Project presentation
PPSS 2022

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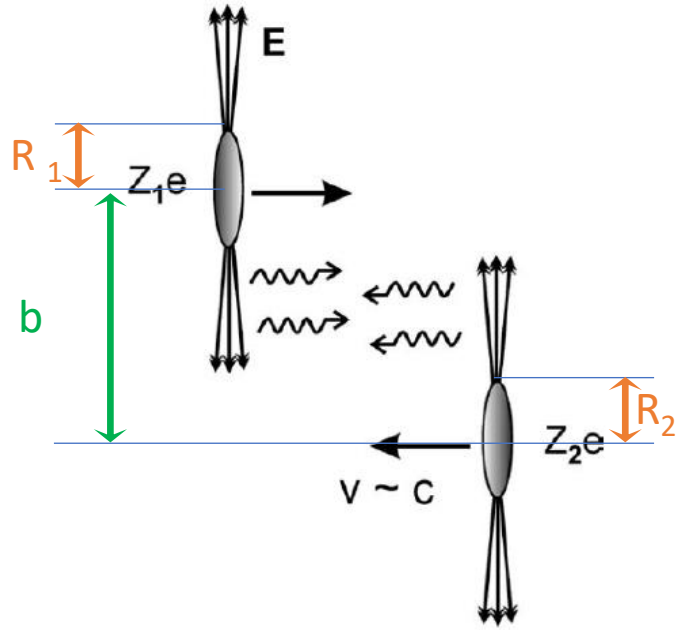
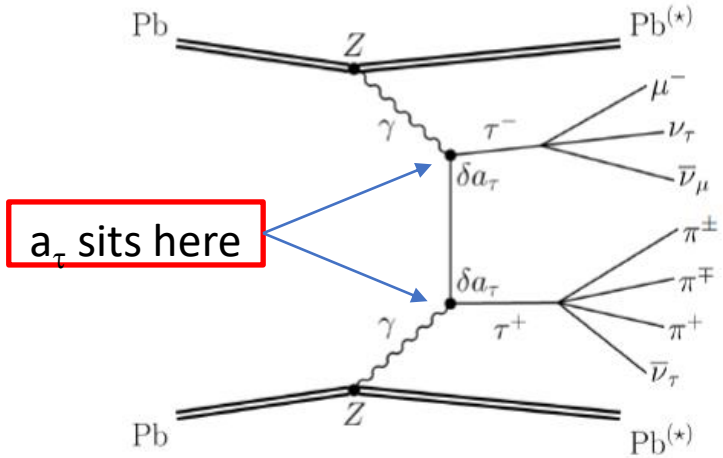
Project

- Remote Project 4: **New physics searches in ultra-peripheral collisions in ALICE**

Ultra Peripheral Collisions (UPC)



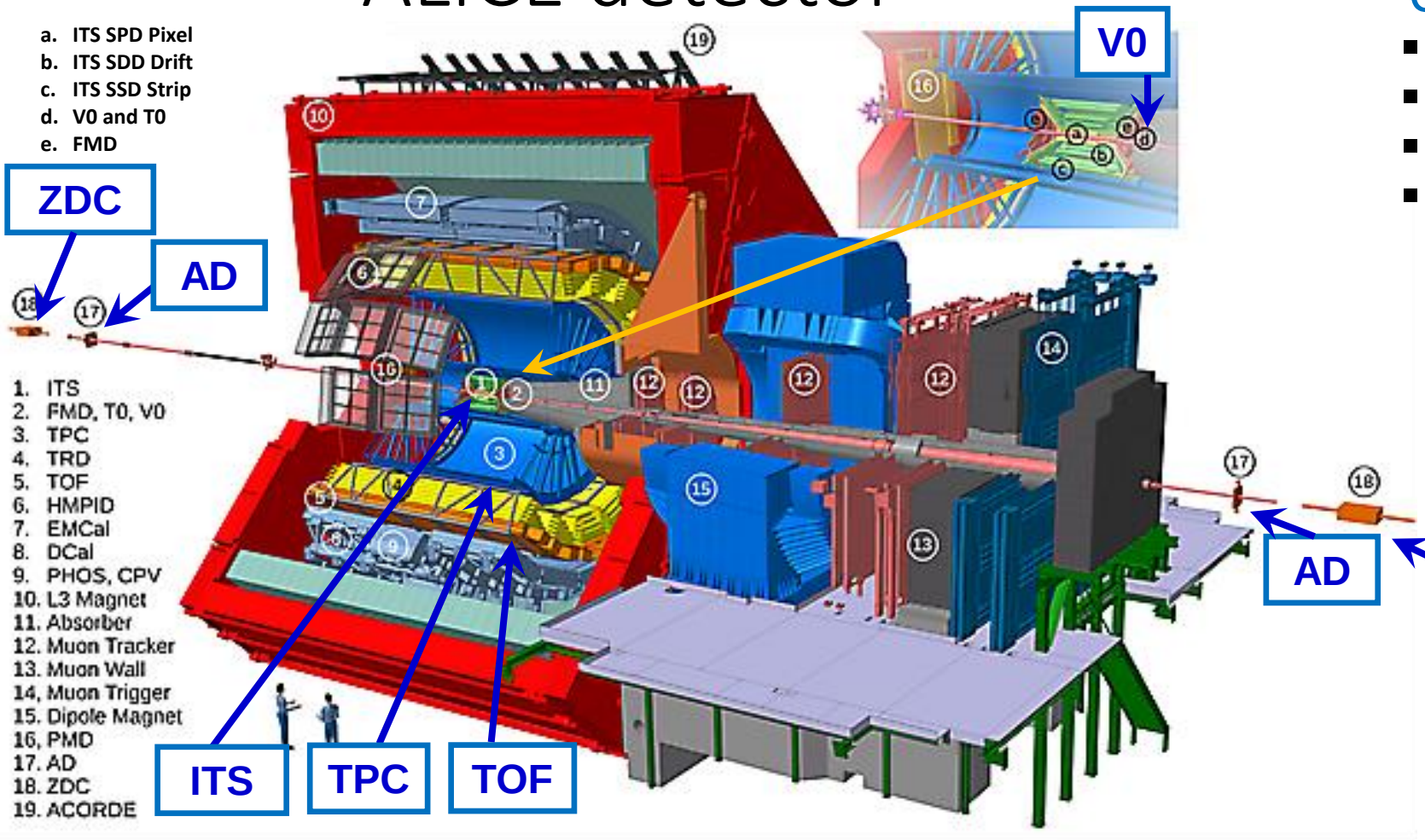


- Impact parameter is larger than twice the radius of nuclei ($b > R_1 + R_2$) in UPC
- Strong interaction does not play a role
- Photon flux scales with Z^2 ($Z_{Pb} = 82$)

τ pair production

- Cross section scales with Z^4
- τ leptons decays quickly and cannot be observed directly
  - Difficult due to at least 1 ν in each τ dacay → at least 2 ν
- Sensitive to anomalous magnetic moment: $a_\ell = (g-2)_\ell/2$
  - a_τ^{exp} = −0.018(17) (DELPHI, EPJC 35 (2004) 159)
  - a_τ^{SM} = 0.00117721(5) (S. Eidelman and M. Passera, Mod. Phys. Lett. A 22, 159 (2007))
- Cross section and tau kinematics sensitive to a_τ
  - L. Beresford and J. Liu, PRD 102 (2020) 113008
  - M. Dyndał et al., PLB 809 (2020) 135682
  - Burmasov et al., arXiv:2203.00990 (2022)

ALICE detector

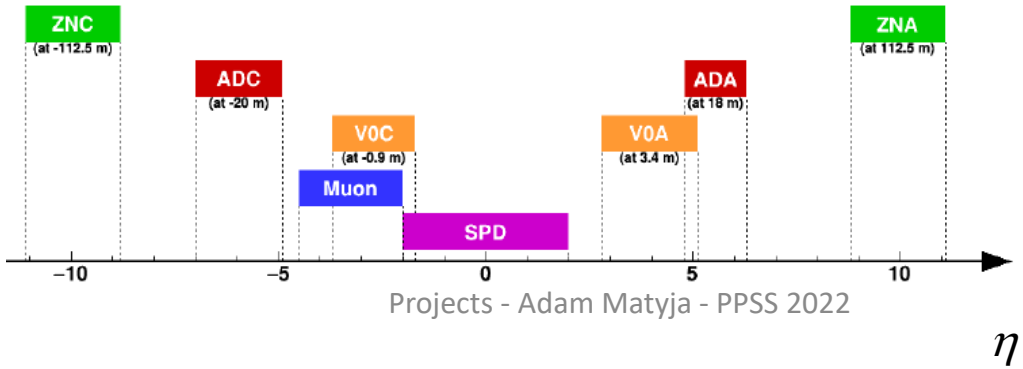


- Central Barrel tracking ($e^{\pm}$, $\mu^{\pm}$, $h^{\pm}$)
  - $|\eta| < 0.9$, $0 < \varphi < 2\pi$
  - ITS - silicon detector
  - TPC - gas drift detector
  - TOF - resistive plate chambers

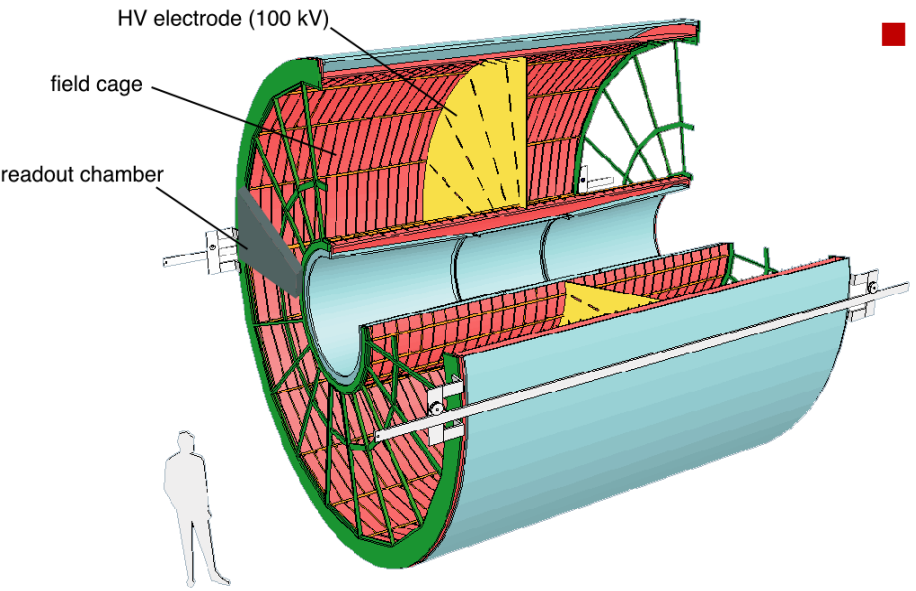
Collaboration:
40 countries
173 institutes
2032 members

- Diffractive detectors
  - AD - scintillator counter
  - V0 - scintillator counter
  - ZDC - sampling calorimeter
- Vertex
  - Pixel
- Trigger
  - SPD, TOF, AD, V0

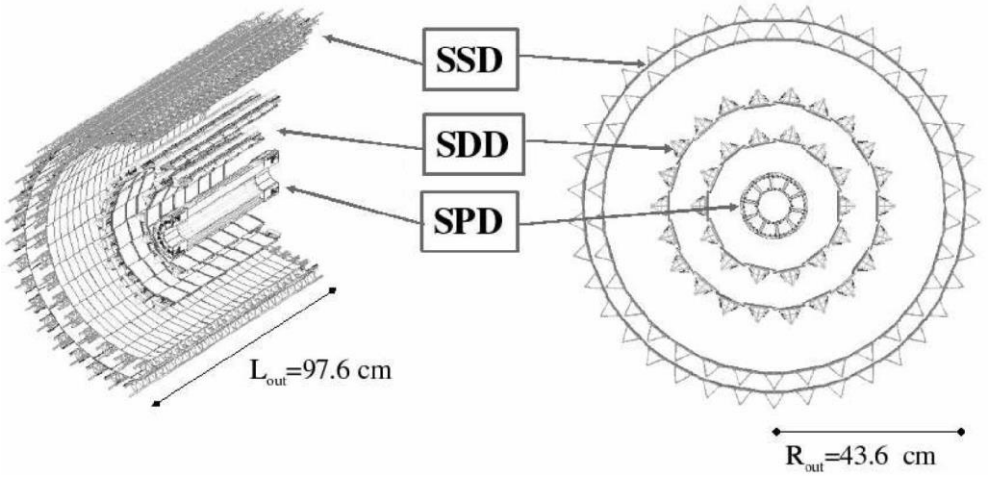
Detector:
Size: $16 \times 16 \times 26$ m^3
Weight: 10000 tons



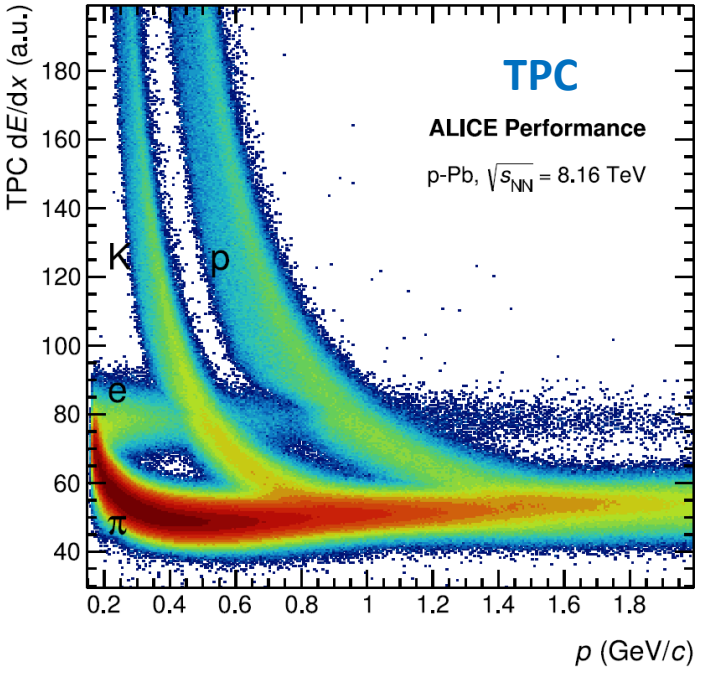
Main tracking detectors: TPC and ITS

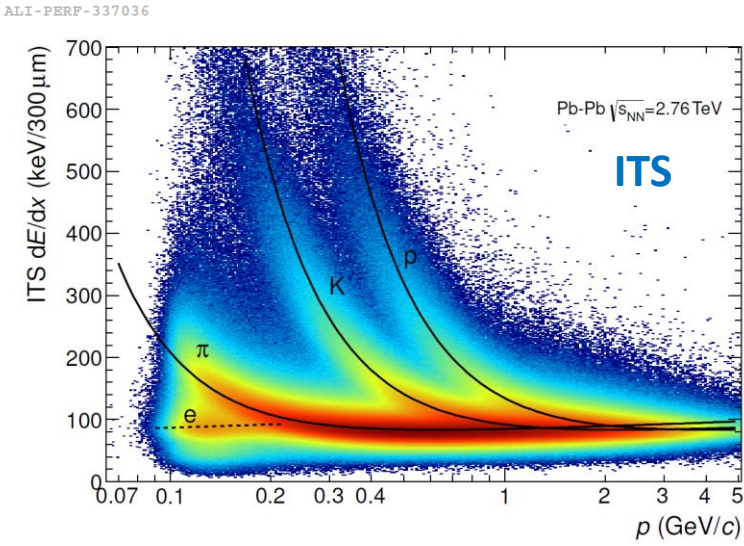


- TPC – Time Projection Chamber:
  - Diameter × Length : 5 m × 5 m
  - Geometry: $\Delta\varphi = 2\pi$, $|\eta|<0.9$
  - Readout chambers: 72
  - Pads (3 types): 557 568
  - Samples in time direction: 1000
  - Central electrode HV: 100 kV
  - Drift field: 400 V/cm
  - Maximum drift time: 92 μs
  - Gas:
    - Active volume: 90 m^3
    - Ne-CO_2-N_2: 85.7% - 9.5% - 4.8%



- ITS – Inner Tracking System
  - Setup
    - 2 pixel layers (SPD)
    - 2 drift layers (SDD)
    - 2 strip layers (SSD)
  - Geometry: $\Delta\varphi = 2\pi$, $|\eta|<0.9$





More about the internship

I. Requirements:

1. Linux/Unix oriented analysis
2. Object oriented (C++) analysis

II. Goals of Project

- Different trigger types in ALICE UPC
- Statistical data analysis in Root
- Prospects for future analyses
- Short report in Latex
- Final presentation

III. Added value:

- Basics of Linux system environment
- Data analysis in the ALICE experiment
- Data processing in ROOT/AliRoot
- Ultra peripheral collisions vs pp or heavy-ion collisions
- Statistical data analysis