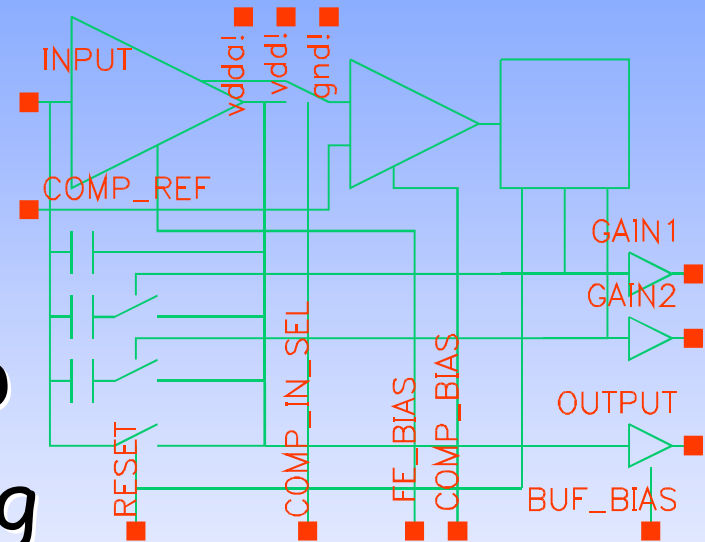




HH_AGIPD_FC_FE

Front-end with

- Folded-Cascode Preamp
- Adaptive Gain Switching
- 2.4V Operation
- Only Thin-Oxide Transistors (except for a few NMOSes)



Ulrich Trunk

PAUL SCHERRER INSTITUT

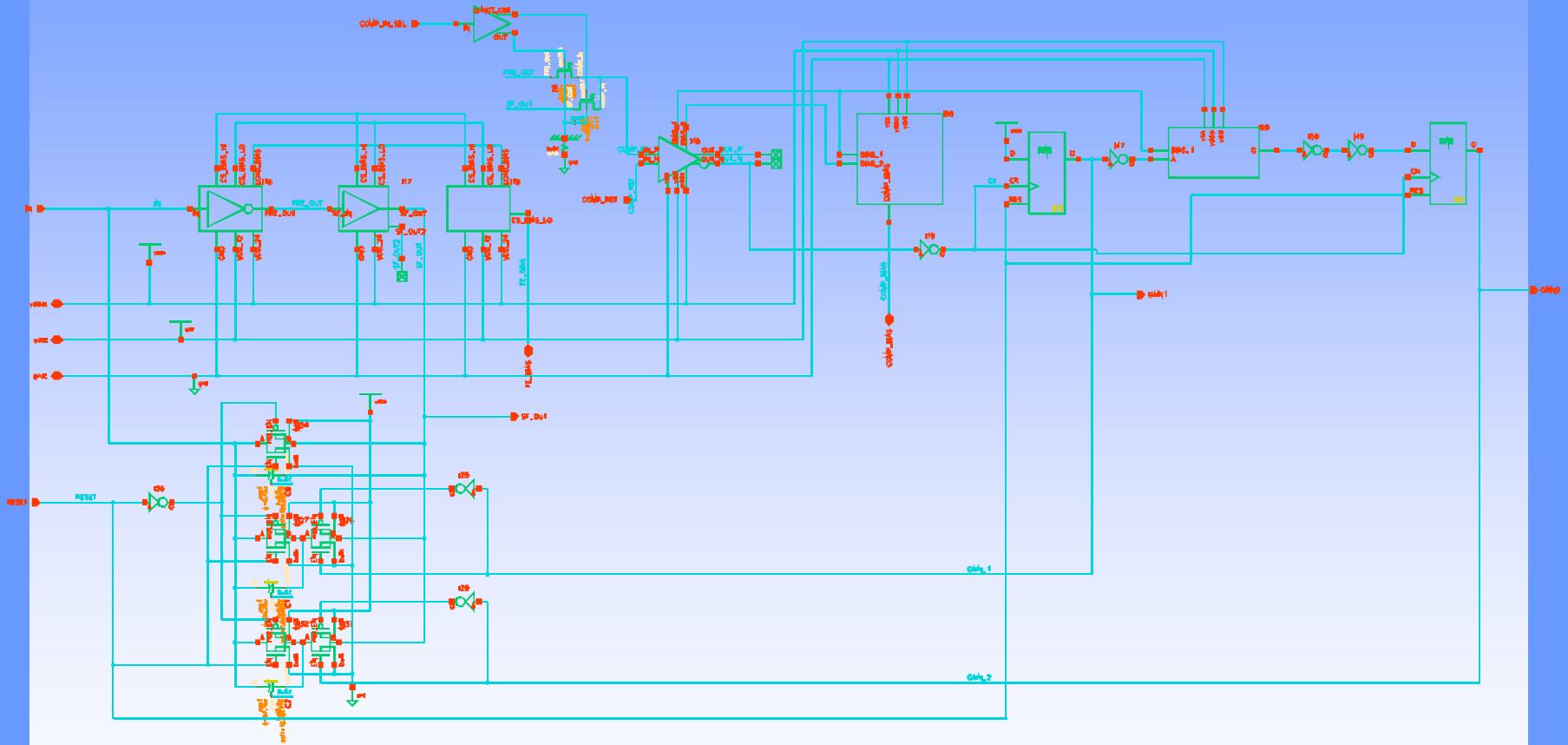


HH_AGIPD_FC_FE



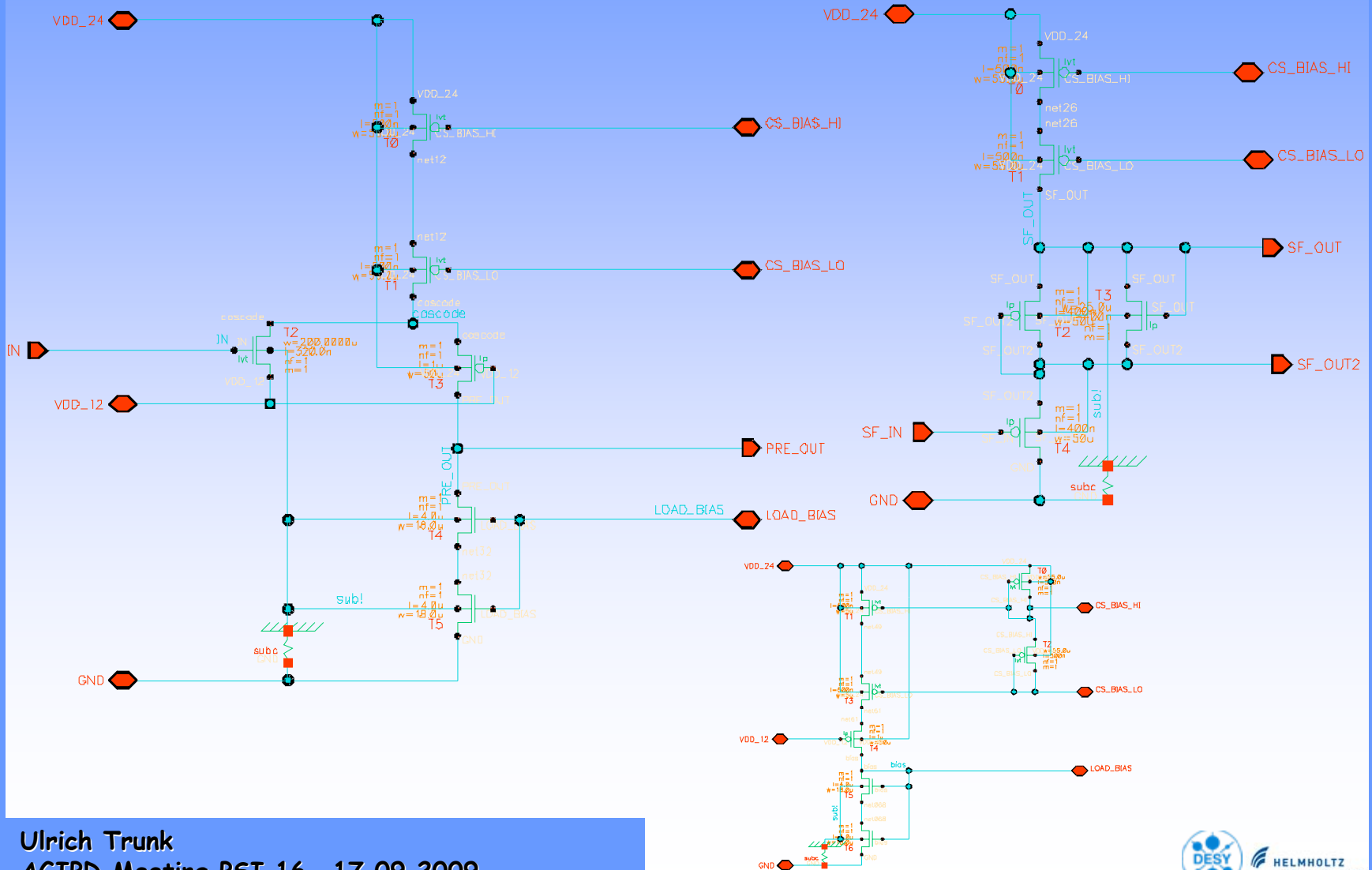
- Schematics
- Simulation
- Layout
- Outlook

HH_AGIPD_FC_FE Schematics

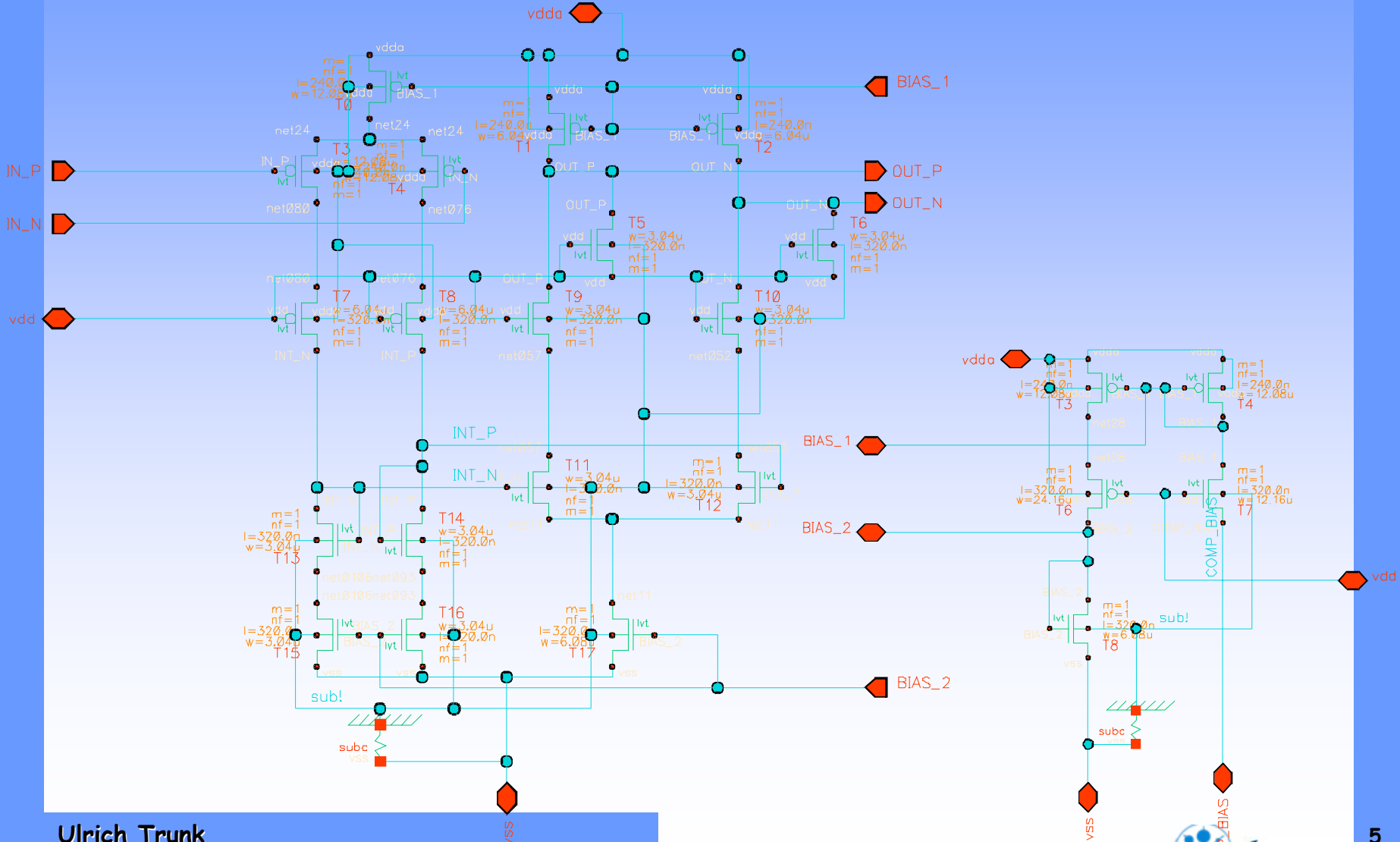


HH_AGIPD_FC_FE

FC Preamp



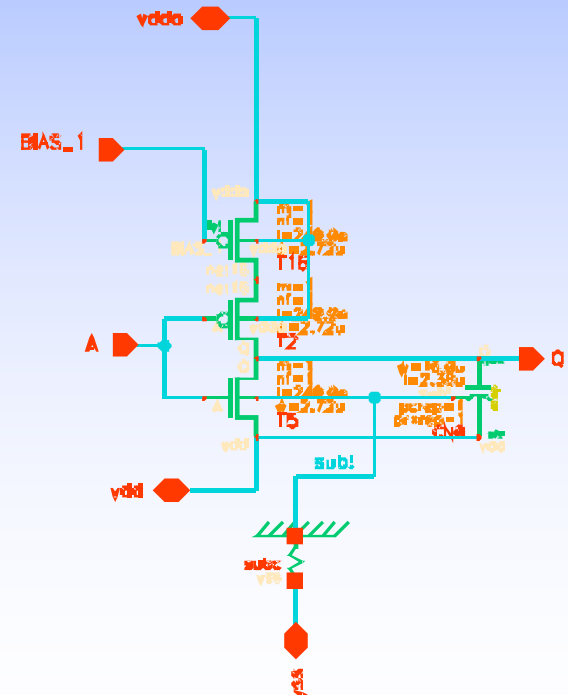
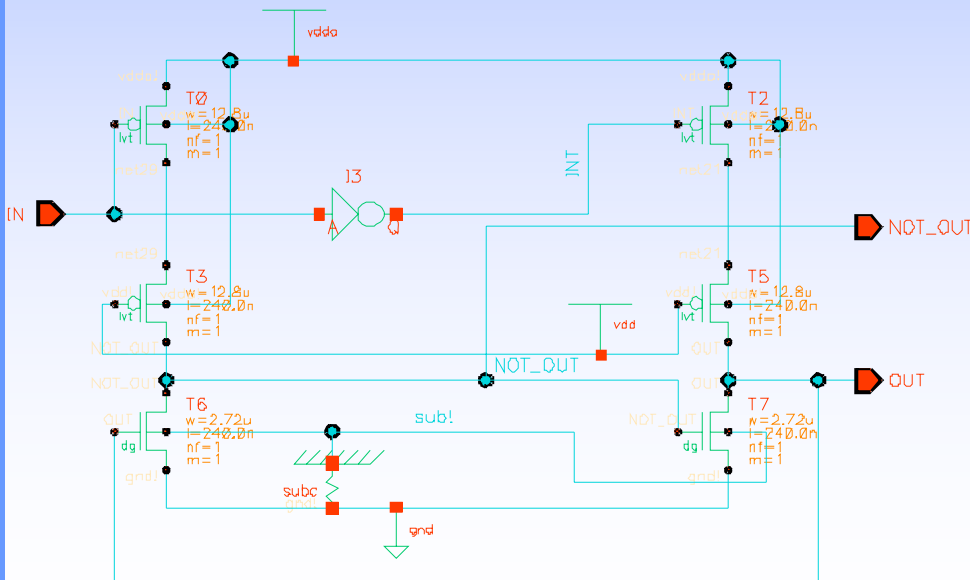
HH_AGIPD_FC_FE Discriminator



HH_AGIPD_FC_FE

Other

- Level Shifter
 - 1.2V -> 2.4V
- Delay Circuit

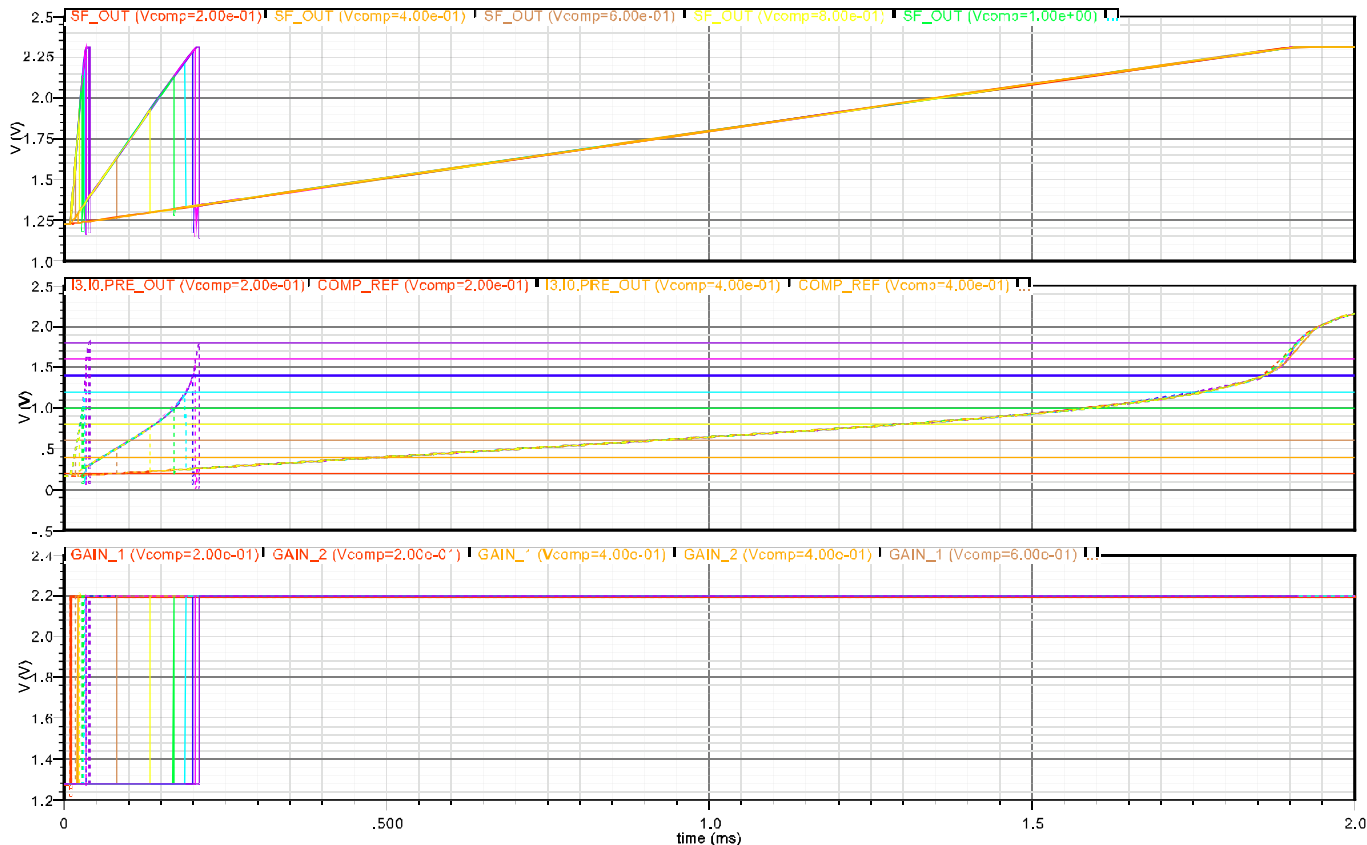


HH_AGIPD_FC_FE Simulations



User: trunk Date: Sep 7, 2009 6:48:37 PM CEST HH_AGIPD_FC_FE Test_HH_AGIPD_FE_ramp schematic : Sep 7 18:10:48 2009 24

- Integration of a constant current

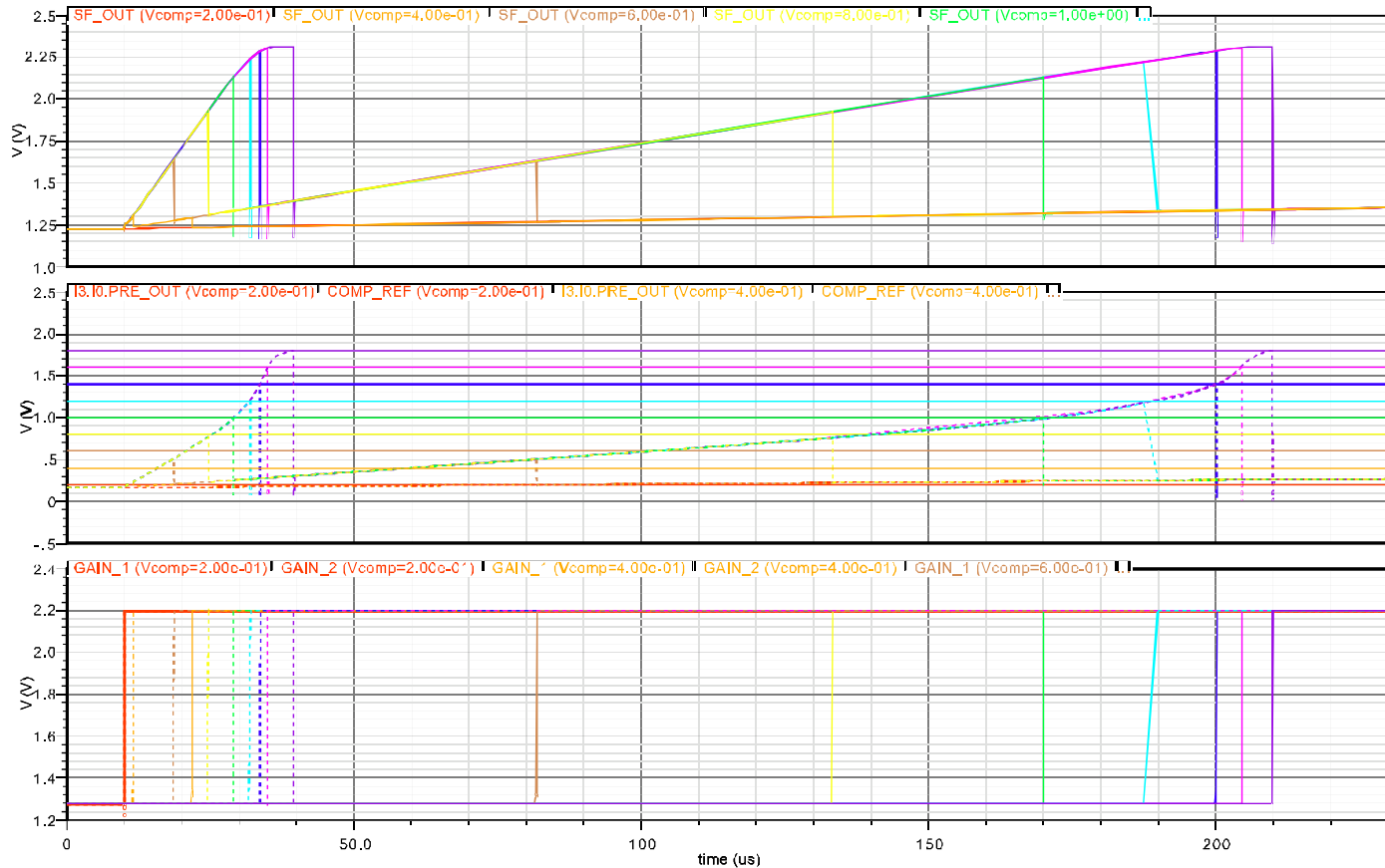


HH_AGIPD_FC_FE Simulations



User: trunk Date: Sep 7, 2009 6:49:37 PM CEST HH_AGIPD_FC_FE Test_HH_AGIPD_FE_ramp schematic : Sep 7 18:10:48 2009 24

- High- and medium gain

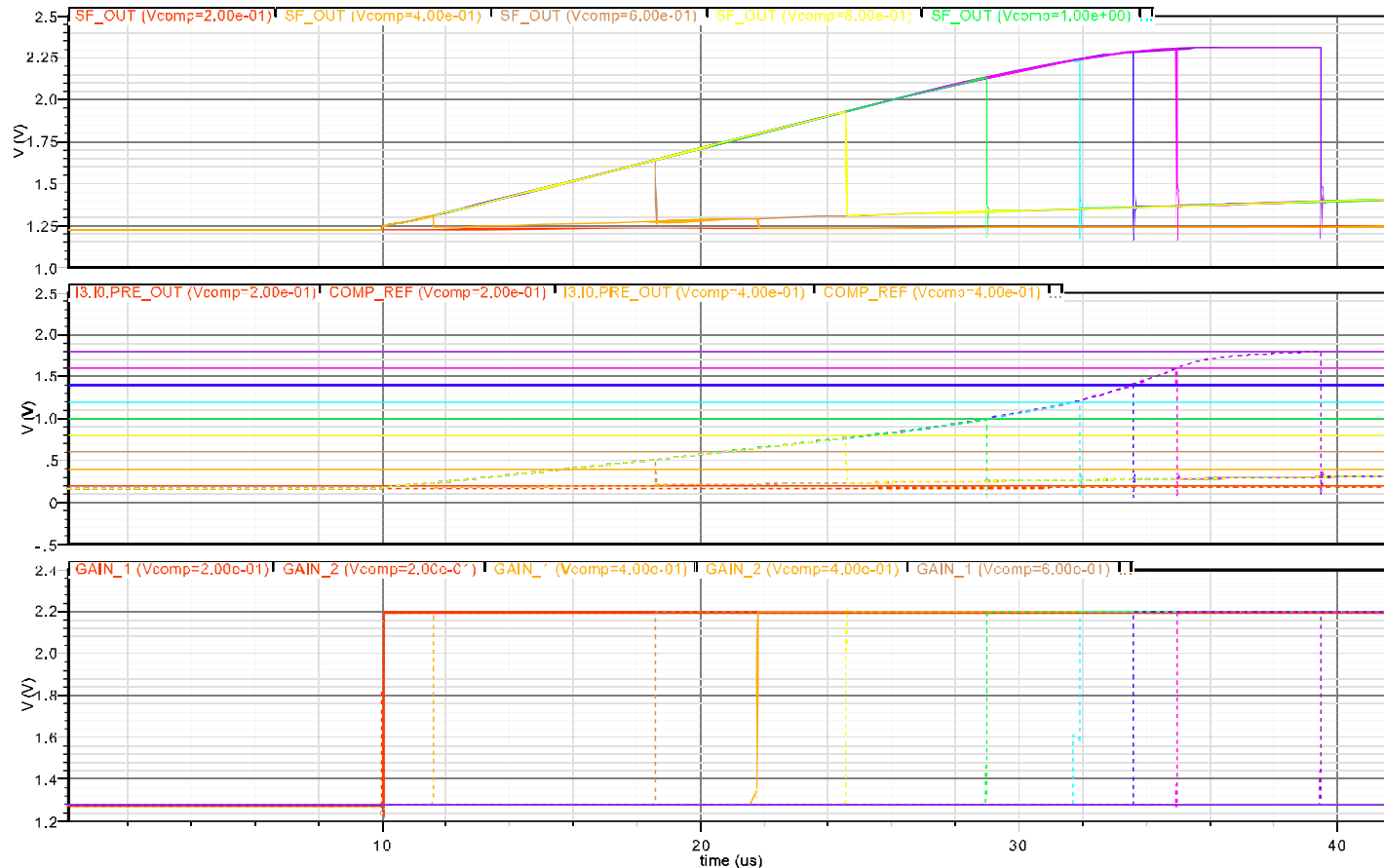


HH_AGIPD_FC_FE Simulations



User: trunk Date: Sep 7, 2009 6:51:08 PM CEST HH_AGIPD_FC_FE Test_HH_AGIPD_FE_ramp schematic : Sep 7 18:10:48 2009 24

- High gain only



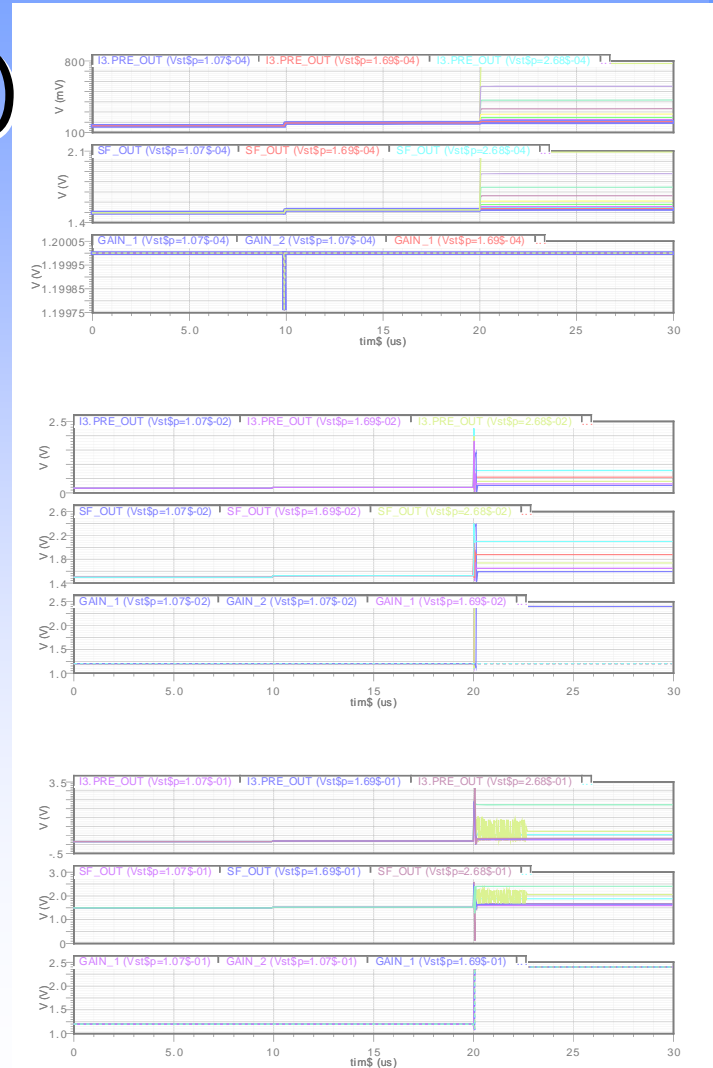
HH_AGIPD_FC_FE Simulations



Us\$ trunk Dns\$ SSp 8, 2009 7:24:54 PM CEST

HH_AGIPD_FC_FE_T3331_HH_AGIPD_FE_s1Sp sch\$matic - SSp 8 18:37:55 2009 3

- Voltage step ($t_{\text{rise}}=10\text{ns}$)
- From 1.066fC
- To 10,66pC
- 5 steps/decade

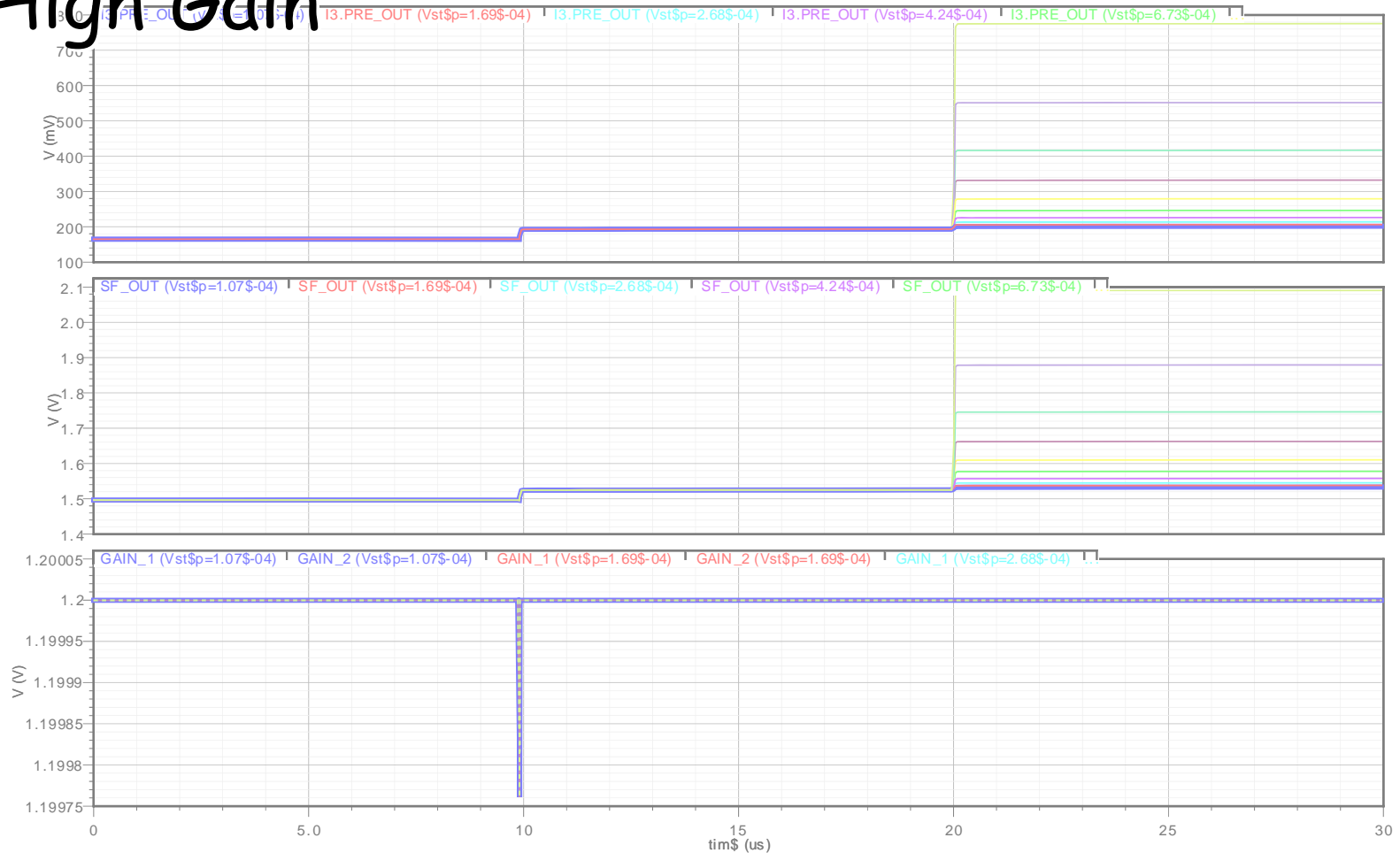


HH_AGIPD_FC_FE



Us\$trunk Des\$ 8. 2009 7:32:08 PM CEST HH_AGIPD_FC_FE T\$st_HH_AGIPD_FE_st\$p sch\$matic : S\$p 8 18:37:55 2009 35

- High Gain



HH_AGIPD_FC_FE



Us\$: trunk Date : Sep 8, 2009 7:32:34 PM GEST Path : HH_AGIPD_FC_FE Tst\$: HH_AGIPD_FC_FE St\$: sch\$: S\$: 8 18:37:55 2009 35

Simulations

- Medium Gain
- 5 traces = 1 decade!



HH_AGIPD_FC_FE



Us\$trunk D:\\$S\$ 8, 2009 7:32:49 PM CEST HH_AGIPD_FC_FE T\$st_HH_AGIPD_FE_st\$p sch\$matic : S\$ 8 18:37:55 2009 35

Simulations

- Low Gain



HH_AGIPD_FC_FE Simulations



UsSr: trunk Dat\$: SSp 14, 2009 2:11:04 PM CEST

HH_AGIPD_FC_FE TSS: HH_AGIPD_FC_FE_noise.schematic: SSp 14 11:40:46 2009 23

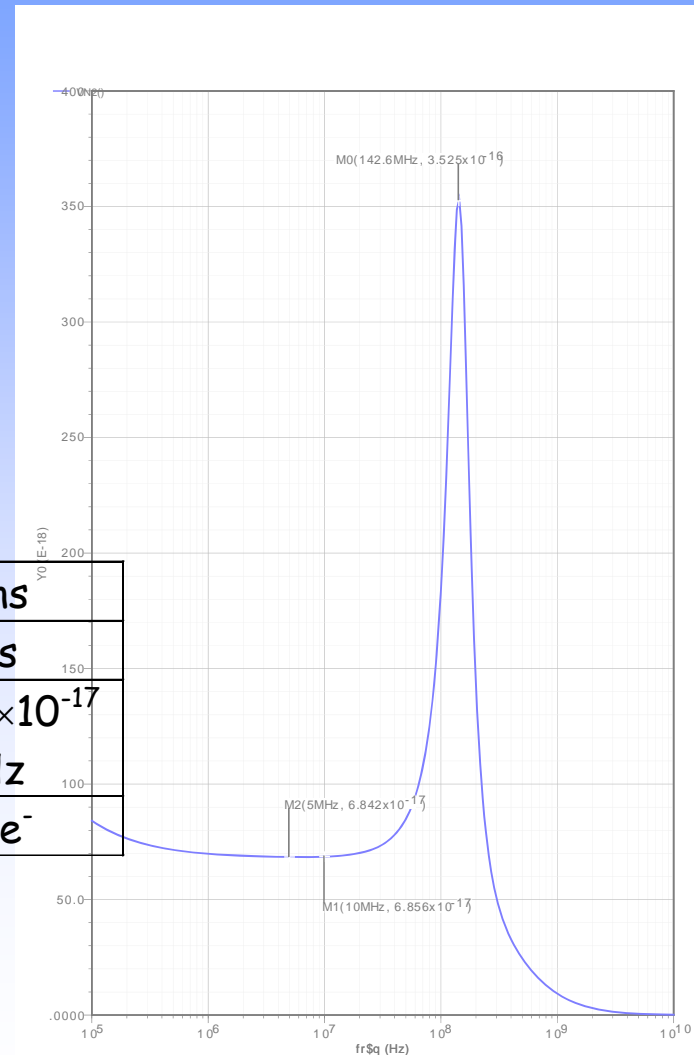
- Noise

$$Q_{nv} = \sqrt{\frac{c_p^2 \cdot e_n^2}{\tau} \cdot \frac{1}{2(1 - e^{-T/\tau})}}$$

T = distance between samples

τ = Integrator RC time constant

τ	1.12ns	10ns	15.9ns	31.8ns
T	100ns	100ns	100ns	100ns
e_n^2	3.53×10^{-16}	3.53×10^{-16}	6.86×10^{-17}	6.84×10^{-17}
	V ² /Hz	V ² /Hz	V ² /Hz	V ² /Hz
ENC	608e ⁻	203e ⁻	71.2 e ⁻	51.3 e ⁻

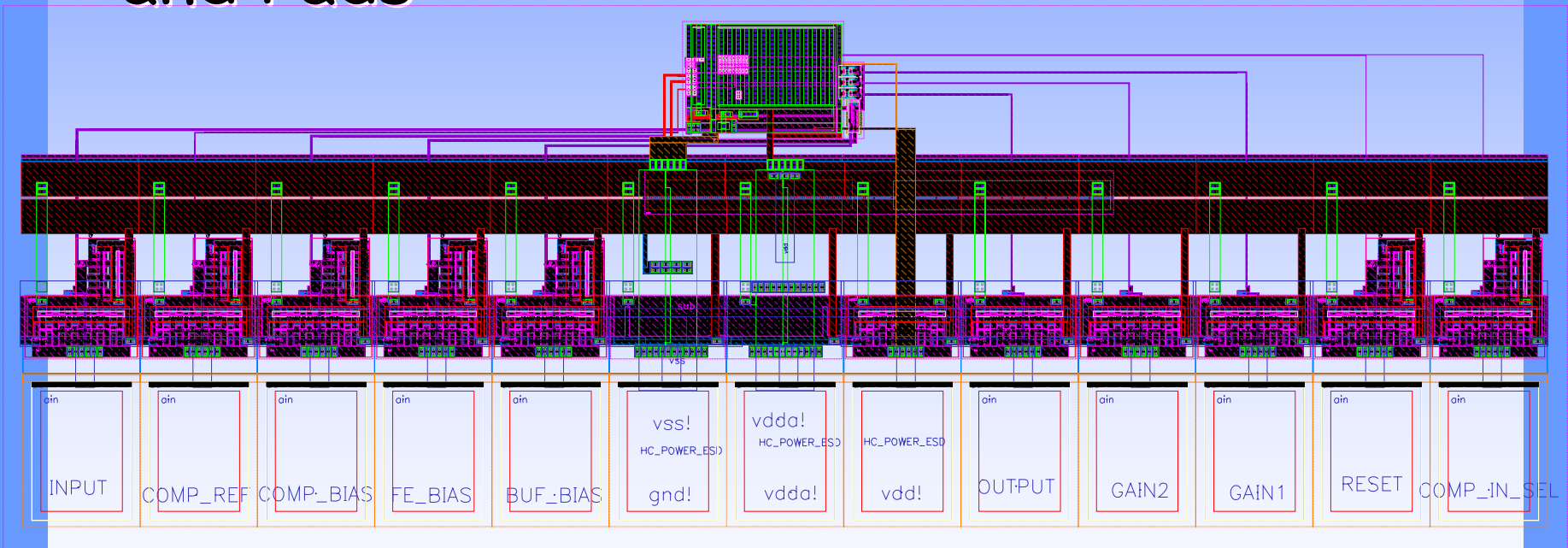


HH_AGIPD_FC_FE



Layout

- Complete Block with Buffers (ZVT-SF) and Pads

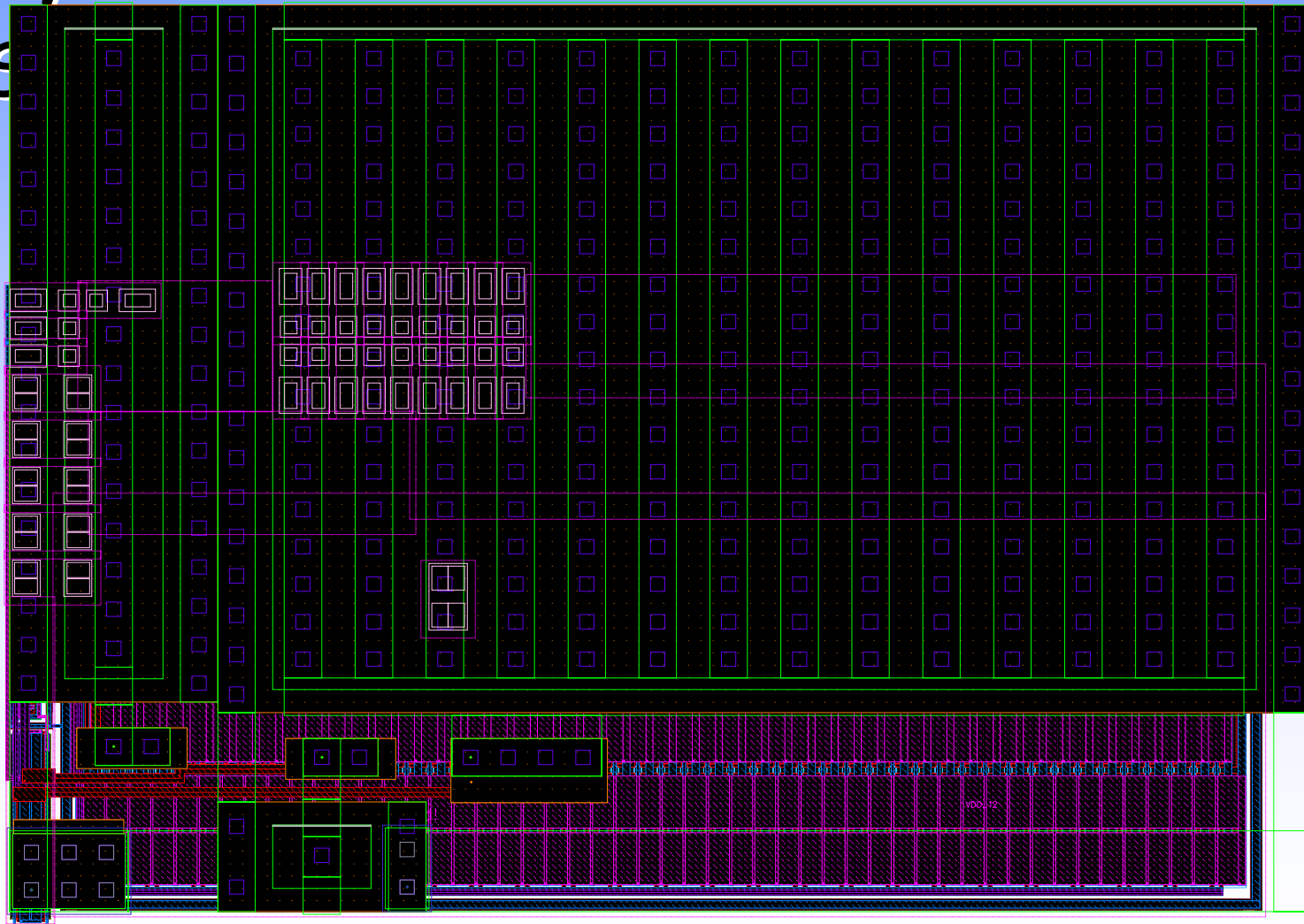


HH_AGIPD_FC_FE



Layout

- s



HH_AGIPD_FC_FE



Summary

- It is possible to build a Folded-Cascode based AGIPD front end...
 - Operating from 2.4V supply
 - Using only thin oxide (P)MOS devices
- **Perspectives:**
 - Higher OL gain and speed
 - Lower noise
 - Higher dynamic range
- **Requires additional power supply**
- Will be submitted in Nov. '09
- Stay tuned for results.....