Report on ATF2 Third Project Meeting
ATF2 Magnet Movers
ATF2 Q-BPM Electronics

ATF2 Magnet Mover progress

- 10 crates (24 movers) and electronics at ATF
- Four movers and electronics sent to France for testing on CERN IP table.

ATF2 Magnet Movers

- SLAC is providing all electronics to operate movers
- Movers require space for 17 chassis taking a total of 55 rack units plus one camac crate with 15 empty slots.
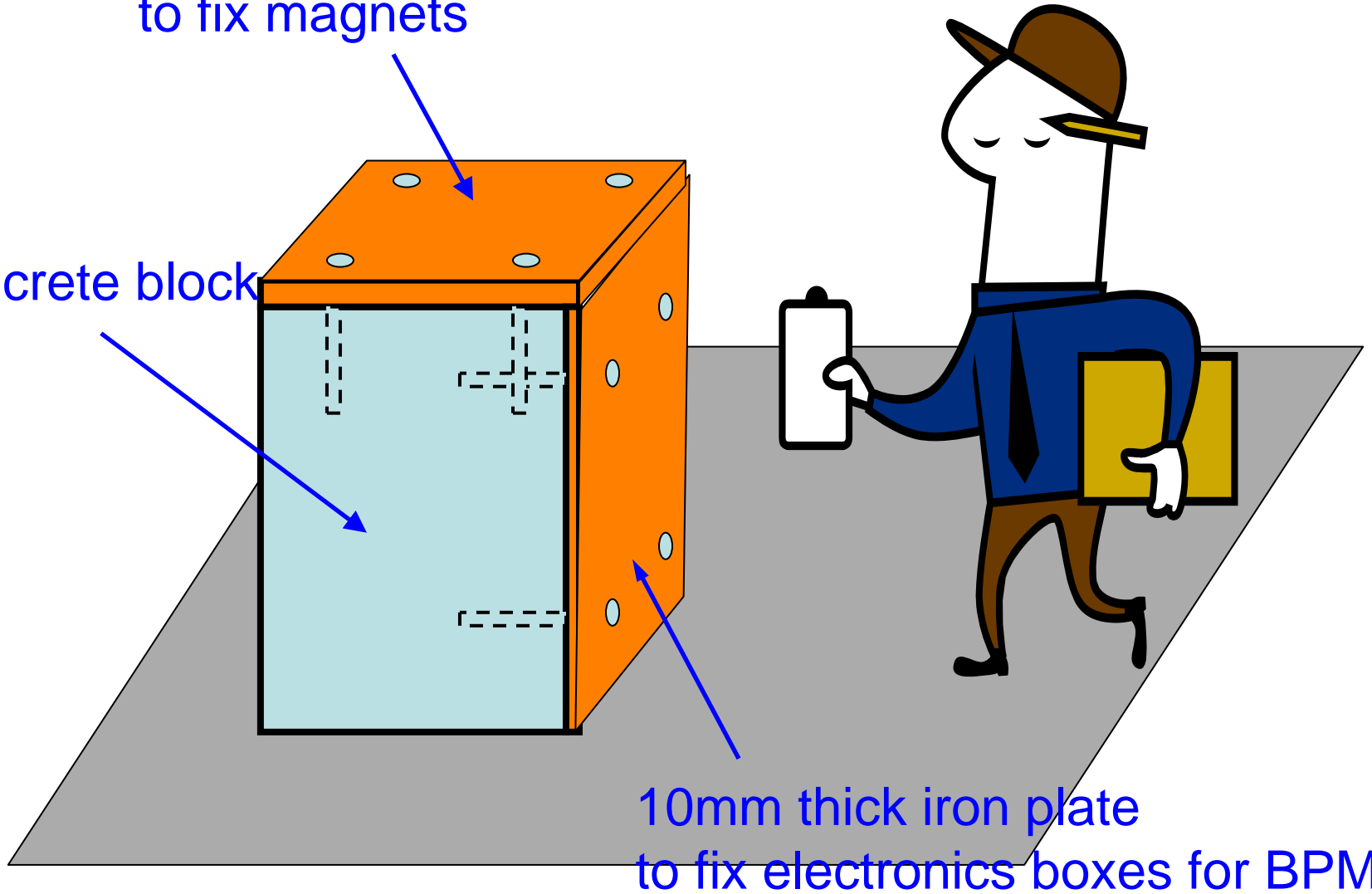- Optimum layout will require three racks loaded something like this .

15 slots required for camac crate:

2 magnet mover modules
2 ADC modules
11 LVDT modules

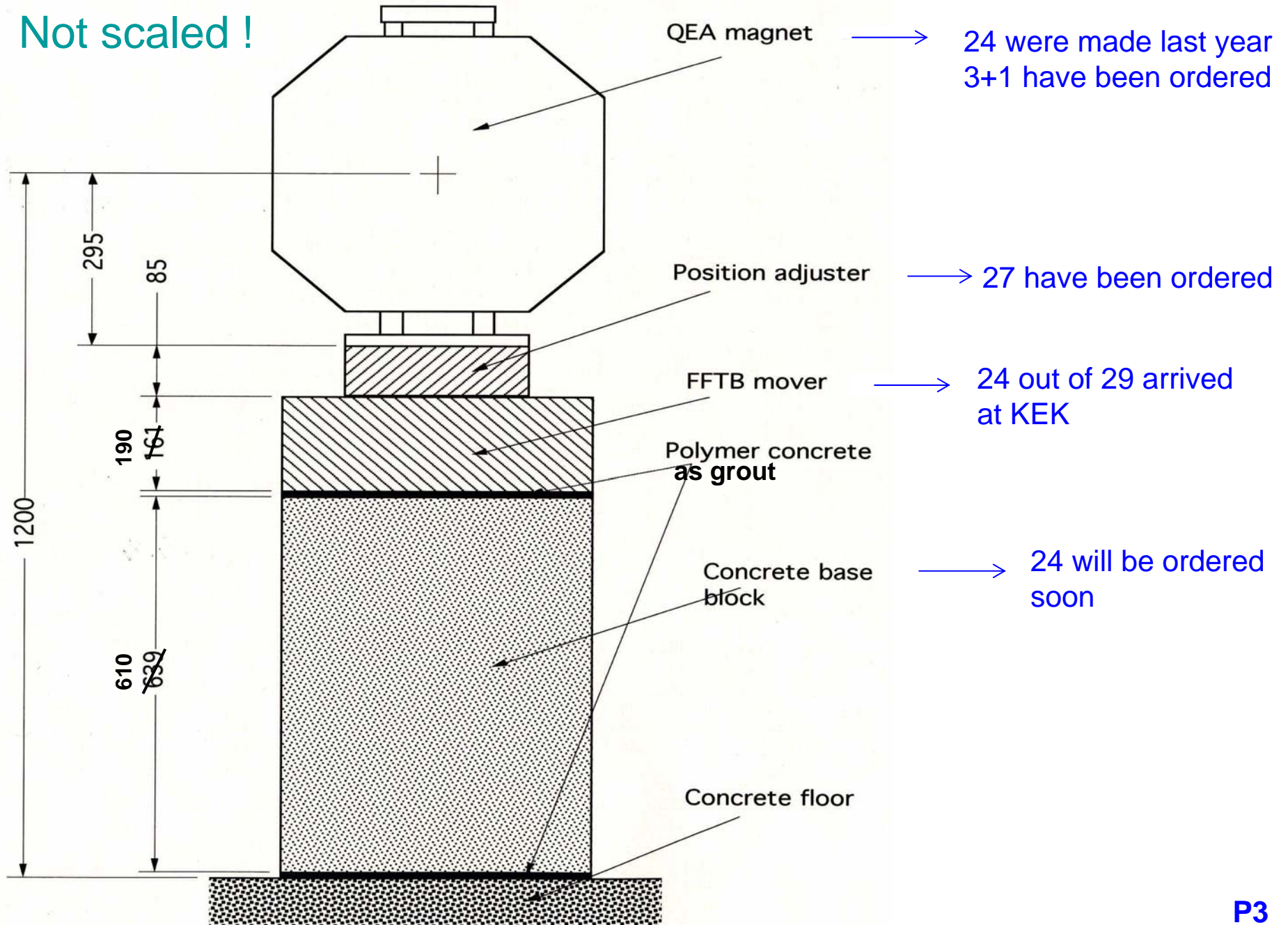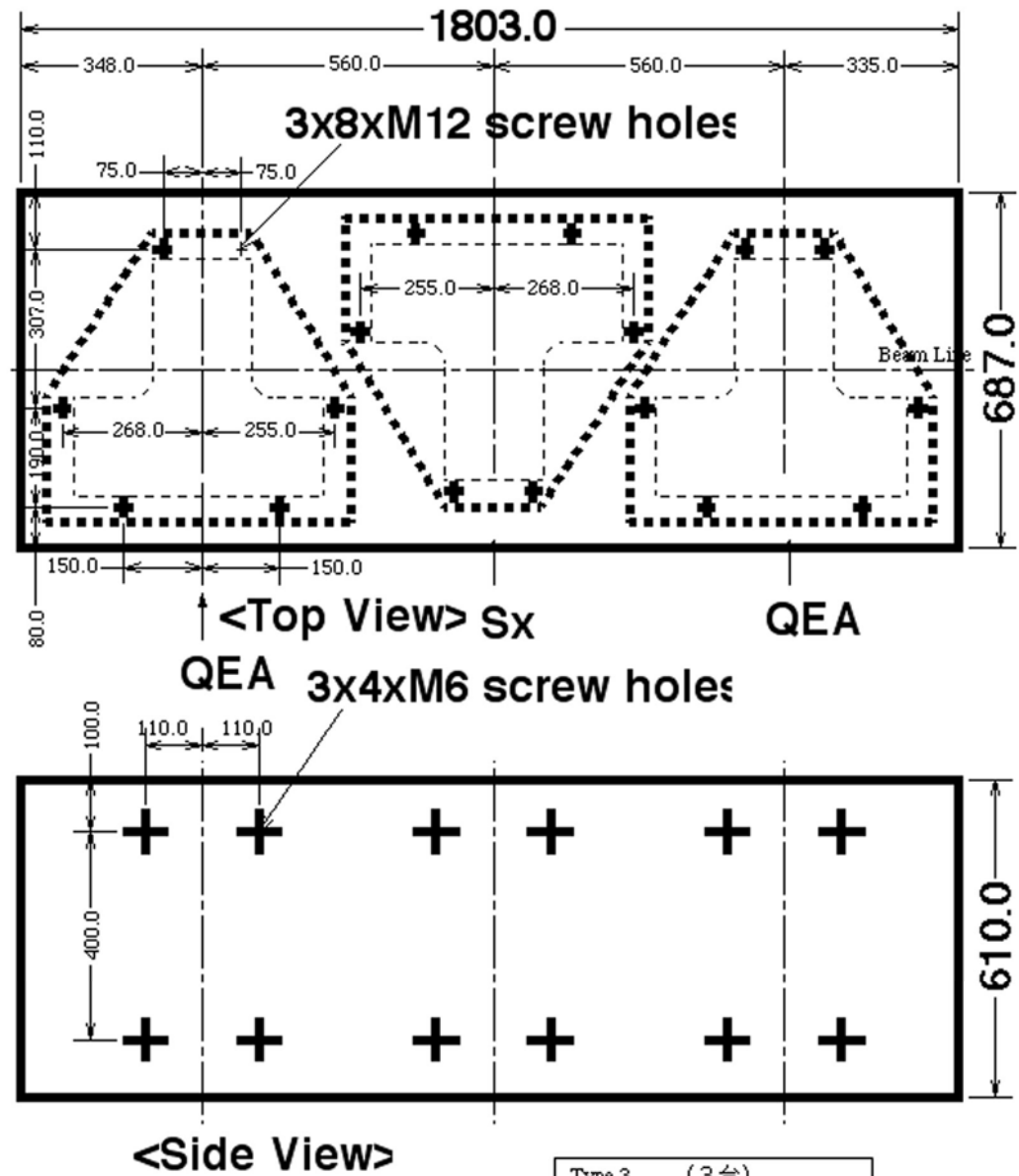| Magnet mover chassis | magmovr | Magnet mover chassis |
Magnet mover chassis		Magnet mover chassis
Magnet mover chassis	Camac crate	Magnet mover chassis
Resistor chassis	Dc power supply	Resistor chassis
Resistor chassis	Dc power supply	Resistor chassis
Resistor chassis	Resistor chassis	Resistor chassis
Resistor chassis		Resistor chassis

30mm thick iron plate
to fix magnets

Concrete block

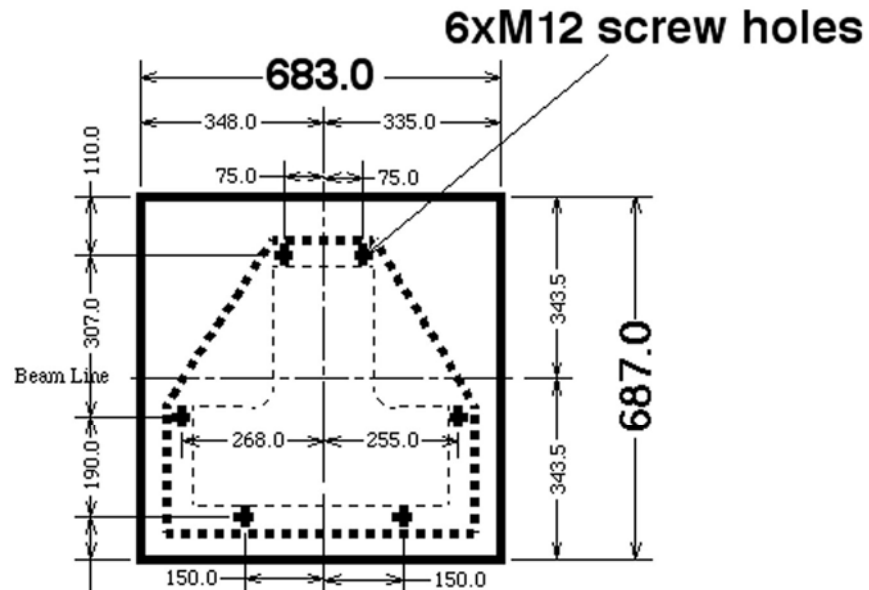10mm thick iron plate
to fix electronics boxes for BPM

Not scaled !

QEA magnet → 24 were made last year
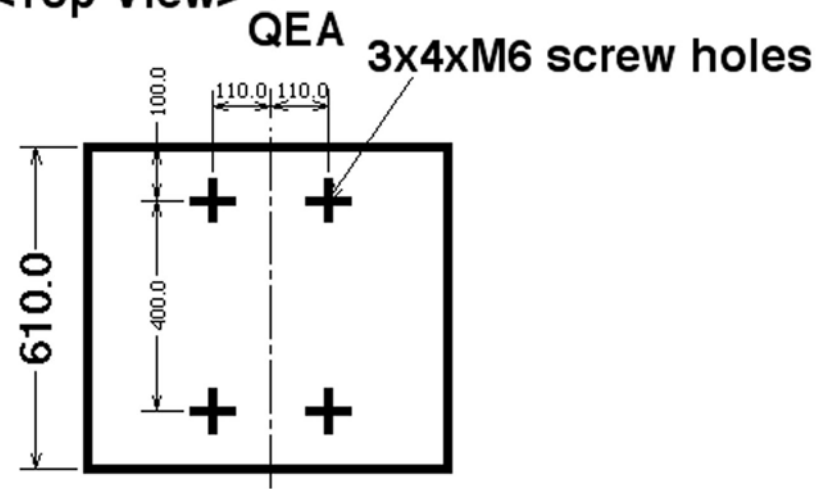3+1 have been ordered

Position adjuster → 27 have been ordered

FFTB mover → 24 out of 29 arrived
at KEK

Polymer concrete
as grout

Concrete base
block → 24 will be ordered
soon

Concrete floor

295
85
190
157
1200
610
639

P3

Type 3
(3 blocks)

1803.0

348.0 — 560.0 — 560.0 — 335.0

110.0

3x8xM12 screw holes

75.0 — 75.0

307.0

255.0 — 268.0

687.0

Beam Line

190.0

268.0 — 255.0

150.0 — 150.0

80.0

<Top View> Sx

QEA

QEA   3x4xM6 screw holes

100.0

110.0 · 110.0

400.0

610.0

<Side View>

Type 3   （3台）
高エネルギー加速器研究機構
S = 1/10
菅原   2006.11.01

6

**Type 4
(14 blocks)**

6xM12 screw holes

683.0

348.0 | 335.0

110.0

75.0 | 75.0

307.0

687.0

343.5

Beam Line

268.0 | 255.0

190.0

343.5

150.0 | 150.0

<Top View>

QEA

3x4xM6 screw holes

100.0

110.0 | 110.0
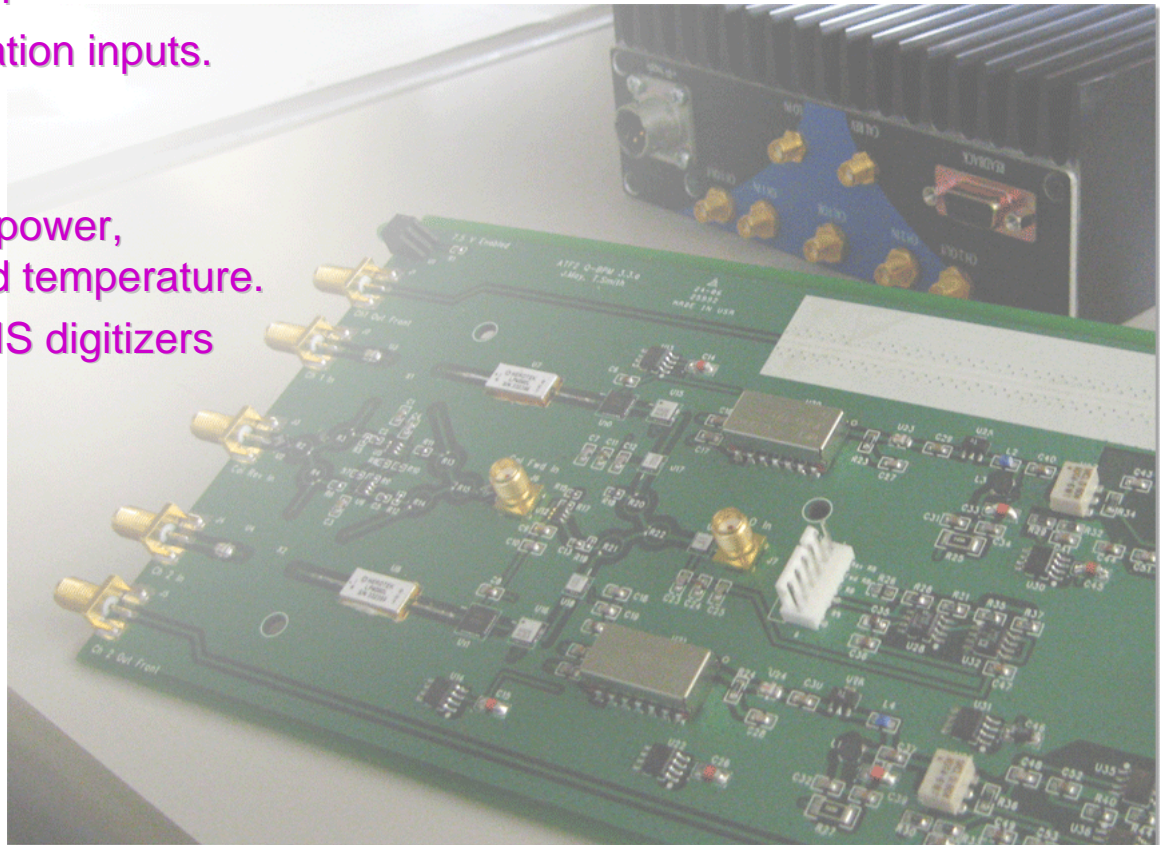
610.0

400.0

<Side View>

Type 4　（14台）

高エネルギー加速器研究機構
S = 1/10
菅原　　2006.11.01

Electronics Overview

- Downmix ~6426 MHz to 26 MHz
- 2ch/box
- Single LO input. Level 3dbm
- Forward and reverse calibration inputs. Level from 0 to 20dbm
- DC input 5.8 W at 8V
- Analog outputs monitor LO power, Calibration power and board temperature.
- Output to 14-bit 100 MHz SIS digitizers

Performance Results

ATF2 BPM downmix electronics:
IP3, gain, and noise figure results, 39 boards
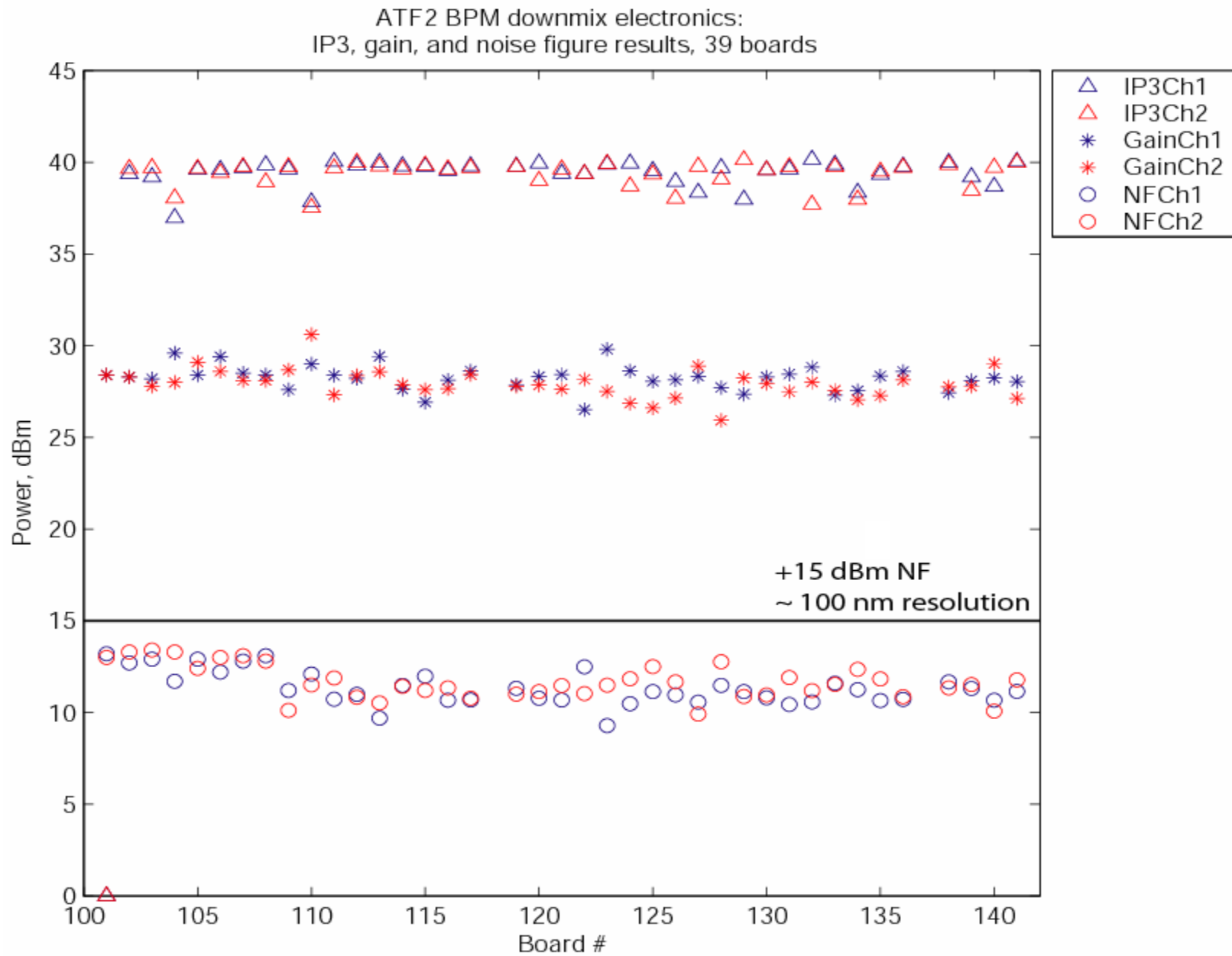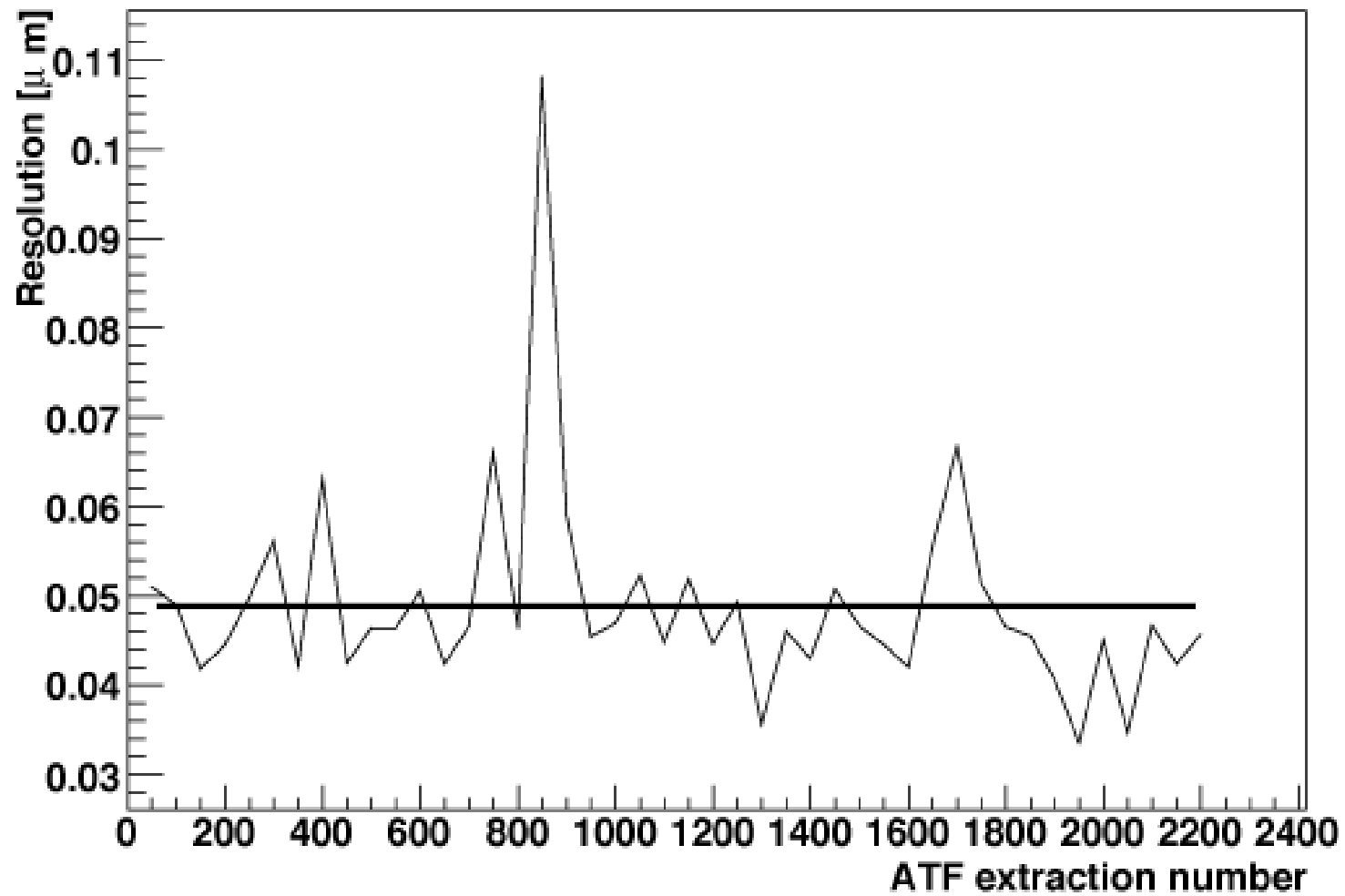
Crosstalk
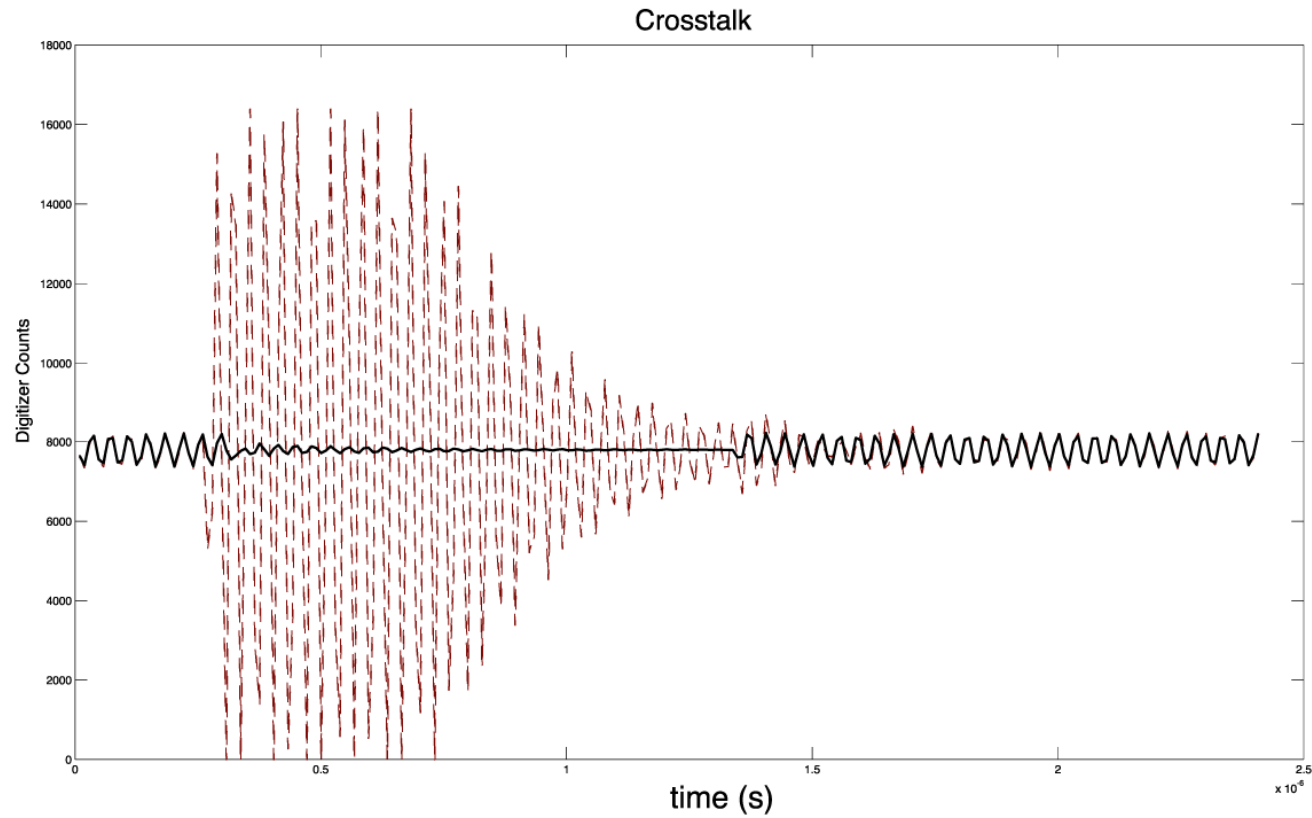
Heavily saturated BPM pulse in channel 1 of electronics

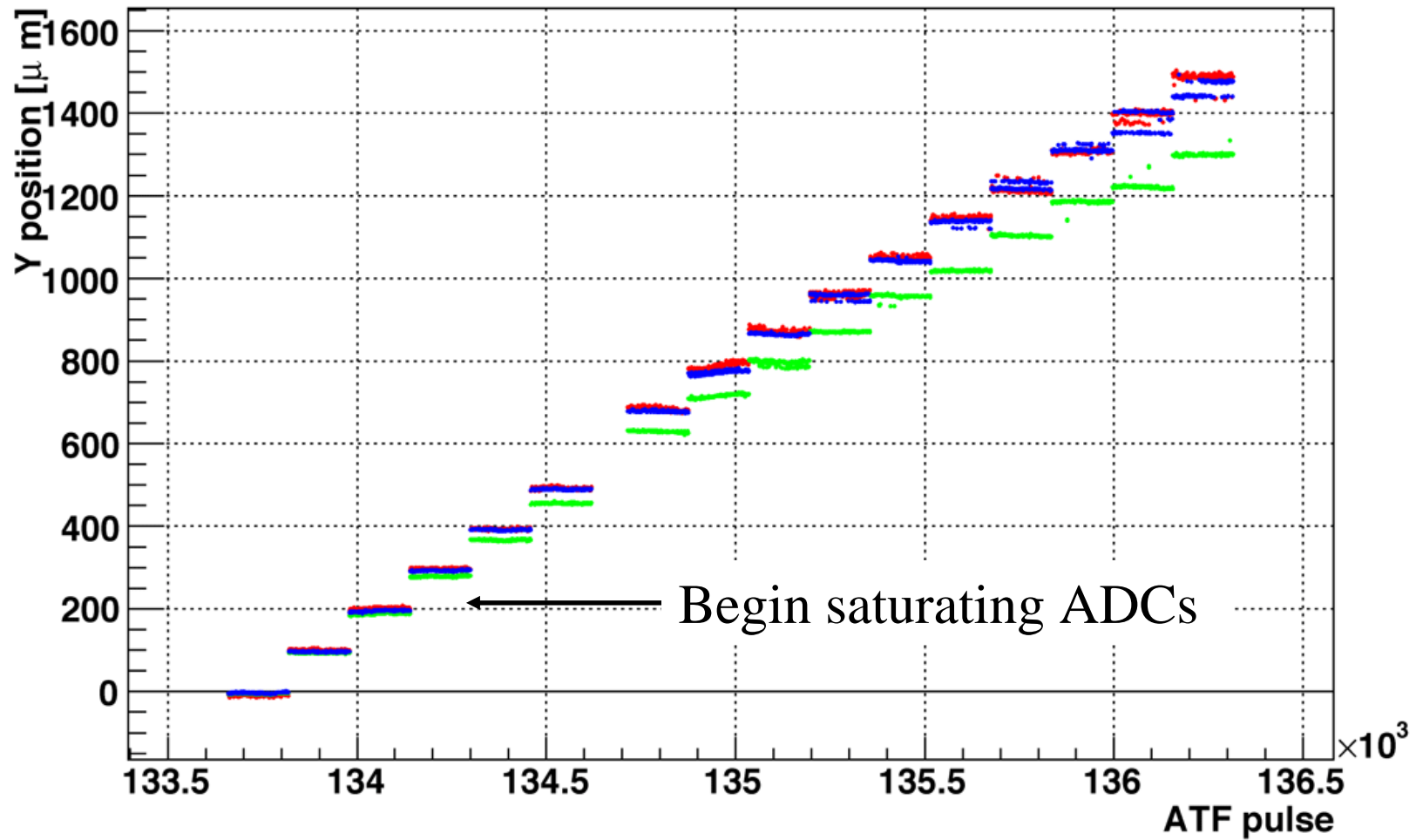Solid line is the response in channel 2 with no input (terminated)

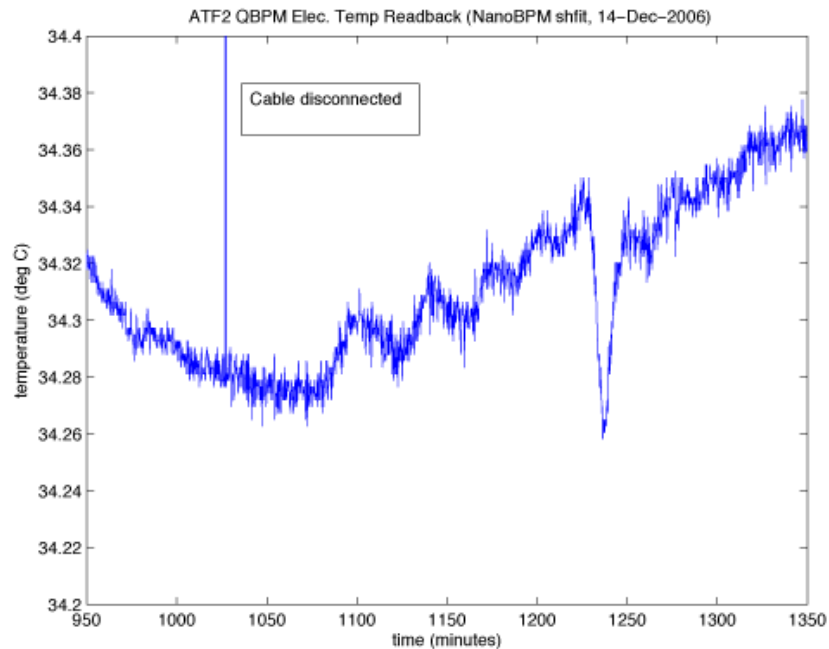*~60 dB channel-to-channel isolation on same board*

Resolution
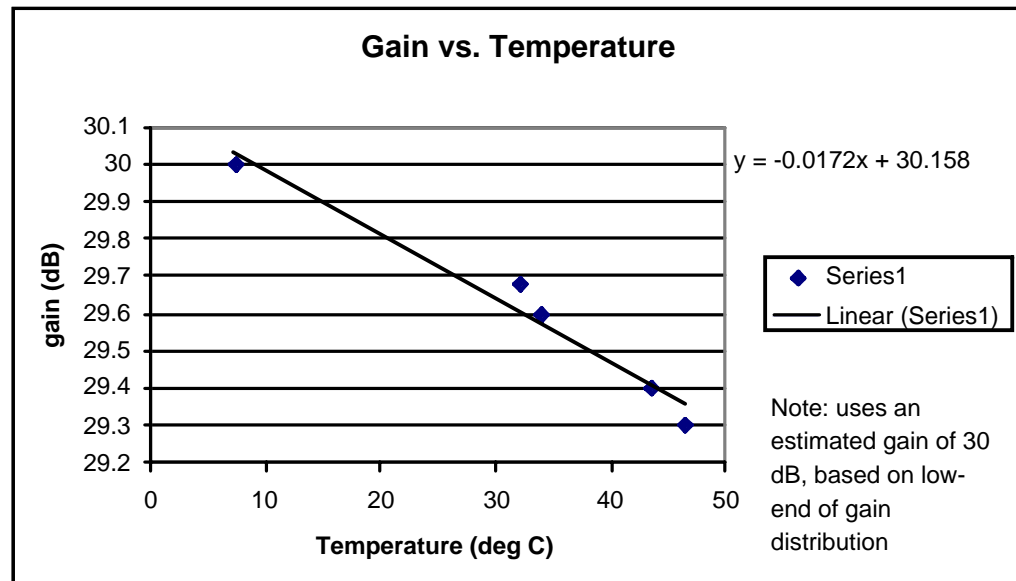
Performance in Saturation

- Digitizer limits +/- 1 V

Begin saturating ADCs

Read Back Results

Temperature data sample from 14-Dec-2006 (NanoBPM shift running ATF2 electronics)

Test ramp using temperature control enclosure at ESB

OPERATION

- ## First pulse calibration
  - Provide a rapid method of obtaining relative x and y positions with the correct sign from each QBPM. Beam only required to be through the first QBPM and Reference cavity.
  - Requires careful setup and measuring of Z positions of QBPMs and REF cavities. Phase advance of RF and IF cable plant must also be measured or adjusted.
  - All this is to be done before beam operation.

First Pulse Calibration

Difference in z position results in non-integer or **delta phase**

QBPM

REF BPM

Downmix Electronics

SIS
ADC
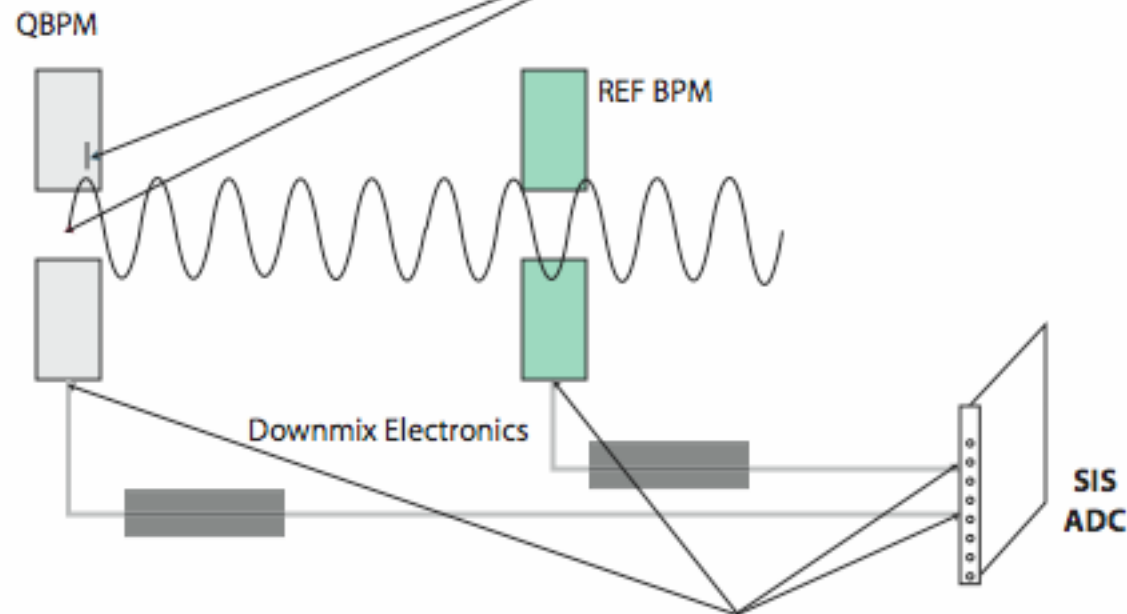
Set equal, or precisely determine the LO phase and signal path for each BPM

The distance between the reference cavity and a given BPM produces a noninteger cycle of 6426MHz.
This is the phase difference betweent he REF cavity and the BPM.signal phase (**delta phase**).

Calibrate one BPM with corrector ::
This BPM's signal minus its BPM **delta phase** is the **signal phase** for a positive (x and y) orbit through BPM
For each downstream BPM, correct its signal with its **delta phase** and compare with the **signal phase**.

A corrected BPM signal that is 0-179° from the **signal phase** indicates a positive(x and y) orbit in the BPM.

Relative amplitude of the position can be produced scaling the digitizers 14bits to +-10mm.

- **Mover Calibration**
  - Use X and Y movers to perform absolute calibration.
  - Use DDC analysis to obtain I and Q phases and produce calibrations. Corrector scans for QBPMs with no movers?
  - Need to improve program to improve response time, and handle saturated signal conditions
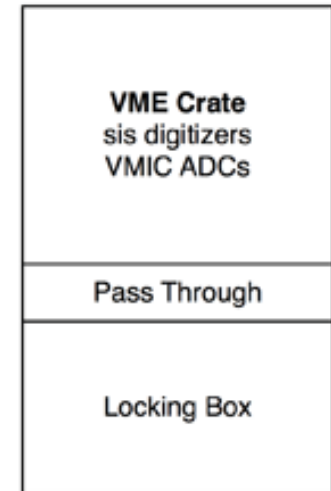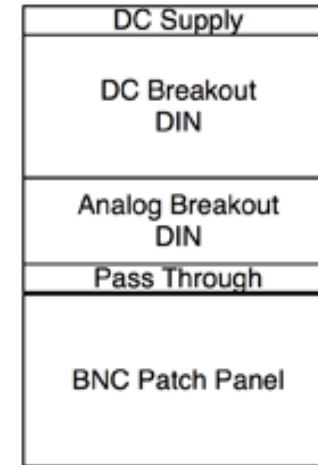
Installation

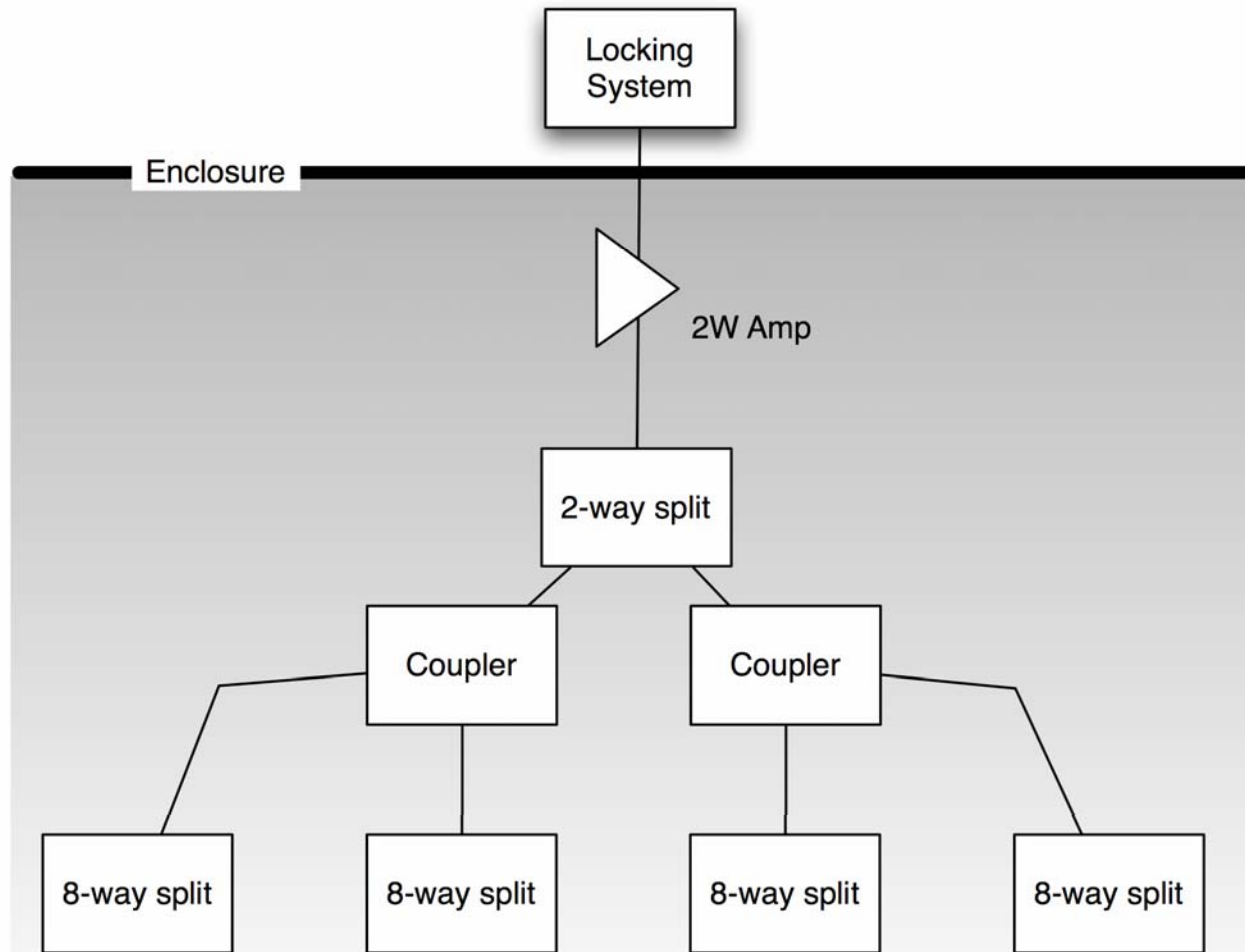- Electronics and hardware
- Software development

Electronics and hardware

- **Components**
  - 38 down mix boxes
  - VME 64x crate
    - VME cpu type yet to be determined. Support vxWorks or RTEMS
    - 10 SIS digitizers (80 channels).
    - 2 analog read back digitizers (VMIC 3122)
  - DC power supply, cables and distribution chassis
  - Analog read back cables and patch panel system
  - 20 MHz signal cables patch panel and jumper cables.
  - BPM magnet mover test bed.
    - ATF2 quad with ,QBPM on magnet mover in ATF extraction line.
  - RF infrastructure (see next)
    - LO/CAL locking system
    - LO/CAL distribution system
      - 2 Watt 6444MHz distribution amp, couplers and splitters

DC Supply
DC Breakout DIN
Analog Breakout DIN
Pass Through
BNC Patch Panel

VME Crate sis digitizers VMIC ADCs
Pass Through
Locking Box

RF Infrastructure in tunnel

Software development

- EPICS IOC for VME control.
- Single pulse readout.
- Magnet mover calibration.
- Position calculation. DDC analysis for normal and saturated BPM signals.
- Calibration tone amplifier gain monitoring.
- LO, CAL power and temperature monitoring.
- EPICS communication with ATF control system.

Delivered

- 38 Down mix boxes
- 10 SIS modules
- 2 Analog input modules
- DC power distribution
- Analog distribution
- LO locking box. (Tested during Dec. run) Still need to add CAL tone locking system

Still to go…

- Need detailed information on rack locations, penetrations into the housing, and cable routing in the tunnel before finalizing cable plant for LO and CAL systems
- Select VME crate controller
  - RTEMS or vxWorks
- Software development
- Test bed setup. Ready for spring '07 testing.
  - Test first pulse and mover calibration schemes

EXTRA: Detailed RF Dist. Path