

Rivelatori con misura di tempo fuori dalla drift chamber di IDEA



The IDEA silicon wrapper



~90 m² of silicon detectors (one layer) In principle, very different requirements and environment wrt. vertex detector



er	In the IDEA concept, the drift chamber complemented by an external tracking layer to:
ut = 200 cm	- improve p_T resolution;
n = 35 cm	 provide absolute reference for tracks pol angles;
$= 250 \mathrm{cm}$	- extend tracking coverage at large $ \eta $;
= 450 cm	 possibly provide time stamp to associate tracks in the vertex detector → relax power requirements









Time measurement in the silicon wrapper?

PID in IDEA (π -K, K-p separation) provided by the dE/dx or dN/dx (cluster counting) measurement in the drift chamber

Addition of a time measurements in the silicon wrapper (~2 m from the IP) would complement PID with a TOF system

- Few tens of ps resolution would "fill" the region around 1 GeV/c not covered by dN/dx for $K-\pi$ separation
- Possible improvement of sensitivity in flavour physics studies; new handle for "exotic" signatures







TOF integration in simulation

Studies ongoing on benchmark channel $B_s \rightarrow D_s K$

- In general, as expected, inclusion of TOF nicely extends π -K separation
- In this channel, K and π spectra are hard, well into the dN/dx discrimination region \Rightarrow TOF contribution is marginal
- Not a compelling case for TOF unless dN/dx performance is overestimated
- But little doubt additional timing handle can be used if available in channels with softer spectra, LLP searches,...







AC-LGAD, or Resistive Silicon Detectors

Initial concept: LGAD with AC readout: a resistive layer is needed for charge collection











RSD for the silicon wrapper?

RSD main features:

- position resolution much smaller than channel pitch: $\sigma_{xy} = 3-5\% a$;
- timing resolution close to "standard" LGADs;
- reasonable radiation tolerance

- RSD may be an attractive option for a large area detector far from the IP: - excellent position resolution with reduced number of channels;
- suitable for low-density hit environment;
- no stringent radiation hardness requirements

Cost estimates not straightforward:

- detectors (ATLAS HGTD, CMS ETL);
- readout electronics?

- very likely significant reduction in sensor production costs wrt. current first large area LGAD









Studies in other communities

Recently, other communities working on future e⁺e⁻ colliders have expressed interest in using AC-LGAD-type detectors for an external tracker:

FCC-US (UCSC)

- Chat with proponents in the next days

CEPC

- Presentation at CEPC workshop in Marseille, 8-11/4/2024: https://indico.in2p3.fr/event/20053/contributions/137850
- China currently heavily involved in LGAD productions for HL-LHC; also various AC-LGAD prototype runs





09:00	Rivelatori con misure di tempo dopo la drift chamber	Enrico Rol
	INFN Torino	09:00 - 09
Alternative, dedicated non-silicon	Opzioni per un timing layer dedicato a cristalli	Marco Toliman Luco
timing layer	INFN Torino	09:20 - 09
DCD state of the ort	Sensori RSD: stato delle produzioni e risultati dai test	Federico Siv
RSD state of the art	INFN Torino	09:40 - 10
10:00	Picosecond timing con rivelatori monolitici: stato e prospettive	Lucio Panc
Integration in monolithic structures	INFN Torino	10:00 - 10
Integration in monolithic structures	Tecnologia RSD: stato e prospettive.	Marco Mandur
	INFN Torino	10:20 - 10
Deedeut entions fambularia data atam	Stato e prospettive di IGNITE	Adriano
Readout options for hybrid detectors	INFN Torino	10:40 - 11
11:00		

This session





