Random effect u:

- Variance of prediction errors $(u-\hat{u})$

$$\text{var}(u-\hat{u}) = \text{var}(u) - 2\,\text{cov}(u,\hat{u}) + \text{var}(\hat{u})$$

- With BLUP, it can be shown that

$$\text{cov}(u,\hat{u}) = \text{var}(\hat{u})$$

$$\Rightarrow \text{var}(u-\hat{u}) = \text{var}(u) - 2\text{var}(\hat{u}) + \text{var}(\hat{u})$$

$$= \text{var}(u) - \text{var}(\hat{u}) - \underbrace{PEV(\hat{u})}_{\text{Prediction Error Variance of } \hat{u}}$$

- Aim of Prediction of breeding values:
  - $\hat{u}$ and its variance ($\text{var}(\hat{u})$) should be as close as possible to true breeding value u

$\Rightarrow$ $\text{var}(u) - \text{var}(\hat{u})$ is very small $\Rightarrow$ PEV of $\hat{u}$ is very small