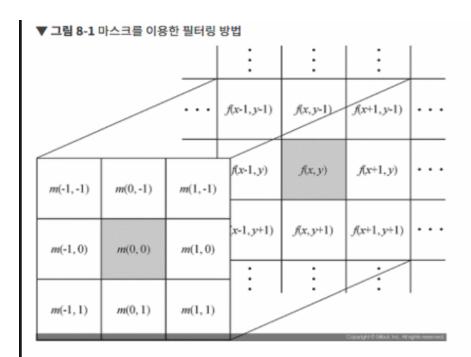
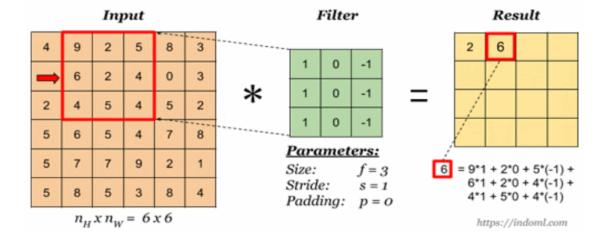
#### 필터 컨볼루션



마스크 연산에 의해 새로 결정되는 영상의 픽셀 값은 다음과 같다.

$$\begin{split} g(x,y) &= \sum_{j=-1}^{1} \sum_{i=-1}^{1} m(i,j) f(x+i,y+j) \\ &= m(-1,-1) f(x-1,y-1) + m(0,-1) f(x,y-1) + m(1,-1) f(x+1,y-1) \\ &+ m(-1,0) f(x-1,y) + m(0,0) f(x,y) + m(1,0) f(x+1,y) \\ &+ m(-1,1) f(x-1,y+1) + m(0,1) f(x,y+1) + m(1,1) f(x+1,y+1) \end{split}$$



## 가우시안 필터

$$G_{\mu,\sigma}(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{\frac{(x-\mu)^2}{2\sigma^2}} \quad \bullet \quad \mu : 평균 한 ...$$
  $\sigma : 표준 편차$ 

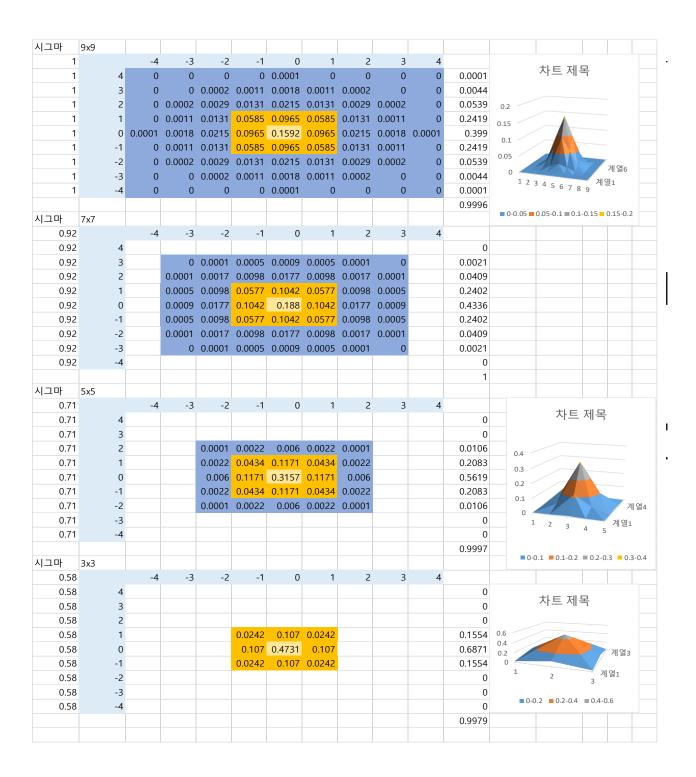
$$G_{\sigma}(x,y) = \frac{1}{2\pi\sigma^2} e^{\left(-\frac{x^2+y^2}{2\sigma^2}\right)}$$

$$\begin{cases} \mu_x = \mu_y = 0 \\ \sigma_x = \sigma_y = \sigma \end{cases}$$

#### 2차원 가우시안 필터 마스크 (σ=1.0)

• 필터 마스크 크기 : (8 $\sigma$  + 1) 또는 (6 $\sigma$  + 1)

4	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
3	0.0000	0.0000	0.0002	0.0011	0.0018	0.0011	0.0002	0.0000	0.0000
2	0.0000	0.0002	0.0029	0. 0131	0.0215	0.0131	0.0029	0.0002	0.0000
1	0.0000	0.0011	0.0131	0.0585	0.0965	0.0585	0.0131	0.0011	0.0000
0	0.0001	0.0018	0.0215	0.0965	0.1592	0.0965	0.0215	0.0018	0.0001
-1	0.0000	0.0011	0.0131	0.0585	0.0965	0.0585	0.0131	0.0011	0.0000
-2	0.0000	0.0002	0.0029	0. 0131	0.0215	0.0131	0.0029	0.0002	0.0000
-3	0.0000	0.0000	0.0002	0.0011	0.0018	0.0011	0.0002	0.0000	0.0000
-4	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000
	-4	-3	-2	-1	0	1	2	3	4



#### 라플라시안 필터

$$\nabla^{2} f = \frac{d^{2} f}{dx^{2}} + \frac{d^{2} f}{dy^{2}}$$

$$\frac{d^{2} f}{dx^{2}} = \frac{df(x+1,y)}{dx} - \frac{df(x,y)}{dx}$$

$$= [f(x+1,y) - f(x,y)] - [f(x,y) - f(x-1,y)]$$

$$= f(x+1,y) - 2f(x,y) + f(x-1,y)$$

$$\frac{d^2f}{dy^2} = \frac{df(x,y+1)}{dy} - \frac{df(x,y)}{dy}$$

$$= [f(x,y+1) - f(x,y)] - [f(x,y) - f(x,y-1)]$$

$$= f(x,y+1) - 2f(x,y) + f(x,y-1)$$

$$\nabla^2 f(x,y) = f(x-1,y) + f(x+1,y) + f(x,y-1) + f(x,y+1) - 4f(x,y)$$

1	1	1
1	-8	1
1	1	1

					_
	1	2	-16	2	1
	0	1	2	1	0
	0	0	1	0	0
,		- 71.2		01 11	. –

0

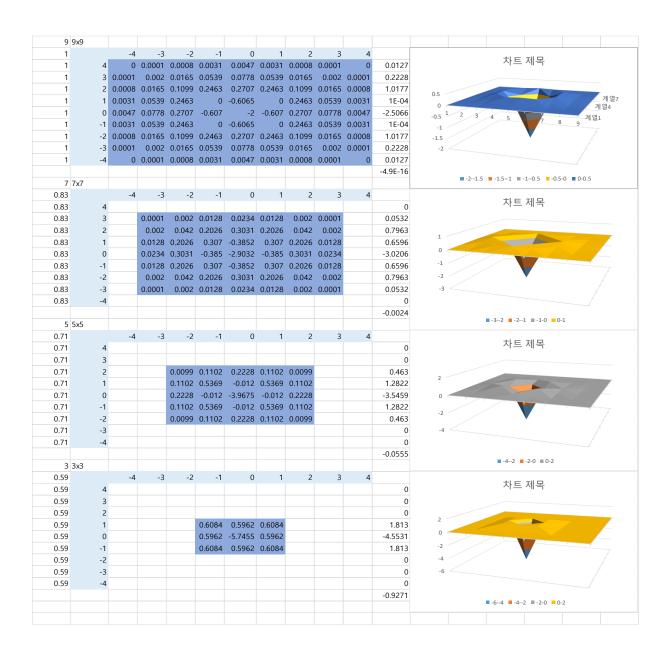
(a) 3x3 라플라시안 마스크 (OFF-center 신경절세포 모방)

-1	-1	-1
-1	8	-1
-1	-1	-1

(b) 5x5 라플라시안 마스크 (OFF-center 신경절세포 모방)

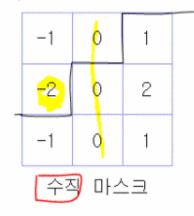
0	0	-1	0	0
0	-1	-2	-1	0
-1	-2	16	-2	-1
0	-1	-2	-1	0
0	0	-1	0	0

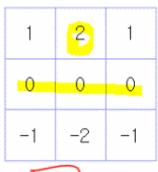
(c) 3x3 라플라시안 마스크 (ON-center 신경절세포 모방) (d) 5x5 라플라시안 마스크 (ON-center 신경절세포 모방)



## 소벨 필터

- 3. 소벨(Sobel) 에지추출
  - 1) 에지 추출의 가장 대표적인 1차 미분 연산자중 하나
  - 2) 소벨 마스크 모양





수평) 마스크

- 3) 소벨 마스크의 특징
  - 모든 방향의 에지 추출
  - 돌출한 화소값을 비교적 평균화하므로 잡음에 대체적으로 강함
  - 수직 수평 방향 에지 보다 대각선 방향 에지에 더 민감하게 반응
- 4) 소벨 마스크의 크기 3x3으로 고정된 것은 아니다.
- 5) 5x5 소벨 마스크

-1	-1	0	1	1
-1	-1	0	1	1
-2	-2		2	2
-1	-1	0	1	1
-1	-1	0	1	1

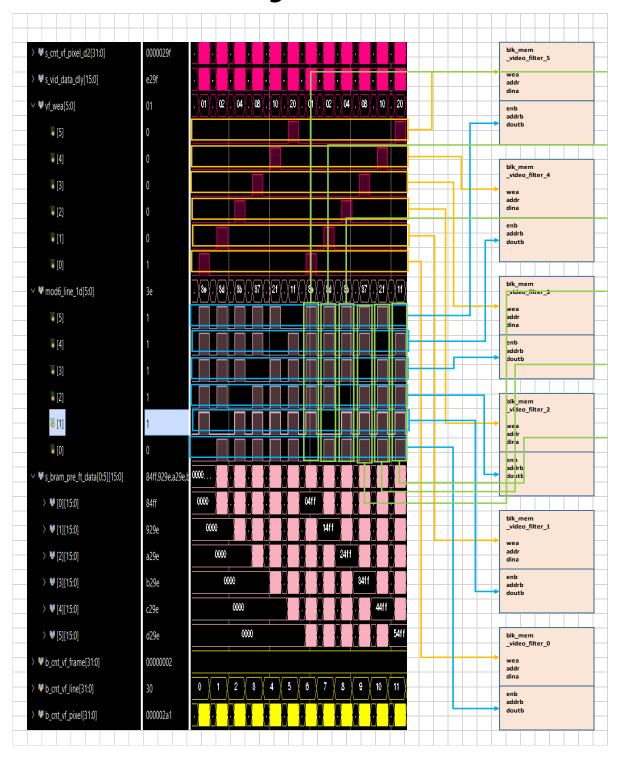
_	۸.	$\overline{}$	-	м	- 4	٨.	-
-	_	-0.	- 8.3	ш	-	-	-
		_	-	٠,	**		-

1	1	2	1	1
1	1	2	1	1
0		0	0	0
	-1		-1	-1
-1	-1	-2	-1	-1

수평 마스크

6) 결과: 3x3마스크보다에지가 더 두껍고 좋은 효과를 나타내지 못함

# filter circular data align



```
else if ( mod6 line wt wide[0]==1 )begin
1
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[1];
                                            [0]
2
3
                                                    <= s bram pre ft data[2];
              arrange pre ft data
                                            [1]
4
              arrange pre ft data
                                           [2]
                                                    <= s bram pre ft data[3];
5
              arrange pre ft data
                                            [3]
                                                    <= s bram pre ft data[4];
              arrange pre ft data
                                            [4]
                                                    <= s_bram_pre_ft_data[5];
          end
          else if( mod6_line_wt_wide[l]==l )begin
2
              arrange pre ft data
                                                    <= s bram pre ft data[2];
3
4
              arrange pre ft data
                                            [1]
                                                    <= s bram pre ft data[3];
5
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[4];
                                           [2]
0
              arrange_pre_ft_data
                                            [3]
                                                   <= s_bram_pre_ft_data[5];
                                                    <= s_bram_pre_ft_data[0];</pre>
              arrange_pre_ft_data
                                            [4]
          end
          else if( mod6_line_wt_wide[2]==1 )begin
3
              arrange pre ft data
                                                    <= s bram pre ft data[3];
                                           [0]
4
              arrange pre ft data
                                           [1]
                                                    <= s_bram_pre_ft_data[4];
0
              arrange_pre_ft_data
                                            [2]
                                                    <= s_bram_pre_ft_data[5];
1
              arrange_pre_ft_data
                                            [3]
                                                    <= s bram pre ft data[0];
              arrange pre ft data
                                                    <= s bram pre ft data[1];
                                            [4]
          end
          else if ( mod6 line wt wide[3] == 1 )begin
4
              arrange pre ft data
                                           [0]
                                                    <= s bram pre ft data[4];
5
0
              arrange pre ft data
                                           [1]
                                                    <= s bram pre ft data[5];
1
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[0];
                                           [2]
2
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[1];</pre>
                                           [3]
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[2];
                                            [4]
          end
          else if( mod6_line_wt_wide[4]==1 )begin
5
                                                    <= s bram pre ft data[5];
              arrange pre ft data
                                           [0]
0
              arrange pre ft data
                                            [1]
                                                    <= s_bram_pre_ft_data[0];</pre>
1
2
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[1];
                                           [2]
3
              arrange_pre_ft_data
                                            [3]
                                                    <= s_bram_pre_ft_data[2];
4
              arrange_pre_ft_data
                                                    <= s_bram_pre_ft_data[3];
                                            [4]
          end
          else if ( mod6 line wt wide[5] == 1 )begin
0
              arrange pre ft data
                                                    <= s bram pre ft data[0];
                                            [0]
1
2
              arrange_pre_ft_data
                                            [1]
                                                    <= s_bram_pre_ft_data[1];
3
              arrange_pre_ft_data
                                            [2]
                                                    <= s_bram_pre_ft_data[2];
4
              arrange_pre_ft_data
                                            [3]
                                                    <= s_bram_pre_ft_data[3];
              arrange pre ft data
                                            [4]
                                                    <= s bram pre ft data[4];
          end
```

circular data align line control

```
영상데이터와 필터계수의 convoluton을 위해 먼저 5개의 line을 저장할 5개의 bram을 설정임시 write buffer 역할을 할 bram 1개를 설정총 6개의 bram을 circular 형태로 사용하여 5개 line의 영상데이터를 한 line씩 이동하면서 출력총 6개의 bram 중에 1개 bram(write buffer bram)에 최신 1line data 를 write write 하고 있는 1개의 write buffer bram을 제외한 나머지 5개 bram(reading filter bram)에서 data 를 read write 가 진행되고 있는 bram 을 제외한 5개의 bram(reading filter bram) 값을 순서대로 재배열 하여 1차원 배열 인덱스에 각각 write
```

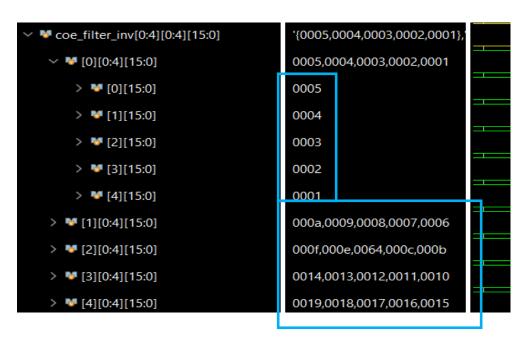
✓ <b>™</b> s_bram_pre_ft_data[0:5][15:0]	0006,1006,2006,3006,4006,0000	04ff,14ff,24ff	0000,100,	0001,100	0002,100	0003,100	0004, 100,	0005,100,
> ▶ [0][15:0]	0006	04ff	0000	0001	0002	0008	0004	0005
> ₩ [1][15:0]	1006	14ff	1000	1001	1002	1008	1004	1005
> • [2][15:0]	2006	24ff	2000	2001	2002	2008	2004	2005
> <b>W</b> [3][15:0]	3006	84ff	3000	3001	3002	3003	3004	3005
> • [4][15:0]	4006	0000	4000	4001	4002	4003	4004	4005
> <b>W</b> [5][15:0]	0000		N	1 <mark></mark>		1	<u> </u>	1
■ arrange_pre_ft_data[0:4][15:0]	0005,1005,2005,3005,4005	04ff,14ff,24ff,34f	ff.0000	0000,100	0001,100	0002,100	0008,100,	0004, 100
> W [0][15:0]	0005	04ff		0000	0001	0002	0008	0004
> • [1][15:0]	1005	14ff		1000	1001	1002	1008	1004
		24ff		2000	2001	2002	2008	2004
> • [2][15:0]	2005	84ff		8000	8001	8002	8008	8004
> • [3][15:0]	3005	0000		4000	4001	4002	4003	4004
> • [4][15:0]	4005	000		4000	4001	4002	4008	4004
M - h (4 d(0.5)(45.0)	04#1006 2006 2006 4006 5006	04ff,14ff,24ff,	04ff, 100	04ff,100	04ff,100	04ff.100	04ff.100	04ff, 100
<b>™</b> s_bram_pre_ft_data[0:5][15:0]	04ff,1006,2006,3006,4006,5006	0411, 1411,2411,	0411,100	0411,100,	0411.100	0411,100,	0411,100	(0411.100
> • [0][15:0]	04ff	****	1222	4004	1000	1000	1001	1005
> 🕨 [1][15:0]	1006	14ff	1000	1001	1002	1008	1004	1005
> 😽 [2][15:0]	2006	24ff	2000	2001	2002	2008	2004	2005
> 💆 [3][15:0]	3006	84ff	3000	3001	3002	3003	3004	3005
> ▶ [4][15:0]	4006	44ff	4000	4001	4002	4008	4004	4005
> 💆 [5][15:0]	5006	0000	5000	5001	5002	5008	5004	5005
arrange_pre_ft_data[0:4][15:0]	1005,2005,3005,4005,5005	14ff,24ff,34ff,44	lff,0000	1000,200	1001,200	1002,200	1008,200	1004,200,
> 💆 [0][15:0]	1005	14ff		1000	1001	1002	1008	1004
> 💆 [1][15:0]	2005	24ff		2000	2001	2002	2008	2004
> 🕨 [2][15:0]	3005	84ff		8000	8001	3002	8008	8004
> 💆 [3][15:0]	4005	44ff		4000	4001	4002	4003	4004
> ▶ [4][15:0]	5005	0000		5000	5001	5002	5008	5004
		VI.			DE .			V
	6006,14ff,2006,3006,4006,5006			6001,14ff	6002,14ff	6008,14ff	6004,14ff	-√
> ▶ [0][15:0]	6006	04ff.14ff.24f 04ff	8000, 14ff 8000	6001,14ff	6002,14ff	6008, 14ff 6008	6004, 14ff	6005,14ff,
> <b>♥</b> [0][15:0] > <b>♥</b> [1][15:0]		04ff	6000	6001	6002	6008	6004	6005
> ▶ [0][15:0]	6006	2411	2000	6001	6002 2002	2008	2004	2005
> <b>♥</b> [0][15:0] > <b>♥</b> [1][15:0]	6006 14ff	04ff	6000	6001	6002	6008	6004	6005
> ♥ [0][15:0] > ♥ [1][15:0] > ♥ [2][15:0]	6006 14ff 2006	2411	2000	6001	6002 2002	2008	2004	2005
> ♥ [0][15:0] > ♥ [1][15:0] > ♥ [2][15:0] > ♥ [3][15:0]	6006 14ff 2006 3006	2411 3411	2000 2000 3000	2001	2002 2002 3002	2008 2008 3008	2004 2004 3004	2005 2005 3005
> ♥ [0][15:0] > ♥ [1][15:0] > ♥ [2][15:0] > ♥ [3][15:0] > ♥ [4][15:0] > ♥ [4][15:0]	6006 14ff 2006 3006 4006	24ff 24ff 34ff 44ff	2000 3000 4000 5000	2001 3001 4001	2002 2002 3002 4002	2008 2008 3008 4008	2004 2004 3004 4004	2005 2005 3005 4005
> ♥ [0][15:0] > № [1][15:0] > ♥ [2][15:0] > № [3][15:0] > ♥ [4][15:0] > ♥ [4][15:0]	6006 14ff 2006 3006 4006 5006	24ff 34ff 44ff 54ff	2000 3000 4000 5000	2001 2001 3001 4001 5001	2002 2002 3002 4002 5002	2008 3008 4008 5008	2004 3004 4004 5004	2005 2005 3005 4005 5005
> ♥ [0][15:0] > ♥ [1][15:0] > ♥ [2][15:0] > ♥ [3][15:0] > ♥ [4][15:0] > ♥ [5][15:0]  ▼ arrange_pre_ft_data[0:4][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005	24ff 34ff 44ff 54ff 24ff,34ff,44ff,54	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000,3000	2002 2002 3002 4002 5002 2001,3001	2008 2008 3008 4008 5008 2002, 5002	2004 3004 4004 5004 2003,3008	2005 2005 3005 4005 5005 2004, 3004
> ₩ [0][15:0] > ₩ [1][15:0] > ₩ [3][15:0] > ₩ [3][15:0] > ₩ [4][15:0] > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0] > № [0][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005	24ff 34ff 44ff 54ff 24ff, 84ff, 44ff, 54f 24ff	2000 3000 4000 5000	2001 3001 4001 5001 2000, 3000	2002 2002 3002 4002 5002 2001,3001	2003 3008 4008 5008 2002, 3002	2004 3004 4004 5004 2008, 3008	2005 3005 4005 5005 2004, 3004.
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > № [0][15:0]  > № [1][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54f 24ff 34ff	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000 2000	6002 2002 8002 4002 5002 2001, 3001	2008 2008 3008 4008 5008 2002, 5002 2002 3002	2004 3004 4004 5004 2008, 3008	2005 3005 4005 5005 2004, 3004 2004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > № [0][15:0]  > ₩ [1][15:0]  > ₩ [1][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005	24ff 34ff 44ff 54ff 24ff, 84ff, 44ff, 54ff 34ff 44ff	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000	6002 2002 3002 4002 5002 2001,3001 2001 3001	2008 2008 3008 4008 5008 2002,3002 2002 3002 4002	2004 3004 4004 5004 2008, 3008 2008 3008 4003	2005 3005 4005 5005 2004, 3004 2004 3004
> ₩ [0][15:0] > ₩ [1][15:0] > ₩ [2][15:0] > ₩ [3][15:0] > ₩ [4][15:0] > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0] > ₩ [0][15:0] > ₩ [1][15:0] > ₩ [2][15:0] > ₩ [3][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 54ff	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000 2000 4000 5000	9002 2002 3002 4002 5002 2001,3001 2001 3001 4001	2008 2008 3008 4008 5008 2002, 8002 2002 3002 4002 5002	2004 3004 4004 5004 2008,3008 2008 3008 4009 5003	2005 3005 4005 5005 2004, 8004, 2004 3004 4004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 54ff	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000 2000 4000 5000 6000	9002 2002 3002 4002 5002 2001,3001 2001 3001 4001	2008 2008 3008 4008 5008 2002, 3002 2002 4002 5002 6002	2004 3004 4004 5004 2008, 3008 2008 3008 4009 5003	2005 3005 4005 5005 2004, 8004, 2004 3004 4004 5004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 44ff 44ff 44ff 44ff	2000 2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000 2000 4000 5000 6000	2002 2002 3002 4002 5002 2001,3001 2001 3001 4001 5001	2008 2008 3008 4008 5008 2002, 8002 2002 3002 4002 5002 6002	2004 3004 4004 5004 2008, 3008 2008 3008 4008 5003 6008	2005 3005 4005 5005 2004, 8004, 2004 3004 4004 5004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6006,7006,24ff,3006,4006,5006	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 44ff 54ff 44ff 54ff 64ff,14ff,24ff,8	2000 3000 4000 5000	2001 2001 3001 4001 5001 2000, 3000 3000 4000 5000 6000	2002 2002 3002 4002 5002 2001,3001 2001 3001 4001 5001 6001	2003 2003 3003 4003 5003 2002, 3002 2002 3002 4002 5002 6002	2004 3004 4004 5004 2008, 8008 2008 3008 4008 5003	2005 3005 4005 5005 2004, 3004 2004 3004 4004 5004 6004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [5][15:0]  W arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  > ₩ [6][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6006 6006,7006,24ff,3006,4006,5006 6006	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 44ff 54ff 04ff 04ff 04ff	2000 3000 4000 5000 11,0411	2001 2001 3001 4001 5001 2000, 3000	2002 3002 4002 5002 2001,3001 2001 3001 4001 5001 6001	2003 2003 3003 4003 5008 2002, 3002 2002 3002 4002 5002 6002 6003	2004 3004 4004 5004 2003, 8003 2003 3008 4008 5008 6009	2005 3005 4005 5005 2004, 3004 2004 3004 4004 5004 60004
> \( [0][15:0] \) > \( [1][15:0] \) > \( [2][15:0] \) > \( [3][15:0] \) > \( [4][15:0] \) > \( [5][15:0] \) \( [3][15:0] \) > \( [0][15:0] \) > \( [3][15:0] \) > \( [3][15:0] \) > \( [3][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \) > \( [4][15:0] \)	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6006 6006 7006	24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 44ff 54ff 04ff 04ff 04ff	2000 3000 4000 5000 11,0411	2001 2001 3001 4001 5001 2000, 3000	2002 3002 4002 5002 2001,3001 2001 3001 4001 5001 6001	2003 2003 3003 4003 5008 2002, 3002 2002 3002 4002 5002 6002 6003	2004 3004 4004 5004 2003, 8003 2003 3008 4008 5008 6009	2005 3005 4005 5005 2004, 3004 2004 3004 4004 5004 60004
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]   ₩ [5][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff	24ff 24ff 34ff 44ff 54ff 24ff,84ff,44ff,54 24ff 34ff 44ff 54ff 04ff 04ff 14ff 14ff	2000 3000 4000 5000 11,04ff	2001 2001 3001 4001 5001 2000, 3000 2000 3000 4000 5000 6000 6001 7001	6002 2002 3002 4002 5002 2001, 3001 3001 4001 5001 6002, 700 6002 7002	2008 2008 3008 4008 5008 2002, 3002 2002 3002 4002 5002 6002 6008 7008	2004 3004 4004 5004 2008, 3008 2008 3003 4008 5008 6003	2005 3005 4005 5005 2004, 3004 2004 3004 4004 5004 6004 (6005, 700.
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [5][15:0]  M arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]   ₩ [5]bram_pre_ft_data[0:5][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff 3006 4006	24ff 34ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 64ff 44ff 54ff 44ff 54ff 5	2000 3000 4000 5000 ff.04ff 2000,700	6001   2001   3001   4001   5000   4000   5000   6001   7001   5001   5001   5000   6001   7001   5001	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  6001  6002  7002	2008 2008 3008 4008 5008 2002, 8002 2002 3002 4002 5002 6008 7008	2004 3004 4004 5004 2008, 3008 2008 3009 4008 5008 6004, 700 6004 7004	2005 3005 4005 5005 2004, 3004 2004 3004 4004 5004 6005, 700. 6005 7005
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff 3006 4006 5006	24ff 34ff 44ff 54ff 44ff 54ff 24ff,84ff,44ff,54ff 44ff 54ff 64ff,14ff,24ff,8 64ff 14ff 44ff 54ff 54ff	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	2001 3001 4001 5001 2000, 3000 2000 3000 4000 5000 6001 7001 3001 4001 5001	6002  2002  3002  4002  5002  2001,3001  4001  5001  6002  7002  3002  4002  5002	2008 2008 3009 4008 5008 2002.3002. 2002 3002 4002 5002 6008 7008 3008 4008 5008	2004 3004 4004 5004 2008, 3008 2008 3008 4009 5008 6004 7004 3004 4004 5004	2005 3005 4005 5005 2004, 3004 3004 4004 5004 6005, 700. 6005 7005
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [0][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  > ₩ [5][15:0]  > ₩ [5][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff 3006 4006 5006 3005,4005,5005,6005,7005	24ff 24ff 34ff 44ff 54ff 24ff, 84ff, 44ff, 54ff 24ff 34ff 44ff 54ff 44ff 54ff 44ff 54ff 44ff 54ff 44ff 54ff 44ff 54ff 54f	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	2001 2001 3001 4001 5001 2000, 3000 2000 3000 4000 5000 6000 6001 7001 3001 4001 5001 3000, 400	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  5001  6002  7002  3002  4002  5002  3001,400	2003 2003 3003 4008 5003 2002, 8002 2002 3002 4002 5002 6002 6003 7003 3008 4008 5008 3000 3000 3000 3000 3000	2004 3004 4004 5004 2008, 3008 2008 3008 4003 5003 6004 7004 3004 4004 5004	2005 2005 3005 4005 5005 2004, 8004, 2004 3004 4004 5004 6005, 700, 6005, 700, 6005 7005
>	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6006 7006 24ff 3006 4006 5006 3005,4005,5005,6005,7005 3005	04ff 24ff 34ff 44ff 54ff 44ff 54ff 24ff,34ff,44ff,54ff 54ff 04ff 14ff 14ff 54ff 44ff 54ff 44ff 54ff 5	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	0001   2001   2001   2000	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  5001  6002  7002  3002  4002  5002  3001,400  3001	6008  2003  3003  4008  5003  2002,8002  4002  5002  6003  7005  8008  4008  5008  3002,400  8002	2004 3004 4004 5004 2008, 3008 2008 3008 4008 5009 6004 7004 3004 4004 5004 3008, 400 3008	2005 3005 4005 5005 2004, 8004. 2004 4004 5004 6005, 700. 6005 7005 3005 4005 5005 3004, 400.
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [3][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff 3006 4006 5006 3005,4005,5005,6005,7005 3005 4005	04ff 24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 24ff 34ff 44ff 54ff 04ff 14ff 14ff 54ff 44ff	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	6001   2001   3001   4001   5001   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  6002,700  6002  7002  3002  4002  5002  3001,400  3001  4001	6008  2003  3003  4008  5003  2002, 8002  4002  5002  6002  6003  7008  \$008  4008  5008  \$0002, 4000  \$0002  40002  40003  \$0003	2004 3004 4004 5004 2008, 8008 2008 3008 4008 5003 6004 7004 3004 4004 5004 3008, 400 3008	2005 2005 3005 4005 5005 2004,8004 4004 5004 6004 6005,700. 6005 7005 3005 4005 5005 3004,400.
	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6006 7006 24ff 3006 4006 5006 3005,4005,5005,6005,7005 3005 4005 5005	04ff 24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 34ff 44ff 54ff 04ff 14ff 14ff 54ff 34ff 44ff 54ff 44ff 54ff 54ff 5	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	6001   2001   2001   4001   2000   4000   4000   4000   4000   4000   4000   4000   4000   4000   4000   4000   4000   4000   5000   4000   4000   5000   4000   4000   5000   4000	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  5001  6002,700  6002  7002  3002  4002  5002  3001,400  3001  4001  5001	6008  2003  3008  4008  5008  2002  3002  2002  3002  4002  5002  6002  6003  7008  8008  4008  5008  3002  4002  5002	2004 3004 4004 5004 2003, 8003 2003 3008 4008 5008 6004, 700 6004 7004 3004 4004 5004 3008, 400 3008 4009	8005 8005 8005 4005 5005 2004, 8004 8004 4004 5004 6005 7005 8005 4005 5005 5006 8004 4004 8005 4005 5006 8006
> ₩ [0][15:0]  > ₩ [1][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [5][15:0]  * ₩ arrange_pre_ft_data[0:4][15:0]  > ₩ [0][15:0]  > ₩ [2][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [3][15:0]  > ₩ [4][15:0]  > ₩ [4][15:0]  > ₩ [5][15:0]  > ₩ [6][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]  > ₩ [7][15:0]	6006 14ff 2006 3006 4006 5006 2005,3005,4005,5005,6005 2005 3005 4005 5005 6005  6006,7006,24ff,3006,4006,5006 6006 7006 24ff 3006 4006 5006 3005,4005,5005,6005,7005 3005 4005	04ff 24ff 34ff 44ff 54ff 24ff,84ff,44ff,54ff 24ff 34ff 44ff 54ff 04ff 14ff 14ff 54ff 44ff	2000 3000 4000 5000 ff .04ff 0000.700 6000 7000	6001   2001   3001   4001   5001   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000   3000   4000	6002  2002  3002  4002  5002  2001,3001  2001  3001  4001  6002,700  6002  7002  3002  4002  5002  3001,400  3001  4001	6008  2003  3003  4008  5003  2002, 8002  4002  5002  6002  6003  7008  \$008  4008  5008  \$0002, 4000  \$0002  40002  40003  \$0003	2004 3004 4004 5004 2008, 8008 2008 3008 4008 5003 6004 7004 3004 4004 5004 3008, 400 3008	2005 2005 3005 4005 5005 2004,8004 4004 5004 6004 6005,700. 6005 7005 3005 4005 5005 3004,400.

#### filter coe multi

영상데이터와 필터계수를 convolution을 하기 위해 필터계수를 재배열.

. 일차원배열 중 큰 인수가 가장 과거의 값으로 설정

```
else begin
   coe filter
                                [0][0] <= 1;
   coe filter
                                [0][1] <= 2;
    coe filter
                                 [0][2] <= 3;
   coe filter
                                [0][3] <= 4;
    coe filter
                                [0][4]  <= 5;
    coe filter
                                [1][0] \leftarrow 6;
    coe filter
                                [1][1]  <= 7;
                                [1][2] <= 8;
    coe filter
    coe filter
                                [1][3] <= 9;
    coe filter
                                [1][4] <= 10;
                                [2][0] <= 11;
    coe filter
                                [2][1] <= 12;
    coe_filter
                                [2][2] <= 100;
    coe filter
                                [2][3] <= 14;
    coe_filter
                                [2][4] <= 15;
    coe filter
    coe_filter
                                [3][0] <= 16;
    coe filter
                                [3][1] <= 17;
    coe filter
                                [3][2] <= 18;
    coe filter
                                [3][3] <= 19;
    coe filter
                                [3][4] <= 20;
    coe filter
                                [4][0] <= 21;
    coe filter
                                [4][1] <= 22;
                                [4][2] <= 23;
    coe filter
                                [4][3] <= 24;
    coe filter
    coe_filter
                                [4][4] <= 25;
end
```



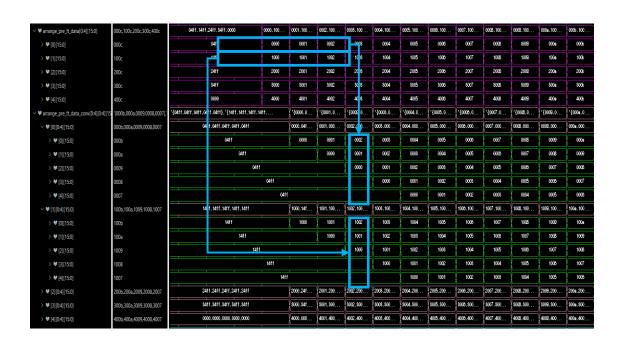
영상데이터와 필터계수를 convolution을 하기 위해 영상데이터를 1clock씩 5회 delay 시켜 각각 array register 인덱스에 저장. 가장 큰 인덱스에 가장 과거의 값을 가지게 설정

```
generate
for(j=0; j < 5; j=j+1) begin: gen_pre_ft_data_conv_j</pre>
    for(i=0; i < 5; i=i+l) begin: gen_i</pre>
    delay_data #(
        .BIT WIDTH
                                                               ),
                         (16
        .NUM DELAY
                         (i+1
                                                               )
        )
        vf_d3_val_delay_data
                                                               (
        .aclk
                         (aclk
                                                               ),
        .delay_array_i (arrange_pre_ft_data
                                                              ),
                                                       [5]
        .delay_array_o (arrange_pre_ft_data_conv
                                                       [j] [i] ),
        .aresetn
                         (aresetn
                                                               )
    );
    end
-end
endgenerate
```

convolution을 위해 재배열된 영상데이터와 필터계수의 각각 25개 팩터를 곱함

```
generate
for(j=0; j < 5; j=j+1) begin: gen_mult_filter_j</pre>
    for(i=0; i < 5; i=i+1) begin: gen_i
    mult_filter mult_filter (
        .CLK (aclk
        .A
                (arrange_pre_ft_data_conv
                                          [j] [i] ),
        .B
               (coe_filter_inv
                                          [j] [i] ),
        .P
               (mult_ft_data
                                           [j] [i] )
    );
    end
-end
endgenerate
```

convolution된 5개 pixel array의 영상데이터를 합하여 한 라인의 값으로 합함. 각각 pixel 별로 합해진 5개의 Line을 더함.



∨ ♥ coe_filter_inv[0:4][0:4][15:0]	'(0005,0004,0003,0002,0001),'(000a,000								-	'{0005	,0004,0008,000	2,0001}, '{000e	,000,0006,000	7,0008},'{000f	000s,0084,000	,000b}, '{0014,0
<ul> <li>✓ [0][0:4][15:0]</li> </ul>	0005,0004,0003,0002,0001															008,0002,0001
> <b>V</b> [0][15:0]	0005															0005
> <b>V</b> [1][15:0]	0004															0004
> * [2][15:0]	0003															0008
> <b>V</b> [3][15:0]	0002															0002
> <b>♥</b> [4][15:0]	0001															0001
> <b>♥</b> [1][0:4][15:0]	000a,0009,0008,0007,0006	_													000a,0009,0	008,0007,0008
> <b>♥</b> [2][0:4][15:0]	000f,000e,0064,000c,000b														0.e000,1000	064,000s,000s
> <b>V</b> [3][0:4][15:0]	0014,0013,0012,0011,0010														0014,0018,0	012,0011,0010
> <b>V</b> [4][0:4][15:0]	0019,0018,0017,0016,0015														0019,0018,0	017,0016,0015
∨ ₩ arrange_pre_ft_data_conv[0:4][0:4][15:0]	'(000e,000d,000c,000b,000a),'(100e,100	'{04ff,04	'{0000,0,	¹{0001,0,	'{0002,0	'{0008.0	¹{0004.0	'{0005,0,	'{0008,0	*{0007.0	'{0008,0	'{0009,0	'{000a,0	'{000b,0	'{000c,0,	'{000d,0
<ul> <li>✓ [0][0:4][15:0]</li> </ul>	000e,000d,000c,000b,000a	04ff,04ff	0000,04f	0001,000	0002.000	0008,000	0004,000	0005,000	0006,000	0007,000	0008,000	0009,000	000a.000	0006.000	0000,000,	000d,000
> ♥ [0][15:0]	000e	04ff	0000	0001	0002	0008	0004	0005	0006	0007	0008	0009	000a	000b	000s	000d
> <b>V</b> [1][15:0]	000d		04ff	0000	0001	0002	0008	0004	0005	0006	0007	0008	0000	000a	0006	000c
> ♥ [2][15:0]	000c	_	04ff		0000	0001	0002	0000	0004	- MAE	0000		0008	0009	000a	000b
> ♥ [3][15:0]	000b			¥ff		0000	0001	0002	0008	0004	0005	0 08	0007	0006	0009	000a
> <b>♥</b> [4][15:0]	000a			04ff			0000	0001	0002	0008	0004	0 (5	0006	0007	0008	0009
> ♥ [1][0:4][15:0]	100e,100d,100c,100b,100a	14ff,14ff	1000,14f	1001,100	1002, 00	1008, 100	1004, 100,	1005,100,	1008,100	1007,100,	1008,100	1009, 00,	100a,100,	1006,100	1000,100,	100d, 100,
> <b>U</b> [2][0:4][15:0]	200e,200d,200c,200b,200a	24ff,24ff,	2000,24f	2001,200	2002.00	2008,200	2004,200	2005,200	2006,200	2007,200	2008,200	2009,: 00	200a,200	2006,200	2000,200,	200d.200
> ♥ [3][0.4][15.0]	300e,300d,300c,300b,300a	84ff,84ff	8000,84f	8001,800	8002.00	8008,800	3004, 300	3005,300	8006,800	\$007,500	8008,800	5009, 00	300a, 300	\$00b,\$00	\$00c,\$00	300d, 300
> ♥ [4][0:4][15:0]	400e,400d,400c,400b,400a	0000,0000	4000,000	4001,400	4002,00	4008,400	4004,400	4005,400	4006,400	4007,400	4008,400	4009, 00,	400a,400	4006,400,	400c,400,	400d,400,
> W mult_ft_data[0:4][0:4][31:0]	'(00000037,00000028,0000001b,000000		00013fc,00000efd	<u> </u>	<u> </u>	¹{000000	`{000000	'{000000	'{000000	`{000000	`{000000	'{000 00	'{000000	'{000000	`{000000	'{000000,
> • mult_ft_data_1d[0:4][0:4][31:0]	'{00000032,00000024,00000018,000000		00018fc,00000efc			<u> </u>	*{000000	¹{000000	`{000000	*{000000,	{000000	'{000 00	'{000000	'{000000	`{000000	'{000000,
✓ mult_ft_data_shift[0:4][0:4][31:0]	'{0000002d,00000020,00000015,000000		ble00000, p181000			f6,0000bcf7,00	<u> </u>	'{000000	'{000000	'{000000,	`{000000	'{000 00,	'{000000	'{000000,	'{000000	'{000000,
√ [0][0:4][31:0]	00000024,00000020,00000015,000000			00013fc,00000e				00000000	0000005	0000000a	0000000f	00000 14	00000019	0000001e	0000023	00000028
> <b>W</b> [0][31:0]	000002d				718fb			0000000	0000005	000000a	0000000f	0000014	00000019	0000001e	00000023	0000028
> <b>V</b> [1][31:0]	00000020				0000   8fc			<u> </u>	00000000	0000004	00000008	0000000s	00000010	00000014	00000018	0000001e
> • [2][31:0]	00000015	_				20.44				00000000	00000008	00000006	00000009	000000c	0000000f	00000012
> 12[31:0]	00000015					000009fe					00000000	0000002	000 004	00000008	00000008	000000a
> <b>V</b> [4][31:0]	00000005						XX4ff					0000000	0000 0001	0000002	00000008	0000004
> <b>V</b> [1][0.4][31:0]	0000a05a.00009048.00008038.0000702		0000d1f6.0	000bef7,0000a7	f8,000092f9,00			0000a000,	0000a00a	0000e014	0000a01e	0000e028,	0000a \$2	0000a06c	0000a045	0000a050
> <b>V</b> [2][0:4][31:0]	0001e087.0001c070.000c82bc.00018044	_			Sc., 0001bb f4, 00			0001e000,	0001e00f	0001e01e	0001e02d	0001e08c	0001si 4b	0001e05e	0001e069	0001e078
> V [3][0:4][31:0]	0003c0b4,00039098,0003607e,0003306				se, 000\$84ef, 00			0008e000	00080014	000%e028,	0008e08e	0008e050	00080 34	0008e078	0008e08e	0008e0a0
> • [4][0:4][31:0]	000640e1.000600c0,0005c0a1.0005808				00,00000000,00			00084000	00064019	00064082	00064046	00064064	00064 7d	00064096	000840ef	00064068
∨  ▼ mult_ft_data_sum_pixel[0:4][31:0]	00000064.000280fa.0013039a.0010e226	_			,0015f768,0012				000081f8	00001dff,	00000f0b	00000519	00002 75	00000087	0000045	00000055
> <b>♥</b> [0][31:0]	0000064				00004af1				000081fB	00001dff	00000f06	00000519	0000028	0000 0087	00000046	00000055
> * [1][31:0]	000280fa				000847d8				000815e2	0002±8f5	00020110	00029s82	0002805a	0002 0082	000280ea	00028042
> • [2][31:0]	0013039a				0015f768				0015ec77	00150064	00187815	001887±2	0015018a	0018 )162	0018026a	00180802
> * [3][31:0]	0010e226				0012a1aô				00123dba	0011dee1	0011851a	00118064	0010e0be	001(-)118	0010e172	00109100
> • [3][31:0] > • [4][31:0]	001cc2bc				00000000				00084000	000x4019	0012004a	00178092	001cc0f0	001 788	001cc1d3	001cc2 <b>49</b>
> • mult_ft_data_sum_line[31:0]	0043283e					2bd7				00817209	00668482	0039:894	005e8be8	0045236e	00482508	004526e2
- maic_ic_aata_sam_imc[s i.o]	00.02000									Λ	Λ	Λ	A			A

## **StandardHD**

	blank		а	active		blank		blank		active		blank		active_L	total_L	H_level	L_level
Field	1			1		2		2		2		1					
1080p	1	4	1	42	1121	1122	1125									3FB	4
		4	1		1080		4							1080	1125	FE	1
1080i	1	2	0	21	560	561	563	564	583	584	1123	1124	1125			3FB	4
		2	0		540		3		20		540		2	1080	1125	FE	1
Pal	1	2	2	23	310	311	332	333	335	336	623	624	625				
		2	2		288		22		3		288		2	576	625	F0	10
NTSC	1	2	1	22	261	262	282	283	284	285	524	525	525				
		2	1		240		21		2		240		1	480	525	F0	10

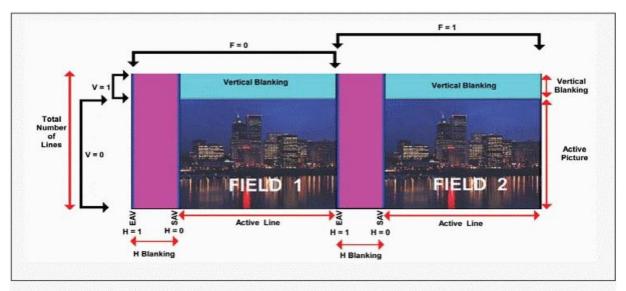


Figure 12. Layout of 2:1 interlaced digital frame.

	Field Line	525 Line	625 Line	1080P Line	1080i Line	1035i Line	720P	SAV	EAV	9	F	V	Н	P3	P2	P1	P0	1	0
Active Video	1	20-236	23-310	42-1121	21-560	41-557	26-745	200		1	0	0	0	0	0	0	0	0	0
									274	0	0	1	1	1	0	1	0	0	
Field Blanking	1	4-19,	1-22,	1-41,	1-20,	1-40,	1-25,	2AC		1	0	1	0	1	0	1	1	0	0
		264-265	311-312	1122-1125	561-563	558-563	746-750		2D8	1	0	1	1	0	1	1	0	0	0
Active Video	2	283-525	336-623	NA	584-1123	603-1120	NA	31C		1	1	0	0	0	1	1	1	0	0
									368	1	0	1	1	0	1	0	0	0	
Field Blanking	2	1-3,	624-625,	NA	1124-1125,	1121-1125,	NA	3B0		1	1	1	0	1	1	0	0	0	0
		266-282	313-335		564-583	564-602			3C4	1	1	1	1	0	0	0	1	0	0