Symmetric Moeller/Bhabha Luminosity Monitor

Status Report

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Team

- The actual list of SYMB members in Mainz are:
  - Frank Maas (Professors)
  - Sebastian Baunack (Academic staff)
  - Yue Ma (Academic staff)
  - Roberto Perez-Benito (Academic staff)
  - Boris Gläser (PhD Student)
  - Dmitry Khaneft (PhD Student)
  - Eric Göbel (Diploma student)
  - David Rodriguez Piñeiro (Engineer)

Overview

- Mechanics
- Detector Parts
  - Electronics
  - Gain Monitoring
  - PMT
- Simulation MC

Mechanics

Just to remind you...

- Mechanical design finished
- Parts are in the Institute's workshop

(status Nov.2010)

- Mechanics:
  - Crystal Modules: holder mechanically modified,

    Holder removed
  - Gluing starts coming week, need to be tested after

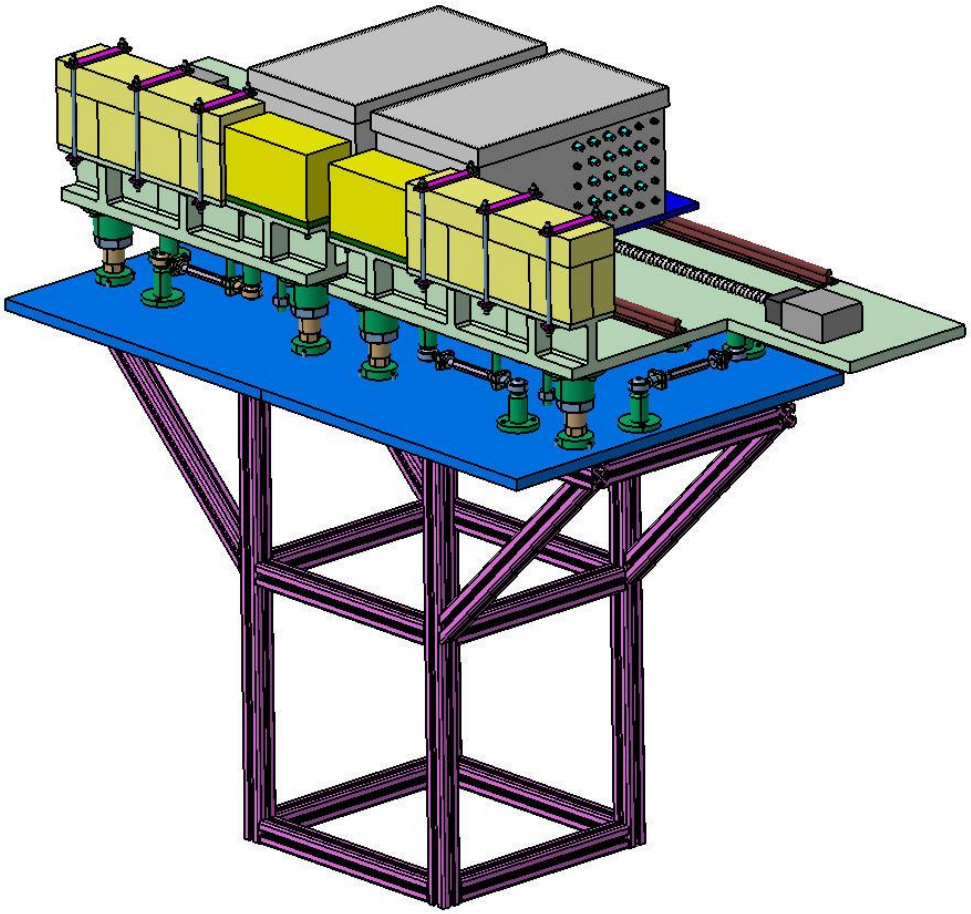
    Two weeks, beginning end of march
  - Need optic fibers system for stability monitoring

    Order for fibers will take up to one month
- Mechanical Support:
  - Parts in institute technical workshop
  - Potentiometer for position readout Mechanical design finished
  - Movable tables on rails, drawings in preparation

    Order for rails will take up to three weeks

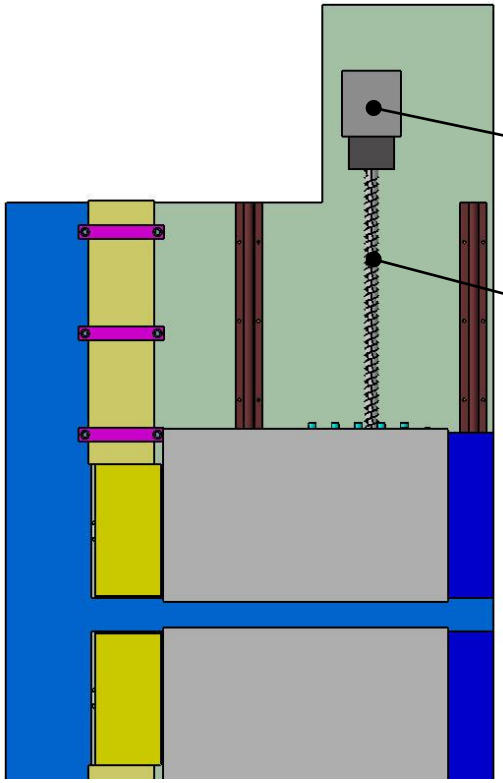
(status Nov.2010)

Mechanics

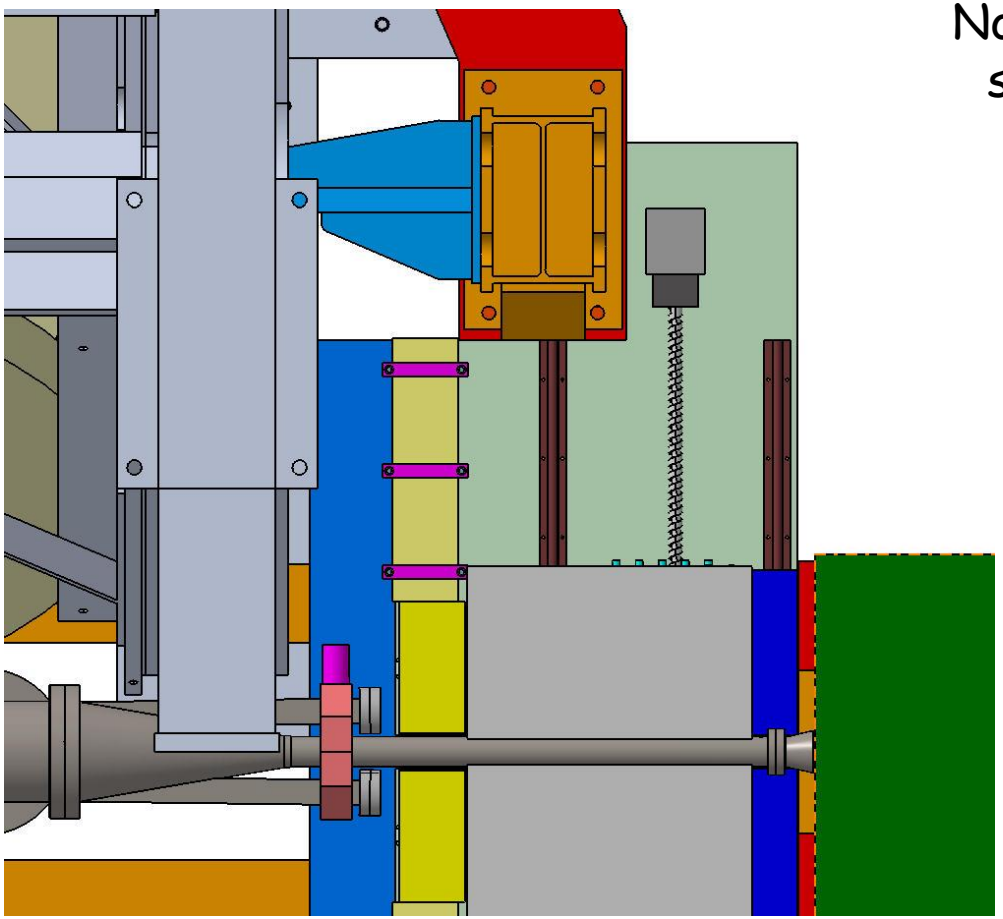


Platform extension

Platform extended to host motor for crystals movement (away from beam)

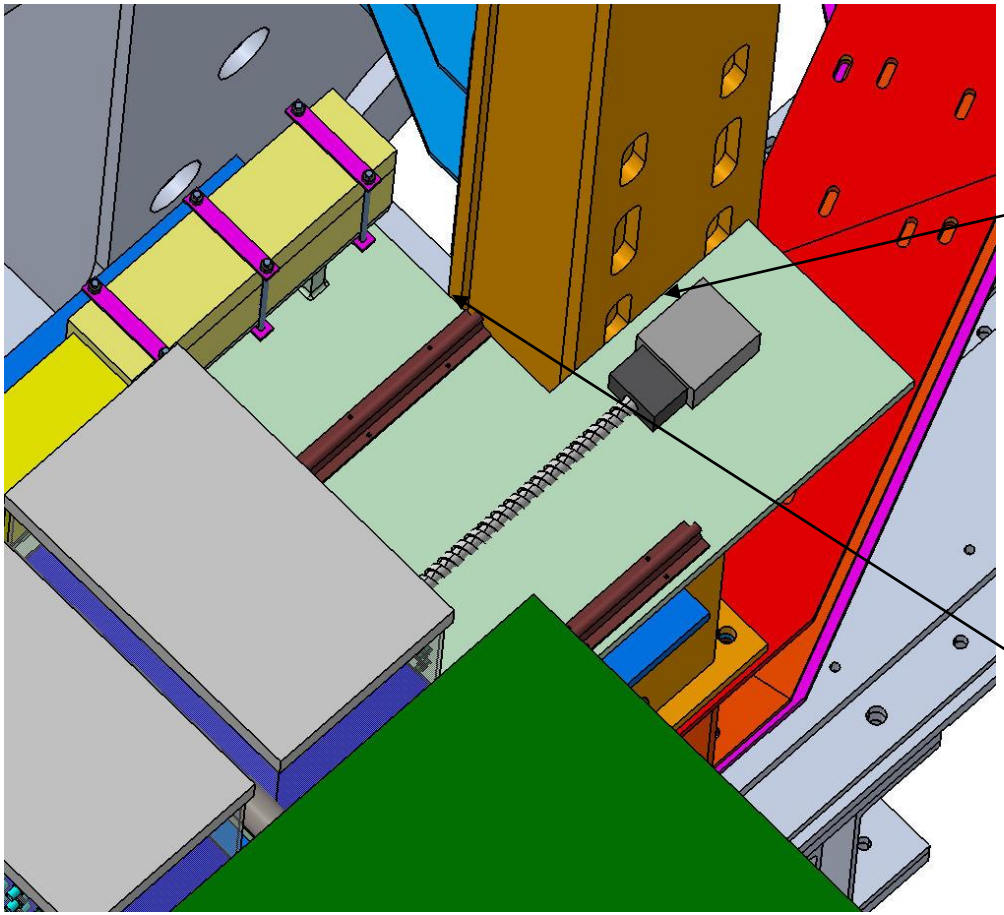


Platform extension

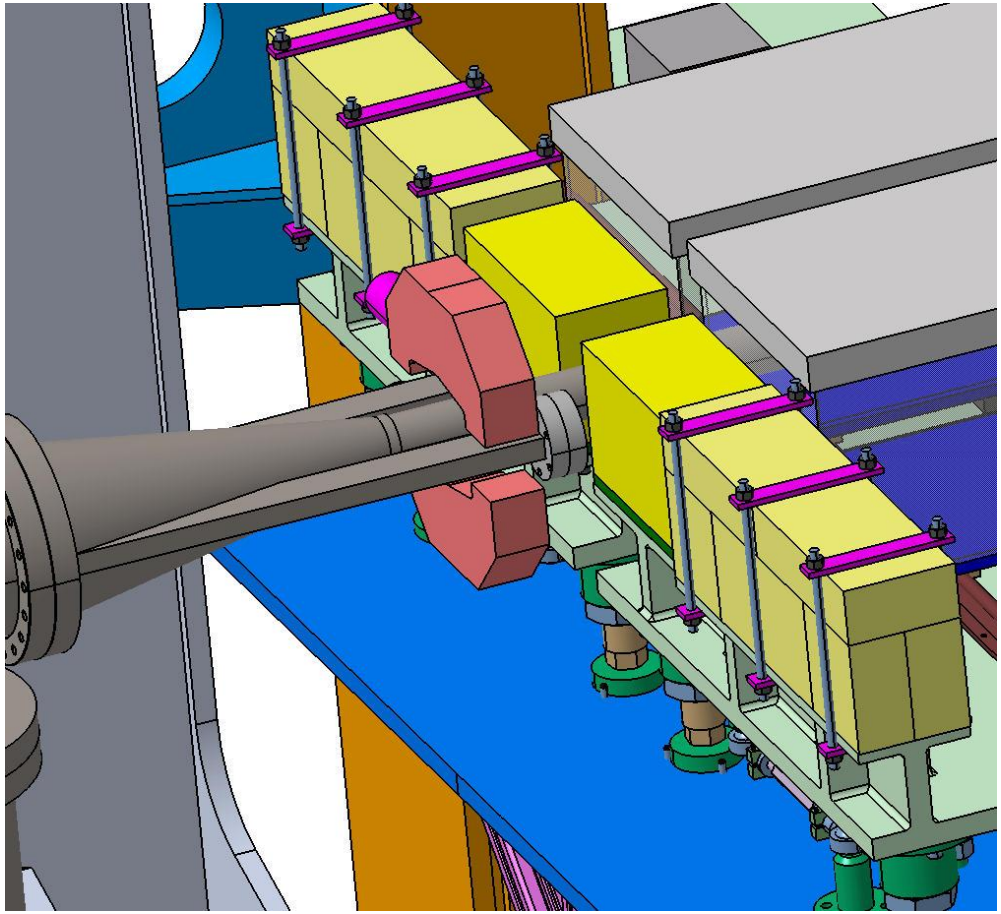


No interference with other subsystems (ToF frame)

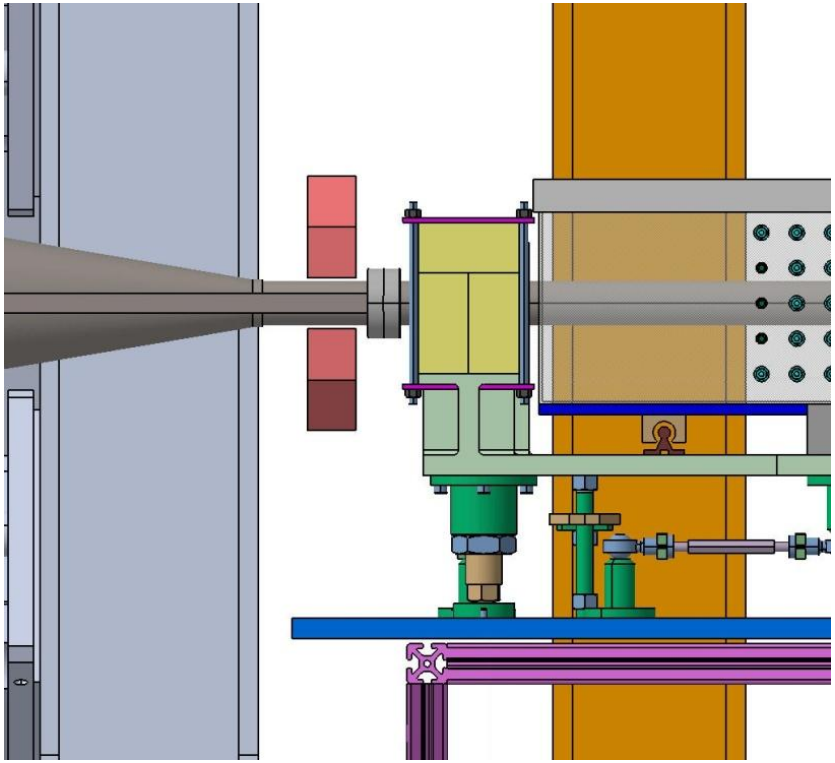
Platform extension



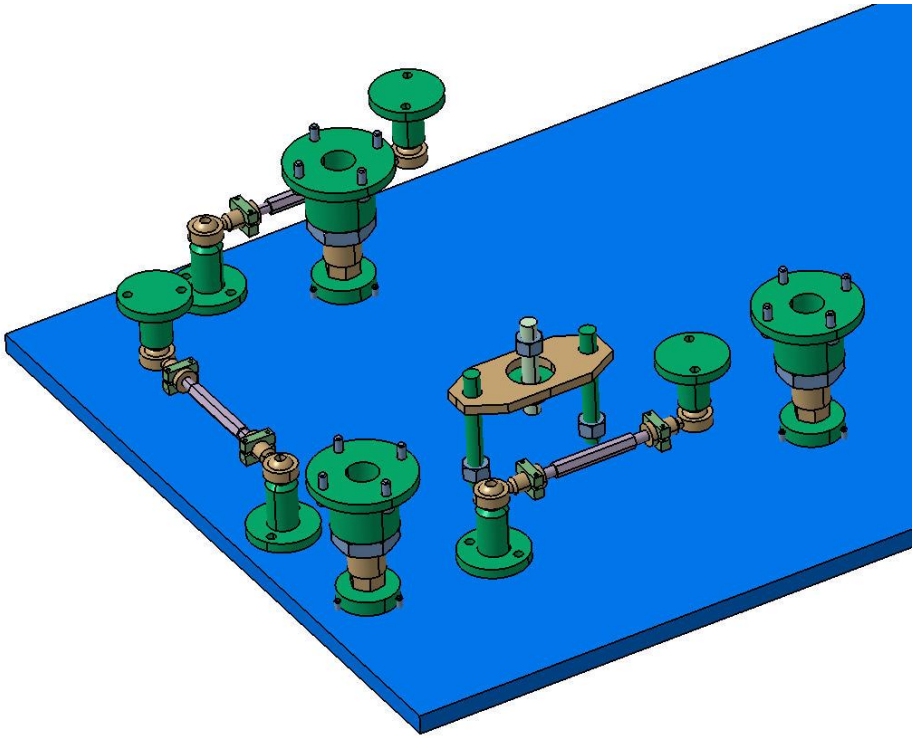
Halo Counter



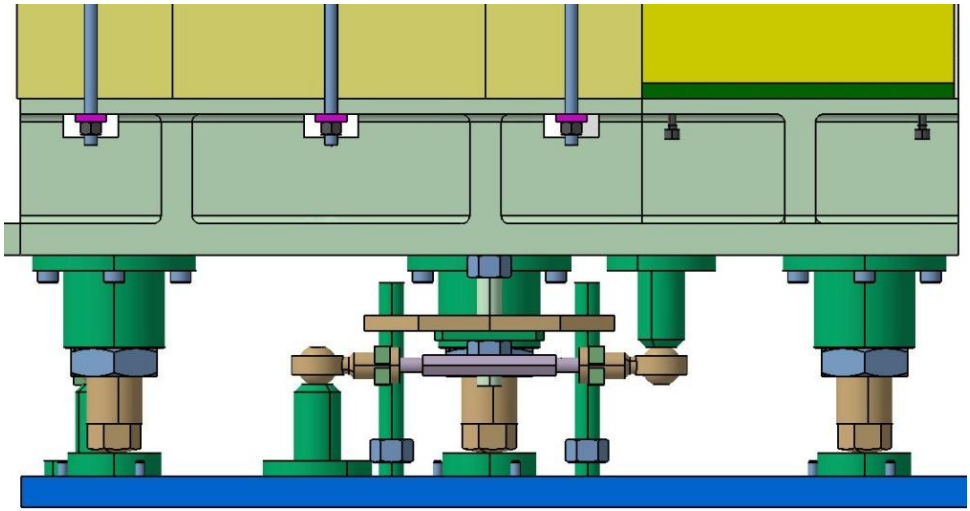
Halo counter supported in our main (blue) platform



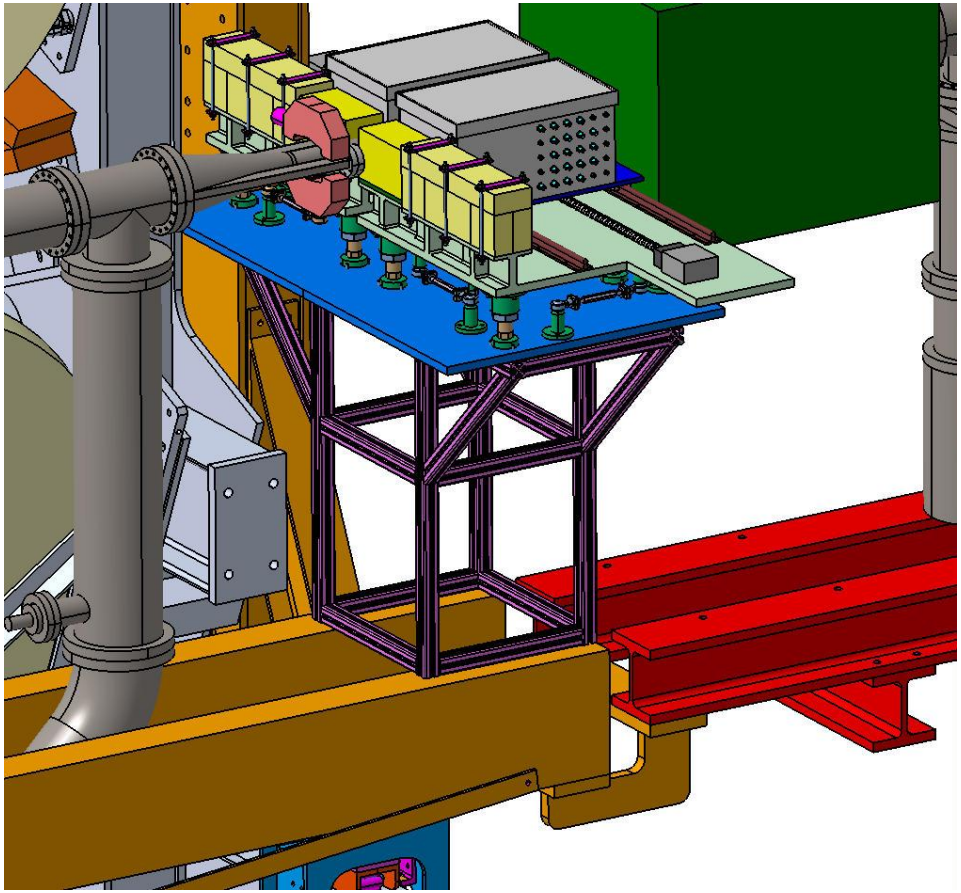
Alignment



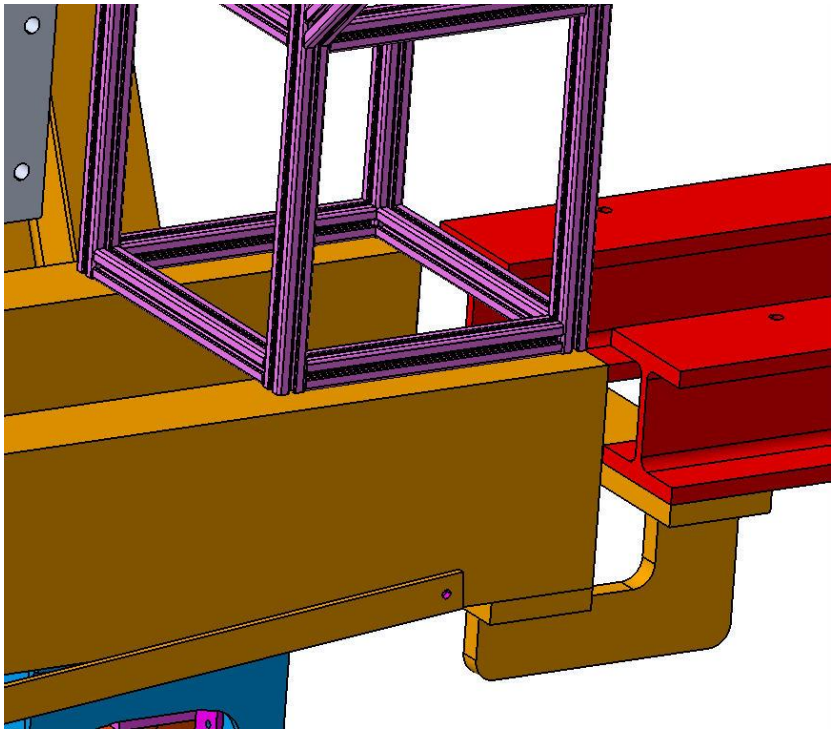
Alignment system made according to DESY MEA2 group



Main Support



SYMB support attached to vacuum system support beams

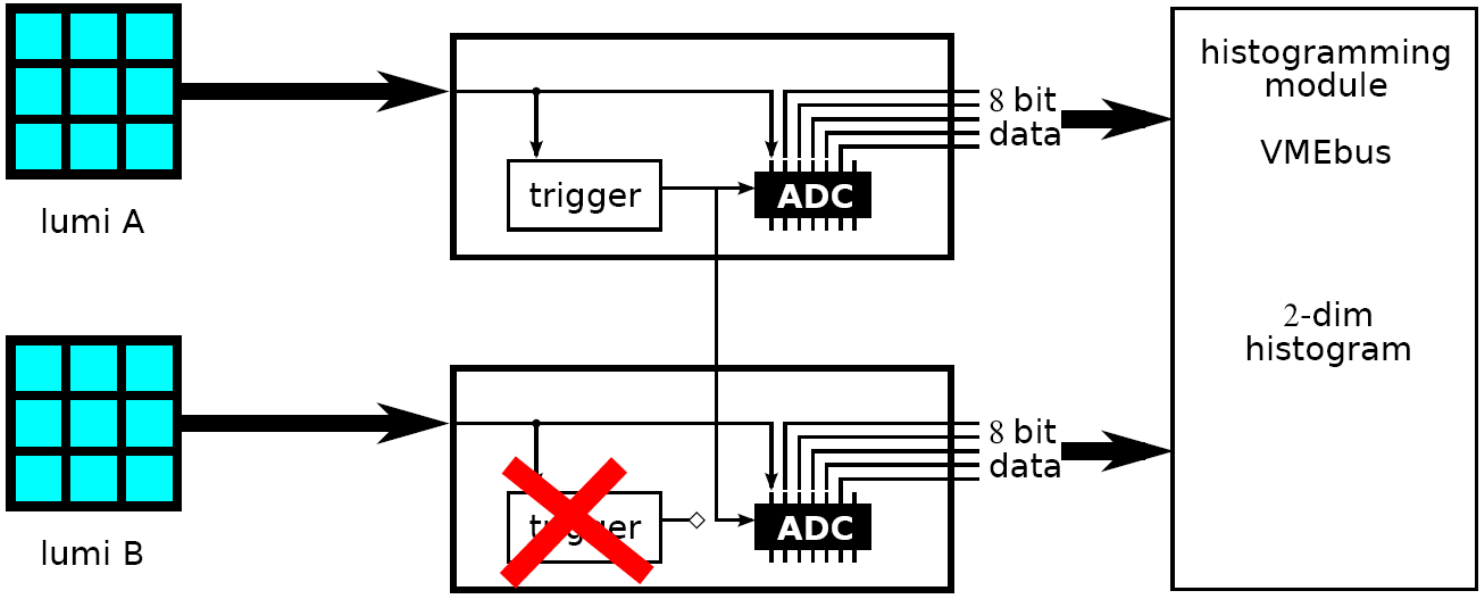


Detector Parts

Data acquisition principle

Three types of triggers

- Lumi A Trigger - Lumi B Slave
- Lumi A Slave - Lumi B Trigger
- Trigger on Lumi A&B



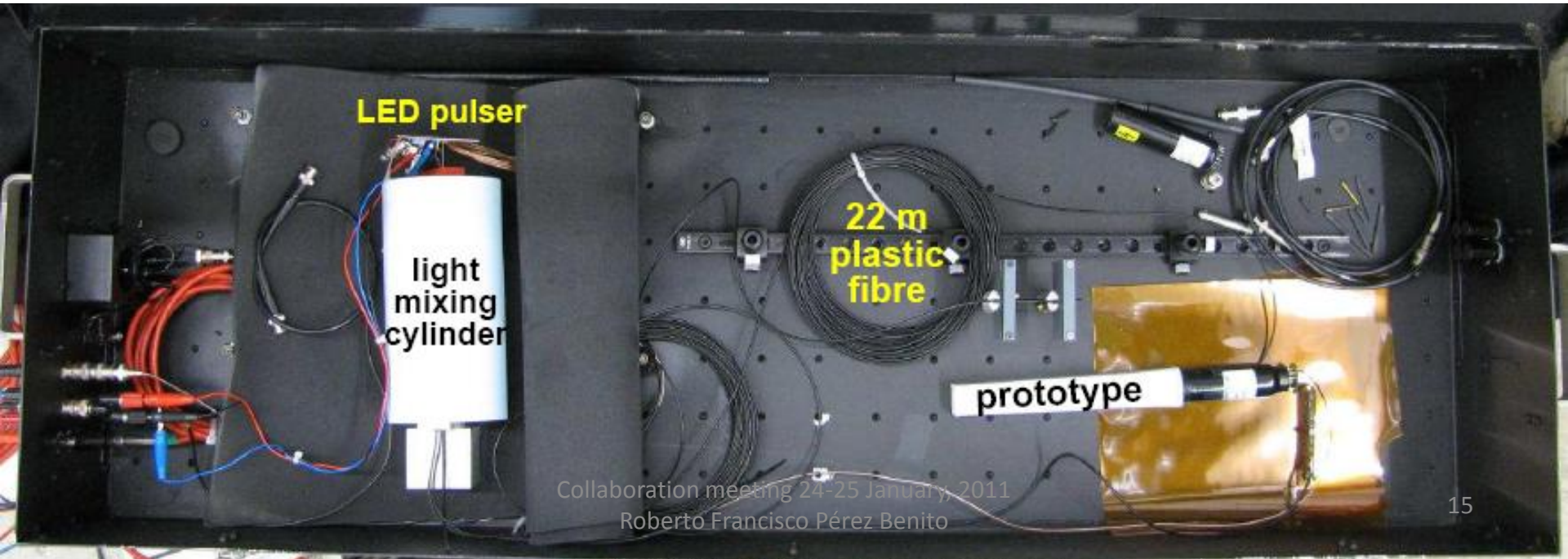
KPH-MZ electronics workshop:

redesign trigger card (by electronics workshop and J. Diefenbach)

build in progress… (no time estimation know)

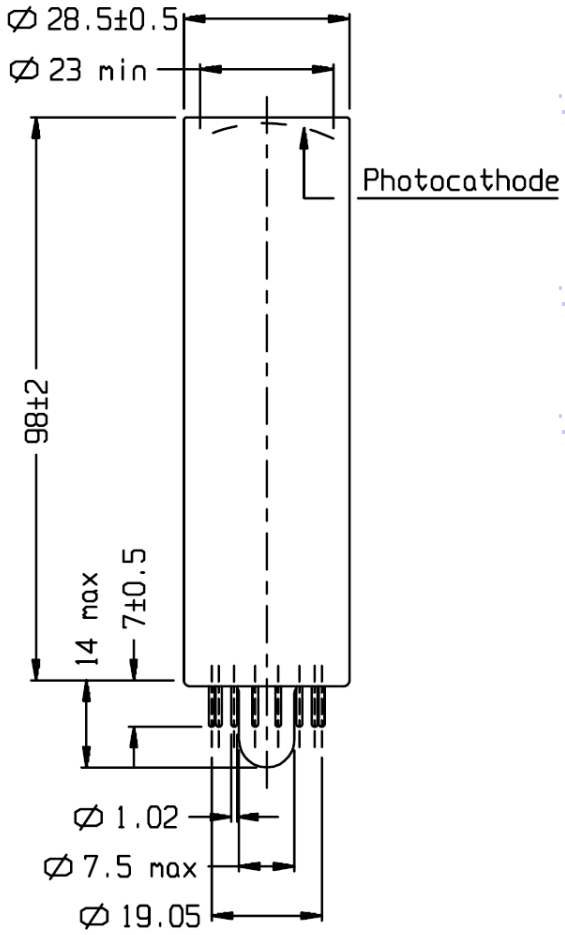
mechanical design for DAQ boards

- **Gain Monitoring** NIM A, 521, 2-3 (2004), 343-360
  - tested Gain Monitor parts in light-tight box
    - LED: use different led – Need to be tested carefully
    - Fiber connector are test, choose and order
      Connectors will arrive soon to Mainz
    - LED driver Board: LDB ready
    - Light mixing cylinder
      LED position's should be designed



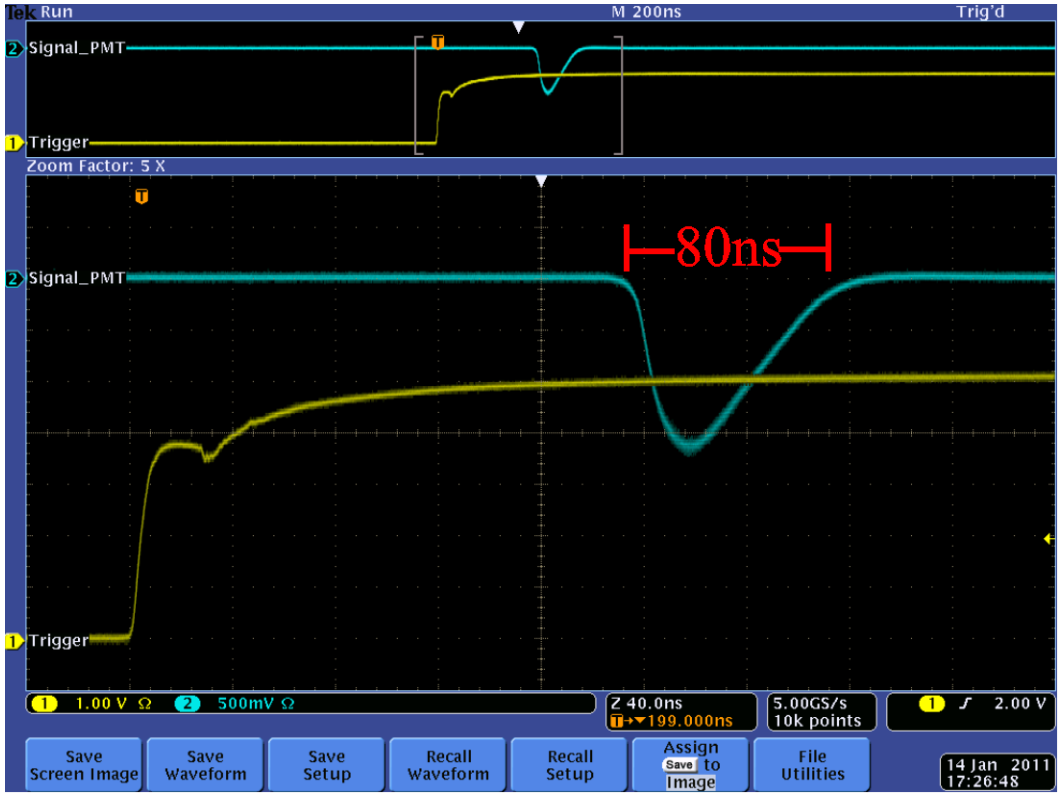
PMT – Type XP2900

PMT documentation



- Test all PMT by A4 Collaboration (June 1998)
  - PMT SN corresponds with electronic SN
    One time not equal (1/21)
  - Define HV for a gain & noise level at this HV
  - Sensitivity characteristics
    - SkB = cathode luminous sensitivity to white-light
    - Sk337= luminous sensitivity for monochromatic light
    - SkCB = luminous sensitivity to blue light
      peaks at around 430nm. (Corning Blue)

PMT Test

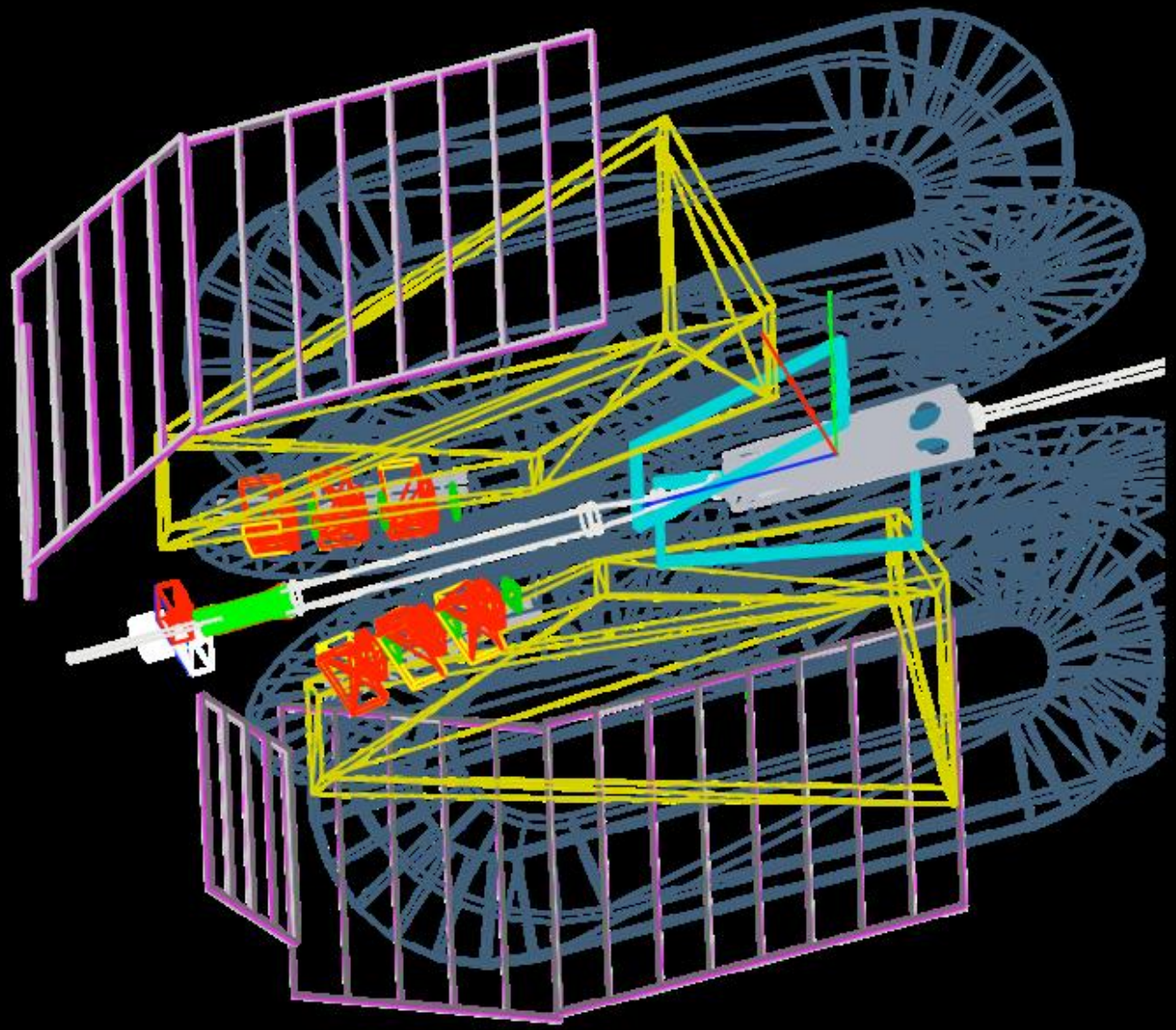


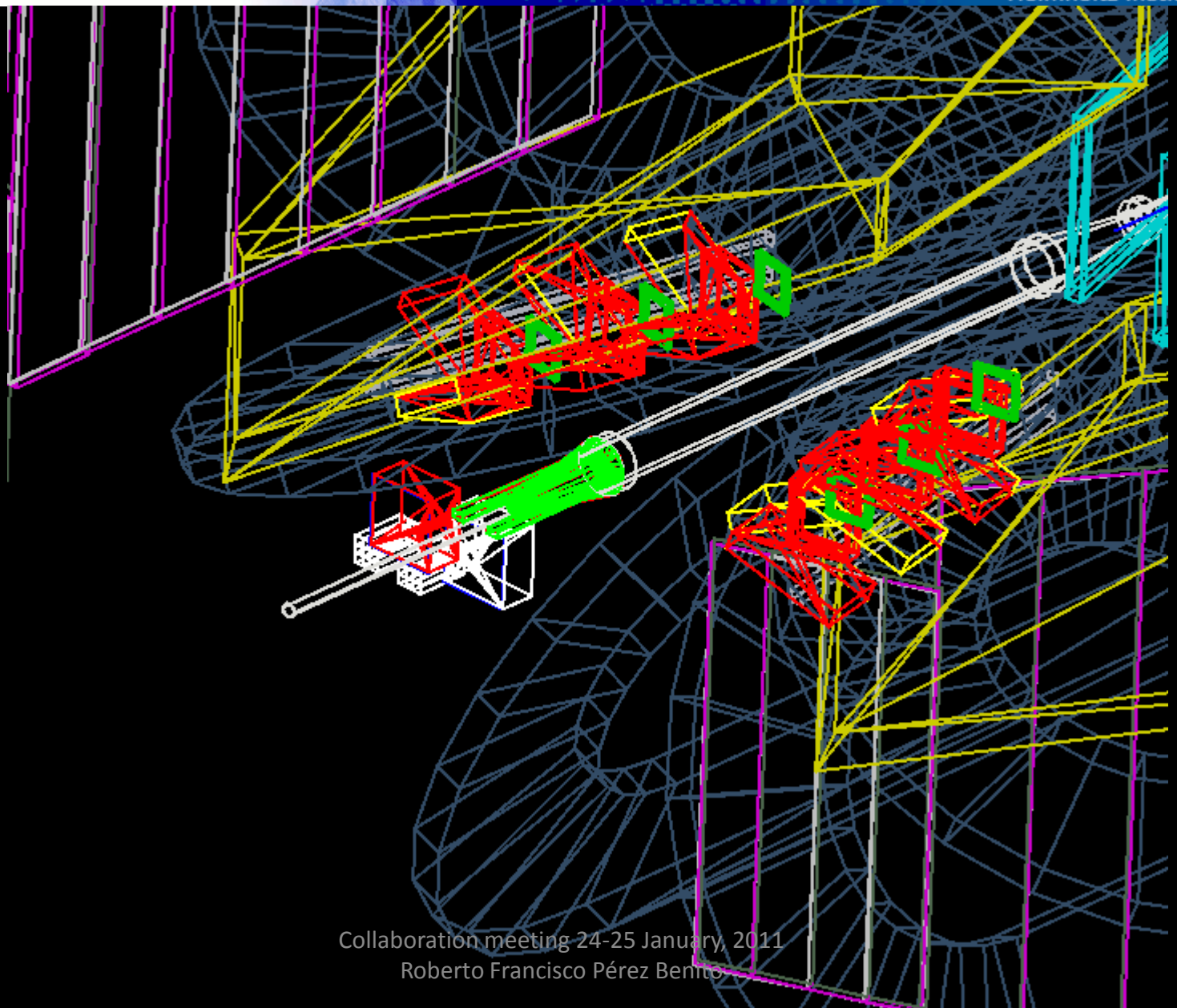
Example plot

- Test setup in light-tight box
  - Same light source
  - Same pulse generator
- At the specific HV same result all PMT signal can be compared

All PMT are tested and ready to be glued on the crystal

- Simulation MC

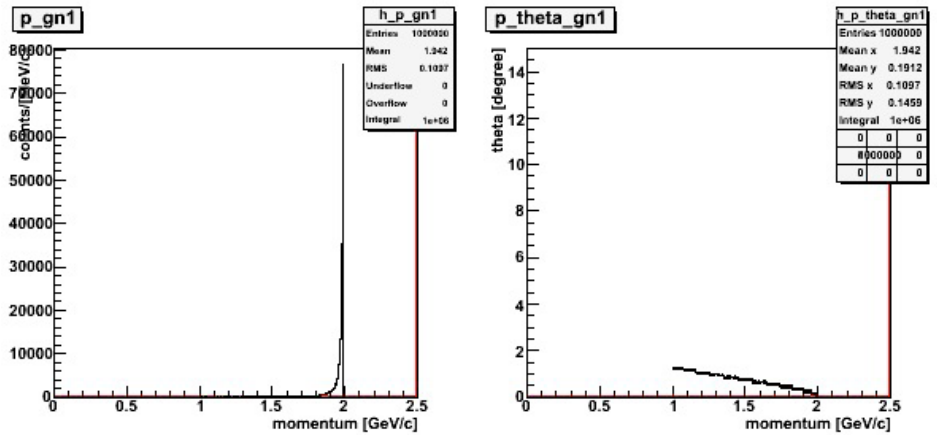


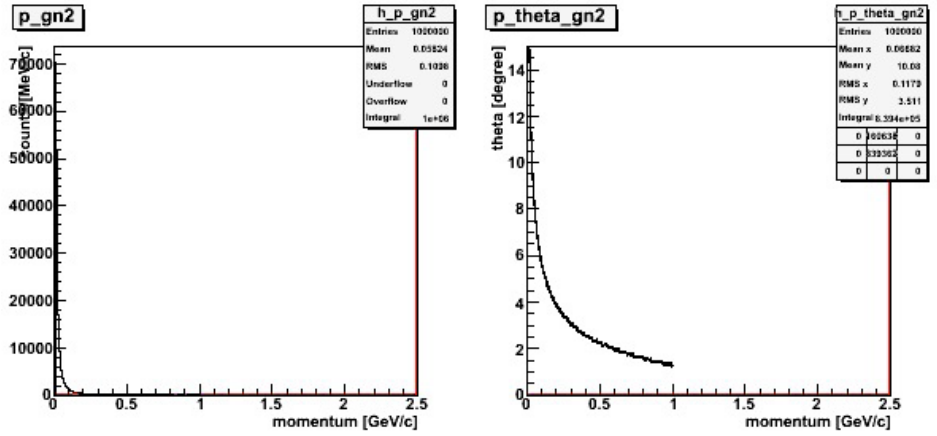


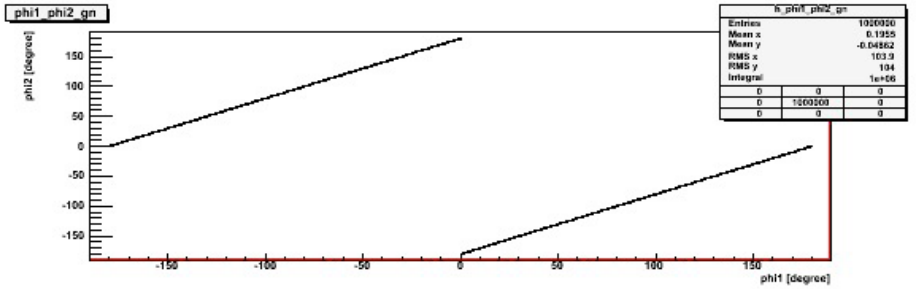
- **Simulation MC** - Olympus G4 package
  - Mainly coded by D. Hassel@MIT
  - SYMB section coded by Y. Ma
- **Simulation MC** - Moeller/Bhabha Event generator
  - Luigi's event generator has been implemented
  - Y. Ma put it into Olympus G4 package

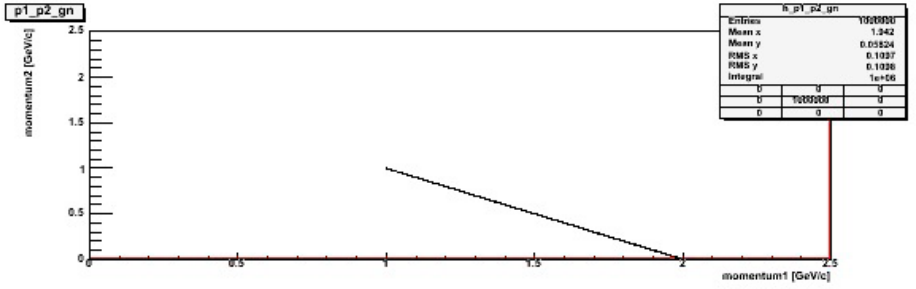
Event generator performance

beam energy : 2 GeV/c
theta : 0.1~14 degree
phi : 2 pi
# of events : 1 million









gn_1 high Energy
gn_2 low Energy

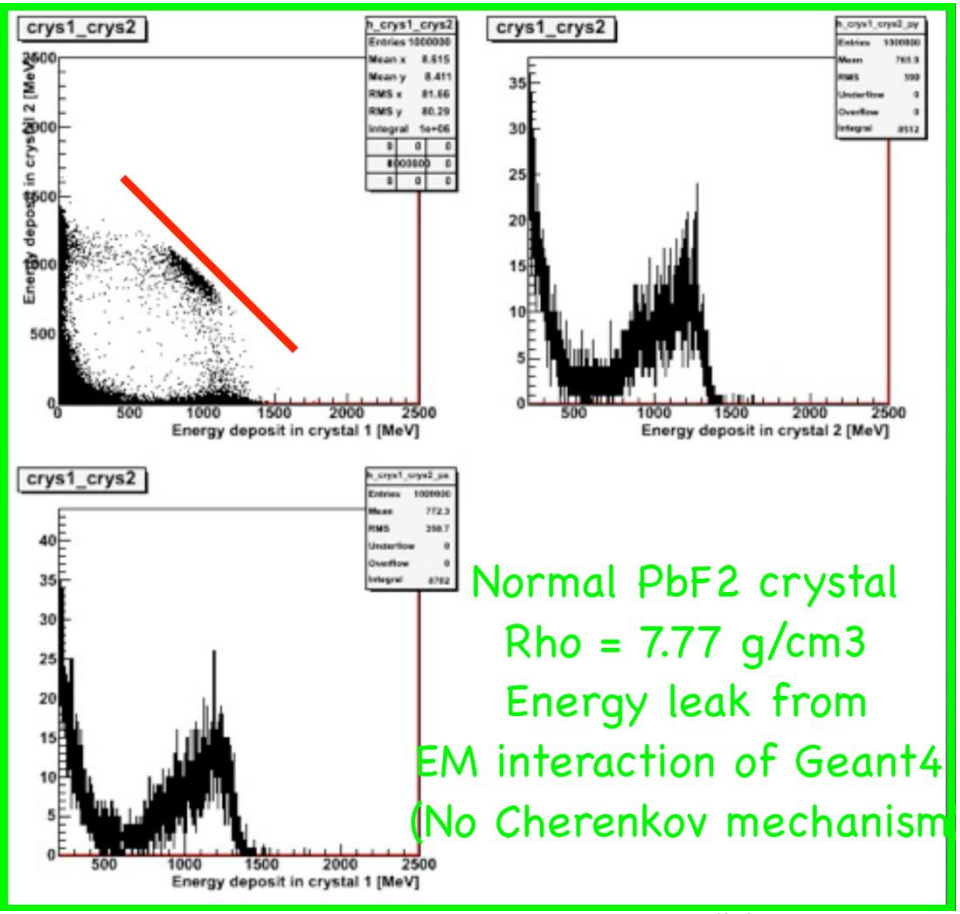
Event generator performance

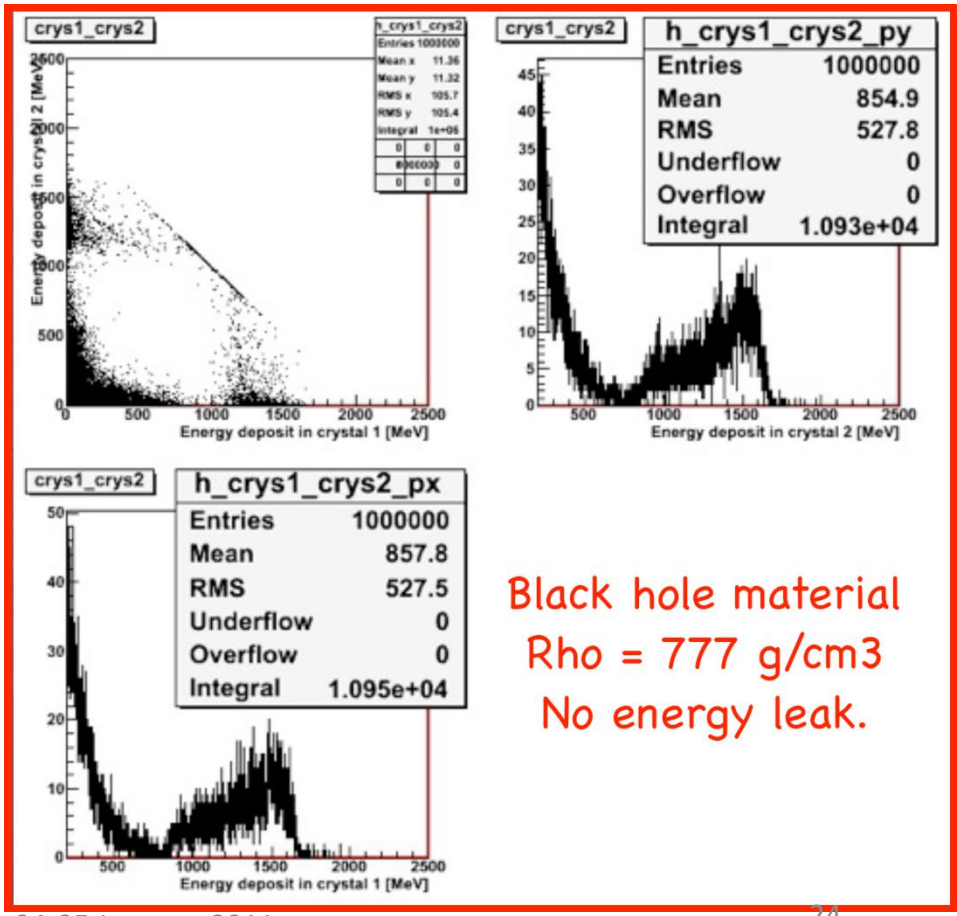
- **Symmetric Moeller/Bhabha Luminosity Monitor** can be use as:
  - Calorimeter - measure energy deposition.
  - Cherenkov – measure angle.
    - Luigi developed a more sophisticated implementation for Cherenkov in Gean4

If Luigi can find time to help us,
we can revisit the simulation within a few weeks

Magnetic field & SYMB pipe effect

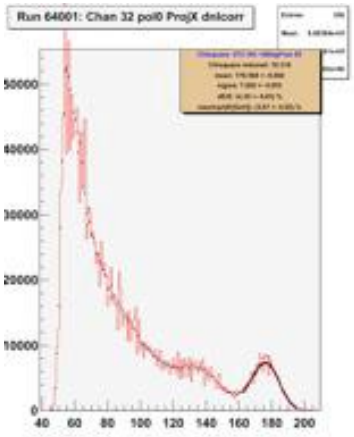
sigma 1mm beam dispersion (x,y)
With vertex distribution in z
Artificial PbF2 : 777g/cm3
(100 times density : black hole)
No collimator





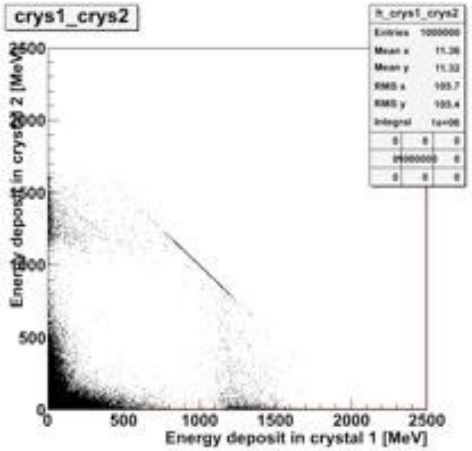
Black hole method

- Use a artificial material to achieve a "super" good energy resolution
- Convolute energy spectrum from A4 data



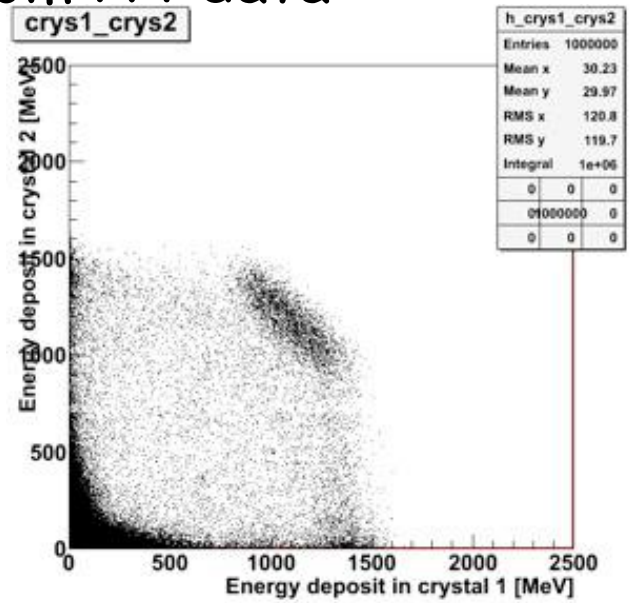
176.6 ADC ch (1.17GeV/c)
fixed shape and width

+



Convoluted to events with
E>700 MeV

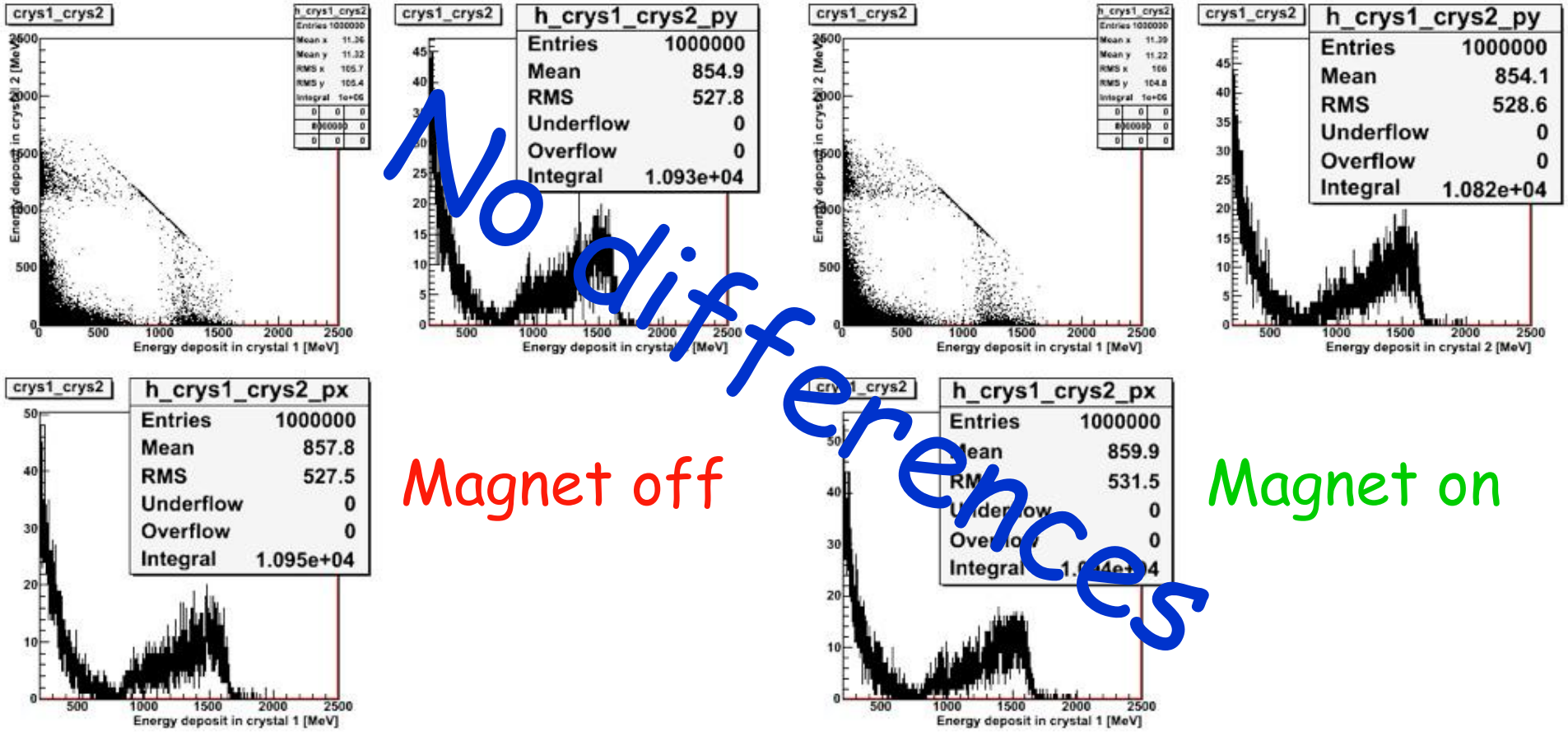
=



"hopefully" not necessary to implement cone development of Cherenkov light

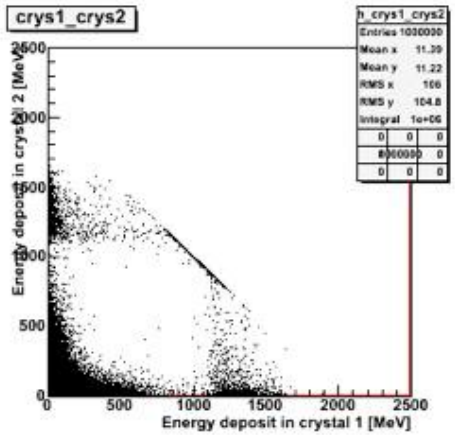
Magnetic field effect

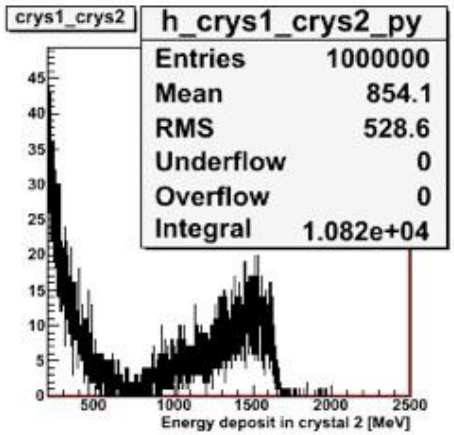
(No SYMB pipe, Not convoluted)

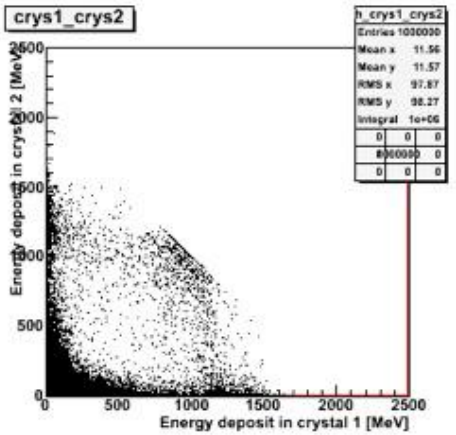


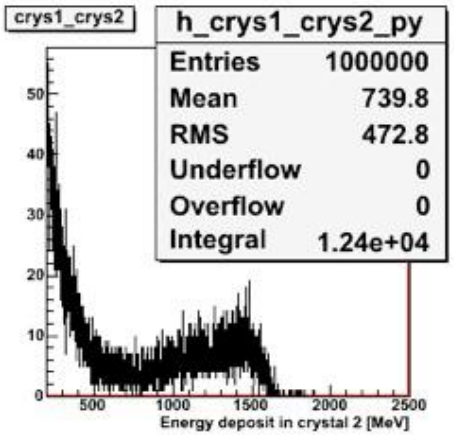
SYMB pipe effect

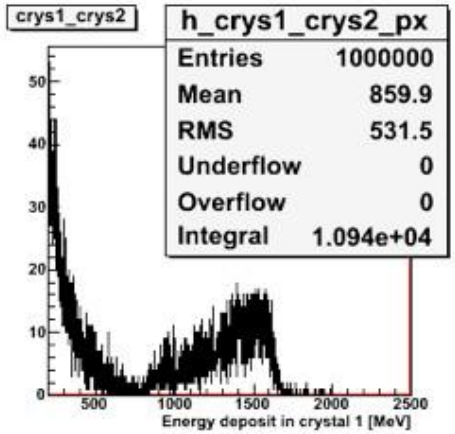
(Magnet on, Not convoluted)



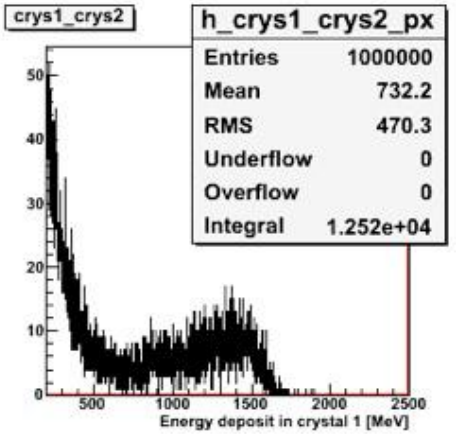








Pipe off



Pipe on

Scattered on the wall of the pipe

- **Conclusion**
  - Platform, extension, alignment system and main support ready begin March 2011 .
  - Electronics building in progress… (no time estimation know)
  - Light guide will take up to one month to arrive at Mainz
  - Connectors are in the mechanical workshop at Mainz
  - PMT are tested and ready to be glued on the crystal (time estimation two weeks)
  - Light mixing cylinder and light source should be designed as soon as possible. (maximum one month the building and test)

THANKS