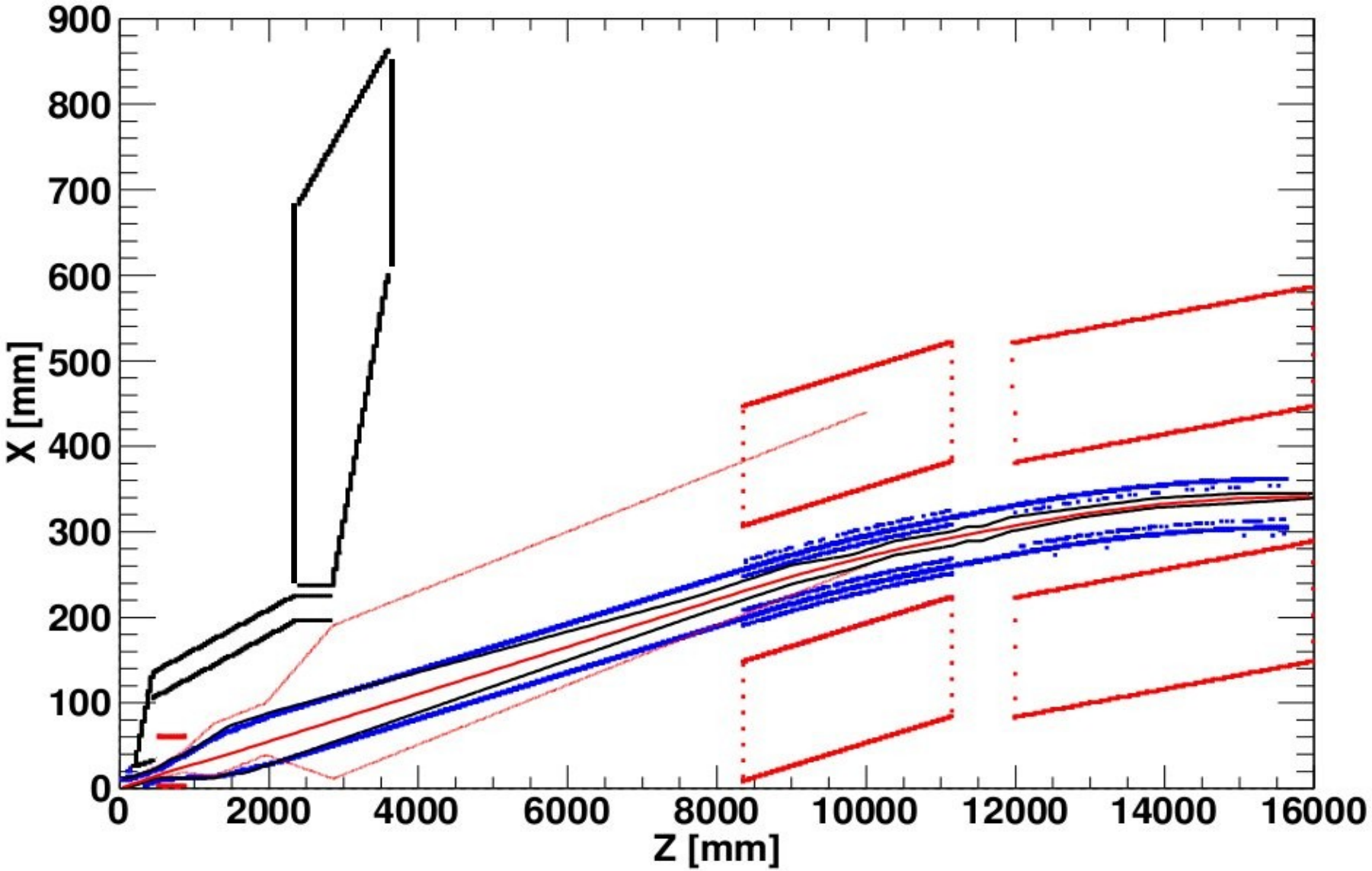








Beam pipes profile: LER Downstream



Beam pipes profile: LER Upstream