

X線モニター用ディテクター読み出し回路

フラナガン

STURM Specifications

- Designer: G. Varner, UH (Belle)
- 8 Channels/ASIC
- 32 samples/channel
 - Up to 8 external timing strobcs
 - Each timing strobe can fire 4 timing samples, with minimum spacing < 5 ps.
- 例:
 - 8 bunches, 4 samples/bunch
 - 32 bunches
 - 8 trains, 4 bunches/train
- Total readout $8 \mu s$
 - Turn-by-turn

Key Specifications of the STURM ASIC.

<i>Parameter</i>	Value	Comment
Number Channels	8	detector pix/chip
Storage cells/channel	32	$8 \times 32 = 256$ total
Timing Strobcs	8	Independent
Analog bandwidth	$\geq 10\text{GHz}$	resolve bunch
Effective Sampling	$\leq 5\text{ps}$	≥ 200 GSa/s
Conversion cycle	$1\mu s$	for 32 samples
Total readout	$8\mu s$	for all samples

Sampler of Transients for Uniformly Redundant Masks (STURM)

2. System Overview

In order to monitor the x-ray fingerprint of each bunch ... as discussed conceptually in [1], we propose to instrument a detector array with a set of custom ASICs. This arrangement is shown in block diagram form in Fig. 1. The use of high-performance RF amplifiers will depend upon the effective source impedance of the detector, as discussed below.

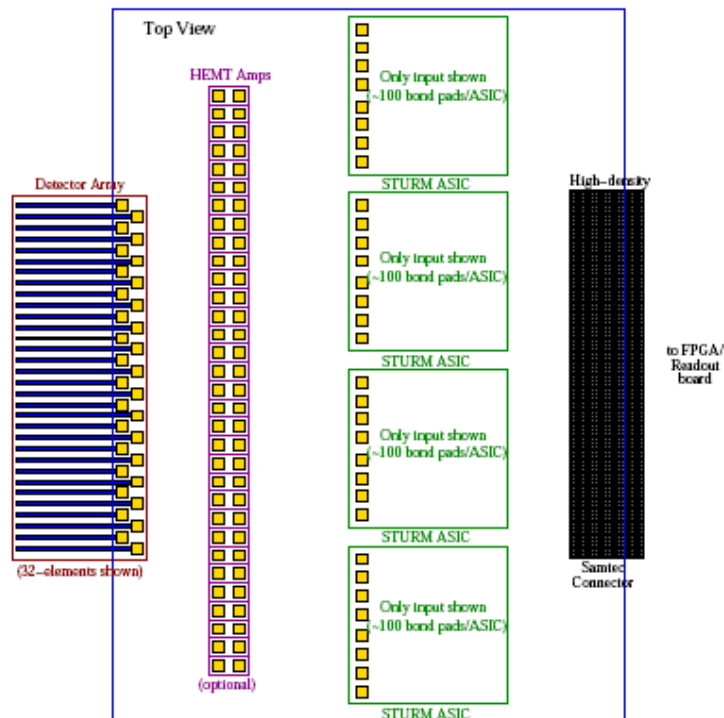


Fig. 1. Overview of the URM readout system (top view).

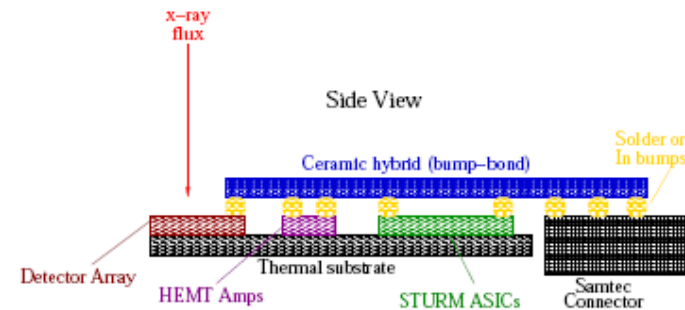


Fig. 2. Side view of the URM readout system, with the bump-bonded solid-state devices and interface connect shown. Electrical coupling is provided through a ceramic or silicon hybrid board, and all devices are mounted onto a thermal substrate for temperature stabilization.

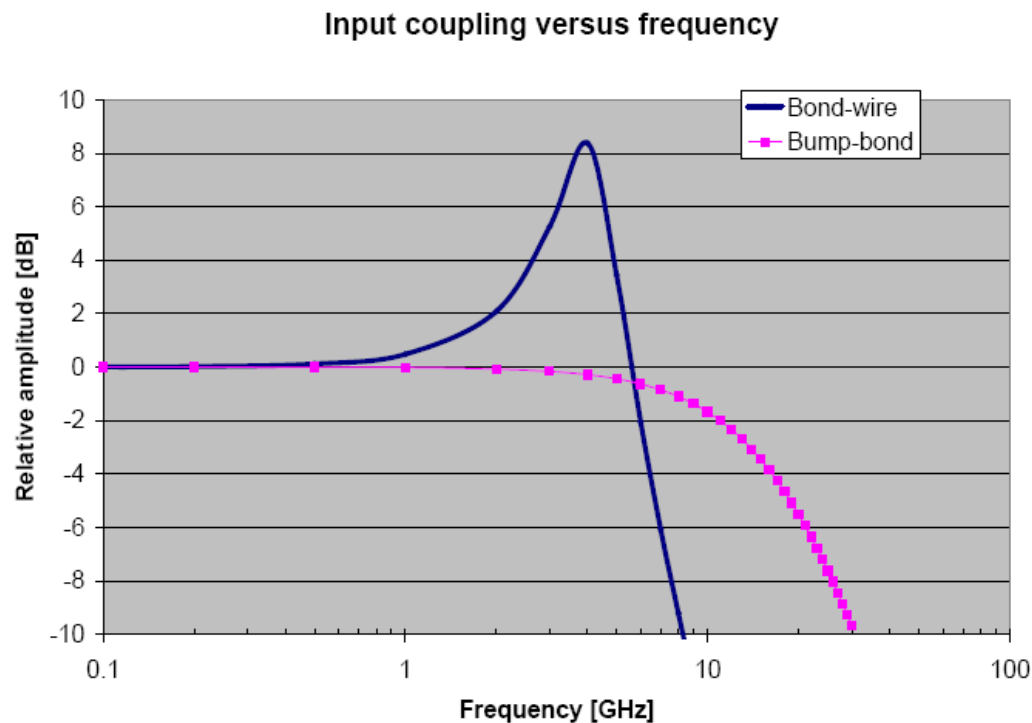
(ASIC) is being designed to the set of specifications listed in Table 1. An acronym indicative of its functionality has been chosen: the Sampler of Transients for Uniformly Redundant Masks (STURM).

Table 1

Key Specifications of the STURM ASIC.

Parameter	Value	Comment
Number Channels	8	detector pix/chip
Storage cells/channel	32	$8 \times 32 = 256$ total
Timing Strobes	8	Independent
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Total readout	$8\mu\text{s}$	for all samples

Wire bonding vs bump bonding



$\frac{2L}{C} \text{ (13)}$
Fig. 10 Input coupling versus frequency for the modified gain due to the addition of inductance due to lead interconnect. Very strong peaking is seen for the bonding-wire case.

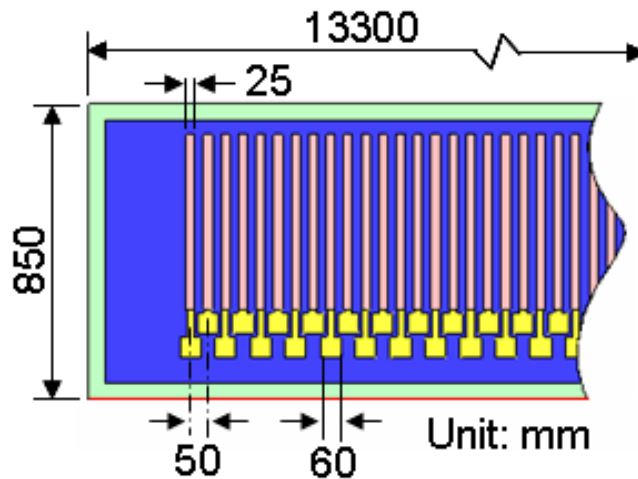
- レイアウトが決まるまでwire-bondingで接続する必要。
- すると、cutoff周波数が約14 GHz->約7 GHzまで落ちる。(理想ケース: HEMTがインピーダンスマッチングのため必要可能性がある。)
- Time resolution:
 - $t_{\text{rise}} = 1/(4 * f_{\text{cutoff}})$
 - 7 GHz=>36 ps (~PFの σz)
 - 14 GHz=>18 ps (~KEKBの σz)

Test plans

- Spring 2009: Test performance at Photon Factory
 - Test that the thing works, find major bugs
 - Try to readout single-bunches
 - Experiment with pushing the timing tighter and tighter to find out where the resolution limit is, and evaluate the need for HEMTs as a result.
- Once layout is finalized, ceramic bump-bonded flip-chip, + (probably) HEMTs, will be added for next version.
- Test detector: Kyosemi KPA256C-35M?
 - Wait for test results at CsrTA to order?

Sensor

InGaAs Linear Array for Optical Performance Monitoring KPA256C-35M



Features

- Low dark current
- Low capacitance
- High reliability

Description

Kyosemi InGaAs linear array is designed for spectroscopic applications in the wavelength range of 1000 nm to 1650 nm. The structure is PIN and the photosensitive element size is 500 μm x 25 μm , spaced on a 50 μm pitch. The bond pads on a surface is anode and the bottom surface is the common cathode. Photosensitive areas are anti-reflection coated. The length is 256 pixels. (128-pixel is also available upon request)

Applications

- IR spectroscopy
- Optical channel performance monitor
- Optical coherent tomography

