Contribuição Brasileira ao Muon Forward Tracker do ALICE/CERN

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Workshop RENAFAE 2018 – 30/07/2018

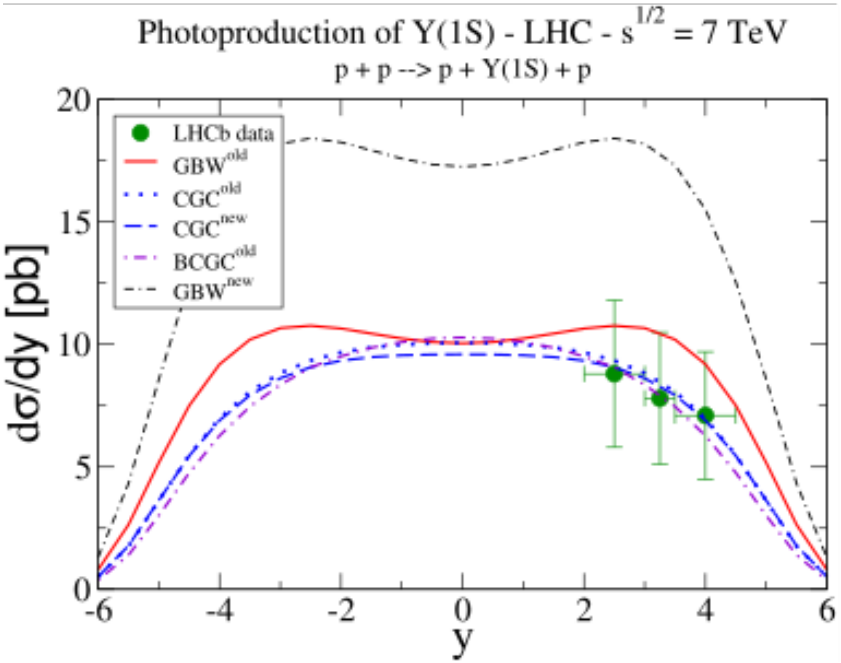
Tópicos

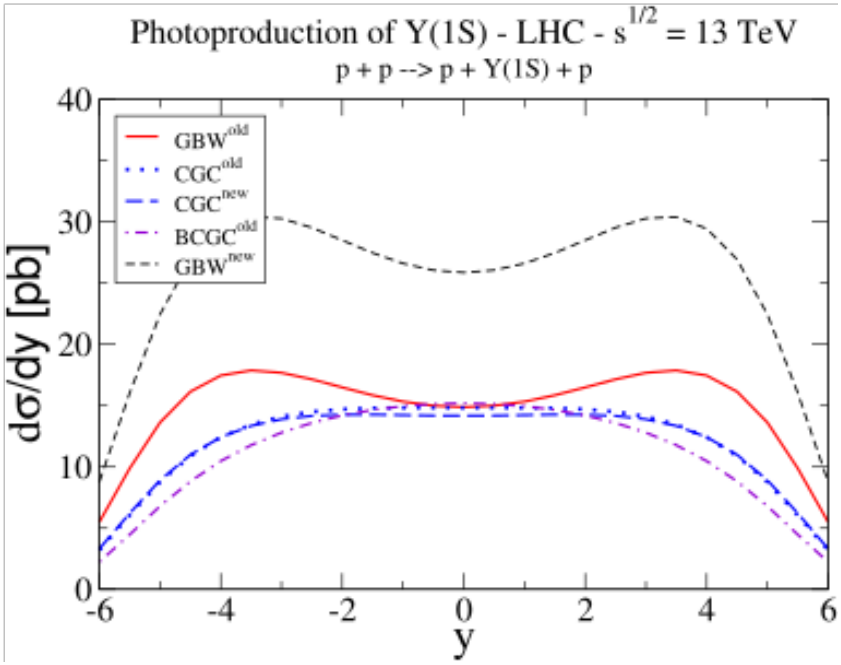
- Motivação
  - MFT WP5 (Barrel) & WP9 (Physics)
  - ALICE PAGs Dilepton&Quarkonia + UPC
- O espectrômetro de múons de ALICE
- ALICE Upgrade: Muon Forward Tracker (MFT)
- Contribuição GEFAE – Work Packages do MFT
  - Patch Panel (MFT WP5)
  - Physics (MFT WP9)

Motivação: Experiência GFPAE

- Comparison of the rapidity distribution for pp collisions with LHCb data [1]
  (M. B. Gay Ducati, F. Kopp, M. V. T. Machado, and S. Martins, Phys. ReV. D 94, 094023, (2017)).

$$\frac{d\sigma}{dy}(pp \to p \otimes V \otimes p) = \omega \frac{dN_\gamma}{d\omega} \sigma(\gamma p \to Vp) + (y \to -y)$$



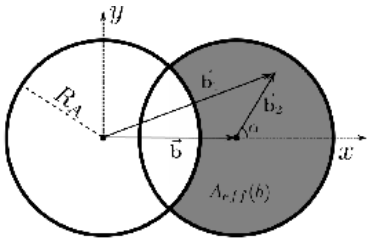


[1] R. Aaij et al., JHEP 1509, 084 (2015).

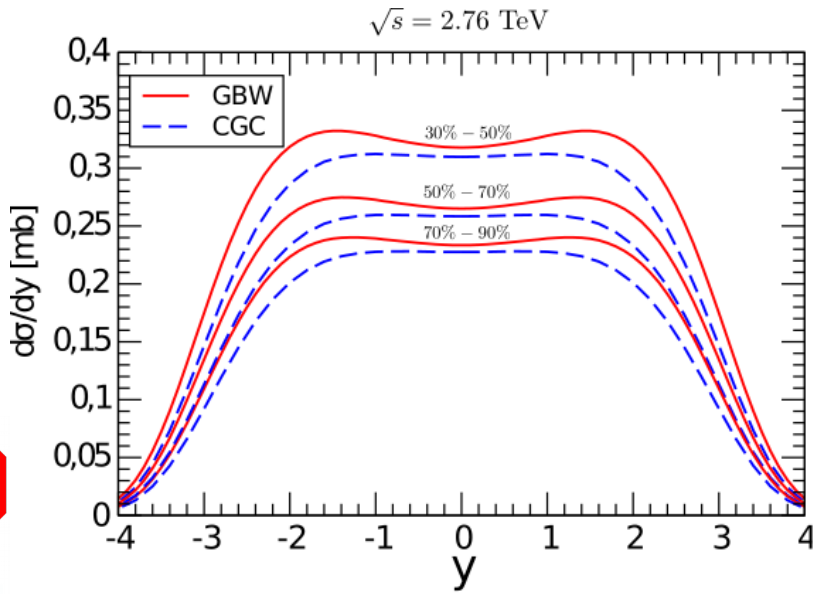
Photoproduction in Peripheral Collisions

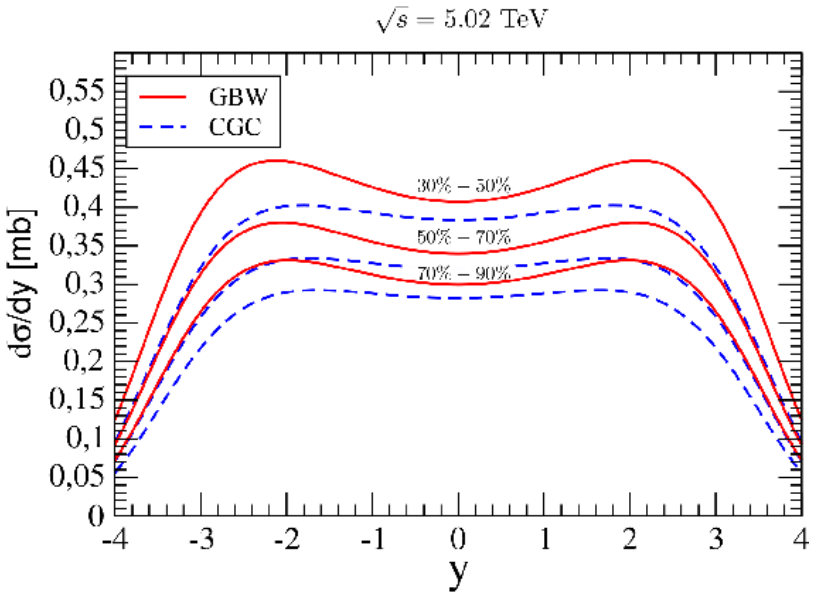
- Coherent photoproduction of J/ψ at √s = 2.76 TeV and √s = 5.02. TeV
- The effective photon flux (only spectators interact coherently with the photon),

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



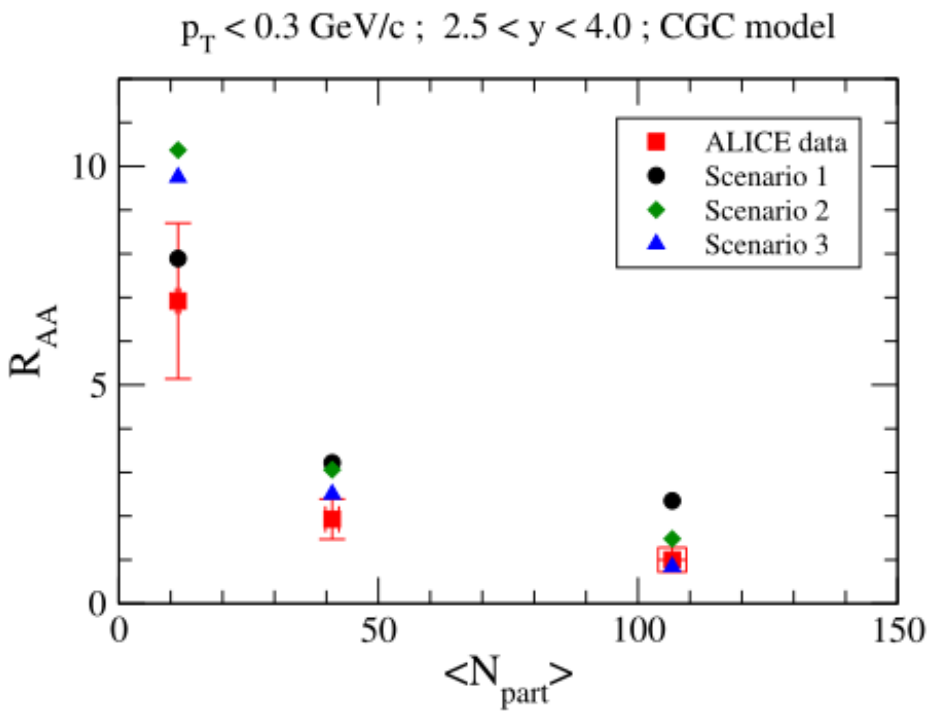
- Rapidity distribution of J/ψ for three centrality classes:





The Nuclear Modification Factor (R_{AA})

- Comparison of GFPAE results with the ALICE data[2]
  (M. B. Gay Ducati and S. Martins, Phys. Rev. D97, 116013, (2018)) .



$$R_{AA}^{hJ/\psi} = \frac{N_{AA}^{J/\psi}}{BR_{J/\psi \to l^+l^-} \langle N_{events} \rangle \langle (A \times \varepsilon)_{AA}^{J/\psi} \rangle \langle T_{AA} \rangle \langle \sigma_{pp}^{hJ/\psi}}$$

Scenario 1: = UPC (no correction)

Scenario 2: the effective photon flux

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

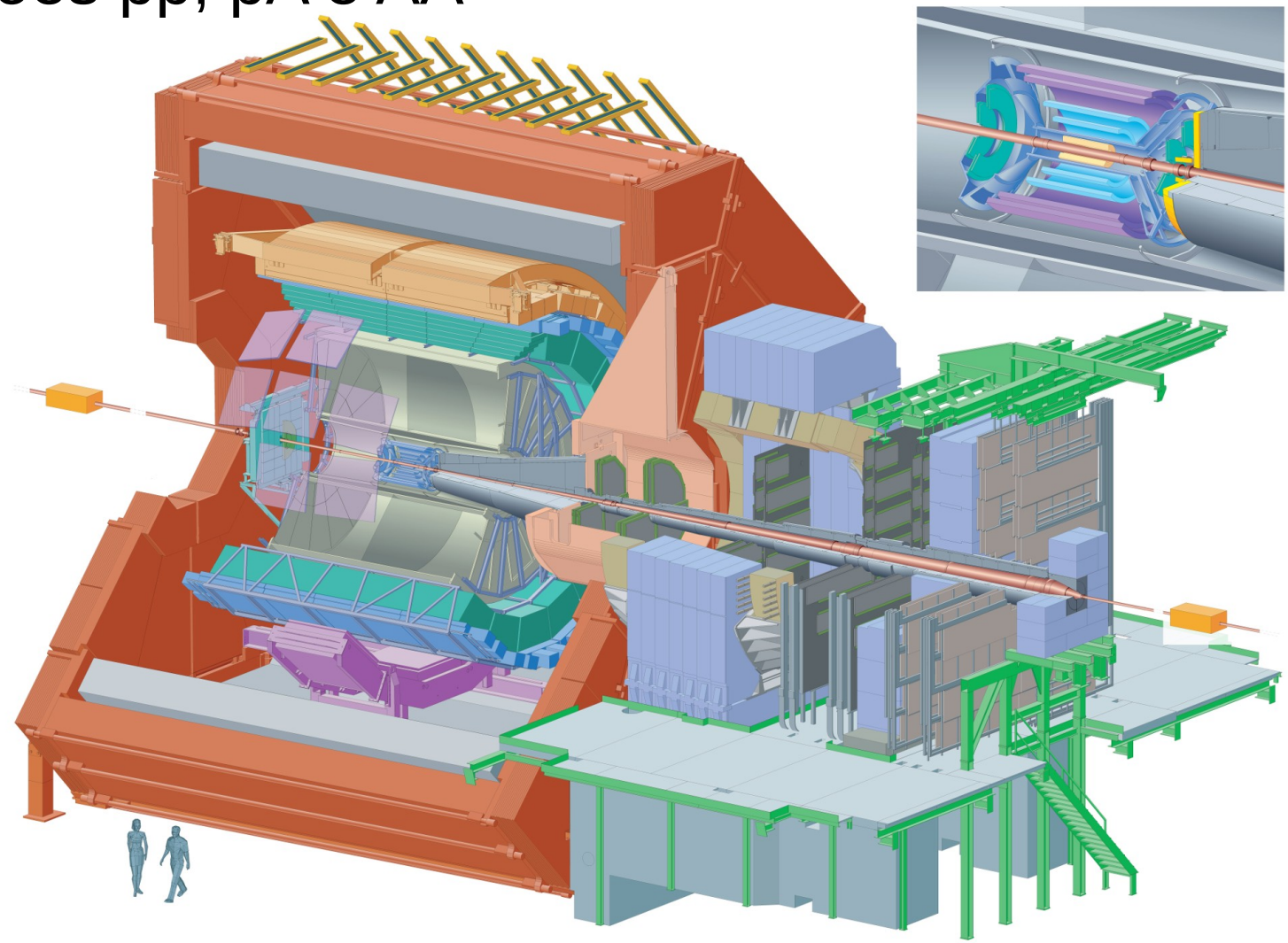
Scenario 3: the effective photonuclear cross section,

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

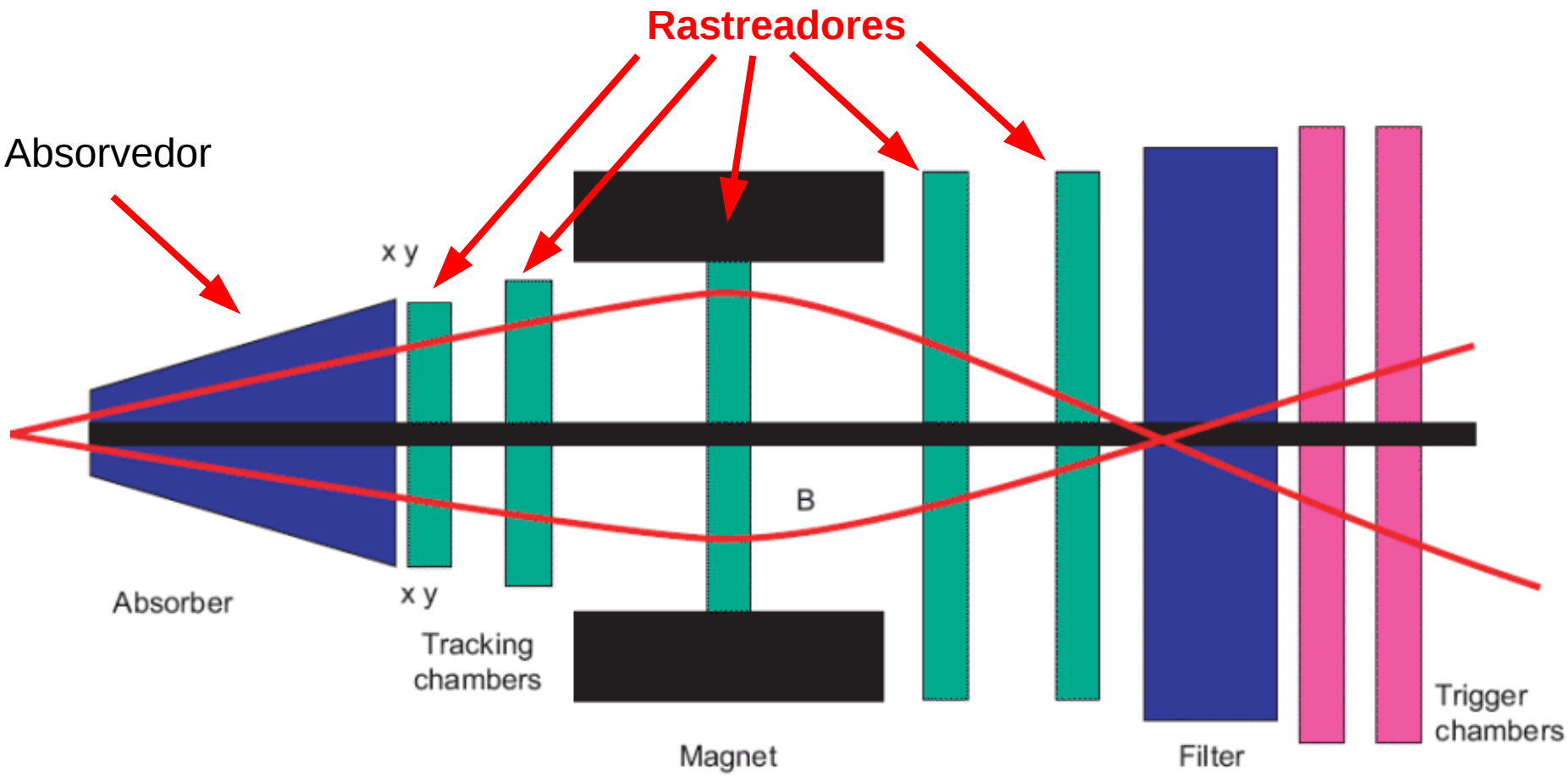
[2]ALICE Collaboration, J. Adam et al., Phys. Rev. Lett 116, 222301 (2016)

ALICE/LHC
A Large Ion Collider Experiment

- Investigações do Plasma de Quarks e Glúons
  - Colisões pp, pA e AA



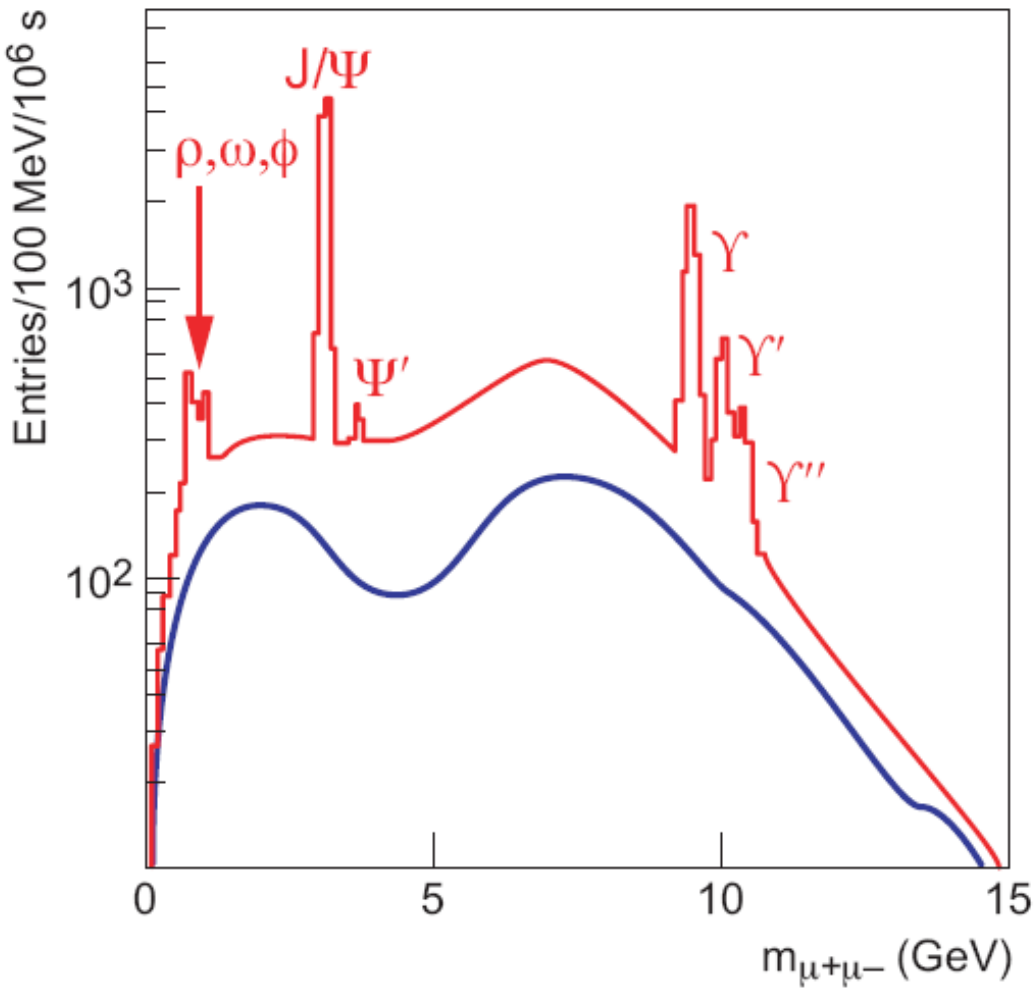
Espectrômetro de Múons



Intervalo angular de 2° a 9°
(-4.0 < η < -2.5)

http://aliceinfo.cern.ch/Public/en/Chapter2/Chap2_dim_spec.html

Exemplo e limitação



- Baixa resolução espacial na determinação dos vértices das trajetórias de dimuons
- Incapaz de separar J/ψ prompts daqueles deslocados pelos decaimentos de mésons B.

ALICE Upgrade – LHC LS2

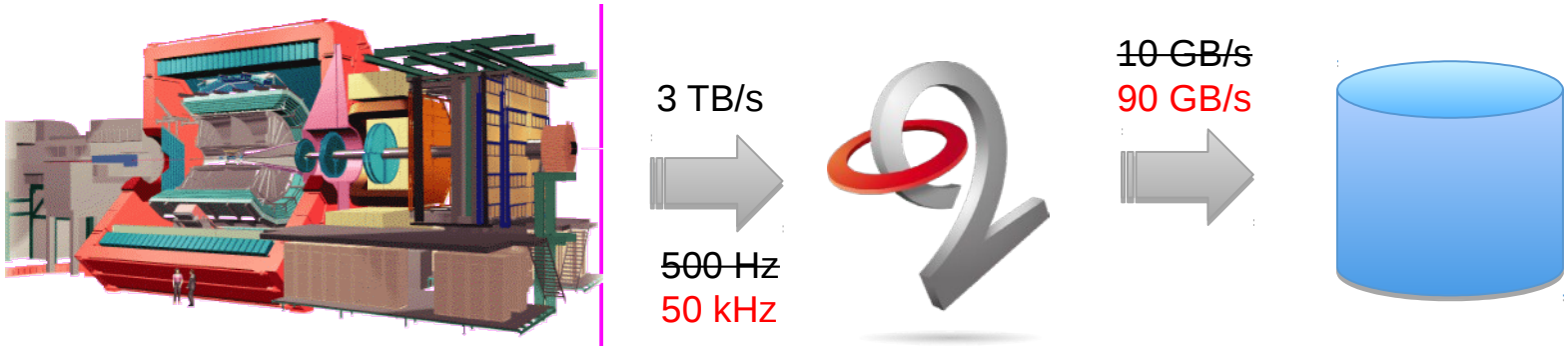
- Aumento da luminosidade do LHC após o Long Shutdown 2 (2019-2020)
- O Detector ALICE será atualizado:
  - Diversos sistemas de detecção atualizados
  - Instalação de novo sistema: MFT
  - Nova eletrônica de leitura de dados
- Novo sistema computacional
  - O2 (On-line Off-line)

Online-Offline computing system

Upgrade do sistema computacional para o Run 3

- Atingir o alvo de luminosidade integrada de ~~1~~ 13 nb^{-1} em para observação de gatilhos raros em colisões Pb-Pb

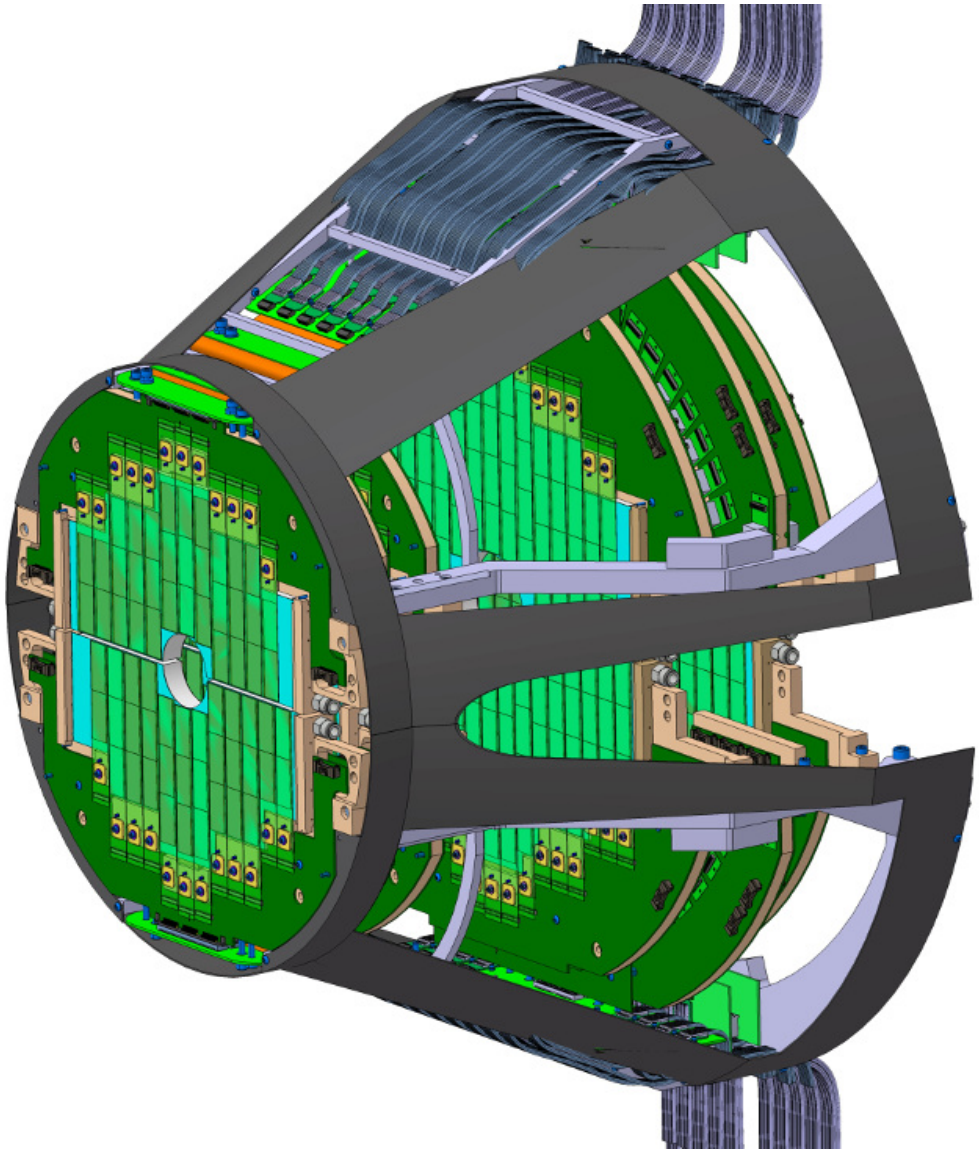
- Fluxo de dados do detector estimado em valores maiores que 1TB/s, aproximadamente duas ordens de magnitude maior que no Run 1



Predrag Buncic, Analysis in Run 3 (Offiline Week 08/11/2017)
https://indico.cern.ch/event/675166/

ALICE Collaboration, Technical Design Report for the Upgrade of the Online-Offline Computing System
https://cds.cern.ch/record/2011297

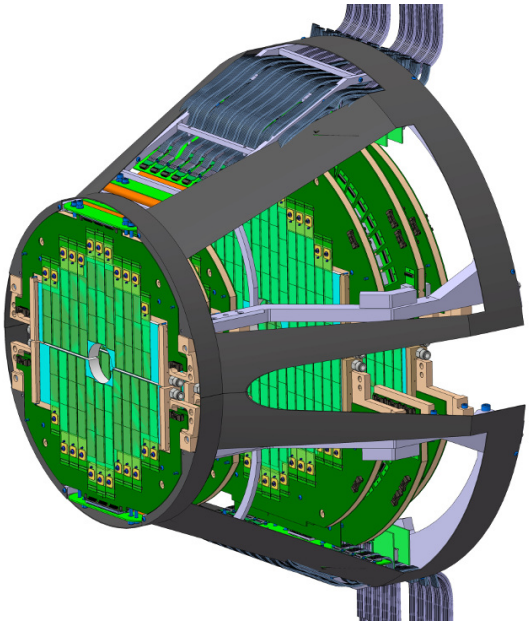
Muon Forward Tracker

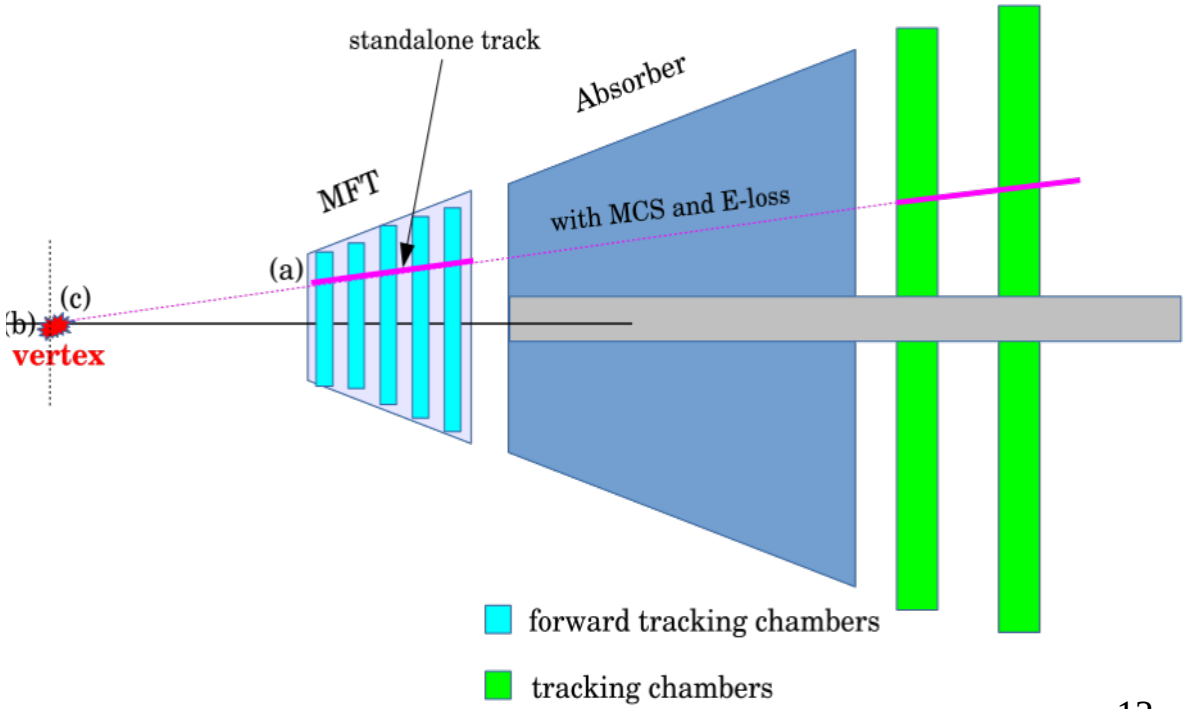


ALICE Collaboration, Technical Design Report for the Muon Forward Tracker
http://cds.cern.ch/record/1981898

Muon Forward Tracker

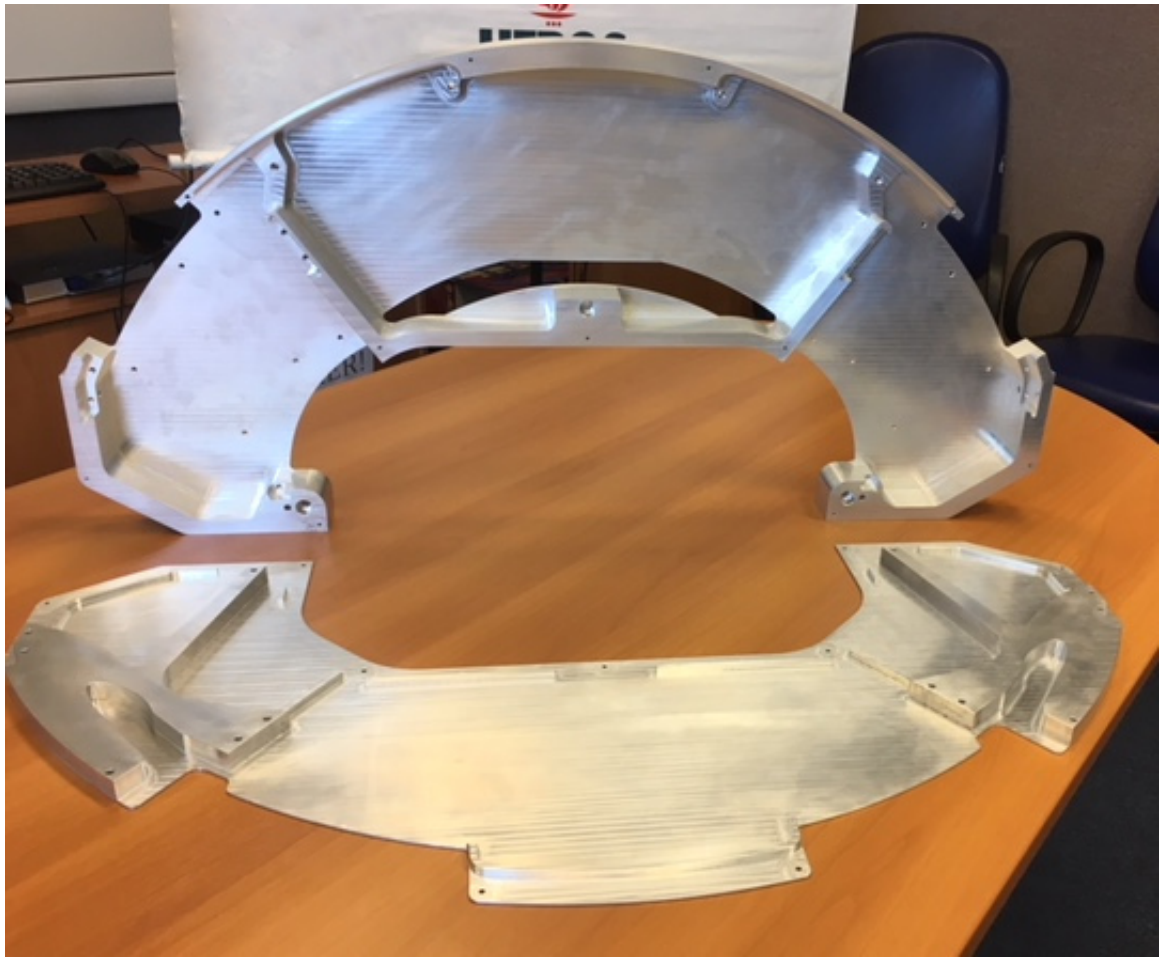
- 5 discos formando 10 planos de detecção com sensores de pixeis de silício
- Rastreamento de trilhas com alta resolução espacial diante do espetrômetro de múons
- Permitirá separação dos vértices de pares dimuons originados do ponto de interação de decaimentos secundários (como mésons B e D)





MFT Patch Panel

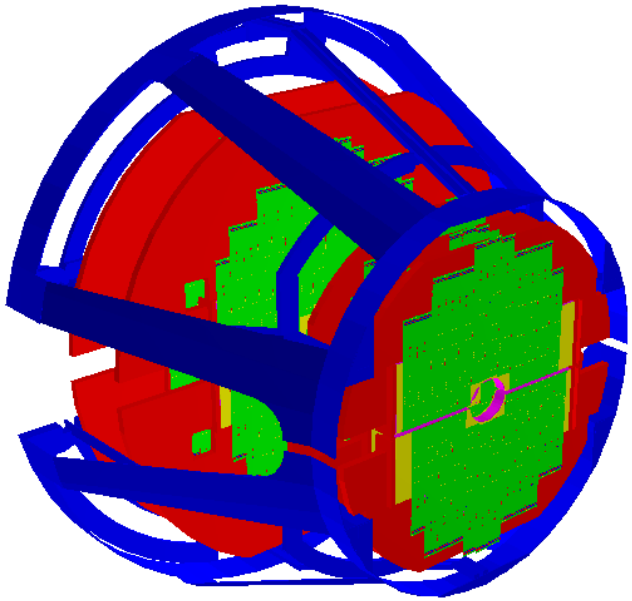
- Equipe GEFAE: aprimoramento e fabricação



Protótipo fabricado em Porto Alegre
Abril 2018

MFT no O2

- Descrição geométrica
  - Elementos passivos
  - posicionamento dos sensores tipo pixel de silício
- Elaboração dos algoritmos e protocolos de calibração



MFT Institutional Board Meeting – Julho 2018

A Large Ion Collider Experiment

Muon Forward Tracker

A status report

Stefano Matthias PANEBIANCO – CEA Saclay

MFT Institutional Board meeting

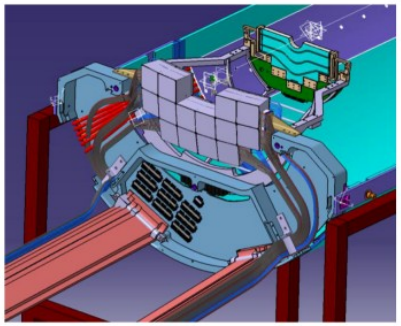
July 18th 2018

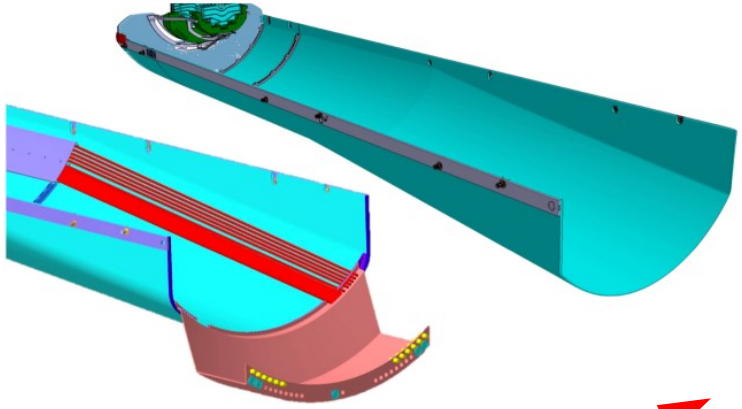
MFT Technical Coordinator Report

MFT Technical Coordinator Report

MFT – Barrel (WP5)

- Barrel design is finalized: call for tender launched yesterday
- Insertion procedure fully revised and validated at CERN with mockup
- Patch Panel pre-series produced in Porto Alegre
- Service routing thought Patch Panel very delicate





Verificação das dimensões do protótipo em Lyon/Fr

MFT Technical Coordinator Report

A Large Ion Collider Experiment

MFT – Physics (WP9)

- Growing activity for the full integration of MFT software in O2
- Effective contribution from LPC, Porto Alegre, Lyon and Lima
- Increasing participation of CEA: Javier Castillo and Satoshi Yano (postdoc)
- Detector geometry fully implemented, clustering operational: tracking implementation is ongoing
- Next months will be devoted to alignment implementation and commissioning preparation

Agradecimentos

- RENAFAE pelo apoio para participação no evento
- Stefano Panebianco – Slides MFT IB Meeting
- UFRGS – Suporte financeiro integral