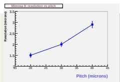

VTX Design Strategy for 2009–2012

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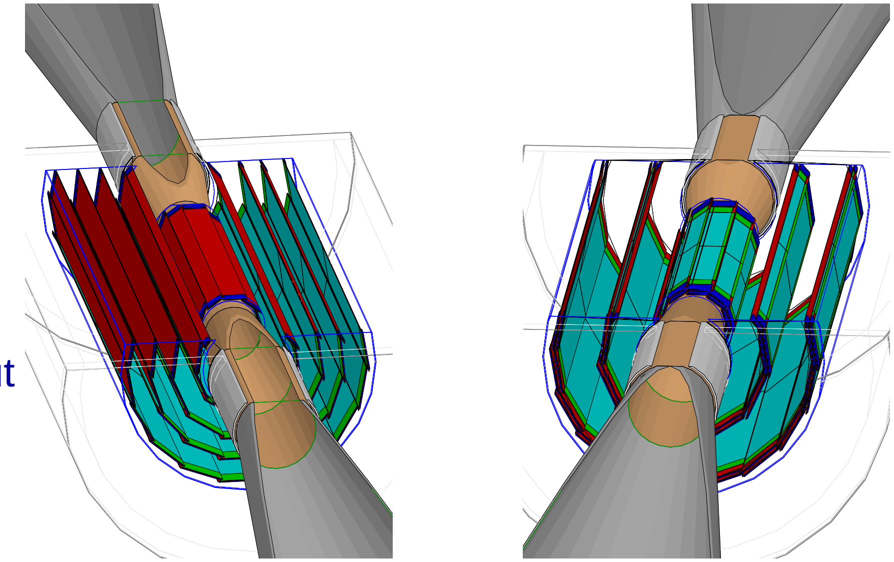
on behalf of IPHC/Strasbourg, DESY-Hamburg, Univ. Oxford, Univ. Bristol, ...

OUTLINE

- **Questions addressed :**
  - ⋇ *How shall the high precision of the pixel sensors be preserved while integrating them in VTX ?*
  - ⋇ *How will the pixel sensor R&D continue ?*
  - ⋇ *How to refine the VTX design w.r.t. physics requirements ?*
- **Framework**
- **Expected Contributions**



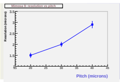
- **Sensor requirements defined w.r.t. ILD VTX geometries**
  - ✳ 2 alternative geometries :
    - ◇ 5 single-sided layers
    - ◇ 3 double-sided layers (mini-vectors)
  - ✳ continuous (power cycled) or delayed (low power) read-out

- **Prominent specifications :**
  - ✳ time stamping target values :

    SL1/SL2 /SL3 /SL4 /SL5 — DL1 / DL2 / DL3
    - ◇ single-sided : 25 / 50 / 100 / 100 / 100 μs
    - ◇ double-sided : 25–25 / 100–100 / 100–100 μs
  - ✳ $\sigma_{sp} \lesssim 3\ \mu m$
  - ✳ full ladder material budget in sensitive area ($\lesssim 50\ \mu m$ thin sensors) :
    - ◇ single-sided : < 0.2 % X_0
    - ◇ double-sided : ~ 0.2 % X_0
  - ✳ $P_{diss} \lesssim$ 0.1–1 W/cm^2 $\times$ 1/50 duty cycle (5, 1 ms long, bunch trains/s)

    Alternative: low P_{diss} during train, followed by very slow ($\equiv$ low power) read-out

▷▷▷ **R&D on swift, high resolution, sensors and ultra-light (double-sided) ladders**



Questions Addressed

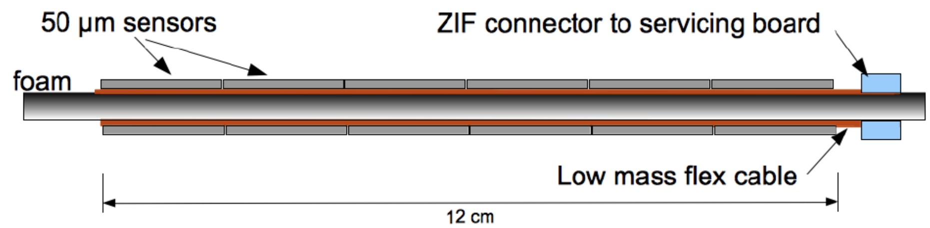
- **Question 1: How to preserve the high precision of pixel sensors while integrating them in VTX ?**
  - *material budget of ladder versus stability against air flow and power cycling*
  - *alignment : hardware and software tools*
  - *track linking towards SIT & FTD*
  - *added value of double-sided ladders w.r.t. single-sided ones*

- **Question 2 : How will the pixel sensor R&D continue ?**
  - *validate* $\sim$ *completely (real scale, fast, thin, accurate, ...)* $\geq$ *1 technology by 2012 :*
    2D CMOS sensors, ISIS, FPCCD, etc.
  - *consolidate technologies with highest potential ("2nd generation" sensors): 3D sensors, etc.*
  - *follow the potential emergence of technological improvements ...*

- **Question 3 : How to refine the VTX design w.r.t. physics requirements ?**
  - *incorporate results of questions 1 and 2 in the design / concept*
    - $\triangleright$ *is* $\sigma_{sp} \sim 3\ \mu m$ *good enough once system integration limitations are accounted for ?*
  - *refine physics simulations and final state reconstruction :*
    - $\triangleright$ *flavour tagging accounting for VTX integration timeS vs BG, 2-sided ladders, ...*

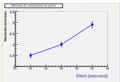
Framework

- **PLUME collaboration:**
  - *R&D on 2-sided ladder concept (MIMOSA. ISIS. ...)*
  - *total material budget $\sim$ 0.2–0.3 % X_0*
  - *investigate double-sided ladder feasibility and performances*



- **Hadron Physics 2 (accepted FP7 project):**
  - *WP-26: development of sensors embedded in ultra-thin polymerised film*
  - *goal: $<$ 0.1 % X_0 for sensors $\oplus$ flex $\oplus$ film*
  - $\Rrightarrow$ *may match cylindrical surfaces* $\Rrightarrow$ *mounted on beam pipe ??????*

- **AIDA (FP7 proposal):**
  - *investigate ladder alignment strategy*
  - *linking to SIT & FTD (related to double-sided ladder)*
  - *investigate ladder properties (power cycling, cooling, etc.)*
  - *assess added value of double-sided ladders w.r.t. single-sided ones*



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Expected Contributions

- **Laboratories involved:**
  - *PLUME: IPHC-Strasbourg, Univ. Oxford, Univ. Bristol, DESY, Univ. Warsaw*
  - *Sensor R&D: IPHC (+ IRFU/Saclay ?), Oxford, Japan ????, Bergamo ?, etc.*
  - *HP-2: IPHC (partnership with IKF/Frankfurt for CBM expt. at FAIR/GSI)*
  - *AIDA (prelim.): IPHC, Oxford, Bristol, DESY, Univ. Geneva, Warsaw*

- **Current status:**
  - *Mainly hardware expertise available*
  - *Software tasks coverage seems critical*
  - *Funding uncertain (may come ?)*