The SuperB-SVT
Test-Beam in september 2011

S.Bettarini

On behalf of the SuperB-SVT

Update: 7 October 2011

OUTLINE:

- Beam: SPS@CERN 120 GeV $\pi^{+/-}$
- DUTs list and priorities
- The movable table
- Drawings for config files
- Beam info
- DATA taking
- Conclusions

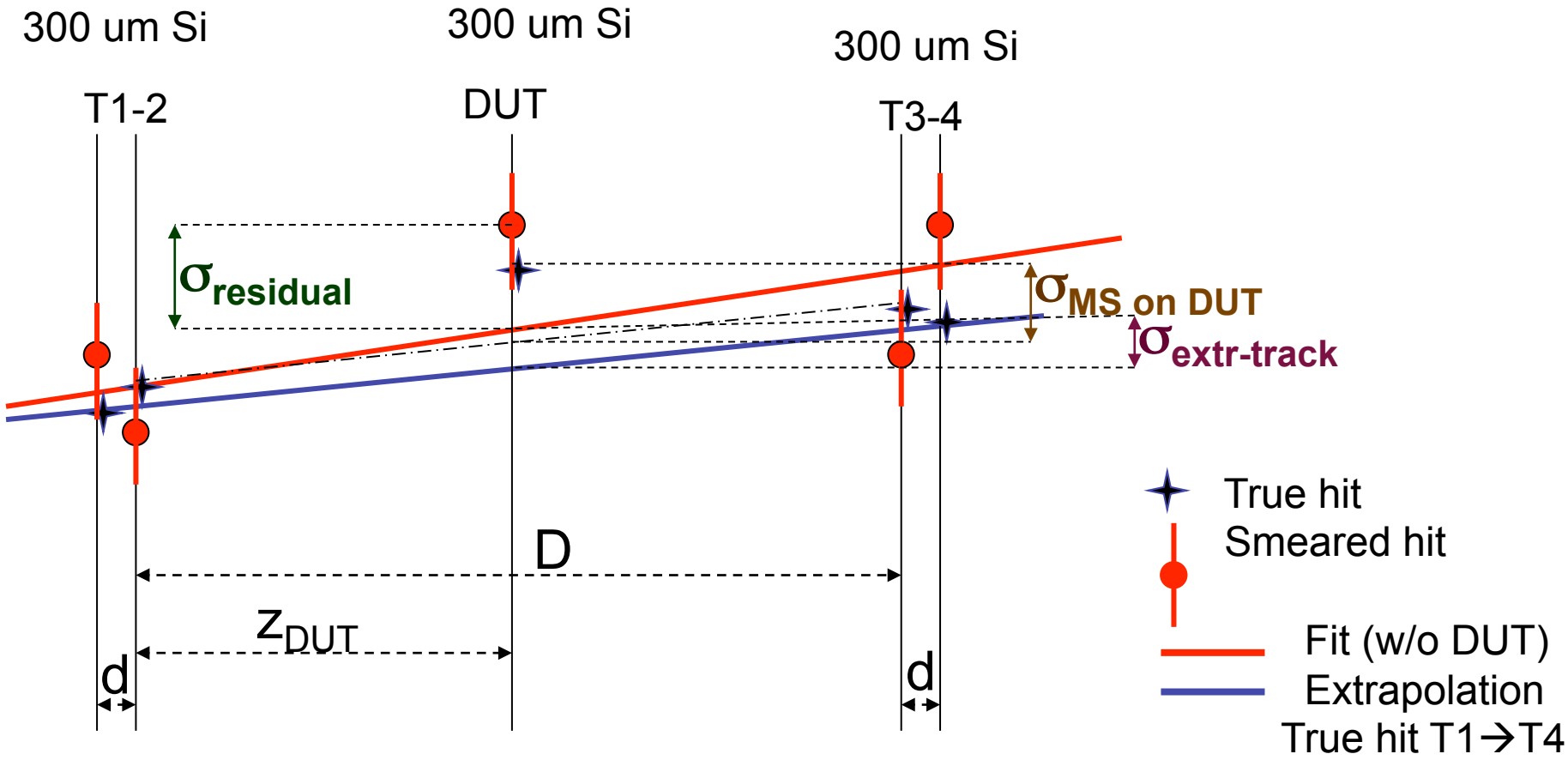
Pictures (by Fabio)

- https://picasaweb.google.com/morsanipicasa/CERN_20110916?authkey=Gv1sRgCNTB5dq95OWqVQ
- https://picasaweb.google.com/morsanipicasa/CERN_20110917?authkey=Gv1sRgCMPqid3khpDZvQE
- https://picasaweb.google.com/morsanipicasa/CERN_20110918?authkey=Gv1sRgCLCIlZG6xfrSpwE
- https://picasaweb.google.com/morsanipicasa/CERN_20110919?authkey=Gv1sRgCLLUq_zp_pyYlAE#
- https://picasaweb.google.com/morsanipicasa/CERN_20110920?authkey=Gv1sRgCMflhMqAhrLpVQ
- https://picasaweb.google.com/morsanipicasa/CERN_20110921?authkey=Gv1sRgCNHAxtu7uJm_Xg#
- https://picasaweb.google.com/morsanipicasa/CERN_20110922?authkey=Gv1sRgCKXS0NrKo4OOvgE#
- https://picasaweb.google.com/morsanipicasa/CERN_20110923?authkey=Gv1sRgCPTog-j83s3k6wE
- https://picasaweb.google.com/morsanipicasa/CERN_20110924?authkey=Gv1sRgCNGD0annrIr4RA#
- https://picasaweb.google.com/morsanipicasa/CERN_20110925?authkey=Gv1sRgCOCxyMmOjf2gyQE
- https://picasaweb.google.com/morsanipicasa/CERN_20110926?authkey=Gv1sRgCJ3EvtCjtay1DQ

Pictures by al.

- Richiesta: rendiamo disponibili le varie foto scattate in test-beam!

HOW TO FIND THE RESOLUTION OF THE DUT

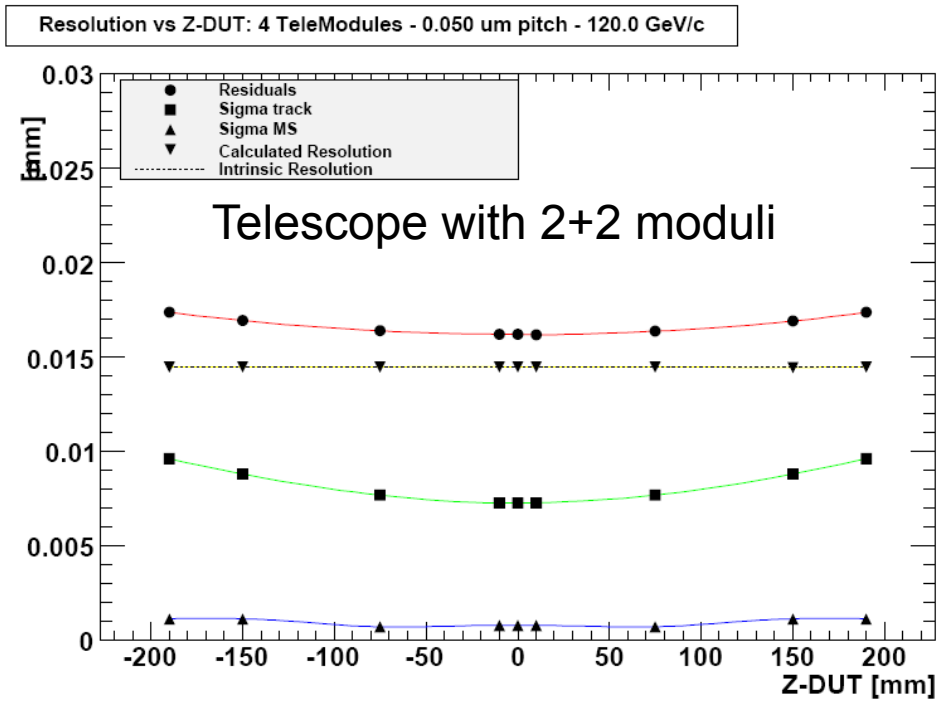


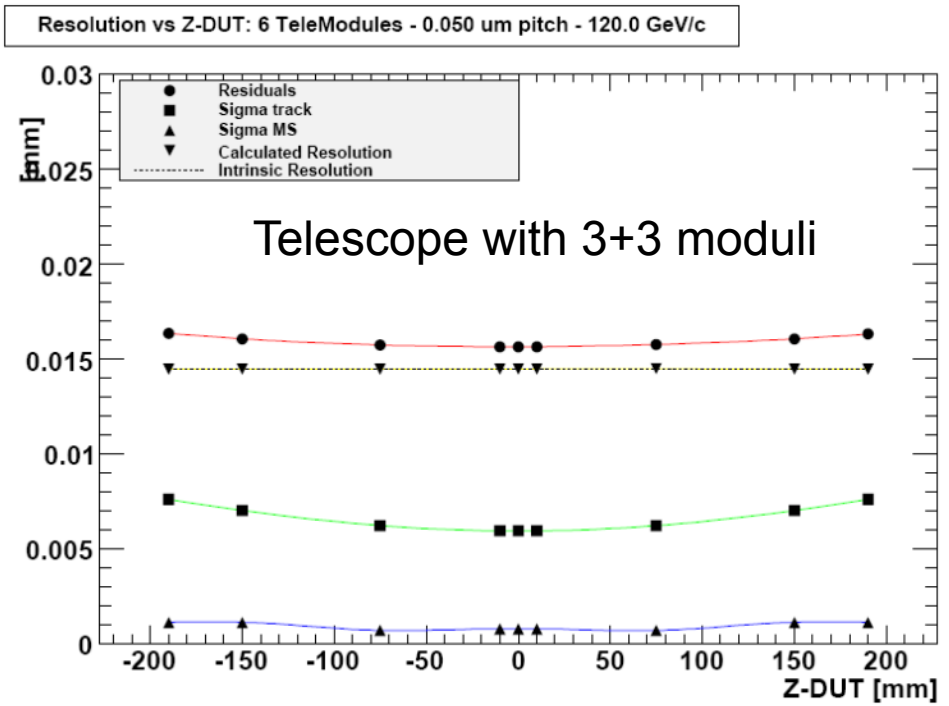
$$\sigma^2_{resolution} = \sigma^2_{residual} - \sigma^2_{extr\text{-}track} - \sigma^2_{MS\ on\ DUT}$$

depends on $(z_{DUT}, reso_T, MS_T)$

depends on (z_{DUT}, MS_{DUT})

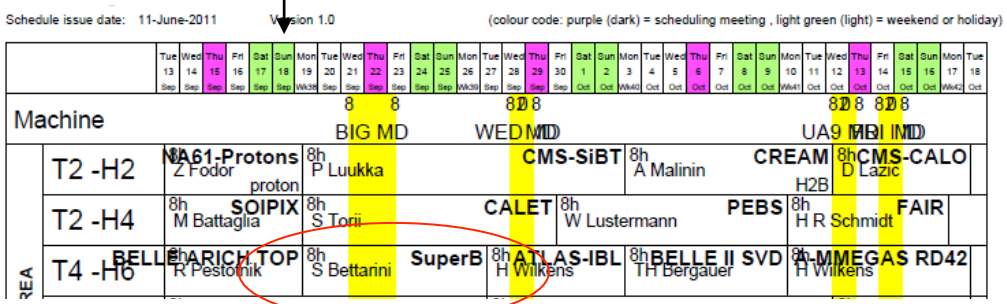
SPS (@CERN H6B): 120 GeV $\pi^{+/-}$





Latest SPS schedule

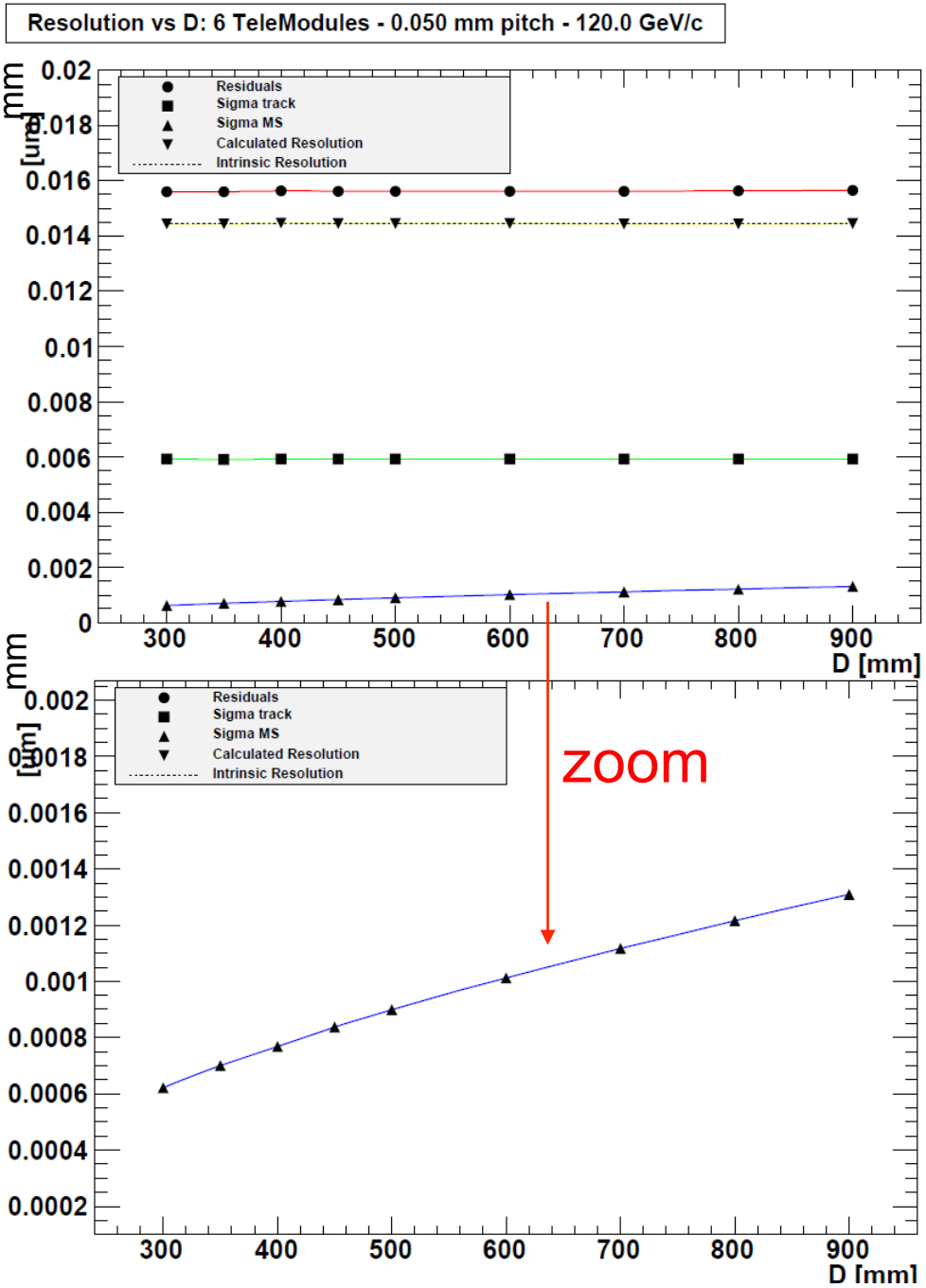
Beam on the 19 h 8:00.
Leaving on Sunday 18?



4+1 Telescope modules under Construction by TS
(last module to be bonded in Pisa)

Schedule:
BIG-MD inside our period

Configurazione Tele

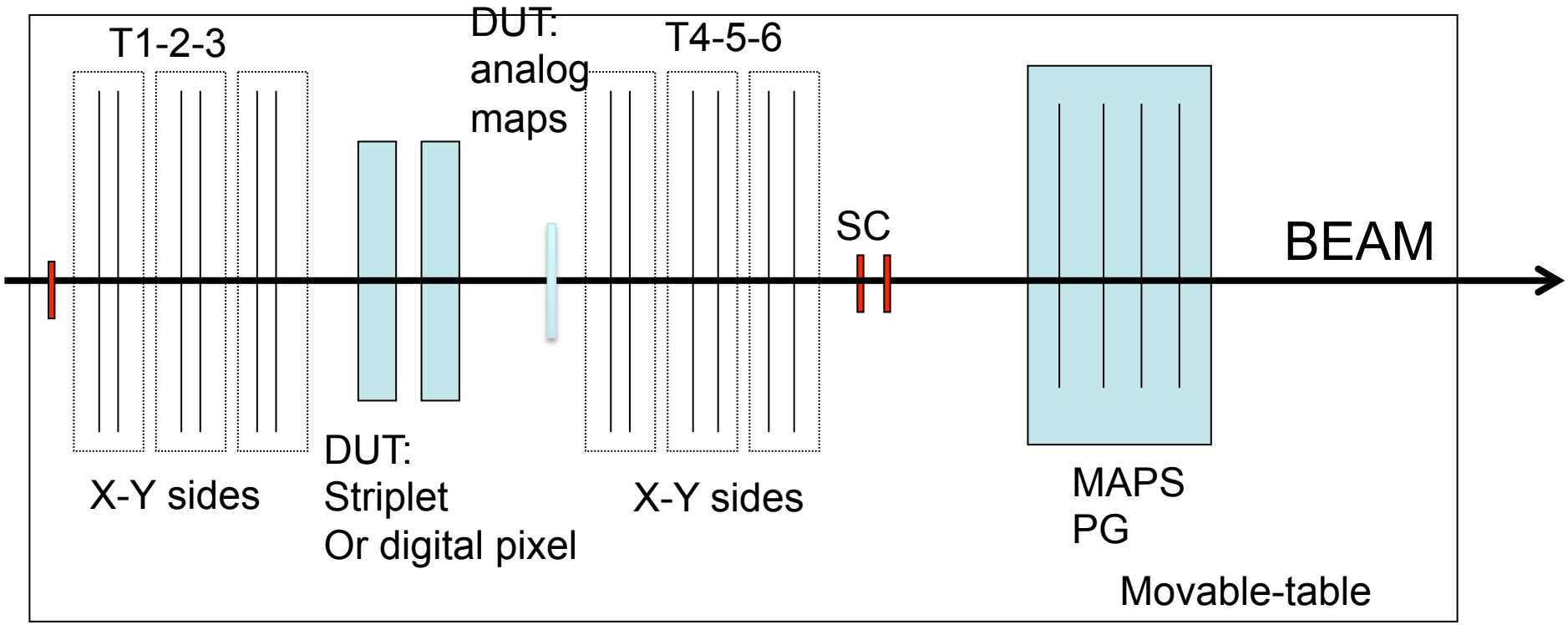


D=distanza tra T2-T3
(ultimo dei moduli Front
e primo dei Back del telescopio)

Il contributo del MS cresce da
0.8 um (D=40 cm) a
1.0 um (D=60 cm)
sempre trascurabile rispetto
alla risoluzione sul telescopio (6um)

Si puo' posizionare subito
il telescopio in modo da non
cambiarne mai la distanza
(D=66 cm stabilito dall'ingombro
Max. del DUT sotto rot.)

Layout of the “demonstrator”



Telescope hits available (offline) for track-reconstructions for MAPS-PG
DAQ PG (and PI for analog maps) synchronized to the main DAQ

High P and small divergence beam necessary for test of small sensor → SPS
Il file di configurazione ADOTTATO e’ stato quello di traccie parallele→alignment OK!

Test-Beam 2011: DUTs list

- Hybrid pixel det: superpix0 (32x128) bump-bonded to High-Ω pixel det. for efficiency/resolution vs THRs and angle scan:
  - carrier mounted on the apsel4D modified PCB
  - under test the feasability to run the DAQ with ¼ of the matrix at a time (known r.o. feature of the chip)
  - fiducial region CUT for (for efficiency)
- "V.I." MAPS (pilot run) for efficiency measurement
  - 3x3 matrices (called 5T_3D) on 2D wafer
    - carrier mounted on PCB of 5T
- 3x3 matrices (M1 &2) apsel3T1 for efficiency measurements before and after neutron irradiation.
- Matrix 3x3 run IBM 65 nm (tested in BG & Fe55 in Pisa)

- Striplets Module: under test in 2008. Further studies needed (lower THRs and 45°→70° angle)

Selection CRITERIA

- In FRASCATI, M.Villa clearly SET a constraint by the DAQ: the striplet DUT is not compatible (unless a huge work in re-design of the DAQ arch.) with digital pixel DUTs.
- Thus, the mechanical set-up must arrange:
  - Angle scan with 1! DUT (with rot. axis on the det.)
    - Hybrid pixel, striplet module and apsel4D
  - Normal incidence
    - At least 2 modules at a time:
      - 1 large digital (apsel4D, hybrid) pixel module + 1 small analog pixel module
      - 2 large digital (apsel4D, hybrid) pixel module
      - 1 striplet module + 1 small analog pixel module
      - 2 large digital (apsel4D, hybrid) pixel module + 1 small analog pixel module
- Criteria: give new detectors higher priorities wrt further (TDR) studies.
- TS must carefully estimate the BEAM-TIME for the test needed to give the necessary information for the (striplets) TDR studies.

PRIORITIES

(set according to TDR needs)

1. Superpix0: 3 chips under test
    1. Thr's studies
    2. Angle scan
2. V.I. MAPS 3x3 analog matrices
3. 3T1 3x3 n.i. / n-irradiated efficiency
4. Striplets:
    1. Thr's studies
    2. Large Angle Scan studies
5. Apsel65nm (if DONE the above meas.)
6. Apsel4D angle scan in very low priorities

Mounting Movable Table (TO)

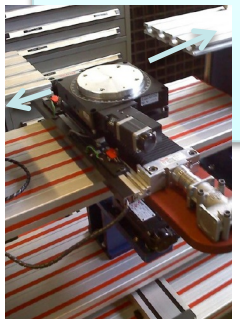
Table positioned on the concrete platform in the middle of H6B area.
Set min. h from the floor.
Take red line as a ref. for beam.

DAT & motors cables exit on the left wrt beam
2 CERN racks on the left side, hosting:

- 2 TS small crates (middle position)
- FieldPoint for T monitoring (high pos.)
- CAEN PS crate (low pos.)
- TABLE motors (low pos.)

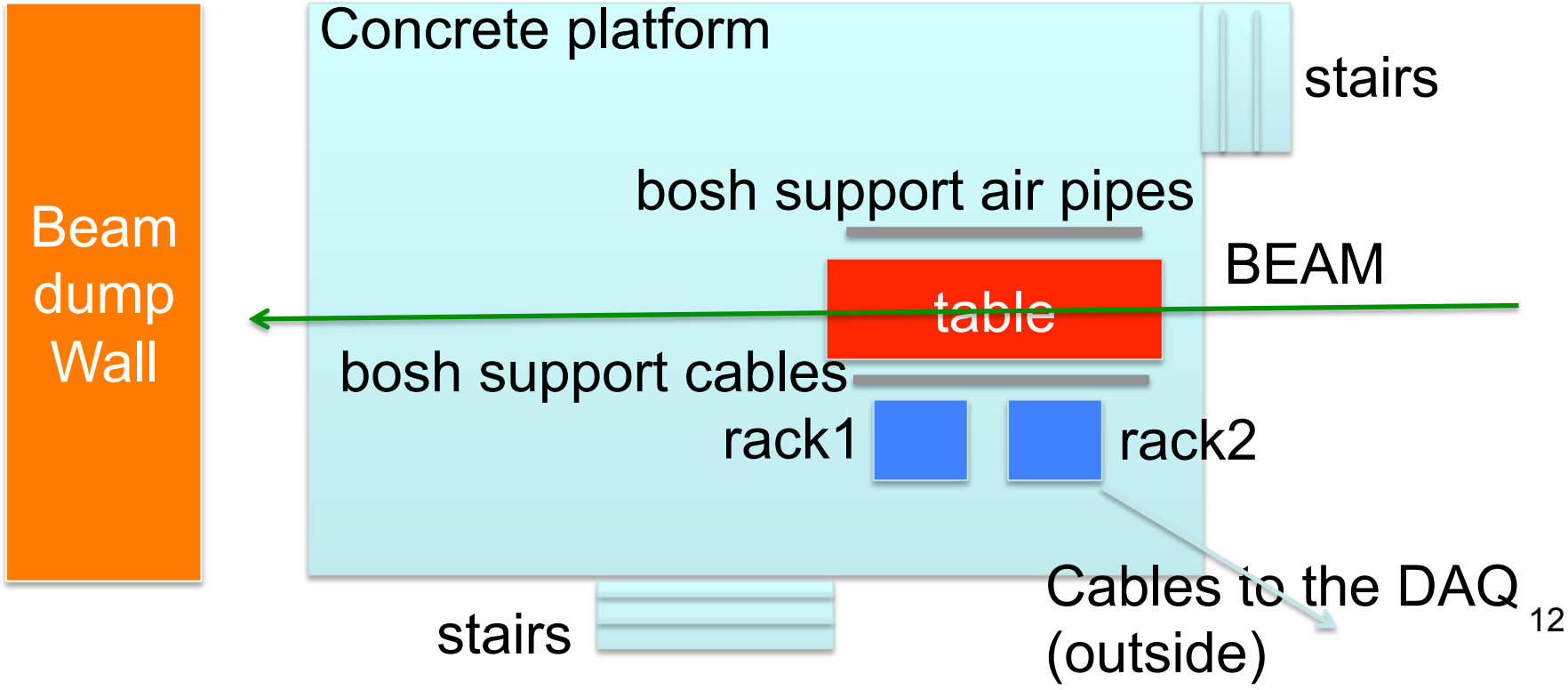
Cooling pipes exit on the right.
Strain relief mounted on both sides

Rails as far as possible (untill the mech. stop)

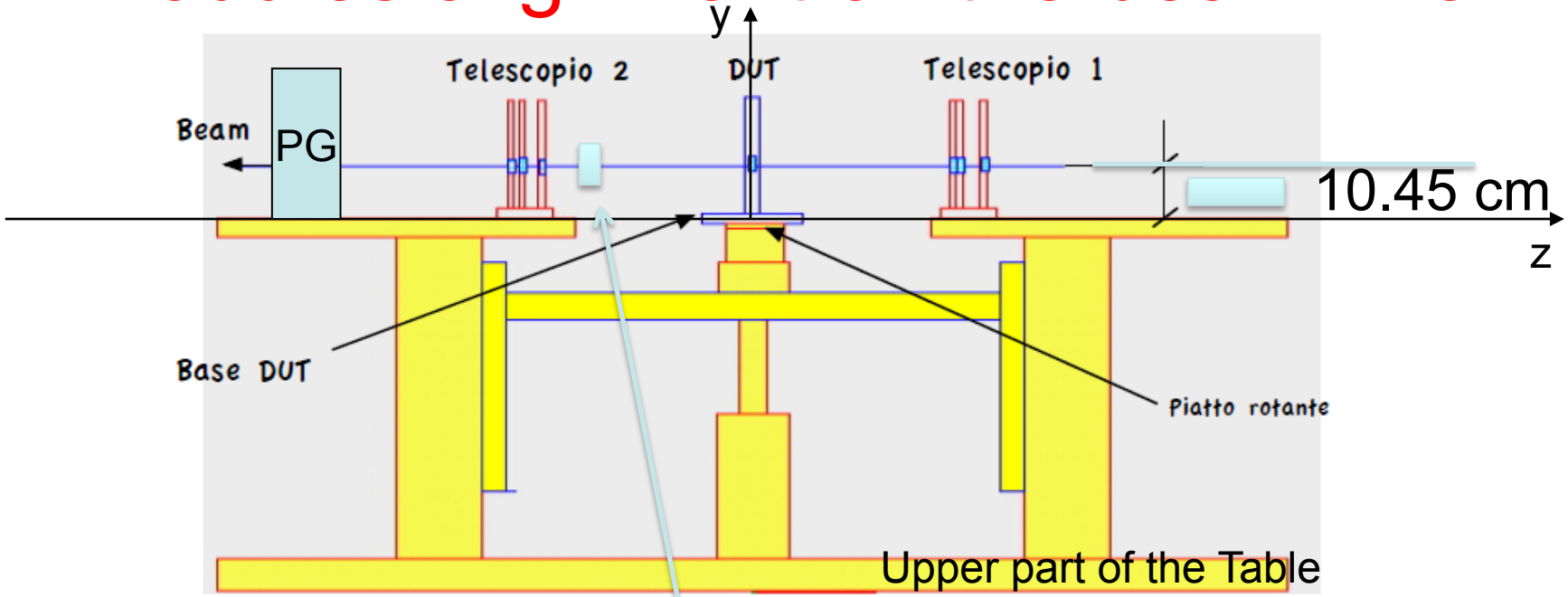


Schematic layout of the exp. area

- The motors must be switched OFF (HW) during the run (to avoid noise) w/o accessing to the ilk area (best if the switch is in front of the DAQ in the barrack).
- The laptop (with LabView) positioned in front of the DAQ as well.



Modules alignment on the beam line



Possible configurations:

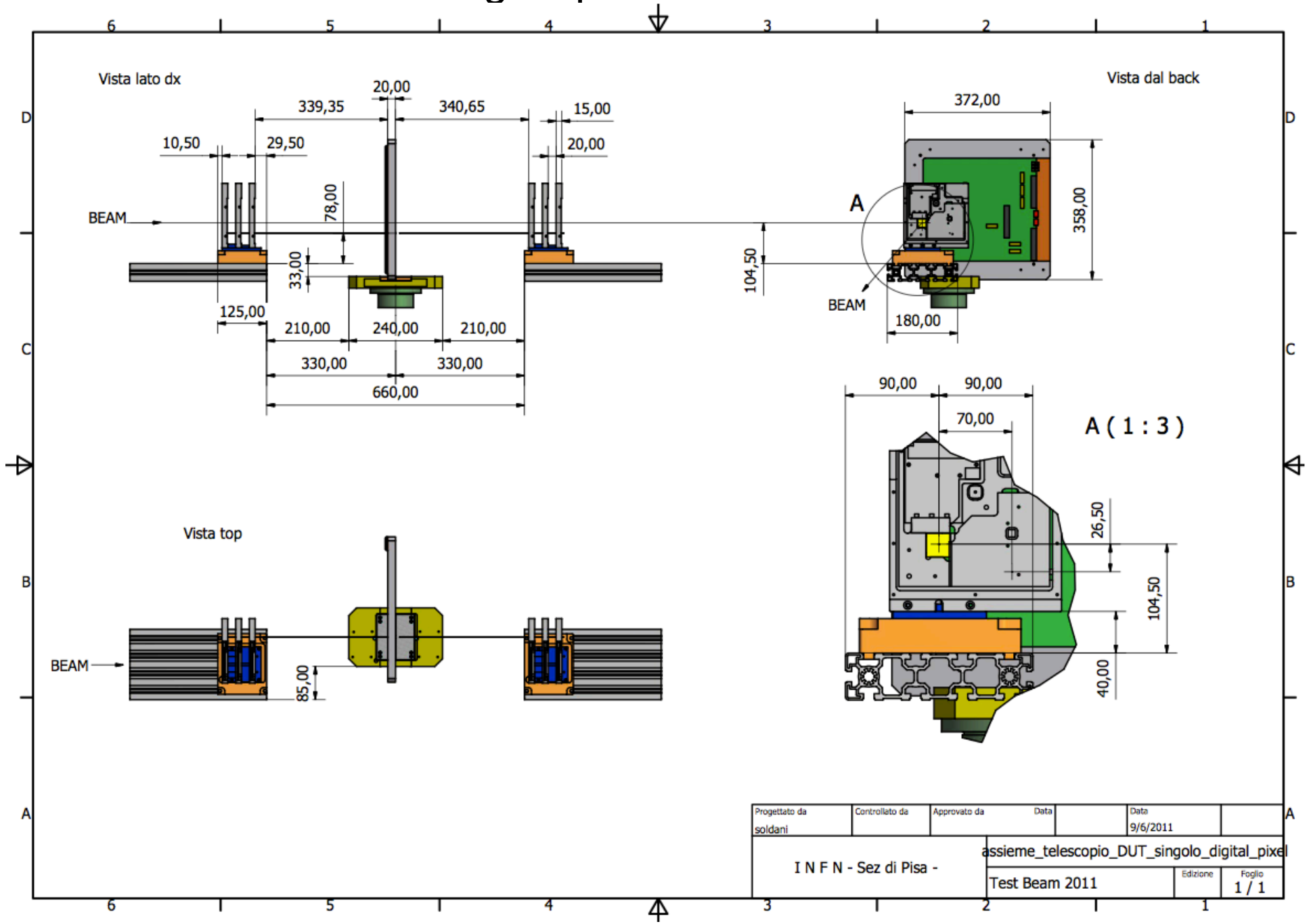
- With rotation (1! DUT):
  - superpix0
  - striplet
- W/o rotation:
  - 1 or 2 digital pixels (superpix0 or apsel4D)
  - 1 or 2 striplets

In addition, we can have the analog 3x3 matrices (1! chip) in front of the backward telescope modules

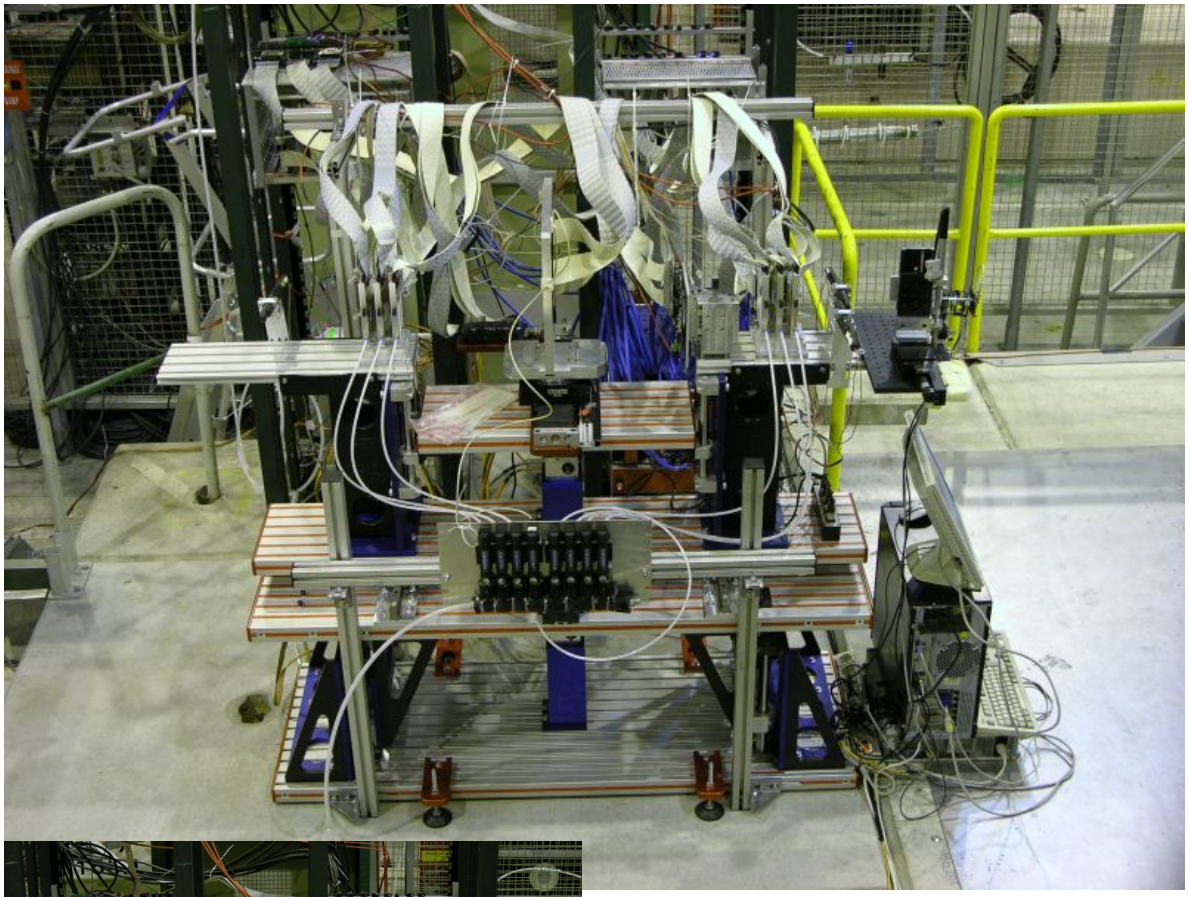
.txt Config files for analysis

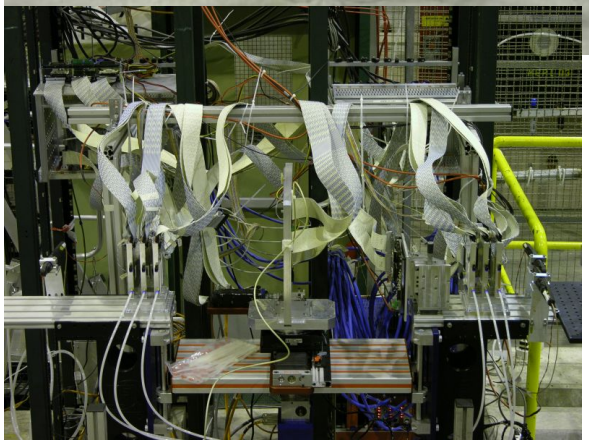
- The position of the central base of the DUTs is referred to the zero HW of the stages.
- The following drawings provide the translations in the plane orthogonal to the beam in order to put the DUTs on the axis passing at the centers of the tele-modules.
- For the nominal position along the beam we must consider the positions of the sensitive area of the modules and their thickness.

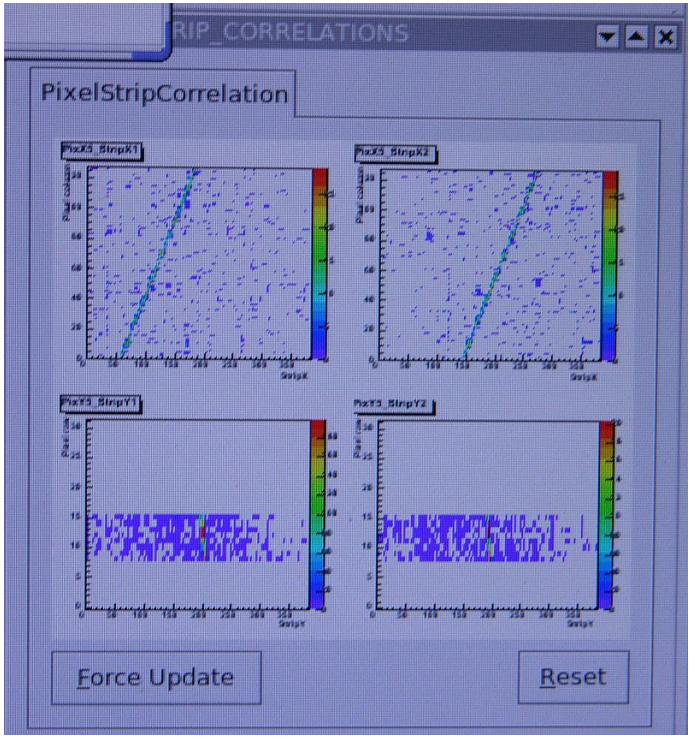
1! digital pixel with rotation



SuperPix0



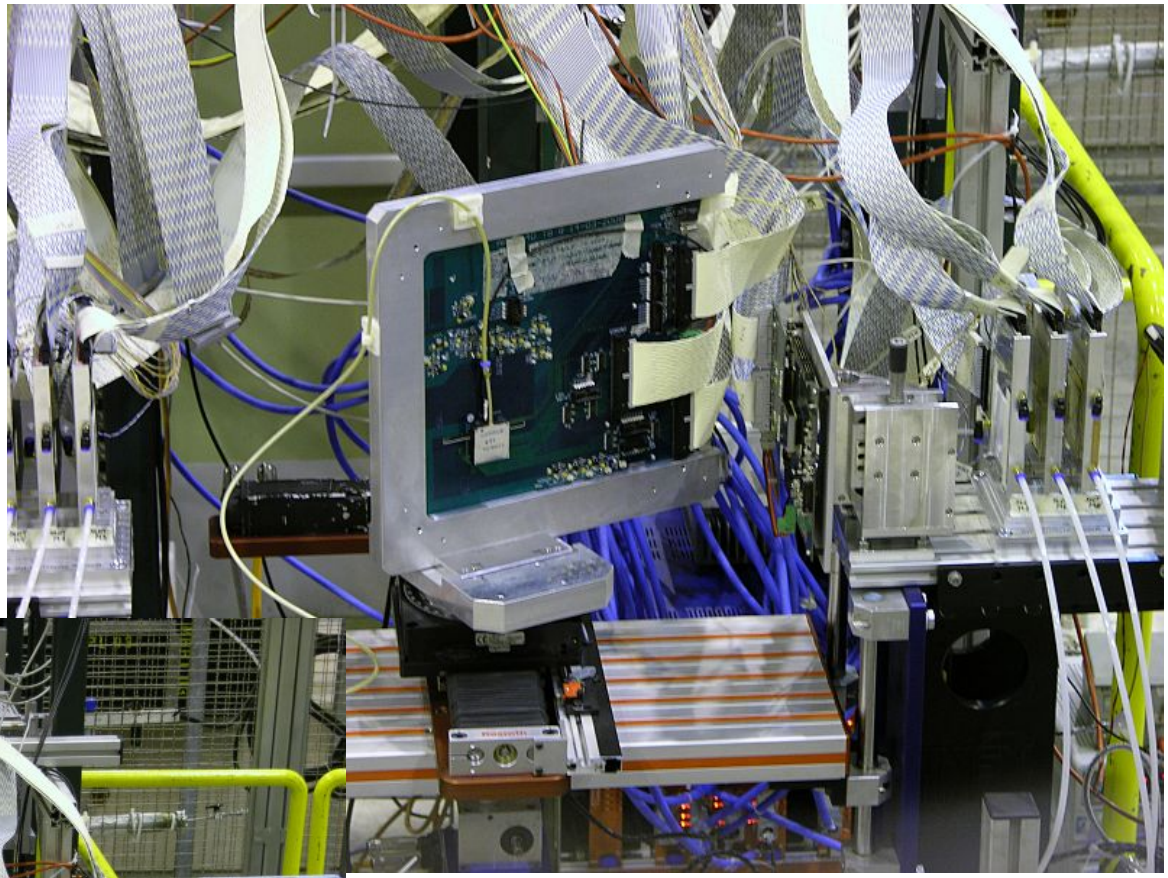


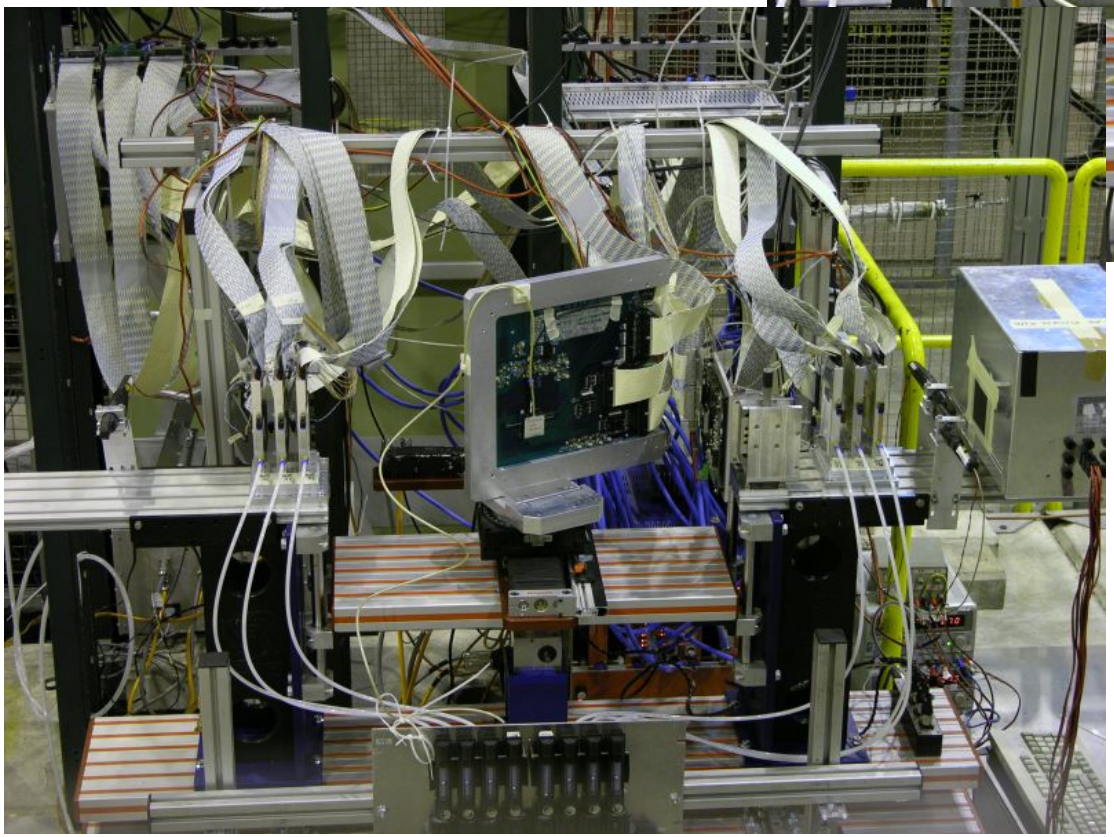


Correlazioni:

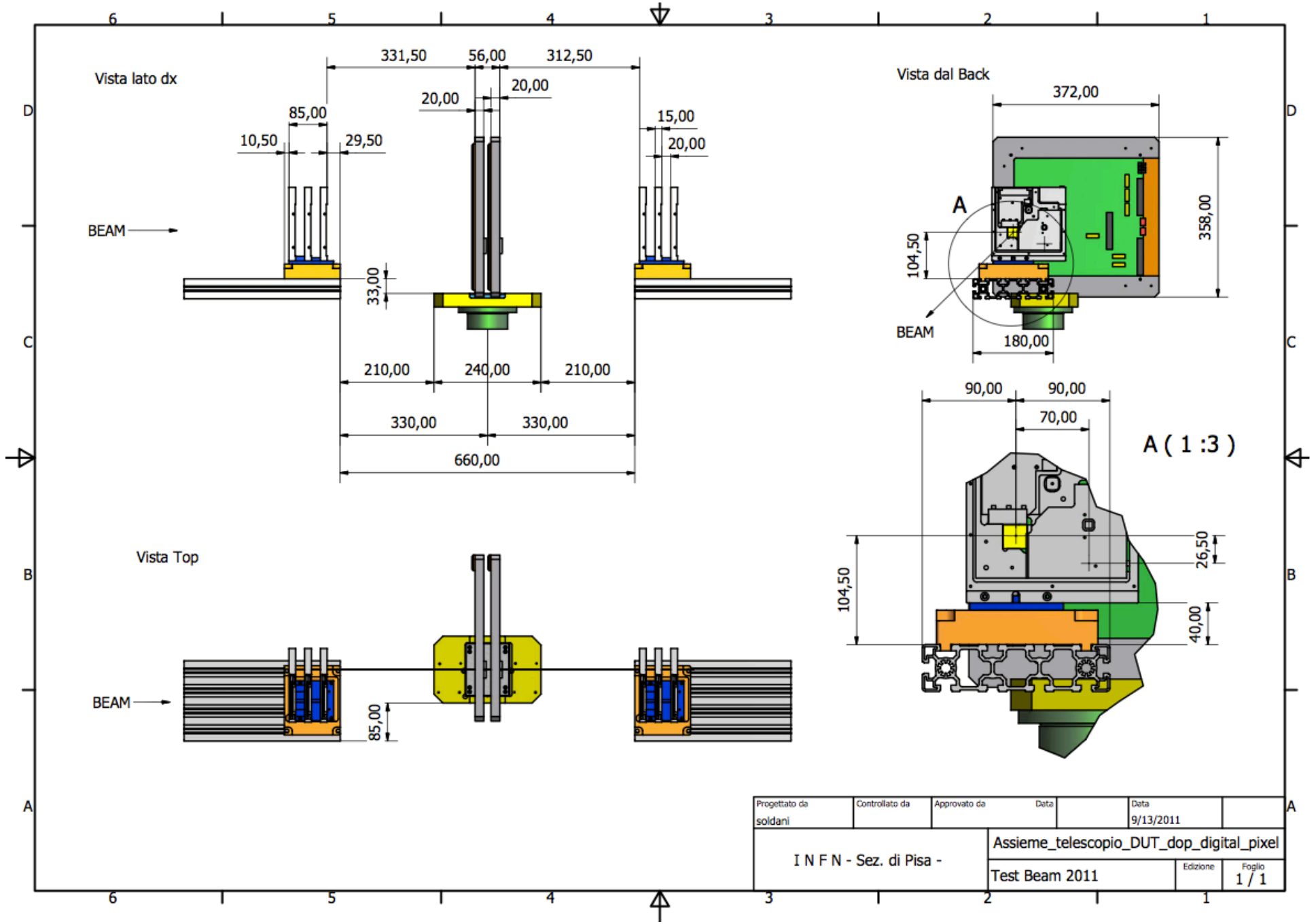
- #stripX-tele vs #colonna pixel
- #stripY-tele vs #riga pixel

SuperPix0
con angolo [0,70] gradi
3 chips

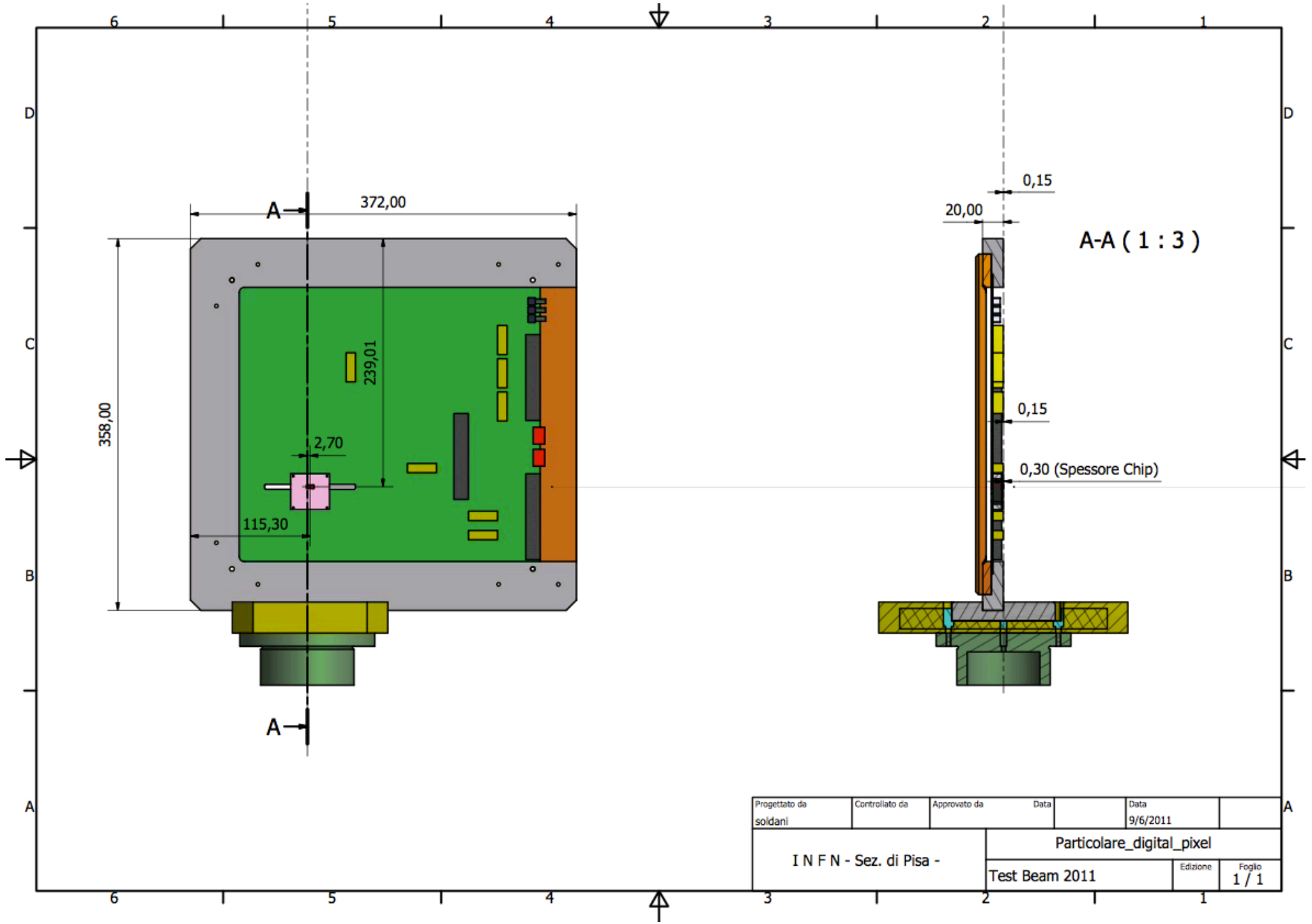




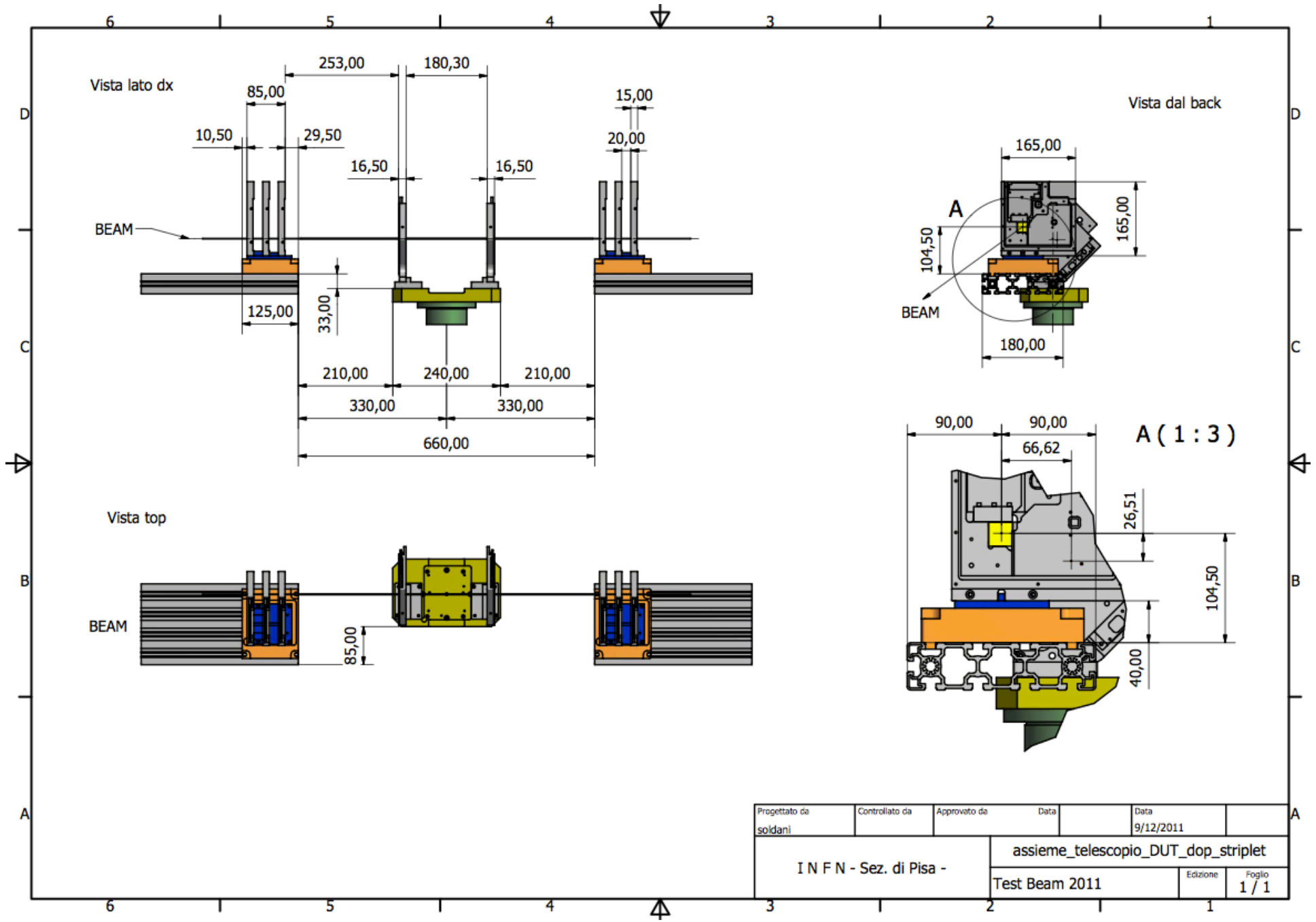
2 digital pixels



Digital Pixel Module



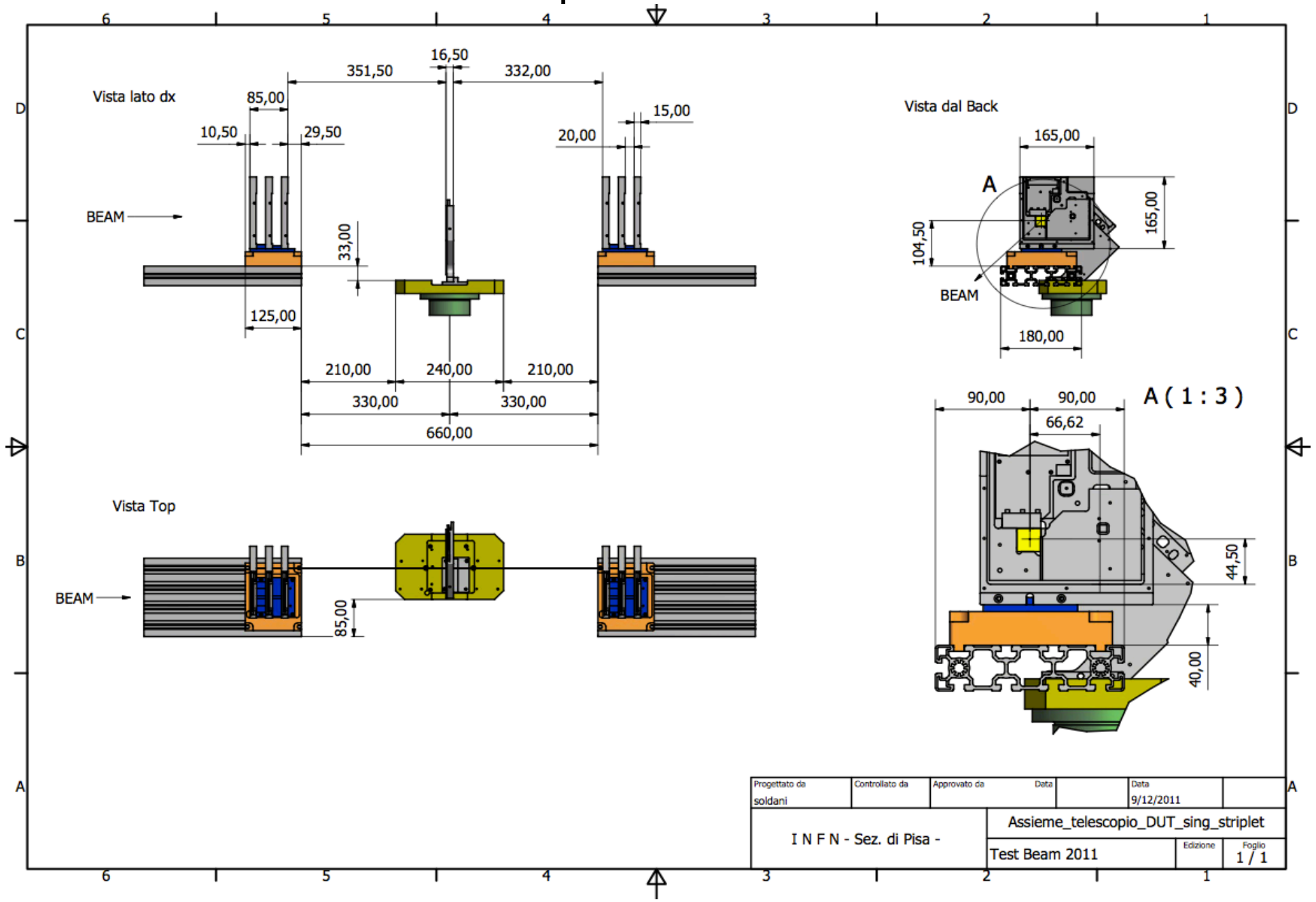
2 striplets



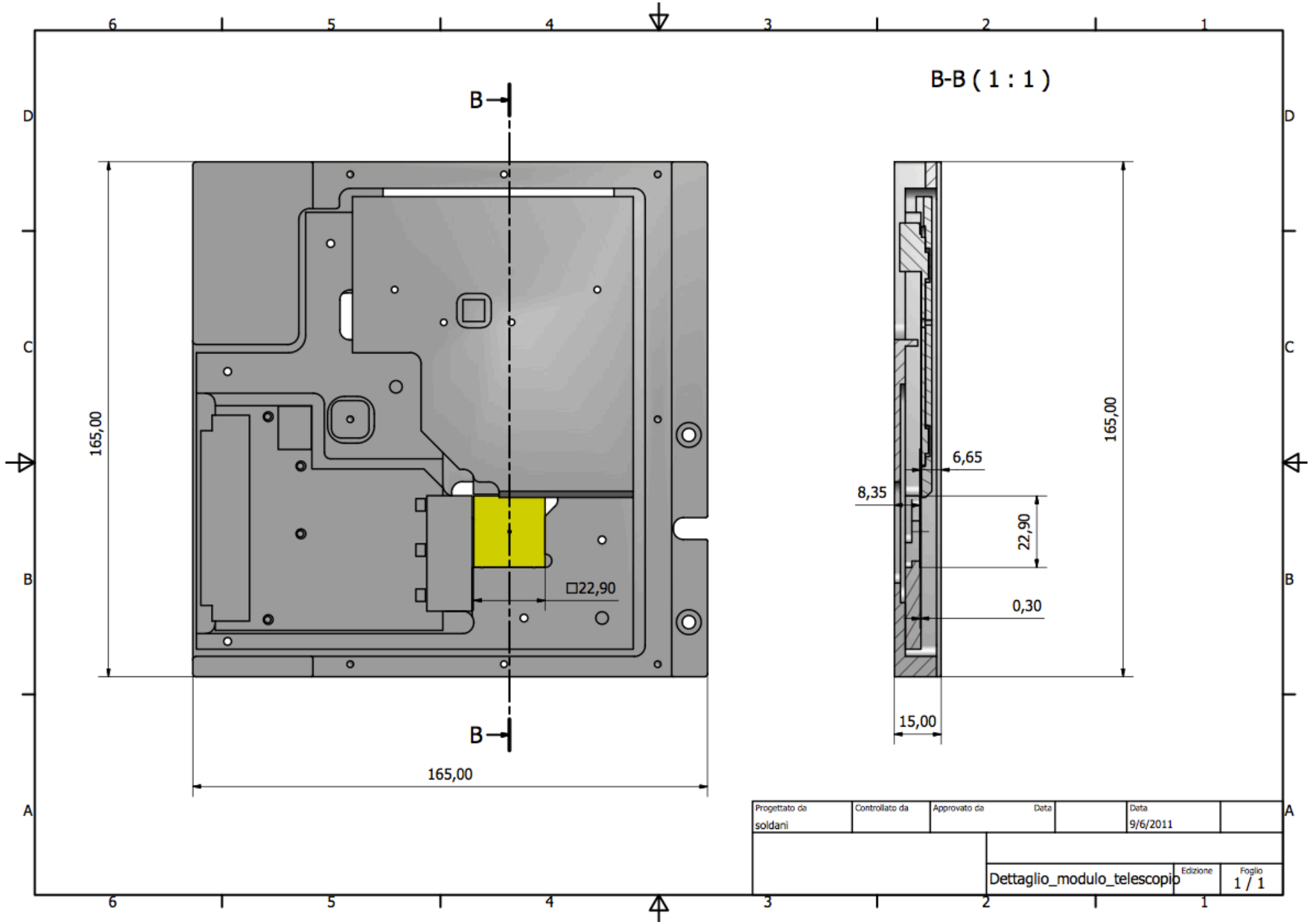
Progettato da	Controllato da	Approvato da	Data		Data	
soldani					9/12/2011	

I N F N - Sez. di Pisa -	assieme_telescopio_DUT_dop_striplet		
	Test Beam 2011	Edizione	Foglio 1 / 1

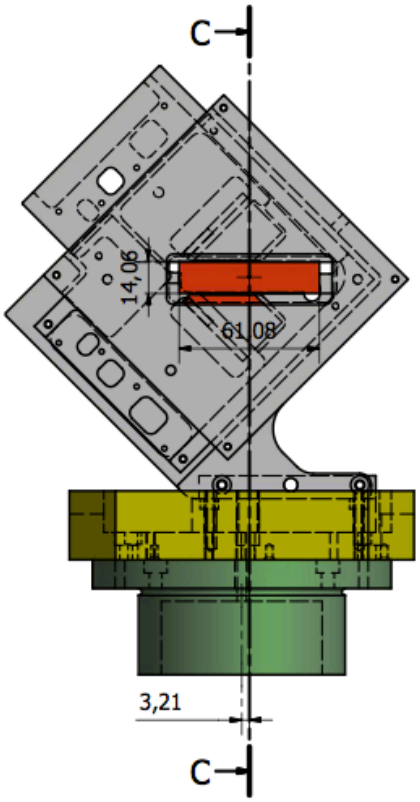
1! Striplet with rotation

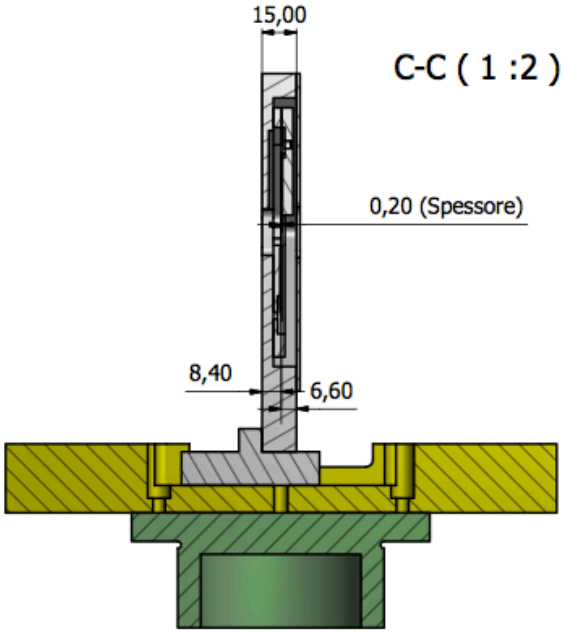


Telescope Module



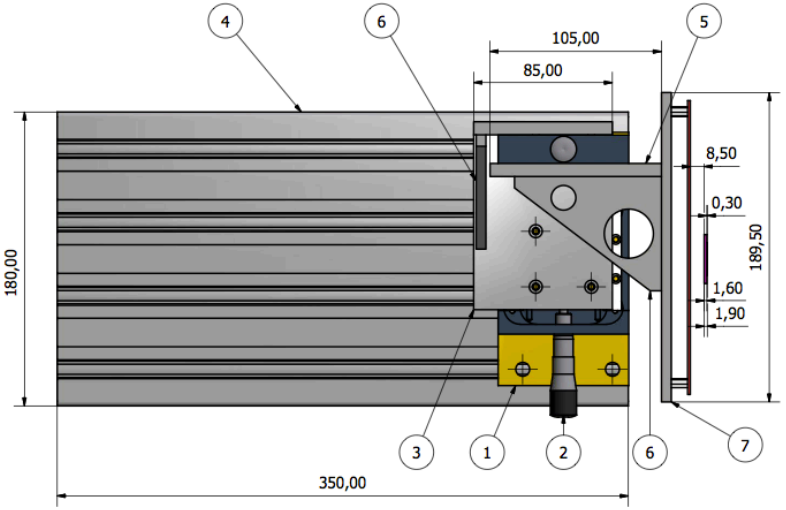
Striplet Module

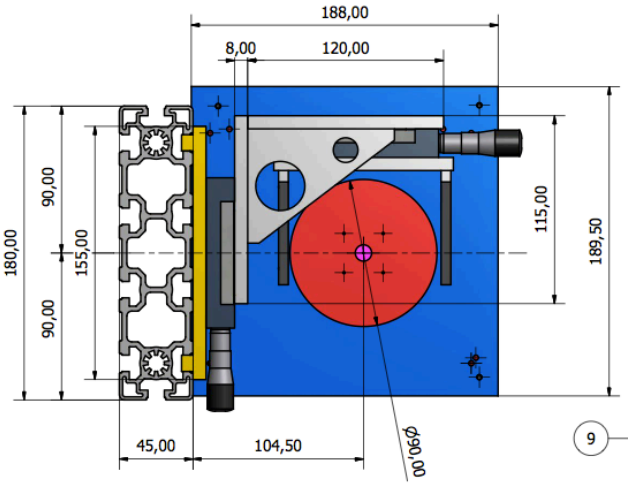


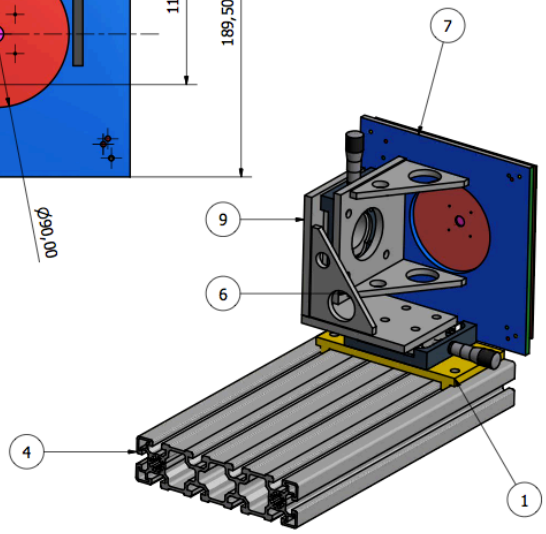


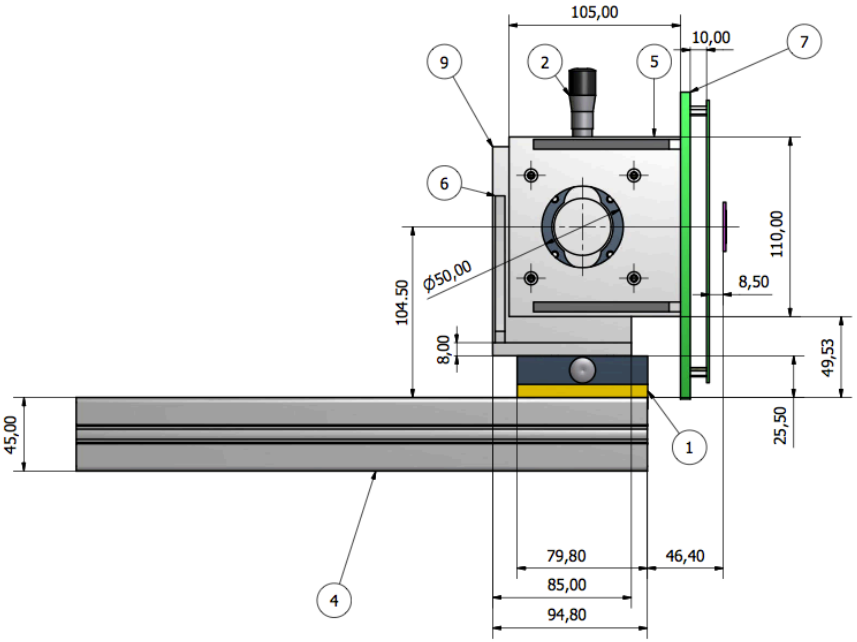
Progettato da	Controllato da	Approvato da	Data		Data	
soldani					9/6/2011	
I N F N - Sez. di Pisa -				Particolare_Striplet		
				Test Beam 2011	Edizione	Foglio 1 / 1

Analog Pixel









ELENCO PARTI			
ELEMENTO	QTÀ	NUMERO PARTE	DESCRIZIONE
1	1	Interfaccia_orizzontale_profilato_traslatori	
2	2	Assieme_traslatore_micrometro_singolo	
3	1	Piastra_interfaccia_traslatore_x	
4	1	Tavolo-ott	
5	1	Piastra_interfaccia_traslatore_Y	
6	3	Controventatura_Board_maps	
7	1	Telaio Board	
8	17	ISO 4762 - M3 x 10	Vite con esagono incassato
9	1	Schienale_interfaccia_traslatore_X_Y	

Progettato da	Controllato da	Approvato da	Data		Data
soldani	F.Bosi				7/20/2011

Istituto Nazionale di Fisica Nucleare - Sez. di Pisa -	Layout_movimentazione_maps		
	Test_Beam_2011	Edizione	Foglio 1 / 1

Other Important issues

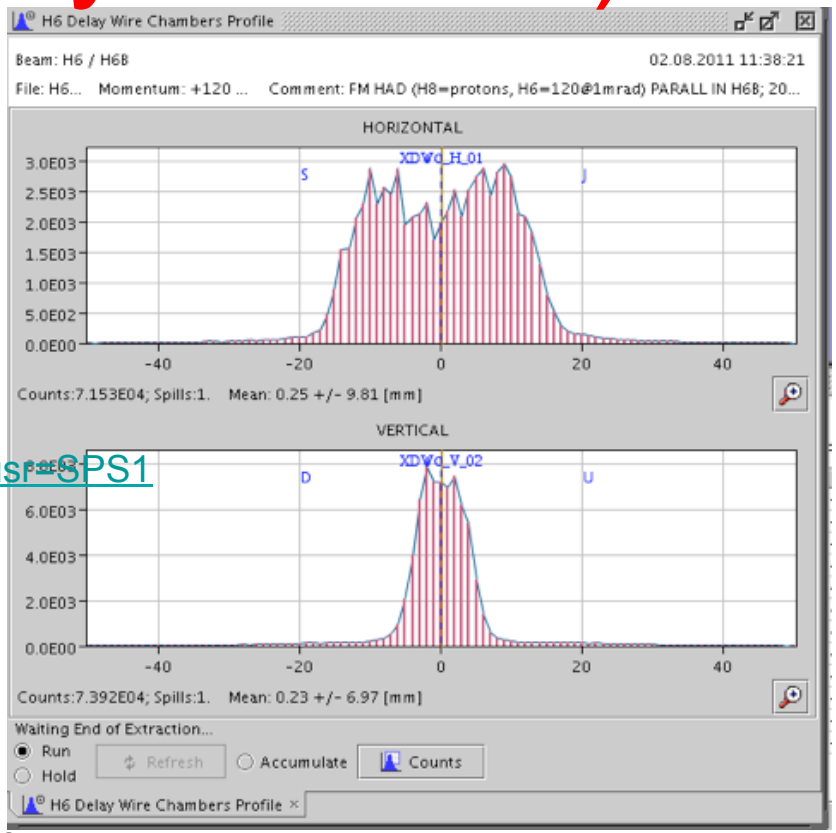
- Dry (…and clean) air-cooling:
  - Filter (provided by TS's friend)
  - 8 channels manifold + Vortex: 6-Tele + 2-DUTs
    - TS must converge on that
- T monitoring: field-point (PI) with Power Supply interlock
- Beam-scintillators (BO: as in 2009)
  - NIM crate outside, at the top of the DAQ crates

INFO on beam (by Edda G.)

- Fixed Target cycle length is 15.6 sec.

Flat top length is 9.69 sec.

Total length of SPS supercycle which also has CNGS cycles and LHC cycles included depends on how much of these are in there. Often the supercycle length is 45.6 secs with always one fixed target cycle/supercycle.



- Have a look at

http://op-webtools.web.cern.ch/op-webtools/vistar/vistars.php?usr=SPS1

where you see the SPS supercycle which is currently running.

- Typical fluxes are 10^5 to 10^6 pions/extraction.

It should not go beyond ~5x10^6 pions, and can go as low as ~10^3 pions/extraction.

- The figure reports typical beam sizes of the 120GeV beam for the pixel detector users.

- The distance between the floor and the beam height is 200.6cm. However, we have some platforms in the area that can be used. For example the one you mention in this photos is already 80cm and I think it is free and can be used. There are some lines on the floor for aligning, otherwise you can call the geometers and they can align for you.

To be still sorted out (logistics):

1. A safe&fence-closed storage area for the goods
2. Rooms with ethernet where to sit down and work, in addition to the control-room of H6B:
    1. Network plug for ip request: done
3. Soon two DAQ racks outside the fence:
    1. +Two det's racks to be put inside on the 19th
    2. A table on the side of the DAQ racks for calibrations:
4. Compressed air filter
5. How to take by the crane the movable table when mounted to be carried inside
6. Red line for alignment
7. Slide off beam Eudet telescope: on 19th

Monday morning plan (beam area)

- Start at 8:15:
  - carry the table inside (by the crane) on the platform. Diego G. follows this operations. Start mounting table (aligned on the beam line: pay attention that the beam sees cables exit on its left). At 8:45 again crane: carry the 80 cm concrete blocks at the left of the table. Put the 2 empty crates on the new blocks (face to table).
  - 10:00 Continue mounting the table and then put motors on a rack (on the left of the table). Test movements.
  - 9:00 Cables HV and signal scintillators (2 Front, 1 back)
  - 9:00 start installing little crates (TS) and pass black cables to the DAQ crates: use scaffolding (given by Michael).
  - 9:00 Install Power Supply crate and insert PS boards. Start installing blue PS cables.
  - 11:00 Install monitoring
  - A seguire Mount dry-air system (with filters).

Initial geometry

- Mount (on the table):
  - 6 Tele modules
  - Two striplets + 1 superpix0 + 1 a5ttc
  - Scintillatori check
  - PG MAPS
- Perform calibrations:
  - Tele + striplets (1 h)
  - Superpix0 (0.5 h)
  - apsel5TTC anamaps (~0)
- Ext. Time: 4 pm. Close the door and start beam: let's find the beam (positioning of the table at the max rate.

Starting phase (estimated@4pm)

Let’s start debug the DAQ for superpix0 and analog MAPS. After understanding the problems, take off superpix0 and analog MAPS and start Low Energy runs for striplets

Striplets plan for Low Energy runs (untill 8 am of Tuesday)

- Punto di partenza: predisponiamo sul tavolo i 6 moduli del telescopio e

due DUT Striplets (S1 e S2) a incidenza normale e controlliamo con uno o più run di noise (durano minuti) che che le soglie nominali siano ok: 1 h (senza fascio)

- Calibrazioni con due DUT (S1 e S2): 1 h
- un run alta statistica (1 Mevts) a incidenza normale con due DUT (S1 e S2) con soglie nominali: 4 runs (0.5 h)
- Si abbassano progressivamente le soglie (5 steps a 15 min/step) dei DUT con la procedura di controllare prima con un run di noise (senza fascio: TRG striplets) e poi con run a media statistica (200kevts, TRG Tele) fino a quanto si possono abbassare: 1 h
- Per l'ultima (la piu' bassa) soglia buona si ripete run alta statistica:10 min
- Togliere 2 striplets e metterne una sotto rotazione.
- Arrivati prima delle 8 am a 70 gradi, si prender il doppio punto e si ritorna indietro prendendo a ritroso i dati per gli stessi angoli.
- Per i run angolati: si mette in config. 1! DUT striplets il DUT migliore (nel 2008 era S2) con la soglia minore che non fa divergere il rate dal punto 3) e si fanno run

ad alta statistica (1 Mevts) per gli angoli 0 15 30 45 60 70.

Utilia

- E-log: http://pcslim2.bo.infn.it:8080/demo/
- DB-mysql: via pclumi1→pcslim mysql
- By CARLA: queries on DB templates:
  - http://www.pi.infn.it/~bettarin/streamMapping
  - http://www.pi.infn.it/~bettarin/TB2011/Comandi.sql
  - http://www.pi.infn.it/~bettarin/TB2011/RunList2.xlsx

QUALI risultati preliminari in ~10 gg?

- SuperPix0:
  - Efficienza vs THR scan +-30 attorno a 770 per I tre chips
  - Risoluzione: compatibile con pitch/Sqrt(12)
  - NO scan in angolo
- Analog MAPS: a5ttc
  - Landau (MPV)
  - NO Efficienza

Come proseguire fino a compimento delle analisi?

- SuperPix0
- Analog MAPS
- Striplets

IN QUESTA PRIORITA'

MANPOWER:

Possibili contributi da:

PI: Alberto, Ben, Antonio, Laureando

MI: Nicola

TS: sentiamo

BO: sentiamo

SuperB/VIPIX Test-beam milestones proposed for 2011

7/2011 system test in BO

12/2011 Preliminary results on test-beam data analysis on V.I. devices and hybrid pixel.

PROPOSTA

- (A gennaio/febbraio) dopo la scrittura della prima vs del TDR, al termine delle analisi che dovrebbero portare ai risultati quasi definitivi, penso sia il caso di prevedere la scrittura di 3 articoli.
- Rispetto al 2008 non c'e' piu' l'idea del dimostratore sottile (ne' le AM) ma il focus e' sulle diverse tecnologie dei DUTs per il goal di SuperB.
- Vanno identificati 3 editors per far convergere il porcesso della scrittura, dei checks suidati da fare prima/durante la sottomssione.
- Questi a sua volta, oltre a seguire da vicino l'analisi (DA ORA!), chiederanno la disponibilita' di altri, secondo il loro schema di draft per la scrittura delle subsections.
- Bisogna EVITARE che si vada a presentare alle conferenze durante il 2012 senza aver prima finalizzato gli articoli.

3 Articoli

- SuperPix0
  - Editor
  - Writers
- Analog MAPS
  - Editor
  - Writers
- Striplets
  - Editor
  - Writers

Adottiamo il metodo
Seguito x il paper 2008?

Conclusions