



Generic information about the testbeam at the SPS

Wolfgang Kiesenhofer
for the SiLC Testbeam Team

2. July 2008

Aim of the effort

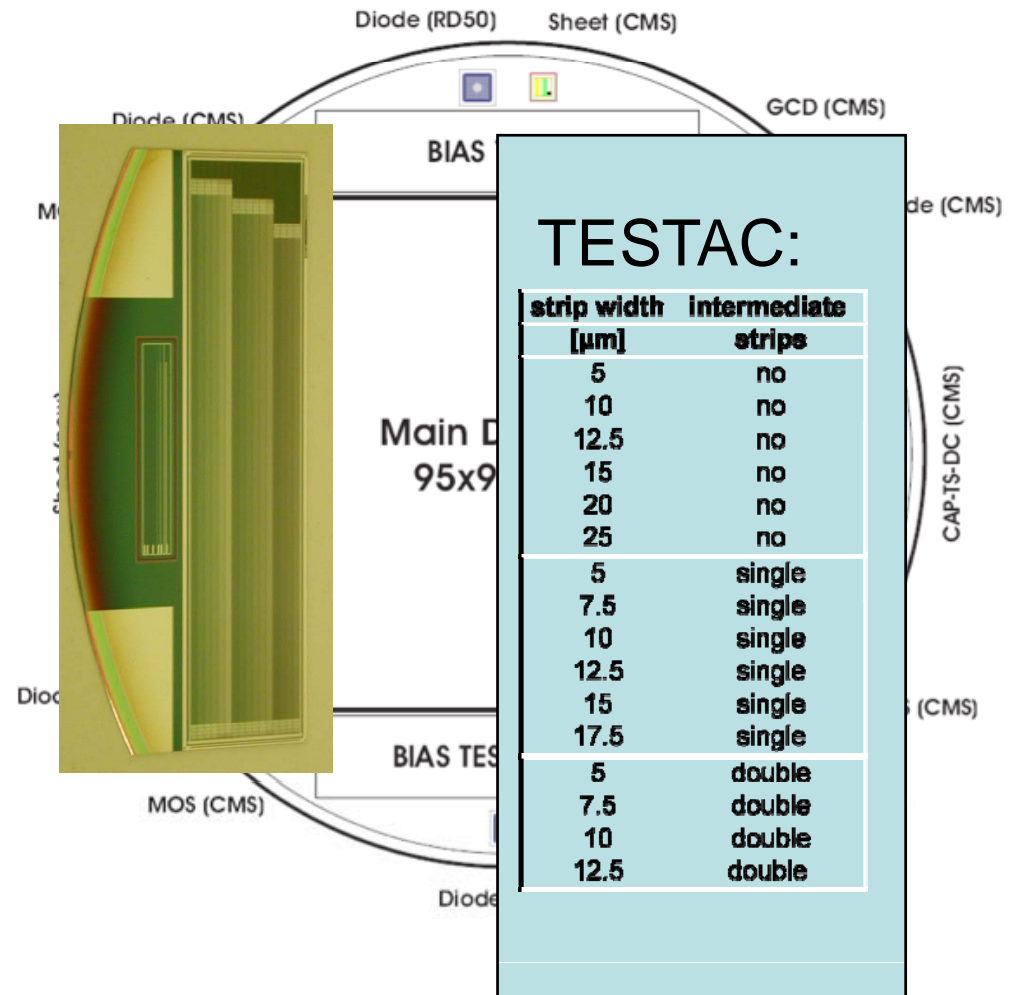
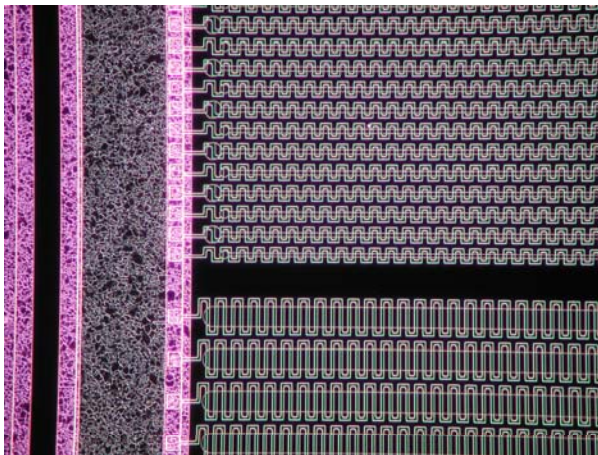
The goal of this testbeam:

- Evaluate the best strip geometry of silicon strip sensors with 50 micron pitch to achieve the highest possible spatial resolution
- For this purpose we are using a dedicated mini sensor with different zones, each with a different strip geometry:
 - Different strip widths
 - 0, 1 or 2 intermediate strips
- We are using the fine resolution of the EUDET pixel telescope to get high precision tracks to determine the residuals for our DUTs [Devices under Test]

DUT Sensors

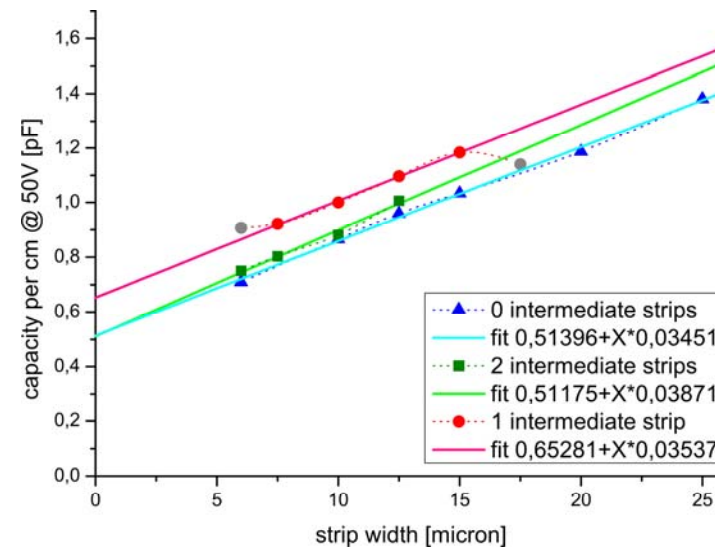
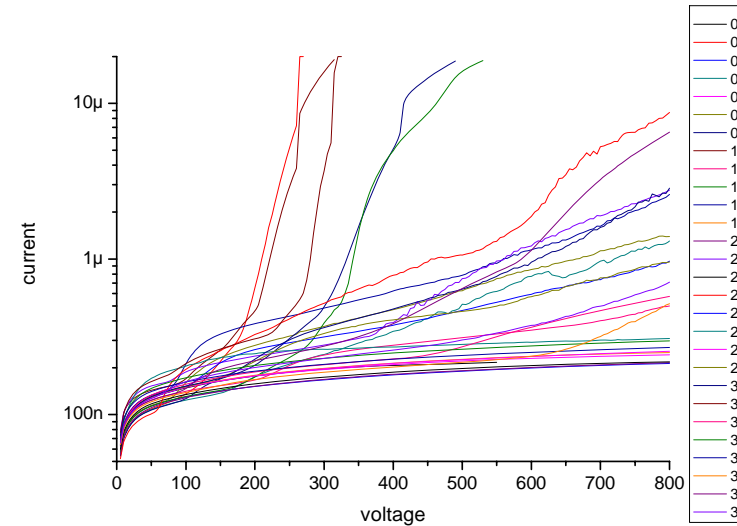
Last sensor order at HPK from SiLC collaboration contains a multi-geometry mini sensor:

- 256 strips with 50um pitch
- 16 zones with 16 strips each
- Layout constant within each zone
- **Strip width and number of intermediate strips** vary between the zones

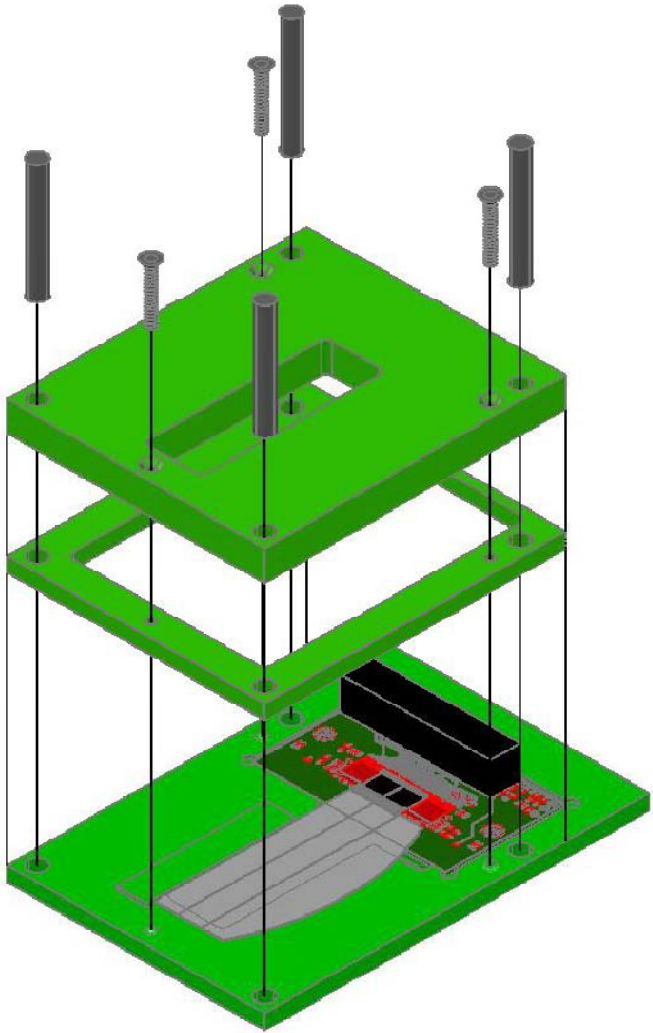


DUT Sensors

- DUT sensors have been intensively tested in Vienna, e.g.:
- IV curves on all sensors to determine full depletion voltages
 - approx. 60V
- CV curves
- Measurement of the interstrip capacitance revealed different values for each zone:
 - Capacitance scales linearly with strip width
 - Different offset for region with one or two intermediate strips



DUT Module



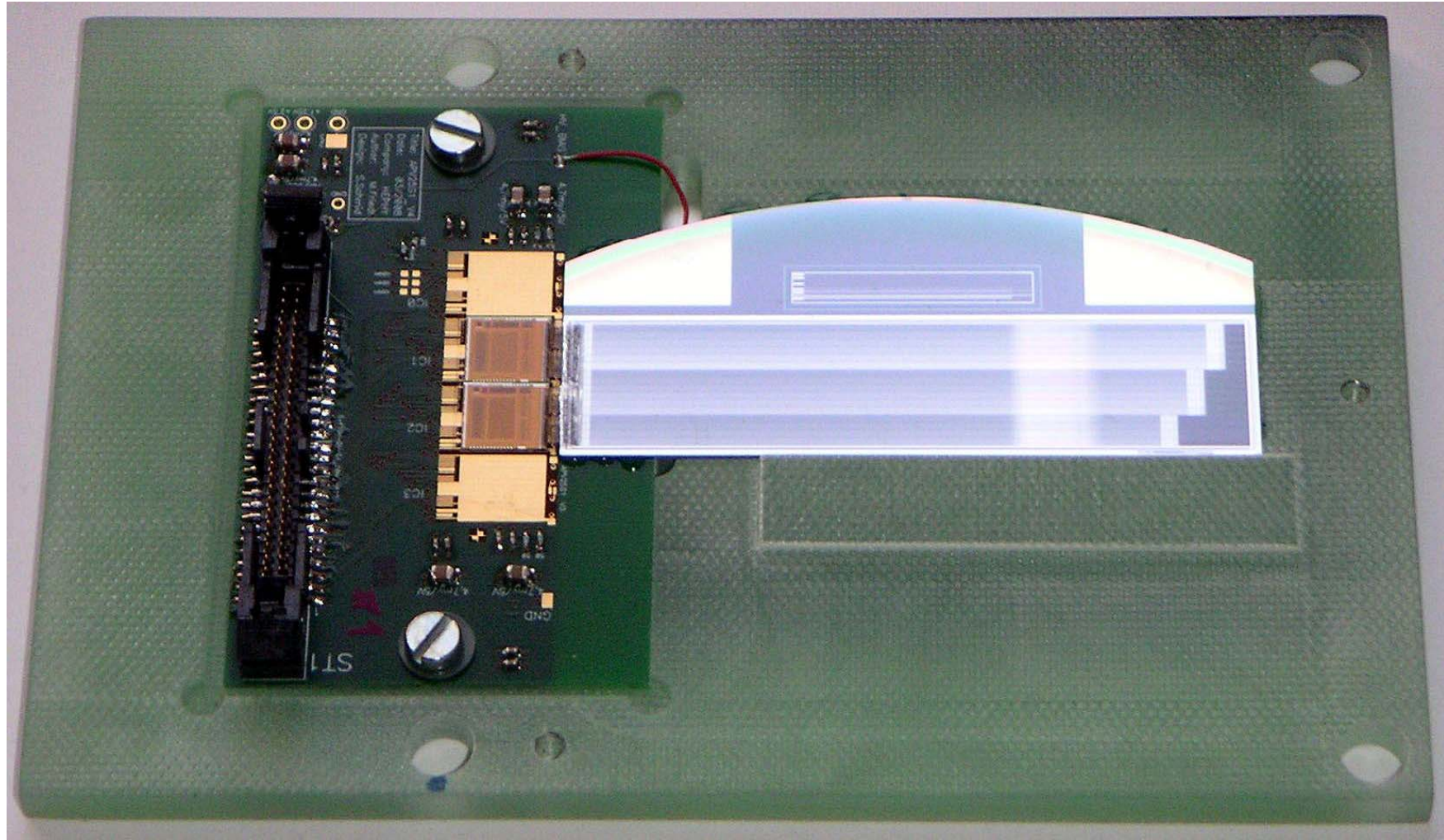
9 modules have been built in Vienna:

Front side:

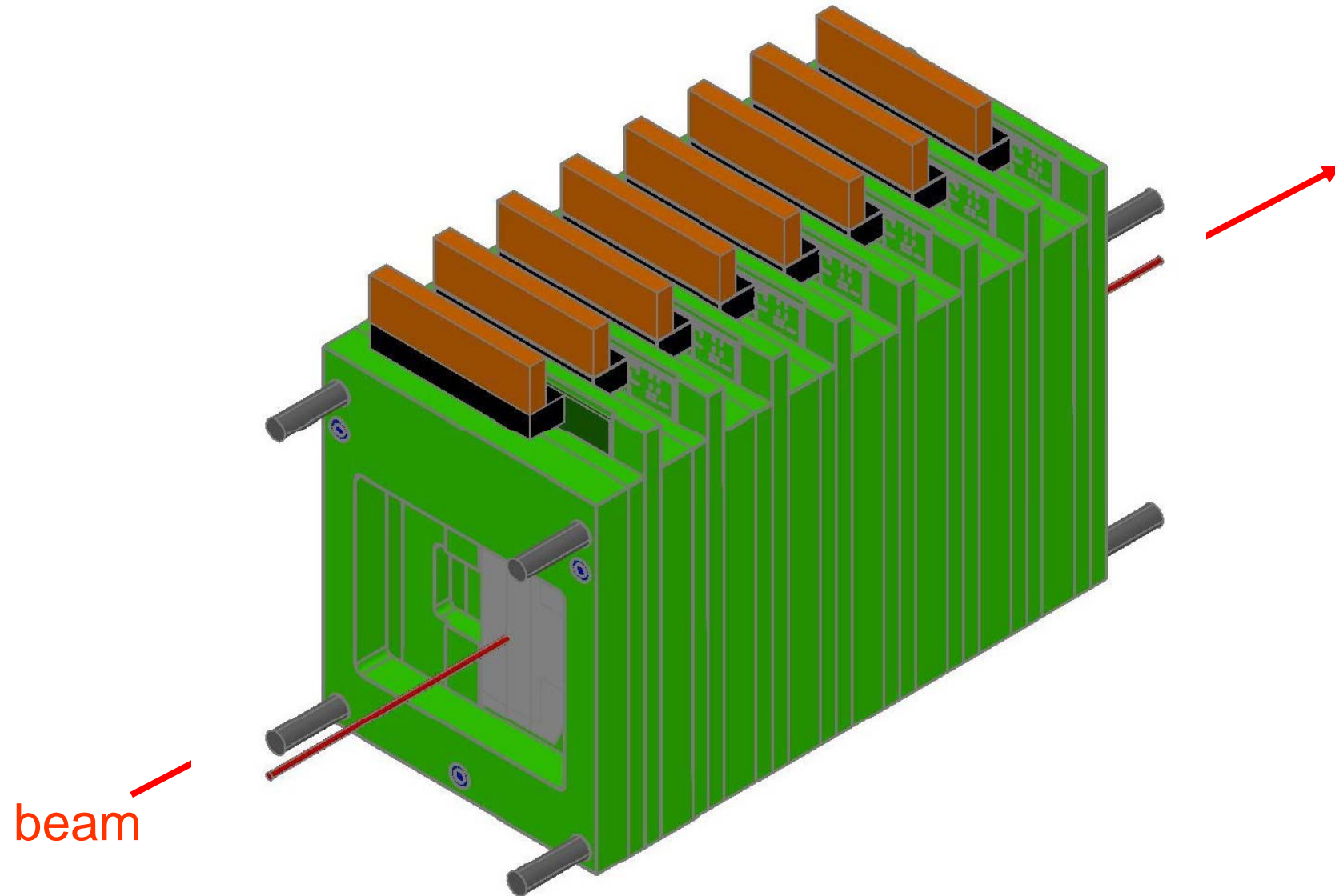
Back side:



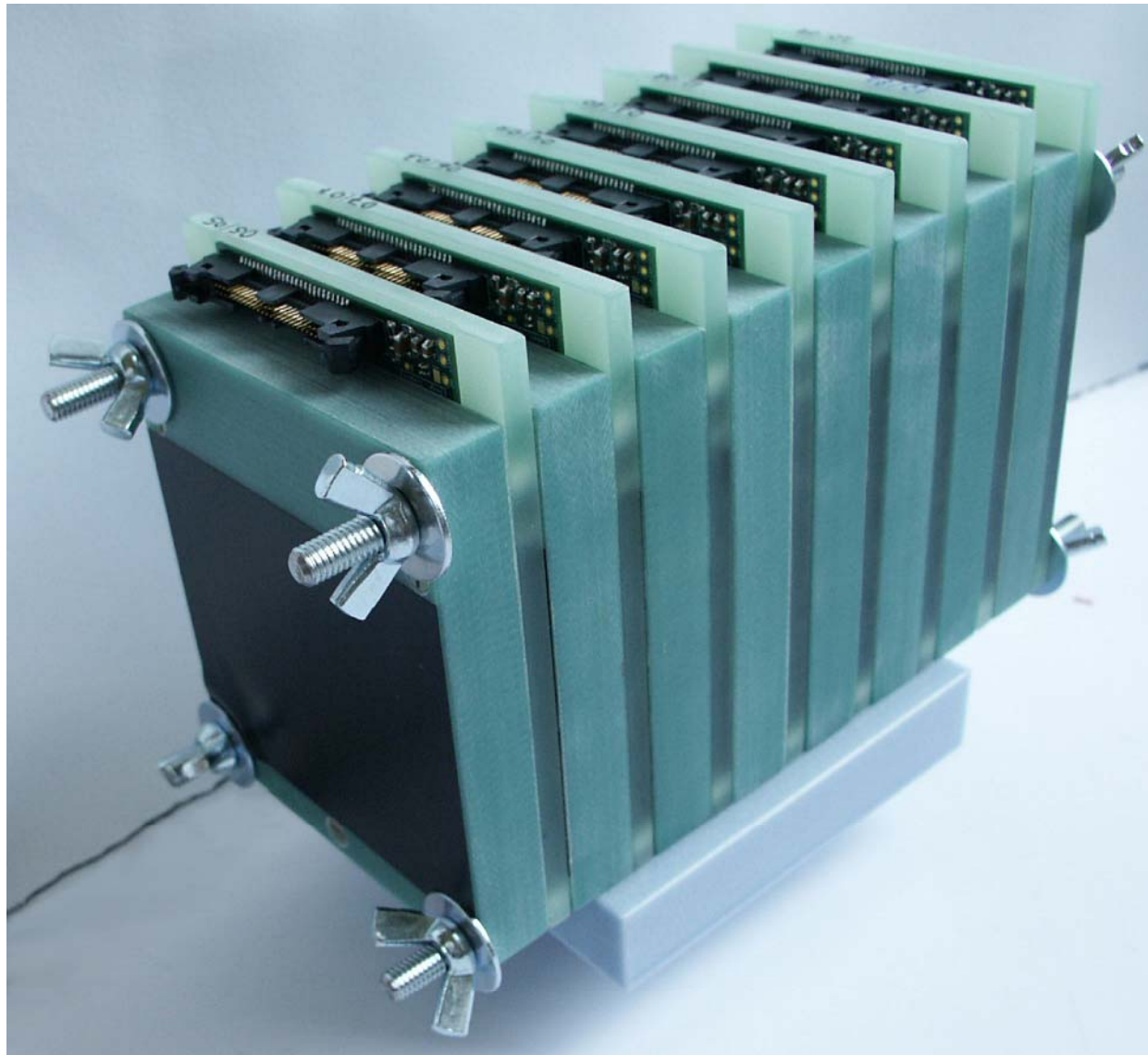
Front End Hybrid with APV25



8 Modules screwed together

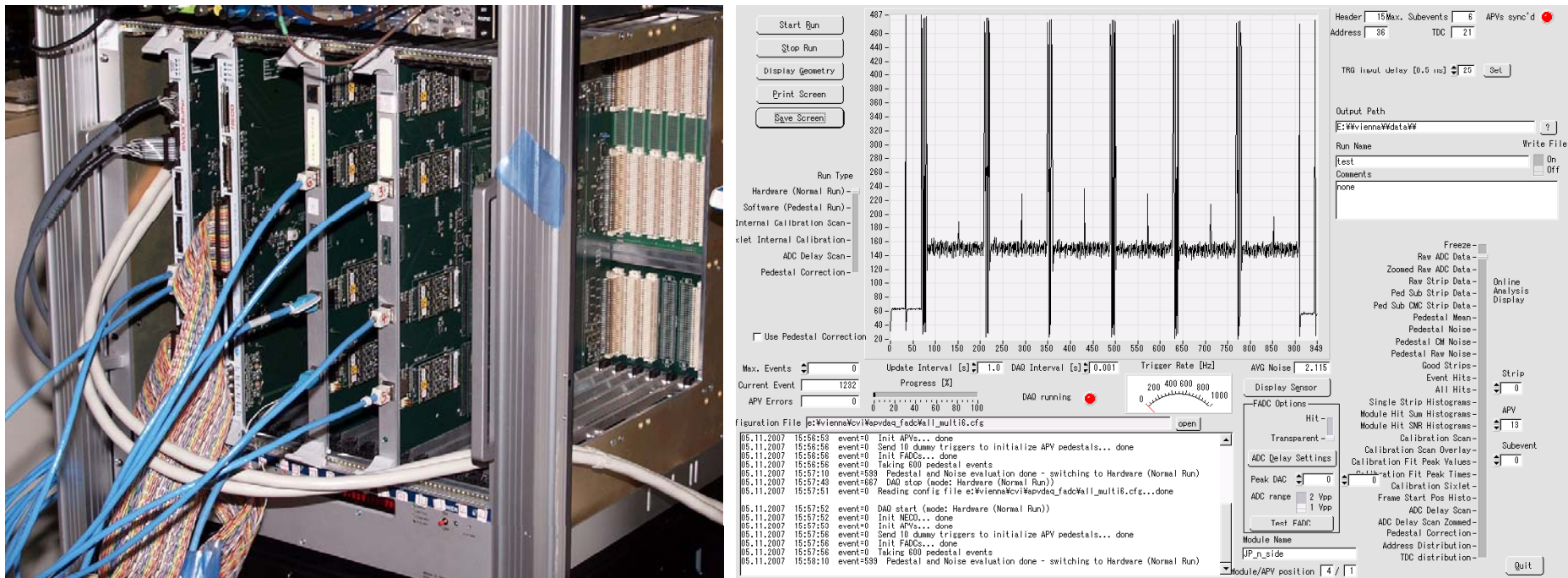


8 Modules screwed together



DAQ: APV25 Readout System

- APVDAQ was developed in-house (Electronics 2: Markus Friedl)
- DAQ Hard- and Software (including predecessors) has already been used for more than 10 testbeams in the past.
 - stable and reliable
- Extensive on-line data quality control



EUDET Telescope

EUDET Telescope worked very reliable!

- 6 detector planes
 - only 5 planes active, one was broken
- XYZ table with rotation stage
 - rotation did not work
- RAW mode was not reliable
 - most runs in zero-suppressed mode



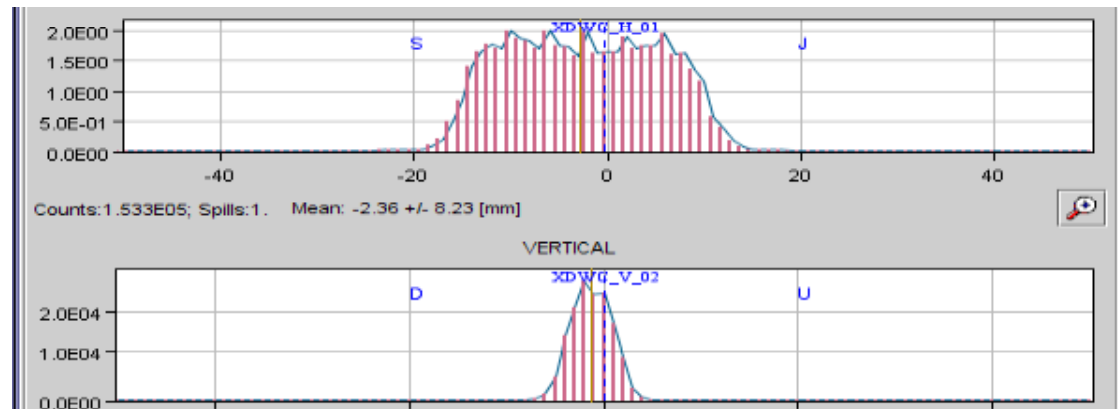
Thank you!

Thanks to the Eudet Beam Telescope People
for their excellent help:
Antonio, Daniel, Emlyn, Ingrid, Phillip



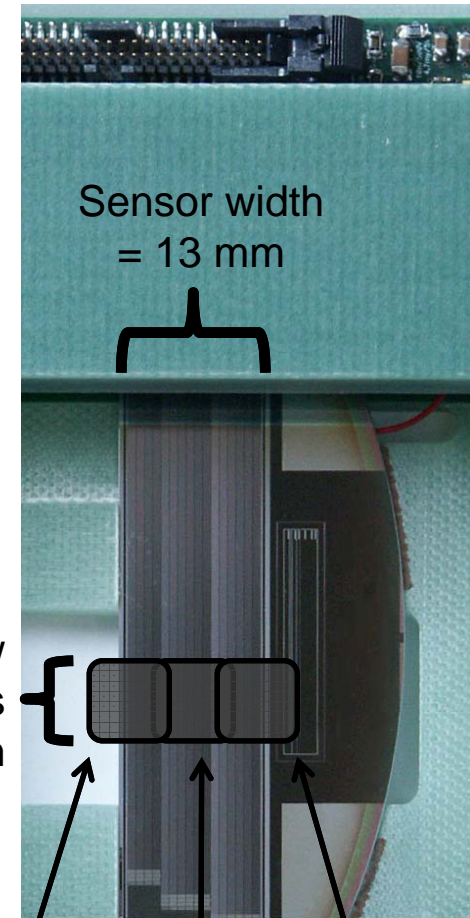
Geometry Setup I

- Trigger Window:
 - Beam spot: 10 x 40 mm
 - Scintillator 1&2: 9 x 9 mm
 - Scintillator 3&4: 4 x 4 mm
 - Telescope active area: 7 x 7 mm
- Most runs with scintillators 1&2 only (9 x 9 mm)
 - Some hits (~ 40%) are without tracks in the telescope
- 3 runs needed to reliably cover the full width of our sensors (13 mm)



Beam Profile

Trigger window
with tracks
= 7 x 7 mm



LEFT
position

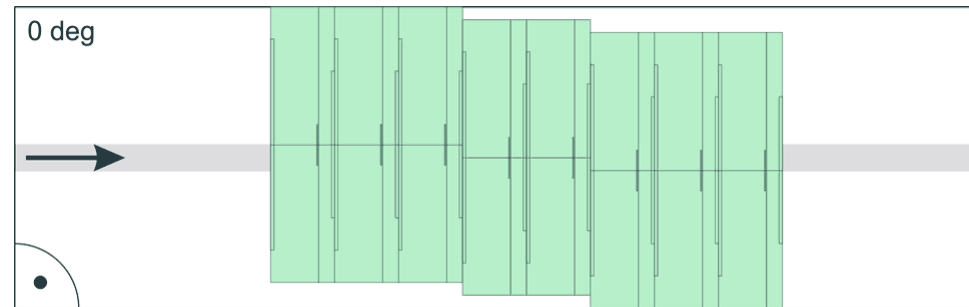
MID
position

RIGHT
position

Geometry Setup II

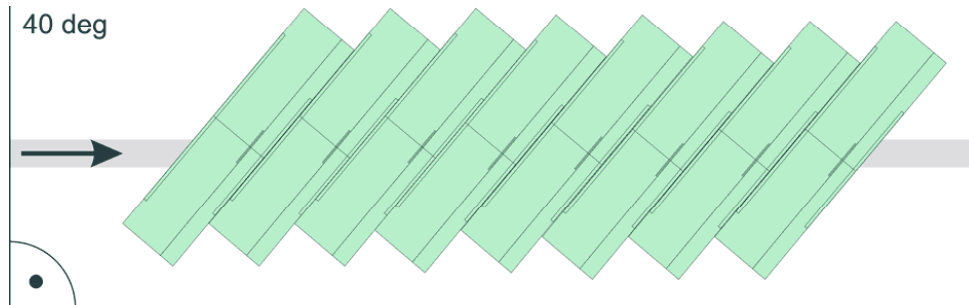
Reduced Manipulation

- Hit all zones with one configuration
- Statistics per zone is reduced
- Tricky to mount on table



Angle Scans

- Intention: rotate single module
- But: rotation stage not working
- Solution: Manual positioning of modules for each angle step
 - Even more tricky to mount
 - But higher statistics due to 8 modules in the beam,



Run Matrix

Run #	Objective	# events	APVDAQ	Telescope	Comments	Date
1	First attempt without telescope	~52k	raw	n.a.	No beam after 22:00h. Run terminated	30.05.2008
2716	Test	20k	raw	zs	All scintillators on	31.05.2008
2717	Test	~6k	raw	zs	trigger window didn't cover sensor	31.05.2008
2718	Resolution Test	100k	raw	zs	RIGHT pos, long break - beam dropped out	31.05.2008
2719	Resolution Test	100k	raw	zs	MID pos	31.05.2008
2720	Resolution Test	100k	raw	zs	LEFT pos	01.06.2008
2721	Resolution Test (Raw)	22k	raw	raw (2721-2737)	LEFT pos	01.06.2008
2	APVDAQ Hit Mode Test	100k	zs	n.a.	LEFT pos	01.06.2008
3	APVDAQ Hit Mode Test	100k	zs	n.a.	MID pos	01.06.2008
2738	Pedestal Run (Telescope)	1k	n.a.	?	Pedestal (Telescope)	01.06.2008
2739		n.a.	n.a.	n.a.	after start beam dropped out	01.06.2008
2741	Resolution Test (Raw)	22k	raw	raw (2741-2757)	MID pos, beam dropped out	
4	APVDAQ Hit Mode Test	100k	zs	n.a.	RIGHT pos (APVDAQ in Hit Mode)	01.06.2008
2758	Resolution Test (Raw)	~35k	raw	raw (2758-2783)	RIGHT pos, last total raw mode run	01.06.2008
2784-2786					telescope only	02.06.2008
2787	Voltage Scan	30k	raw	zs	HV=100 (Modules rearranged)	02.06.2008
2788	Voltage Scan	10k	raw	zs	HV=10 (Modules rearranged)	02.06.2008
2789	Voltage Scan	10k	raw	zs	HV=20 (Modules rearranged)	02.06.2008
2790	Voltage Scan	10k	raw	zs	HV=30 (Modules rearranged)	02.06.2008
2791	Voltage Scan	10k	raw	zs	HV=40 (Modules rearranged)	02.06.2008
2792	Voltage Scan	~5k	raw	zs	HV=50 (Modules rearranged), stopped/beam drop out	02.06.2008
2821	Voltage Scan	10k	raw	zs	HV=50 (Modules rearranged), retry	02.06.2008
2822	Voltage Scan	10k	raw	zs	HV=60 (Modules rearranged)	02.06.2008
2823	Voltage Scan	10k	raw	zs	HV=70 (Modules rearranged)	02.06.2008
2824	Voltage Scan	10k	raw	zs	HV=80 (Modules rearranged)	02.06.2008
2825	Voltage Scan	10k	raw	zs	HV=90 (Modules rearranged)	02.06.2008
2826	Voltage Scan	10k	raw	zs	HV=120 (Modules rearranged)	02.06.2008
2827	Voltage Scan	10k	raw	zs	HV=150 (Modules rearranged)	02.06.2008
2828	Voltage Scan	10k	raw	zs	HV=200 (Modules rearranged)	02.06.2008
2831	Angle Scan	10k	raw	zs	angle=10deg	02.06.2008
2832	Angle Scan	10k	raw	zs	angle=20deg	02.06.2008
2833	Angle Scan	10k	raw	zs	angle=30deg	02.06.2008
2834	Angle Scan	10k	raw	zs	angle=40deg	02.06.2008
2835	Angle Scan	10k	raw	zs	angle=50deg	02.06.2008
2836	Angle Scan	10k	raw	zs	angle=60deg, only 7 modules in beam	02.06.2008
2837	Angle Scan	20k	raw	zs	angle=0deg	02.06.2008
2838	2D-Scan	~478k	raw	zs	(0,2,4,6)->normal, (1,3,5,7)->rotated	03.06.2008

Summary

- Goal: Find strip geometry with highest resolution for strip sensors with 50 micron pitch
- We were very well prepared for data taking
 - Well known DAQ system built by in-house experts
 - Robust modules designed for easy handling
 - Synchronization between telescope and DUT (TLU) was tested prior going to CERN
- Data taking at CERN was smoothly for the most part
 - Modules proved to be very robust and practicable
 - APVDAQ was running smoothly
 - EUDET Telescope ran very stable
 - Damaged rotation stage caused some headaches
 - SPS beam was the limiting factor in terms of data taking time
- We collected about 1.5M events in several configurations
- Access to the data can be provided on request