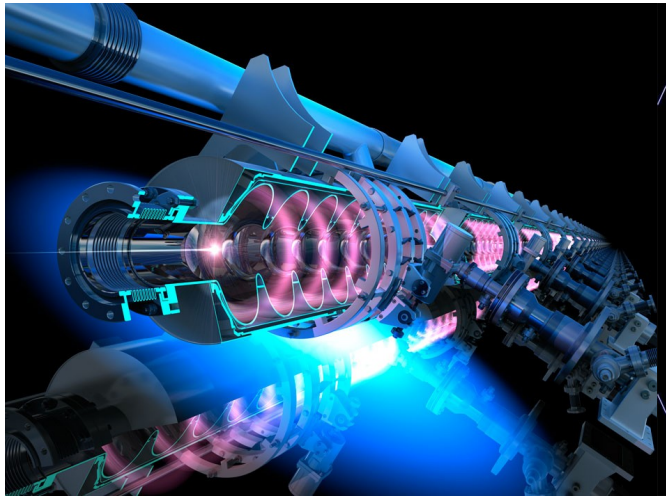
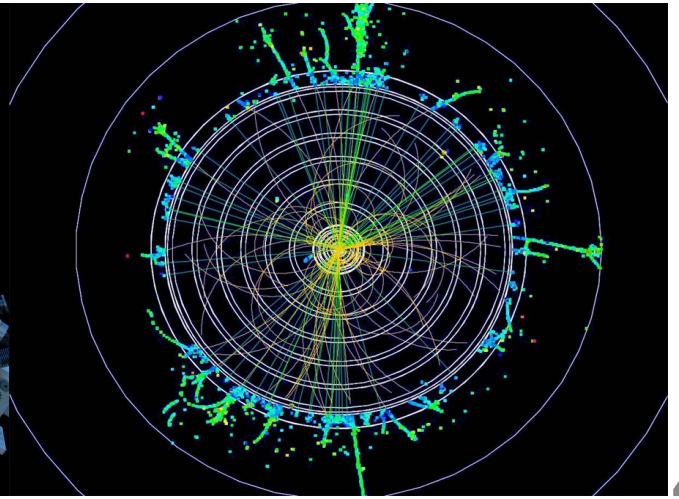
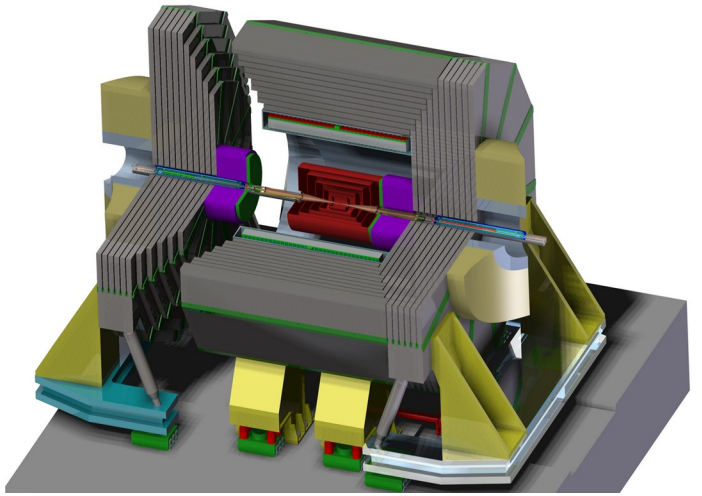
SiD

PiD or not to PiD





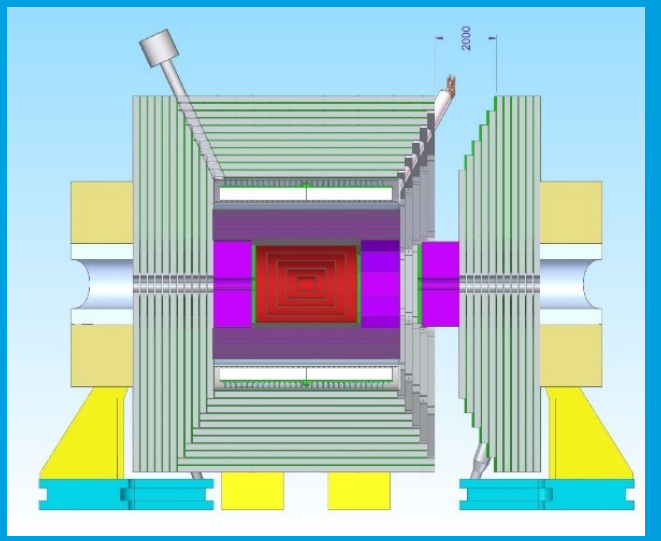


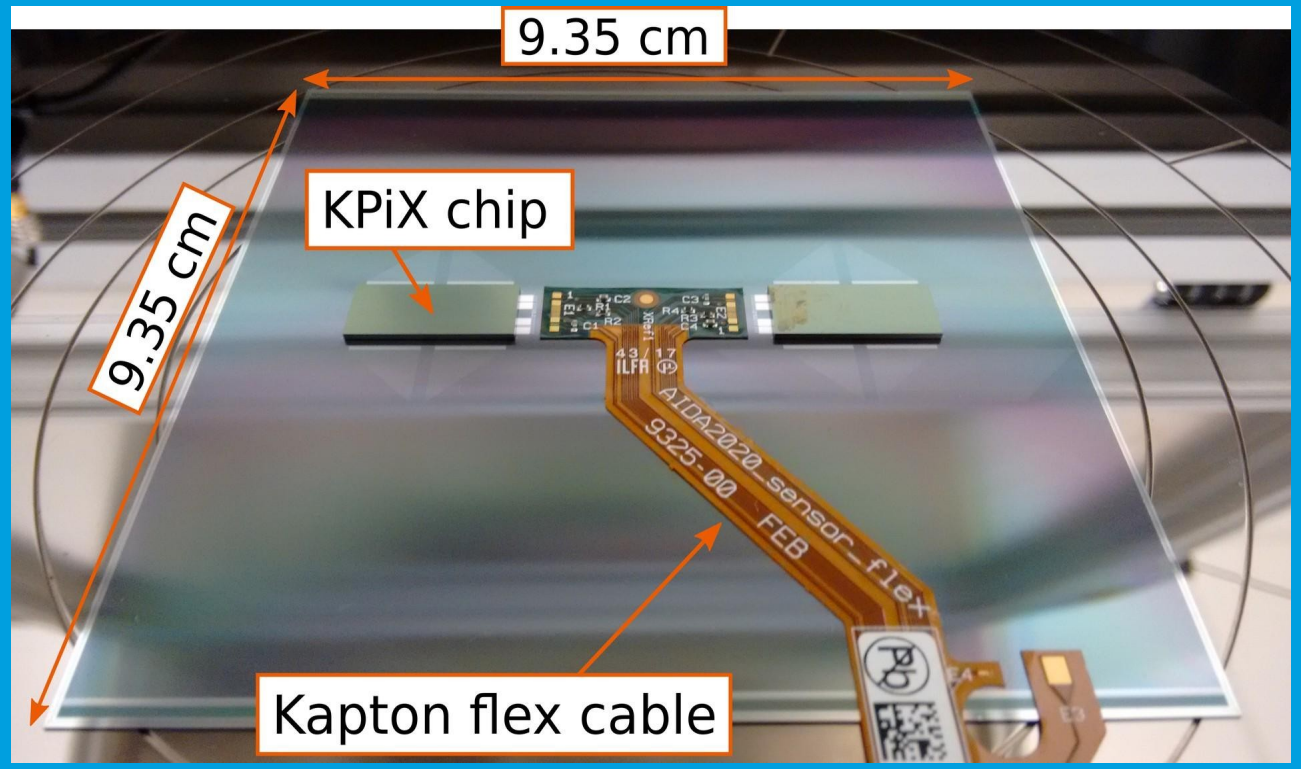
Marcel Stanitzki
LCWS 17/03/2021

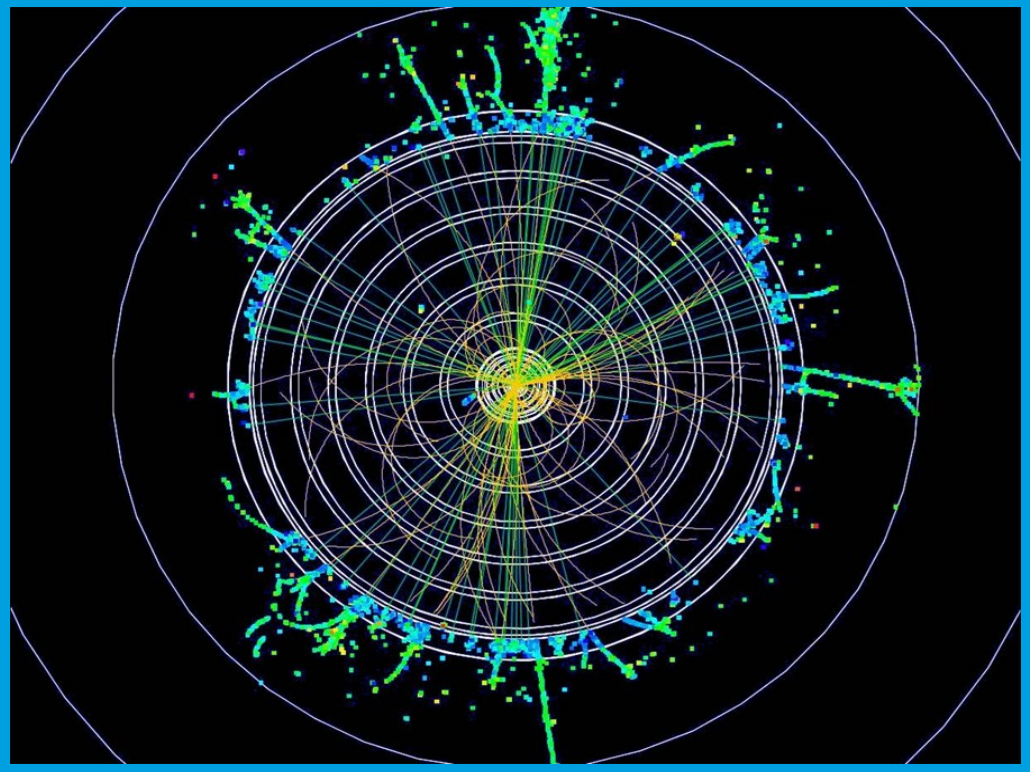
HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

DESY.

SiD Status

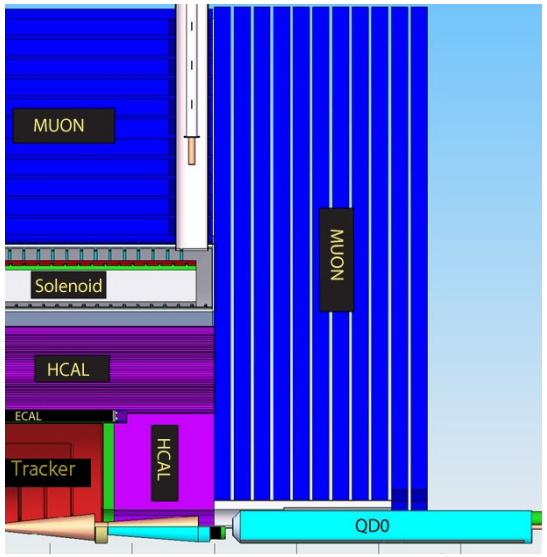



9.35 cm
9.35 cm
KPiX chip
Kapton flex cable
AIDA2020_sensor_flex
9325-00
FEB



SiD – Compact Silicon Detector

The "Post-DBD" Configuration



- Compact high-field design
- All-Silicon tracking
- B Field 5 T, r_{ECAL}=1.25 m
- Robustness against backgrounds
- Integrated Design
- Designed for PFA

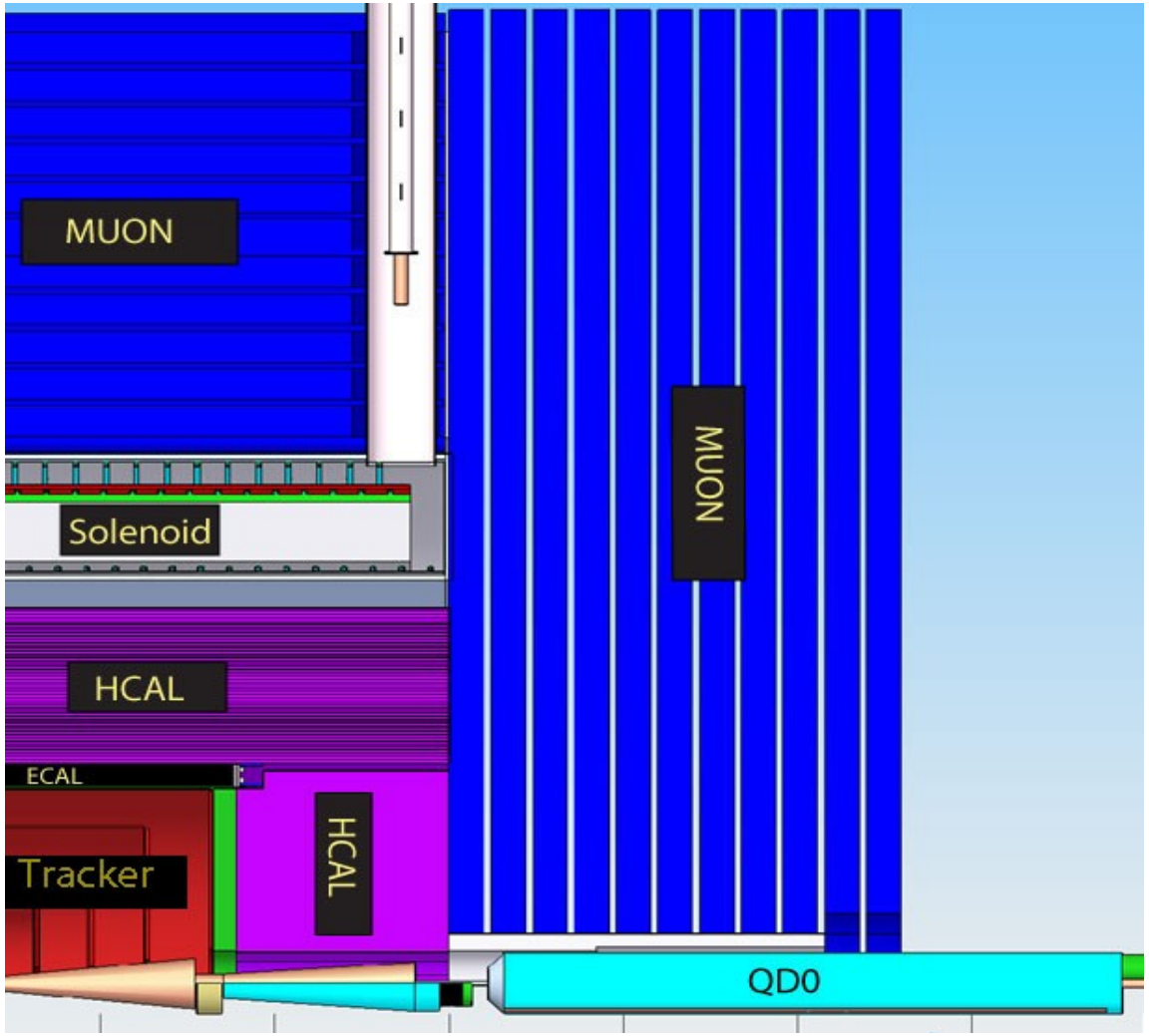
SiD BARREL	Technology	Inner radius	Outer radius		z max
Vertex detector	Silicon pixels	1.4	6.0	±	6.25
Tracker	Silicon strips	21.7	122.1	±	152.2
ECAL	Silicon pixels-W	126.5	140.9	±	176.5
HCAL	Scintillator-Steel	141.7	249.3	±	301.8
Solenoid	5 Tesla	259.1	339.2	±	298.3
Flux return	Scintillator/steel	340.2	604.2	±	303.3

SiD ENDCAP	Technology	Inner z	Outer z	Outer radius
Vertex detector	Silicon pixels	7.3	83.4	16.6
Tracker	Silicon strips	77.0	164.3	125.5
ECAL	Silicon pixel-W	165.7	180.0	125.0
HCAL	Scintillator-Steel	180.5	302.8	140.2
Flux return	Scintillator/steel	303.3	567.3	604.2
LumiCal	Silicon-W	155.7	170.0	20.0
BeamCal	Semiconductor-W	277.5	300.7	13.5

SiD – Baseline choices

Baseline Technologies

- The DBD was finalized 2012/13
  - Clearly technology has made huge progress since then
  - HL-LHC as technology driver
- But overall assessment
  - Basic concept of a compact all-silicon detector is sound
- Decisions already taken
  - Move from DHCAL (RPC-based) to SiPM-AHCAL
- A lot of obvious points to take advantage of new technology
- State of conceptual design studies
  - To take it further many studies will now require effort & engineering



Timing Detectors

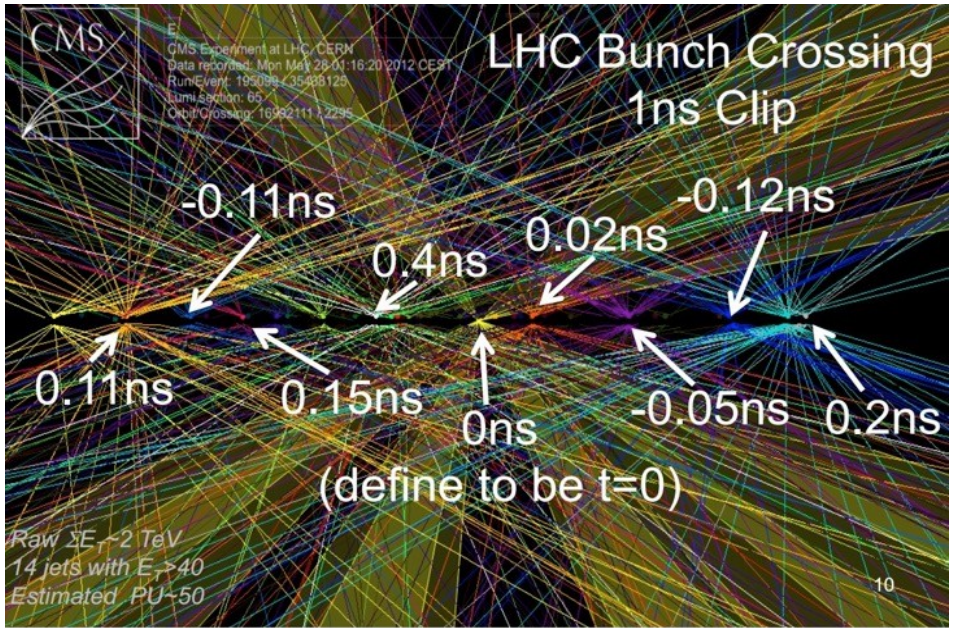
The next "hot thing?

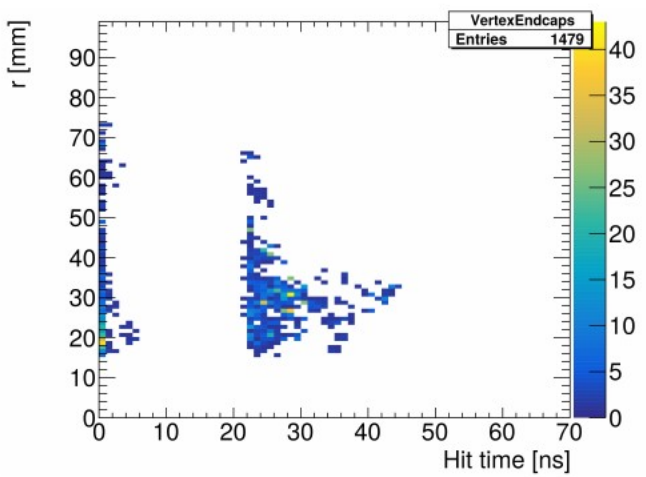
Integrated time-stamping in the trackers

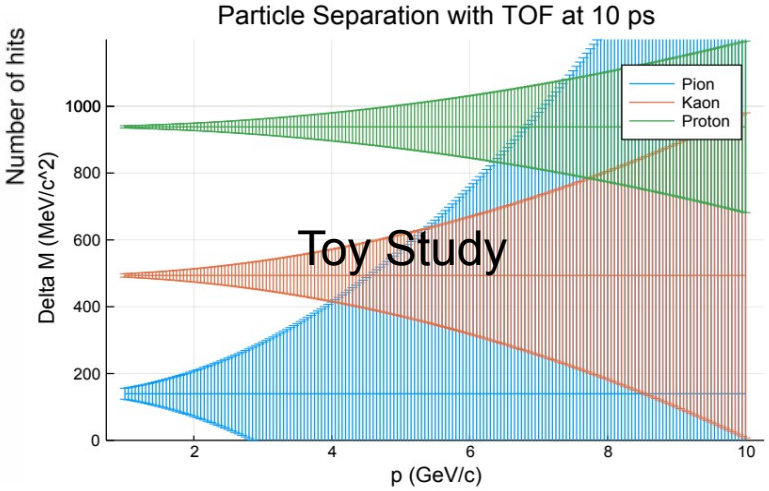
- e.g. Background rejection in the Vertex Detector
- Requires ns-level resolution
- This is doable – already today

Dedicated Timing Layers

- Full 4D Tracking – in the ILC environment
  - Nothing like the LHC
- Time-of-Flight systems for PiD
  - 10 ps resolution as a goal to be competitive
- What kind of physics does this enable?
  - For a detector designed for 250-1000 GeV
- Lots of things to study and opportunities to contribute

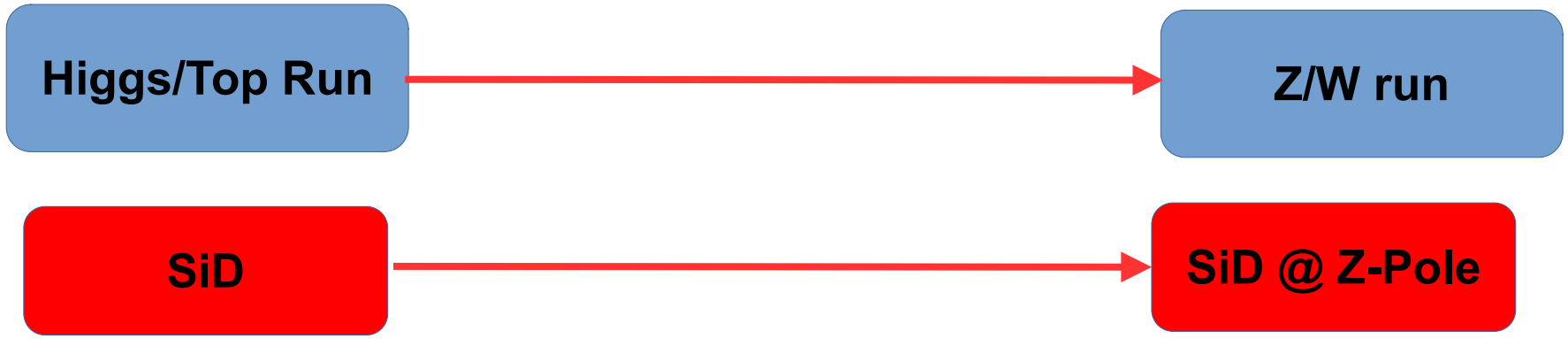






PiD and SiD

Fuel for discussion



Physics case

- What key analyses benefit & Which analyses would suffer

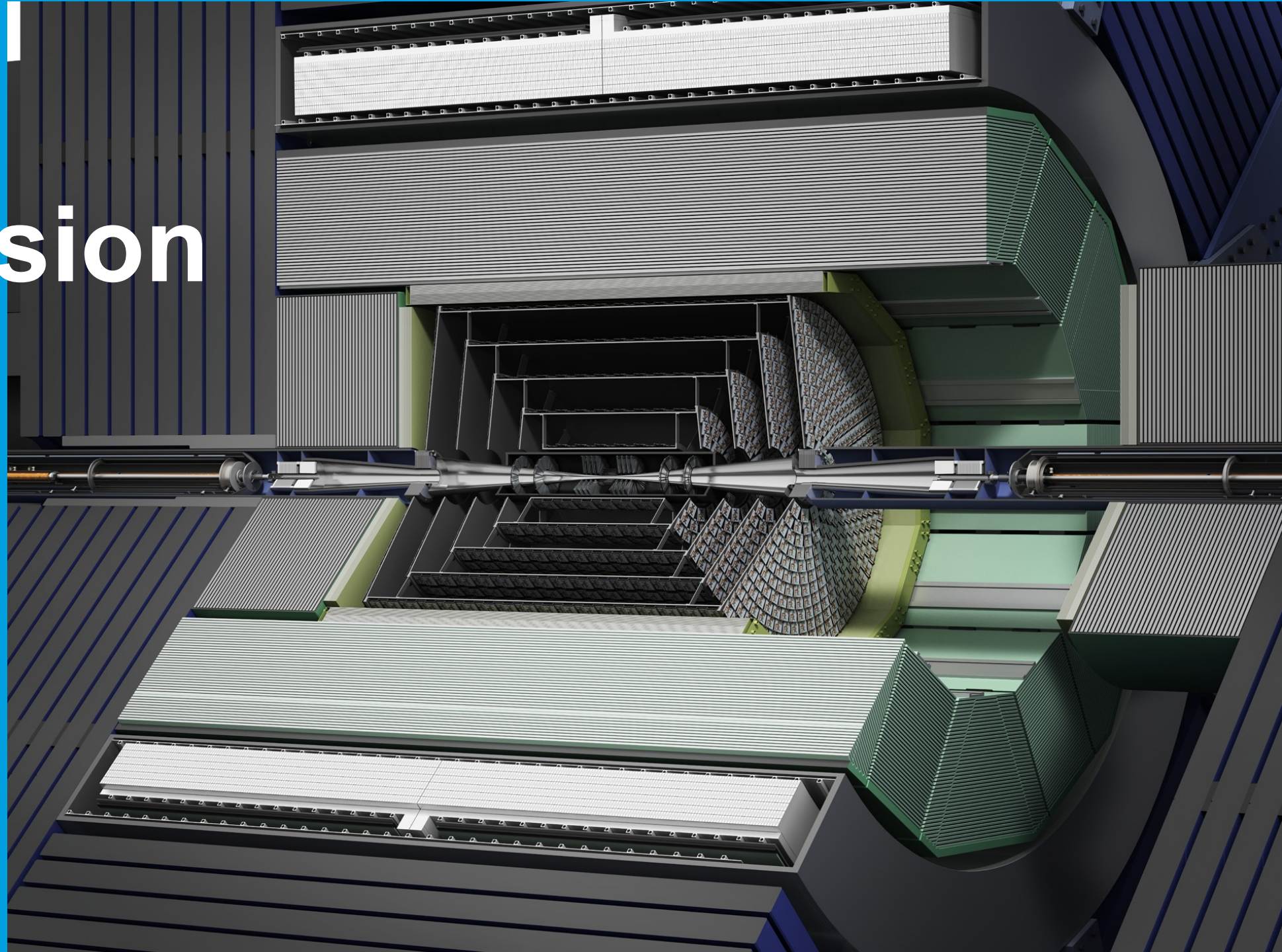
Low Impact PiD

- TOF system but only coverage up to 5 GeV
- dE/dx in silicon ?

High Impact PiD

- The only way to do π/K up to 30 GeV is a RICH
- Where would one put in and what would we need to give up

Discussion



Thank you