CORNELL UNIVERSITY LEPP
LABORATORY FOR ELEMENTARY-PARTICLE PHYSICS

Progress in Pixelless Electron-Finding

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last time: submitted dummy producer and object (SiStripElectronProducer and SiStripElectron)

implemented simple "band" algorithm

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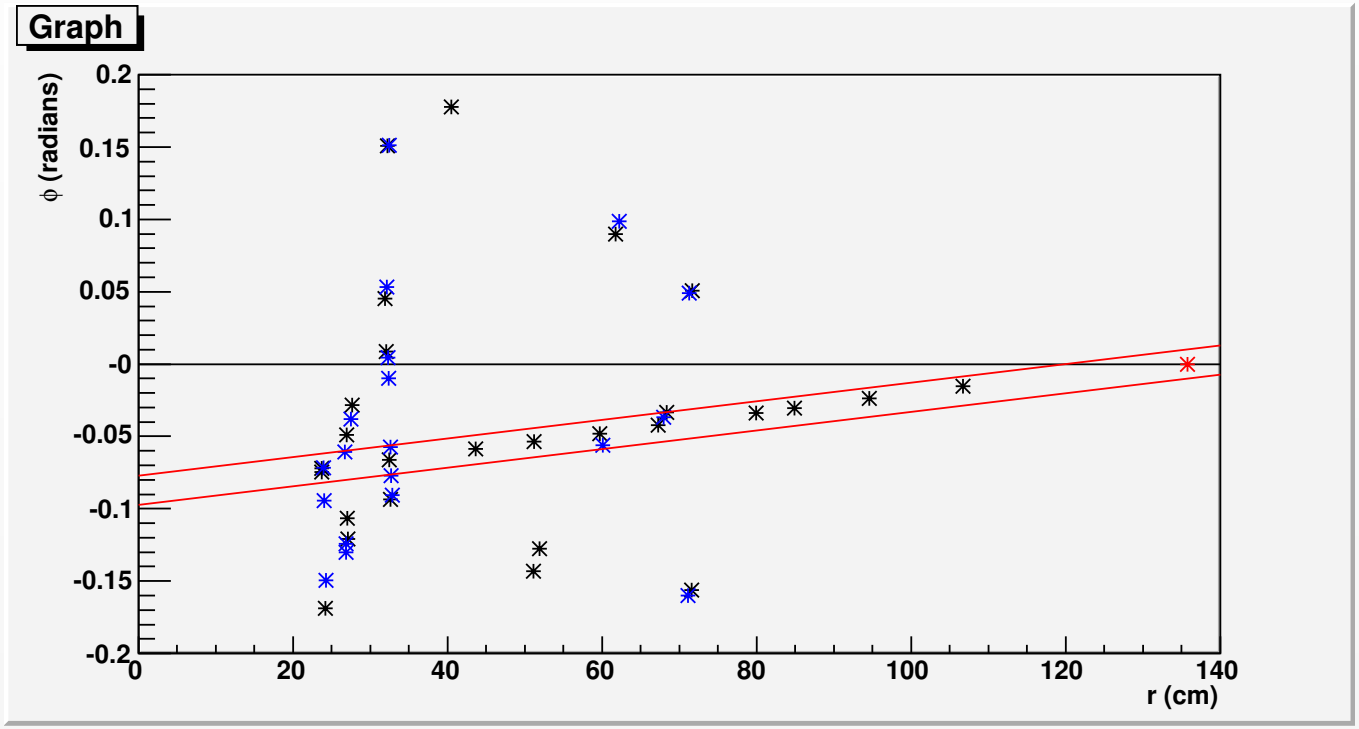
however: tracking efficiency is 3%

electrons and fitted tracks are not yet associated

Band Algorithm



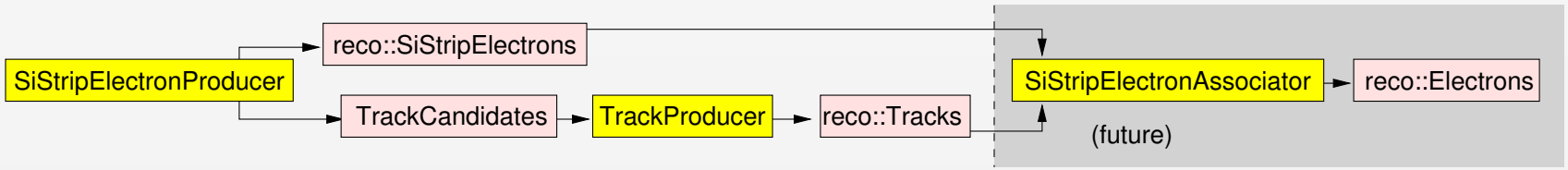
- plot hit ϕ versus hit radius (mentally)
- project a line from SuperCluster position and energy
- count hits within a $\Delta\phi$ band

New Features in SiStripElectronProducer

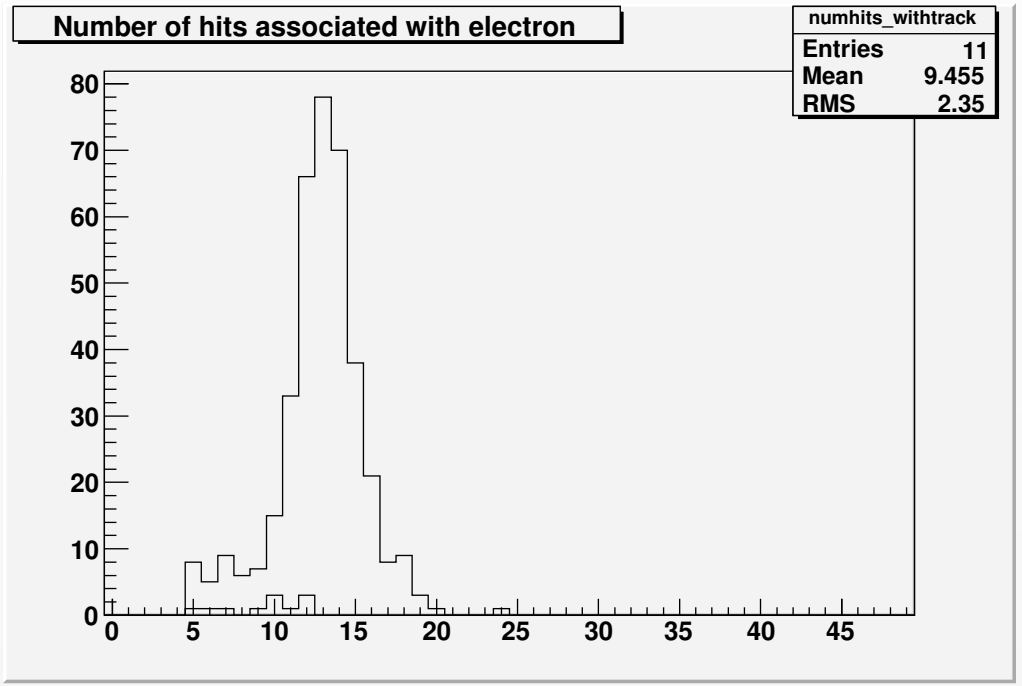
- linear fit $z(r)$ of stereo hits determine vertex z and η
- Δz window provides more hit discrimination
- linear fit to $\phi(r)$ yields ϕ_0, average p_T, and χ^2
- we try both charge hypotheses but accept only one
- hits associated with each SuperCluster are disjoint sets
- output hits and trajectory as a TrackCandidate for fitting

Sample .cfg excerpt

```
# Find the electrons
include "RecoEgamma/EgammaElectronProducers/data/findElectronsInSiStrips.cfi"

# TrackProducer
include "RecoTracker/TrackProducer/data/CTFFinalFitWithMaterial.cfi"
replace CTFWMaterial.src = "findElectronsInSiStrips"

# Associate fitted tracks with SiStripElectrons to make reco::Electrons (future)
include "RecoEgamma/EgammaElectronProducers/data/buildElectronObjects.cfi"

path p = {
    findElectronsInSiStrips,
    CTFWMaterial,
    buildElectronObjects    # (future)
  }
```



Diagnostic Plots



- Using Chris Jones's new FWCore/TFWLiteSelector
- 50 GeV, $\eta = 0$ electron gun, $\Delta\phi$ band width $= 0.01$ rad
- 400 events, 378 identified electrons, 11 fitted tracks

Late-breaking news:

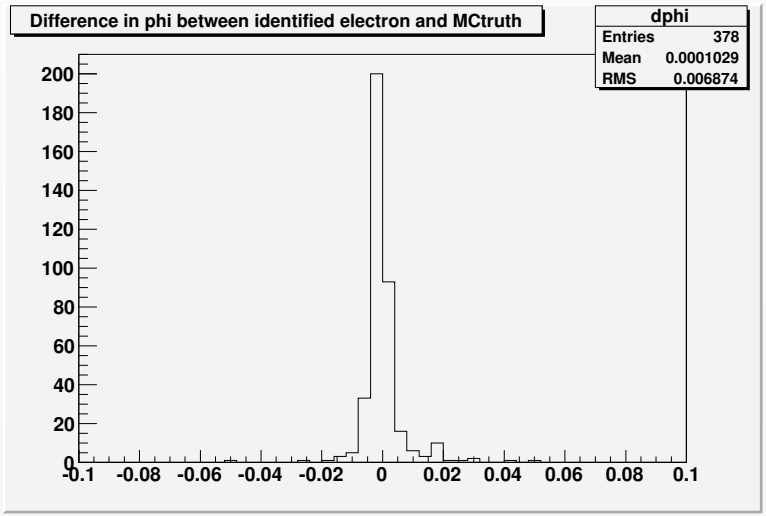
I brought this up at the tracking meeting, and they pointed out two things:

- We need to sort hits given to the tracker.
- We need to reduce the number of noise hits.

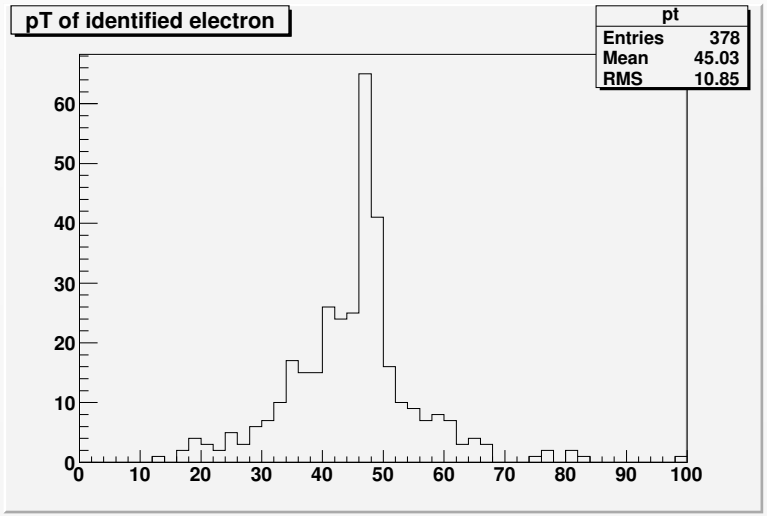
This will probably make a difference.

Before track fitting (reco::SiStripElectrons)

Linear fit of hits to $\phi(r)$ yields ϕ_0 and average p_T



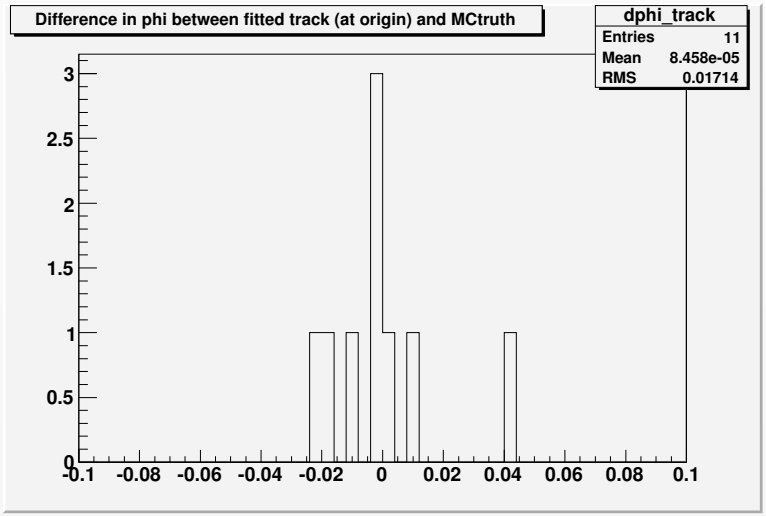
fitted ϕ_0 − true ϕ_0



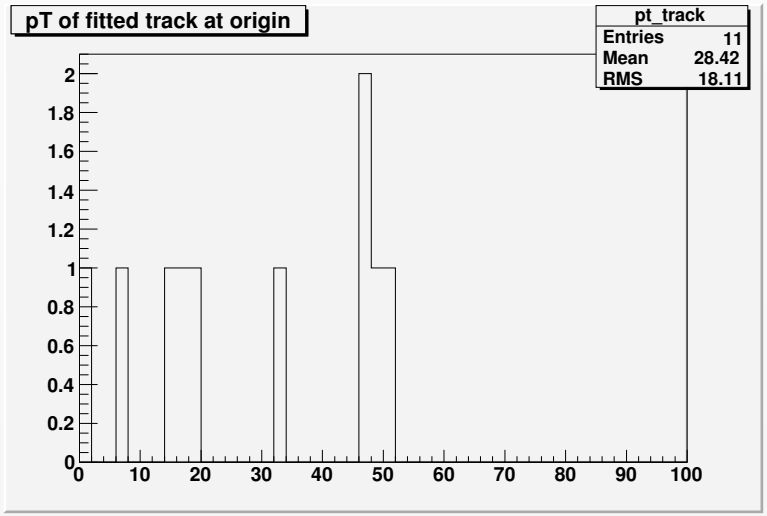
fitted p_T for 50 GeV

After track fitting (reco::Tracks)

Full track-fit, evaluated at the closest point to the origin



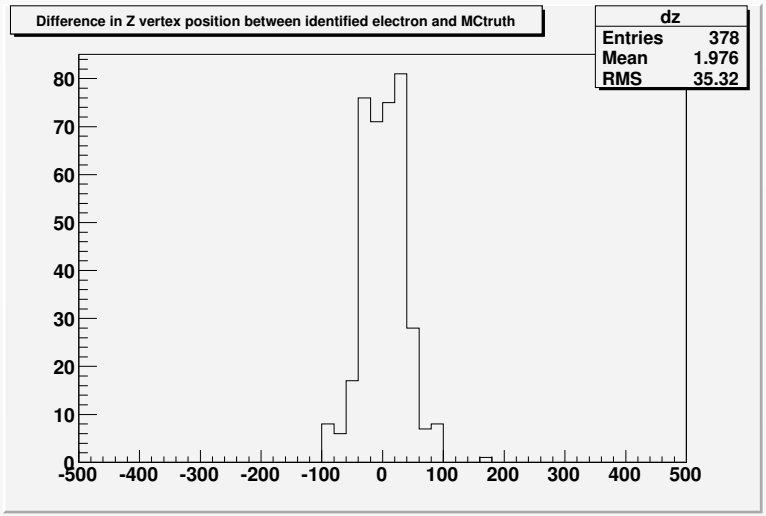
fitted ϕ_0 − true ϕ_0

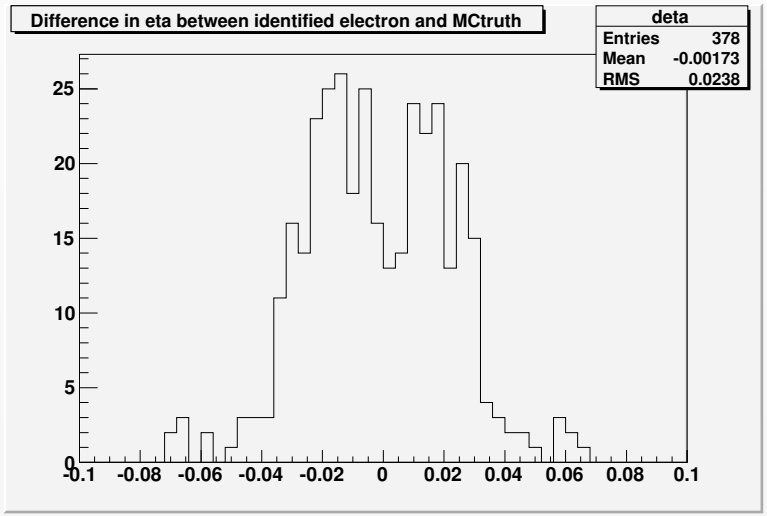


fitted p_T for 50 GeV

Before track fitting (reco::SiStripElectrons)

Linear fit of stereo hits to $z(r)$ yields z_0 and η



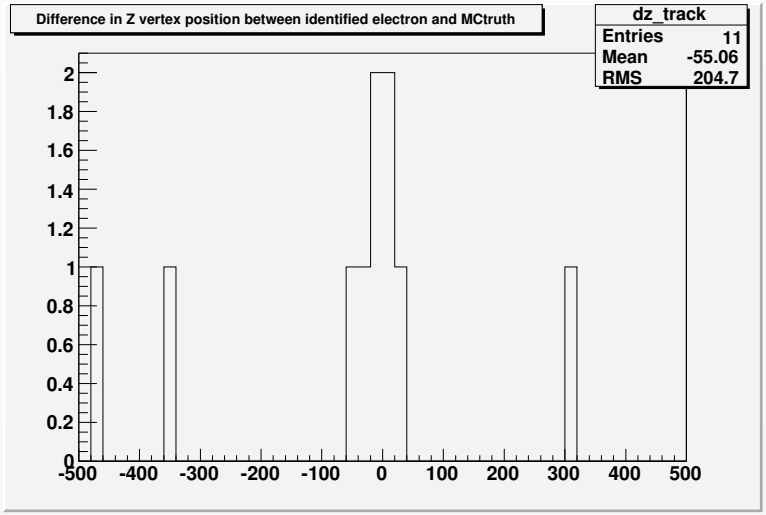


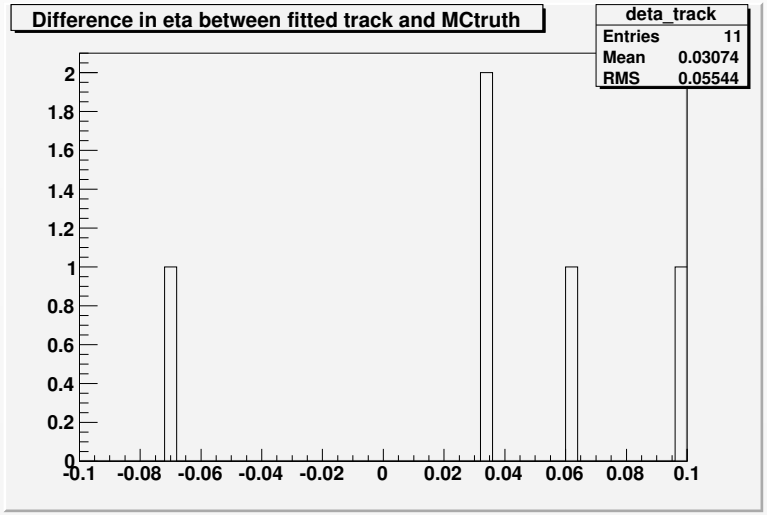
fitted z_0 − true z_0 (mm?)

fitted η for $\eta = 0$

After track fitting (reco::Tracks)

Full track-fit, evaluated at the closest point to the origin





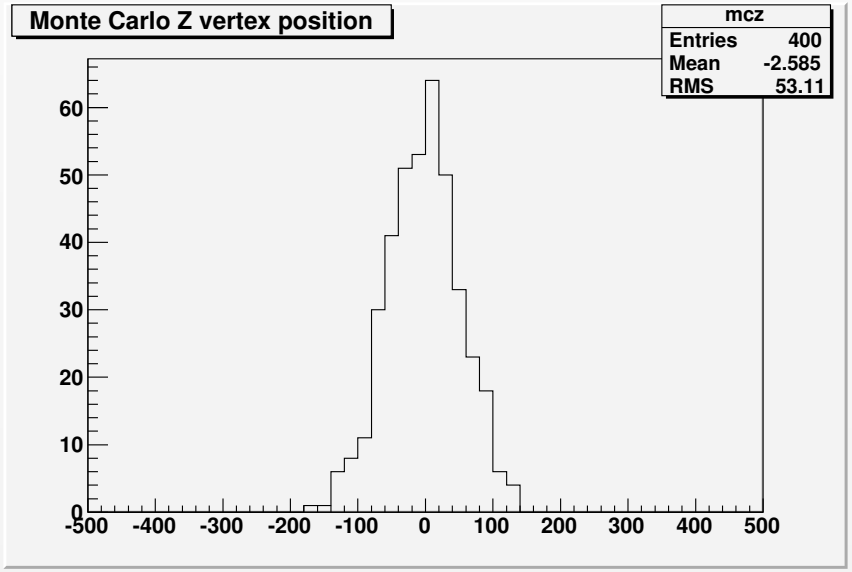
fitted z_0 − true z_0 (mm?)

fitted η for $\eta = 0$

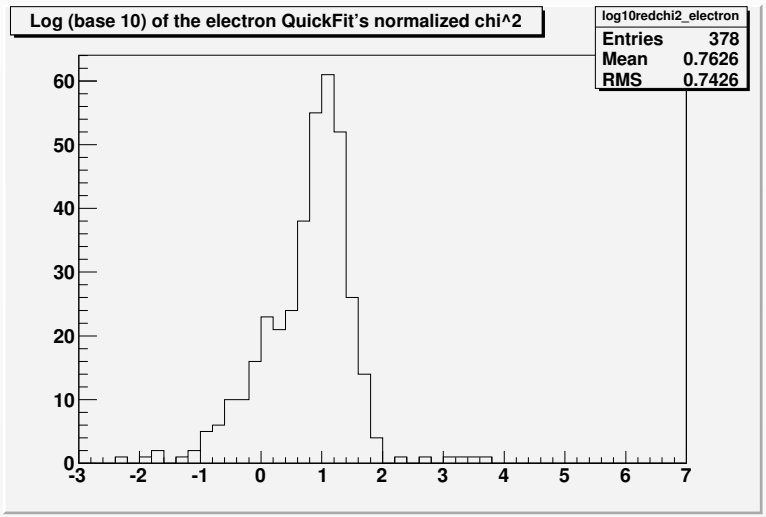
What units is the vertex in, anyway?

```
module VtxSmeared = VertexGenerator {
    string type = "IOMC/EventVertexGenerators/GaussianEventVertexGenerator"
    double SigmaX = 0.015
    double SigmaY = 0.015
    double SigmaZ = 53.0  // in mm (as in COBRA/OSCAR)
}
```

Output of HepMC::GenParticle::CreationVertex().z():

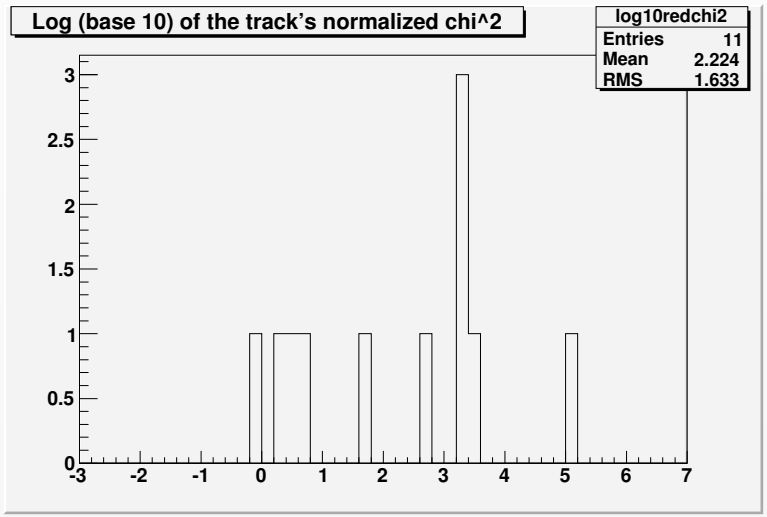


χ^2 values are very poor



$\log_{10}(\chi^2/N_{\text{dof}})$ of linear fit

(reco::SiStripElectrons)



$\log_{10}(\chi^2/N_{\text{dof}})$ of full fit

(reco::Tracks)

Next steps

Track seeding

- Ask tracking experts about track-fitting failures
- Ask Ursula and Claude how they are seeding tracks
- Write track-electron associator

Hit matching

- Apply it to multi-electron (physics!) events, QCD
- Study hit distributions and track efficiency in a realistic environment
- Improve electron identification algorithm