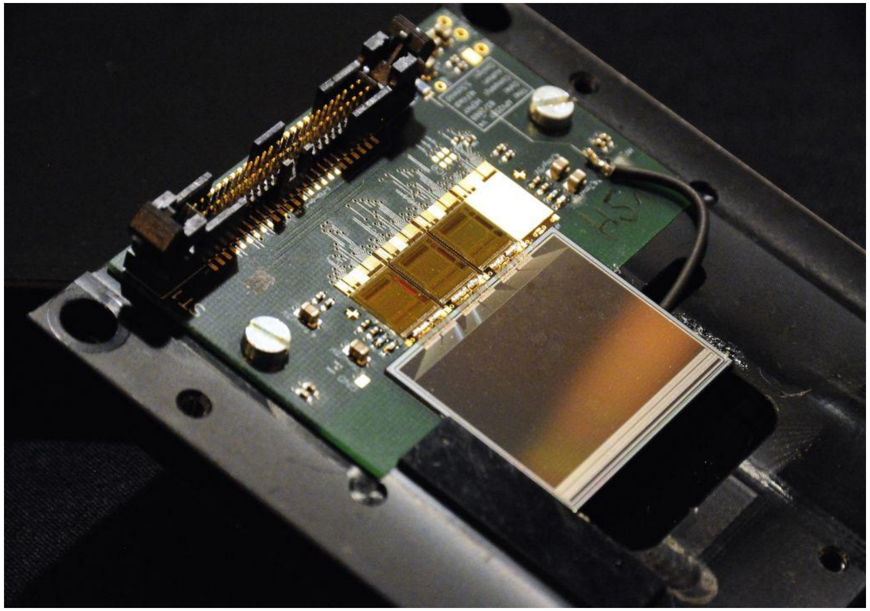


WP9.4 Status

Thomas Bergauer (HEPHY Vienna)

AIDA WP9.4 meeting

7. Feb 2012

WP9.4 Silicon Tracking

- Creation of a **multi-layer micro-strip detector coverage for the calorimeter infrastructure of Task 9.5** to provide a precise entry point of charged particle
  - The calorimeter infrastructure of task 9.5 will be preceded by **several layers** of Silicon micro-strip detectors to provide a precise entry point **over a large area**.

WP9.4 Silicon Tracking

- **Finely segmented** and **thin** Silicon micro-strip detectors will be **designed** and **procured** by the participating institutes [OEAW; IPASCR (CUNI)].
- In the baseline design the system will be read out by **electronics developed for the LHC experiments** with established performance. [CSIC (IFCA, IFIC, UB)]
- For optimal read-out of **long ladders** a **custom IC** with longer shaping time **will be developed** and validated.
- Part of the ladders will be equipped with realistic services, including **cooling**, **powering**, **alignment**, structural and environmental **monitoring**.

Current Status

- AIDA is already in Month 13 since its start in February 2011
- Deadlines:
  - Interim Activity Report (due 20th Feb) **done.**
  - Milestone report documenting deliverable design (due Month 13) **TODO!**

Requirements from Calorimetry

- **What are the expected trigger rates you expect?** To be safe, assume that we would record events at a maxiumum speed of few kHz maximum, although **typically we are below a kHz**. To saturate DAQ bandwidth, the raw trigger rate could be higher, say 20 kHz.

- **What should be the area to cover with silicon? 10x10 cm is rather easy, but anything more makes the project much more expensive.** We think that **10x10 cm2 is just sufficient,** a bit more (12x12 or 15x15) would give us some safety margin.

- **How precise should the entry points in the calorimeter be defined, or, in other words, what is the (realistic) resolution you require for that?** A sub-millimeter accuracy would be by far sufficient. For most studies drift chambers would do, actually. However, for detailed uniformity checks more precision would be desirable, and **0.1 mm would cover it all**.

- **Concerning DAQ integration and data flow: We will provide a TLU style online DAQ synchronization with event numbers stored into our local data stream, which will be converted to LCIO afterwards. Do you also accept TLU input in your DAQ?** We foresee to work with the TLU, but we have not exercised it yet, and not all preparations are finished. However, as a working assumption it is OK. Vincent can give more details.

Kick-off meeting Status

Baseline Deliverable						Advanced Deliverable					
Two orthogonal layers of u-strips					Provide precise entry point to calorimeter	Ultra-light strip layer of thin sensors (230 um)					Demonstrator of ILD silicon tracker
HPK SiLC sensors ?	AVP25 based hybrid	Conventional mechanics	Integration with CaloDAQ	Offline software	Deliverable 2nd QT 2014	Integrated PA or 2D-Poly silicon or short strip sensors.	APV25 based hybrid	Light mechanics with embedded Fiber Optic Sensors	Integration with caloDAQ	Offline Software	No deadline

SENSORS

Sensors: Baseline Options

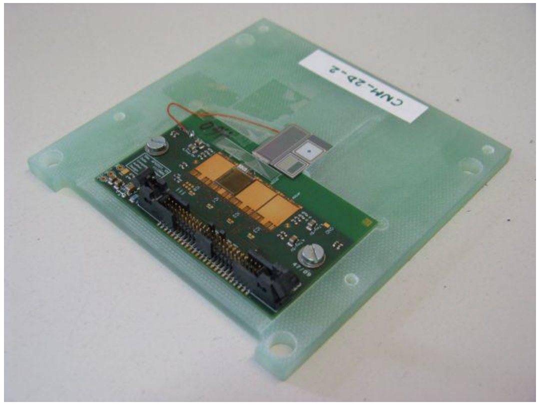
- **SiLC Sensors from HPK**: 6+4 seems to be available at LPNHE Paris (unknown functionality)
- Need to be removed from modules/hybrids and tested afterwards

Inventaire des capteurs Si dans la cage carbone

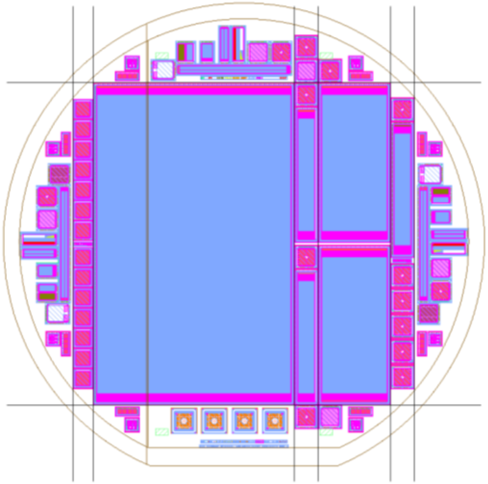
capteur			
marque	pas de lecture	remarque	carte électronique
HPK	100µ		8VA1
HPK	100µ		8VA1
HPK	100µ		
HPK	50µ	transparent	4VA1
HPK	50µ	transparent	4VA1
HPK	50µ		
HPK	50µ	transparent	4VA1
HPK	100µ		8VA1
HPK	100µ		
HPK	100µ		8VA1

Sensors: Advanced Options

- 2d-sensors from ICFA/CNM:
  - Initial results are very encouraging
  - ICFA has successfully validated a SPICE sensor simulation against the prototype sensors. Will use this simulation to carry out further prototype's optimization

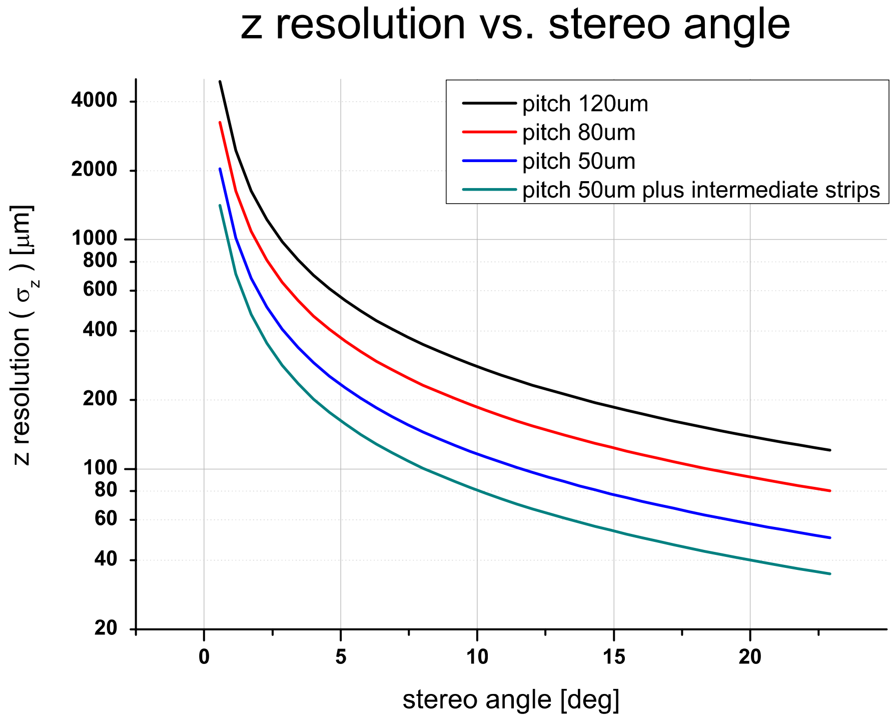


- ON Semi production with IPASCR Prague
  - Sample layout sent to Vaclav Vrba to validate with company
  - "Test the fabrication of large reticles on the present production line by the application of stitching technique"



Sensor Pitch and Stereo Angle

- Requirement in resolution ~100 micron
- This equals to 350 micron pitch on sensor (assuming digital readout) in one coordinate
- Stereo Module configuration: very bad resolution with 350 micron pitch and reasonable stereo angle along strips
- Possible scenarios:
  - Use narrow pitch and ~5deg stereo angle
  - Use wide (~350µm) pitch but with orthogonal strips



ROC AND DAQ

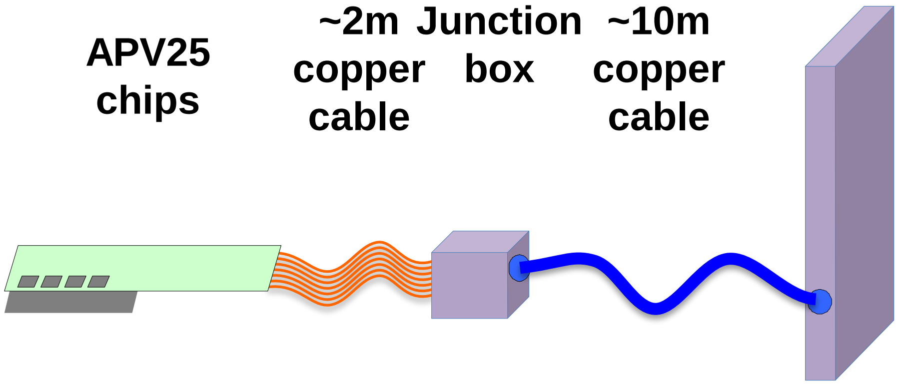
Read-out chip

- **Baseline:** APV25 readout chip

- **Advanced deliverable:** New chip by Barcelona

APV25-based readout systems

- Actually 3 systems for APV25 available
    - APVDAQ system (available in Santander and Vienna)
    - Current Belle-II system (Vienna only)
    - Future Belle-II System (Vienna only starting from 2013)
  - – Details on next slide



Trigger rates for APV-based systems

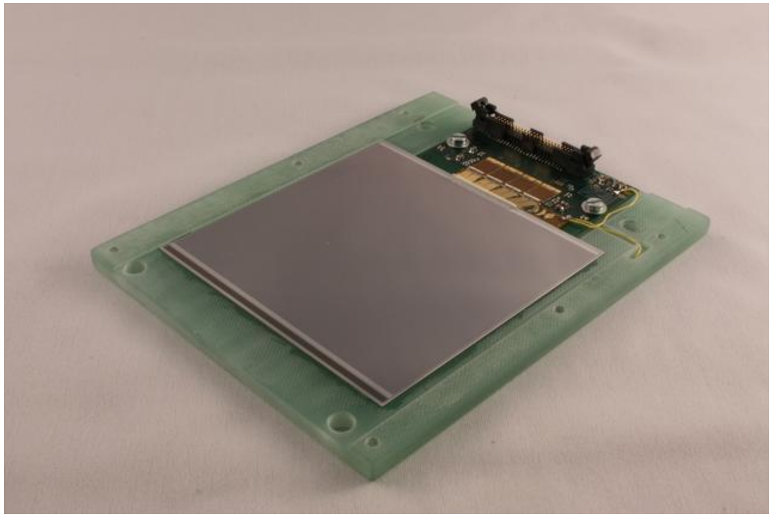
- APVDAQ:
  - Number of APVs: 4 chips/boards
  - Rate: 1kHz using 1 card (scales with #boards)
  - Advantage: many boards available; more availability for AIDA

- Current Belle-System:
  - 16 APVs/board
  - Rate: 3kHz (Zero Suppressed), 400Hz (raw with 8APVs)

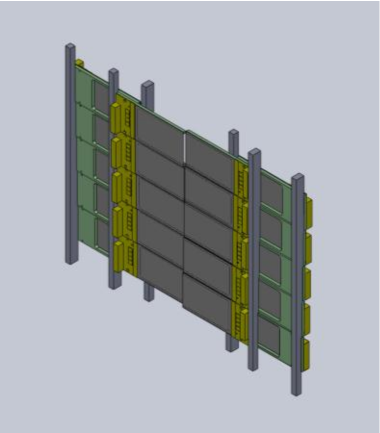
- Future Belle System (currently under development in Vienna):
  - 48APVs/board
  - Rates up to 20kHz
  - Disadvantage: production system for Belle-II; limited availability (i.e. only for one dedicated beam test)

MECHANICS

Mechanics: Baseline option



- Simple mechanics made of plastic frame
  - similar to test-beam modules
  - second sensor underneath for stereo
- Stacked arrangement?
  - 2 sensors next to each other (staggered)
  - 2 sensors orthogonal
  - Trigger rates getting down when using APVDAQ system



Mechanics: Advanced Options

- Design of a self-monitoring supporting structure at IFCA
  - made of Carbon-Fiber-Reinforced Polymer (CFRP) composite,
  - equipped with embedded Fiber Bragg Gratings (FBG) sensors for temperature and deformation monitoring.
- Status:
  - FEA Element mechanical simulation performed of CFRP support
  - Next steps: Production of Carbon-Fiber-Reinforced Polymer demonstrator equipped with FBG sensors

SOFTWARE

Software

- Integration with CaloDAQ
  - TLU-style synchronization of events
  - Save data to two different data streams

- Offline software
  - HAT software (HEPHY Analysis Toolkit) currently being developed in Vienna
    - Part of it also becomes online part of TuxDAQ
  - LCIO conversion to be used to have common data format among calorimetry and silicon

Schedule for today

14:00	Status WP9.4
14:20	Status chip development in UB
14:40	Status Vienna
15:00	Status CUNI and IPASCR
15:20	Status mechanics & environmental sensors
15:40	Discussion on Milestone

- Discussion on Milestone report:
  - Basically a summary of the conclusion of this session as few-pages paper