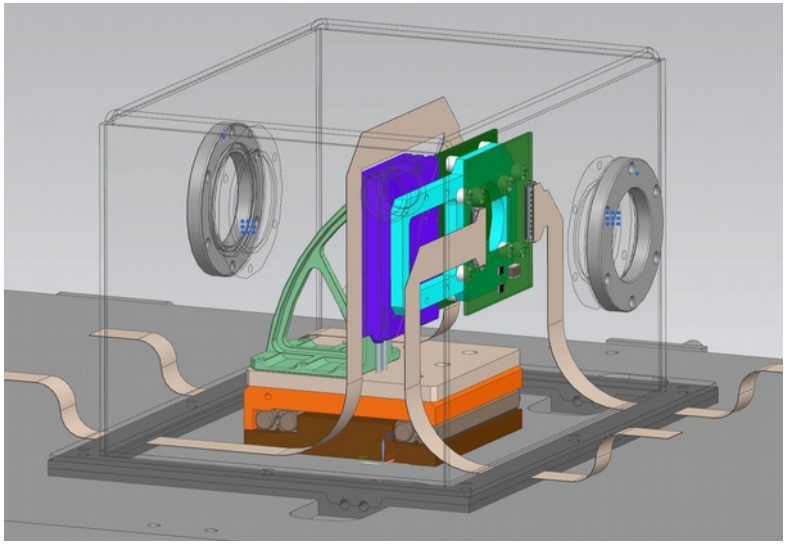
Measurements at Clear



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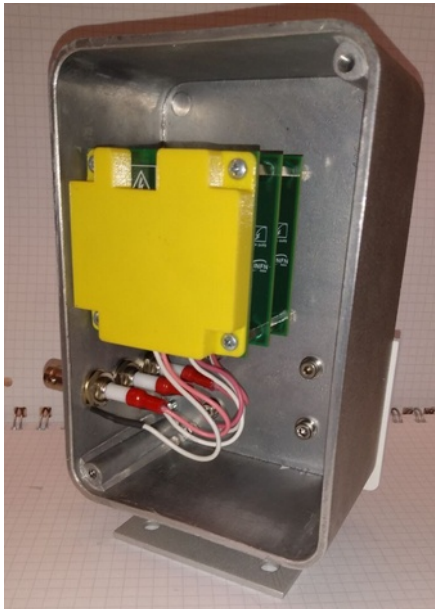
GBP "site" in Confluence

- setup an area where to keep all our technical documentation and information related to test beams and laboratory measurements
  - https://confluence.desy.de/display/GBP/Gamma+Beam+Profiler
- everybody in GBP who is registered at DESY should have access

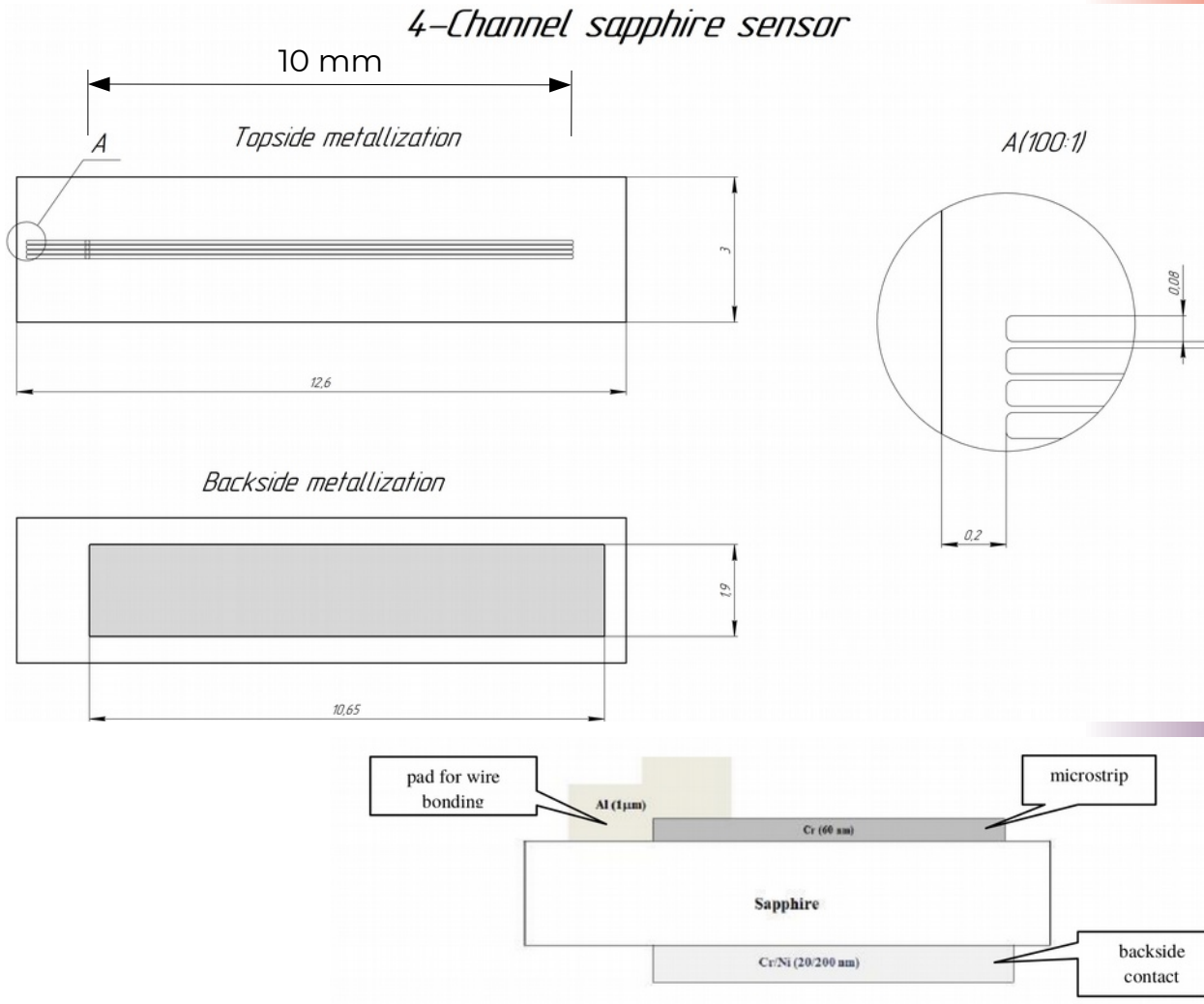
Test@Clear: detectors

- three 4-ch detectors to be tested
- sapphire from Germany (Wuppertal), US (Univ. Wafers) and Russia (Monocrystal)
- total of 12 channels to be readout simultaneously
- three HV channels



4 Strip sensors

- 100 um strip pitch
  - 80 um width
- develop to perform test before electronics for 200 stips sensors becomes available
- sensitive are:
  - 10 x 0.38 mm

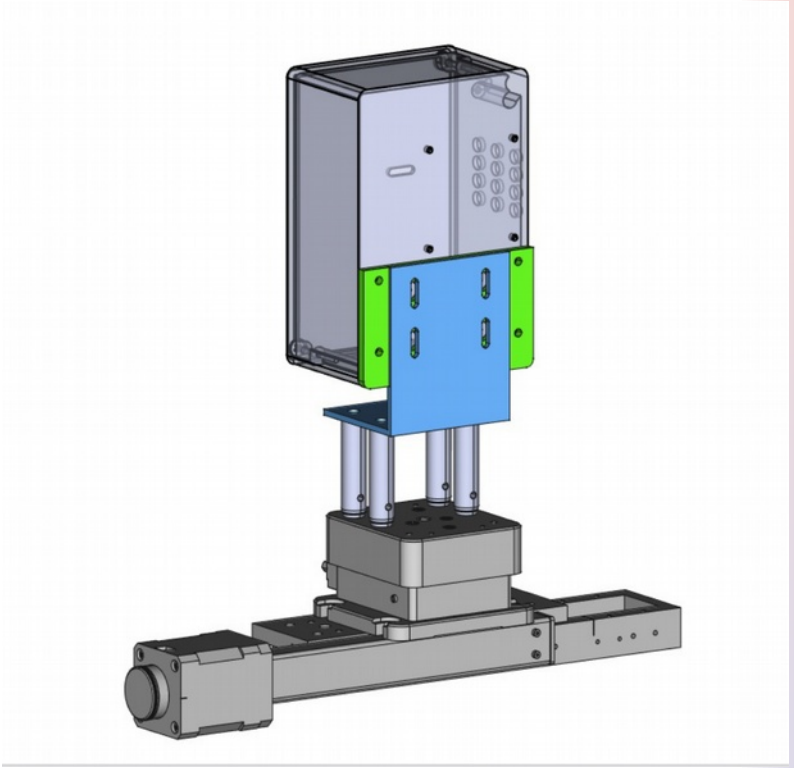


Test@Clear: digitizers

- Aquiris DC 271:
  - 50 mV-5 V f.s.,
  - 1 GHz bandwidth
  - 4 Gs/s, 8 bit
  - 128 ks memory
    - 8 us x 4 ch. @4 Gs/s
- bandwidth limitation provided: - 3dB [70%] @ 20, 200, 700 MHz
- we can use the 20 MHz cut for taking measurements to integrate over the bunches of a train

Test @ Clear: mechanics

- setup with two movements
- parts in Padova have been machined
- 4-ch. detectors mounted in the box
- last check to be done with Clear people



Test @ Clear: HV PS

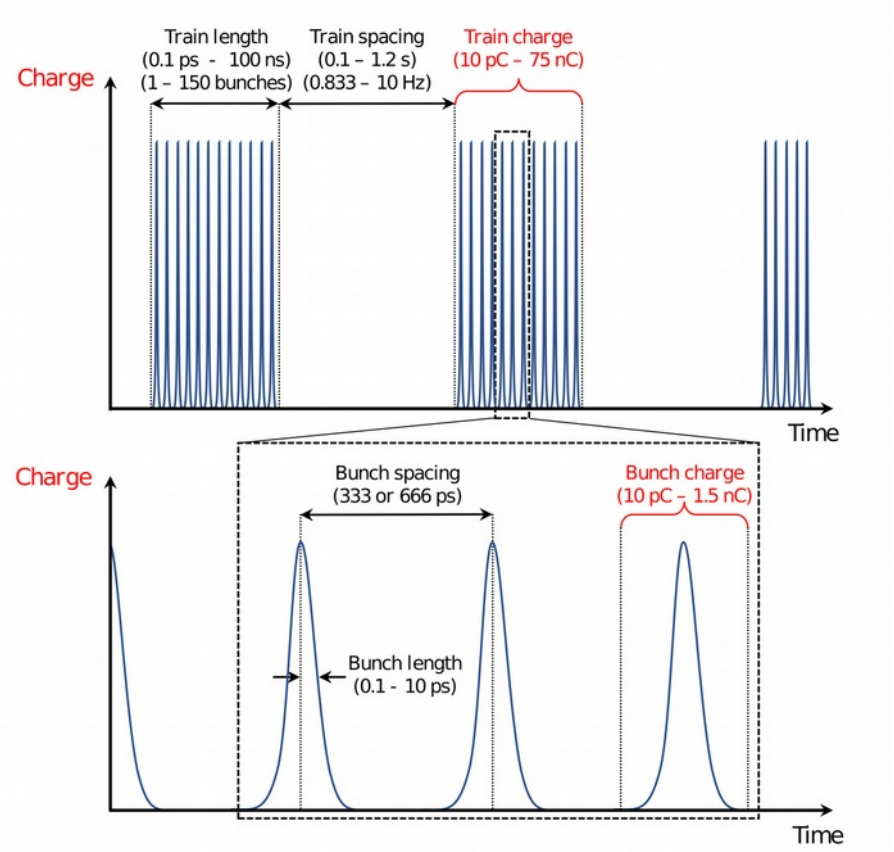
- HV systems under test:
  - N1471H, NIM module
  - A156 in SY552, baseline option for the GBP
- see Sergeii V. report

Test of 4-ch detectors with alpha source

- PCB for wafers studies has been modified to host a 4-ch sensor with 4 charge amplifiers
- first outcome:
  - one amplifier not working
  - a second one shows periodic short noise pulses
    - much shorter than the shaper time constant
  - the other two seem OK
  - Flavio is working to recover the amplifiers not working
  - anyway, with the alpha source we were not able to see any signal yet
- we are going to check that everything work with the pads on wafers used at LNF first

CLEAR Beam characteristics

- 200 MeV standard electron energy
- n. of bunches per train typical: 80 bunches separated by 666 ps (or 160 with 333 ps)
- train rate: up to 10 Hz, however only data from Bergoz devise are acquired at 10 Hz, the rest comes at 1 Hz



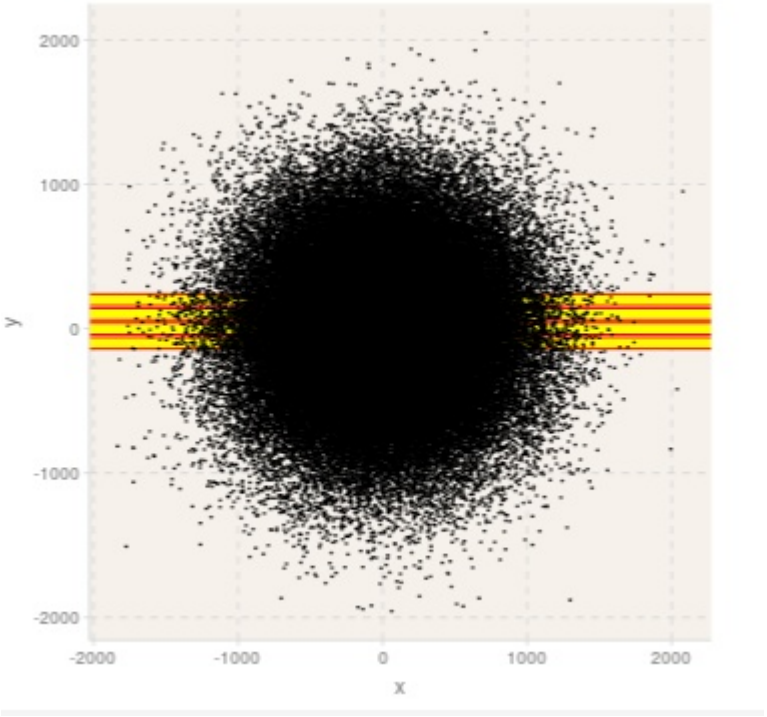
test@Clear: first ideas on planning

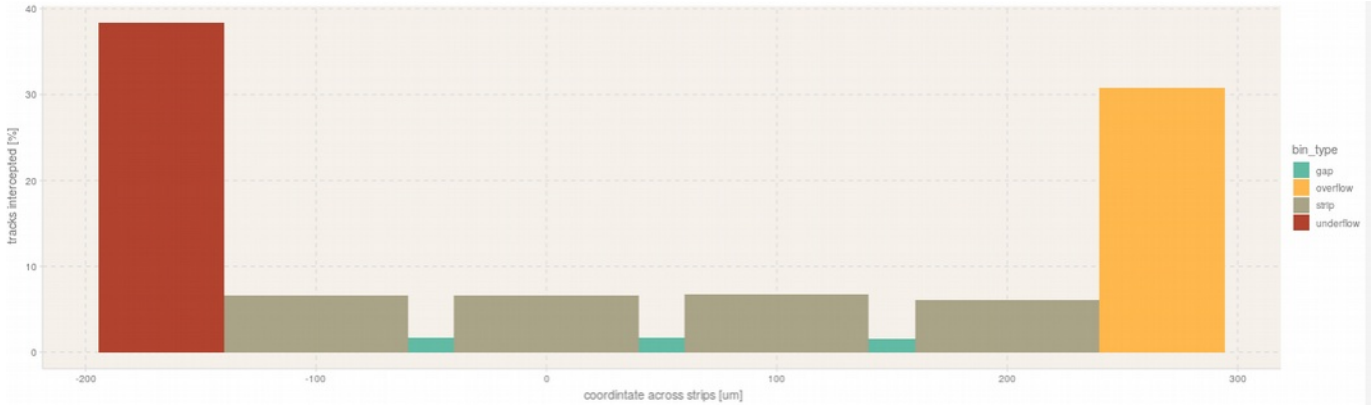
1. in parallel **w/o beam**:
   a) installation and alignment [2 h]
   b) coax cable measurements [1 h]
   c) DAQ check out, test of digitizers readout and bandwidth setting [2 h]
2. with **beam at low intensity**, minimum horizontal size:
   a) check signal with the oscilloscope [1 h]
   b) check signal with DAQ [1 h]
   c) test of alignment by moving the detectors in x and y [1 h]
   d) measurement at low intensity [4 h] and various V_{drift} forward and reverse:
      - signal time profile
      - linearity with beam intensity
   - strip scan in x direction
3. with **beam at growing intensity**:
   a) irradiation
   b) periodic measurements on irradiated and non-irradiated areas

Parameter	Low intensity	High intensity
bunch size: typical sigma ~ 0.5 mm on both direction	x: as small as possible for scanning (**0.1 ??**) y: large for uniformity and lower doses w.r.t total charge (**1 mm ?**), small for scanning and testing y-profile reconstruction (**0.1 ??**)	x: small enough to have regions with no dose for comparison (**0.5 mm** OK) y: largest possible for uniformity (**0.5 mm** OK)
bunch length: 0.1 to 10 ps	should not matter, but better to be as similar as possible to LUXE beam (**10 ps**); may be worthwhile to check if CCE varies with bunch length	
train frequency: 0.8-10 Hz	maximum (**10 Hz**) to accumulate more data in less time	maximum (**10 Hz**) to lower the current per bunch
charge per bunch:	low enough to not saturate the digitizer at the highest voltages;	sufficient to provide 1 MRad/with 10 Hz train
train length: 1-150 bunches at 666 ps bunch separation (1.5 GHz) or twice at 333 ps (3 GHz)	assuming the charge per bunch remains the same, one can measure the sensor response with very few bunches and then take the measurement of the current with many bunches to be compatible with Bergoz sensitivity (2-3 pC per train).	typical value of **80** (or **160** at **3** GHz bunch frequency) is OK; the largest the better to distribute the charge along time

Uniformity

- beam with: σ_x, σ_y ~ 500 μm





1.b - Test of Coaxial cables

- equipment needed:
  - fast pulser is needed with rise time ~ 100 ps (from Clear or pool ?)
  - oscilloscope 20 Gs/s (from pool)
- could take data both with step function and short pulse obtained with a series capacitor

1.c - DAQ checkout w/o beam

- test that all data are accessible and properly recorded
  - bunch train charge
  - beam profile monitor
  - other beam parameters (bunch #, etc.)
  - x-y positions
  - HV setting and current monitoring
  - digitizer output
- digitizer:
    - test feature extraction (-> amplitude of the signals)
    - setting of bandwidth

2. - Low intensity beam tests and measurements

- ideally:
  - single bunch or a few bunches per train
  - trains at 10 Hz
  - beam σ_x ~0.1 mm
  - beam σ_y ~ 1 mm
  - first with oscilloscope, then with digitizers at highest sensitivity