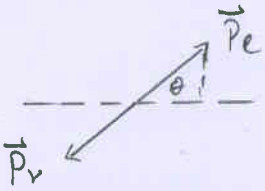
Jacobian Peak

e.g. in electron p_T spectrum from $W \to e\nu$ decay

- Assume W decay at rest: $p_{T,e} = p_{T,\nu} = \frac{m_W}{2} \sin\theta$



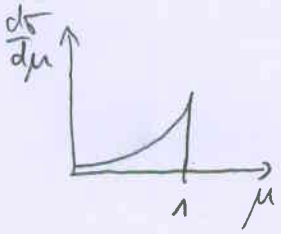
→ define $\mu \equiv \frac{p_{T,e}}{p_{T,e\,max}} = \sin\theta$

- Angular distribution = differential cross section $\frac{d\sigma}{d\cos\theta}$
  → Variable transformation to $\frac{d\sigma}{d\mu}$

$$\frac{d\sigma}{d\mu} = \frac{d\sigma}{d\cos\theta} \cdot \left| \frac{d\cos\theta}{d\mu} \right|$$ ← Jacobian (determinant) of this transformation

$$\frac{d\sqrt{1-\sin^2\theta}}{d\mu} = \frac{d\sqrt{1-\mu^2}}{d\mu} = -\frac{\mu}{\sqrt{1-\mu^2}}$$

⇒ peak at $\mu = 1$



- In practice:
  - W not at rest
  - finite W width ≈ 2 GeV

} peak smeared out