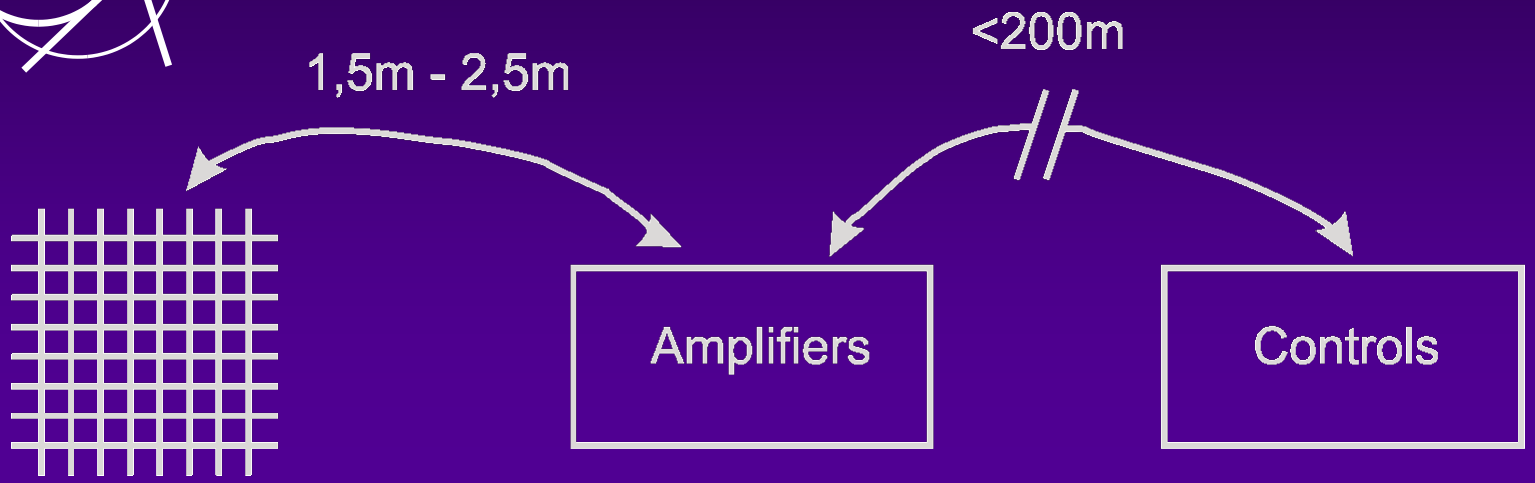
WireGrid electronics in the Linac 4 tunnel

Technology Choice.

- At the time of designing the radiation levels were unknown.
- Relatively little time for development.
- No choice was given about where to place the equipment.
- To reach the specifications the electronics should be near the detectors (Initially 1m80, new design would allow ~8m).
- Therefore we have opted for a system with only the absolutely necessary electronics near the beamline:
  - Only amplifiers,
  - No logic,
  - Remote power supplies.

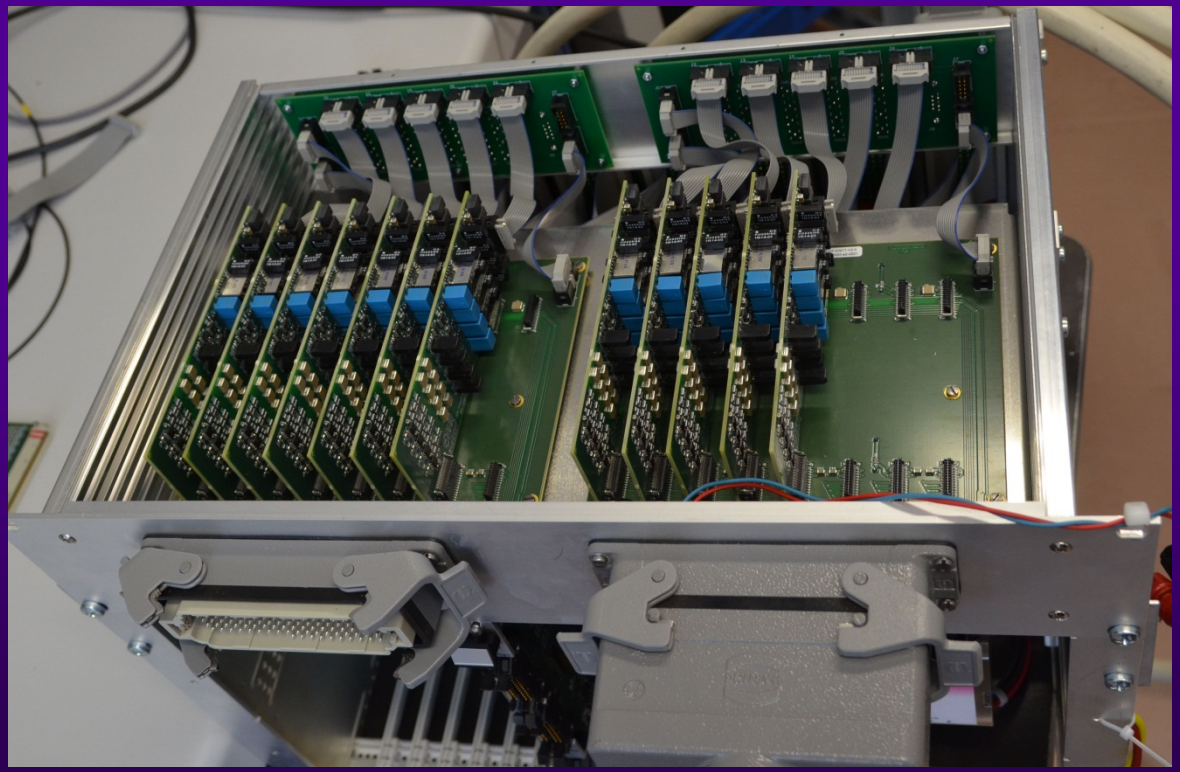
Grid overview.



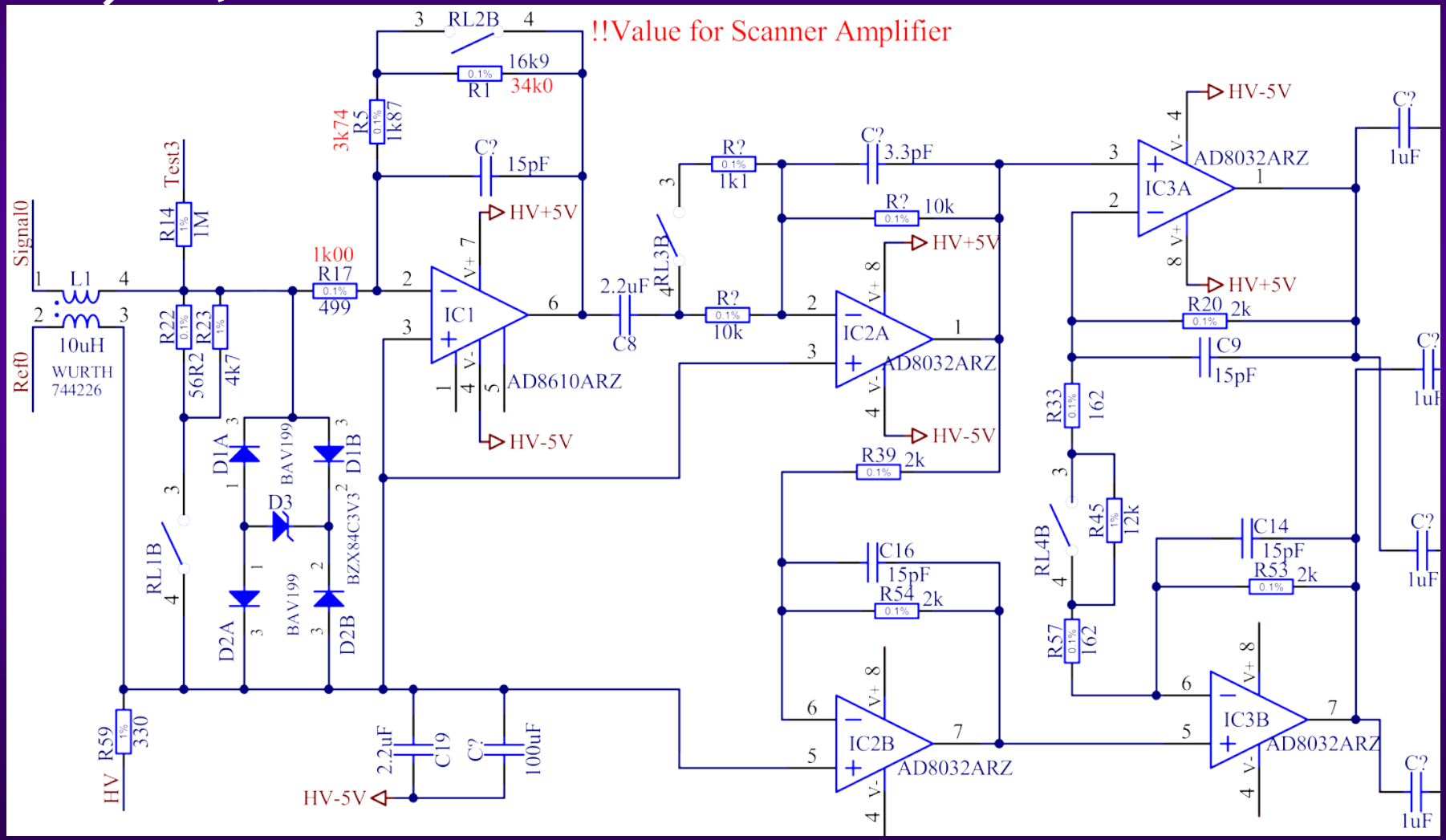
- Between Grid and Amplifier: two cables with twisted pairs with *individual* screening. The two cables will be mounted together in large Harting 72-pin connectors.
- Between Amplifiers and Controls a single cable is proposed (CERN ND100) mounted with Harting 108-pin connectors.
- Power and I/O control are handled by the same ND100 cables, no additional cabling is foreseen.
- Bias ±120V directly onto measuring wires.

Amplifier-boxes

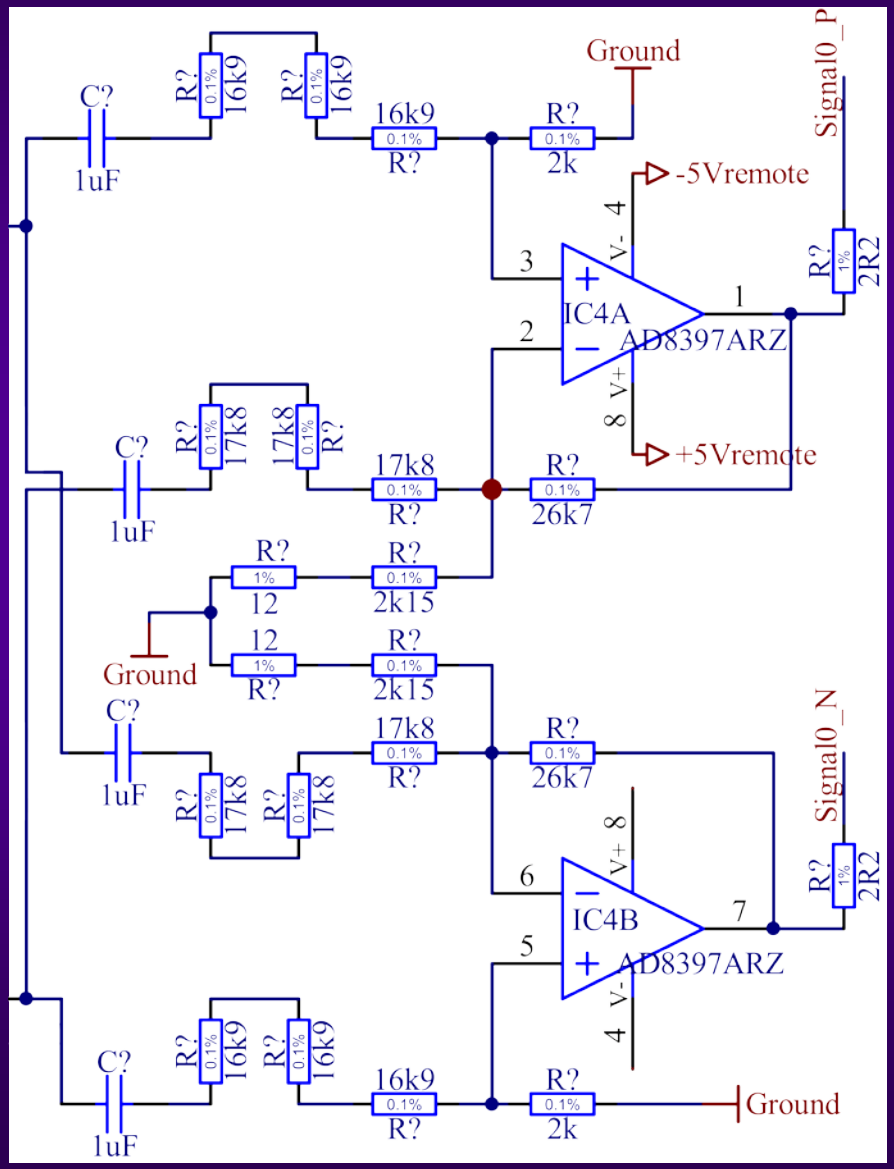
- Up to 32 channels per box.
- Motherboard with daughter-boards carrying 4 amplifiers each.
  - Amplifiers with BW = ~1MHz,
  - Input amplifiers can be biased up to ±120V.



Linac4 Amplifier (1)



Linac4 Amplifier (2).



Design Details (1).

- Amplifier's Maximum Electrical Input: 10mA,
- Amplifier's highest sensitivity: 1µA full scale,
  - The calculated input-related noise-level is ~2nA at 1MHz BW.
  - With software amplification highest sensitivity will be (=<)200nA full scale.
- Overall BW is defined by the cable-length between grid and electronics,
  - The newer design allows longer cables (8m).
- Isolated input-stage: Bias of up to ±120V on measuring wires.
- The design foresees to use test-resistances:
  - At the grid in the vacuum-chamber,
  - Outside the vacuum-chamber at the cable-connection,
  - At the amplifier-inputs.
- The design is made to accept different types of amplifiers so it can be used for other machines as well.

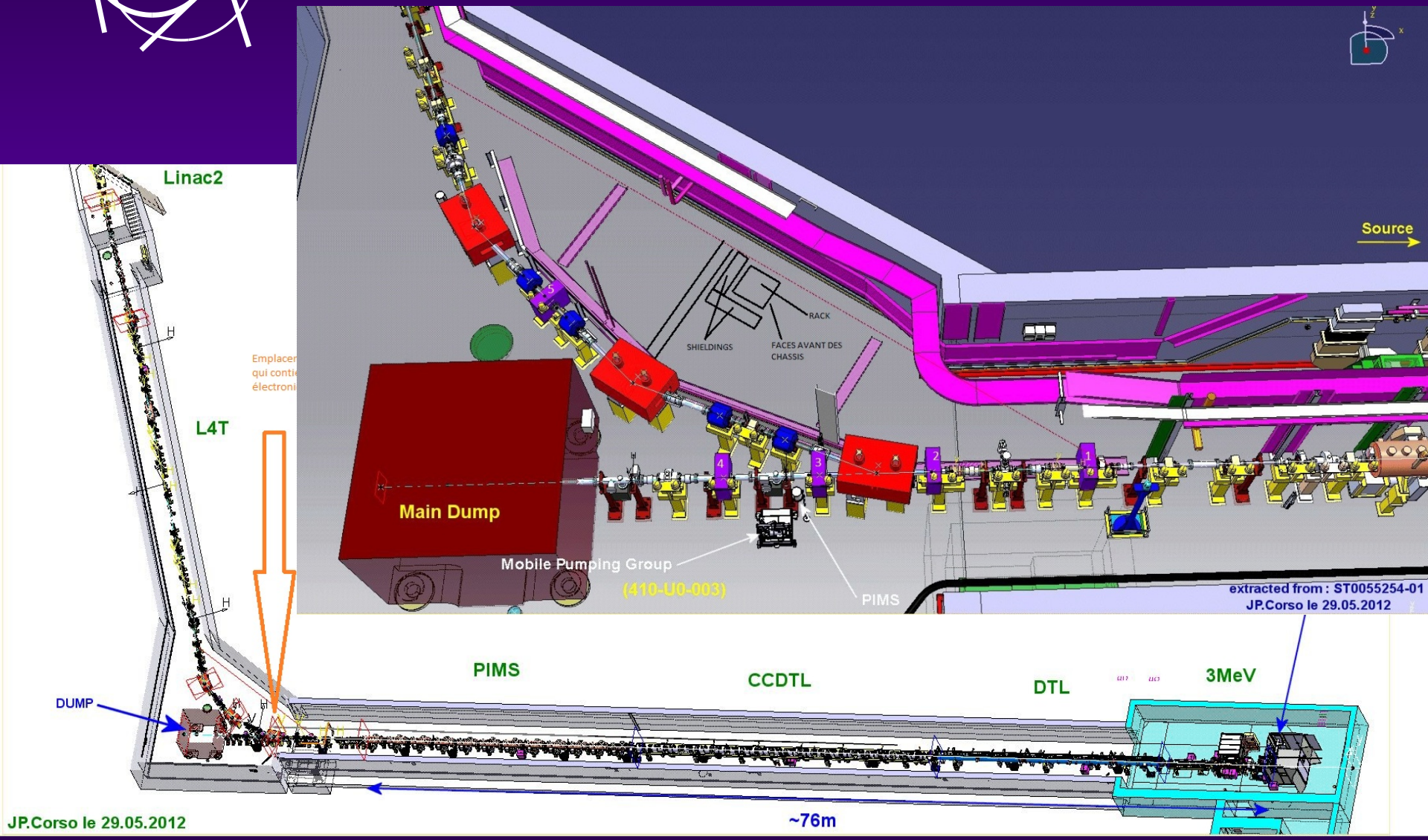
Design Details (2).

- No electronic switches: miniature reed-relays.
- The amplifiers cannot consume too much power,
  - Cable-length, noise-level and lifetime.
- Input-protection by small-signal diodes BAV199 and one small zener-diode BZX84C3,3.
- Amplifiers AD8610ARZ, AD8032ARZ and AD8397ARZ,
  - All from Analog Devices XFCB process,
  - Not that much choice anyway…
  - Report from the European Space Agency and NASA:
    - “Commercial Components Identification In Naturally Radiation Hardened Technologies” 2002ESASP.507...17M
    - They have tested chips from this family which were still o.k. after 100kRad(Si) radiation.
    - These chips appear not to suffer from single event upset.

Place in the tunnel.

Emplacement	Type de montage	Type de capteur	Position
LEBT	Montage sur la poutre	SEM grid 2 x 24 wires	L4L.BSGH.1151 L4L.BSGV.1151
Chopper line	Montage sur la poutre	2 Wire scanners	L4L.BWS.3312 L4L.BWS.3712
DTL	Rien	Rien	
CCDTL	Au sol	SEM grid 2 x 24 wires	L4C.BSGH.0121 L4C.BSGV.0121
CCDTL	Au sol	Wire scanner	L4C.BWS.02112
CCDTL	Au sol	SEM grid 2 x 24 wires	L4C.BSGH.0421 L4C.BSGV.0421
CCDTL	Au sol	Wire scanner	L4C.BWS.0622
PIMS	Au sol	SEM grid 2 x 24 wires	L4P.BSGH.0121 L4P.BSGV.0121
PIMS	Au mur, on a 75cm	Wire scanner	L4P.BWS.0402
PIMS	Au mur , on a 75cm	SEM grid 2 x 24 wires	L4P.BSGH.0601 L4P.BSGV.0601
PIMS	Au mur , on a 75cm	Wire scanner	L4P.BWS.1002
	Au sol	SEM grid 2 x 24 wires	L4T.BSGH.0223 L4T.BSGV.0223
Juste avant ligne dump	Rien	BSM	
	Rack	**SEM grid 2 x 24 wires**	**L4T.BSGH.0243 L4T.BSGV.0243**
Ligne dump	**Rack**	**SEM grid 2 x 24 wires**	**L4Z.BSGH.0273 L4Z.BSGV.0273**
Ligne dump	**Rack**	**SEM grid 2 x 24 wires**	**L4Z.BSGH.0287 L4Z.BSGV.0287**
Virage	**Rack**	**SEM grid 2 x 24 wires**	**L4T.BSGH.0523 L4T.BSGV.0523**
L4T	Au sol	SEM grid 2 x 24 wires	L4T.BSGH.1247 L4T.BSGV.1247

Place in the tunnel.



Our goal of this meeting.

- At the place of our rack we had expected more radiation due to the bend in the beam and especially due to the beam dump.
- Our questions:
  - Is it useful to have screening around our electronics?
  - If yes, what could this screening consist of?
  - Do the experts have any idea about the lifetime of our electronics?