Recent Simulations (Backgrounds)

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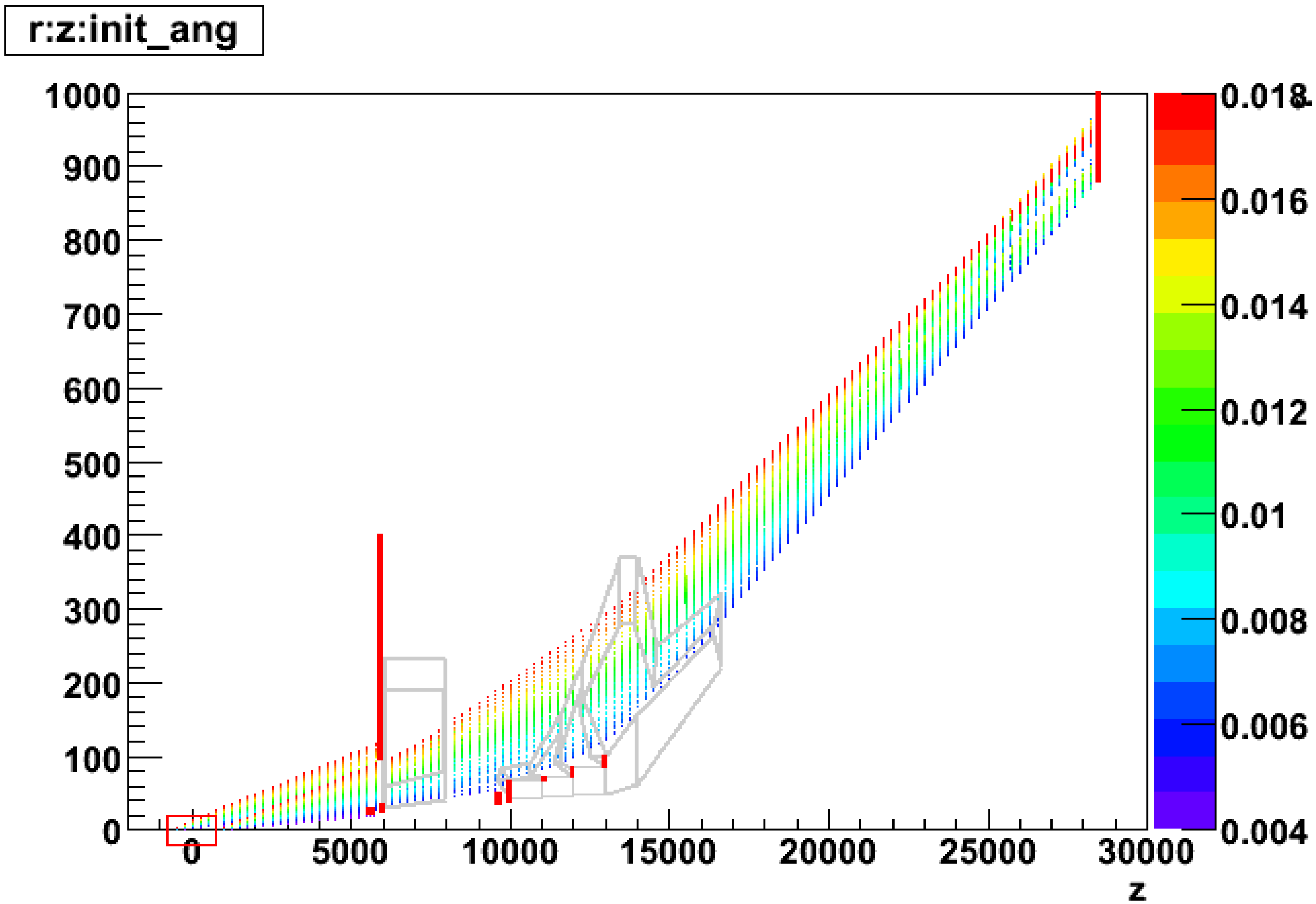
Recent Simulations (Backgrounds)

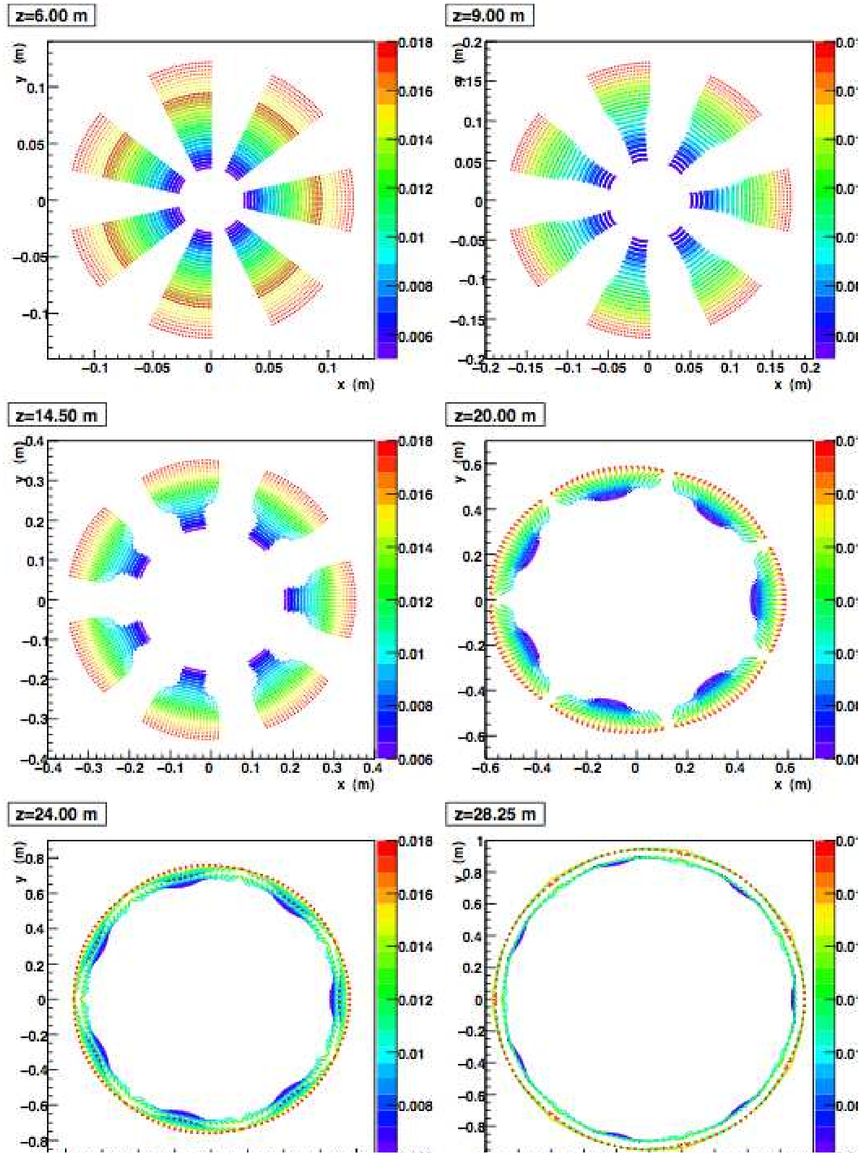
Outline

- Review: Luis's GEANT Photon Generation
  - –Single Bounce γ Collimation
  - –Raw Power in 1st Collimator
- Handling the Inelastic Background Correction
  - –The Strategy
  - –Review Detector Rates
  - –Q^2-weighted W^2 Distributions

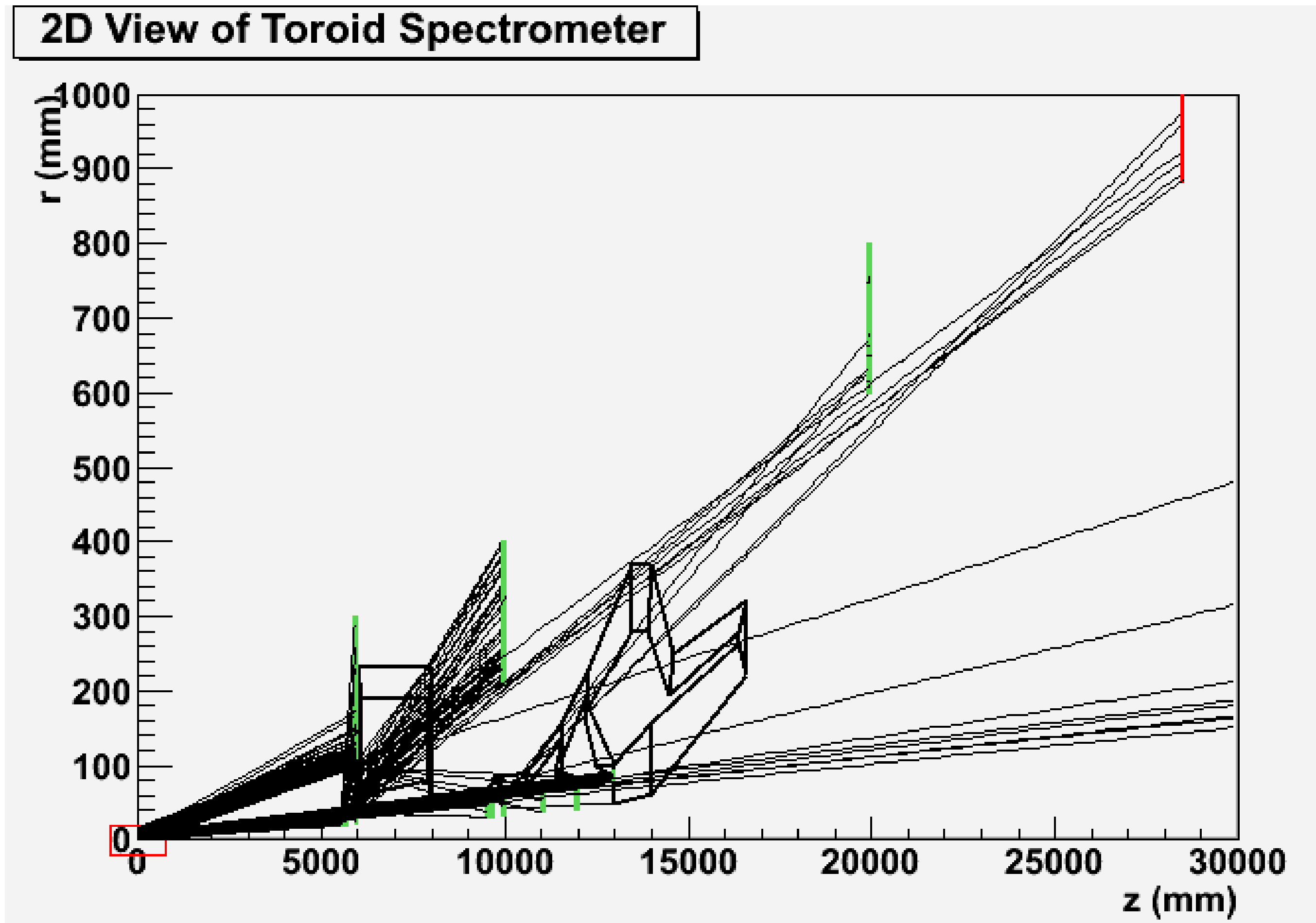
Møller Trajectories



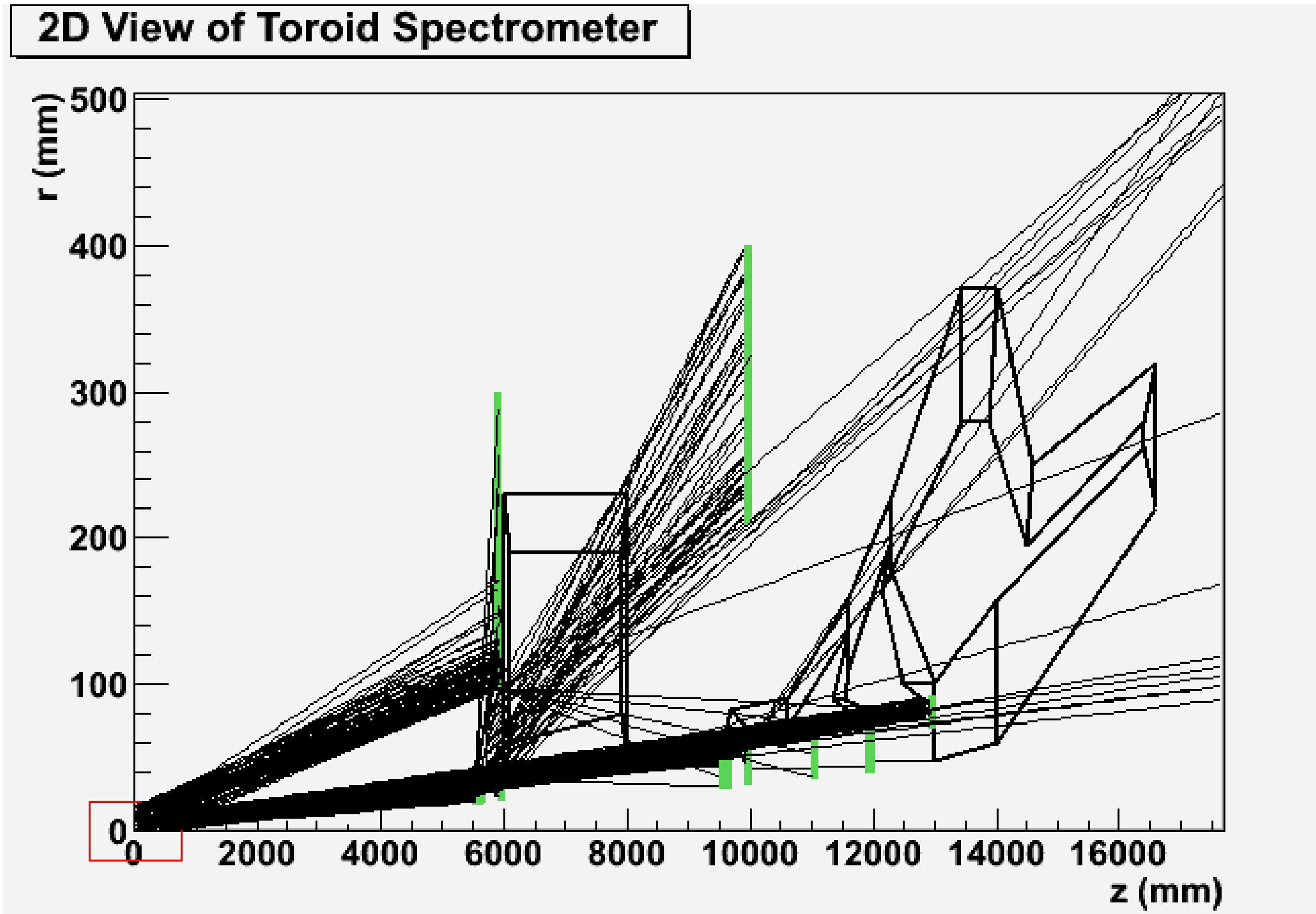
Møller Trajectories



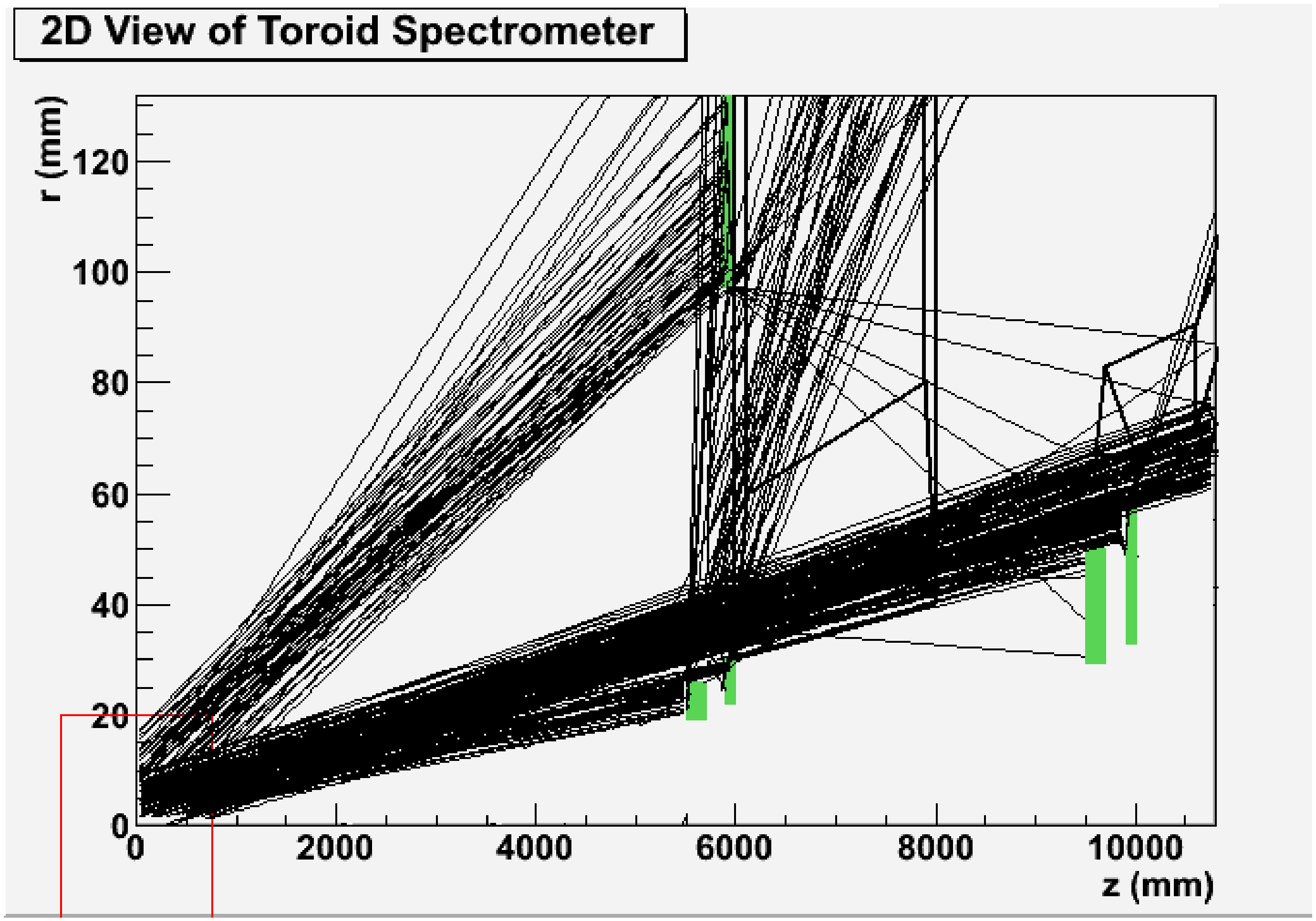
Photon Trajectories (1000 Møller Events Generated)



Photon Trajectories (1000 Møller Events Generated)



Photon Trajectories (1000 Møller Events Generated)



GEANT Photon Summary

(Note: 100MeV Energy cut applied here)

1000 Moller events generated

- Out of 1000 Moller events generated, about 70% hit the detector.
- Only 6 photons get through the collimators.
- Photon energies are mostly a few hundred MeV.

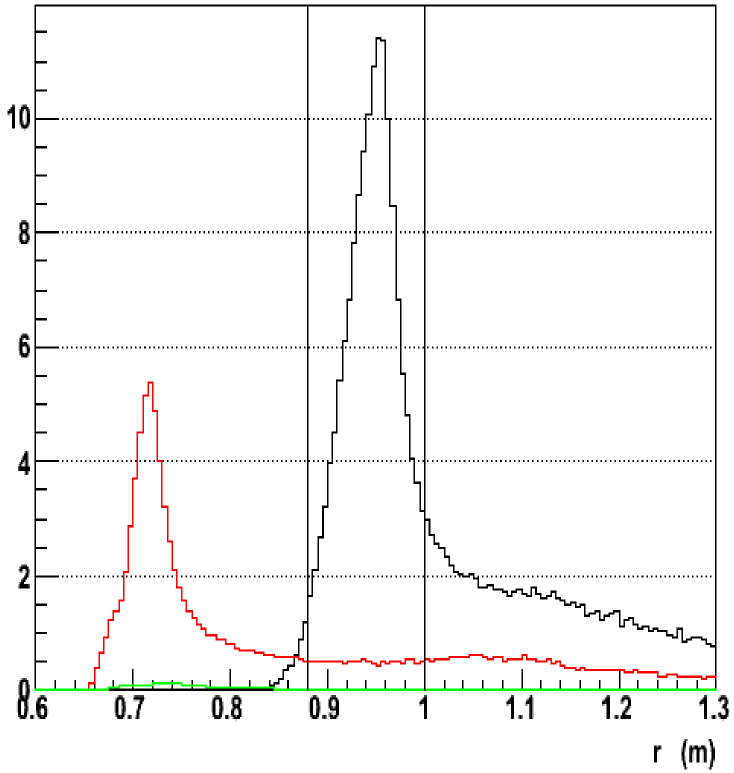
Power Dumped in 1st Collimator (preliminary)

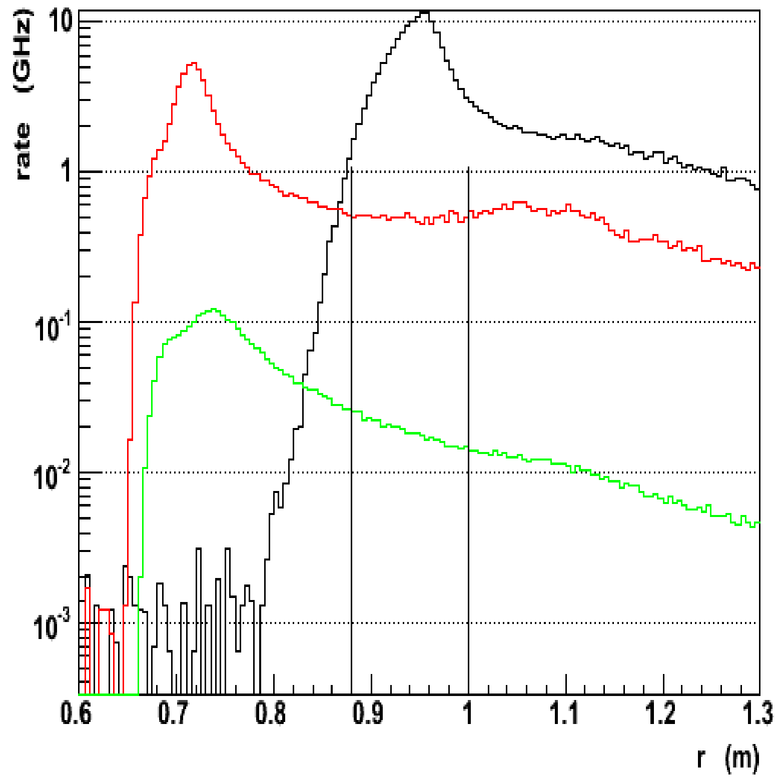
- Threw 100,000 beam electrons through target
- These generated 820 GeV total integrated energy absorbed in 1st collimator
- For 75μA beam current, this gives **620 Watts**
- This is for 20cm thick collimator centered at z=5.6m from target center, with inner radius of 2.3 cm and outer radius of 3.1 cm

Møller Signal Background Corrections

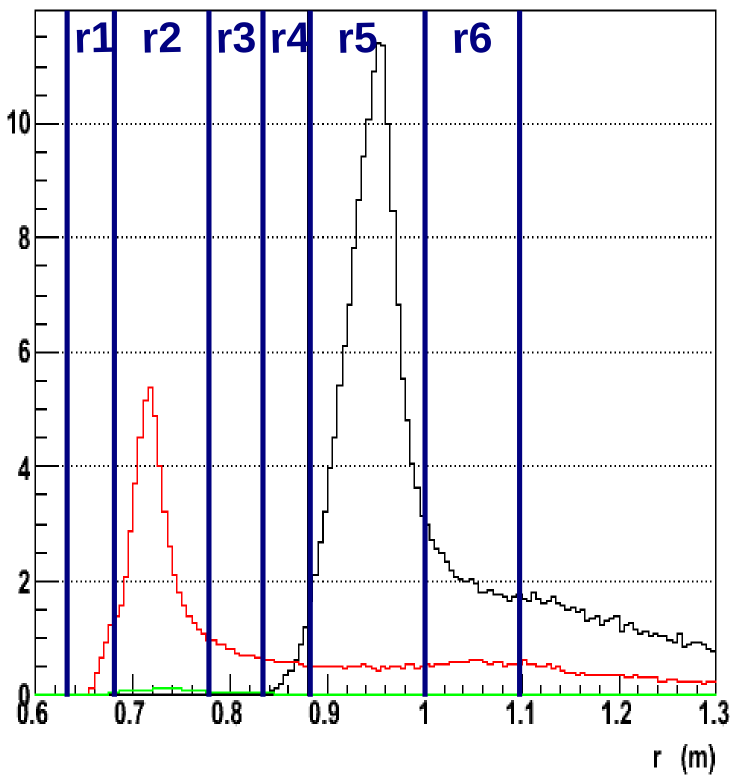
- Systematic corrections resulting from radiative tails of elastic and inelastic ep processes under the measured Møller signal
- For elastic ep ($\sim$ 8% of signal) , the PV asymmetry is well known and can be modeled and measured quite easily
- From proposal, with $< \mathrm{Q}^2 >= 0.004\ \mathrm{GeV}^2$ for the elastic ep's, assuming 4% uncertainty in $\mathrm{Q}_\mathrm{W}^\mathrm{p}$ leads to a 0.3% systematic
- For inelastic ep's ($\lesssim$ 0.5% of signal), the PV asym is significantly ($\sim 20\times$) larger than for Møller and $\sim 12\times$ larger than for elastics – but is not well known
- The idea is to measure the inelastic asymmetry in a radial region where it dominates, and use simulation to scale this measurement to the Møller signal contamination (using Q^2-weighted W^2 to characterize)

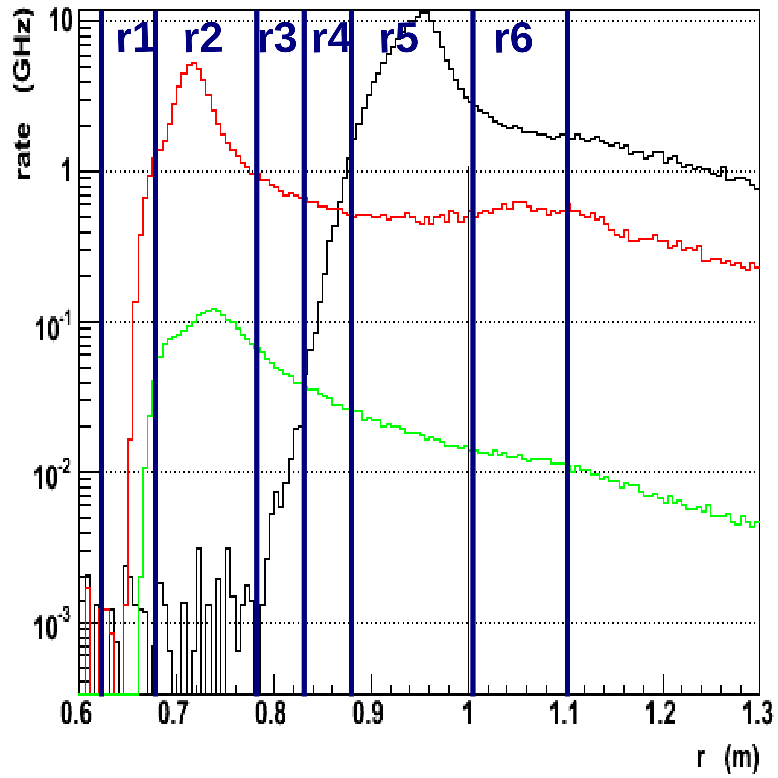
Radial Rates





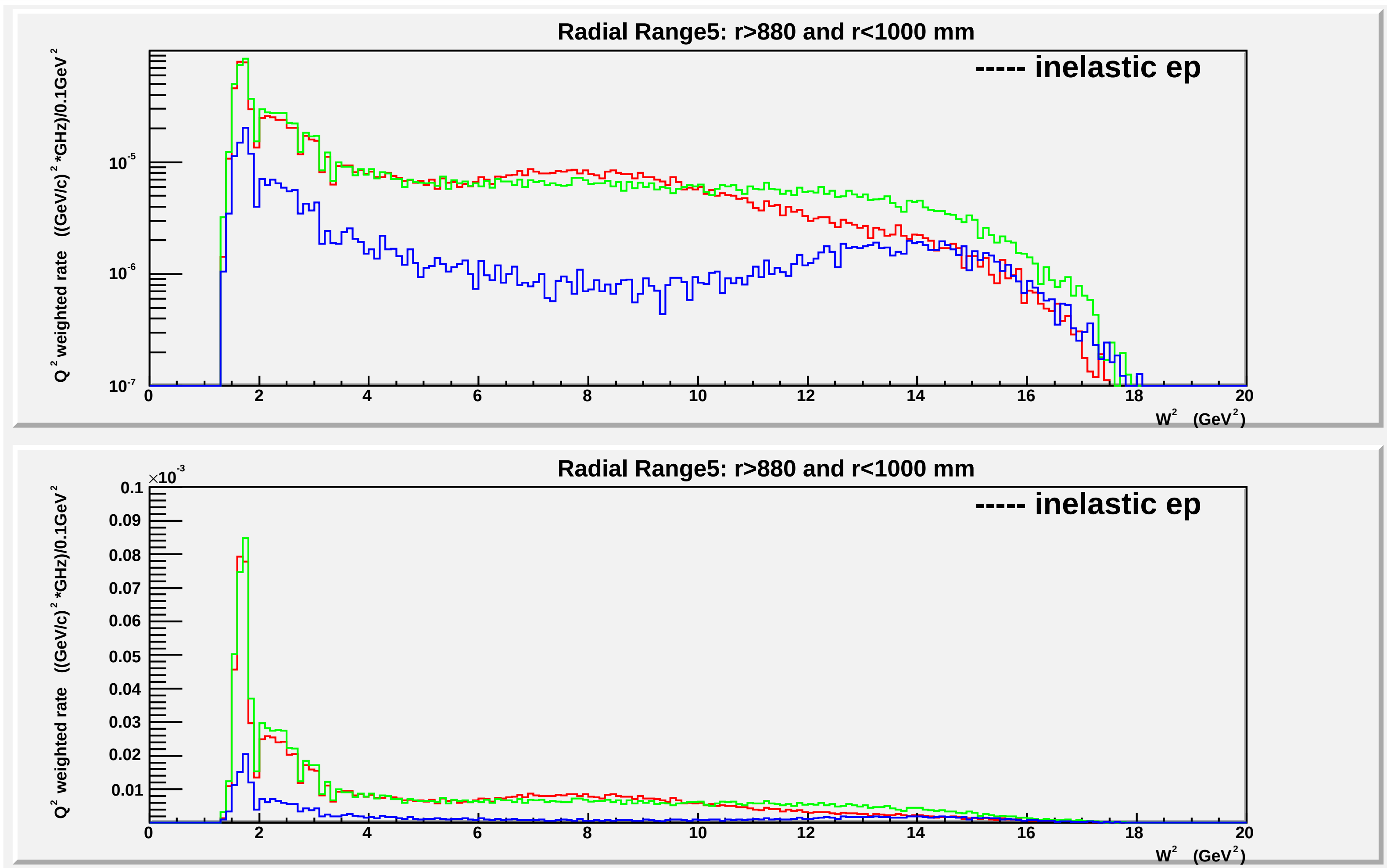
Radial Rates with Auxiliary Detector Regions





W^2 Signature of Inelastic ep Contamination

(in Møller Det. Ring: $880 < r < 1000$ mm)



W^2 of Inelastic ep 's in Region 4:

(830 < r < 880 **mm**)

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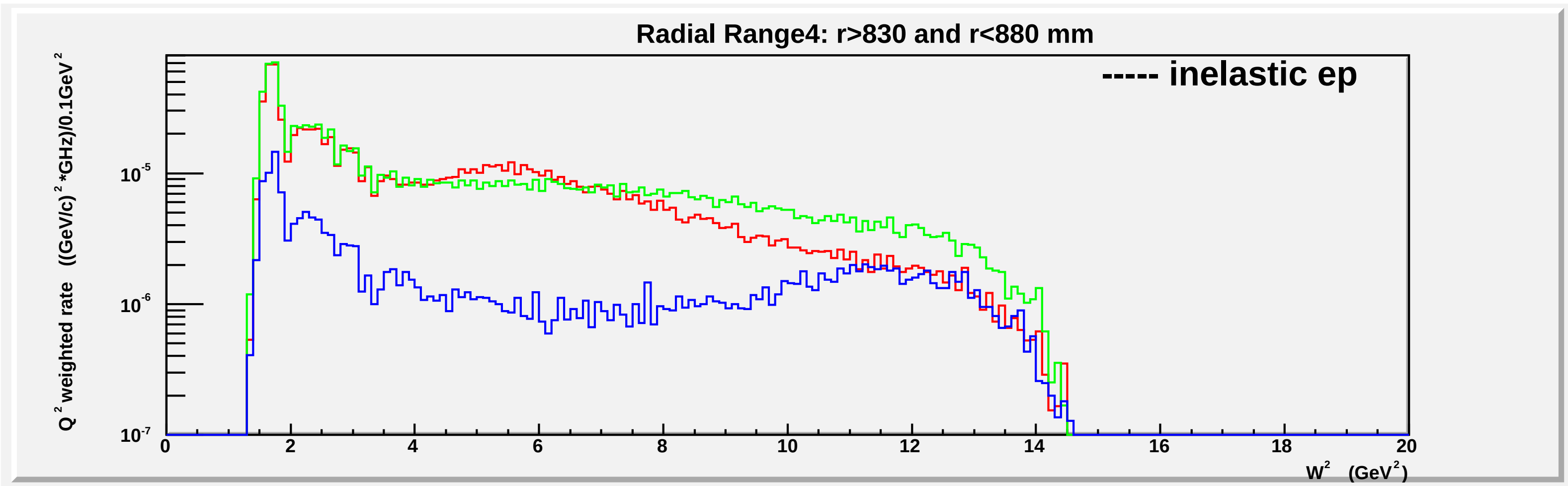
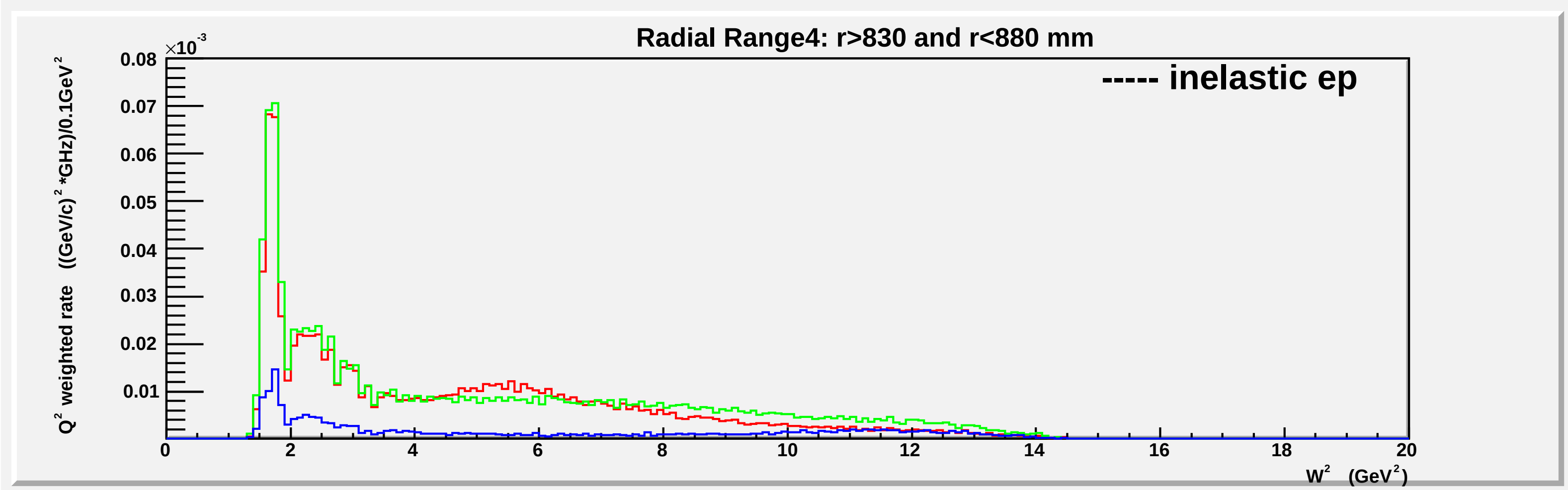
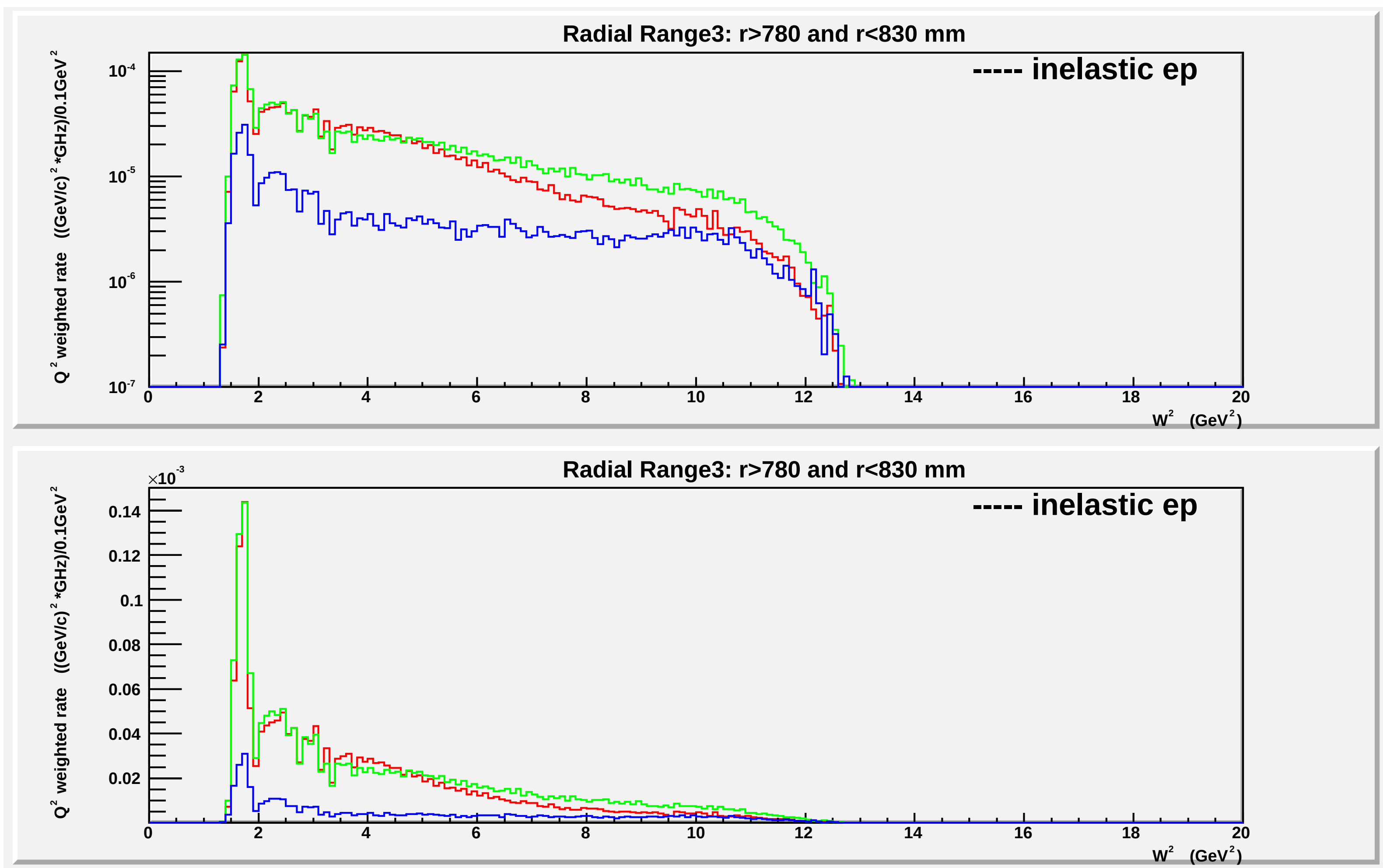




W^2 of Inelastic ep 's in Region 3:

(780 < r < 830 **mm**)



W^2 of Inelastic ep 's in Region 6:

(1000 < r < 1100 **mm**)

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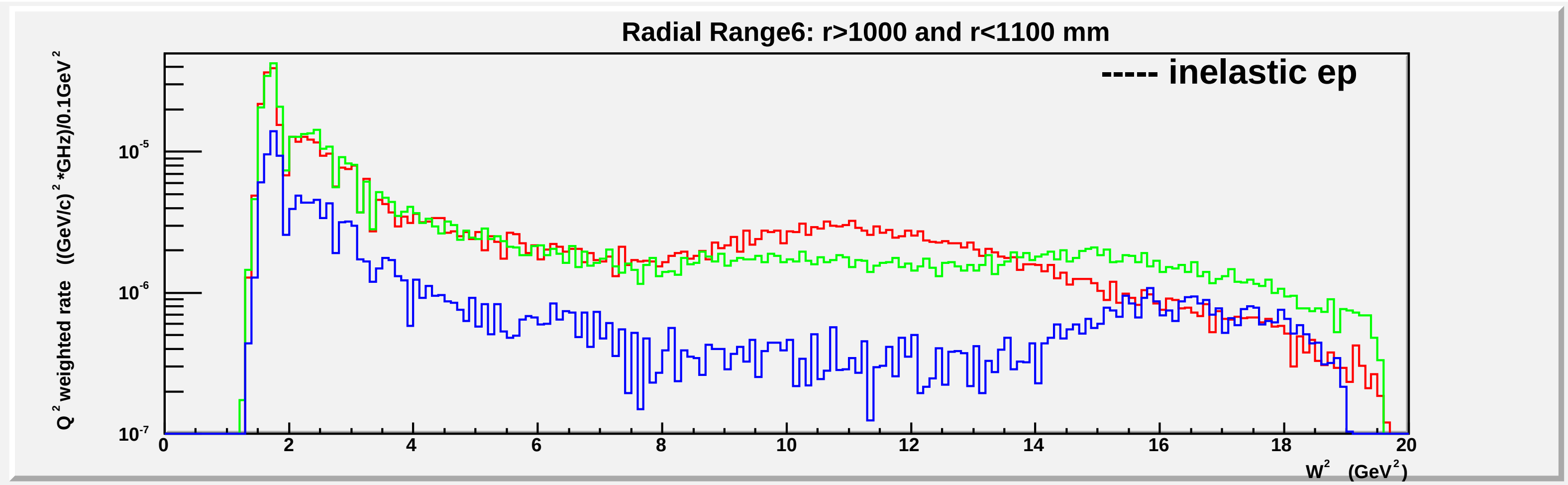
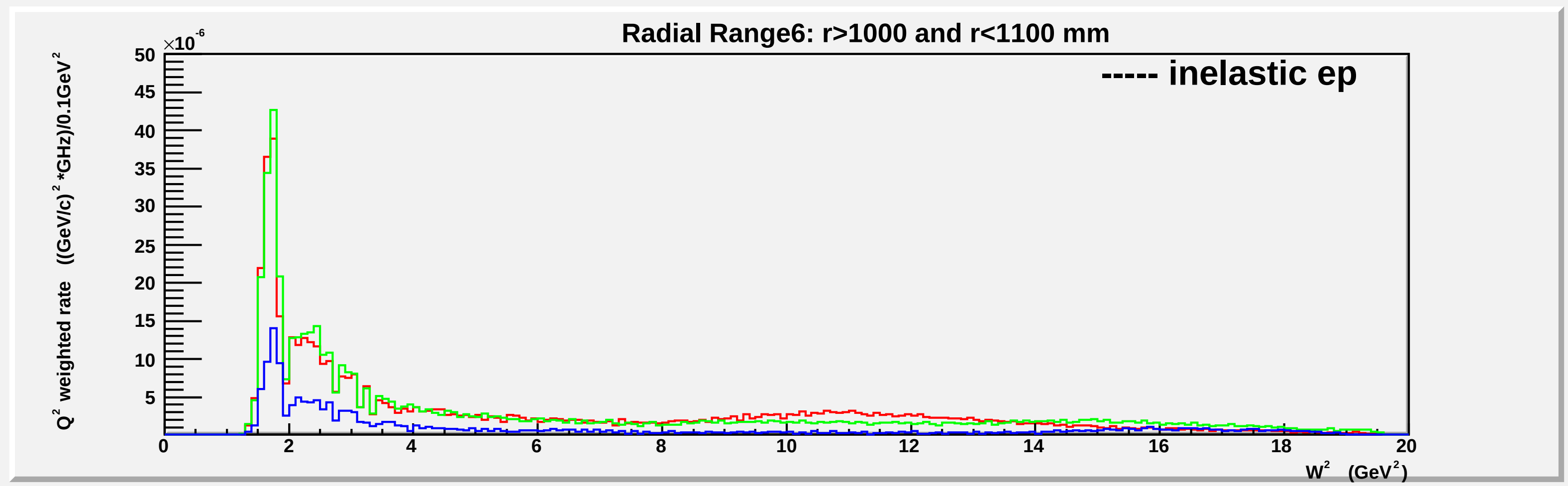
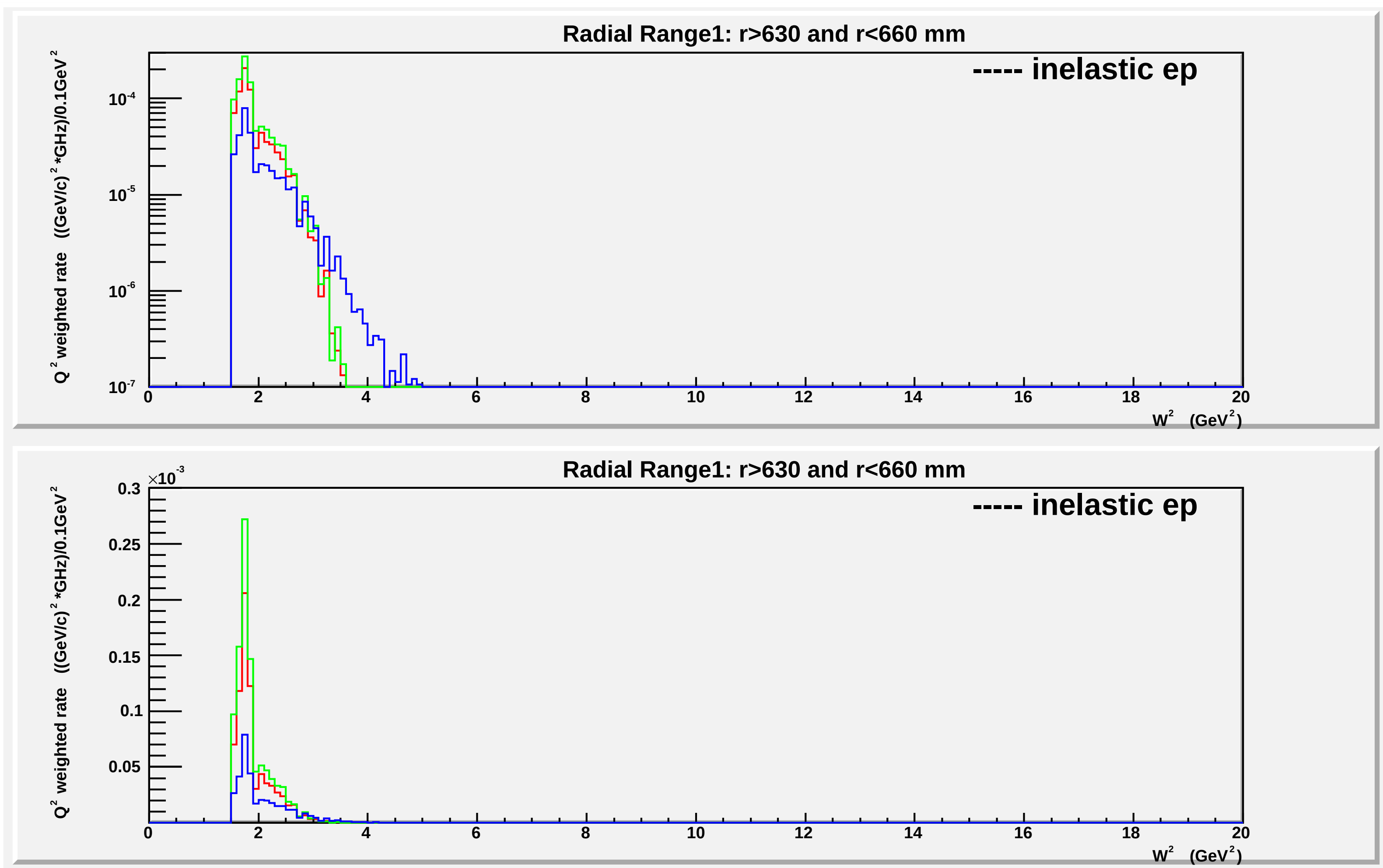




W^2 of Inelastic ep 's in Region 1:

(630 < r < 680 **mm**)



Event Fractions for Different W^2, ϕ, r regions

Range3 780 < r < 830:

phi	0 - 2	2 - 3	3 - 4	4 - 6	6 - 8	8 -10	10-12	12-14	14-20
red:	0.212	0.221	0.166	0.221	0.097	0.053	0.028	0.002	0.000
green:	0.205	0.206	0.131	0.200	0.125	0.082	0.047	0.004	0.000
blue:	0.205	0.186	0.102	0.154	0.133	0.119	0.089	0.010	0.000

Range4: 830 < r < 880:

phi	0 - 2	2 - 3	3 - 4	4 - 6	6 - 8	8 -10	10-12	12-14	14-20
red:	0.205	0.186	0.103	0.200	0.153	0.080	0.046	0.025	0.002
green:	0.203	0.181	0.096	0.149	0.137	0.110	0.077	0.045	0.003
blue:	0.199	0.176	0.082	0.099	0.080	0.096	0.152	0.107	0.008

Range5: 880 < r < 1000:

phi	0 - 2	2 - 3	3 - 4	4 - 6	6 - 8	8 -10	10-12	12-14	14-20
red:	0.208	0.180	0.088	0.117	0.132	0.123	0.077	0.045	0.029
green:	0.206	0.184	0.084	0.107	0.102	0.096	0.089	0.077	0.054
blue:	0.217	0.191	0.086	0.090	0.060	0.052	0.069	0.111	0.124

Summary and Future Work

- Outlook for inelastic correction is promising. Additional radial focusing of Møller signal can further improve situation. Work ongoing.
- Photon backgrounds are very preliminary. Work in this area is quickly ramping-up to meet Jan review deadline. Single bounce γ shielding and raw power deposited in 1^{st} collimator.
- Checked radiative effects built-in to Møller event generator with high statics GEANT-generated event simulation: Preliminary results show agreement at 3% level for detected Møller signal rate, and kinematic distribution look very similar. Work also in progress.
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