Look at TCTVB Issue at IR2

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- There are **no fast design errors in the vertical plane** (the beam dump acts in the horizontal plane). So a priori, there is no formal requirement for vertical triplet protection. We added it anyway, to be on the safe side in case that fast vertical errors appear (collimators are less expensive than triplets and easily replacable) and for beam cleaning.

- Vertical triplet protection provides important and necessary halo cleaning for proton teriary halo. This is **not required for ion beam intensities**.

- Even though there is **no formal need**, it is **desirable to have this protection in place** (it might also be useful for background control). We include it in all beam loss simulations. Settings were never really optimized for IR2, so it is worth looking what is really needed.

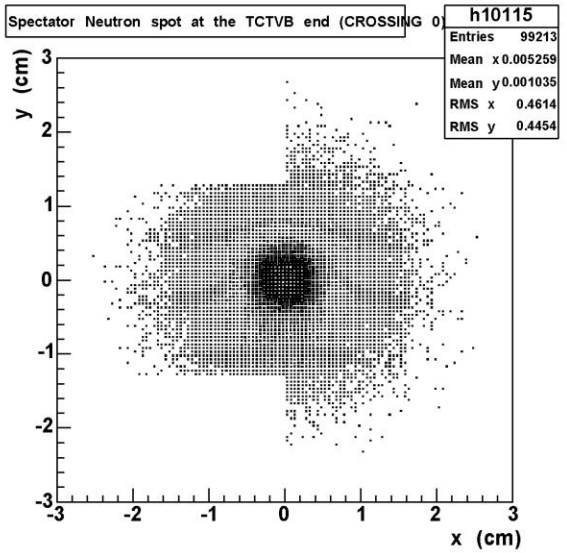
- After a quick look at IR2 details (beam 1, beta*=0.5m): Preliminary impression that we can live with a **TCTVB half gap of 13 mm** for ion operation (providing a ~3 mm margin to the triplet which is only 20m away). The gap is centered around the ideal orbit (zero crossing angle) and does not need to follow the crossing angle offset due to the 180 degree phase advance from IR2L to IR2R (to be confirmed). For zero crossing angle we can gain 1 mm more (half gap of 14 mm).

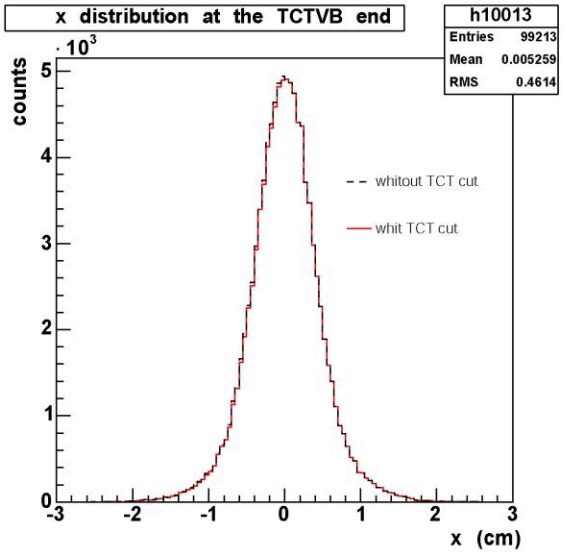
- This is much **more relaxed than our original 7.8 mm half gap**, which was based on the generic target aperture of the LHC and does not take into account local gains which are possible (for example, the crossing angle offset at triplet and TCTVB is necessarily correlated). This **gap increase by a factor 1.7** might already solve the ALICE problem, while keeping vertical triplet protection?

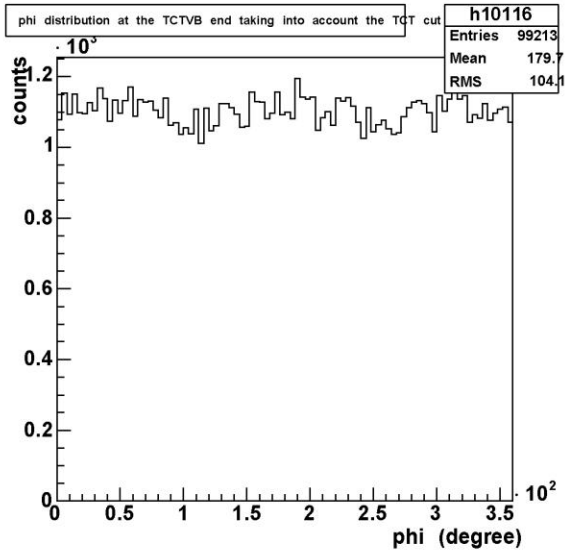
How to Increase Gap?

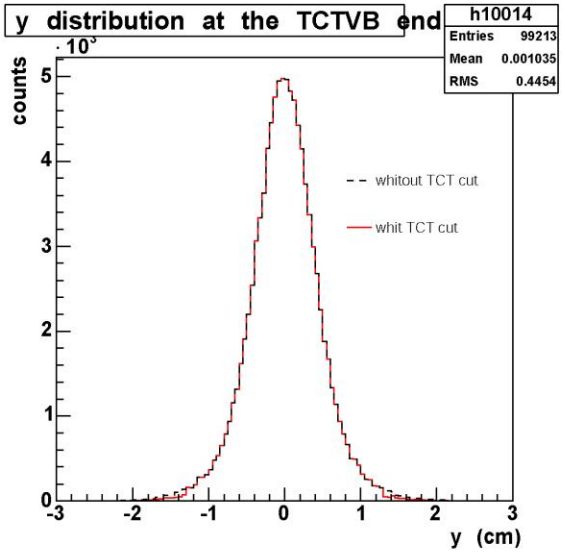
- There is an aperture of around **n1=7** at the triplet.
- A **collimator far away would need to be set to 8.4 sigma** (1.2 times 7).
- However, for small beta* and location close to triplet (TCTVB) we have a **local protection**. Ideally, collimator could be set at the same gap as triplet aperture, if at exactly the same location. However, some changes:
  - **50% smaller beta** at TCTVB ➔ reduce gap accordingly.
  - **Crossing bump offsets mostly correlated** but about 20% difference (1 mm).
  - A **few degree phase advance**: Minor difference.
  - **Mechanical alignment** can be different (1.4 mm).
- Final half gap with 3 mm margin (orbit, beta beat, … differences): **13 mm**.

Zero Crossing Angle

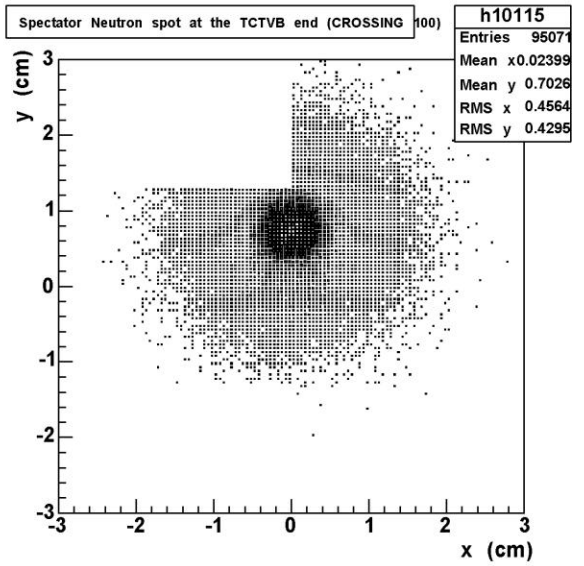


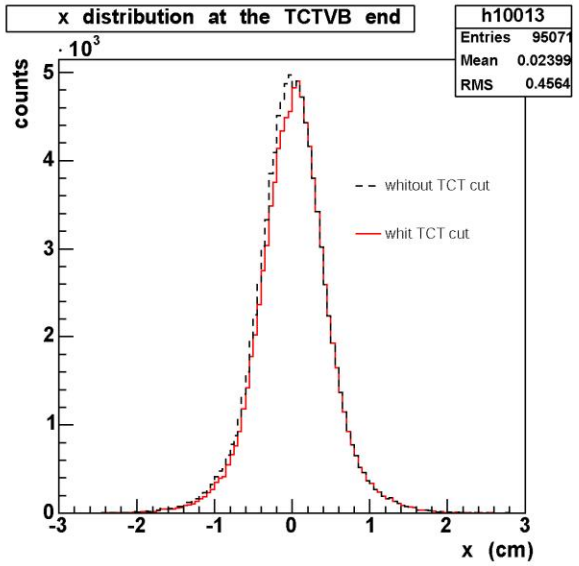


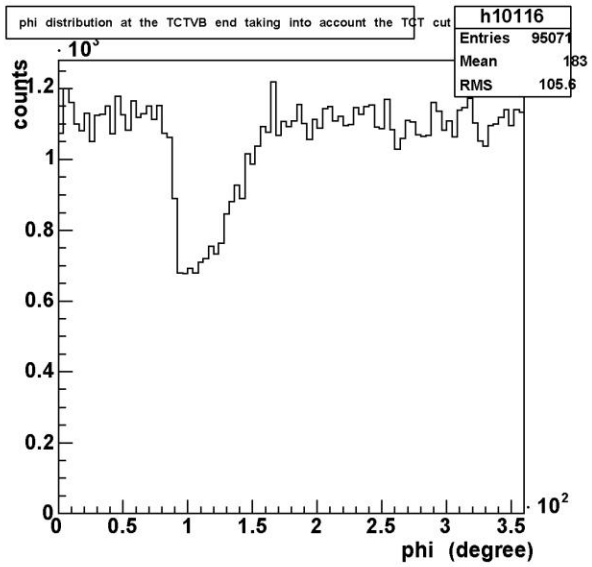


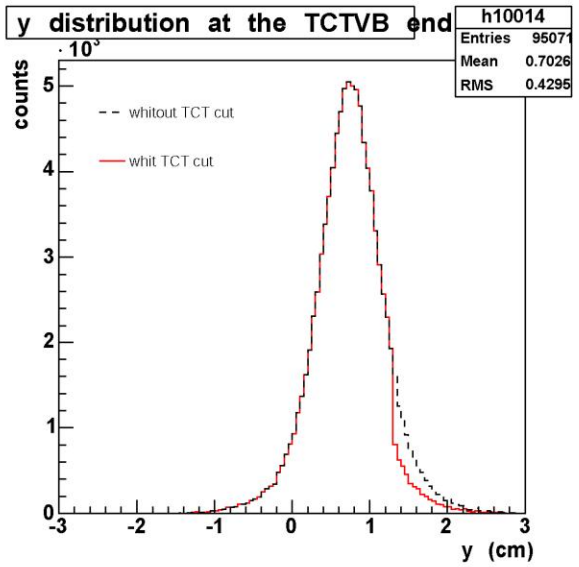


100 μrad Crossing Angle









Their Feedback

- Zero crossing angle: The number of spectator neutrons hitting the jaws is 0.8% and the phi distribution appears flat.
- 100 microrad crossing angle at IP2 with 30 microrad beam divergence: The number of spectator neutrons hitting the jaws is 5% and the phi distribution is not flat.
- First scenario OK.
- Still interested to reserve additional collimator locations ➔ I am not yet convinced that this is needed.
- Further follow-up to clarify needs.