#004 – Poster E03

A hardware implementation of the Levinson routine in a radio detector of cosmic rays to improve a suppression of the non-stationary RFI

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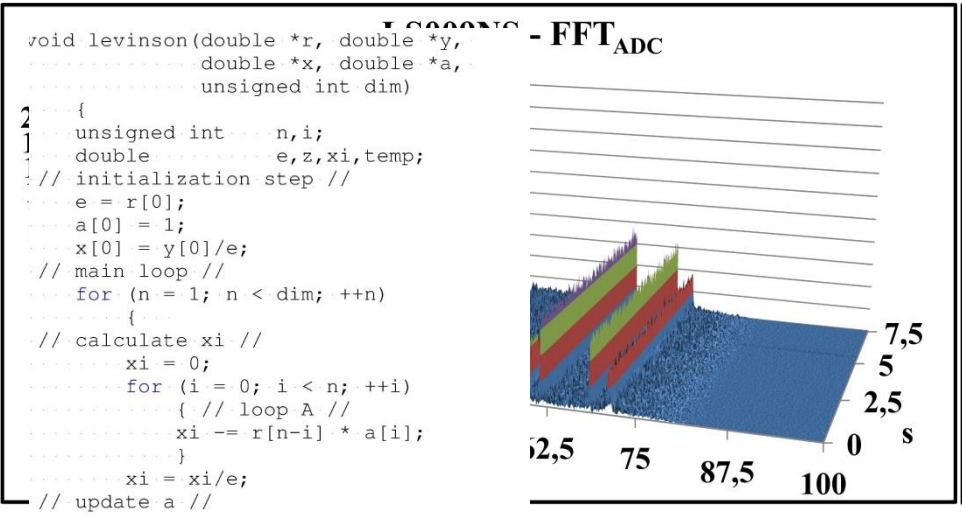
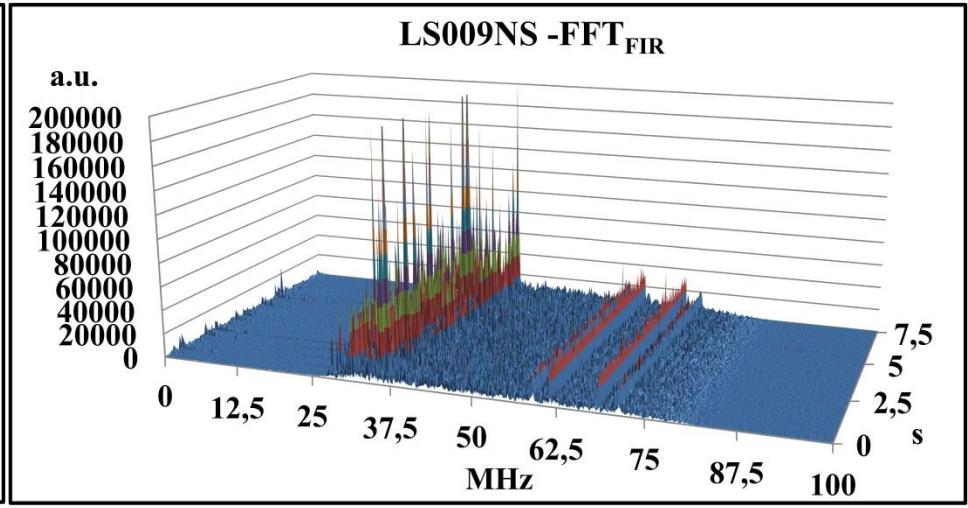
IEEE Real Time Conference, Padova, Italy, June 2016

Levinson C code

```
void levinson(double *r, double *y,
              double *x, double *a,
              unsigned int dim)
    {
    unsigned int     n,i;
    double           e,z,xi,temp;
// initialization step //
    e = r[0];
    a[0] = 1;
    x[0] = y[0]/e;
// main loop //
    for (n = 1; n < dim; ++n)
        {
// calculate xi //
        xi = 0;
        for (i = 0; i < n; ++i)
            { // loop A //
            xi -= r[n-i] * a[i];
            }
        xi = xi/e;
// update a //
        a[n] = 0;
        for (i = 0; i <= (n-1)/2; ++i)
            { // loop B //
            temp = a[i];
            a[i]   = temp + a[n-i] * xi;
            a[n-i] = a[n-i] + temp * xi;
            }
        if (n div 2 == 0)
            {
            a[i] = a[i] + a[n-i] * xi;
            }
// calculate e //
        e = e * (1 - xi*xi);
// calculate l //
        z = y[n];
        for (i = 0; i < n; ++i)
            { // loop C //
            z -= r[n-i] * x[i];
            }
// update x //
        x[n] = 0;
        for (i = 0; i <= n; ++i)
            { // loop D //
            x[i] += a[n-i] * z/e;
            }
        }
    return;
    }
```





	Loop A	Loop B	Loop C	Loop D

n=1	xi = 0;
	xi -= r[1] * a[0];
	xi /= e;
		a[1] = 0;
		a[1] += a[0] * xi;
			z = y[1];
			z -= r[1] * x[0];
			pm = z/e;
				x[1] = 0;
				x[0] += a[1] * pm;
				x[1] += a[0] * pm;

n=2	xi = 0;
	xi -= r[2] * a[0];
	xi -= r[1] * a[1];
	xi /= e;
		a[2] = 0;
		a[2] += a[0] * xi;
		a[1] += a[1] * xi;
			z = y[2];
			z -= r[2] * x[0];
			z -= r[1] * x[1];
			pm = z/e;
				x[2] = 0;
				x[0] += a[2] * pm;
				x[1] += a[1] * pm;
				x[2] += a[0] * pm;

n=3	xi = 0;
	xi -= r[3] * a[0];
	xi -= r[2] * a[1];
	xi -= r[1] * a[2];
	xi /= e;
		a[3] = 0;
		a[3] += a[0] * xi;
		a[2] += a[1] * xi;
		a[1] += a[2] * xi;
			z = y[3];
			z -= r[3] * x[0];
			z -= r[2] * x[1];
			z -= r[1] * x[2];
			pm = z/e;
				x[3] = 0;
				x[0] += a[3] * pm;
				x[1] += a[2] * pm;
				x[2] += a[1] * pm;
				x[3] += a[0] * pm;

n=4	xi = 0;
	xi -= r[4] * a[0];
	xi -= r[3] * a[1];
	xi -= r[2] * a[2];
	xi -= r[1] * a[3];
	xi /= e;
		a[4] = 0;
		a[4] += a[0] * xi;
		a[3] += a[1] * xi;
		a[2] += a[2] * xi;
		a[1] += a[3] * xi;
			z = y[4];
			z -= r[4] * x[0];
			z -= r[3] * x[1];
			z -= r[2] * x[2];
			z -= r[1] * x[3];
			pm = z/e;
				x[4] = 0;
				x[0] += a[4] * pm;
				x[1] += a[3] * pm;
				x[2] += a[2] * pm;
				x[3] += a[1] * pm;

etc				

VC++ calculation + simulations

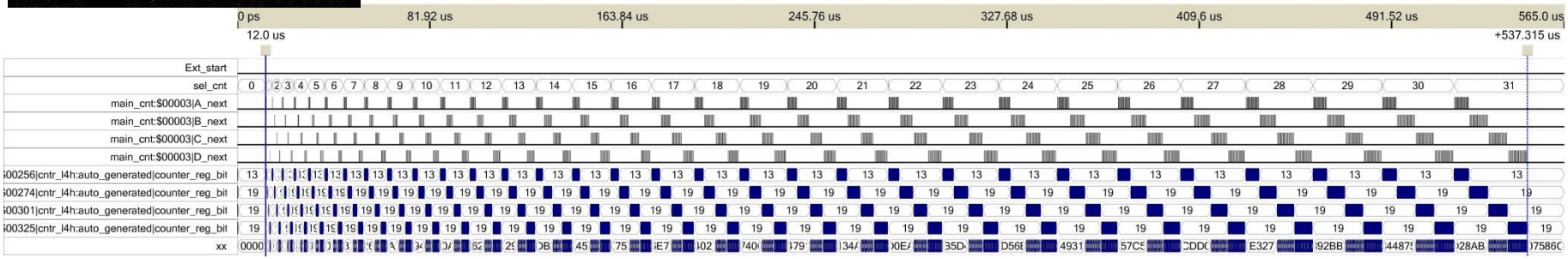
```
r[ 0] = 41C 9B90FA1000000
r[ 1] = C18 B1E4650000000
r[ 2] = C1B 8D29003000000
r[ 3] = 41A 3F75D56000000
r[ 4] = 41B 62BB675000000
r[ 5] = C1A FBE876C000000
r[ 6] = C1B 1F4713000000
r[ 7] = 41B 4A42C99000000
r[ 8] = 41A 8F1BB14000000
r[ 9] = C1B 7F44206000000
r[10] = C19 87006E4000000
r[11] = 41B 993B0A7000000
r[12] = C16 5E69A20000000
r[13] = C1B 96528E4000000
r[14] = 419 DB827E0000000
r[15] = 41B 76BF048000000
r[16] = C1A B4D57E8000000
r[17] = C1B 3CBAEF4000000
r[18] = 41B 2E8BDDA000000
r[19] = 41A D8BC7A8000000
r[20] = C1B 6D549B0000000
r[21] = C1A 16A85D6000000
r[22] = 41B 9256DD6000000
r[23] = 418 03AC340000000
r[24] = C1B 9AF60D1000000
r[25] = 419 32CDD44000000
r[26] = 41B 8696AD6000000
r[27] = C1A 68E61F0000000
r[28] = C1B 56A867F000000
r[29] = 41B 0F77527000000
r[30] = 41B 0E8D2E7000000
r[31] = C1B 5754418000000
```

A4 . . . A0	Addr	Data
00000	0	41C9B90FA1000000
00001	1	C18B1E4650000000
00010	2	C1B8D29003000000
00011	3	41A3F75D56000000
00100	4	41B62BB675000000
00101	5	C1AFBE876C000000
00110	6	C1B1F47130000000
00111	7	41B4A42C99000000
01000	8	41A8F1BB14000000
01001	9	C1B7F44206000000
01010	10	C1987006E4000000
01011	11	41B993B0A7000000
01100	12	C165E69A20000000
01101	13	C1B96528E4000000
01110	14	419DB827E0000000
01111	15	41B76BF048000000
10000	16	C1AB4D57E8000000
10001	17	C1B3CBAEF4000000
10010	18	41B2E8BDDA000000
10011	19	41AD8BC7A8000000
10100	20	C1B6D549B0000000
10101	21	C1A16A85D6000000
10110	22	41B9256DD6000000
10111	23	41803AC340000000
11000	24	C1B9AF60D1000000
11001	25	41932CDD44000000
11010	26	41B8696AD6000000
11011	27	C1A68E61F0000000
11100	28	C1B56A867F000000
11101	29	41B0F77527000000
11110	30	41B0E8D2E7000000
11111	31	C1B5754418000000

```
x[ 0] = BFA 6F07586C27DED
x[ 1] = 3FA 57F9E6A740A43
x[ 2] = BFA 12F38D2EFEF18
x[ 3] = BFA A193AC848139C
x[ 4] = BF9 4656A3BE54885
x[ 5] = 3FA CD412690B7731
x[ 6] = 3F7 3DB44E3564BCA
x[ 7] = BFA D7E5DCDA7CC38
x[ 8] = 3F8 5A695C7E31657
x[ 9] = 3FA C0B680B07FE61
x[10] = BF9 9D6F1546EF95B
x[11] = BFA 895F3ACB7CC66
x[12] = 3FA 3806BF55DAC07
x[13] = 3FA 35D93444F2774
x[14] = BFA 8AF7128440296
x[15] = BF9 983FF4D05F382
x[16] = 3FA C197FE3E98D67
x[17] = 3F8 4F268C9FFF32C
x[18] = BFA D8046074CCE1D
x[19] = 3F7 54758B4FFEA3A
x[20] = 3FA CCA2605997661
x[21] = BF9 4BBB29C08D25C
x[22] = BFA A03BAD04D720D
x[23] = 3FA 15495DC86954A
x[24] = 3FA 5600703DE1B5D
x[25] = BFA 70D82CA51A5F5
x[26] = BF9 E68FBE15D3C04
x[27] = 3FA B1FA41D565400
x[28] = 3F8 FC703BA76DFA1
x[29] = BFA D401D8A638B4B
x[30] = BF2 D9E9B8548D7CB
x[31] = 3FA D47CE3F1FC98A
```

A4 . . . A0	Addr	Data
00000	0	BFA6F07586C27DEC
00001	1	3FA57F9E6A740A50
00010	2	3FA12F38D2EFEF1A
00011	3	BFAA193AC84813A8
00100	4	BF94656A3BE5487B
00101	5	3FACD412690B773D
00110	6	3F73DB44E3564BBA
00111	7	BFAD7E5DCDA7CC45
01000	8	3F85A695C7E31640
01001	9	3FAC0B680B07FE51
01010	10	BF99D6F1546EF95B
01011	11	BFA895F3ACB7CC6F
01100	12	3FA3806BF55DAC03
01101	13	3FA35D93444F276E
01110	14	BFA8AF7128440292
01111	15	BF9983FF4D05F369
10000	16	3FAC197FE3E98D5F
10001	17	3F84F268C9FFF333
10010	18	BFAD8046074CCE1A
10011	19	3F754758B4FFE9FA
10100	20	3FACCA2605997662
10101	21	BF94BBB29C08D23E
10110	22	BFAA03BAD04D721C
10111	23	3FA15495DC86952D
11000	24	3FA5600703DE1B6A
11001	25	BFA70D82CA51A5E3
11010	26	BF9E68FBE15D3BE5
11011	27	3FAB1FA41D56540D
11100	28	3F8FC703BA76DF5C
11101	29	BFAD401D8A638B4C
11110	30	BF2D9E9B8548D05C
11111	31	3FAD47CE3F1FC99F

A4 . . . A0	Addr	Data
00000	0	BFA6DBDF1763
00001	1	3FA5A2633C72
00010	2	3FA114C1A420
00011	3	BFAA3231EB6E
00100	4	BF942AFF5924
00101	5	3FACE3B91FC7
00110	6	3F72F1F900E9
00111	7	BFAD85ACBC40
01000	8	3F8610AB1112
01001	9	3FAC0C57D25A
01010	10	BF9A034EDADE
01011	11	BFA89319F72B
01100	12	3FA391F8054B
01101	13	3FA359146CA4
01110	14	BFA8BCD1888F
01111	15	BF997B67F9C3
10000	16	3FAC241284F8
10001	17	3F84E6219809
10010	18	BFAD892ACE87
10011	19	3F754FA1BD7E
10100	20	3FACD331C8BD
10101	21	BF94B8FF8316
10110	22	BFAA0EEF105C
10111	23	3FA151F1B57D
11000	24	3FA56EA8367F
11001	25	BFA70B4E5097
11010	26	BF9E8DF57638
11011	27	3FAB1FBC0ACE
11100	28	3F9010A098A2
11101	29	BFAD44F3D8FF
11110	30	BF3B83C098F7
11111	31	3FAD53DBFD56



Measurements