MDI-AREA GENERATED RADIATION

Andrea Ciarma

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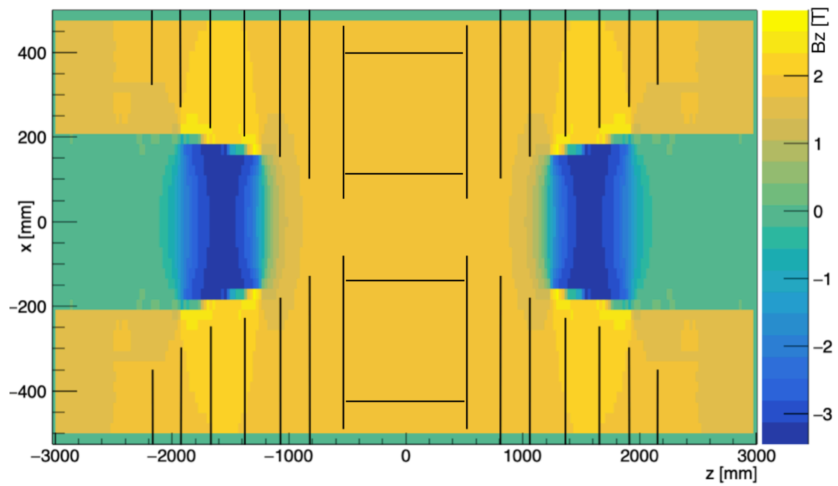
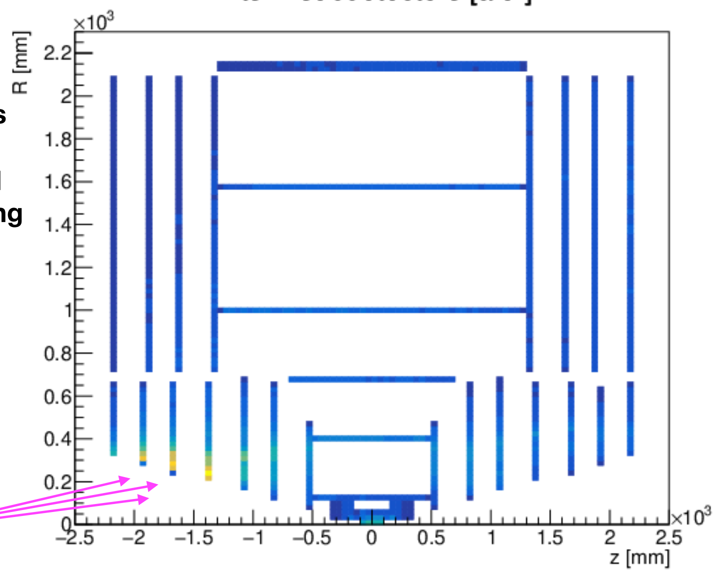
Status and Perspectives for FCC-ee Detector Background Studies (from Krakow Physics workshop)





Beam losses induced Background in CLD tracking system

- Repeated backgrounds tracking studies after possibility to import **magnetic field map** key4hep, including screening and compensating solenoids.
- Occupancy from **incoherent pair production** still tolerable
- **Failure scenario** losses bckg: overall reduction of a factor 2
  - horizontal primary coll. losses: not concerning at Z, high occupancy at ttbar
  - **off-momentum** collimators: only Z data available, occupancy above 1% for negative mom. offset
  - energy deposited in FFQs **below quenching limit**, but total power may be an issue
- **SR induced background** studies started:
  - still not enough **statistic** for tip-scattered photons
  - Efficiency of the CDR tungsten shielding (180kg)

Many Thanks to K. Andrè for the SR photons

Update on the EM radiation sources in the FCCee MDI region

In order to have a more **complete description** of the photons irradiating downstream from the IP, it is important to compare all the **major sources**:

- Beamstrahlung
- Radiative Bhabhas *
- Synchrotron Radiation from:
  - Final Focus Quadrupoles
  - 2T Detector Solenoid
  - Last upstream dipole

Source	Location	s [m]	Power at Z [kW]	Power at Top [W]
Beamstrahlung	IP	0	370	77
Synchrotron Radiation	Last upstream Dipole *	-2.12	6	0.3
	Solenoid	+2.1	73	4.6
	FFQs	+8.44	11	1.8
Radiative Bhabha	IP	0	0.4	2

Just by looking at the power carried by the photons we can see that the second largest contribution comes from the **solenoid**.

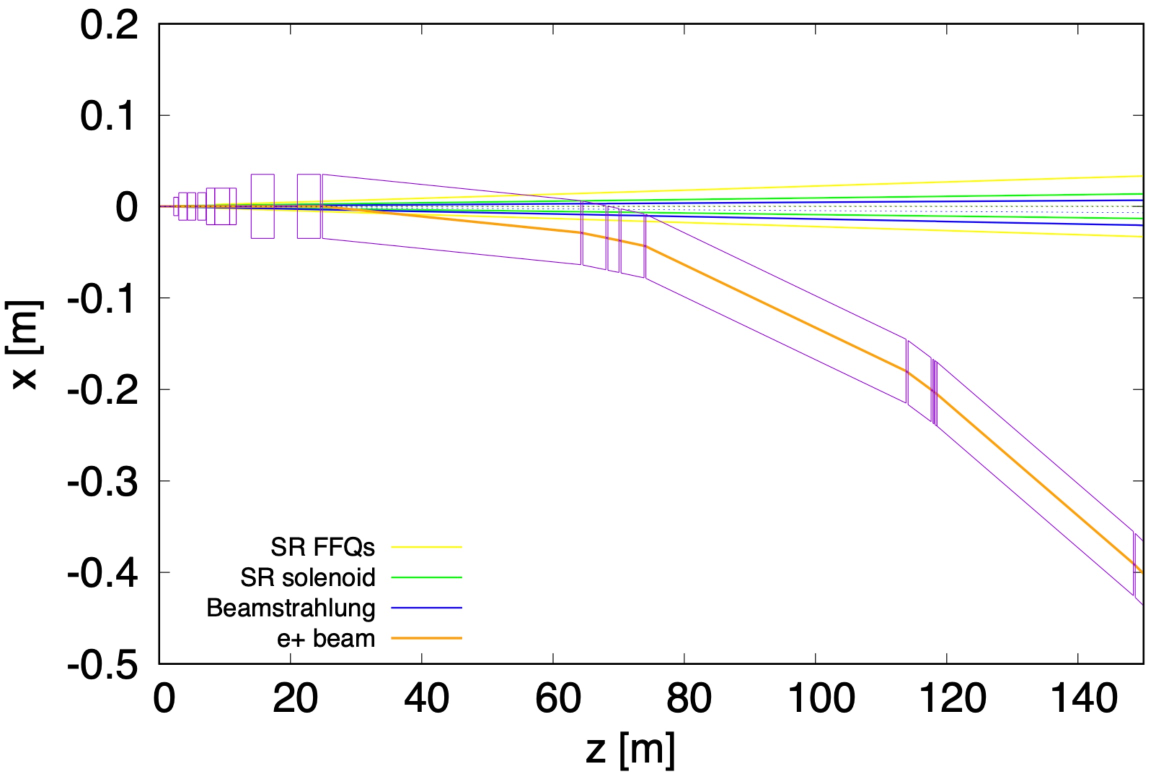
The radiation cones have been propagated downstream to have a first estimate of the interested magnetic elements, in vision of the beamstrahlung **extraction line** and **photon dump** design.

*radiative bhabha not propagated downstream yet, but minor contribution in terms of power.
*note that some part of this radiation is blocked by the upstream SR mask, so by using the total power we are overestimating.

E = 46.5GeV (Z)

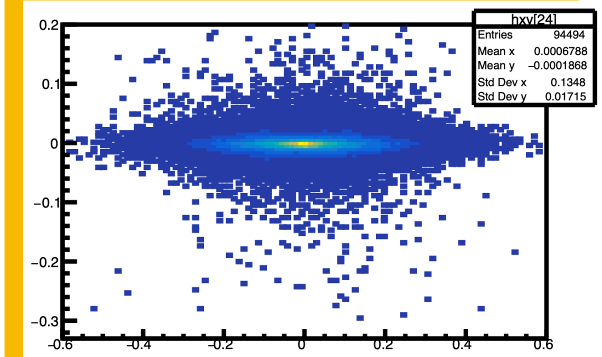
The radiation produced by the **solenoid** has a **“round” profile**, and is comparable in size and direction to the beamstrahlung. SR from **FFQs** instead is much **flatter** and with a larger divergence.

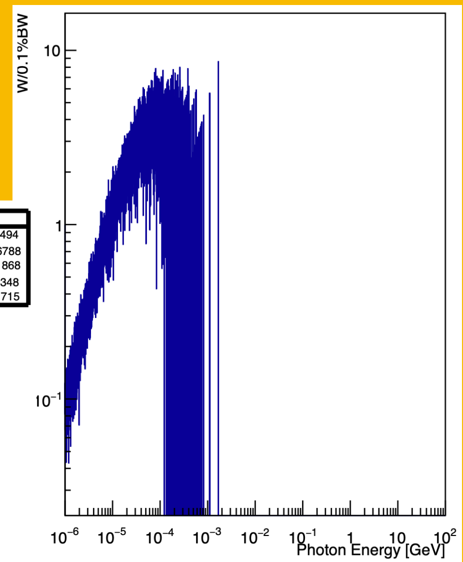
1 sigma cones



SR FFQs

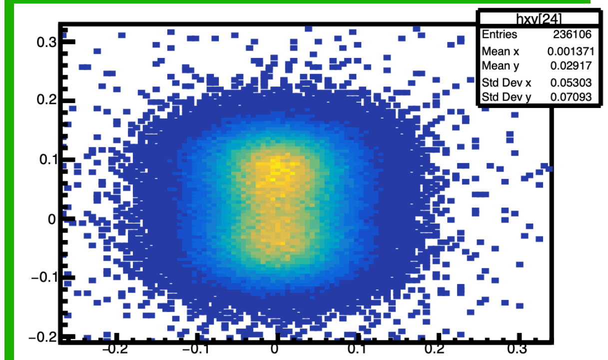
Beam size at 600m from IP

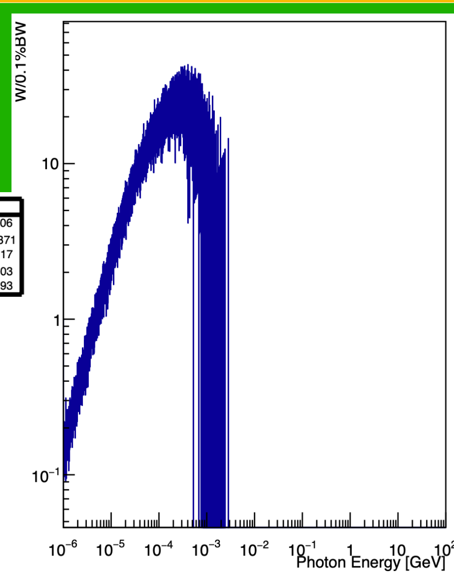




SR Solenoid

Beam size at 600m from IP





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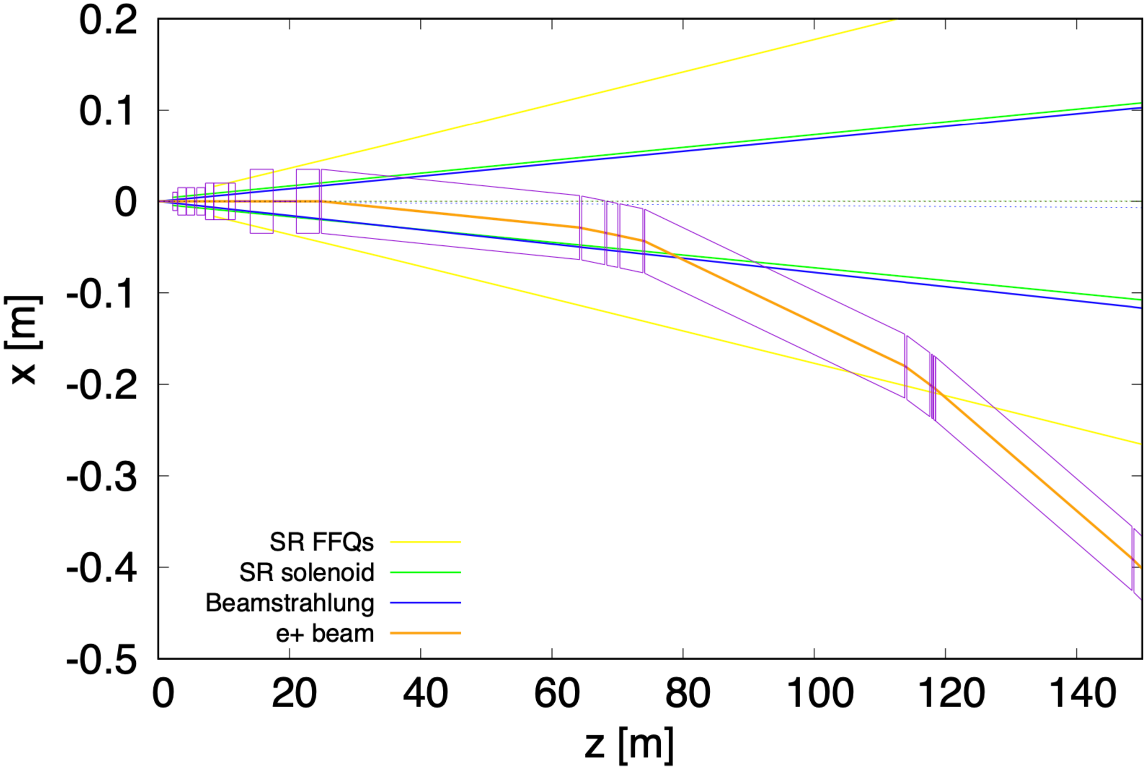
8 sigma cones



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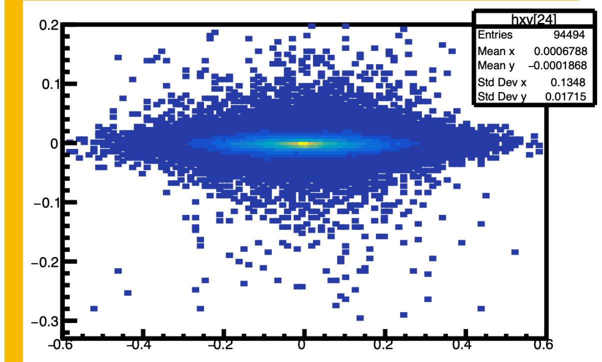

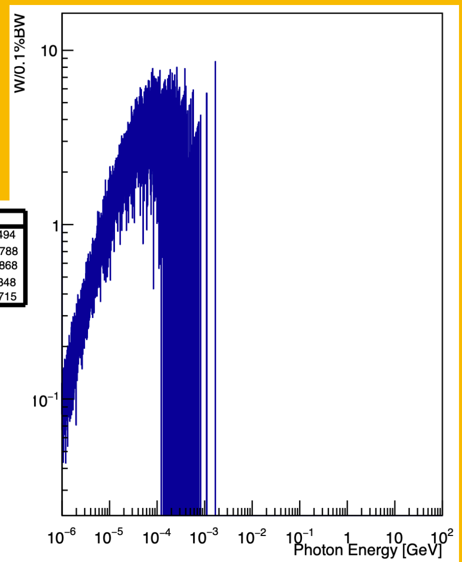

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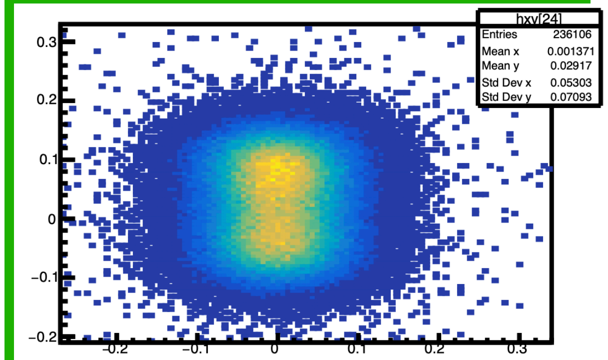
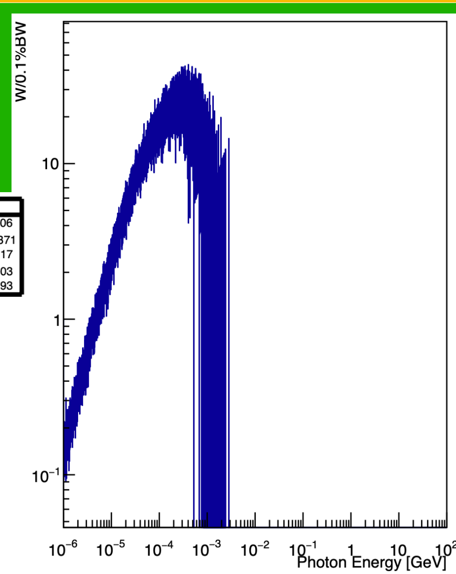
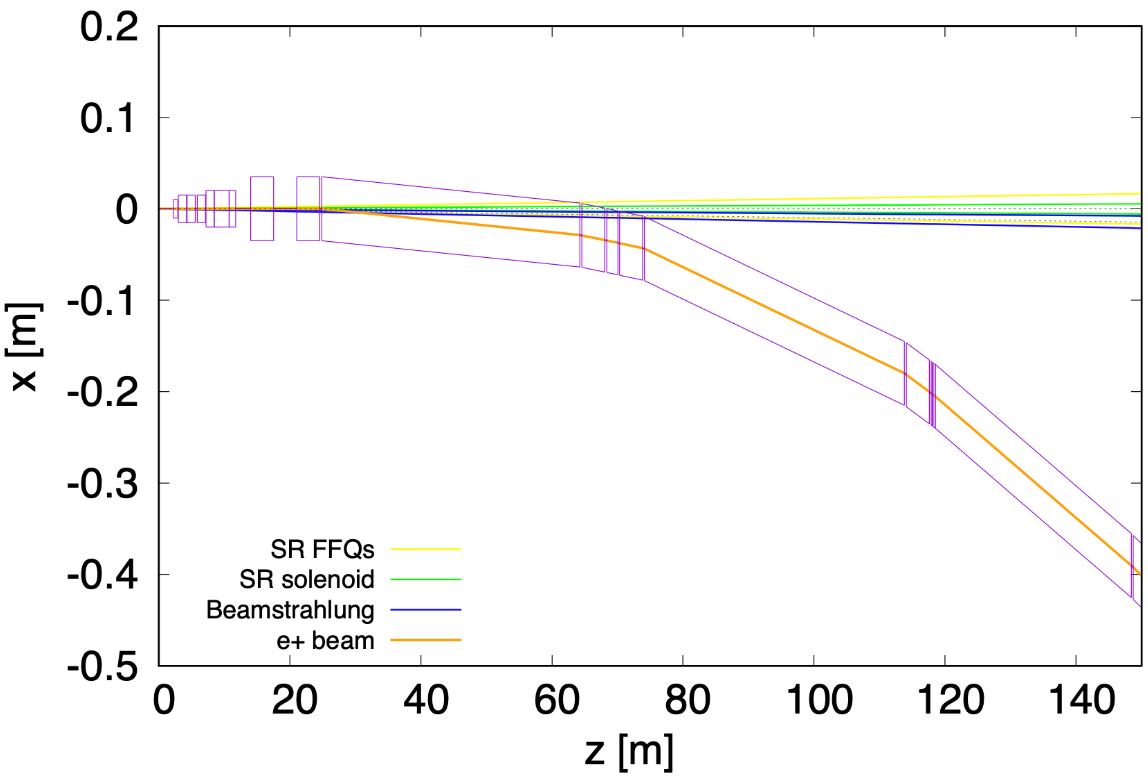




E = 182.5GeV (Top)

Similar behavior is found at the Top energy. Here the **vertical contribution** is more important. Also the stronger kick due to **beam beam** is more evident on the beamstrahlung.

1 sigma cones



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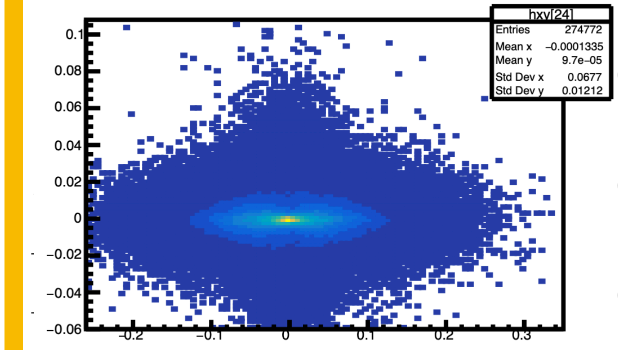

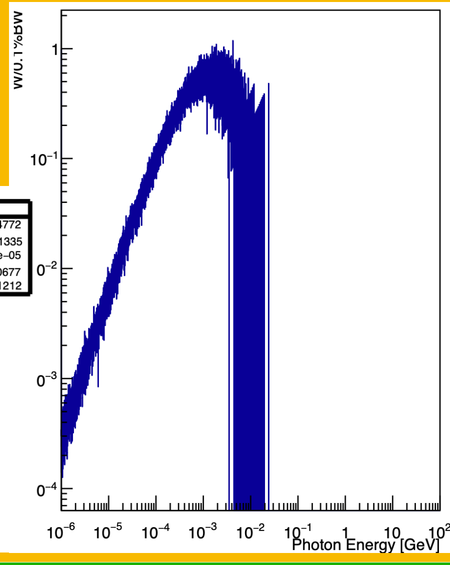

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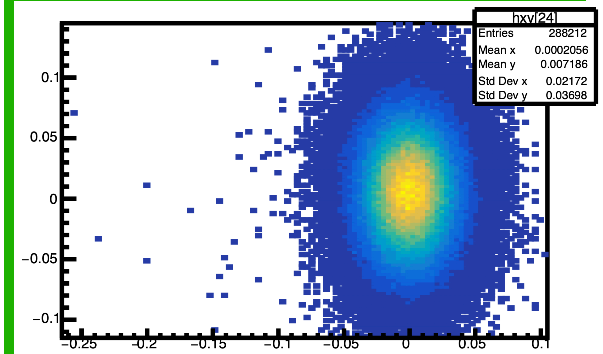

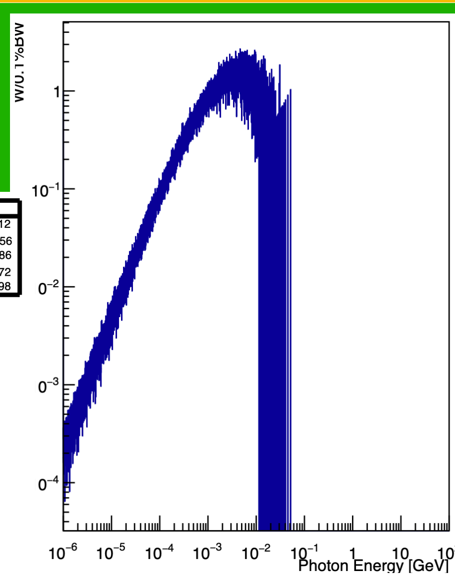

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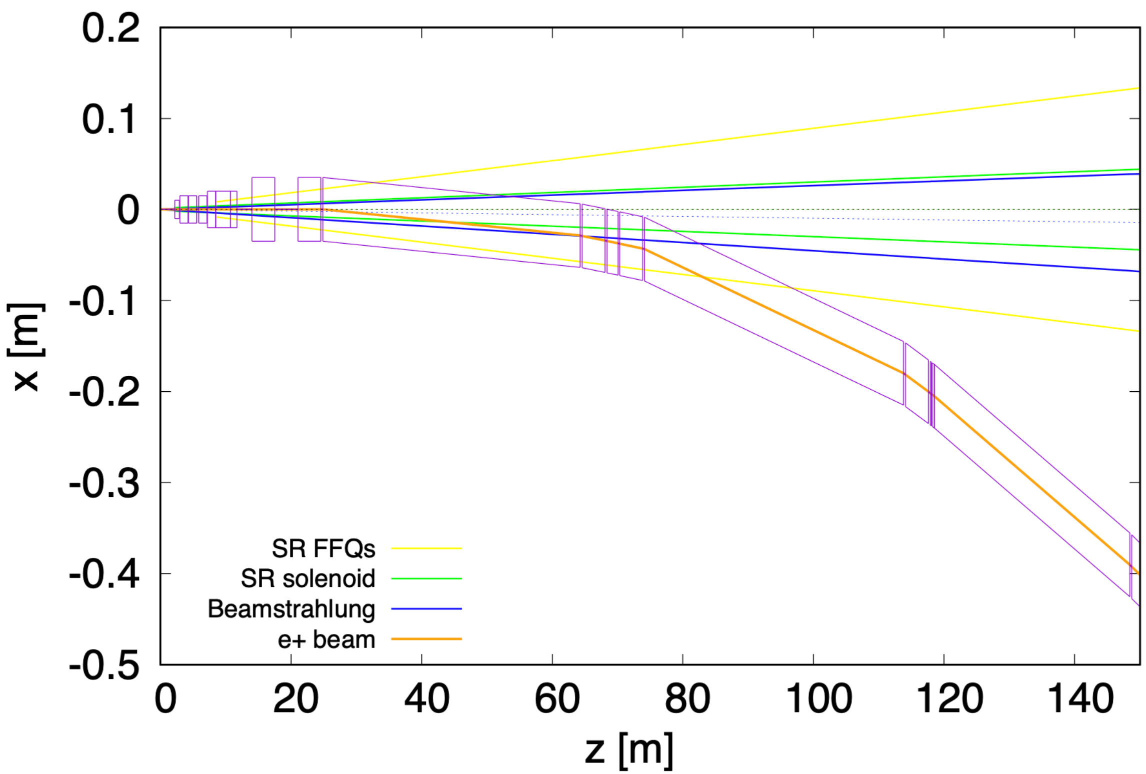

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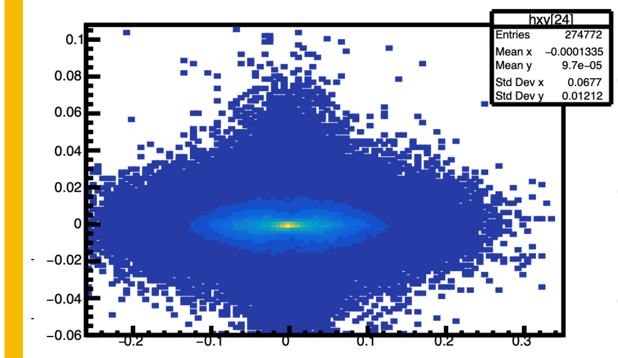

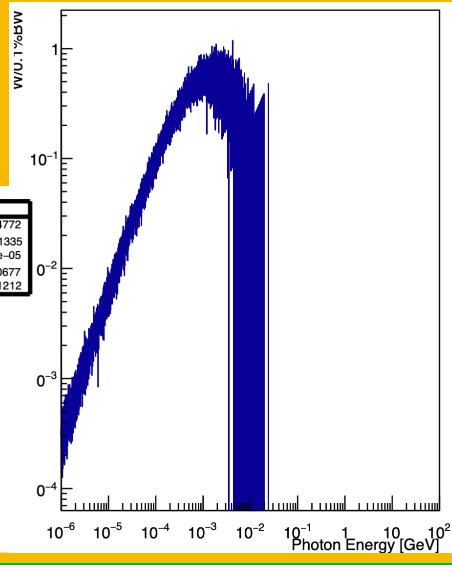

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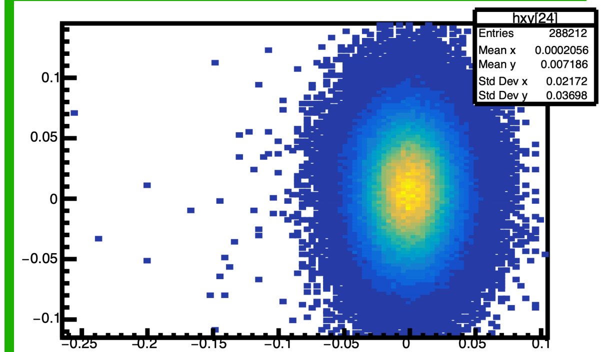
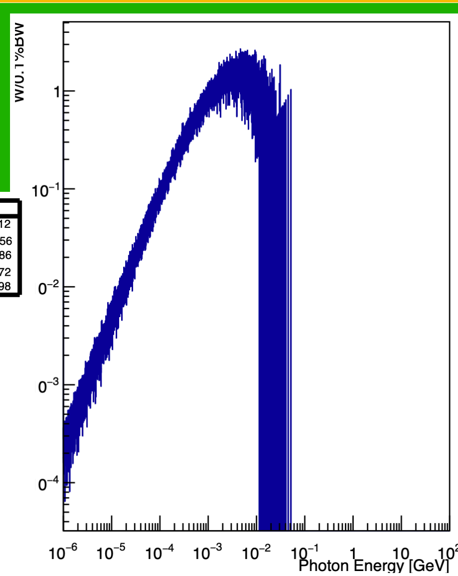




Summary

Update on other **sources of radiation** coming from the MDI area and impinging on the "beamstrahlung dump" location has been presented.

Dominant contribution after beamstrahlung comes from the **solenoid SR**. The spot size is comparable to the beamstrahlung, but without the horizontal kick due to beam beam.

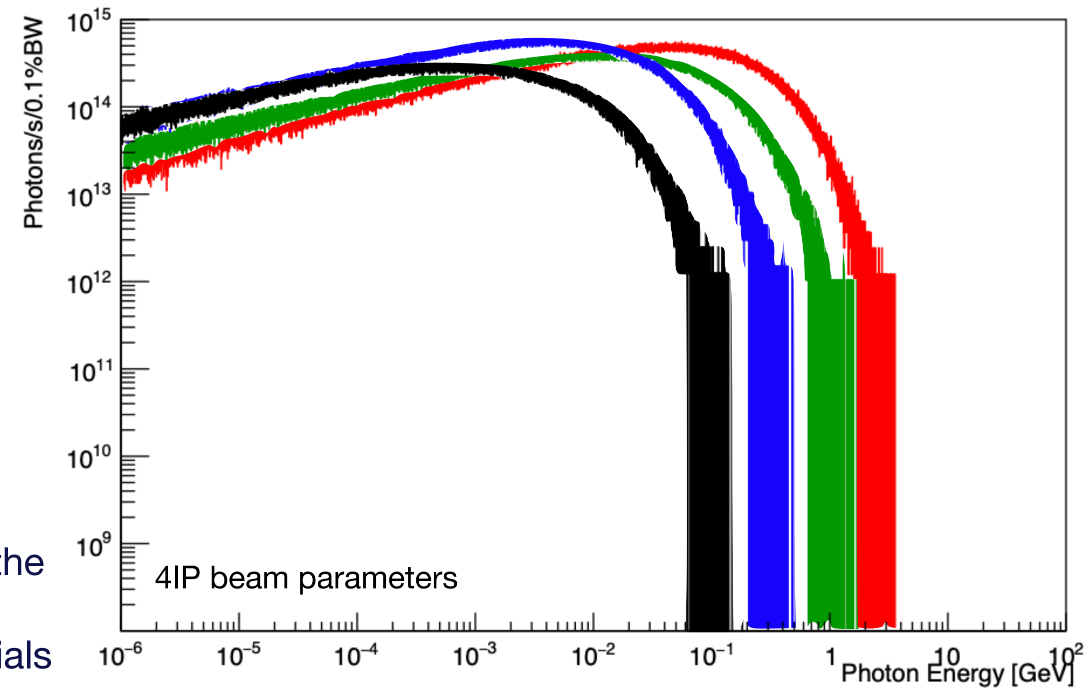
- Study only SR photons surviving after the IP
- Propagate also the Radiative Bhabha photons downstream (not much power, but maybe useful for monitoring)
- Other features to be characterised? Please comment!

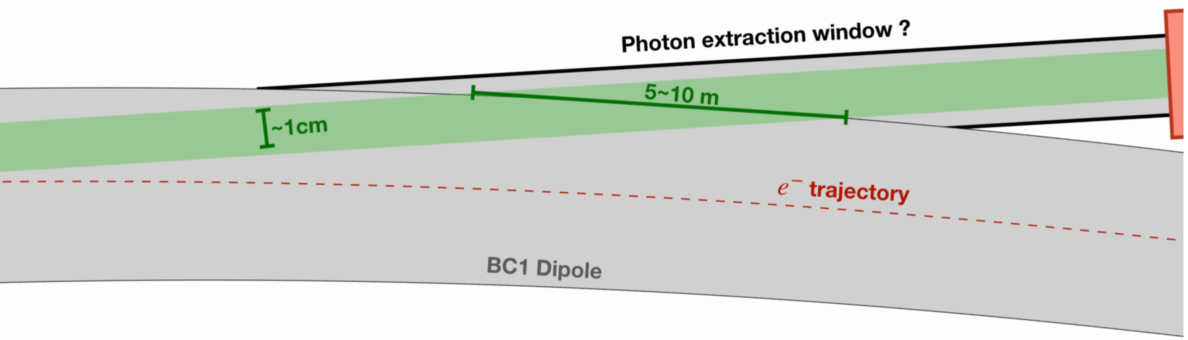
Beamstrahlung radiation Characterisation

The photons are emitted **collinear to the beam** with an angle proportional to the beam-beam kick. This radiation is extremely intense **O(100kW)** and **hits the beam pipe** at the end of the first downstream dipole.

The generator for the beamstrahlung radiation is **GuineaPig++**

The design of a **dedicated extraction line** and **beam dump** for the beamstrahlung photons is currently in progress, exploring tunnel integration, magnets design, cooling system, and different materials for the beam dump.





	Total Power [kW]	Mean Energy [MeV]
Z	370	1.7
WW	236	7.2
ZH	147	22.9
Top	77	62.3

Radiative Bhabha photons Characterisation

The radiation emitted in Bhabha events at the IP consists in **very hard photons** emitted collinear to the **beam direction**, so it will hit the beam pipe in the same location of the beamstrahlung photons, but with much **lower intensity**.

The RB photons energy spectrum endpoint is the nominal energy of the e+/e- beams, and have been generated using **BBBrem** (courtesy of H. Burkhardt)

Dedicated tracking of the **very off-energy e+/e-** after the emission should be performed in order to assess the **beam losses** due to this effect.

Considerations on the possibility to have a **selective beam dump** will be discussed by A. Di Domenico on Thursday 27/10