UNIVERSITÀ
DEGLI STUDI DI TRIESTE


# Template List for SVT Fanouts

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# Summary

- First contacts with Erik Vallazza (CERN, Mipot)
- BaBar experience (unfortunately not mine)
- I've started writing Latex Template
  - Adding Layer0 (see Stefano presentation)
  - Layer 1-5 as BaBar with the extended geometry
    - Numbers will still be very rough (I can assume same number of Φ strips and 45% more Z strips)
  - Prototypes and possible improvements: needed for Layer0, probably not needed for Layer 1-5

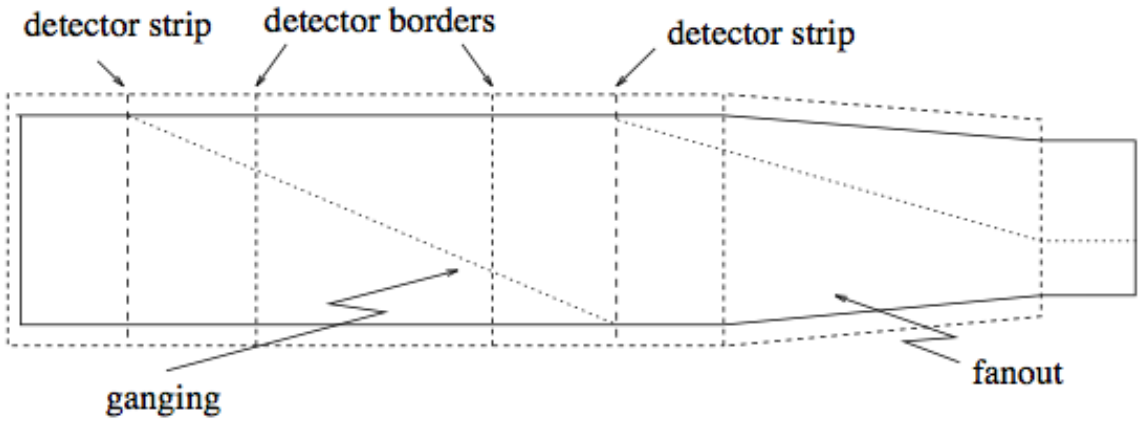
# Some Final Fanout parameters from BaBar

Biblio: TDR, BaBar Notes 376 (Fanout specs), 307 (Assembly), 312 (Final Geom), 273 (Numbering Conventions), 306, 392, BaBar detector.

- 50 µm thick Upilex substrate
- 4.5 µm Cu layer deposited on 150 nm layer of adhesive Cr
- <1 µm Au layer on another 150 nm layer of Cr
- Average rad. length 0.03%$X_0$
- R=1.6 Ω/cm $R_{IS}$>2MΩ
- $C_{IS}$=0.52pF/cm

# Some Fanout parameters from BaBar (cont.)

- 28 different designs to accommodate all layer specs: 01 02 03 4A 4B 5A 5B; Forw Backw; Z Phi.
- Total 208 fanouts for the 6 6 6 16 18 modules
- Minimum pitch 41 µm (on wafer type VI Wedge)
- Line width depends on strip pitch, 30(70) µm on 100 (210) µm strip pitch, reducing to 20 µm on electronics side (min. 8 µm)
- 2x Ganging on Layers Z 4 & 5 (from 55% to 98.9 %)



# Production and Quality Control Procedures

- Design @ Trieste (PCAD including test structures)
- CERN production and first visual inspection (to check for opens and to remove shorts)
- Trieste (~~Della Ricca,~~ Lanceri, ~~Pontoni, Poropat, Prest~~?, Vallazza) + (tecn. Bari, Benedetti) more accurate tests, shorts removal, cut test structures and second test after cut (150 working days)
- Accepted only 3 lost strips (<0.55%) and 0 shorts (90% yield on Φ and 70% on Z)

# Table

I can starting updating this table (that is not the final one)

| Layer | Fanout Type | Length (cm) | Number of Readout | | Typical Pitch at | | Number of Circuits |
|---|---|---|---|---|---|---|---|
| | | | Strips | Channels | Input($\mu$m) | Output ($\mu$m) | |
| 1 | $z$, F+B | 12.5 | 950 | 768 | 100 | 50 | 12 |
| | $\phi$, F+B | 3.0 | 768 | 768 | 50 | 50 | 12 |
| 2 | $z$, F+B | 14.5 | 1150 | 1024 | 100 | 50 | 12 |
| | $\phi$, F+B | 3.0 | 960 | 1024 | 50 | 50 | 12 |
| 3 | $z$, F+B | 15.6 | 1360 | 1280 | 100 | 50 | 12 |
| | $\phi$, F+B | 2.0 | 1280 | 1280 | 50 | 50 | 12 |
| 4a | $z$, F | 19.7 | 885 | 512 | 200 | 50 | 8 |
| | $z$, B | 24.3 | 1115 | 512 | 200 | 50 | 8 |
| | $\phi$, F+B | 2.0 | 512 | 512 | 65 | 50 | 16 |
| 4b | $z$,F | 20.6 | 930 | 512 | 200 | 50 | 8 |
| | $z$,B | 24.2 | 1160 | 512 | 200 | 50 | 8 |
| | $\phi$, F+B | 2.0 | 512 | 512 | 65 | 50 | 16 |
| 5a | $z$, F | 25.2 | 1160 | 512 | 200 | 50 | 9 |
| | $z$, B | 25.1 | 1205 | 512 | 200 | 50 | 9 |
| | $\phi$, F+B | 2.0 | 512 | 512 | 65 | 50 | 18 |
| 5b | $z$, F+B | 26.1 | 1205 | 512 | 200 | 50 | 18 |
| | $\phi$, F+B | 2.0 | 512 | 512 | 65 | 50 | 18 |

**Table 4-5.** *Summary of fanout circuit characteristics.*

# Latex template

- Separate description for Layer 0 and Layer1-5
- Paragraphs:
  - Description and Requirements
    - Specs (typical R,C,$X_0$)
  - Design
    - Table with Types, #pieces, #lines, %ganging

    (Final depends on wafers size, pitch, #readout strips, #chips)
  - Fabrication
  - Quality Control Procedures
  - Need to put a final paragraph on R&D, Prototypes, Optimization, Improvements? (for layer0 yes)

# Backup
# Final BaBar Tables

| Layer | #wafers/fwd mod | #wafers/bkwd mod | phi pitch($\mu$m) | z pitch ($\mu$m) |
|---|---|---|---|---|
| 1 | 2 | 2 | 50 | 100 |
| 2 | 2 | 2 | 55 | 100 |
| 3 | 3 | 3 | 55 | 100 |
| 4a | 3 | 4 | 100 | 210 |
| 4b | 3 | 4 | 100 | 210 |
| 5a | 4 | 4 | 100 | 210 |
| 5b | 4 | 4 | 100 | 210 |

| Wafer type | I | II | III | IV | V | VI (wedge) |
|---|---|---|---|---|---|---|
| Dimensions (mm) | | | | | | |
| z | 42.40 | 45.40 | 43.90 | 67.55 | 53.9 | 67.97 |
| phi | 41.30 | 49.415 | 71.47 | 52.50 | 52.50 | 52.80 $\rightarrow$ 43.30 |
| Readout pitch ($\mu$m) | | | | | | |
| z | 100 | 100 | 100 | 210 | 210 | 210 |
| phi | 50 | 55 | 55 | 100 | 100 | 100 $\rightarrow$ 82 |
| Number of strips | | | | | | |
| z | 411 | 441 | 426 | 316 | 251 | 318 |
| phi | 799 | 874 | 1275 | 512 | 512 | 512 |

From
BaBar Note 273

| Layer | #chips/readout section | # r/o channels | # phi r/o strips | # z r/o strips (f/b) |
|---|---|---|---|---|
| 1 | 7 | 896 | 799 | 822 |
| 2 | 7 | 896 | 874 | 882 |
| 3 | 10 | 1280 | 1275 | 1278 |
| 4a | 5 | 640 | 512 | 885/1071 |
| 4b | 5 | 640 | 512 | 950/1071 |
| 5a | 5 | 640 | 512 | 1201/1266 |
| 5b | 5 | 640 | 512 | 1266/1266 |

| Wafer type | I | II | III | IV | V | VI (wedge) |
|---|---|---|---|---|---|---|
| Dimensions (mm) | | | | | | |
| z (L) | 42.40 | 45.40 | 43.90 | 67.55 | 53.9 | 67.97 |
| $\phi$ (W) | 41.30 | 49.415 | 71.47 | 52.50 | 52.50 | 52.80 $\rightarrow$ 43.30 |
| Readout pitch ($\mu$m) | | | | | | |
| z | 100 | 100 | 100 | 210 | 210 | 210 |
| $\phi$ | 50 | 55 | 55 | 100 | 100 | 100 $\rightarrow$ 82 |
| Number of readout strips | | | | | | |
| z | 411 | 441 | 426 | 316 | 251 | 318 |
| $\phi$ | 799 | 874 | 1275 | 512 | 512 | 512 |
| Phys. strip pitch ($\mu$m) | | | | | | |
| z | 50 | 50 | 50 | 105 | 105 | 105 |
| $\phi$ | 50 | 55 | 55 | 50 | 50 | 50 $\rightarrow$ 41 |

From
BaBar Note 312
& 307

| Quantity | Layer 1 | Layer 2 | Layer 3 | Layer 4a | Layer 4b | Layer 5a | Layer 5b |
|---|---|---|---|---|---|---|---|
| Radius (mm) | 32 | 40 | 54 | 124 | 127 | 140 | 144 |
| Wafers/Module | 4 | 4 | 6 | 7 | 7 | 8 | 8 |
| Modules/Layer | 6 | 6 | 6 | 8 | 8 | 9 | 9 |
| R.O. Sections/Module | 4 | 4 | 4 | 4 | | 4 | |
| ICs/R.O. Section | 7 | 7 | 10 | 5 | | 5 | |
| Strip Length, b/f (mm): | | | | | | | |
| $\phi$ | 82 | 88 | 127 | 230/189 | 230/203 | 270/257 | 270/270 |
| $z$ | 40 | 48 | 70 | 42–51 | 42–51 | 42–51 | 42–51 |
| $z$ Ganging (f/b): | | | | 34%/67% | 48%/67% | 88%/98% | 98%/98% |
| Readout pitch ($\mu$m): | | | | | | | |
| $\phi$ | 50 | 55 | 55 | 80–100 | | 80–100 | |
| $z$ | 100 | 100 | 100 | 210 | | 210 | |
| Floating Strips: | | | | | | | |
| $\phi$ | — | — | — | 1 | | 1 | |
| $z$ | 1 | 1 | 1 | 1 | | 1 | |
| Intrinsic Resolution($\mu$m): | | | | | | | |
| $\phi$ | 10 | 10 | 10 | 10–12 | | 10–12 | |
| $z$ | 12 | 12 | 12 | 25 | | 25 | |

From
BaBar Note 306