Update on the noise performance of the FE chip for the Silicon Strip Detectors of the Super B SVT Inner Layers

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\textsuperscript{3}Universit\`a degli Studi di Pavia

September 19, 2012
Detector Model and Parameters

- **Total Capacitance:** $C_T = C_D + C_{Fan}$
- **Total Resistance:** $R_T = R_S + R_{Fan}$
- **Decoupling Capacitance:** $C_{AC} = 20 \cdot C_D$
- **Leakage Current Shot Noise:** $S_{leak}(f) = 2qI_{leak}$
- **1/3 coefficient for the distributed resistances**
- **Pairing $\times 2$ only in $z$ side Layers 1, 2 and 3**
- **Option A only for Layer 3**

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1L. Bosisio - 03/09/2012
Equivalent Noise Charge for Inner Layers (L0-L3)

For each Layer the total ENC has been evaluated

- for fresh detectors with \( \approx \) no leakage \((\times 0)\)
- after 7.5 years of operation \((\times 7.5)\)
- after 7.5 years of operation with a safety factor of 5 \((\times 37.5)\)

A detailed evaluation of ENC contributions can be found in backup slides:
S/N ratio vs $t_P$ at 1 MIP for Inner Layers (L0-L3)

S/N evaluated at 1 MIP (16 ke- in L0 and 24 ke- in L1 to L3)
The performance of the chip developed for the inner layers has been evaluated also for the outer layers with an extended range of peaking times.

**Equivalent Noise Charge**

- Layer 4 - Phi Side
- Layer 5 - Phi Side
- Layer 4 - Z Side
- Layer 5 - Z Side

**S/N ratio vs $t_P$ at 1 MIP**

- Layer 4 - Phi Side
- Layer 5 - Phi Side
- Layer 4 - Z Side
- Layer 5 - Z Side

A detailed evaluation of ENC contributions can be found in backup slides:
Optimum S/N vs $t_p$ at 1 MIP for Outer Layers (L4-L5)

Simulation performed at $T=20 \, ^\circ\text{C}$

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Simulation performed at $T=14 \, ^\circ\text{C}$

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**ENC in Layer 1**

### Phi Side

**Layer 1 - Phi Side**

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**Total ENC**

- **RS**
- **RFan**
- **CSA**
- **RB**

Leakage: x 7.5

**TP ENC**

- **TP ENC**
- **TP ENC**
- **TP ENC**
- **TP ENC**

**Total ENC**

- **RS x 7.5**
- **RFan x 7.5**
- **CSA x 7.5**
- **RB x 7.5**

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### Z Side with Pairing ×2 only

**Layer 1 - Z Side**

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**Total ENC**

- **RS**
- **RFan**
- **CSA**
- **RB**

Leakage: x 7.5

**TP ENC**

- **TP ENC**
- **TP ENC**
- **TP ENC**
- **TP ENC**

**Total ENC**

- **RS x 7.5**
- **RFan x 7.5**
- **CSA x 7.5**
- **RB x 7.5**

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### Phi Side

#### ENC in Layer 2 - Phi Side

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#### ENC in Layer 2 - Z Side

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**ENC in Layer 3**

**Phi Side**

![Graph showing ENC in Layer 3 - Phi Side](image)

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**Z Side with Pairing ×2 only**

![Graph showing ENC in Layer 3 - Z Side](image)

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ENC in Layer 4

Phi Side

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Z Side

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## ENC in Layer 5

### Phi Side

![Graph showing ENC in Layer 5 - Phi Side with data points and annotations.]  

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### Z Side

![Graph showing ENC in Layer 5 - Z Side with data points and annotations.]  

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