PANDA Barrel DIRC

PADIWA & FLASH Studies

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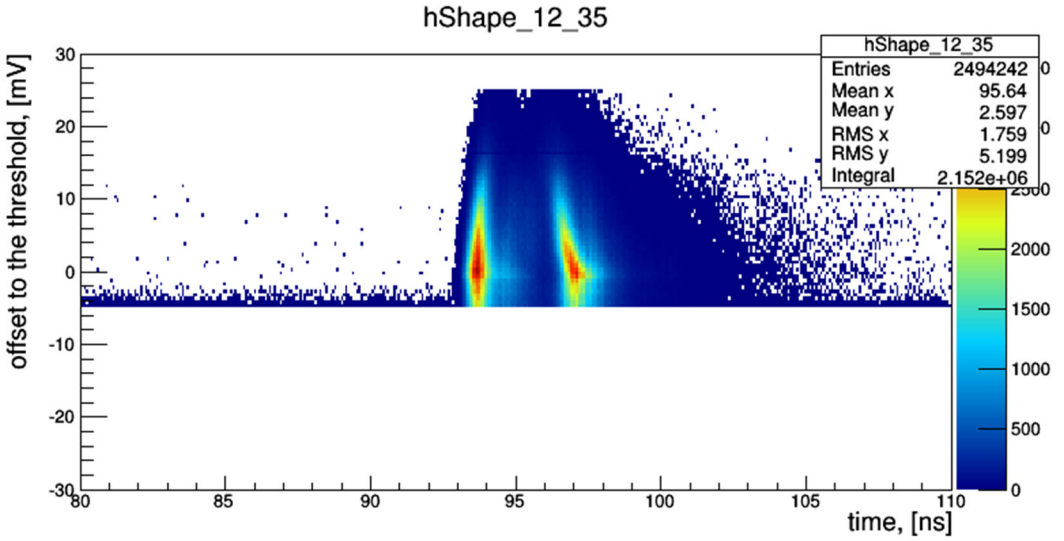
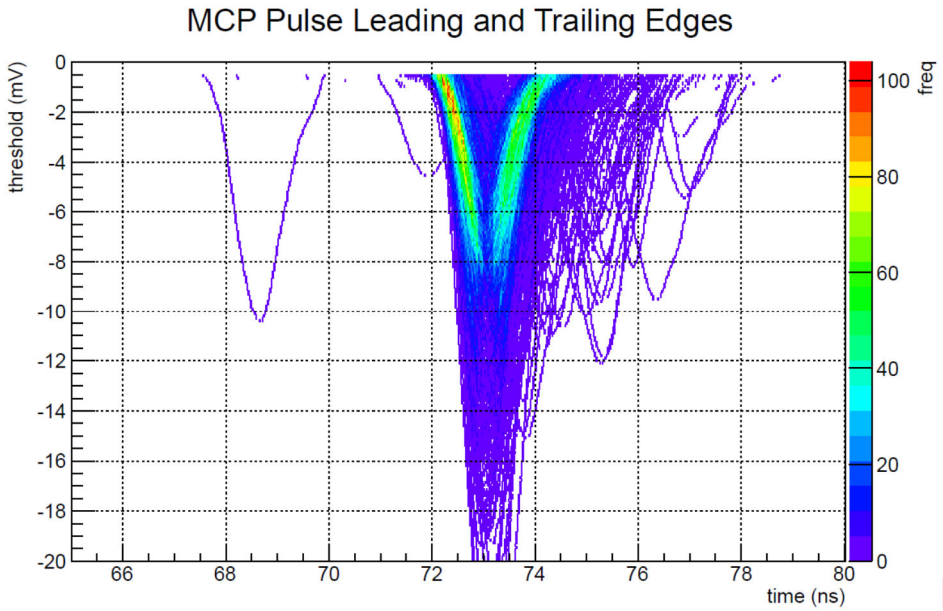
JOHANNES GUTENBERG UNIVERSITÄT MAINZ

JG|U

Investigation of PADIWA Response

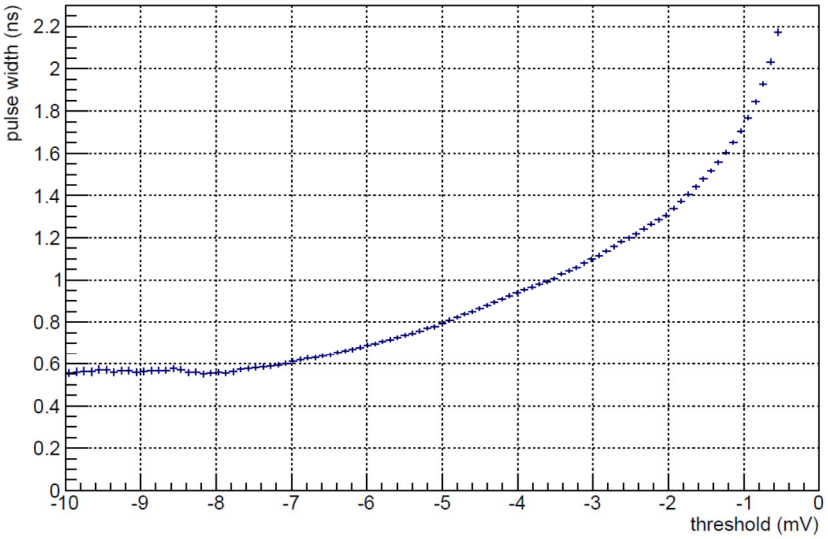
- Crosscheck PADIWA results from GSI test experiment 2014
- Use sampled waveforms
  - SPE level (avg. amplitude ~8mV)
  - Gain ~1e6 w/o pre-amplifier

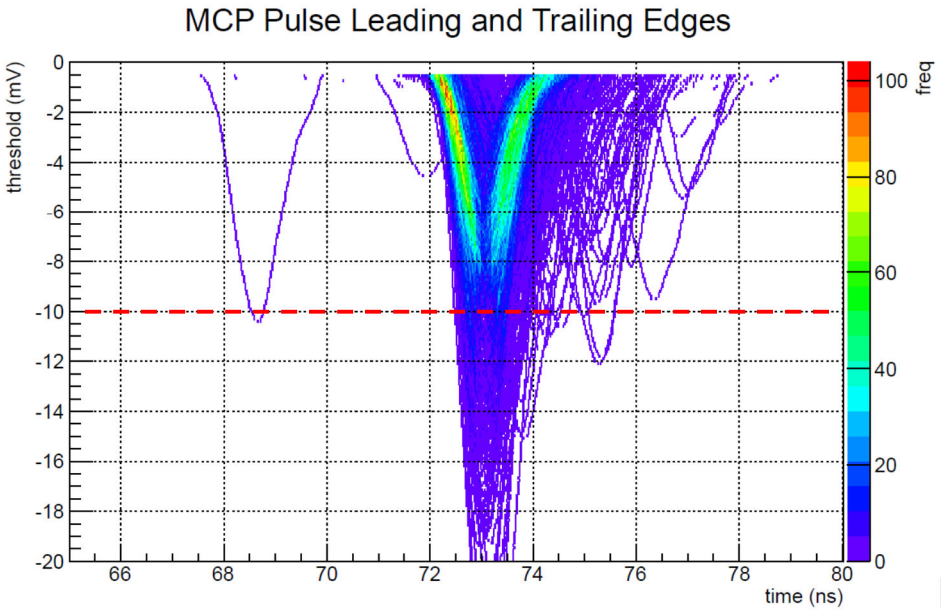




Investigation of PADIWA Response

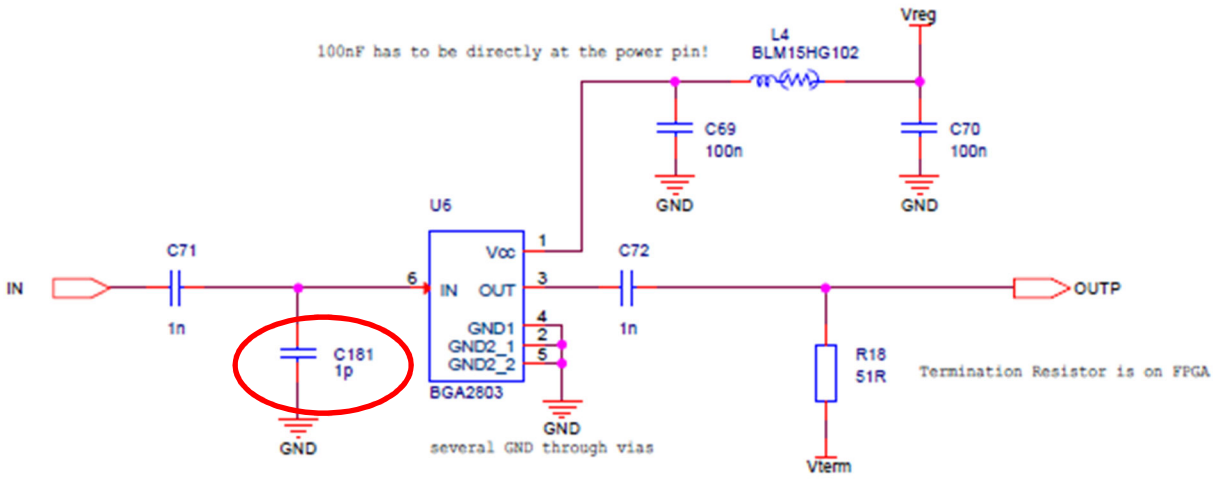
- Crosscheck PADIWA results from GSI test experiment 2014
- Use sampled waveforms
  - SPE level (avg. amplitude ~8mV)
  - Gain ~1e6 w/o pre-amplifier
- Amplitudes range up to ~12mV
- Pulse widths from 0.6-2.2ns
  - Short pulse detection deficiency?





PADIWA Input Stage Modifications

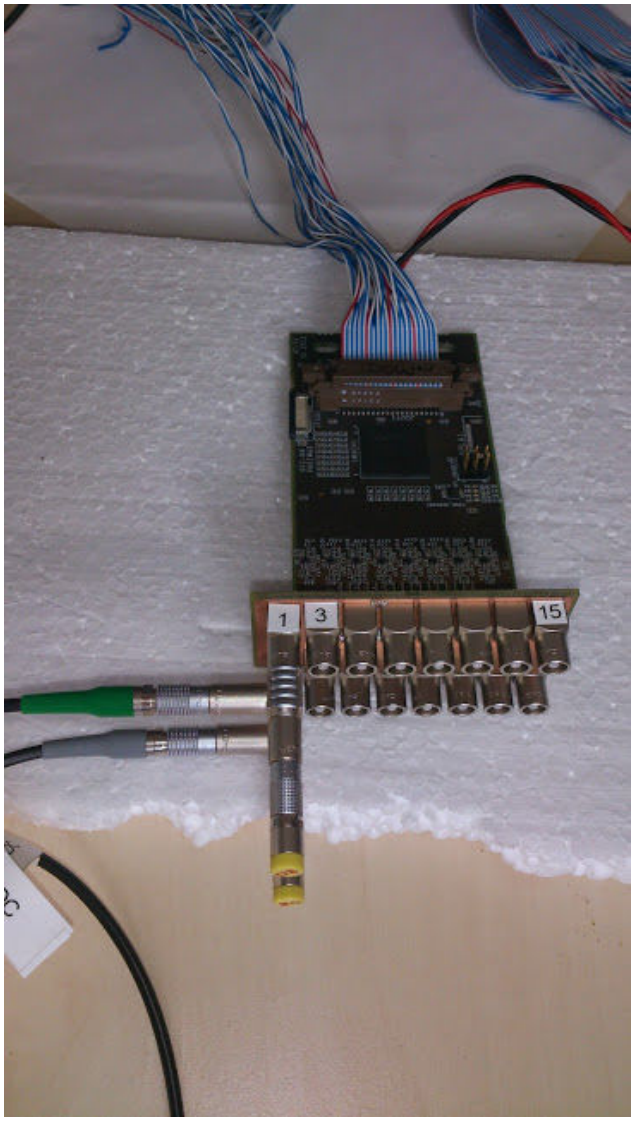
- Limit bandwidth to reduce noise
  - Standard 1pF (~3.2GHz cut-off)
- Study impact on timing
  - 1pF – 100pF selected (see table)



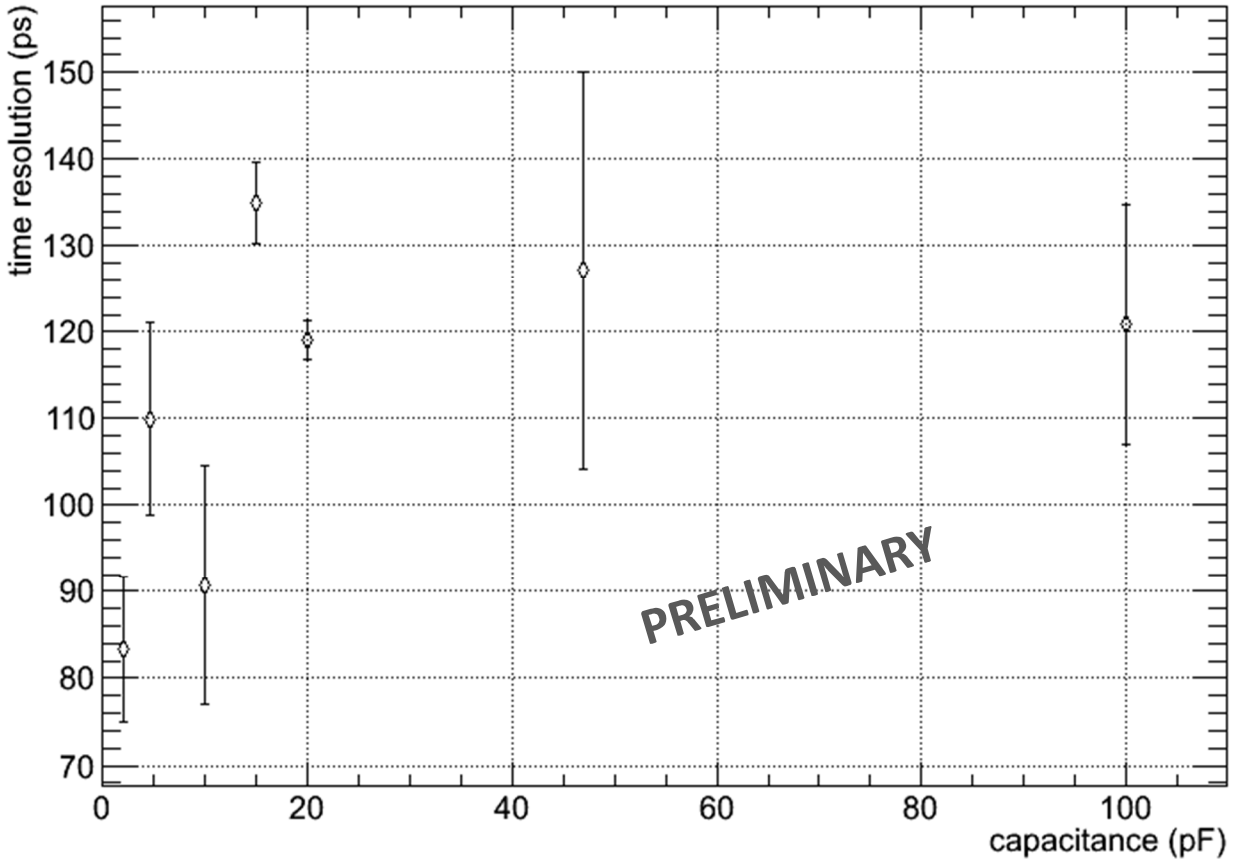
Input	Cap ID	Capacitance (pF)	Cut-off (GHz)
1	C196	1	3.2
2	C181	15	0.2
3	C182	1	3.2
4	C189	15	0.2
5	C183	2	1.6
6	C190	20	0.16
7	C184	2	1.6
8	C191	20	0.16
9	C185	4.7	0.7
10	C192	47	0.07
11	C186	4.7	0.7
12	C193	47	0.07
13	C187	10	0.3
14	C194	100	0.03
15	C188	10	0.3
16	C195	100	0.03

PADIWA Input Stage Modifications

- Setup
  - Modified PADIWA card
  - Tektronix AFG3252 Pulse Generator
    - Rectangular pulse
    - Slow rise time (~3ns)
    - 10kHz rate
  - Passive attenuator 13dB (adjust to SPE level)
  - Use 0xC0 offset (0x20 possible but too much ringing observed)
- Split signal
  - Channel 1 as reference
- Issues
  - Signal reflections on input (100kΩ)
  - Low efficiency (trigger not synchronised)
  - Long signals (400ns)



PADIWA Input Stage Modifications

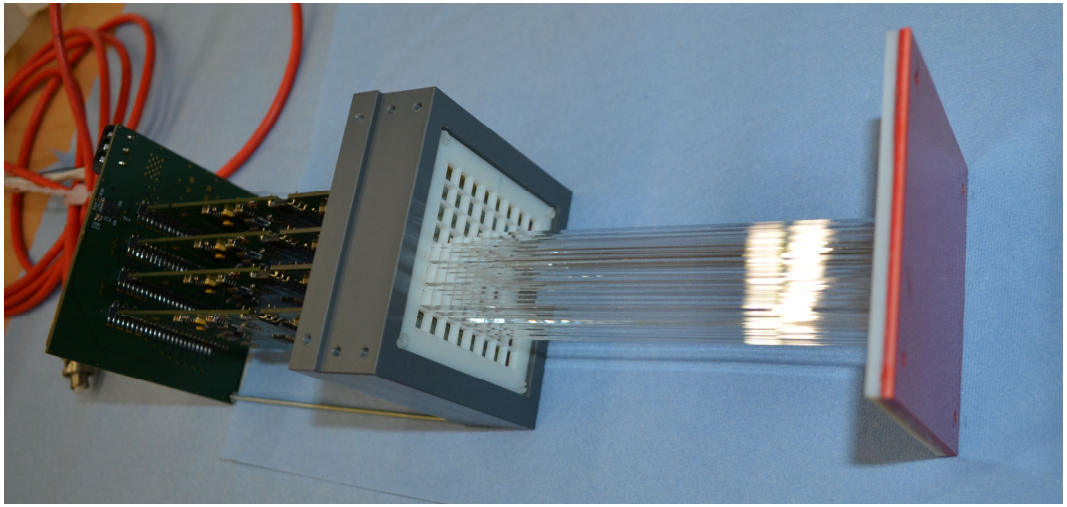


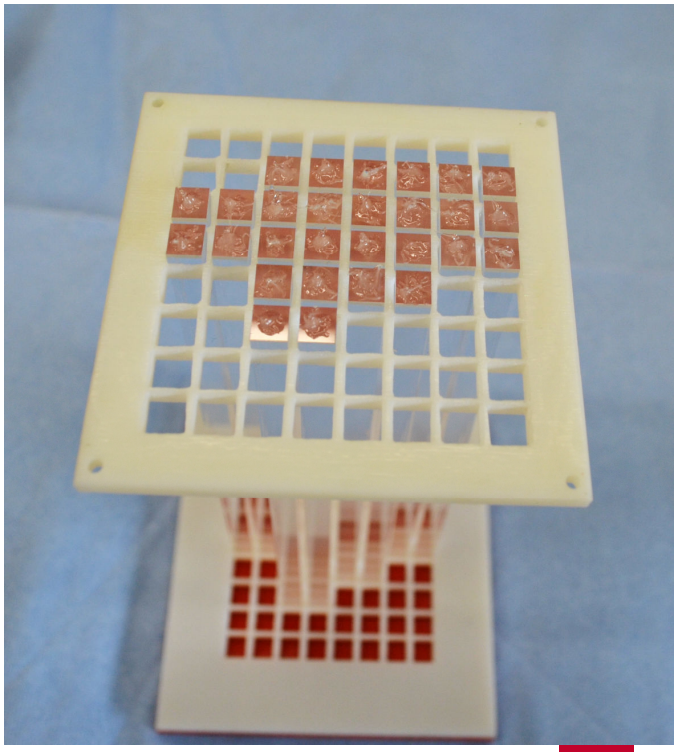
Input	Cap ID	Capacitance (pF)
1	C196	1
2	C181	15
3	C182	1
4	C189	15
5	C183	2
6	C190	20
7	C184	2
8	C191	20
9	C185	4.7
10	C192	47
11	C186	4.7
12	C193	47
13	C187	10
14	C194	100
15	C188	10
16	C195	100

Reference channel contribution (~59ps) removed

FLASH Test Experiment in Mainz

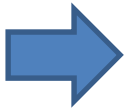
- Build a fast start counter (a la QUARTIC)
  - Time resolution under 60 ps
  - Instrument w NINO cards incl pre-amplifiers
  - Read MCP_OUT with fast oscilloscope
- Time resolution improvement:
  - Separate detectors: Factor $\frac{1}{\sqrt{N_{det}}}$
  - Separate measurements on one MCP-PMT: Factor $\frac{1}{\sqrt{N_{pixel}}}$

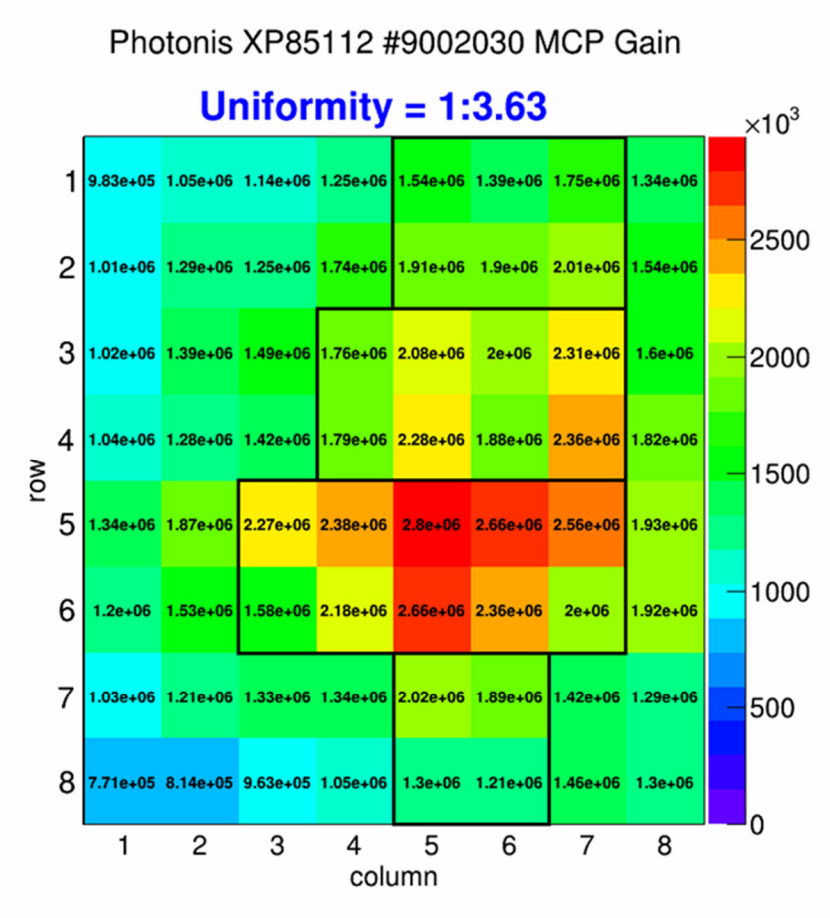


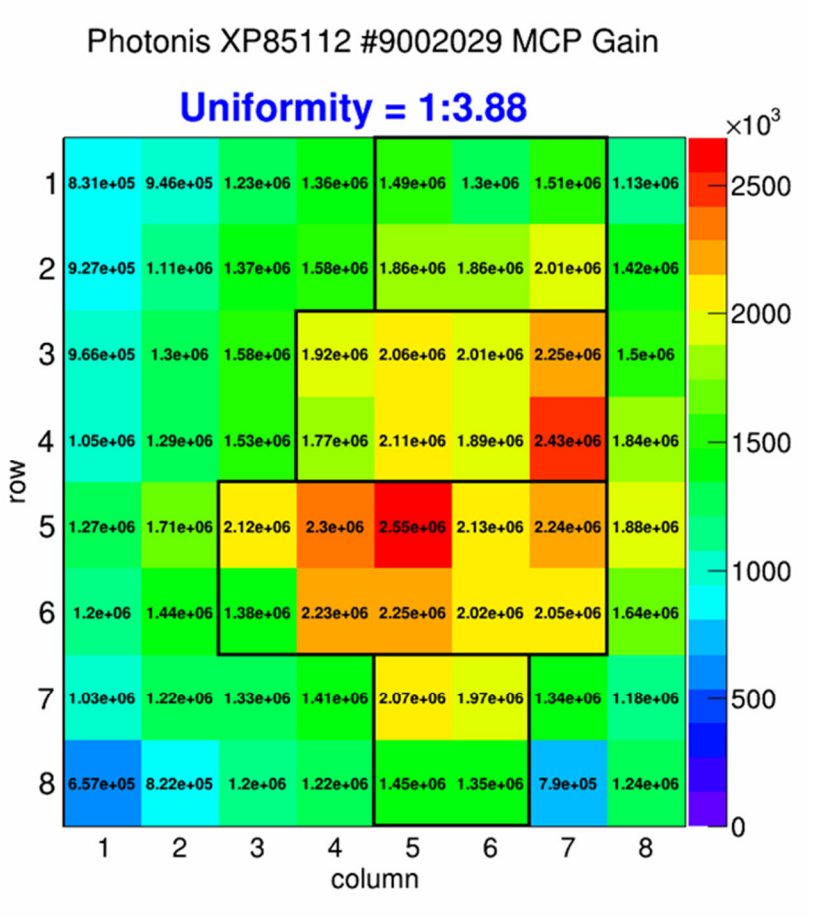


FLASH Test Experiment in Mainz

- Match MCP gain map (provided by Erlangen)
- Test different geometries

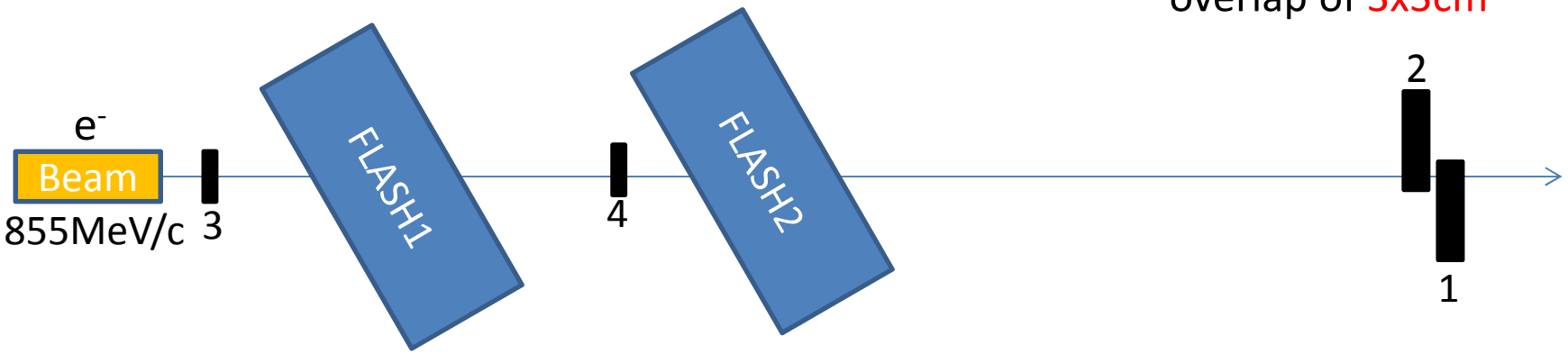


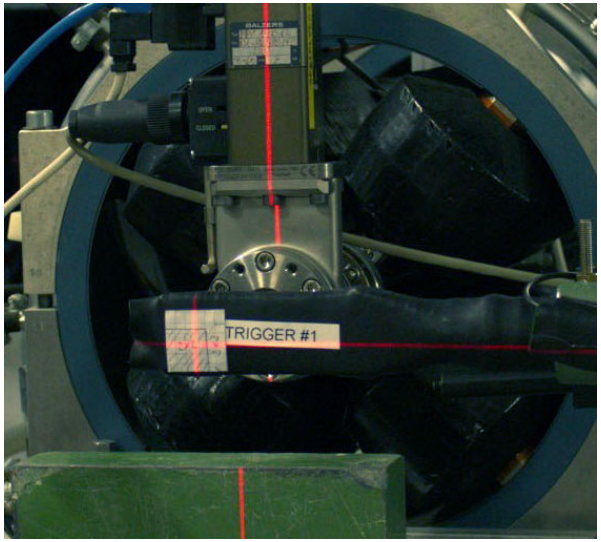




FLASH Setup at MAMI

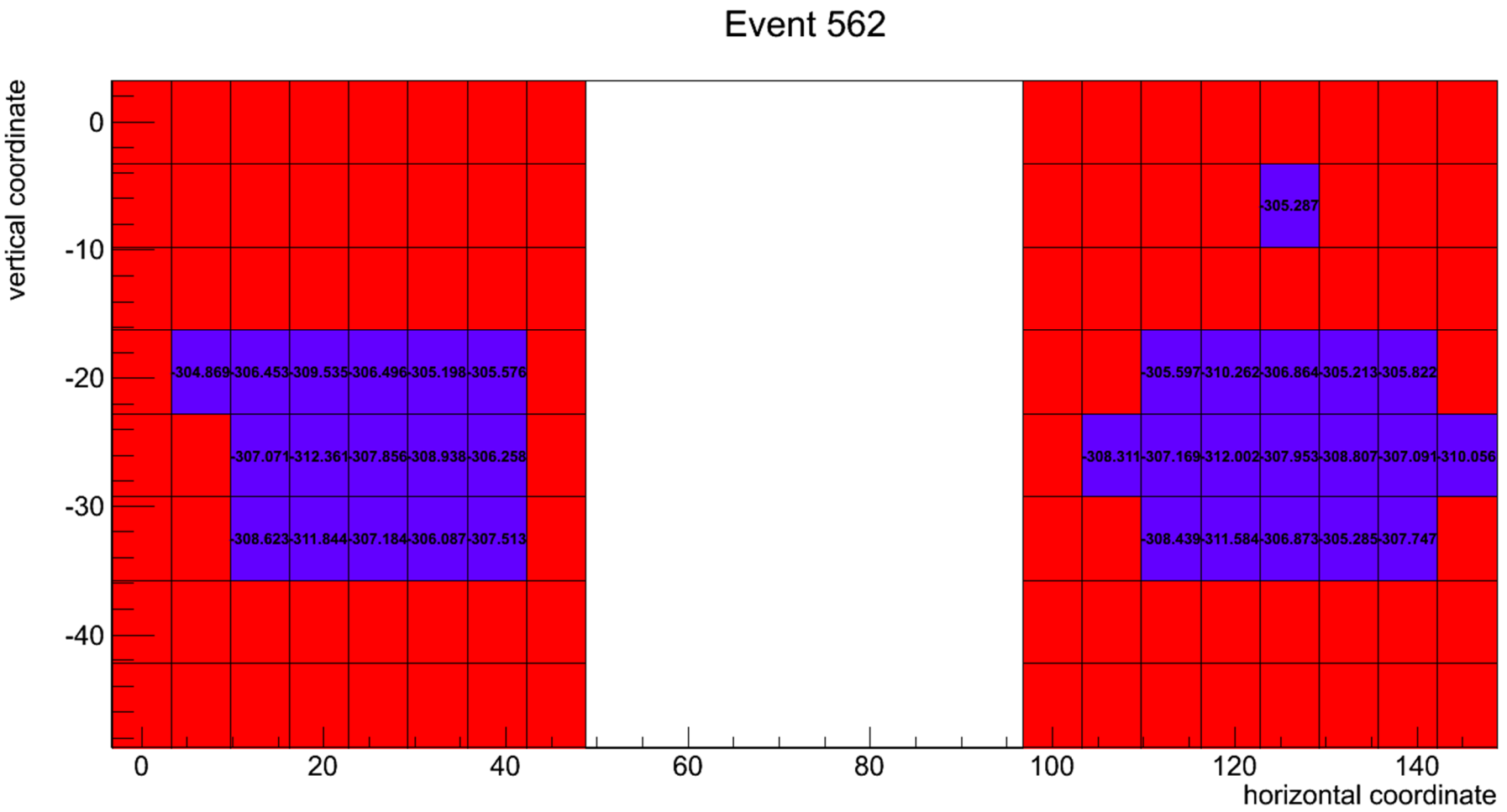
Coincidence scintillators:
overlap of 3x3cm





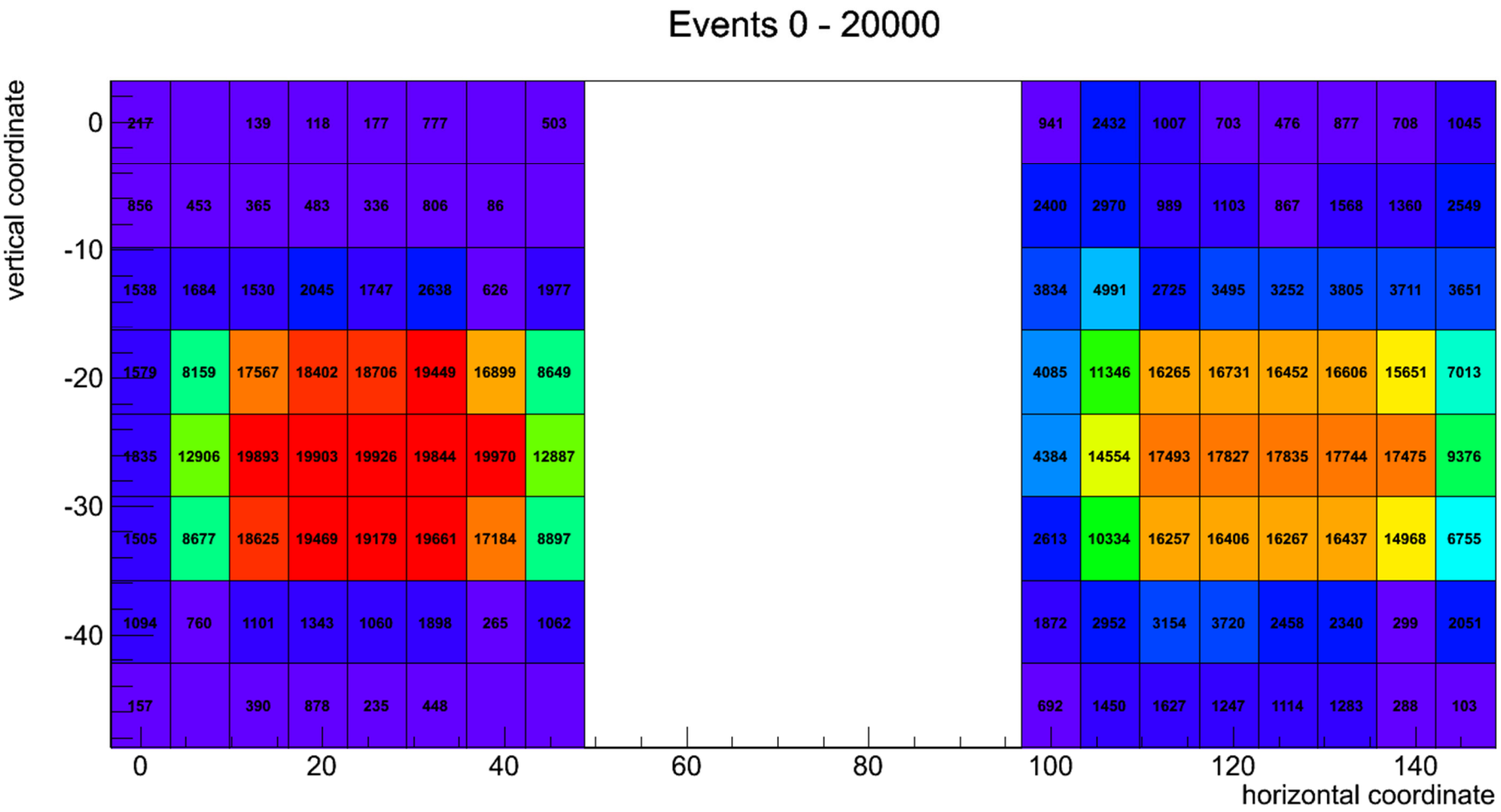
Trigger rates ~3-7kHz depending on FLASH configuration

FLASH Event Display - Single Event…



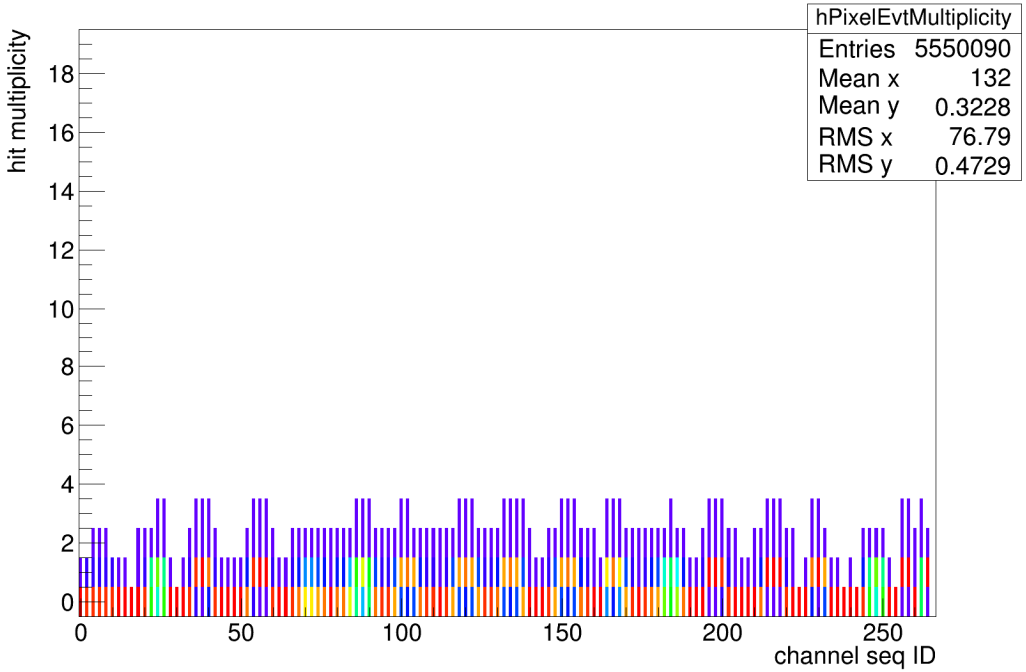
- Clear signs of optical crosstalk
- High efficiency observed (>98% in first counter)

FLASH Event Display – 20000 Events



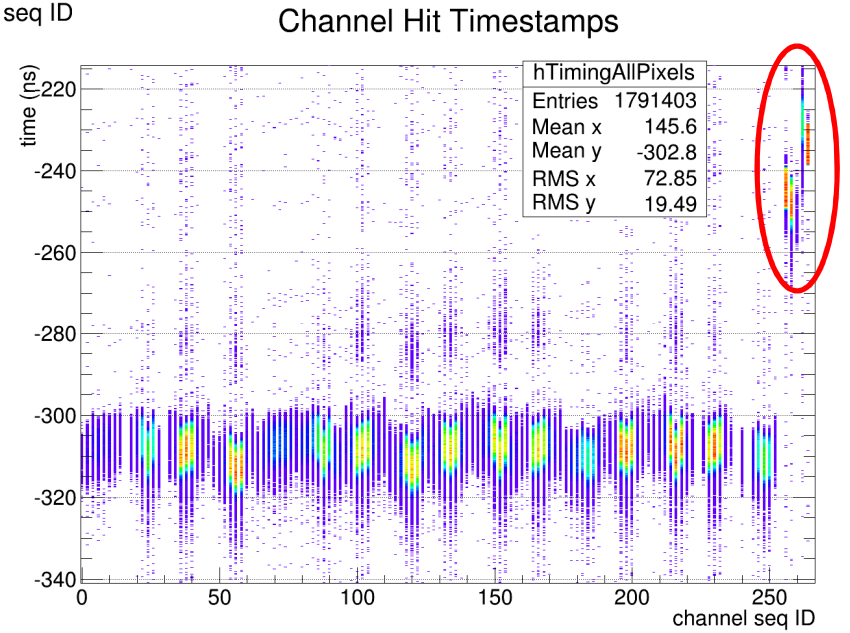
- Clear signs of optical crosstalk
- High efficiency observed (>98% in first counter)

FLASH Event Hit Distributions (-400.0 – 100.0ns)



Very clean hit signatures in time window
Multiple hits negligible

Clear correlation of leading edge times



Trigger counters

FLASH Analysis Outlook

- Extract timing resolution
  - Observed ~60ps w online corrections
- Apply corrections
  - Walk corrections are possible, but need optimisation
  - Narrow Time-over-Threshold cuts
- Characterise performance
  - Mapped detector response on 5x8 matrix
  - Various gain and threshold combinations tested
- Investigate Time-over-Threshold distributions
- Study tracking capabilities