Readout of Zeus RADFET System

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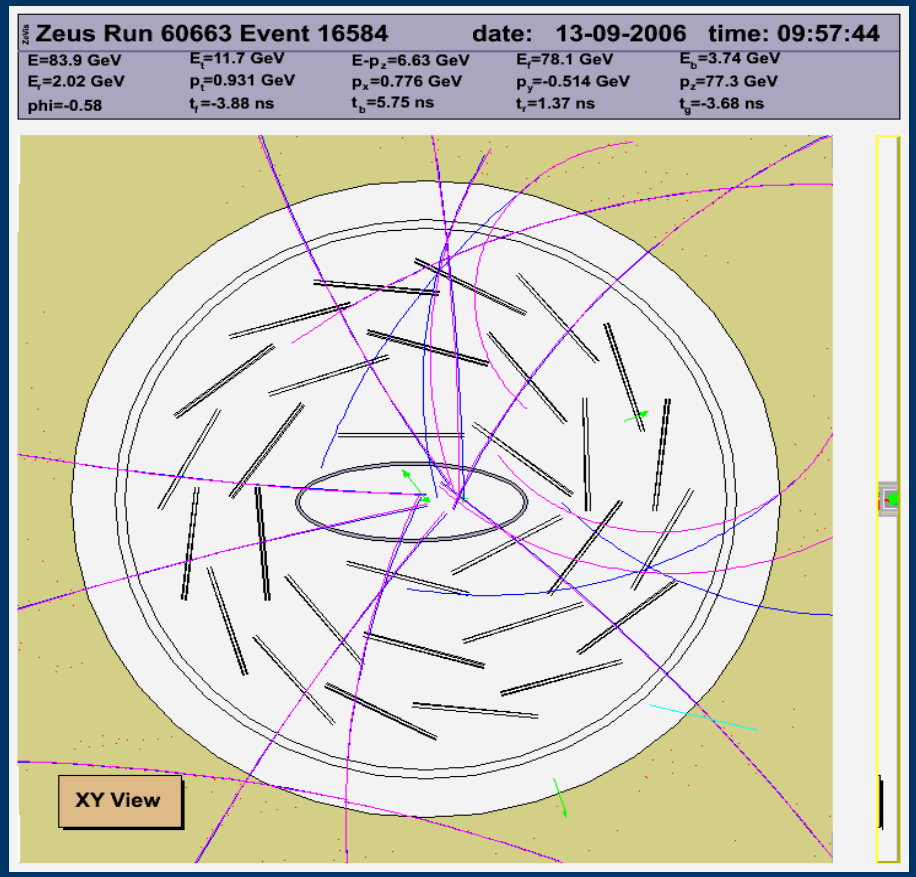
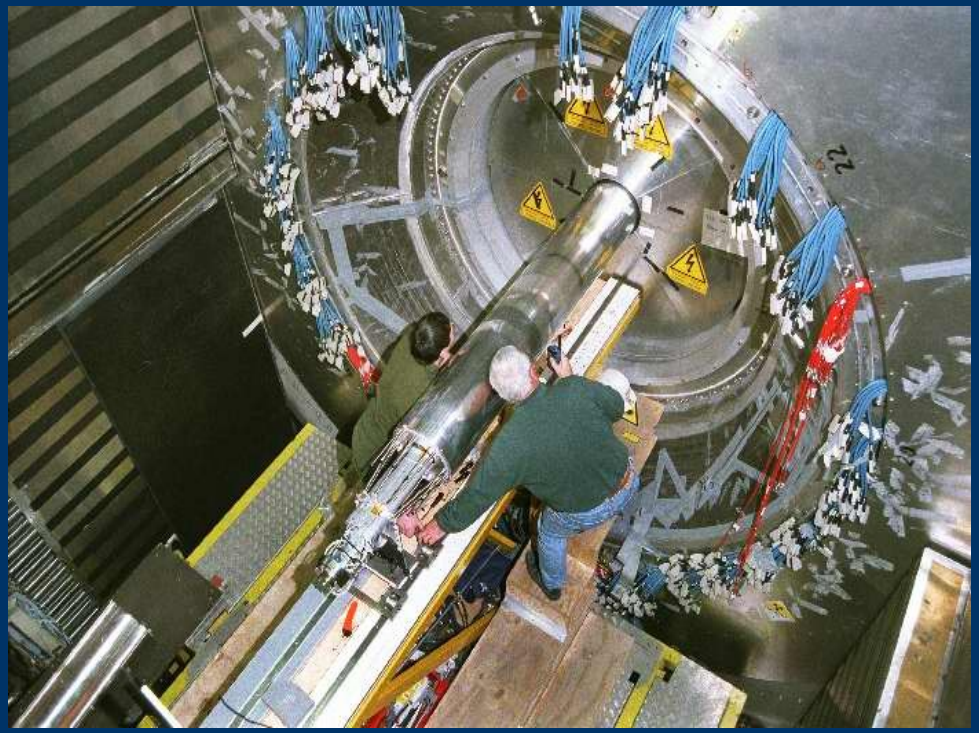
- Overview on background radiation at Zeus
- Radiation monitoring with RADFET system
- Handling of RADFET data using MySQL
- Integration into MVD DQM framework

Micro Vertex Detector @ Zeus



XY view of MVD Barrel Section

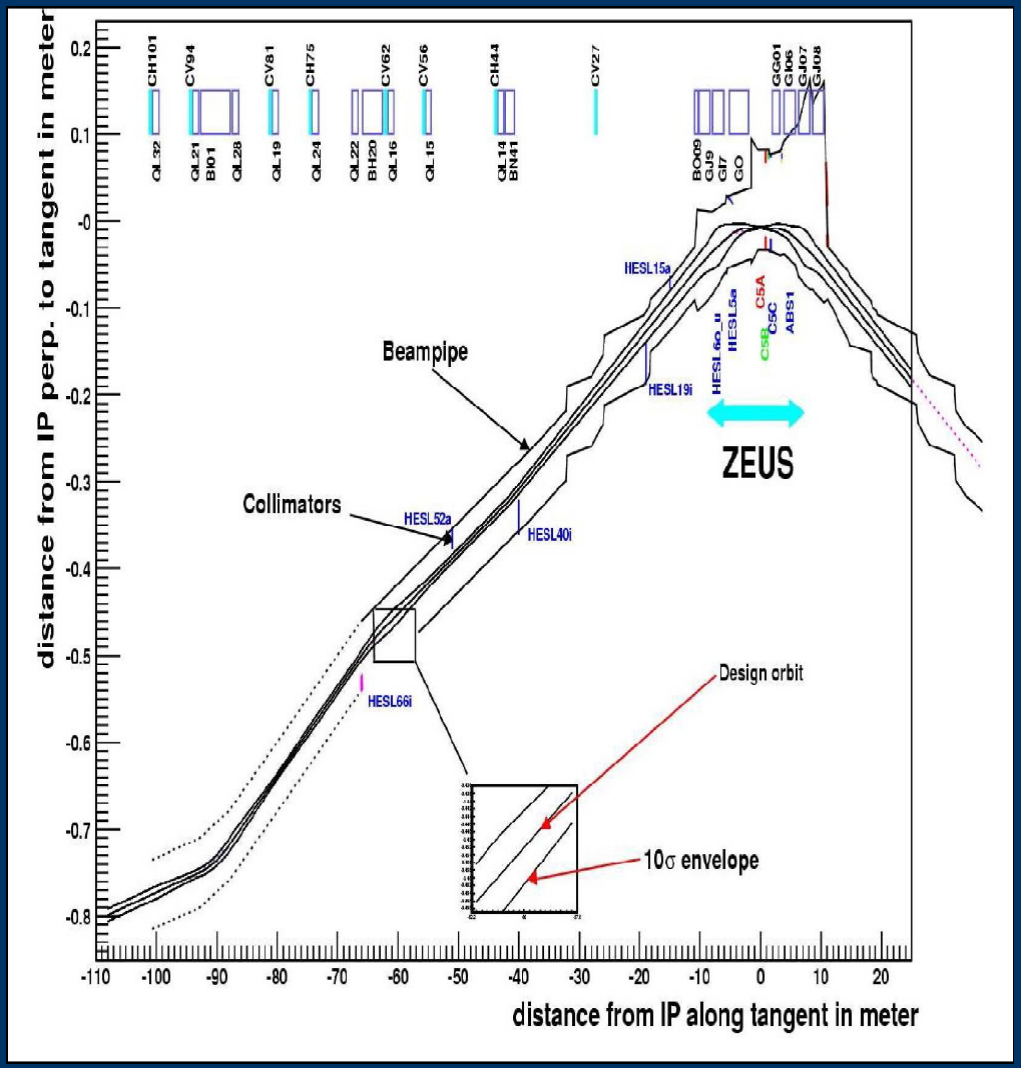
MVD Installation at Zeus in 2001



Background Radiation At Zeus Overview

- In direct vicinity of beam pipe total ionised radiation is dominated by background radiation.
- Sources of background radiation:
  - Off momentum electrons/positrons
  - Direct and backscattered synchrotron radiation
  - Proton beam-gas events
- MVD sensors and readout electronics suffer from prolonged exposition to background radiation.

Synchrotron Radiation

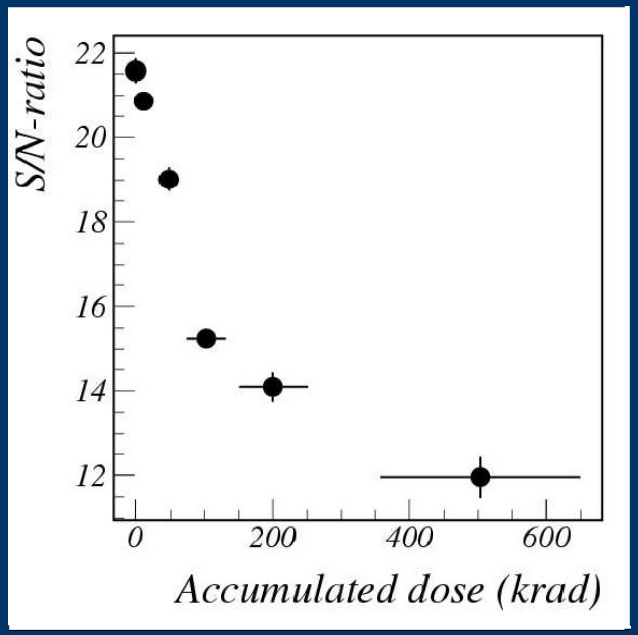


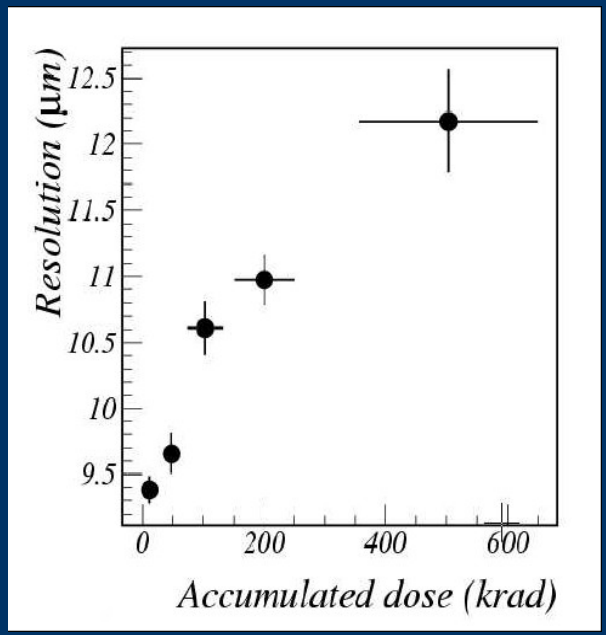
- Direct synchrotron radiation is emitted from lepton bunches in field of focusing magnets.
- Shielded from touching anything near interaction region by collimators.
- Backscattering of photons to IP region in interactions with absorber material.
- Reflected synchrotron radiation needs to be shielded before hitting beam pipe (particle sprays).

Irradiation Damages on MVD

Irradiation and test beam studies with prototypes lead to conclusion:

- Front end chips for silicon strip readout (Helix 3.0) deteriorate under ^{60}Co photon irradiation (S/N, spatial hit resolution).
- Bulk damage in active layer of silicon strips (300μm) increases leakage current (electronic noise)



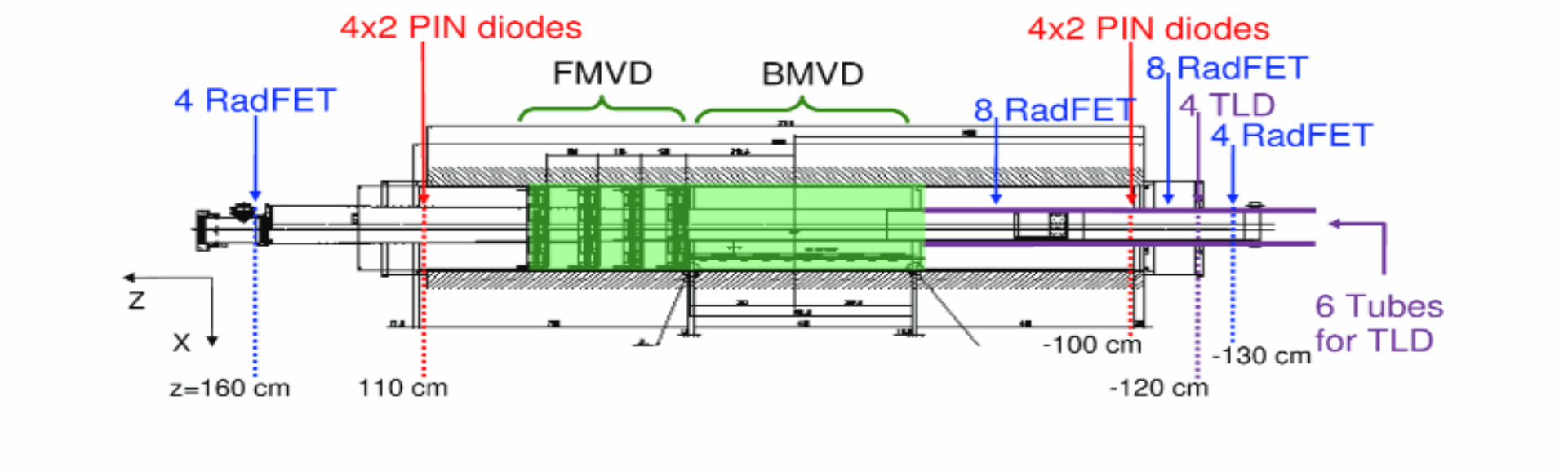


PhD Thesis J. Velthuis

Radiation Monitoring with RADFET System

- Radiation monitoring allows MVD operation under controlled conditions:
  - Protect MVD from persisting high levels of background radiation
  - Interplay of beam alignment, shielding effort, level of background radiation
- RADFET System measures accumulated doses in the vicinity of beam pipe on a timescale from minutes to years.

The RADFET System



- 24 RADFET's placed at beam pipe
- 16 RADFET's in rear part of MVD
- Also other systems visible:
  - PIN Diodes
  - TLD

Handling Of RADFET Data (1)

RADFET Data is currently stored in logfiles starting in mid 2004.

04.10.14 00:04:00 - Opening new logfile: /usr/users/radmon/vers/log/20041014.log
04.10.14 00:04:00 - ADC Voltage Measurement (Volt):
- ADC0: 9.708, 9.149, 8.763, 9.213, 9.577, 9.127, 9.113, 8.817.
- ADC1: 9.262, 8.412, 10.471, 8.280, 10.036, 7.752, 10.479, 8.316.
- ADC2: 12.254, 9.808, 10.543, 7.786, 6.651, 5.409, 9.590, 7.505.
04.10.14 00:04:00 - ADC Dose Meausurement (krad):
- ADC0: 15.478, 7.494, 2.583, 6.530, 18.522, 6.195, 4.816, 3.371.
- ADC1: 48.632, 54.068, 58.407, 50.620, 54.553, 51.739, 59.954, 55.120.
- ADC2: 77.530, 59.124, 61.796, 43.260, 26.521, 23.359, 51.068, 40.902.
04.10.14 00:14:00 - ADC Voltage Measurement (Volt):
- ADC0: 9.708, 9.150, 8.763, 9.214, 9.578, 9.126, 9.114, 8.817.
- ADC1: 9.261, 8.413, 10.471, 8.281, 10.035, 7.752, 10.478, 8.316.

Handling Of RADFET Data (2)

Storing RADFET Data in a MySQL database is much more convenient.

```
CREATE TABLE RADFET (
      DateAndTime      DATETIME DEFAULT '0000-00-00 00:00:00' NOT NULL,
      VolCh0          FLOAT    DEFAULT '-1' NOT NULL,
      VolCh1          FLOAT    DEFAULT '-1' NOT NULL,
      VolCh2          FLOAT    DEFAULT '-1' NOT NULL,
      VolCh3          FLOAT    DEFAULT '-1' NOT NULL,
      ...
      ...
      DoseCh0         FLOAT    DEFAULT '-1' NOT NULL,
      DoseCh1         FLOAT    DEFAULT '-1' NOT NULL,
      DoseCh2         FLOAT    DEFAULT '-1' NOT NULL,
      DoseCh3         FLOAT    DEFAULT '-1' NOT NULL,
      ...
      ...
      PRIMARY KEY(DateAndTime)
);
```

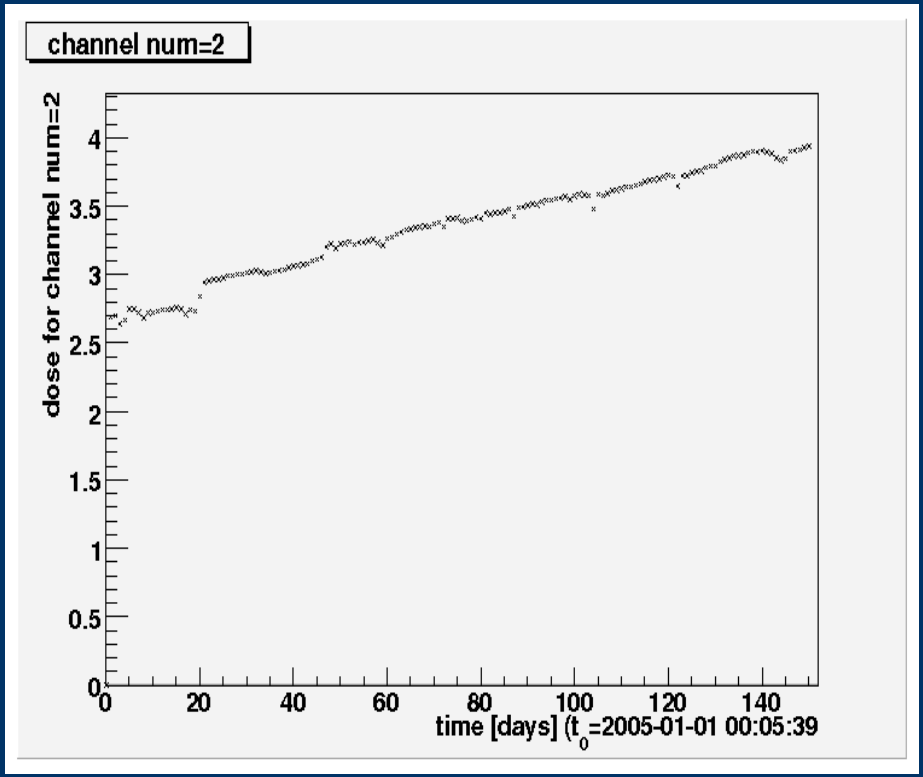
Handling Of RADFET Data (3)

In order to provide a data analysis interface to RADFET table a C++ class was developed.

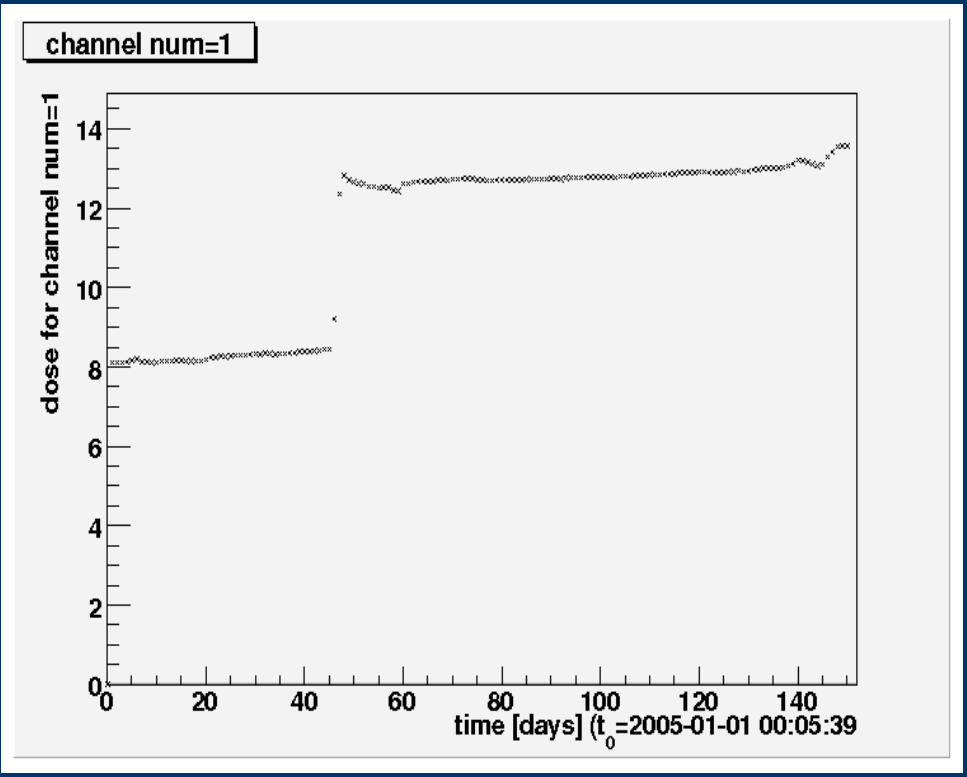
```
...
#include <vector>
using namespace std;

struct MVDRADFETtable
{
  char  DateAndTime[32];        // data and time
  float voltage[24];            // in volt
  float dose[24];               // in krad
};

class  MVDRADFET {

  //Some data members:
  vector<char*>  ListOfMeasurements;
  MVDRADFETtable CurrentEntry;
  int  Pointer;
  //Some member functions
  void Select(char *);
  void Select(char* Start_Date, char* End_Date);

  void Move(int);
  void Next();
  void Previous();
  void Read();

  void CleanListOfMeasurements();
};
```

First Look At Data (1)

Dose in krad



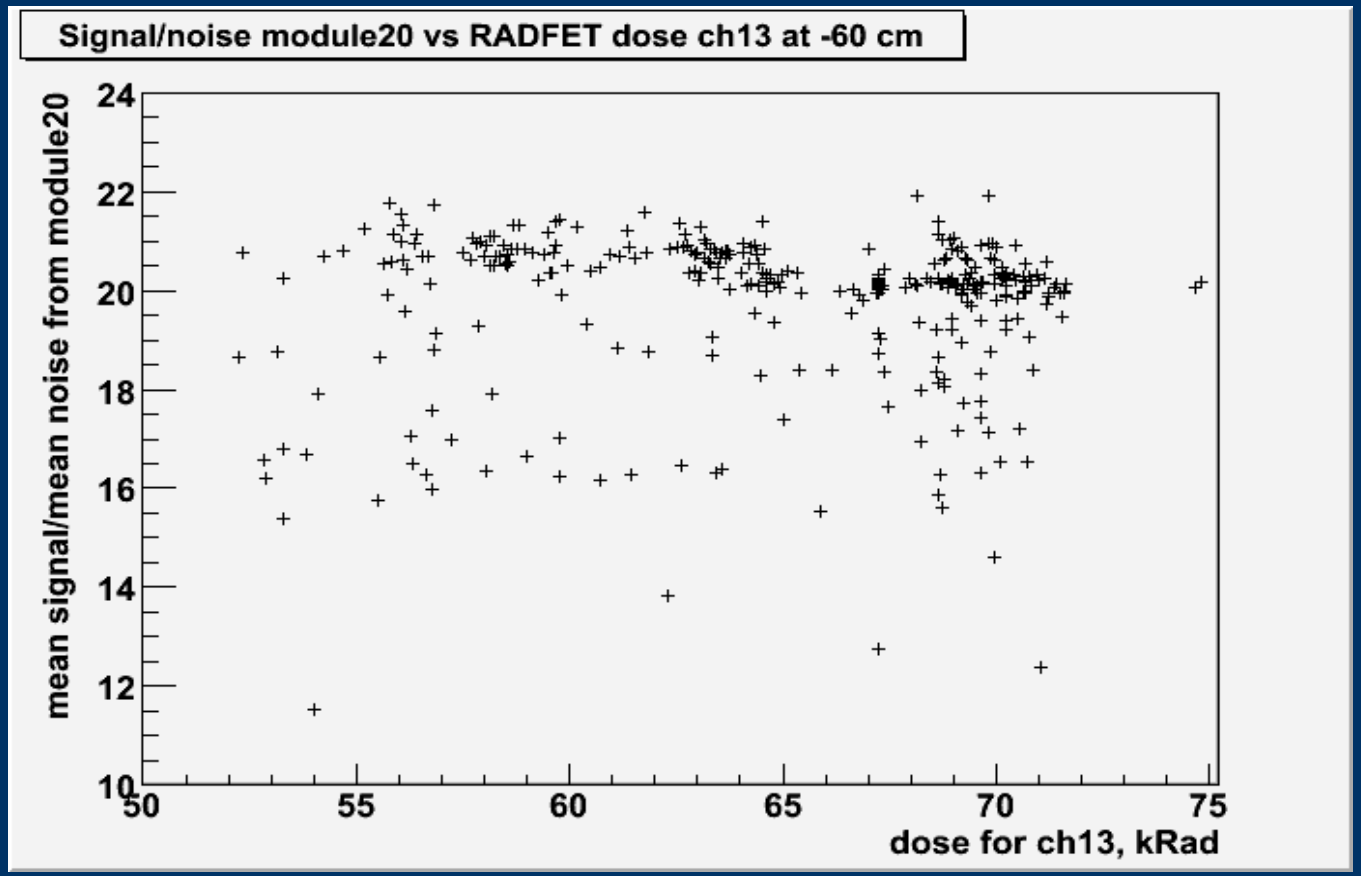
Dose in krad



Ruslan Baimakhanov

- Both RADFET at +170cm along beam pipe, but different angular position.
- On RHS: candidate for partial beam loss event

First Look At Data (2)



- Data: 2004 to 2005
- RADFET: -60cm
- MVD Module ~ -40 cm

Ruslan Baimakhanov

Summary

- RADFET data is fed into a new table (RADFET) on a MySQL database.
- Database can be updated from logfiles using C++ routine logreader.
- Datebase can by accessed within Root using C++ class MVDRADFET.
- Class MVDRADFET provides interface similiar to existing code for other MVDQM tables.
- MVDRADFET is available in compiled form as a shared library.