

Outline

Beamspills

What could happen?

A) Sensor

common discussion

B) Sensor in connection with Switcher and DCD

Precautions?

beam spill/beam loss - known from old LEP days

beam is out of control, hits the beam pipe ... and detectors

generates huge amount of charge, diodes are getting
low ohmic, voltage breakdown

AC coupled strip detectors

oxide damage, since full bias voltage drops across
integrated coupling capacitors



Initiative coming from SVD

They do:

Power shut down (at least HV) if charge corresponding to 1nC / per strip is accumulated in a diamond sensor
-> $50\text{nC}/\text{cm}^2$

Question -> PXD: possible common reactions!

PXD:
situation a bit easier (less HV)

but much more complicated, no experience about possible damage mechanisms



As in all accident scenarios

We probably cannot protect the PXD against a total beam loss directly hitting the detector

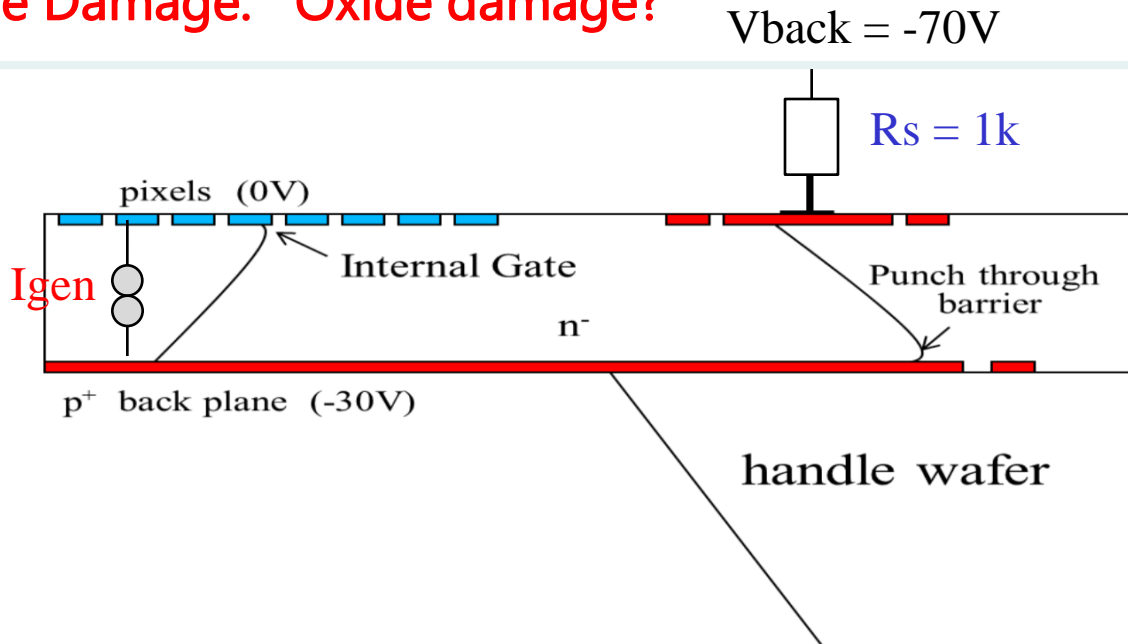
But we should be prepared at least for milder showers ...

Since we don't know neither the total amount of generated charge nor the time structure

General reasonings and speculations ☹

A) damage mechanisms in the sensor

Possible Damage: Oxide damage?

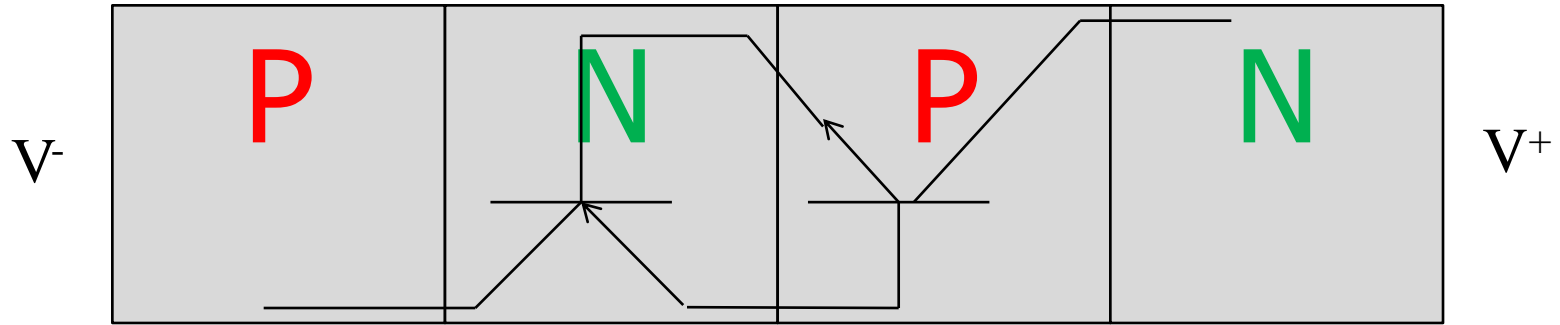


No oxide damage since max (theoretical) voltage drop is $V_{clear_hi} - V_{back} = 100V$
oxides should stand this

Even relaxed: max voltage drop cannot occur in the matrix,
for instance: $I_{gen} = 70mA \rightarrow$ all the voltage drops over R_s

In addition: $R_s \gg R_{on} (Clears)$ all in parallel, matrix will be kept at frontside potentials

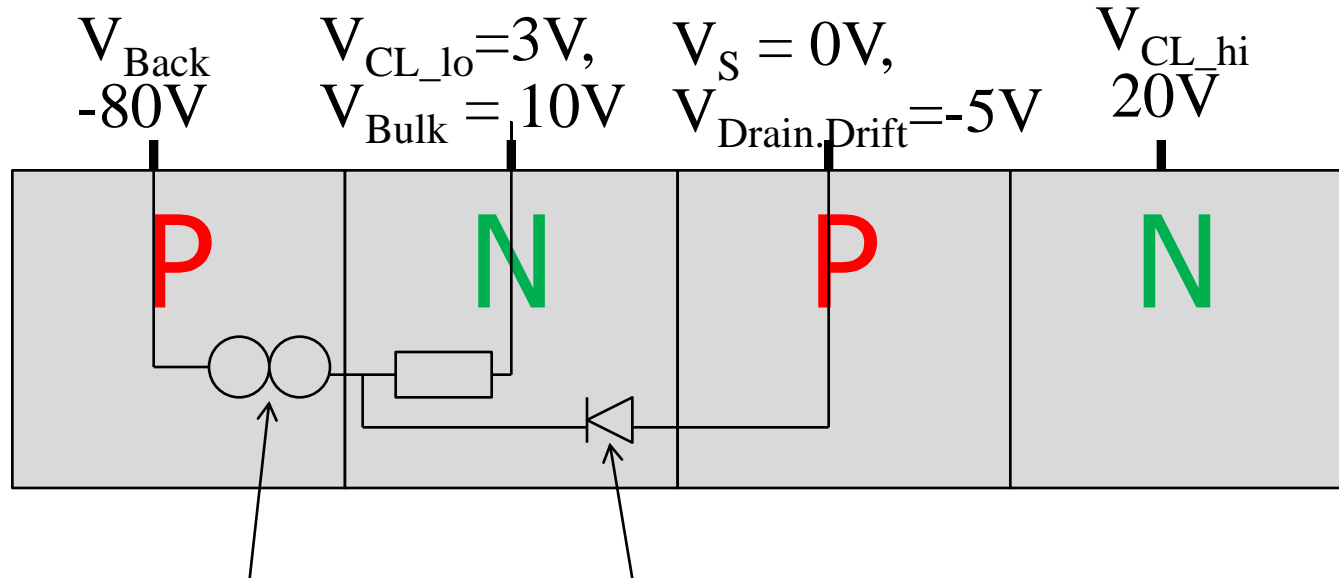
Possible Damage: Thermal destruction?



Forward bias of base emitter diodes
by intention -> thyristor
parasitically -> latch up as in CMOS chips
destructive (thermal) and
non destructive latch up possible
device switches off if voltage drops and current falls
below holding current

The hole device is swammed
over with carriers
getting very low ohmic

all junction contacts
always reversed biased

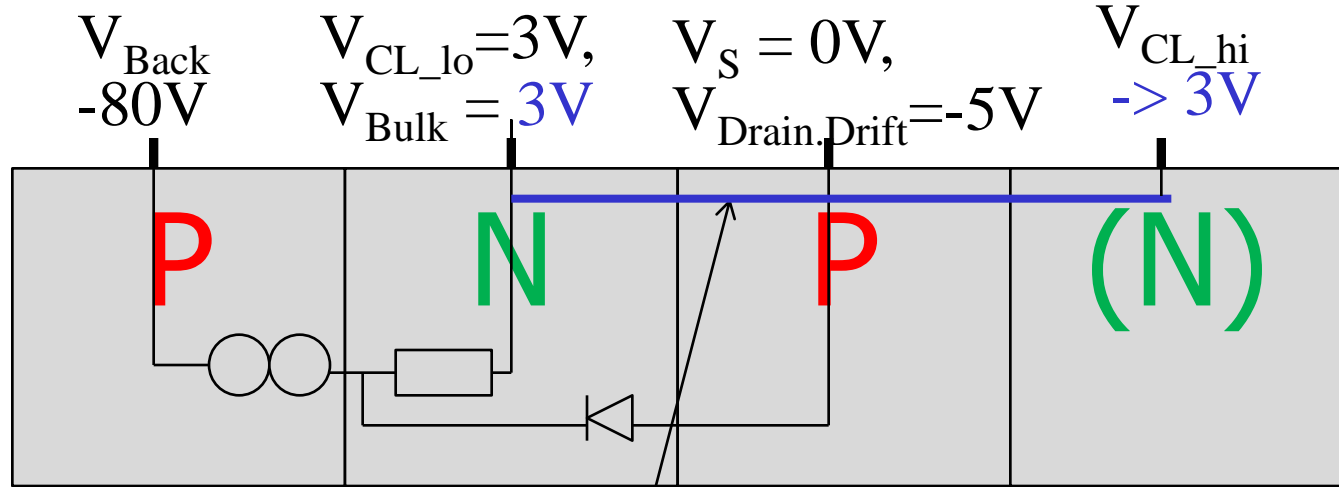


What would help in case of beam spill

Operate: $V_{\text{Bulk}} = V_{\text{CL_lo}}$

Stop sequence

Set: $V_{\text{CL_hi}} = V_{\text{CL_lo}}$



Thyristor becomes a pnp bipolar transistor with partially ,floating‘ gate. Part of the generated electrons will be amplified other part extracted N – contacts.

B) damage mechanisms within Switcher and DCD in connection with sensor



His main concern:

all DEPFET Drains in the matrix are shorten to Source
DCD inputs at 7V, DCD breaks

my question?

If DCD power lines are switched off in time (current limits)
it shouldn't harm ...

Can this be realized?



Switcher outputs have very high driving capability

all outputs in parallel ... it helps

Any mechanism possible theta V_{sub} is getting to positive ?



Reactions

- A) Same as Strips, controlled bias ramp down?
response time?
- B) Gated Mode ?
- C) Exceeding the current limits ...
- D) Emergency power shut down?
- E) Nothing?