

Discussion Input from DESY

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07.05.204 - Vertex Detector Discussion

HELMHOLTZ



Recap Requirements

Lepton collider

- Challenging requirements for future lepton collider
 - Low mass → low power and gas cooling
 - Good timing → fast shaping → higher power
 - Point resolution → small pixels/charge sharing → high number of channels → higher power
- **Can we have it all in one?**

	HL-LHC	Lepton collider
x/X_0	10 %	<1 %
Time resolution	25 ns	< ns
Pitch	50 μm	< 25 μm
Point resolution	15 μm	3 μm
$n_{\text{eq}} / \text{cm}^2$	10^{16}	10^{11}

Where do we stand

Summary from yesterday and a bit beyond

Simulations

AllPix2 + TCAD toolkit

- Optimization
- Validated with data
- still a few open questions
- Transient studies
- N-Gap seems to be required for us at the moment

Design

CSA+Krummenacher

- Fully functional
- Relatively large
- Fast
- ~35e noise

H2M

- Multi purpose chip
- digital-on-top
- Fully functional
- ~70e noise

Testing

DAQ

- Caribou
- ### Laboratory
- Fe55
 - Signal injection
 - TCT

→ X-ray (Uni HH)

Testbeam

- 1-6 GeV e-
- EUDAQ2 integration
- Corry reco
- APTS, MLR1 & H2M

Integration

Building large detectors

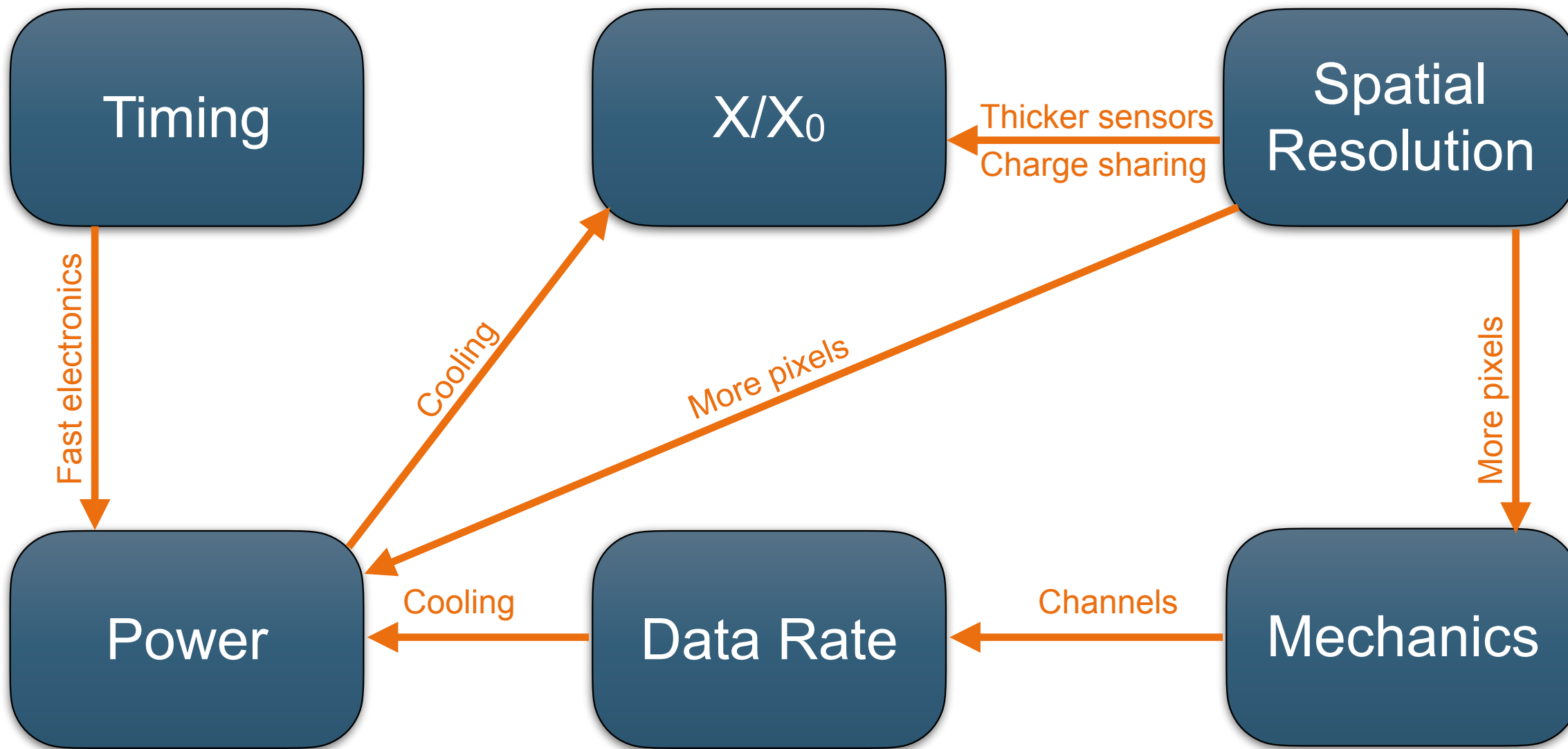
- Huge cleanrooms
- ATLAS/CMS endcaps
- Light mechanics
- Two phase CO₂ cooling

Future vertex detectors

- Light mechanics
- Microchannel cooling?
- Silicon photonics
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Challenges

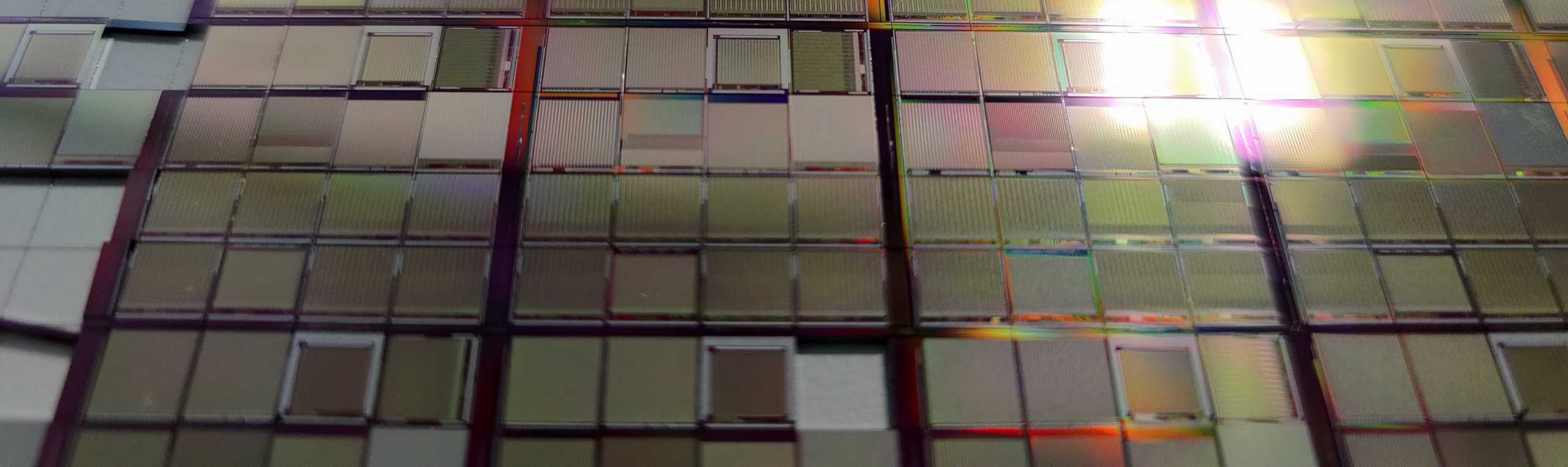
Simplified overview



The future?

Where can we go and what could we sacrifice - not conclusive, should trigger discussions

- (Single) high power plane for timing
 - One close to vertex? → bad in terms of material, good in terms of timing
 - Can we afford more?
- Need for stitching? Overlap of ca 25-40um thick sensor still okay? → simulations
- Variable pixel pitch → interconnecting pixels to reduce data output in outer layers?
- Light mechanics, Kapton support, He/Air cooling folds? micro channel cooling in MAPS bulk material?
- Silicon photonics for readout?
- What could be the mid-term application of these developments?
- We would like to contribute on all topics from design to construction - but need to secure funding for it.



Contact

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