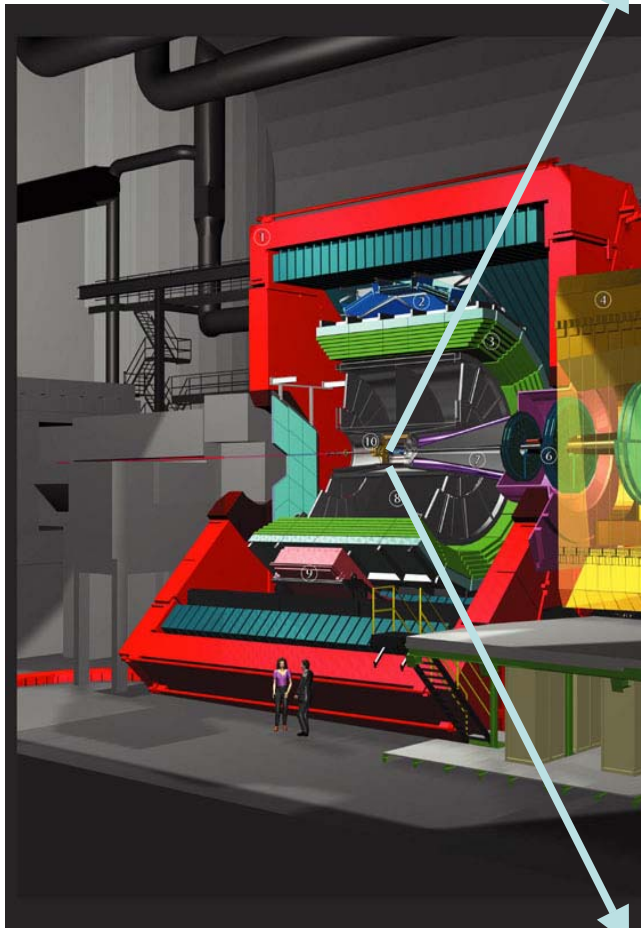




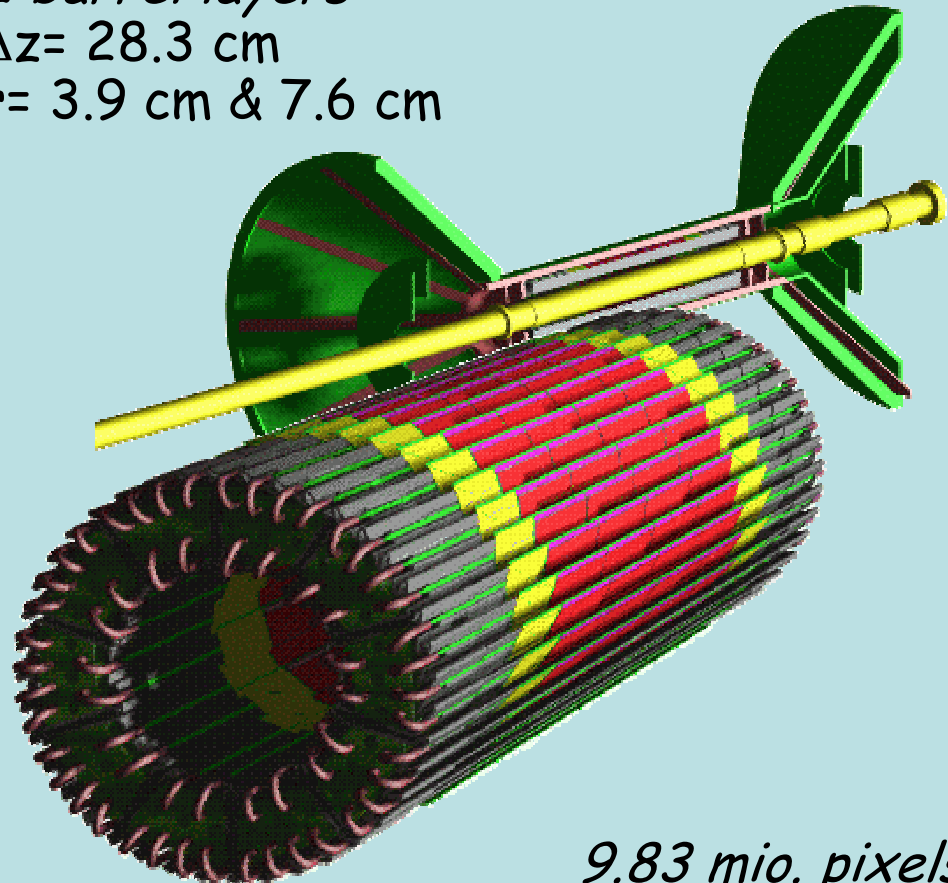
The ALICE Silicon Pixel Detector

P. Riedler/CERN
For the ALICE SPD Team

The ALICE Silicon Pixel Detector (SPD)



2 barrel layers
 $\Delta z = 28.3 \text{ cm}$
 $r = 3.9 \text{ cm} \ \& \ 7.6 \text{ cm}$



9.83 mio. pixels

The two barrels will be built of 10 sectors, each equipped with 6 staves:



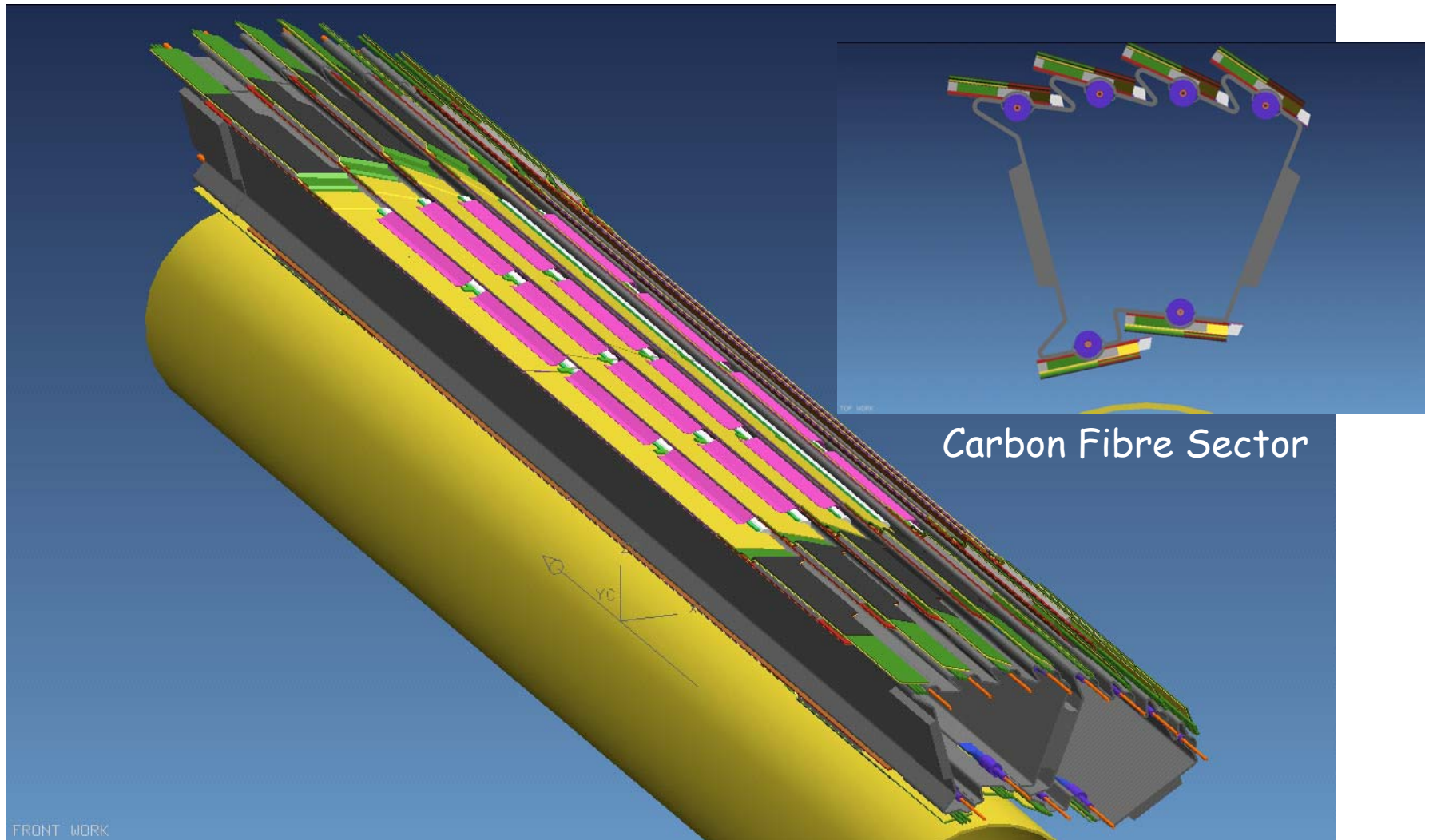
Sector - Carbon Fibre Support



INFN Padova

Material budget(each layer)

$\approx 0.9\% X_0$ (Si ≈ 0.37 , cooling ≈ 0.3 , bus 0.17, support ≈ 0.1)



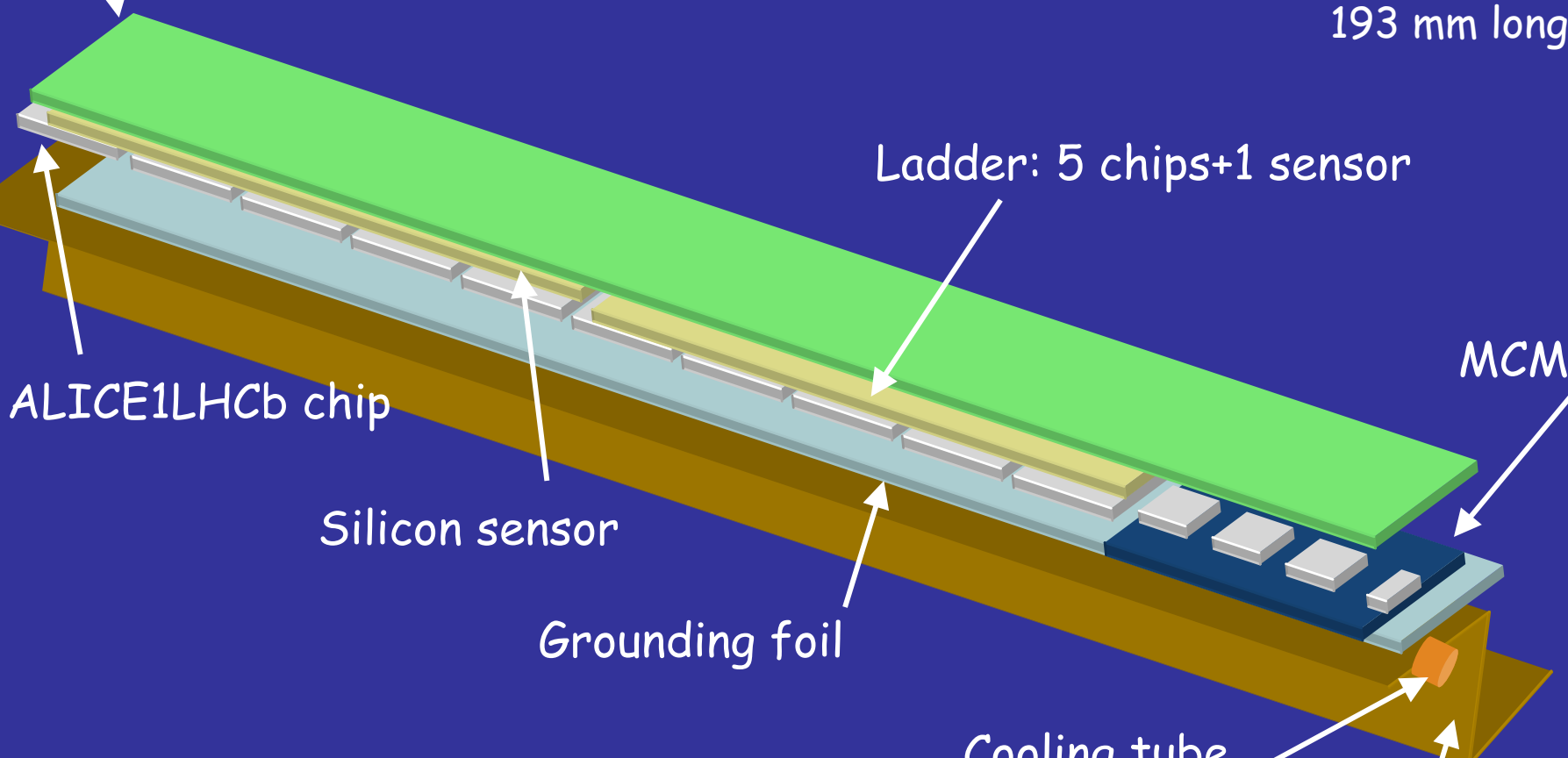


Bus

Each Stave is built of two **HALF-STAVES**, read out on the two sides of the barrel, respectively.



193 mm long



ALICE1LHCb chip

Ladder: 5 chips+1 sensor

Silicon sensor

Grounding foil

MCM

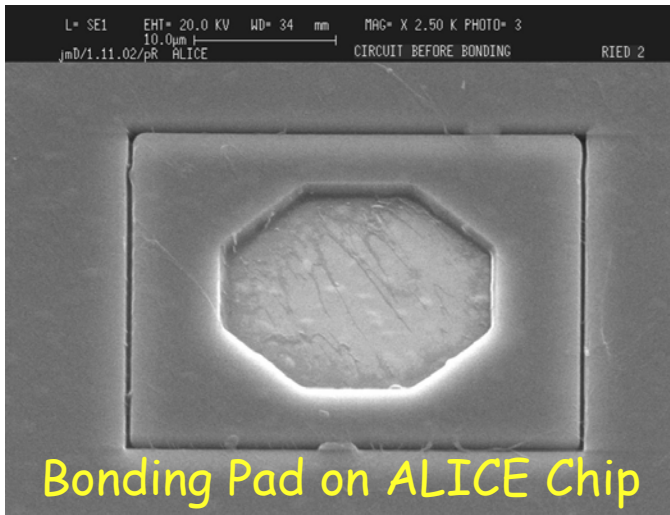
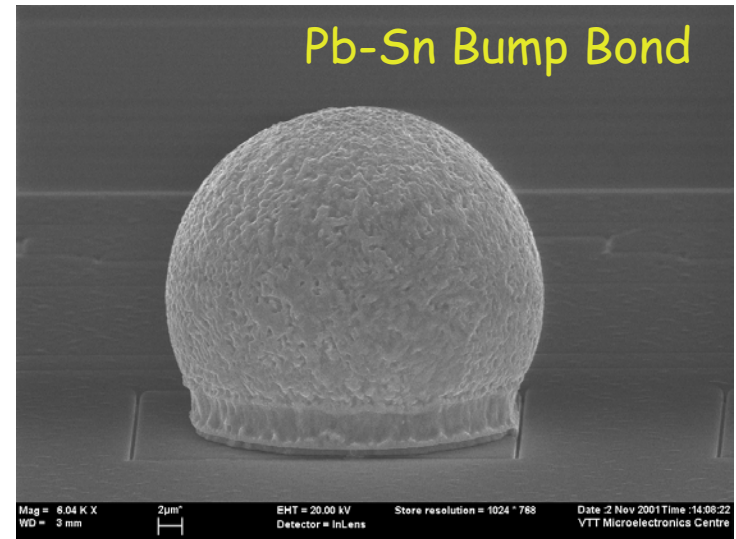
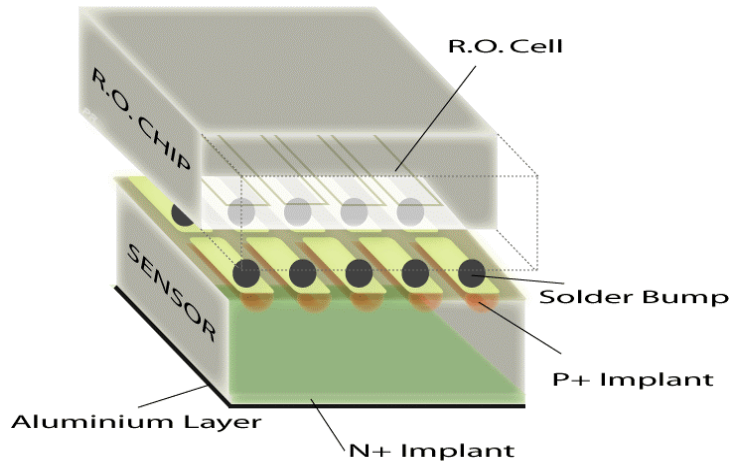
Cooling tube

Carbon-fibre sector

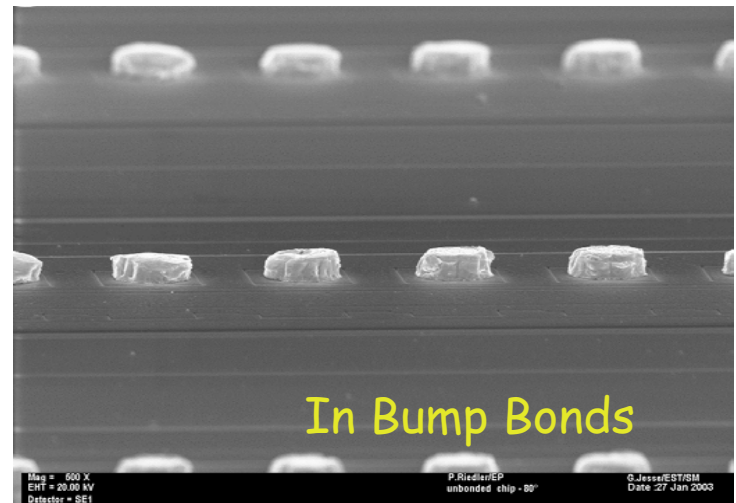
Assembly: see talk by R. Santoro

Bump Bonding

See talks by M. Campbell, J. Salmi



SEM Pictures (CERN, VTT)



1 p-in-n silicon sensor

- 72.72 mm x 13.92 mm
- 200 μ m thick

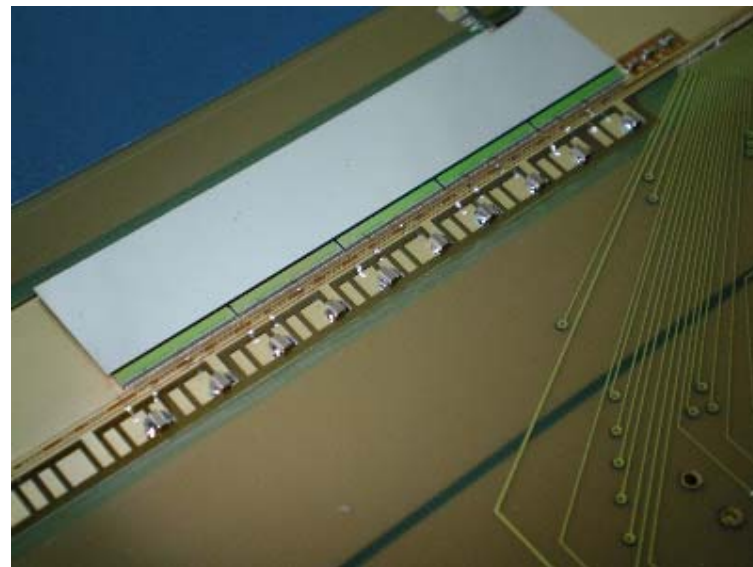
5 readout chips

- 0.25 μ m CMOS
- 13.68 mm x 15.58 mm
- 750 μ m native thickness
thinned to 150 μ m thickness

40960 bump bonds

~25 μ m diameter

Stand-off: ~12 μ m (In), ~20 μ m (Pb-Sn)





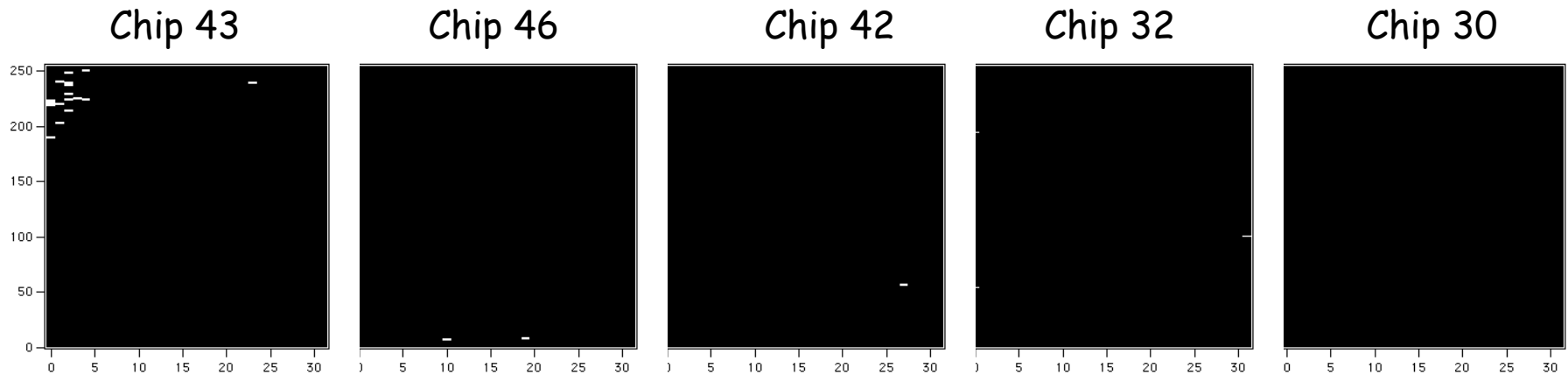
ALICE Ladder - $200\mu\text{m}+150\mu\text{m}$



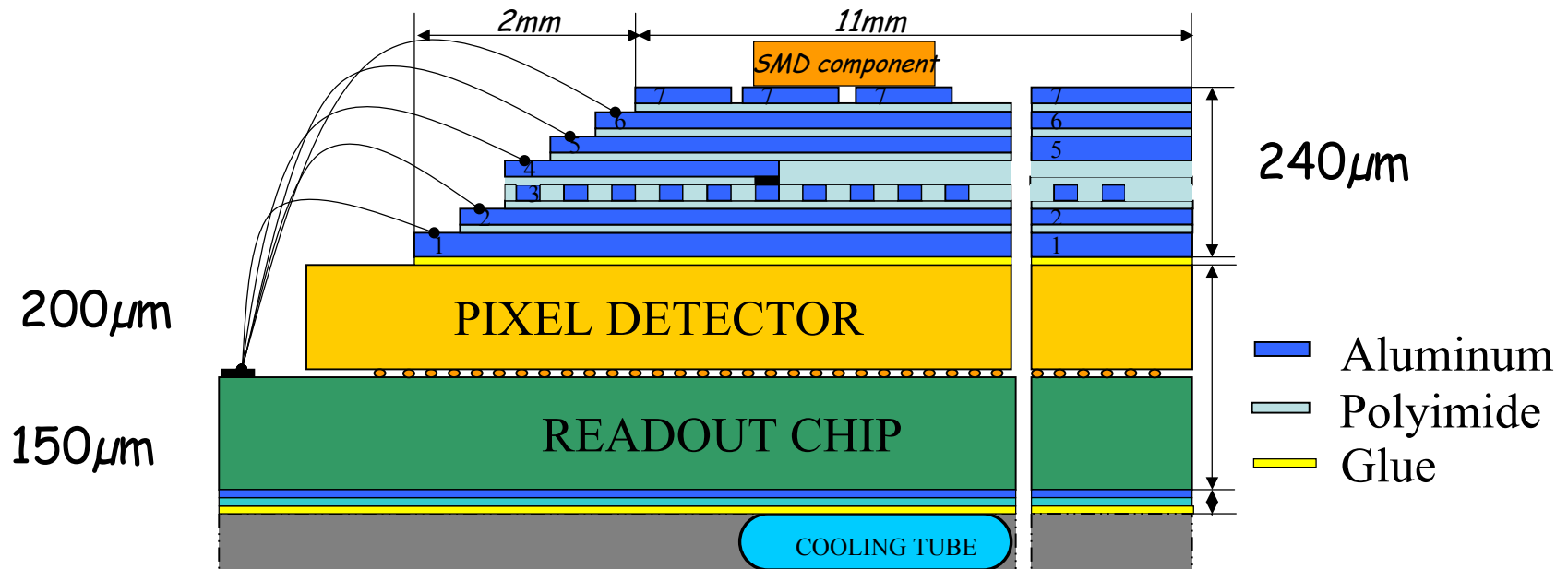
Idet @50V=180nA

Sr-Measurements :

	Chip43	Chip46	Chip42	Chip32	Chip30
Working pixels	99.7%	99.95%	99.98%	99.98%	100%
Missing pixels	28	4	2	2	0

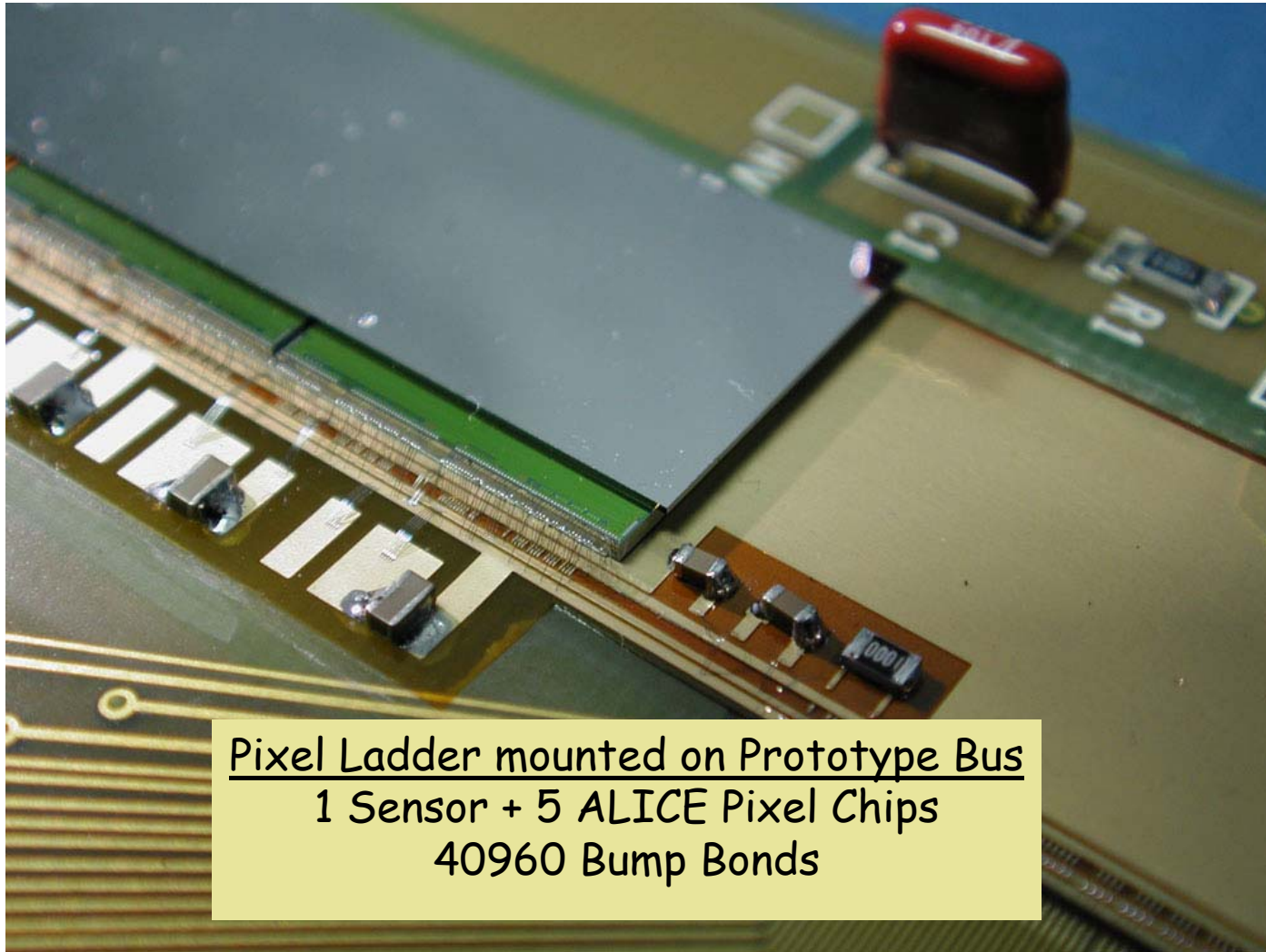


- 5 layer Al-Kapton flex
- wire bonds to the ALICE1LHCb chip
- provides data -, control- and power-lines between MCM and chips

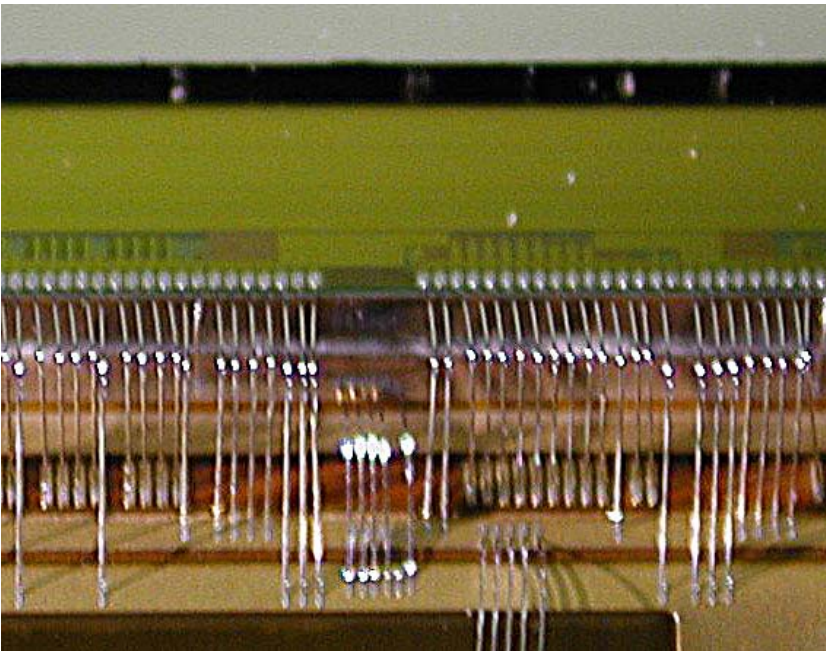


M. Morel

ALICE Ladder Mounted on a Prototype Bus

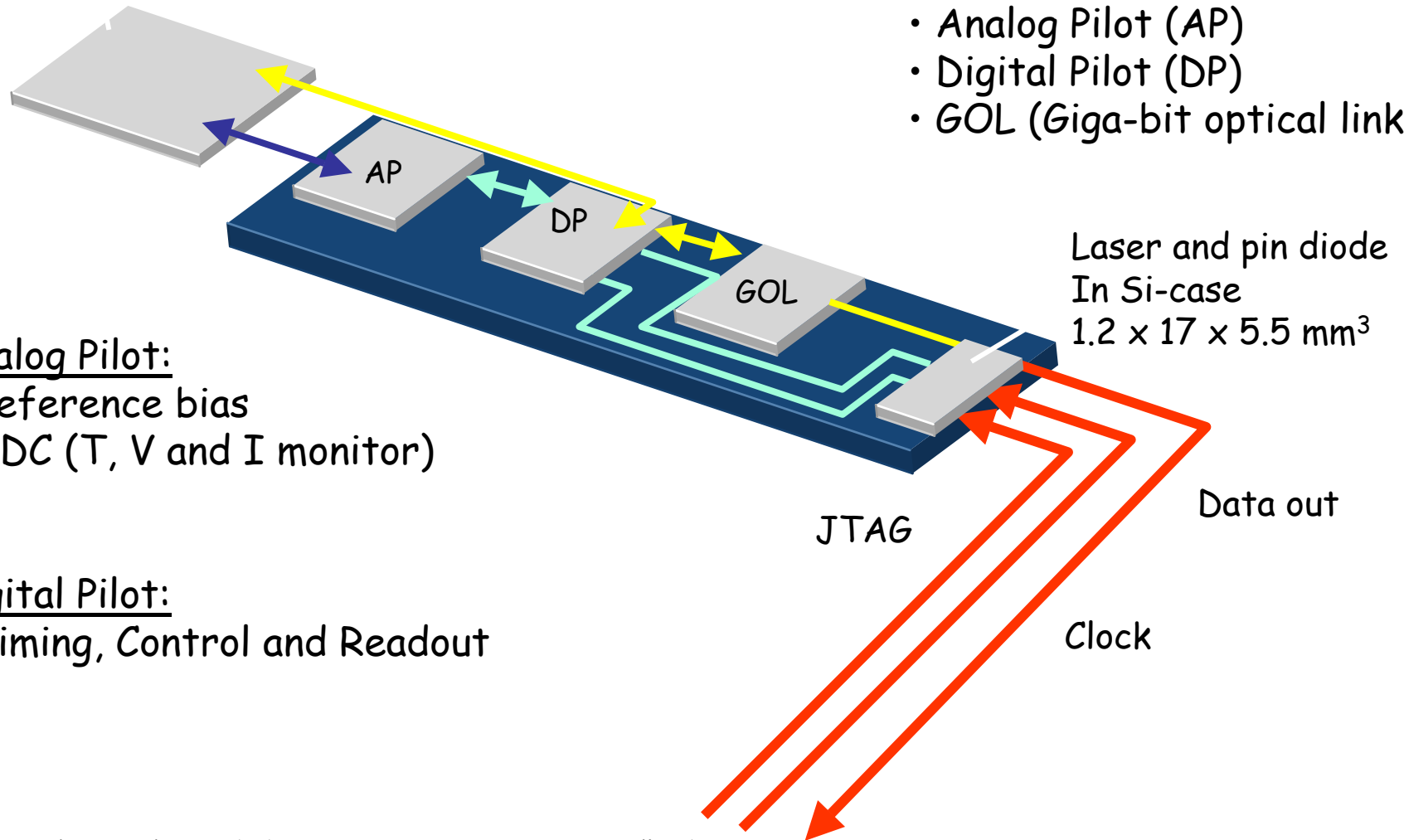


Wire bonding from ALICE pixel chips to a prototype bus



- ~1100 Wire bonds/half-stave
- 25 μm diameter wire
- Bonding to 4 different levels
- Bonding pads on the bus:
80 x 300 μm^2
- Step height: 40-60 μm

ALICE1LHCb chip

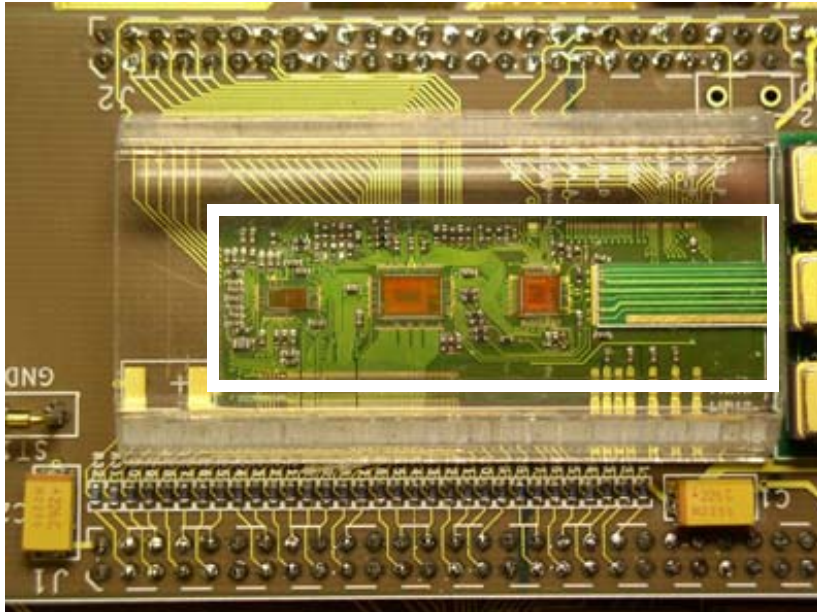


Analog Pilot:

- Reference bias
- ADC (T, V and I monitor)

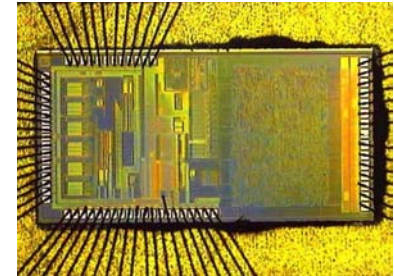
Digital Pilot:

- Timing, Control and Readout

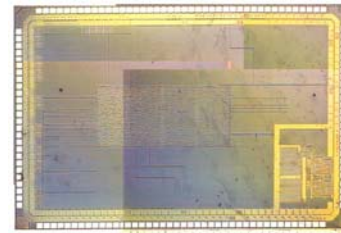


Prototype

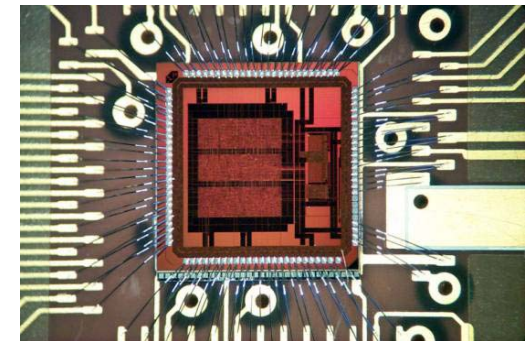
Final version: ceramic hybrid (100 x 11 mm²)



Analog Pilot

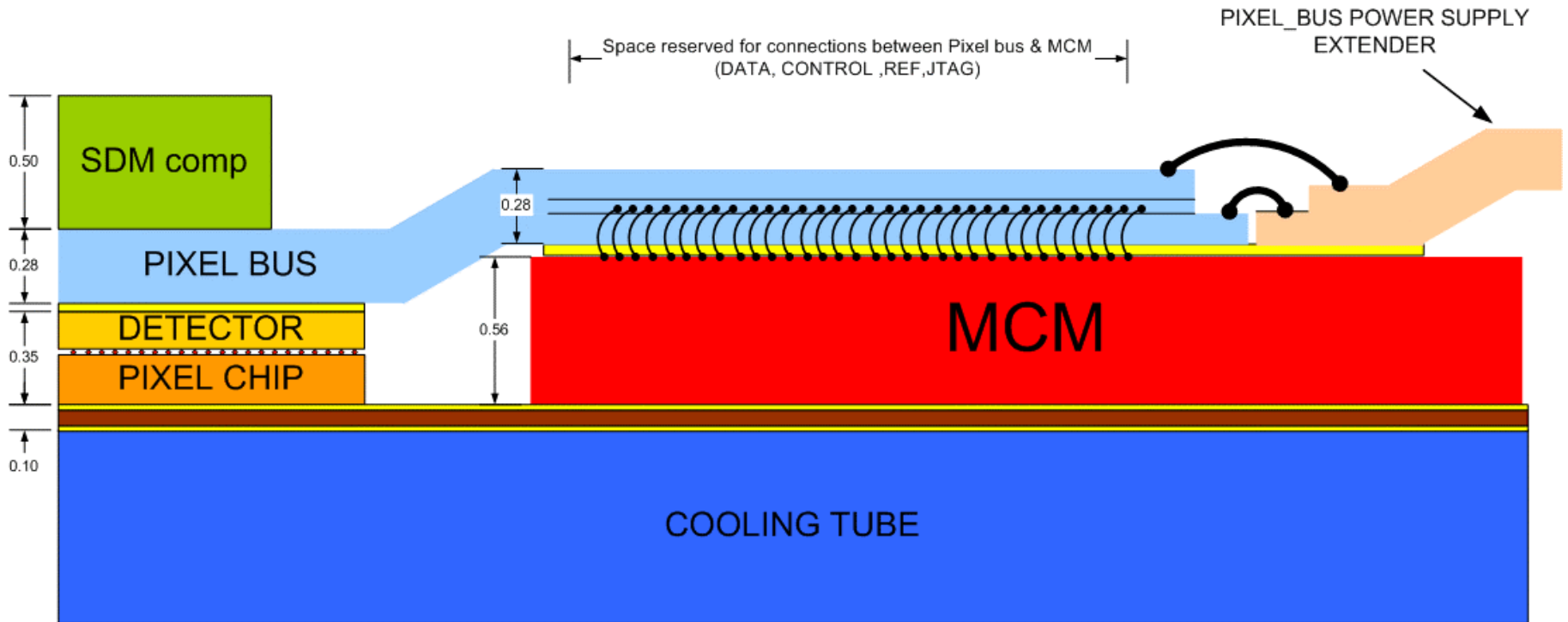


Digital Pilot



GOL

Connection between Bus and MCM



M. Morel



Summary



- The ALICE SPD will start production at the end of 2003.
- The SPD will contain
 - 240 bump bonded ladders
 - 1200 r.o. chips
 - 60 staves
 - ~ 9.81 mio bump bonds
 - ~ 150.000 wire bonds
- Al-Kapton bus will be produced at CERN, prototypes have been received.
- Due to material budget constraints the r.o. chips are thinned to $150\mu\text{m}$ and sensors of $200\mu\text{m}$ thickness are used.
- The complex assembly procedure is in preparation.
(see talk by R. Santoro).