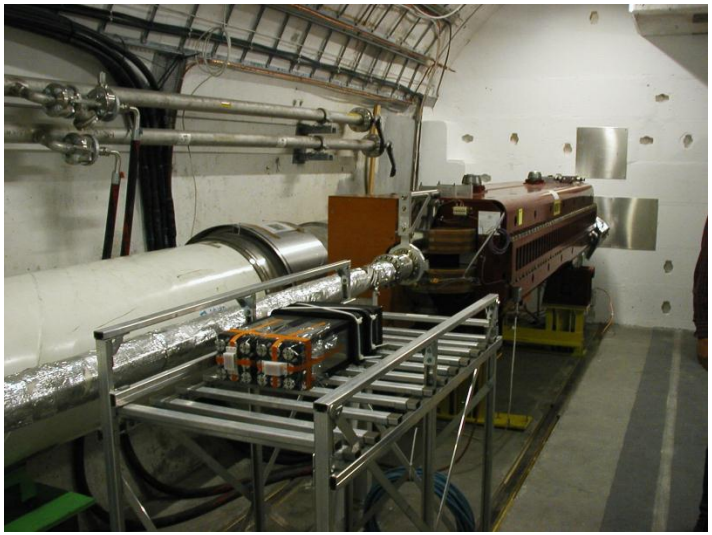
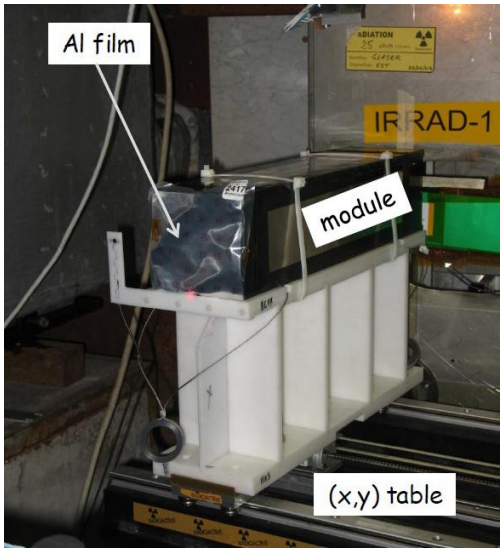
Scanning the irradiated ECAL modules with ^{137}Cs source

Irradiation of ECAL modules



Two Inner type modules are being irradiated in the LHC tunnel upstream of LHCb near the beam pipe. Expected dose by now: ~100 krad



One Outer type module was irradiated at PS to ~2 Mrad

The (macro) consequences of radiation damage for ECAL modules:

1) Overall light yield reduction – not harmful by itself, until < ~300 ph.el./GeV (non irradiated module ~ 3000 ph.el./GeV)

2) Longitudinal non-uniformity of response – leads to resolution deterioration, via longitudinal fluctuations of e.m. shower.

The latter can be studied by scanning with radioactive source, e.g. ^{137}Cs (like in HCAL) *.

The module irradiated at PS was studied at e^- beam; significant degradation observed.

For the modules irradiated in the tunnel a noticeable degradation can also take place (~100 krad)

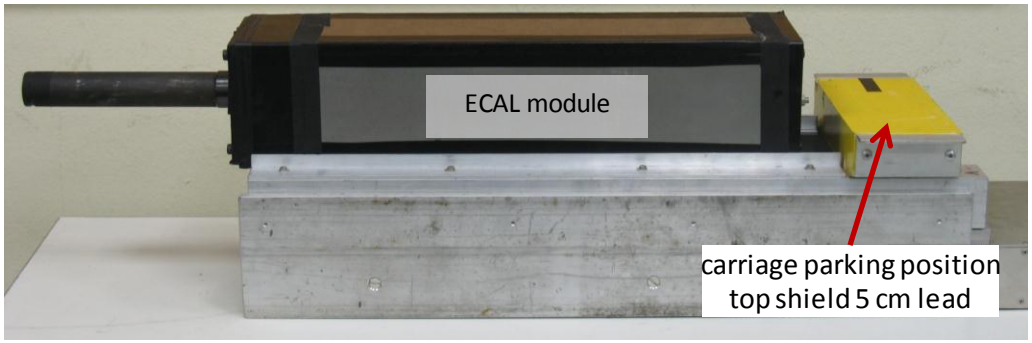
The proposal is to perform the scan of these three modules during the winter shutdown 2011/2012.

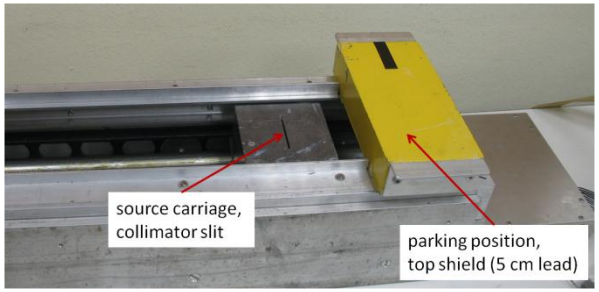
* *The general idea and scanner layout: © Rustem*

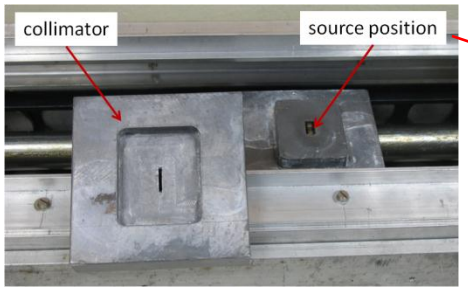
Study of radiation damage of ECAL modules – Cs scan

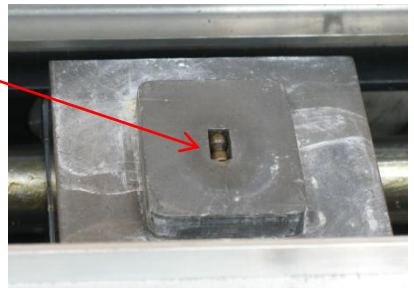
The scanning tool exists.

- Same type ^{137}Cs source as in HCAL
- Carriage with collimator; remotely controlled motion
- PMT anode current (DC) readout, like in HCAL









Cs scan procedure – proposal

- Preliminary, the scan will be performed in February 2012.
- We have to scan total of 5 modules: the 3 irradiated and 2 reference, Inner and Outer types.
- One source passage back and forth takes ~ 8 minutes
  - the whole procedure will take < half a day
- We can either loan from RP the spare HCAL source, 4186RP, or use any of the sources currently installed in HCAL (4145RP or 4146RP). In the latter case, the annual inspection of the HCAL sources can be done the same day
  - to be decided by RP.
- The best place for the test is a room in UX85A.
  - The system will be installed and checked with the reference (non irradiated) modules few days in advance.
  - The irradiated modules will be delivered to UX85A in advance and kept in the radioactive material storage.
- After the test the two modules from the tunnel will be installed back at their place for further irradiation. The module irradiated in PS will be kept at UX85A storage till its planned (?) additional irradiation at PS in 2012.