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# MCP: ECAL timing upgrade

This page is a documentation of the testbeams aiming to MCP testing, performed at CERN (H2/H4/T9) and at the BTF, since the 2014 till today

# June 2016 - T9

Main measurements:

- HV scans on MiB -25mu stack in Bicocca's camerone with 5 GeV pions.
- Timing long run on MiB -25mu stack in Bicocca's camerone with 5 GeV pions.
- HV scans on MiB -10mu stack in Bicocca's camerone with 5 GeV pions.
- Timing long run on MiB -10mu stack in Bicocca's camerone with 5 GeV pions.
- Long run on MiB -10mu @ 2GeV: e- ~20%.
- Long run on MiB -10mu @ 2GeV: e- ~20% with 3X0 lead absorber in front of MiB2.
- Long run on MiB -10mu @ 1GeV: e- ~80% with 3X0 lead absorber in front of MiB2.
- Long run on MiB -10mu @ 3.5GeV: e- ~10% with 3X0 lead absorber in front of MiB2.

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- HV scan with Bicocca's Camerone at T9 with 5 GeV pions.
- Configuration inside the Camerone: 25mu (HVIN1), 10mu (HVIN2)
- Configuration on the beam line: Cerenkov - Scint1 (6x6 cm<sup>2</sup>) - MiB2 - Scint2 (1x1 cm<sup>2</sup>) - Camerone (~2m from XDWC) - RM2 - Scint3
- Stacks in camerone have been modified wrt BFT with 1k resistor on anode closing on ground inside the chamber to avoid reflections. MCP MID & MCP OUT in parallel between 25mu & 10mu with a resistor (100k?)
- Using digitiser MIB group 1:

ch0 -> MIB2  
ch1 -> 25mu  
ch2 -> 10mu  
ch3 -> RM2  
ch4 -> N/A  
ch5 -> N/A  
ch6 -> S3  
ch7 -> CHERENKOV

- ♦ HV SCAN on MiB -25mu - HV MID=1000V  
Run HVIN1 (V) HVIN2 (V) HV MID (V) Events  
4521 2500 1000 1000 10.3k  
4522 2600 1000 1000 10.3k  
4523 2700 1000 1000 10.3k  
4524 2800 1000 1000 10.1k  
4525 2900 1000 1000 10.2k  
4526 3000 1000 1000 10.2k  
4527 3100 1000 1000 10.2k  
4528 3200 1000 1000 10.3k  
4529 3300 1000 1000 10.2k  
4530 3400 1000 1000 10.2k  
4531 3500 1000 1000 10.2k
- ♦ HV SCAN on MiB -25mu 1300V - HV MID =1300V  
Run HVIN1 (V) HVIN2 (V) HV MID (V) Events  
4537 2800 1300 1300 9.8k (Small misplacement of S1)  
4538 2900 1300 1300 9.8k (Small misplacement of S1)  
4539 3000 1300 1300 10.1k (Small misplacement of S1)  
4540 3100 1300 1300 10k (Small misplacement of S1)

4542 3200 1300 1300 13k  
4543 3300 1300 1300 13k  
4544 3400 1300 1300 10.2k  
4545 3500 1300 1300 10k  
4546 3600 1300 1300 10k  
4547 3700 1300 1300 3k (Restart DAQ in between)  
4552 3700 1300 1300 7k  
4553 3800 1300 1300 10k

- ◆ Long run for TIMING on MiB -25mu  
Run HVIN1 (V) HVIN2 (V) HVMID (V) Events  
4532 3700 1200 1200 130.7k

- New configuration: Added another scintillator (2x2) readout on digitizer ch5 on the table ~10cm before the 1x1 scintillator). S1 back to 6x6,

ch0 -> MIB2  
ch1 -> 25mu  
ch2 -> 10mu  
ch3 -> RM2  
ch4 -> N/A  
ch5 -> S4  
ch6 -> S3  
ch7 -> CHERENKOV

- ◆ HV SCAN MiB -25mu HVMID=1200V  
Run HVIN1 (V) HVIN2 (V) HVMID (V) Events  
4585 3500 1200 1200 13k  
4586 3600 1200 1200 10k  
4587 3700 1200 1200 12k  
4588 3400 1200 1200 10k  
4589 3300 1200 1200 10k  
4590 3200 1200 1200 10k

- ◆ HV SCAN on MiB -10mu - HVMID=1000V  
Run HVIN1 (V) HVIN2 (V) HVMID (V) Events  
4562 1000 2600 1000 5K  
4563 1000 2700 1000 5K  
4564 1000 2800 1000 5K

- ◆ HV scan MiB -10mu HVMID=1200V  
Run HVIN1 (V) HVIN2 (V) HVMID (V) Events  
4567 1200 2800 1200 10k  
4568 1200 2900 1200 10k  
4569 1200 3000 1200 13k  
4570 1200 3100 1200 13k  
4571 1200 3200 1200 10k  
4572 1200 3300 1200 10k  
4573 1200 3500 1200 10k (pressure stable @ 1.9E-5)  
4574 1200 3600 1200 19k (pressure stable @ 1.9E-5)  
4575 1200 3700 1200 13k (pressure stable @ 1.9E-5)

- ◆ Long run for TIMING on MiB -10mu  
Run HVIN1 (V) HVIN2 (V) HVMID (V) Events

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4566 1200 3400 1200 178k

- ◆ Continuing HV scan MiB -10mu HV MID=1000V

Run HVIN1 (V) HVIN2 (V) HV MID (V) Events

4576 1000 3500 1000 10k

4577 1000 3400 1000 13k

4578 1000 3300 1000 12k

4579 1000 3200 1000 16k

4580 1000 3100 1000 13k

4581 1000 3000 1000 13k

4582 1000 2900 1000 15k

- Moving to lower energy to have an electrons enriched beam:

- ◆ Long run @ 2GeV: e- ~20% of events

Run HVIN1 (V) HVIN2 (V) HV MID (V) Events

4594 1200 3400 1200 190k

- Also preshower configuration: add 3X0 lead absorber in front of MiB2, add attenuation of factor x10 for 10mu:

- ◆ Long run @ 2GeV: e- ~20% of events Run HVIN1 (V) HVIN2 (V) HV MID (V) Events

4597 1200 3500 1200 307k

- ◆ Long run @ 1GeV: e- ~80% of events

Run HVIN1 (V) HVIN2 (V) HV MID (V) Events

4598 1200 3500 1200 4.5k

4599 1200 3500 1200 16k

- ◆ Long run @ 3.5GeV: e- ~10% of events

Run HVIN1 (V) HVIN2 (V) HV MID (V) Events

4600 1200 3500 1200 80k

# May/June 2016 - BTF

Main measurements:

- HV scans on Russian BINPs
- Timing long on runs Russian BINPs
- Timing runs on Russian BINPs with different HVs
- HV scans on Camerone-MiB stacks: MiB -25mu and MiB -10mu
- HV scans on MiB -25mu only (no crosstalk)
- HV scans on Camerone-Roma stacks: Rm-5mu and Rm-8mu

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- Configuration on the beam line: Scint - Hodoscope - MiB2 - BINPs - RM2
- Start HV Scan with negative polarity on BINP MCPs ("Russian")
- MCP configuration in the digitizer: BNP2 (1, 1) BNP3 (1, 2) BNP4 (1, 3), fixed positive HV-BINP2 = 3200 V, HV-BINP3 = 3200 V, HV-BINP4 = 3100 V, negatives HV:

- ◆ Run HV-BINP2 (V) HV-BINP3 (V) HV-BINP4 (V) Events

2328 200 400 400 19k  
2329 400 800 800 13k  
2330 500 900 900 14k  
2331 600 1000 1000 14k  
2332 700 1100 1100 23k  
2333 800 1200 1200 18k  
2334 900 1300 1300 5k (problems in LINAC, non beam, run stopped)  
2335 900 1300 1300 7k (problems in LINAC, non beam, run stopped)  
2336 900 1300 1300 26k (from spill 9-20 (11000 evts) positrons)

- Changed positive HV-BINP2 = 3700 V, HV-BINP3 = 3700 V, HV-BINP4 = 3700 V:

- ◆ Run HV-BINP2 (V) HV-BINP3 (V) HV-BINP4 (V) Events

2338 OFF 1400 2400 13k (BINP2 discharging)  
2339 1400 1400 2400 9k  
2340 1400 1400 0 12k

- Changed MCP configuration: BNP3 (1, 2) BNP4 (1, 3) BNP1 (1, 1), fixed positive HV-BINP3 = 3700 V, HV-BINP4 = 3700 V, HV-BINP1 = 3700 V, negatives HV:

- ◆ Run HV-BINP3 (V) HV-BINP4 (V) HV-BINP1 (V) Events

2341 1400 2400 2400 21k  
2342 1300 2300 2300 18k  
2343 1200 2200 2200 16k  
2344 1100 2100 2100 16k  
2345 1000 2000 2000 16k  
2346 900 1800 1800 16k  
2347 800 1600 1600 15k  
2348 700 1400 1400 16k  
2349 600 1200 1200 16k  
2350 500 1000 1000 16k  
2351 300 600 600 8k

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- Changed MCP configuration: BNP4 (1, 3) BNP1 (1, 1) BNP2 (1, 2), fixed positive HV-BINP4 = 3700 V, HV-BINP1= 3700 V, HV-BINP2 = 3700 V, negatives HV:
  - ◆ Run HV-BINP4 (V) HV-BINP1 (V) HV-BINP2 (V) Events  
2352 2400 2400 1400 16k  
2353 2300 2300 1300 17k  
2354 2200 2200 1200 17k  
2355 2100 2100 1100 16k  
2356 2000 2000 1000 16k  
2357 1900 1900 900 15k  
2358 1700 1700 800 16k  
2359 1500 1500 700 18k  
2360 1300 1300 600 16k  
2361 1100 1100 500 17k  
2362 600 600 300 11k
- Changed MCP configuration: BNP1 (1, 1) BNP2 (1, 2) BNP3 (1, 3). fixed positive HV-BINP1 = 3700 V, HV-BINP2 = 3700 V, HV-BINP3 = 3700 V, negative HV-BINP3 set at 1400 or 1300 for timing measurements (no digitizer saturation):
  - ◆ By mistake MCP RM2 was not powered during the following runs
  - ◆ Run HV-BINP1 (V) HV-BINP2 (V) HV-BINP3 (V) Events  
2363 2400 1400 1400 16k  
2364 2300 1300 1400 16k  
2365 2200 1200 1400 15k  
2366 2100 1100 1400 16k  
2367 2000 1000 1300 14k  
2368 1800 800 1300 15k  
2369 1600 600 1300 16k  
2370 1400 400 1300 15k  
2371 1200 200 1300 5k
- Changed MCP configuration: BNP4 (1, 3) BNP1 (1, 1) BNP2 (1, 2) and long runs for timing:
  - ◆ RUN HV-BINP1 HV-BINP2 HV-BINP4 Events  
2378 -2150,+3700 -1400,+3700 -2150,+3700 120k  
2384 -2400,+2900 -1500,+3300 -2400,+2900 60k
- Configuration on the beam line: Scint1 - Hodoscope - MiB2 - Camerone-MiB - RM2, digitizer channels:  
  
Ch0 -> MiB2  
Ch1 -> 10micron  
Ch2 -> 25micron  
Ch3 -> Rm2
- HV scan MiB -25mu:
  - ◆ Run HVIN1 HVMID Events  
  
2386 2700 700 many  
2387 2600 700 35k  
2388 2300 700 15k  
2389 2100 700 11k  
2392 2200 700 20k  
2393 2400 700 20k

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2394 2500 700 20k  
2395 2800 700 20k  
2396 2900 700 20k

2390 2100 900 10k

2391 2100 1000 9k  
2397 2900 1000 20k  
2398 2800 1000 20k  
2399 2700 1000 20k  
2401 2600 1000 22k  
2402 2500 1000 20k  
2403 2400 1000 20k  
2404 2300 1000 20k  
2405 2200 1000 20k  
2406 3000 1000 20k  
2407 3100 1000 20k  
2408 3200 1000 20k

2426 3000 700 20k  
2427 3100 700 20k  
2428 3200 700 20k  
2429 3300 1000 22k  
2430 3400 1000 20k  
2431 3500 1000 20k

- HV scan MiB -10mu:

- ◆ Run HVIN2 HVMID Events

2409 2900 700 20k  
2410 2800 700 20k  
2411 2700 700 20k  
2412 2600 700 20k  
2413 2500 700 20k  
2414 2400 700 20k  
2415 2300 700 20k

2416 2300 1000 20k  
2417 2400 1000 20k  
2418 2500 1000 10k  
2419 2600 1000 20k  
2420 2700 1000 20k  
2421 2800 1000 21k  
2422 2900 1000 20k  
2423 3000 1000 21k  
2424 3100 1000 20k  
2425 3200 1000 20k

2432 3000 700 20k  
2433 3100 700 20k  
2434 3200 700 20k  
2435 3300 1000 20k  
2436 3400 1000 20k



- Configuration on the beam line: Scint1 - Hodoscope - MiB2 - Camerone-RM - RM2, digitizer channels:

Ch0 -> MiB2  
Ch1 -> 5micron  
Ch2 -> 8micron  
Ch3 -> Rm2

- HV scan Rm-5mu:

- ◆ Run HVIN1 HVMID Events

2440 1900 700 40k  
2441 2000 700 21k  
2442 1600 700 21k  
2443 1700 700 21k

2444 2100 1000 21k  
2445 2200 1000 24k  
2446 2300 1000 23k  
2447 1900 1000 20k  
2448 2000 1000 21k

(misalignment fixed)

2470 1600 700 21k  
2471 1700 700 21k  
2472 1800 700 21k  
2473 1900 700 21k  
2474 2000 700 20k  
2491 2100 700 20k  
2492 2200 700 19k  
2493 2300 700 20k

2475 1900 1000 26k  
2476 2000 1000 24k  
2477 2100 1000 20k  
2478 2200 1000 23k  
2479 2300 1000 24k  
2488 2400 1000 20k  
2489 2500 1000 20k  
2490 2600 1000 20k

2480 2100 1200 20k  
2481 2200 1200 22k  
2482 2300 1200 20k  
2483 2400 1200 20k

2484 2500 1200 21k  
2485 2600 1200 20k  
2486 2700 1200 20k  
2487 2800 1200 20k

- HV scan Rm-8mu:

- ◆ Run HVIN2 HV MID Events

2455 1900 700 21k  
2456 2000 700 21k  
2457 1600 700 18k  
2458 1700 700 20k  
2459 1800 700 21k  
2494 2100 700 19k  
2495 2200 700 24k  
2496 2300 700 20k

2460 2100 1000 19k  
2461 2200 1000 21k  
2462 2300 1000 21k  
2463 1900 1000 21k  
2464 2000 1000 21k  
2497 2400 1000 19k  
2498 2500 1000 25k  
2499 2600 1000 21k

2465 2300 1200 19k  
2466 2400 1200 20k  
2467 2500 1200 20k  
2468 2100 1200 22k  
2469 2200 1200 21k  
2500 2600 1200 21k  
2501 2700 1200 20k  
2502 2800 1200 20k

- Configuration on the beam line: Scint1 - Hodoscope - MiB2 - MiB -25mu (only) - RM2, digitizer channels:

Ch0 -> MiB2  
Ch2 -> 25micron  
Ch3 -> Rm2

- HV scan MiB -25mu:

- ◆ Run HVIN1 HV MID Events

2517 3100 1200 20k  
2518 3000 1200 16k  
2519 2900 1200 16k  
2520 2800 1200 17k  
2521 2700 1200 20k  
2522 2600 1200 20k  
2523 2500 1200 15k  
2524 2400 1200 10k

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2525 3200 1200 15k  
2526 3300 1200 10k  
2527 3400 1200 10k  
2528 3500 1200 12k  
2529 3600 1200 12k

- Configuration on the beam line: Scint1 - Hodoscope - MiB2 - BINPS - RM2 for timing studies, channels on digitizer: BINP4(1,3) - BINP2(1,2) - BINP3(1,1):

- ◆ Run BINP4+ BINP4- BINP2+ BINP2- BINP3+ BINP3- Events

2547 2900 2400 3700 1400 3700 1400 29k  
2549 2900 2300 3700 1300 3700 1300 34k

2550 2900 2200 2900 1300 2900 1300 19k  
2551 2900 2100 2900 1400 2900 1400 40k  
2552 3000 2100 3700 1200 3700 1200 30k  
2553 3100 2100 3700 1100 3700 1100 31k  
2554 3200 2100 3300 1400 3300 1400 22k  
2555 3300 2100 3500 1400 3500 1400 30k  
2556 3300 2200 3100 1400 3100 1400 20k  
2557 3300 2300 3600 1400 3600 1400 11k  
2558 3200 2300 3600 1400 3600 1400 6k  
2559 3100 2300 3400 1400 3400 1400 22k  
2560 3100 2200 3200 1400 3200 1400 24k  
2561 3100 2100 3000 1400 3000 1400 30k

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