Status of the GPD proposal

Proposal for an experimental programme dedicated to the studies of Generalized Parton Distributions (GPD) at COMPASS

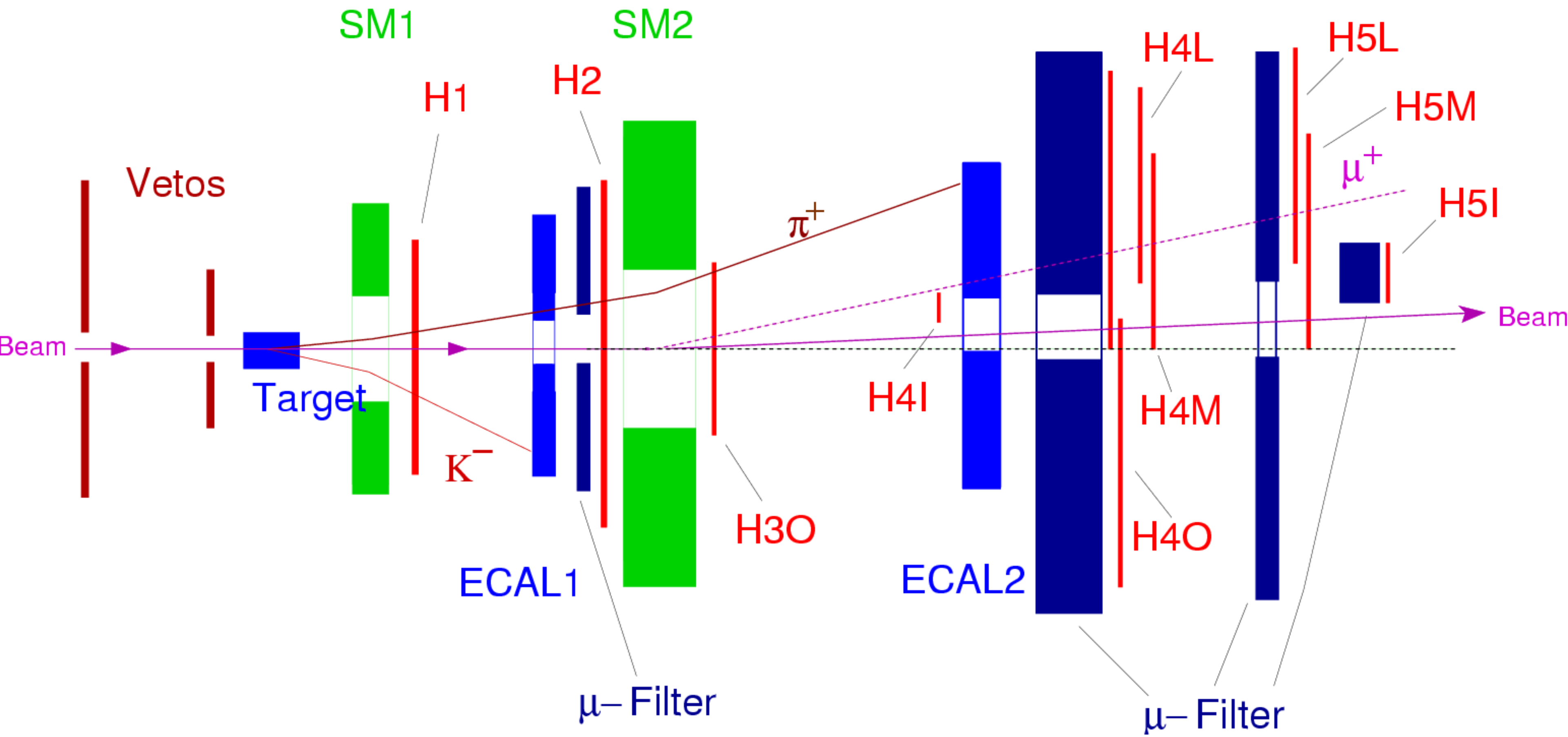
DRAFT_v3.1

Last update on October 26, 2009

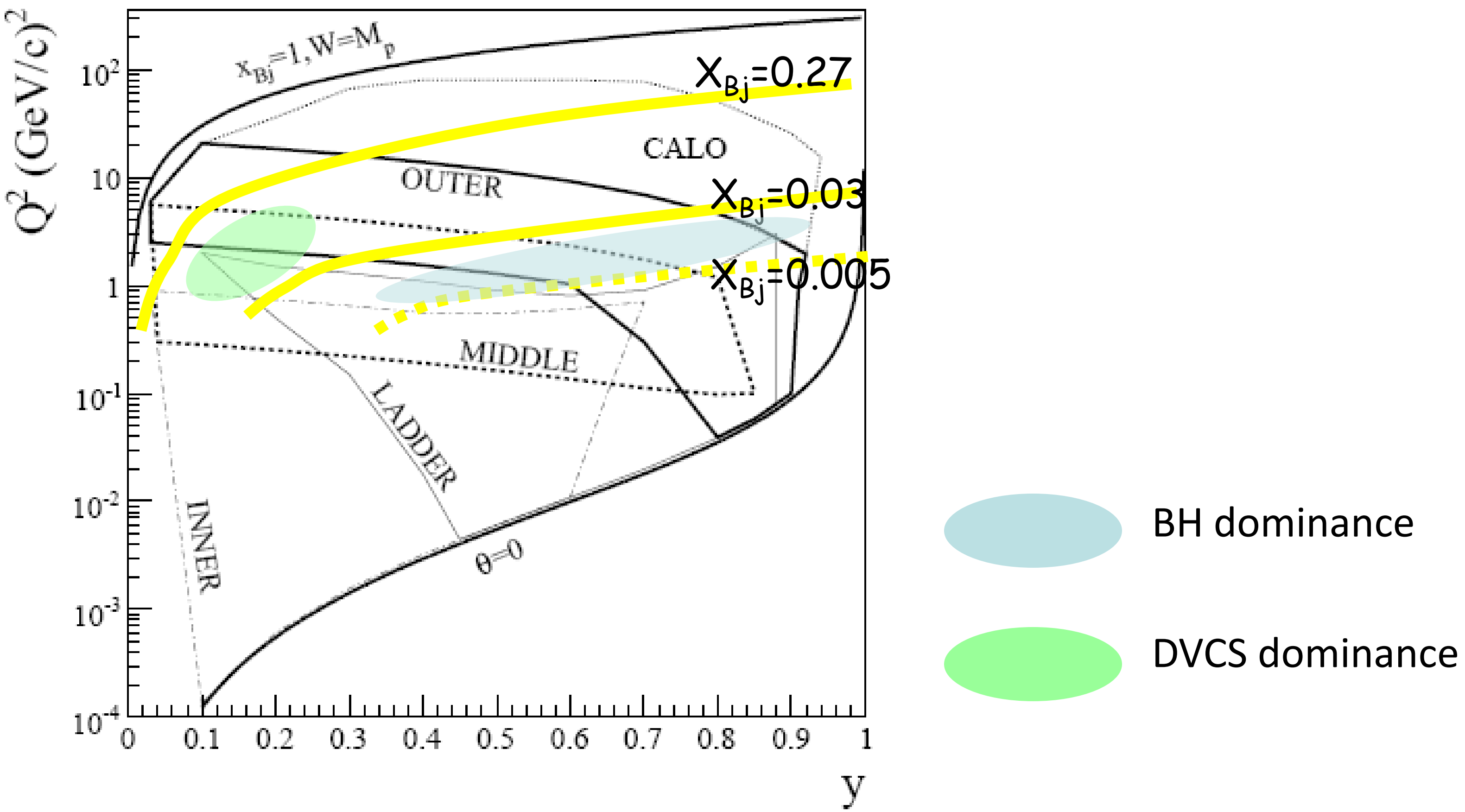
- Improvement of the Physics case (Wolf-Dieter)
- Transverse Target Asymmetry (Andrzej)
- Trigger with LAS (Eva)

To be found on d/dhose/public/GPDproposal.pdf
or d/dhose/w0/GPDproposal/v3.1_Oct2009/…

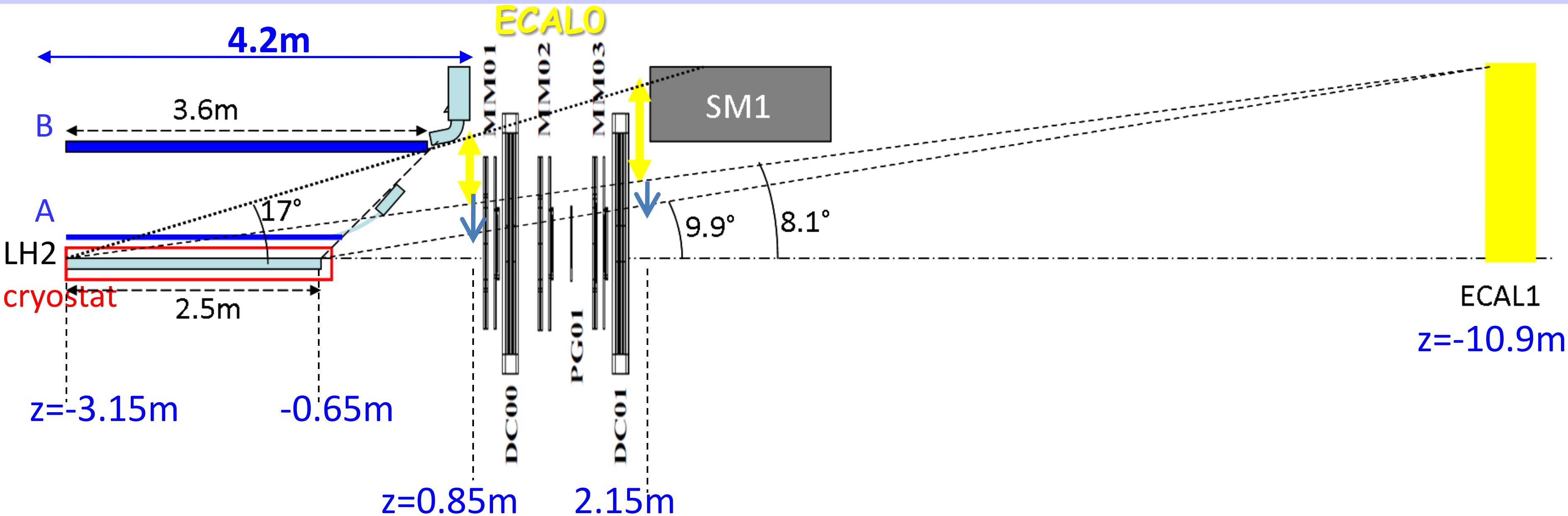
Figure of the New setup for the Trigger



The distribution of DVCS and BH events is still missing



Possible Sizes for ECAL0



External size	1.22m×2	1.62m×2

Large aperture: H: 0.57m×2 0.75m×2 — it exists an acceptance gap between ECAL0 and ECAL1
V: 0.41m×2 0.54m×2

Small aperture: H: 0.26m×2 0.48m×2 — there is no accept. gap between ECAL0 and ECAL1 but the tracking of charged particles is considerably reduced
V: 0.19m×2 0.35m×2

If ECAL1 at 14m, the acceptance gap between ECAL0 and ECAL1 shoud be still larger

IMPACT OF ECALO

$$dN/dt = \exp(-Bt)$$

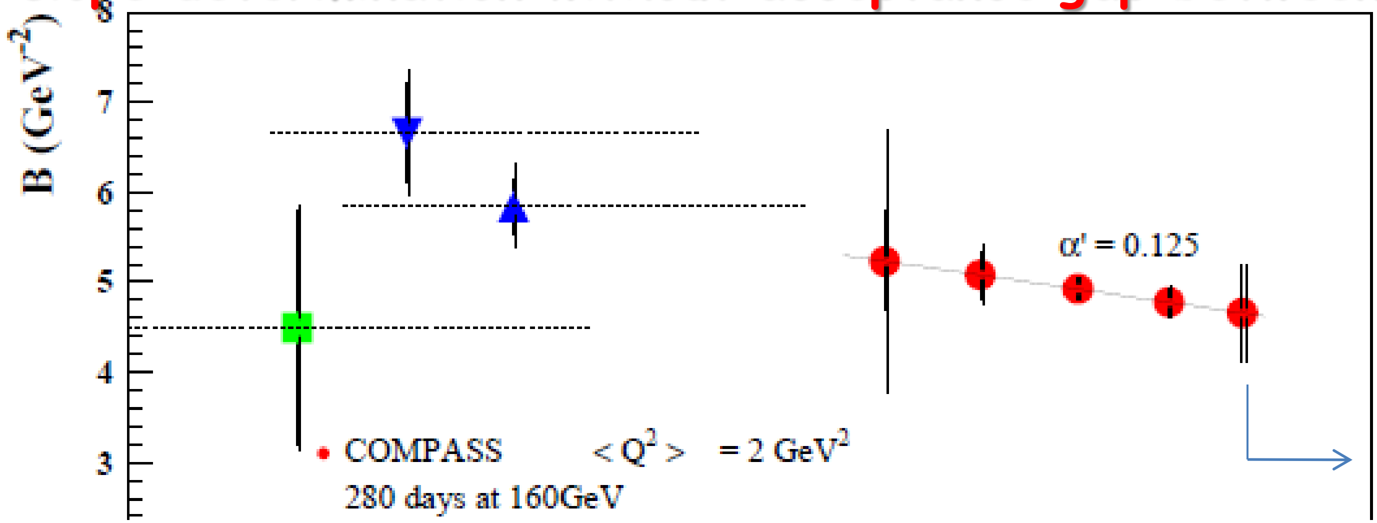
Statistic in 280 days with $N\mu+=3\times N\mu-$

Systematic effects on the B slope
Due to a relative normalisation factor within 3% accuracy

We measure $(N_{BH} + N_{DVCS})$

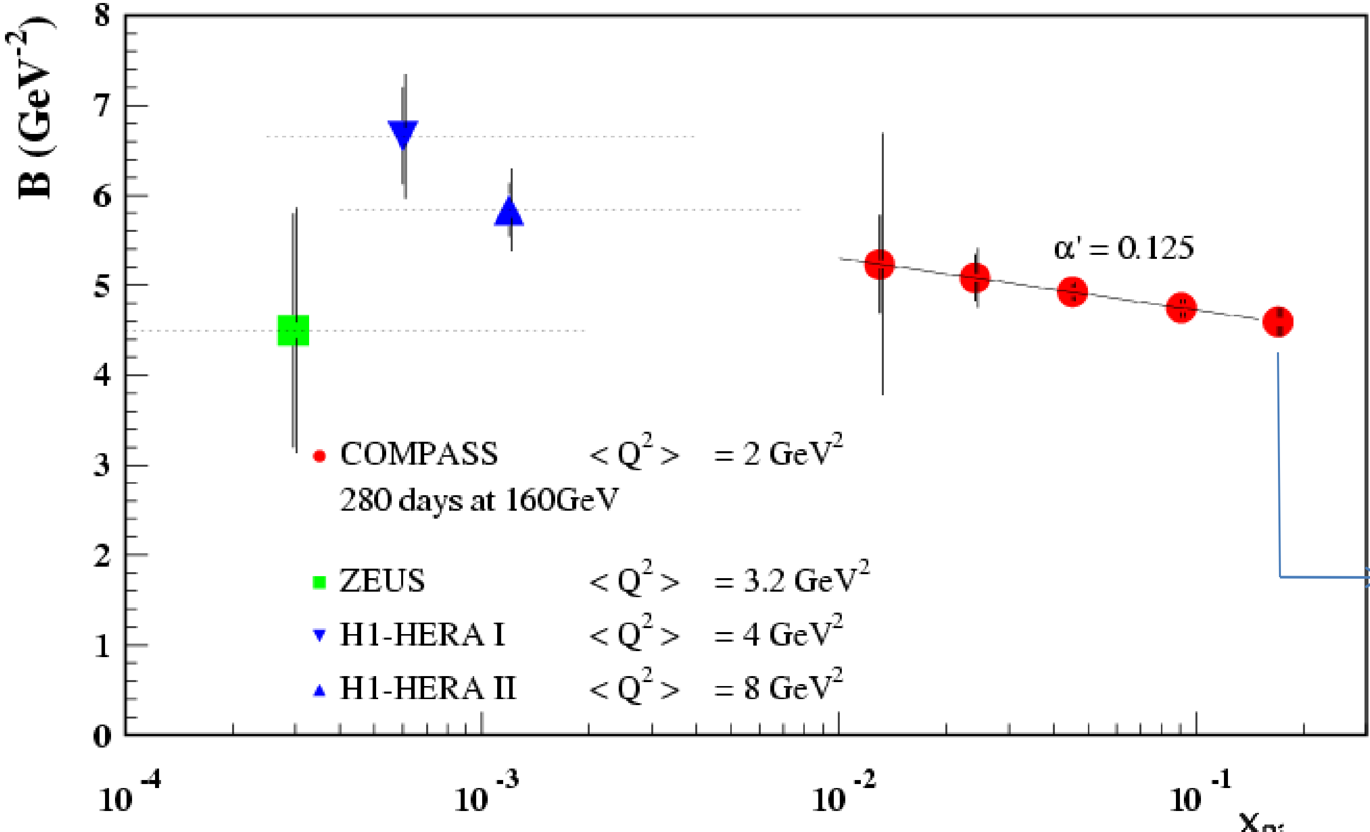
$\Rightarrow$Statistical errors ~ $\sqrt{(N_{BH}+N_{DVCS})} / N_{DVCS}$
$\Rightarrow$Systematic errors for the BH subtraction ~ 3% N_{BH} / N_{DVCS}

t-slope determination without acceptance gap between ECAL1 and ECAL2



Without ECAL0

146 DVCS evts



With ECAL0

(with no acceptance Gap between ECAL0 and ECAL1)

1127 DVCS evts

Which accuracy on B and the slope parameter α' ?

$$dN/dt = \exp(-Bt)$$

$$B = B_0 + 2 \times \alpha' \times \log(x_0/x_{Bj})$$

Hypothesis: $B = 5.83 + 2 \times 0.125 \times \log(0.0012/x_{Bj})$

The mean value of B is very well determined $\Delta B = 0.1\ GeV^2$

within COMPASS x-range
a stand-alone determination of the α'-slope is possible with a (total) accuracy better than 3 sigma (i.e. $\Delta\alpha'/\alpha' < 1/3$)

-for values of α' above 0.3 (with only ECAL1+2 without accept gap)
-for values of α' above 0.16 (with ECAL0+1+2 without accept gap)

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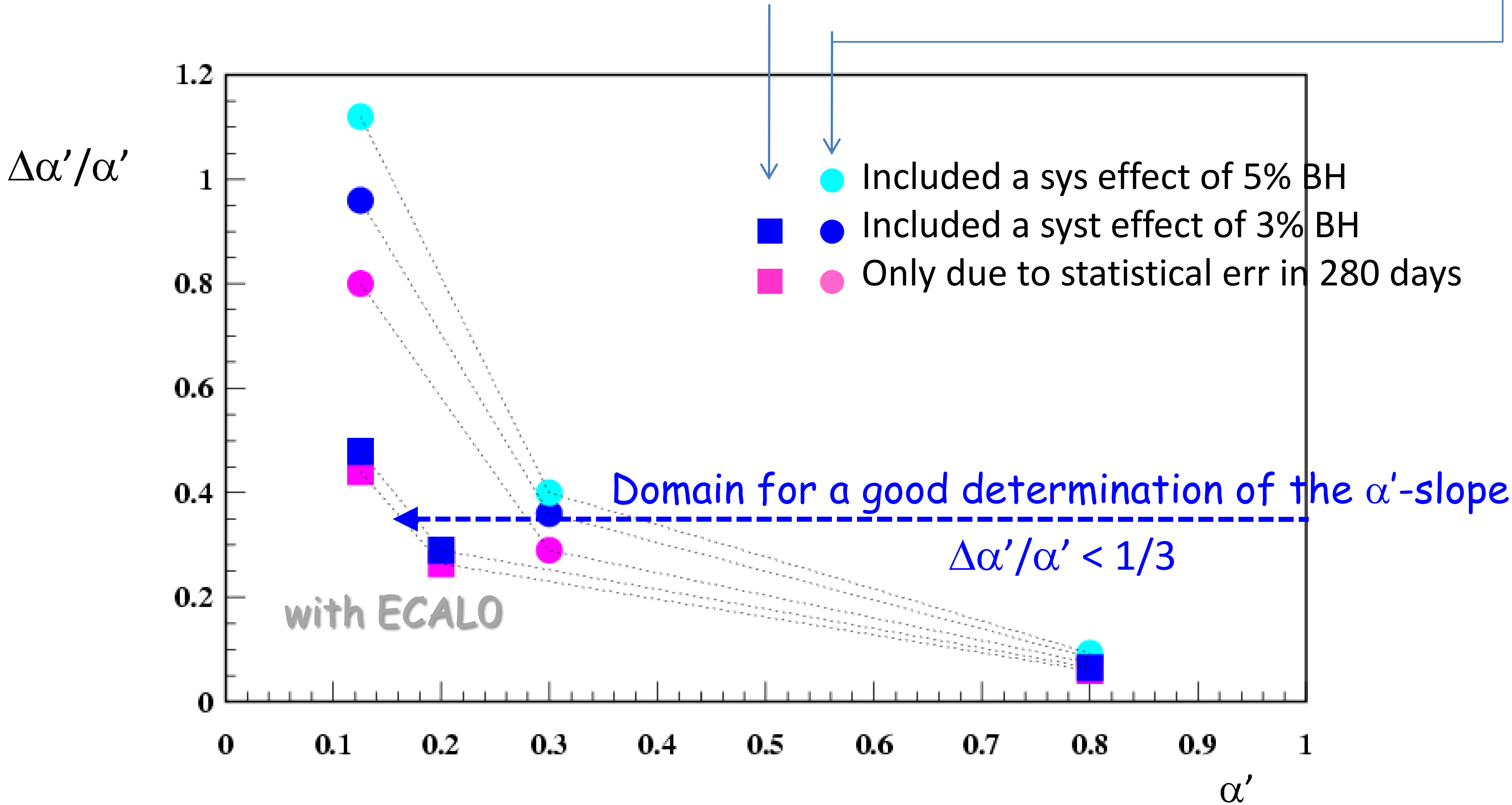
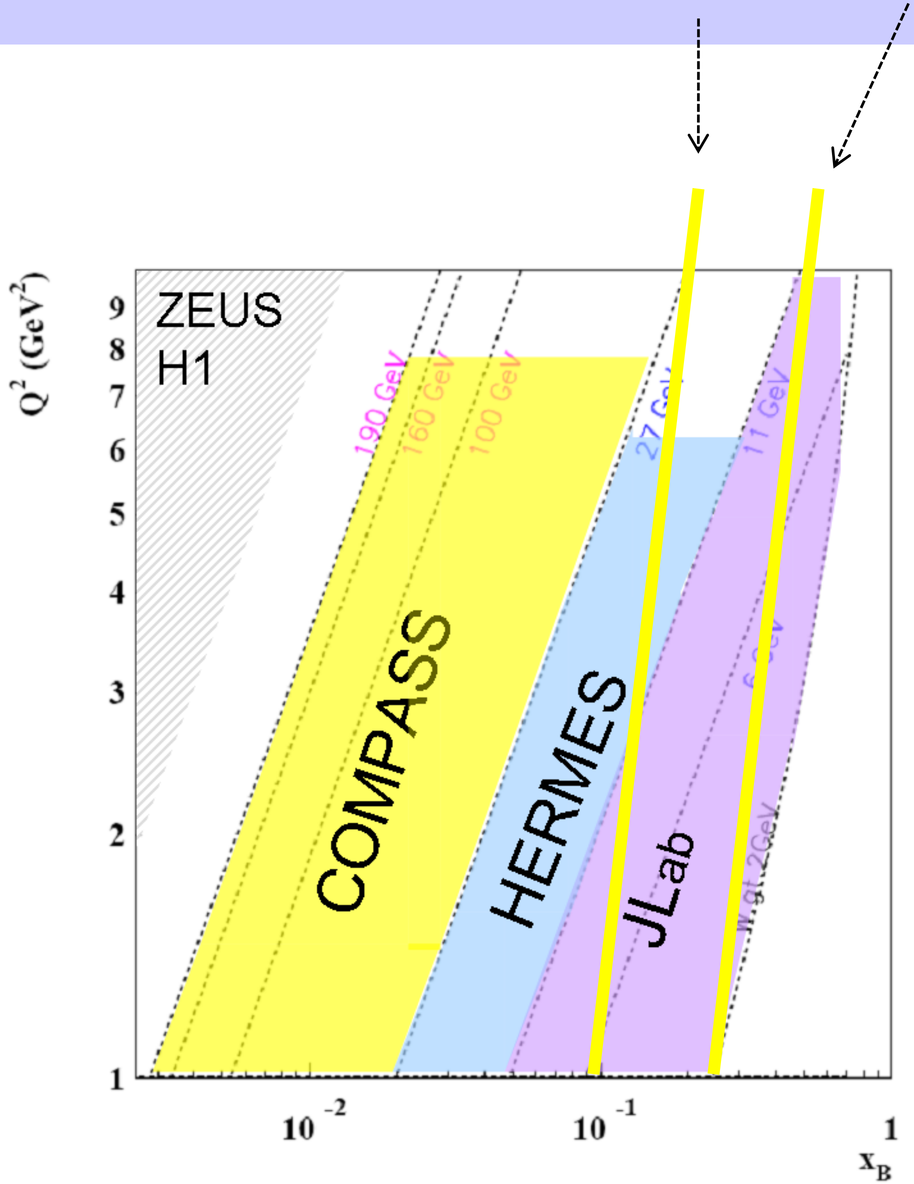


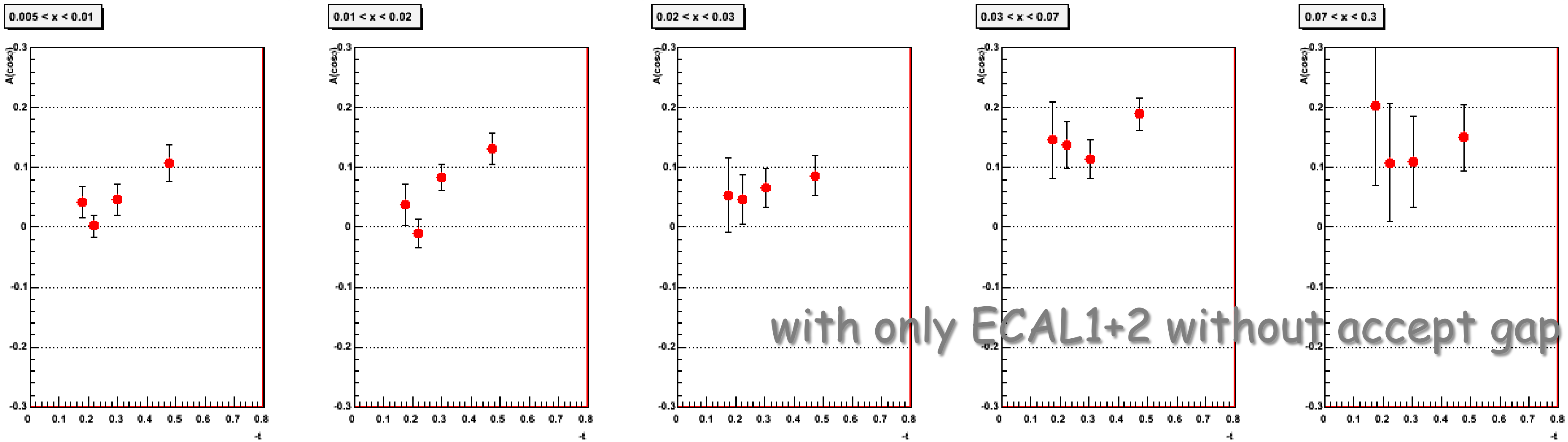
Kinematic domain without and with ECAL0



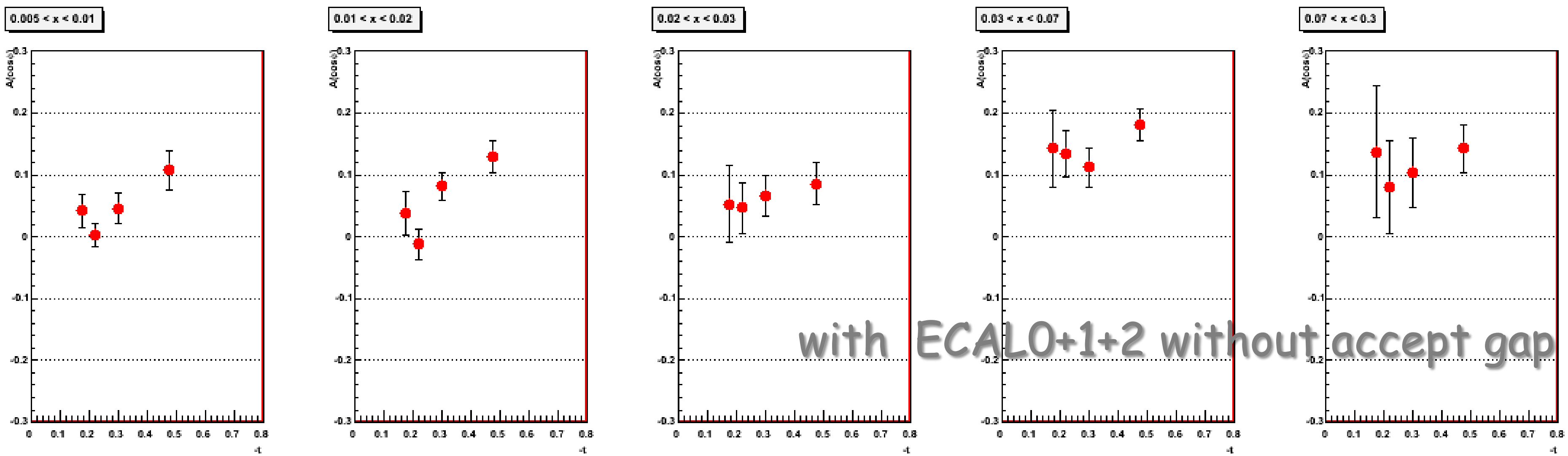
extraction of c1 (cosΦ) from the BCSA and c1 ~ $\int dx\, H(x,\xi,t)\, 1/(x-\xi)$

Etienne

0.005 < x < 0.01 < x < 0.02 < x < 0.03 < x <0.07 < x 0.3



→ t



→ t

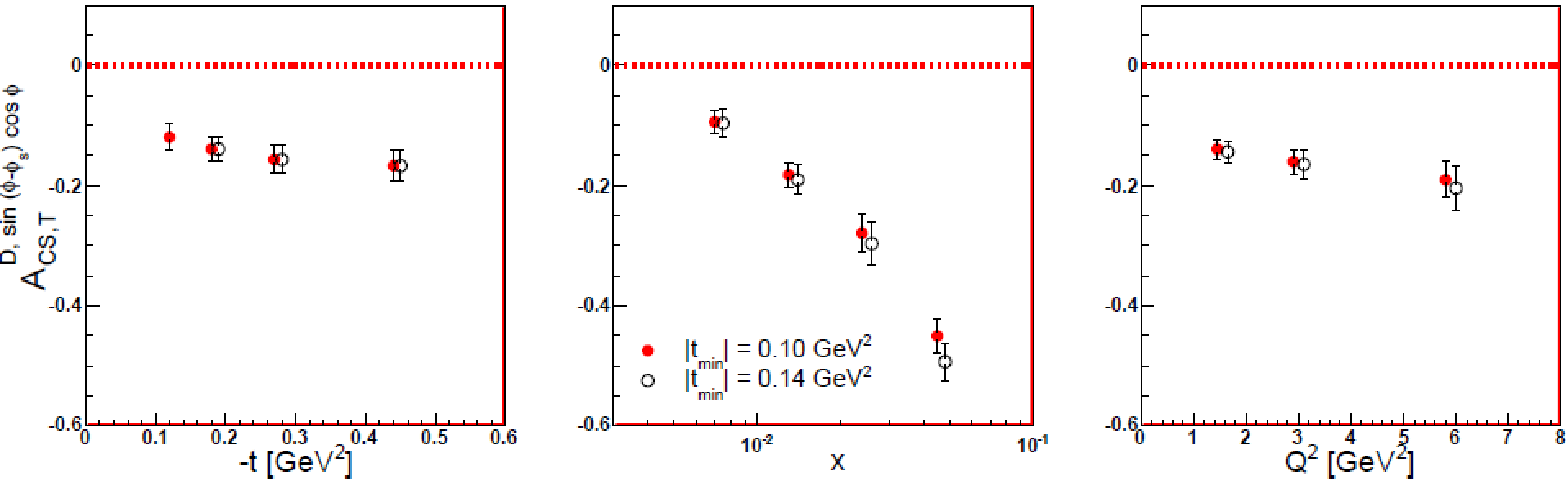
Simulations for the Transverse Target Polarisation

Andrzej

An important point for a NH3 target:

- for inclusive measurment
  The dilution factor is the ratio of polarized protons to all nucleons f= 0.17
- for an exclusive measurement with recoil proton detection
  The dilution factor is the ratio of polarized protons to all protons f=0.26

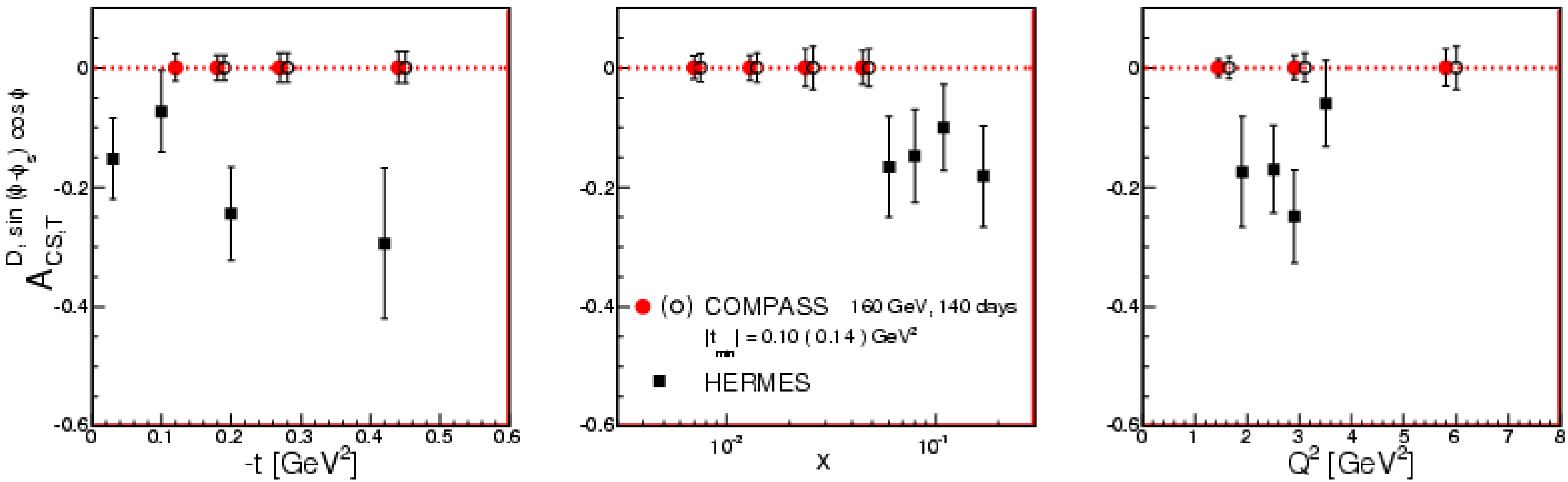
$A_{UT}^{\sin(\phi-\phi_s)\cos\phi}$ **Related to E (and mainly to Ju)**



In conclusion, the statistical accuracy of the future COMPASS results on the transverse target spin asymmetries is expected to be significantly higher, by a factor of 2.5 – 3, compared to the analogous HERMES results.

Comparison to HERMES

$A_{UT}^{\sin(\phi-\phi_s)\cos\phi}$ **Related to E (and mainly to Ju)**



Simulations for the exclusive $\pi0$ contribution estimated using Goloskokov/Kroll model

Andrzej

For 160 GeV and the kinematical range
$1 < Q2 < 12$ GeV^2
$8 < \nu < 144$ GeV
$0.06 < |t| < 0.64$ GeV^2
for GK model the cross section = **10.70 pb**
(model described in EPJC 59 (2009), publication in progress)

For Mankiewicz' parameterisation for exclusive pi0,
with the assumed t-slope 4.5 GeV^{-2},the cross section = **6.21 pb**
(hep-ex/0009534)

DVCS cross section for Reggeized amplitude with α'=0.8
and in the (almost) identical kinematic range
the DVCS cross section = **97.18 pb**

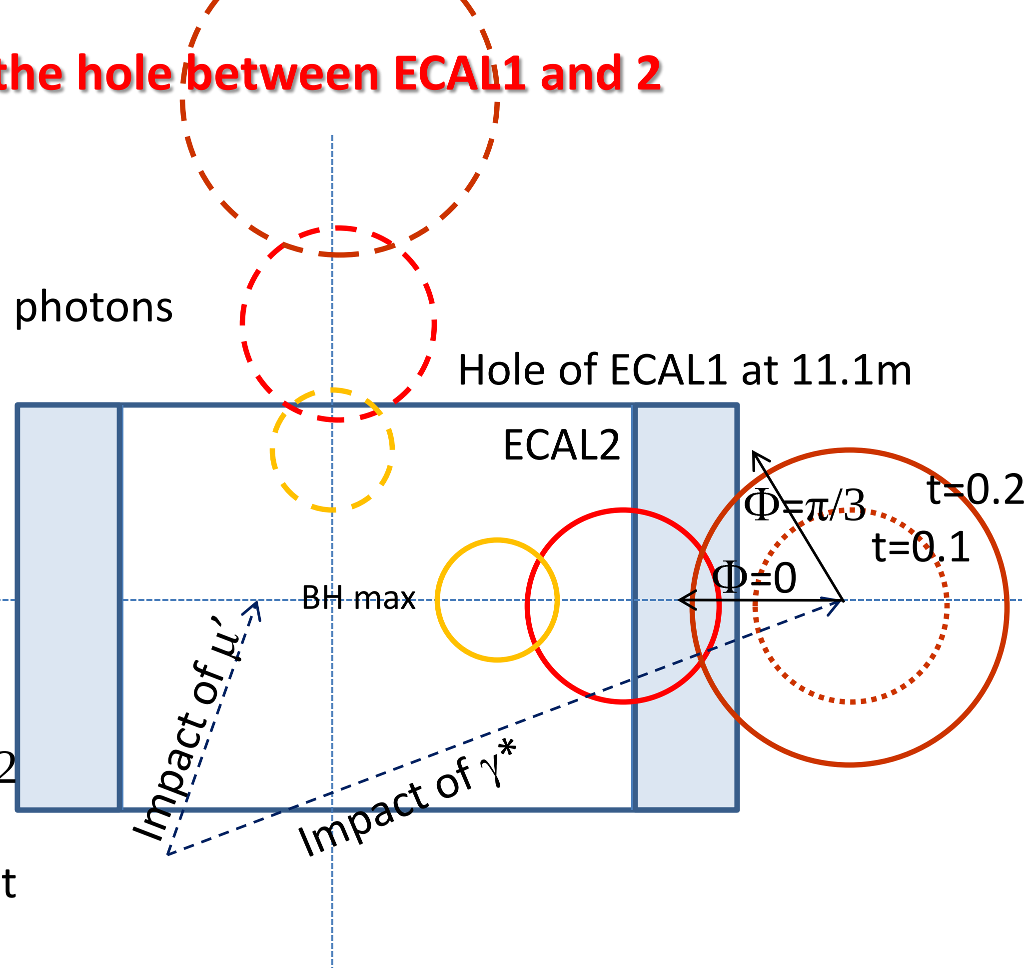
Detailed study of Andrzej for exclusive $\pi0$ contribution to single-photon detection
(one photon outside acceptance
two photons in the same cell
one photon below one threshold…)

→ at maximum 2%

Simulations will start on the impact of the hole between ECAL1 and 2

The 4 variables are Q2,x,t(or θ) and Φ

If Q2 is fixed:
the solid cercles represent the 3 rings of real photons
around the virtual photon when the
leptonique plane is horizontal
at a fixed value of t (~0.2) when x ↗



So we can see that
If x is very small there is no effect
If x ↗ there is an effect first at $\Phi = \pi$
then at Φ around $\pi/2$ and around $-\pi/2$
then at $\Phi = 0$
If x is large enough there is no more an effect

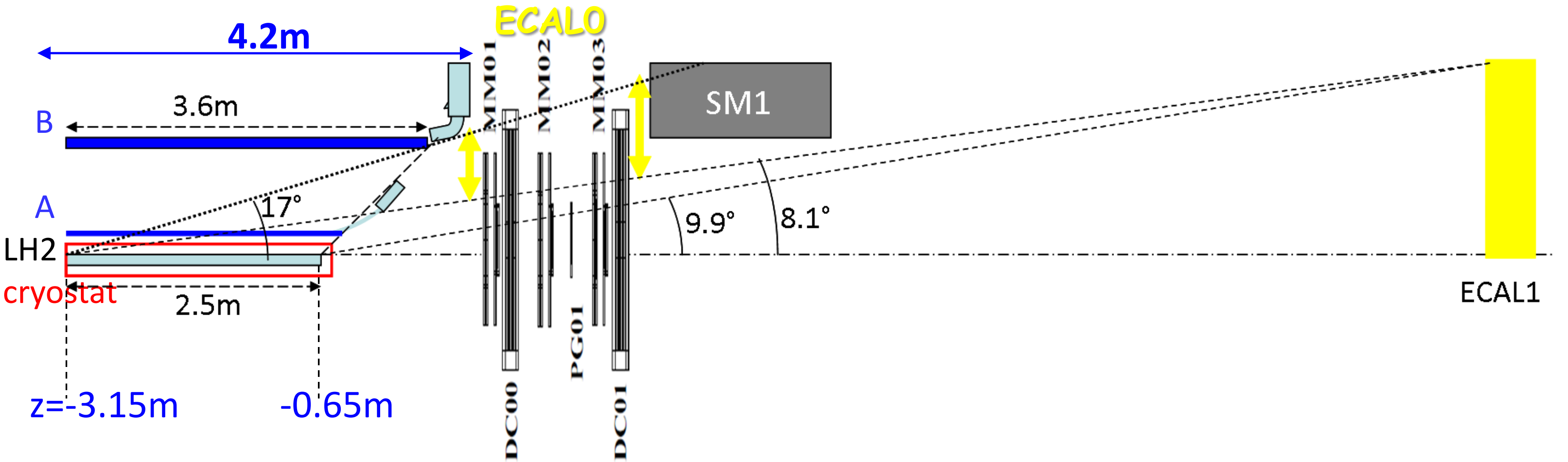
The dashed cercles represent the corresponding rings
when the leptonic plane is vertical and of course there is no problem

→ So in each (Q2,x) bins define by us (with phase space distribution)
we can easily determine the geometrical acceptance in Φ (integrated on t)

→We can then convolute with the BH distribution (peaked in the geometrical center and for Φ=0)

→We can also convolute with the DVCS distribution (which is more flat)

First design of the RPD design in the COMPASS setup



How do we introduce the LH2 target into the RPD?
Ring B could open up and ½ of Ring B move horizontally on the present rails

Size of the cryostat: minimum thickness (1.8mm Al, ∅=40cm)
Should Ring A be attached to the LH2 target cryostat?

Do we need to remove or only empty the target for ECALs calibration with e-?

Do we need to access the downstream end of the RPD?

Do we need to run the Cold Silicon conical cryostat for DVCS data taking?

Etienne extraction of c1 from the BCSA and c1 ~ ∫dx H(x,ξ,t) 1/(x-ξ)

Old presentation but with comparison to HERMES