Update on the new lattice for Compton polarimeter at ESR

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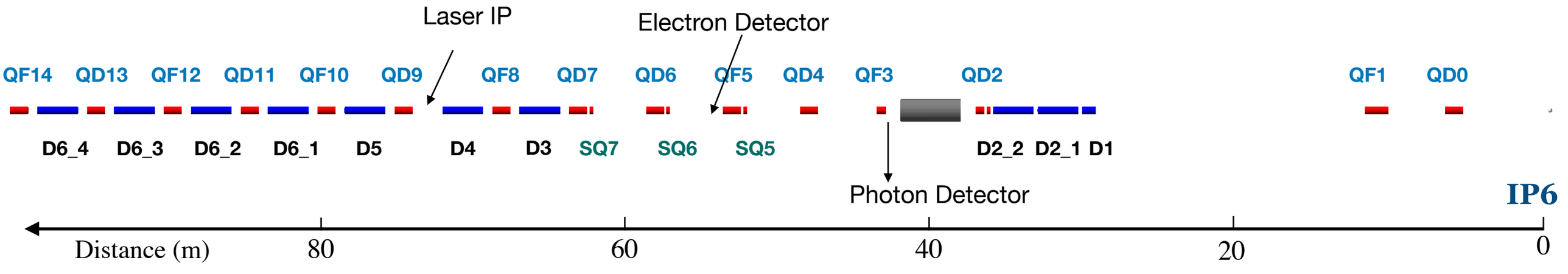
New version

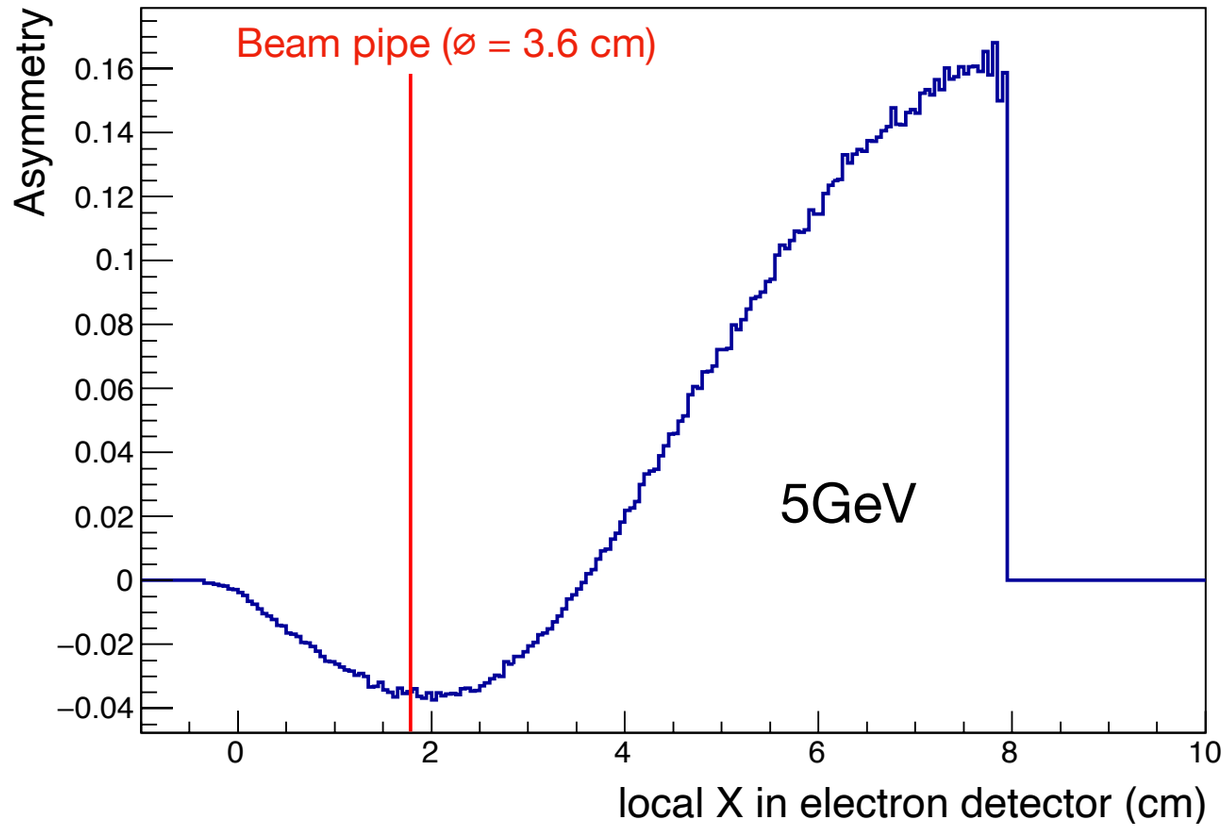


Beam Energy	P_L	P_T
5GeV	99.3%	11.8%
10GeV	97.3%	23.0%
18GeV	91.4%	40.5%

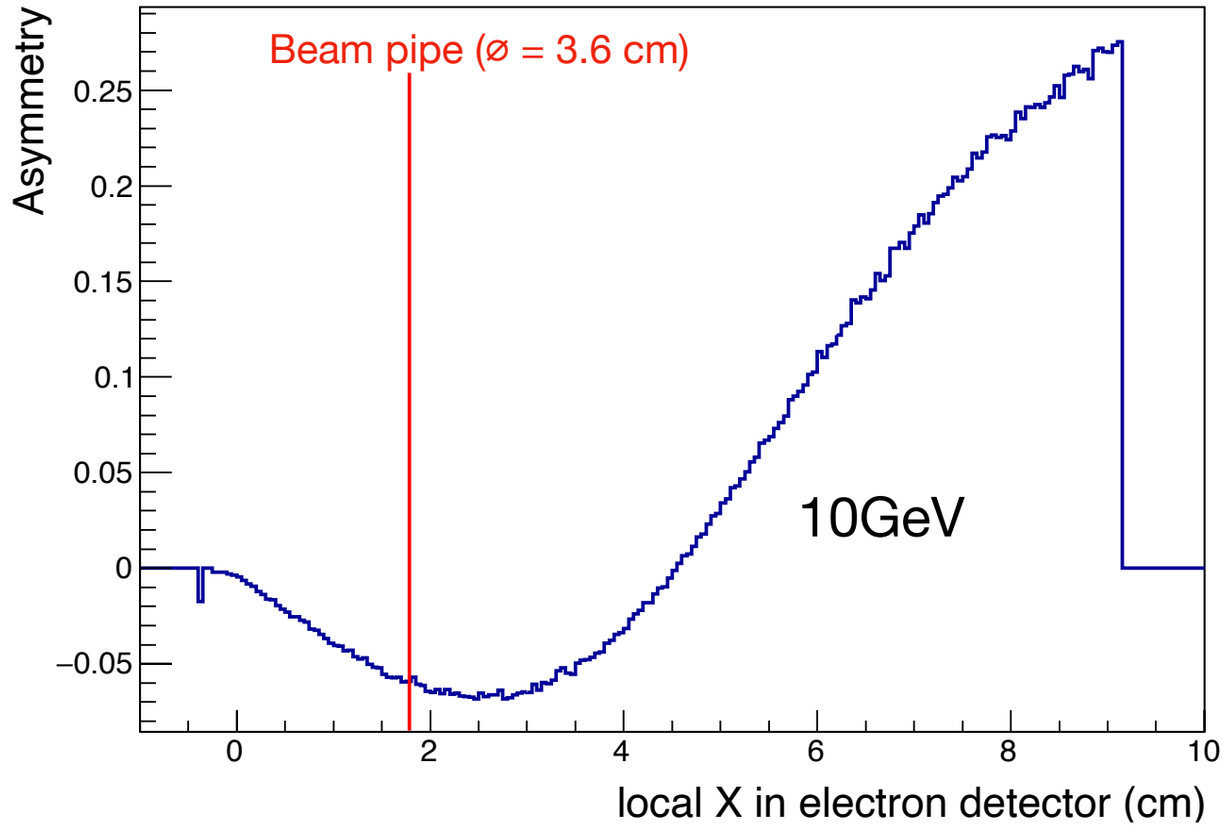
D6	bending angle	length
D5, D4	1.5 mrad	2.726 meters
D3	13.0 mrad	2.726 meters
D2	-11.7 mrad	2.726 meters
D1	-1.5 mrad	0.89 meters

18GeV: QD7 and **QF6**
10GeV: QD7 and QD6
5GeV: QD7 and QD6

- Here we set the inner diameter of the Quadrupoles to be 12.0 cm;
- It's important to note that the acceptance of the recoil electrons is significantly influenced by the inner diameter of these quadrupole magnets;

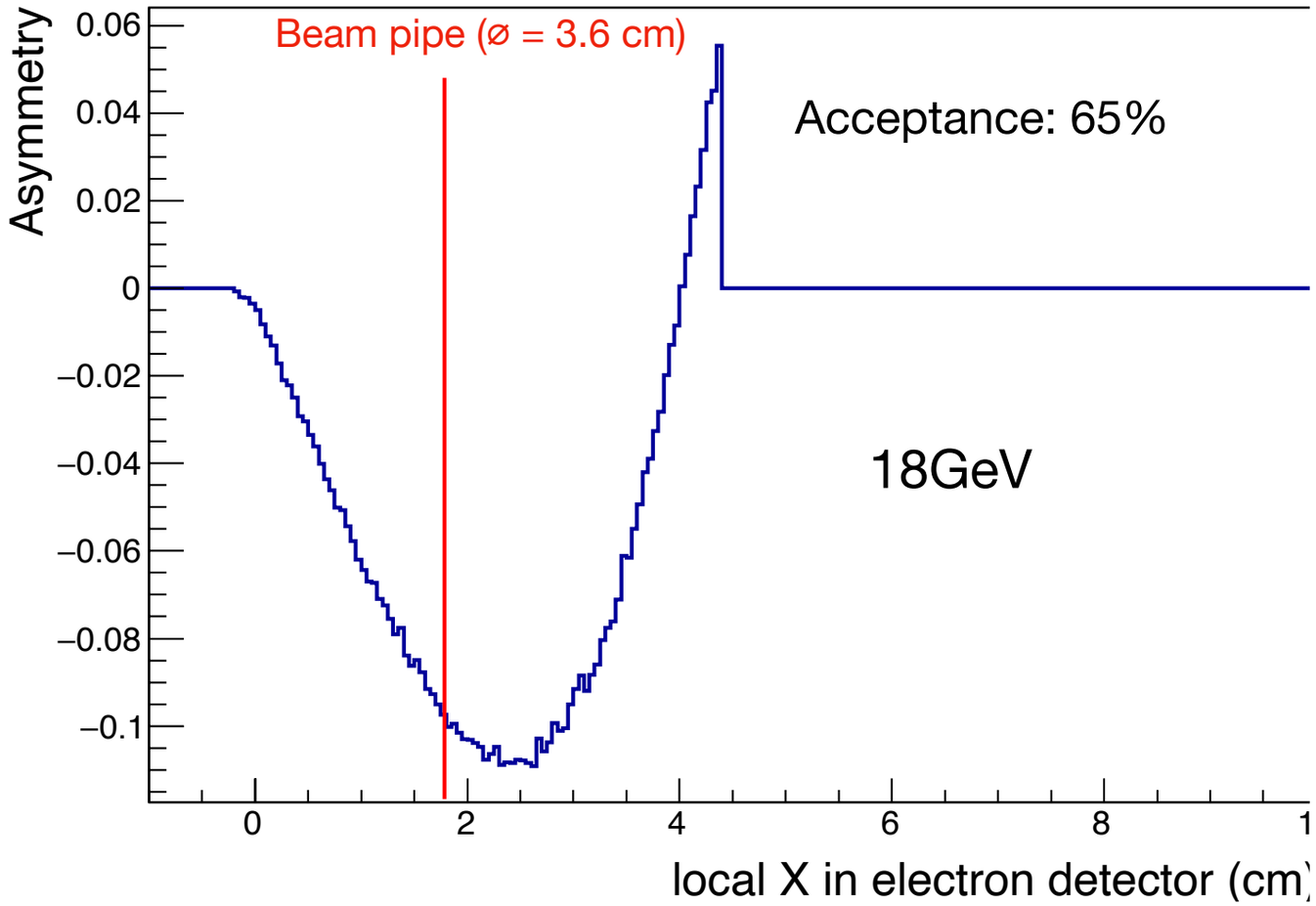


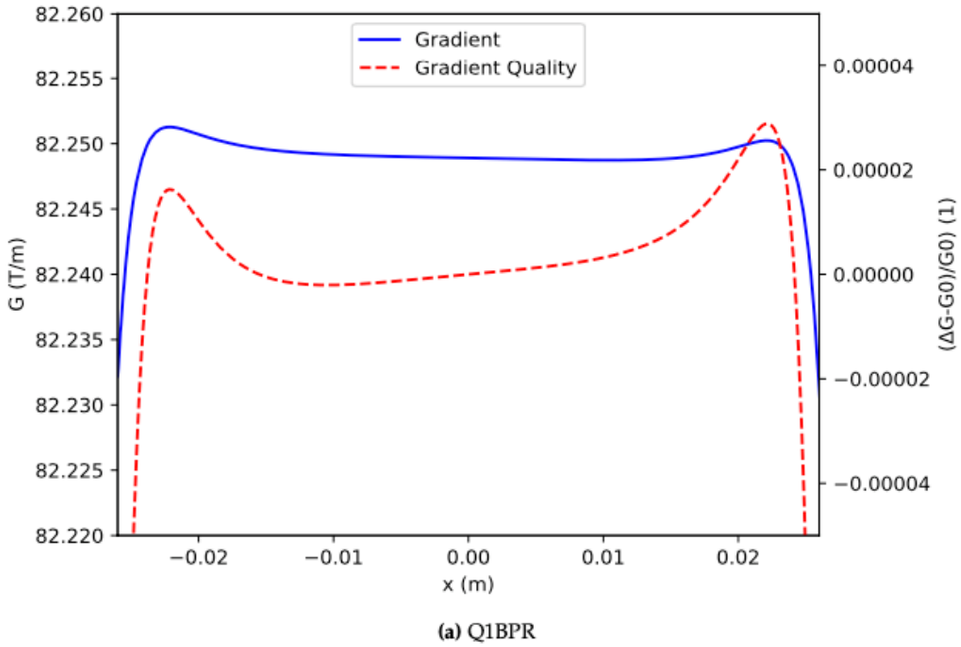
Acceptance: 100%



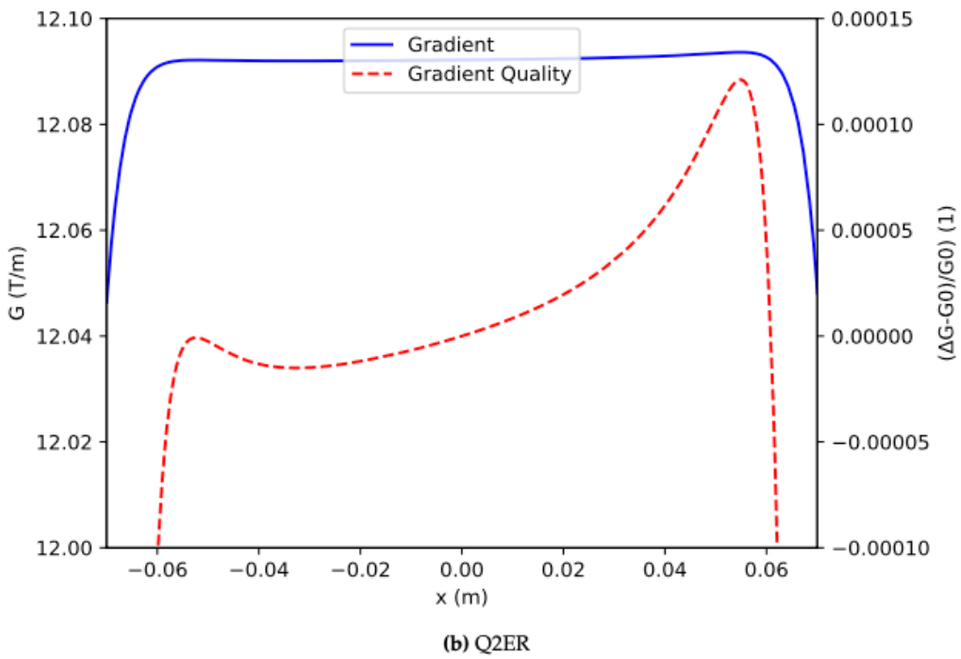
Acceptance: 95%

- Here we set the inner diameter of the quadrupoles to be 12.0 cm;
- Given that Q6 exerts horizontal focusing, it results in a narrow dispersion of the recoil electrons;
- The quality of the gradient at the boundary of the magnetic field directly impacts the precision of the electron energy resolution;
- It looks like the asymmetry is significantly distorted comparing to the original due to the different acceptance of the spin align and anti-align recoil electrons;



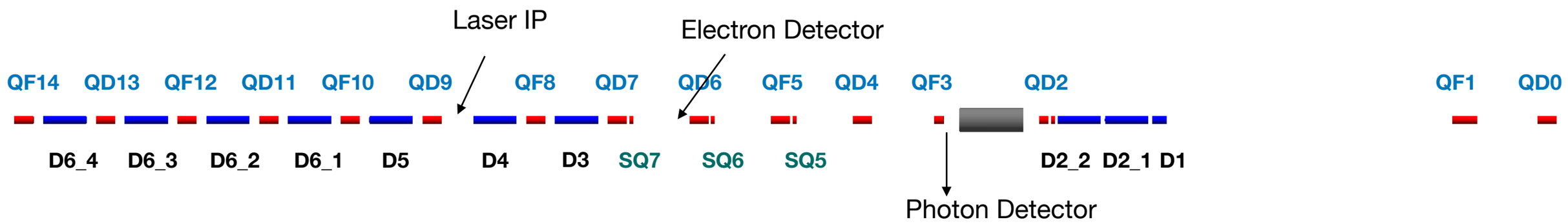


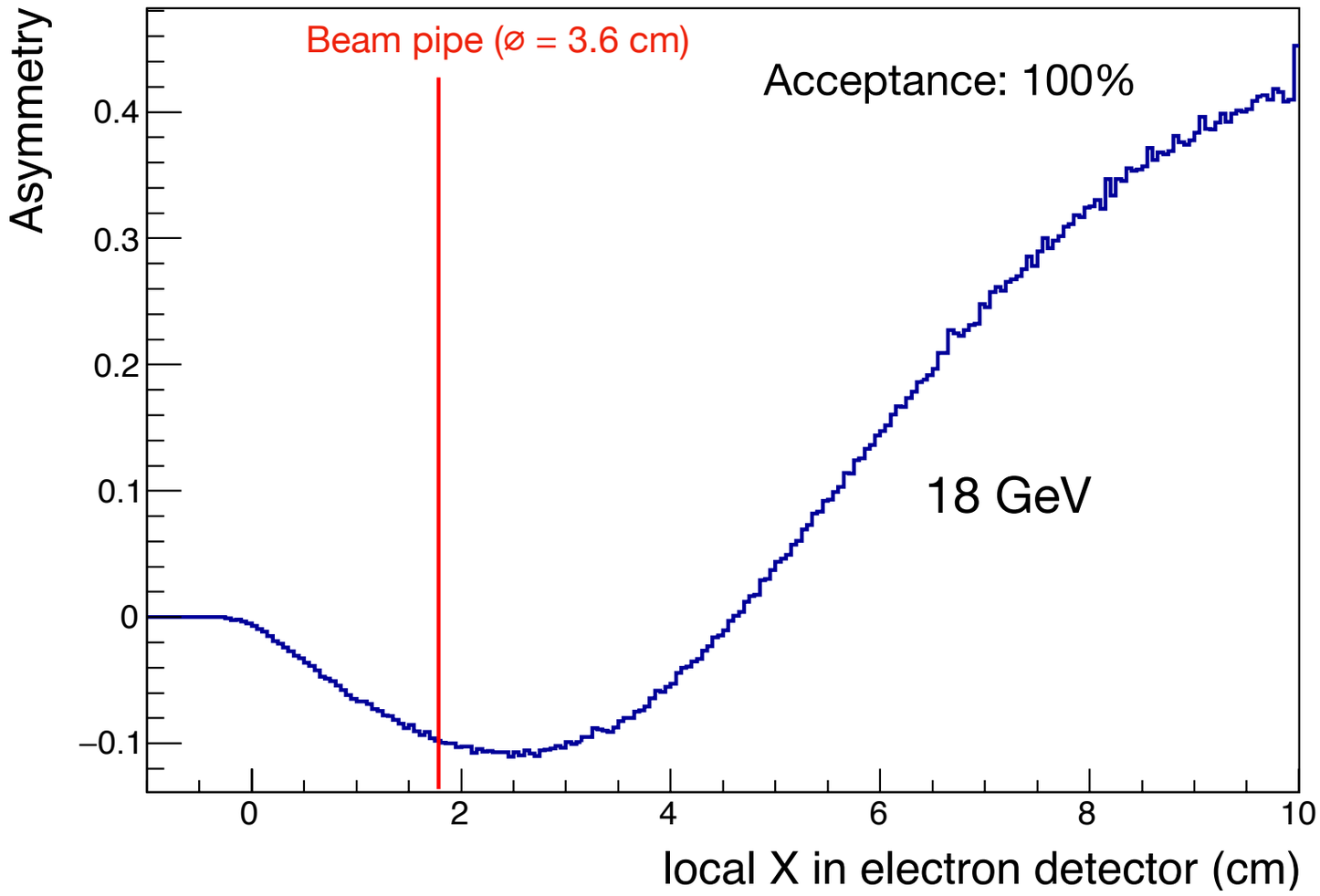
(a) Q1BPR



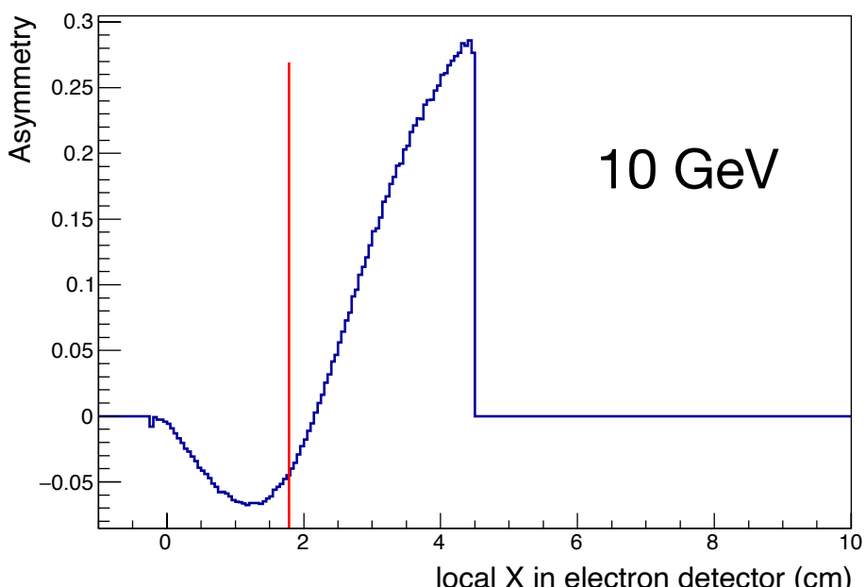
(b) Q2ER

Figure 6.47: Gradient and gradient quality for the Q1BPR and Q2ER magnet (front end).

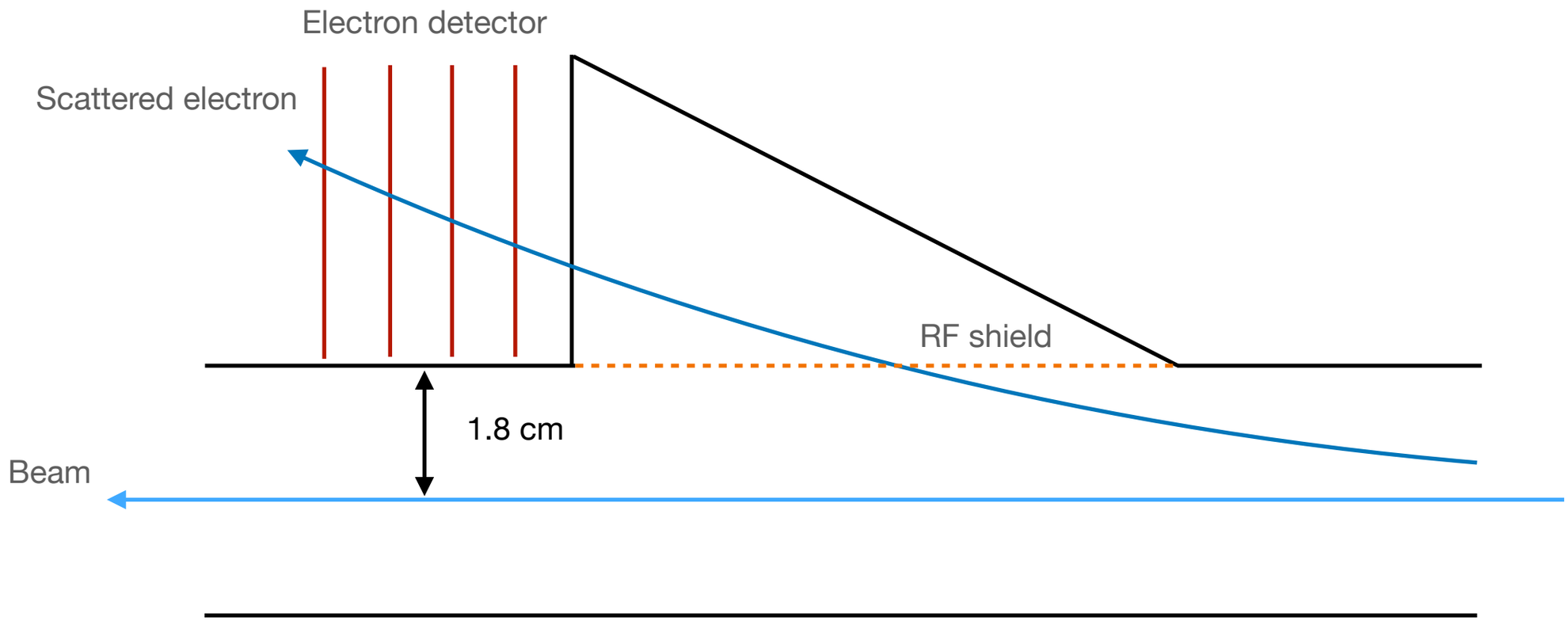




- If we have another electron before QF6, then we can have 100% acceptance for 18GeV;
- The spread of the recoil electrons is wider, we should have better energy resolution;
- The quality of the gradient at the boundary of the magnetic field would not impact the precision of the electron energy resolution;
- But this additional would block the propagation paths of the recoil electrons from the 10 GeV and 5 GeV beams!
- The only solution may be requiring a larger radius (10cm) at the recoil electron side and make sure the gradient quality is still high at 10cm fro Q6;



Backup



Based on Christoph’s suggestion, we've decided on a beam pipe radius of 1.8cm and add an extra 0.5cm cover over the zero-crossing,
so we require,

R16*3.0/18.0 > 2.3cm for the 18GeV;

*R16**1.0/10.0 > 2.3cm for the 10GeV;

For the 5GeV, achieving 15*sigmaX for the zero-crossing is already very difficult, it might not be possible to achieve 2.3cm for the zero-crossing at this energy. Therefore, for 5 GeV, we are just aiming to maximize the value of R16*0.24/5.0.