Atividades do Grupo Experimental de Física de Altas Energias do Instituto de Física / UFRGS

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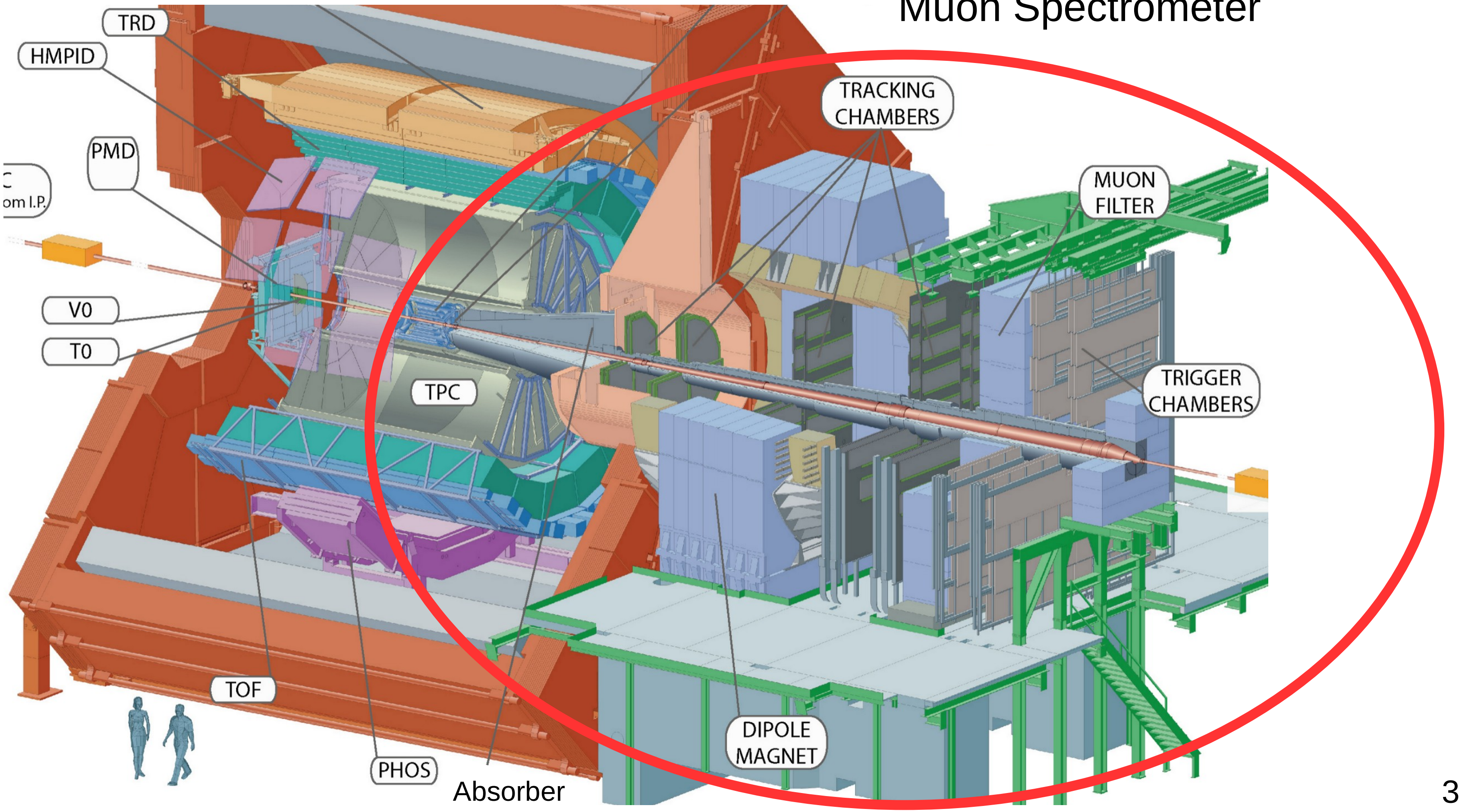
Outline

- Overview of Forward Tracking in ALICE (RUN3+)
- MFT Standalone tracking
  - Track reconstruction and assessment
  - Pre-alignment
- MFT-MCH Matching
  - Reconstruction and assessment
- Ultraperipheral calculations for data analysis
  - J/Psi photoproduction with effective photon flows

ALICE/LHC - A Large Ion Collider Experiment

- Quark-Gluon Plasma

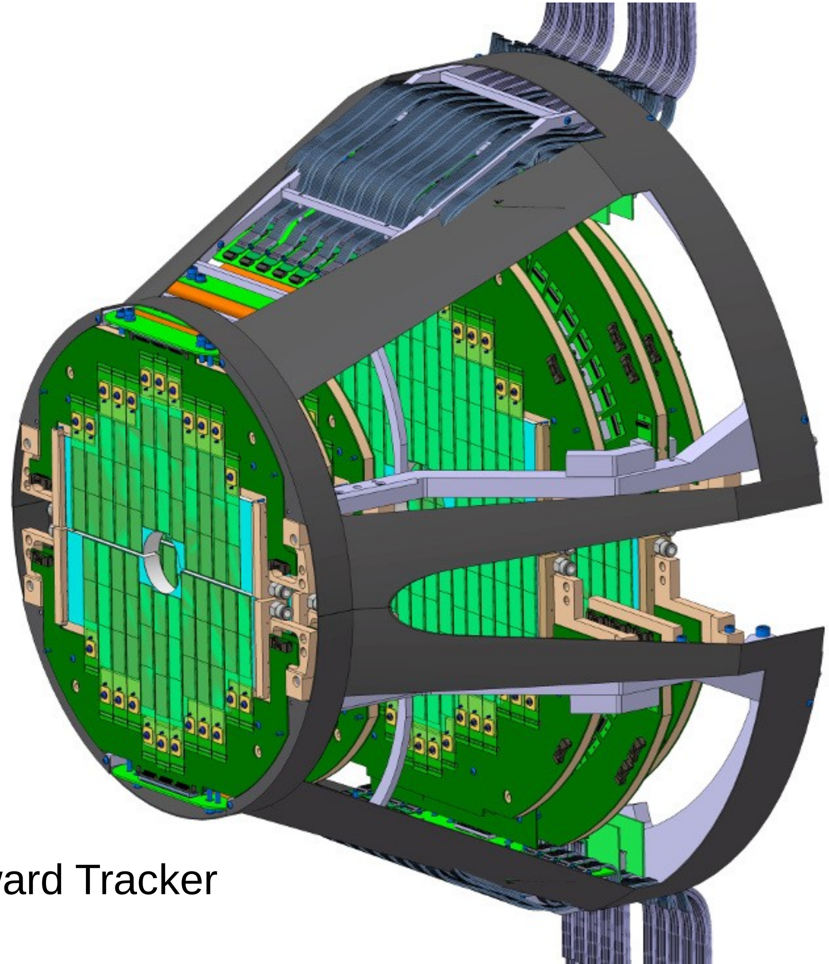
Muon Spectrometer



Absorber

Muon Forward Tracker

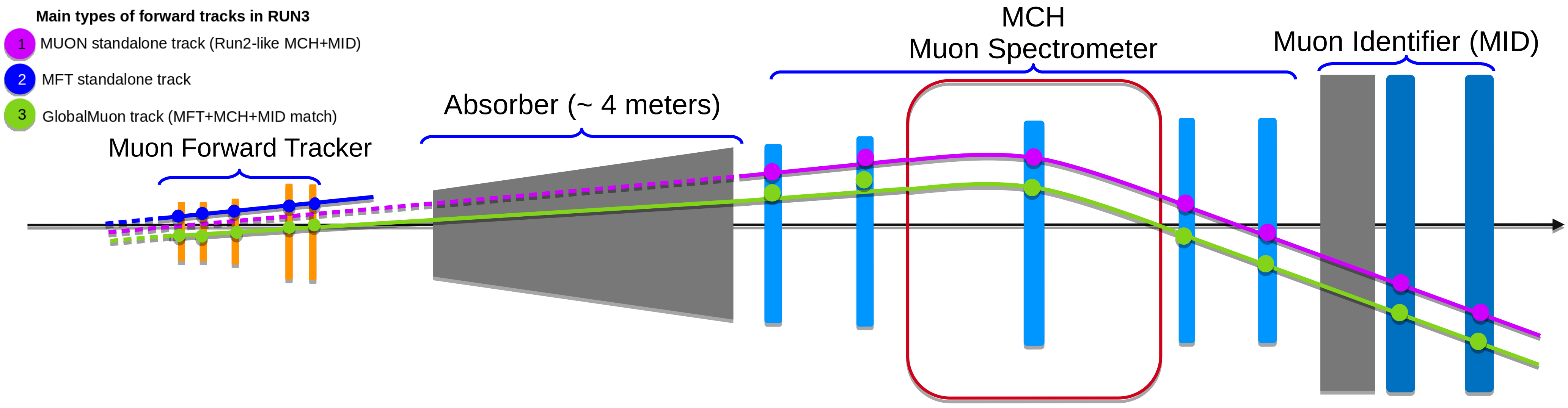
- Forward pseudorapidity: -3.6 < eta < -2.45
- 5 disks / 10 active layers
- 936 ALICE Pixel Detectors (ALPIDE)
  - MAPS: Monolithic Active Pixel Sensors
- Improve vertexing resolution at forward
  - B mesons studies
    - prompt/non-prompt dimuon separation



ALICE Collaboration, Technical Design Report for the Muon Forward Tracker
http://cds.cern.ch/record/1981898

Forward track reconstruction and assessment

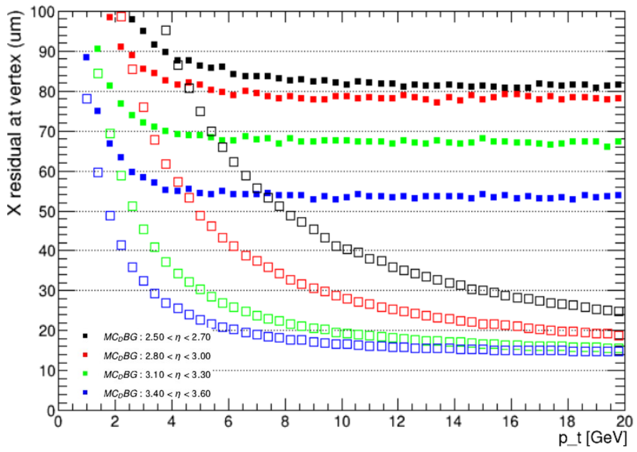
- MFT Standalone
  - Prealignement geometry using pilot beam data
- Global Forward Matching (MFT-MCH-MID)



MFT Standalone

- Group responsible for MFT Software coordination
  - Standalone reconstruction. Kalman filter implemented from scratch: from track model to final data format
- Detailed tracking assessment tool
- MFT prealignment using pilot beam data

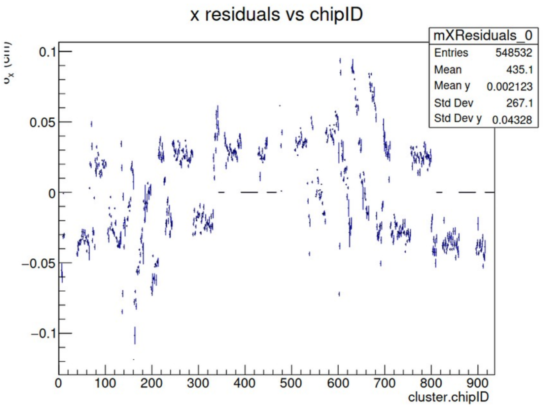
MFT standalone
performance assessment

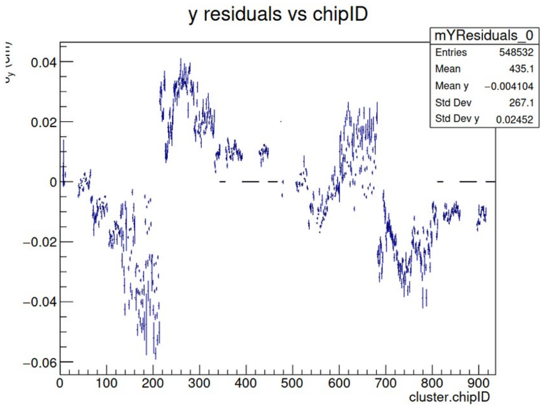


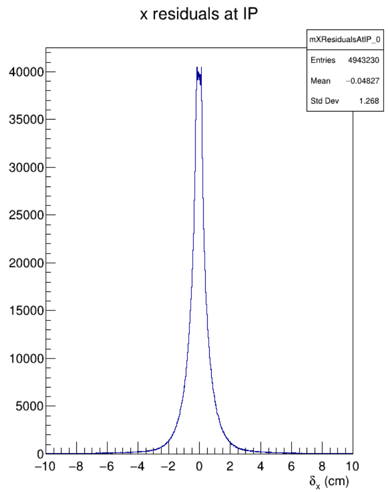
Misaligned MFT

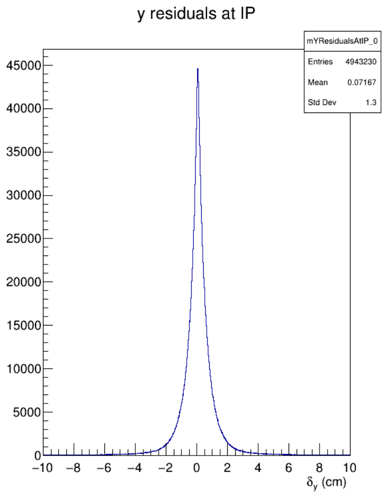
- Linear track finding with generous search radius

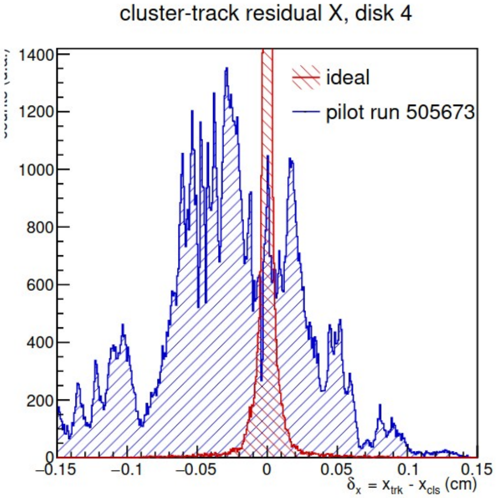
- Track parameters computed using first and last clusters

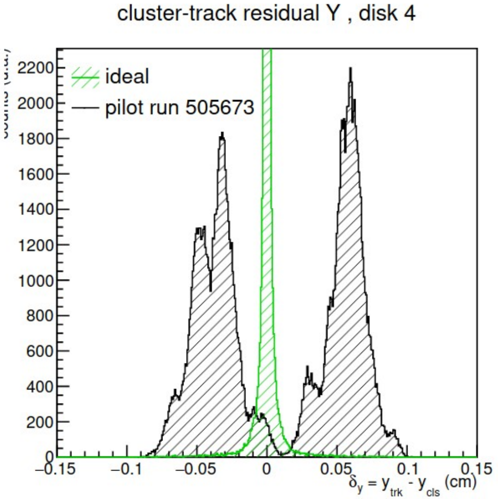








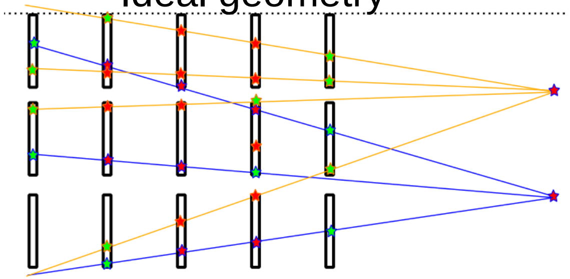




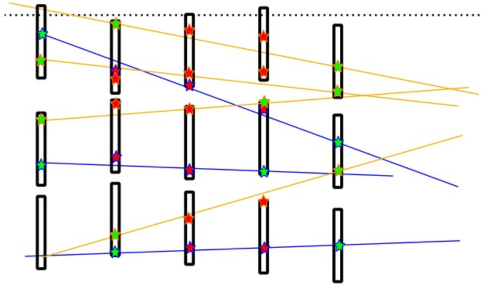
https://indico.cern.ch/event/1123701/contributions/4716991/attachments/2383120/4072228/mft_prealignment_rc.pdf

MFT Standalone Prealigner

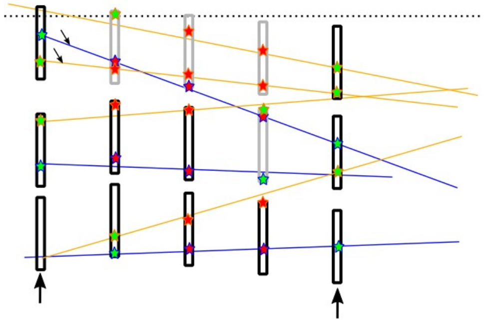
0
Ideal geometry



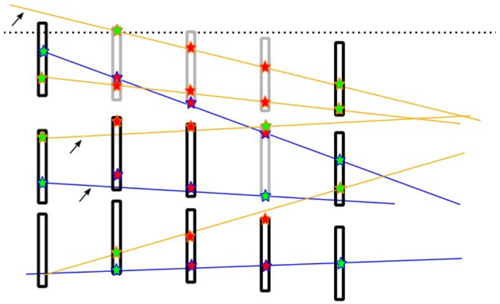
1
Misaligned tracks



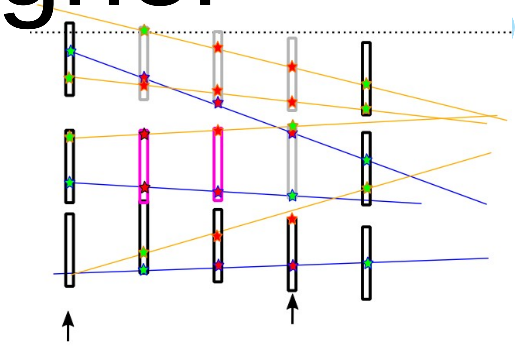
2.
Correction using residuals based longest tracks:
Reference layers 0 and 4
(track reference clusters at first and last layer)



3.
Recalculate track parameters

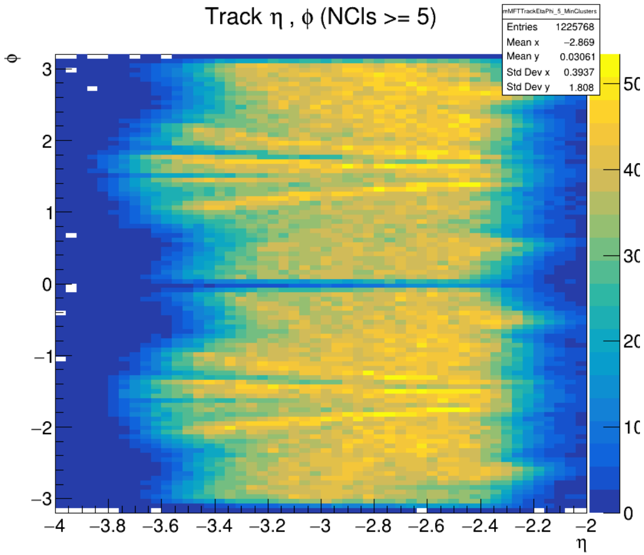


Loop with corrections using other sets of reference layers
Ex. 1 and 3, then 0 and 3...

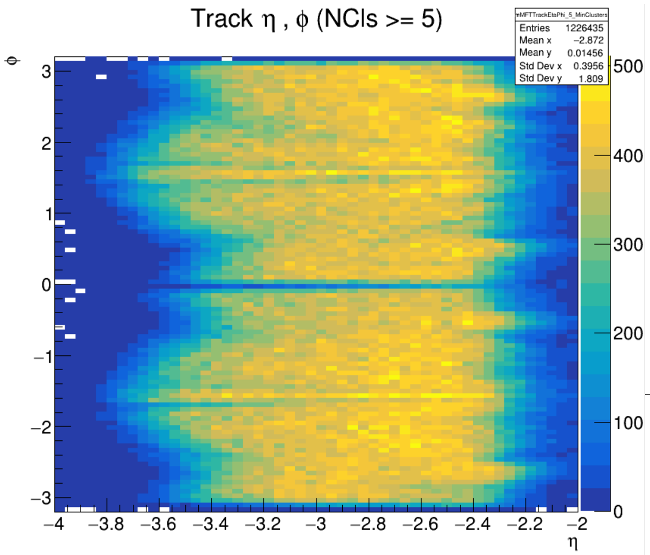


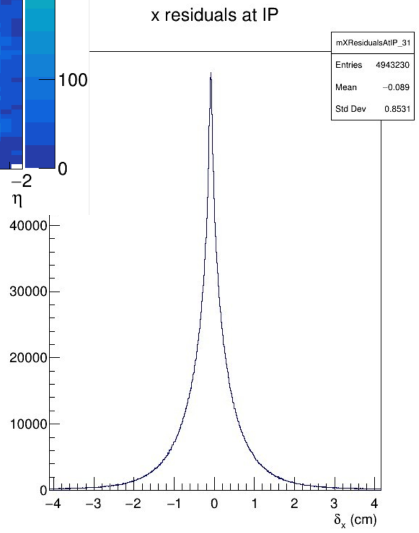
Prealigned geometry

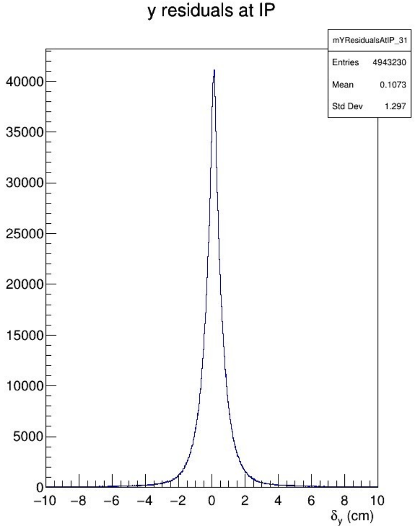
Ideal geometry



Prealigned geometry



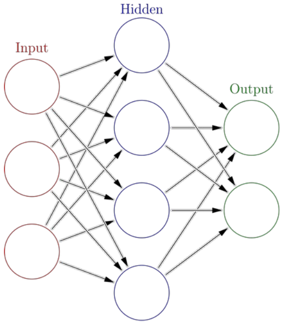




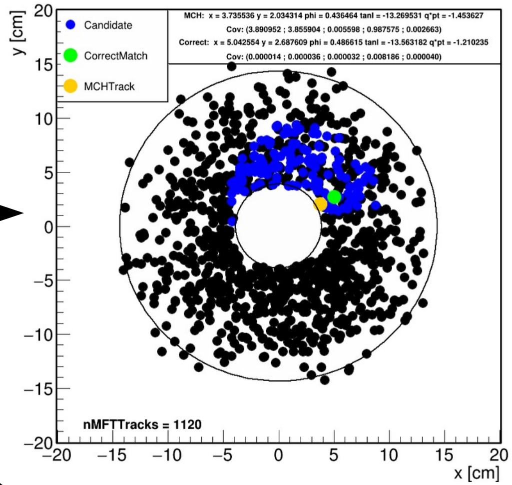
https://indico.cern.ch/event/1134871/contributions/4761522/attachments/2400141/4104479/mft_prealigner.pdf

MFT-MCH Matching

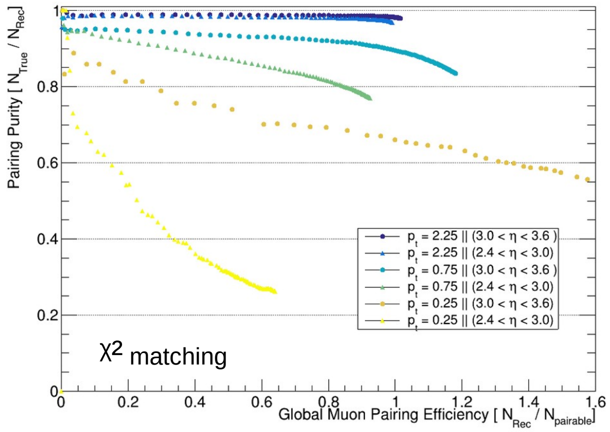
- Implementation of MFT-MCH matching
  - MCH tracks propagated to last MFT plane
  - χ^2-minimization matching
- Detailed matching assessment tool
- Machine learning interface
  - Generation of training data from MC simulation
  - Trained networks can be used in production
  - WIP



Single event matching plane view



Matching purity and efficiency:



Ultra peripheral collisions

The Effective Photon Flow

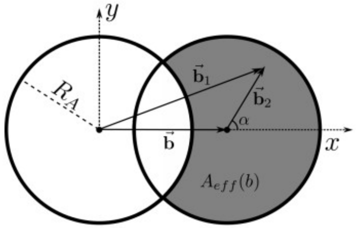
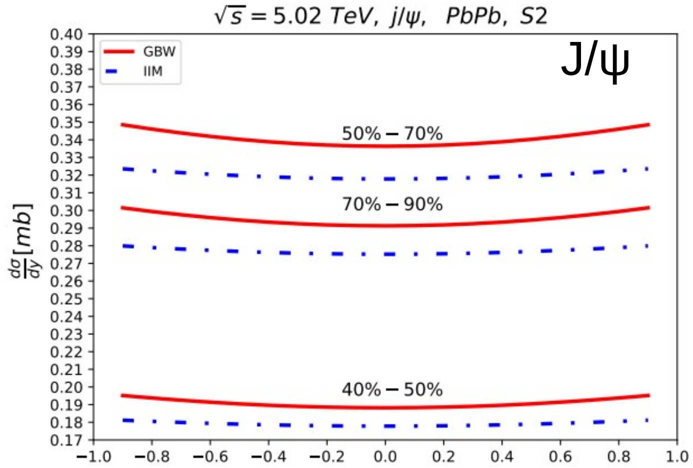
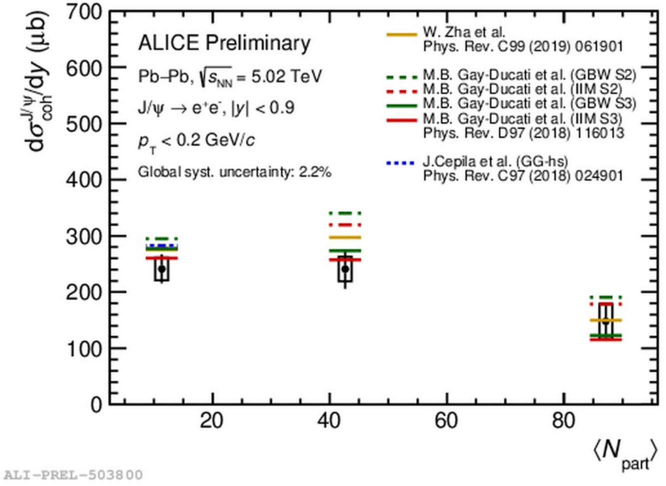


Fig. 1: Scheme of the interaction according to scenario 2.



- From the standard photon flux (N^{usual}) emitted by the projectile nucleus, only the photons that reach the geometric region of the target nucleus will be considered;
- Photons that reach the nuclear superposition region will be discarded (dominated by the strong interaction).



effective photon flow:

$$N^{eff}(\omega, b) = \int N^{usual}(\omega, b_1)\frac{\theta(b_1 - R_A)\theta(R_A - b_2)}{A_{eff}(b)} d^2 b_2$$

spectators area:

$$A_{eff}(b) = R_A^2\left[\pi - 2\cos^{-1}\left(\frac{b}{2R_A}\right)\right] + \frac{b}{2}\sqrt{4R_A^2 - b^2}.$$

Ultra peripheral collisions

The effective photonuclear cross section

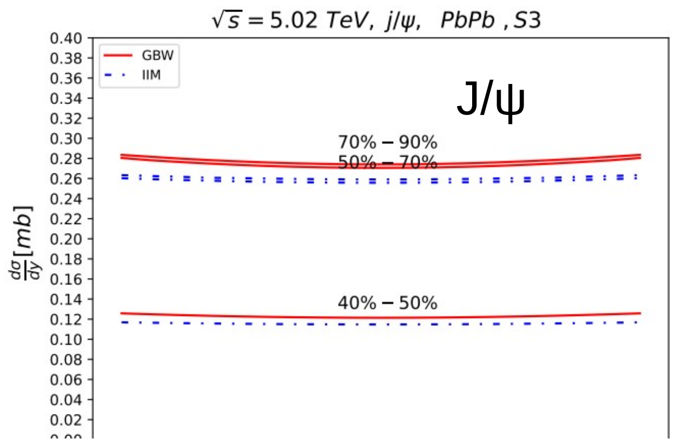
- Applying the same geometric constraint on the photonuclear cross section.
  - The dipole-core interaction will be restricted to only the dipole interaction with the part of the core that forms the spectator region

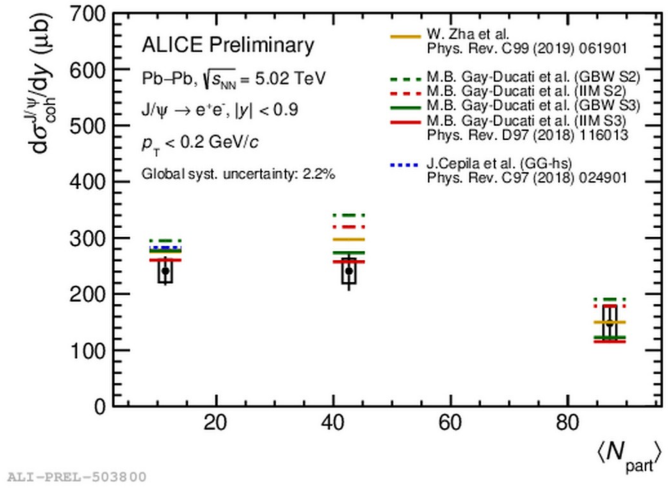
$$\sigma_{\text{dip}}^{\text{nucleus}}(x,r) = 2\int d^2b_2\Theta(b_1 - R_A)\left\{1 - \exp\left[-\frac{1}{2}T_A(b)\sigma_{\text{dip}}^{\text{proton}}(x,r)\right]\right\}$$

$$b_1^2 = b^2 + b_2^2 + 2bb_2\cos(\alpha)$$

➢ Effective photon flux and an effective photonuclear cross section

Results obtained the dipole cross section of
- Golec-Biernat Wüsthoff (GBW) and
- Iancu, Itakura e Munier (IIM)





Backup slides