

# Vertex Detector related Activities : Status & Plans

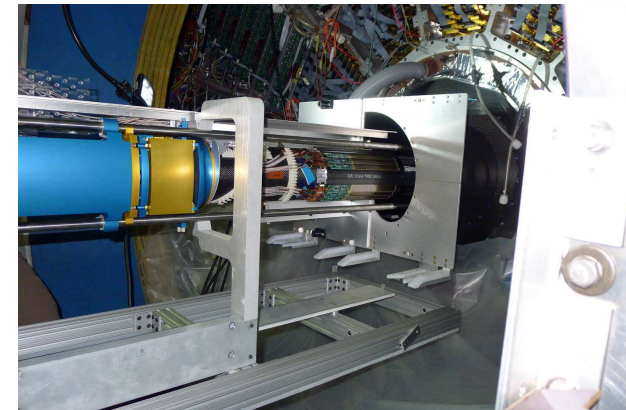
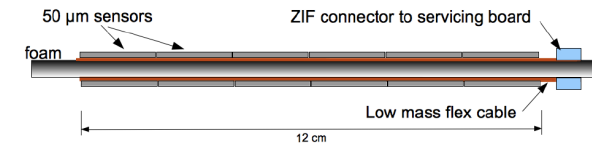
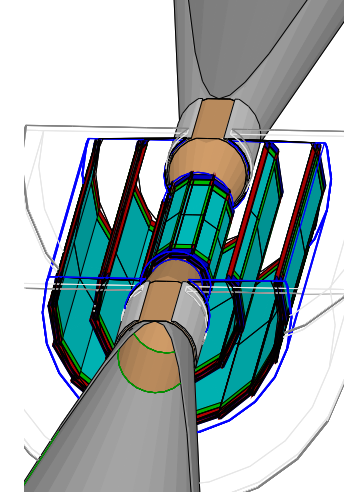
M.Winter / 28th of Novembre 2013

## Outline

- *R&D areas & status*
- *On-going activities & 2014 plans*
- *Objectives & plans beyond 2014*

# Achievements of the R&D

- AREAS OF ACTIVITY (IPHC) :
  - \* Development of CMOS pixel sensors (CPS), primarily for the ILD concept
  - \* Development of ultra-light pixelated ladders
  - \* Development of a VXD concept optimised to best exploit CPS potential
- CONTEXT & PARTERSHIPS :
  - \* R&D for ILC pursued simultaneously for several other applications
  - \* Numerous (mainly downstream) partners : some for ILC (DESY, Bristol) but most outside ILC :
    - subatomic phys. : EU projects (EUDET, HP-2, AIDA),  
HI phys. (STAR, CBM, ALICE, NA-61),  $e^+e^-$  phys. (BES-3)
    - other domains : hadrontherapy, bio-medical imaging, etc.
- + REALISATIONS :
  - \* CPS design based on rolling shutter read-out suited to  $\sqrt{s} \lesssim 500$  GeV
  - \* Double-sided ladders (PLUME project) featuring 0.6 %  $X_0$
  - \* VXD concept using 3 complementary CPS designs to comply with  $\sigma_{sp}$ ,  $t_{r.o.}$  & P requirements up to  $\sqrt{s} \sim 500$  GeV



# On-going Activities & 2014 Plans

- Since 2011 : devt of CPS in a more advanced ( $0.18 \mu m$ ) CMOS process for ALICE-ITS & CBM-MVD

- ✧ process added value :  $\sim 10 - 100$  times faster and rad-harder combined with 2-3 times lower power

- $\hookrightarrow$  perspectives for ILC-VXD : suited to 1 TeV running and to standalone Si tracking

- ✧ 2 alternative sensors under devt :

- MISTRAL ( $30 \mu s, < 200 \text{ mW/cm}^2$ )

- ASTRAL ( $\lesssim 20 \mu s, < 100 \text{ mW/cm}^2$ )

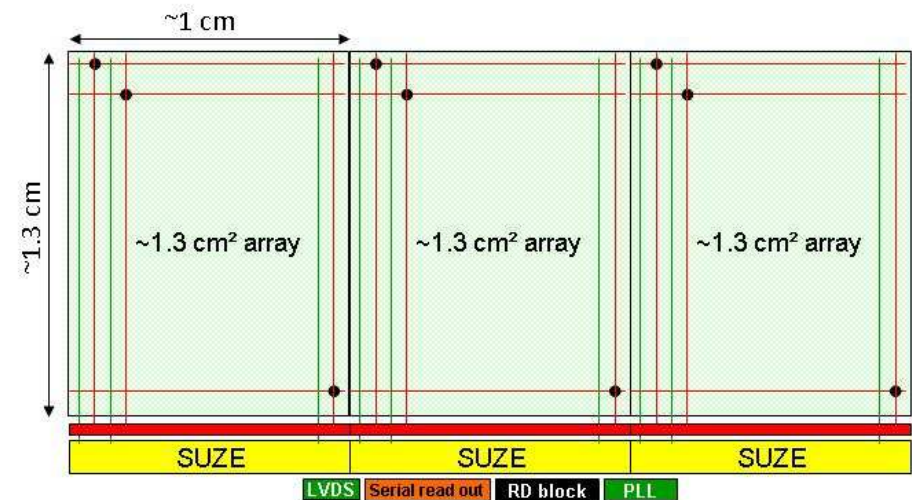
- ✧ Status : all elements of sensing & read-out chain validated, some still requiring optimisation (e.g. noise reduction)

$\Rightarrow$  Next steps :

- fab. of full scale ( $15 \times 30 \text{ mm}^2$ ) prototypes :  
submissions in Q1/'14 & Q4/'14

- fab. of proto. for specific sensor element optimisation :  
submissions in Nov/'13 & Q1/'14

ASTRAL\_in



- Development of ultra-light double-sided ladders :

- ✧ Status : production of  $0.35 \% X_0$  ladder under way

- ✧ Next step : validate potential of concept on beam  
and investigate performance of ladder assemblies

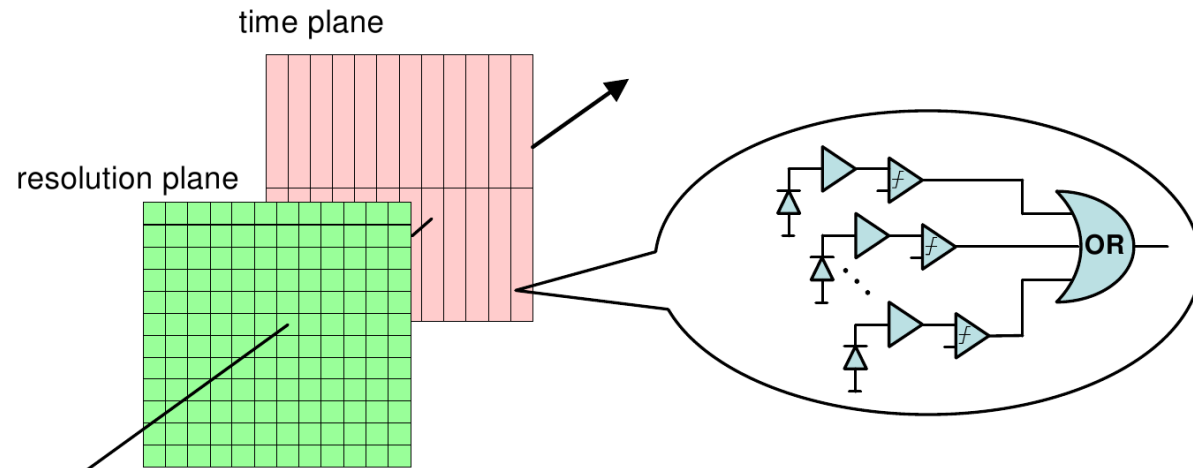
# Plans beyond 2014

- **Finalise development of CPS** for ALICE-ITS & CBM-MVD (direct impact on ILC-VXD)

- ✧ ASTRAL or MISTRAL for ALICE-ITS & CBM-MVD (until 2016)

- ✧ Adapt ASTRAL & MISTRAL to ILC VXD  $\gtrsim$  2016 :

- 3 different sensors for ILC-VXD :
  - 1 for L1, 1 for L2, 1 for L3-6
- elongated pixel allowing bunch tagging
- sensor with in-pixel ADC
- Fine Pixel CPS with delayed read-out
- etc.



- **Development of ultra-light pixelated systems**

- ✧ try to realise 2-sided ladders with  $< 0.3 \% X_0$  mat. budget

- ↳ new ladder concept ???

- ✧ validate all aspects of ladder power cycling in high mag. field

- ✧ study services & system aspects of VXD

- ✧ investigate concept of pixelated tracker (extrapolate from ALICE-ITS)

- ✧ etc.

