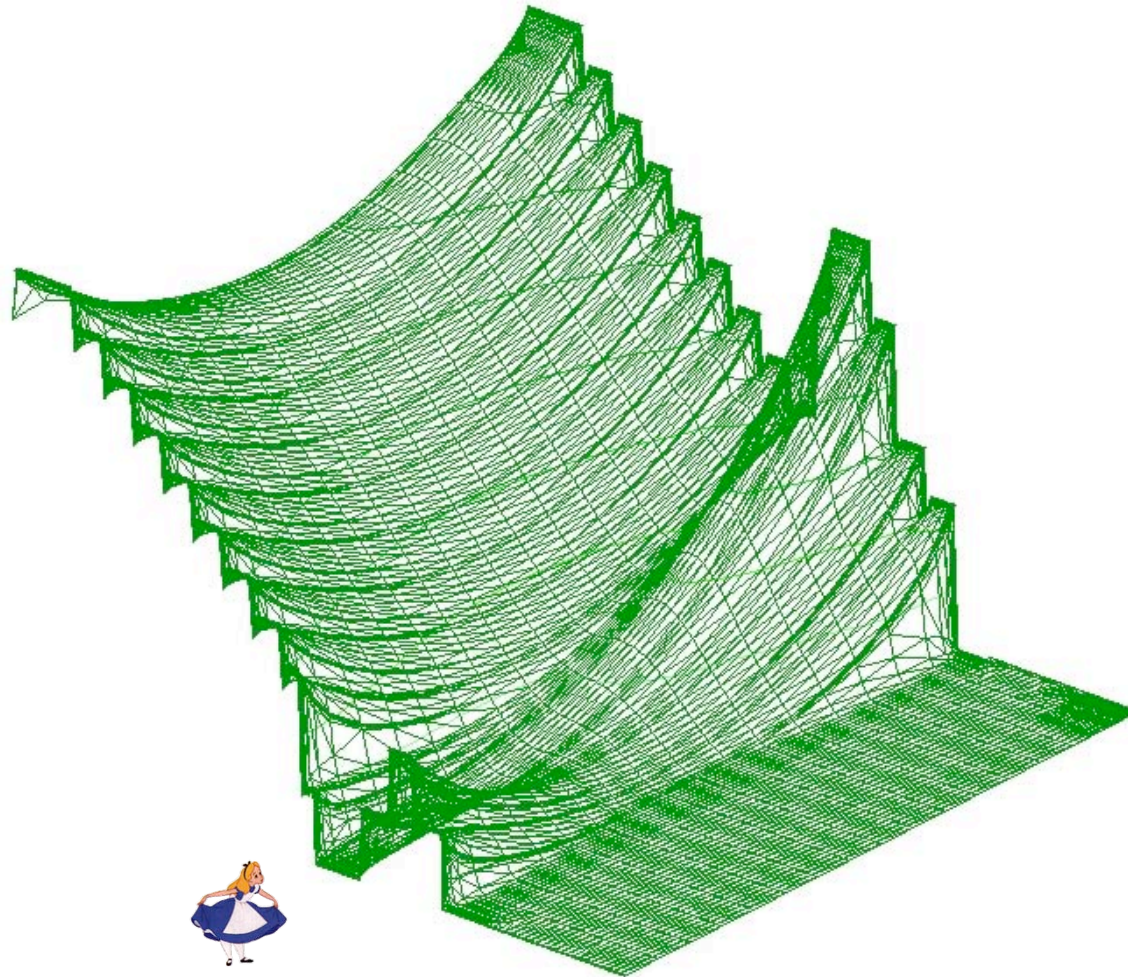


Camere a deriva di silicio per ALICE

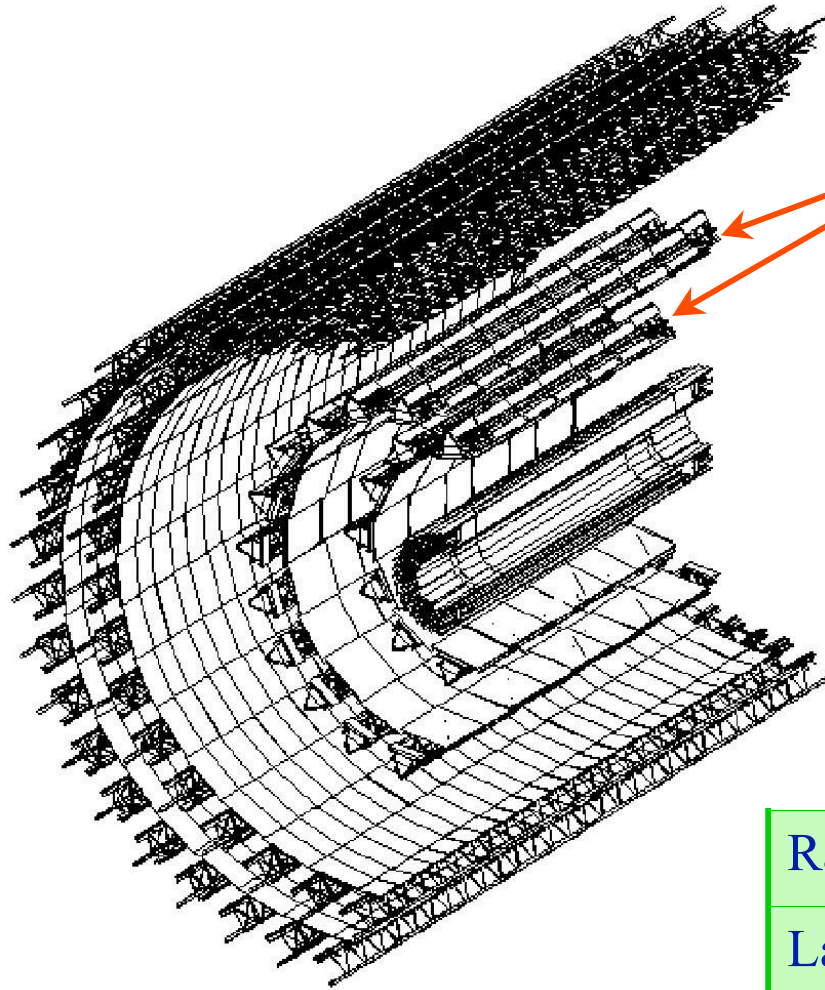
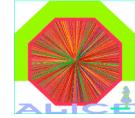
Alexander Rashevsky

INFN, Sezione di Trieste, Via A. Valerio 2, I-34127 Trieste, Italy





Due strati cilindrici dell'ITS sono equipaggiati con le camere a deriva



Silicon Drift Detectors

Tot. No. channels $133 \cdot 10^3$

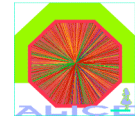
Tot. No. detectors 260

total area 1.37 m^2

	Layer 3	Layer 4
Radius (mm)	14.9	23.8
Ladders	14	22
SDDs per ladder	6	8

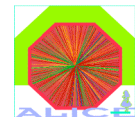
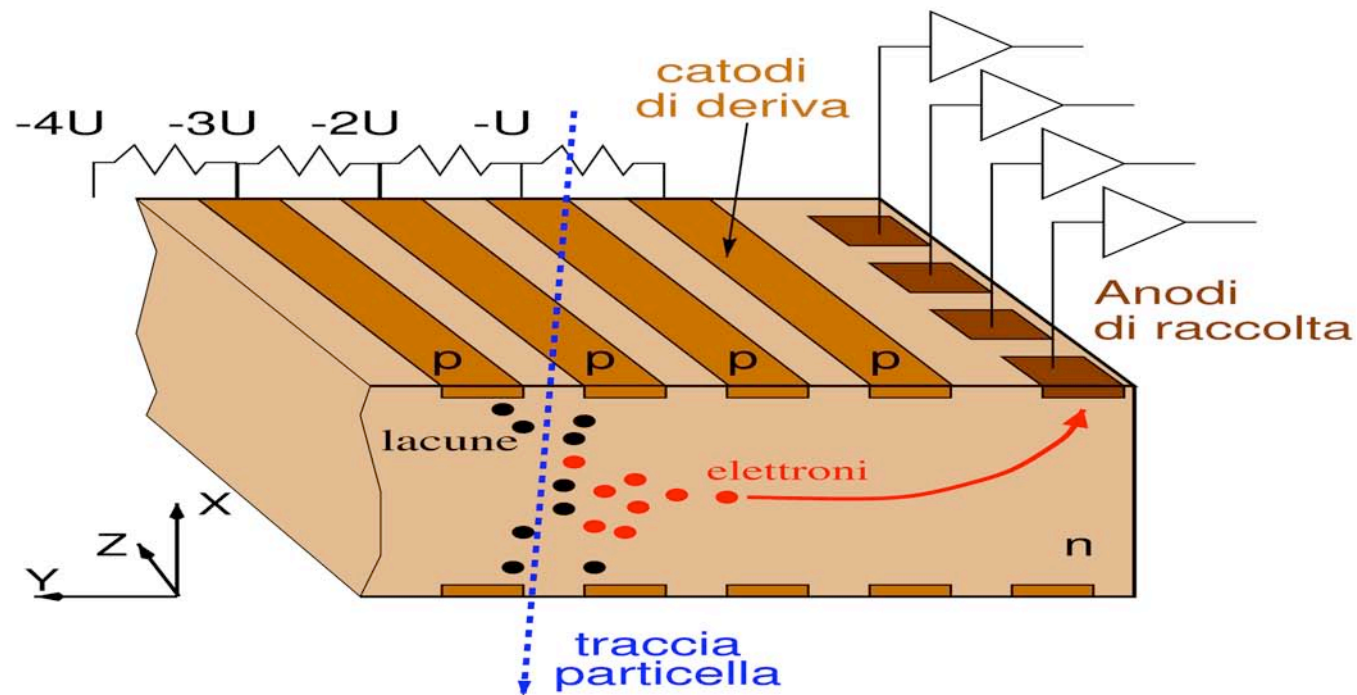


Collaborazione SDD



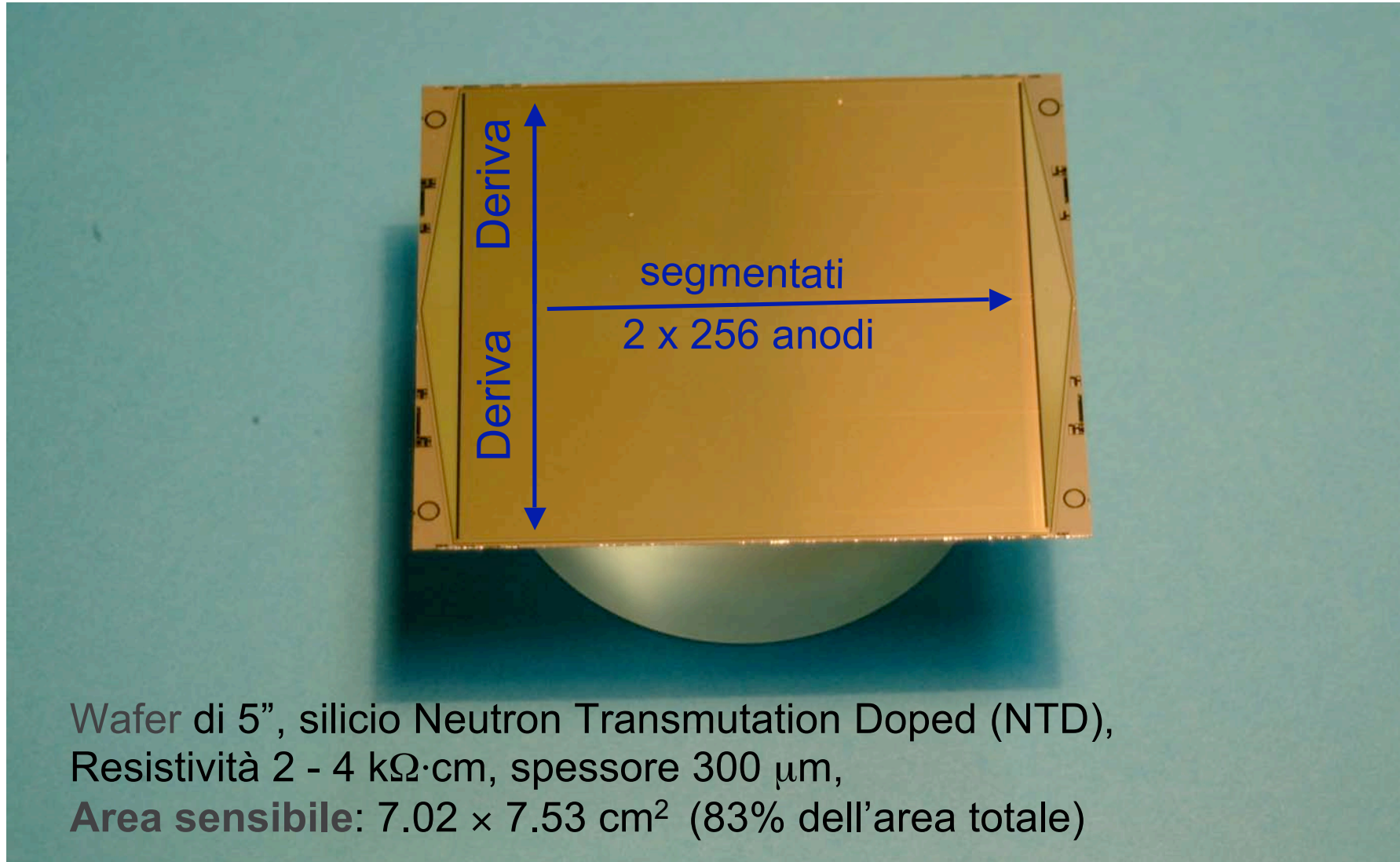
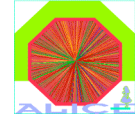
- **INFN – Torino – Italia**
- **INFN – Trieste – Italia**
- **INFN – Bologna – Italia**
- **INFN – Roma – Italia**
- **INFN - Alessandria- Italia**
- **Ohio State University - Columbus - Ohio - USA**
- **University of Jyvaskyla - Jyvaskyla - Finland**
- **Nat. Acad. of Sciences, Bogolyubov Inst. for Th. Phys. - Kiev - Ukraine**
- **Scientific Res. Techn. Inst. of Instrument Making - Kharkov - Ukraine**
- **Acad. of Sciences of Czech Republic – Řež near Prague - Czech Republic**
- **Czech Technical University – Prague - Czech Republic**
- **St. Petersburg State University - St. Petersburg - Russia**

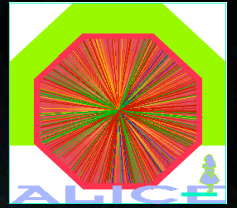
Principio di funzionamento del rivelatore a deriva di silicio



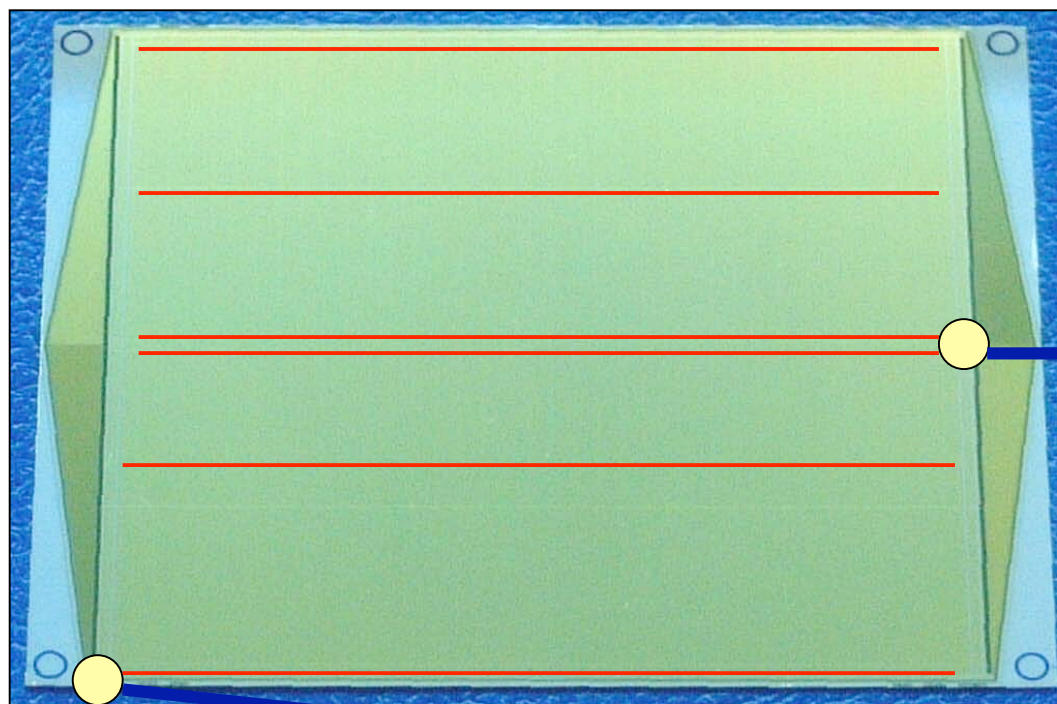
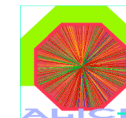


Camera a deriva di silicio ALICE-D4

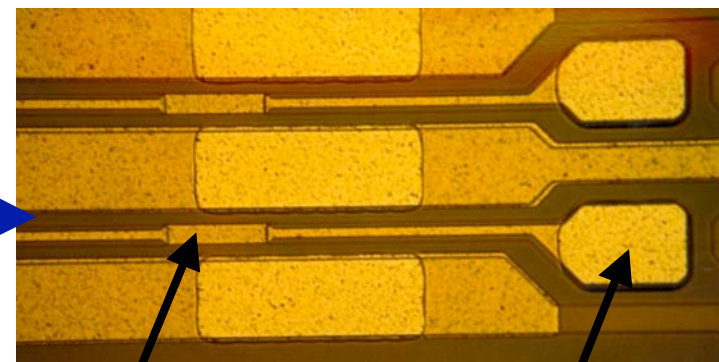




Dettagli del disegno: iniettori di carica e zona di raccolta



linee di iniezione



piazzola di bonding

iniettore MOS (ogni 8° anodo)

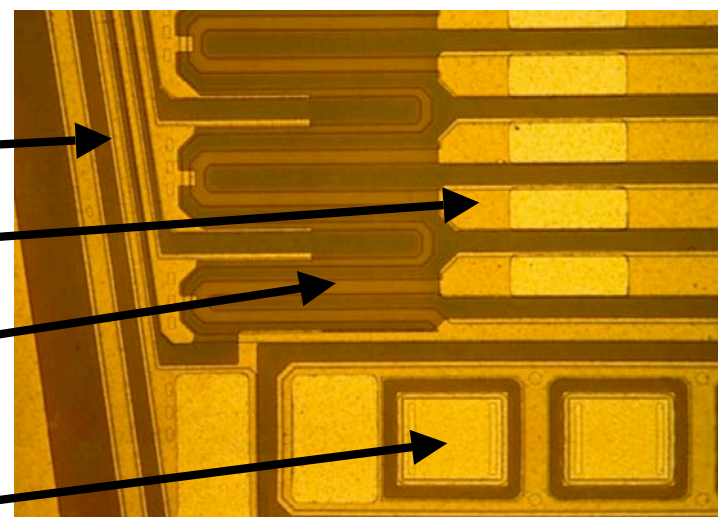
zona di raccolta di carica

Catodi di guardia (passo 32 μm)

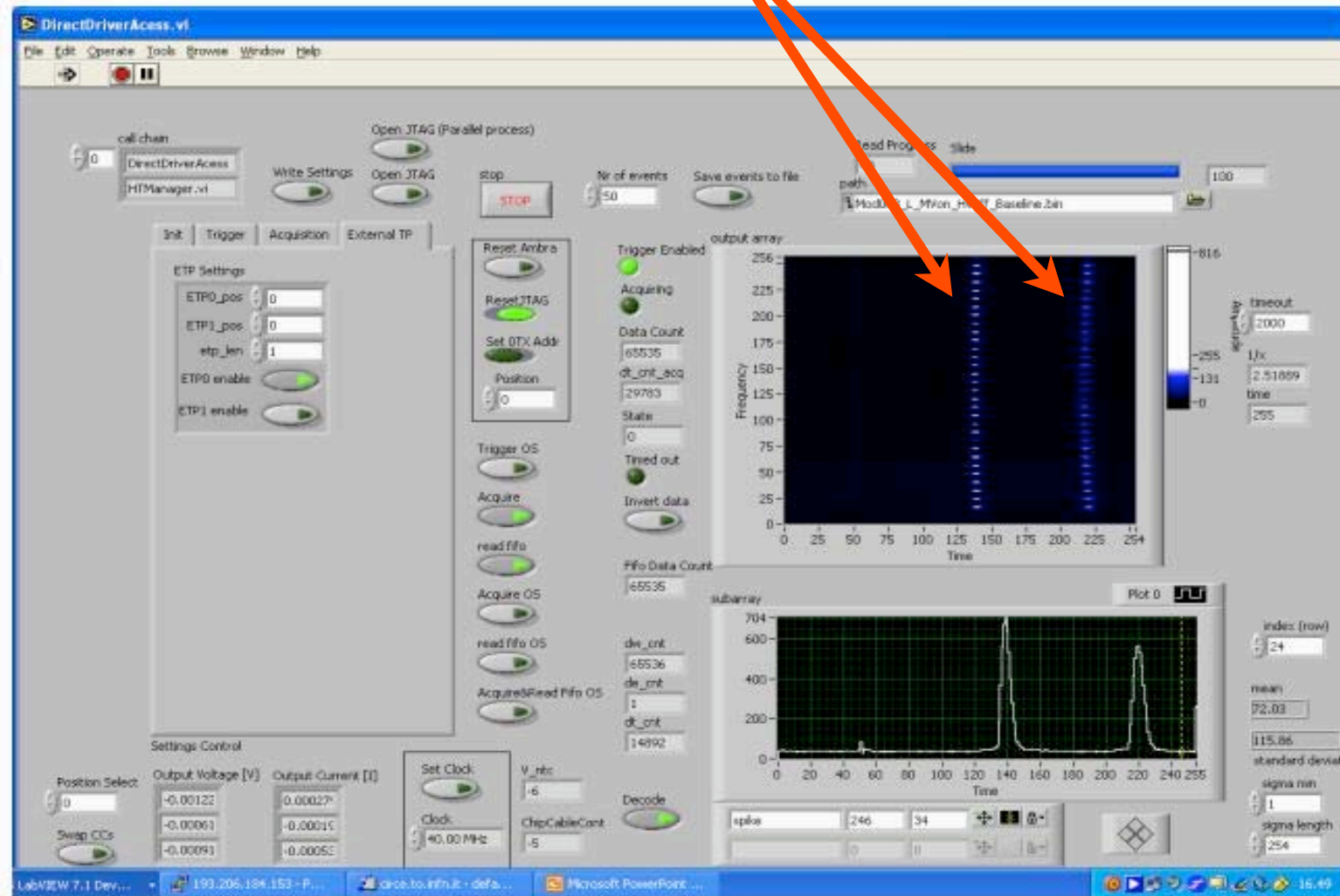
Catodi di deriva (passo 120 μm)

Partitore di tensione HV impiantato a
bordo del rivelatore

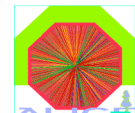
Anodi di raccolta (passo 294 μm)



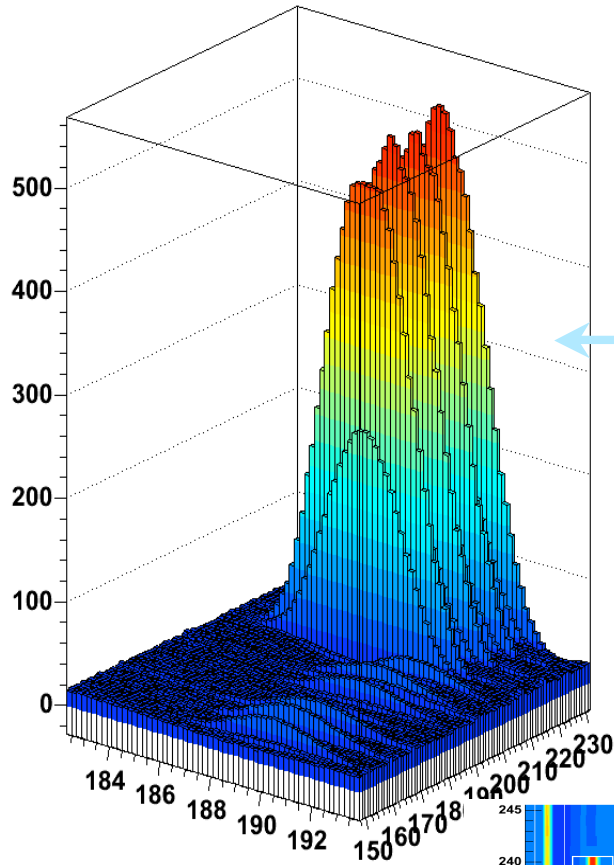
Iniettori di carica in funzione



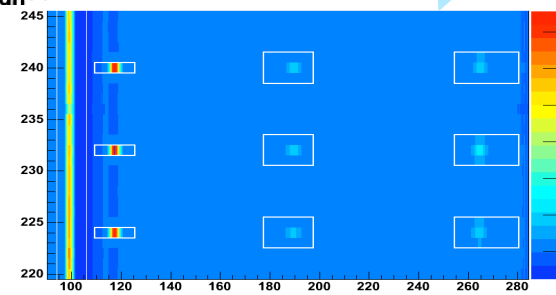
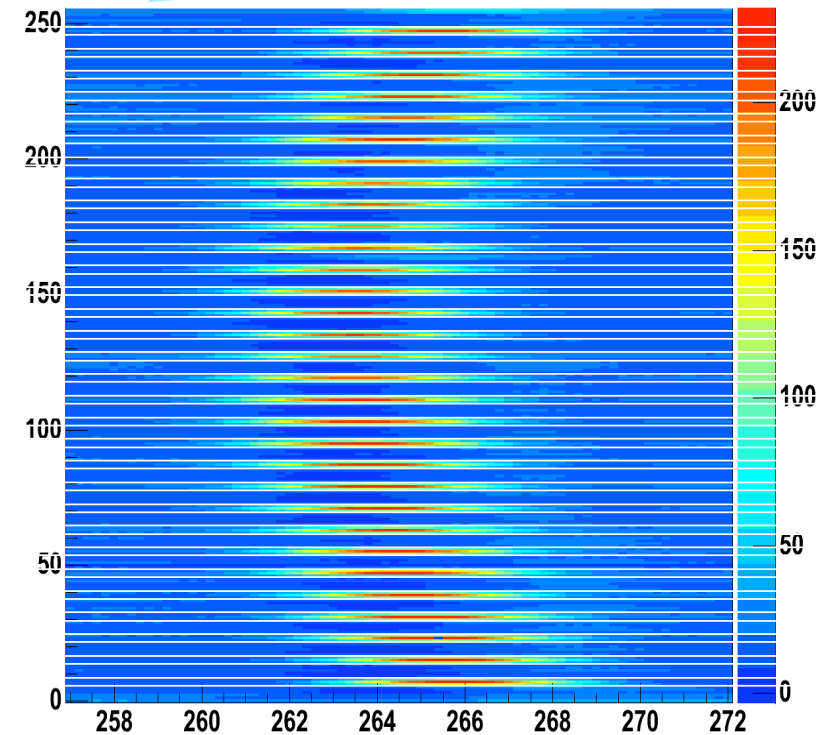
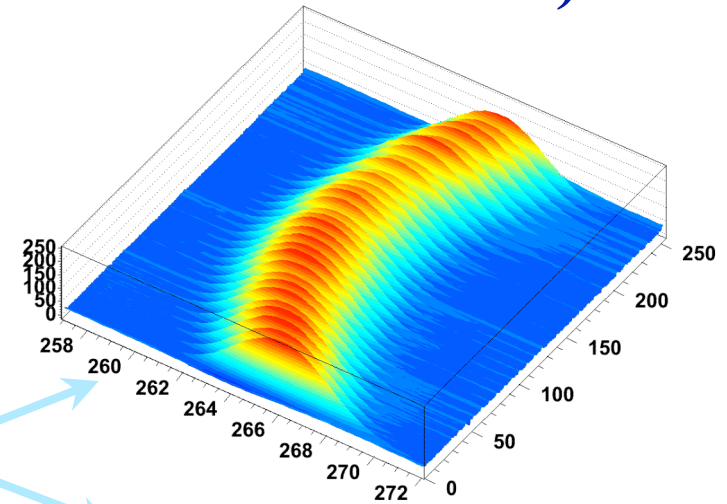
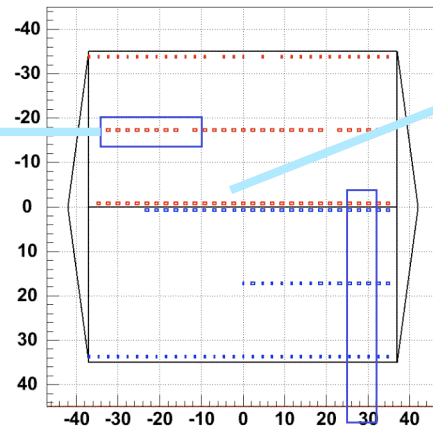
Ibrido "Right", iniettori lontani



Iniettori: SDD beam test (agosto – settembre 2004)



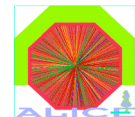
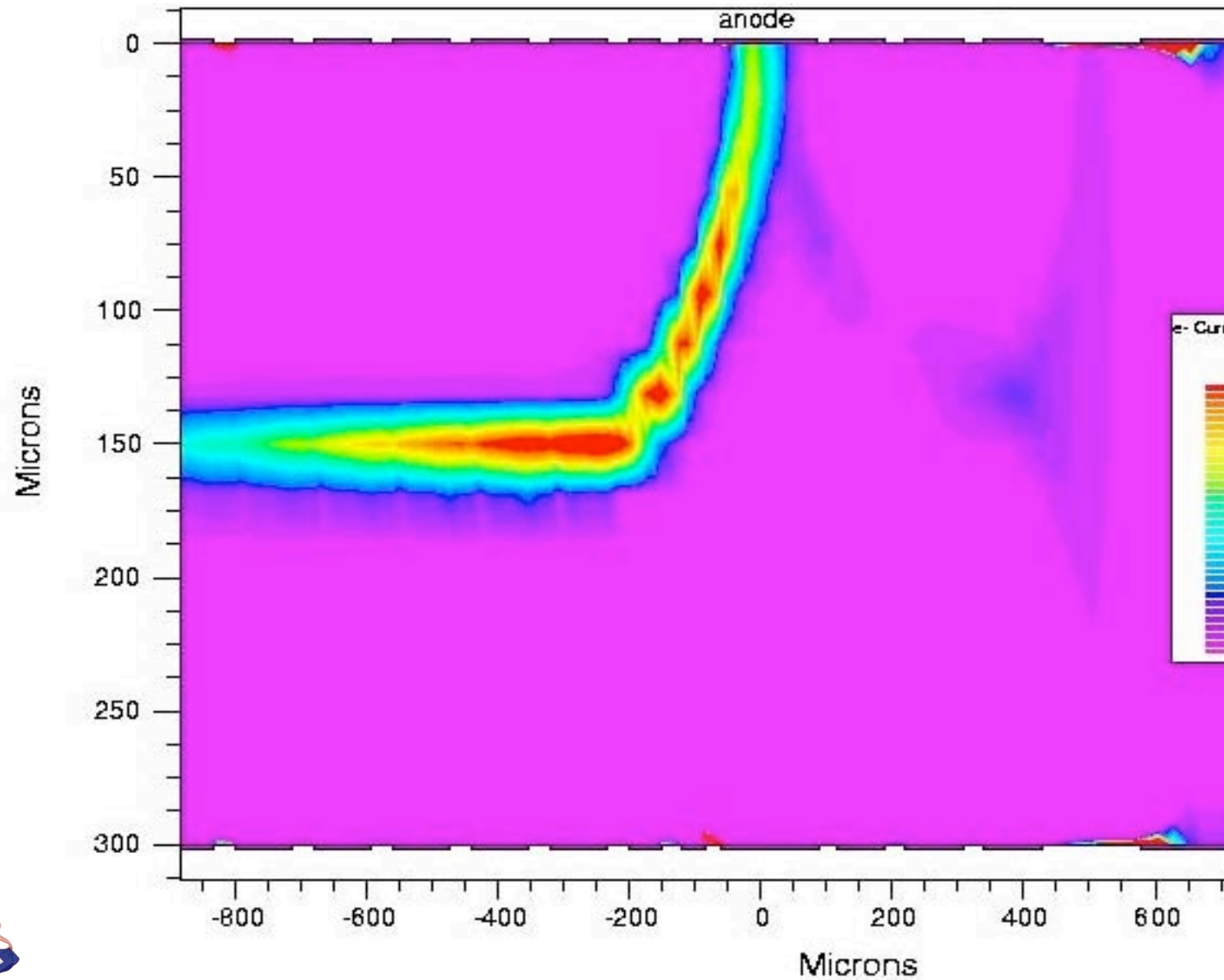
Run 6317 (top side)



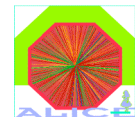
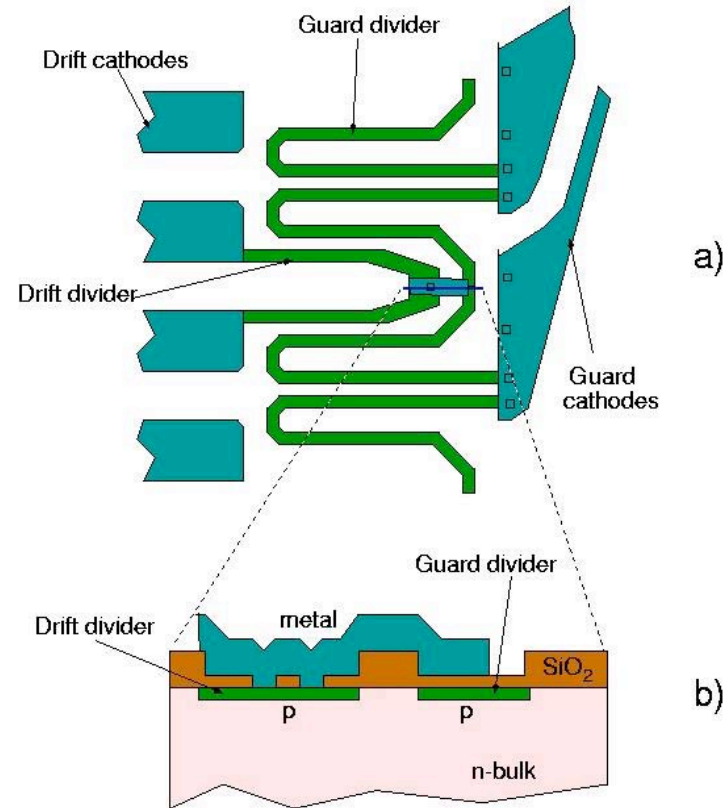
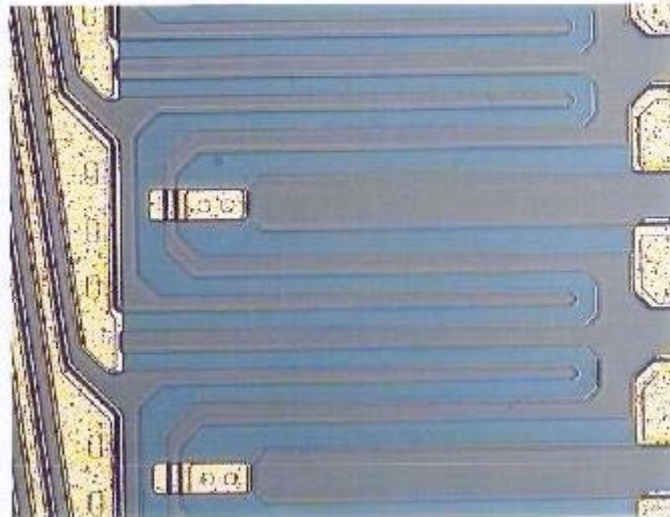
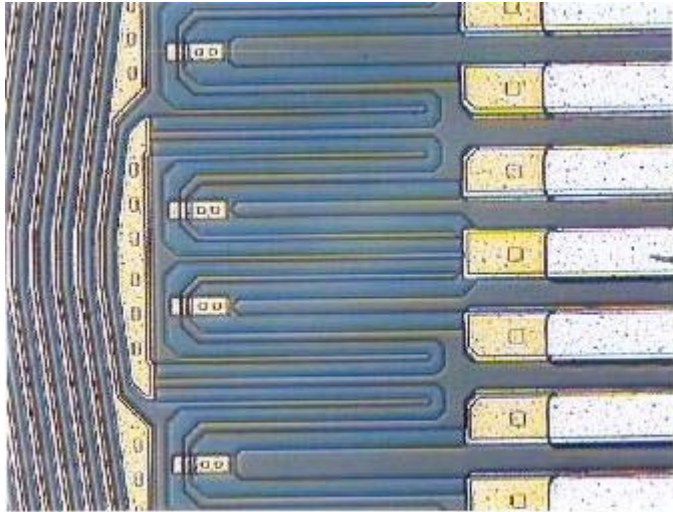
Run 6245 (down side)



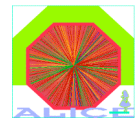
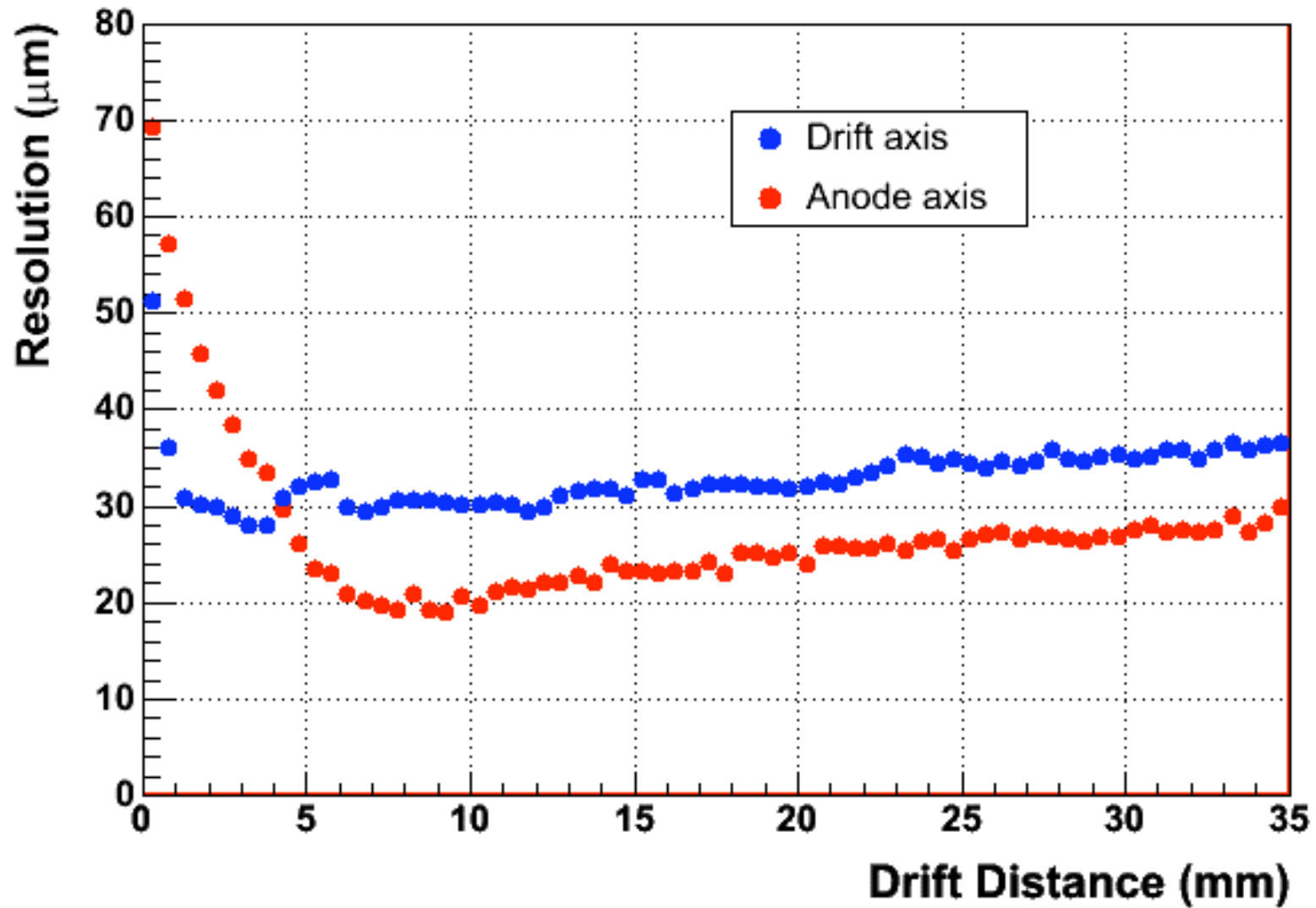
Zona di raccolta: elettroni arrivano sull'anodo



Dettagli del disegno: partitore di tensione HV



Risoluzione spaziale (beam test del giugno 2003)



Produzione di massa: parametri di qualifica

- **Misure sono suddivise in due fasi:**

Misure Preliminari

- **Diodo lungo(44 + 10) metri!:**

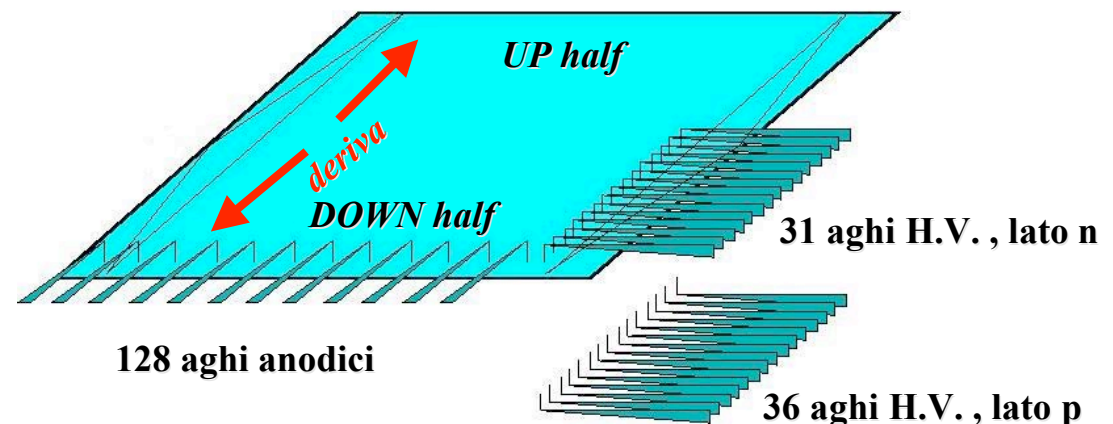
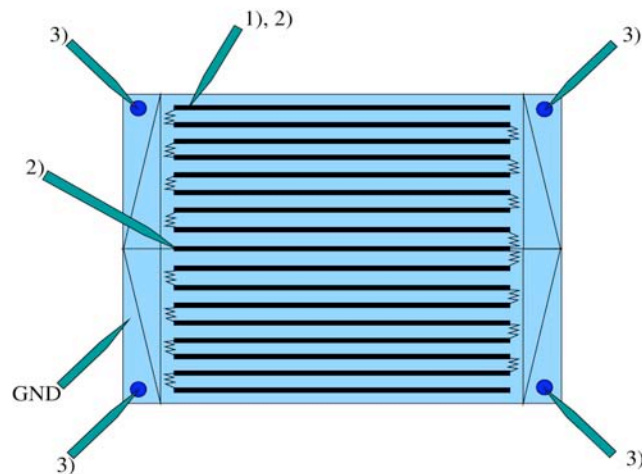
- 1) Caratteristica Corrente-Tensione viene misurata da 0... a -80 V;
Corrente di buio < 5 μA @ $U = -30 \text{ V}$
- 2) Caratteristica Tensione -Tensione

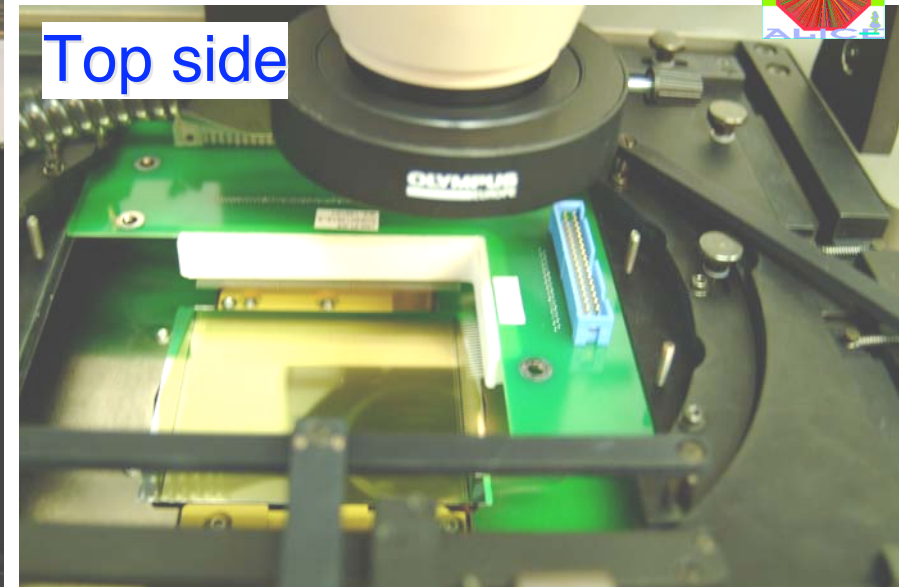
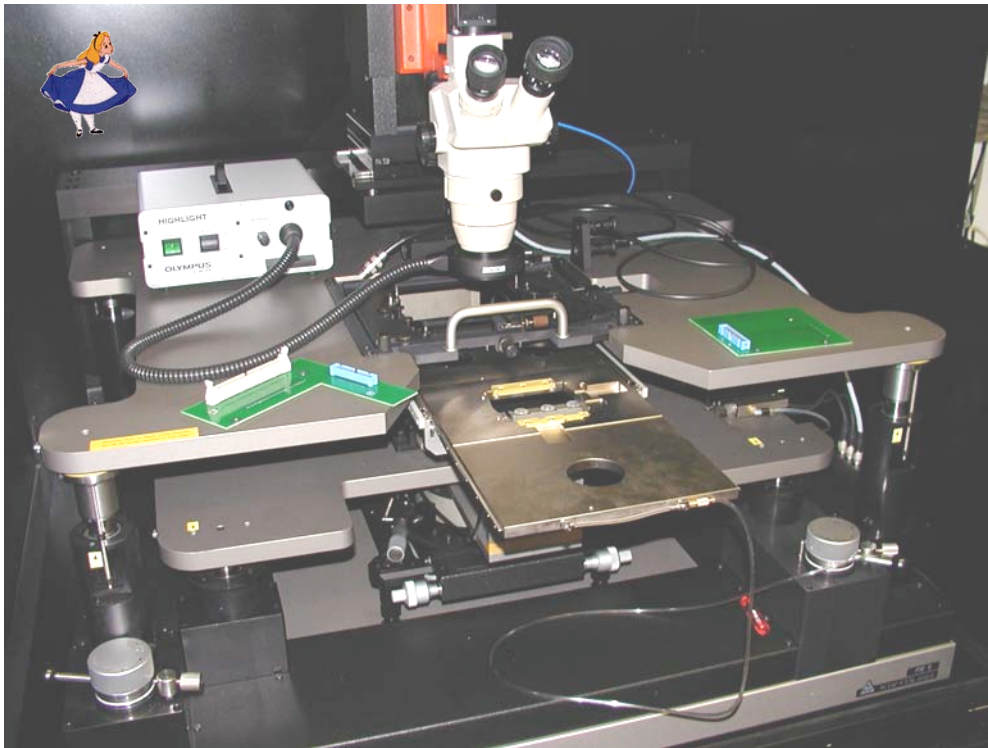
- **Condensatore MOS permette di vedere la qualità dell'ossido:**

- 3) Curva Capacità - Tensione
 $2.0\text{E}+11 \text{ q/cm}^2 < Q_{\text{ox}} < 7.0\text{E}+11 \text{ q/cm}^2$

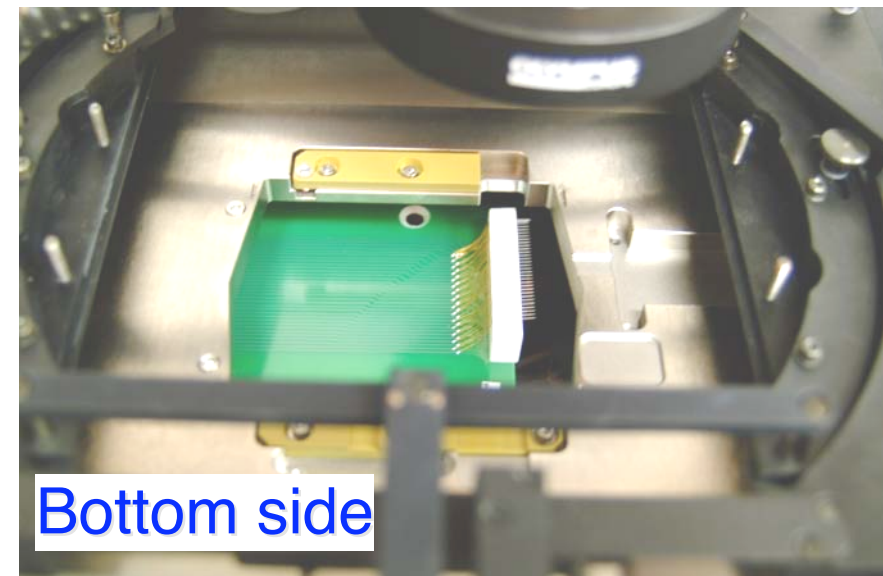
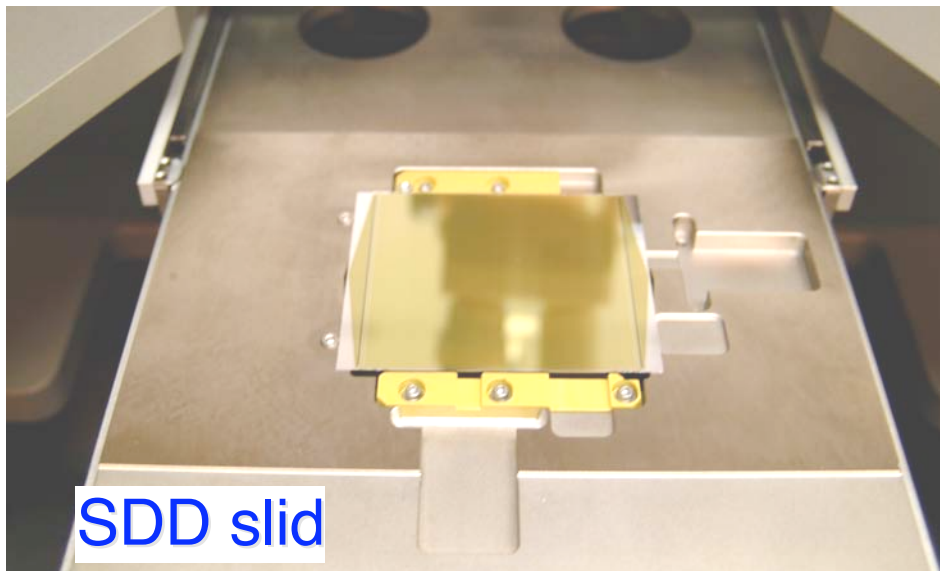
Misure Complete ($U_{\text{bias}} = -2373 \text{ V}$)

- 1) corrente anodica
98% di anodi: $I < 100 \text{ nA}$ / anodo, con un valore medio < 10 nA
- 2) distribuzione di potenziale sui catodi
sbilanciamento massimo di potenziale fra i catodi di deriva corrispondenti
 $\Delta U < 35 \text{ V}$





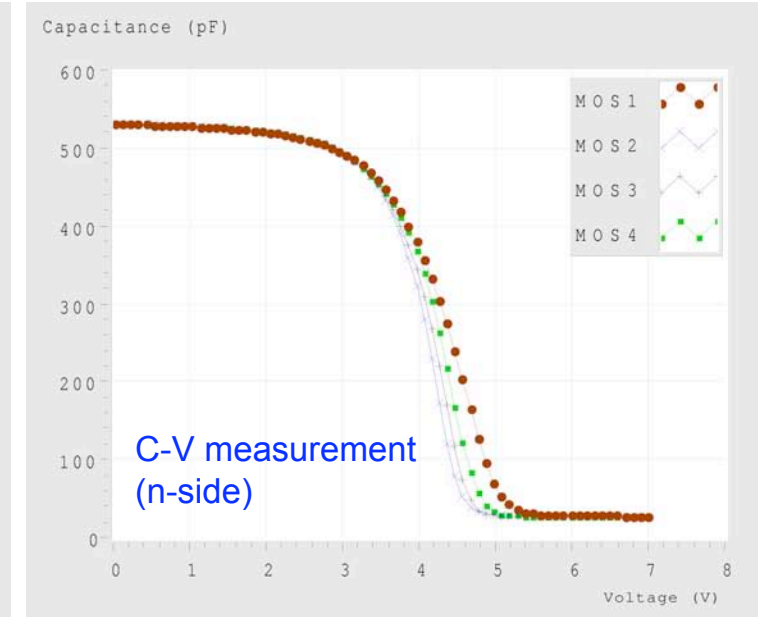
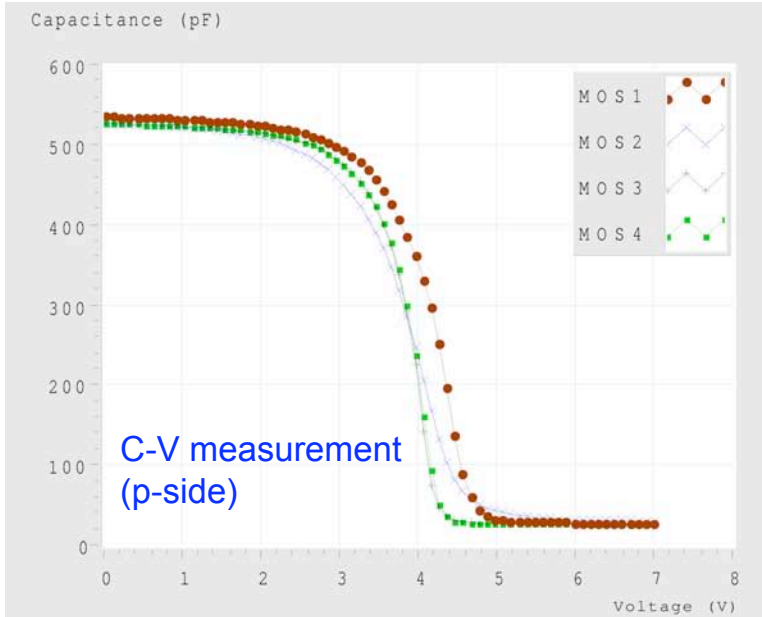
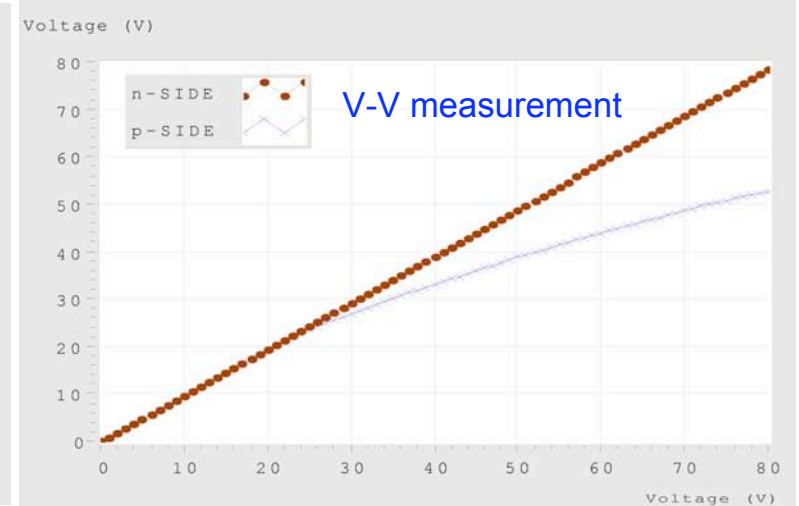
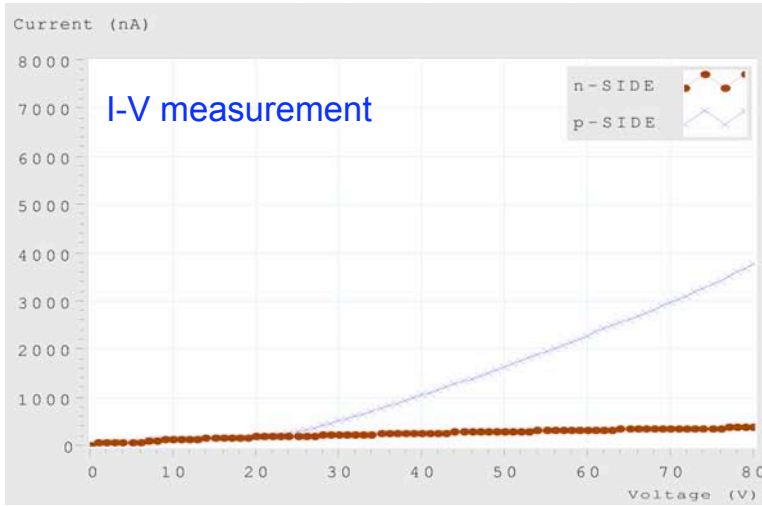
Stazione di prova a doppia faccia presso INFN Trieste





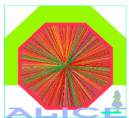
Esempio di output delle Misure preliminari

SDD ALICE-D4
#49303



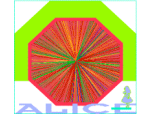
	MOS 1	MOS 2	MOS 3	MOS 4
Tox (nm)	257	261	261	261
Vfb (V)	4.5	4.3	4.1	4.2
Qox (q/cm ²)	3.4E+11	3.2E+11	3.0E+11	3.0E+11
Res. (Ohm*cm)	2938	2343	3168	3059

	MOS 1	MOS 2	MOS 3	MOS 4
Tox (nm)	259	258	259	259
Vfb (V)	4.8	4.4	4.5	4.6
Qox (q/cm ²)	3.6E+11	3.3E+11	3.3E+11	3.4E+11
Res. (Ohm*cm)	2897	3016	3174	3081

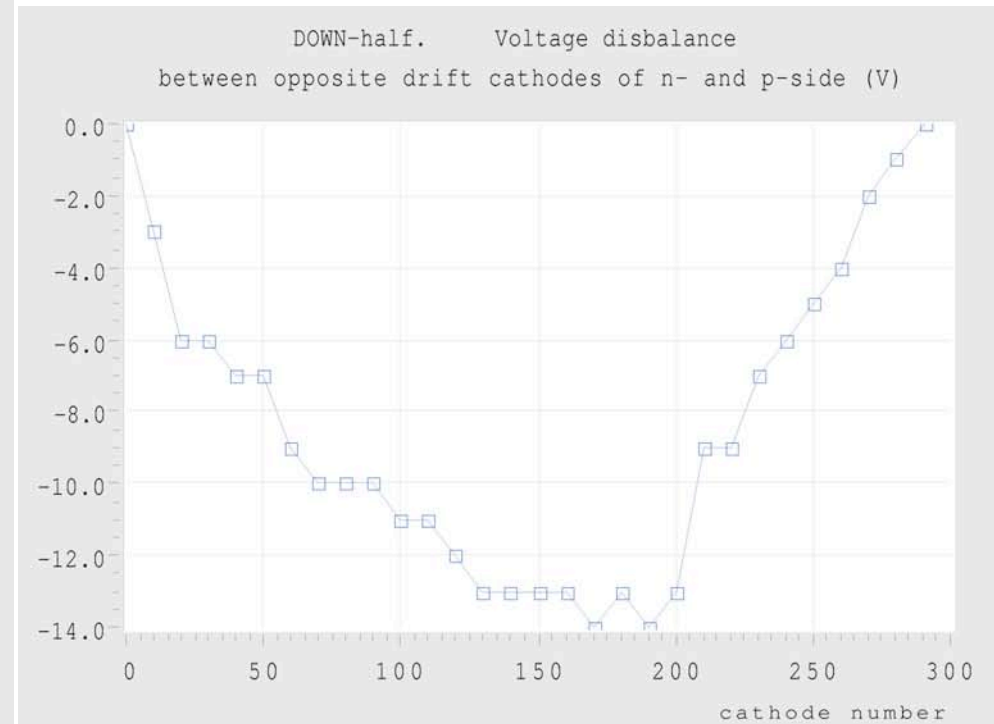
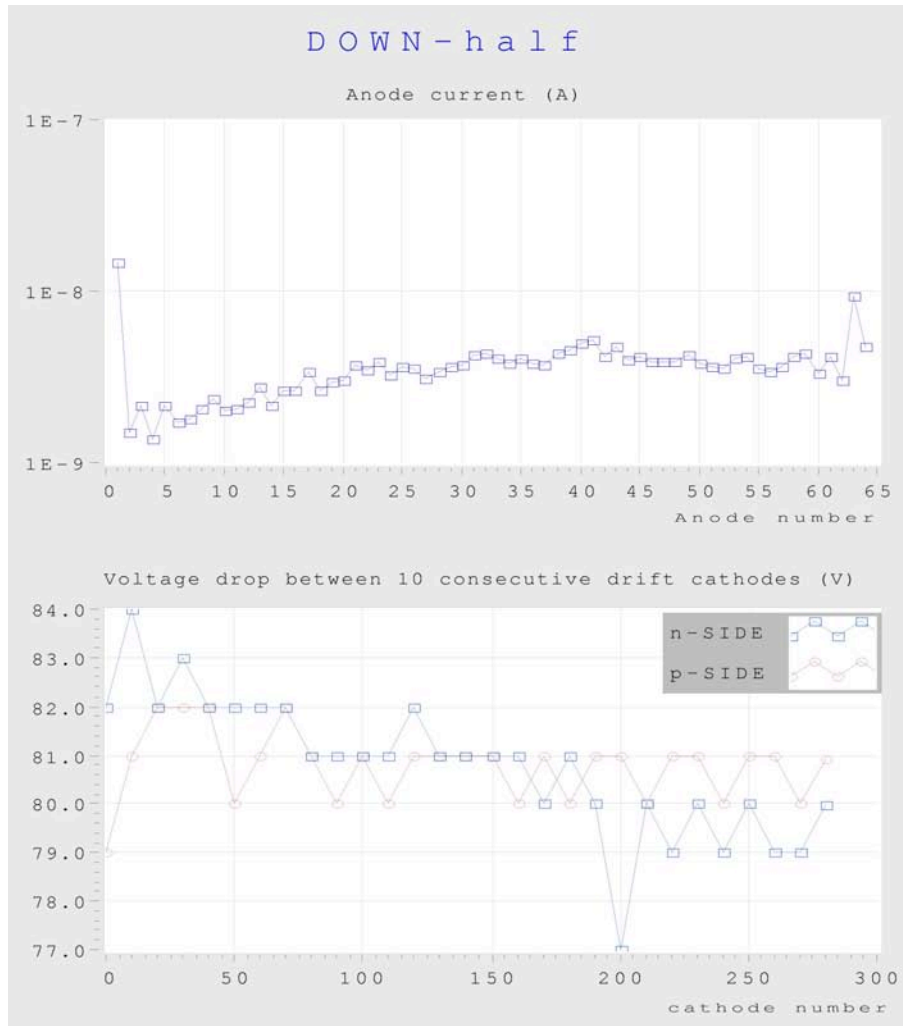




Esempio di output delle **Misure complete**

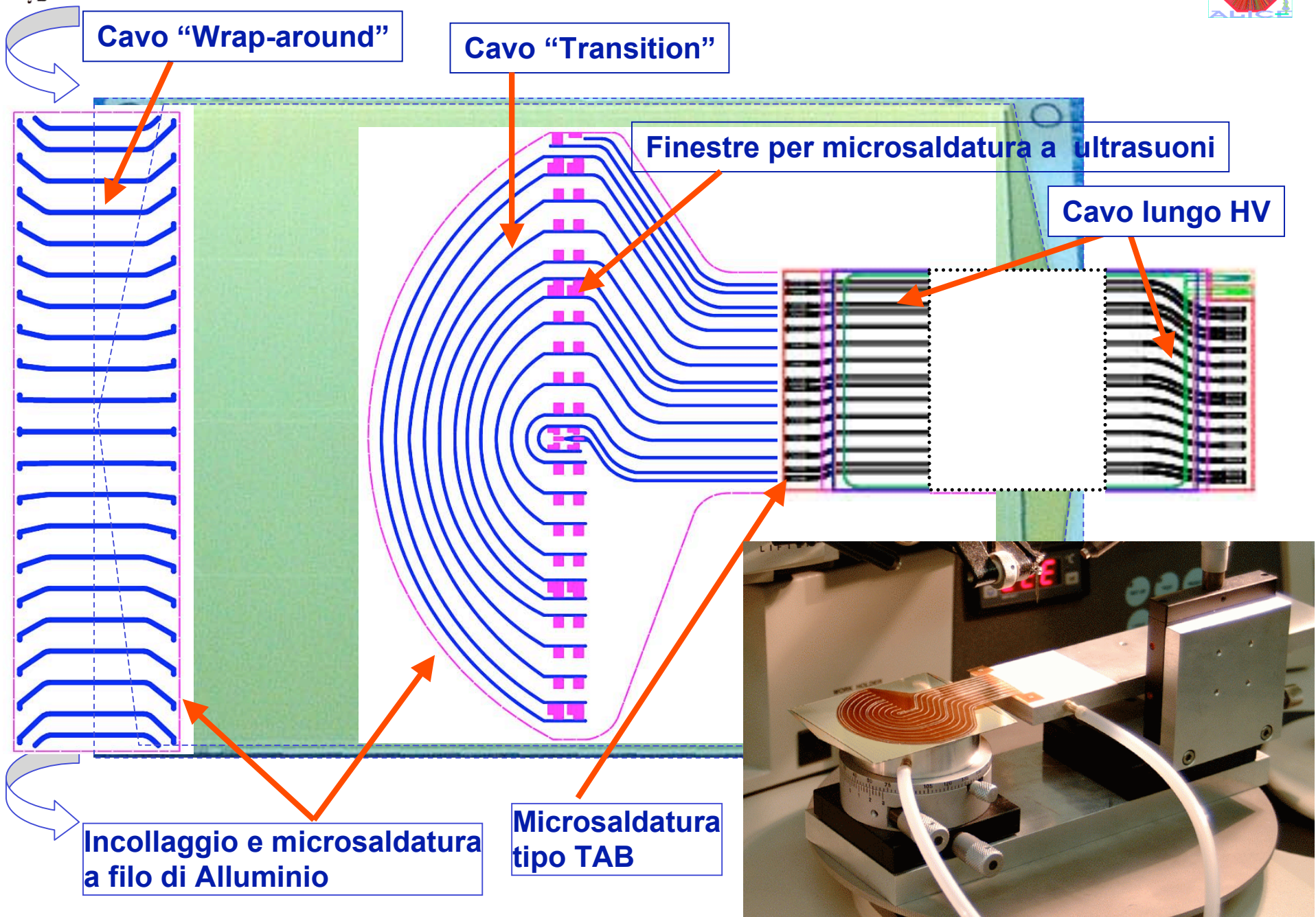
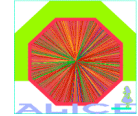


SDD ALICE-D4 #49303



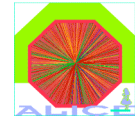


Montaggio di microcavi HV sul rivelatore



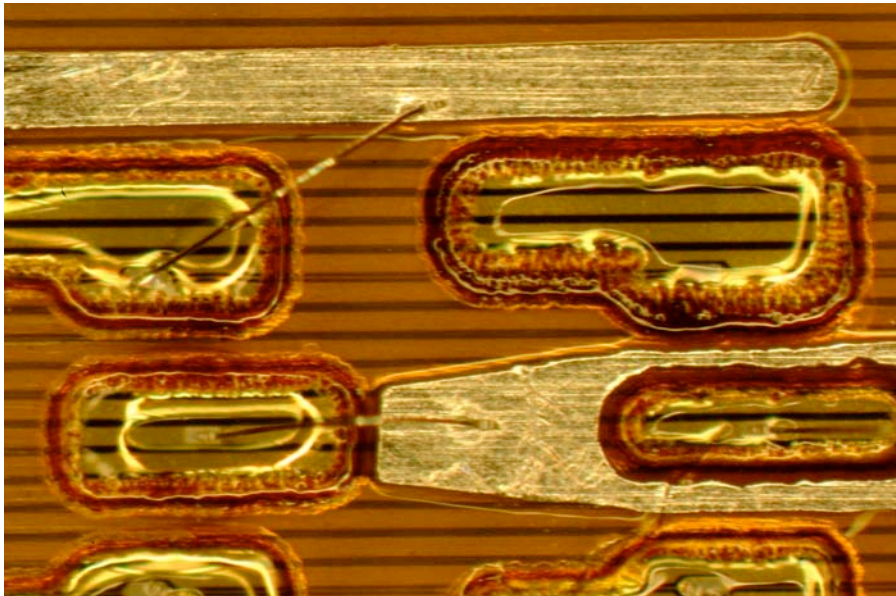


Scelta della colla

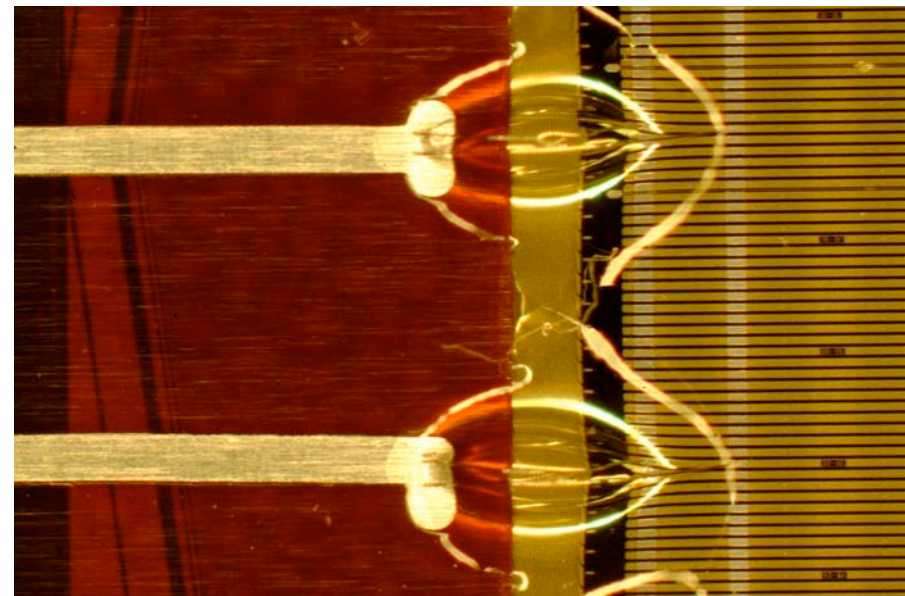


- Per incollare i microcavi "Transition" e "Wrap-around" sulla camera a deriva, nonchè proteggere le microsaldature fra di loro, è stato scelto **High Strength Transparent Silicone Rubber Compound RTV 615**
 - Consigliata da industria (MIPOT, Cormons, Italy)
 - Viscosità bassa – penetra facilmente in fessure strette; si evitano bollicine d'aria
 - Trasparente – facilita il controllo ottico degli assemblaggi realizzati
 - Gommoso, non diventa mai rigido – si evita lo stress meccanico sul rivelatore

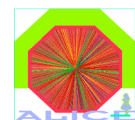
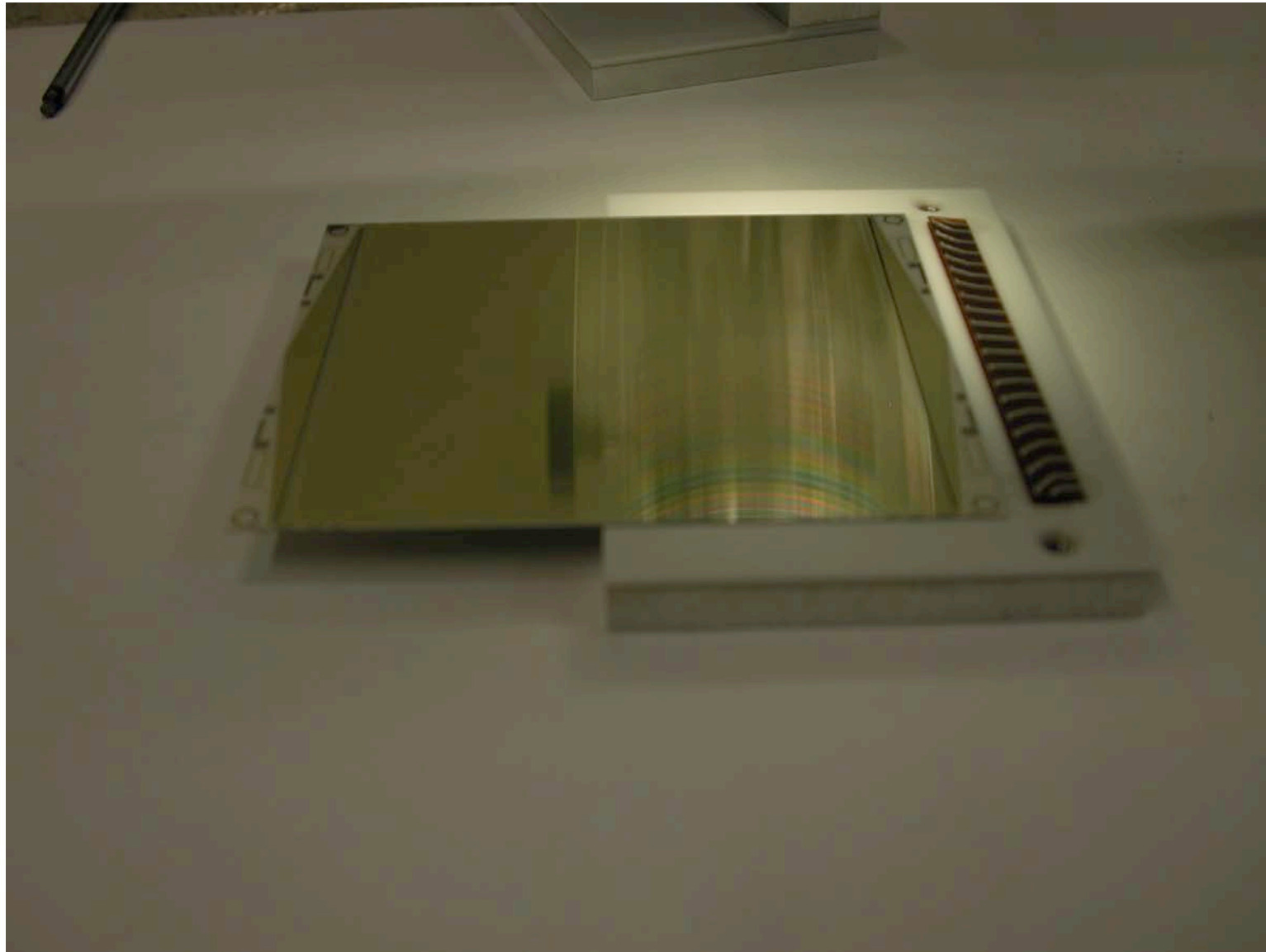
Cavo "Transition": zona di microsaldatura fra piste HV e iniettori centrali



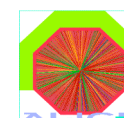
Cavo "Wrap-around": microsaldatura fra piste HV e catodi di deriva



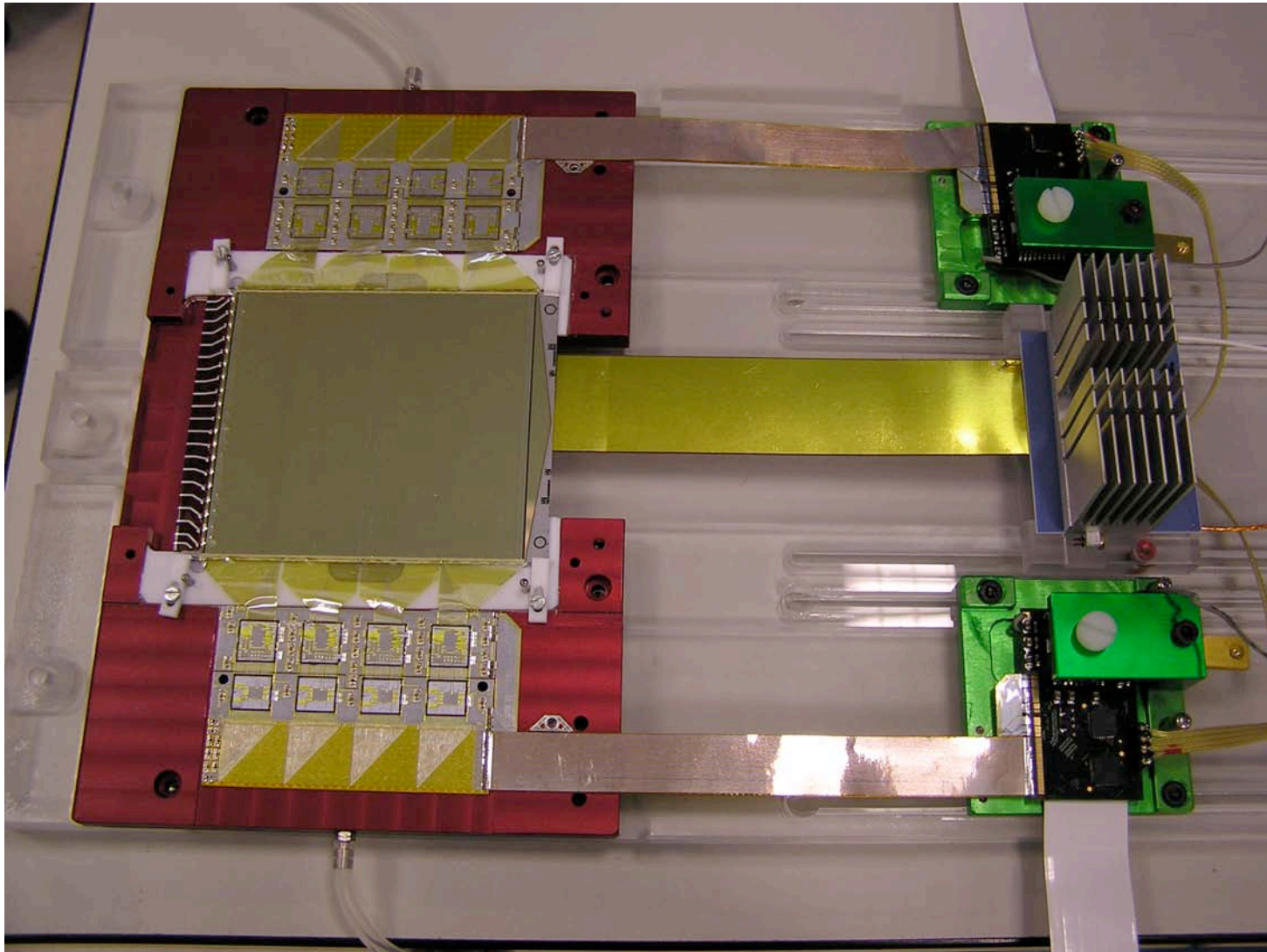
Montaggio del cavo “wrap-around” sulla camera a deriva



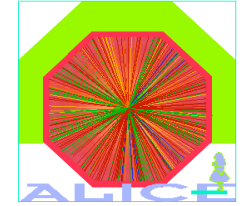
Cavo “wrap-around” montato sulla camera a deriva



Modulo completo (rivelatore + microcavi + elettronica di frontend + elettronica di end-ladder)



Molto difficile da realizzare...ma anche molto bello!



Per una descrizione dettagliata della
Camera a Deriva di Silicio per l'esperimento ALICE
(simulazione, strutture di base, soluzioni tecniche), **VISITATE:**
<http://www.ts.infn.it/experiments/alice/sdd/internal-notes/>

