

BACKGROUND STUDIES: SUMMARY AND FUTURE WORKS

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OUTLINE

- Background sources
- Updates on Touschek rates
- Open questions
- Future work

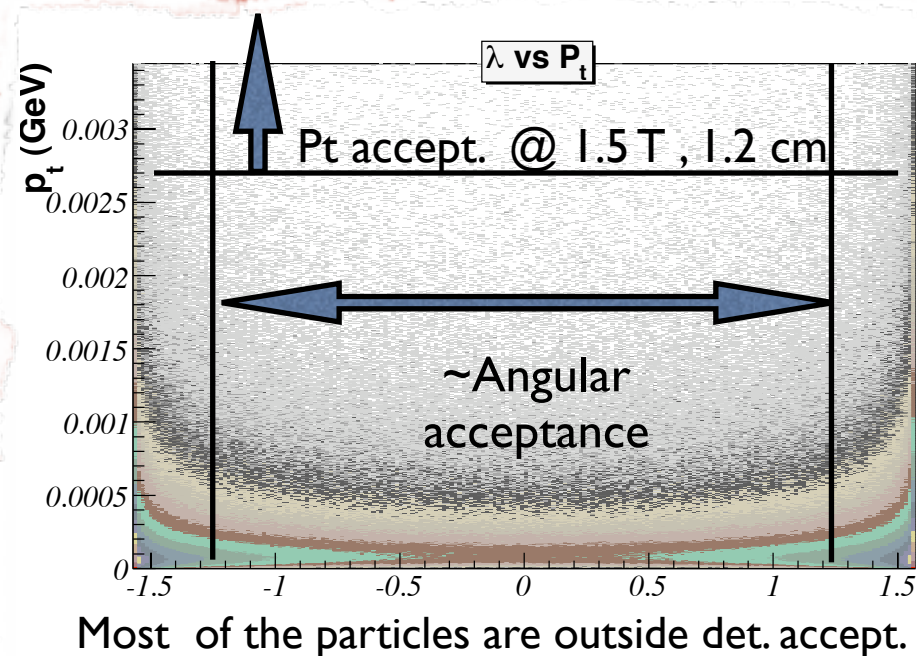
BACKGROUND SOURCES

- Pair Production
- Touscheck particles
- “Beam Beam”
- Single beam

PAIR PRODUCTION

► Generator: Diag36

► Affect SVT Layer 0



0.022 mbarn

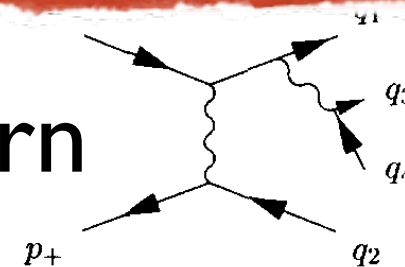


Fig. 1. One of the sixteen bremsstrahlung graphs representing the leading t -channel d

7.27 mbarn

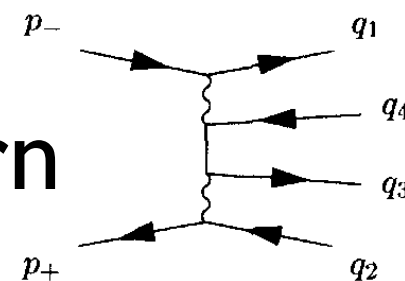
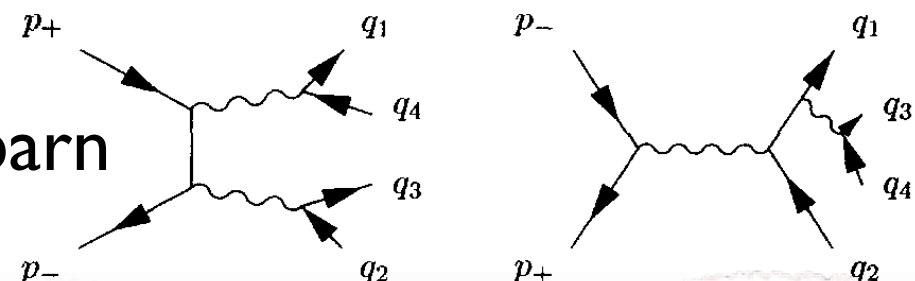


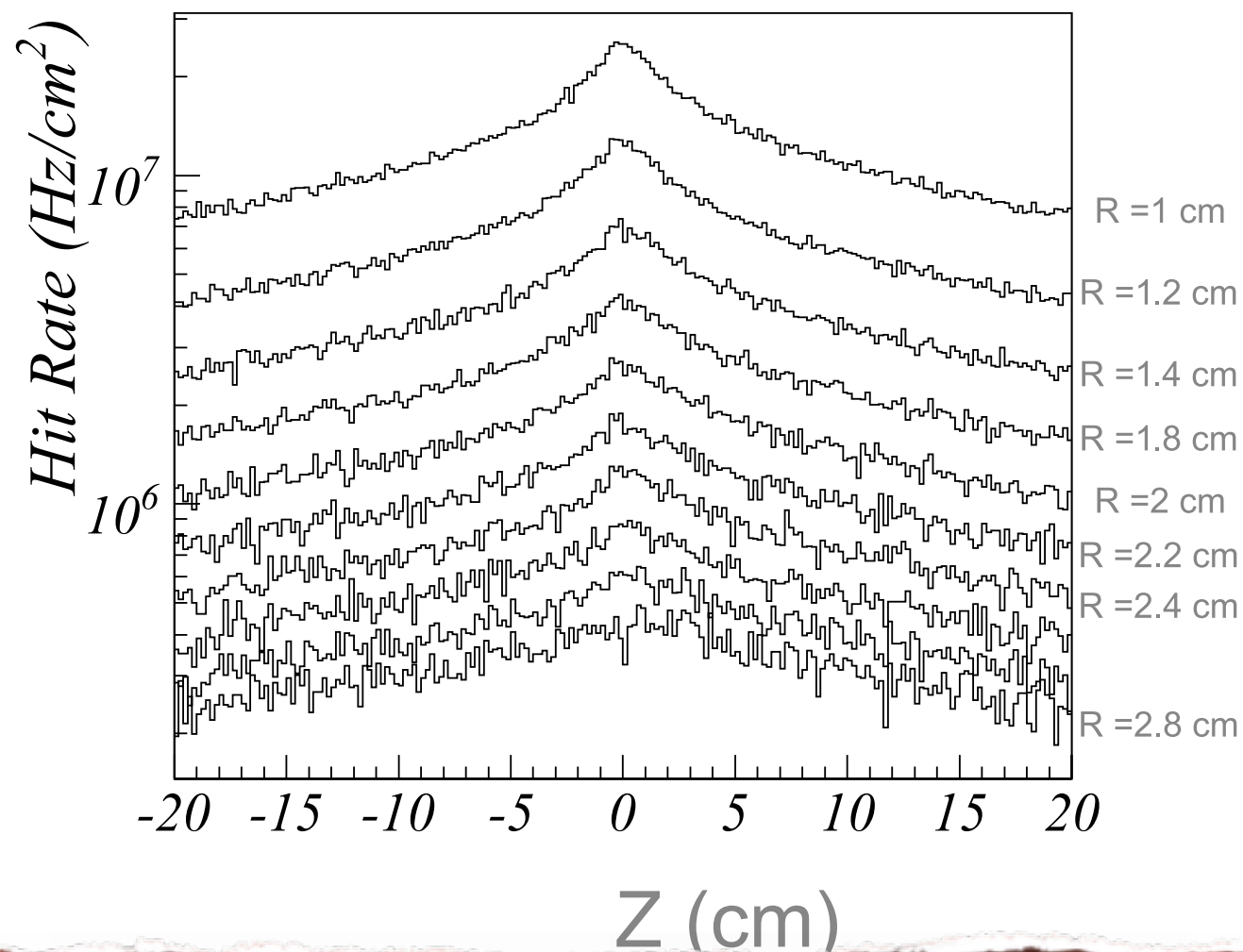
Fig. 2. One of the eight Feynman diagrams for multiperipheral dynamics.

1.1 nbarn

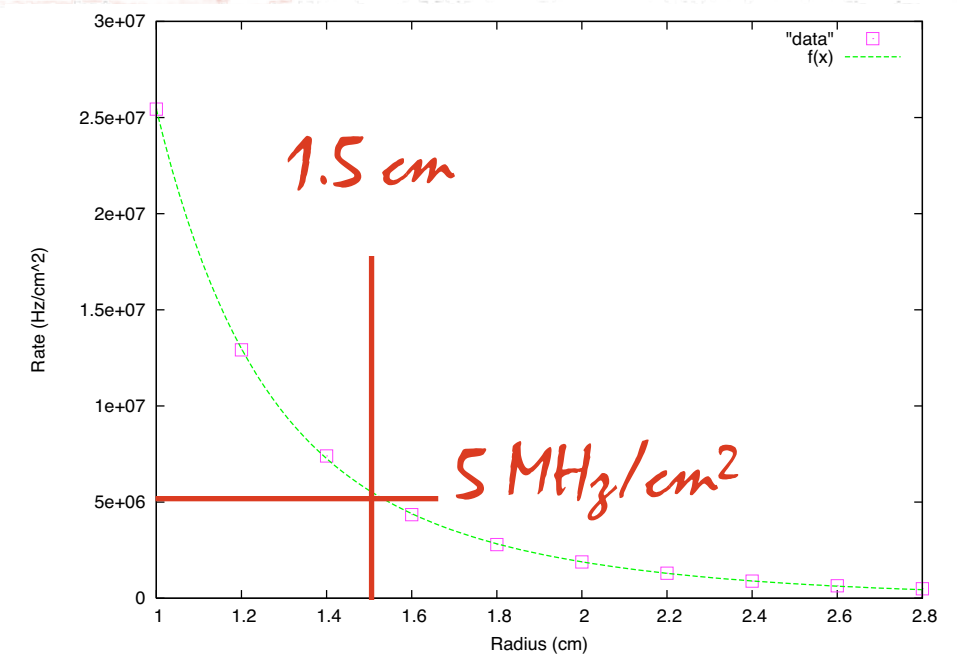


RATE VS RADIUS

- Occupancies based on parametric simulation
- Geant4 simulation still in the TODO queue



Cluster multiplicity = 1

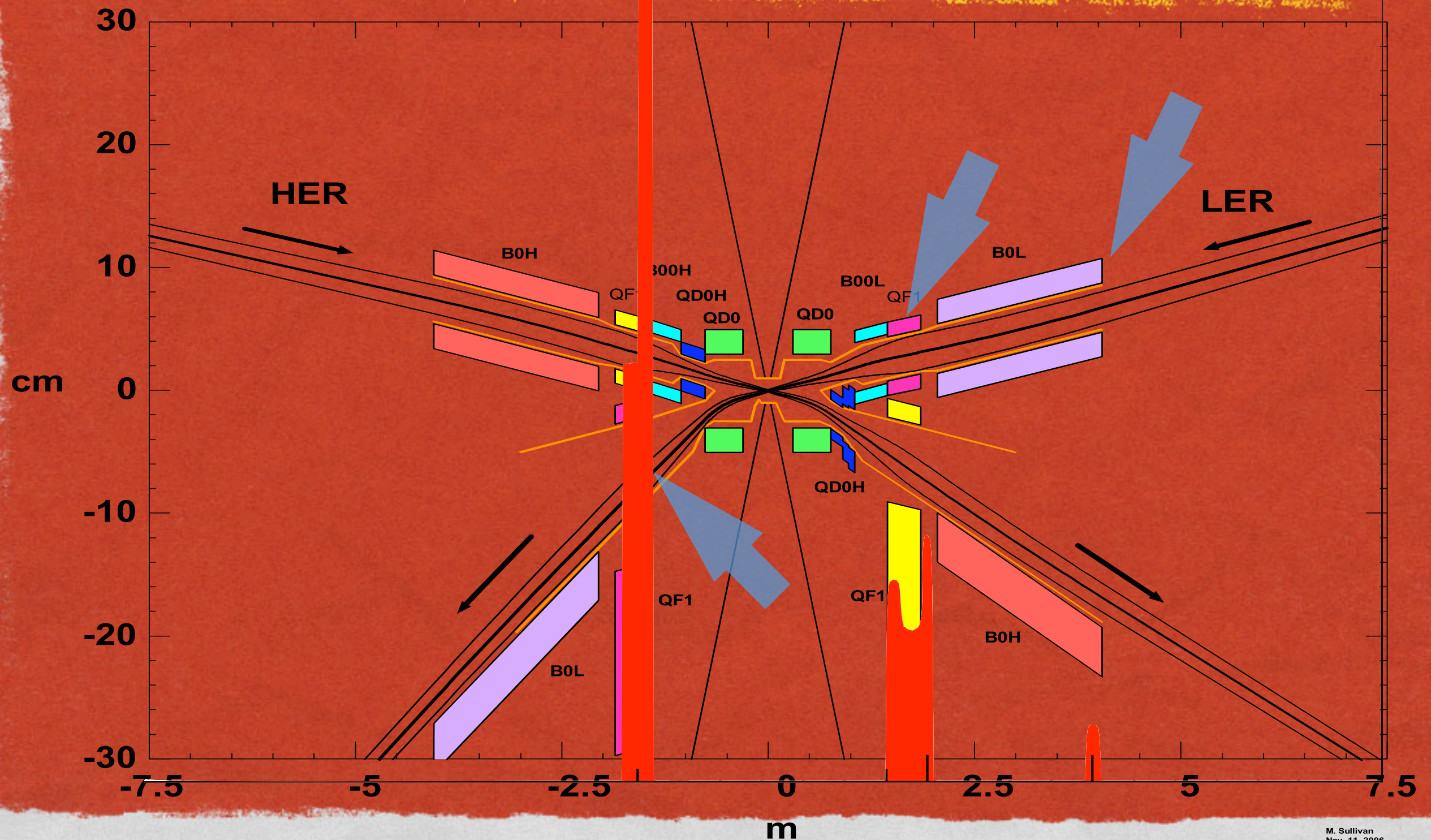


TOUSCHEK BACKGROUNDS

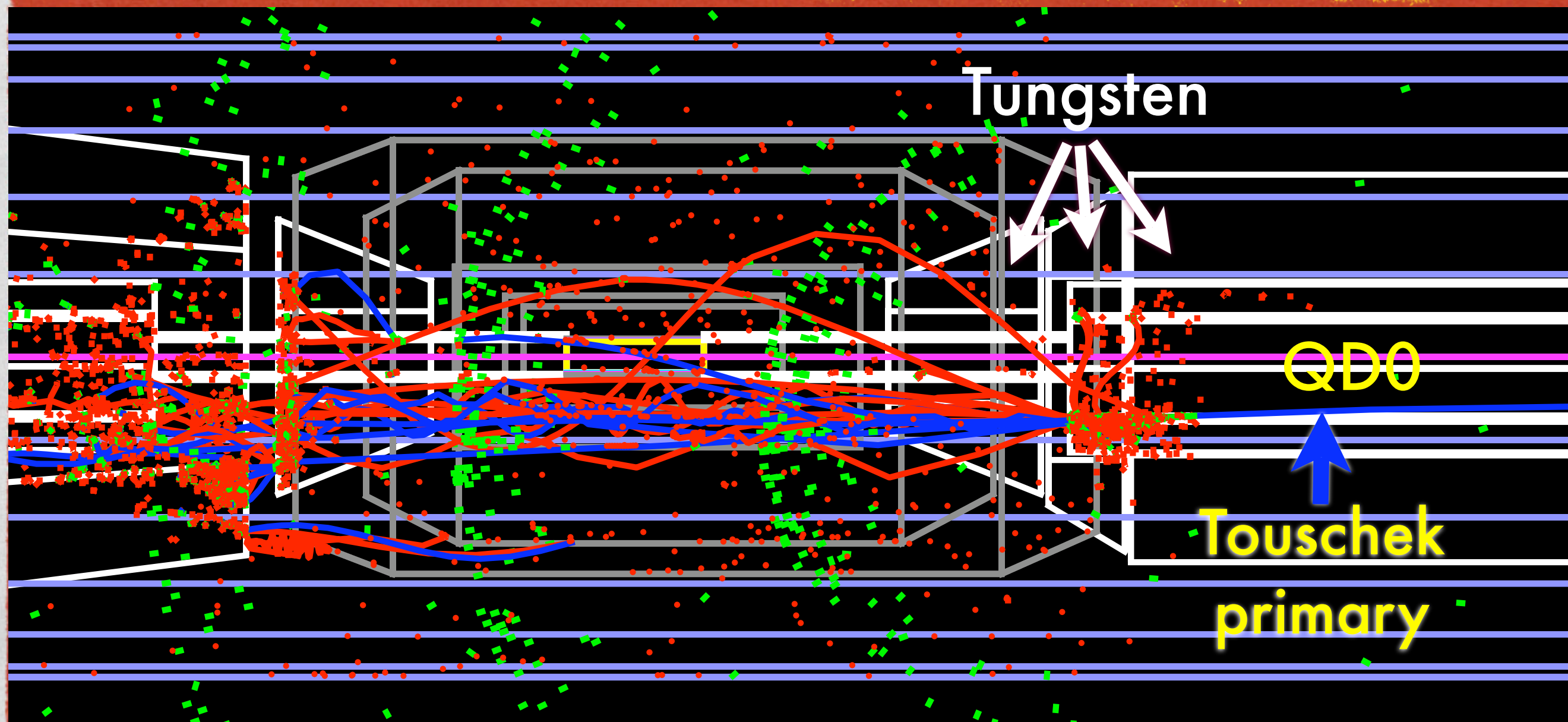
- ▶ Particles in the same bunch can undergo Touschek scattering and escape the ring energy acceptance window
- ▶ Off energy particles are overbent/underbent by the magnetic elements till they hit the vacuum chamber producing backgrounds
- ▶ Manuela Boscolo (LNF) developed a tool to simulate Touschek scattering around the ring validated on Daphne

TOUSCHEK (CDR DESIGN)

SuperB Interaction Region



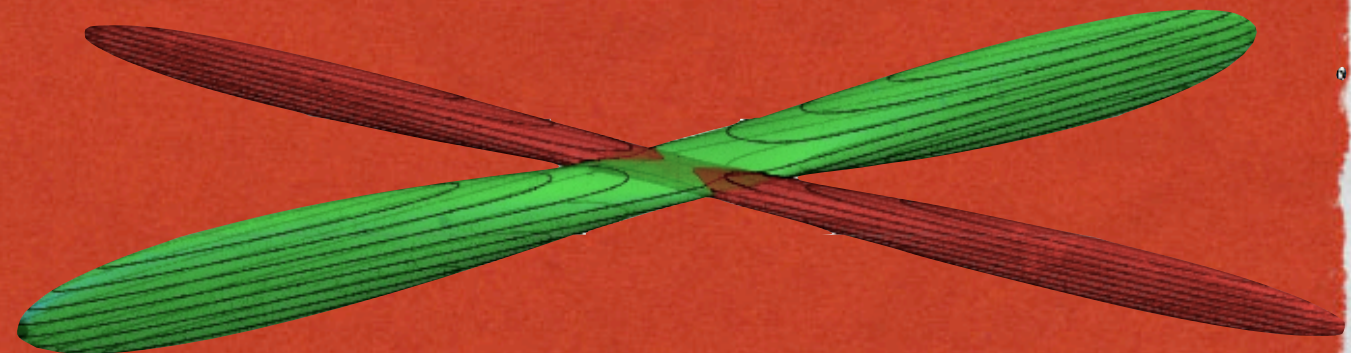
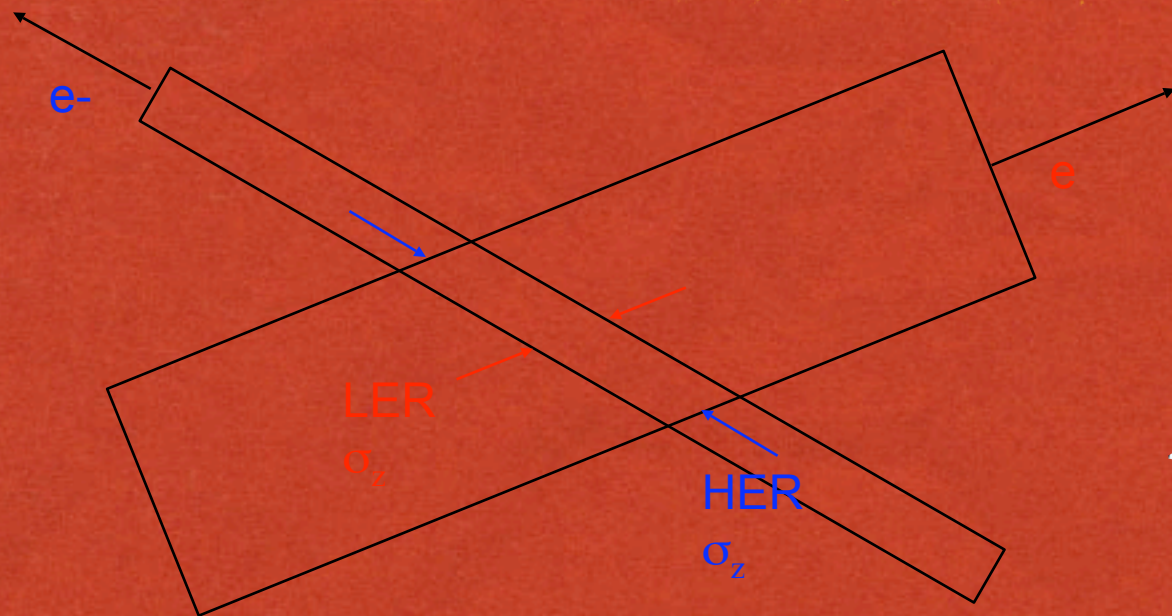
EVENT DISPLAY



CDR TOUSCHEK RATE

Shielding	e ⁺ Rate (MHz / cm ²)		e ⁻ Rate (MHz / cm ²)		total	
	W	Air	W	Air	W	Air
Layer 0	8.86	6.42	14.3	8.59	23.16	15.01
Layer I	11.5	10.8	24.3	26.0	35.8	36.8
Layer II	8.0	7.0	21.5	12.2	29.5	19.2
Layer III	2.5	2.5	5.5	9.7	8	12.2
Layer IV	0.045	0.96	0.84	0.67	0.885	1.63
Layer V	0.017	0.06	0.50	0.40	0.517	0.46

NEW MACHINE PARAMETERS AND COLLIMATORS



<i>Layer</i>	<i>Old (kHz/cm2)</i>	<i>New (kHz/cm2)</i>
0	23160	3.7
1	35800	7.0
2	29500	2.6
3	8000	4.9
4	885	0.0
5	510	0.0

BEAM-BEAM

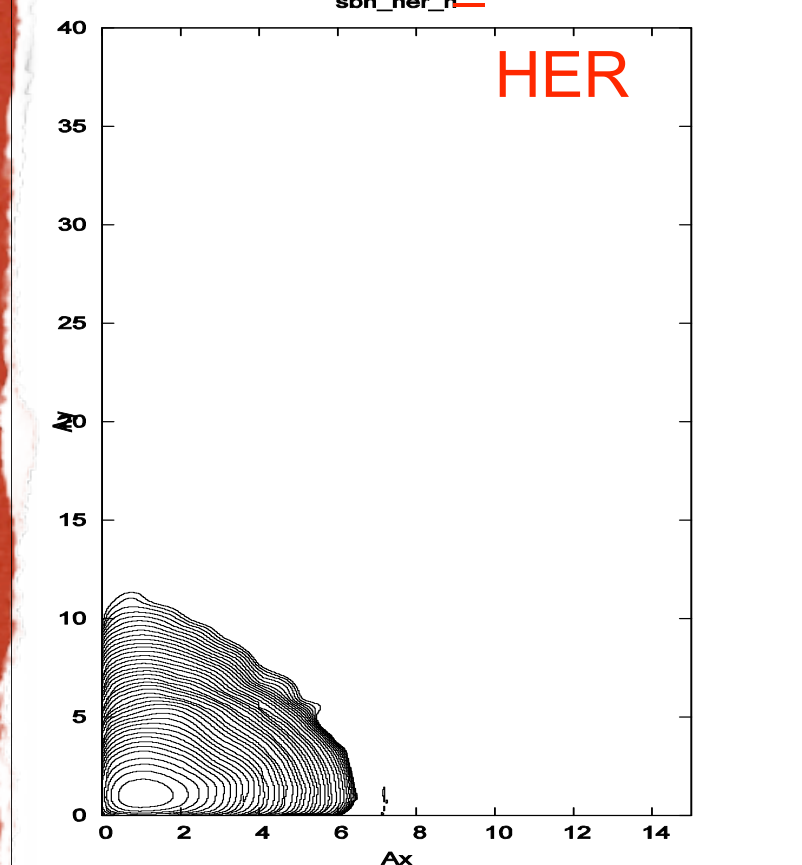
- Beam halo: non gaussian tails in the transverse profile of the bunches
- Beam halo depends on:
 - machine imperfections, non linearity in the single turn map of the ring
 - beam beam non linear forces

BEAM-BEAM

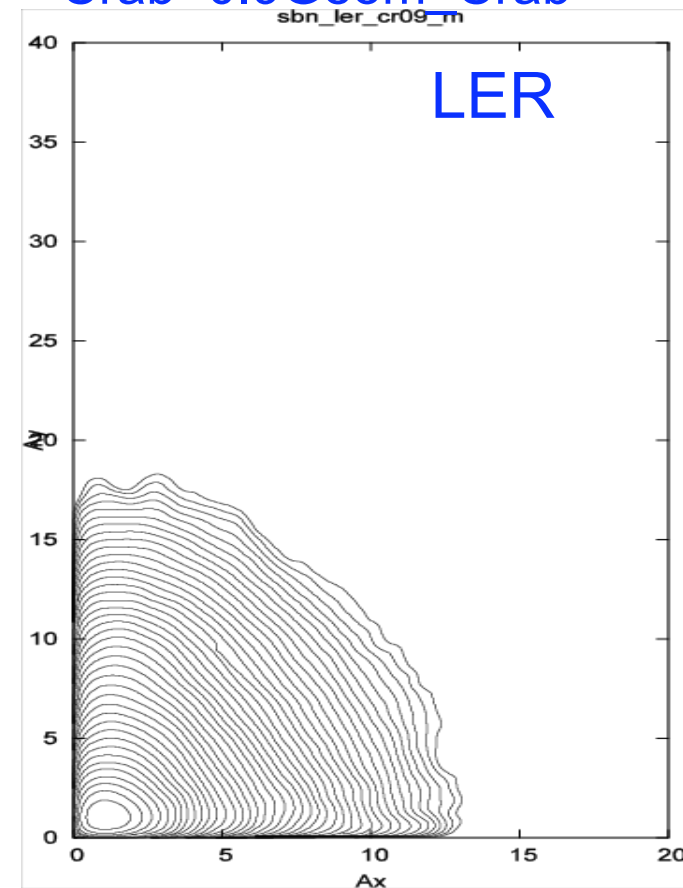
- Hard (if ever possible) to simulate from first principle...

Beam Beam Blowup weak-strong simulations

Crab=0.8Geom_Crab



Crab=0.9Geom_Crab



$L=10^{36} \text{ cm}^{-2} \text{ s}^{-1}$

SINGLE BEAM

- In the CDR we scaled the BaBar occupancies by a factor close to 1
- BaBar single beam post-diction: “Years to make it working for the HER...” (P.Grenier)

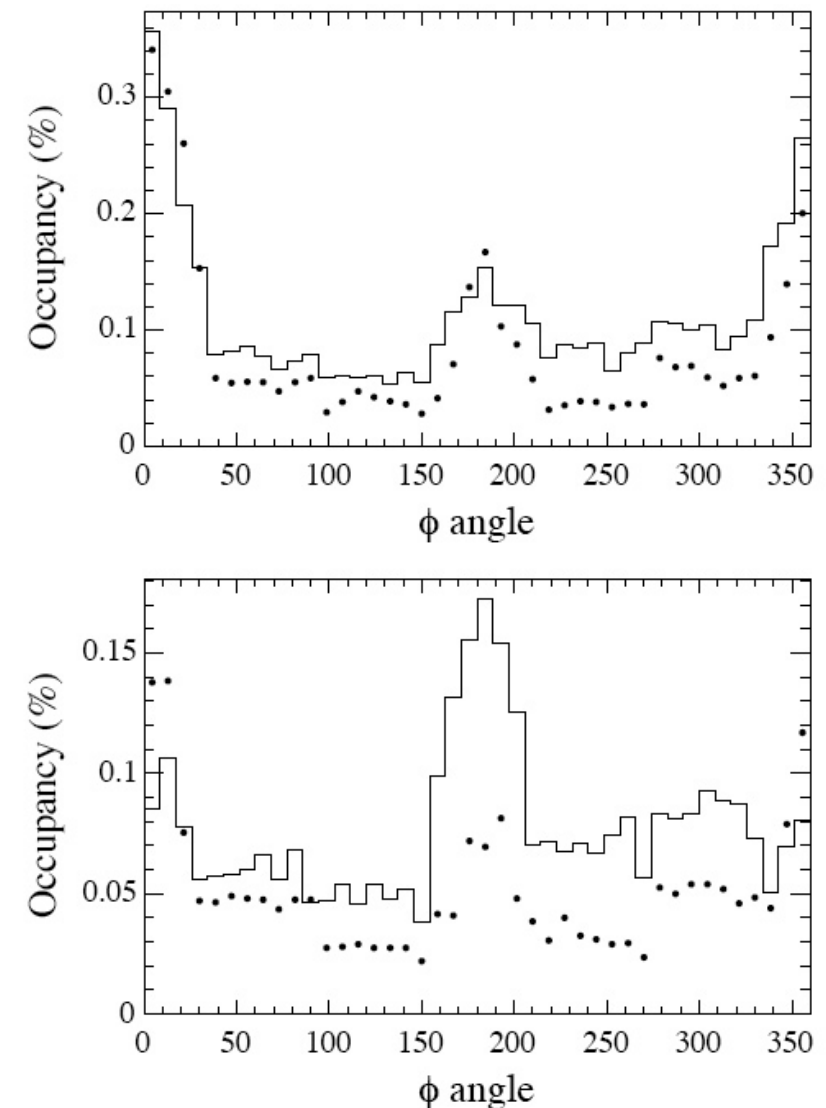
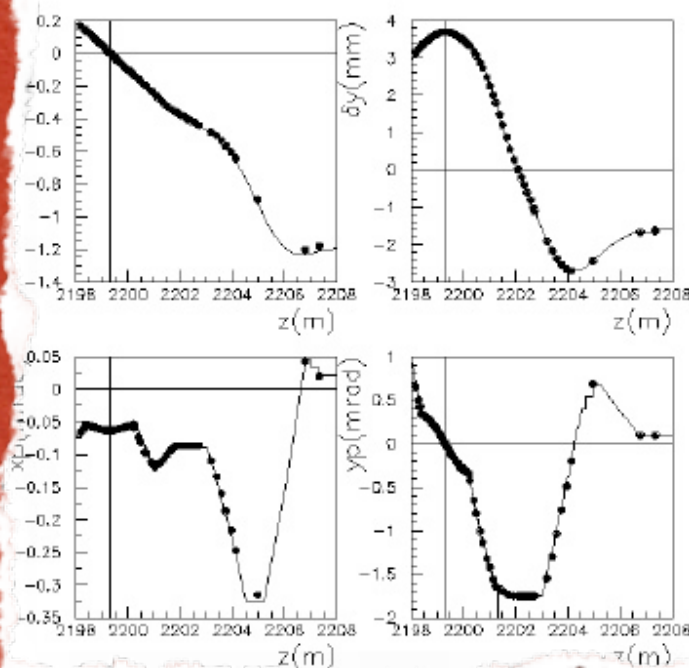


Figure 1: Single-beam SVT ϕ chip occupancies measured with a 1A e^+ beam (solid circles) and predicted by G4 (histograms) for layer 1 (top) and layer 2 (bottom). The simulation assumes a 1 nTorr pressure around the ring.

OPEN QUESTIONS

- Beam-beam halo: how to produce a reasonable estimate?
- Single beam: can we afford to simulate the SuperB beam line with the needed accuracy (human time)?
- Are we forgetting some other source of backgrounds?

TO DO LIST

- Gean4 simulation of pair production
- Radiation dose evaluation on silicon detector wafers and readout electronic silicon wafers
- Implement a more accurate algorithm to handle detector segmentation and to simulate cluster multiplicity
- Machine experts involvement in the “beam halo” problem