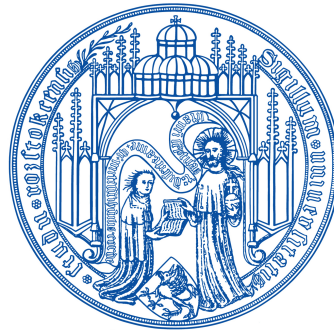


# Data-driven electronics for ILC TPC

## Status report



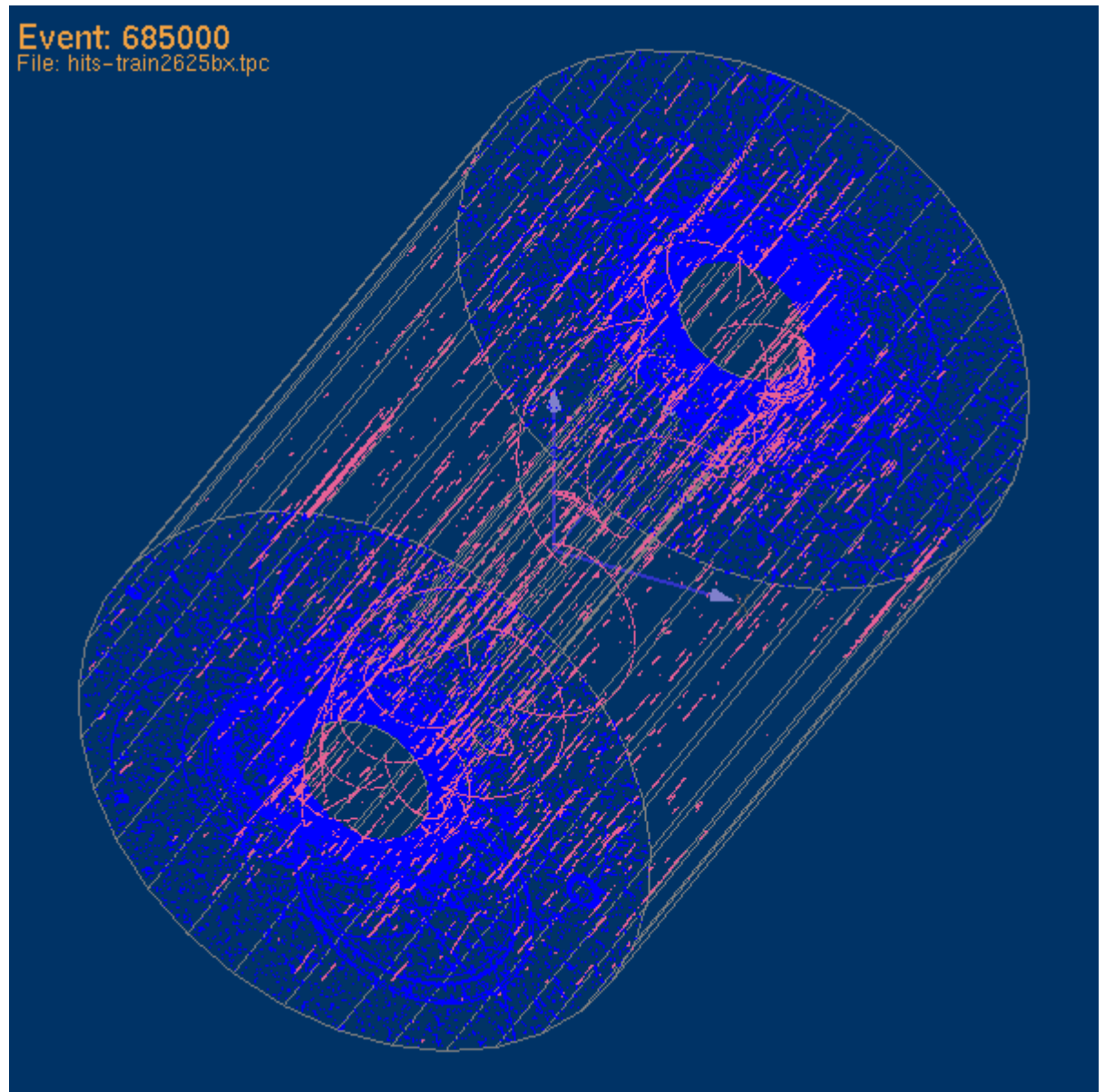
University of Rostock

A.Kaukher O.Schäfer H.Schröder R.Wurth

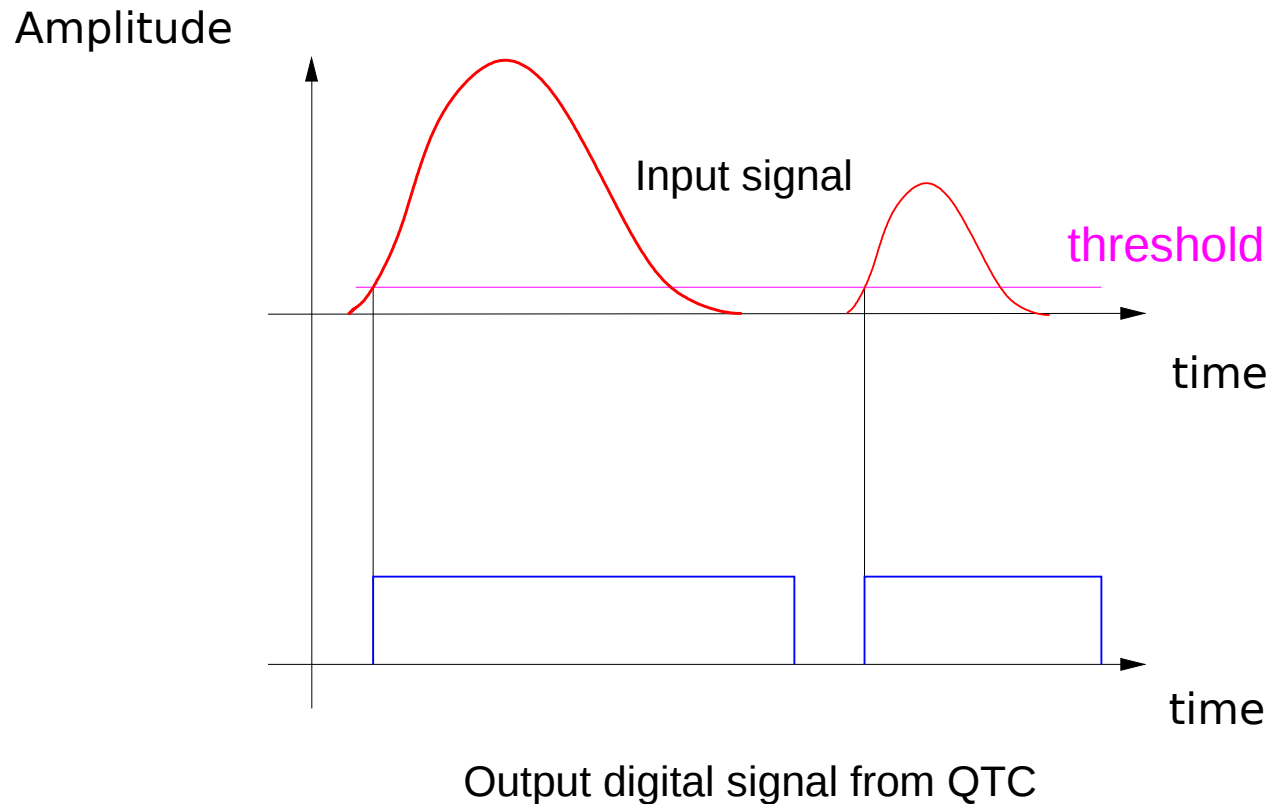
# Beam Background as a Main Source of Signals

ILC: no event trigger available.

Beam background is  
the main source of signals for  
ILC TPC readout electronic.



# Data-driven Electronics

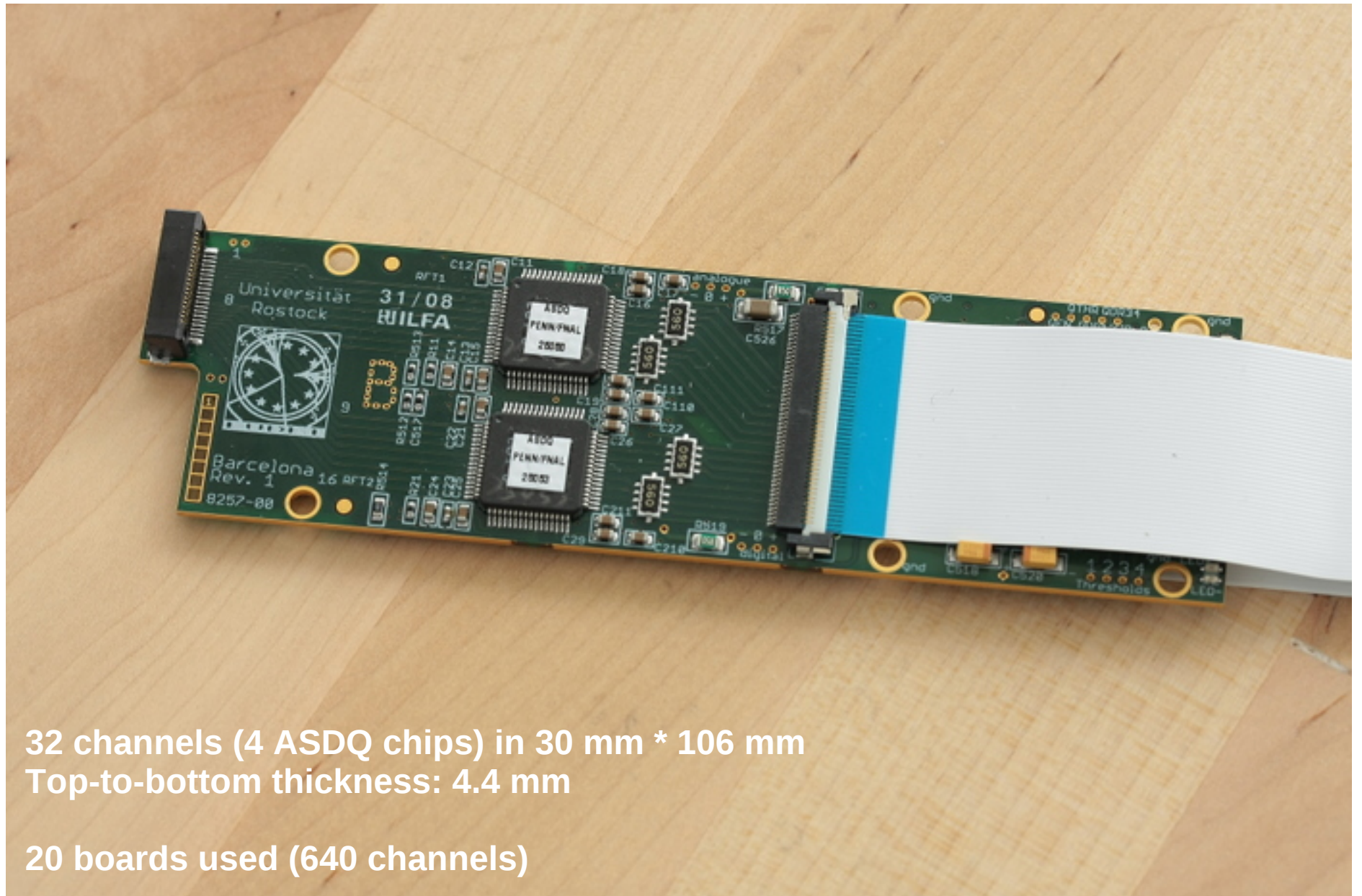


Data zero suppression by analogue data processing.

Here example with threshold timing and charge-to-time conversion.

- The time of arrival is derived using the leading edge discriminator.
- The charge of the input signal is encoded into the width of output digital pulse.

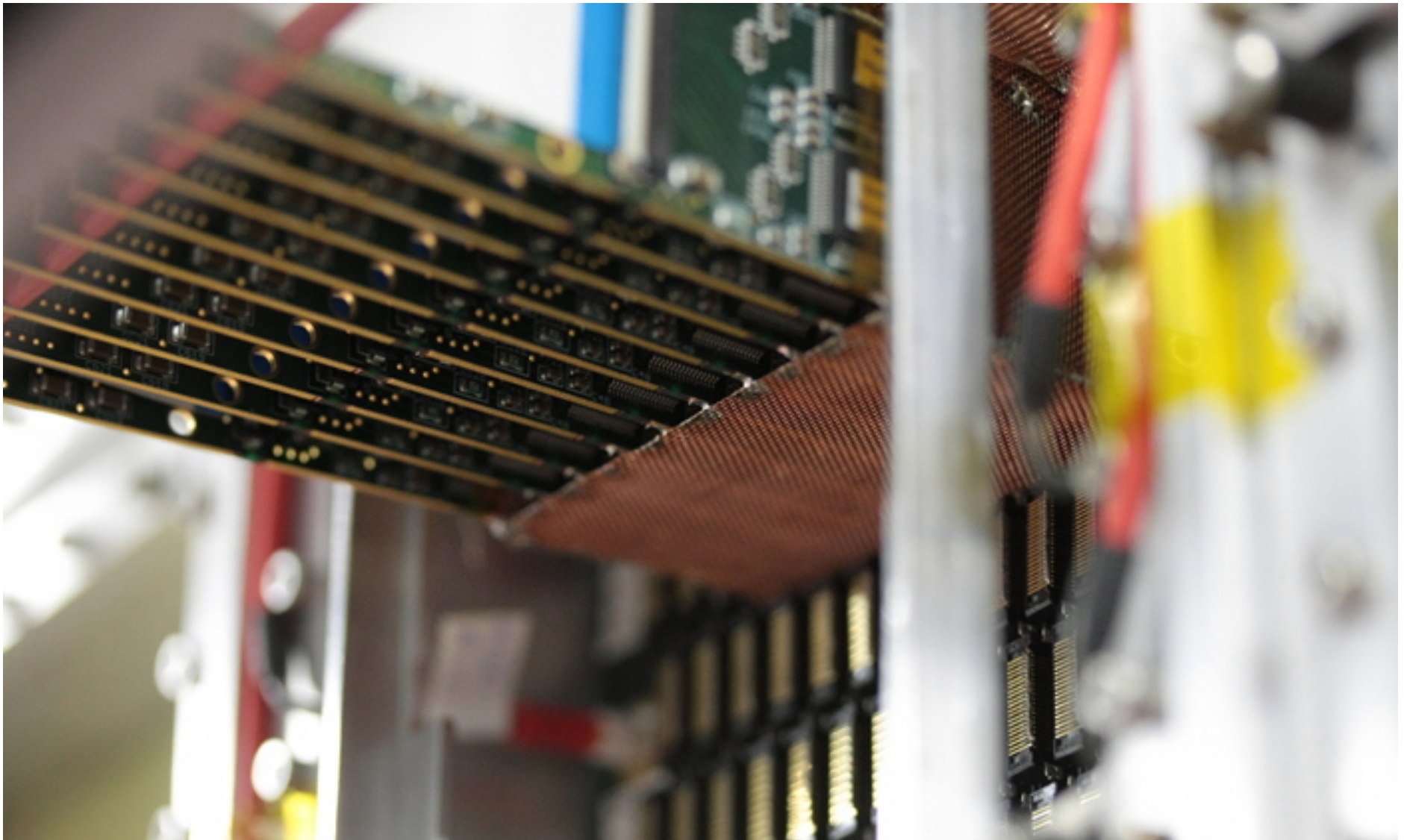
# “Barcelona” Board



32 channels (4 ASDQ chips) in 30 mm \* 106 mm  
Top-to-bottom thickness: 4.4 mm

20 boards used (640 channels)

# Electronics on a GEM Module



**GEM Module with  $\sim 1 \text{ mm} * 5 \text{ mm}$  pads  
Low working threshold after installation of shielding :  $\sim 0.15 \text{ v}$**

# Complete Setup



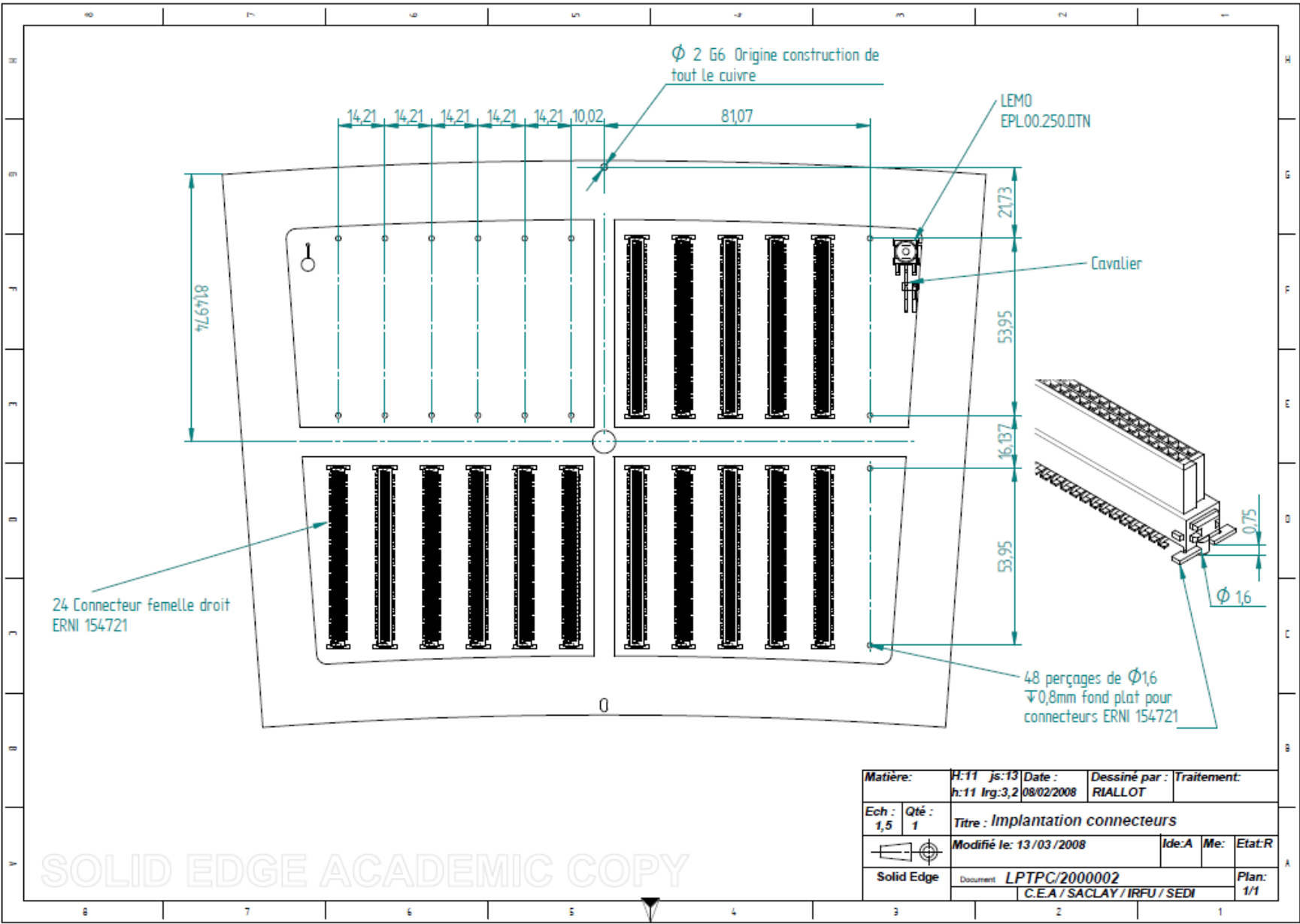
EUDET Annual Meeting 2009

# Pads of a Micromegas Module

6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67
6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67
6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67
6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67
6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67
6	12	18	24	30	36	42	48	54	60	66	72	6	12	18	24	30	36	42	48	54	60	66	72
5	17	23	29	35	41	47	53	59	65	71	77	5	11	17	23	29	35	41	47	53	59	65	71
4	16	22	28	34	40	46	52	58	64	70	76	4	10	16	22	28	34	40	46	52	58	64	70
3	15	21	27	33	39	45	51	57	63	69	75	3	9	15	21	27	33	39	45	51	57	63	69
2	14	20	26	32	38	44	50	56	62	68	74	2	8	14	20	26	32	38	44	50	56	62	68
1	13	19	25	31	37	43	49	55	61	67	73	1	7	13	19	25	31	37	43	49	55	61	67

~ 3mm \* 7 mm pads

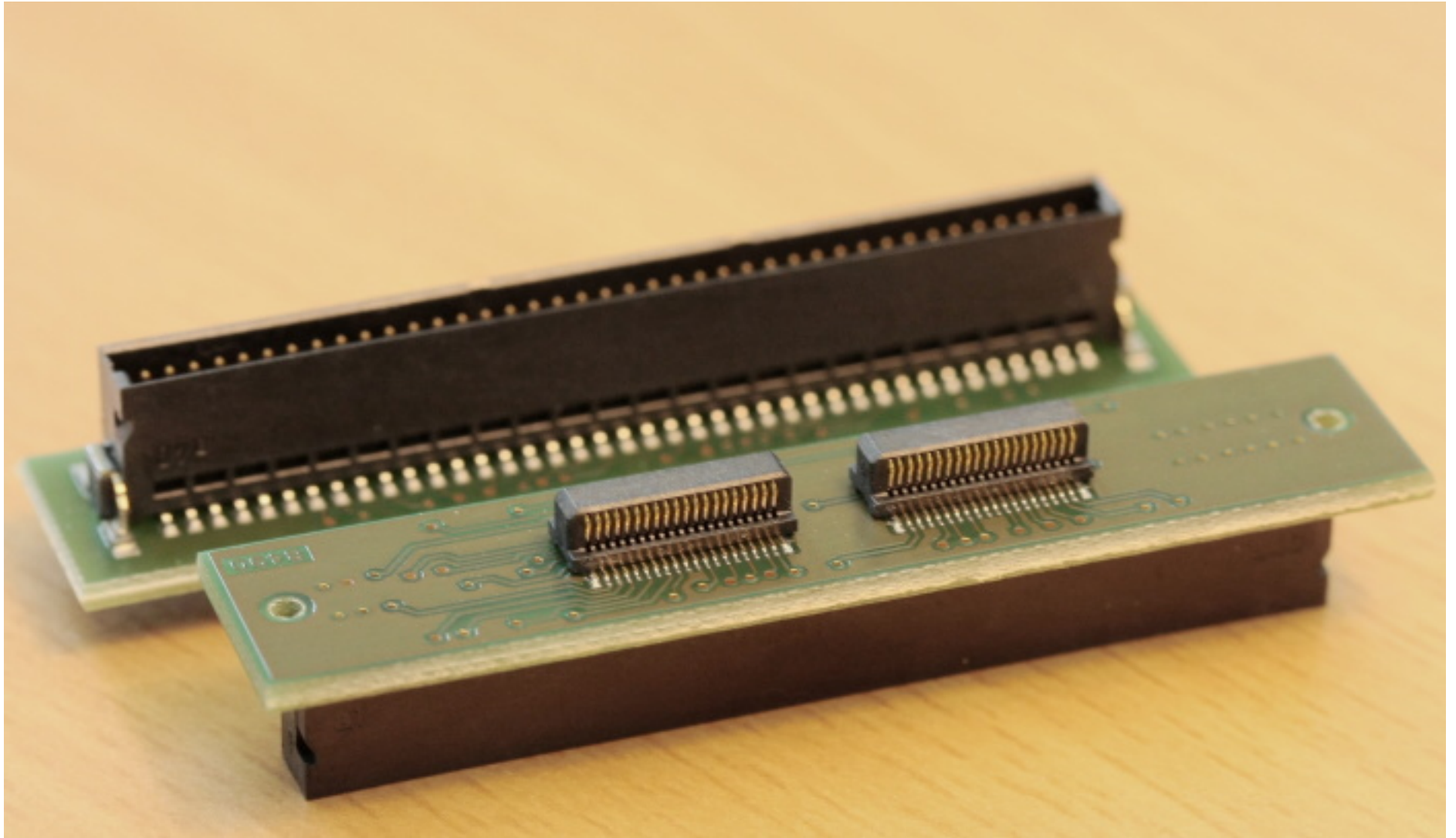
# Connectors of a Micromegas Module



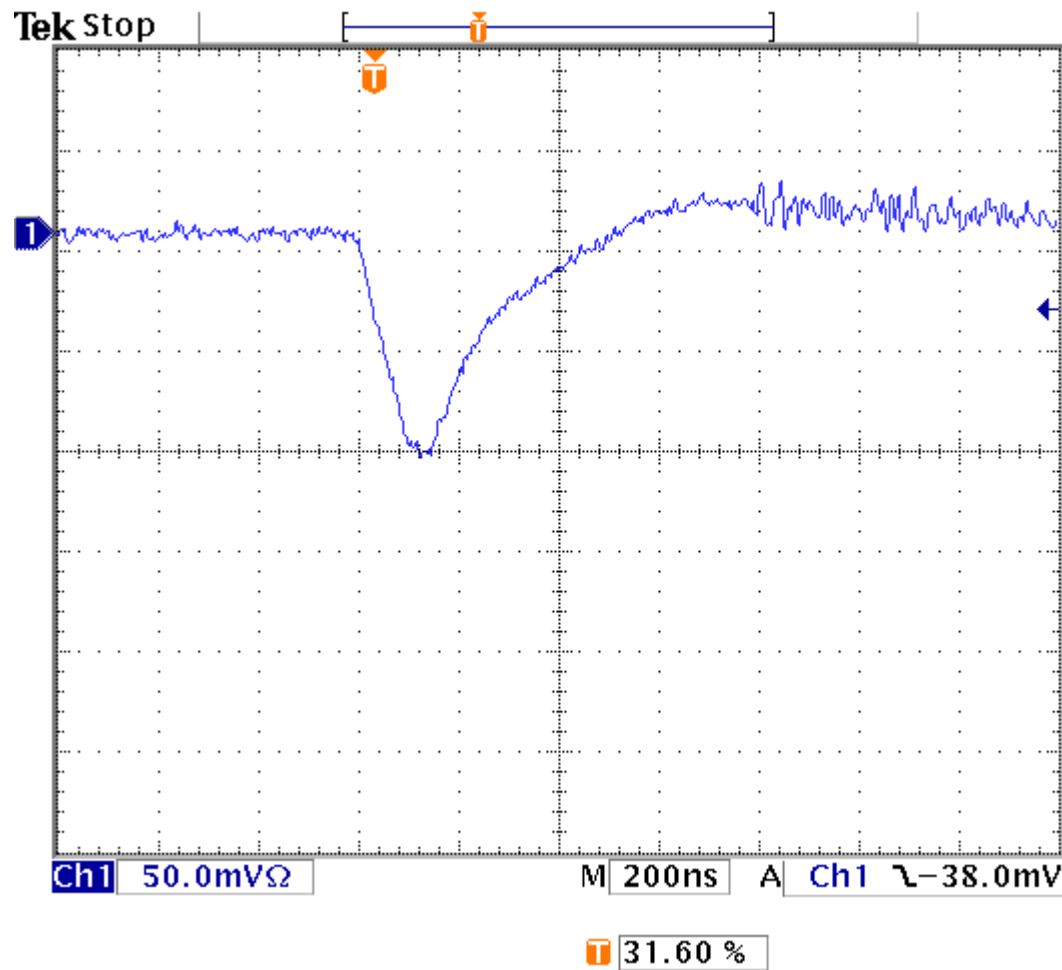


# Adapters for a Micromegas Module

---



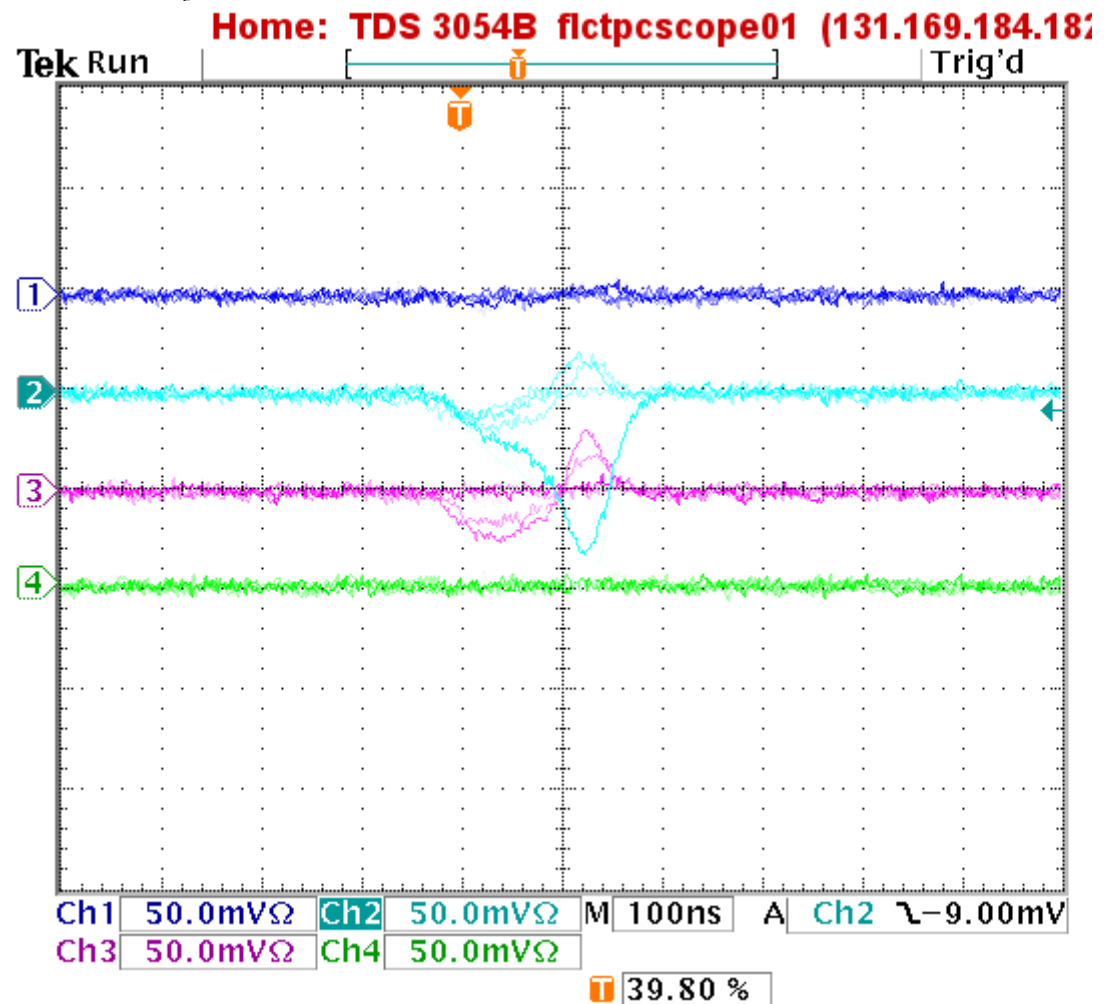
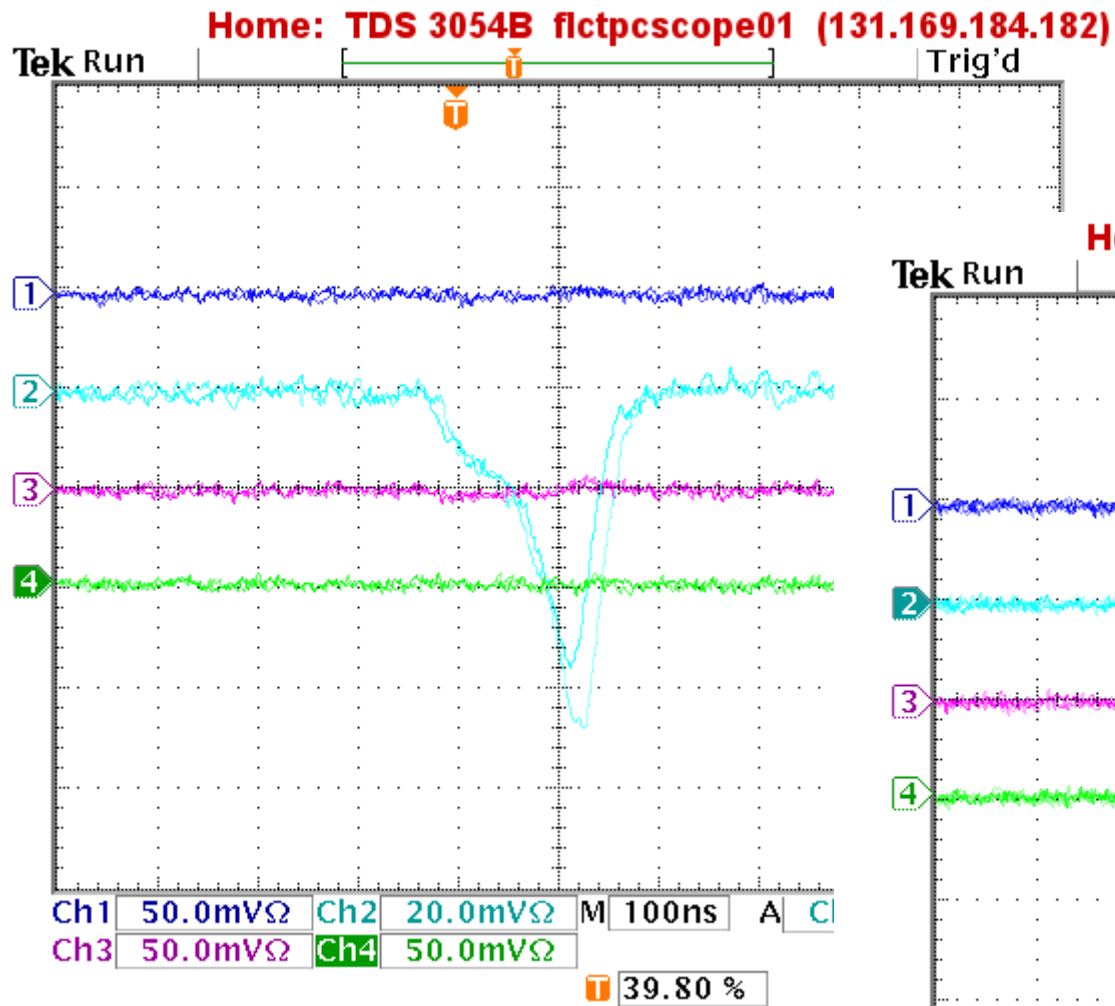
# A Signal from a Micromegas Module



Micromegas (“+resistive ink”) at 410 V  
Gas: T2K  
Signals from cosmic particles  
Amplifier “HERMES”

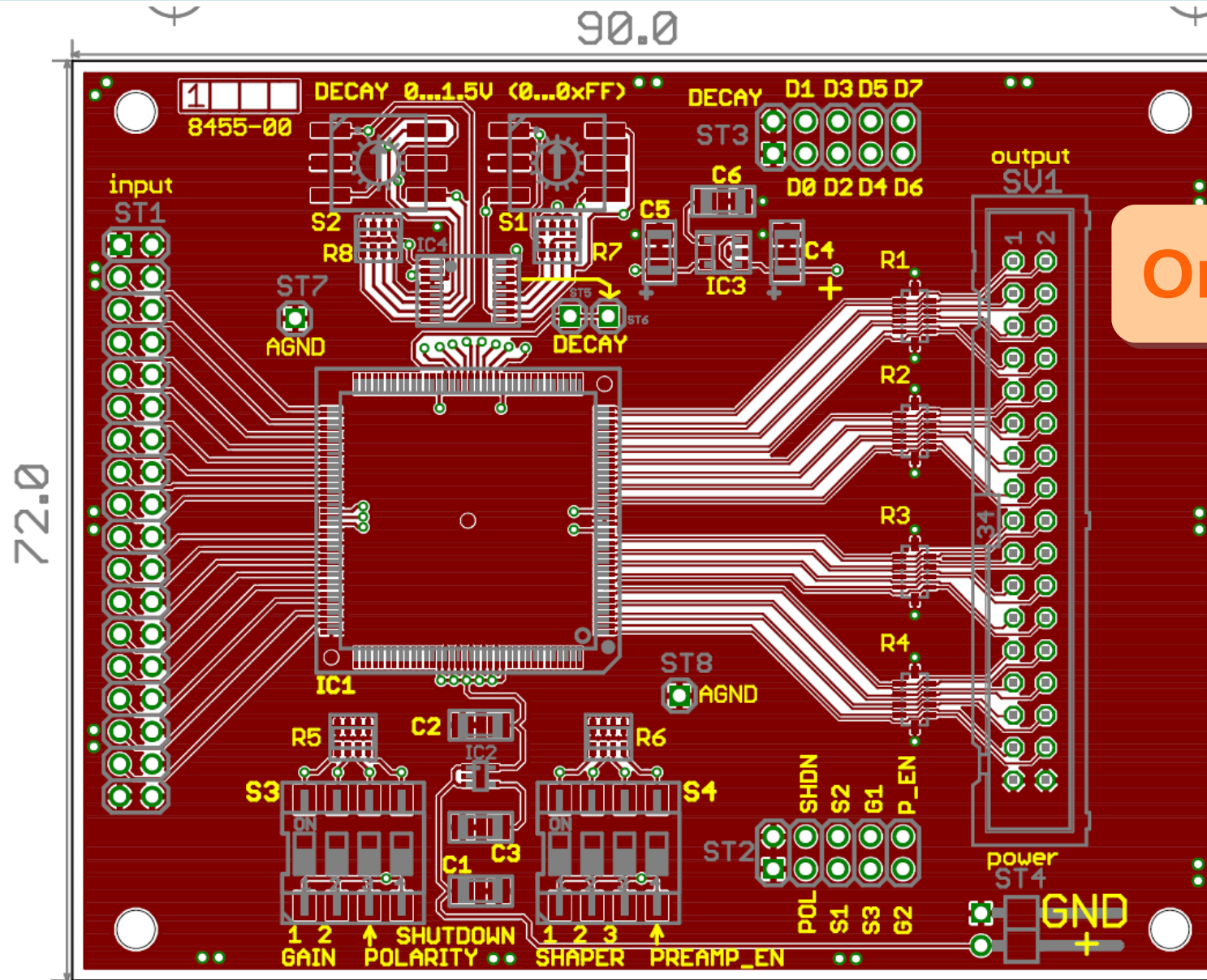
EUDET Annual Meeting 2009

# Signals from a GEM (!) Detector



**3GEM, 5mm induction gap  
Signals from Fe55**

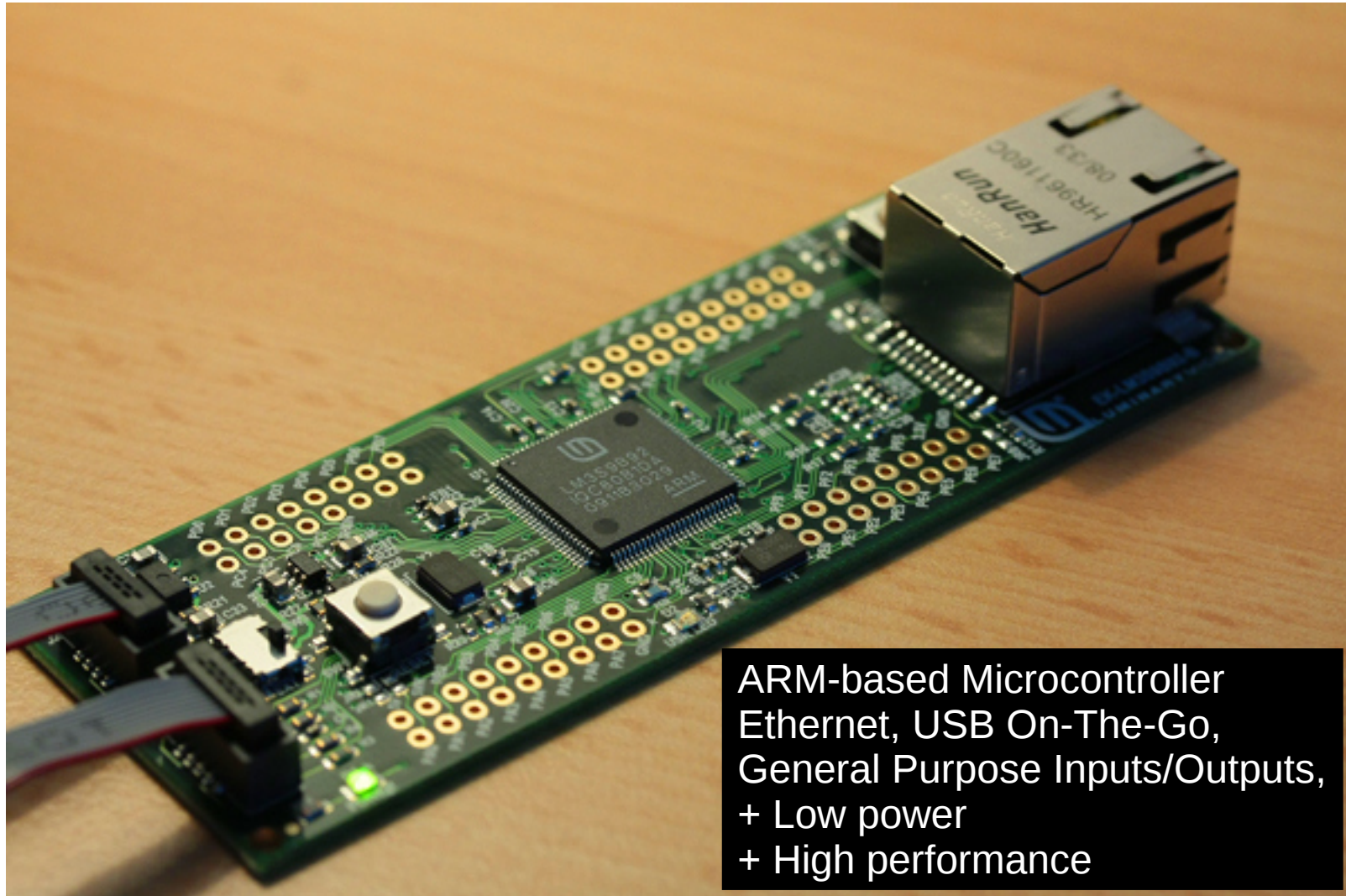
# Readout Prototype: Part I



PCA16 based readout board, to be used for study of signals from a GEM detector.

EUDET Annual Meeting 2009

## Readout Prototype: Part II



An evaluation kit for a Stellaris ARM Microcontroller

**Fast lane from a readout system (ADC/TDC) to existing industry solutions.**

EUDET Annual Meeting 2009

# Readout Prototype: Part II

---

Assume

30 mW/channel

3 M channels for a TPC endplate

Power reduction factor 1:100 (power pulsing)

Then 900 W needs to be delivered to ~100 modules of the ILC TPC.

***Power over Ethernet*** would be able to deliver ~10W per connection...

... this will not be studied, at least for now.

# Summary and Outlook

---

No results with GEM Modules, yet. Higher gas gain is necessary. Currently, VME crate is not prepared to work in (stray) B-field.

It is planned to use a Micromegas Module. Higher gas gains are possible. Larger area can be covered.

Next step:

- Threshold / efficiency scan,

- Charge-to-time conversion parameter (QDR) scan,

- Z-scan in LPTPC.

Signal simulation for a GEM detector is being prepared.

Last milestone (31.12.2009) to be reached in time.