update on ee → tau tau @ 500 GeV

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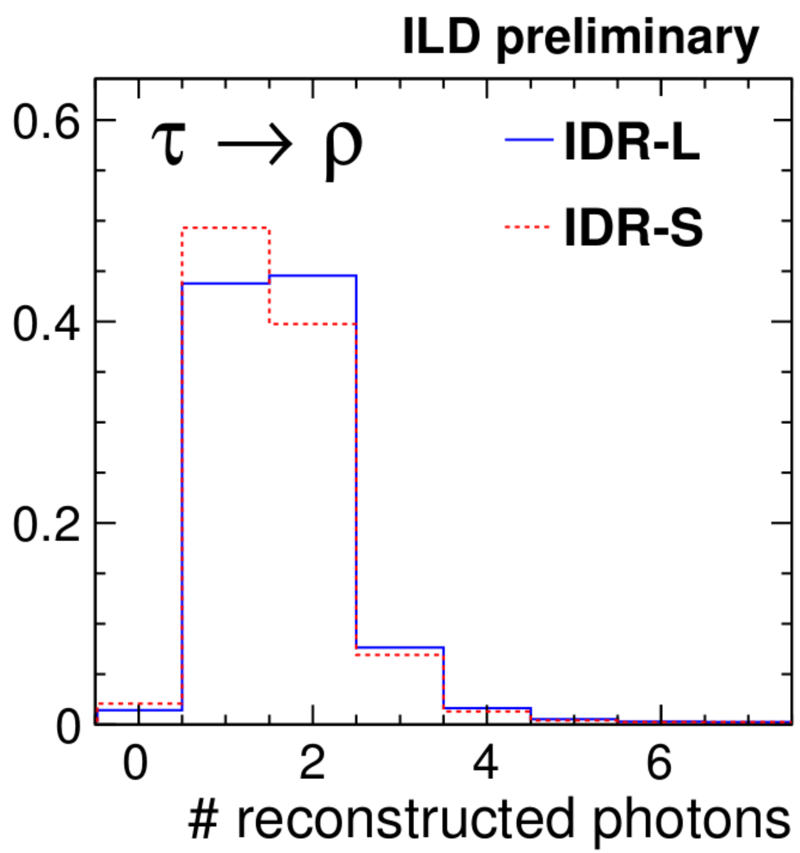
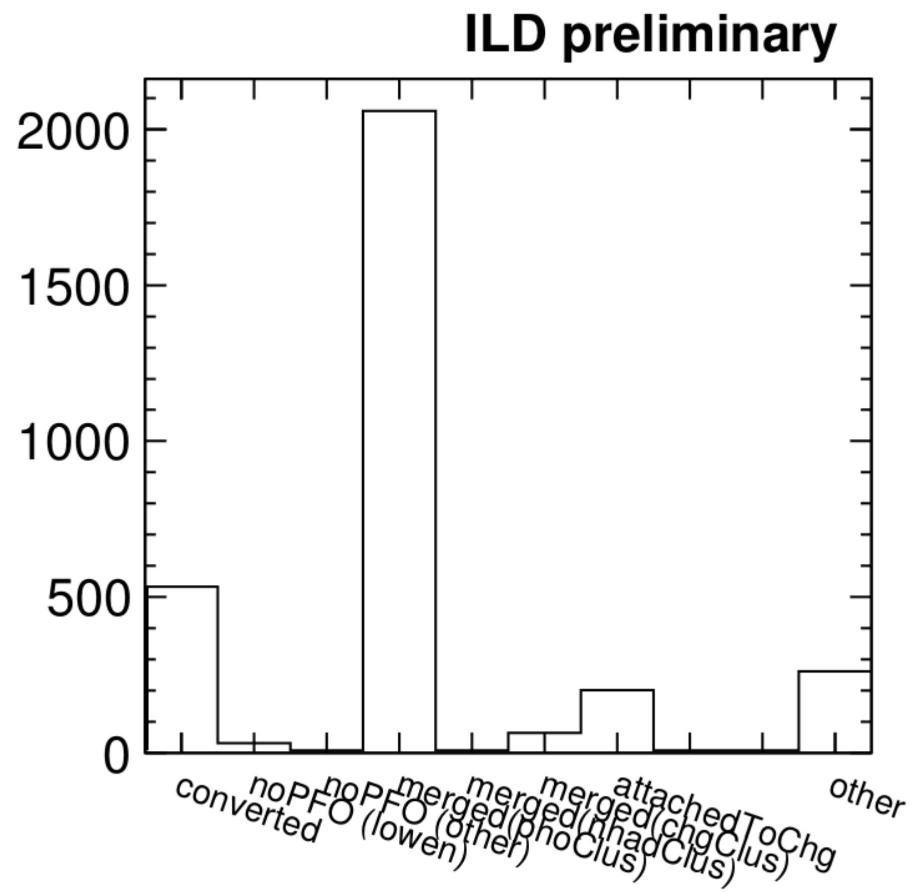
changes:

- use usual PandoraPFOs (un-distilled)
- tweaks to selection criteria
- make use of cluster shapes to distinguish
  charged hadrons from electrons & muons
- tau decay mode separation
- polarimeter extraction
- experimental sensitivity estimation

number of photon PFOs in
tau → rho decays
[expect 2 photons/decay]

why often < 2 ?

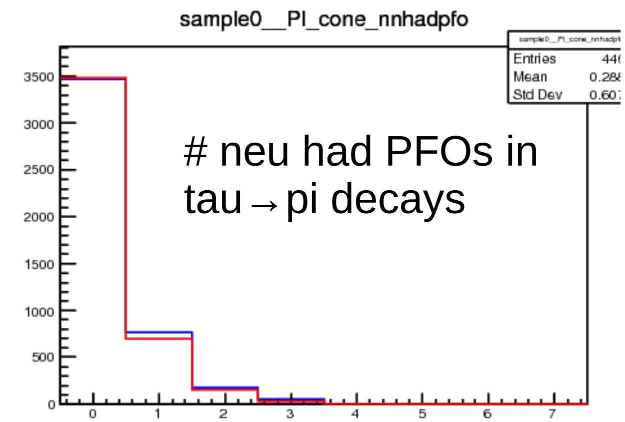


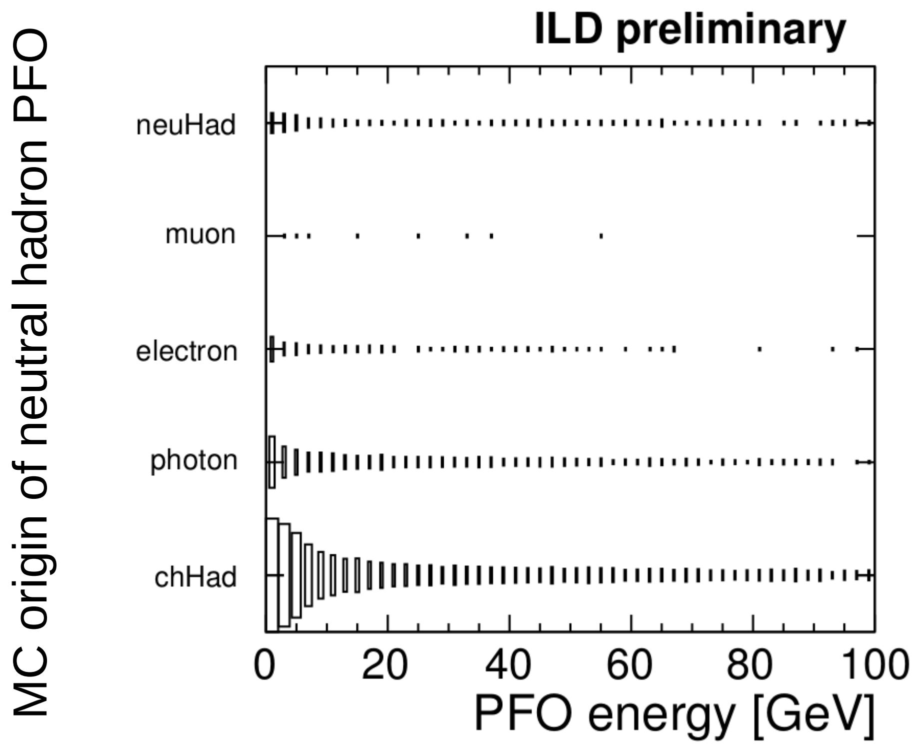


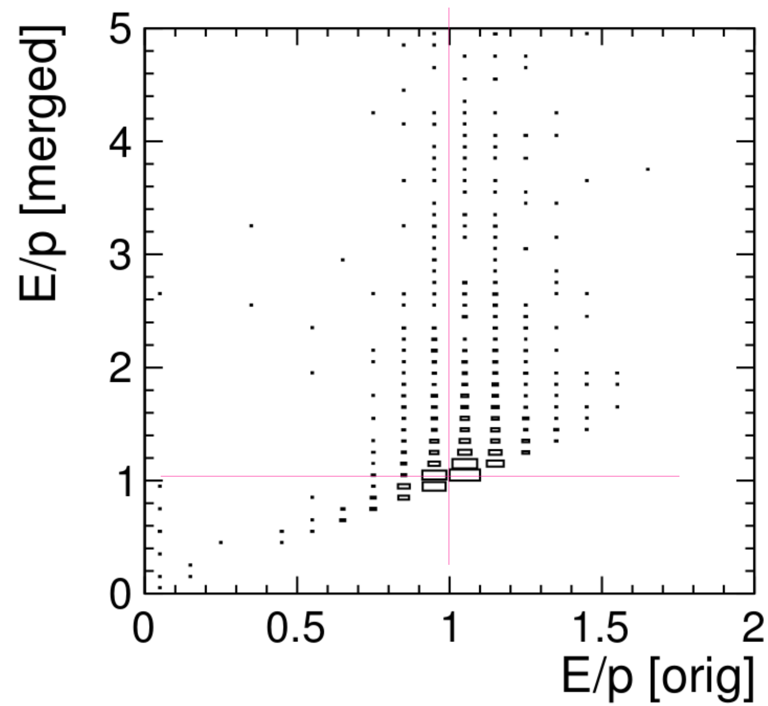
plot for IDR?

major reason: two photons merged
into single “photon-like” PFO

expect very few neutral hadrons in tau decays
but we often reconstruct one







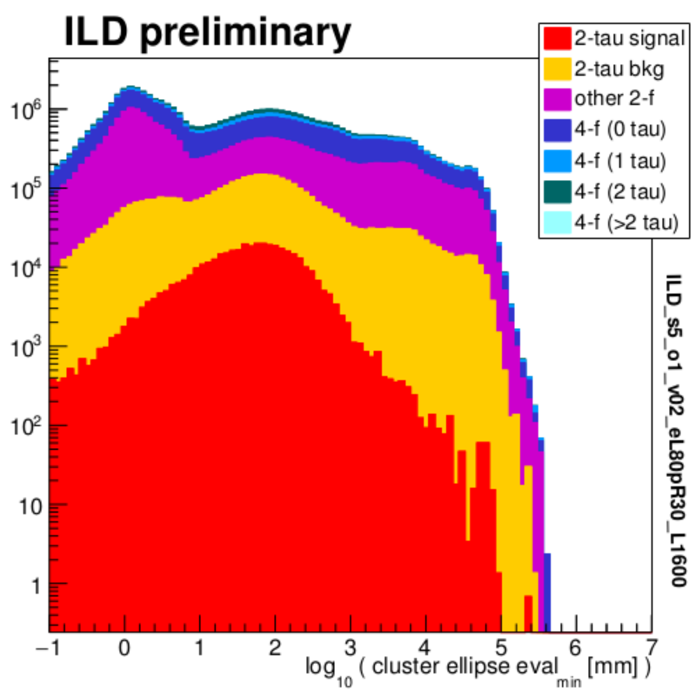
the neutral hadron PFOs are usually split off the charged hadron cluster
this split improves the E/p for the charged PFO

shower shapes for chg.pi – electron – muon separation

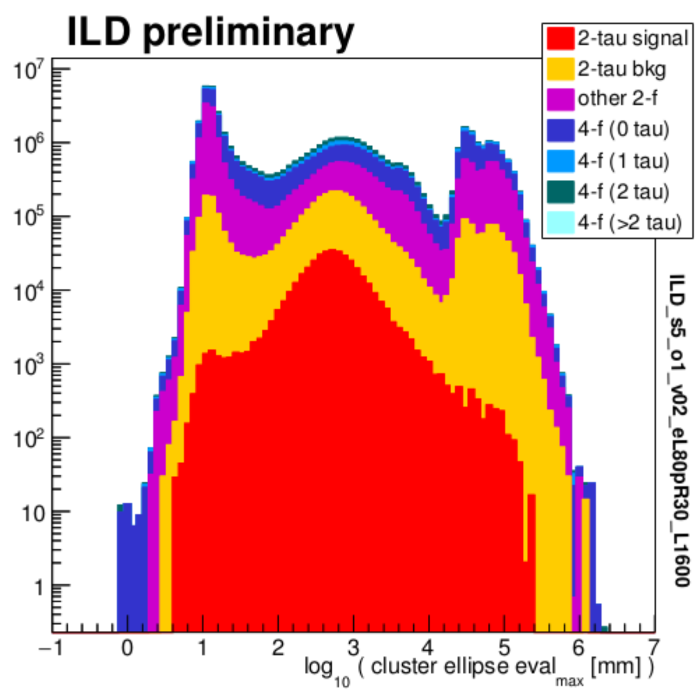
we want to reject electrons and muons
before used E/p, total calo energy

now use shower shapes: smallest and largest of the 3 eigenvalues of
the ellipsoid fitted to the calorimeter energy distribution

red =
chg had
in signal

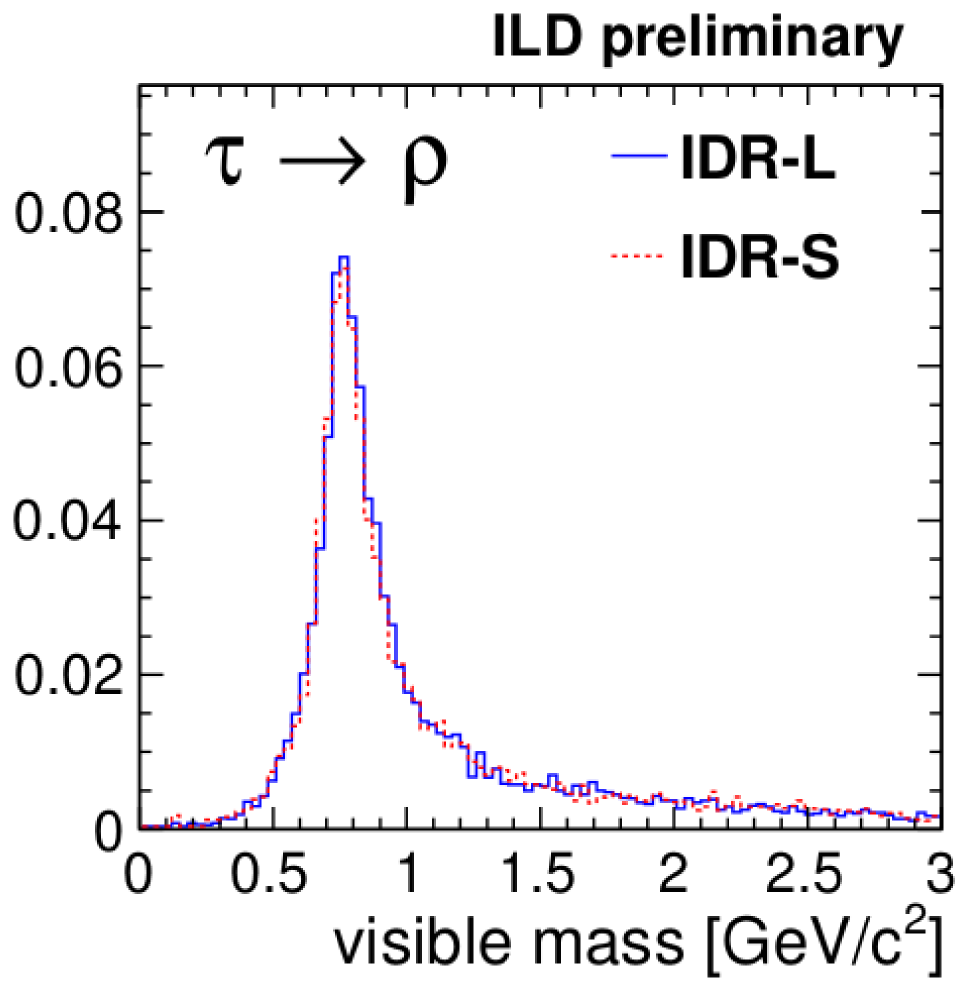


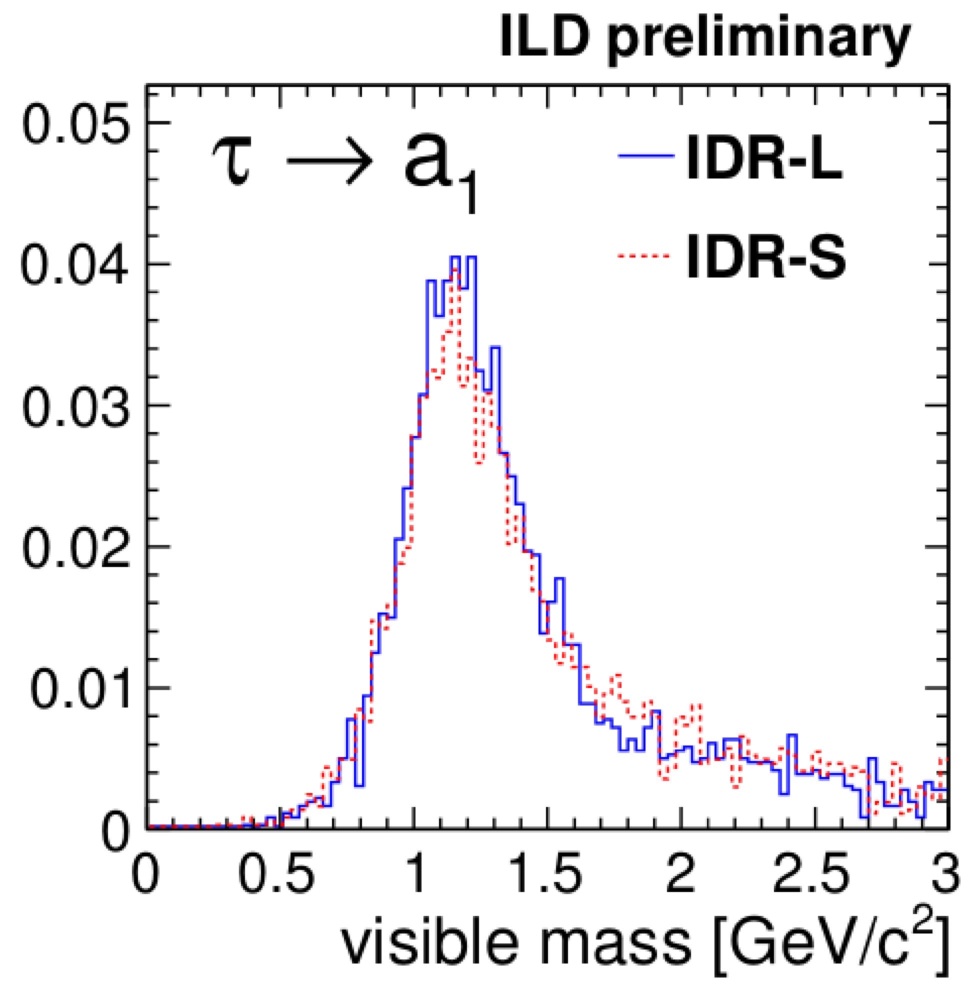
smallest eigenvalue ~ width



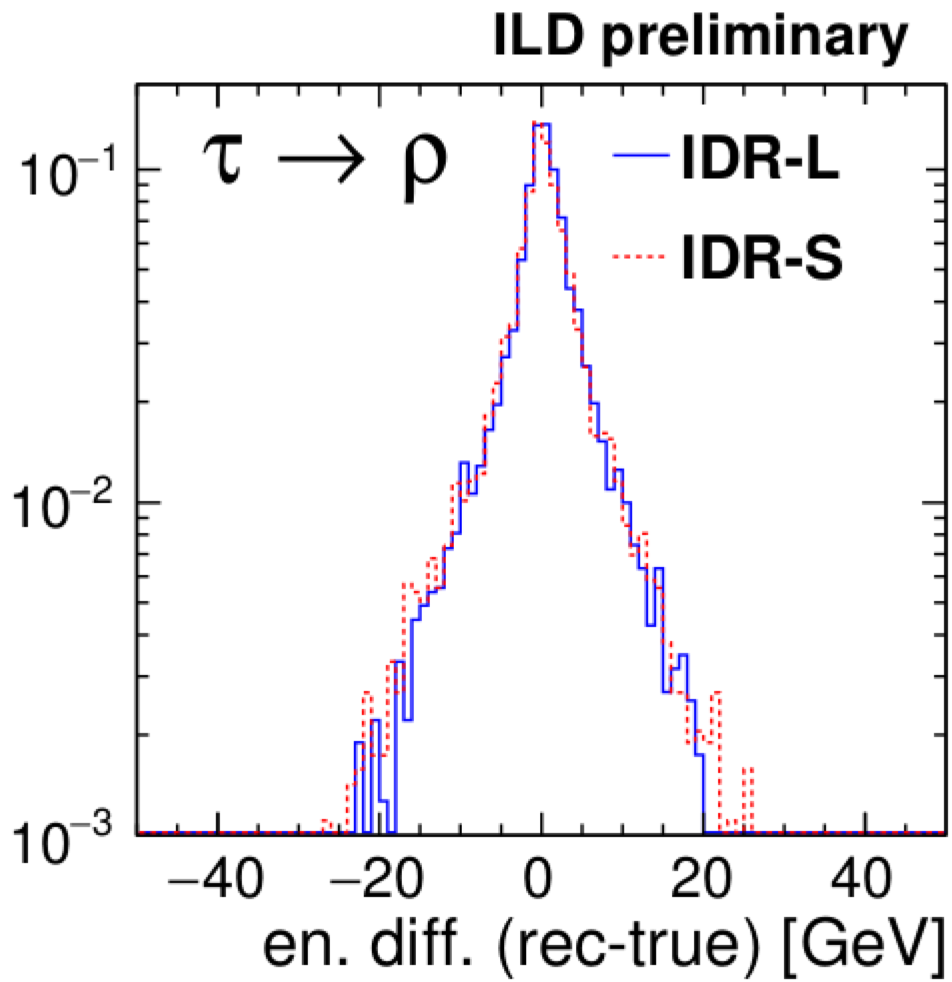
largest eigenvalue ~ length

reconstructed jet mass in MC-matched tau jets in selected events



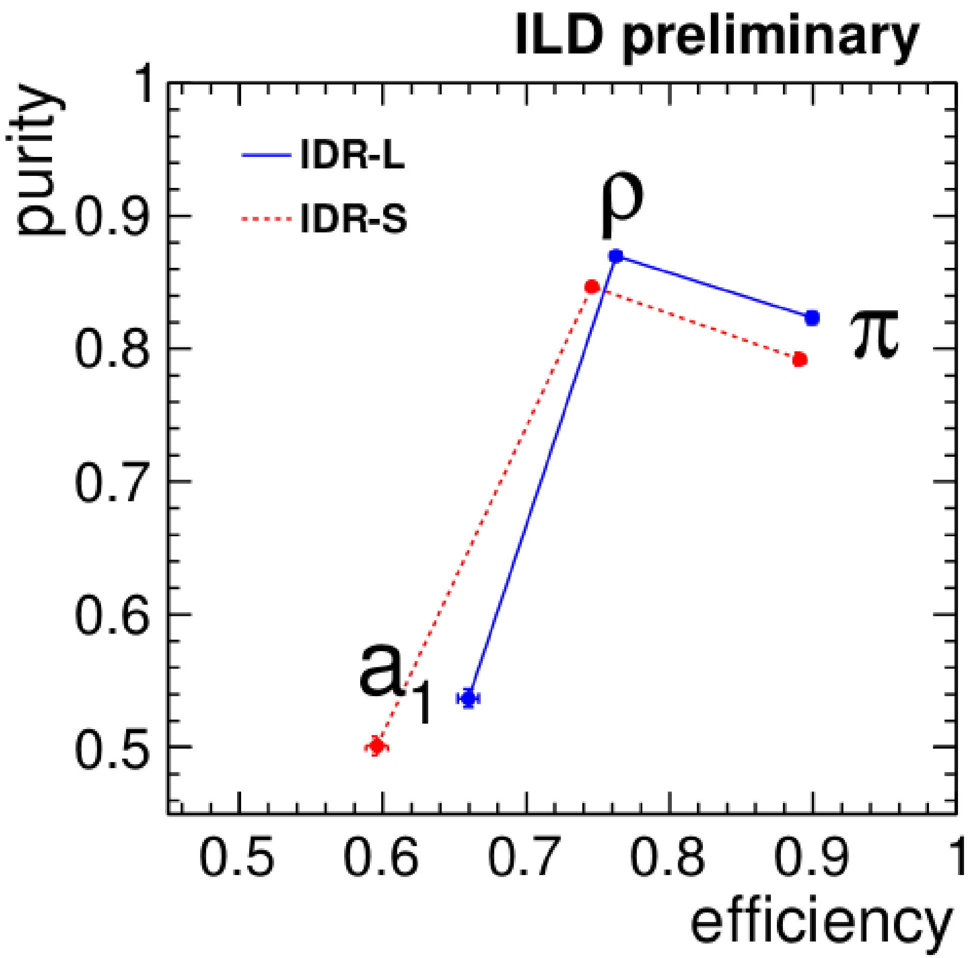


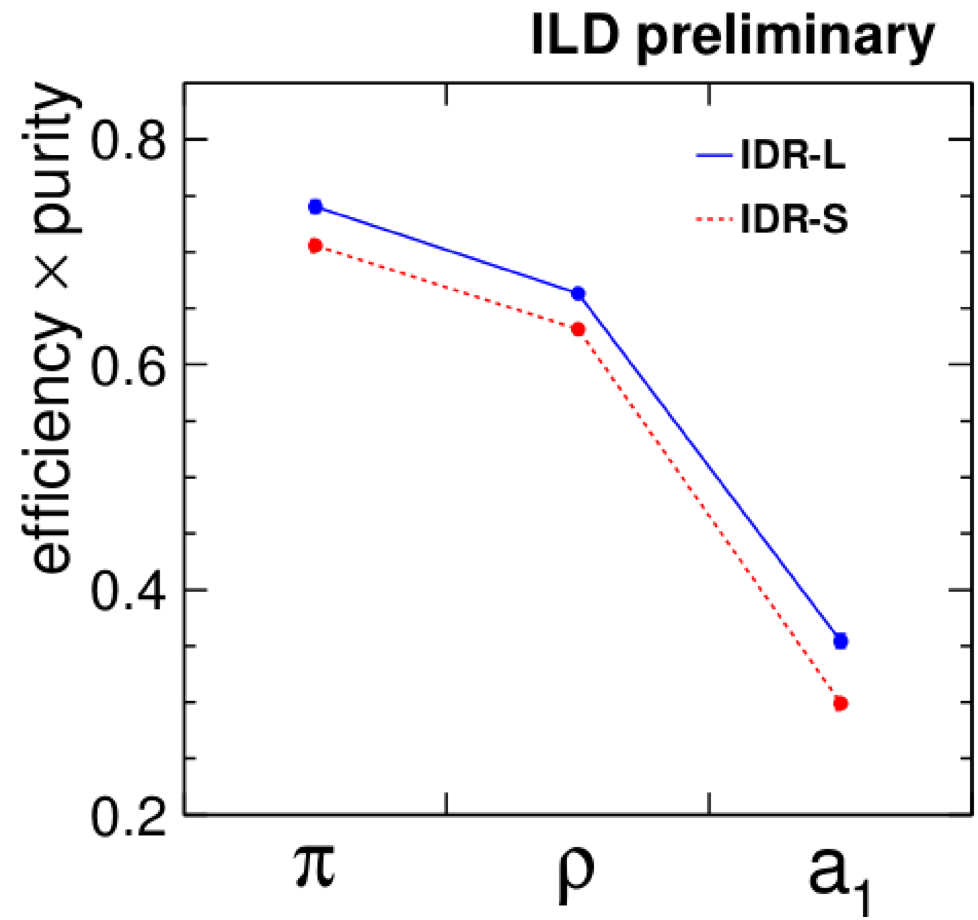
how well is visible tau energy reconstructed?



efficiency and purity of tau decay mode identification

ILD_l5_o1_v02	MC-pi	MC-rho	MC-a1p	MC-other	purity
SELECTED AS PI	89.93 ± 0.39	2.04 ± 0.13	0.89 ± 0.14	9.33 ± 0.31	82.34 ± 0.47
SELECTED AS RHO	6.52 ± 0.32	76.25 ± 0.38	12.86 ± 0.51	5.75 ± 0.24	86.99 ± 0.32
SELECTED AS A1P	2.21 ± 0.19	13.27 ± 0.30	65.96 ± 0.72	6.78 ± 0.26	53.69 ± 0.69
ILD_s5_o1_v02	MC-pi	MC-rho	MC-a1p	MC-other	purity
SELECTED AS PI	89.08 ± 0.41	3.21 ± 0.16	1.17 ± 0.17	10.06 ± 0.32	79.21 ± 0.50
SELECTED AS RHO	7.54 ± 0.35	74.59 ± 0.39	17.49 ± 0.59	5.81 ± 0.25	84.70 ± 0.34
SELECTED AS A1P	2.20 ± 0.19	14.14 ± 0.31	59.59 ± 0.76	6.31 ± 0.25	50.11 ± 0.71





plot for IDR?

polarimeter estimation

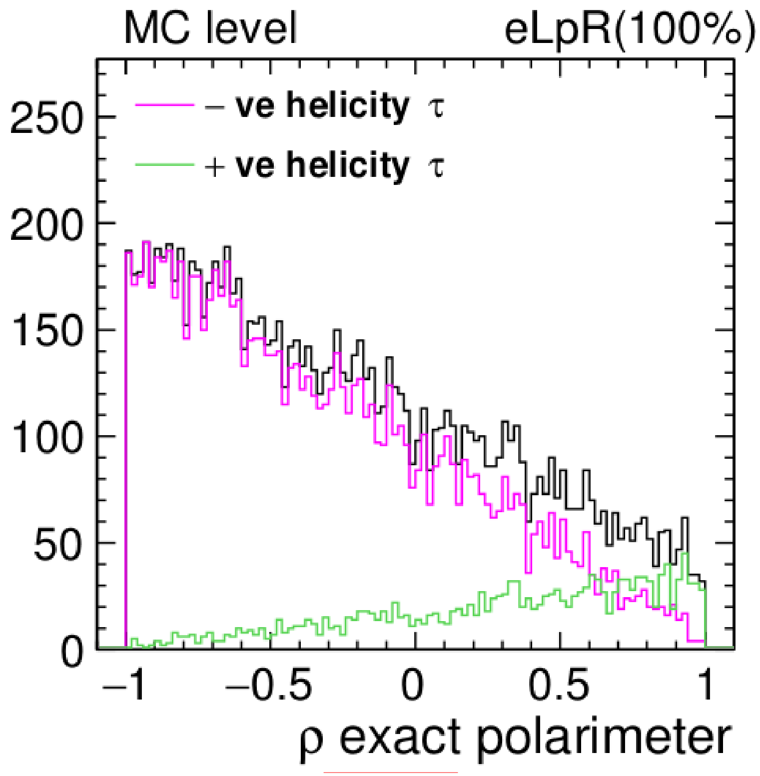
for given up on reconstructing neutrino momentum

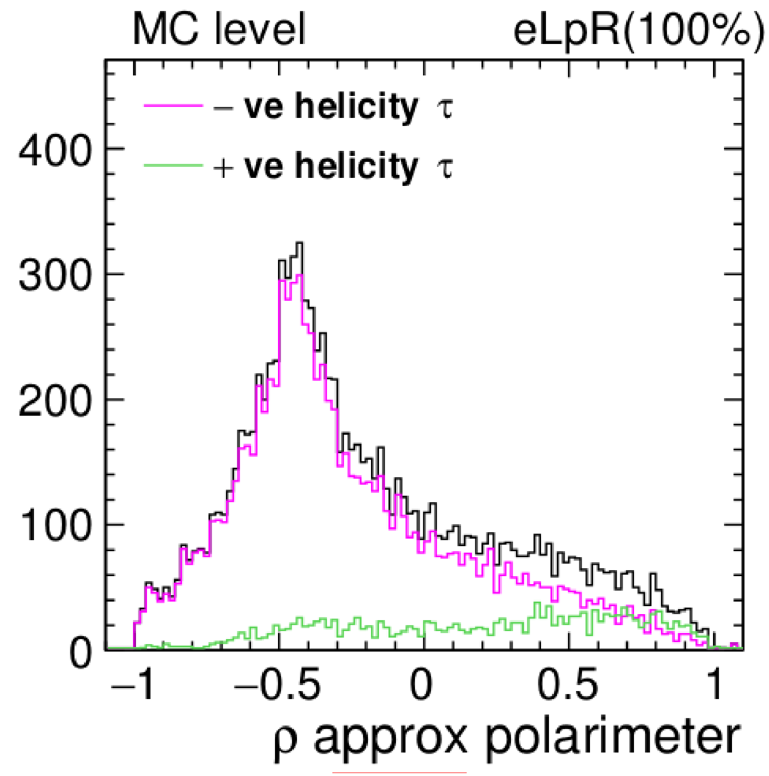
e.g. using impact-parameter: a pity, since we lose dependence on VXD

use approximate methods which use only measured momenta

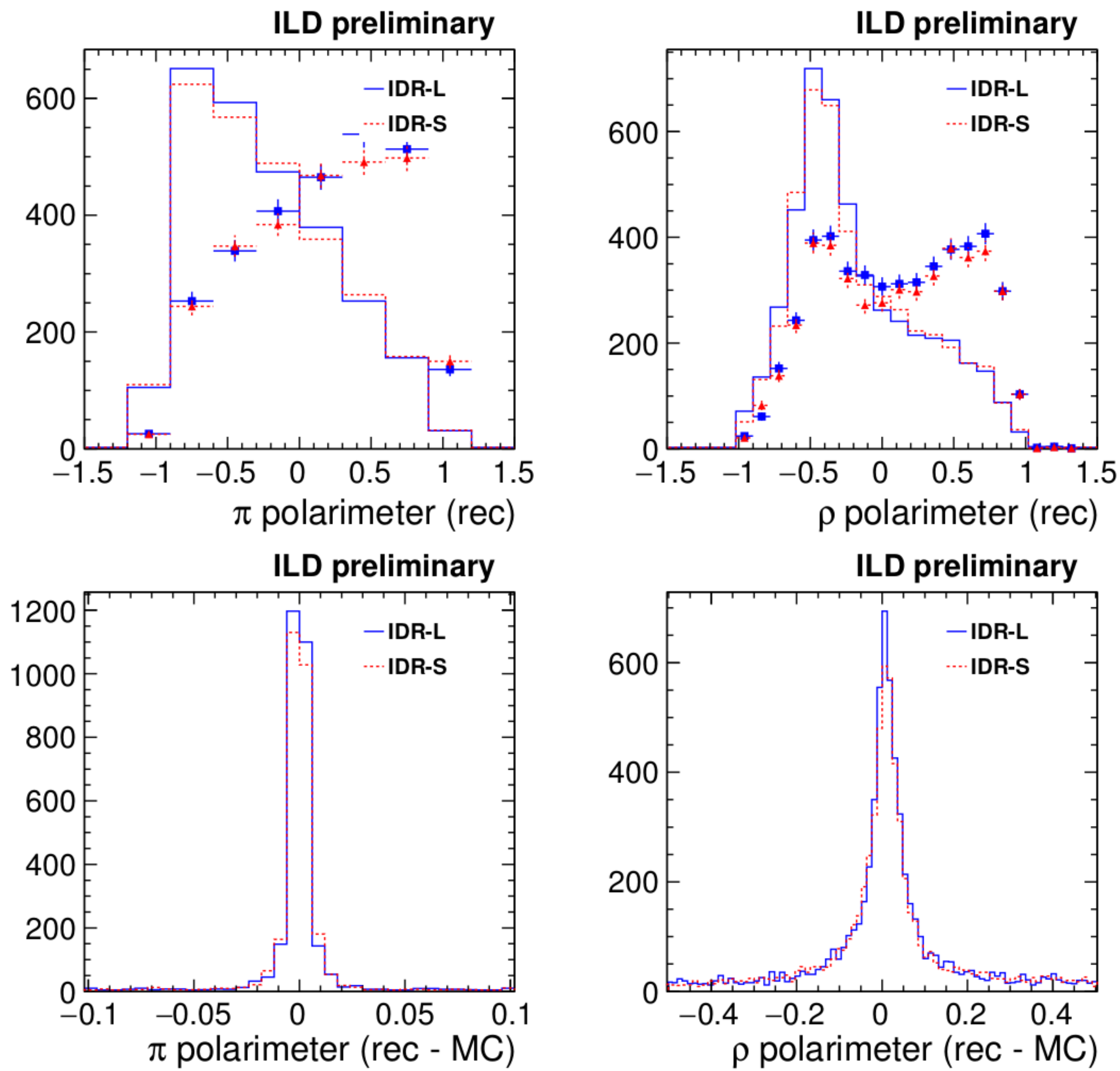
→ almost equivalent for pi decays

→ less powerful for rho decays



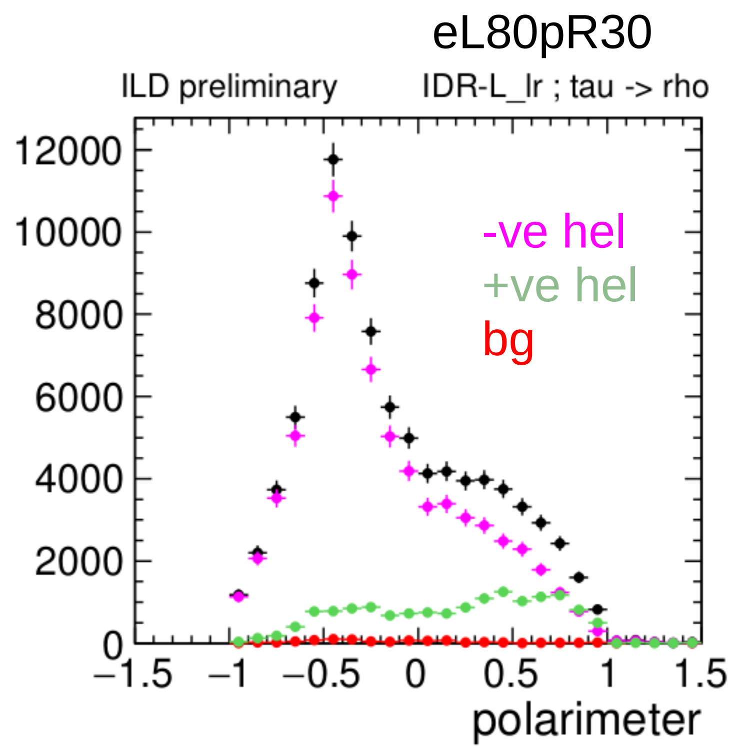


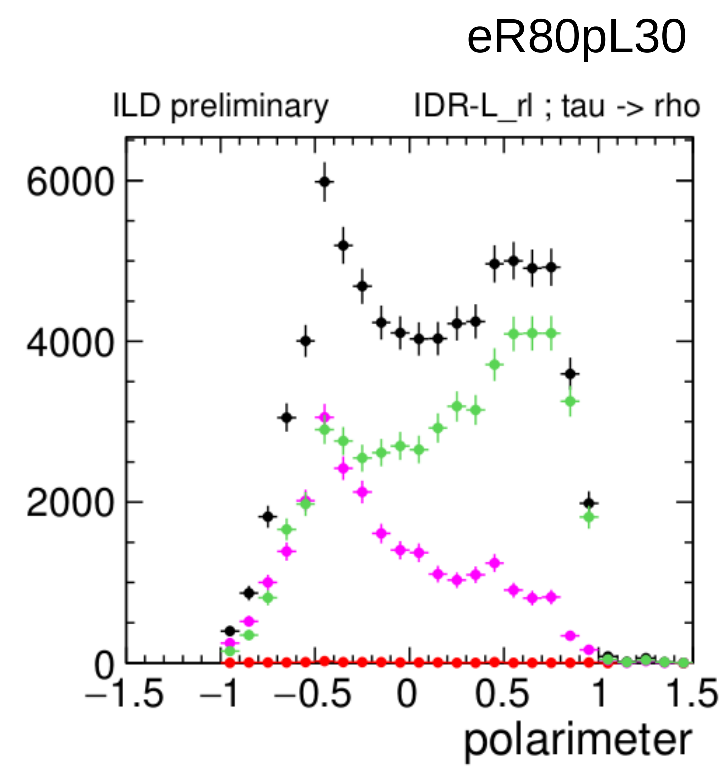
polarimeter reconstruction



estimating sensitivity

templates from MC





use tempates to run pseudo-experiments, fit to extract +ve/-ve fraction
mean of fit error distribution → measurement precision

		Precision on helicity fraction [%]						
		$\tau \to \pi$			$\tau \to \rho$			
Beam Pol.	Int. Lum.	MC	fullsim		MC		fullsim	
80/30	4/ab	exact	IDR-L	IDR-S	exact	approx	IDR-L	IDR-S
eLpR	40%	0.283	0.365	0.386	0.190	0.243	0.360	0.346
eRpL	40%	0.329	0.469	0.461	0.218	0.306	0.439	0.471
eLpL	10%	0.773	1.005	1.040	0.518	0.657	0.963	0.941
eRpR	10%	0.874	1.214	1.202	0.581	0.780	1.117	1.172

no clear L/S winner

differences
due to MC stats ?

future work:

- sensitivities with intermediate cheating
  - perfect decay mode ID
  - perfect photon energy measurement

practical details:

- github now up to date (as of a few hours ago)
- note updated, sent to referee a few hours ago (Mikael)
  - available from the confluence page
    https://confluence.desy.de/pages/viewpage.action?pageId=89671185