

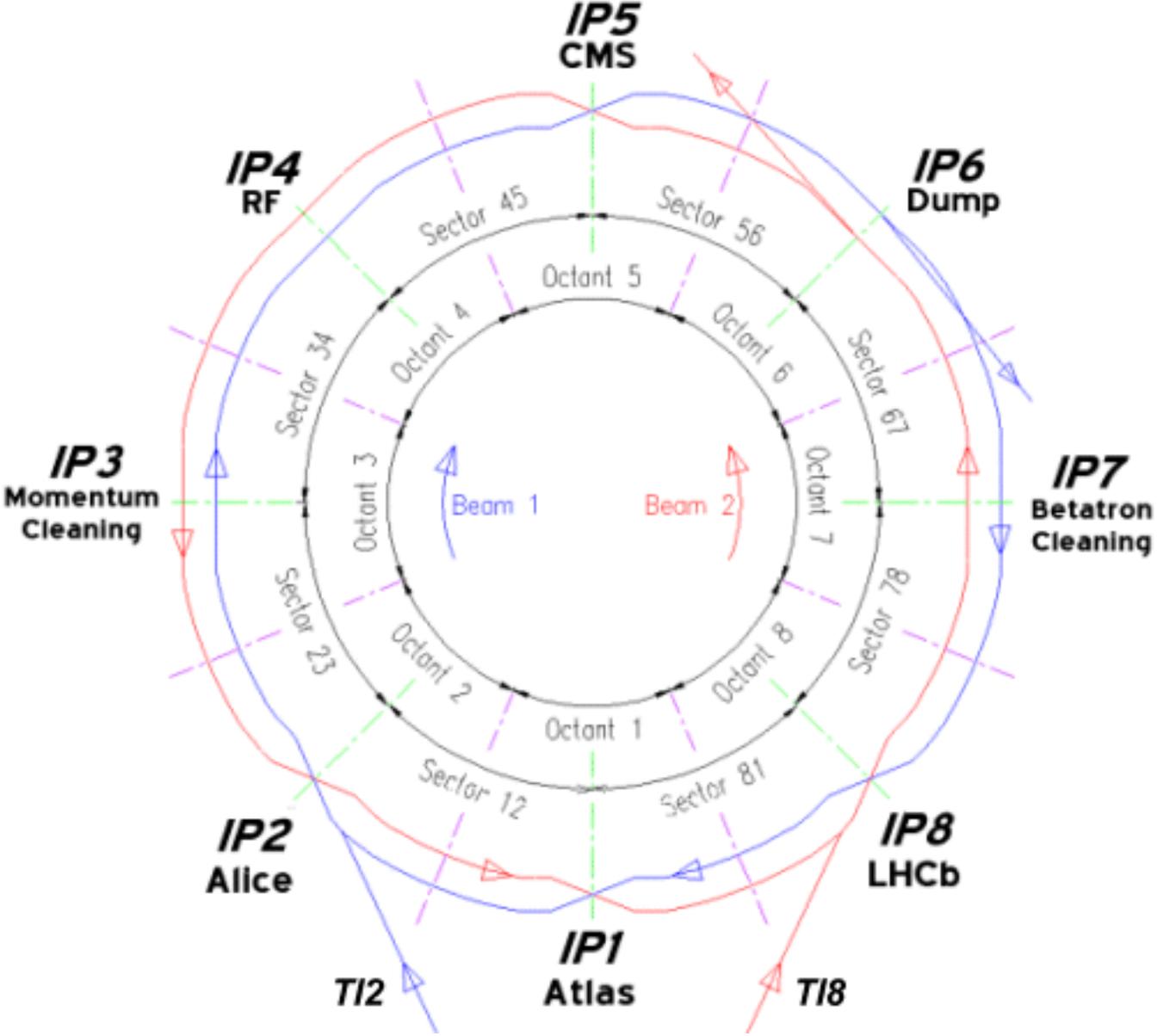
# **Protection at Beam Accidents at LHC**

I. Rakhno for CERN-US collaboration group

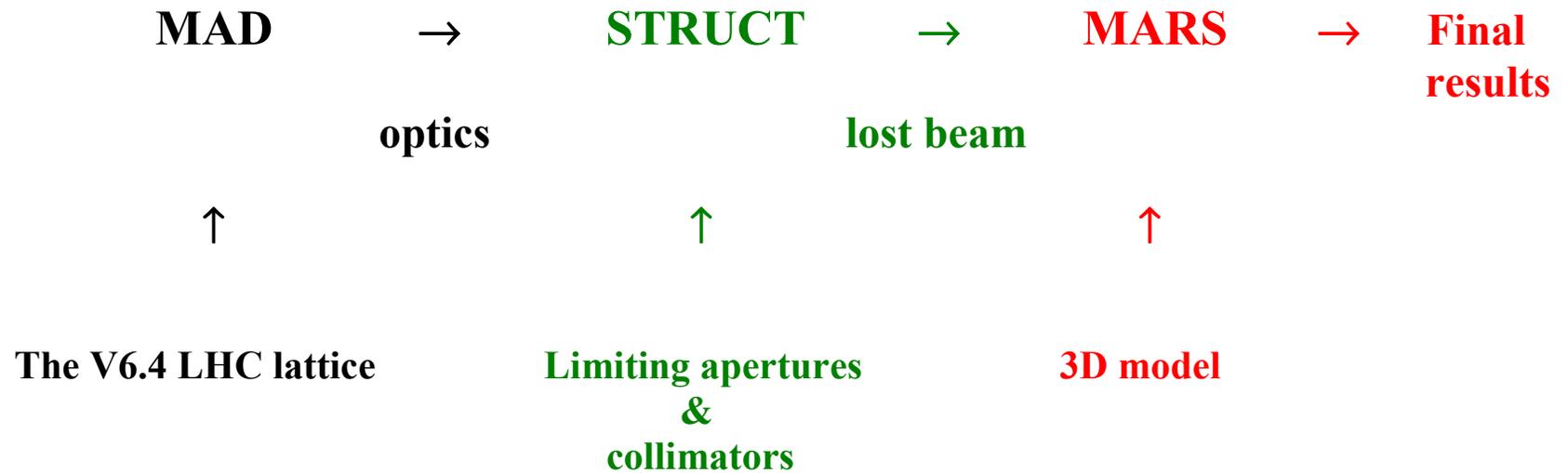
B. Goddard, M. Gyr, M. Sans, **CERN, Geneva, Switzerland**

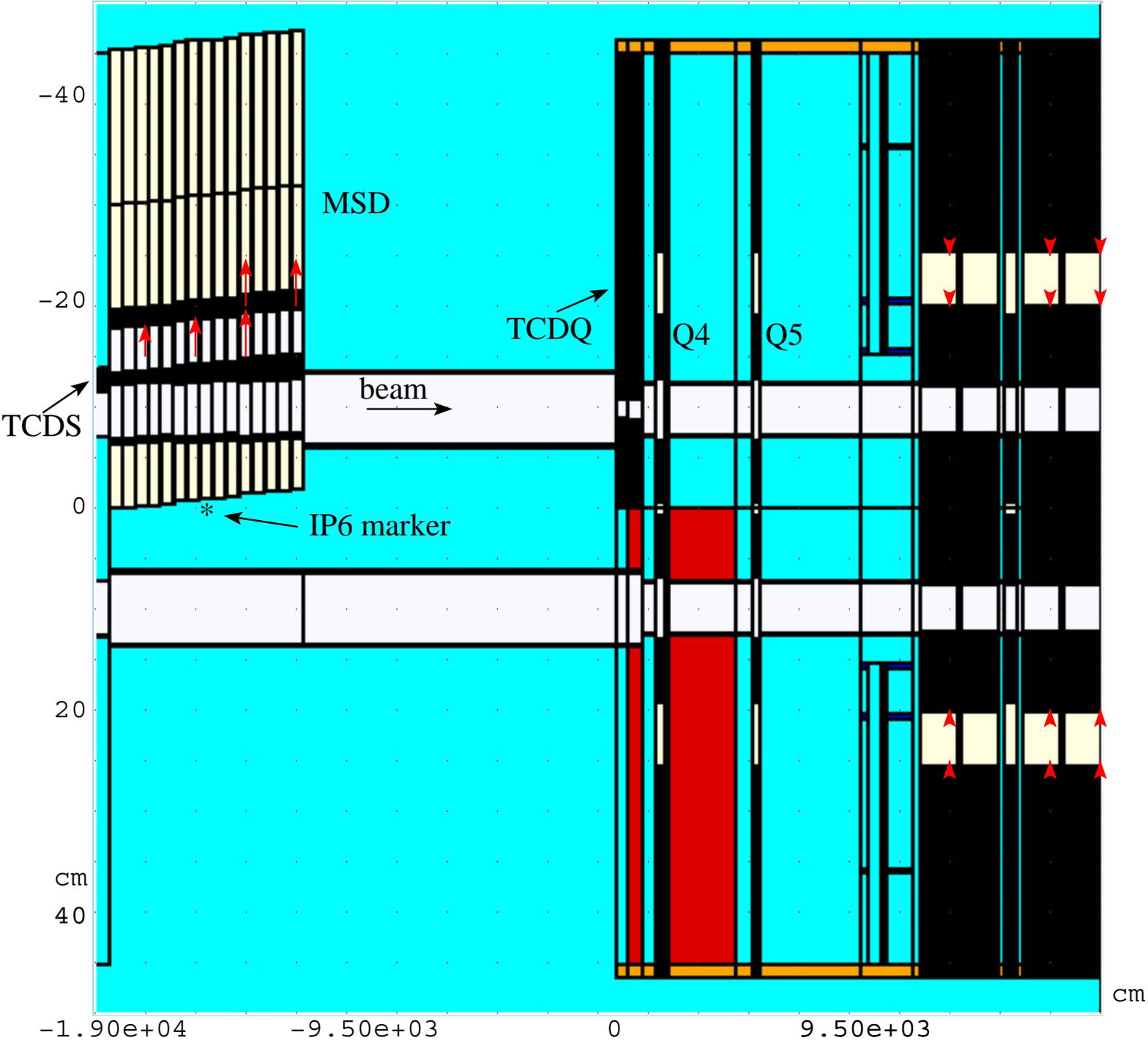
A. Drozhdin, N. Mokhov, I. Rakhno, **Fermilab, Batavia, USA**

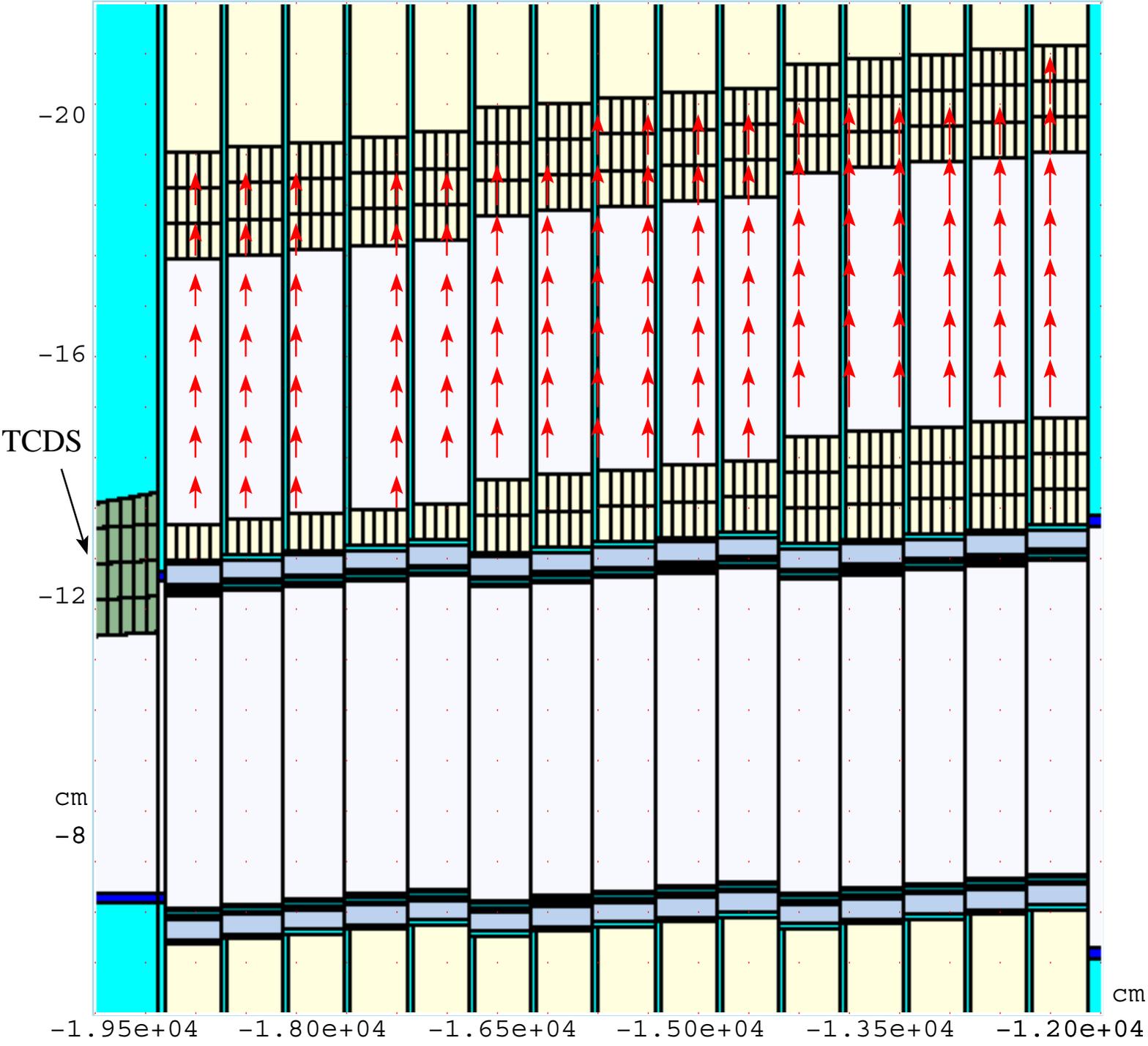
**HALO'03 - Montauk, NY, USA**

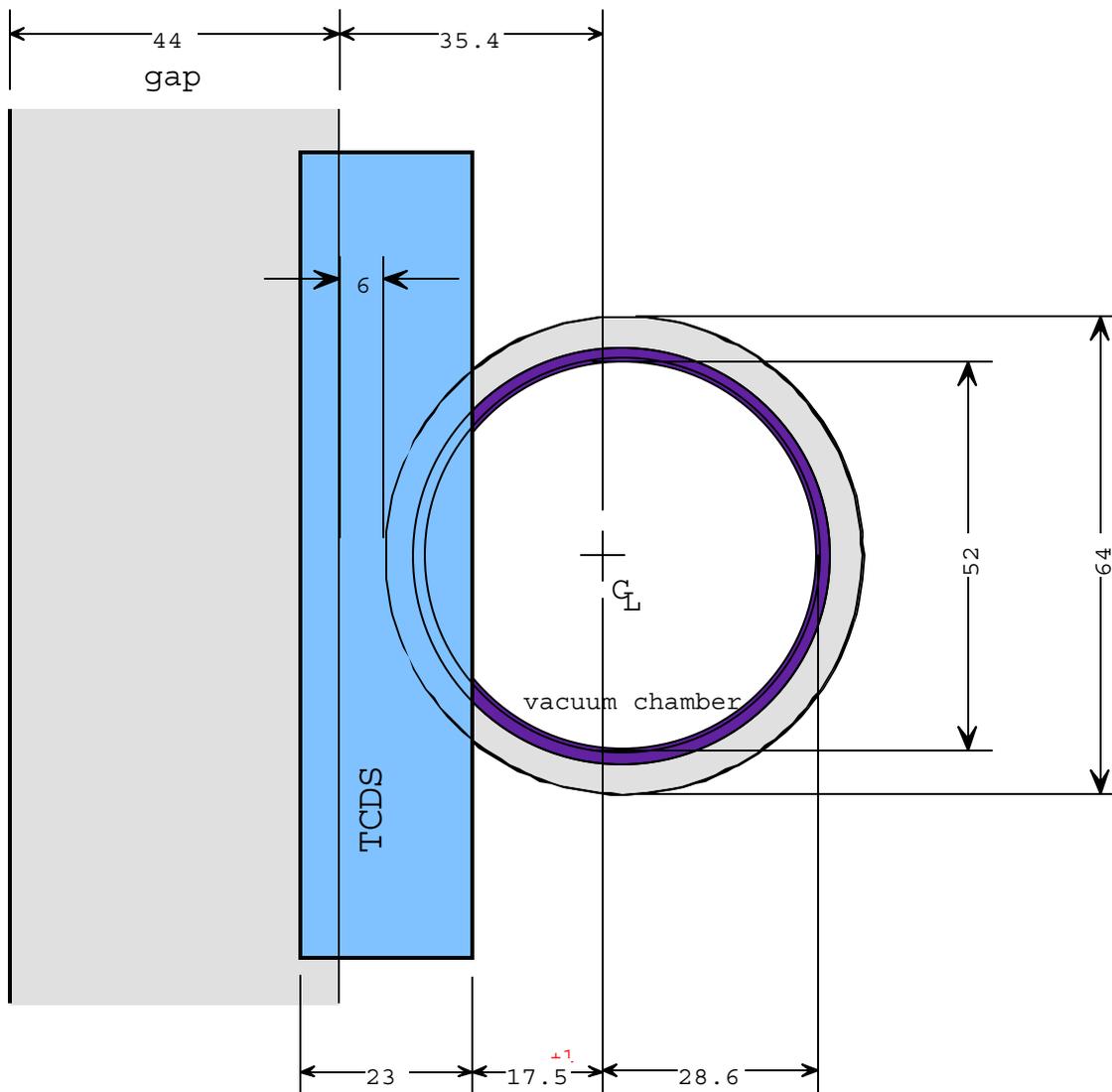


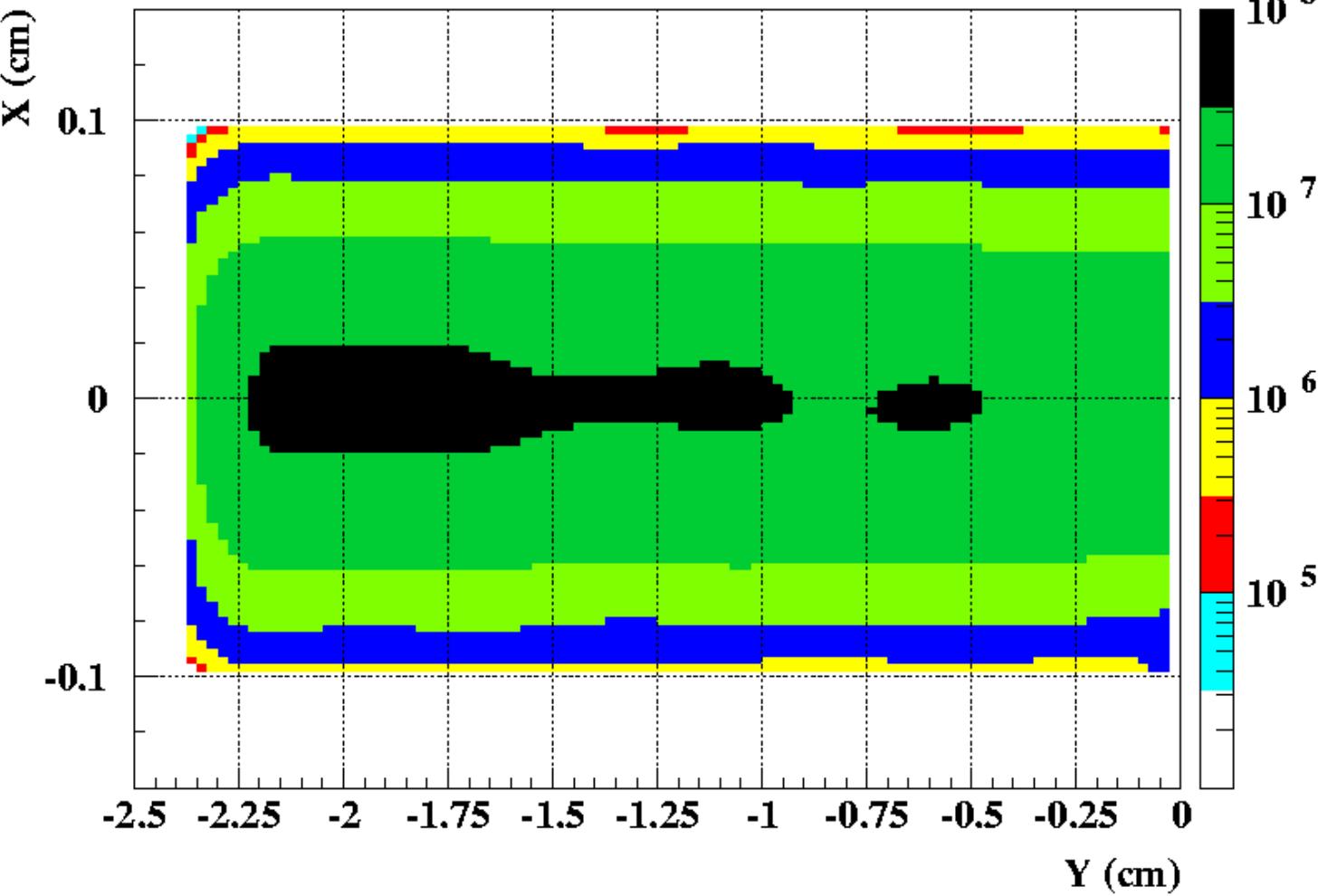
### 3-Stage Calculation Scheme

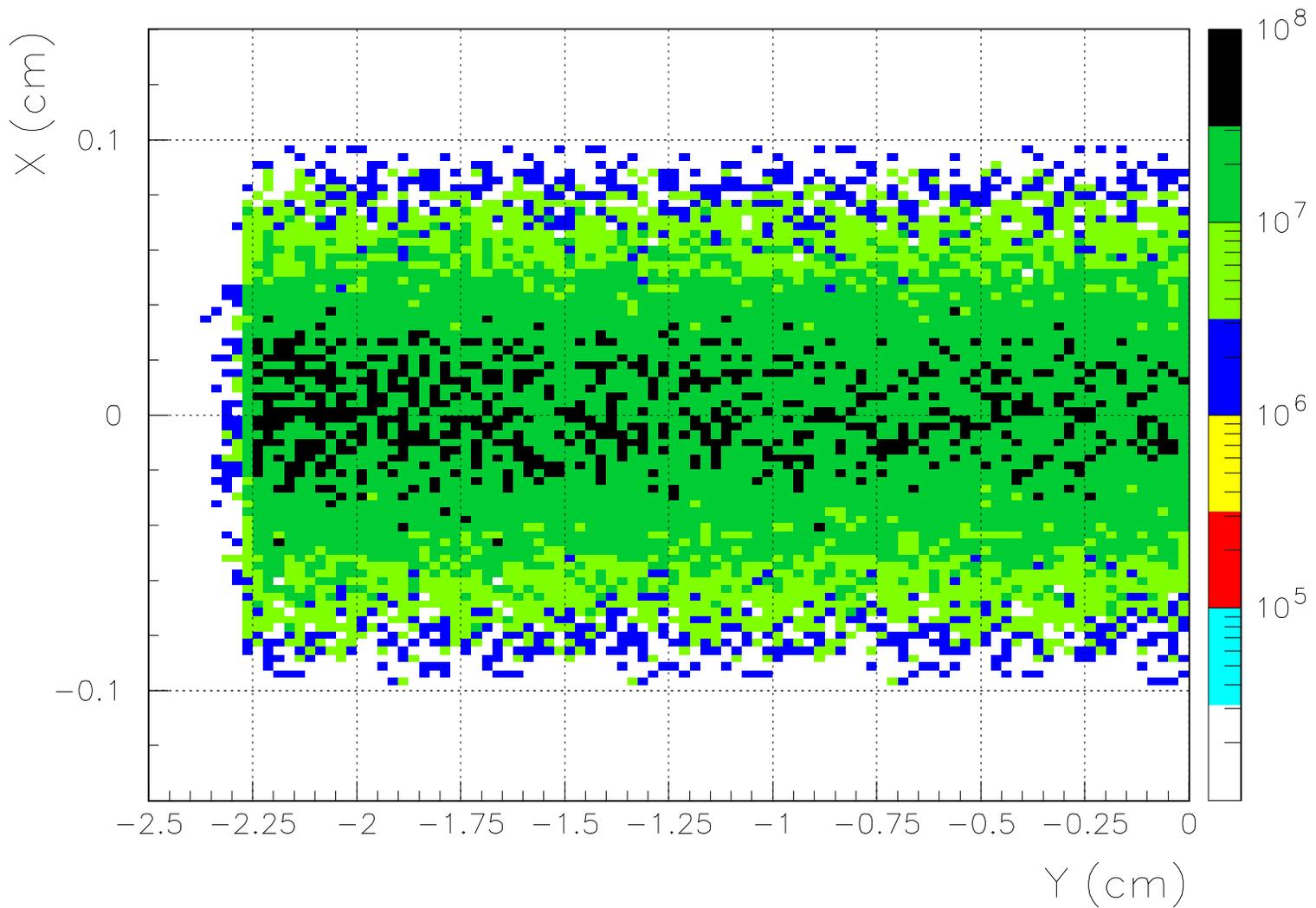


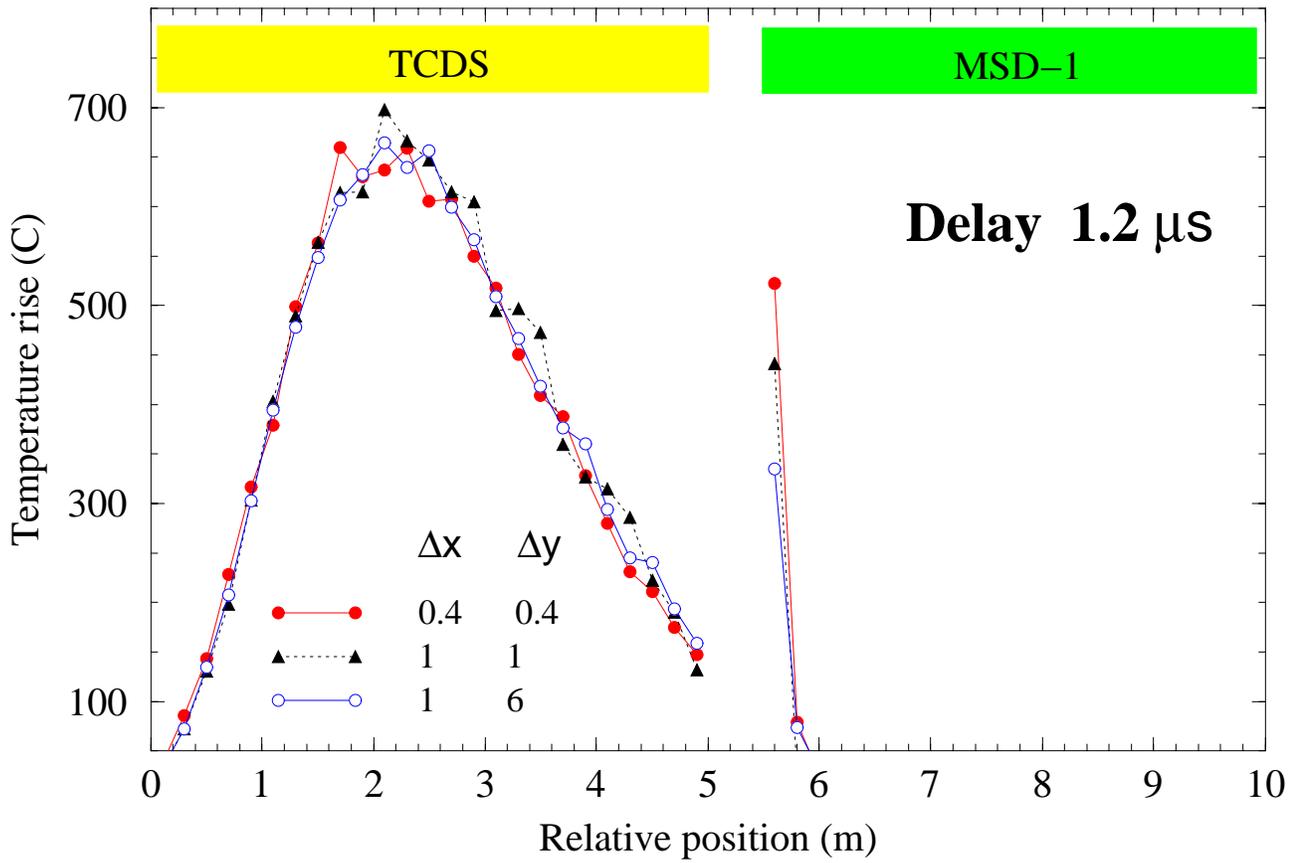


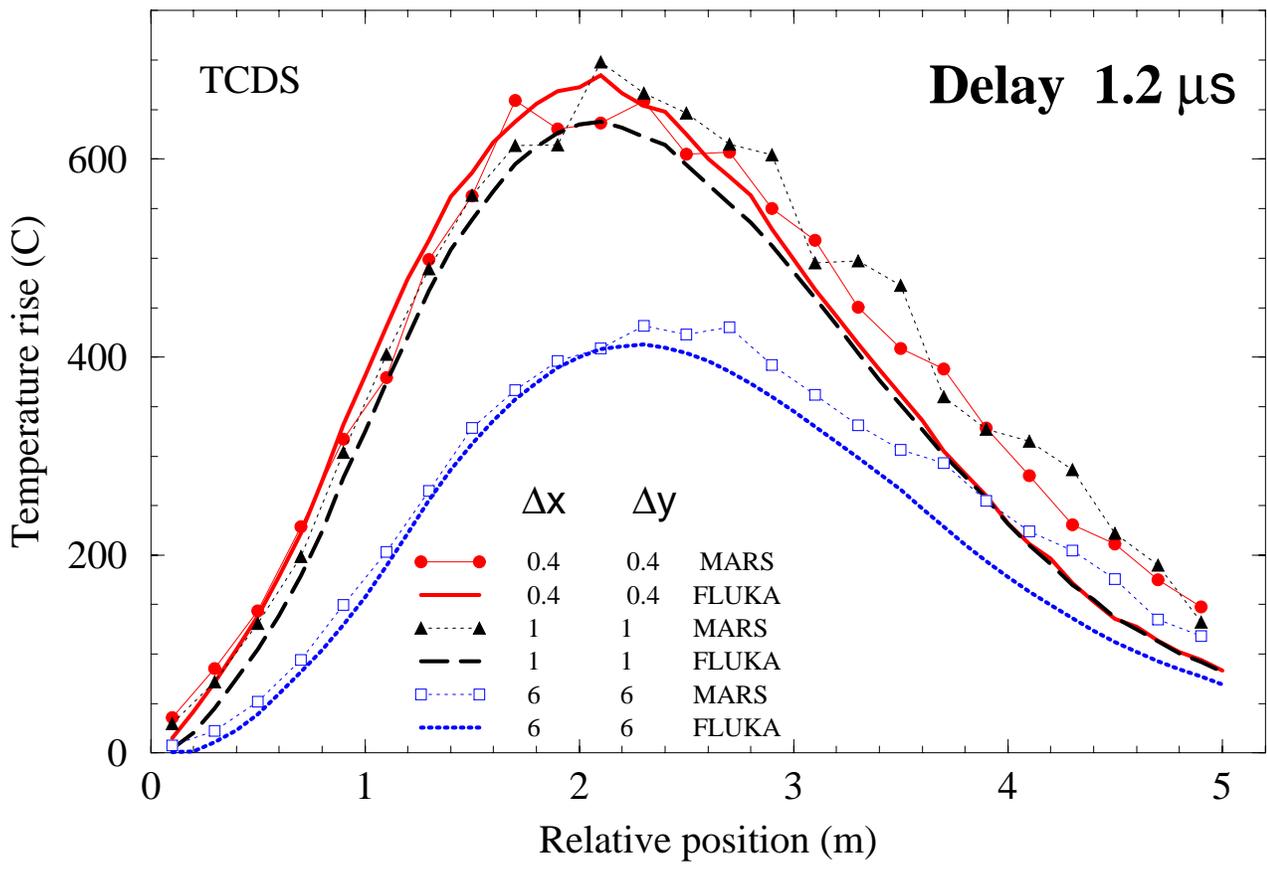


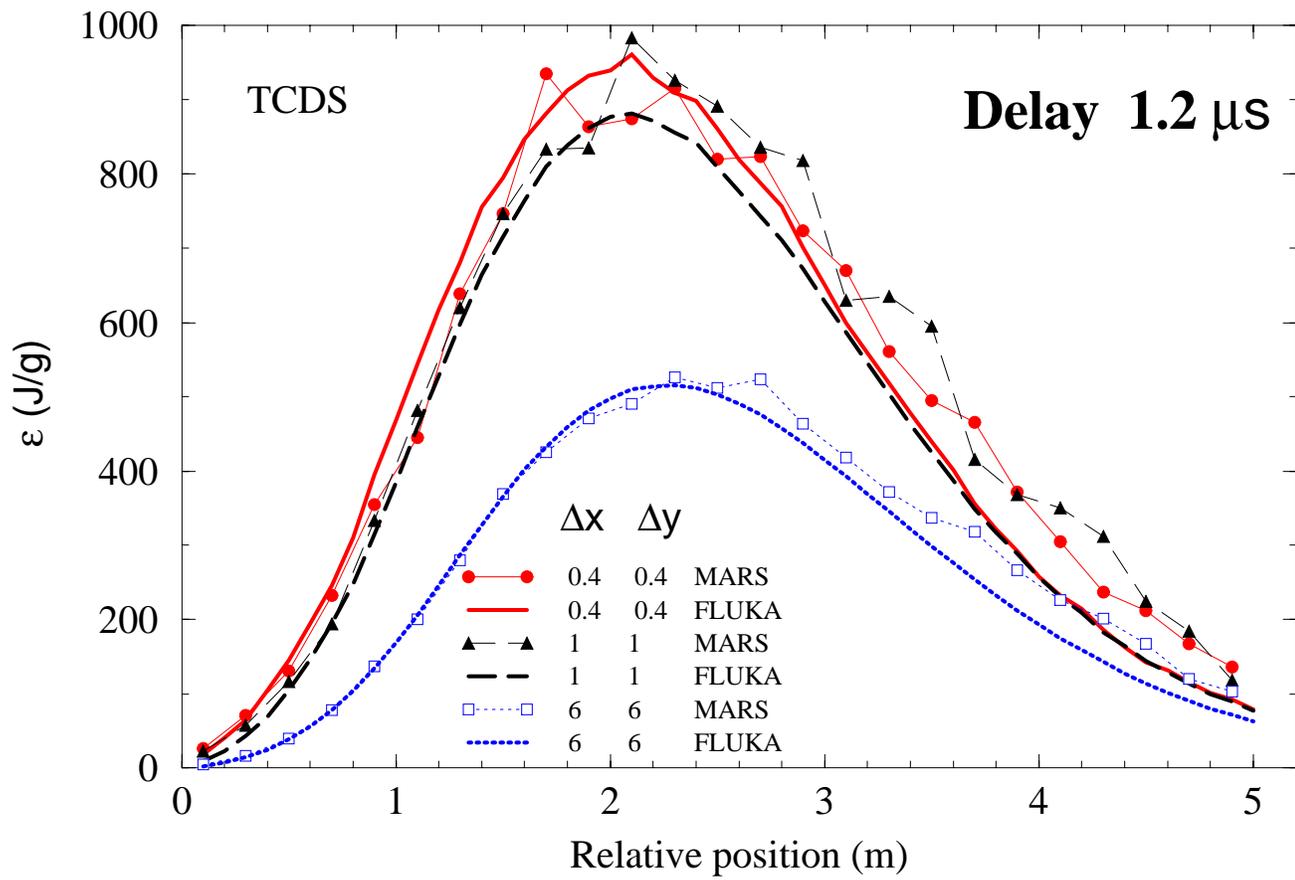


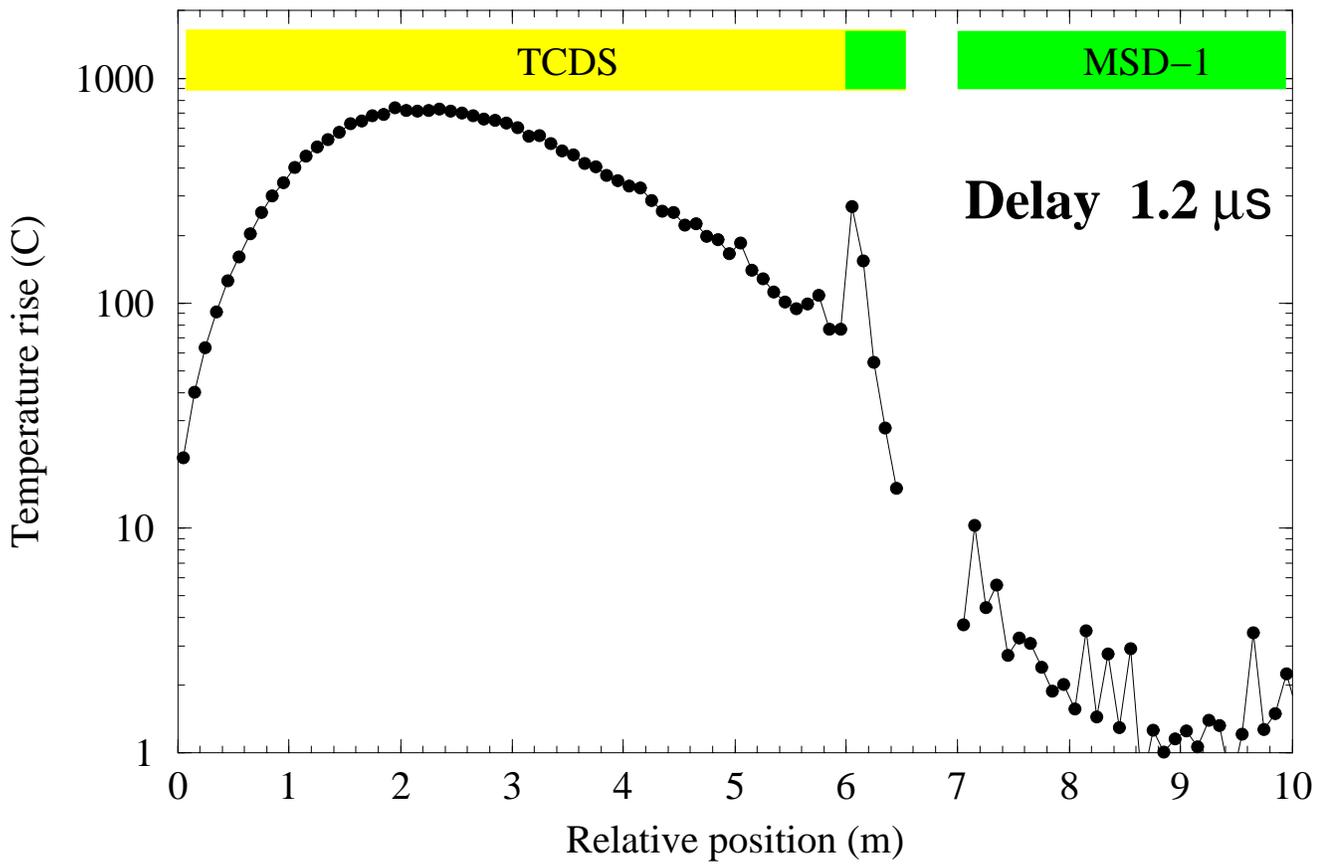
Energy flux isocontours (J/cm<sup>2</sup>) at TCDS for 1.2 microsecond delay

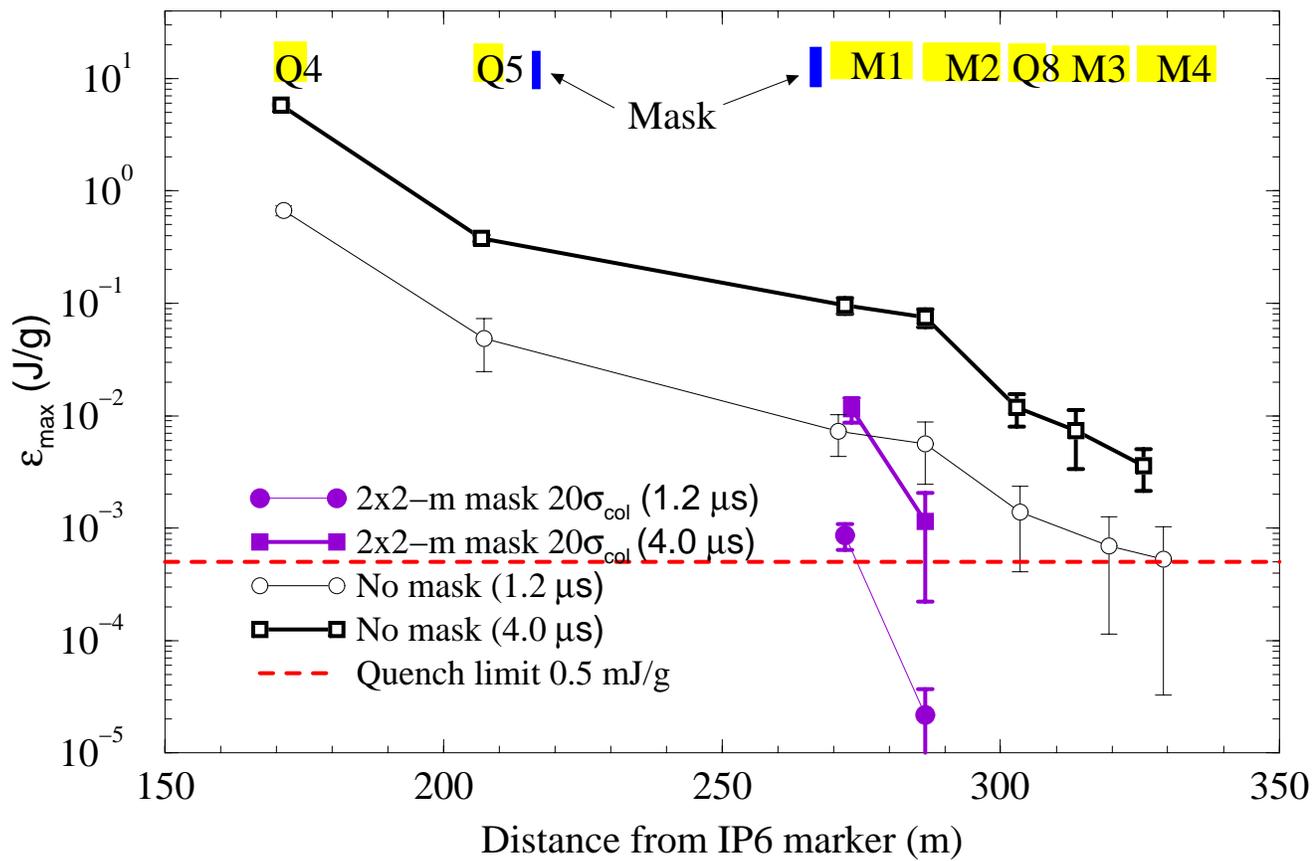


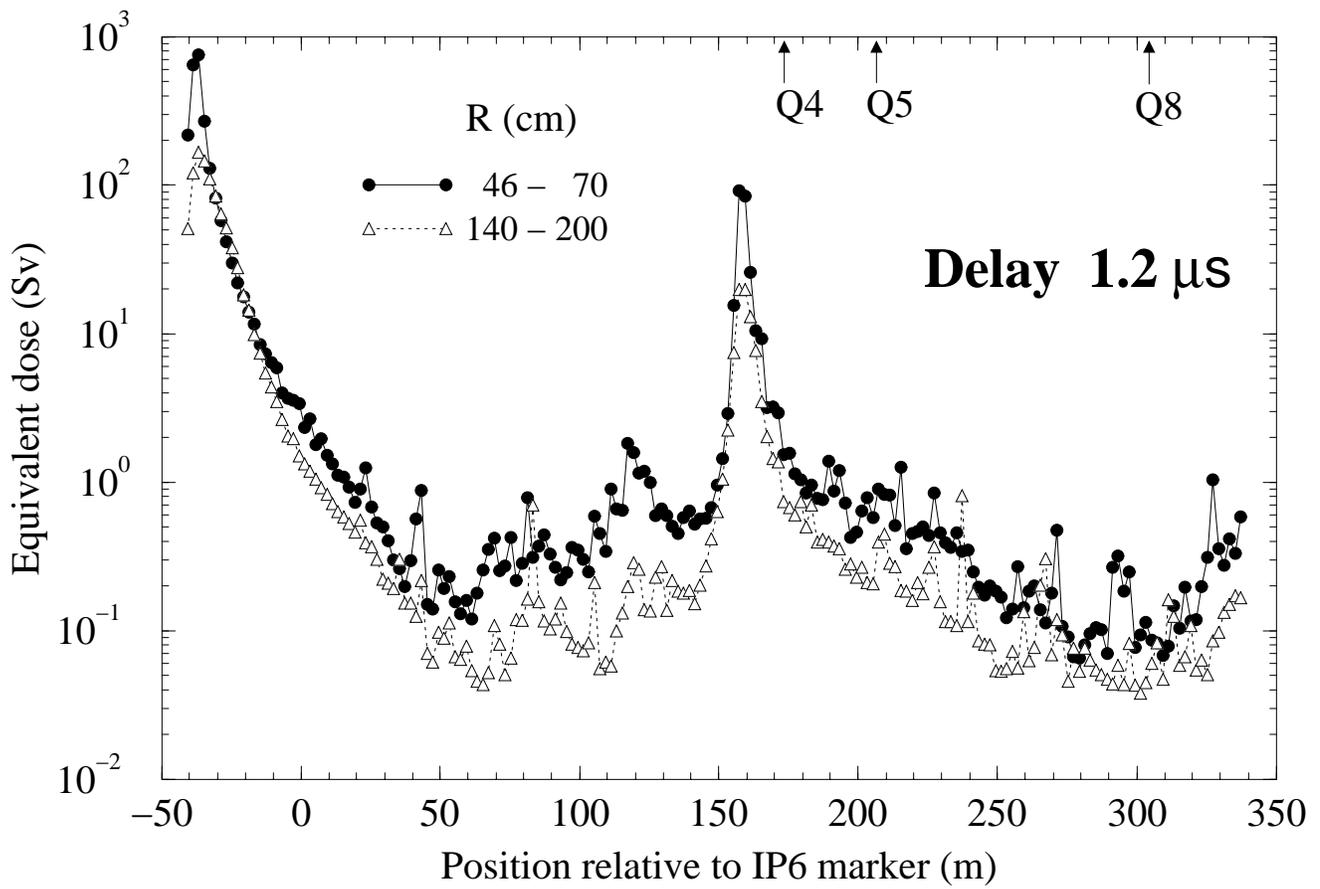












## Ongoing Updates

1. Recent measurements in CERN have revealed that the shortest real re-triggering delay is  $0.7 \mu\text{s}$  instead of previously assumed  $1.2 \mu\text{s}$ .
2. There is a possibility the TCDQ might become a **secondary collimator**. Slow (continuous) beam loss on the TCDQ should be estimated with respect to provoking a quench in the downstream SC magnets.
3. For possible LHC operations with **Pb ions** it should be checked that the protection system as conceived will work.

## Conclusions

1. The proposed protection system will reliably protect the machine components from an unsynchronized abort in the LHC IP6.
2. No beam losses in the IP5 are found with the proposed collimators TCDS and TCDQ in the appropriate positions.
3. The peak local temperature rise in IP6 components is quite acceptable. In septum MSD magnets the highest temperature rise is about  $10^{\circ}$  C.
4. All the IP6 SC dipoles and quadrupoles are protected against damage in the event of such an accident.
5. The first seven to eight SC magnets downstream of IP6 are subject to quench at unsynchronized abort, even for the lowest delay time considered ( $1.2 \mu\text{s}$ ).