PSD12 Poster Awards

- Thank you to all poster presenters both in person and virtual we had almost 100 submissions
- Thank you to all delegates who engaged with the posters.
- Thank you to the LOC and members of the NOC who have been marking the posters this week
- Thank you to the UoB events team for organising and maintain EventAir during our sessions.
- Thank you to **Nature Publishing** who kindly provided the prize fund

3rd place

12th International Conference on
POSITION SENSITIVE DETECTORS

Hosted by
UNIVERSITY OF BIRMINGHAM

Testbeam performance results of bent ALPIDE Monolithic Active Pixel Sensors in view of the ALICE Inner Tracking System 3

Bogdan-Mihail BLIDARU on behalf of the ALICE collaboration

ALICE
GSI
HighR
UNIVERSITÄT HEIDELBERG ZUKUNFT SEIT 1386

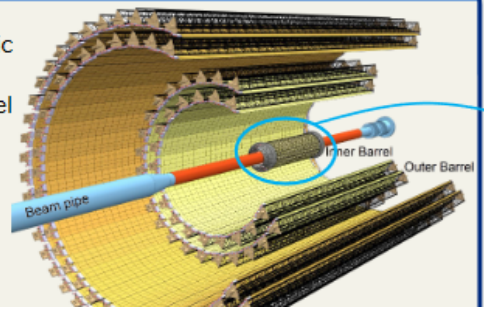
Paving the way towards the golden age of massless detectors

The ALICE experiment at CERN is planning the construction of a novel ultra-light vertex detector during the next LHC LS3 (2025-2027). The new design features highly-integrated ultra-thin (20-40µm) curved sensors, held in place by spacers made of open-cell carbon foam, inserted between layers to define their relative radial position. First encouraging results with bent monolithic pixel sensors show that the chips remain unaffected by the bending in terms of detection efficiency and spatial resolution.

ALICE ITS2

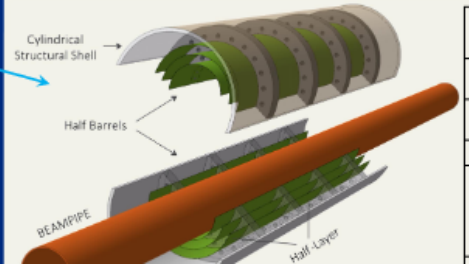
- New tracker entirely based on Monolithic Active Pixel Sensors (MAPS) [1]
- 3 layer Inner Barrel + 4 layer Outer Barrel → 12.5 Gigapixel active area detector

- Custom sensor design → **ALPIDE**
- Low power consumption (40mW/cm^2)
- Excellent detection efficiency (≫99%)
- Spatial resolution ~5µm



ALICE ITS3

- During LS3 (2025-2027), the Inner Barrel of ITS2 will be replaced → ITS3 project [2,3]



Beam pipe inner/outer radius (mm)	16 / 16.5		
Layer parameters	Layer 0	Layer 1	Layer 2
Radial position (mm)	18	24	30
Length of active area (mm)	300		
Pixel sensor dimension (mm^2)	280 × 56.5	280 × 75.5	280 × 94.0

2nd Place

12th International Conference on POSITION SENSITIVE DETECTORS

Hosted by UNIVERSITY OF BIRMINGHAM

Precision Antihydrogen Annihilation Reconstructions using the ALPHA-g Apparatus

UNIVERSITY OF CALGARY

Pooja Woosaree
Department of Physics and Astronomy, University of Calgary, Alberta, Canada
pooja.woosaree@ucalgary.ca

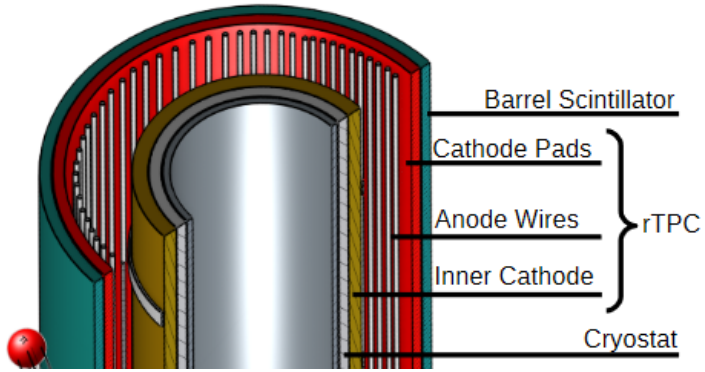
ALPHA

Introduction

Moments after the Big Bang, matter and antimatter should have been created in equal parts [1]. When a matter particle interacts with its antimatter counterpart, they annihilate. Yet matter has prevailed. How then does our world exist? To understand the baryonic assymetry problem, we develop experiments that compare aspects of matter to antimatter, one such aspect being gravity. Does antimatter fall down like matter, or does it fall up?

Antihydrogen

Antihydrogen, the antimatter equivalent of hydrogen, is the simplest anti-atom as it only requires a positron (e^+) and an antiproton ($\bar{p}$) [2]. Imagine trapping antihydrogen, releasing it, and observing which direction it falls. This will test the theory known as the Weak Equivalence Principle (WEP), where the acceleration due to gravity that a body experiences is independent of its stucture or composition [3].



Annihilation Simulations

Using toolkits such as GEANT4 and Garfield++, we can simulate annihilation events within ALPHA-g. GEANT4 is used to simulate particle trajectories through matter, and establish the geometry of the detector [7]. Garfield++ inputs the physics necessary to track events in a gas medium, and calculates electric fields [8]. Together, they can accurately simulate the expected annihilation and cosmic events in ALPHA-g. This is all done in an effort to accurately understand the physics data obtained, as we are

1st Place

12th International Conference on
POSITION SENSITIVE DETECTORS

Hosted by
UNIVERSITY OF BIRMINGHAM

Application of material budget imaging for the design of the ATLAS ITk strip detector.

Jan-Hendrik Arling, Ingrid-Maria Gregor

Motivation.

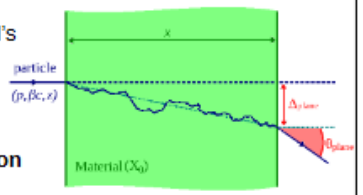
» a charged particle in a material interacts with the nuclei's electric field and can be **deflected** via Coulomb scattering

» for a material traversal, many small-angle scatters sum up to an effective deflection of the incident particle, called **multiple Coulomb scattering**

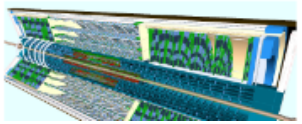
» the deflection angle depends on the material's **density** and **thickness**

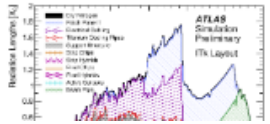
» the **material budget** ε is defined with the **thickness x** and the material specific **radiation length X_0** as

$$\epsilon := \frac{x}{X_0}$$



» minimizing the material budget is important factor in the **design of tracking detectors** → e.g. in the design of the new phase-2 ATLAS Inner Tracker (ITk) [1]



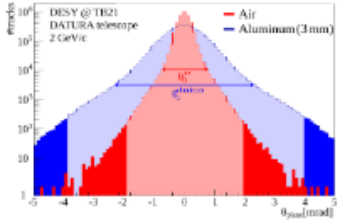


Method.

» the scattering distribution can be described in the core by a **Gaussian function** (central-limit theorem) superposed with **non-Gaussian tails** due to less frequent hard scatters

» the theoretical description of multiple Coulomb scattering by Molière with **Highland formula** as good approximation:

$$\theta_0 = \frac{13.6\,\mathrm{MeV}}{\beta cp} z\sqrt{\epsilon}\,(1 + 0.038\ln(\epsilon))$$



» exploit dependence between the scattering width and the material budget in a **test beam experiment** → use of the **DESY II test beam facility** [2] with electrons (1-6 GeV/c)

» measurement of the **deflected particle tracks** after material traversal with highly sensitive beam telescopes → use of the high resolution **EUDET-type beam telescopes** [3]

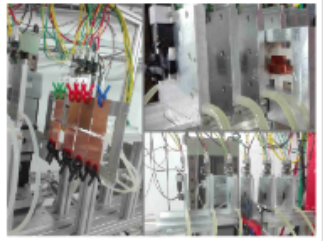
» **track reconstruction** and unbiased measurement of the individual **scattering angles** → use of the **EUTelescope** framework [4] with the **General Broken Lines** track model

Experiment.

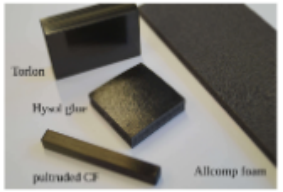
» several **test beam campaigns** on material budget studies were performed at DESY between 2017 and 2020

» systematic testing of **beam and telescope parameters** → **momentum scan** between 1 to 6 GeV/c and variation of **telescope geometry** to optimize angular & spatial resolution

» measurement routine:
→ choose **parameters**
→ measure **air scattering**
→ insert **scatterer (SUT)**



» investigate **homogeneous** samples with **known X_0**
→ Al, Cu, C, Fe, Ni, Sn, Ti, W
→ d = 0.05 to 10.0 mm
→ ε = 3.5·10⁻⁴ to 1.42



» investigate various materials planned for the use in the **local supports** of the ATLAS ITk detector with **unknown X_0**

» **position-resolved** analysis allows **2D imaging** of structures and assemblies