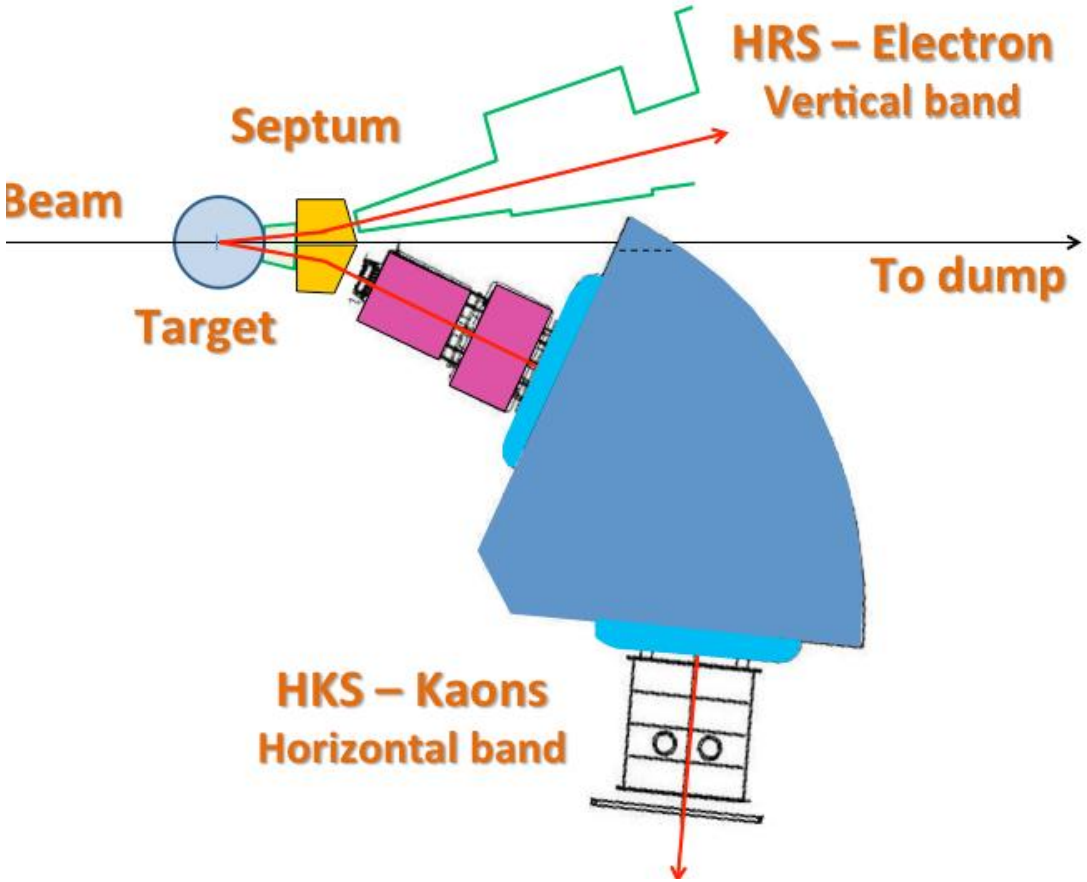
$^{208}_{\Lambda}Tl$ *spectroscopy*

through

$^{208}Pb(e,e'K^{+})^{208}_{\Lambda}Tl$

reaction at Jlab:

Resolution and Rates



Missing mass resolution depends on moment and scattering angle resolutions of two spectrometers: HKS and HRS

Resolution Calculation

- $E_{miss} = E_e + M_A - E_{e'} - E_K$
- $\vec{P}_{miss} = \vec{P}_e - \vec{P}_{e'} - \vec{P}_K$
- $E_{bind} = M_{A-1} + M_\Lambda - \sqrt{(E_{miss})^2 - (\vec{P}_{miss})^2}$
- The first step of the apparatus resolution calculation will be determining, through Montecarlo "GEANT4" simulations, the uncertainties on the reconstruction of electron and scattering variables as provided by HRS and HKS spectrometers respectively.
- The resolution will be then calculated with a Montecarlo spanning the electron momentum and angular acceptance of e' in HRS and calculating, for a definite bound state, for example the ground state, the corresponding Kaon momentum and scattering angles. Calculating back E_{bind} after adding the uncertainties these electron and kaon scattering variables will be known as estimated by GEANT4 simulations, the calculated values of E_{bind} will spread around the energy level of the definite bound state considered. The FWHM of this spread will estimate the resolution of the whole apparatus.

HRS and HKS resolutions

HRS and HKS features, like resolutions and acceptances, are now well known by previous experiments in Hall A and in Hall C. Disturbances in resolution performances could arise from the presence of one septum magnet in front of HRS and HKS spectrometers respectively. The presence of a Lead Target could be a possible cause of energy resolution worsening too, although that was proved not be the case during the experiment E06-007 that used both HRS arms and the same target thickness as the one proposed for ${}^{208}_{\Lambda}Tl$ spectroscopy at Jlab. HRS was already used with a septum in front of it, with no decrease in its resolutions, above all its momentum resolution, still below

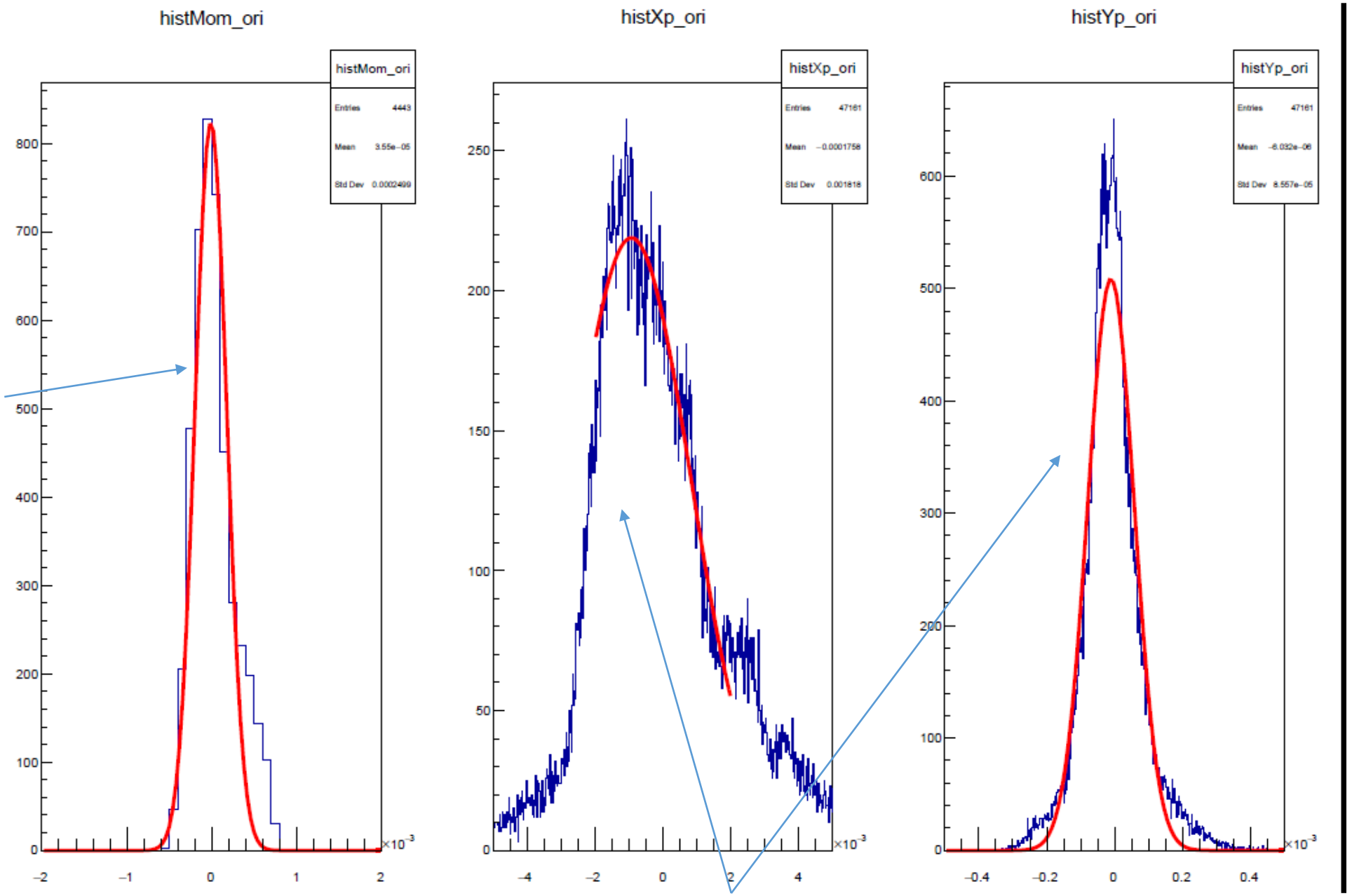
$1*10^{-4}$. HKS is then being studied firstly. The goal is to obtain, with a Lead Target and a septum in front of HKS, the nominal design resolutions of this spectrometer , above all its momentum resolution ($2.5*10^{-4}$).

GEANT4 simulations

Toshi and Suzuki kindly gave me programs that simulate with the Montecarlo GEANT4 the tracking and detection of electrons and kaons in HRS and HKS respectively. At the moment the simulation to estimate HKS performsnces are in progress. The search of the best setup of Q1 and Q2 HKS magnets is not completed. Nevertheless, the momentum and scattering angle resolutions requirements are fulfilled at least for a (not very much) reduced acceptance as shown in next slide. The simulations were performed with a 100/mg^2 thick Lead target

Momentum resolution (FWHM) ~ (2.5*10^{-4}; bin width = 5*10^{-5}).

Momentum reconstruction;



Reconstruction of the Scattering angles

Resolution estimates so far:

- Kaon momentum (HKS): $2.5*10^{-4}$ ➔ 300 keV (to be confirmed over the whole acceptance)
- Electron momentum (HRS): $1.*10^{-4}$ ➔ 300 keV (to be checked by simulations)
- Beam Energy: $5.*10^{-5}$ ➔ 200 keV

- We could expect a global missing mass resolution of the order of 700 keV

Next steps

(to be completed by PAC deadline):

- To obtain HKS project performances (above all those concerning momentum resolution) for the whole HKS acceptance.
- To check HRS performances are not spoiled by the septum presence in front of it.
- Estimate with a Montcarlo, the apparatus missing mass resolution for the reaction $^{208}Pb(e,e'K^+)^{208}_{\Lambda}Tl$

Rates

(preliminary)

For the time being simulations seem to confirm the rate estimates presented at PAC 46.

Thickness (mg/cm^2)	<I> (mA)	(e,e') (kHz)	(e,K') (kHz)	(e,p') (kHz)	Accid. (e,e')(e,k')DT	Back. (c/h/MeV)	Coinc.	Peak Sig.	peak
100	25	37	0.07	16	0.01	0.10	0.06	6.3	s-shell g.s
100	25	37	0.07	16	0.01	0.10	0.21	20.8	p-shell g.s