Rad-BhaBha Losses with the v12 sf11 final focus layout

Alejandro Pérez
INFN – Sezione di Pisa

Elba SuperB Workshop

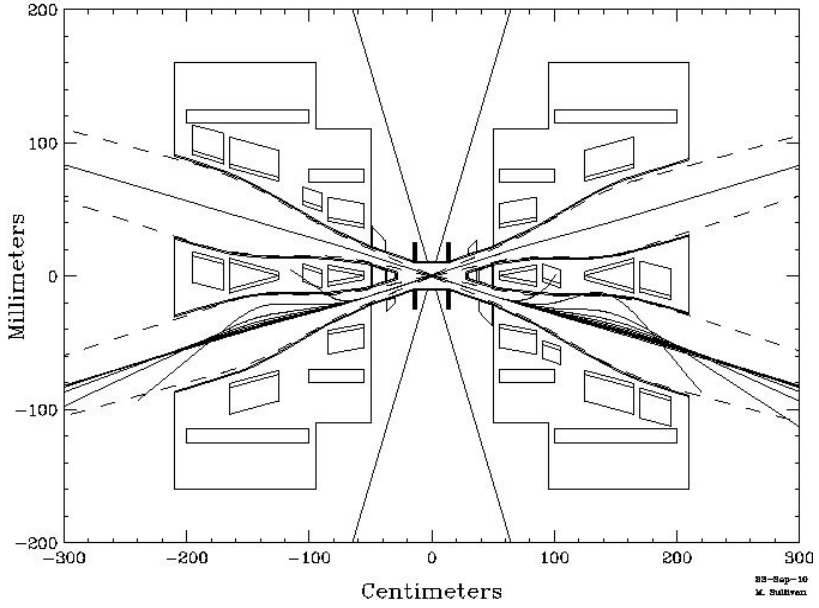
INFN Istituto Nazionale di Fisica Nucleare SEZIONE DI PISA

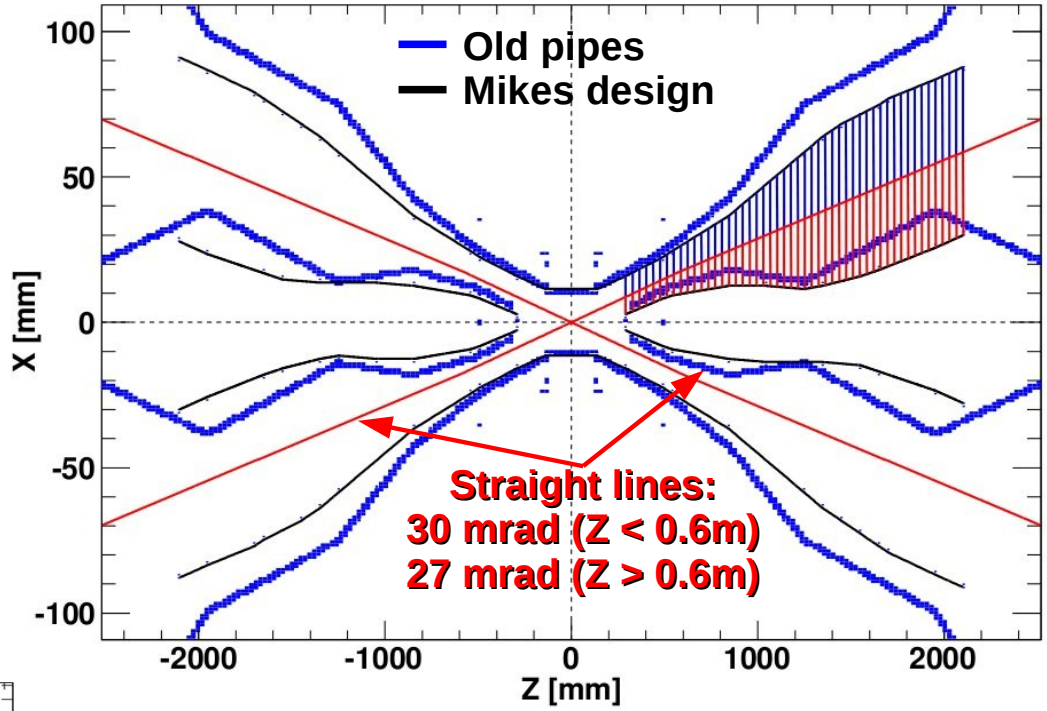
Outline

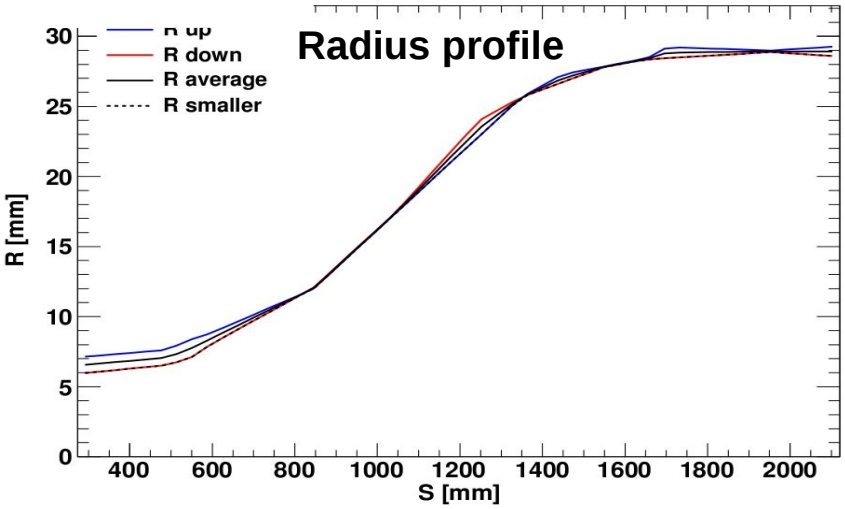
- **The new Final Focus:** a reminder
- **Rad-Bhabha losses at the beam pipes with v12 sf11 layout**

V12 SF11 Final Focus (I)

Mikes drawings

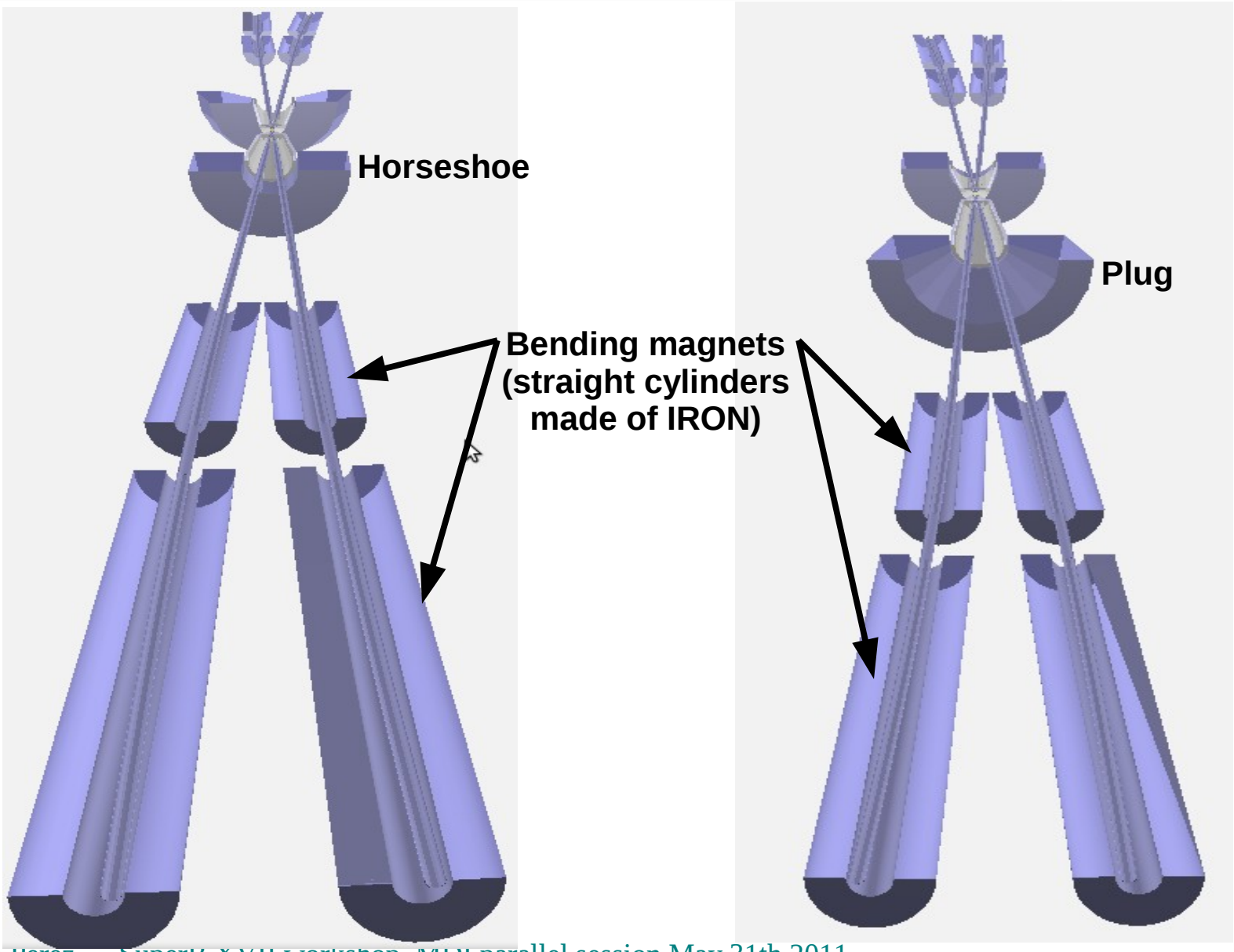




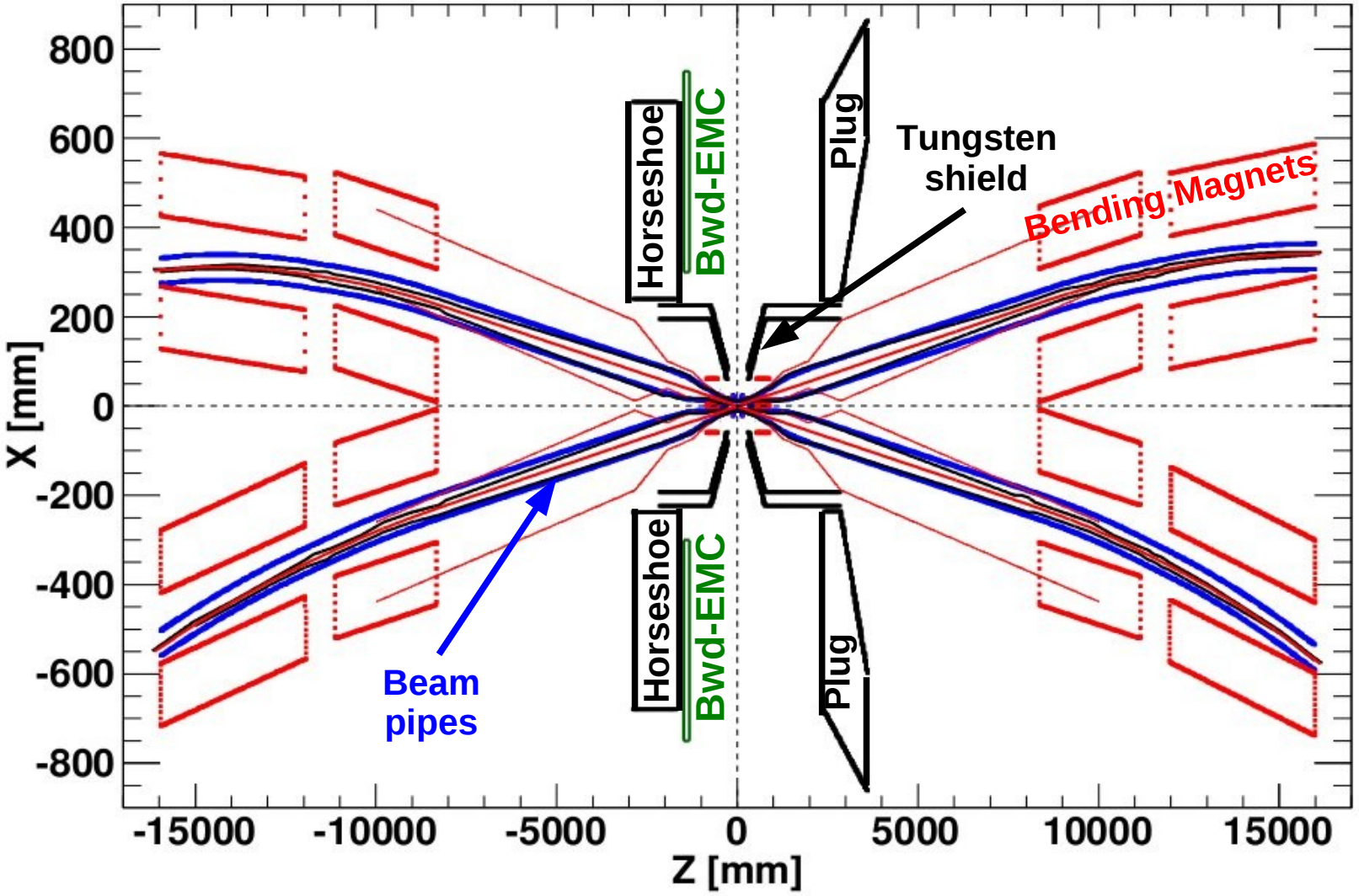


- **Use Mike Sullivan's drawings as inputs (no information on the vertical dimensions)**
- **Out of that get:**
  - Curves with the pipes walls
  - Calculate pipes radius profile as a function of distance to IP
- **Use straight pipes with constant radius from 2.4 m on until 1st bend**

V12 SF11 Final Focus (II)



V12 SF11 Final Focus (IV)

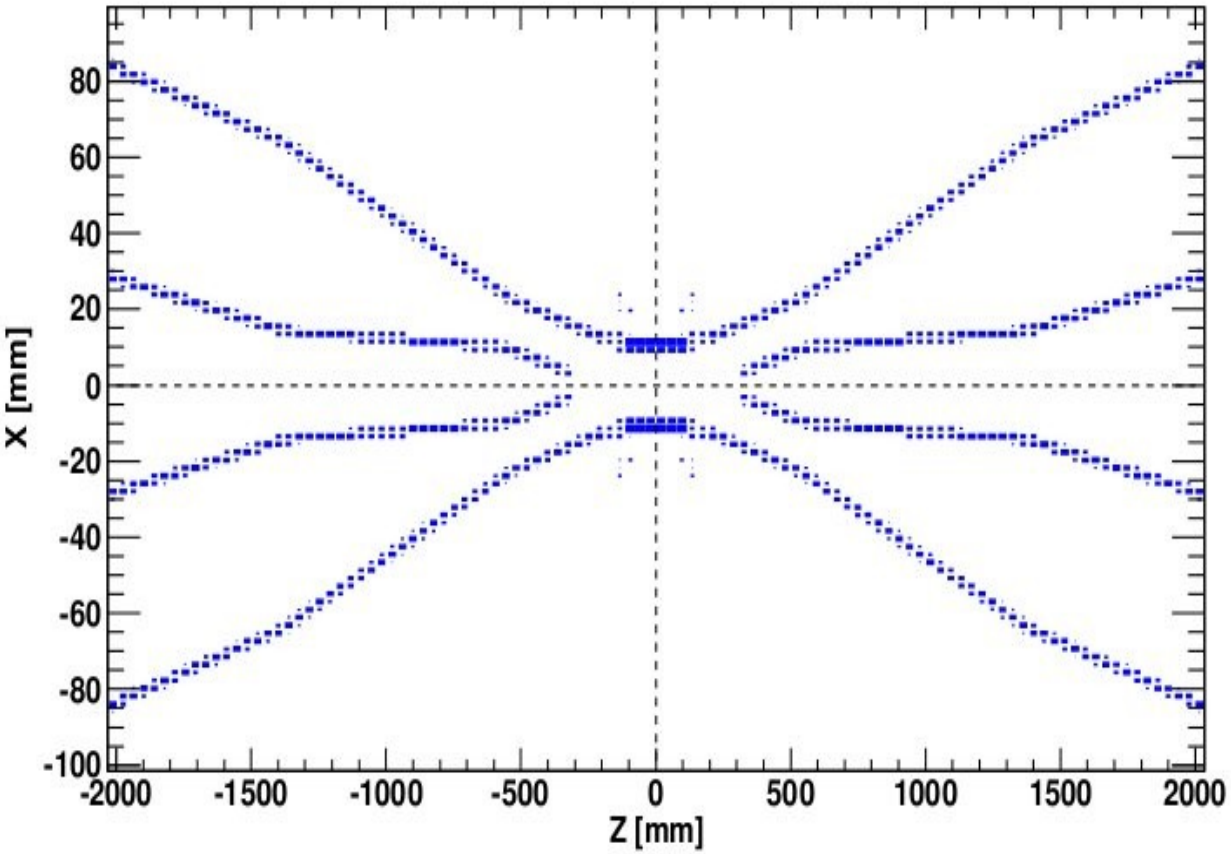


Losses rates: Instrumenting the pipes

- **Run Bruno with the final focus only (Rad-BhaBha generator)**
- **Only use the pipes material (remove magnets, flanges, ...)**
- **Replace beam pipes material by vacuum**

- **To evaluate the rates**:
  - Loop over the truth particles
  - Check if produced any hits
  - Look for the hit with the smallest time (the 1st hit)

V12-sf11 layout



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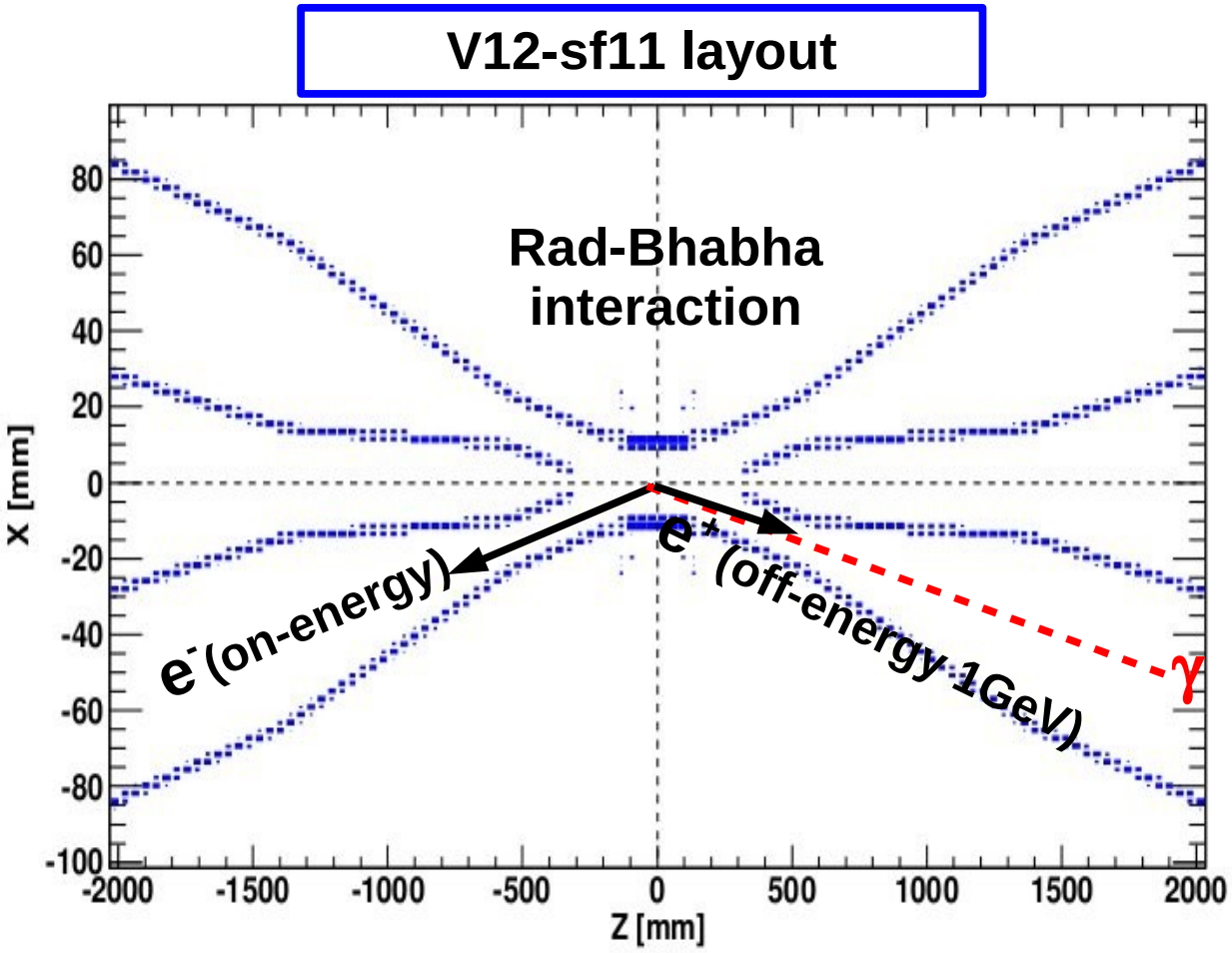

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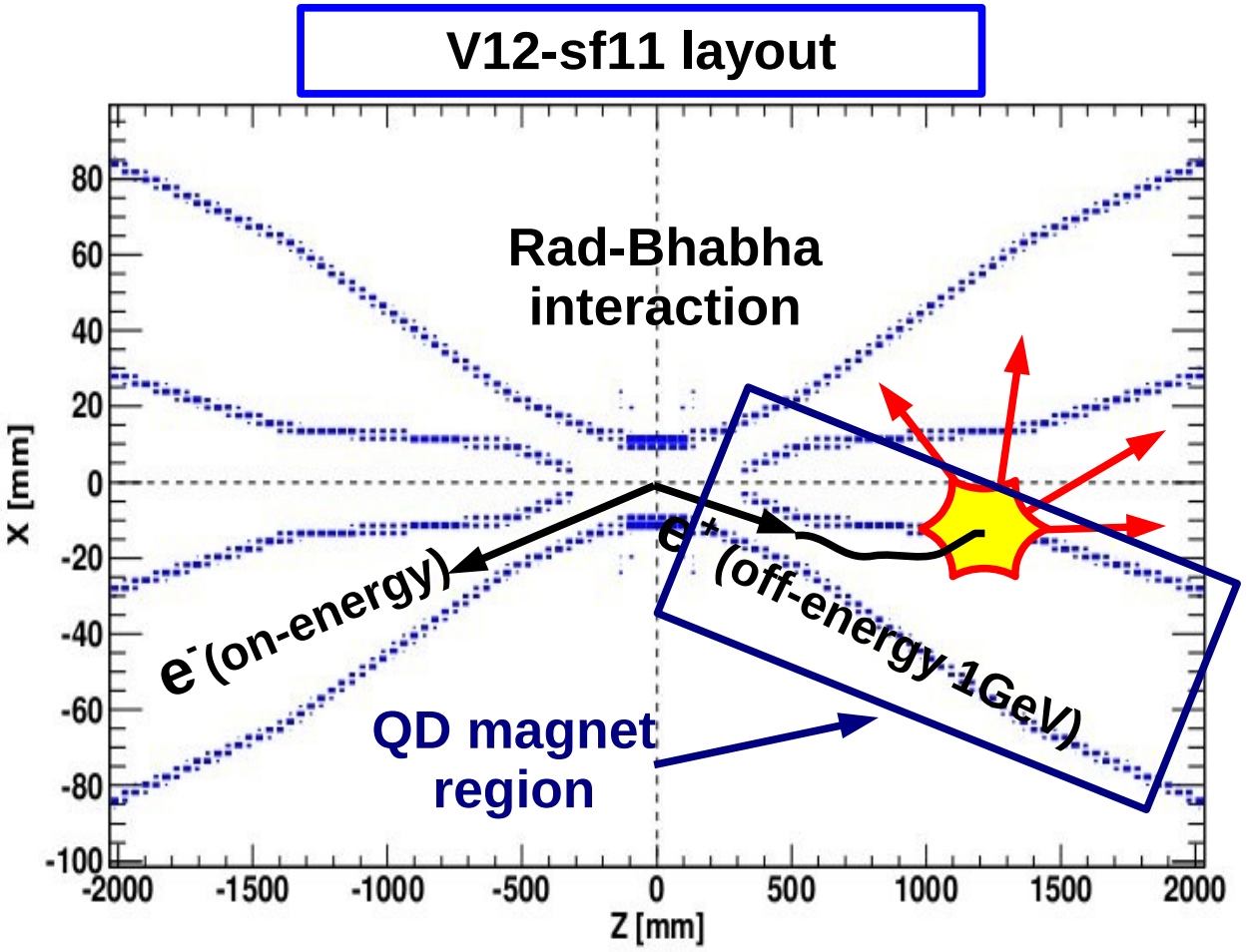
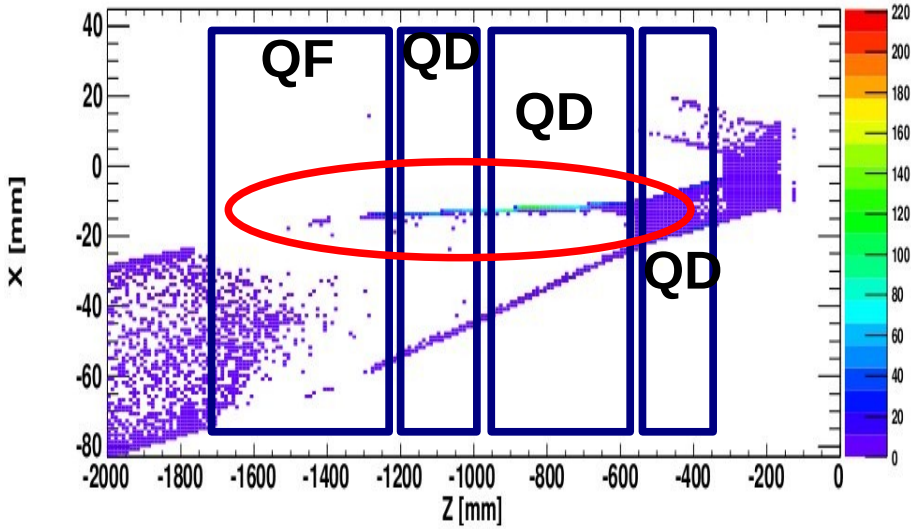
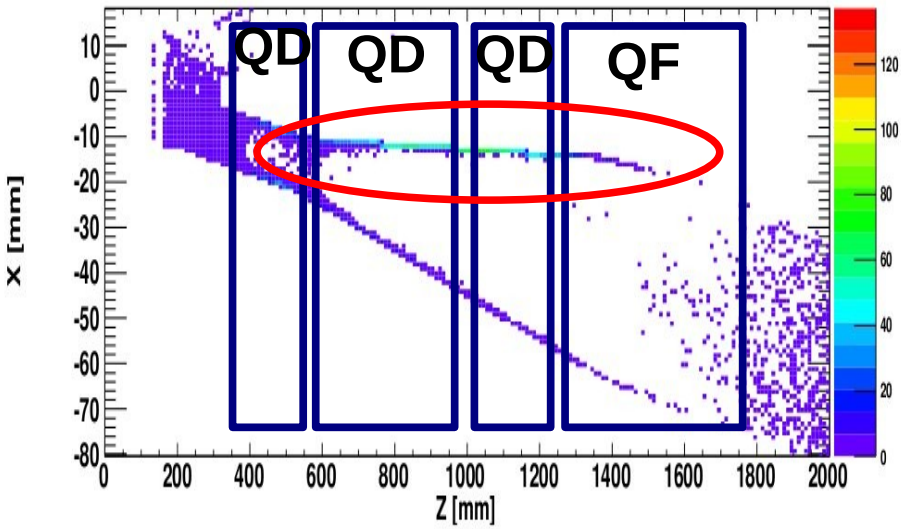
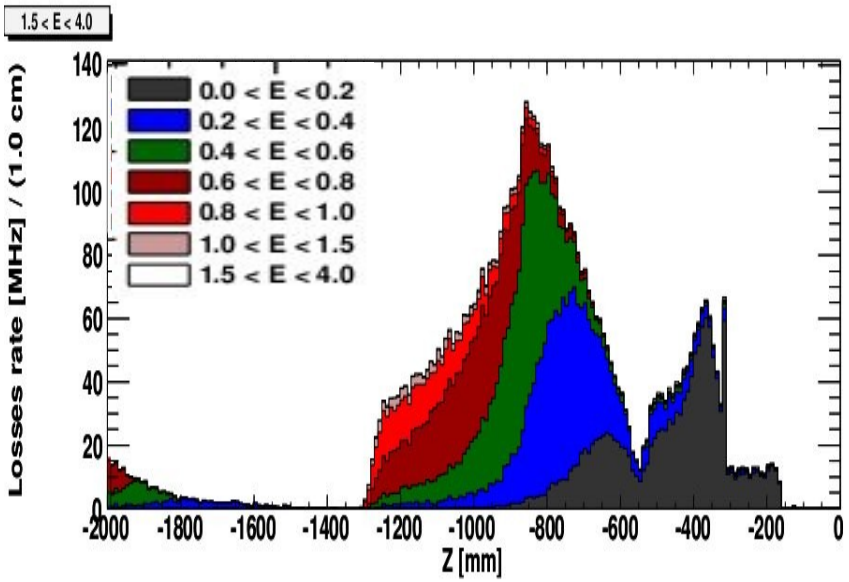


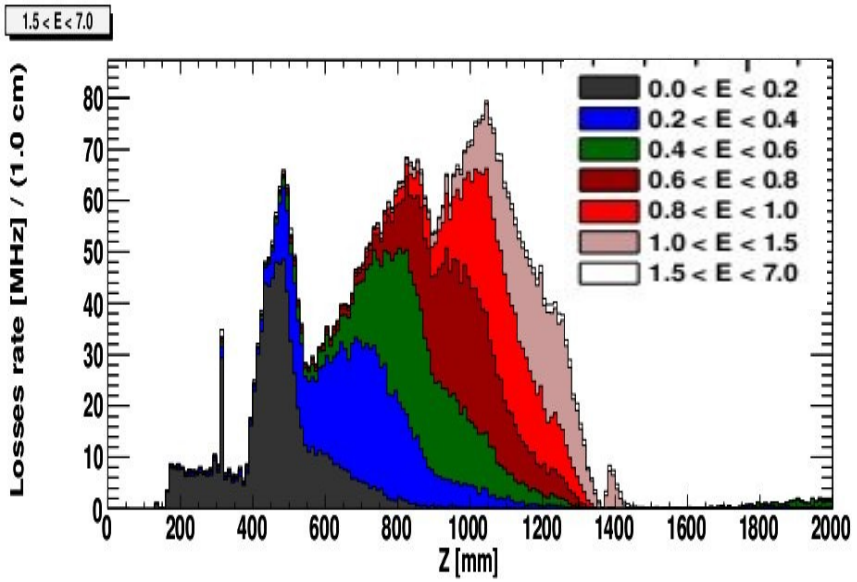
Losses rates: results v12-sf11 (leptons)

- V12-sf11 layout: HER = e^+ (6.69 GeV) and LER = e^- (4.18 GeV)









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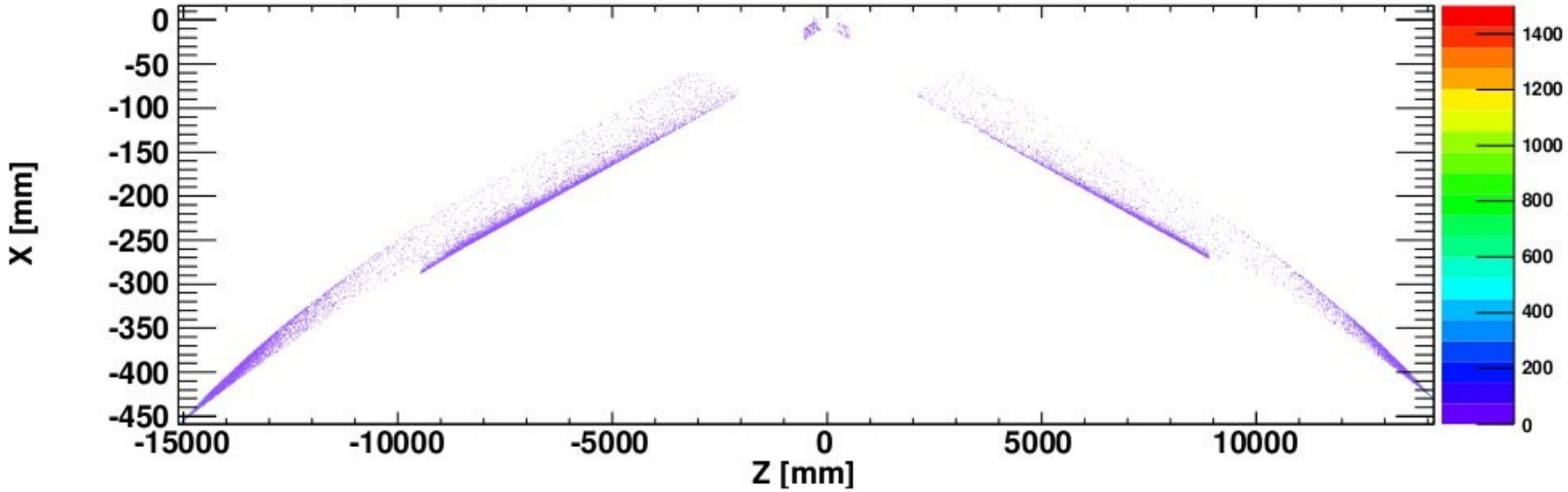

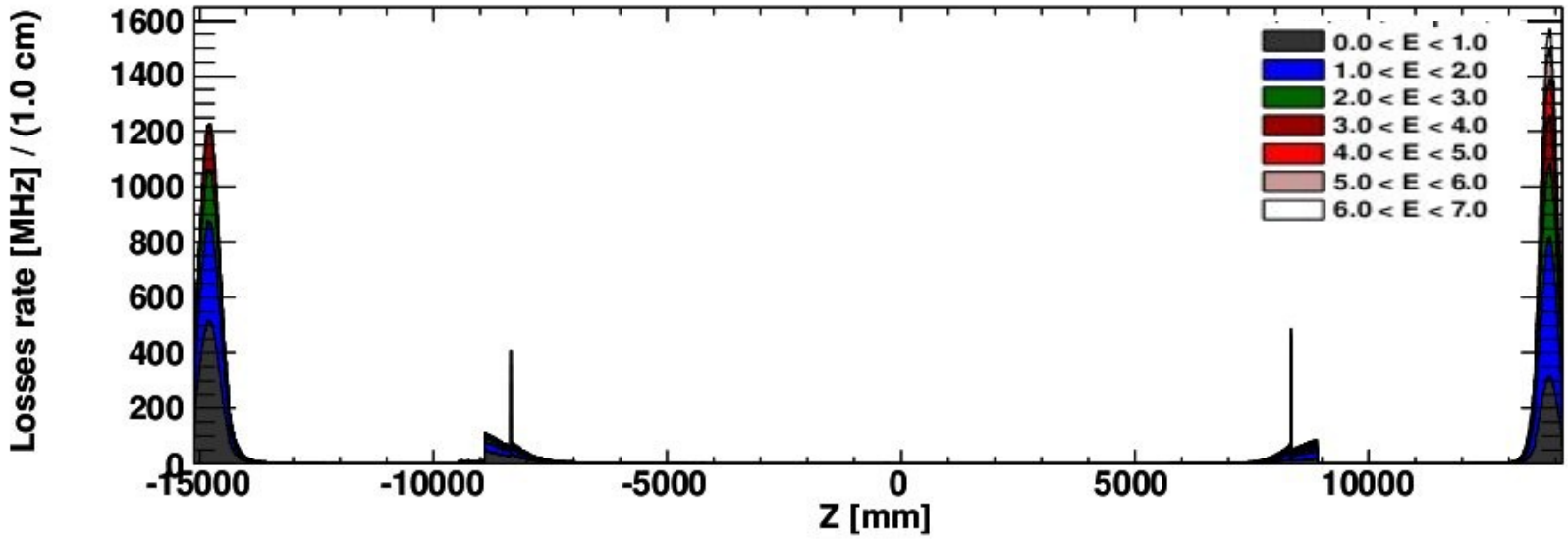

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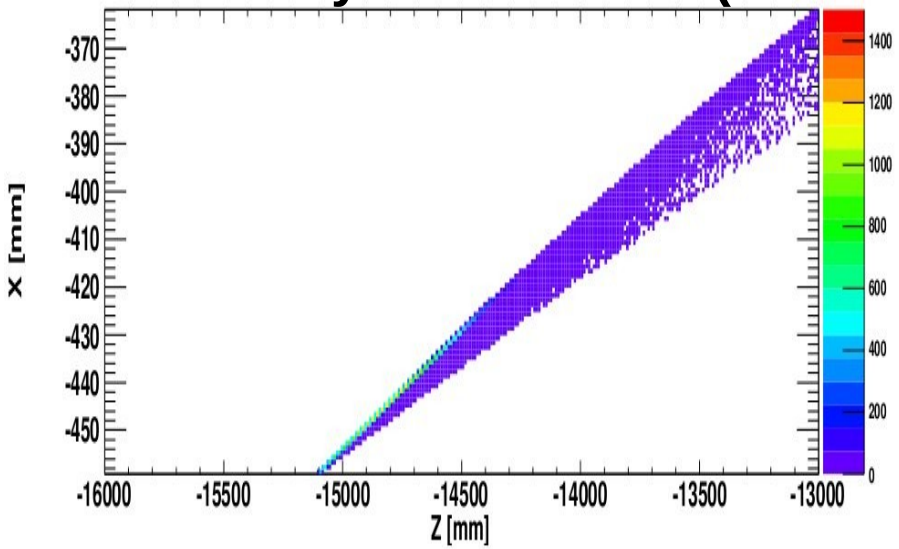
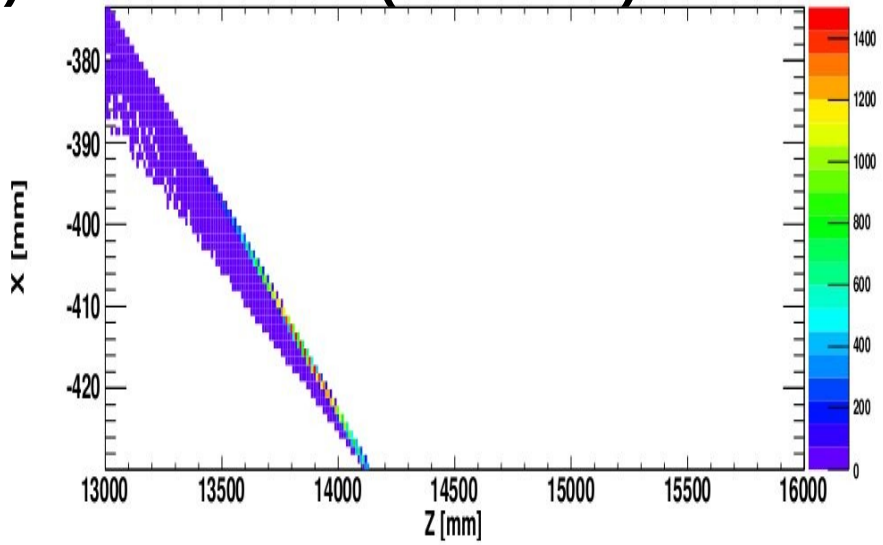
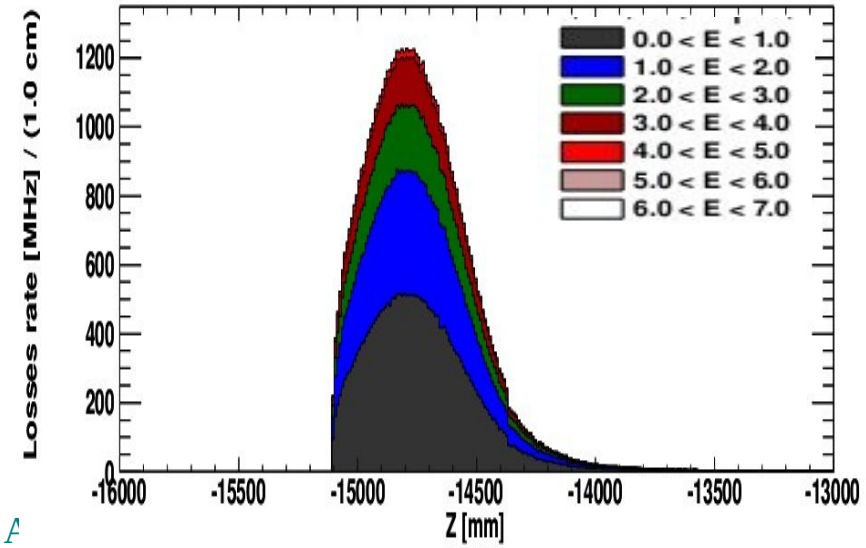
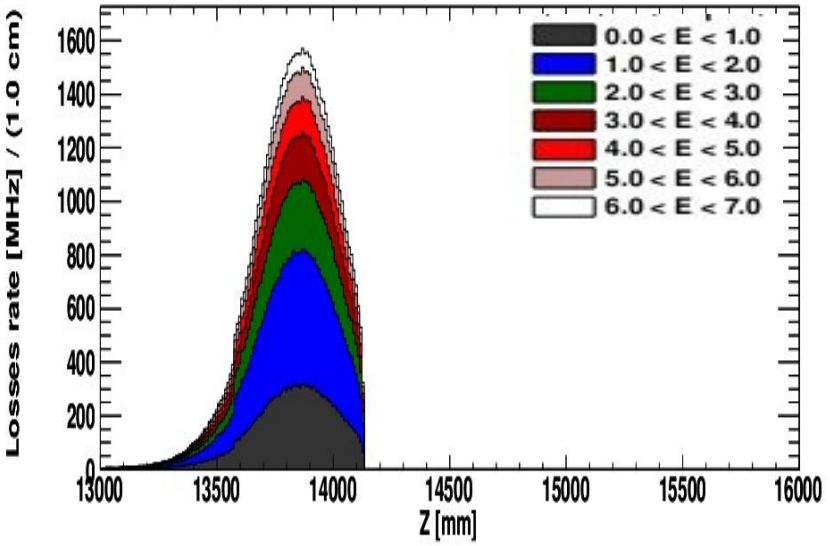


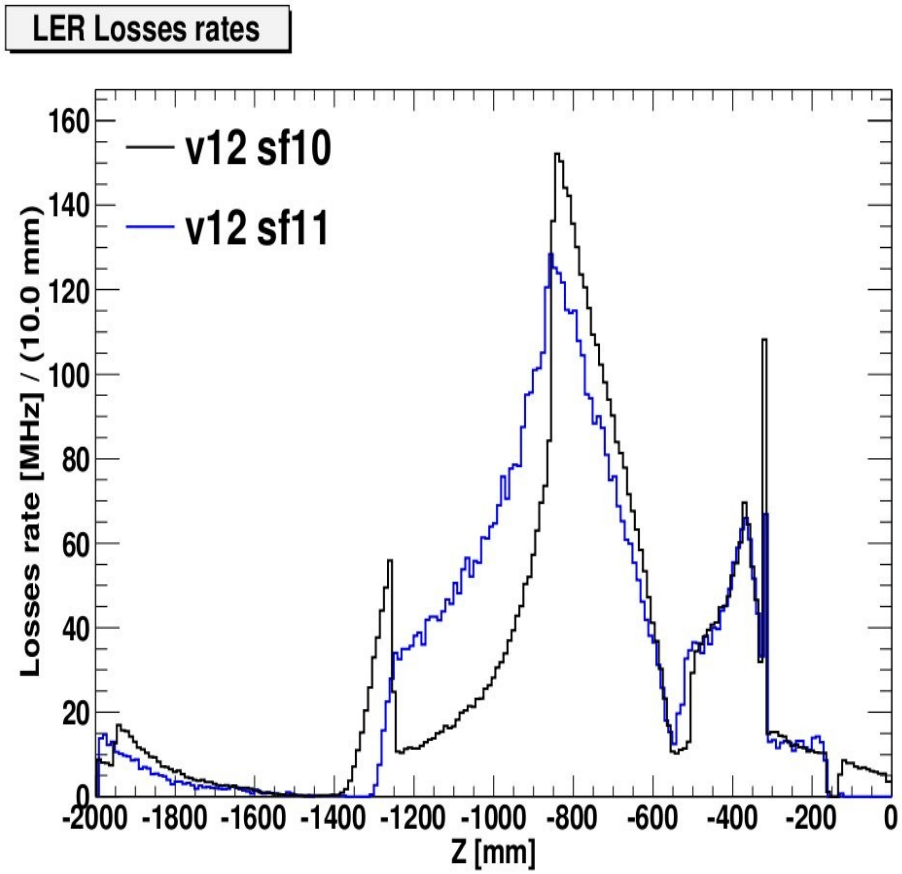


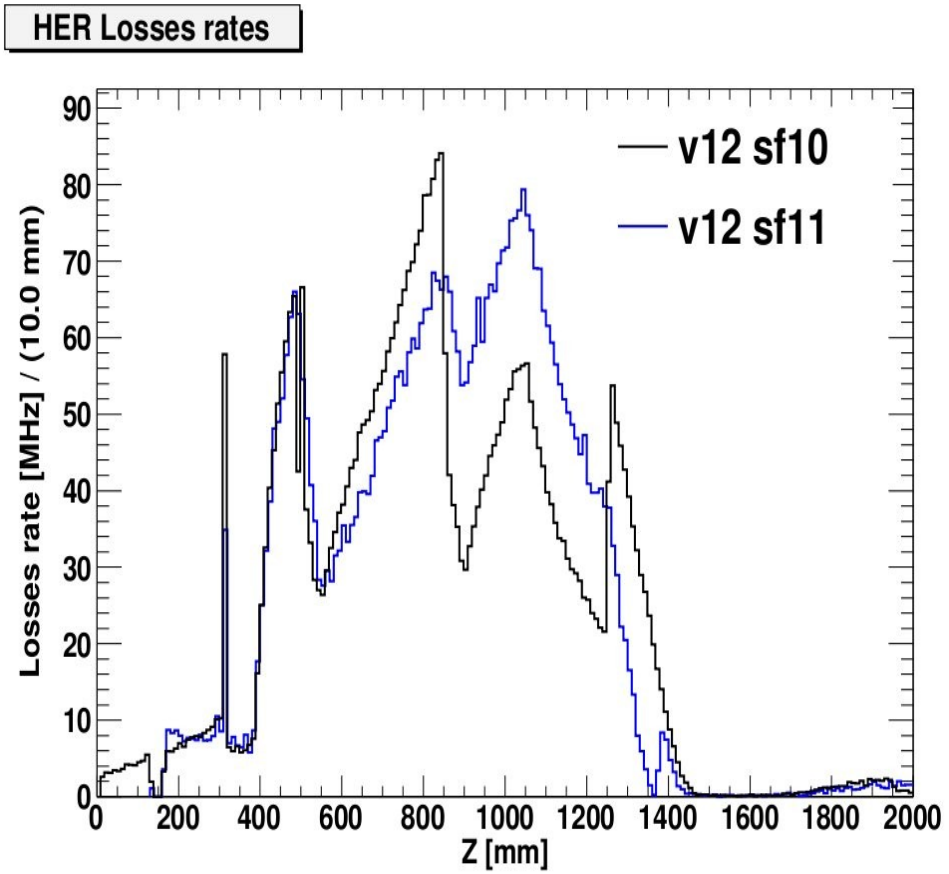




sf10 vs sf11

- **V12-sf11:**
  - Optimized beam pipe shapes from IP up to 16m
  - Lower pipe radii w.r.t sf10 beyond 2m from IP
  - Very similar magnetic modeling as sf10





Total rates near by the IP (-2,2)m

- Total rates around the IP

LER rates (MHz) around the IP (-2.0,2.0) m

E range (GeV)	P3	v12 sf11	v12 sf10
(0.0,1.0)	4501.60	6080.05	5619.19
(1.0,1.5)	61.81	129.75	80.80
(1.5,2.0)	12.97	15.13	12.88
(2.0,2.5)	5.25	6.41	5.13
(2.5,3.0)	3.51	3.97	3.75
(3.0,3.5)	3.98	4.48	3.58
(3.5,4.0)	4.37	3.23	2.62
all	4593.50	6243.01	5727.95

HER rates (MHz) around the IP (-2.0,2.0) m

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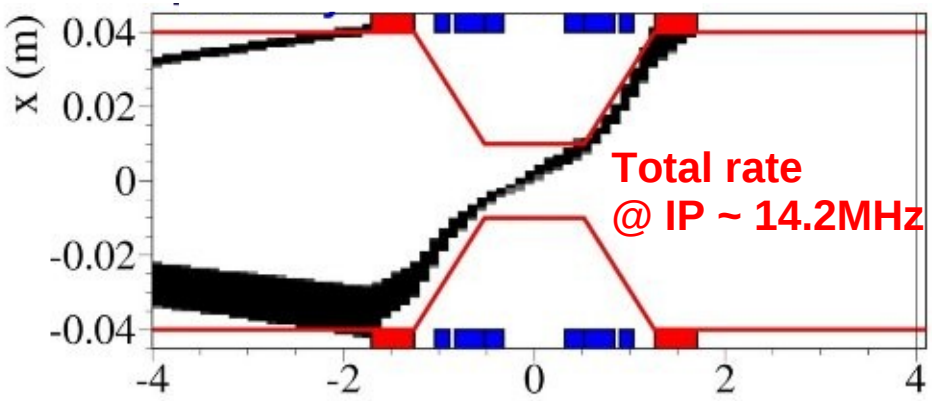
(0.0,1.0)	3489.64	4289.28	4215.48
(1.0,2.0)	88.85	683.76	522.91
(2.0,3.0)	7.54	15.64	12.28
(3.0,4.0)	2.03	2.89	3.77
(4.0,5.0)	1.17	2.66	1.89
(5.0,6.0)	1.37	3.00	2.54
(6.0,7.0)	1.70	5.04	4.68
all	3592.31	5002.29	4763.55

LER Touschek Losses



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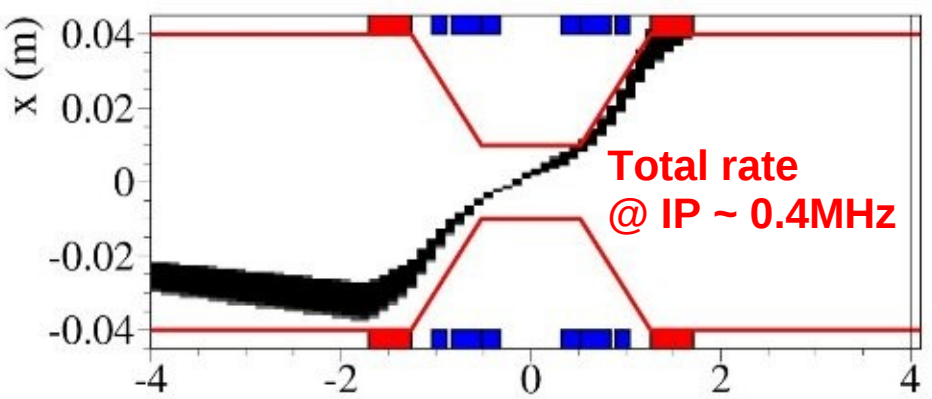

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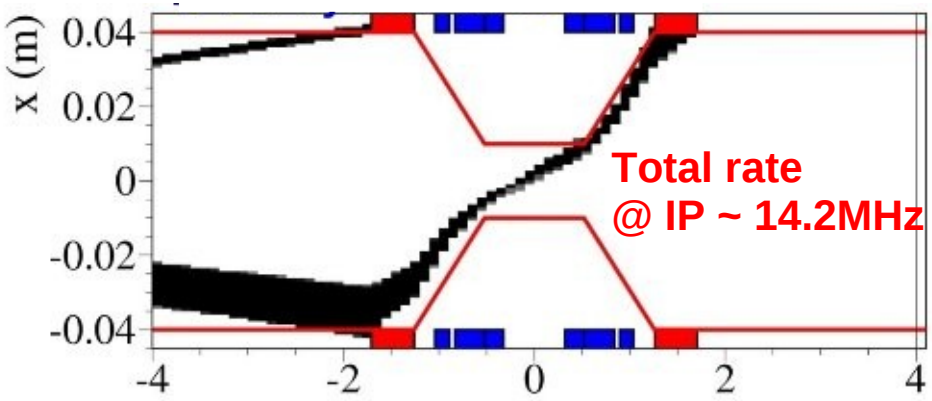

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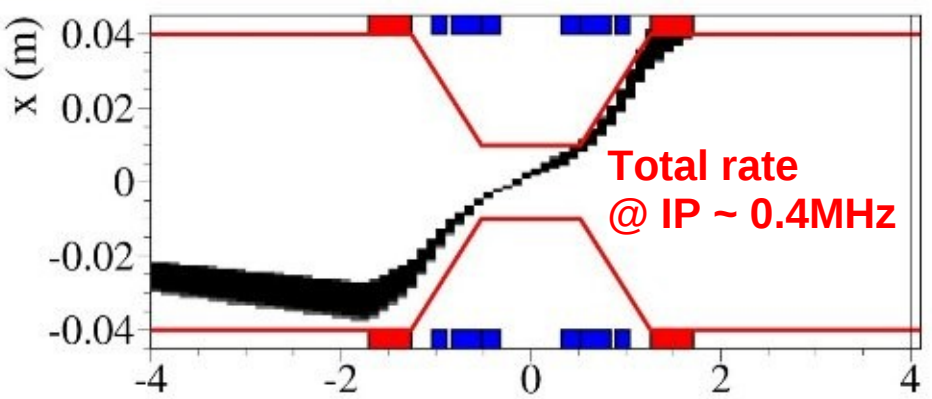
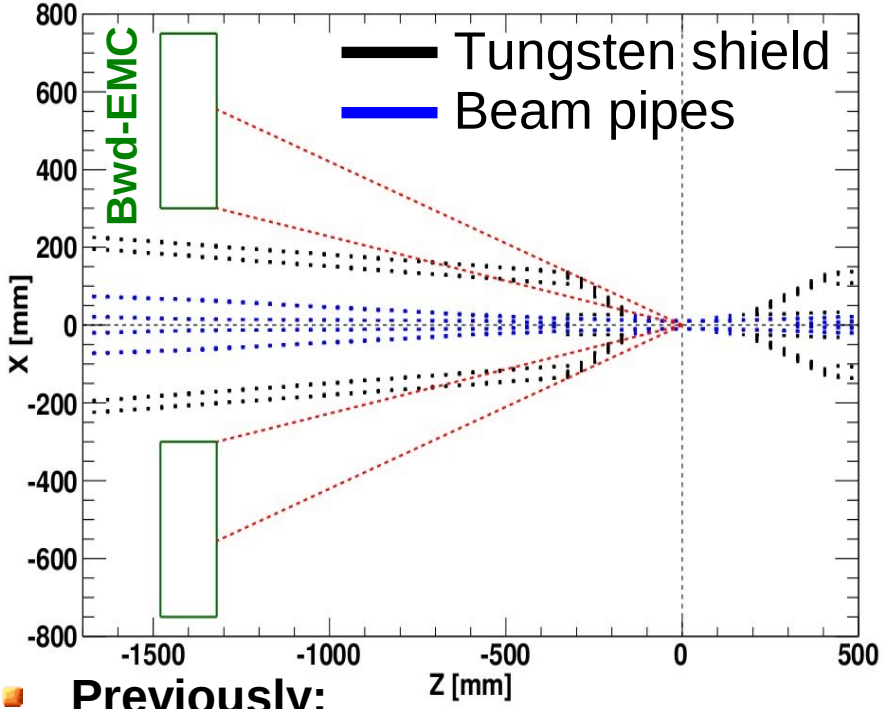


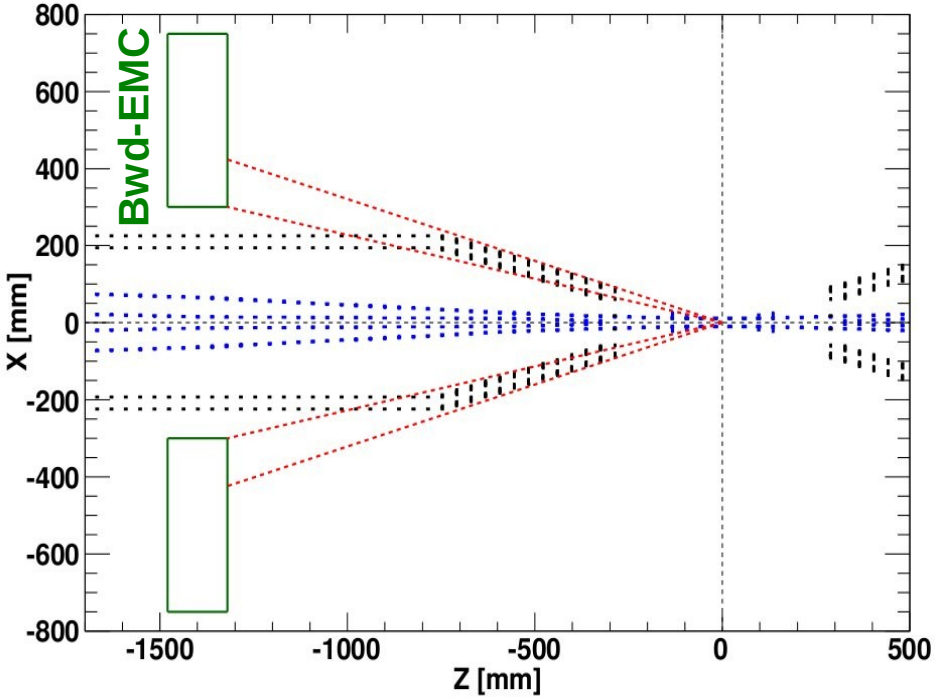
Summary and outlook

- **Rad-BhaBha losses at beam pipes near by IP:**
  - Losses mainly to very off-energy particles
  - Losses rates are somewhat higher for sf11 (lower beam pipe radius) w.r.t sf10
  - Total rates of almost on-energy particles are of same order of magnitude of Touscheck losses


Backup

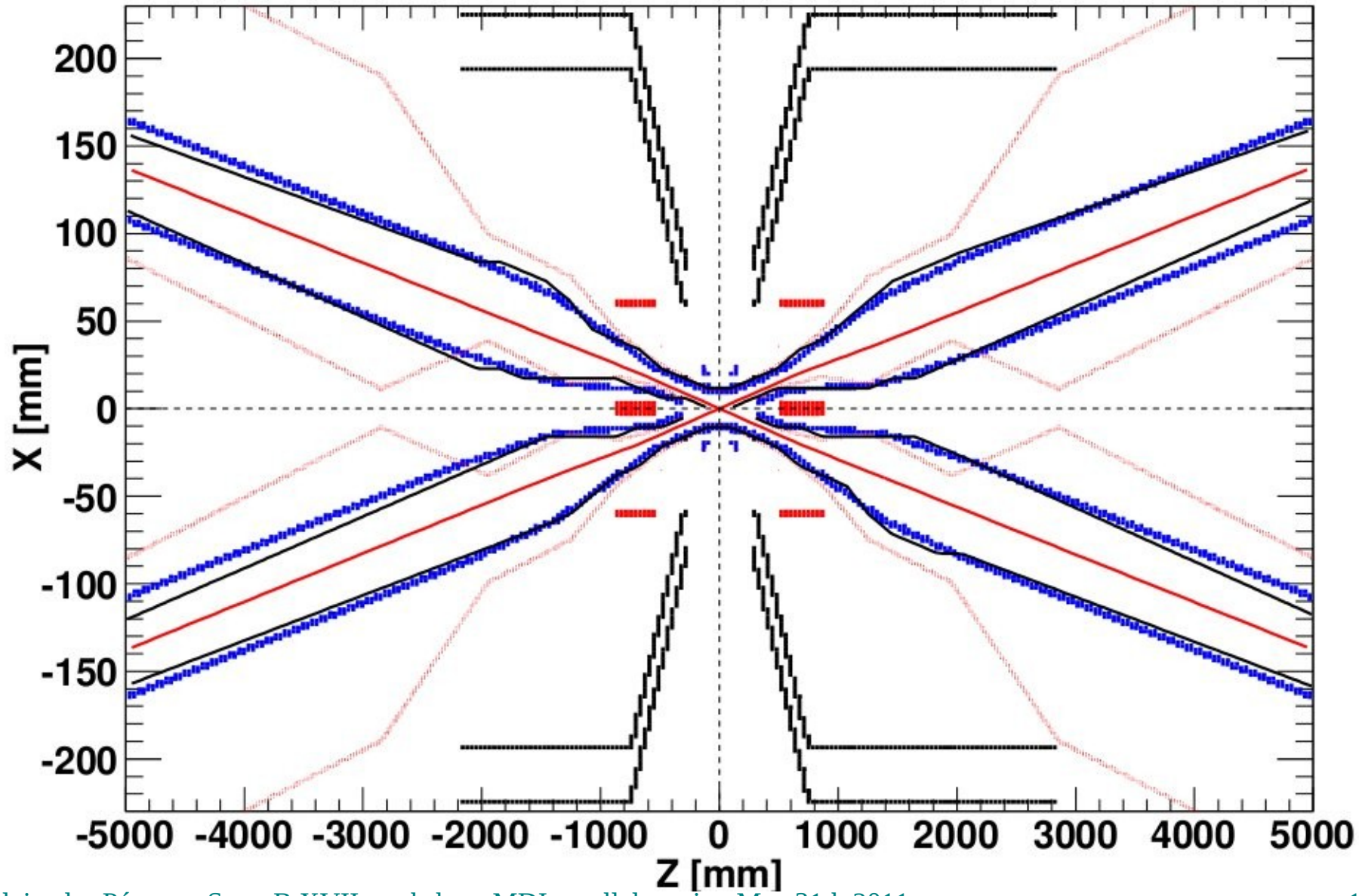
V12 SF11 Final Focus (III)





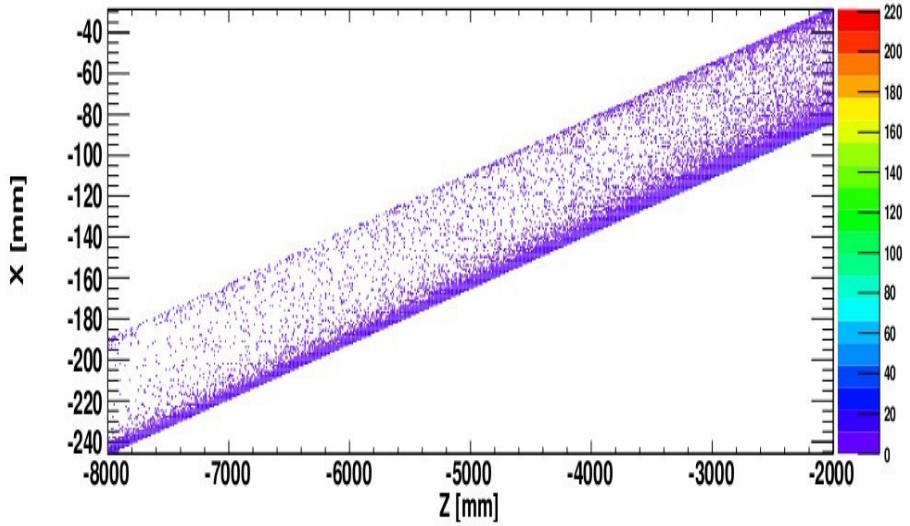
- **Previously:**
  - Conical shape (polycone)
  - Shielded above 300mrad on bwd-side
- **Currently:**
  - Cone (300mrad angle) and straight pipe
  - Now shield is below the 300mrad angular coverage
  - Constant thickness of material (3 cm)
  - More room for the super-conducting magnet cryostat

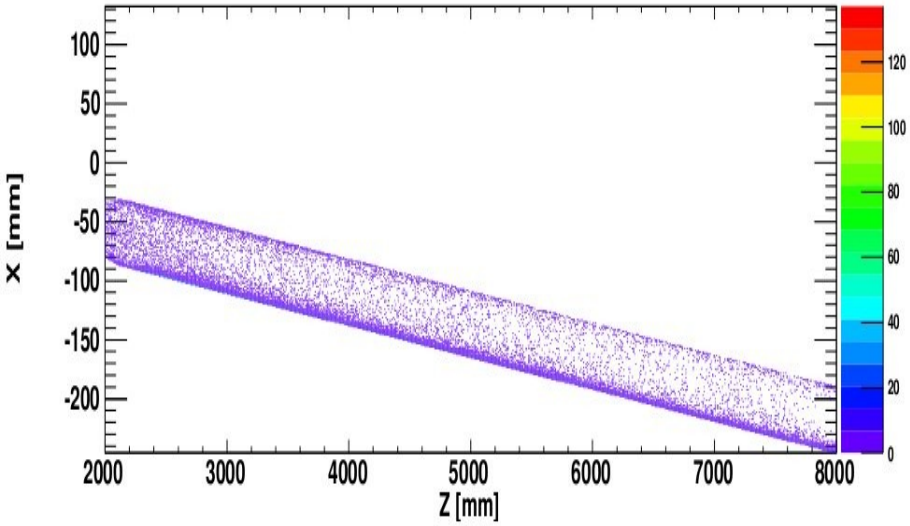
V12 SF11 Final Focus: Near IP

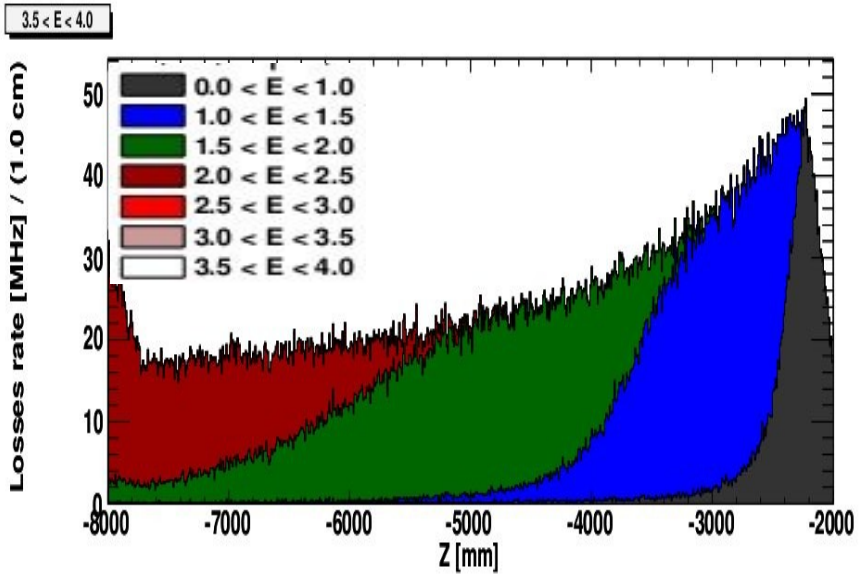


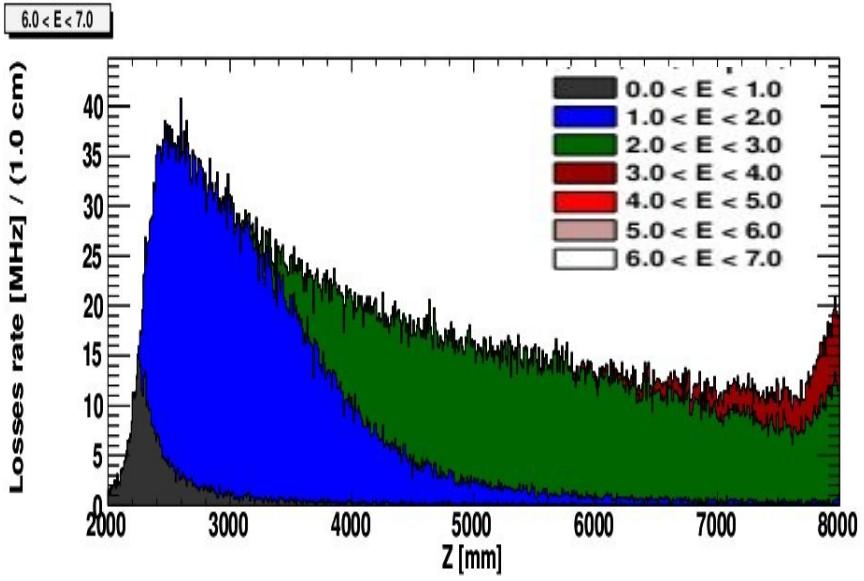
Losses results: v12-sf11 (leptons)

- V12-sf11 layout: HER = e^+ (6.69 GeV) and LER = e^- (4.18 GeV)









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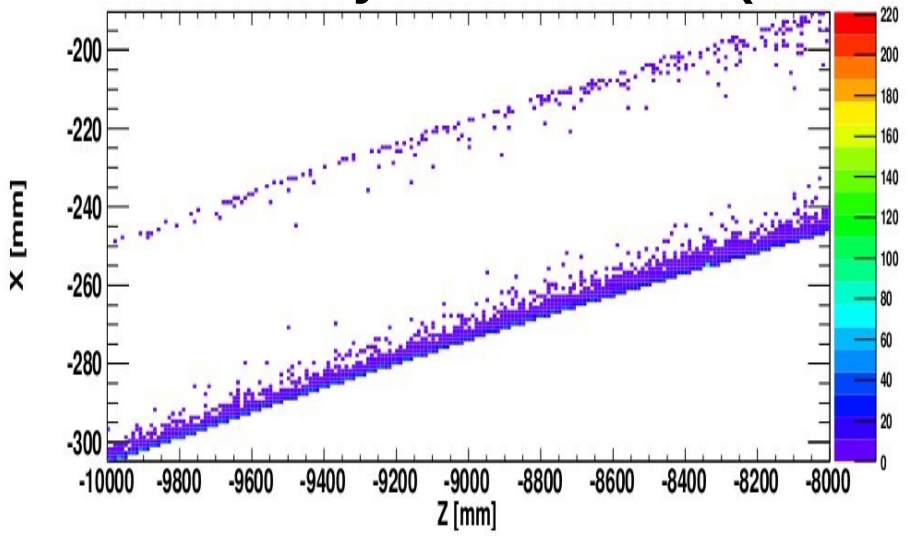

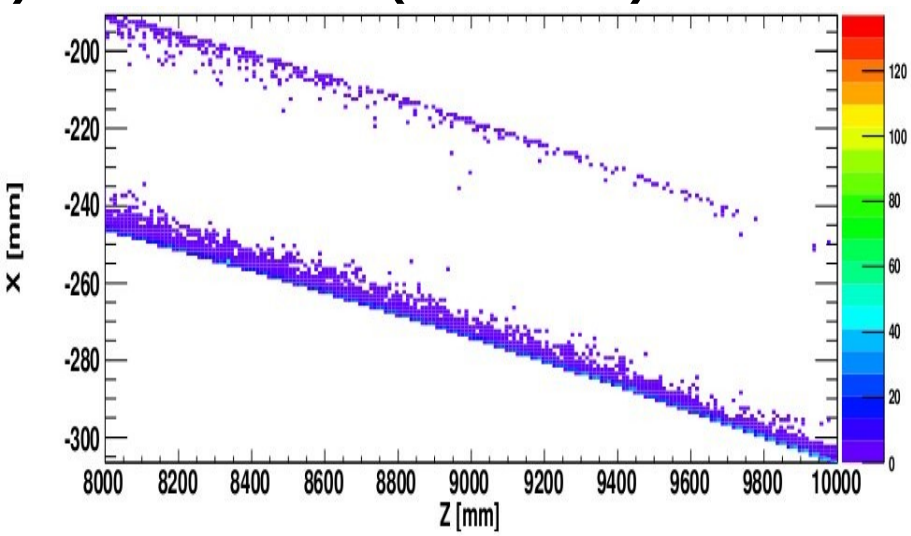

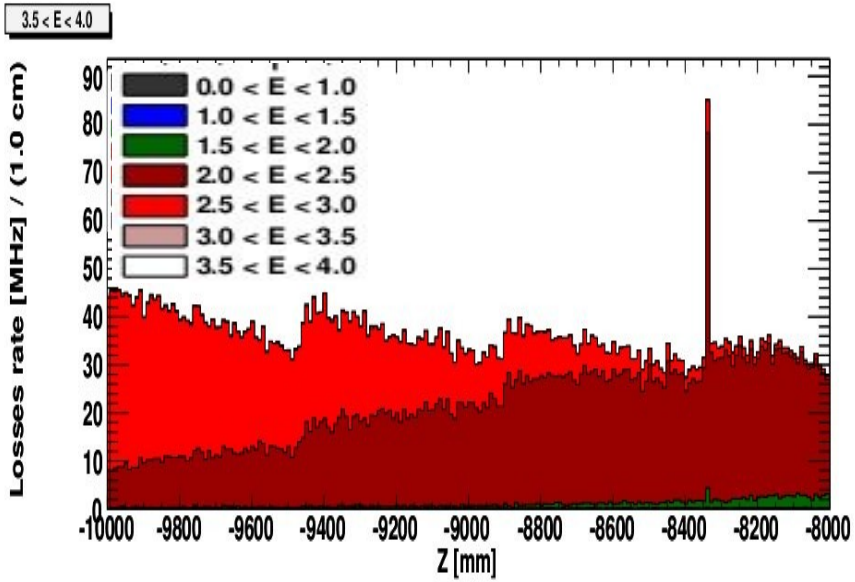

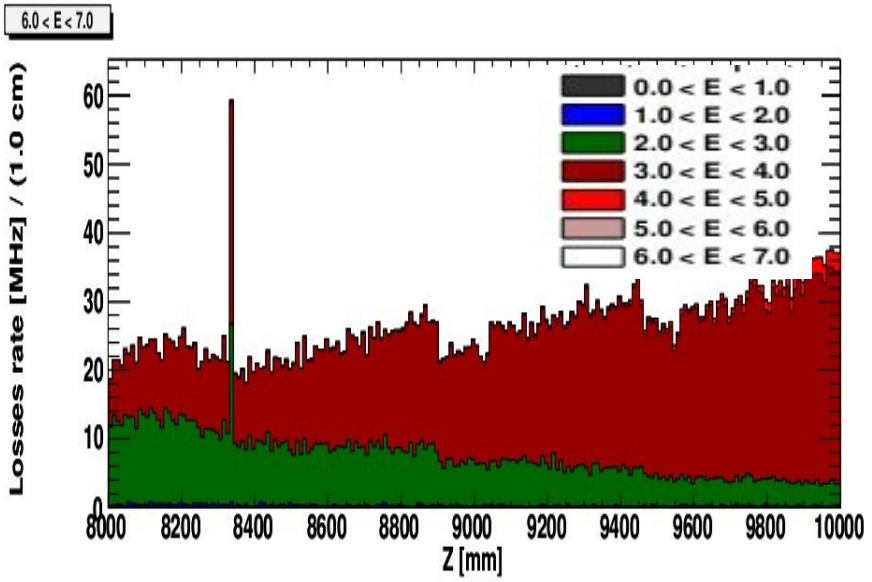

Losses results: v12-sf11 (leptons)

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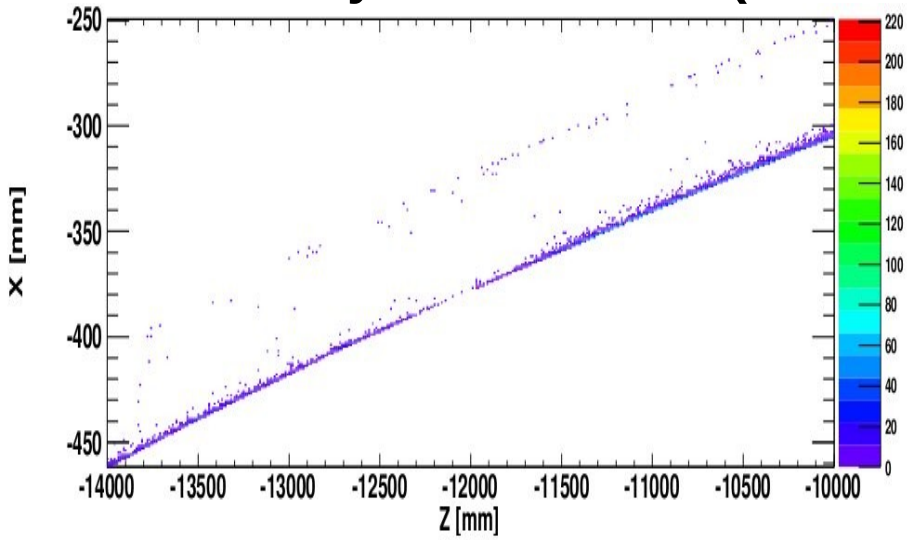

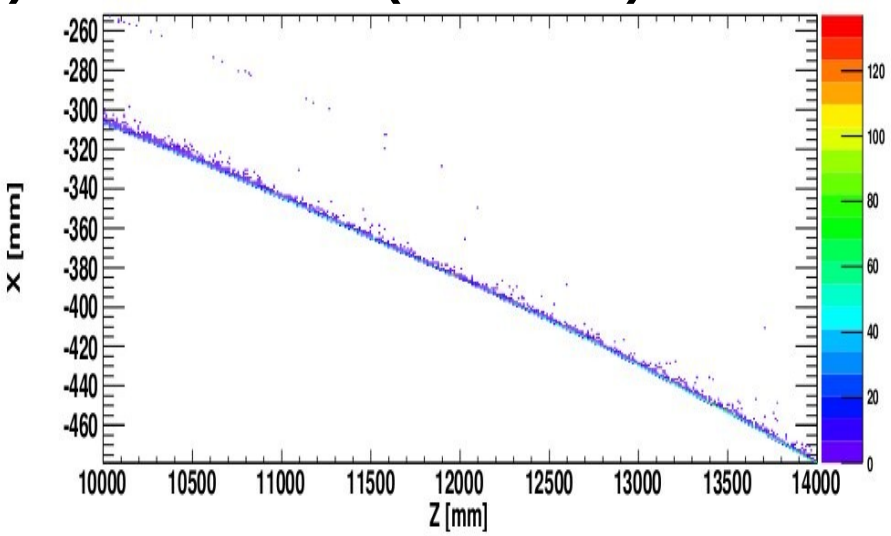

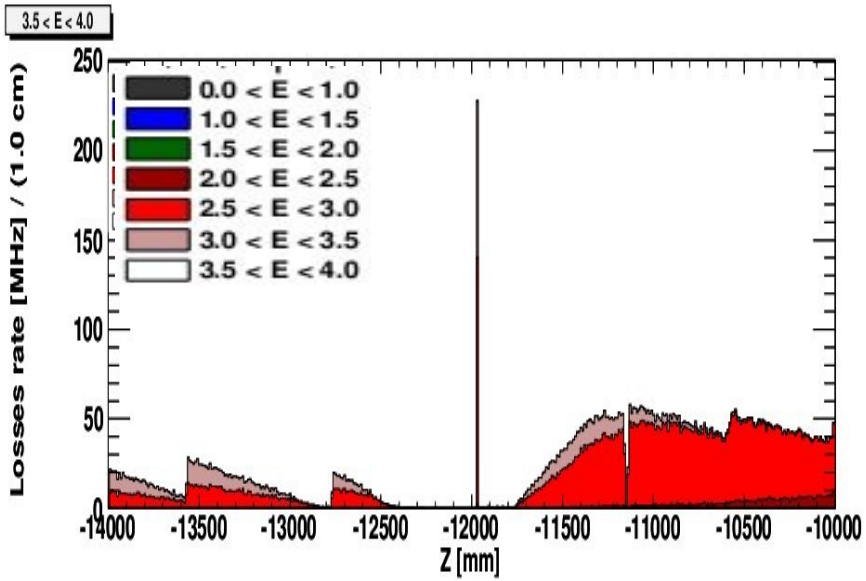

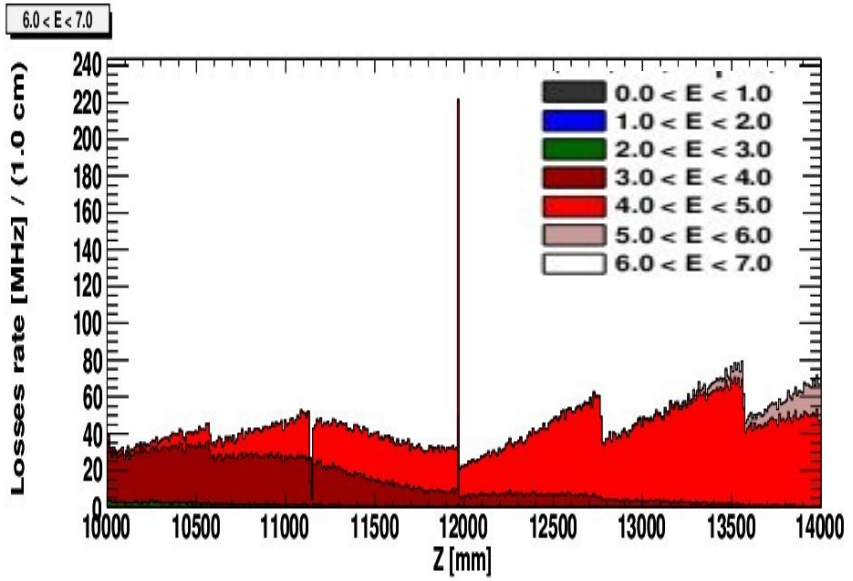

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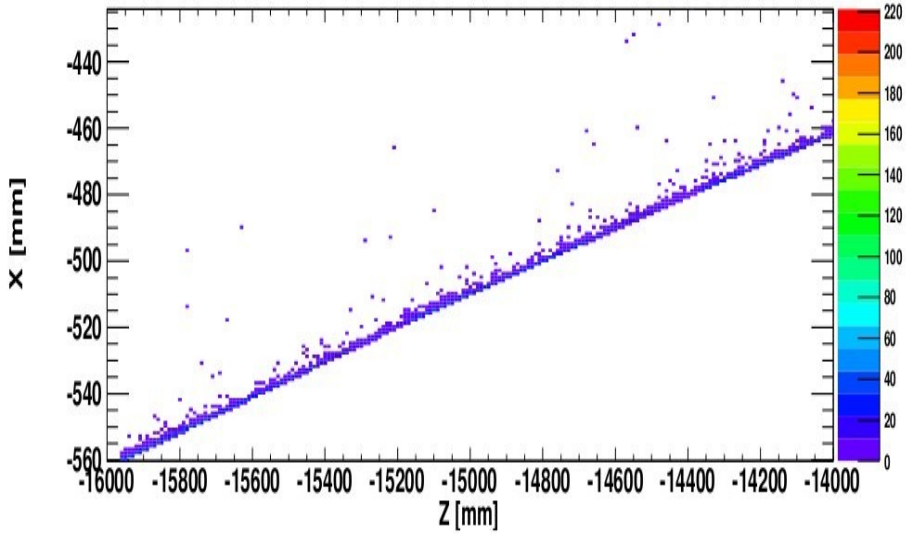
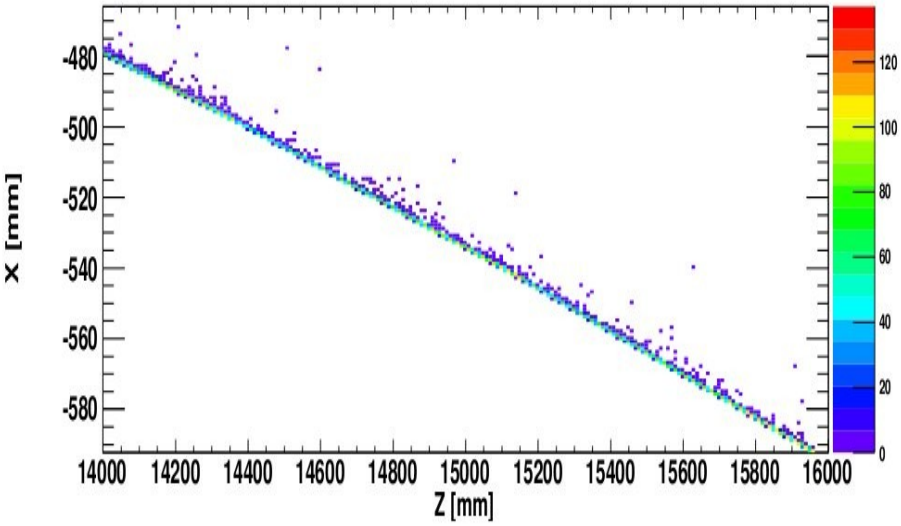
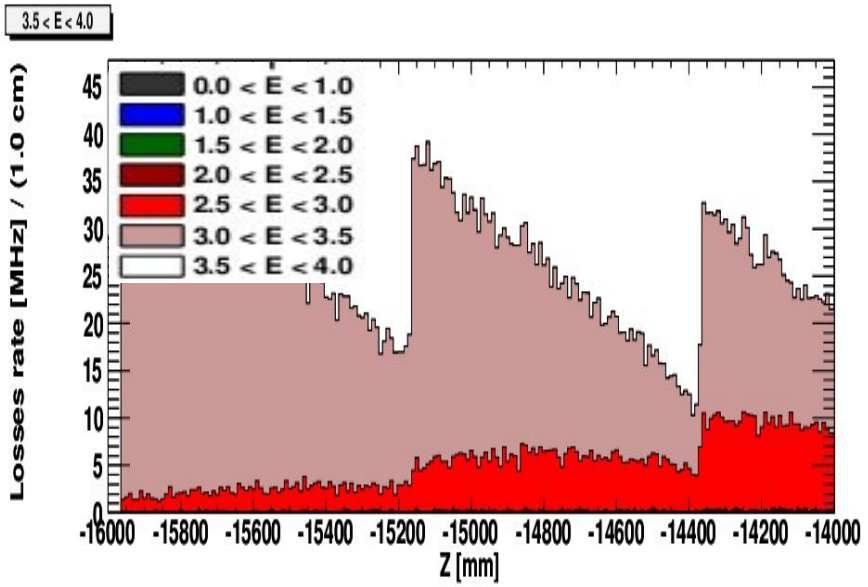
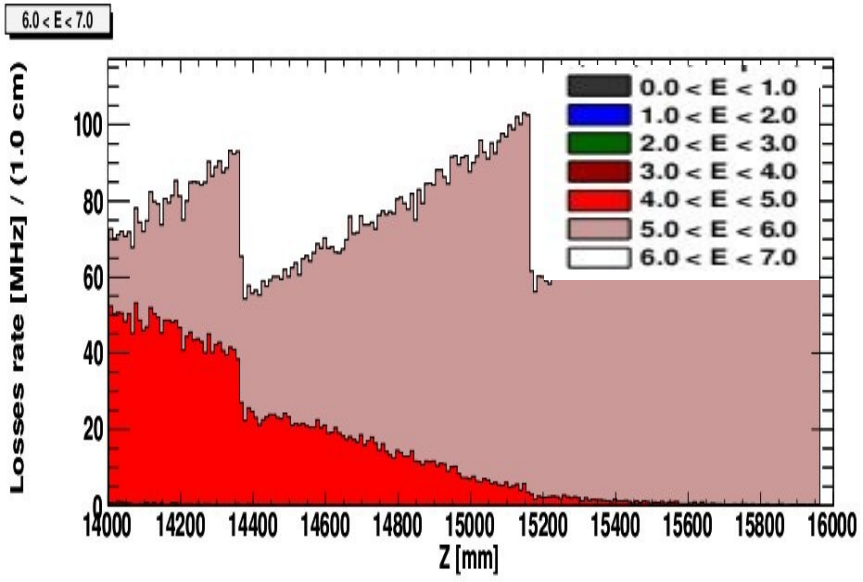
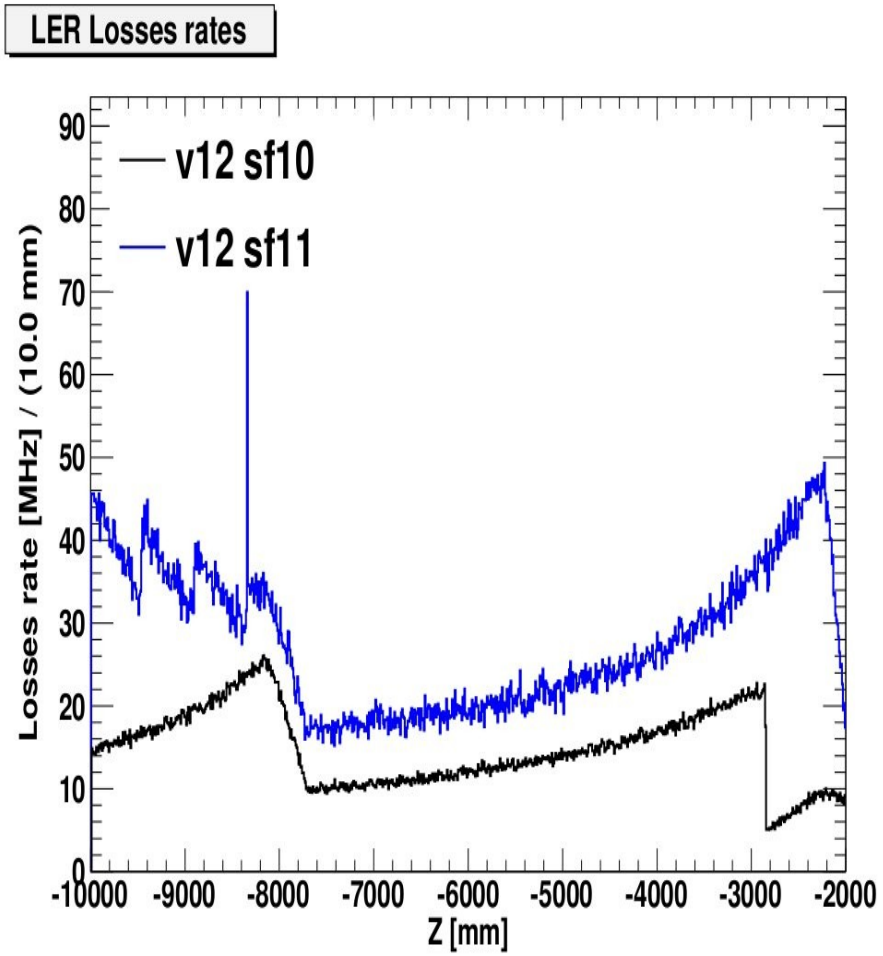


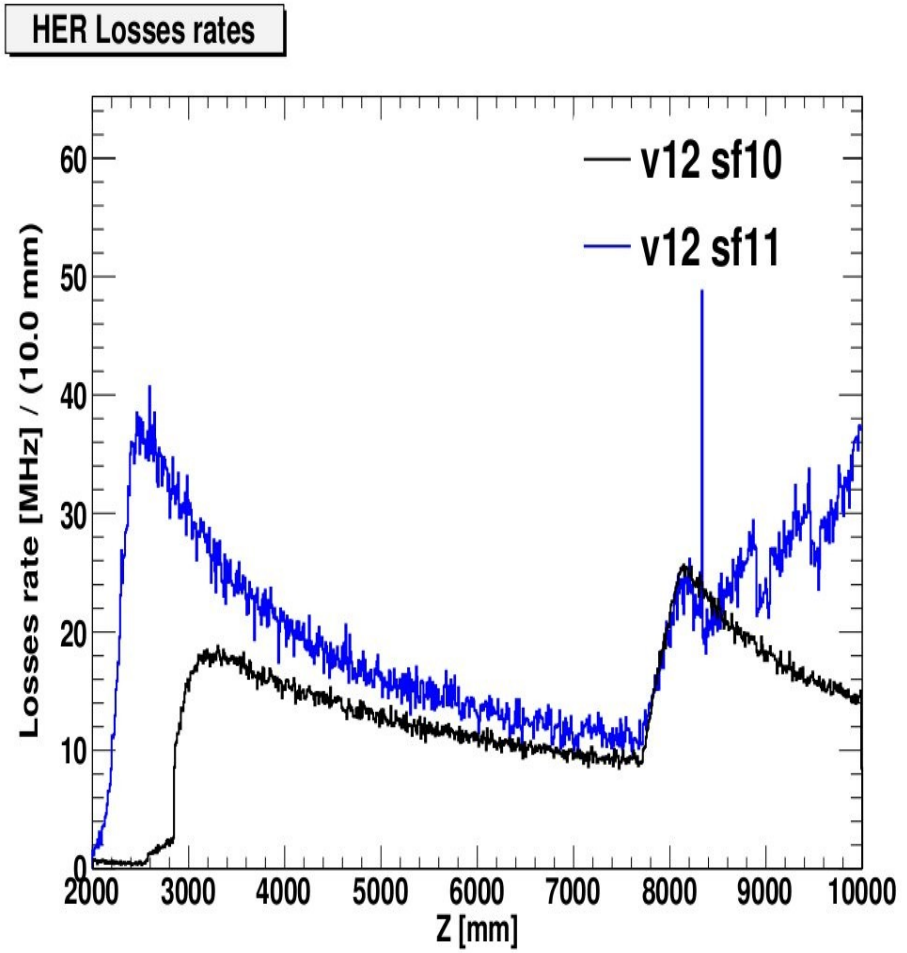




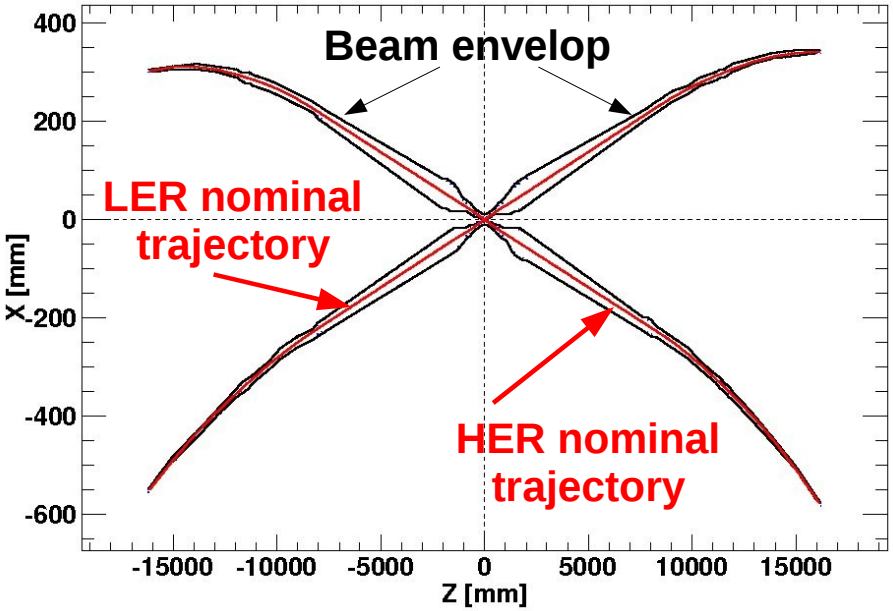


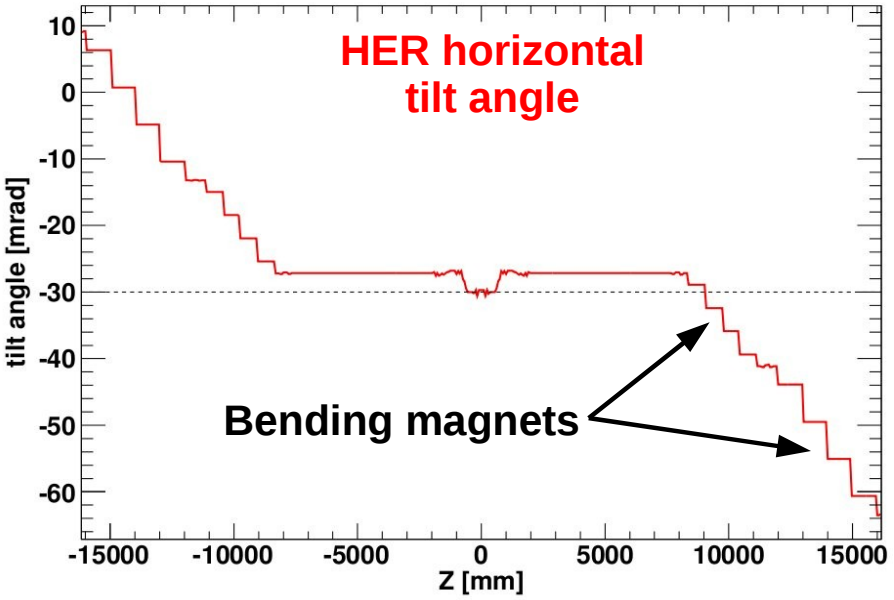
sf10 vs sf11 (II)





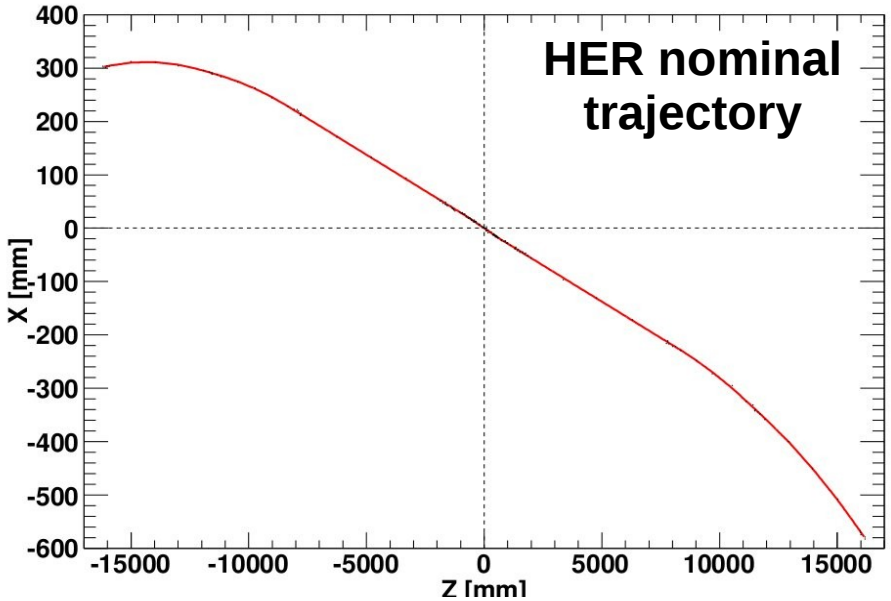
V12 SF11 nominal trajectories

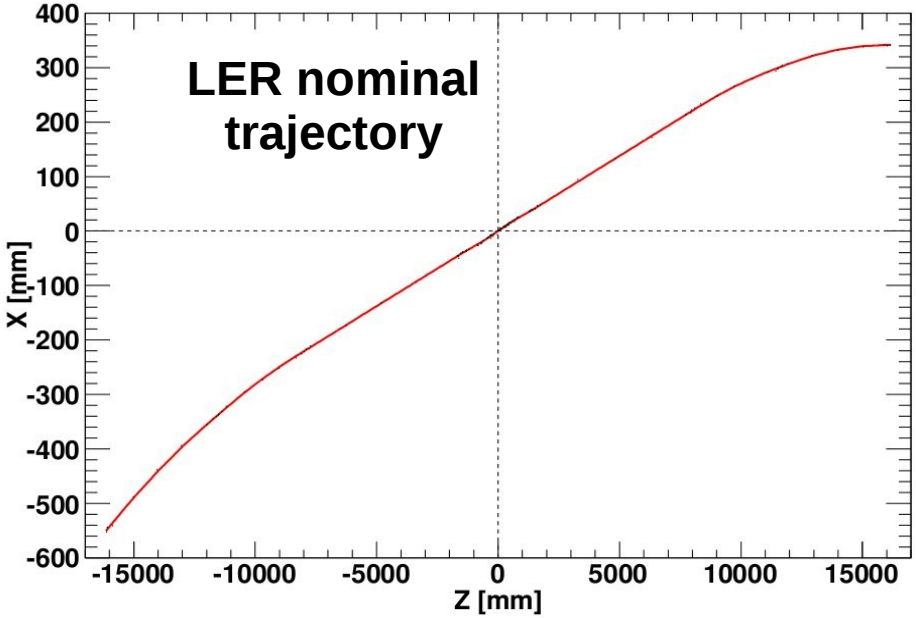


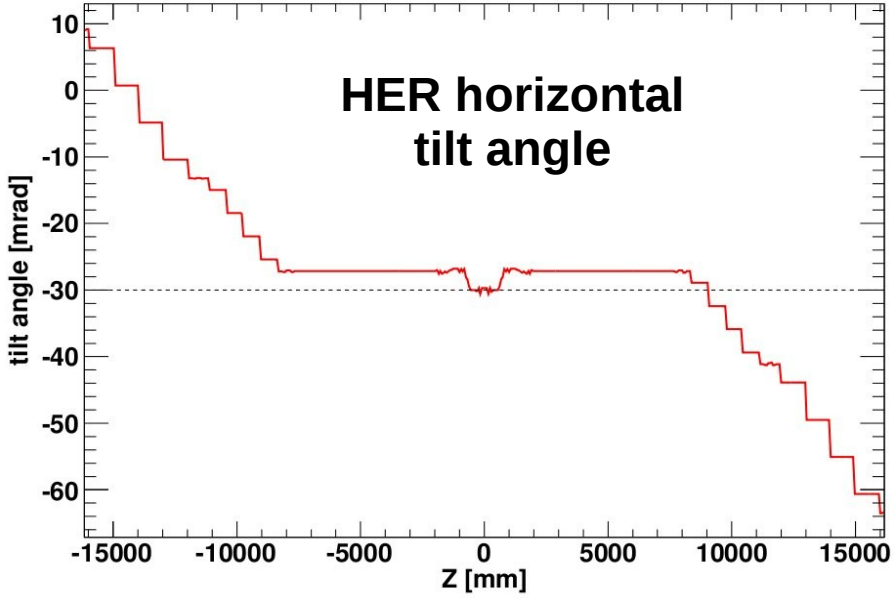


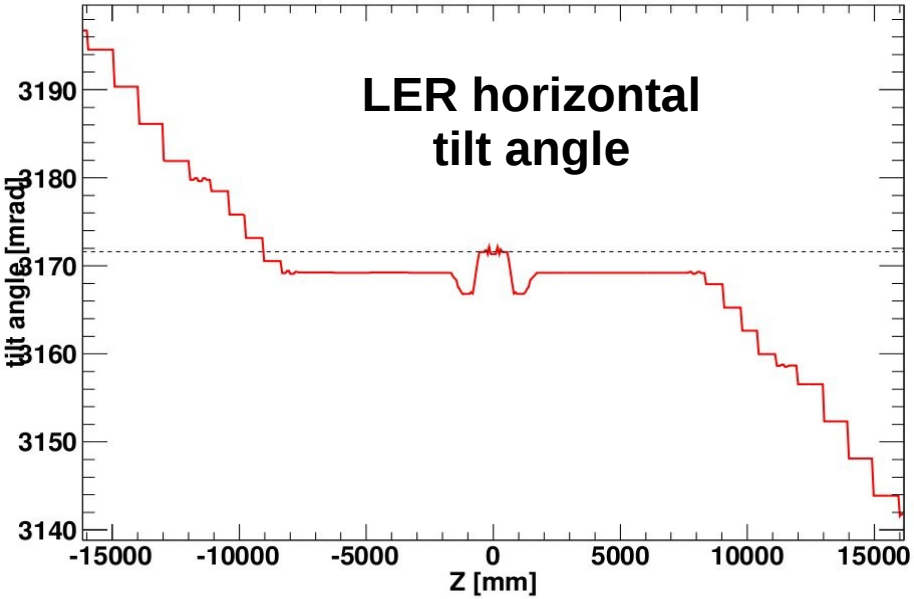
- Beam pipe design only up to ~2m from IP
- After that only have beam envelop ($10\times\sigma_X$ and $10\times\sigma_Y$ beam sizes) up to ±16m from IP
- Essentially two horizontal tilt before 1st bend:
  - 30mrad near IP (Z < 0.6m)
  - 27 mrad up to 1st bend
- Will try to use two straight sections for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

V12 SF11 nominal trajectories









New Beam pipes (I)

- **Previously:**
  - Pipes inside bending magnets modeled as torus
  - Torus gives some navigation problems when testing geometry with Geant4
- **Currently:**
  - Pipes inside bending magnets are modeled as the union of straight pipe sections (3) that follows the bending curvarure